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CONTENTS

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AN INVESTIGATION INTO HOW DIFFERENT BLENDS OF BIO-DIESEL AT A RANGE OF TEMPERATURES AFFECT ENGINE HORSEPOWER, TORQUE AND EMISSIONS

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Keywords: *bio-Diesel, temperature, horsepower, torque, emissions*

Abstract

The report aims to show how horsepower torque, & emissions from bio-diesel manufactured from waste vegetable oil are affected by the temperature of the mixed blends of biodiesel that are being fed into the engine. Using bio-diesel manufactured from waste vegetable oil this project aims to see how the engine horsepower, torque and emissions on a 7.5L, 6 cylinder turbocharged Fiat/New Holland tractor engine are affected by the multiple blends of bio-diesel (B10, B30, B50, B70 & 100% mineral diesel), which will be fed into the engine at a range of temperature's (+30°C, + 15°C, -5°C & -10°C).

INTRODUCTION

The global price of fuel has increased especially over the last few years and the effects of global warming are becoming apparent it is necessary to look for fuel elsewhere. Biofuels are an alternative to petroleum based fuels and have become more of a viable option over the last few years. Biofuels can consist of the following bio ethanol, vegetable oils and bio-diesel. These are agricultural crops such as wheat, rape seed and corn that require high quality agricultural land for growth [3]. Bio-diesel is made essentially from plants and when they are burnt it leads to a complete recycle of CO_2 emissions [2].

Bio-diesel is one alternative of renewable energy; however bio-diesel is not a new alternative in relation to fossil diesel [1]. The effects that bio-diesel fuels have on modern engines is still relatively unknown, and with the uncertainty, there is much speculation to what effects the fuels have on engine power and torque, the environmental health (emissions) and differences in fuel consumption compared to the industry accepted fossil diesel.

There is a great deal of interest in biodiesel in the agricultural sector as biodiesel is renewable and therefore will never run out, it is also cheaper than mineral diesel at just 0.89 pence per litre (PPL).

Considerable waste vegetable oil from commercial food producing companies (e.g. McDonalds) needs to be disposed of or recycled; the concept of converting it into bio-diesel.

Bio-diesel manufacturing can easily be carried out by the small user, for example a small farmer. The Etruk 100 biodiesel processor used in this research programme can produce 2 X 100 litres of bio-diesel per day and requires very little supervision.

MATERIALS AND METHODS

Test Equipment

Dynamometer: The horse power from the Fiat/New Holland engine rig will be calculated from the Power take off (PTO). The PTO power is measured using a dynamometer coupled to the PTO shaft. The data is displayed via the dynamometers own onboard hand held computer, this can also be used to print off the power and torque graphs produced from the engine tests (figure 1).

Fig. 1. Fromet Sigma 5 pto dynamometer

Emissions Analyser: The emissions analyser used was a Testo 350 XL (figure 2), this was hired in for the duration of the testing. The Testo 350 XL is capable of reading the following exhaust gasses; Nitrogen Oxide (NO), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Oxygen (O_2) and the exhaust temperature. These gasses are needed to properly analyse the engine emissions.

Fig. 2. Testo 350 XL emissions analyser

Heating and Cooling the Fuel: To heat the fuel an Etruk 100 biodiesel processor (Eco2tec Resources UK Ltd) provided a thermostat temperature range from 0 –

50°C. The temperature is easily adjusted by turning the thermostat to give an accurate reading (figure 3).

Fig. 3. Etruk 100

To cool the fuel a domestic freezer was used, this provided a temperature range, adjustable between -3°C to -25°C.

RESULTS AND DISCUSSIONS

Out of the fuels that were tested B70 at -10 °C was unable to be tested because of the properties that it consists of at low temperatures. At -10°C the blend turned into a very thick liquid which is not suitable to be used in an internal combustion engine. Figure 4 shows the B70 blend at -10°c, waxing into a 'gel like' state.

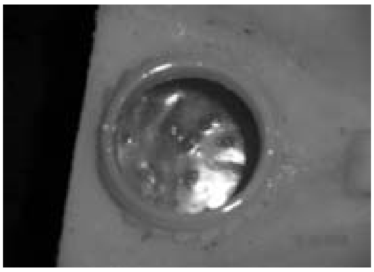

Fig. 4. The "gel like" B70 blend at -10ºC

Table 1 shows the maximum horsepower from each blend of biodiesel, each blend achieved its maximum horsepower at -5°C; this is a positive result to show that the temperature of the fuel effects engine horse power. In each blend of biodiesel the horsepower decreases with the increase in percentage of biodiesel.

Maximum torque has been achieved at -5°C in every blend of biodiesel; this is consistent with the horsepower results, table 2 below shows the maximum torque achieved at -5°C.

NOx and CO_2 emissions increase the colder the bio-diesel temperature becomes, which matches with the effect on horsepower at this temperature, as it is also the highest.

Table 1

The maximum horsepower of tested biodiesel blends

Fuel Blend	Temperature (°C)	Maximum Horsepower Blended bio-diesel	Maximum Horsepower 100% fossil diesel	Revs/min max power achieved
10%	-5	160.8	163.8	964
30%	-5	159.2	163.8	965
50%	-5	157.0	163.8	974
70%	-5	155.6	163.8	968

Table 2

The maximum torque of tested biodiesel blends (at -5ºC)

Fuel Blend	Temperature (°C)	Maximum Torque Nm Blended bio-diesel	Maximum Torque Nm 100% fossil diesel	Revs/min max power achieved
10%	-5	1304.5	1340.9	820
30%	-5	1304.5	1340.9	768
50%	-5	1234.0	1340.9	809
70%	-5	1239.0	1340.9	789

Table 3 shows the percentage increase of CO_2 emissions between 100% fossil diesel at 30°c and at -10°c. Due to the high content of oxygen in bio-diesel this lead to a reduction of CO emissions. Also it was found that the exhaust temperatures decreased with the amount of bio-diesel in the blend. Further testing is needed with a full analysis of blended fuel properties to see if this has any effect on the emissions.

Analysing both the NOx and the CO_2 emissions results shows that they both have the highest emissions at -5 and -10°C. This coincides with the horsepower results gained from the testing as Burland. M (2009) found that at -5°C the NHER produced the most horsepower at every blend and indeed the highest horsepower overall. Coincidently at maximum horsepower the engine requires more fuel to be burnt so in turn increases the amount of NOx and CO_2 produced.

Table 3

The increase of CO_2 emissions

Blend Percentage (%)	**CO_2 Emission Percentage** (%)	**Temperature** (°C)	**Percentage CO_2 Increase** (%)
100% Fossil Diesel	9.68	30	13.2
100% Fossil Diesel	10.96	-10	

CONCLUSIONS

1. The first clear conclusion that can be drawn is the effect -10°C had on the blended biodiesels with horsepower's dropping down to 85.3 HP this equated 92.4% loss in horsepower from the 100% benchmark mineral diesel which produced164.2 HP. The second result is that in every blend -5°C produced the highest power and torque.
2. As the B70 blend was not suitable for use in an engine at -10°C or below. It is recommended that a tank or fuel line heater needs to be fitted, so bio-diesel can be used in colder conditions. This in turn would decrease the viscosity of the bio-diesel.
3. The results show there is a close relationship between bio-diesel and the temperature at which the fuel is entering the engine at, because both affect each other's parameters. It can be confirmed that the following occurrences happened during testing:

- The exhaust temperatures dropped the more bio-diesel that was added to the blend due to lower combustion temperatures;
- The NOx and CO_2 content is highest at -5 and -10°C due to the oxygen content at these temperatures;
- The oxygen content in the emissions is higher in bio-diesel which promotes the oxidation of carbon in the fuel leading to lower CO emissions in comparison to fossil diesel [4].

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EFFECT OF MULCH AND FOLIAR SPRAY WITH BIOSTIMULANTS AND CHEMICAL NUTRIENTS ON CUCUMBER PLANTS UNDER PLASTIC HOUSES: I-MULCH EFFECT

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Keywords: *Cucumber, plastic house, mulch*

Abstract

The experiments were carried out during successive early summer season of 2004 and 2005 years, under doublespan plastic house (5.1 x 17 x 55 m), Kafr El-Sheikh Governorate. The main objective of this research was to study the effect of mulches (black plastic and rice straw) and foliar nutrition with biostimulants and chemical fertilizer on growth, yield, analysis of disease infection of hybrid cucumber (Petostar, gynoecious), as well as soil temperature. The results are summarized as follows:

Soil mulched with black plastic had higher monthly minimum, maximum and mean temperatures than both rice straw and bare soil, while soil mulched with rice straw had higher min. temperature, but it had lower max. temperature than of the bare soil. Also gave the highest values of vegetative growth parameters (stem length and diameter, internodes and lateral branches), early, and total yields, compared with control (bare soil) which had the lowest values.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is essentially a warm season crop. In Egypt cucumberis grown in open field during summer, and under plastics in winter and spring. Cucumber is considered the main protected crop in Egypt, it occupied 5404924 m^2 (52.5% from the total covered area) with an average yield of 11.52 kg/m^2. The main problems are the low temperature, salinity and fertilizer pollution. Therefore, the present research was carried out to study the effect of some mulching treatments (black plastic and rice straw) and foliar application with biostimulants (soft bread yeast and seaweed extracts) and chemical fertilizer (containing macro-and micronutrients) on cucumber growth and yield, disease severity % during early summer season inside unheated double span plastic house under Kafrelsheikh conditions.

Temperature strongly influences plant growth. Karlsen [9] found that a maximum vegetative growth of cucumber plants was reached at air temperature of 30°C and roots temperature within the range from 16 to 25°C. Tachibana [15] showed that air temperature of 20-25°C and soil temperature of 23-25°C gave the best growth of cucumber plants. Krug and Liebig [10] deduced that cucumber growth was divided into three phases: in the first phase (one week after planting) stem growth was increased by raising soil temperature up to about 24°C, such stage of plant was most sensitive for soil temperature. In the 2nd (from the second week after planting to anthesis) and 3rd phase (from anthesis to the end of fruit harvesting), cold treatment during night caused a depression in growth, increased lateral branching and showed leaf chlorosis.

Many kinds of mulch are used in cucumber and other vegetable crops in the open field and inside plastic houses, several investigators indicated that all mulch types (black and clear plastic and organic, i.e., rice straw and grass mulches) increased the minimum soil temperature at 5 and 10 cm depths compared with the unmulched control [12]. El-Aidy et al. [5] found on cucumber plants of plastic house that, using rice hulls mulch decreased EC, pH and soil temperature.

Several researchers showed that application of black plastic mulch increased vegetative growth of cucumber [12, 5 and 6]. Using black plastic mulch on cucumber plants increased early and total fruit yields [12, 7, 16 and 13]. Meanwhile, application of black plastic mulch increased total fruits yield more than rice straw mulch [16, 5 and 13].

MATERIAL AND METHODS

Two experiments were carried out under unheated doublespan plastic house, during successive early summer seasons of 2004 and 2005, at Kafr El-Sheikh Governorate. The main objective of this research work was to study the influence of mulch types (black plastic and rice straw) and foliar nutrition with biostimulants (seaweed extracts and soft yeast) and chemical nutrients on growth and yield of cucumber F_1 hybrid cv. Petostar (gynoecious), as well as temperature and biological activity of the soil and disease incidence, i.e., downy and powdery mildew.

Treatments were the following:

1. Black plastic film 40 mm.
2. Rice straw which was cut and spread on the soil surface about 5 cm layer.
3. Bare soil.
4. Treatments 4, 5, 6 and 7 are mentioned in Part II.

All cultural practices were carried out whenever necessary. Harvesting started on March 21st and continued until June 21st in both years. The experiment included 12 treatments which were the combinations of the three mulch treatments and four foliar nutrition treatments. The previous treatments were arranged in a split-plot using a randomized complete blocks design with four replications. Mulching treatments were assigned in the main plots where each main plot was splitted to four treatments of foliar nutrition as sub-plots. The control treatment was no spray with bare soil. The experimental sub-plot area was 9.75 m^2 and 2.6 plant/m^2. Data were tested by analysis of variance [11]. Duncan's multiple range test was used for comparison among treatments means [4].

Data recorded:

Soil temperature (°C): It was recorded at 10 cm below the soil surface at 3-days interval during the growing season and recorded at 8.00 and 18.00 o'clock.

Vegetative growth parameters such as stem length and diameter, number of nodes, number of lateral branches were recorded at 30, 60 and 90 days after transplanting (DAT). Fruit yield: Data included early (first 10 pickings) and total fruit yields. Downy mildew (*Pseudoperonospora cubensis*) and powdery mildew (*Erysiphe chichoracearum*) were estimated as disease severity percentage according to scale of Biswas [1]. (D.S.%) after 90 days from transplanting.

RESULTS AND DISCUSSION

Vegetative growth:

Effect of mulch: The application of black plastic mulch had the best effect on promoting vegetative growth of cucumber plants compared with the nonmulched plants (table 2). Therefore plants grown in black plastic mulch had the tallest and the thickset stem, internodes and lateral branches. On the contrary, the nonmulched plants had the lowest values of tested growth characters at all sampling dates in both seasons. Rice straw mulch occupied an intermediate position between black plastic mulch and the bare soil with nonsignificant differences between this treatment and the bare soil in most tested growth parameters during both seasons.

Table 1

Effect of mulch on soil temperature (°C) at 10 cm depth

Treatments	Bare soil			Rice straw mulch			Black plastic mulch		
Month	Min.	Max	Mean	Min	Max.	Mean	Min	Max	Mean
February (04)	17.1	22.1	19.6	18.7	20.5	19.6	19.4	25.2	22.3
March	18.1	22.9	20.5	19.5	21.2	20.4	19.9	24.4	22.2
April	19.6	22.5	21.1	20.7	21.8	21.3	20.6	23.3	22.0
May	21.1	23.4	22.3	21.7	22.9	22.3	21.8	24.3	23.1
June	23.0	25.8	24.4	23.4	25.0	24.2	23.4	25.9	24.7
Mean	19.8	23.3	21.6	20.8	22.3	21.6	21.0	24.6	22.9
February (05)	17.1	22.1	19.6	18.2	22.0	20.1	19.4	23.4	21.4
March	18.2	22.0	20.1	19.6	21.4	20.5	19.6	23.4	21.5
April	18.8	21.5	20.2	20.5	21.0	20.8	20.0	22.0	21.0
May	20.2	22.9	21.6	21.5	22.2	21.9	22.0	24.3	23.2
June	23.5	26.2	24.9	23.7	24.7	24.2	25.1	28.3	26.7
Mean	19.6	22.9	21.3	20.7	22.3	21.5	21.2	24.3	22.8

Several researchers obtained similar results [12, 5]. Improvement of vegetative growth characters of cucumber plants by mulch with either black plastic or somewhat with rice straw might be due to maintaining uniform soil moisture by reducing evaporation from surface soil, inhibiting weed growth by reducing light penetration [7], decreasing soil compaction and fertilizer leaching [7], increasing mineral nutrients uptake as N, P, K, Ca, Mg, Cu, B, Zn &Mn [3], activating roots growth [6], more microbial population and CO_2 production [8], raising minimum soil temperature in roots zone and reducing salt accumulation on the soil surface [5].

Table 2

Effect of mulch on some stem growth characteristics of cucumber plants

Characters	Stem length (cm)			Stem D (cm)		No. of internodes/plant			No. of branches/plant		
	Days after transplanting										
Mulch	**30**	**60**	**90**	**60**	**90**	**30**	**60**	**90**	**30**	**60**	**90**
	2004 season										
Black plastic	66.8 a	166.8 a	297.5 a	0.93 a	1.10 a	11.2 a	28.0 a	42.0 a	2.9 a	5.5 a	7.6 a
Rice straw	43.3 b	133.7 c	281.3 b	0.88 a	1.07 ab	8.5 b	23.0 b	39.4 b	2.5 b	4.9 b	6.3 b
Bare soil	44.6 b	146.2 b	278.8 b	0.81 b	1.03 b	8.9 b	24.4 b	40.7 b	2.3 b	5.0 b	6.0 b
	2005 season										
Black plastic	71.8 a	173.1 a	307.9 a	0.94 a	1.17 a	13.8 a	30.8 a	47.9 a	3.7 a	8.5 a	8.7 a
Rice straw	60.6 bc	155.6 b	289.2 b	0.91 a	1.12 ab	12.5 b	29.0 b	46.8 b	2.8 b	7.2 ab	7.6 ab
Bare soil	56.5 c	158.7 b	287.5 b	0.83 b	1.09 b	12.2 b	29.4 b	46.5 b	2.3 b	6.5 b	7.2 b

Fruit yield:

Early fruit yield: Effect of mulch:

Data in table 3 indicate that black plastic mulch had a highly significant increase in number and weight of early fruit yield over both the rice straw mulch and nonmulched plants that did not considerably differ from each other in both seasons. The increment in early yield by using black plastic mulch might be due to producing more vigorous plants (table 3). Similar results were obtained by Salman, [12]. Total fruit yield: Data in table 3 illustrate that the differences in total fruit yield were highly significant due to mulch treatments in both seasons. The plots of cucumber plants which were mulched with black plastic produced the heaviest weight and number of total fruit yield, followed by the plots of plants mulched with rice straw and finally the nonmulched plants which had the lowest values in both seasons. The increases % in weight of total fruit yield over no mulch were 18.2 and 13.7% for black plastic mulch and 7.4 and 8.2% for rice straw mulch in both seasons, respectively. Such increases in total fruit yield by mulch was a reflection to its stimulatory effect on vegetative growth characters, successful fruiting % and early yield that were previously discussed. These results are in accordance with those obtained by Singha *et al.* [14].

Diseases infection

Table 3

Effect of mulch on early and total yields of cucumber plants during

Characters	Early fruits yield/m^2			Total fruits yield/m^2 (2.66 plants)		
Mulch	No. of fruits	Wt. of fruits (kg)	Increase in wt. %	No. of fruits	Wt. of fruits (kg)	Increase in wt. %
	2004 season					
Black plastic	40.8 a	3.819 a	47.4	165.6 a	16.494 a	18.2
Rice straw	27.0 b	2.415 b	-6.8	150.2 b	14.989 b	7.4
Bare soil	28.8 b	2.591 b	-	139.9 c	13.952 c	-
	2005 season					
Black plastic	52.4 a	5.270 a	24.0	152.2 a	16.048 a	13.7
Rice straw	46.9 ab	4.643 ab	9.2	147.6 a	15.282 a	8.2
Bare soil	42.7 b	4.250 b		135.7 b	14.119 b	

Values having the same alphabetical letter within each column are not significantly different at the 5% level, according to Duncan's test

Effect of mulch on downy and powdery mildews infection: Data in (figure 1) demonstrate that there was a highly significant reduction in disease severity percentage (D.S. %) of downy and powdery mildews when plots of cucumber plants were covered with either black plastic or rice straw compared with the plants of bare soil which had the highest D.S.% in both seasons. Black plastic mulch tended to be the best treatment for reducing downy and powdery mildews infection in most cases during both seasons.

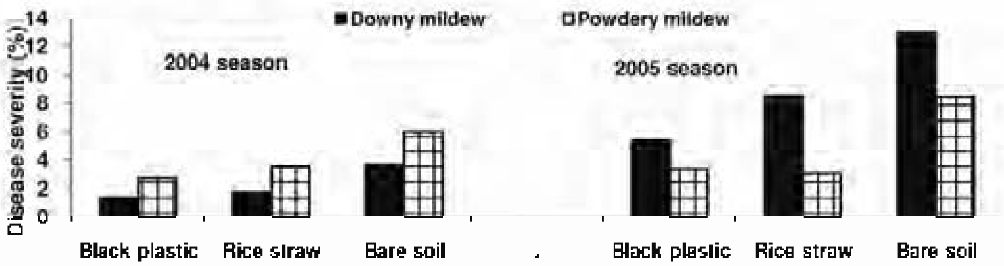

Fig. 1. Effect of mulch on disease severity (%) of downy and powdery mildews.

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EFFECT OF MULCH AND FOLIAR SPRAY WITH BIOSTIMULANTS AND CHEMICAL NUTRIENTS ON CUCUMBER PLANTS GROWN UNDER PLASTIC HOUSES II-FOLIAR SPRAY EFFECT

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Keywords: *Cucumber, plastichouse, foliar spray*

Abstract

The experiments were carried out during successive early summer season of 2004 and 2005 years, under doublespan plastic house (5.1 x 17 x 55 m) at, Kafr El-Sheikgh Governorate. The main objective of this research was to study the effect of mulches and foliar nutrition with biostimulants (soft bread yeast plus K citrate and seaweed extracts) and chemical fertilizer (containing macro- and micro nutrients) on growth, yield, analysis of disease infection of hybrid cucumber (Petostar). The results are summarized as follows:

Application of yeast plus K cit. gave the highest values of vegetative growth parameters (stem length and diameter no. of internodes and lateral branches), fruits yield (early, and total yields, compared with control (no spray) which had the lowest values. In contrast, the previous treatments gave the lowest values of D.S. % of downy and powdery mildews compared with whether bare soil, no spray or control which had the highest values.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is essentially a warm season crop. In Egypt cucumberis grown in open field during summer, and under plastics in winter and spring. Cucumber is considered the main protected crop in Egypt, it occupied 5404924 m^2 (52.5% from the total covered area) with an average yield of 11.52 kg/m^2. The main problems are the low temperature, salinity and fertilizers pollution. Therefore, the present research was carried out to study the effect of some mulching treatments and foliar application (soft bread yeast, seaweed extracts and chemical fertilizer containing macro-and micronutrients) on cucumber growth, yield and diseases infection during early summer season inside unheated double span plastic house under Kafrelsheikh conditions.

Effect of yeast spray on vegetative growth and yield has been studied by many workers. Hewedy *et al.* [5] studied the influence of soft bread yeast, biozyme and stimufol. They found that foliar spray with yeast (2 g/l), biozyme and stimufol (1 g/l) enhanced vegetative growth. El-Kassas and Abd El-Moulla [6] showed that foliar application of cucumber plants grown under plastic house with Fe (150 ppm), Mn (150 pm) or Zn (100 ppm) seven times significantly increased fruits yield over the control. Kolota *et al.* [10] showed that foliar fertilization with Ekolist U increased marketable fruits yield of cucumber plants by 7.3% and decreased the level of cucumber leaf infestation by downy mildew. Other works have been done on the effect of foliar applications on reduced the incidence of downy and powdery mildew on cucumber [14, 15].

MATERIAL AND METHODS

Two experiments were carried out under unheated doublespan plastic house, during successive early summer seasons of 2004 and 2005, at Kafr El-Sheikh Governorate. The main objective of this research work was to study the influence of mulch types (black plastic and rice straw) and foliar nutrition: soft yeast seaweed extracts, and chemical nutrients on growth and yield of cucumber F_1 hybrid cv. Petostar and disease incidence, i.e., downy and powdery mildew.

Treatments were the following:

1. Black plastic film 40 mm.
2. Rice straw which was cut and spread on the soil surface about 5 cm layer.
3. Bare soil.
4. Soft bread yeast at 10 g/l + potassium citrate (38% K) at 1.5 cm/l were used. Soft bread yeast was mixed with sugar at a ratio of 1:1 and dissolved in water then left for 12 hours (at room temperature) before spraying.
5. Seaweed extract was obtained commercially as Promex, it was used at 1 cm/l.
6. Chemical fertilizer was obtained commercially as "High grow" and used at 1.7 g/l. (contains 10% N, 4% P, 36% K, 100 ppm Fe, 600 ppm Zn, 400 ppm Mn, 100 pm Cu, 300 ppm B and 50 ppm Mo, the microelements were in a chelated form).
7. Control (unmulched and non sprayed).

Cucumber plants were sprayed with the previous nutrient materials four times at 15-days interval, beginning three weeks after transplanting. In early summer season, seeds of cucumber cv. Petostar F_1 hybrid were sown on January 21st in both seasons in the nursery. The seedlings were transplanted at 2.6 plants/m^2 into an unheated plastic house on February 15th in both years. All cultural practices were carried out whenever necessary. Harvesting started on March 21st and continued until June 21st in both years. The experiment included 12 treatments which were the combinations of the three mulch treatments and four foliar nutrition treatments. The previous treatments were arranged in a split-plot using a randomized complete blocks design with four replications. Mulching treatments were assigned in the main plots where each main plot was splitted to four treatments of foliar nutrition as sub-plots. The control treatment was no spray with bare soil. The experimental sub-plot area was 9.75 m^2 (1.5 x 6.5 m) and contained of 26 plants. Data were tested by analysis of variance [11]. Duncan's multiple range test was used for comparison among treatments means [3].

Data recorded:

Vegetative growth parameters such as stem length and diameter, number of nodes, number of lateral branches were recorded at 30, 60 and 90 days after transplanting (DAT). Fruit yield: early (first 10 pickings) and total fruit yields. Downy mildew (*Pseudoperonospora cubensis*) and powdery mildew (*Erysiphe chichoracearum*) were estimated as disease severity percentage according to scale of Biswas [2] (D.S.%) after 90 days from transplanting.

RESULTS AND DISCUSSION

Vegetative growth:

Effect of foliar nutrition: Data in table 1 reveal that there were highly significant differences in all vegetables growth characteristics among the treatments of foliar nutrition at all sampling dates in both seasons. Therefore, foliar nutrition of cucumber plants with yeast + K citrate, seaweed extracts and chemical fertilizer increased the mentioned characteristics with nonsignificant differences of each other over the nonsprayed plants which had the lowest records at all tested ages of plants in both seasons. Many researchers had similar results for the effect of yeast on plant growth [13, 14 and 7].

Table 1

Effect of foliar nutrition on some stem growth characteristics of cucumber plants

Characters	Stem length (cm)			Stem D (cm)		No. of internodes/plant			No. of branches/plant		
	Days after transplanting										
Foliar nutrition	**30**	**60**	**90**	**60**	**90**	**30**	**60**	**90**	**30**	**60**	**90**
	2004 season										
Yeast + K citrate	52.4 a	153.2 a	289.2 a	0.89 a	1.09 a	10.2 a	25.8 a	41.3 a	2.8 a	5.8 a	7.0 a
Seaweed ext	52.3 a	149.0 ab	291.7 a	0.89 a	1.08a	9.7 a	26.3 a	42.3 a	2.9 a	5.6 a	7.2 a
Chemical fert	53.1 a	156.3 a	298.3 a	0.89 a	1.09 a	10.3 a	26.7 a	42.1 a	2.8 a	5.7 a	7.1 a
No spray	48.4 b	137.0 b	264.2 b	0.80 b	1.01 b	7.9 b	21.8 b	37.2 b	1.9 b	3.7 b	5.2 b
	2005 season										
Yeast + K citrate	66.4 a	169.7 a	305.9 a	0.92 a	1.16 a	13.2 a	30.8 a	48.2 a	3.1 a	8.4 a	9.2 a
Seaweed ext	61.6 ab	162.4 ab	294.9 ab	0.91 ab	1.15 a	12.9 ab	29.8 ab	48.0 a	3.5 a	7.9 a	8.4 a
Chemical fert.	64.8ab	162.8 ab	290.7 ab	0.90 b	1.13 a	13.1 a	30.1 a	46.6 ab	3.0 ab	7.5 a	7.0 b
No spray	58.9 b	155.0 b	288.0 b	0.84 c	1.08 b	12.0 b	28.3 b	45.2 b	2.2 b	5.8 b	6.6 b

Fruit yield: Early fruit yield:

Early fruit yield: Data in table 2 reveal that all foliar nutrition treatments caused a highly significant increase in early fruit yield (as weight and number) with nonsignificant differences from each other compared with the nonsprayed treatment in both seasons. The highest early fruit yield was obtained from the plants sprayed with soft yeast plus K citrate in both seasons. The increases (%) in weight of early yield over the no spray were 26.8 and 20.0% for yeast + K citrate, 27.0 and 12.7% for chemical fertilizer and 17.1 and 10.0% for seaweed extracts in both seasons, respectively. Similar results were obtained by El-Kassas &. Abd El-Moulla, [7].

Total fruit yield: Data presented in table 2 illustrate that all foliar nutrition treatments resulted in a highly significant increase in total fruit yield (as weight and number) in comparison with the non sprayed treatment in both seasons. The highest total fruit yield was obtained from the plants sprayed with yeast plus K citrate followed by both chemical fertilizer and seaweed extracts, however the differences in between were significant in the second season only. The increase (%) in weight of total yield over the no spray were 19.9 and 33.6% for yeast + K citrate, 18.1 and 19.4% for chemical fertilizer and 17.9 and 17.6% for seaweed extracts in both seasons, receptively. Similar behavior was obtained by many researchers using foliar spray with yeast [15, 12], potassium citrate [1], K and Ca macro-and microelements [9, 10] and seaweed extracts [6]. The promotive effect of foliar spray with whether yeast plus K citrate, commercial fertilizer or seaweed extracts on total fruit yield of cucumber might be due to increased CO_2 production which lead to increasing photosynthesis and carbohydrates accumulation and in turn increased fruiting table 2 as well as decreased downy and powdery mildews incidence (figure 1) hence increased total fruit yield of cucumber.

Table 2

Effect of foliar nutrition on early and total yields of cucumber plants

Characters	Early fruits yield/m^2			Total fruits yield/m^2		
Foliar nutrition	Fruits No.	fruits (kg)	Increase in wt. %	Fruits No.	fruits (kg)	Increase in wt. %
	2004 season					
Yeast + K citrate	35.3 a	3.168 a	26.8	158.5 a	15.928 a	19.9
Seaweed ext.	32.6 ab	2.926 ab	17.1	156.1 a	15.665 a	17.9
Chemical fert.	33.7 ab	3.173 a	27.0	156.4 a	15.699 a	18.1
No spray	27.3 b	2.498 b	-	133.8 b	13.289 b	-
	2005 season					
Yeast + K citrate	50.9 a	5.119 a	20.0	163.1 a	17.210 a	33.6
Seaweed ext.	47.2 ab	4.692 ab	10.0	146.8 b	15.146 b	17.6
Chemical fert.	47.6 ab	4.807 ab	12.7	145.5 b	15.369 b	19.4
No spray	45.4 b	4.267 b	-	125.0 c	12.877 c	-

Values having the same alphabetical letter within each column are not significantly different at the 5% level, according to Duncan's test

Diseases infection

Data in figure 1 illustrate that foliar nutrition of cucumber plants with whether yeast+K citrate, chemical fertilizer or seaweed extracts induced a highly significant reduction in D.S. % of downy and powdery mildews compared with the non sprayed plants which had the highest % in both seasons. Foliar spray of with yeast + K citrate tended to be the best treatment for reducing downy and powdery mildews infection in both seasons. In this respect, moreover, some reports showed that foliar spray with phosphate alone or in combination with potassium that reduced powdery mildew infection on cucumber plants caused an increase in peroxidase activity [12], enhanced beta-1,3 glucanase content and increased uptake of Ca in cucumber plant, in turn, increased systemic resistance against powdery mildew in cucumber plants[15]. Regarding downy mildew incidence on cucumber plants, some researchers found that foliar application of compound fertilizer Ekolist at 1.5% reduced the incidence of downy mildew on cucumber [12].

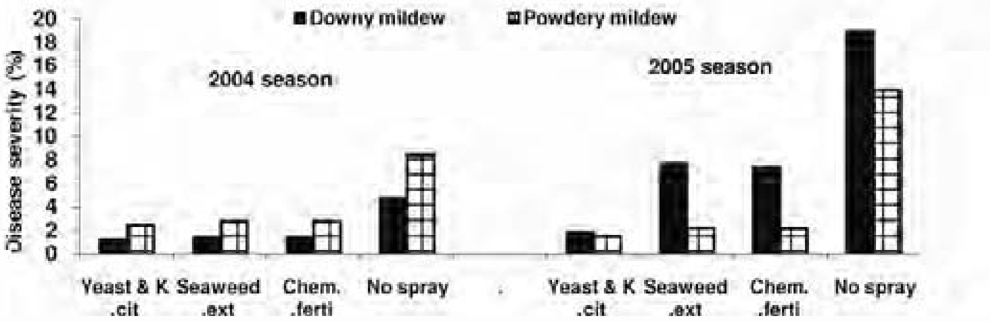

Fig. 1. Effect of foliar nutrition on disease severity (%) of downy and Powdery mildews.

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IMPLEMENTATION OF THE EDUCATIONAL PROGRAM ABOUT GENETICALLY MODIFIED PRODUCTS (GMP) BY A LEONARDO DA VINCI PROJECT - "AGROHEALTH"

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Keywords: *„Agrohealth" project, GMOs, GMP, educational program*

Abstract

The paper presents the activities, aims and objectives of "AGROHEALTH" – Leonardo da Vinci Project. Objective of the particular Project is the exploitation of the methodology and the results of the study: "Education about the needs of not Genetically Modified Products (GMPs) certification – Investigation for the structure of a certification system", as well as the assistance to the resolution of similar subjects which appear in 3 countries (Bulgaria, Cyprus and Romania), taking into consideration the particular environments of these countries. The briefing of farmers and consumers about Genetically Modified Organisms (GMOs) is another objective of the project.

Additionally, the project will help the increase of professional mobility, of those involved in the agricultural sector, as well as their professional profile. Finally, it will contribute to possible long-term production of improved or even new agricultural products.

Another objective of the project is the creation of a Genetically Modified Products (GMPs) Certification Structure, in each country, by a responsible Organization.

INTRODUCTION

The question of Genetically Modified Products (GMP) seriously concerns the EU, the national institutions, but also all those who are involved in the agricultural sector (producers, consumers, etc.).

Genetically modified organisms (GMOs) can be defined as organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally by pairing or natural recombination (Regulation (EC) No 1829/2003). As an application of modern biotechnology, this technique allows selected individual genes to be transferred from one organism into another, also between non-related species.

According to EU legislation (Regulation (EC) No 1829/2003 and Regulation (EC) No 1830/2003 concerning the traceability and labelling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms), any responsible deployment of genetically modified (GM) crops needs to comprise the whole technology development process. Specifically, this includes pre-release risk assessment, biosafety considerations, and post release monitoring.

According to the report elaborated by the Agro-Biotechnology Agency ISAAA (*International Service for the Acquisition of Agri-Biotech Applications, Cornell University New York*), in 2008, 107 mil. ha was cultivated in 22 countries from 6 continents (Africa, North America, South America, Asia, Europe and Australia) (figure 1).

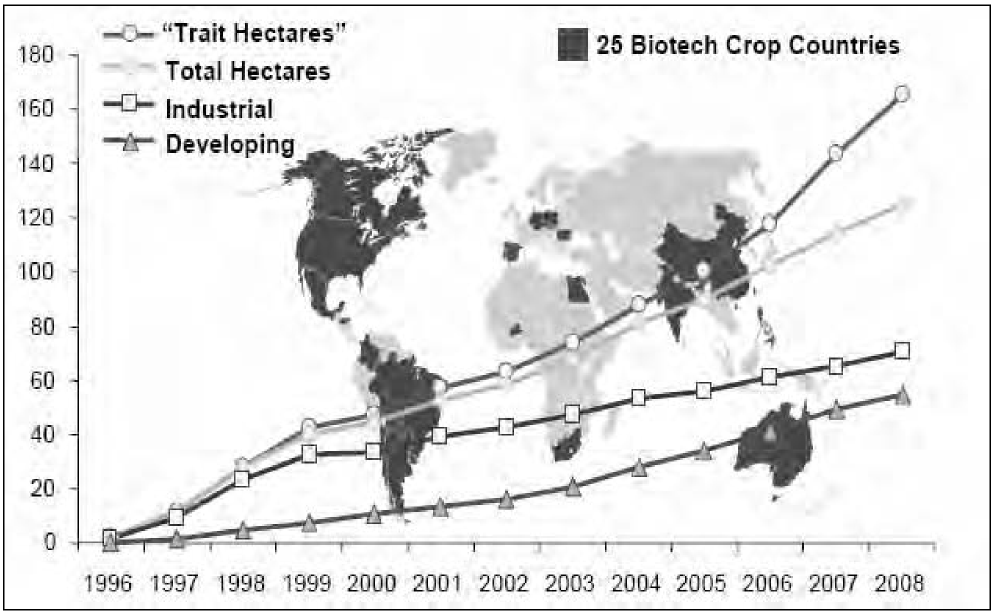

Fig. 1. ***GMOs cultivations statistic worldwide***
(source: James Clivel, ISAAA, 2009)

In the last ten years this number has on average been augmenting over more then 10 million hectares per year. About half of the current GMO occupied area is for the account of the United States. Other main GM cultivating countries are Argentina, Brazil, Canada, India and China. Worldwide, four different types of GM crops are grown. These are soybeans, maize, cotton and rapeseed.

In Europe, in 2008 year, 108,000 ha were dedicated to Bt maize. Despite the cultivation in France in 2008, the GM cultivation area only slightly decreased compared to 2007 (110,000 hectares). In 2007, French farmers had grown GM maize on 21,000 hectares.

Romania has shown the largest increase in GMO acreage and currently grows GM maize on more than 7,000 hectares. This represents an increase of almost 20-fold in comparison to 2007. Other countries with significant increases include Poland, which has increased to 3,000 hectares in 2008. Slovakia has more than doubled its GMO cultivation to 1,900 hectares. In 2008, the Czech Republic planted GM crops on 8,380 hectares (68% increases) and Germany cultivated GM crops on 3,173 hectares (39% increase). Portugal and Spain experienced increases of GMO acreage of 8% and 5%, cultivating on 4,851 and 79,269 hectares respectively.

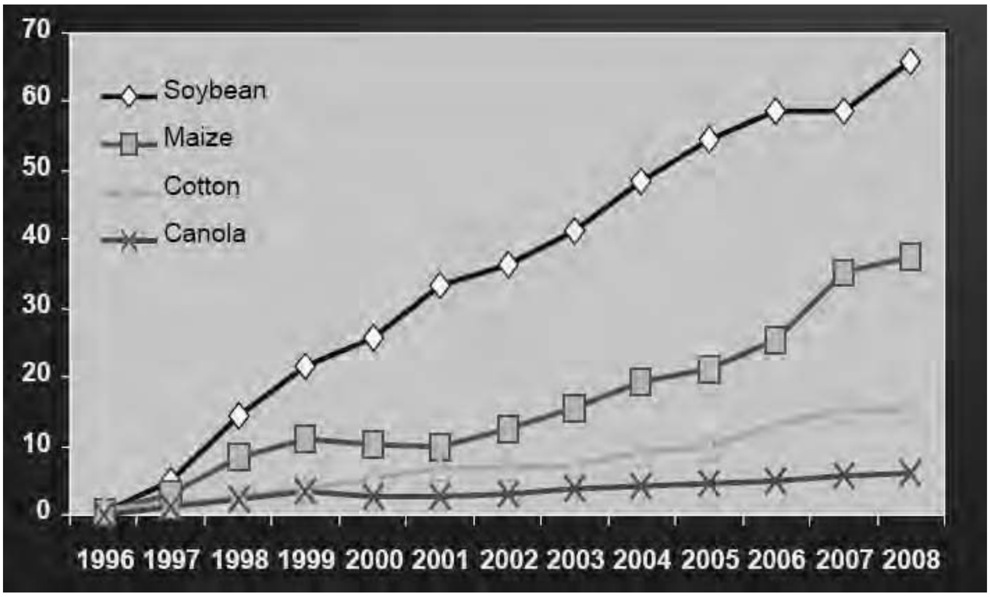

Fig. 2. ***The mains biotech crops at world level (source: ISAAA, 2009)***

According to Euro-barometer official pools from the latest years, over 70% from the EU consumers don't wish to consume genetically modified alimentary products. Also, over 95% from the interrogated people want to have the right to choose between a genetically modified product and one unmodified. Europeans are afraid ever more of the food artificiality, and they prefer ecological, natural products.

In this context, at present, all over the world exists so called GMO Free Zones. Currently, within the EU there exist at least 174 regions, over 4500 municipalities and other local entities, 10000 of farmers and food producers in Europe that have declared themselves "GMO-free", expressing their commitment not to allow the use of genetically modified organisms in the agriculture and food production in their territories. These include, for example, all cities and villages in Greece and Austria, and 90% of all land in Italy. In Romania, a number of 26 localities from the Bistrita Nasaud County declared themselves as GMO Free Zones.

MATERIAL AND METHODS

"AGROHEALT" project is an EU project funded under the Leonardo da Vinci Programme that it will help the increase of business mobility, of those involved in the agricultural sector, as well as the enhancement of their business profile. Finally, it will contribute to possible long-term production of improved or even new agricultural products.

The Consortium that will materialize the project is composed from 4 partners: Planning Group Ltd. from Greece, Obraztsov Chiflik from Bulgaria, Company of control and certification of Organic Products DIO Ltd. from Cyprus, University of Agronomic Sciences and Veterinary Medicine – Faculty of Agriculture (USAMVB-FA) from Romania.

RESULTS AND DISCUSSION

At present, the scientifically world discuss of the potential positive and negative effects of genetically modified organisms (GMOs). Arguments for GMOs are: recombinant DNA-modified crops have already increased crop yields and food production, and reduced the use of synthetic chemical pesticides in both industrialized and less developed countries; these advances are critical in a world where natural resources are finite and where hundreds of millions of people suffer from hunger and malnutrition; increased crop productivity, either through direct increase in yield or crops with greater tolerance to stresses; increased crop quality, through improvements in post harvest and processing quality and storage life, and improved nutritional quality (increases in available Vitamin A, Fe, Zn, I, and lysine); herbicide-resistance, to reduce labour costs in weed management and facilitate reduced tillage.

In this connection, it has been estimated that if half the maize, oilseed rape, sugar beet, and cotton grown in Europe were genetically modified to resist their pests, there would be a reduction of about 14.5 million kilograms of formulated pesticide product applied, a saving of approximately 20.5 million liters of diesel, and the prevention of the emission of 73,000 tones of carbon dioxide into the atmosphere.

In this sense, one of the objectives of the "AGROHEALT" project is the creation of the right conditions (Structure of a Certification System) in order for a Certification Organization with regard to the GMOs to be created in Bulgaria, Cyprus and Romania. In this way is ensured the continuity of the project that simultaneously constitutes the exploitation of all work.

Also, the aim of project is the exploitation of the methodology and the results of the study: "Education about the needs of no Genetically Modified Products certification – Investigation for the structure of a certification system", as well as the assistance to the resolution of similar subjects which appear in the other 3 countries (Bulgaria, Cyprus, Romania), taking into consideration the particular

environments of each country. The briefing of farmers and consumers about GMOs consists of another project objective.
The others objectives of "AGROHEALT" project are: creation of a web site – http://www.agrohealth.eu which will consist of a briefing on Community initiatives (mainly for the Leonardo programme) regarding the agricultural sector as well as the developments in technological and institutional level in the aforementioned methodology (the supported languages will be Greek and English); production of Educational material (in printed and electronic form); implementation of educational programs for the instructors of the all partners; realisation of meetings with all actors involved in this area as well as the need for help resolving special subjects and application of the EU institutional frame regarding the GMOs (eg. which are the necessary measures that should be received, advisable cultivating distances, types of cultures and products, etc.).
The web-site will includes also a forum and a chat room for direct briefing concerning particular questions and will help at promoting the education, sensitization and research.
Another objective of the plan is the functionality and updates of the web site even afterwards the expiry of the programme. Additionally the creation of a CD-ROM and a DVD, which will contain audiovisual material as well as modern learning methods, constitutes an important aid in the transport and diffusion of acquired knowledge and experience.
The added value will emerge through the creation of a GMP Certification Structure, in each country, by a responsible Organization, as well as the researches, in each country, about the acceptance or not of the GMP from consumers and producers. The target groups are: farmers and members of cooperatives (not only GMP but also conventional cultivators or organic agricultures); the people who work in the agricultural sector and in the alteration of agricultural products. The existing needs concern the: briefing, in different level and depth per category, of cultivators (GMP, conventional and Organic agriculturists), manufacturers, retailers and consumers; education of all actors involved in GMOs; resolving of special subjects and application of the EU institutional frame regarding the GMOs;
The results of this Plan will concern all the citizens, since everyone is interested in the food quality which he consumes and more generally is interested in his health.
During the project the consortium will create printed and electronic (CD-ROM, DVD) educational material, an informative video spot, a web site and will establish a market research in Bulgaria, Cyprus and Romania. The results of the project will be used for the briefing and sensitization of all actors involved in the agricultural production.
The project has great importance because of its European dimension and great interest to the conventional and Organic farmers (by presenting them ways of protecting their production) as well as to the consumers.

CONCLUSIONS

1. The results of "AGROHEALT" project will concern all the citizens, since everyone is interested in the food quality which he consumes and more generally is interested in his health.
2. The added value will emerge through the creation of a GMP Certification Structure, in each country, by a responsible Organization, as well as the researches, in each country, about the acceptance or not of the GMP from consumers and producers.
3. Strategies and best practices for coexistence of genetically modified crops with conventional and organic farming need to be developed and implemented at national or regional level, with the participation of farmers and other stakeholders and taking account of national and regional factors

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THE MAP OF THE CLAY MINERAL ASSOCIATIONS IN THE CLAY FRACTION BELLOW 2 μm FROM THE SURFACE HORIZON OF THE ROMANIAN SOILS

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Keywords: *mineralogical map, clay minerals*

Abstract

The map has been prepared on the basis of information supplied by the 400 soil profiles investigated at the colloidal level by X-ray difraction, taking into account not only the field surveys and laboratory results, but available soil and lithological maps also.

The 8 mineralogical classes from the map legend, representative for the certain clay mineral associations, established in the clay fraction of the soil surface horizon have been displayed in an ascending order of the structural mobility, determined by the massive presence of some clay minerals having specific crystalo-chemical characteristics to promote certain processes, which leads to changes of the soil physical and chemical properties.

The map presents information regarding not only the clay mineral association, but the clay mineral contents for each association also, even if this last aspect has semi-quantitative character. Concerning this last aspect it has to highlight the fact that the 25-50% interval considered as a reference system, express a moderate participation of the association components. The other intervals of values under and over this interval, are considered expressing a subordinate and dominant participation, respectively.

INTRODUCTION

The chemical and physical properties of soil are influenced strongly by soil constituents which have high specific surface or highly reactive surface. Since such of surfaces are associated with small particle size, the clay fraction of the soil will be dominant factor influencing interactions between soil components and between those and the other components of the environment.

Clay minerals represent the most active inorganic part of soils, both in terms of their influence on soil properties and functions and of soil response to different natural and/or artificial intervention or stimuls.

The purpose of this paper is to highlight a map which refers to clay minerals distribution in the fraction bellow 2 μm of the surface horizon (A 0-20 cm) in Romanian soils.

MATERIAL AND METHODS

The map has been prepared on the basis of information supplied by the mineralogical studies of the soil clay fraction from Romanian soils carried out in the last 25 years, taking into account not only the field survey and laboratory results, but available soil and lithological maps too. From samples collected from about 400 soil profiles, the results reffering to soil surface horizon (A 0-20 cm) were selected.

The clay fraction was separated by pipette method, after which it was treated with calcium, potasium, chloride and ethylene glycol. The obtained oriented clay preparates below 2 µm were examined by X-ray diffraction.

A method, which use the intensities of the 001 basal reflection of the indentified clay minerals was used for the semi-quantitative evaluation of the mineralogical composition of the clay fraction [3, 4].

RESULTS AND DISCUSSION

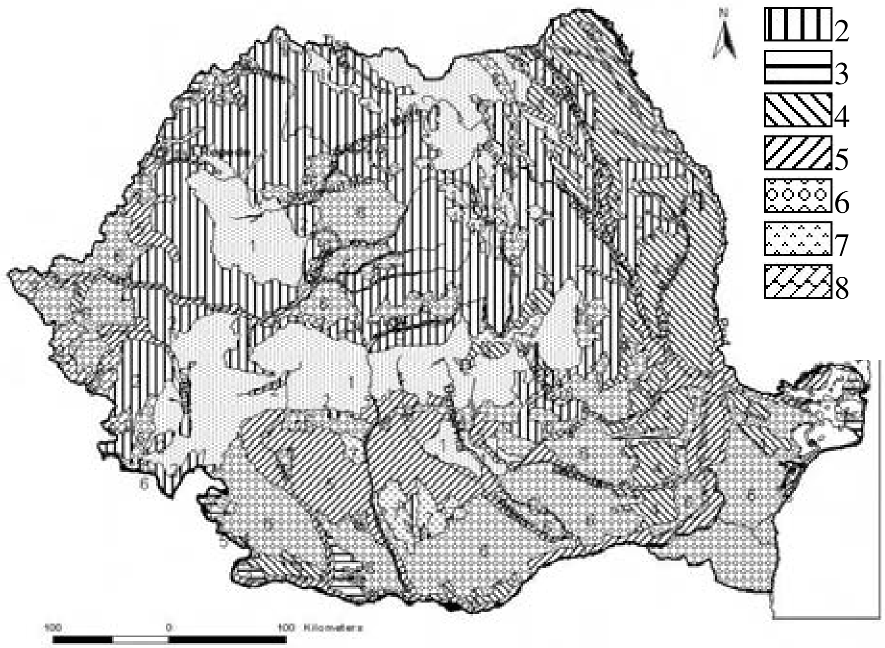
In the figure 1, the mineralogical map of the soil clay fraction from surface horizon of the Romanian soils is presented.

The 8 mineralogical classes in the legend represented by certain clay mineral associations found in the soil surface horizon are displayed in the increasing order of structural mobility, determined especially by the massive presence of some clay minerals having specific crystalo-chemical chracteristics, to promote certain processes which lead to changes of the soil physical and chemical properties.

The changes of physical properties which refer especially to the volume of soil (the solid-lacunar space ratio) and those chemical which refer to the exchange properties of the soil, play a substantial role concerning the soil fertility.

The map provides information concerning not only the clay mineral associations but also the content of components of these mineralogical associations, even if this last aspect has a semiquantitative character. A 25-50% share of clay minerals is regarded as the reference, it proving a moderate participation of the components of such association. The other deviations from the values found below and over this range are considered as expressing a subordonate and dominant participation respectively.

Occurance in dominant quantities of the smectite minerals which have contraction-swelling properties, can induce modifications in the soil particle and aggregates settling or packing at the horizon or soil level. Such modifications can also be deppended by some structural characteristics facilitating the water penetration between the structural layers of the crystalline network of these minerals. The high content of smectitic clays provides to the soil a certain behaviour when wet intervals alternate the dry ones.



Legend

Simbol	Dominant	Moderate	Subordinate
1		I, Cl	C±In
2	I	Cl	C±V, In
3	I		S C
4	I	S	C
5		I, S	C±V, Cl
6		I, S	C±V
7	S	I	C
8	S		I, C

I – Illite
S – Smectite
Cl – Chlorite
C – Kaolinite
V – Vermiculite
In – Interstratifications

Fig. 1. Mineralogical map of the clay fraction (<2μm) from surface horizon of the Romanian soils

The high cation exchange capacity imparts to the status of smectite minerals a significant role to the nutrients or contaminants occurred in soil as a result of certain human activities.

Potasium fixation has been reported for soils containing smectites [1]. However in comparasion with other clay minerals like vermiculite, weathered illite that can occure in these soils as well, the potasium fixation power of smectite mineral is lower. The high CEC of smectite is available to hold fertilizer cations such K and NH_4, macronutrients such Ca and Mg and micronutrients like Cu and Zn.

In the case of some nutrients the temporary fixation facilitates a slow rate of their availibility for plants. In the case of contaminants (heavy metals, radionuclides, hydrocarbons, pesticides) occurance in large quantities of smectite minerals leads to an increase of soil capacity to retain by absorption these substances a certain period of time. In this way the interaction between these contaminants with the other environmental components (air, water) can be impeded [2].

Unfortunately, smectite in large amounts may produce unfavorable hydraulic conditions and root growth may be restricted.

Unlike the soils with prevailing smectitic association, those with dominant and moderate illitic and chloritic associations indicate a more stable structure because these two clay minerals have a rigid structure in comparision with smectite.

Illite is the principal K reserve at the soil colloidal level. As function of its weathering degree, this clay mineral can become an important K source, but it can become a competitor for the plant concerning the nutrients as K and NH_4 proceeded from fertilizers.

The weathered illite (and vermiculite) have a remarcable fixation power for K or NH_4, which is much superior those of smectite.

Chlorite in soil are largely inherited minerals formed as alteration products from minerals such as horblende, biotite and other ferro-manganian minerals. They have a low frequency in soil due primarly to their low stability.

In the majority of the cases, the chlorite from Romanian soils can be considered as hidroxy interlayered minerals (smectite or vermiculite). These minerals may be described as chlorite-like minerals but the interlayer hidroxide sheet (Al or Fe) of the chlorite structure is incomplete.

The presence of hydroxy interlayers in expandable minerals determins certain changes of the soil properties:

- a decrease of some physical properties (tensile strenght, liquid limit, sweeling);
- an increase of the potential sites for anion adsorption;
- a reduction of the effective cation exchange capacity;
- a decrease of K selectivity and fixation.

The other mineralogical components vermiculite and kaolinite show different behaviours but which draw them near smectite and illite respectively.

Their presence in moderate quantities can influence K and NH_4 fixation (vermiculite) and an increase of anion retention (kaolinite). Their influence on the soil properties is much lower due mainly to their small amounts in soil compared to the other clay minerals.

A short characterisation of these mineralogical associations from the point of view of soil-clay quality relation appears necessary.

Association 1 is characteristic for the mountain areas ocupied generaly by podzols and distric cambisols, representing about 15% from Romanian total area.

Association 2 is frequent in the clay from haplic luvisols, albic luvisols and planosols located in zones of hills and plateau (Transylvania, Moldavia and high areas of the West Plain). This association can be found also in the clay of distric cambisols located into a intramontain depressions (Haţeg, Maramureş, Dornelor). The mineralogical diference at the colloidal level between luvisols and distric cambisols is the fact that this association which occures on the all soil profile in distric cambisols, in the case of luvosols it appears only in the surface and eluvial horizons. About 24% from the country surface is occupied by this association.

Association 3 dominated by illite is common for the arenosoils located especialy in the zones of plains (the Easthern part of Romanian Plain, Oltenia Plain, Carei Plain) and Danube Delta. The spreading of this association is very low (about 1%).

Association 4 is frequent in the clay of kastanozems (N-Dobrogea) and chernozems from plain zones (Transylvania, Moldavia, E-Romanian Plain). The soils which have this type of association at the clay level in the surface horizon ocupy about 10% from the total country area.

The next type of associations (5 and 6) are quite similar from the clay mineralogical composition point of view. The two principal components of the clay illite and smectite occure in moderate quantities, the difference reffering to the order in witch they are presented. This order suggest a weak domination tendency of the respective mineral. These association are frequently met in the areas from South part of Romania occupied by chernozems (Dobrogea, Romanian Plain, Banato-Crisan Plain) and phaezems (the high areas of these mentioned plains and Est part of Transylvania Plain).

The association 5 is also frequent in clay of fluvisols. The area occupied by these two associations togheter is about 40% from total surface area of Romania.

The last two types of minerals associations (7 and 8) have a similar characteristic given by the smectite domination which can be accompanied in moderate quantities (case frequent to gleyosols and sometimes to eutric cambisols) and in subordinate quantities (case frequent to vertisols) by illite.

The mentioned soils occur frequent in Banat Plain, Banat Hills, Moldavia Plain, Romanian Plain between Olt and Arges rivers (vertisols) and in Somes Plain, Timis Plain (gleyosols). The occupied surface by these two associations represent about 10% from total surface of the country.

CONCLUSIONS

1. The map of clay mineral association in the clay fraction (<2 µm) from the surface horizon of the Romanian soils highlight 8 mineralogical classes, ordered ascending by structural mobility determined by the massive presence of some clay minerals having specific crystalo-chemical characteristics to promote certain processes, which leads to changes of the soil physical and chemical properties.
2. The clay minerals which occur in the clay fraction from the surface horizon of the all Romanian soils are illite and kaolinite. In comparison with the illite, which occurs with rare exceptions, in dominant and moderate quantities, the kaolinite occurs with very rare excetions in the subordinate quantities.
3. The two minerals are accompanied by smectite, chlorite and vermiculite. In comparision with smectite which can become a dominant component, the other two clay minerals occur only in moderate or subordinate quantities. In the certain cases the interstratifications can be presented, too.
4. The mineralogical associations dominated by illite occur in the soils which take up a surface which represent about 40% from the total country area, while the associations dominated by smectite, ocupy about 10% from the same area.
5. A surface of 40% from the total country area is occupied by the soils, with clay fraction composed by illite and smectite in moderate quantities.

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SOME PEDO-ECOLOGICAL CHARACTERISTICS OF THE ACTIVE LAYER OF VERTIC LUVOSOL FROM ALBOTA - ARGES

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Keywords: *Luvosol, land capability, micromorphology, mineralogy*

Abstract

The paper point out, by the aim of the field observations and the laboratory data, some pedo-ecological characteristics of the active layer of the Vertic Luvosol from Albota – Arges. The results showed that pedological properties were affected by tillage, the horizon being structureless and moderate compacted. As a result, the micromorphological characteristics were also influenced: the structure being with packing and rarely with planar voids (or fissures) induced by a moderate compaction. The mineralogical composition of the clay (<2μm) showed the dominance of the chlorite and illite (the kaolinite being very low). The smectite appears as distinct phase under the active layer (giving to the Luvosol the Vertic character). The ecological characteristics of the active layer are emphasized by the soil reaction that is strong acid and the exchanges properties (cation exchange capacity and base saturation degree), which have small to medium values. The organic matter and the clay (the two main components of the soil colloidal complex), suffer quantitative and qualitative changes under the influence of the pedological processes. The organic matter content is small. The values of the nitrogen are medium and of the mobile phosphorus are high. The mobile potassium values are medium-low. The micronutrients supply of the soil is over the susceptibility limit. In these conditions, the land capability for crops production of the studied area belongs to the II-nd class, with low limitations for crop production, being the most favorable for wheat, maize, potato and sugar beat (52 points for each crop), and the less favorable for sunflower (37 points).

INTRODUCTION

The ecological characteristics of the soil are strongly influenced by the properties of the edaphic environment.

The aim of this paper is to present the data concerning some properties (micromorphological, mineralogical, physical and chemical) of the active layer of the Vertic Luvosol from Albota – Arges and the consequences of these properties from the ecological point of view.

MATERIAL AND METHODS

The investigated site is located in the experimental field of the Research Development Agricultural Station Albota, in the Piteşti Plain (part of the West Romanian Plain), on a terrace of Arges River [1]. The soil is Vertic Luvisol formed in loess-like deposits. The absolute altitude is 334 m. The average of the annual temperature is 9.8^{o}C and of precipitations is 700 mm, while the potential evapotranspiration is 662mm and the aridity index is 34. The water table is at > 10 m depth. The vegetation was, in the past, the *Quercus* forests, replaced at present by the arable lands and pasture. The soil was sampled from the active layer (the upper 50cm): for the micromorphological (undisturbed samples), as well as for the mineralogical, physical and chemical analyses. The analytical determinations were carried out by using ICPA methodology [2, 3].

RESULTS AND DISCUSSION

A structural crust was formed in the topsoil (1-1.5 cm), as a result of the aggregate collapse, under the raindrop impact.

From the morphological point of view, the surface horizon (Ao+El)p (0-23 cm) has a loam texture and a very dark grayish brown – dark brown (10YR 3/2.5) color when wet. The structure was affected by tillage, the horizon being structureless and moderate compacted. Along the horizon there were observed very fine and frequent plant roots, as well as the fine pores. Small nodules (Fe±Mn) appear randomly distributed into the surface horizon. The morphology of the El horizon (23-32 cm) is relatively similar with the top horizon, but more friable when dries. The EB (31-50 cm) horizon has a different morphology: loam texture and dark grayish brown - brown (10YR 4/2.5) color when wet. The structure is medium subangular blocky, well developed. The fine pores were frequents and the fine roots rare. Small and frequent nodules (Fe±Mn) were also present into the horizon.

At microscopic level the characteristics of the upper part of the active layer (the [Ao+El]p and El horizon respectively) are also the same, showing a structure (figure 1) with packing and planar voids as a result of a moderate compaction and a small-medium subangular blocky and vughy structure (generated mainly by the soil fauna activity). Sporadically were observed deformed lumbric canals (as a result of compaction). The soil plasma is poor in humic substances. The amorphous features as very small (0.5-2mm) Fe± Mn nodules were observed into the horizon matrix. The micromorphology of the EB horizon showed a complex structure: spongy (with more or less interconnected voids) and vughy structure (with many irregular voids generated by mezofauna activity) and small areas with packing voids (due to the compaction processes). The other characteristics are, generally, the same as the other two horizons.

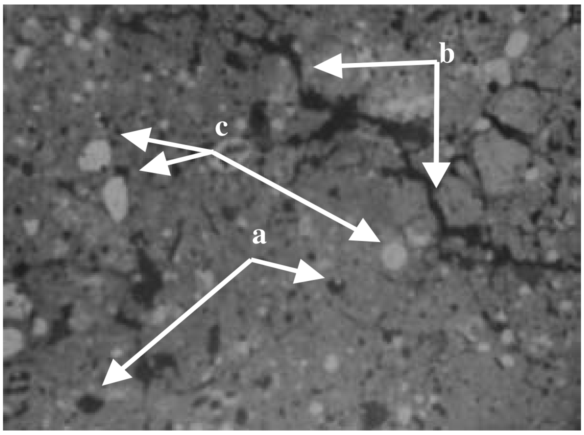

Fig. 1. The El horizon: compacted area with packed voids (a); planar voids (b); Fe± Mn nodules (c).

The granulometric analysis (figure 2) showed that clay content is 26.1% in the upper part of the active layer and increased to 30.9% in its bottom part. The loam has higher values than the clay (33.7% – 35.4%), while the coarse sand have the lowest values (11.5%-11.4%), comparing with the others granulometric fractions. The fine sand content is medium (26.2%-22.3%) and decreases with the depth.

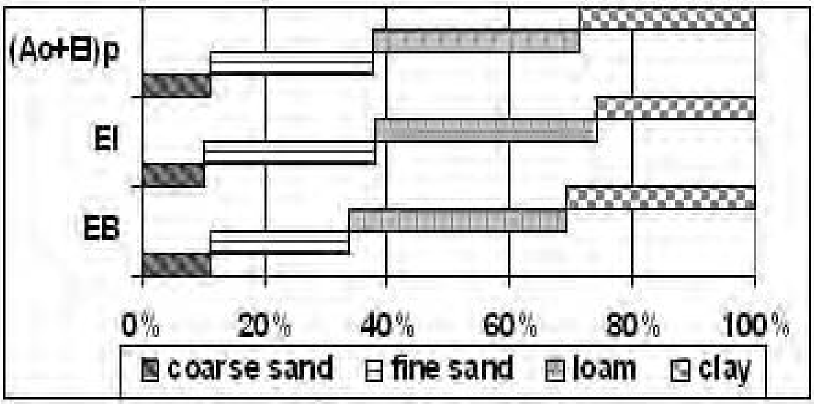

Fig. 2. The granulometry of the active layer of Vertic Luvosol

The mineralogical composition (figure 3) of the clay (< 2μm) showed the dominance of the chlorite and illite (46-51% and 41-46% respectively), while the kaolinite content is very low (8%). The smectite minerals, as distinct phase, became the dominant component of the clay under the active layer (giving to the soil the Vertic character).

The total porosity is high (52%) in the surface horizon and medium in the El and EB (42% and 43% respectively). The bulk density is also high (1,27 gcm^{-3}) in the upper horizon medium-high in El (1.56 gcm^{-3}) and EB (1.52 gcm^{-3}). The resistance of the soil to penetration in low (14 kgf/cm2) in the first 22 cm and it is medium (25-34 $kgfcm^{-2}$) under this depth. The field capacity is medium to high (23.5-25.6%) and the available water capacity is very high (13.3-17.2%). The wilting point is low to medium (8.2-10.2%gg^{-1}). The permeability of the (Ao+El)p horizon is high (16.3mmh^{-1}) and medium (3.3-3.8mmh^{-1}) in the others two horizons.

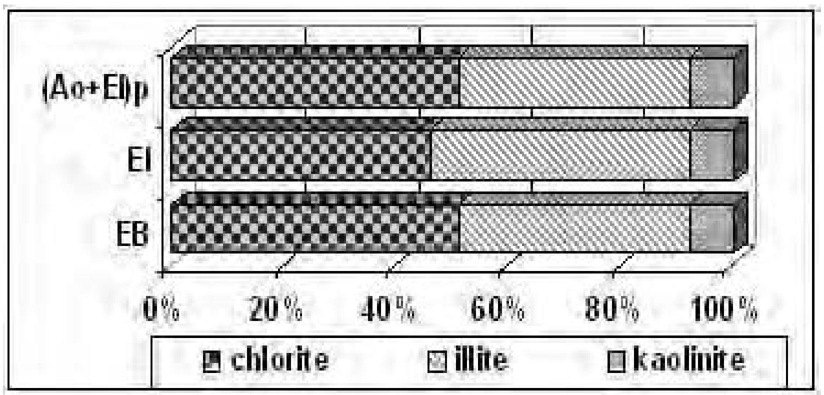

Fig. 3. The mineralogical composition of the clay (< 2μm)

The organic matter content decreases with the depth: from the 2.94% in the (Ao+El)p horizon to 2.70% in El and 1,56% into the EB horizon. The pH is strong acid (5.02-5.03) into the upper horizons and medium acid (5.18) in the EB horizon. In spite of an acid pH, the exchangeable Al content is low (0.92-1.39 me/100gsoil) in the all studied horizons. The cation exchange capacity is also low (18.86-19.46 me/100g), while the base saturation degree is high (57.3-73.9%). The values of the total N content (0.120-0.135%) and mobile K (69-75ppm) are low, while of the mobile P are high (49 ppm) in the (Ao+El)p horizon and low (11 ppm) in El, respectively.

The ecological characteristics of the soil active layer are emphasized by the reaction that is strong acid and the exchange properties (cation exchange capacity and base saturation degree), which have small to medium values. The organic matter and the clay, the two main components of the soil colloidal complex, suffer quantitative and qualitative changes under the influence of the pedological processes. According to the base saturation degree the soil is oligomesobasic. The organic matter content is low. The nitrogen content is medium, while the mobile phosphorus is high and the potassium is medium-low. The micronutrients supply of the soil is over the susceptibility limit.

In what concerning the land capability, the studied area belongs to the II-nd class, having a good capability for crop production and low limitations. The limiting factors for the arable land is the clayey texture (from the 40 cm depth), which induced: stagnogleysation, vertic process and hardpan formation. After the agro-pedomelioration (including irrigation) the land is most favorable for the wheat, maize, potato and sugar beat (52 points for each crop), while the less favorable is for sunflower (37 points).

CONCLUSIONS

1. The obtained results showed that the pedological characteristics (micromorphological, mineralogical, physical and chemical) of the active layer of the soil were influenced by the properties of the edaphic environment and by soil tillage.
2. The ecological characteristics of the active layer developed on the background of an oligomesobasic soil (according to small-medium base saturation degree), due to a strong acid reaction, a small-medium exchange cation capacity, a low organic matter content and a moderate good micronutrient supply.
3. The studied area belongs to the II-nd class of land capability for crop production, having low limitations for crop production and being most favorable for wheat, maize, potato and sugar beat, and less favorable for sunflower.

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MICROMORPHOLOGY AND EVOLUTION OF THE IMPURE CLAY COATINGS IN SOME PHAEOZEMS FROM ROMANIA

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Keywords: *impure clay coatings, micromorphology, Phaeozem*

Abstract

The paper point out, by the aim of micromorphology, the characteristics and the evolution of the impure clay coatings. The study was focused on four Phaeozems from Romania, soils with a high content of organic matter and a relatively intense iluvial process. The micromorphological researches were performed: 1) on soil thin sections (20-30µm) prepared from the undisturbed soil and studied with optical microscope; 2) on soil aggregates, studied with the scanning electron microscope (SEM). The results showed that in the studied Phaeozems many types of illuvial coatings appear: from the impure clay coatings (with organic±mineral impurities) to limpid clay coatings (free from impurities). The observations with optical and scanning electron microscopes showed that the impure clay coatings are colonized by the microorganisms which, in time consume the organic constituents (impurities) having two important results: 1) gives to the coatings a layered appearance; 2) induce the evolution of these coatings which became, in time, limpid clay coatings (after the total consumption of the organic matter). As a result of the microorganism activity, sequences of many types of illuvial clay coatings (with different quantities of impurities) were observed in each studied Phaeozem. All these aspects underlined that biological activity has a very high influence on the evolution of clay coatings, soil being not only a simple habitat for them, but also a result of their activity.

INTRODUCTION

The acquisition of knowledge of the microhabitats and the interaction of microorganisms and soil is a challenging task, as little is known about the related processes at microscale [1]. Micromorphological studies of the spatial relationships between soils and microorganisms have been made since '80s [3]. Although there are many approaches to investigate microorganisms in soil [2] the knowledge of distribution and colonization behavior of soil microorganisms is limited [1].

The objective of the paper was to point out, by the aim of optical and scanning electronic microscopes, the micromorphological characteristics and the evolution of the impure clay coatings from some Phaeozems from Romania.

MATERIAL AND METHODS

Four soil profiles were studied:

P_1 - Cambic Phaeozem (Haplic Phaeozem – WRB-SR, 1998) located in Târgu Secuiesc Depression, formed in (stratified) clayey loam deposits; on piedmont relief with 565 m absolute altitude and the water table at 10m; the mean annual temperature (Tma) and the total annual precipitation (Pma) are 7,1^{o}C and 598,7mm, respectively.

P_2 - Cambic Phaeozems (Haplic Phaeozem – WRB-SR, 1998) and

P_3 - Argic Phaeozems (Luvic Phaeozem – WRB-SR, 1998), both located in Suceava Table-land, formed in marly clayey deposits, on the absolute altitude of 380m and the water table at 4-5m; with Tma = 9,6^{o}C and Pma = 675mm.

P_4 - Tipic Rendzinic Phaeozem (Endoleptic Phaeozem – WRB-SR, 1998) located in Miercurea Ciuc Depression, formed in clayey loam alluvo-proluvial deposits, at 690m absolute altitude; the water table is at >10m; with Tma = 5,9^{o}C; Pma = 577 mm. All soil profiles are located on arable land.

For the micromorphological study, undisturbed soil was sampled from each horizon of the four soil profiles, impregnated with polyester resins and used to prepared thin sections (20-30µm and 6x9cm), studied, afterwards, with Amplival microscope. Soil aggregates were also sampled for the scanning electron microscope (SEM) analyzes.

RESULTS AND DISCUSSION

The micromorphological study, aimed on optical and scanning electronic microscopes, emphasized (in each horizon of the studied Phaeozems) the presence of a large number of different types of illuvial coatings: from the clay coatings containing abundant organic-mineral impurities (humons, Fe, etc.) of fine silt-size and known as *impure clay coatings*; to coatings with sporadically or no impurities, the classical illuvial clay coatings, known as *limped clay coatings*.

The presence of such a mosaic of coatings is difficult to be explained only on the base of alternating seasonal climatic conditions or on polyphasic evolution of the soils (in which case, the older coatings should be present in the deeper horizons of the soils).

The most frequent coatings are the impure clay coatings, known (in SRCS, 1980), as “organic-mineral coatings” being also a diagnostic criterion of the Phaeozems (previously named Chernozem-like soils).

The impure clay coatings have a specific morphology: dark color due to the presence of the organic matter impurities, which covered the clay. The dark color of the organic matter (impurities) reflects the specific conditions of its transformation: a high humidity and the presence of microorganisms, which by autholysis produced blackish, melanized organic plasma (humons). These types of clay coatings are the most frequent coatings in the studied Phaeozems, being practically specific for the mollic epipedon. Such impure clay coatings were also observed in Chernozems (Răducu, 2000).

Together with these coatings appears, relatively frequent, clay coatings with less organic matter. Many of them have layered structure (alternating layers of different composition and color).

The optical microscopes (figure 1 and 2) and SEM (figure 3) observations showed: that the impure clay coatings are colonized by the microorganisms that, in time "biodegraded" the organic constituents (impurities) having two important results: 1) gives to the coatings a layered appearance (figure 1 and 2-a); 2) induce the evolution of these coatings which, in time, became limpid clay coatings (figure. 2-b), after the total consumption of the organic matter [4]. As a result of the microorganism activity, many types of illuvial coatings (with different quantities of impurities) are present in each studied Phaeozem.

The importance of this paper release from: 1) the technique used in the study, based on microscopic tools (optical and electronic microscopes) which are major in the researches of soil processes and pedofeatures and 2) the results, which showed that microorganisms have a huge influence on the characteristics of soil pedofeatures (clay coatings) and their evolution, unknown until now.

It was supposed that the layered structure of the textural pedofeatures is the exclusive result of a successive deposition of illuvial material having different composition and that limpid clay coatings are old illuvial coatings deposited in more humid climatic conditions.

The paper clearly emphasized (also by the aim of the images - figure 1-3) that microorganisms are more than simple soil habitants. They built the soil, according to their needs and together with the others pedogenetic factors, and influenced the characteristics and the evolution of the pedofeatures (impure clay coatings respectively).

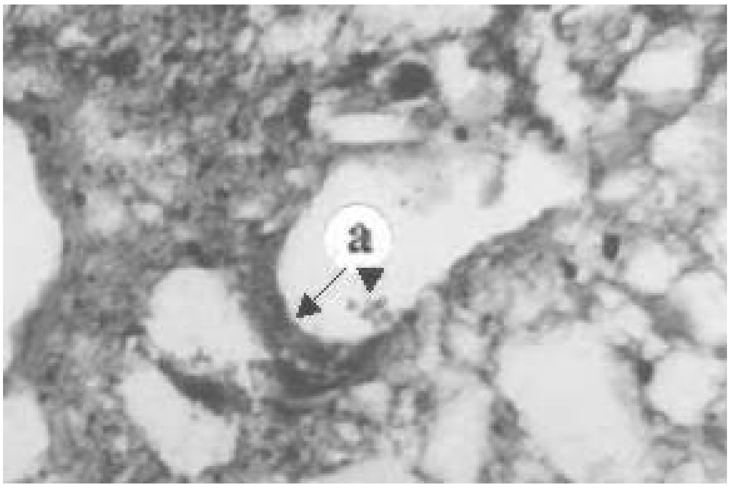

Fig. 1. ***Impure clay coatings with microorganisms (P2); 75X, N II***

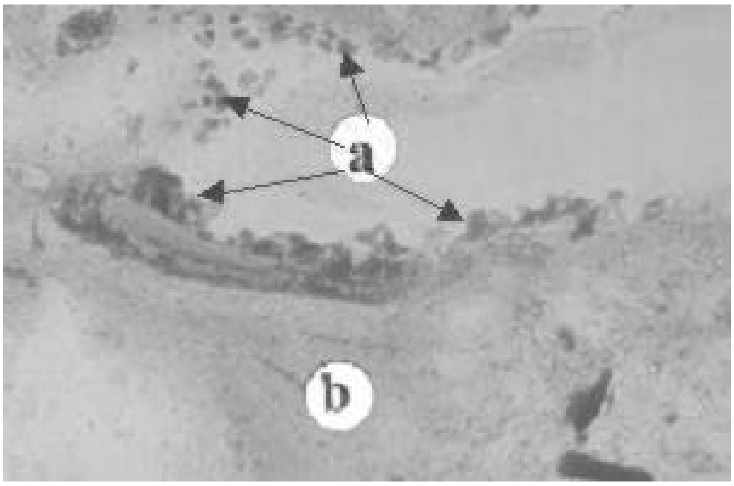

Fig. 2. ***Impure clay coatings with microorganisms (P1); 184 X, N II***

Fig. 3. M*icroorganisms on clay coatings (P4); SEM, 2000X*

CONCLUSIONS

1. Many types of illuvial coatings were observed in the studied Phaeozems: from the *impure clay coatings* containing abundant organic-mineral impurities to the *limped clay coatings* with sporadically or no impurities.
2. The optical microscopes and SEM observations showed: that impure clay coatings are colonized by the microorganisms that consume, in time, the organic constituents (impurities).
3. The microorganism activity has two important results: 1) gives to the coatings a layered appearance; 2) induce the evolution of the impure clay coatings throughout limpid clay coatings.
4. As a result of the microorganism activity, many types of illuvial coatings (with different quantities of impurities) are present in each studied Phaeozem.
5. The microorganisms are more than simple soil habitants, they built the soils according to their needs and, together with the others pedogenetic factors, induce specific characteristics of the textural pedofeatures (clay coatings) and influence their evolution.

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ASPECTS CONCERNING MORPHOLOGICAL, CHEMICAL, PHYSICAL AND AGROPRODUCTIVE CHARACTERIZATION OF THE GLEYIC SOLONETZ FROM VIZIRU PLANE

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Keywords: *plain, soils, gleyic solonetz*

Abstract

Situated in the Southern extremity of the Romanian Plane, Viziru Plane presents a relative large soils scale, unified in Cernisoils and Salsodisoils classes. From Salsodisoils class are found gleyic solonetz that occupies relative small areas (900 ha) and appears locally in Northern part of the plane, which corresponds to some microdeppresions area imperfect drained.

INTRODUCTION

In the present paper the collective author presents some aspects concerning morphological characteristics, chemical and physical attributes concerning agroproductive characterstics of gleyic solonetz from Viziru Plane.

MATERIAL AND METHODS

To establish the principal properties of the gleyic solonetz from Viziru Plane a series of chemical and physical analyses were effected. Physical analyses effected on soil drawing samples were ascertained in apparent density, total porosity, aeration porosity, withering coefficient, field capacity, utile water capacity, total capacity for water and saturate hydraulic conductivity determination.

Chemical analyses were ascertained in determination of the: pH, organic matter, total nitrogen, accessible phosphorus and potassium.

Physical and chemical analysis for drawing soil samples were made in conformity with “Methodology of pedologycal studies elaboration” made by I.C.P.A. Bucharest and soils type were established in conformity with “Romanian System of Soils Taxonomy, 2003”.

RESULTS AND DISCUSSION

From geographical point of view, Viziru Plane is situated in Eastern extremity of the Romanian Plane, in a subunit of this, the Northern Baragan.

Geologically, like part of the Romanian Plane, Viziru Plane is formed and it has evolved concomitant with this. Surface deposits are represented by loess, loess deposits and sandy aeolian deposits.

Relief is formed of one plate plane with altitudes by 20 - 21 m at South from Viziru locality and 13 - 16 m in North part (Braila). Although the plane surface is apparent plate, this is distrubed in North by sand dunes and in central part by some low portion with callow aspects named gullyes.

As result of effected researches in Viziru Plane, it was put into evidence a relative large scale of soils unified in class Cernisoils and Salsodisoils.

From these the smallest spreading have soils from Salsodisoils class that occupy 7% through territory. Among soils from this class are counting gleyic solonetz (900 ha), over which we stop in this paper.

In the frame of the Viziru Plane, gleyic solonetz appear locally, on small area, in Northern part that corresponds with micro callows. Gleyic solonetz presents the following morphological characters:

Ao horizon (0 - 12 cm), texture (LL) average clay, dark brown nuances color (10YR 3/1) at wet state, and brown dry state (10YR 4/1), granular, weakly compact, herbs roots relative gauge frequents, clear passing.

Btna horizon (12 -65 cm), texture (LL) average clay, dark gray brown (10YR 3/2) at wet state, and gray dry state (10YR 5/1), columnar, compact, separation ferimanganics, net passing.

Cca horizon (65 – 90 cm), texture (LL) average clay, dark yellowish brown (10YR 5/4) at wet state, and yellowish brown dry state (10YR 5/4 cu 4/1), slightly compact, massive, newformation limestone and salt, gradual transition.

C/Go horizon (90 – 130 cm), texture (LL) average clay, yellowish brown with spots of color dark gray (10YR 5/4) at wet state, and gray open dry state (2.5YR 7/2), newformation limestone and salt, gradual transition.

Gr horizon (under 132 cm), sandy-claying (LN) texture, gray (10Y 5-6/1) frequency spots yellowish red and greenish gray, massive, separation ferimanganics and stains, concretion small $CaCO_3$ friable.

Physical and *hydro-physical characteristics*. Gleyic solonetz shows clear differentiation texture on profile, but in the same class (medium). Thus if Ao horizon in clay is 22.6%, in Cca, this significantly increases, reaching 27.3% in Btna, for deep decrease slightly, reaching 19.6% in Gr horizon (table 1, figure 1). Btna horizon is extremely compacty in state dry, but state in wet becomes a table viscous, plastics and impermeable.

Chemical characteristics. Organic matter content up to 12 cm presents medium values (4.05%), then becomes smaller in depth. Low values presents also the supply of nitrogen (0.07 – 0.22 %) (table 2, figure 2). Reaction of the gleyic solonety is neutral in the superior part (pH = 7.1), and below where complex adsortiv is saturated change in sodium large proportion becomes weak to strong alkaline (table 2, figure 2). In the composition of soluble salts it is remarkable the high content of Na^+ (table 3).

Table 1

Analytical data regarding particle size distribution of the gleyic solonetz

Horizons	Depth cm	Granulometric composition (mm in %)				Texture
		Coarse sand (2.0 – 0.2)	Fine sand (0.2 – 0.02)	Dust (0.02 – 0.002)	Clay < 0.002	
Ao	0 – 12	1.2	51.4	24.8	22.6	LL
Btna	12 – 65	1.3	48.9	22.5	27.3	LL
Cca	65 – 90	1.4	48.1	22.0	28.5	LL
CGo	90 – 130	0.1	50.5	24.8	24.6	LL
CGr	130 - 140	0.1	59.1	21.2	19.6	LN

Table 2

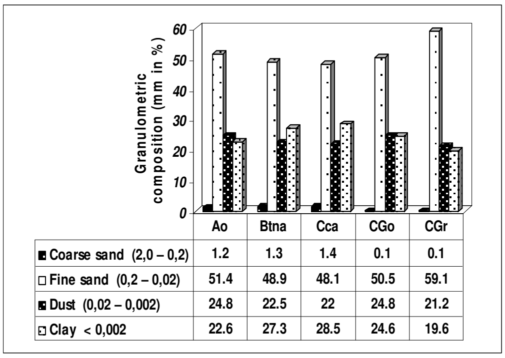
Analytical data regarding chemical properties of the gleyic solonetz

Horizons	Depth cm	pH (H_2O)	Organic matter %	N total %	C/N	*$CaCO_3$ %*
Ao	0 – 12	7.1	4.05	0.22	12.4	-
Btna	12 – 6 5	8.2	2.96	0.13	15.6	-
Cca	65 – 90	8.9	0.64	0.09	13.5	*26.8*
CGo	90 – 130	9.3	0.29	0.07	12.0	*29.8*
CGr	*130 - 140*	*9.3*	-	-	-	*22.0*

Table 3

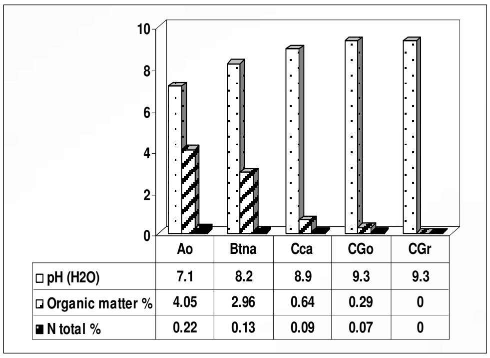
Analytical data regarding soluble salt content (in aqueous medium 1: 5) of the gleyic solonetz

Horizons	Depth cm	Soluble salts %	HCO^-_3	SO^-_4	Cl^-	Na^+
			% the amount soluble salts			
Ao	0 – 12	0.05	17.7	15.0	17.3	34.4
Btna	12 – 65	0.12	14.9	10.4	24.7	39.5
Cca	65 – 90	0.51	3.0	2.5	43.9	43.4
CGo	90 – 130	0.35	4.8	4.5	38.4	45.9
CGr	130 - 140	0.28	6.1	6.6	34.5	44.5



	Ao	Btna	Cca	CGo	CGr
Coarse sand (2,0 – 0,2)	1.2	1.3	1.4	0.1	0.1
Fine sand (0,2 – 0,02)	51.4	48.9	48.1	50.5	59.1
Dust (0,02 – 0,002)	24.8	22.5	22	24.8	21.2
Clay < 0,002	22.6	27.3	28.5	24.6	19.6

Fig. 1. Granulometric composition of the gleyic solonetz



	Ao	Btna	Cca	CGo	CGr
pH (H2O)	7.1	8.2	8.9	9.3	9.3
Organic matter %	4.05	2.96	0.64	0.29	0
N total %	0.22	0.13	0.09	0.07	0

Fig. 2. Chemical properties of gleyic solonetz

Agro-productive characteristics. Gleyic solonetz is characterized by small natural fertility. Fertility is low because of the high Na changeble and possibly slightly soluble salts, to which is added the water regime and heat regime. The largest part of gleyic solonetz are used as pastures, but with small productivity. To improve the soil is costly.

CONCLUSIONS

1. Gleyic solonetz are soils with local spreading, occupying a surface of approximate 900 ha.
2. These soils have physical and chemical properties less favorable, which lead to low fertility.
3. These are soils with weaker fertility comparative to other chernozems because of the relative high content of changeable Na and easy soluble mineral salts, they are used mostly as pastures.

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MODIFICATION OF SOME INDICATORS OF THE PRODUCTION POTENTIAL IN PLUM, UNDER THE INFLUENCE OF EDAPHIC CONDITIONS SPECIFIC TO SATURATED SOILS

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Keywords: *plum, calcium carbonate, saturated soils*

Abstract

The favorability evaluation of a field for the fruit growing culture is performed taking into account not only the climatic conditions of the field and the soil conditions. For the industrial cultivation of fruit species on saturated soils, the factor which conditions the production potential can be ordered into four groups: soil carbonates and the phyto-toxicity of calcium, the aero-hydrical regime, the probability of the appearance of secondary compacting and the risk of the starting of calcic chlorosis. The research led to the identification of limiting factors specific to saturated soils, and distinguished the fact that the nutritional unbalances induced by the presence of these in the soil, do not manifest just at the roots level through the modification of the root system distribution and the appearance of dead roots but also at the upper part of the trees through the decrease of trunk thickness growing, a steady indicator of the production potential.

INTRODUCTION

The trunk thickness of trees in an orchard is induced by age and soil conditions, the climatic influence is evenly in the frame of limited surface which it is covered in an orchard. The research led to the identification of limiting factors specific to saturated soils and they have distinguished the fact that the nutritional unbalances induced by the presence of these in the soil do not manifest just at the roots level through the modification of the roots system distribution and the appearance of dead roots but also at the upper part of the trees through the decrease of trunk thickness growing, steady indicator of production potential [1]. Recent research reveals that from the 227,200 hectares of orchards and fruit growing nurseries of the Romanian fruit growing resources (2003), 52% are located on saturated soils (figure 1) characterized through the prevalent saturation of the clay-humic complexes with calcium and magnesium ions.

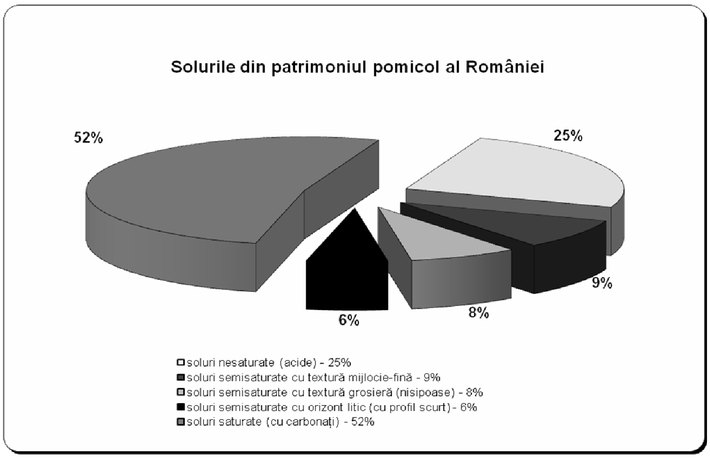

Fig. 1. Pedological structure of the Romanian fruit tree patrimony

MATERIAL AND METHODS

For the relevance of the information regarding the nutrition condition of fruit species on saturated soils, the properties of soil established according to the ICPA [4] methodology they have grouped in three categories: physical properties, soil fertility and the properties of cationic change.

In plum, the studies were performed on the cultivars Busuioaca and Stanley, on antrosoil at Dragoieni, Gorj county and in the cultivar Vanat romanesc at a typical regosol at Zalau, Salaj county, and for the comparison of the results on eutricambosol at Balota, Mehedinti in optimum ecological conditions considered.
The revealing of limiting soil factors upon the root system was realized in graphic form through the synthetic root system indicators: surface of root section (SSR); surface section of dead roots (SSRM); root frequency (FR); root distribution index (IDR). These three indicators react to the presence in soil of limiting factors inducing modifications opposite of normal distribution of the fruit trees root system [2].

RESULTS AND DISCUSSION

Between the trunk thickness and the production potential of fruit trees there is a direct link, every decreasing of the truck thickness opposite the normal values for the counted age is followed by the proportional decreasing of the production level, with major effects upon the economic efficiency of the orchards.

The root system as the first organ of the fruit trees, which are in contact with the soil reacts at the specific conditions of nutrition, modifying their distribution under the effect of concerted factors [3].

The effects of the unfavourable soil conditions act on the root system distribution are visibile in the cultivar plum Busuioaca grafted on Myrobolan, 6 years old, on the calcic argic antrosoil from Dragoieni, Gorj county (figure 2).

pH (H_2O)	DA (g/cm^3)	PA (%)	Clay < 2µ (%)	$CaCO_3$ Total (%)	$CaCO_3$ Activ (ppm)	Name and thickness
8.1	1.42	11	49.8	17.4	1.75	Ap 25 cm
8.1	1.53	5	45.0	20.1	1.37	Cpr_1 35 cm
7.8	1.36	15	40.2	19.3	1.25	Cpr_2 10 cm
5.2	1.63	3	42.3	0	0	Bt 30 cm

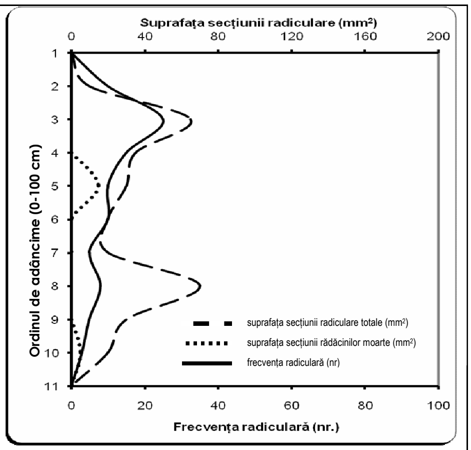

Fig. 2. Modification of the root system distribution under the concerted effect of the appearance density, airing porosity and the $CaCO_3$ content in the plum Busuioaca/Myrobolan at the age of 6 years, on calcic argic antrosoil at Dragoieni, Gorj county

The small values of the root cross section area and the root frequency from the Cpr and Bt horizon are due to unfavourable aero-hydric condition induced by the air porosity and the high dry bulk density.

The curve of the root cross section area distribution is correlated in this case, with the values of the dry bulk density, air porosity, and penetration resistance, registering bigger values in the the Ap and Cpr_2 horizon and lower in Cpr_2 and Bt horizon. The unfavorable condition from the Cpr_1 and Bt horizon, had as effect the appearance of dead roots.

Once with the depth it can be observed the decreasing of the root frequency values and the increasing of the root cross section area which indicates the presence at this level, mostly of the dead base roots with a great diameter, frequently over 10 mm.

The effect of this nutritions condition is reflected in the growing in thickness of the trunk, which at age of 6 years has a diameter of just 6.37 cm (79.43%) opposite of the potential of 8.02 cm in normal nutrition condition (table 1).

The decreasing effect of the unfavorable soil condition can be observed also in the case of the Stanley plum cultivar grafted on myrobolan on calcic argic antrosoil from the same zone.

In this conditions induced by the soil properties, the fruit tree realizes at 6 years old, a trunk circumference of only 19 cm, according to a diameter of 6.05 cm opposite of the diameter 7.7 cm wich it could be realized in optimum conditions.

The same data analysis methodology has also been applied in the case of a field planted with plum, Vanat romanesc cultivar, grafted on myrobolan, 8 years old, on a tipical regosol at Zalau, Salaj county, placed in the superior one third of a slope with 10 % gradient and SV exposition.

Although this will not present major restriction factors with the exception of the fertility one, which can be improved, from the root distribution analysis it can be observed a lax modification in the sense of quartering of the major root mass in the median zone of the soil profile and the presence of little amount or the absence of roots in the Ao and C3 horizons (figure 3).

pH (H_2O)	DA (g/cm^3)	PA (%)	Clay < 2µ (%)	$CaCO_3$		Horizon
				Total (%)	Activ (ppm)	
8.48	1.25	20	38.6	9.4	4.5	Ao 20 cm
8.65	1.55	28	25.8	8.0	3.6	C_1 30 cm
8.50	1.54	12	27.0	2.1	1.2	C_2 40 cm
8.68	1.35	19	24.5	11.6	5.1	C_3 10 cm

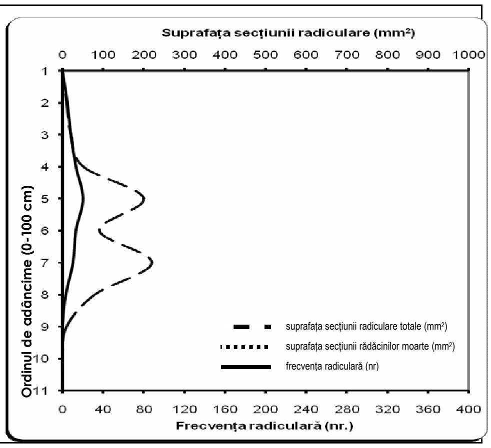

Fig. 3. Modification of root system distribution unde the effect of increased quantity of $CaCO_3$, in Vanat romanesc cultivar/Myrobolan at the age of 8, on a typical regosol in Zalau, Salaj county

This movement induced by the presence of some increased quantity of calcium carbonate in the Ao and C3 horizons. As it results from the analytical data and the distribution curves of the root system, although in this levels the amount of active calcium carbonate do not reaches the toxicity threshold which could induce the appearance of dead roots, this has an inhibition effect upon the growing and development of the roots.

Simultaneously with this, on the decreased fertility content of the soil it can be ascertained also a decreasing regarding the number of active roots which is maintained on the whole soil profile, this aspect is revealed by the little amplitude of the root frequency curve.

This leads to a decreasing of the soil volume explored by the roots and the quantity of the nutrition elements available for the tree.

Table 1

Effect of nutritions condition act on the trunk growing thickness

No.	Location	Soil type	Eclogical conditions	Cultivar/ rootstock	Age	Trunk indicators			
						Circumf. (cm)	Ø realized (cm)	Ø normal (cm)	% realized
1	Dragoieni/ Gorj	calcic argic antrosoil	Critical	Busuioaca/ Myrobolan	6	20	6.37	8.02	79.43
2	Dragoieni/ Gorj	calcic argic antrosoil	Critical	Stanley/ Myrobolan	6	19	6.05	7.7	78.57
3	Zalau/ Salaj	typical regosoil	Critical	Vanat rom/ Myrobolan	9	28	8.92	18.96	47.05
4	Balota/ Mehedinti	stagnic preluvosoil	Optimum	Vanat rom/ Myrobolan	10	51	16.24	15.80	102.8

- semisaturated soils with medium fine texture   - saturated soils (with carbonates)

The data present in table 1 are reveal the fact that in optimum nutrition conditions, the tree could realize a trunk diameter of 18.96 cm. The unfavorable nutrition conditions which is offered by the presented soil, had a strong inhibition effect upon the thickness growing of the trunk, therefore at age of 9 with a diameter of only 8.92 cm, this realizes only 47.05% from the potential.

The characteristics of these soils and the effects of these on soils, were compared with the properties of a stagnic preluvosol from a plum plantation Vanat romanesc/Myrobolan, in the age of 10 at Balota, Mehedinti county.

Compared with the above mentioned situations in the lack of limiting edaphic factors, the root system has a normal distribution on the soil profile, characteristic for this cultivar/rootstock combination (figure 4).
The distribution curves of the root system reveal a profound rooting with a high index of root distribution of 4.59. The analysis of root distribution curves shoes that a great amount of the active roots are billeted in the superior part of the soil profile, at the level of Ao and A/B.

The good nutrition conditions have as effect an adequate development of the airy part, which could be appreciated through the trunk thickness.
Data from table 1 reveal the fact that at age of 10 the tree realizes a trunk circumference of 51 cm proper to a diameter of 16.24 cm (102.8%) opposite to the diameter of 15.8 cm, normal at the optimal ecological conditions.

pH (H_2O)	DA (g/cm^3)	PA (%)	Clay < 2µ (%)	$CaCO_3$ Total (%)	$CaCO_3$ Activ (ppm)	Horizon
5.60	1.38	20	22.7	-	-	Ao 33 cm
5.60	1.39	18	24.3	-	-	A/B 12 cm
5.37	1.40	14	36.6	-	-	Btw_1 35 cm
5.43	1.40	14	49.7	-	-	Btw_2 20 cm

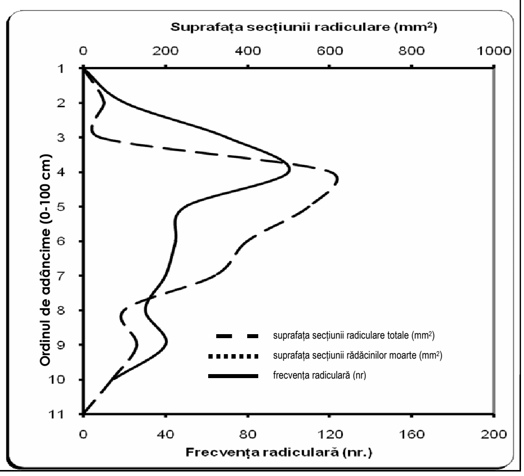

Fig. 4. Normal distribution of root system in the Vanat romanesc cultivar/myrobolan at the age of 10, on a stagnic preluvosoil at Balota, Mehedinti county

CONCLUSIONS

1. In some condition the calcium carbonate from the soil can be limiting factors having as an effect a diminishing tree vigour and a reduction of trunk thickness of these.
2. The intensity of decreasing effects upon the root system and implicit upon the airy part of the trees is induced by the repartition of carbonates on the soil profile, the appearance depth of the level with carbonates and the amount of active calcium carbonate.
3. The compactness of soil induced by the great number of mechanized works scheduled by the actual technology of fruit tree orchards, hard to effectuate always at the optimum humidity contributes as well as to the reduction of the absorbing capacity of the iron by the root system also through the mechanical effect upon the roots but also through the poor airing conditions.

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ACCUMULATION AND MINERALISATION OF ORGANIC MATTER IN ROMANIAN SOILS

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Keywords: *organic matter accumulation, cations, migration terms*

Abstract

Samples from surface and subjacent horizons of main soil types from chernozem to podzol were selected. The organic matter of natural and agricultural ecosystems is associated with a mineralisation of dead vegetal organism in the two investigated horizons.

Both soil colloids and released cations may be retained or deplaced to the depth. The differences of the averages and medians and the histograms of the two horizon properties show the translocation of clay and free sesquioxides and the retention or migration of some nutrient cations. The correlation of the same component from the surface and subjacent horizons are very high and show the strong influence of parent materials.

INTRODUCTION

During the soil evolution the parent materials enrich its profile surface with organic matter due to the plant and microorganism decay [3]. This humification process is accompagned by the descomposition of dead vegetals by mineralisation and release many nutrient cations.

This work is an atempt to emphasize by statistical methods the accumulation of organic matter in soils and its part in the repartition of some nutrient cations in surface horizons of soil profiles.

MATERIAL AND METHODS

Due the to vast aspect of organic matter concerning the composition, the polimerisation degree, the nature of chemical active function, the concentration e.s.o in this paper were investigated only the cantitative line of research of humus and these relations with some cations.

182 samples of surface horizons A_1 (Ap, Am, Ao, Aou, OA) and the same number of the subjacent horizons A_2 (Am, Ame, El, Ea, AB, Es) of main soil types of many regions of Roumania were selected (chernozems, luvisols, vertisols, arenosols dystric cambisols, eutric cambisols and podzols). Do not selected fluvisols to avoid the accentuated influence of present stratification.

A great part of analytical results are utilised from “Excursion Guide of Romanian Soil Science Society Conferences” between 1973 and 2006.

RESULTS AND DISCUSSION

After the descomposition of dead organisms on the surface and the surface horizons of soils is formed the humus, the soil organic matter. Its content decrease continously with the depth (figure 1) at chernozem of Afumați (Dolj) and more accentuated at Beliu (Arad) but little at albic luvisol of Dumbrava (Timiş). The smaller decrease at albic luvisol would suggest the presence of a stratification even the surface of the profile. At the soils more acids an eutric cambisol from Sucevita, a dystric cambisol from Busteni (Bucegi Mountain) and a humic popdzol from Cascada Balea (Fagaras Mountain) the quantity of organic matter is more accentuated (figure 2) but an orthic podzol from Bâlea Lac (Fagaras Mountain) appear a minim in spodic horizon Es.

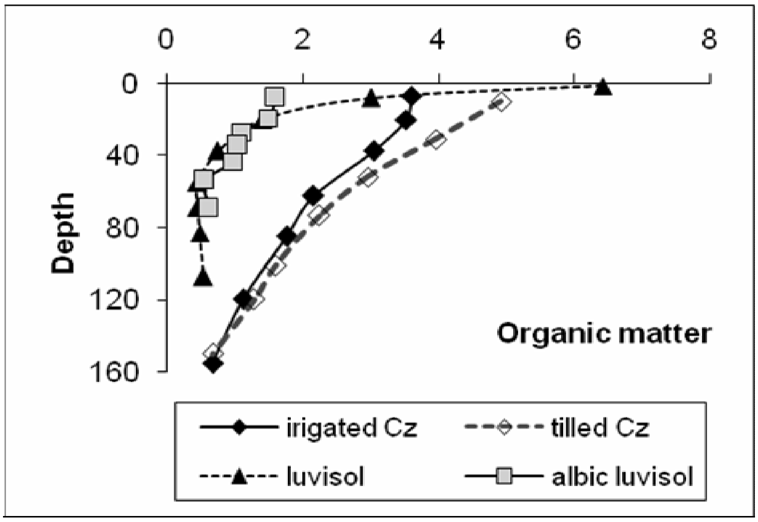

Fig. 1. Variation with the depth of organic matter

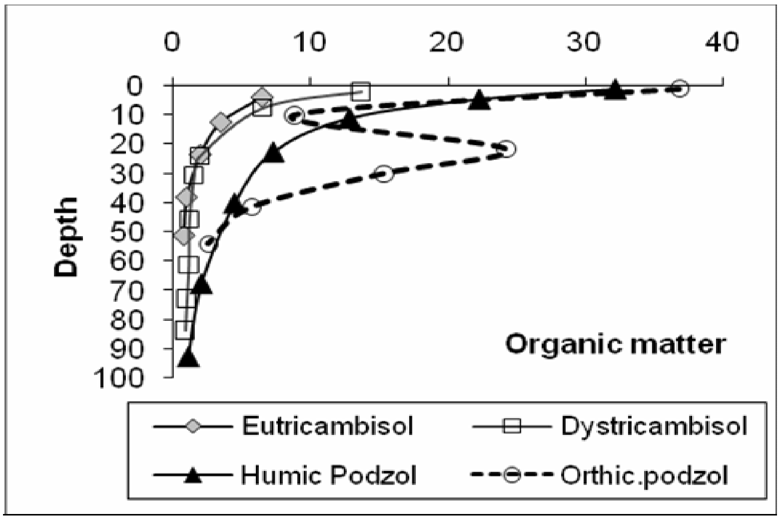

Fig. 2. Organic matter as a function of the depth

In addition the micromorfological caractherization of soil profiles emphasized the argillo-humic-ferric plasma [7, 8, 9] which take part to the colloid translocation to the depth with the formation sometimes at tilled soils of the plough pan [4]. The color variation of plasma suggest its variable composition which would determine a different translocation of its colloidal components.

The colloid translocation produces a displacement to the depth of elements from the clay mineral lattice and from free sesquioxides, from adsorbed cations on the mineral colloids and from chelated cations on organic matter. In the same time are depaced to the depth the cations from soil solution after their solubility, their retention of mineral surfaces and the organic matter stability.

Some statistical data of investigated samples are presented in the tables 1 and 2. The large property ranges and the great values of variation coefficients (tables 1 and 2) permit to consider the two sample groups as statistical representative for surface and subjacent horizons of soils from our country. The differences between the mean and median values are generally great enough and suggest multiple distribution and/or large ranges of assimetry.

The two averages of organic matter contents from A_1 and A_2 5.68% and 3.26% respectively have values greater as medians 3.05% and 2.1% rspectively (tables 1 and 2).

Table 1

Statistical date of investigated samples of A_1 surface horizons

Propriety	No.	Mean	Var. coeff.	Minim	Maxim	Median
Humus %	180	5.68	101.86	0.9	47.12	3.05
Clay %	180	27.58	53.56	3.5	75.6	26.15
pH	180	6.03	26,28	3.3	9.39	5.95
C.E.C.*	82	24.42	59.69	7.2	76.55	21.24
% saturation V*	82	65.45	45.26	3.3	100	72.05
Exch.Ca+Mg*	82	14.93	73.47	0.5	47.92	12.65
Exchangeable K	82	0.39	72.68	0.05	1.26	0.32
Aridity Index	82	39.21	64.64	17.4	182	30.85
Bacteria number	62	4854	285	3.79	105606	1514
Fungi number	62	11.23	98.64	0.1	53	2.6

**Exchangeable cations in me/100 g soil.*

Table 2

Statistical dates of investigated samples of A_2 subjacent horizonts

Propriety	No.	Mean	Var. coeff.	Minim	Maxim	Median
Humus %	180	3.26	98.82	0.3	23.86	2.1
Clay %	180	30.27	56.22	2.5	75.7	27.75
pH	180	6.17	27.59	3.7	9.97	6.16
C.E.C.*	82	19.7	56.17	3.9	65.2	18.97
% saturation V	82	66.12	48.16	2.5	100	81.9
Exch.Ca+Mg*	82	14.45	90.36	0.02	63.49	14.09
Exchangeable K	82	0.3	70.88	0.01	1.13	0.3
Aridity Index	82	39.21	64.64	17.4	182	30.85
Bacteria number	62	2603	153	0.1	19250	1187
Fungi number	62	5.58	82.66	0.08	22.8	4.75

**Exchangeable cations in me/100 g soil.*

Although their distribution are uninominal right assymetrical (figure 3) with the maxim at 4.46% and 2.1% respectively. The maxim of A_2 subjacent horizons is smaller and outside of the distribution curve of surface A_1 horizons. The assymetry range of both distribution is very large between 15.12% and 47.12% for A_1 and

7.55% and 23.85% for A_2 and justify the differences between averages and medians.

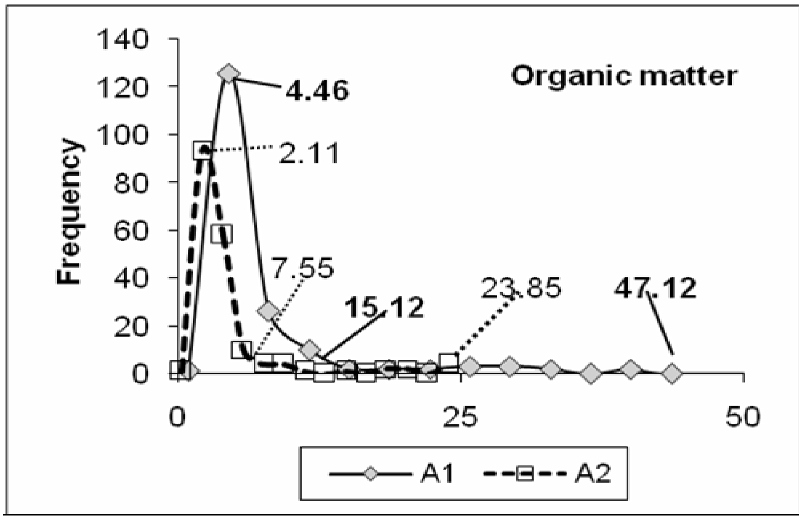

Fig. 3. Distribution of organic matter in A1 and A2

CONCLUSIONS

1. The organic matter is accumulated in the surface soil horizons due to the dead microorganism and plant decay.
2. By means of selected sample group from surface (A_1) ans subjacent (A_2) horizons is emphasized an organic matter accumulation. The humification is associated with a mineralisation which releases nutrient cations.
3. The accumulation of the organic matter is influenced by clay content, pH, percent saturation and apparent density and correlate with heavy metals and exchangeable cations.
4. The component concentrations of A_2 high correlated with these of A_1 and show a strong inheritance from parental materials.

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REACTION BUFFERING CAPACITY OF SOILS IN THE ZLATNA AREA

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Keywords: *reaction buffering capacity, heavy metals, vulnerability, acid rains*

Abstract

This paper presents studies concerning the soil reaction buffering capacity within affected areas by emissions from the non-ferrous metallurgical industry in the Zlatna city (the emissions into air of huge amounts of sulphur oxides and dust loaded with heavy metals).

The soil reaction buffering capacity is estimated of been very low and low for Preluvosols and Districambosols and reduced and very high for Eutricambosols, Aluviosols and Regosols.

Within the Zlatna area low and very low soil reaction buffering capacity correlated with the high and moderate soil vulnerability to the impact of the acid rains and heavy metal pollution and very high and reduced soil reaction buffering capacity correlated with low soil vulnerability.

INTRODUCTION

The results were based on the field investigations carried out in the Zlatna areas. Soil samples have been collected within the areas affected by emissions of the S.C. Ampellum S.A. Zlatna located on 41 km length (east-west) and 25 km width (north-south).

The research performed by means of the 60 soil profile analysis and the surface affected by pollution was estimated by 55,664 hectares.

The objectives of the paper are the evaluation of the soil reaction buffering capacity from Zlatna industrial areas, the correlation between this and heavy metals mobility and the comparison between the soil reaction buffering capacity and the soil vulnerability to the impact of the acid rains and heavy metal pollution.

MATERIAL AND METHODS

To characterize the soils and to evaluate the soil reaction buffering capacity, the main soil physical and chemical properties have been determinate: particle-size distribution, soil reaction (pH), hydrolitical acidity (Ah), sum of exchangeable bases (SEB), cation exchange capacity (CEC), saturation degree (V), reaction buffering capacity of soil (RBCS) and the mobile contents of heavy metals. Mobile forms have been extracted by EDTA – CH_3COONH_4 solution at 7.0 pH and have been dosaged by means of atomic absorption spectrometry [5].

Using two indicators of reaction buffering capacity of soils (I-RBCS), proposed by Borlan [1] the soils have been characterized and classified from the reaction buffering capacity's point of view.

Indicators of reaction buffering capacity of soils: I-RBCS^{SEB} - in term of sum of exchangeable bases and I-RBCS^{CEC} - in term of cationic exchange capacity formula and definition as follow:

$$\mathrm{I-RBCS}^{\mathrm{SEB}} = \lg\frac{[\mathrm{SEB}]}{(\mathrm{H}^+)};\quad \mathrm{I-RBCS}^{\mathrm{CEC}} = \lg\frac{[\mathrm{CEC}]}{(\mathrm{H}^+)};$$

in which:

SEB = sum of exchangeable bases; [SEB] = equivalents·kg^{-1}·0,4;
CEC = cation exchange capacity; [CEC] = equivalents·kg^{-1}·0,4;
H = proton activity in the soil solution; (H^+) = moles·liter^{-1}.

Using the indicators I-RBCS values we have been evaluated the reaction buffering capacity of soil according to the table 1.

Table 1

Border values for conventional interpretation of I-RBCS as well as the reaction buffering capacity of soil [1]

Values domains		Soil reaction buffering capacity
I-RBCS^{SEB}	**I-RBCS^{CEC}**	
> 5.6	> 5.6	very high
5.1 - 5.6	5.2 - 5.6	high
4.5 - 5.1	4.7 - 5.2	moderate
3.9 - 4.5	4.1 - 4.7	reduced
3.1 - 3.9	3.5 - 4.1	low
< 3.1	< 3.5	very low

RESULTS AND DISCUSSION

In the Zlatna areas acid rains affected the soils through progressive acidification, which determinated soil reaction decrease, depletion of bases and base saturation degree decrease [4].

We evaluated the reaction buffering capacity of soil from 29 soils from this area. Table 2 presented main physical and chemical properties (A horizon) since few soil types within areas influenced by emissions from non-ferrous metallurgical industry in the Zlatna area.

Acid soils are represented by Districambosols and Preluvosols and slightly acid to slightly alkaline soils is represented by Eutricambols, Aluviosols and Regosols.

The class of Cambisols is predominant (83.74% of the total area), the soils types including: Eumesobasic Brown soils (19.36% of the total area) and Acid Brown soils (64.36%) [2].

The soil reaction buffering capacity is estimated of been very low and low for Preluvosols and Districambosols and reduced and very high for Eutricambosols, Aluviosols and Regosols.

Table 2

Main physical and chemical properties (A horizon) within areas influenced by emissions from non-ferrous metallurgical industry in the Zlatna

Profile no.	Soil type SRTS*/FAO-UNESCO	pH	V** (%)	OM*** (%)	Texture	I - $RBCS^{CEC}$	Soil reaction buffering capacity	Vulnera-bility
18	Preluvosol/ Haplic Luvisol	4.3	33	4.7	medium	3.20	very low	high
24		4.6	27	2.9	medium	3.49	very low	high
9		4.8	47	6.4	medium	3.56	low	high
19		4.9	25	1.1	medium	3.60	low	excessive
42		5.1	62	5.0	medium	4.00	low	moderate
47		5.6	73	5.7	fine	4.54	reduced	low
34		5.5	76	5.5	fine	4.53	reduced	low
20		5.9	79	3.0	medium	4.73	moderate	medium
46	Luvosol/ Luvisol	6.8	92	7.7	fine	5.83	very low	low
45		5.6	65	4.9	medium	4.44	reduced	low
6	Districambosol/ Dystric Cambisol	5.0	54	6.0	medium	3.99	low	moderate
1		4.9	46	7.0	medium	3.76	low	high
41		4.9	32	10.3	medium	3.80	low	high
2		4.7	36	8.6	medium	3.59	low	high
8	Faeoziom/ Phaeozem	5.5	82	5.5	fine	4.62	reduced	low
10	Eutricambosol/Eutric Cambisol	7.1	96	2.7	medium	6.07	very high	low
11		6.9	92	3.4	medium	5.83	very high	low
4		5.5	70	2.9	medium	4.26	reduced	moderate
40	Aluviosol/ Fluvisol	7.1	93	3.5	medium	5.98	very high	low
3		5.4	72	6.7	medium	4.34	reduced	moderate
7		5.1	60	4.3	coarse	3.84	low	moderate
37	Regosol/ Regosol	7.1	96	3.3	medium	6.19	very high	low
22		6.6	93	8.7	medium	5.78	very high	low
28		5.5	81	4.7	fine	4.49	reduced	low
36		5.3	5,4	5.4	medium	4.05	low	moderate
32	Erodosol	5.4	67	4.6	fine	4.34	reduced	low
39		5.6	74	5.4	fine	4.59	reduced	low

*SRTS - Romanian Soil Classification System; **V - Base saturation degree; ***OM - Organic matter

The soil of second group being practically non vulnerable to the impact of acid rains and heavy metal pollution, because base saturation degree, organic matter content and texture of these soils induce an increasing degree of resistance to the action of deteriorating factors.

The soil reaction buffering capacity has been compared with soil vulnerability to the impact of the acid rains and heavy metal pollution, which were evaluated by Lacatusu [2] in terms of soil reactions, organic matter content and texture.

Within the Zlatna areas low and very low soil reaction buffering capacity correlated with the high soil vulnerability, and very high soil reaction buffering capacity correlated with low soil vulnerability.

On the basis of the soil reaction buffering capacity, the vulnerability indicated that 68 per cent represent soils with high soil vulnerability, 22 per cent represent soils with moderate soil vulnerability and 10 per cent represent soils with low vulnerability.

Into surface horizon, when were the biggest impact to acid rains and the accumulation of the heavy metals, soil acidification process determinate the decrease of the soil reaction and soil bases depletion, and the soil reaction buffering capacity decreased. If the soil reaction buffering capacity I-RBCS^{CEC} (in term of cationic exchange capacity) and I-RBCS^{SEB} (in term of sum of exchangeable bases) increased into soil profile**,** his mobile contents of the heavy metals decreased (figure 1, 2 and 3).

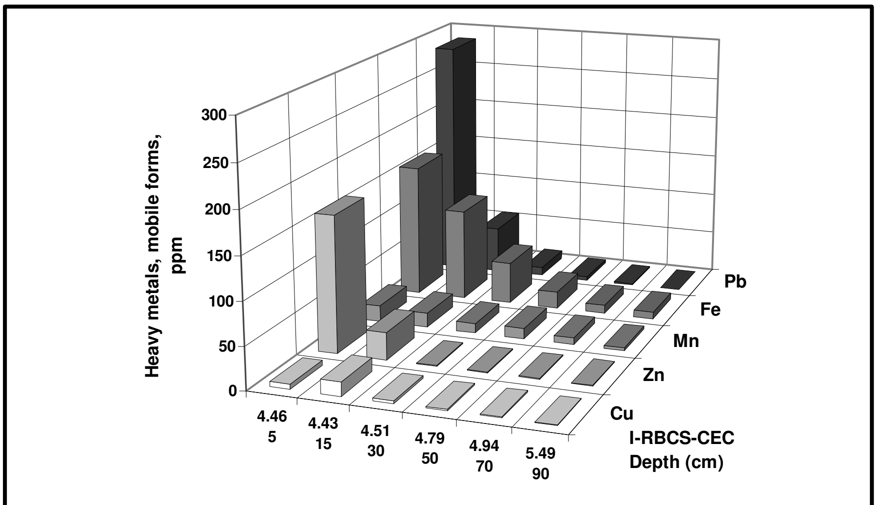

Fig. 1. The correlation between soil reaction buffering capacity I-RBCS^{CEC} (in term of cationic exchange capacity) and heavy metals content in profile no. 45 (Disticambosol, Galati)

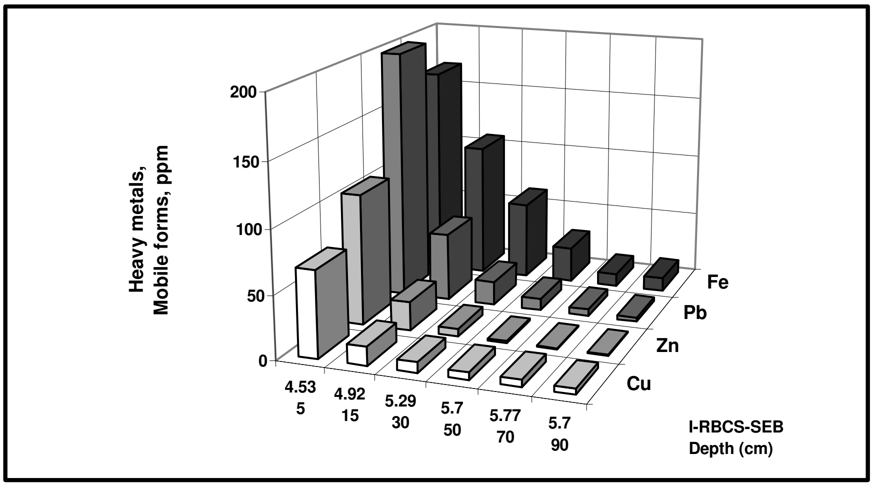

Fig. 2. The correlation between soil reaction buffering capacity I-RBCS^{SEB} (in term of sum of exchangeable bases) and heavy metals content in profile no. 8 (Cambic Faeoziom, Zlatna)

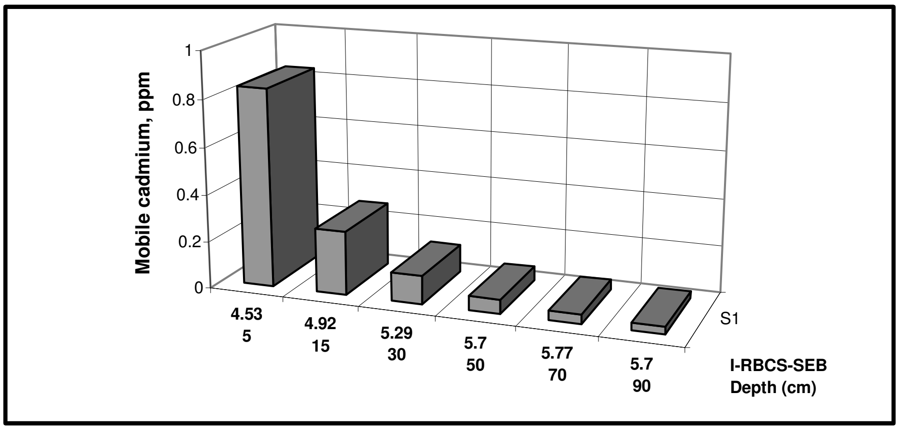

Fig. 3. The correlation between soil reaction buffering capacity I-RBCS^{SEB} (in term of sum of exchangeable bases) and mobile cadmium content in profile no. 8 (Cambic Faeoziom, Zlatna)

For 29 soil profiles analyzed in this paper were obtained inverse correlations between the soil reaction buffering capacity (I-RBCS) and mobile content of heavy metals: very significant for Fe, significant for Mn and no significant for Cd, Pb, Zn and Cu.

CONCLUSIONS

1. In Zlatna, areas acid soils are represented by Districambosols and Preluvosols and slightly acid to slightly alkaline soils are represented by Eutricambols, Aluviosols and Regosols; the class of Cambisols is predominant.
2. The soil reaction buffering capacity was estimated of been very low and low for Preluvosols and Districambosols and reduced and very high for Eutricambosols, Aluviosols and Regosols.
3. In the Zlatna areas, low and very low soil reaction buffering capacity was correlated with the high soil vulnerability, and very high soil reaction buffering capacity was correlated with low soil vulnerability.
4. On the basis of the soil reaction buffering capacity, the vulnerability indicated that 68 per cent represent soils with high soil vulnerability, 22 per cent represent soils with moderate soil vulnerability and 10 per cent represent soils with low vulnerability.
5. Into surface horizon, when was the biggest impact to acid rains and accumulation of the heavy metals, soil acidification process determined the decrease of the soil reaction and soil bases depletion, and the soil reaction buffering capacity decreased.
6. For 29 soil profiles analyzed in this paper were obtained inverse correlations between the soil reaction buffering capacity (I-RBCS) and mobile content of heavy metals: very significant for Fe, significant for Mn and no significant for Cd, Pb, Zn and Cu.

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ESTIMATION OF SOME HEAVY METALS ACCUMULATION IN PLANTS AND SOILS FROM COPSA MICA AREA

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Keywords: *pollution, soil, heavy metals, regression curves, Copsa Mica*

Abstract

Heavy metals pollution of soil enhances plant uptake causing accumulation in plant tissues and eventual phytotoxicity and change of plant community. The research was carried out within the area affected by emissions released from Copsa Mica industrial platform. The sampling grid of soil and plant was regular - 118 plant samples and 103 soil samples were collected. Main crops identified within investigated area were: maize (Zea mays), wheat (Triticum aestivum), oat (Avena sativa), soybean (Glycine max). The analyses carried out to determine the heavy metals (Cd, Zn and Pb) contents in plants revealed that Equisetum pratense, Cynodon dactylon, Verbascum phlomoides, Calamagrostis pseudophragmites and Asclepias syriaca accumulated high amounts of heavy metals in their tissues. The regression curves were used to assess the stochastic dependences between heavy metal content in soil and heavy metal content in plant.

INTRODUCTION

Copsa Mica is a small town that developed around two industrial SOMETRA and CARBOSIN, both with a high potential pollutant: SOMETRA - producer of zinc, lead, cadmium and ferrous alloys and CARBOSIN - producer of carbon black, a product used in manufacturing tires. The paper presents the regression curves that estimate stochastic dependence between the total metal content of soil and the metal content in plant.

MATERIAL AND METHODS

The sampling of soil was done on a radial network of 103 collection sites. Plant samples were harvested from the same points with soil. The plant samples were collected from agricultural crops, pasture, meadow and spontaneous vegetation.

The total content of heavy metals (Cd, Pb and Zn) was measured with flame atomic absorption spectrometer in hydrochloric solution resulted by digestion of soil samples in $HClO_4$-HNO_3 mixture.

Estimating the stochastic dependencies between total metal content of soil and metal content of plants was achieved by means of the regression curves.

RESULTS AND DISCUSSION

Main crops identified in the investigated area were: maize (*Zea mays*), wheat (*Triticum aestivum*), oats (*Avena sativa*), soybean (*Glycine max*), lucerne (*Medicago sativa*) and red clover (*Trifolium pratense).* Of these the most common is maize, of the 37 plant samples collected from specific agricultural crop area, 25 were samples of maize (leaves).

The main plant species belonging of meadows and pastures vegetation from studied area were: *Festuca pratensis, Lolium perenne, Poa pratensis,* etc. These samples represented approximately 18% of total samples analyzed.

From spontaneous vegetation of Copşa Mică area were collected plants belonging to the following species: *Amaranthus retroflexus, Artemisia vulgaris, Asclepias syriaca, Calamagrostis epigeios, Calamagrostis pseudophragmites, Cynodon dactylon, Daucus carota, Equisetum pratense, Phragmites australis, Picris hieracioides, Setaria glauca, Sinapis arvensis, Verbascum phlomoides* and *Xanthium strumarium.*

Log-log diagram for regression curve that estimates the dependency between the zinc content in soil and the zinc content in plant is presented in figure 1. Values of zinc content in plant ranged between 41 mg/kg and 3162 mg/kg. The highest value was determined for plants of *Verbascum phlomoides* developed on a soil with a total zinc content of 4151 mg/kg.

Plants identified and harvested from areas where the zinc content in soil exceeded 4000 mg/kg belonging to the species: *Cynodon dactylon, Calamagrostis pseudophragmites, Phragmites australis* and *Equisetum pratense*. These plants have adapted to stressful conditions induced by excessive levels of heavy metals in soil managing to grow even in such a hostile environment. *Phragmites australis* is a plant species recognized as able to tolerate high levels of zinc in the culture [2]. With regard to agricultural crops, values of zinc content in plant ranged between 41 mg/kg and 1273 mg/kg. The lowest value of zinc content was determined in maize leaves, when the plants were grown on soil with a relatively low content of zinc (79 mg/kg). Maize plants harvested at 1 km SE from the source were the most polluted (1273 mg/kg). Worrying is the fact that these plants were cultivated near a building housing city Copşa Mică. Long-term consumption of products with high content of heavy metals may damage the health of the population.

Changes of the cadmium content in plants depending on the total content of cadmium in soil is presented in figure 2. Values of cadmium content of plants analyzed varied between 0.3-83 mg/kg. The lowest value (0.3 mg/kg) was determined in plants of *Medicago sativa*.

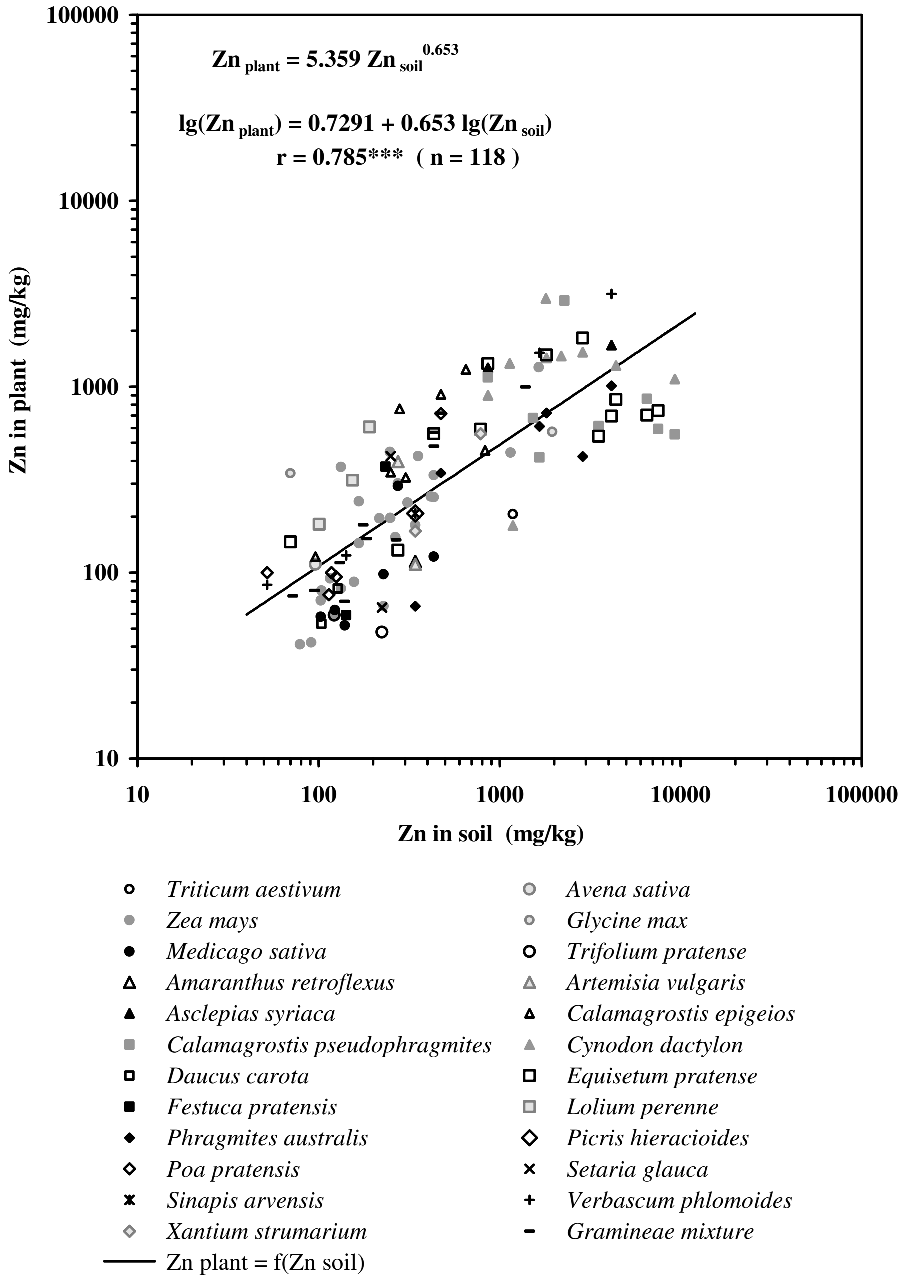

Fig. 1. Log-log diagram for regression curve that estimates the dependency between the zinc content in soil and the zinc content in plant

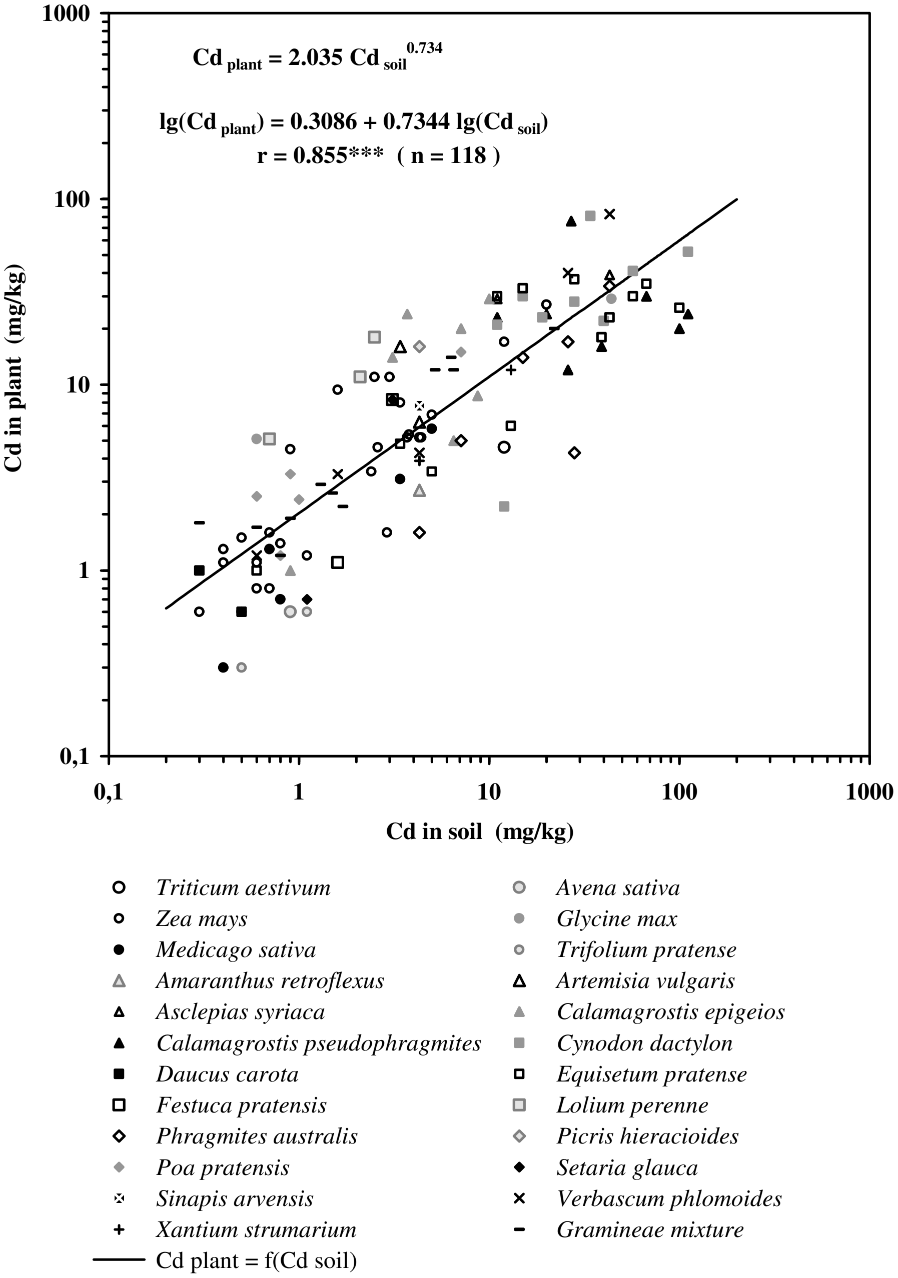

Fig. 2. Log-log diagram for regression curve that estimates the dependency between the cadmium content in soil and the cadmium content in plant

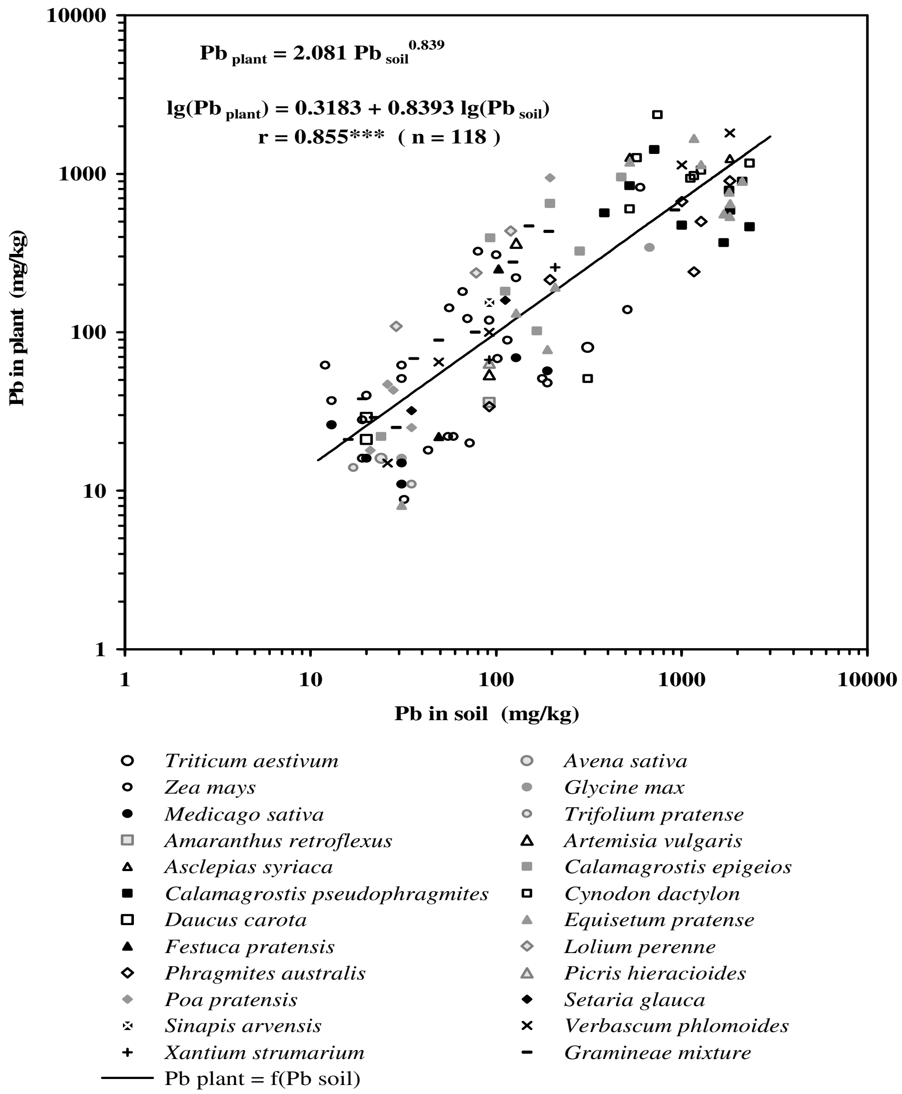

Fig. 3. Log-log diagram for regression curve that estimates the dependency between the lead content in soil and the lead content in plant

Plants of the species *Verbascum phlomoides* and *Cynodon dactylon* had the highest content of cadmium (83 respectively 81 mg/kg). The crop plants growing on soils with the highest levels of cadmium were those of *Glycine max* (29 mg/kg Cd), and *Zea mays* (27 mg/kg).

Figure 3 is shown log-log diagram for regression curve that estimates the dependency between the lead content in soil and the lead content in plant from Copsa Mica area. The total content of lead in the 0-40 cm layer of soil on which were harvested plant samples ranged from 12 mg/kg to 2320 mg/kg.

The lead content determined in plants of spontaneous vegetation ranged from 8.1 mg/kg (*Equisetum pratense*) and 2362 mg/kg (*Cynodon dactylon*). The highest levels of lead content were determined in plants of the spontaneous vegetation of the area. Of the 9 samples of *Cynodon dactylon*, 8 samples had lead content greater than 600 mg/kg. It confirms the ability of these species to accumulate excessive amounts of lead without the visible signs of toxicity.

Crop plants had lead content levels that ranged between 8.8 mg/kg and 820 mg/kg, these extreme values being determined in maize leaves (*Zea mays*). Of the 25 samples collected from maize crops, for one sample the lead content determined was lower than the tolerance limit (10 mg/kg) presented by Kabata Pendias and Pendias (1992) quoted by [1]. The other 24 samples had lead contents higher than 10 mg/kg, presenting risk of toxicity.

Estimation of metal content in plant depending on the total metal content in soil based on the proposed regression equation for each element (Cd, Pb and Zn) can sometimes lead to results with high degree of uncertainty. However this estimation is useful in the preliminary stage of the study of risk assessment in the Copsa Mica area.

CONCLUSIONS

1. The intensity of stochastic dependence, as measured by correlation coefficient corresponding linear form of equation ($\lg y = \lg a + b \lg x$) is very high for each of the metals considered ($r_{Zn}=0.785^{***}$, $r_{Cd}=r_{Pb}= .855^{***}$).
2. In the very polluted area were identified plant species able to accumulate heavy metals in tissues in excessive amounts without adverse effects on the general development of the plant (*Asclepias syriaca, Cynodon dactylon, Calamagrostis pseudophragmites, Equisetum pratense, Verbascum phlomoides*).

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DISTRIBUTION OF SELENIUM TOTAL CONTENT IN THE SOILS SITUATED IN THE SOUTH-EASTERN PART OF ROMANIA, FROM CENTRAL AND SOUTH DOBRUDJA

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Keywords: *soil, selenium, distribution*

Abstract

A number of 49 soil samples were collected from the South-Eastern part of Romanian territory, in Central and South Dobrudja, from the upper horizon (0-20 cm) of some soils with predominantly agricultural use, especially arable lands, consisting of wheat crops. These soils belong to the next types: Fluvisol[1] (FL), Chernozem (CH), Kastanozems (KZ).

Selenium total content was determined from the analysed samples through the optic method of analyse, the atomic absorption spectroflamephotometry coupled with hydrides generator. Grouping centre parameters ($\overline{x}$ -arithmetic mean, Me-median, Mo-module) and spreading parameters (x_{min}-minimum value, x_{max}-maximum value, σ-standard deviation, and cv%-coefficient of variation) were computed for total selenium contents in the analysed samples to outline the distribution of these chemical elements in the soils of the studied area.

INTRODUCTION

Total content of selenium from the upper horizon (0-20 cm) of the soils in the South-Eastern part of Romanian territory, in Central and South Dobrudja, was studied. These soils have predominanthly agricultural use, especially arable lands consisting of wheat crops. The studied soils belong to the following types: Fluvisol (FL), Chernozem (CZ) and Kastanozems (KZ) [1]. Selenium total contents differ from one soil type to another. The areas where wheat is cultivated must be carefully studied, because, as selenium transfers from soil to plant, its hyperaccumulation or deficiency in the edible parts of wheat plants would have negative effects on consumers health.

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[1] WRB-SR-1998

MATERIAL AND METHODS

A number of 49 soil samples were collected from the South-Eastern part of the Romanian territory, in Central and South Dobrudja, from the upper horizon (0-20 cm) of some soils with predominantly agricultural use, especialy arable lands consisting of wheat crops.

To establish the loading or pollution level with this kind of chemical element, the soil samples were analysed in the laboratory from the viewpoint of total content of selenium. Selenium total content was determined in hydrochloric solution obtained by soil digestion with a mixture of mineral acids, HCl-HNO_3, and H_2O_2, using atomic absorption spectrophotometry coupled with hydrides generation in alternative atomization with air-acetylene flame, for selenium dosage [2].

Grouping centre parameters (x-arithmetic mean, Me-median, Mo-module) and spreading parameters (x_{min}-minimum value, x_{max}-maximum value, σ-standard deviation, and cv%-coefficient of variation) were computed for total selenium content to outline the distribution of this chemical element in the soils of the studied area.

RESULTS AND DISCUSSION

Figure 1 presents the localization of the sampling points together with the characteristic type of soil. Selenium total contents from the studied soil are situated in the 0.001-0.329 $mg \cdot kg^{-1}$ interval, with a mean value of 0.189 $mg \cdot kg^{-1}$ in Baragan, respectively of 0.143 $mg \cdot kg^{-1}$ in Dobrudja, resulting that in Bărăgan soils selenium total content from the upper horizon is bigger, with an average of 0.046 $mg \cdot kg^{-1}$, than in Dobrudja soils. The high value of the coefficient of variations shows a wide spreading of the selenium total content values. The soil distribution of selenium total contents from both areas is of bimodal type (figure 2). The obtained values are situated in the inferior third part of the variation interval of the world's soils, characterized by the following values: If we compare the value obtained by us with the values interval of selenium total content given by Pendias and Pendias (2001) [3]for soils from many countries (23) of world map, namely: x_{min}=0.005 $mg \cdot kg^{-1}$; x_{max}=4.0 $mg \cdot kg^{-1}$; $\bar{x}$=0.383 $mg \cdot kg^{-1}$; σ=0.225 $mg \cdot kg^{-1}$, consequently in a domain with small values of selenium total content. Within the framework of this domain, the values of selenium total content from the Dobrudja soil are on an average, inferior to those from the South-Eastern Baragan soils.

Table 1 shows the analytic data of selenium total content, together with localization and soil type. In table 2 the statistical parameters of these data are presented, grouped by region: the South-Eastern area of the Romanian territory (Baragan) and the Central and South Dobrudja.

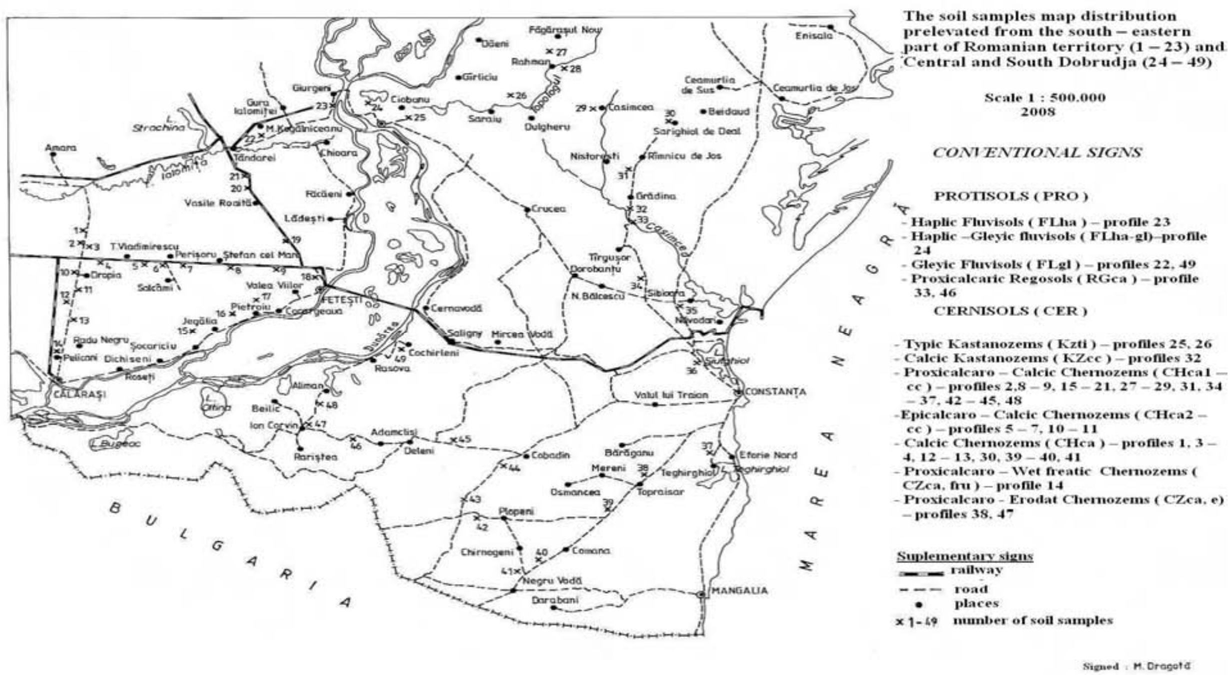

Fig. 1. Localization of sampling points and the characteristic types of soil

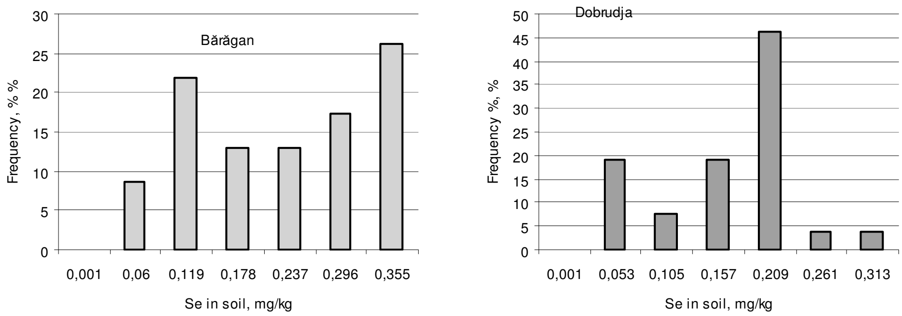

Fig. 2. Frequency histograms of selenium total content in soil (0-20 cm)

Table 1

Selenium total content from the upper horizon (0-20 cm) of soils where wheat was cultivated in the agricultural year 2007/2008

No.	Localization*	Latitude/Longitude	Soil type	Total Se ($mg \cdot kg^{-1}$)
		Bărăgan		
1	S Slobozia	N 44º27.160' / EO 26º04.846'	CZ ti	0.094
2	S Slobozia	N 44º27.137' / EO 26º04.833'	CZ ka$_1$-kz	0.108
3	S Slobozia 1 km N Drajna	N 44º26.248' / EO 27º22.899'	CZ ti	0.298
4	E Drajna	N 44º25.465' / EO 27º25.058'	CZ ti	0.255
5	E Drajna	N 44º25.490' / EO 267º28.122'	CZ ka-kz	0.329
6	Perisoru – Marculesti	N 44º25.430' / EO 27º31.041'	CZ ka$_2$-kz	0.163
7	Jegălia	N 44º25.370' / EO 27º33.561'	CZ ka$_2$-kz	0.245
8	E Stefan cel Mare	N 44º25.226' / EO 27º40.176'	CZ ka$_2$-kz	0.303
9	7 km înainte de Fetesti	N 44º25.118' / EO 27º44.990'	CZ$_1$ ka$_1$-kz	0.303
10	S Drajna spre Calarasi	N 44º23.866' / EO 27º22.282'	CZ$_1$ ka$_2$-kz	0.272
11	S Drajna 2	N 44º22.941' / EO 27º22.139'	CZ ka$_2$-kz	0.125
12	S Drajna 3	N 44º21.137' / EO 27º21.813'	CZ ti	0.223
13	N Calarasi 15 km	N 44º18.729' / EO 27º21.391'	CZ ti	0.325
14	N Calarasi 7 km	N 44º15.226' / EO 27º20.786'	CZ ka$_1$, fru	0.001
15	NE Unirea	N 44º16.987' / EO 27º36.213'	CZ$_1$ ka$_1$-kz	0.305
16	NE Unirea	N 44º19.147' / EO 27º41.027'	CZ$_1$ ka$_1$-kz	0.252
17	NE Unirea	N 44º21.093' / EO 27º44.131'	CZ$_1$ ka$_1$-kz	0.199
18	NE Unirea	N 44º26.093' / EO 27º48.196'	CZ$_1$ ka$_1$-kz	0.067
19	NE Unirea	N 44º30.825' / EO 27º44.221'	CZ$_1$ ka$_1$-kz	0.097
20	S Tandarei	N 44º34.947' / EO 27º41.886'	CZ$_1$ ka$_1$-kz	0.120
21	S Tandarei	N 44º35.270' / EO 27º41.874'	CZ$_1$ ka$_1$-kz	0.086
22	E Tandarei	N 44º39.097' / EO 27º42.192'	AS gc	0.185
23	V Giurgeni	N 44º42.522' / EO 27º50.935'	AS en	0.001

		Dobrudja		
24	SE Vadu Oii	N 44º43.809’ / EO 27º54.276’	AS en-gc	0.306
25	N Harşova	N 44º41.897’ / EO 28º00.021’	KZ ti	0.127
26	N Saraiu	N 44º45.477’ / EO 28º11.967’	KZ ti	0.019
27	Movilele Babei	N 44º49.434’ / EO 28º16.100’	CZ_1 ka_1-kz	0.052
28	SE Rahmanu	N 44º47.407’ / EO 28º17.900’	CZ_1 ka_1-kz	0.198
29	V Casimcea	N 44º43.413’ / EO 28º21.617’	CZ_1 ka_1-kz	0.067
30	V Sarighiol de Deal	N 44º42.148’ / EO 28º29.084’	CZ ti	0.178
31	S Ramnicu de Jos	N 44º36.738’ / EO 28º26.437’	CZ_1 ka_1-kz	0.140
32	V Cheia	N 44º31.430’ / EO 28º35.730’	KZ mr	0.129
33	E Cheia	N 44º30.472’ / EO 28º25.871’	RS ka	0.168
34	N Mihail Kogalniceanu	N 44º23.815’ / EO 28º27.685’	CZ_1 ka_1-kz	0.178
35	V Sibioara	N 44º21.569’ / EO 28º31.327’	CZ_1 ka_1-kz	0.012
36	Ovidiu	N 44º14.406’ / EO 28º34.548’	CZ ka_1-kz	0.087
37	Agigea V	N 44º04.663’ / EO 28º36.055’	CZ ka_1-kz	0.140
38	Movilița	N 44º02.883’ / EO 28º29.815’	CZ ka, e	0.012
39	N Amzacea	N 43º58.519’ / EO 28º24.597’	CZ ti	0.209
40	SV Comana	N 43º52.759’ / EO 28º17.332’	CZ ti	0.179
41	N Negru Voda	N 43º51.011’ / EO 28º14.272’	CZ ti	0.203
42	SE Movila Verde	N 43º57.334’ / EO 28º09.992’	CZ ka_1-kz	0.164
43	S Negresti	N 43º59.025’ / EO 28º07.521’	CZ ka_1-kz	0.176
44	S Cobadin	N 44º03.054’ / EO 28º11.141’	CZ ka_1-kz	0.209
45	E Pietreni	N 44º05.166’ / EO 28º06.134’	CZ ka_1-kz	0.201
46	Adamclisi - vale	N 44º05.955’ / EO 27º55.126’	RS ka	0.152
47	Ion Corvin - vale	N 44º06.906’ / EO 27º49.044’	CZ ka_2, e	0.006
48	S Alimanu	N 44º09.451’ / EO 27º50.034’	CZ_1 ka_1-kz	0.181
49	S Cochirleni	N 44º16.685’ / EO 27º58.953’	AS gc	0.219

**see figure 1*

Table 2

Statistical parameters of selenium total content from the upper horizon (0-20 cm) of soils where wheat was cultivated in the agricultural year 2007/2008

Statistical parameters	Baragan	Dobrudja
n	23	26
x_{min}	0.001	0.006
x_{max}	0.329	0.306
$\bar{x}$	0.189	0.143
σ	0.104	0.076
x_g	0.119	0.104
cv (%)	55	53
Me	0.199	0.166
Mo	0.095; 0.311	0.177

n-total number of samples; x_{min}-minimum value; x_{max}-maximum value; x_{med}-mean value; σ-standard deviation; c.v.%-coefficient of variation; Me-median; Mo-module; x_g-geometric mean, $\bar{x}$ -arithmetics mean

CONCLUSIONS

1. The average selenium total content from upper horizon of the South-Eastern Baragan soils is 0.189 $mg\cdot kg^{-1}$, and 0.143 $mg\cdot kg^{-1}$ in the Central and South Dobrudja soils.
2. In the soils from these two areas Baragan and Dobrudja, results a differention of selenium abundance, wich is greater in Bărăgan and smaller in Dobrudja.

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THE INFLUENCE OF CHELATING AGENT CONCENTRATION (AC-EDTA) ON LEAD MOBILIZATION IN AN ARTIFICIAL SOIL

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Keywords: *pollution, heavy metals, AC-EDTA*

Abstract

The paper presents the preliminary laboratory research concerning lead mobilization in an artificial polluted soil with $Pb(NO_3)_2$ *- (1000 mg/Kg, 2000 mg/Kg, 3000 mg/Kg), by using the chelating agent AC-EDTA (ethylenediaminetetraacetic acid). The EDTA addition has as purpose to increase of lead bioaccesibility, being known from the literature that it is the lowest bioaccesible heavy metal.*

INTRODUCTION

Soil contamination with heavy metals became a serious problem in high industrialized areas, but also in agriculture. This problem has an impact on human and animal health and imposes the using of soil remediation practices [1].

Lead is considered as the frequent heavy metal met as pollutant into the environment, especially in soil being very strong bound with the organic matter of the soil. Severe soil contamination with lead could have serious impact as: vegetation loss, groundwater contamination and plant, animals and human decay [2].

As a series of studied showed, there are substances named chelating agents, that are having the capacity to increase lead mobilization into the soil. The most efficient chelating agent for lead is the natrium salt of the ethylenediaminetetraacetic acid (EDTA). It is ascertained that EDTA produces not only lead mobilization, but also the shoots accumulation [3].

MATERIAL AND METHODS

The research from the present study is directed to the lead mobilization in the artificial polluted soil by using the chelating agent AC-EDTA (ethylenediaminetetraacetic acid).

The soil used in the experiment were sampled from the surface (0-20 cm), homogenized and dried at air temperature.

The soil were treated with Pb like $Pb(NO_3)_2$ – (1000 mg/Kg, 2000 mg/Kg, 3000 mg/Kg) and EDTA. The EDTA addition has as purpose to increase the lead bioaccesability, being known from the literature as the lowest bioaccesible heavy metal.

It was verified the retention degree of the lead in soil samples by the solubilization of the soil – lead azotate mix in water, in the following conditions:

- solid:liquid ratio by 1:5 and 1:10;
- contact time - 2 hours;
- continuous stirring up;
- surrounding temperature.

In the table 1, there can be observed a very easy increase of the lead extraction yield in accordance with the increase of total lead concentration in the artificial polluted soil sample.

Table 1

The solubilization yields of the lead in the soil samples artificial polluted with lead, at solid: liquid ratio by 1:5 and 1:10

Lead content in soil	**Extraction yields of lead, %**	
	Solid:liquid ratio by 1:5	Solid:liquid ratio by 1:10
1000 mg Pb/kg soil	0.05	0.05
2000 mg Pb/kg soil	0.10	0.10
3000 mg Pb/kg soil	0.15	0.15

The influence of EDTA concentration on lead solubilization

The ethylenediaminetetraacetic acid was selected from the literature data as optimum mobilization agent. In view to study the influence of EDTA concentration on lead mobilization (the tracing of lead mobilization curve), there was used the EDTA mixture, Merck quality.

It was prepared 20 mixtures from artificial pollutes soil with lead and EDTA in different concentrations, as it follows:
For the polluted soil with 3000 mg lead/kg sol were prepared 9 polluted soil – EDTA mixtures, EDTA molarities between 2–25 mmol.

For the polluted soil with 2000 mg lead/kg sol were prepared 6 polluted soil – EDTA mixtures, EDTA molarities between 3.4–20 mmol and for the polluted soil with 1000 mg Pb/kg sol were prepared 5 polluted soil – EDTA mixtures, EDTA molarities between 1.7–9.65 mmol EDTA.

For achieving the tracing of the lead mobility curve for these samples, it was adopted the following working method:

- water solubilization, solid:liquid ratio by 1:5 and 1:10;
- contact time - 2 hours;
- stirring up;
- surrounding temperature.

When the contact time is ending, the samples were filtered by solid phase separation. In the solutions obtained were determined pH and lead concentration by atomic absorption spectrometric method.

RESULTS AND DISCUSSION

As it can be observed in the table 2, the yield of lead mobilization in soil increases with the molar ratio EDTA:Pb increase, and the pH decreasing (normally, EDTA being a weak acid).

The mobilized lead concentration (the mobilization yield from table 2) in the solutions resulted at the extraction at 1:5 solid – liquid ratio is higher than the ones obtained at 1:10 solid – liquid ratio.

Table 2

Results obtained at lead mobilization in soil samples artificial polluted with 3000 mg Pb/kg sol

Molarity EDTA Addition (mmol)	**EDTA:Pb Molar ratio**	**Extraction yield Pb (%)**		**pH of the extraction aqueous solution**	
		Solid:liquid ratio		Solid:liquid ratio	
		1:5	1:10	1:5	1:10
0	0	0.15	0.15	7.4	7.8
2	0.14	7.6	6.3	7.3	7.6
2.75	0.2	11.5	9.83	7.2	7.5
3.5	0.25	14.9	10.85	7.13	7.4
4.1	0.28	17.9	12	7.09	7.2
6.85	0.47	35.1	15.8	6.7	6.9
10	0.7	54.5	24	5.9	6.3
14.5	1	68.5	35	5.7	6.3
20	1.4	76.5	43.5	5.45	6.1
25	1.7	83.5	54.9	5.1	5.8

In the table 3, there are presented the results obtained in lead mobilization in soil samples polluted with 2000 mg Pb/kg soil, under different EDTA concentratios, at 2 extraction Solid:Liquid ratio (by 1:5 and 1:10).

Table 3

Results obtained at lead mobilization in soil samples artificial polluted with 2000 mg Pb/kg soil

Molarity EDTA Addition (mmol)	**EDTA:Pb Molar ratio**	**Extraction yield Pb (%)**		**pH of the extraction aqueous solution**	
		Solid:liquid ratio		Solid:liquid ratio	
		1:5	1:10	1:5	1:10
0	0	0.10	0.10	7.4	7.8
3.4	0.35	38.9	22.8	7.1	7.4
6.8	0.7	52.7	38.6	6.7	7
9.65	1	73.8	48.8	5.8	6.8
14	1.45	89.7	72.8	5.6	6.6
17	1.76	99.8	78.6	5.4	6.3
20	2.1	99.9	83.7	4.8	5.2

Analyzing the data from the table, 3 it can be observed the same behavior of the soil samples polluted with 2000 mg Pb/kg soil and 3000 mg Pb/ kg soil, namely:

- lead mobilization yield in soil increases in accordance with the increasing of EDTA:Pb molar ratio and pH decrease (normally, EDTA being a weak acid);
- mobilized lead concentration (the mobilization yield from table) in solution resulted at Solid:Liquid extraction ratio by 1:5 is higher than the one obtained at Solid:Liquid extraction ratio by 1:10.

In the table 4, there are the date obtained at lead mobilization in the soil polluted with 1000 mg Pb/kg soil.

The data presented in the table 4 allow the same observations as the soil samples polluted with 3000 and 2000 mg Pb/kg soil.

CONCLUSIONS

1. The yields of lead extraction from aqueous solutions at 1:5 soil:water ratio were higher in all cases reported to the extraction yields obtained at 1:10 soil:water ratio, probably because of hydrolysis that can appear in diluted solution causing partial coagulation of lead.
2. In the soil samples polluted with 3000 mg Pb/kg soil (hypothetical situation that do not occur in practice), the EDTA contribution needed for lead

mobilization is very high. Not even an addition by 25 mmol EDTA in soil samples do not lead to a maximum yield of lead mobilization. Theoretical, the EDTA quantity could be increased, but from economical point of view–EDTA is very expensive–but also from plant tolerance at EDTA, this is not possible.

Table 4

Results obtained at lead mobilization in soil samples artificial polluted with 1000 mg Pb/kg soil

Molarity EDTA Addition (mmol)	EDTA:Pb Molar ratio	Extraction yield Pb (%)		pH of the extraction aqueous solution	
		Solid:liquid ratio		Solid:liquid ratio	
		1:5	1:10	1:5	1:10
0	0	0.05	0.05	7.45	7.8
1.7	0.35	50.4	20	7.3	7.6
3.4	0.7	71	34.6	7	7.2
4.83	1	84.3	46	5.85	6.5
6.9	1.43	99	62	5.6	6.3
9.65	2	99.9	86.9	5.0	5.4

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OXIDATION OF CLAY MINERALS WITH OXYGENATED WATER

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Keywords: *oxidation of clay minerals, oxygenate water, oxidation effects*

Abstract

An oxidation method with oxygenated water was used on the separated and calcium saturated clay fractions and were estimated the concentrations of smectite and illite by means of X-ray diffraction patterns. In addition were calculated three crystallinity indices. The illite crystallinity indices are greater than those of smectite and show that illite has greater particles and higher ordering of atoms on broken surface and in lattice structure. This suggest a particle corrosion with a releasing of some structural elements and an accentuation of the illite→smectite transformation.

INTRODUCTION

The alteration processes of soil minerals are surface processes [5] which depend on the stability of each mineral their crystallinity, intensity of microbiological activity, composition and ionic strengh of soil solution, the removing speed of alteration products from the surface mineral proximity, climate conditions.

In the present work were investigated in laboratory the effect of treatment with oxygenated water on the clay minerals by comparison of samples with or without treatment.

MATERIAL AND METHODS

A group of 157 soil samples were selected from main types of soils (chernozem, phaeozem, luvisols, rendzic leptosol, vertisol, arenosol, fluvisol), from all horizons and many Romanian regions (Banat, Oltenia, Muntenia, Moldavia, Transylvania).

The clay fraction were separated by sedimentation from suspensions dispersed with natrium hydroxide at pH 9, saturated by calcium, deposited on glass plates as orientated preparates. An alicot part with 1±0.1 Ca saturated clay in 100 cm^3 suspension were treated with 1 cm^3 oxygenated water and holded a 30 minutes on the boiling water bath. Then the H_2O_2 is removed by a leaching treatment with $CaCl_2$ 1n and deposided on glass plates.

RESULTS AND DISCUSSION

Oxygen is the strongest oxidant in soil, it diffuses from the atmosphere into soil surface horizons and this diffusion is greater when increase the soil aeration porosity. The agricultural technologies increase the air volume into tilled horizons and accentuate the oxidation reactions. But pore distribution is heterogenous in soils and the contact with the minerals is affected on the one hand by alteration pellicles [5] and on the other side deposits which cover the crystallites surfaces and on the other by the aggregation of soil particles.

The oxidation effect on clay minerals were investigated by comparison of concentration and crystallinity indices of untreated and treated samples with oxygenated water. In order to research this reactions were selected 157 samples from the main soil types all horizons and many Romanian regions. Some statistical data are presented in table 1. Kaolinite is not investigated because of its low concentration in clay fractions.

Table 1

Statistical date of the investigated soils

Property	Mean	Minim	Maxim	Median
Smectite and intergrade minerals				
Content untreated	43.94	13.8	80.5	43.9
Content treated	44.52	15.5	76.5	44.3
IA index untreated	0.433	0.254	1.52	0.392
IA index treated	0.422	0.25	1.72	0.385
IB index untreated	0.165	0	0.74	0.11
IB index treated	0.158	0	0.91	0.1
Illite and its interstatifications				
Content untreated	50.12	17.6	75.5	50.6
Content treated	49.53	20	83.9	50.5
IA index untreated	0.925	0.192	2.08	0.877
IA index treated	0.945	0.404	2.13	0.893
IB index untreated	0.501	0.05	0.79	0.53
IB index treated	0.51	0.02	0.79	0.53
IC index untreated	0.372	0.17	0.926	0.341
IC index treated	0.369	0.189	0.98	0.334

The mean values of mineralogic properties are changed only a little by the treatment with oxygenated water (table 1). The smectite content increase with 1.33% and the IA and IB indices decrease with 2.54% and 4.24% respectively while the illite quantity decreases with 1.18% but the IA and IB indices increase with 2.16% and 1.76% and IC index, the interne ordering decreases with 0.81%. These differences would suggest that smectite is altered with release of structural ions in about the same proportions as illite. IA index namely the mean size of mineral decreases with 2.54% and those of illite increases with 2.16% comparable values but not identical which suggest a higher dissolving of smectite accompagned of a transformation in smectite of the illite particles with smaller size. The variation of IB index-atom ordering on the broken surface, shows a higher alteration of smectite and an increasing of illite crystallinity due to transformation in smectite of crystallites with smaller dimensions and more alterated.

The comparison of the averages with the medians from table 1 shows small differences for the smectite (<0.5%) ans of illite concentrations (<0.95%) and greater differences for crystallinity indices of clay minerals. That suggest beside unimodal distribution multiple histograms or/and with asymmetrical ranges.

The smectite concentration of samples treated with oxygenated water correlates very high with the content of untreated samples (n=157, Rpow=0.909***, Rlin=0.907***, F=715). The power curbe with the greatest correlation coefficient is superposed on the representative straight line (figure 1). The representative points are placed very strong along to statistical curves and show that the oxidation effect remains at a low level for all smectite concentration. Nevertheless the treated samples have their concentration greater under 47.6% smectit and smaller concentration than the untreated samples over this content. This would suggest that oxidation would reduce the smectite concentration and release elements from its structure especially at smaller concentrations and greater surface area.

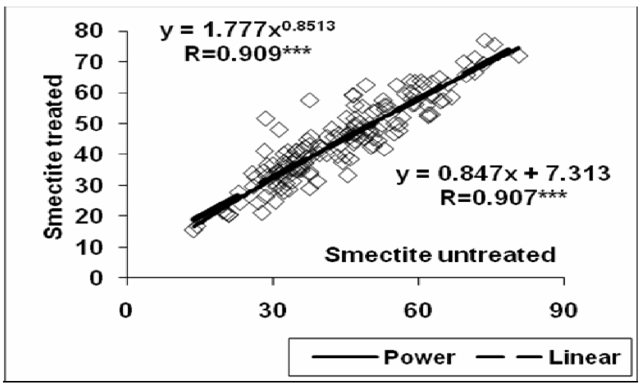

Fig. 1. Effect of treatment on the smectite content

The relation between the mean size of smectite particles (IA) at treated and untreated samples (figure 2) is very high (n=157, Rpoly=0.711***, Rlin=0.704***, F=152) and representative curves are superposed on a large portion of their trajects beginning with the small dimensions where the representative point density is greater. The IA indices of samples with and without treatment are equal for IA=0.395 and show that under this value the particle size of treated samples is greater than those untreated samples and over this the treated samples have smaller values. This suggest that oxidation corrodes the smectite particles and dissolves the smaller particles due to their specific surface area.

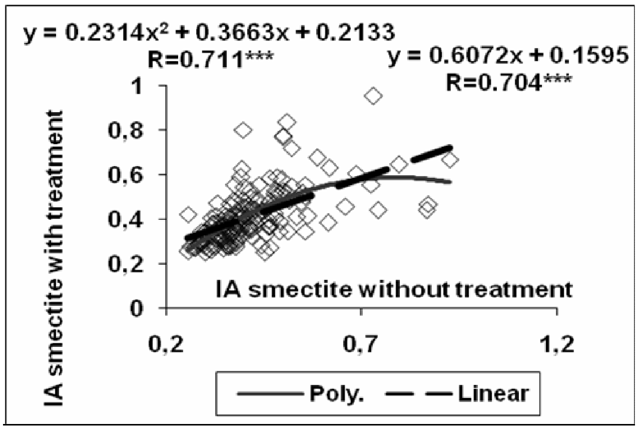

Fig. 2. Effect of treatment on smectite IA index

The smectite IB index of treated particles high correlates with the index of untreated samples (n=157, Rpoly=0.888***, Rlin=0.888***, F=580) and the representative points are placed along to the straight line (figure 3). The atom ordering on the broken surfaces of crystallites has the same value when IB=0.12 for untreated and treated samples. Under this value the ordering is higher for treated and over is higher for untreated samples. This show that all broken surface of smectite particles are corroded in the oxidation processes and at the greatest alterated surfaces are dissolved many structural elements.

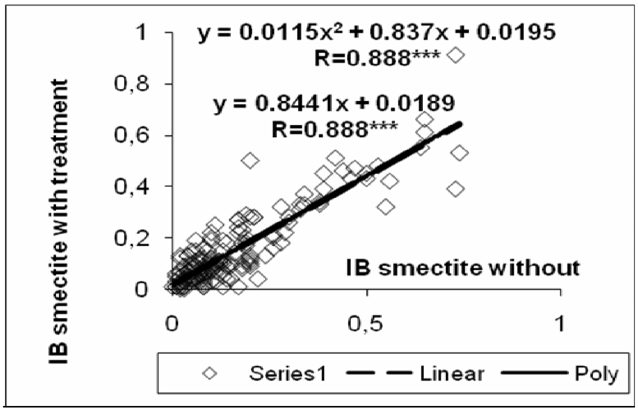

Fig. 3. Effect of oxidation on the smectite IB index

The illite content of treated samples strong correlates with the content of untreated samples (n=157, Rpoly=0.907***, Rlin=0.906***, F=707) and the reprezentative points are placed along to the statistical curve (figure 4). The concentrations are equal at 45.1% illit in clay fraction. Under this value the illite concentrations of treated samples are greater than these untreated and over smaller. This suggest that the oxidation processes release structural ions from crystylline lattice and accentutes transformation reaction illite→smectite of the smallest illite concentration.

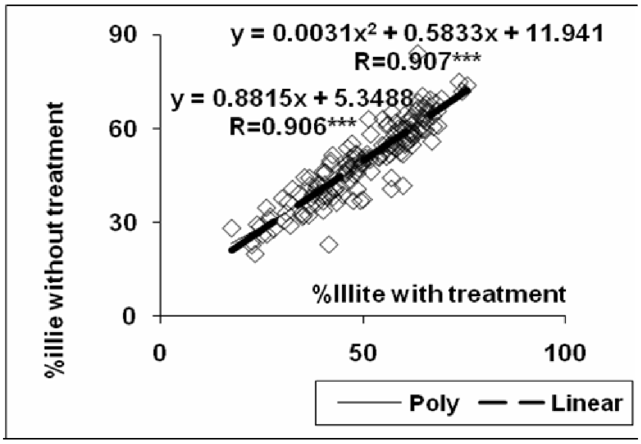

Fig. 4. Effect of oxidation on the illite content

CONCLUSIONS

1. The comparison of statistical mean of mineralogical properties, of their histograms and of relations between the treated and untreated samples show that the elaborated oxidation method modify a little the concentrations and the crystallinity indices of clay minerals with 2:1 structure from Romanian soils.
2. The oxidation increases the smectite concentration and decreases the concentration of illite with about 2%. Under approximatively 45% illite mineral the treated samples have greater concentration than the untreated samples and smaller over this value than untreated samples.
3. Illite has crystallinity indices greater than smectite. This show that illite has particle size greater than smectite, an higher atom ordering on the broken surface and a more ordonate interne crystaline structure.
4. The agricultural technologies increase the oxygen diffusion from atmosphere to soil horizons, intensify the biological activity and the oxidation reaction which release structural ions from clay minerals proportionaly with their surfaces, produces the diminish of their particle sizes but affect a little the interne structure of clay minerals.

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RECOVERY OF SOIL RESOURCES IN ROMANA UNDER IRRIGATION CONDITIONS

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Keywords: *irrigation, fertility, chernozem clay, organic matter*

Abstract

Addressing the role and place of irrigation agriculture in Romania is one of the most debated issues. Irrigation is one of the most important technological sequences with a strong impact on soil physical features, through the process of moistening and because the issues they raise as a result of land degradation physical and chemical state of degradation of aggregates by moistening being influenced at the macroscopic stability of their mechanical and fluid specify.

Also through irrigation, soil work is affected too, whose significance is related aggregates and structural ability to resist to the destructive action of the impact of irrigation, or mechanical means of the soil processing.

Thus, the work put in question some aspects of the impact of irrigation on soil and agriculture, in the south area of the Romanian Plain.

INTRODUCTION

The rational development of the soil should be realized by combining the agricultural technologies in such a way that it will be realized concomitant: bio productivity, alimentary security, the soil quality protection, the economical viability and social acceptance.

In order to increase the efficiency of the entire complex of hydro ameliorative, agro soil ameliorative and tillage soil is important to know the types of soil specific to every area and the physical, chemical and biological properties of them, and also the different problems which are appearing as a result of the agricultural technological works, to increase fertility.

MATERIAL AND METHOD

For the study undertaken were conducted data analysis and interpretation, as a result of its having been undertaken at SCDA – Teleorman Country. The type of soil taken in the study clay is mold subtype, type of soil that occupies the largest area in Teleorman Country.

Documentation remains a basic element by which are updated processes and phenomena that make problems in agriculture, due to the impact of the irrigation during a long period of time.

Methods used in determining the humus and biological characteristics of soil were made after taking samples of soil amended with the settlement determinations in laboratory studies under preparation Methodology Soil (ICPA).

RESULTS AND DISCUSSION

The culture of plants in the scale irrigation has taken towards the end of the years'60 and early 70s, when some of the major systems, Calafat - Bailesti, Terrace Braila, Constanta country, totaled more than 700 000 ha arranged. **Situation arrangements for land improvements**. Surface arranged with various agricultural works in the background level of 2007 total 7,926,702 hectares, with 483 hectares less than in 2005. Surface irrigation has arranged for a share of theoretically 37.85% of all arrangements, reducing to 598 ha in 2008 compared to 2005. According statistical directories, between 2000-2006 were reduced irrigation areas, between 85,000 ha and 569,100 ha, and in 2007, 96,224 ha (table 1).

Table 1

Area actually irrigated (at least watered) during 2000-2007

Area	**Years**					
	2000	**2003**	**2004**	**2005**	**2006**	**2007**
ha	85,000	216,100	327,900	569,100	45,719	96,224
%	100	254	286	670	54	113

Regarding the losses caused by risk factors, according to the data MAPDR in 2007, each county in the country has suffered from risk factors, where the floods and drought, there is damage caused by an area of 622,380.7 ha.

In 2000, the governments of Romania, Bulgaria, Ukraine and Moldova sign agreement for ***Green Corridor of the Lower Danube***, the largest international initiative for the protection and restoration of nature in Europe, with the purpose of rational use of renewable natural resources, where we are and the greening continues some areas of the premises Meadow Danube Delta.

Thus, it is necessary to examine current land use, particularly in units where they were partially or completely drain the great lakes, and areas are included in the Teleorman Country: Nedeia, Suhaia and Greaka.

Chemical and biological changes in soil type mold clay Alexandria area under the influence of irrigation.

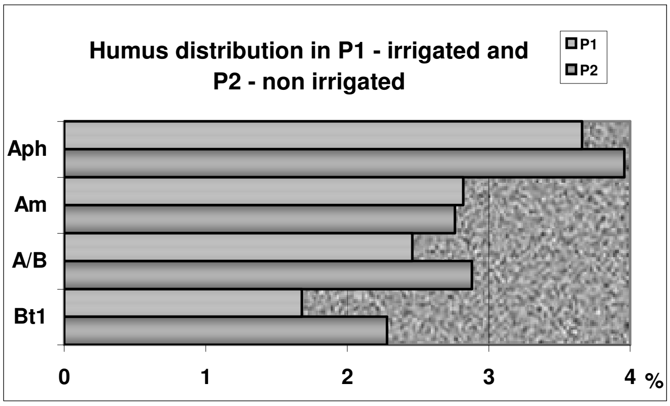

Fig. 1. Graphic distribution in the two humus profiles of Alexandria area (P1 and P2)

Humus content decreased on irrigated land in 2007, reaching a content of 3.60% versus 3.94% in non-irrigated variant from 2001 (figure 1).

Organic matter is present to the horizon and BT_1 are different in the two sections, being represented by humon soil particles strong matrix that ingrain horizons soil oftness and rare plant fragments and in advanced stages of decomposition and grind.

Biological activity. In P1 area Alexandria biological activity, is more intense than in the second profile (non-irrigated), which showed an abundance of structural elements of small size (figure 2). In P2, activity fauna is dominated by worms, structural elements are larger (figure 3).

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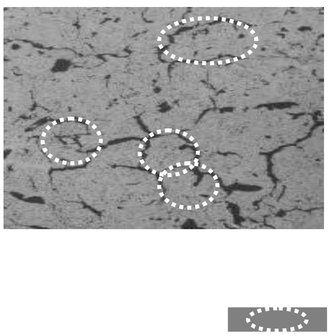	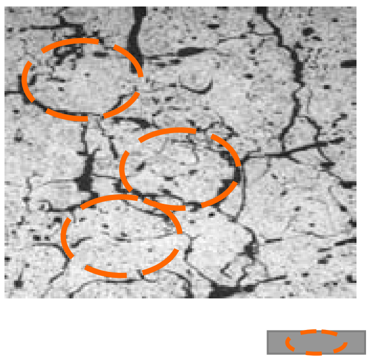
Fig. 2. P1-irrigated. Am horizon - structural elements	**Fig. 3. P2-non-irrigated. Am horizon - structural elements**

Wildlife movement from surface to depth is much greater in irrigated profile (P1), which revealed the presence pedo tubes oriented vertically.

This is because the application of irrigation extended period of time that is active fauna, and emphasizing the formations round of A horizon material specific Bt horizon.

CONCLUSIONS

1. Highlighting the crucial role of irrigation in the environment protection, which is fundamental to correct the deficiency or moisture.
2. Possible use of alternate sources of local water, such as groundwater.
3. In the irrigated, humus has a tendency to decrease during the first 30 cm, values reaching 3.6%.
4. Applying irrigation extend period of time that the fauna is active, resulting in a greater movement of worms in soil.

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SOME CHARACTERISTICS OF RHODIC-DYSTRIC CAMBISOLS FROM AMPOI BASIN, APUSENI MOUNTAINS

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Keywords: *rhodic, dystric, cambisols, Ampoi*

Abstract

The studied soil is located in the Ampoi basin, in the Southeastern part of Apuseni Mountains. Cambisols are the most wide-spreaded soils in the studied area (around 75.6%).

The paper presents some physic-chemical characteristics of the Rhodic-Dystric Cambisols, a particular subtype in Dystric Cambisols in the area.

Rhodic-Dystric Cambisols are located on the sloped moderate-strongly versants, over 500 m altitude, both Northern and Southern side of the Ampoi River. The parent materials are represented by sandy-loam deluvium derived from polimictic conglomerates and Tortonian brick-reddish sandstones with intercalation of magmatic rocks (Neogen quartzite amphibole andesite).

The reddish colour of the parent material induces red colour of the soil and further their rhodic character.

From the morphological point of view, these soils belong to the Dystric Cambisols. The chemical data showed a very high depletion of bases ($V_{\%}$=6-8%), specific to Spodisols. These chemical characteristics are strongly induced by the acid rains.

INTRODUCTION

The studied soils are located in the Ampoi basin, in the South-Eastern part of Apuseni Mountains. Cambisols are the most representative soils from Ampoi Basin and are located on 36520 ha, represented 76% from this area. Dystric Cambisols are spread on 13680 ha (28%). Them are occurring on narrow crest and moderate-strongly sloped versants, over 500 m altitude, both northern and southern side of the Ampoi River. Them are represented by Dystric Cambisols associate with Lepti-dystric Cambisols and Dystric-lithic Leptosol; Rhodi-dystric cambisols associate with Lithic-rhodi-dystric Cambisols.

The paper presents some morphological, physical and chemical characteristics of the Rhodic-Dystric Cambisols, a particulars subtype in Dystric Cambisols in this area.

MATERIAL AND METHODS

Research was carried out during 2001-2004, by field studies. The assignment of work itineraries was made according to ICPA Methodology (vol. I) for mountain relief. Soils samples were collected on genetic horizons, the soil profile was characterized by soil texture and basic chemical properties (pH_{H2O}, cation exchange capacity, content of organic carbon, nitrogen, available phosphorus and potassium, base saturation percentage).

Soil reaction (pH) was determined potentiometric method, in water suspension (1:2.5). The values of the percentage base saturation ($V_{8.3}$, %) were determined by calculation as a percentage ratio between the content of exchangeable bases (EB, me/100 g soil – Kappen procedure) and the total cation exchange capacity ($T_{8.3} = BE + A_{8.3}$).

Organic carbon content (Corg, %) was determined by wet combustion procedure (Walkley-Black method modified by Gogoaşă).

The available phosphorus and potassium contents were determined by the Egner-Riehm-Domingo procedure, by extraction the ammonium lactate acetate, in soils were rated as per the principles and criteria of WRB-SB (1998).

RESULTS AND DISCUSSION

Rhodic-Dystric Cambisols occur on the sloped moderate-strongly versants with gullies, over 500 m altitude, both Northern and Southern side of the Ampoi River.

The parent materials consist of sandy-loam deluvium derived from polymictic conglomerates and Tortonian brick-reddish sandstones with intercalation of magmatic rocks (Neogen quartzite amphibolic andesites). Natural global drainage is excessive. Bioclimatic province belong to broad-leaved trees-*Fagus sylvatica* forest floor. Soil profile is of Ao-AB-Bv-BC-Cn. The soils are semi-deep to moderately deep (51-100 cm). The soils are primarily used as forest.

Morphological characterization

Ao1 0-10 cm; loam with coarse fragments (5%) from amphibolic andesites in different stages of weathering; dark reddish brown (5 YR 3/4) in moist state; reddish brown (5 YR 4/4) in dry state; weak granular structure; weak compact; dry; hard in dry state; friable in moist state; thin grassy roots; gradually transition.

Ao2 10-25 cm; loam with coarse fragments (5%) from amphibolic andesites in different stages of weathering; reddish brown (5 YR 4/4) in moist state; light reddish brown (5 YR 6/3-6/4) in dry state; subangular blocky structure; friable inmoist state; thin grassy roots; slightly moist; compact; gradually transition.

AB 25-42 cm; loam with coarse fragments (10%) from amphibolic andesites in different stages of weathering; reddish brown (2.5 YR 4/4-5/4) in moist state; light reddish brown (5 YR 6/4) in dry state; strong-moderate blocky structure; friable in moist state; hard in dry state; thin grassy roots; compact; gradually transition.

Bv 42-60 cm; loam with coarse fragments (15%) from amphibolic andesites in different stages of weathering; reddish brown (2.5 YR 4/4-4/6) in moist state; light red (2.5 YR 6/6-7/6) in dry state; massive structure; very tough in dry state; friable in moist state; compact; slightly moist; gradually transition.

BC 60-75 cm; sandy loam with coarse fragments (20%) from weathered amphibolic andesites; red (2.5 YR 4/6-5/6) in moist state; red-light red (2.5 YR 5/8-6/8) in dry state; massive structure; hard in dry state, friable in moist state.

Physical Properties (table 1). Analitical data show uniformly distribution of clay (<0.002 mm) along the soil profile (21.3-23.4%). From the pedological point of view there is not texture differentiation.

The content of silt (0.02-0.002 mm) decreases from 23.6% in Ao1 horizon to 20.5% in BC horizon; fine sand (0.2-0.02 mm) increase from 38.4% in Ao1 to 40.3% in BC and coarse sand (2.0-0.2 mm) is constant along profile with low values (14.8-16.8%). The textural class is loamy-sandy loamy.

Table 1

Physical properties of Rhodic-Dystric Cambisols

Horizon	UM	Ao_1	Ao_2	A/B	Bv	B/C
Depth	cm	0-10	10-25	25-42	42-60	60-75
Skeleton	% g/g	5	5	10	15	20
Coarse sand (2.0-0.2 mm)	% g/g	15.5	14.8	15.1	16.8	15.8
Fine sand (0.2-0.02 mm)	% g/g	38.4	39.8	42.6	39.4	40,3
Silt (0.02-0.002 mm)	% g/g	23.6	22.8	21.0	20.2	20.5
Clay (<0.002 mm)	% g/g	22.5	22.6	21.3	23.6	23.4

Chemical properties (table 2). Soil reactions is strong acid (pH 3.9-4.4) on the whole profile. Cation exchange capacity (CEC) is very low (8.6-9.7 me/100 g soil) in Ao1, Ao2, AB, Bv and low (14.3 me/100 g soil) in BC horizon. The adsorption complex is dominated by the exchangeable hydrogen with very high values (8-12 me/100 g soil). The exchangeable base sum is extremely low (0.6-2.2 me/100 g soil). The percentage of bases saturation (V, %) is extremely oligobasic (6.8-8.3%) along Ao1, Ao2, Bv horizons and oligobasic (15.5%) in BC horizon, consequently the soil is extremely debasified. Organic carbon content is low (1.6%) in Ao1 horizon, very low (0.87%) in Ao2 horizon and extremely low (0.3-0.6%) along the AB, Bv and BC horizons. Total nitrogen content is very low (0.032-0.068%) along the whole profile. Available phosphorus content is extremely low (2 $mg.kg^{-1}$) along the profile and available potassium content is low (73 mg.kg-1) in Ao1 horizon, very low (59 mg.kg^{-1}) in Ao2, AB horizons and low in (86 mg.kg^{-1}) in subjacent horizon.

Table 2

Chemical properties of Rhodic-Dystric Cambisols

Horizon	**UM**	**Ao_1**	**Ao_2**	**A/B**	**Bv**	**B/C**
Depth	cm	0-10	10-25	25-42	42-60	60-75
Humus (Cx1.72)	%	1.60	0.87	0.67	0,53	0.25
Total N	%	0.068	0.049	0.046	0,032	0.040
pH in H_2O	pH unit.	3.88	4.08	4.14	4,20	4.42
SB	me/100 g sol	0.61	0.56	0.67	0.72	2.22
T	me/100 g sol	9.74	8.56	8.62	8.75	14.27
$V_{8.3}$	% (T=100)	6.0	7.0	8.0	8.0	16.0
P-m	mg.kg^{-1}	2	2	2	2	2
K-m	mg.kg^{-1}	73	59	59	86	86

CONCLUSIONS

1. The reddish colour of the parent material induces the red colour of the soil and further their rhodic character and this subtype is not mentioned in SRTS, 2003.
2. The data showed a very high depletion of bases ($V_{\%}$<10<; pH_{H2O}=3.9-4.4), specific to Spodisols; these chemical characteristics were strongly induced by the acid rains. Also, the bioclimatic conditions are not specified to Spodisols.
3. From the morphological point of view, these soils belong to the Dystric Cambisols.

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THE EVALUATION OF NATURAL AND ANTROPICALY RESOURCES FROM MURES`S INFERIOR BASIN, FOR A DURABLE DEVELOPMENT

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Keywords: *biovariety, cooperation, cohesion, sustenability, monitoring*

Abstract

The natural conditions of researched area (Mures`s inferior basin) are generally favourable for agro-alimentary sector development, under all the aspects, being an old tradition for cereal cultivation and valorization, especially for animal breedinds.

However, that area is situated in subsidiary, divagation and accumulation of Mures`s plain and his geomorfological evolution is correlated by the evolution, in time, of marine domain (Thetys) or lakes domain (Panonic), thing that have generate several types of soils (vertisols, pelosols). These types of soils present two situations: excess of humidity in cold season and deficit of humidity in warm season of the year, the both situation generating multiple form of stress, with negative effects on agro-ecosystems productivity and quality.

Also, the intensive drainages practiced in Banat`s NV area in the last decades of the XXth century have lead to a descend of underground wather from 1-2 m to 5-7 m. In climatic changes and unreasonable exploitation background, the apparence of winds, who had break out by climate aridity, have lead to the apparence of dusty phenomena.

Having in view all this aspects concerning at risk existence, owing sundries manifestation of natural factors or anthropical irational interventions, the authors of this paper try to transfer the teoretical describetively activities to analitical activities, who offers practical solutions for durable management of soils resources.

INTRODUCTION

Beying an important part of national wealth, natural resources are constitued by all the resources from nature: soil, water, air, flora, fauna, solar energy. In some technologycal, economical and social conditions, these resources are extracted from their natural places and transformed in goods that their use supposing their direct consumption.

The use of these resources have to be practice in a complex, co-ordinated manner, for a simultaneous accomplish of many purposes harmonized with requirements reffering environmental protection [1, 2, 3, 4, 5, 6, 7].

The applying of inpropried and incomplete technologies can cause some irreversible changes of natural resources and modify their restoring character.

The factor who transform almost totally and irreversible the natural restoried resources is the man.

Natural and anthropic induce resources management represents a modern manner in dealing with land fund and have the aim to maintain or increase soil fertility. Those would allow obtaining high quality alimentary products on long term.

Durable soil management in case of agricultural and forestry terrains, imply taking into account information, energy, material exchange fluxes cycles between soil and the environment (atmosphere, water, flow courses, wildlife, land, vegetation).

In FAO`s terminology “land quality” is defined as a complex of factors which inflame terrain sustained capacity to comply to planned aims. The term covers a wide range of meanings. “Land” refers to soil, shape of terrain, climate, hydrology, wildlife and vegetation, land amelioration, other management measures [4].

Land quality (in Romanian school of Pedology) is defined by all essential qualities and particularities (defined from topographical, geographical, geomorpholocal, pedological, agrochemical a.s.o. point of view) through which someone can discriminate among land zones a better or a worse quality [7].

Starting from these reasons, the authors try to present in this paper, in base of the dates extracted from scientifical researches themes and dates from OSPA Timisoara archives, some aspects regarding the quality state of soils and the evolution of main factors that compete at his accomplishement.

MATERIAL AND METHODS

The treated problems are refering to an surface of 110017.91 ha (table 1), whence 99822.91 ha agricultural land.

Table 1

The structure of land for main utilization categories

Specifi-cation	Arable	Pasture	Hayfield	Vine-yard	Orchard	Agricul-tural	Woods	Other use	Total
ha	86197.9	11315	420	550	1340	99822.91	1671	8524	110017.91
%	86.35	11.34	0.42	0.55	1.34	100	-	-	-
%	78.35	10.28	0.38	0.50	1.22	90.73	1.52	7.75	100

OJCPI Timiş/From statistical report concerning the situation of land fund at 31.12.2006

The examination of ecopedological conditions, werw seting in order and processing dates were made according to „The Pedological Studies Elaboration Methodology“ of ICPA Bucharest, in 1987 and Romanian Taxonomic System of Soils (SRTS-2003).

RESULTS AND DISCUSSION

Owing to his possition, the natural conditions (relief, soil, hydrology, vegetation) are specific to a subsidiary, divagation and accumulation low plain, where have developed the main types of soils, that mirrores, through their geo-bio-chemical and morphological appropriations, the main landscape characteristics that are decisive for growing and fruit-bearing of main cultivated plants.

The researched area makes part of Aranca Plain and Galatca Plain, like a component of Mures Plain, situated to South of curent flow of Mures. The geological past of researched area is connected with the past of Banato-Crisana Plain, beying one of the Eastearn part of the great basin of sedimentation called Panonic Depression.

The formation phases of Carpathians have differentiate the mouvement of crystaline blocks from foundation of plain, creating periodicaly areas with tendency of dip or inverse, the crystaline blocks from East, generaly much raised, situated to 1000 m deepth (980 m to Gavojdia, in West and South-West goind down to 200 m at Giulvaz-Foeni).

The forming of plains from investigated space is strongly connected to base level of Panonic Depression from Middle Danube area, to varied rivers that come from mountains, thing that had determinate the evolution of two groups of plains: high plains (situated near hills) and low plains (situated near Tisa).

Low plains start to 80 m altitude and are superposed over subsident area of Pannonic Depression, made by under water evacuation cons, that have been identified under lacustrian sediments, cover with different materials: recent alluvial deposits or eolian deposits.

Depending on variation of morphological, hydrografical, soil conditions and the nature of generating agents, can be identified more sub-units.

Aranca Plain (Felnac-Periam-Valcani), situated between Mures river and Galatca it seems like a large depression and it is the lowest part of researched area, with 77-83 m altitude, with little depressions and banks with general level biger with 0.5-1.0 m confronted with general level. Also, there are here and there antropical knolls who are lifting with 3-5 m over general level. Generaly, this plain is a low area, with old abandoned flows, with high percent of clay in superficial stratification of soils and extended clay minerals, place where an important attention have been gived to hidro-improvement works.

Galatca Plain (Pesac-Lovrin-Teremia) is centred on an old bank of Mures and the main flow of Galatca river, with 100 m altitude. This plain is formed by dense alluvial deposits and sand deposits, in Teremia Mare area the surface is covered by sand hill and it is fixed with vineyards.

Though is delimited by actual flow of Mures river, the researched area belonging to hydrographical basin Bega, under basin Berecsău, the most importants flows of wather beeing Aranca and Galatca.

Aranca, an old flow of Mures river, has its springs in waterside of Mures at Felnac, on 10 m under river level and after it crossing our country on 108 km it pouring in Tisa on Hungary territory. Has an important role in collecting wather on 1016 km^2 depressionary surface, with underground wather at 1-2 m and standstill of surface wather. In rainy periods, because wather gates from border, it can not be evacuate all the wather and the land near are inundated.

For the characterisation of climatic conditions we have use the dates from meteorology stations Sânicolau Mare and Lovrin, but also from Beba Veche, Teremia Mare, Periam.

From the dates of Lovrin and Sanicolau Mare (table 2), we can see that the bigest average of temperature is at Lovrin (10.9^{0}C) and the smallest average is at Sânicolau Mare (10.8^{0}C).

The bigest monthly temperature average was at Lovrin in august (21.7^{0}C) and the smallest at Sânicolau Mare in january (-1.7^{0}C).

Table 2

Montly, yearly and multiannualy temperature values (^{0}C)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yearly
Lovrin	-1.2	0.8	5.5	11.0	16.6	19.7	21.6	21.7	17.9	11.3	5.4	1.5	10.9
Sanicolau Mare	-1.7	0.4	5.4	11.1	16.3	19.7	21.7	20.9	17.0	11.0	6.6	0.9	10.8

Because of cyclones activityes and humid air invasion from West, South-West and Norh-West, in high plains from the West area of Romania the precipitations are quantitatively biger than others part of the country (table 3), exception made by North-West part of the plain.

Table 3

Montly, yearly and multiannualy rainfals values (mm)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yearly
Lovrin	31.2	27.5	28.0	40.6	51.6	67.0	54.1	46.1	36.5	36.0	43.1	44.5	506.2
Beba Veche	32.4	30.4	27.4	41.2	55.5	68.6	54.8	53.6	34.1	33.1	42.8	45.6	527.0
Teremia Mare	34.9	33.2	31.0	46.4	57.9	77.4	52.2	52.0	35.0	37.2	46.3	48.8	552.3
Sanicolau Mare	32.8	30.9	29.6	45.4	55.9	75.8	54.1	51.1	37.1	36.5	44.0	47.8	541.4
Periam	35.5	32.7	29.4	45.4	55.2	71.4	48.7	51.4	35.1	35.2	43.5	46.8	530.3

Wind conditions in South-West part of Romania is defined by development of baric systems who interfere above Europe at 45^0 North latitude (azoric, syberian, scandinavian anticyclone and mediteranean, islandish cyclone).

In the Plain of Mures we find flora and fauna elements similar to all West Plain, represented by historical province Banat and Crisana, with thermophyte and xerophyte plants, balcanic and central-europeean ecosystems.

From phito-geografical point of view, the flora of researched area belong to "province daco-ilirica" region, the "Plain of Banat" district.

In this context it is necessary to distinguish the importance of wooden species like: *Quercus cerris, Quercus fornitto, Quercus pubescens, Tillia tomentosa, Fraxinus ornus, Cornus mas*, species that are associated in complex and protect a great number of thermophile grassy species [3].
As a result of geographical position, at the interference of low plains and hills, in the old delta of Mures, the studied territory presents various geological and physical-geographical conditions, matter that have condition the forming of a complex cover of soils.

So, in pressed correlation with the variety of geomorphological factors that cause the existence of a diverse types of relief units, of geological factors that have guide to a diversity of materials (even for a reduced territory, of ha) and of climatic or hydrological factors, with antrophical interventions, have result a varied population of soils with specific characteristics (related or totally different) in permanent evolution.

According with Romanian Taxonomic System of Soils (SRTS 2003) and WRB for SR 1998, in researched area have been identified 6 classes, 8 types, 13 undertypes, 136 varietys and other units, which are different through their properties, their productiv capacity and measures for maintainance and increase their fertility. So, the map of soils includes types and undertypes of soil, on a surface of ha, that represents 100% of researched area:

- Arenosols (mollic, gleyed, sodic), represented by 5 TEO (1-5), on a surface of 467.10 ha (0.47%).
- Fluviosols (mollic, gleyed, salic, sodic), represented by 19 TEO (6-24), on a surface of 10328.50 ha (10.35%).
- Chernozems (gleyed, salic, sodic, vertic), represented by 7 TEO (25-82), on a surface of 60279.89 ha (60.39%).
- Cambisols (mollic, gleyed, salic, vertic, sodic), represented by 23 TEO (83-105), on a surface of 5319.06 ha (5.33%).
- Pelosols (gleyed), represented by 9 TEO (106-114), on a surface of 8785.02 ha (8.80%).

- Vertosols (gleyed, salic, sodic), represented by 7 TEO (115-121), on a surface of 8801.94 ha (8.82%).
- Gleysols (mollic, pelic, sodic, salic), represented by 11 TEO (122-132), on a surface of 389.30 ha (3.90%).
- Solonetz (mollic, gleyed), represented by 4 TEO (133-136), on a surface of 1944.10 ha (1.94%).

CONCLUSIONS

1. The systematic pedological and agrochemical mapping carried out by the Pedological and Agrochemical institutes from our country offers valuable data concerning the evolution of the quality status of the soils, the differentiated establishing and application of culture technologies, the bonification of the land, the favoured cultures, the land works, the ameliorative technologyes, the organisation and systematisation of the territory.
2. The evalution and evolution of lands quality is necessary for establishment of the proper technologies in order to assure an ecological equilibrium and which are grounded on the long experiments results with fertilizers, amendments, crop-rotations etc., placed in specific pedo-climatic areas of the Timiş county and managed by representative research and educational institutions: USAMVB Timisoara, SCDA Lovrin, OSPA Timisoara.

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INFLUENCE OF SOIL CONDITIONS ON MAIZE CROP AT TWO AGRARY SOCIETIES LOCATED IN BRAILA AND BUZAU COUNTIES

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Keywords: *maize crop, chernozem, vertic chernozem, level of yield*

Abstract

The scientific paper shows the differences of yield level at maize crop inside two agrary farms, at similar crop technology application. The differences are explained by the soil influence, respectively vertic chernozem at the first farm and typical chernozem at the second one. The analysis of maize crop during vegetation, as well as the level of yield at both farms (in t/h) revealed that low water permeability, the field water capacity and withered coefficient have been the restrictive elements for vertic chernozem. So, despite quite similar technology, the maize yield was 9.5 t/ha on chernozem soil at one farm and 8 t/ha on vertic chernozem at the second farm, which represents almost 16% difference between the two agrary units. Results reveal that, at similar crop technology, the soil is the one element which can make a significant difference.

INTRODUCTION

The present work-paper has as objective the analysis of the soil influence on maize crop, in its position as active layer for plants. The study is based on the results obtained at two agrary societies from Braila and Buzau counties, in 2008 agrarian year.

MATERIAL AND METHODS

The study took place at two agrary units, respectively SC Agroterra SRL located in Viziru area - Braila county and SC Agrisan SRL, located in the area of Buzau town. The fields at SC Agroterra SRL are represented by chernozems, while at SC Agrisan SRL the soil is vertic chernozem (figure 1). For soil type establishing, Soil Map of Romania has been consulted, 1: 1 000 000 scale, elaborated by Romanian Research Institute for Pedology and Agrochemistry and, in parallel, soil samples were prevailed from the fields of the two agrary societies, in order to determine a few of the soil indicators, necessary in underlining the influence of soil type.

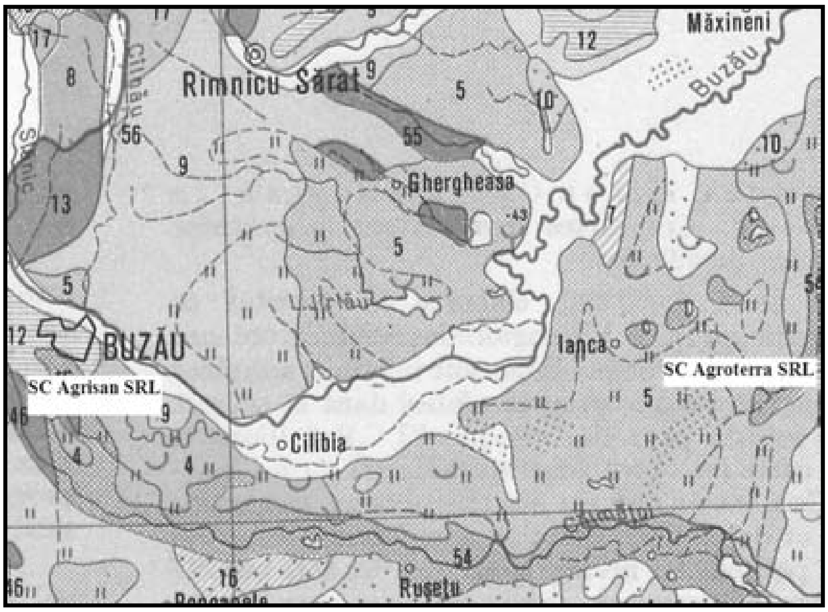

Fig. 1. Soil type at the two agrary units - chernozem at SC Agroterra SRL (5) and vertic chernozem at SC Agrisan SRL (12) (extras from Soil Map of Romania, 1: 1 000 000 scale, ICPA Bucharest)

Regarding cultivation technology at maize crop, it is to mention that the technological elements have been very similar, as follows:

- previous crop: winter wheat at SC Agroterra SRL and two row winter barley at SC Agrisan SRL
- fertilization: NPK 20-20-20 (200 kg/ha) and 100 kg/ha ammonium azotate at both agrary units
- maize hybrid: Thermo, produced by Syngenta company
- sowing time: April, the 18th at SC Agroterra SRL and April 22nd at SC Agrisan SRL
- herbicides: preemergence Guardian 2 l/ha and postemergence Mistral 1 l/ha and Calisto 0.3 l/ha, at both farms
- irrigation in both cases
- crop harvesting humidity: 12% at both farms.

During vegetation period, all maize surfaces have been monitorized at both farms, modification in plant growth have been observed comparatively and pictures have been taken, with main purpose of emphasizing the differencies which appear as a result of soil influence. Soil characterization coefficients are appreciated in according with The Methodology of Pedologic Studies Elaboration [1].

RESULTS AND DISCUSSION

The study has been made on two soil units, chernozem and vertic chernozem, which present a few notable differentiation in terms of soil characteristics, an aspect reflected in the plants development in their first stages of vegetation, as well as in the yield data. Thus, at SC Agrisan SRL, on vertic chernozem, a slowing of growth at maize plants during their first vegetation stages was discovered, due to a lower permeability of this kind of soil, as well as its more unfavourable features, compared to chernozem from SC Agroterra SRL. In table 1 a series of soil characterization data are shown, both for SC Agrisan SRL vertic chernozem, Buzau county and typical chernozem from SC Agroterra SRL, Braila county. As the table data show, there are differencies between the two soil types, regarding clay content, total porosity, permeability, whitered coefficient and field water capacity (table 1).

Table 1

Values of a few soil indicators at chernozem from SC Agroterra SRL and vertic chernozem from SC Agrisan SRL

Chernozem - SC Agroterra SRL (Braila county)								
Soil profile	Mineral composition			B.D. (g/cm^3)	TP (%)	K (mm/h)	FWC (%)	WCf (%)
	Sand (%)	Loam (%)	Clay (%)					
Ap	41.5	31	27.5	1.21	52	4.8	27.1	9.4
Am	41	33.4	25.6	1.17	56	2.70	25.6	10.2
A/Cca	41.6	32.6	25.8	1.19	55	2.63	24.4	10.6
Cca	43	32.4	24.6	1.22	53	1.46	22.7	9.7

Vertic chernozem – SC Agrisan SRL (Buzau county)								
Soil profile	Mineral composition			B.D. (g/cm^3)	TP (%)	K (mm/h)	FWC (%)	WCf (%)
	Sand (%)	Loam (%)	Clay (%)					
Apy	22.7	34.2	43.1	1.20	52.1	11.2	24.5	10.3
Amy	22.3	33.4	44.3	1.37	46.5	0.5	23.8	12.1
Bvy	24.5	30.7	44.8	1.43	43.4	0.4	22.4	14.3
Cca	28.3	29.5	42.2	1.50	43.1	0.3	22.1	13.8

So, at SC Agroterra SRL chernozem, the clay content in all four soil horizons is between 24.6 – 27.5% limits; that, along with sand and loam values generates a loamy texture. Instead, at vertic chernozem from SC Agrisan SRL, the clay content is increased in all soil horizons (values from 42.2 – 44.8%), generating a fine texture. This is also reflected in bulk density values, more increased at vertic chernozem, compared to chernozem from SC Agroterra SRL (BD is 1.22 g/cm^3 at chernozem and 1.5 g/cm^3 at vertic chernozem). More, total porosity (TP) has a decreasing tendence (52% minimum value at chernozem, respectively 43.1% minimum value at vertic chernozem), which means high and very high porosity in the first case and decreased porosity in the second case. Table data also show the diminution of water and air permeability at vertic chernozem: values between 0.3 – 0.5 mm/h in depth horizons (appreciated as very low), compared to supraunitary values of permeability at chernozem (in this case, permeability is appreciated as normal for all soil horizons). It is also to mention the increasing of whitered coefficient at vertic chernozem (WCf is between 10.3-14.3%), in comparison to its values on chernozem soil (9.4-10.6%).

The high values of bulk density, associated with lower permeability at vertic chernozem generated a more reduced starting in vegetation for plants at SC Agrisan SRL, in comparison with SC Agroterra SRL crop, as could be observed in the field (figure 2). This aspect, as well as the appearence of flat bog phenomenon three weeks after sowing time, leaded to 10% decreasing the crop density.

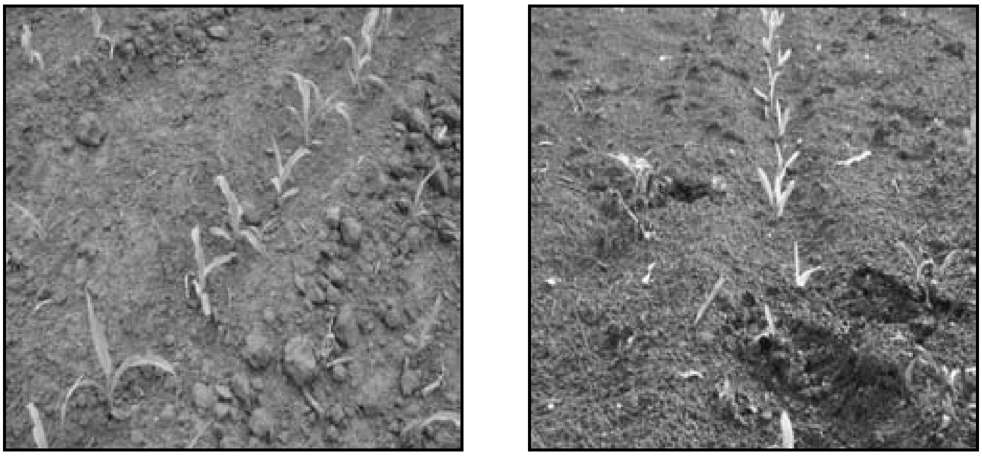

Fig. 2. Plant growth differencies in the first stage of vegetation SC Agroterra SRL (left) and SC Agrisan SRL (right)

Despite their reduced start, maize plants from SC Agrisan SRL had a normal growth during vegetation, except for some periods in July when, due to the lack of rainfalls and delay of irrigation, they deeply experienced the lack of water at soil level, which caused temporary wither of plants. It is also to mention that vertisolage process and the cracks appearence in the soil surface (during warm season) generated temporary disturbance for maize plants on vertic chernozem from SC Agrisan SRL (as could be observed in figure 3).


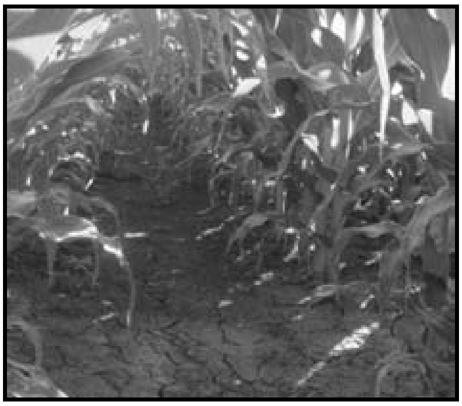

Fig. 3. Cracks in surface horizon at vertic chernozem in the area of Agrisan SRL (at different stages of plants vegetation)

All these differences between soils have been reflected in the maize yields, at the same technology application. The influence of soil has been observed at yield level registered at the two societies, in condition in which the crop technology has been almost the same. This way, at SC Agroterra SRL from Braila county, the maize yield (t/ha) has been 9.5 (grains), while at SC Agrisan SRL from Buzau county the maize yield was 8.5 t/ha (figure 4). It isn't a very significant difference; however, it is notable, if we think that soil is different only at subtype level (chernozem, in first case, vertic chernozem, in the second one). However, the results show how striking the influence of soil can be in some cases, especially when we deal with the same crop technology.

CONCLUSIONS

1. At two agrary societies, located in Braila and Buzau counties, the maize yields (t/ha) have been different at similar crop technology application.
2. The only element which created differencies regarding yields was the soil: chernozem at SC Agroterra SRL and vertic chernozem at SC Agrisan SRL.
3. The vertic features of chernozem from SC Agrisan SRL (increased bulk density, lower permeability, high clay content) generated differences at maize crop for the two farms.
4. The yield was 9.5 t/ha on chernozem soil and 8 t/ha on vertic chernozem, which represents almost 16% difference between the two agrary units.

5. Results reveal that, at similar crop technology, the soil is the one element which can make a significant difference.

Fig. 4. Maize yield (t/ha) at the two agrary units, on different soil subtype

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RESEARCH ON THE INFLUENCE OF IRRIGATION ON THE MAIN FEATURES OF THE TYPICAL CHERNOZEM FROM BAILESTI PLAIN

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Keywords: *soil profile, irrigation, physico-mechanical and chemical features*

Abstract

In order to study how the long term irrigation influences the typical chernozem from Bailesti Plain as regard the morphological, physico-mechanical and chemical features there was, in the same time, studied a typical chernozem that was cropped rainfed. There was established that the main morphological features do not differ from the rainfed treatment, while the physico-chemical ones have significantly changed. The bulk density has increased over the entire soil profile; the total and the aeration porosity have decreased due to compaction determined by irrigation, the hydro physical indicators have recorded higher values and the humus content has decreased, especially within the shallow horizons. The total nitrogen content with the irrigated soil has decreased and the reaction has modified recording an increasing on the entire soil profile as a result of high accumulation of limestone from the irrigation water.

INTRODUCTION

Irrigation is one of the most important measures of the cropping systems with a high impact upon physical and chemical features. In this respect, the irrigated surfaces from our country raise a series of problems, especially in plain zones where the soils have a short profile with an enriched salt substrate and seldom, with shallow watertable or low mineralized, aspects that determine a negative evolution of these soils, the recovery of fertility of these soils being very costly, the prevention of the negative influence being a necessity of high importance for the irrigation terrains.

MATERIAL AND METHODS

There were accomplished comparative researches on a typical chernozem that was cropped and irrigated a long period of time (over 25 years) as well as with a typical cropped, rainfed chernozem, both situated near Bailesti, next one another that evolved in similar conditions. The typical chernozem was formed on loess deposits with the watertable at 4 m deep, very good permeability, rich in humus, silty texture, alkaline reaction.

The irrigation water comes from Danube and it has no high salinisation degree, so it is not harmfull for the soil (under 200 mg/l).

RESULTS AND DISCUSSION

The researches that have been carried out on the field as well as in laboratory in order to know the evolution of the soil profile of the typical irrigated chernozem over the rainfed one taken as control have emphasized modifications of the main features.

In this manner, the irrigated soil morphological features do not show essential changes. However, there are recorded at the base of the Ap horizon of discontinue compacted zone a more degraded structure over the rainfed one. Also, there is recorded a tendency of lifting of the salts toward the soil surface and humus taking along on a deeper zone.

The physical properties of the irrigated soil have suffered more evident changes. The bulk density have recorded an increasing on the soil profile as a result of the irrigation water recording the 1.48 g/cm^3 under the 25 cm depth that is the usual depth of plowing (table 1a; b). This tendency of plowpan formation was noticed over the entire irrigated chenozem zone from Bailesti Plain.

Table 1a

The main physical features of the typical, rainfed chernozem from Bailesti Plain

Horizon	Size fractions %				Bulk dens. (g/cm^3)	D (g/cm^3)	Tp (%)	Ap (%)	Hygr. Coeff (%)	ME (%)
	Thick sand 2-0.2	Fine sand 0.2-0.02	Silt 0.002-0.0002	Clay < 0.0002						
Ap 0-25 cm	8.5	42.1	22.4	27.0	1.33	2.64	50	22	6.2	21.2
Am 25-60 cm	8.4	40.9	23.2	27.5	1.43	2.64	46	15	6.3	21.7
AC 60-90 cm	7.1	41.4	24.4	27.1	1.40	2.66	48	18	5.9	21.5
C < 90 cm	7.9	43.2	22.8	26.1	1.37	2.70	50	22	4.9	20.1

The soil compaction determined by the irrigation has conducted to the decreasing of the total and aeration porosity on the irrigated soil. Thus, the total porosity has decreased with the irrigated soil by 1-2% over the rainfed one and the aeration porosity is lower by 1-3%.

The granulometric analysis does not show evident changes. Among the two studied soils, the thick fractions of both soil profiles can not be put as a result of irrigation. The higher clay quantities from the inferior soil horizons are determined by the action of irrigation water that takes along the fine fractions on the depth of the soil profile.

As regard the hydro physical properties they have recorded light changes by irrigation applying. The hygroscopicity coefficient and the moisture equivalent have higher values with the irrigated soil into the horizons where the clay content is higher, too.

Table 1b

The main physical features of the typical, irrigated chernozem from Bailesti Plain

Horizon	Size fractions %				Bulk dens. (g/cm^3)	D (g/cm^3)	Tp (%)	Ap (%)	Hygr. Coeff (%)	ME (%)
	Thick sand 2-0.2	Fine sand 0.2-0.02	Silt 0.002-0.0002	Clay < 0.0002						
Ap 0-25 cm	8.3	43.2	21.8	26.7	1.35	2.65	49	21	6.1	21.6
Am 25-55 cm	8.2	40.9	22.3	28.6	1.48	2.65	44	12	6.5	22.4
AC 55-80 cm	6.4	42.5	23.8	27.3	1.41	2.68	48	18	5.9	21.2
C < 80 cm	7.0	44.6	21.9	26.5	1.40	2.70	48	19	5.1	20.7

Table 2a

The main chemical features of the typical, rainfed chernozem from Bailesti Plain

Horizon (cm)	Humus (%)	Total N (%)	P_2O_5 (mg/100 g soil)	K_2O (mg/100 g soil)	$CaCO_3$ (%)	pH (H_2O)	T (me/100 g soil)	V (%)
Ap 0-25 cm	4.42	0.210	22.0	28.8	0.9	8.1	34.71	100
Am 25-60 cm	3.96	0.189	9.1	13.4	2.7	8.1	33.13	100
AC 60-90 cm	2.96	0.140	5.0	9.6	8.2	8.2	33.46	100
C<90 cm	1.28	0.096	2.5	8.2	18.9	8.3	28.90	100

The chemical features record changes with the irrigated soil, as well (table 2b). Thus, the humus content is lower with the typical, irrigated chernozem, especially within the shallow layer. The total nitrogen has recorded changes in the same way as the organic matter with the rainfed soil as a result of different oxide-reduction conditions within the first 35 cm, there was accumulated a higher nitrogen quantity over the irrigated soil (table 2a).

Table 2b

The main chemical features of the typical, irrigated chernozem from Bailesti Plain

Horizon (cm)	Humus (%)	Total N (%)	P_2O_5 (mg/100 g soil)	K_2O (mg/100 g soil)	$CaCO_3$ (%)	pH (H_2O)	T (me/100 g soil)	V (%)
Ap 0-25 cm	3.60	0.185	16.6	18.0	4.2	8.3	36.95	100
Am 25-60 cm	3.52	0.175	15.8	15.4	4.3	8.3	36.96	100
AC 60-90 cm	2.16	0.119	8.2	12.0	12.6	8.4	36.59	100
C<90 cm	1.76	0.106	5.5	9.6	17.8	8.5	31.33	100

Due to the irrigation water that contains lime, there was accumulated a higher lime quantity, especially within the shallow layer. Thus, within the Ap horizon the lime quantity has increased from 0.9% within the rainfed soil to 4.2% with the irrigated soil (table 2b).

The exchangeable capacity of ions records a slight increase within the first 100 cm with the irrigated chernozem over the rainfed one.

The higher lime accumulation on the soil profile has determined a change of its reaction, too. Thus, with the typical, irrigated chernozem there was determined an increase of the pH value on the entire soil profile, with more evident differentiations within the first horizons.

CONCLUSIONS

1. By irrigation and unsuitable cropping measures for a long time period the typical chernozem from Bailesti Plain has recorded some changes. Thus, the irrigated soil was more compacted, its structure was a little damaged, especially within the shallow layer as well as a decrease of the porosity.
2. The irrigation has determined a decrease of the organic matter quantity, an increase of the lime content and a change toward alkaline sector of the soil reaction.
3. The changes under the influence of irrigation have not determined the accentuated improvement of the soil properties maintaining a good environment for plant development.
4. Through observations that were made in the irrigation system Calafat – Bailesti there was noticed a raising of the watertable level in lower sites, in some places, the water reaching the soil surface. This phenomenon can

determine the secondary salinisation or soil waterlogging and radical lose of the soil fertility.

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SOME ASPECTS OF GENESIS, DISTRIBUTION AND AMELIORATION OF SALINE SOILS FROM THE BRAILA PLAIN

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Keywords: *saline soils, Braila Plain, soluble salts, groundwater*

Abstract

In Romania, saline soils occur in the low-lying accumulative plains with arid climate and deficient water drainage. In the Braila Plain, the saline soils show a zonal distribution on the East-West direction and occupy 5% of the land surface. Here soils and groundwater with the highest concentrations of salts, especially chlorides and sulphates are to be found. Their occurrence is favoured by the arid climate, accumulative land forms, shallow groundwater, low gradient of groundwater flow.

There are two types of salts accumulation: continental-phreatic and lacustrian, within each type being several mechanisms of migration and accumulation of salts specific for various local conditions in which this process takes place.

For a better agricultural use of land resources of the Braila Plain, progressive soil desalination is necessary. A drainage system located in areas with saline soils has to maintain groundwater table levels below the critical depth of salinization.

INTRODUCTION

One of the main concern of today's soil specialists is to prevent and combat soil degradation processes, which can be natural or anthropogenic.

One of these processes, rather widespread in this more or less arid plain, is the soil salinization with harmful effects on agricultural production. Extending irrigation in poorly drained fields increased the risk of soil salinization even more.

One of the main aim of research on saline soils is the knowledge of specific occurrence and characteristics of these soils, the factors favouring them and the growth conditions for plants, in order to establish amelioration measures and to define the most appropriate management technologies.

MATERIAL AND METHODS

To highlight aspects of the genesis, distribution and amelioration of saline soils from Braila Plain (Northern Baragan), both literature alongside with own observations, field and laboratory analyses and their interpretation were used.

RESULTS AND DISCUSSION

Saline soils (salsodisols) occupy in Romania an area of approximately 614,000 ha (table 1), occurring in low lying accumulative plains with arid climate and deficient natural drainage.

The Braila Plain is a part of the Romanian Lower Danube Plain and belongs to Northern Baragan, it is known as a geographic subunit with large areas of saline soils and groundwater with high mineralization. It represents the eastern part of the Buzau-Calmatui interfluve and is bounded by Calmatui river plain (valley) to the south, eastward by the Danube valley, northward by the Buzau valley and westward by the Buzau floodplain which continues south with Buzoel valley (between Faurei and North Ulmu), [1, 8, 9, 10].

In the Braila Plain (northern Baragan) soils distribution exhibits a zonal character on the East-West direction: Vermic Calcaro-Calcic Chernozems, characteristic for the Danube terrace, pass toward West in Vermic Calcic Chernozems, then in Haplic Chernozems.

Saline soils occur locally in poorly drained low lying areas of interfluve and occupies 5% of the surface. In this unit, there are large amounts of salts in soils and groundwater, and among the accumulated salts large quantities of chlorides and sulphates are to be found.

The accumulation of salts in groundwater and soil depends on several factors: climate, lithology, hydrogeology, geomorphology, natural vegetation etc.

Generally, in arid and semiarid areas, the climate, saline rocks or the landform have the dominant role in this process. In these areas, mineralizated groundwater, salts bearing rocks and saline and hyposodic soils occur when the groundwater level is high, internal drainage of the soil weak or even absent, and potential evapotranspiration exceeds rainfall amount.

Occurrence of saline soil in the Braila Plain is due to the existence of large areas in which there are met a number of local conditions. Besides on a relatively dry climate, favouring the accumulation of salts in soil and groundwater, high annual average temperatures (9 - 11^{0}C) and particularly very dry and hot summers, cause a large potential evapotranspiration (700 mm) which significantly exceeds the average annual rainfall (400 - 650 mm) and results in a moisture deficit (50 - 300 mm); during the summer time evapotranspiration exceeds several times the average rainfall, which in areas with shallow groundwater creates the possibility of a large quantities of water to evaporate.

Table 1

Area of salt affected soils in Romania [7]

Geographic region	Total area 10^3 (ha)	Soils							
		Saline		Afected		Total		Potential saline	
		10^3 ha	%	10^3 ha	%	10^3 ha	%	10^3 ha	%
Romanian Plain	5,228.70 (100%)	70.25	1.35	130.35	2.49	200.60	3.84	611	11.69
Western plain	2,841.30 (100%)	69.75	2.45	105.25	3.71	175.00	6.16	400	14.08
Moldova	2,510.30 (100%)	31.60	1.26	82.40	3.28	114.00	4.54	135	5.38
Transylvania	4,816.40 (100%)	1.60	0.03	18.80	0.39	20.40	0.42	30	0.62
Dobrogea	1,557.00 (100%)	35.50	2.28	68.50	4.40	104.00	6.68	45	2.89
TOTAL	**16,953.700 (100%)**	**208.70**	**1.23**	**405.30**	**3.39**	**614.00**	**4.62**	**1221**	**7.20**

The accumulation of salts in the soil takes place - as already mentioned - only under certain local relief and hydrological conditions. Landforms favouring the development of this process in the Braila Plain (a flat, low terrace plain, poorly drained and unfragmented) are generally negative microrelief forms: lower parts of the unfragmented or weak fragmented interfluves, or unfloodable river plains, lower terraces, subsidence areas, old river beds valleys, lake shores, especially of the brackish ones; contact areas between two different landforms (terrace - flood plain, high terrace - low terrace).

The most important role in soil salts accumulation is played by local hydrogeological conditions represented by shallow groundwater and poor drainage [6]. There is a close relationship between these hydrogeological and relief conditions mentioned above. These landforms correspond to conditions with the lowest depth of groundwater and most deficient drainage in the Braila plain. In these areas, groundwater is approaching the surface, having a very low flowing gradient, so favouring evaporation of soil water and the accumulation of salts. Surface deposits play another important role in the salt accumulation. Areas with sandy deposits easily percolated by water, and with low capillary rise of water do not usually or seldom present saline soils, contrariwise, areas with clayey loam deposits and with good capillary ascent and with a slow movement of groundwater favour the accumulation of salts and present often saline soils; in areas of higher relief a removal of accumulated salts along with lowering the groundwater table was noticed.

Hydrographic network influences, at least partly, accumulation of salts in the plain, both by supplying groundwater table and through drainage of the dissected plain sectors. Enrichment in salts (chlorides in particular), of rivers crossing the Subcarpathians Bend and reaching the Braila Plain, mostly explains the wide availability of these salts in groundwater and soils. One could add to this explanation the rivers activity, older and more intense, from the filling-up stage of this plain with alluvial deposits, containing small amounts of salts, that following redistribution, resulted in the current pattern of salts accumulation [3]. Other influence of hydrographic network, by drainage of the plain, acts positively, taking salts from aquifer layers and lithological substrate and removing them out from the territory increasingly along with the intensification of drainage.

The process of soil salinization and that of groundwater salt eurichment are in fact a single process: the accumulation of salts in soil and groundwaters. Given the characteristic occurring in these phenomena of migration and accumulation of salts, two types of accumulation of salts [3, 4, 5] have been differentiate namely: continental-phreatic and lacustrine. Within each type there are several mechanisms for migration and accumulation of salts specific for various local conditions in which this process takes place.

Relatively high content of salts in soils and groundwater from Braila Plain and wide spread of areas with highly salinized soils lead to very difficult issues for agriculture in that region. For more efficient land use of the Braila Plain, especially in the case of irrigation, it is imperative that the soil natural hydrosalin regime and salt balance of the plain, the major cause of soluble salts accumulation, need to be fundamentally modified in order to ensure a desalinsation by driving it with much care in the desired direction [2]. This can be done only through a drainage system capable to change, in conditions without irrigation, the hidrosalin regime of areas with saline soils, making no longer possible accumulation of salts in soil by lowering the groundwater table below critical depth of salinization. Changing the hidrosalin regime of areas with saline and alkali soils could be obtained through a system of drainage ditches, whose location be grounded on knowledge of the origin of salts, the areas and conditions that favour their accumulation and the mechanisms of their migration and accumulation. Basically, the main drainage ditches network have been located within a system that may intercept the flow of groundwater before reaching the areas with conditions favourable of salts accumulation and thus to improve groundwater outflow (drainage) of aquifer layer from the area with saline soils, in order to lower the groundwater level and enchance salt discharge with water captured by the drainage system. In some cases, when the situation in the field allows, the main drainage ditches can be placed within the existing valleys, this intensifying their natural drainage.

In cases when irrigation is used in areas with saline soils, drainage system has to be provided with supple mentory drainage ditches to ensure the evacuation of water and salts.

CONCLUSIONS

1. The Braila Plain is one of the poorest drained area of the North-Eastern part of the Romanian Lower Danube Plain, with groundwater at low depth on large areas and with the high mineralization. It is characterized by a wide distribution of Calcaro-Calcic Chernozems, and Calcic Chernozems developed on loess, mostly phreatic phase. In lower areas, Chernozems are associated with Hyposalic Chernozems and Solonchaks, and here and there with salt lakes.
2. Saline soils occur locally in poorly drained low lying areas on interfluve and are characterized by large amounts of salts in soils and groundwater; among the accumulated salts large quantities of chlorides and sulphates are to be found.
3. Saline soils occurence in the Braila Plain is due to the existence of local conditions, and to relatively dry climate, favouring the accumulation of salts in soil and groundwater.

4. The processes of soil salinization of and groundwater mineralization are acting as a single process: the accumulation of salts in soil and groundwater.
5. For more efficient land use of the Braila Plain, even without irrigation, but especially in case of irrigation, it is imperative that the soil natural hydrosalin regime and salt balance of the plain, that leads to accumulation of soluble salts, have to be fundamentally modified in order to ensure a desalination the of groundwater soils and improving salts regime and driving it carefully in a desired direction.

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MOISTURE DYNAMICS FOR A SLOPY SOIL UNDER BEETROOT, BETWEEN 2006 AND 2008 AND ITS INFLUENCE ON SOIL EROSION

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Keywords: *protection crop rotation, moisture, cover degree*

ABSTRACT

Research was carried out in Aldeni Stationary for Erosion Control sited in the middle third of Slanic catchment, Buzau and the following were monitored: the recording and analysis of rain events in the growing season; the analysis of surface leaks, leaking coefficients and the amount of soil washed by torrential rains off control parcels under different crops. All these analyses could be performed because two batteries of control parcels are sited on the premises of the Stationary, different crops being experimented there.

INTRODUCTION

The research was carried out at the Aldeni-Buzau Station (figure 1), between 2006 and 2008, on erosion control lots sited on two slope types and cultivated in a long-term crop rotation with annual crops which are very extensive in the area (corn, wheat, beetroot, peas, perennial grasses etc.), monitoring: precipitation dynamics, amount of surface flow (mm), soil losses (t/ha) and soil cover degree.

MATERIAL AND METHODS

Fig. 1. Soil Erosion Control Station, Valea cu Drum catchment, Aldeni-Buzau

The crop distribution on control lots was done according to a rotation differentiated in time.

The beetroot was sown in bands, 45 cm apart from each other and 12.5 cm between band isles (figure 2). The seed comes from Unisem Buzau.

The cover degree was determined with the metric frame, with random measurements in the upper and lower third of each parcel cultivated with beetroot. The crop influence on soil erosion is highlighted by the amount of surface flows and by the amount of soil washed off by torrential rains on control parcels, fitted with intake devices downstream.

Fig. 2. Parcels cultivated with band-sown beetroot, in 2007 and 2008

RESULTS AND DISCUSSIONS

The precipitation dynamics for the station (figure 3) highlight that 2006 was the rainiest and 2008 the driest, August having the lowest values recorded (1.4 mm). The soil cover degree in the parcel with the 15% slope, cultivated with red beetroot (figure 4), had high variations in the studied period.

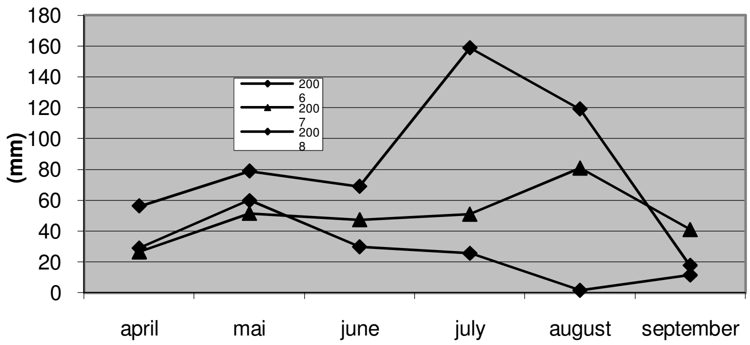

Fig. 3. Dynamics of monthly precipitation in the growing season, between 2006 and 2008

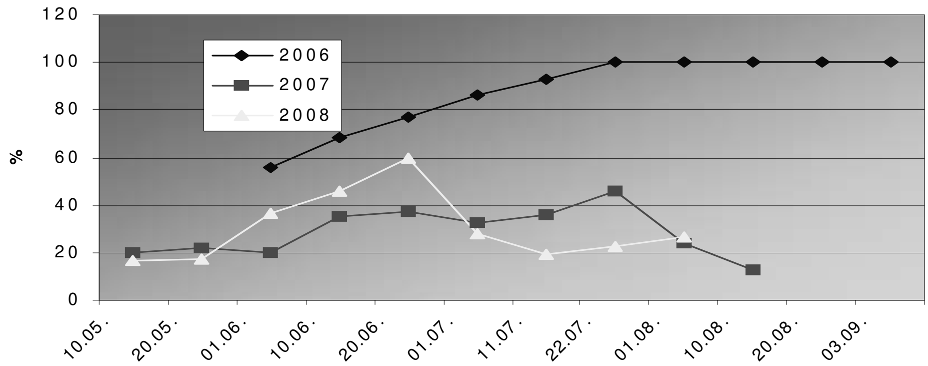

Fig. 4. Dynamics of soil cover degree, in the parcel with 15% slope, cultivated with red beetroot between 2006 and 2008

In 2006, despite a growth delay in the beginning of the growing season, the cover degree was the highest, 100% in the second half of July. In 2008, the driest year, the cover degree was higher in June compared with the same month in 2007, dropping in July and August. Anyway, the crop dried in late August in 2008 and the yield was totally lost because of high temperatures and lack of rainfall.

The soil cover degree in the parcel with the 20% slope cultivated with red beetroot (figure 5), had a similar dynamics to that from the 15% slope parcel, with lower values varying between 75% and 90% in July and August in 2006, compared to the same period in 2006 when the cover degree in the 15% slope parcel was 100%. A higher degree could be noticed in the beginning of the growing season in 2008, due to the higher water amount stored from the previous years.

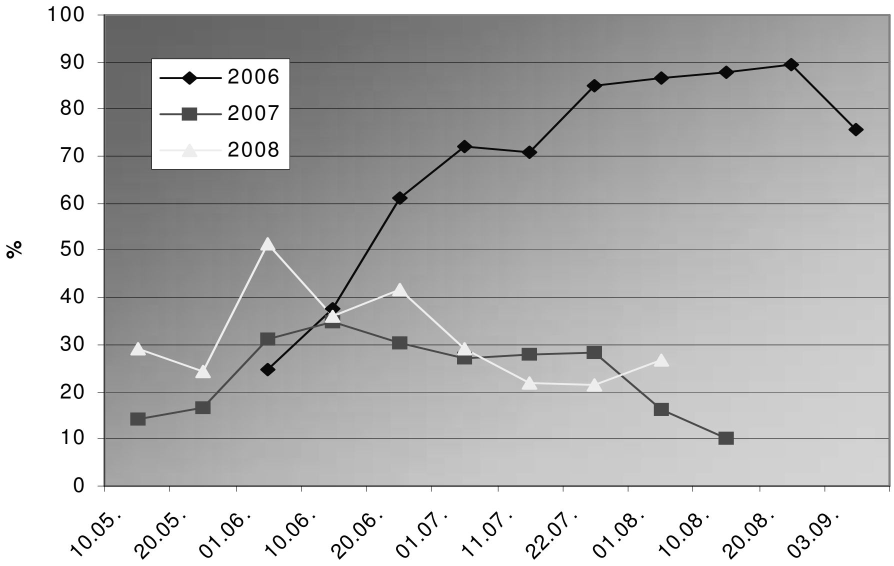

Fig. 5. Dynamics of soil cover degree, in the parcel with 20% slope, cultivated with red beetroot between 2006 and 2008

The influence of beetroot on soil erosion is given by the data regarding the amount of surface flow on the control parcels sited on slopes of 15% and 20% respectively, compared to the moisture values and the precipitations recorded in 2007 (figure 6). It was found that the moisture (on 40 cm) in the 15% slope parcel is by 40.6 mm higher than that in the 20% slope parcel. The amount of surface flow on the 15% slope parcel is by 4.2 mm lower than that on the 20% slope parcel. Water loss is lower in the 15% slope parcel compared to that recorded in the 20% slope parcel.
The band-sown beetroot insures a better protection to the soil in the growing season when soil moisture is easily available to plants.

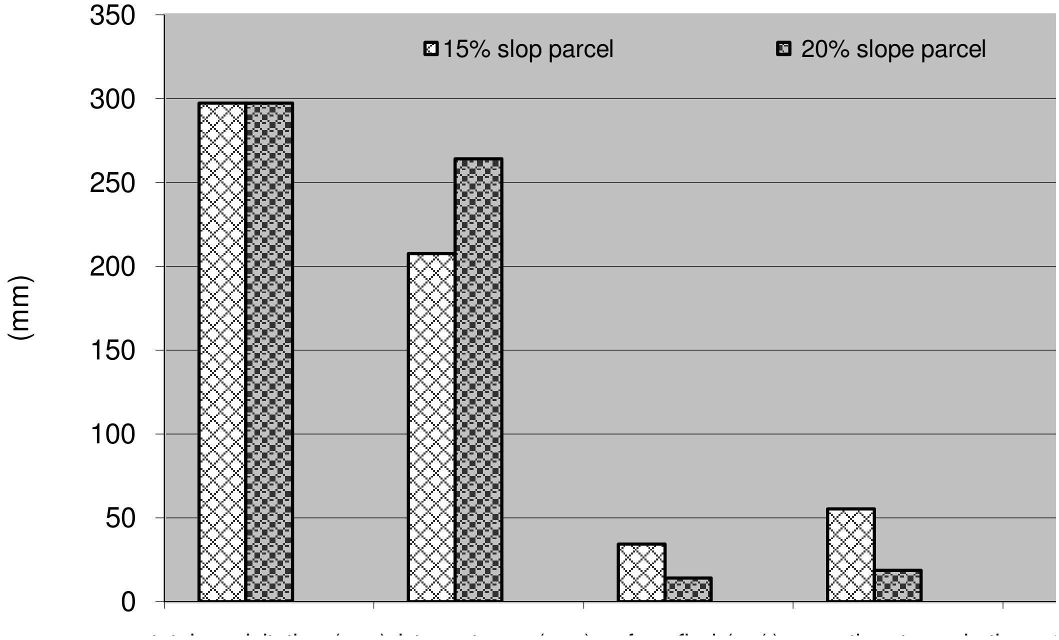

Fig. 6. Water regime in the growing season on the parcels cultivated with red beetroot in 2007

CONCLUSIONS

1. The soil cover degree in the 15% slope parcel varies between 12.6% and 46% in 2007 and between 26.2% and 59% in 2008; in the 20% slope parcel the cover degree is between 10.1% and 47% in 2007, and between 27.6% and 59% respectively in 2008.
2. The amount of water stored by soil in the beginning of the growing season has a decisive role on crop evolution, even under drought.
3. Between 2006 and 2008 on the parcels cultivated with red beetroot water losses were much lower than the amount of water stored in soil.

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ANALYZING THE LANDFORMS - AGRICULTURAL LAND-USE TYPES RELATIONSHIP USING A DTM-BASED INDICATOR

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Keywords: *DTM, landforms, TPI, SRTM, agricultural land-use*

Abstract

The topographic complexity of hilly terrains and its influence on crop growth and soil energy and water balance could be described using a comprehensiv system of Agro-Environmental Indicators. These could be very useful in order to develop agricultural politics in hilly regions. The derived parameters are the most helpful, by quatifying the topography contribution to water redistribution in landscape, the changes in solar radiation received at the Earth's surface, etc. One of them, the index of the landforms is described in this paper, and a test for Bend Subcharpathians unit is performed. It could be used in describing or assessing the variability induced by topography on spatial distribution of the agricultural land-use types.

INTRODUCTION

In Romania, an important part of arable land is located on slopes of hilly regions, the spatial variability of potential yields being function of soil properties, including texture and drainage characteristics that control the available soil water. These properties are depending on terrain characteristics. The topographic complexity of these areas induces some particularities for water, temperature and radiation regimes with direct effects on agri-environmental potential.

It seems that about 80% of yield variability is explained by a combination between soil and terrain properties [1]. Therefore, a series of indicators derived from Digital Terrain Models (DTM) could be very useful in assessing the variability induced by topography on climatic conditions and crop management (as function of elevation, slope, aspect etc.).

The digital terrain model is a digital representation of Earth surface, providing different sets of basic data, the topographical parameters being the most important. The watercourse on a surface is depending on the shape of the surface, therefore the hydrological features are often extracted from the DTM. The flow direction could be determinated as a function of slope. The upper slope could be used to identify the ridges and valleys. Therefore, the DTMs represent an important data source for several GIS-based applications.

As a consequence, the objective of this paper is to discuss some aspects concerning the identification of terrain characteristics and parameters that could contribute to the development of several Agri-Environmental Indicators needed to assess the vulnerability of farm systems in the hilly regions, and to support the politics for a sustainable agriculture management in these regions.

MATERIAL AND METHODS

In order to analyse the landforms - agricultural land-use types relationship and to develop Agri-Environmental Indicators used to characterise the vulnerability of farm systems, a DTM for Romania at a medium resolution could be used. The SRTM model has been chosen to be used for developing the indicators.

NASA Shuttle Radar Topographic Mission (SRTM) is a joint international project developed by National Imagery and Mapping Agency (NIMA) and National Aeronautics and Space Administration (NASA). The main objective of this project is to produce elevation data in digital format (DEM) for about 80% of the Earth surface. The original data have a resolution of 1'' (approximately 30 m). They have been post-processed and are available only for few countries, primarily for the United States. The free online data have a resolution of about 90 m (3'').

The SRTM model was developed through the use of "radar interferometry" technique. A radar signal is transmitted to the ground (figure 1), being reflected and captured at the same time in two points located not far from each other; thus two radar images are captured. The differences between these two images permit the estimation of the elevation of a point.

Presently, the CGIAR-CSI geoportal is authorized to provide SRTM Digital Elevation Data [7]. The initial data being collected in Geographical projection on a WGS84 spheroid, a transformation to Stereographic '70 projection (specific for Romania) has been necessary.

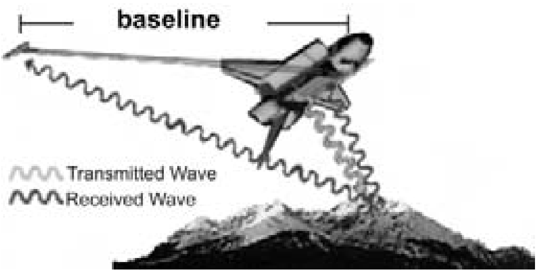


Fig. 1. The achievement of the SRTM model based on radar signals (source: [6])

Although the initial resolution was approximately 90 m, it was required to adapt and improve the SRTM digital terrain model so that to receive adequate resolutions in order to use the model at detailed scales and in different applications. To do that, the SRTM model was interpolated and exported with a 30 m resolution, fact that helps to reach better results in DTM-based applications (figure 2).

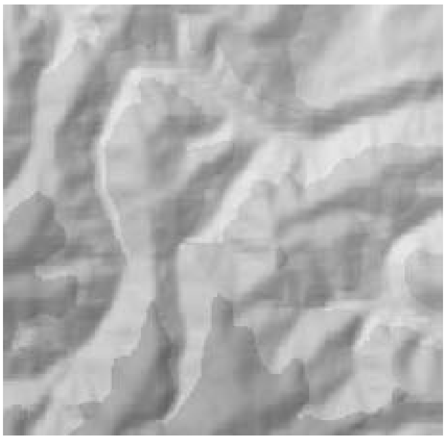
a)  b) 

Fig. 2. SRTM model: a) 90 m resolution; b) 30 m resolution

In order to define new topographical parameters from the DTM, a series of spatial analysis functions is called, which are usually included in most of the GIS software packages (ArcView, Idrisi, GRASS, Surfer, MapInfo, Geomedia, Envi, SAGA, LandSerf etc.). Many of the most well-known topographic parameters can be derived from the elevation data according to the characteristics of the neighbouring areas. There can be distinguished primary characteristics that can be calculated directly from DTM, as well as derivative or secondary ones, which involve the primary characteristics combination [4].

A more complex index, that uses several primary parameters could be considered ***the index of the landforms***. For the automatic extraction of some landforms, on the basis of the Terrain Digital Model, it starts from a simple succession peak – slope – horizontal surface – depression. This is an increasingly complicated process, as these forms became more detalied, through the increasing of the DTM discretizing step, or of the criteria that define the landforms.

One of the methods that provide satisfactory results in the process of landforms extraction and that can be subsequently used in several GIS analysis is TPI (Topographic Position Index) (figure 3). This represents the difference between a cell elevation and the average of the vicinity cells elevation [3], being implemented in an ArcView application. A main advantage is the fact that the classification criteria definition can be modified by the user [2].

This index, along with the slope, allows the DTM classification and the forms differentiation in six classes: ridge, upper slope, middle slope, lower slope, flat slope, and valley. It depends on the chosen scale, therefore, using two calculation algorithms, or two different diameters of the cell vicinity definition, Weiss [3] obtained an increased accuracy of the landforms classification. Applying this methodology, 10 categories have been generated.

RESULTS AND DISCUSSION

For testing this index, the hilly region of Bend Subcarpathians has been chosen (about 6,417 km^2). The main characteristic of this area is an association and alternation of large depresssions and hillsides, that shape distinctively different slope and channel features. These two types of relief correspond to some unevenly tectonised geological structures which account for the main Subcarpathian traits.

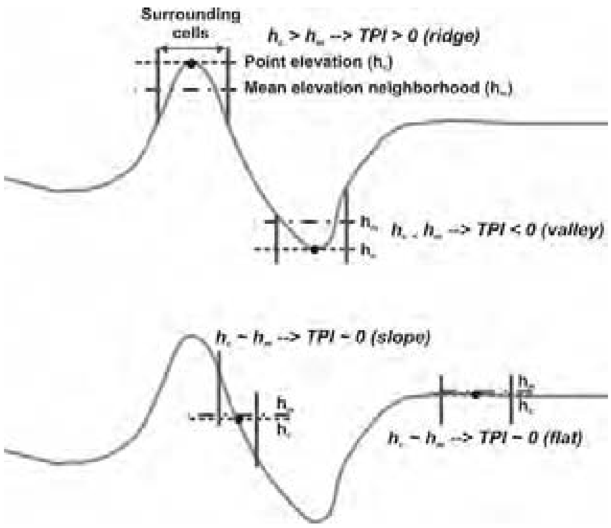


Fig. 3. The Topographic Position Index Definition (after [3])

For an optimal degree of generalization of the landforms, the circle radius defining the neighborhood area for each cell has been considered 2000 m (figure 4). Taking into account six (1-6) values for the landforms, the specific functions for regional statistics could be applied. Different analysis highlighting the homogenous character of the two major relief types (hills, and valleys and depressions) could be performed.

In Prahova Subcarpathians, the hilly regions are well individualized. This fact is highlighted by the large percent of lower slope (11.8%) to the detriment of the middle slope (32.2% relative to 40% for the other subunits). The middle slope occupy the largest part from Subcarpathians, the total percent being 38.5%.

Important for agricultural purposes is the large percent of flat slope (generally speaking, they define the horizontal surface of the terraces or the botom part of large depresions) laying on about 19 – 20% from Prahova and Buzau Subcarpathians areas, but decreasing to 16.8% in Vrancea Subcarpathians, due to the relief of Vrancea Depression, very fragmented by hilly regions, with a clear rippled and heterogen character.

From figure 5, one can notice that the agricultural lands (extracted from Corine Land Cover [5]) lie on about 50% from lands defined as lower slope and flat slope (48.3, respectively 45.7%), even that, due to their smaller area, only 30% from agricultural lands are distributed on these landforms.

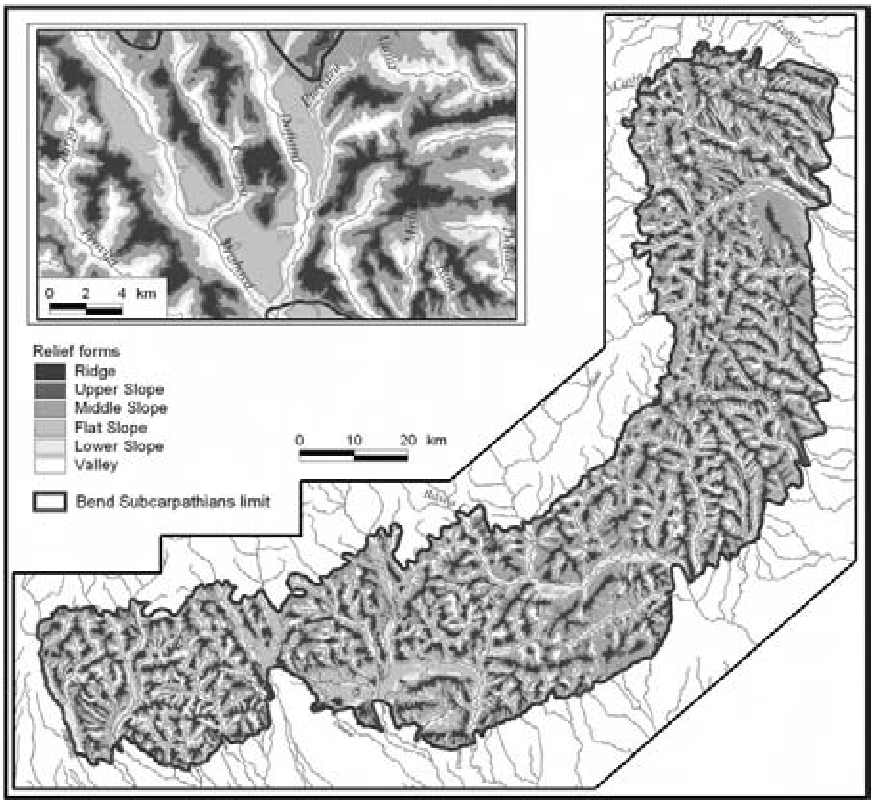


Fig. 4. The main landforms generated on the DTM basis

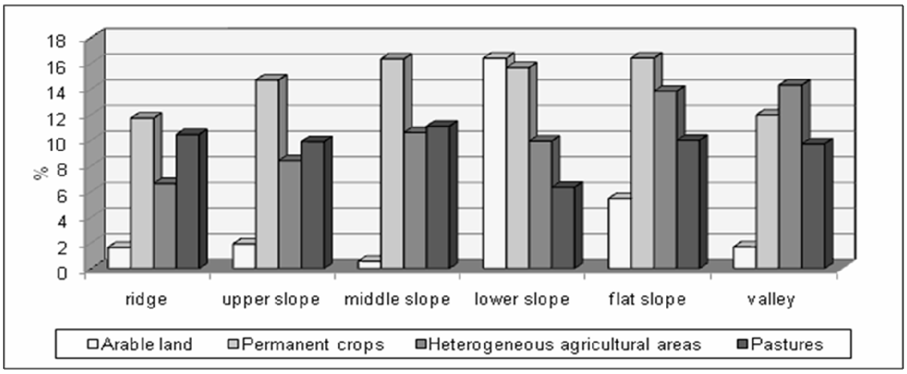


Fig. 5. The percent of main agricultural land-use types on different landforms

Arable lands lie on about 16% from lower slope, having the greatest percent on this landform. The same area (about 66 km^2) from flat slope is occupied by arable lands, but the percent is only 5.5%.

CONCLUSIONS

1. There are several topographical parameters that could be derived from elevation data as functions of the characteristics of the neighbouring areas. In this paper a topographical parameter, the Index of the landforms, is presented, as well as its assessment method based on TPI (Topographic Position Index). The landforms are generated as function of slope and relative position (the elevation of each DTM cell relative to the neighbouring cells elevation). It allows the DTM classification and the forms differentiation in six classes, depending on the chosen scale. This index was tested for the Bend Subcarpathian unit.
2. The Index of the landforms, having values in the range 1-6, allows a series of statistical analysis and correlations with agricultural land-use types. Valleys and depressions relief types (including lower slope, flat slope and valley landforms) represent about 36% from the studied area, flat slope lying on about 19%. The agricultural lands lie on about 50% of lands defined as lower slope and flat slope. About 70% of arable lands are situated on the two landforms.
3. While a large part of crop yield variability is explained by the combination between soil and terrain properties, the variability of agricultural land-use types could be explained by analysing the Index of the landforms derived from Digital Terrain Models. This index could be used in describing and assessing the variability induced by topography on climatic conditions and crop management.

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CRITERIA AND INDICATORS FOR AN EXPERT SYSTEM IN FRUIT-TREE LANDS AND ORCHARDS

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Keywords: *expert system, orchard, fruit tree*

Abstract

The paper presents an integrated and operational set of measurable criteria and indicators as a basis for a harmonized comprehensive information system used for achieving an intelligent infrastructure to create an ecologic quantified and integrated model of the climate, land and infrastructure resources, specific to fruit-tree lands and orchards.

The objectives were to emphasize the monitorisation of the climatic conditions, soil fertility and biometrical measurements in some of the studied areas, in order to supplement the database.

INTRODUCTION

It is unanimously admitted, nowadays, that a category of assortments can achieve its biological potential (even in the case of an avant-garde technology is applied) only if the ecological offer of the area optimally satisfies the biological needs.

The specific objective of the paper is the management of the natural (climate, soil, relief etc.) and artificial (orchards, infrastructure) resources, as well as the quantification and the characterization of the indicators of these resources, in an expert system.

The purpose of the researchers is to show the criteria and indicators necessary for an expert system in fruit-tree lands and orchards in S.C.D.P. Bistrita.

MATERIAL AND METHODS

The researchers were carried out on Dystric Anthrosol from a Bistrita orchard, at two varieties of apple: Golden Delicious and Florina.

The physical properties as non-gleyed, non-pseudogleyed soil volume (%), particle size distribution (%), bulk density (g/cm^3), aeration porosity (volume-%), permeability (mm/hour) and resistance to penetration (kg/cm^2) were analyzed. Soil fertility was characterized by humus content (%), C/N ratio, content of total nitrogen (%), available P and K (ppm) and microelements (ppm). The chemical parameter as pH_{H2O}, total cation exchange capacity (me/100g soil), base saturation degree (%), exchangeable aluminum (ppm), total and active carbonates (%) and exchangeable cations (%) were also determined according to the ICPA methodology [1].

RESULTS AND DISCUSSION

The results showed that from all the relevant scientific indicators for fruit-tree cultivation, the air thermic conditions have a basic role. These thermic conditions refer to the optimal average air temperature of months and of monthly intervals required for phenological phases, for each fruit-tree category at species/variety/rootstock level. The relevant *scientific indicators* for fruit-tree ecosystem are:

Temperature

The *minimum absolute temperature* with different values when decrease suddenly or slowly at species level; the *thermic amplitude* in: November-February for plum tree, cherry tree, apricot tree and peach tree; December-February for apple tree, pear tree and sweet cherry tree.

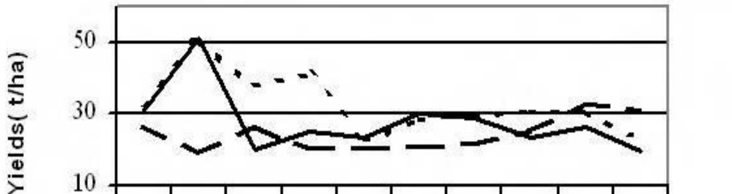
Rainfalls

Rainfalls are also quantified in the period of V-VII months for apple tree, pear tree, plum tree, sweet cherry tree, cherry tree and peach tree, and apricot tree.

According to this method, the frequency of repetitiveness of thresholds and optimal climatic intervals in the last 10 years is expressed by frequency (%) in five classes: null (frequency of 0-5%), very low, low, moderate and optimum (with frequency of 90-100%).

The paper prognosis the frequency of repetitiveness of thresholds and optimum climatic intervals and considers some studied fruit-tree species grouped considering the soil type. In this view, grouping the lands of fruit-tree patrimony in *no restrictions* lands, lands with restrictions and lands excluded from climatic point of view, will be achieved for further integration in the ecological quantified module.

In order to achieve the tasks of the objective and to develop the climatic model quantified in addition points, as well as to test and to validate in the field the thresholds and climatic intervals values, the climate data and the yield (between 1996 and 2005) were statistically processed. The obtained yields for apple in Bistrita orchard, at the 2 varieties of apple were studied in relation to the thermic amplitude (°C, XI–II months). For the studied years, the apple yield fluctuated, according to the climate and thermic amplitude (figure 1).



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Golden delicios	30,6	50,9	20,3	25,0	23,4	30,1	28,9	23,2	26,7	19,8
Florina	32,7	51,4	38,1	41,0	22,4	28,5	29,7	30,4	31,2	22,4
Thermic amplitude XI-II	26,5	19,0	26,4	20,4	20,4	20,8	21,4	25,3	33,1	30,7

Fig. 1. The variation of the yield levels (t/ha) in relation to the thermic amplitude (°C, XI –II months) for apple: Golden Delicious and Florina, S. C. D. P. Bistrița

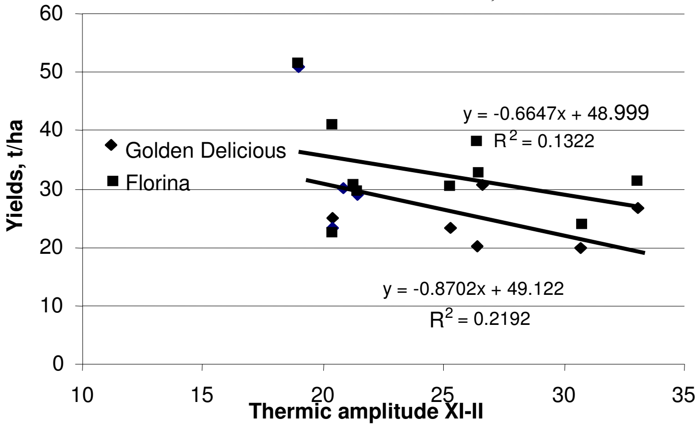


Fig. 2. The relation between the yields and thermic amplitude (°C, XI-II months) for apple: Golden Delicious and Florina, S. C. D. P. Bistrița for 1996-2005

The yield decreases while the quantum of this thermic element is higher than 20ºC, as shown in figure 1 and 2.

Soil fertility

Soil is an essential component of the fruit-tree ecosystems. The paper has in view to quantify relief, drainage and soil conditions (active edaphic volume, pH, salinization, alkalization, mobile Al content of acid soils and $CaCO_3$ in relation with depth of Cca, Cpr, Rz horizons, and active $CaCO_2$ in carbonates horizon) and industrial pollution [2].

Baseline values for relief, drainage and soil condition depending on their role in the fruit-tree ecosystem are granted with addition points. Depending on their baseline values, the fruit-tree lands are also grouped from the soil characteristic point of view in no restriction lands, lands with some restrictions and lands that cannot be used for fruit-tree cultivation.

To accomplish this objective, one important activity was to sample the soil for physical and chemical analysis in order to characterize soil fertility. The granulometric data (table 1) emphasize that Dystric Anthrosols from Bistrița orchard have a sandy-loam texture.

Table 1

Phisycal properties of Dystric Anthrosol from Bistrita

Horizon	Depth horizon	Non-gleied non-pseudogleyed soil volume	Granulometric fractions (%) Coarse sand 2,0-0,2	Fine sand 0,2-0,02	Loam 0,02-0,002	Clay < 0,002	Bulk density	Porosity aeration	Permeability	Resistance to penetration
	cm	%	mm				g/cm^3	% vol.	mm/hour	kgf/cm^2
Do	30	100	28,0	37,0	14,8	20,2	1,23	26	89,97	4
Do/R	20	100	29,8	38,1	16,0	16,1	1,17	32	152,8	3
R	50	100	26,6	33,3	18,2	21,9	1,10	30	215,68	2
0-100	*100*	100	*28,1*	*36,1*	*16,3*	*21,9*	1,23	26	89,97	4

The bulk density is higher in the surface horizon (1.23 g/cm^3), decreasing drastically in the lower horizon (1.10 g/cm^3 - 1.17 g/cm^3).

As a result, the aeration porosity is very high and the permeability is also extremely high, which could positively influence the tree roots development.

Soil fertility (table 2) is also emphasizing by the data of physico-chemical analysis as organic matter and N, P, K.

Table 2

Fertility of Dystric Anthrosol from Bistrita

Horizon	Depth horizon	Humus	C/N	Total nitrogen	Available P	Available K	Microelements Fe	Cu	Mn	Zn	B	Co
	cm	%		%	ppm							
Do	30	2,66	14	0,132	8	295	63	8	200	3	0,3	4
Do/R	20	1,53	9	0,117	16	137	59	6	148	3	0,2	4
R	50	1,20	9	0,090	6	120	54	3	96	2	0,1	3
0-100	*100*	*1,55*	*10*	*0,106*	*10*	*154*	57	5	131	3	0,2	4

The organic matter content is low, excepting of bioaccumulation horizon, and has directly influences the N, P, K values. The analytic data form table 2, show a low content of total N, a low level of mobile P and a high content of mobile K in the surface horizon.

Biometrical measurements

Biometrical measurements concern with the measurements of roots and trunks.

The indicators for roots biometry are:

The roots frequency representing the number of the roots, calculated according to the depth (from 10 to 10 cm) of soil profile, until 100 cm depth. In the field, the roots from each group of diameter were counted, according to the depths, and recorder in the field register card (figure 3):

1. The surface of root section;
2. The main root masse;
3. The indices of roots distribution.

The indicators for trunk biometry are:

1. The trunk of real age - use for the plantation characterization and for the expeditive estimation of fruit-tree yield;
2. The trunk of conventional age is use for the correlations with soil properties.

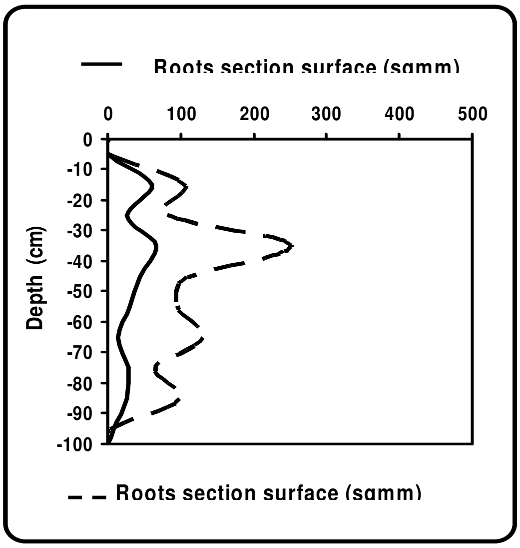


Fig. 3. Biometrical measurements at apple tree, Florina-SCDP Bistrița

The influence of soil conditions on trees trunk thickness is synthesized in these tow indicators for trunk biometry. These indicators react at the presence in soil of limiting factors inducing modifications opposite of normal distribution of the fruit trees root system [3].

CONCLUSIONS

1. The obtained yields for apple in Bistrita orchard, at the 2 varieties of apple were studied in relation to the thermic amplitude (°C, XI–II months). For the

studied years the apple yield fluctuated, according to the climate and thermic amplitude.

2. The granulometric data emphasize that Dystric Anthrosols from Bistrita orchard have a sandy-loam texture.
3. The organic matter content is low, excepting of bioaccumulation horizon, and has directly influences the N, P, K values. The analytic data show a low content of total N, a low level of mobile P and a high content of mobile K in the surface horizon.
4. The trunk biometry showed the influence of soil conditions on trees trunk thickness by the aim of two indicators: the trunk of real age and the trunk of conventional age.

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DEVELOPING AN INTEGRATED CROP-METEOROLOGICAL MODEL FOR HILLY TERRAINS USING DIGITAL TERRAIN MODELS

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Keywords: *Agro-Meteorological Models, Digital Terrain Models, hilly terrains*

Abstract

Modelling the induced effect of configuration and land characteristics on crop physical environment represents a way to quantify crop variabilities, especially in hilly regions, where agricultural terrains are characterised by relatively high slopes. Therefore, there is a need to develop an integrated model of crop growth and energy and water balance on hilly terrains and it has been developed, having as outputs a series of Agro-Environmental Indicators. The model have been tested in a "virtual" example, in order to support the farmers to comply with environmental issues included in "good agricultural and environmental condition (GAEC)"

INTRODUCTION

The agriculture is one of the most important landuse in Europe, in spatial terms. The management of agricultural areas has a great impact on environment quality through nutrients dynamic, used water resources and biodiversity. On the other hand, the yields are function of soil properties, including texture and drainage characteristics controlling available soil water [3].

In Romania, there is an important part of arable land located in hilly regions, characterised by topographic complexity inducing some particularities for water, temperature and radiation regimes from soil-plant-hydrosphere system. Their conditions have direct effects on used agricultural systems and techniques, on agri-environmental potential and on vulnerability of these regions.

Large areas from the hilly regions are sub-optimal for annual agricultural crops. Therefore, for crop management optimization and for agri-environmental potential evolution prognosis from these areas, the complex approach of cropping systems by using modelling procedures and methods of the soil-atmosphere-plant-hydrosphere system from the hilly regions is necessary.

It seems that about 80% of yield variability is explained by a combination between soil and terrain properties [2]. Therefore, the enhancement of bio-physic processes modelling for hilly regions could reflect the variability induced by topography on climatic conditions and plant growth.

Generally, simulation models for the processes from the soil-plant-atmosphere system have been developed for flat lands (CERES, EPIC – SUA; SWAT, STICS – Europe; SIBIL, ROIMPEL – Romania) [1, 6]. Main specific aspects induced by the complex topography of hilly regions taking into account in simulation models are:

- Spatial distribution as function of slope and aspect of meteorological variables involved in water redistribution and crop growing processes;
- The complex hydrology of the areas (especially, water redistribution at soil surface by lateral fluxes) with direct effects on water deficit/excess.

As a consequence, the objective of this paper is to discuss the development of an integrated simulation model for the specific bio-physical processes from the hilly regions, having as outputs a series of Agro-Environmental Indicators. The model will contribute to the detection of environmental problems in the hilly regions.

MATERIAL AND METHODS

Current crop and land use models assume a flat surface for radiation regimes and for scalar (temperature and humidity) fields and energy fluxes (sensible and latent heat). This is not in accord with the physical principles, because topography, in general, and slope, in particular, greatly influence the physical environment of a catchment. Therefore, an integrated model of crop growth and energy and water balance on hilly terrains has been developed – the IAGINT model, having a series of Agri-Environmental Indicators as outputs. The model has been developed using Visual Basic language, and the link to DTM and GIS has been done using ESRI MapObject. For this purpose, several steps have been achieved as following:

Developing an integrated modelling approach

Crop and soil hydrology models are based on spatially distributed soil parameters. Their "spatialisation" is related to qualitative information and aided by using probability distributions and fuzzy relations for hydrologic properties. Spatial extrapolation of the field scale models into sub-optimal sites being an important problem, new modules describing the peculiarities of mass and energy transport processes on sloped soils have been developed to enhance the existent models.

Developing simulation modules of meteorological and hydrological variables on sloped soils

Several relationships for the assessment of net and latent heat flux variations induced by topography have been derived from measurable agrometeorological parameters (wind speed and direction, surface and air temperature, air humidity), topography (slope, slope length) and crop characteristics (canopy resistance, height, roughness). Others modules have been integrated with used DTM and evaluation platform to account for landscape effects on (a) crop water use, (b) evapotranspiration and sensible heat, and (c) soil water redistribution.

Developing some modules for describing the crop-soil interaction

Modelling crop growth have been enhanced by including some algorithms for the assessment of intercepted radiation and the soil temperature dynamics. Limits due to soil temperature and soil moisture in early growth, as well as the effects of extreme temperatures, have been explicitly accounted for yields assessment.

Integrating and aggregating modules using DTM parameters

Most regional studies are characterised by an up-scaled (black box) approach originating from hydrology. While this technique has been maintained for climate change scenarios, all surface processes have been spatially solved and finally aggregated at catchment level. Crop growth processes are observed and modelled at the field scale, resulting in the need for aggregating the result.

The flow chart (figure 1) shows the procedure used to develop the IAGINT model [4].

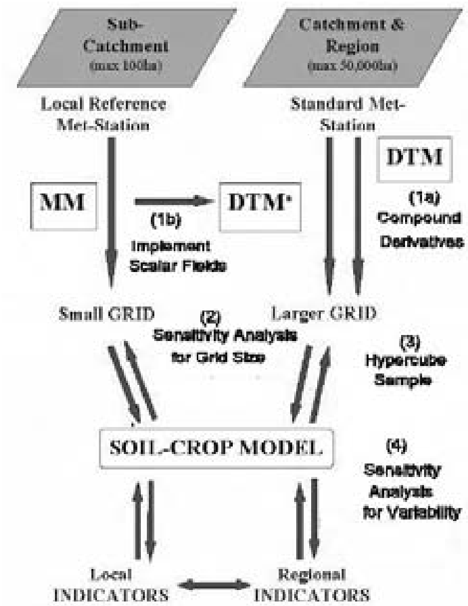

Fig. 1. Schematic flow diagram for scaling model-based AEI

The diagram outlines three main routes and the steps involved.

A. Standard meteorological data are modified using DTM compound derivatives (1a).
B. This implies a procedure of scaling (1b) – an extrapolation of the relationships between the scalar fields of the MM (micrometeorological module) and primary DTM derivatives (slope, aspect, etc.).
C. The meteorological inputs are modified via the model-hybrid DTM and fed into the SCM (Soil Crop Module), which involves the first sensitivity

analysis (2), scaling up from local to standard meteorological data, moving from one grid size to another.

A integrated soil-plant-atmosphere model, the IAGINT model, has been developed (figure 2).

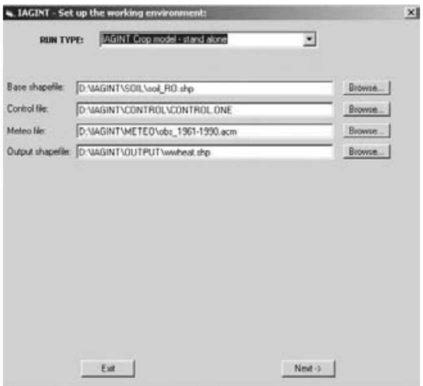

Fig. 2. The main window of IAGINT model

RESULTS AND DISCUSSION

An "virtual" example of adapting IAGINT-type output to a decission support system SSD for helping the farmers to comply with environmental issues included in "good agricultural and environmental condition (GAEC)" considering the climate changes, has been performed.

Three of the four GAEC issues are directly linked with IAGINT outputs: 1) Soil erosion with the following standards: minimum soil cover and minimum land management reflecting site-specific conditions; 2) Soil organic matter with the following standard: standards for crop rotation, national conditions, minimum 3 crops or 2 crops from 2 different crop groups, and no cropping in monoculture on the same parcel more than 3 years organic C-consumers; 3) Soil structure with the following standard: appropriate machinery use, workability assessment.

For including two crops in rotation and evaluating the effect of climate changes an alternative software with daily weather data calculated with spline functions from monthly data has been used. The software handle with various maize and winter wheet varieties (development stages are predicted using CERES type methodology, dynamics of biomass is based on radiation use efficiency and water and temperature stress factors) calculates the dynamics of soil water (predicted using Thornthwaite-Mathers-Benfratello approach) and has an economic block evaluating gross margins. All the physical and biological processes are much better simulated in IAGINT.

A simple "virtual" landscape was selected having equal areas on North and South oriented slopes and in the top-flat surface. This landscape is specific to the hilly region of South Romania. A soil profile from the region (Profile 6618, site: Valea Calugareasca, Longitude: 26.150, Latitude: 44.973) was selected for deriving the soil parameters needed for simulation (figure 3).

The crops selected were winter wheat (Ww), and maize (Mz) with early (e) and late (l) cultivars, in 5 different crop rotations CR1-CR5.

The used climate scenarios have been as follows: 1961-1990 – baseline; 2011-2020 – HADCM3 SRES A2 scenario; 2011-2020 – HADCM3 SRES B1 scenario; and 2011-2020 – PCM – SRES A2 scenario.

The resulting indicators from IAGINT model, used in SSD, are the following: Crop yield average, Crop yield standard deviation; Gross margin average; Gross margin standard deviation; Percentage of years with crop yields less than threshold (3 tha^{-1} for Ww, and 3.5 tha^{-1} for Mz for dry farming; respectively 6 tha^{-1} for Ww, and 9.5 tha^{-1} for Mz in irrigated conditions).

Crop rotation	North	Top	South
CR 1	ww / mz(e)	ww / mz(e)	ww / mz(e)
CR 2	ww / mz(e)	ww / mz(e)	ww / mz(l)
CR 3	ww / mz(e)	ww / mz(l)	ww / mz(l)
CR 4	ww	mz(l)	ww
CR 5	ww	ww / mz(e)	ww

Fig. 3. The position of the three selected points and crop rotations

The SSD outputs represents an indicator ranged from 0 – the smaller acceptable yield, to 1 – the maximum average yield, calculated using Simple Additive Weighting (Saty's method, [5]) for each scenarios and options considered, with/without GAEC constraints (figure 4).

4. CONCLUSIONS

The value in the graph is complementary to risk associated to each crop rotation (CR 1-CR 5) corresponding to the two ways of considering weighting (no GAEC / GAEC) for the baseline (1961-1990) and some future climate change scenarios. The main conclusions coming up from this analysis are:

1. Crop rotation CR 5 is the best crop rotation in almost all scenarios (no for HADCM-A2).
2. There is a net advantage for CR 4 and CR 5 in GAEC weighting scenario.

3. 2011-2020 climate change scenario will change significantly the risk coefficients.
4. The difference between GCMs (HADCM3 vs. PCM) is higher than the differences between SRES scenarios for the same GCM (A2, B1)

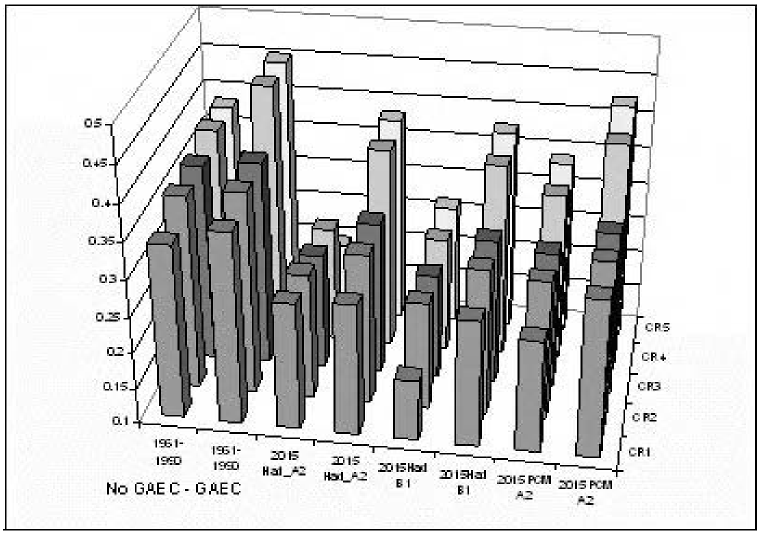

Fig. 4. Comparing the outputs for selected scenarios

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RESEARCH REGARDING CLIMATE CHANGES ON CROPS EVOLUTION IN CENTRAL PART OF THE ROMANIAN PLAIN

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Keywords: *global warming, aridity, variety productive potential*

Abstract

The evolution study of the meteorological parameters in our country evinces a raising frequency and an intensified occurence of extreme phenomena, especially in the last years, under global warming conditions. Immediate effects can be observed at the level of biocenoses: degradation of soil natural characteristics, reduction of crops obtained mostly in the central part of the Romanian Plain where aridity is obvious.

Agrometeorological data analysis for the period 2000-2007 shows a higher frequency of climate stress phenomena (2003, 2005 and 2007); (hydric and thermal) variations are significant as compared to the optimal requirements of field crops (frequency, intensity and duration), which causes production and phenological anomalies as compared to the mean multiannual values typical to the zone and genetic potential of cultivated plants.

INTRODUCTION

The environment influences agricultural production efficiency. The most dynamic ecological factors are the climatic ones (temperature, solar radiation, wind, etc) which are also difficult to monitor and control, especially in the case of field crops.

Lately, in our country, large land areas are exposed to thermal and hydric stress (drought, floods, late frost, hail, intense heat, etc.) exceeding natural systems capacity of adaptation and recovery; this fact may have long term effects on food security and human health, generally, on human life quality.

To limit expansion or intensification of degradation phenomena through drying it is necessary to rigorously evaluate environmental conditions as bedrock for new potential programmes and efficient technologies adapted to the varying climate manifestations.

In agriculture, climate risk management means to identify, analyse, evaluate and permanently monitor the dynamics of climate stress factors on growing plants in order to elaborate preventive measures and reduce damages.

MATERIAL AND METHODS

Research regarding the dynamics of meteorological parameters between 2000-2007, evinces a higher incidence of climate stress phenomena (2003, 2005 si 2007) in relation to cultivated plants, which results in reduced adaptation and crop yields.

The comparative analysis is based on the following agroclimate parameters:

- precipitations amount registered along the whole agricultural year, monthly values, or from the active growing season as well as from the period of maximal water consumption of plants(wheat/May-June, corn/June-August);
- intensity of heat expressed in intense heat units ($\Sigma T_{max} \geq 32°C$) from 01 June to 31 August;
- duration of intense heat, consecutive days of $T_{max} \geq 32°C$;
- soil humidity equivalent at different depths in relation to the growing phase of the main field crops (20 cm, 50 cm and 100 cm).

Reference zone is represented by the agricultural land areas situated in the central part of the Romanian Plain and bordered as follows: in the west, the Olt river, in the north, the Getic plateau and the sub- Carpathians of curvature, in the east, the Baragan Plain, the Saratei Valley up to the confluence with the Ialomita river, further the Dambovitei Valley continued by the Argesului Valley up to the confluence with the Danube river edging the whole southern limit of this region. Climatic data come from the main meteorological stations providing a succesion of phenological observations, biometrical and crop measurements: Alexandria, Fundulea, Giurgiu, Pitesti, Ploiesti, Rosiori de Vede, Oltenita, Targoviste and Turnu Magurele.

RESULTS AND DISCUSSION

The Romanian Plain is the first zone of favourableness for the main cereal crops and technical plants, having the advantage of sufficient thermal resources along the whole growing season. The restrictive factor is represented by atmospheric precipitations that register variations in time and at territorial level. In the last decade the incidence of droughty periods has become higher while floods have manifested themselves for short intervals and related to very great amounts of precipitations, as it happened, for example, in 2005.

The agricultural year September 2004 - August 2005 was characterized by rainy and excessively rainy pluviometric condition.

In 2005, the thermal condition dynamics was close to the climatic norms whereas the hydric condition was described as rainy and excessively rainy in the most of the agricultural land areas; precipitation excess was registered in the majority of months (January-May, July-September). In the central zone of the Romanian Plain the water amounts were between 801-1330 l/mp and in the majority of crop land areas (figure 1), rains had a heavy character; locally, there were over 100 l/m^2 water in 24 hours (Targoviste, 137.6 l/m^2 in May) exceeding the maximal values registered along the years (1961-2000).

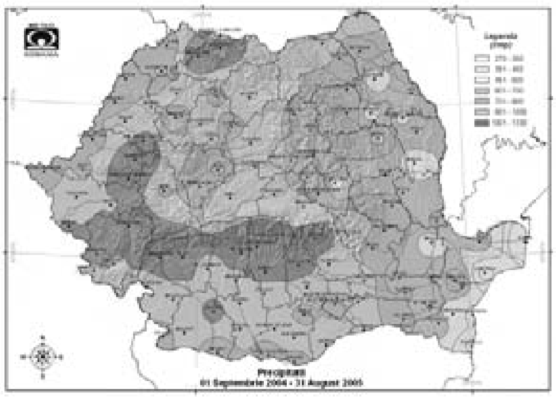

Fig. 1.

Under these circumstances, in 2005, in the central part of the Romanian Plain wheat crops varied between 2200-4500 kg/ha, while corn crops, between 4300-9900 kg/ha.

Climatic data regarding annual precipitation amount show a decreasing tendency, the first years (2000-2003) of the twenty-first century being droughty. Precipitations of 2005 improved to a certain extent the water supply in soil; however, it is drought and not excessive rains that is the main danger to our agriculture. Progressive air warming and significant reduction of precipitation amount in the last decades are restrictive elements for crop development and productivity as well as for water resources use. Variation of crop yields is presented in figures 2 and 3; it can be noticed that in 2005, a rainy year, winter cereal and corn crops were higher than in 2007, an extremely droughty year.

Fig. 2.

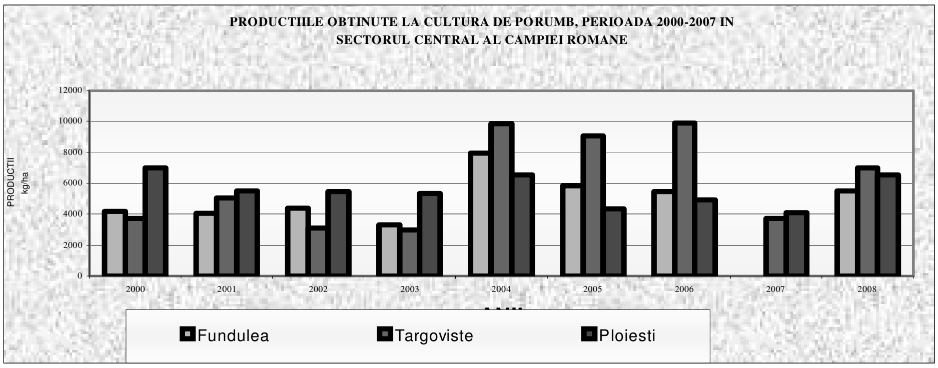

Fig. 3.

2007, the year of climate hazards, was characterized by related risk, extremely high temperature and reduced precipitations/no precipitations, which led to water exhaustion in soil. Days of intense heat (ΣT_{max}>32°C) are specific to summer time (June-August), but sometimes they may happen since May or last till September. Intense heat exceeding 20 units in 5-7 consecutive days is considered a thermal risk factor for crops. As compared to top years 1987 and 1993 when 20-45 days of intense heat were registered, in 2007 there were 30-60 days of high intensity, (91-150 units of intense heat) and extremely high intensity (151-223 units of intense heat) in the largest part of Muntenia, (figure 4), and in comparison to the mean multiannual value of the period 1961-2000, (figure 5). At the same time, days of intense heat ($\sum T_{max} \geq 32$°C) were accompanied by tropical nights ($\sum T_{min}$>17°C), which reduced the rhythm of substance accumulation in beans/seeds up to a temporary stagnation.

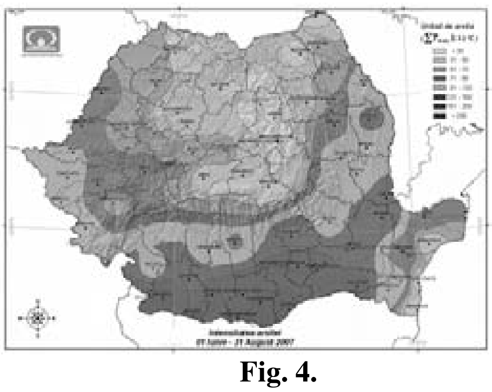

Fig. 4.

Fig. 5.

Simultaneously, in April, June and July, precipitations were extremely poor and the mean national deficit in the period April- July 2007 was 39.4%, this fact intensified deterioration of the growing phase of winter cereals that needed maximal water supply and accelerated ripening and even partial or total degradation of crops (50-100%).

In 2007, crops in the southern part of the country were subject to long term hydric and thermal stress (sharp solar radiation, lack of precipitations) intensifying evapotranspiration; the loss of water from the plant body caused temporary and long term withering up to partial or total degradation of plant system. On some corn-cultivated land areas, plants were harvested for fodder.

CONCLUSIONS

1. Climate change is an important challenge for experts in agriculture in the sense that they have to establish the most efficient measures to reduce negative effects on crops and to assure food security.
2. The permanent character of the droughty climate causes first of all degradation of soil features, reduction or loss of biological productivity. Improvement of water condition, especially in soil, can be achieved by having adequate tilling for different types of soil, namely, minimal tillage or no tillage at all (by sowing directly in the stubble field) or by tilling superficially or less deeply.
3. In the southern zones of the country with permanent hydric deficit it is necessary to rebuild the irrigation systems in order to apply the watering norms according to the economical optimum and at the optimal time for agricultural plants.
4. Pedological drought has different effects on agricultural plants; thus, when choosing new culture structures there are some aspects to be taken into account: the dominant species should be the most fitted species (sorghum, corn) to drought or some hybrids with reduced growing season and smaller water consumption; transgenic species and genetically modified organisms should also be used; field density of plants should be small and sowing seasons should be adapted to the evolution of the air and soil hydric- thermal condition; fertilization should be balanced so that water in soil is efficiently used.
5. Regional sustainable management involves harmonization of natural and anthropic landscape, provision of ecosystems stability, as well as reduction and prevention of erosion.

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RESEARCH ON ECOLOGICAL PROTECTION EFFECT ON THE ENVIRONMENT ENSURED BY FERTILIZATION WITH NEW RANGE OF LIQUID FERTILIZERS

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Keywords: *ecological protection, environment, bell pepper, liquid fertilizers*

Abstract

With the application of natural fertilizers and the products industry fertilizers, as a link technology required to increase crop yields, the risk generally involves degradation of environmental components (soil, groundwater, plants), through phenomena of chemical pollution, mainly due to dissipation entropy of nutrients in environment; these phenomena are always followed by low levels of productive use by crop nutrients in the fertilizers applied.

INTRODUCTION

The phenomena of chemical pollution of the environment with nutrients and ions accompanying their, may occur when fertilization is applied in the soil on a scientific based (DOE) due to the adsorption phenomena, ions nutritive fixation on colloids of soil and the leaching NO^{3-}, Cl^-, which contributes to lowering the degree of utilization of nutrients applied to crop.

In fact, through classical methods of fertilization in the soil, the peak levels of annual use of crop nutrients are: 60-80% in the case of N sources, 15-20% in the case of sources of phosphorus and 70-75% for potassium salts. Incomplete productive use in harvest, by nutrients of fertilizers applied, to determine such the increase incidence by the phenomenon chemical pollution in environment.

In this context, the fertilizers method experimented and the foliar fertilization compositions researched, was tested, were tested as methods and means of fertilization of plants, intended to supplement and correct nutrition of crops in greenhouses and prevent pollution of the environment plant production.

MATERIAL AND METHODS

Activity test experimental fertilizers acquiring organic liquids has been to SC SERE SA Codlea, Braşov in 1374/2003-2006 AGRAL the project, contracted by INCDPAPM-ICPA, and after the completion of this project, aimed at fertilization greenhouse crops in the period from planting seed to physiological maturity of plants. Chemical composition of such fertilizers is presented in table 1.

The biological material used for testing the type of liquid fertilizer made from INCDPAPM - ICPA, Fertec B and K Fertec, especially for vegetables grown under glass, was bell pepper, Carpatia cultivar (2007). For each variant to ensure a minimum number of 3-4 rehearsals.

Experiments were located in the plots of 200 m^2 to 50 m^2 each in 14 glasshouse. Soil was fertilizer base 100 tonnes/ha half ferment manure during vegetation and were incorporated into the soil 100 kg/ha potassium monophosphate 0-52-34 and 40 kg/ha of magnesium sulphate 16.2% MgO.

Table 1

Chemical composition of liquid fertilizers with ecological features manufactured by RISSA

Components	**UM**	**Fertilizers types**	
		FERTEC-B	**FERTEC-K**
N	g/l	30	30
P_2O_5	g/l	30	30
K_2O	g/l	30	30
Mg	g/l	0.5	0.5
S	g/l	3.6	3.6
Plant extract with amino acids and auxine	ml/l	80	-
Sea algae extract with auxine and kinetina	ml/l	-	80
Density	g/cm^3	1.109	1.105

Foliar fertilizers were given 4 treatments during the growing season of plants, in concentrations of 0.5%, the quantity of solution used to dilute a single treatment was 2000 l/ha. These applications were made in the months May to July, at 3 - 4 weeks.

RESULTS AND DISCUSSION

In tables 2 and 3 are present apparent productive use grades of the nutrients from fertilizers applied foliar ($GAUPEN_{ICF}$) and productive use grades of the nutrients from soil reserves (GUPENsol) in crops produced in greenhouses, the culture of bell pepper as a result application of foliar fertilization method.

Analyzing the data obtained can be seen that the apparent levels of use in crop production of the nutrients from foliar treatments ($GAUPEN_{ICF}$) present value of the order of hundreds and even thousands, which shows that foliar treatments had an intense physiological stimulation of plants and led to additional consumption of nutrients from soil reserves and fertilizers applied in soil.

Degrees apparent productive use of the harvest of the nutrients from foliar treatments were, in general, an increase commensurate with the increase of harvest, values having the greater the intake of nutrients foliar treatment was minimal, the high degrees of apparent productive use of the nutrients from foliar treatments applied being determined in particular by the large export of nutrients with the crop increases from low intake and nutrient foliar treatments applied (kilos order to macronutrients) (table 2).

Also, degrees of productive use of the nutrients from the soil (GUPENsol) presented in all of the foliar treatment, more than 100, which highlights the effect of stimulating root nutrition plant provided by foliar treatments (table 3). Levels of productive use of the nutrients from the soil (GUPENsol) recorded in variants fertilized with foliar compositions, had high values, which attest the superiority of these means on the fertilization and prevent the phenomena of chemical pollution of the environment.

CONCLUSIONS

1. In practical terms, using this method of fertilization and foliar application of foliar fertilizers in greenhouses, from bell pepper crop, is obtained, in addition to significant production increases, and significant effects to reduce the phenomenon of chemical pollution environment.
2. Incomplete productive use in a crop nutrients from fertilizers applied to determine the incidence of such phenomenon of increasing chemical pollution of the environment.
3. However, high consumption of soil nutrients, such methods and means of fertilization, in conditions of poor soil supplied with nutrients (fertilization without basic soil) can contribute to degradation of soil fertility.

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Table 2

The apparent productive use degrees of the nutrient from foliar fertilizers to bell-pepper crop, Carpatia cultivar, second cycle, grown in greenhouse at S.C. SERE S.A. Codlea-Braşov, year 2007

Variant	Fertilizer type	No. treatment	Concentration solution (%)	Qantity of fertilizer used (liters/ha)		Production of fruits (t/ha)	Yield increases (t/ha)	$GAUPEN_{ICF}$ (%)		
				one treatment	all treatments			N	P_2O_5	K_2O
1	Control	-	-	-	-	52.0	-	-	-	-
2	FERTEC B	4	0.5	10.0	40.0	61.8	9.8	2368	817	3675
3	FERTEC K	4	0.5	10.0	40.0	63.5	11.5	2779	958	4313

Table 3

The productive use degrees of the nutrient from soil in obtained yields of bell-pepper, Carpatia cultivar, second cycle, grown in greenhouse at S.C. SERE S.A. Codlea-Braşov, year 2007

Variant	Fertilizer type	No. treatment	Concentration solution (%)	Qantity of fertilizer used (liters/ha)		Production of fruits (t/ha)	Yield increases (t/ha)	$GUPEN_{SOIL}$ (%)		
				one treatment	all treatments			N	P_2O_5	K_2O
1	Control	-	-	-	-	52.0	-	-	-	-
2	FERTEC B	4	0.5	10.0	40.0	61.8	9.8	118	117	118
3	FERTEC K	4	0.5	10.0	40.0	63.5	11.5	121	120	122

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RESEARCH REGARDING THE USE OF FAR-INFRARED HEATING TECHNOLOGY OVER THE ENVIRONMENT

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Keywords: *far-infrared, homogenity, agriculture applications*

Abstract

This paper presents results obtained in the frame of an applicative research contract upon the use of ecological, biogenetic heating technology of far-infrared kind, with the purpose of using it in Romania in different domains of activity.

For the climatic conditions of our country, we proposed and performed a measurement program in the following fields: electric expenditure, climatic, microbial loading of air, effects over plants, effects over pets and prolusions over general health, and comfort status of human being. In this work we present the results obtained above the micro-climate measurements, effects over plants and over microbial loading of air from the space in which we used this type of heating system during 2007-2008 and 2008-2009 winter.

In the rely of this research, we are in right to affirm that this type of heating technology has benefic effects in preserving the homogeneity of the micro-climate conditions, in the growth of plants and assures an easily growth of hygiene of medium in which it is act.

INTRODUCTION

Infrared is known as a zone in the electromagnetic specter which has been researched for a long time and scientists have determined three infrared segments: A, B, C, [1]. Each letter corresponds to a specific wave length and each has specific applications in industry, agriculture and human health.

Nowadays, the majority of the usual infrared sources emit short frequency waves that work at thousands Celsius degrees and the dark red colored radiation belonging to the visible specter becomes visible near the emission sources (the lamps). Recent research published in the specialty literature [2, 4, 7] inform that emission sources working at the short-wave side of the specter are being made. Infrared that works with long wavelength (about 10 000 nm) have effects over solid bodies and living organisms. In this case, bodies emit the heat absorbed from the panels. Therefore, the space is heated not by lamps, but by the solid corps inside, that creates a great ambient atmosphere.

Because of the intense research done for the developing of this technology, the future picture gives us hope for using infrared technology in heating human ambient space (houses, commercial spaces, industrial production spaces, farms, saunas, etc.) and for applications in domains that require controlled thermal energy [3]. Actual research is focused both on heating, drying, backing, frying and on cooling, freezing, and transporting products in controlled climate.

MATERIAL AND METHODS

The measurements took place in a room placed on the top floor of an edifice of the North University of Baia Mare, built in 1976. This room is placed in the corner; it has two walls to exterior, which are not isolated, and the ceiling, which is relatively well isolated. The dimensions of the room are: 6.20 m long x 2.95 width x 2.85 height and it is equipped with a new, well-isolating window, which has a North exposition and an entrance door from hall with a South exposition.

The measurements were done in cold period of the winter 2007-2008 and 2008-2009, November-February period.

The measurements had been done in the following domains:

I.Electric expenditure the hourly/daily electric-consumes. The measurements were done using specialized control equipment.

II.Climate

a) Interior – 3 times a day (7:26; 13:26 and 19:26 hour), in 4 different points (1st point was placed in corner, at 2 meters high, near the sealing; 2nd point was placed in the center of the room on a work table; 3rd point was placed near a wall at a chair level; 4th point was placed the opposite corner of point no. 1, on the floor).

b) Exterior – near the building – 3 times a day, at the same hours, following the urban microclimate.

c) Baia Mare Weather Station – 3 times a day, at same hours too, using DigiWeather software and Romanian Meteorological National site, following the regional climate [9].

The meteorological observations were done using a type WMR100 Meteorological station and with common measurement instruments, such as different mercury based thermometers and hygrometers. The data monitoring and evaluation was done using the weather station's PC integrated software.

III. Microbial loading of the air – the analysis and probation had been done in collaboration with an accredited microbiology laboratory. The drawings were taken before long-waved infrared panel started to function, during its running and after turning it off. The working method for analyses was standard „KOCH sedimentation method" [5, 6].

IV.General health and comfort status of human being

There were 14 persons engages in this research work. They were volunteers, and their age and availability were amongst their selection criteria. The research members were selected for having impressions from child's to elder people. As sex criteria, there were 6 female and 8 male. The group had divers characters and daily activityes.

Each team member managed a „Personal Observation Form” during the project time. In the form they marked personal observations regarding the comfort status, general and particular organic health and sanity [8].

RESULTS AND DISCUSSION

I. Climate

The specialized literature mentions that for the Baia Mare Depression, like for the Romania geographical area, January is the coldest recorded month of winter [9, 10]. Sometimes, the minimum temperature is reached in February or in the long, cloudy time from December, but the strongest frost were registered always on January. Although usually it snows a lot in Baia Mare Depression (medium 109 snow-days/year), on 2007-2008 winter, there were registered few snowing-days [8] and no gust of wind during the measurement period.

In table 1 there are presented the maxim, minimum and medium temperature values for air, registered in the winter seasons comparatively from the two years in which the experiment enrolled.

Table 1

Comparative results of the temperatures

Month	Temperature weather station (°C)						Temperature university (°C)					
	max		*min*		*med*		*max*		*min*		*med*	
	2008	*2009*	*2008*	*2009*	*2008*	*2009*	*2008*	*2009*	*2008*	*2009*	*2008*	*2009*
Dec.	12.6	13.7	-7.0	-11.2	-1.5	2.8	9.0	17.3	-3.5	-10.4	0.8	3.5
Ian.	8.0	12.3	-7.0	-13.1	-0.07	-1.1	10.6	15.6	-4.0	-13.8	3.2	-0.1

There is to be noticed that urban air temperature is about 2ºC higher than the temperature registered by the regional weather station. The thermal amplitude is normal for this year period. The minimum temperatures from the urban environment have to be used in programming the functioning of equipment. Regarding the differences between the year 2008 and 2009 we see that in the current year the temperatures varied on a larger scale, but this aspect did not influenced the interior temperature, as we can see in the comparative figures from above.

Obtaining a temperature in the 19-21ºC intervals inside a room is the main objective in the cold periods of the year. Considering the preferences, the comfortable temperature can vary with a couple of grades in a 24 hour cycle.

In figure 1 are shown the daily temperature variation from both inside the room and in the urban environment (outside), comparatively from the both years of the experiment.

It is clear that there were no difficulties in reaching and then maintaining the comfortable temperature. The vast variety is the result of “preference game”. Long-waved infrared heating offers flexibility with no effort, this makes it a great surrounding climate, according to the moment demands, but it is marked by the weather evolution, especially when it has to face long severe cold.

It’s clearly visible the similarities between the two graphs are clearly visible according to the interior temperature and the outside temperature varies in large amounts, but the inside temperature remains in the same range.

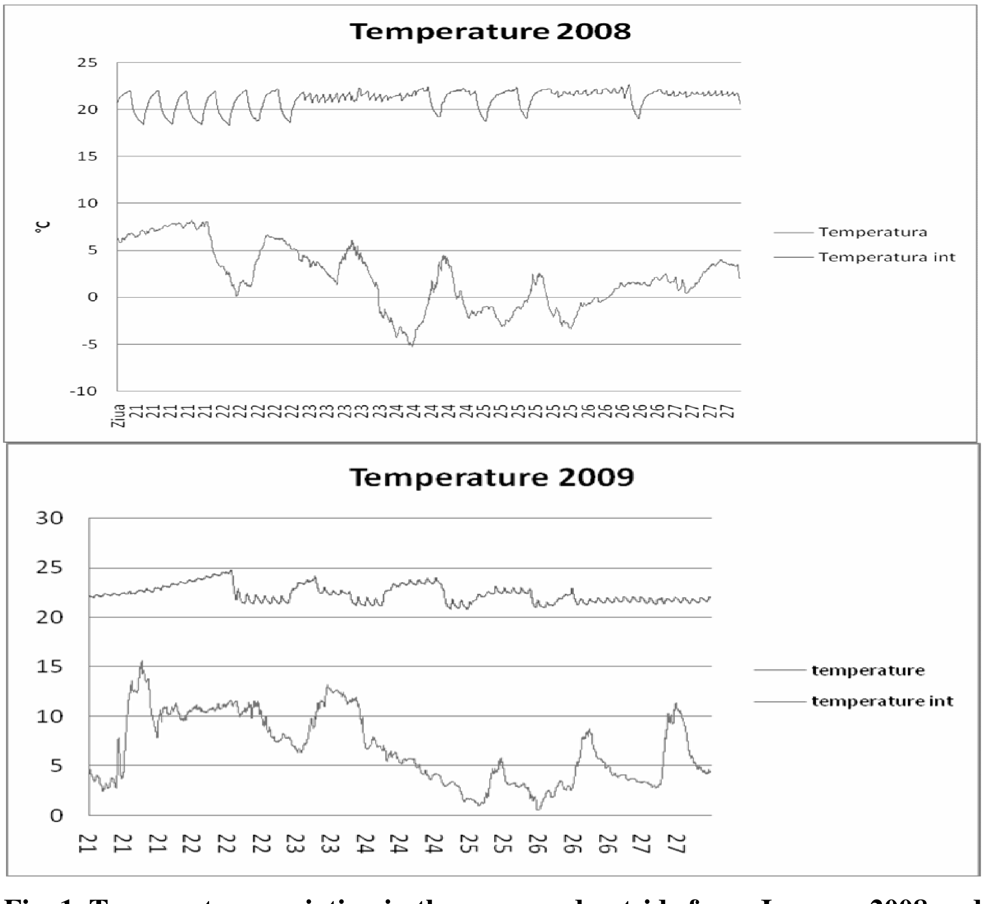

Fig. 1. Temperature variation in the room and outside from January 2008 and January 2009

In figure 2 is shown the daily relative humidity variation inside the room and in the urban environment (outside), the humidity being measured through the both years of the experiment.

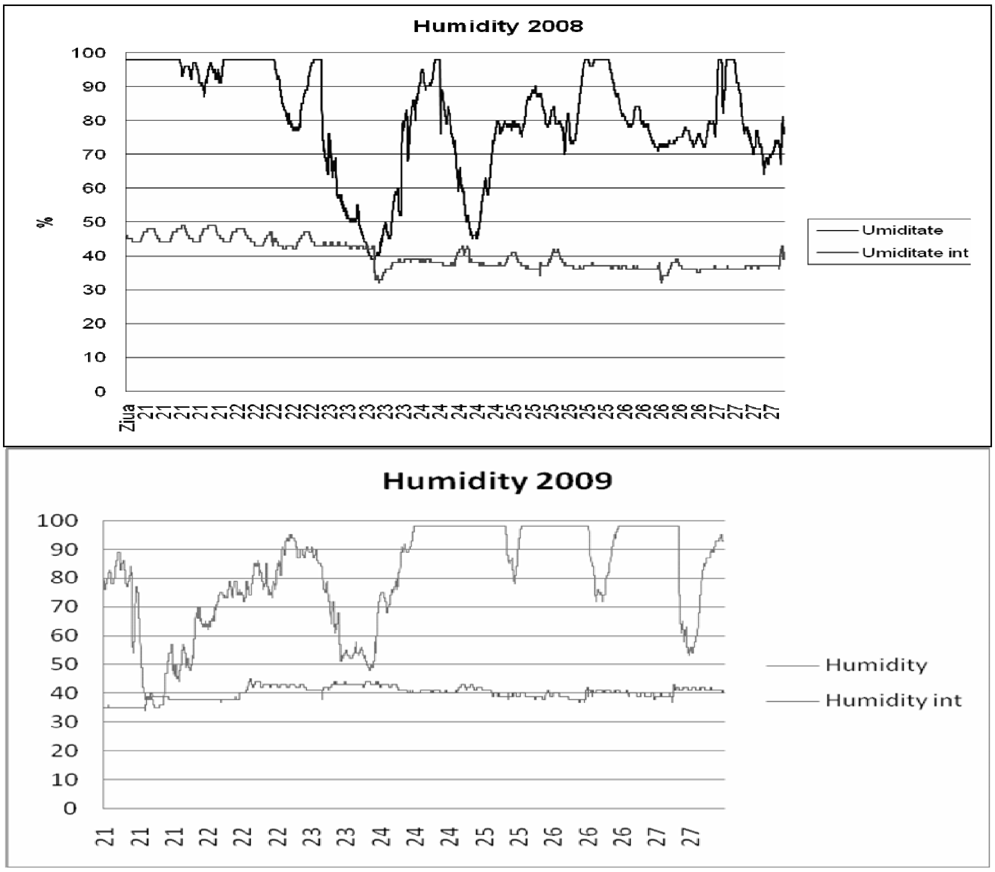

Fig. 2. Humidity variation in the room and outside from January 2008 and January 2009

The relative humidity of the air registered very small variation in the work-room while the relative humidity of the atmospheric air registered normally large variations. This permanently homogeneous environment, created by the relative air humidity makes a microclimate that is well tolerated by the sensitive organisms.

A correlation between the air temperature and the relative humidity in the room shows that for these experimental conditions, maintaining the temperature over 20ºC, the relative humidity of air registers values round 40%. This modification has not been reported as discomfort by the subjects, but it has been registered by the researchers as the object of ulterior studies in which there will also be studied other parameters of the immobile.

CONCLUSIONS

In actual conditions considering the European strategy for the energy and gas emissions domains, the research results show that long-waved infrared technology:

1. is innovative and promising for the future, from ecologic and biogenetic point of view;
2. is clean, efficient, non polluting emission technology;
3. can be used in a very large scale of domains;
4. is just at the beginning when used in the agro-industrial applications;
5. has benefic effects over the organisms, effects that can be fragmental quantified for the moment;
6. can be successfully implemented in Romania.

Research in this domain is to be continued because of the multitude of the less known phenomena and the limits that appear when using a new technology.

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HUMIC FERTILIZERS – FERTILIZING SUBSTANCES OF HIGH EFFICIENCY IN AMELIORATION OF PLANT NUTRITION IN SUSTAINABLE AGRICULTURE

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Key words: *humus-poor soils, organo-mineral fertilizers on lignite support*

Abstract

Relatively low cost and relatively high content of humic acids in low grade coals (brown coal, lignite, leornadite, peat) fully justify their use to for productions of organo-mineral (humic) fertilizers which have been largelly developed in the last time. In some contries (USA, Japan, China, Israel, Spain, Russia) there are numerous factories producing humic fertilizers at an industrial level having in their composition associations of humic acids with nutrients in a form of mineral compounds.

In Romania, the research to produce organo-mineral fertilizers has been started since more two decades ago. At present, there are 6 types of humic fertilizers on lignite support which can produse, in a pilot installation more than 7000 t fertilizers per year, put into operation in 2008, built at Tg. Jiu by the National Research-Development Institute for Soil Science, Agrochemistry and Environmental Protection Bucharest, in cooperation with National Lignite Society, Oltenia, Tg Jiu, within the framework of the project No. 1183 Relansin, 2003-2005.

This paper presents the properties of some fertilizers, their high effects as fertilizers as compared to the classical ones, on the plant nutrition, soil fertility amelioration in time and significants migration of soil chemical pollution.

INTRODUCTION

The obtained knowledge on the properties of humic acids and their importance in defining the multiple proprieties of soil led to the idea to use the low-grade coals (brown coal, lignite, to leonardite, peat) which contain high amounts of humic acids as organic (humic) fertilizers.

Organo-mineral fertilizers on lignite support include in their composition humic acids associated with different mineral salts.

The research to produce organo-mineral fertilizers on lignite support in relative new in Romania. This research started 2.5 decades ago (Dorneanu et al., 1971; Rogoz et al, 1972) and it was continued till now withim the framework of some interdiciplinary programes operated by:

- National Research-Development Institute for Soil Science, Agrochemistry and Environmental Protection, Bucharest;
- Chemical Enterprise, Craiova Industrial Central for Chemical Fertilizers, respectively;
- Research Development Center, Dăbuleni Research Station for Plant Growing on Sands, respectively.

On the basis of positive results obtained in conception of organo-mineral fertilizers on lignite support, in 2000, the Research Development Institute of Soil Science, Agrochemistry and Environmental Protection - ICPA, Bucharest, together with the National Lignite Society, Oltenia, Tg. Jiu, as cofinancing, managed to contract the project Nr. 1183/2001-2003 within the RELANSIN research program that permitted to carry out a pilot installation to produse organo-mineral fertilizers on lignite support with a capacity of 7000 t per year.

At the same time with the starting of this installation function, at present being in the final (and modernization) stage, a real base has been created to extend the production of fertilizers on lignite support in Romania (Dorneanu et al, 2008).

The opportunity to obtain the organo-mineral fertilizers from lingite in Romaia due to the important lignite reserves in Romania, in the large missing exploitations of Oltenia, with organic matter (OM) content of 60.54-69.52%; humic acids SiO_2 14.98-39.46% (AH); 24.94-38.62% (Dorneanu Emilia et al., 2002; Davidoiu et al., 2008).

MATERIAL AND METHODS

The organo-mineral fertilizers obtained by technological mixture of lignite with some minerals salts have been comparatively tested with classical chemical fertilizers applied at equivalent amounts to the corn fertilization.

Testing has been rigorously carried out in field on Psammosols (sandy soils) and Albic (podzolic) luvisols, both soils having a low humus content.

Two categories of fertilizers have been tested:

- organo-mineral fertilizers on pelletized lignite support in successive layers with a urea solution;
- organo-mineral fertilizers on pelletized lignite support in successive layers with humic acids extracted from lignite as the potassium humates.

RESULTS AND DISCUSSION

The first category is represented by the L-200 and L-300 fertilizers with humic acids and nitrogen and by the Super H-210 complex fertilizers, Super H-120, respectively, with humic acids and phosphorus at different rations. All these pelletized fertilizers with urea solution have lower contents of humic acids, between 10 and 22% (table 1).

The second category is represented by the L-200 hum, L-300 hum and by the Super H-210 hum complex fertilizers, Super H-120 hum, respectively.

Table 1

Composition and properties of pelletized organo-mineral fertilizers on lignite support, pelletized in successive layers with a urea solution, prepared in the installation from SNLO, Tg. Jiu and homologated for use in Romania's agriculture

No.	Item	MU	L-200	L-300	Super H-210	Super H-120
1	Composition					
1,1	Humic acids	%	16.0	10.0	17.0	22.7
1,2	Nitrogen (N)	%	22.0	28.0	20.55	9.15
1,3	Phosphorus (P_2O_5)	%	-	-	9.75	16.50
1,4	Potassium (K_2O)	%	0.255	0.197	0.226	0.307
2	Properties					
2,1	Cation exchange capacity	me/100 g	48.0	35.8	41.0	55.7
2,2	Bulk density	g/cm^3	0.738	0.707	0.720	0.813
2,3	Granulation (1-5 mm)	%	82.0	86.0	79.3	88.6

These palletized fertilizers with potassium humates have higher contents of humic acids, between 24.3 and 29.9% higher nitrogen contents and a supplement of potassium included in humates (table 2).

Table 2

Composition and properties of new pelletized organo-mineral fertilizers on lignite support, pelletized in successive layers with potassium humates in a micropilot, which is going to be homologated and follow to be produced in the modernized installation from SNLO, Tg. Jiu

No.	Item	MU	L-200 Hum	L-300 Hum	Super H-210 Hum	Super H-120
1	Composition					
1,1	Humic acids	%	29.9	24.3	28.5	26.4
1,2	Nitrogen (N)	%	23.49	29.21	21.97	10.47
1,3	Phosphorus (P_2O_5)	%	-	-	9.75	16.50
1,4	Potassium (K_2O)	%	2.80	2.80	2.80	2.80
2	Properties					
2,1	Cation exchange	me/100 g	96.3	75.2	70.3	83.9

	capacity					
2,2	Bulk density	g/cm^3	0.823	0.782	0.801	0.852
2,3	Granulation (1-5 mm)	%	89.9	92.3	88.9	93.5

Table 3 shows the average yields obtained with the fertilizers in the first category applied to corn grown on irrigated psammosols for five years.

As compared to the control (M_2) fertilized with chemical fertilizers, the treatments with L-200, L-300, Super H-210 and Super H-120 organo-mineral fertilizers led to yield increases with 15.9-20.8%.

Table 3

Yield increases obtained with palletized organo-mineral fertilizers with a urea solution applied to corn HF-420 grown on irrigated Psammosols (sandy soil) at the Research - Development National Center for Plant Growing on Sands, Dăbuleni - Dolj

No.	Treatments	Average yield kernels (5 years)	Yield increase			
		kg/ha	kg/ha	% as compared to		kg kernels/ kg fertilizer ($N-P_2O_5-K_2O$)
				M_1	M_2	
1	Control (M_1)	2808	-	100.0	-	-
2	Urea,TSP*, Potash salt (M_2)	5290	2482	188.4	100.0	6.2
3	L-200, TSP* Potash salt	6210	3402	221.1	117.4	8.5
4	L-300,TSP* Potash salt	6136	3328	218.5	115.9	8.32
5	SH-210 Potash salt	6353	3545	226.2	120.0	8.86
6	SH-120, Urea Potash salt	6359	3587	227.7	120.8	8.96

LSD 5%	620
1%	900
0.1%	1180

*TSP triple superphosphate

Fertilization rate: N-200; P_2O_5-100; K_2O-100 kg/ha

Table 4 shows the average yields obtained for 2 years with pelletized with humates. Their efficiency has been compared with the pelletized fertilizers with a urea solution, both been applied at a rate of 500 kg/ha physical products. The yield increases recorded in the treatments with pelletized fertilizers with humates are significantly higher than those obtained in the treatments with palletized fertilizers with a urea solution and correlate with the increase of humates included in the respective fertilizers.

The tests carried out with corn and other crops (potatoes, sunflower) proved higher efficiency of organo-mineral fertilizers on lignite support, which improvers plant nutrition by ensuring easily assimilable forms of contained nutrients on way of both solubility and continous changing of ions adsorbed in humates with other-ions in soil solution, as well as the formation of humic chellates which action as active physiological substances with effect of stimulating the germination and vegetative growing of plants (Dorneanu et al., 2008; Kashl et al., 2005). Concomitant these fertilizers improve some qualitative properties of soil by increasing the content of humates, such as cation exchange capacity increase, microstructure fermention, long term water holding capacity increase, biological activity stimulation (Dorneanu et al., 2008; Kline's, 1994).

Table 4

Yield increases obtained with palletized organo-mineral fertilizers with potassium humates applied to corn HS Talman, grown on Albic (podzolic) Luvisols at the Horticultural Research - Development Station, Tg. Jiu

Fertilizers type	**Applied phisical substances kg/ha**	**of which:**		**Total a.i. kg/ha**	**Kernel production kg/ha**	**Yield increase**		
		NPK kg/ha	**Humic acids kg/ha**			**kg/ha**	**%**	**kg kernels/ kg a.i.**
Nefertilizat	-	-	-	-	1260	-	100.0	-
L-200	500	NK-111.3	80.0	191.3	3210	1950	254.8	10.19
L-200 hum	500	NK-131.5	149.5	281.0	3700	2440	293.6	8.61
SH-120	500	NPK-129.8	113.5	243.3	4280	3020	339.7	12.41
SH-120 hum	500	NPK-148.9	132.0	290.0	4450	3190	353.2	11.00
DL 5%					430			
1%					610			
0.1%					820			

On the basis of the tests carried out, it is estimated that, for the first stage, in Romania, a minimum of over 800000 t/year of organo-mineral fertilizers on lignite support is necessary for fertilization of 1.1 million hectares (Dorneanu et al., 2008).

CONCLUSIONS

1. On the basis of presented data, it may be estimated that the organo-mineral fertilizers on lignite support, due to their content in humates, have a series of specific properties that impart them higher fertilization qualities as compared to the classical chemical fertilizers.
2. Incorporation into a organo-mineral matrix with humates ensures the assimilation of nutrients at a higher proportion than by applying chemical fertilizers, and the soil chemical pollution degree is significantly reduced.
3. Use of fertilizers on lignite support presents the advantages that they can economic efficient use, under higher conditions a significant part of the more than 4 miliard tones of coals with humic acids existent in Romania and they can ensure a humic fertilization of an important land area of the more than 7 million ha of humus deficient soils.
4. An essential economic advantage of production of organo-mineral fertilizers on lignite support is represented by the lower energy consumption and production costs, having in view the contribution of active ingredient in coal which are less than costs of the chemical fertilizers with 22-25%.

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DETERMINING AGROCHEMICAL FACTORS FOR NITRATE EXCESS IN THE SOIL-PLANT SYSTEM

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Keywords: *nitrates, N excess, pollution*

Abstract

The excessive presence of nitrates in the soil-plant system, their concentration in certain consumer plant products and last, but not least, their increased presence in water resources raises not only research, but also management issues in certain fields involved in providing food safety and the quality of life and the environment. This paper presents approaches relying on a series of experiments and researches related to some agrochemical factors involved in nitrate chemism and transfer in the soil-plant system. The results confirm predictions and previous findings, which lay large N quantities applied as mineral fertilizers at the basis of soil nitrate excess, an application conducted especially when high levels of residual mineral-N already exist having been determined by the mineralization of the organic forms of this element in soils and by previous fertilizations. Soil acidity and acidification, as well as its dephosphatizing favour nitrate excess and its plant translocation. The reorganization of soil nitrate through organic resources, the optimization of the application of mineral N and P forms may limit nitrate leaching along the soil profile and their plant translocation. Due to the intricacy of this issue and the traceability of these ions in the food chain, approaches in this field require multidisciplinary activities.

INTRODUCTION

For the last decades, one can signal a frequent increase of nitrate (NO_3^-) concentrations in soil, water and plant products (especially fresh products), while the phenomenon of nitrate excess was assessed, in most cases, to coincide with an increase in the employment of mineral N fertilizers and liquid and semi-liquid animal residues in agriculture. Thereby, the same context provides that nitrate excess states are harmful for agricultural and horticultural crops (where "nitric phytotoxicity" is triggered), as well as for the consumers of nitrate-contaminated plant products, where the enhanced risk of diseases can be encountered ("the blue-baby syndrome" in children is caused by the inactivity of the hemoglobin function of O_2 transport and the increased incidence of gastric cancer as an effect of nitrosamines) [1, 2, 4].

Nitrate presence in the soil-plant system, from an agrochemical point of view, can be controlled and monitored through a series of physical, chemical and biologic soil traits (NO_3^-; NH_4^+, MoO_4^{2-} in the substrate, pH, humus, biologic activity and others), as well as plant species and genotypes, assessed through nitrogen consumption and metabolizing activity.

Agriculture is considered to be the main determining agent for nitrate excess and pollution and thus, must attempt at a decrease in nitrate soil representation, limit nitrate accessibility and vulnerability towards phreatic and surface waters and at the same time, attempt at a normalization of nitrate translocation in plant products, which are able to transfer these ions in the food chain onto human and animal consumption [1, 3, 4, 5].

This paper presents results related to the nitrate cycle in the soil-plant system and reveals certain alternatives to regulate this cycle towards the productive employment and metabolizing of nitrogen and thus preventing nitric excess.

MATERIAL AND METHOD

The results interpreted in the present paper originate in field experiments with differentiated fertilization systems and analytical laboratory activity.

Soil-plant analyses were conducted according to ICPAPM Bucharest procedures recommended to agrochemical laboratories.

RESULTS AND DISCUSSIONS

a) Sources of origin for soil nitrates:

• Naturally, a permanent nitrate formation source appears and is maintained in the soil through the preponderantly microbiologic process of humus mineralization (oxidative degradation), and implicitly of organic-N resources, as ammonification and nitrification stages release nutritive nitrogen ions (NH_4^+ and NO_3^-).

The process of ammonium nitrate nitrification is conducted in two stages (involving Nitrosomonas sp. and Nitrobacter sp.), following a global reaction:

$$NH_4^+ + 2O_2 \rightarrow NO_3^- + H_2O + 2H^+$$

$$\Delta G_{298}^{o} = -65.2 \text{ kcal/N mole-gram}$$

In effect, this process engages potentially mineralizing and nitrifiable nitrogen in the soil (N_{pmin}) and is influenced by certain chemical and physical soil factors (pH, N_{pmin} and humus soil reserve, alkali saturation, aeration-O_2 and compression level, moisture, temperature and others). According to these parameters, this microbiologic source provides an annual active and accessible N intake of 20-50kg/ha.

• Upon conventional agricultural technology, the most important nitrate source resides in crop fertilization under a mineral, as well as an organic form of N nutritive ions (NO_3 and NH_4^+).

In principle, however, soil nitrate enrichment through a preponderantly fertilizing source must be fully and significantly substantiated, from a scientific point of view. Towards the economy and productivity of nitrogen application, there is a requirement for the correct control and evaluation of nitrogen “surplus”, most frequently appearing in a nitric form. This form presents a polluting potential for phreatic and surface waters and can appear contaminating for plant products.

In determining potential N excess with subsequent polluting effects, a complex study can be conducted on nitrogen balance in ecosystem components , by establishing N DOE, crop response curves to nitrogen application and evidently an assessment of N excess in the balance: $N_{ex}=N_{nec}+N_{fix}+N_{prec}-N_{cp}$ (N_{nec}= nitrogen necessary for an optimum crop development; N_{fix}= nitrogen fixed by leguminous plants; N_{prec}= nitrogen in the soil from rainfall; N_{cp}= nitrogen quantity obtained from the soil with the agricultural yield produced).

The exceeding amount of nitrogen becomes accessible to plants, with mostly negative effects (“nitric phytotoxicity”) and partly vulnerable to leaching (“washing down”) along the profile down to the aquiferous phreatic level.

b) Leaching and nitrate transportation in soils:

Leached nitrate quantities are real losses of nitrogen, while the models of the descending transfer of these anions (along the profile) are size-dependent on the N excess from the crop balance (in the ecosystem), on the soil type and the characteristics of water movement along the profile, on fertilizer types and the season of fertilizer application, on the representation of the support of internal microbiologic activity. The soil may “limit” the process of nitrate leaching, as long it is agrochemically, physically and biologically-optimized (regarding the pH, humus content and m.o. as an energy support for microorganisms, phosphatizing and structuring) and crops involve such plants for which nitrogen efficiency is enhanced, while differentiated vegetation is active in maintaining N reserves in root-exploration area.

Models created after determinations conducted in many areas and points show that the highest NO_3^- in shallow soil horizons, as well as on the profile originate in mineral fertilization technologies with N and in the ones containing liquid and semi-liquid animal residues. The highest concentrations towards the basis of the soil profile (through leaching) are encountered after the application of nitrogen before the cold and damp season for crops sown in autumn. These nitrate quantities (mostly originating in a N surplus) follow, until the end of the growing cycle, a vertical route to depths of 1.0-2.0 m and even higher. [4, 5].

Modeling nitrate leaching can be functionally complicated by the biologic side of the processes for nitrate productive elaboration, especially dependent on the soil organic matter regimen and microbial activity.

c) Nitrate accumulation in plant products

Nitrate accumulation in plants involves their subsequent reduction (as in the case of nitrites) to the ammonium form exclusively employed in nitrogen metabolism for amino-acid synthesis:

$$NO_3^- + 9H^+ + 8e^- \rightarrow NH_4^+ + OH^- + 2H_2O$$

This process conducted in the cytoplasm and chloroplasts is active in the presence of light (providing electrons necessary for reduction), of molybdenum (as catalyzer) and nitrate and nitrireductase enzymes. For many plant species (wheat, maize, leguminous plants), nitrate and nitrite reduction is conducted in the roots, whereas for many other plants it is conducted in the leaves (tomatoes, cucumbers, potatoes).

It is thus ascertained that intensive agricultural technologies, adapted especially to vegetables (in the field and greenhouses) favour increased nitrate accumulations, especially in the case of some which are freshly consumed. High quantities of nitrates can be accumulated, up to 2000-2500 mg/1 kg for peppers, tomatoes, salad, spinach, red beat, and radish, while under 2000 mg/1 kg in the case of cabbage leaves, cauliflower, celery and carrots. It is assessable that 54-80% of ingested nitrates in the human organism originate in vegetables and only the rest in other food products. As such, in many EC countries, the maximum accepted limits of NO_3 content were established in the case of the main vegetables.

d) Results of researches regarding the effect of certain agrochemical measures for nitrate accumulation in the soil-plant system:

The application of mineral fertilizers and especially of nitrate fertilizers significantly modifies the mineral nitrogen supplies (NO_3^-+NH_4^+) in the soils (tables 1, 2).

The one-sided employment of nitrogen as fertilizer, as well as its imbalanced application compared to phosphorus, determines the highest mineral-N accumulations on the soil profile and a surplus of this element, which potentially becomes vulnerable to toxicity for plants and leacheable. The presence of phosphorus balances and limits a surplus of nitrates in soils and provides plants with a more productive and efficient consumption. The limiting of mineral-N consumption in the presence of phosphorus enhances fertilization efficacy and the efficacy of nitrogen metabolism.

Similarly, favoured by balanced NP fertilizations, agricultural crops within a rotation have differentiated effects in nitrogen economy and balance. In this context, leguminous crops (the case of soybeans) due to a biologic N input (on each symbiotic) provides a constant supply of nitrogen for plants without any sign of exaggerate accumulation o mineral-N on the soil profile.

Table 1

Mineral-N dynamics in two soil types under autumn wheat crops (NP stationary experience for 12 years)

Soils	NP fertilization (kg/ha)	Mineral-N (kg/ha), depth 0-100 cm			
		1. XII.	8. II.	6. III.	9. IV.
Preluvosoil	N_0P_0	61	46	44	70
	$N_{100}P_0$	156	122	120	113
	$N_{200}P_0$	422	205	190	184
	N_0P_{100}	63	36	76	56
	$N_{100}P_{100}$	98	71	90	87
	$N_{200}P_{100}$	160	169	170	191
Aluvisoil	N_0P_0	44	28	76	67
	$N_{100}P_0$	88	118	121	124
	$N_{200}P_0$	367	236	228	165
	N_0P_{100}	61	33	59	64
	$N_{100}P_{100}$	158	103	127	89
	$N_{200}P_{100}$	291	214	165	150

Table 2

Mineral-N dynamics under autumn wheat crop cultivated in different rotations

Soil	Previous plants	Fertilization of previous plants	Mineral-N (kg/ha), depth 0-100 cm			
			1. XII.	8. II.	6. III.	9. IV.
Aluvisoil	Wheat	Unfertilized	59	71	50	72
	Maize	$N_{120}P_{80}$	141	256	191	72
	Soya	$N_{120}P_{80}$	100	184	204	104
	Wheat	$N_{120}P_{80}$	383	191	398	138

Frequent mineral-N excess, especially on acid and dephosphatized soils creates nutrition deficiencies in plants, due to an excessive accumulation of NO_3^- on the background of a decrease in molybdenum (MoO_4^{2-}) mobility and accessibility in the particular agrochemical substrate (table 3).

It can thus be asserted that the activity: acidification, P and Mo deficiency generates an exaggerate accumulation of nitrates in plant tissues, as it diminishes their reduction in plants and finally determines a blockage of the synthesis process of amino-acids and proteins.

Table 3

Nutrition deficiencies in wheat and maize caused by nitrate excess

Crop/ Soil	Mineral-N 0-100 cm	Soil analyses				Growing state *)	$N\text{-}NO_3$ in plants (ppm)
		pH H_2O	Mobile-Al (m.e.)	P-AL (ppm)	Mo (ppm)		
1. Wheat/ Preluvosoil	71	6.2	-	53	0.25	N	275
	260	5.4	0.51	8	0.17	D	2790
2. Maize/ Preluvosoil	58	5.9	0.11	18	0.21	N	840
	111	5.8	0.14	10	0.19	D	2100
	137	5.7	0.14	7	0.18	D	3010
	206	5.6	0.28	6	0.17	D	3185
	312	5.4	0.52	6	0.16	D	3360

*) N= normal; D= nutritionally imbalanced

For a normal nitrate cycle an efficient fertilization practice, it was proven experimentally that the introduction of organic resources as fertilizers (with organic-N and organic-C input) remedies and even limits the effects of nitrogen mineral inputs, on the basis of the revitalization of the soil's microbiologic activity. (table 4).

Table 4

Effect of fertilizing organic resources in the $N\text{-}NO_3$ dynamics in soils (argic phaeozem)

Fertilization	Depth (cm)	$N\text{-}NO_3$ dynamics (ppm)			
		1. XII.	1. II.	1. III.	20. IV
1. $N_{100}P_{80}$	0-20	60	72	44	37
	20-40	40	52	40	38
	40-60	28	37	47	50
2. Stable manure 20 t/ha+ $N_{40}P_{40}$	0-20	50	60	48	42
	20-40	30	40	35	32
	40-60	25	24	23	23
3. Chopped straw+ $N_{60}P_{60}$	0-20	40	46	47	48
	20-40	32	37	37	40
	40-60	16	13	12	12

Organic resources maintain a constant nitrate dynamics, limit their exaggerate vulnerability and mobility, while also reducing the process of their leaching towards the depth of the soil profile. It is thus obvious that organic N and C reserves within these organic resources favourably reorganize nitrogen cycle and the cycle of its components.

CONCLUSIONS

1. Soil nitrate excess and the high accumulations in plant products coincide with the modernization and intensification of agriculture, which triggered an increase of mineral-N inputs.
2. Present research attribute the same causes to soil, water and vegetation nitrate pollution, proving that the process is aggravated by the one-sided application of mineral-N and in opposition with the soil P and Mo content.
3. Soil acidity and acidification are factors which aggravate the phenomenon of nitrate accessibility and vulnerability, as factors for the enhancement of nitric excess and toxicity.
4. NP balance in fertilization, as well as organic N and C input, through fertilizing organic resources limits nitrate accessibility and vulnerability for soils, phreatic waters and agricultural crops.
5. Organic resources (with a different C/N ratio) effectively determine a reorganization of mineral nitrogen forms in soils.
6. Ensuring soil biologic activity (through N-NO_3-consuming microorganisms and high N-consuming plants) effectively protects nitrate cycle and prevents the manifestation of harmful effects in the soil-plant system.

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RESEARCH REGARDING THE INFLUENCE OF SEWAGE SLUDGE IN ORGANIC AGRICULTURE

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Keywords: *organic agriculture, organic carbon, biomass, heavy metals, luvosoil*

Abstract

In case of plants cultivation in organic agriculture, the completion of organic-mineral support is decisive in providing the feed, both in quantitative and qualitative terms. Research performed both to us and in other parts have demonstrated that an extremely valuable support material for agriculture is represented by the sewage sludge. In case of luvosoil there were used progressive doses of sludge, respectively: 0, 5, 10, 25 and 50 t.h^{-1}, with the aim of observing the trends in terms of improving the organic matter reserves. Generally the organic carbon (OC) content increased from approximately 1.5% to over 2%. Due to this fact there was also noticed an increase of total vegetal biomass and an increase in terms of grains, mainly for cultivated field crops, respectively maize, wheat and soybeans. In the same time, the heavy metals content has situated at the lowest levels, not dangerous, some representing in fact microelements: Zn, Cu, Mn.

INTRODUCTION

One of the valuable and available resources for completing the field plants' needs in terms of nutritive elements is represented by sewage sludge. Its obtaining follows a common processing method in the Wastewater Treatment Plant Pitesti and contains considerable quantities of: organic carbon (OC) 25-35 %, macro- and micro-elements, having also a neutral reaction-pH= 6.95-7.20. The specific contents relatively high in fertilizing elements [2, 6] recommends the usage of sewage sludge for field crops cultivation. Recent researches compare the sewage sludge with manure, while a major advantage related to the sludge is represented by the fact that the mineralization process takes place in a very short timeframe, plants taking advantage of those respective nutrients in a short time: total nitrogen, phosphorus, potassium, calcium, magnesium. Yet sewage sludge contains also some heavy metals, some representing microelements with low concentrations [3, 4]. As known, sewage sludge usage for the field crops cultivation requires the specific levels of these heavy metals to be under the admissible European an national levels (Order 708/344, 2004). Until present, two main directions have been considered when using sewage sludge: the organic matter contribution to ensuring the plants needed food, together with observing the heavy metals content, both directions being perceived as guarantees in obtaining some clean plants, grown-up in a normal way. In the present paper, there are presented the results obtained using sewage sludge, in different doses, for the purpose of improving luvosoil's nutrition regime, based on the principles of organic agriculture. As known, in case there is achieved the improvement of the luvosoil's content in terms of organic matter, there is also ensured in broad terms the supply of the plants with fertilizing elements, during the entire vegetation process. In the same time, there are to be observed the levels of the heavy metals in the entire specific eco-system: soil-green organs (leaves on flowering) - mature organs (grains).

MATERIAL AND METHODS

The study regarding the sewage sludge effects upon the agricultural environment contained some complex researches. A cropping system with a duration of 4 years was initiated, for the period 2004-2007 with the following configuration: year 1 for maize, year 2 for winter wheat, year 3 for soybeans and year 4 for winter wheat. Different doses of sludge were used: 0 $t.ha^{-1}$, 5 $t.ha^{-1}$, 10 $t.ha^{-1}$, 25 $t.ha^{-1}$, 50 $t.ha^{-1}$, with and without chemical fertilizers. The present data describe separately only the influence of sewage sludge upon the agricultural environment. The sludge doses were applied in the same quantity in the first 2 years-for maize and wheat in year 2, with soybeans and wheat in the last year allowed to benefit of the remaining effect of these initial doses. Experimental variants (plots) had a surface of 100 sq.m each, in three replications. The cultivation technology of these 3 field plants was the one recommended by the agricultural research station. Chemical analyses performed were according to the last European norms and methodologies (OC- SR ISO 10694-98, heavy metals in leaves and soil, total forms- SR ISO 11047-99, and mobile forms in the soil- SR ISO 14870-99). Soil samples were collected with the agrochemical check-rod from the cultivation horizon 0-20 cm, when plants reached their maturity phase. The organic carbon content in the soil with sewage sludge was determined in all of those 5 average samples. In the same maturity phase those 3 plants were harvested, while their total vegetal mass (dry) was measured. Between the soil's content in OC and the vegetal mass there were determined specific correlations in all those 4 cultivation years. Regarding the heavy metals, several chemical analyses were performed, as follows: i) from the cultivation soil, for total contents and mobile ones; ii) from plants' leaves during the flowering period, specially: leaves corresponding to maize cobs, the last leaves under the wheat ear and respectively from the central part of the soybeans stalk; iii) from the grains in the maturity phase. Determination performed were intended to analyze the following heavy metals: lead (Pb), cadmium (Cd), zinc (Zn), copper (Cu), nickel (Ni), and manganese (Mn).

RESULTS AND DISCUSSION

The contribution of sewage sludge used in the cultivation soil was analyzed in two ways. Chemical analyses were performed for determining the organic matter accumulations and heavy metals contents.

The cultivation soil contains organic matter (OM) coming either from the accumulation of vegetal and animal matter, or in the form of fertilizers, both sources suffering of decompositions or colloidal dispersion [1]. The basic component of the organic matter is represented by humus. In a continous dynamic phase, more or less stable, humus is the result of several biological, chemical and bio-chemical processes [9]. Humus contains a very valuable chemical element-carbon, which stands for a very important ratio- of over 55%.

Sewage sludge contains in a certain ratio this OC, more exactly a ratio of over 30%, with the macro- elements also presenting high levels, as follows: total nitrogen 2.25%, phosphorus 1.25%, potassium 0.35%, calcium 1.90% [5]. The way luvosoil was improved in terms of organic carbon as an effect of using sewage sludge (figure 1).

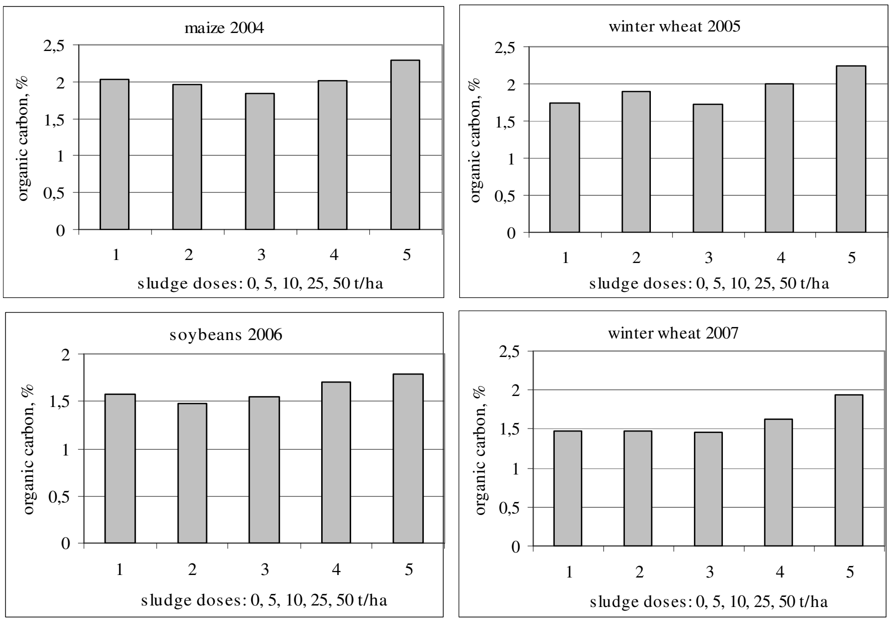

Fig. 1. The influence of sludge doses over soil's organic carbon (OC) contents

Of the 4 situations, the OC contents in the soil were grouped in 2 categories. On one side, both maize in the 1st year and wheat in the following year have a OC content at slightly higher values. For maize, compared to the check plot without sewage sludge and in the first three doses, the OC content was situated around a ratio of 2%, while for the lot with 50 $t.ha^{-1}$ sewage sludge the OC content ratio increased to 2.30%. For wheat, sludge influenced the soil's content in OC starting from a ratio of 1.74% in the check plot without sludge and increased in the case of the lots with the first two sludge doses. At 25 $t.ha^{-1}$ of sewage sludge the OC was found to be around 2%, while for 50 $t.ha^{-1}$ the level was of 2.25%. In case of soybeans and wheat in the last cultivation year there was noticed the remaining effect of sludge, so the results were somehow lower. For soybeans the OC level was between 1.50% in the case of small doses and 1.79% in maximal dose. In case of wheat the OC content was of 1.50% in 4 variants and slightly increased- 1.93% in the case of largest dose of sludge. Being separated, the two situations for sludge effect: direct contribution and remaining effect, there can be capitalized the feature of fast mineralization the sewage sludge possesses.

Based on the sludge doses used, the total biomass of all those 3 crops has increased (figure 2). Biomass growth rates were the following: 491 kg total d.w. (dry weight) maize/10 $t.ha^{-1}$ sludge, 909 kg total d.w. wheat/10 $t.ha^{-1}$ sludge, 277 kg total d.w. soybeans/10 $t.ha^{-1}$ sludge and 334 kg total d.w. wheat/10 $t.ha^{-1}$ sludge. Since data obtained are consistent they can provide a great level of reliability in valorization of this valuable material- the sewage sludge.

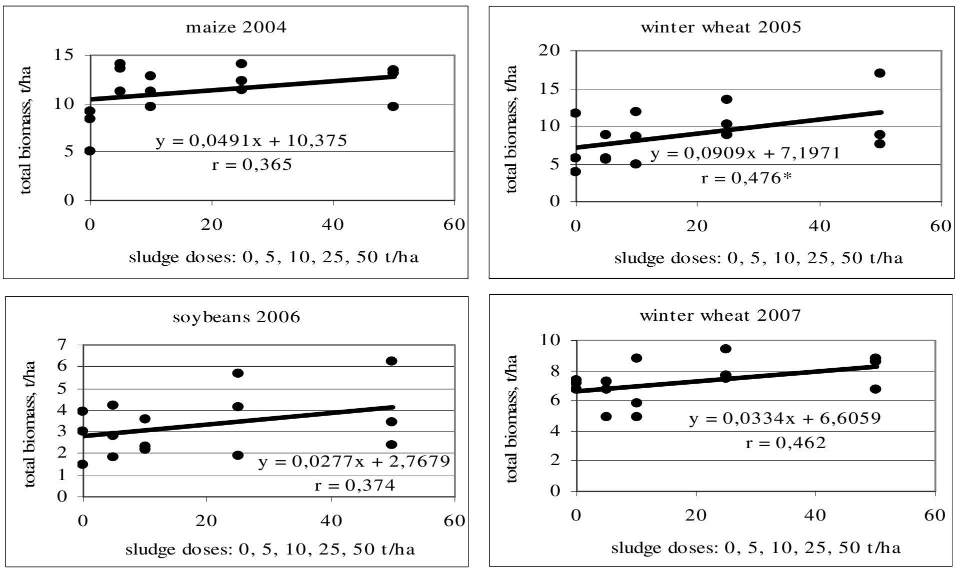

Fig. 2. Correlations between sludge doses and total field crops biomass

Heavy metals are component part of nature [7], including the agricultural environment. On one side the cultivation soil has specific concentrations of chemical elements, together with organic ones, while on the other side the sludge has its own contents. By mixing up the two systems- soil and sludge, accumulations of heavy metals can occur. The important issue is that both original concentrations and the additional ones to be contained within allowable limits, that are not hazardous (table 1). The average values obtained during the entire experiment show low concentrations, under the set limits. Total manganese forms in the soil, before and after using sludge, are slightly higher due to a luvosoil specific phenomenon [8]. Regarding the heavy metals contents in the plants (table 2), there were noticed very low levels of heavy metals, with slight fluctuations in leaves and grains. Lead was found only in the winter wheat; cadmium was discovered more in the maize grains and less in the wheat grains and soybeans; zinc recorded accumulations more in the maize and wheat grains and less in case of soybeans; copper was found more in soybeans, with the same situation in case of nickel; manganese was present in higher concentrations in the leaves of the 3 plants.

Table 1

The means values of heavy metals content in the luvosoil, without and with sewage sludge quantities

Heavy metals	Total forms		Mobile forms	
	without sludge ($mg.kg^{-1}$ dw soil)	with sludge ($mg.kg^{-1}$ dw soil)	without sludge ($mg.kg^{-1}$ dw soil)	with sludge ($mg.kg^{-1}$ dw soil)
Lead, Pb	17	20 - (50)*	6	7
Cadmium, Cd	0.130	0.210 - (3)	0.100	0.115
Zinc, Zn	112	83 - (300)	2.5	7
Copper, Cu	19	20 - (100)	4.2	5
Nickel, Ni	23	22 - (50)	4.7	5
Manganese, Mn	820	840 - (500)	440	500

*344/708/2004

Table 2

The leafs and grains heavy metals content after sludge doses application

Heavy metals	maize		wheat		soybeans		wheat	
	leaves	grains	leaves	grains	leaves	grains	leaves	grains
Lead, Pb	and*	and	2.1**	2.5	and	and	6.0	and
Cadmium, Cd	0.098	0.155	0.192	0.167	0,203	0.109	0.218	0.209
Zinc, Zn	9.4	23.9	31.9	71.5	71.7	49.0	18,7	36.6
Copper, Cu,	2.8	1.9	6.0	6.7	9.2	16.7	6.7	4.3
Nickel, Ni	1.5	0.8	2.3	4.2	8.5	37.3	3.8	3.5
Manganese, Mn	6.0	6.7	127.9	95.2	183.1	40.1	117.7	69.5

*and-andetectable, **$mg.kg^{-1}$ dw

CONCLUSIONS

1. Sewage sludge with important concentrations of organic carbon (OC), in macro- and micro- nutrients and with the heavy metals limits under the hazardous ones, stands for a very good organic fertilizer. With a maximal limit of 50 $t.ha^{-1}$ the sewage sludge can be used as a very good fertilizer for organic agriculture.
2. By using different doses of sludge there was obtained an improvement of the soil's content in organic carbon from 1.84% to 2.30% for maize and between 1.72% to 2.25% to wheat- as a direct effect of using sludge, and between 1.47% and 1.79% for soybeans and between 1.45% and 1.93% for wheat in the last year.
3. Luvosoil benefited of an improvement of its content in terms of organic carbon, creating the required conditions for obtaining higher vegetal productions. The cause is represented by the creation of some superior conditions for plants' growth and development.
4. Heavy metals, both total forms and mobile ones, had lower levels. Leaves and grains were prevalent regarding the absorbtion and translocation of heavy metals from the soil fertilized with sewage sludge.

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THE INFLUENCE OF THE FERTILIZING SYSTEM ON THE MICROELEMENTS CONTENTS IN CONDOR SOYBEAN CULTIVAR

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Keywords: *soybean, fertilizing system, microelements*

Abstract

In the literature there are data regarding the influence of the chemical fertilizers on the microelements contents in different vegetal products considered specific for some plants. Because the pedoclimatic conditions influence to a large extent the microelements contents, also the genetic potential of the species and the genus, the researches made for the Condor soybean tried to establish the effect of the chemical fertilizers in soy plants cultivated on the reddish preluvosol soil from Moara Domneasca, inside the greenhouse USAMV Bucharest [4, 5].

The experimental variants tested doses of 50 and 100 kg N/ha applied on two phosphorus levels of 40 and 80 kg P_2O_5*/ha.*

In the soybean were determined by Atomic Absorption Spectroscopy variable contents of the microelements Zn, Cu, Fe, Mn, Pb, Ni, Co, Cr, Cd depending on the experimental variants.

INTRODUCTION

Soybean is one of the most important agricultural plants for people's and animals' food. There is a developed food industry which has as basic raw material the soybean flour, reach in vegetal protein where a different many products are realized: milk, cheese, vegetal meat, macaroni, biscuits, margarine, oil etc. Although in our country the soybean cultivated area decreased after December 1989, it continued to be a priority for some private enterprisers and researchers [1].

Because of the economic importance of soybean, the present researches had the purpose to establishing the effect of the fertilizing system on the yield and on the microelements content from Condor soybean cultivar.

MATERIAL AND METHODS

Research were made in 2007 within the greenhouse of the University of Agronomic Sciences and Veterinary Medicine Bucharest, in Mitscherlich pots having a capacity of 8 kg.

The used biologic material was the following: late sowings Condor soybean cultivar, fall resistant, a good diseases resistance and a high genetic potential.

The used soil was the reddish preluvosol from Moara Domneasca, mixed in proportion of 2:1 with sand.

When the experiment was started components and soil mixture were analyzed.

For the fertilization, 3 nitrogen levels and 3 phosphorous levels were used in the variants presented in the experimental scheme (table 1).

Table 1

Experimental scheme

No.	Variant		N (kg/ha)	P_2O_5 (kg/ha)
1	N_0P_0 control	N_0P_0 control	-	-
2	N_1P_0	$N_{50}P_0$	50	-
3	N_2P_0	$N_{100}P_0$	100	-
4	N_0P_1	N_0P_{40}	-	40
5	N_1P_1	$N_{50}P_{40}$	50	40
6	N_2P_1	$N_{100}P_{40}$	100	40
7	N_0P_2	N_0P_{80}	-	80
8	N_1P_2	$N_{50}P_{80}$	50	80
9	N_2P_2	$N_{100}P_{80}$	100	80

Nitrate ammonium fertilizer, with 34.4% N, was used for nitrogen and superphosphate fertilizer, with 18% P_2O_5 for phosphorous, calculated according to the pots capacity.

During the vegetation period, in the critical moments of plants development (blooming, beginning of binding pods, end of their growing) were analyzed soil and plants samples, biometrical measurements were effectuated and in the end the beans were analyzed in order to determine the microelements contents.

RESULTS AND DISCUSSION

From table 2 data, the results when we started the experiment are: the soil mixture was poor in nutritive elements, with low content of soluble salts and 7.36 pH.

When the experiment ended, the plants were gathered by variants and the grains yield was recorded. In table 3 the results are discussed.

According to the table 3 data, as compared to the unfertilized control variant, the variants 8 ($N_{50}P_{80}$), 2 ($N_{50}P_0$), and 5 ($N_{50}P_{40}$), had the highest grains yield of 9.4 q/ha, 8.4 q/ha and respectively 7.79 q/ha, the results being statistically very significant.

Table 2

Components and soil mixture analysis

No.	Specification	pH	Content of soluble salts (%)	N-NH_4^+ (ppm)	N-NO_3^- (ppm)	NH_4^++NO_3^- (ppm)	PO_4^{3-} (ppm)	K^+ (ppm)
1	Sand	7.16	0.086	21.5	trace	21.5	trace	10
2	Sol	7.26	0.0480	1.75	15.5	17.25	trace	20
3	Mixture soil-sand 2:1	7.36	0.0329	15.25	5.75	21.0	trace	20

Table 3

The influence of fertilization on the soybeans grains yield

No.	Variant	Yield (q/ha)	%	Differences	Signification
1	N_0P_0 control	5.50	100	Mt	-
2	$N_{50}P_0$	13.90	252.7	+8.4	xxx
3	$N_{100}P_0$	8.94	162.5	+3.44	x
4	N_0P_{40}	8.41	152.9	+2.91	ns
5	$N_{50}P_{40}$	13.29	241.6	+7.79	xxx
6	$N_{100}P_{40}$	8.66	157.4	+3.16	ns
7	N_0P_{80}	7.96	144.7	+2.46	ns
8	$N_{50}P_{80}$	14.90	270.9	+9.40	xxx
9	$N_{100}P_{80}$	7.10	129.0	+1.60	ns
DL 5%= 3.41 q/ha, DL 1%= 4.64 q/ha, DL 0.1% = 6.27 q/ha					

They underline the fact that the soybean which fixes the nitrogen in the nodules, the nitrogen dose of 50 kg/ha is enough from the economic point of view, and the phosphorous which is in synergism with may lead to the efficient growth of yield, but in this case supplementary expenses have to be made, but unjustified related to the phosphate fertilizer.

In soybeans were analyzed the macroelements content of N, P, K [4, 6], and crude protein (%) (table 4), and microelements total forms (ppm) (table 5).

From the table 4 data, one can notice that in the soybeans the limits of total nitrogen content varied between 5.41% (control variant) and 6.19% the variant 3 fertilized with 100 kg N/ha.

The crude protein which in soybean usually varies between 27-50% [1] varied in this case between 33.83% at the unfertilized variant and 38.74% at the variant 3 in which the 100 kg N/ha dose significantly influenced the quantity (+3.44 q/ha).

The total phosphorus content in the soybean grains had maximum values in the case of unfertilized control variant (0.984%) and 0.678% at variant 5 ($N5_0P_{40}$), the variant that as variant 3 ($N_{100}P_0$) had the lowest K_t (1.7%) content.

Table 4

The content of macroelements (%) and crude protein (%) in the soybean grains

No.	Variant	N_t (%)	P_t (%)	K_t (%)	Crude protein (%)
1	N_0P_0 control	5.4130	0.984	1.9	33.83
2	$N_{50}P_0$	5.8158	0.836	1.8	36.34
3	$N_{100}P_0$	6.1989	0.766	1.7	38.74
4	N_0P_{40}	6.0319	0.804	2.15	37.69
5	$N_{50}P_{40}$	5.6979	0.678	1.7	35.61
6	$N_{100}P_{40}$	5.9042	0.813	1.95	36.90
7	N_0P_{80}	5.8158	0.771	1.80	36.34
8	$N_{50}P_{80}$	6.0123	0.807	1.95	37.57
9	$N_{100}P_{80}$	5.6390	0.777	2.0	35.24

From the table 5 data, which present the microelements content of the soybean [5], one may notice that the values for Zn, Cu, Fe, are within the specified limits in the literature, for Mn they have minimum values (at the critical concentration of 13-14 ppm). In the soybean grains were also determined Pb, Ni, Co, Cr, Cd in which the variation limits do not show any differences between the fertilization systems applied.

Table 5

The microelements content (ppm) in soybean grains

No.	Variant	Zn	Cu	Fe	Mn	Pb	Ni	Co	Cr	Cd	Mo
1	N_0P_0 control	37	15	66	14	2	12	0.37	5.8	1.36	0.9
2	$N_{50}P_0$	38	14	74	14	2	8	0.25	trace	1.32	3.5
3	$N_{100}P_0$	46	14	73	15	1	11	0.08	5.4	1.61	3.6
4	N_0P_{40}	40	14	70	14	1	10	trace	0.4	1.53	2.7
5	$N_{50}P_{40}$	50	13	55	13	1	9	trace	0.6	1.54	3.9
6	$N_{100}P_{40}$	37	14	96	14	2	11	trace	0.4	1.56	4.2
7	N_0P_{80}	48	16	81	14	2	13	trace	2.4	1.56	2.5
8	$N_{50}P_{80}$	44	15	120	15	3	14	0.19	17.7	1.56	4.7
9	$N_{100}P_{80}$	52	14	59	13	trace	13	trace	4.2	1.48	1.7
Limits from literature		12 – 80	4 – 30	50 – 300	14 – 100						0.5–5

Regarding the Mo and Zn influence on the crude protein accumulation in the soybean we may notice the followings:
Mo can be found in some enzymes which activate the nitrogen cycle, this way being affected the N fixing in the nodules, the reduction of the nitrate ion is blocked, amino acids formation and proteins synthesis is lowered. This fact is also presented in figure 1 where correlation coefficient is R= 0.764*, significant [2, 3].

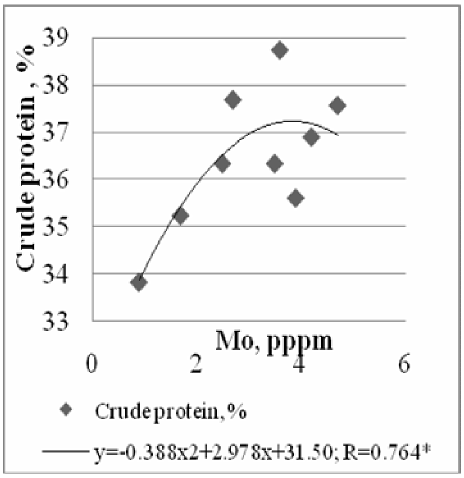

Fig. 1. The influence of the Mo content, ppm, on the soybeans crude protein accumulation (%)

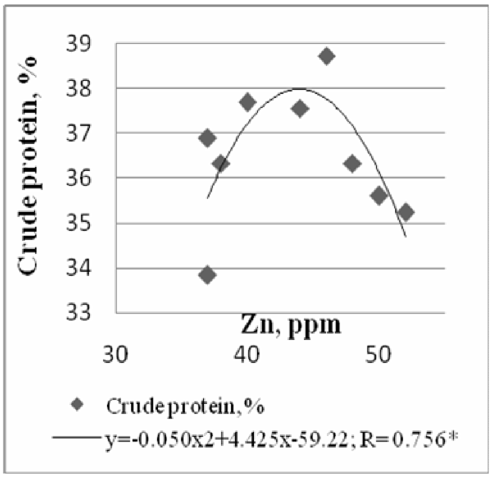

Fig. 2. The influence of the Zn content, ppm, on the soybeans crude protein accumulation (%)

From the figure 2 results that in the case of Zn deficiency, because the enzymes catalyzing the tryptophan synthesis inactivate, is affected the synthesis and metabolism of proteins. The correlation between Zn content and protein accumulation in the soy beans is significant (R=0.756*).

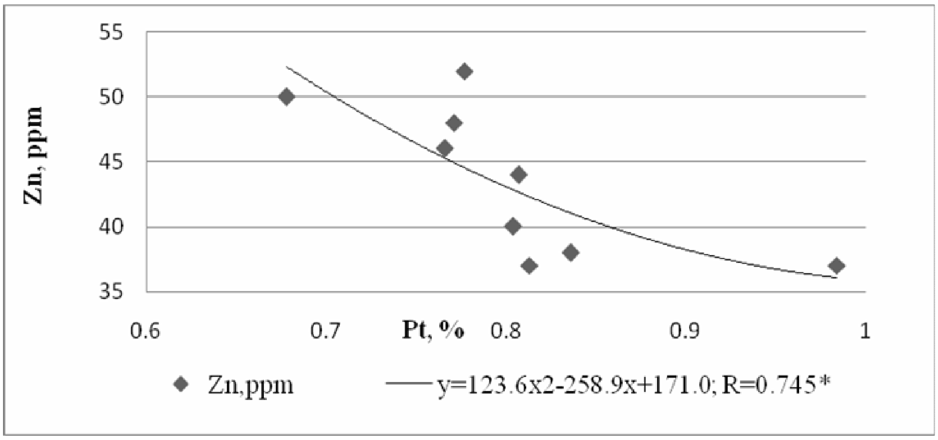

Fig. 3. The soybean Zn absorption, ppm, depending on Pt content (%)

Zn absorption in the soybeans is diminished at higher contents of total phosphorous, phenomenon explained by the antagonistic relation between the two ions.

CONCLUSIONS

1. The nitrogen dose of 50 kg/ha is enough from the economic point of view, the phosphorous doses variation may lead to the production increase, but supplementary expenses are necessary unjustified with the phosphate fertilizer costs.
2. From the statistic point of view very significant results as compared to the unfertilized control variant were obtained in variants 8 ($N_{50}P_{80}$), 2 ($N_{50}P_0$), and 5 ($N_{50}P_{40}$) with grains yields crops of 9.4 q/ha, 8.4 q/ha and respectively 7.79 q/ha.
3. The crude protein which in soybean grains varies between 27-50% [1] varied in this case between 33.83% at the unfertilized variant and 38.74% at the variant 3 in which the 100 kg N/ha dose influenced significantly the quantity (+3.44 q/ha).
4. The soybean grains microelements content of Zn, Cu, and Fe is between the specified limits in the literature.
5. The correlation between the Zn content and protein accumulation in the soybeans is significant (R=0.756*).
6. Zn absorption in soybean is diminished at higher total phosphorous, phenomenon explained by the antagonistic relation between the two ions.

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EFFECT OF A NATURAL BIODEGRADABLE PRODUCT AND BACTERIAL INOCULUM IN A CRUDE OIL POLLUTED SOIL

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Keywords: *natural biodegradable product, bacterial inoculum, polluted soil, total petroleum hydrocarbon*

Abstract

Petroleum hydrocarbons pollution of soils has become a big problem with the development of petrochemical industry and installation of numerous petrol stations and underground pipes. Physical, chemical and biological technologies have been developed to remove petroleum hydrocarbon pollutants from soils and restore environmental quality. However, costs are high, and many techniques are difficult to use for in-situ remediation. It still remains necessary to study the natural attenuation of hydrocarbons in soil and to develop simple cost-effective techniques for enhanced remediation. This paper introduces some research results on natural attenuation and enhanced bioremediation of a polluted soil with a residual petroleum content of 5% and 10% dry soil weight.

INTRODUCTION

Bioremediation is based on the capacity of microorganisms to degrade organic pollutant compounds, such as hydrocarbons. The “time-consuming” bioremediation of hydrocarbon polluted soils can be improved by the increase of hydrocarbon availability [5].

These compounds are important soil pollutants because of the high toxicity of the polycyclic aromatic hydrocarbon (PAH) fraction. According to the Environmental Protection Agency (EPA), 16 PAHs have been reported as carcinogenic and mutagenic compounds [7], so it is necessary to remove them from the contaminated/polluted sites.

Recent studies have reported several bacteria species with the capacity to mineralize or to degrade petroleum hydrocarbons [2]. Several different bioremediation techniques have been developed, but biostimulation is the most often used [4]. This consists of the activation of native soil microorganisms through the addition of nutrients.

The addition of commercial microbial cultures (as bioaugmentation) to contaminated soil concluded that it is not superior to just simply adding nutrients (as biostimulation) to the contaminated soil [1].

It is possible that, even if the native microorganism population is large enough, it does not have the ability to degrade components of high molecular weight or to emulsify insoluble compounds. Bioaugmentation could be used for the latter case. This technique is defined as the addition of pre-grown microbial cultures to perform a specific remediation task in a given environment [3].

The microbial cultures must have the ability to withstand different soil environmental conditions and to survive in the presence of other microorganisms [6].

MATERIAL AND METHODS

The main objective of this research is to enhance the biodegradation processes using a treatment with the natural hydrocarbon absorbent named ECOSOL. It tested the capacity to increase the biodegradation of petroleum hydrocarbons by stimulating the bacteria. To achieve data concerning the bioremediation of polluted soil with petroleum hydrocarbons, a greenhouse experiment was realized. The soil used in this experiment was calcic chernozems.

The experiment was set up by artificial pollution of a cambic chernozem with 5% and 10% petroleum and treated with different quantities of ECOSOL and bacterial inoculum. The bacterial inoculum was developed from microorganisms that occur naturally in the soil like *Pseudomonas, Mycobacterium, Arthrobacter globiformis* and *Bacillus megaterium.*

The polluted soil with petroleum hydrocarbons was treated with different quantities of the natural hydrocarbon absorbent and bacterial inoculum determined variation of the chemical characteristics of the soil. It was analysed the following chemical characteristics using standard methods: soil reaction (pH), organic carbon (Walkley and Black method), total azote (Kjeldahl method), phosphorous and potassium.

The total petroleum hydrocarbons were quantified by a gravimetric method, following previous solid–liquid extraction in a Soxhlet system. The extraction was carried out with methylene chloride in 1-2 g soil samples, which had been previously dried and grounded.

RESULTS AND DISCUSSION

As it can be observed in table 1, the pH values increase with the quantity of ECOSOL in each experimental variant. In the treatments with 50 g ECOSOL, the soil reaction could reach a value around 8.25, with 100g ECOSOL a value around 8.36 and with 200 g ECOSOL a value around 8.58.

The total petroleum hydrocarbons concentration is proportionally with the artificial pollution of the soil in each experimental variant.

The organic carbon content increases with crude oil concentration in the experimental variants where the soil was polluted with 5% crude oil, respectively 10% crude oil, comparatively with the control.

Table 1

Chemical characteristics of soil in the experimental variants at the beginning of the experiment

Experimental variant	pH	TPH (mg kg^{-1})	Organic C (%)	Total N (%)	C/N Ratio	P (mg kg^{-1})	K (mg kg^{-1})
V_1 – unpolluted soil	8.10	0	3.40	0.330	12.09	165	3220
V_2 – polluted soil with 5% crude oil	8.13	39566	7.31	0.313	27.26	158	3220
V_3 – polluted soil with 10% crude oil	8.14	90341	8.54	0.288	35.08	153	3380
V_4 – polluted soil with 5% crude oil + 50 g ECOSOL	8.21	54533	7.91	0.305	31.20	149	3540
V_5 – polluted soil with 5% crude oil + 50 g ECOSOL + bacterial inoculum	8.28	42233	7.56	0.327	27.05	175	3540
V_6 – polluted soil with 5% crude oil + 100 g ECOSOL	8.33	43225	7.84	0.341	26,79	151	3380
V_7 – polluted soil with 5% crude oil + 100 g ECOSOL + bacterial inoculum	8.36	40491	7.69	0.342	26.20	144	3380
V_8 – polluted soil with 10% crude oil + 100 g ECOSOL	8.34	90092	7.37	0.311	27.68	135	3220
V_9 – polluted soil with 10% crude oil + 100 g ECOSOL + bacterial inoculum	8.39	91500	9.50	0.284	39.42	131	3380
V_{10} – polluted soil with 10% crude oil + 200 g ECOSOL	8.60	91050	8.88	0.285	36.41	146	3540
V_{11} – polluted soil with 10% crude oil + 200 g ECOSOL + bacterial inoculum	8.56	90867	8.26	0.286	33.83	122	3220

Table 2

Chemical characteristics of soil in the experimental variants at the end of the experiment

Experimental variant	pH	TPH (mg kg^{-1})	Organic C (%)	Total N (%)	C/N Ratio	P (mg kg^{-1})	K (mg kg^{-1})
V_1 – unpolluted soil	8.02	0	3.22	0.340	11.53	167	3380
V_2 – polluted soil with 5% crude oil	8.13	36278	7.23	0.290	29.67	175	3220
V_3 – polluted soil with 10% crude oil	8.13	81144	7.77	0.326	27.78	95	2580
V_4 – polluted soil with 5% crude oil + 50 g ECOSOL	8.26	46734	7.56	0.284	31.10	127	3220
V_5 – polluted soil with 5% crude oil + 50 g ECOSOL + bacterial inoculum	8.24	38967	7.69	0.298	30.33	120	3380
V_6 – polluted soil with 5% crude oil + 100 g ECOSOL	8.33	42878	7.57	0.324	27.95	110	3380
V_7 – polluted soil with 5% crude oil + 100 g ECOSOL + bacterial inoculum	8.35	38417	7.81	0.369	25.60	96	3220
V_8 – polluted soil with 10% crude oil + 100 g ECOSOL	8.40	81867	10.57	0.357	34.79	128	3220
V_9 – polluted soil with 10% crude oil + 100 g ECOSOL + bacterial inoculum	8.42	81550	7.99	0.304	30.72	118	3220
V_{10} – polluted soil with 10% crude oil + 200 g ECOSOL	8.53	83067	8.29	0.314	31.43	85	3060
V_{11} – polluted soil with 10% crude oil + 200 g ECOSOL + bacterial inoculum	8.56	80134	8.00	0.343	27.87	105	2580

The total nitrogen contents decrease with the hydrocarbon concentrations increase reaching a value around 0.330 in the control, a value around 0.325 in the experimental variants polluted with 5% crude oil, and a value around 0.290 in the experimental variants polluted with 10% crude oil.

The C/N ratios are higher than the control in all experimental variants according to organic carbon increase and nitrogen decrease.

The phosphorous contents fluctuate in the experimental variants polluted with crude oil, treated with ECOSOL and bacterial inoculum.

The potassium contents fluctuate in the experimental variants polluted with crude oil, treated with ECOSOL and bacterial inoculum.

As it can be observed in table 2, the pH values increase with the quantity of ECOSOL in each experimental variant, being lower than the values obtained in the beginning of the experiment, probably, because of the crude oil biodegradation in soil.

The total petroleum hydrocarbons concentration is proportionally with the artificial pollution of the soil in each experimental variant. The TPH concentration dropped because of the bioremediation treatment applied. In the end of the experiment, the total petroleum hydrocarbons are lower than in the beginning of the experiment because of the degradation process.

The organic carbon content increases with crude oil concentration in the experimental variants where the soil was polluted with 5% crude oil, respectively 10% crude oil, comparatively with the control. There was a drop in soil organic carbon comparing to the initial values because of the crude oil biodegradation in soil.

The total nitrogen contents decrease with the hydrocarbon concentrations increase. Comparatively with the initial values from the beginning, could not be observed a fluctuation in the end of the experiment.

The C/N ratios are higher than the control in all experimental variants according to organic carbon increase and nitrogen decrease. In the end of the experiment, comparatively with the values obtained in the beginning of the experiment, there was a drop also in the C/N ratios due to the remediation treatment.

The phosphorous contents fluctuate in the experimental variants polluted with crude oil, treated with ECOSOL and bacterial inoculum. In the end of the experiment, comparatively with the values obtained in the beginning of the experiment, it was not observed a significantly difference during the remediation treatment.

The potassium contents fluctuate in the experimental variants polluted with crude oil, treated with ECOSOL and bacterial inoculum. In the end of the experiment, comparatively with the values obtained in the beginning of the experiment, it was not observed a significantly difference during the remediation treatment.

CONCLUSIONS

1. Some chemical characteristics of soil differ during the bioremediation treatment.
2. The soil reaction, the total petroleum hydrocarbons, the organic carbon and the C/N ratios are proportionally with the artificial pollution of the soil in each experimental variant. In the end of the experiment, these parameters dropped because of the bioremediation treatment applied comparatively with the values obtained in the beginning of the experiment.
3. The total nitrogen contents decrease with the hydrocarbon concentrations increase. Comparatively with the initial values from the beginning, could not be observed a fluctuation in the end of the experiment.
4. The phosphorous and potassium contents fluctuate in the experimental variants polluted with crude oil, treated with ECOSOL and bacterial inoculum. In the end of the experiment, comparatively with the values obtained in the beginning of the experiment, it was not observed a significantly difference during the remediation treatment.
5. The treatment with the natural biodegradable product and the addition of bacterial inoculum recorded the highest rate of degradation, as it can be observed from the total petroleum hydrocarbons concentrations.
6. The experimental research will continue in the greenhouse on the same artificial polluted soil.

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THE INFLUENCE OF FOLIAR FERTILISERS ON THE PENETRATION, UPTAKE AND THE DISTRIBUTION OF THE MICRONUTRIENTS IN DIFERRENT ORGANS OF SUNFLOWER PLANTS

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Keywords: *micronutrient, foliar fertilization*

Abstract

The quantification of the influence of complex foliar fertilizers (CFF) upon the micronutrients absorption through the plant teguments and their translocation in sunflower (Helianthus annuus L.) vegetative organs (leaves, stem and tops), as well as the influence on fresh and dry weight of these organs. The diluted CFF solution have been applied only on a part of these leaves while the micronutrients determination have been done only in the plant organs untouched with CFF solution. The results obtained have revealed that micronutrients uptake and absorption only in the plant organs untouched with CFF solution were significantly higher.

INTRODUCTION

In order to develop a methodology for quantifying the micronutrients foliar absorption applied through leaves plant and their translocation in other organs of the plant test and the study of some factors that may influence these processes were carried out within an experiment in the green house.

MATERIAL AND METHODS

Experience has been organized in a Mitscherlich pots with capacity of 10 kg dry soil and the number of pots being 30 (15 pots with optimal soil fertilisation and 15 deficiency soil fertilization). Foliar fertilizer complex with the following composition: 187 g N, P 38 g, 115 g K, 0.60 g Fe, Mn 0.352 g, 0.251 g Zn, B, 1.005 g, 0.150 g Mo (g/kg of fertilizer). Plant test was sunflower HS Favorit, foliar treatments were applied on four leaves. The number of treatments was three. Samples of plant material were taken at 3 days after the last treatment being harvested untreated organs of plants.

RESULTS AND DISCUSSION

Application of foliar fertilizers (figure 1-2) determined an increases of plant biomass, increases being, in generally, insignificant statistically, excepting with the plants grown on deficiency fertilized soil. In general, data reveals that the plants growing on deficiency substrate responds better to foliar fertilization. Concentrations of micronutrients determined on the dry matter of plant have been multiplied by the ratio between the green mass of the treated leaves and untreated leaves. Accumulation of micronutrients (Zn, Cu, Mn and Fe) in the dry matter of vegetative organs (leaf opposite to the treated leaves) of sunflower are generally higher in a variants with ICF, compared with the control (treated with water) and increases are generally statistically assured. Concerning the influence of soil fertilization condition, the plants growing on poor substrate accumulated in their tissues a higher quantity of micronutrients (figure 3-4).

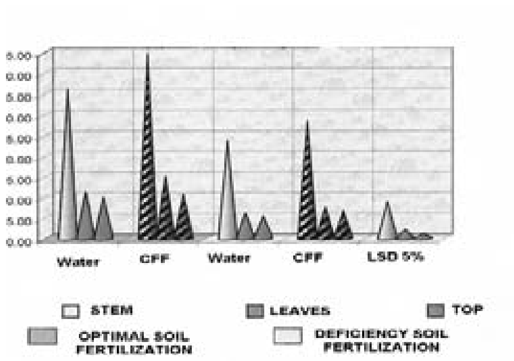

Fig. 1. Influence of CFF application (1.5%), only four leaves on the fresh weight of the plant organs untouched with CFF

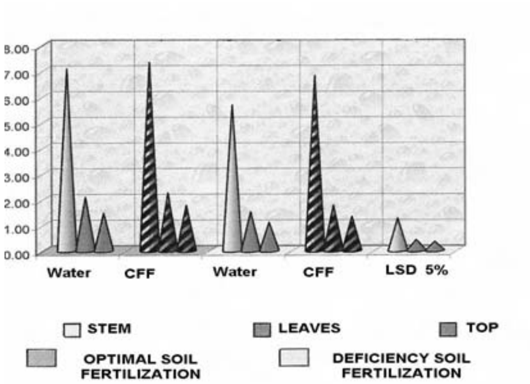

Fig. 2. Influence of CFF application (1.5%), only four leaves on the dry weight of the plant organs untouched with CFF

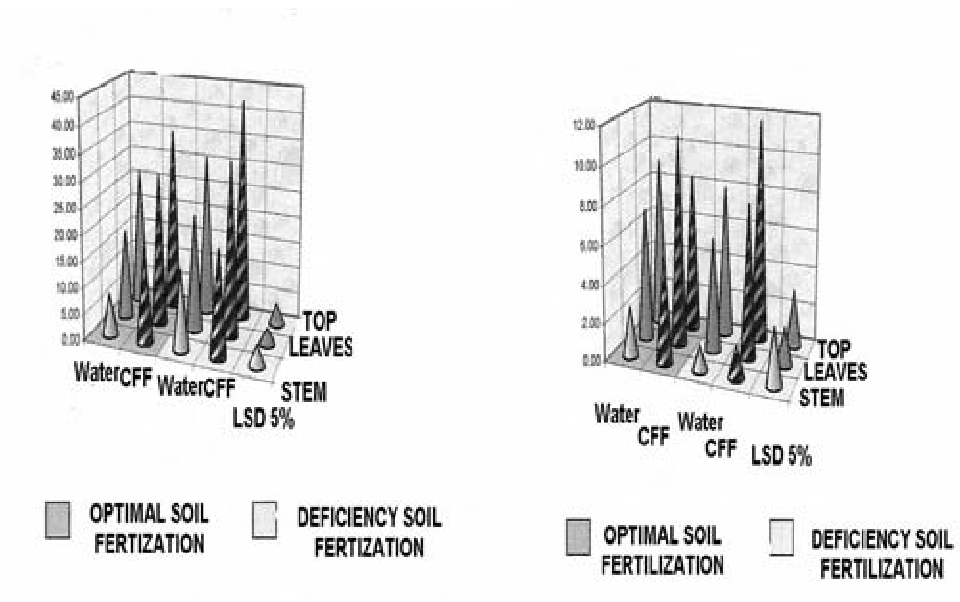

Fig. 3. Influence of CFF application (1.5%), only four leaves on Zn and Cu uptakes in dry matter of the plant organs untouched with CFF

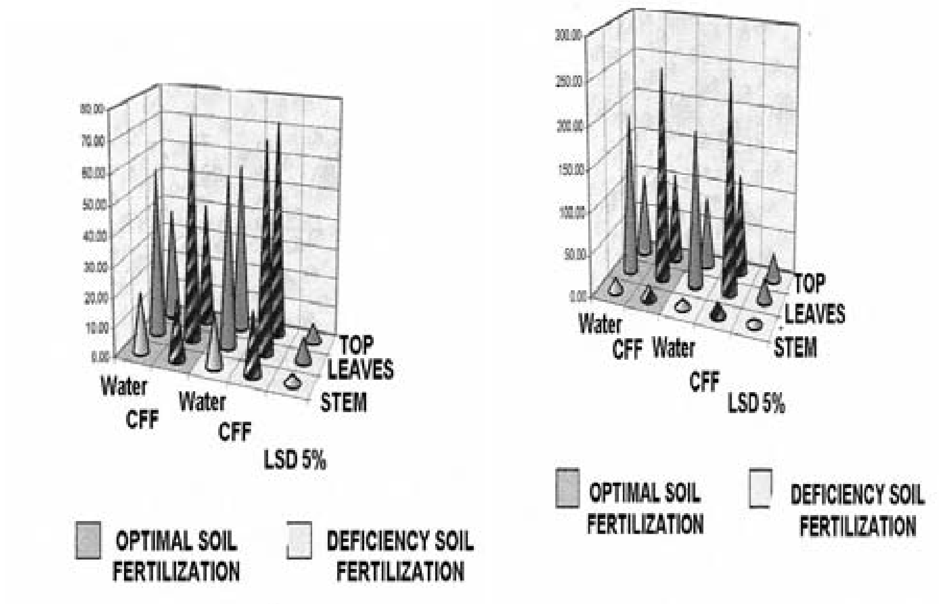

Fig. 4. Influence of CFF application (1.5%), only four leaves on Mn and Fe uptakes in dry matter of the plant organs untouched with CFF

CONCLUSIONS

1. Data obtained in this study confirm the opportunities offered by this method in determination and quantification of and micronutrients penetration and translocation in plants.

ACKNOWLEDGEMENTS

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THE USE OF NITROPHOSKA FOLIAR 20.19.19 IN SOME CROPS ON DIFFERENT SOIL TYPES

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Keywords: *leaf fertilization, development enhancer, agro fond*

*A*bstract

The product nitrophoska foliar 20-19-19 is a universal foliar fertilizer, which have been tested in five experimental trials to the different agricultural and horticultural crops on the different soil and environmentala conditions.

The trials were carried out on unfertilized and NP ground fertilized fields and having the following soil conditions: cambic chernozem (SCDA Podu Iloaiei, Iasi); aluviosol (SCDA Braila); cambic chernozem (SCDSZ Roman, Neamt); cambic chernozem (SCDL Bacau).

MATERIAL AND METHODS

The chemical composition of the fertilizer is shown in table 1.

Table 1

Composition of Nitrophoska foliar product

No.	Chemical compound	Unit.	Concentration on element or oxid
1	Nitrogen total (Nt)	%	19.38
2	Phosporous (P_2O_5)	%	19.92
3	Potassium (K_2O)	%	18.60
4	Calcium (Ca)	%	0.019
5	Magnezium (Mg)	%	0.62
6	Zinc (Zn)	%	0.034
7	Coper (Cu)	%	0.035
8	Iron (Fe)	%	0.101
9	Manganese (Mn)	%	0.100
10	Lead (Pb)	%	0.0001
11	Cadmium (Cd)	%	0.00005
12	Nichel (Ni)	%	0.00012
13	Cromium (Cr)	%	0.0001

The research metods were based on the foliar application in 2-5 treatments at the concentration of 0.2% in 500 l/ha solution, on agricultural and vegetables crops and 1000 liters/ha for vine.

The trials were conducted on the different soil conditions without ground fertilization and on NP ground fertilized variants.

All the maintaining crops measures were executed at the optimum level, speciffic for the crops in each trial location.

Efficacy analysis was considered in all the variants, comparing to the witness variant- without ground and foliar fertilization.

RESULTS AND DISCUSSION

In **winter wheat,** croped on **cambic chernozem**, after two foliar applications was obtained an yield increase to 710 kg/ha representing 71.0 kg of grains/kg of the product applied (table 2).

Table 2

Nitrophoska product efficiency, applied on the winter wheat, Eliana variety cultivated in cambic chernozem durring irigation (SCDA Podu Iloaiei, Iasi)

Var. no.	Treatment	No. of treatm.	Conc. (%)	Yield (kg/ha)	Yield increase		
					kg/ha	%	kg/kg applied
1.	Witness	-	-	3110	-	100.0	-
2.	Nitrophoska 20.19.19	2	1.0	3820	710	122.8	71.0

- Ground fertilization N – 80, P_2O_5 - 60

In **sunflower** cropped on the aluviosol under irrigation conditions, a yield increase of 255 kg/ha were obtained after two application which corresponded to 25,5 kg of grains/kg product applied (table 3).

Table 3

Nitrophoska product efficiency, applied on the sunflower, Favorit variety cultivated in aluviosol (SCDA-Braila)

Var. no.	Treatment	Nr. treatm.	Conc. (%)	Yield (kg/ha)	Yield increase		
					kg/ha	%	kg/kg applied
1.	Witness	-		2031	-	100.0	-
2.	Nitrophoska 20.19.19	2		2826	255	112.5	25.5

- without ground fertilization

When applied on **sugar beet**, Bârsa variety, cropped on cambic chernozem, after three treatments, a yield increase was obtained of 6500 kg /ha coresponding to 433 kg yield/kg of product applied (table 4).

Table 4

Nitrophoska product efficiency, applied on sugar beet, Barsa variety cultivated in cambic chernozem (SCDS Roman, Neamt)

Var. No.	Treatment	No of. treatments	Conc. (%)	Yield (kg/ha)	Yield increase		
					kg/ha	%	kg/kg applied
1.	Witness	-	-	28200	-	100.0	-
2.	Nitrophoska 20.19.19	3	1.0	34700	6500	123.0	433

- without ground fertilization

A yield increase of 9500 kg /ha, coresponding to 633 kg /kg of the product applied were obtained after three treatments **on tomatoes,** cropped on cambic chernozem (table 5).

Table 5

Nitrophoska product efficiency, applied on tomatoes, Unirea variety cultivated in cambic chernozem (SCDL Bacau)

Var. No.	Treatment	No of. treatments	Conc. (%)	Yield (kg/ha)	Yield increase		
					kg/ha	%	kg/kg applied
1.	Witness	-	-	30 000	-	100.0	-
2.	Nitrophoska	3	1.0	39 500	950	131.9	633.0

- without ground fertilization

A yield increase of 1400 kg /ha, coresponding to 46,6 kg /kg of the product applied were obtained after three treatments **on grapevine,** cropped on luvosol (table 6).

Table 6

Nitrophoska product efficiency, applied on the grapevine, Feteasca regală variety cultivated in luvosol (USAMV Cluj)

Var. No.	Treatment	No of. treatments	Conc. (%)	Yield (kg/ha)	Yield increase		
					kg/ha	%	kg/kg applied
1.	Nefertilizat	-	-	7000	-	100.0	-
2.	Kelpak	4	1.0	8400	1400	120.0	46.6

- without ground fertilization

CONCLUSIONS

1. When applied to all crops and on all experiments, Nitrophoska Folir 20-19-19 improved plants development and drived to obtaining significant yield increase.
2. The various crops where it was applied show the quality of the product as universal fertilizer, being efficient for large crops range.
3. The nitrate content analysis carried shows a significantly reduced level on all crops where Nitrophoska Foliar was applied.

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RESEARCH REGARDING BIOLOGICAL CARROT CROP IN ROMANIA

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Keywords: *carrot culture, biological culture, organic fertilizers*

Abstract

The research is aimed at establishing the optimum doses of organic fertilizers that can be applied to carrot culture in an organic system, correlated with high quality and quantity.

Therefore, in 2007 we carried out an experiment in which the organic doses applied had six degrees (2, 4 and 6 kg cow manure/m^2 and 2, 3 and 4 chicken manure/m^2). The biological material used was the De Nantes carrot.

Harvests were made during two periods, and analyses were also performed to determine the quality and quantity of the carrot crop. Every harvest included carrot measurements, analytic analyses of nitrates that characterize the quality of vegetables. The crop was registered and statistical interpretation of the results was performed.

The results obtained show that cow manure fertilization determined a better carrot development in diameter and length, compared with the chicken manure variants. The highest carrot roots were obtained in variants 2 and 3 fertilized with 6 and 8 kg cow manure/m^2.

Nitrates accumulated with high intensity in the middle phase of harvest; the nitrates content accumulated in carrots were under the maximum admissible limits of 400 ppm mentioned in literature and the Romanian law of vegetable quality [2]. The carrot crop was significantly influenced by the culture fertilization with 6 and 8 cow manure/m^2.

INTRODUCTION

Organic agriculture is an alternative to the usual modern agricultural practices, an intensive one whose main objective is to obtain agro-food products with a high content in biological active substances, so that they do not negatively influence human health and environment. That practice is aimed at increasing soil organic matter by using natural organic fertilizers (manure, compost, green fertilizers), and is an important sector for Romania which provides numerous development opportunities and is a tool in conservation of nature and revival of rural space.

Among the characteristics of agro-food products that must be strictly verified, there are nitrates, phosphorus, potassium, heavy metals and pesticide contents [2, 4, 5].

The aim of this research was to establish the optimum doses of organic fertilizers correlated with establishing the quality and quantity obtained from some vegetables cultivated in an organic system.

MATERIAL AND METHODS

The experience was carried out at the Vegetable Department of USAMV Bucharest, on an unprotected solarium, on a 120 m^2 area. The incorporation of organic fertilizers was made in six doses (4, 6 and 8 kg cow manure/m^2 and 2, 3 and 4 chicken manure/m^2), at the same time with the preparation of soil and at the beginning of the culture. Every variant had 10 m^2 total area.

The De Nantes carrot was sown on 16 March 2007 whereas emergence was on 2 April 2007.

During the vegetation period, nursery practices were applied according to the culture technology; the first weed was recorded on 11 May 2007 and the second on 8 June 2007, when roots recorded a pencil size. Harvest was made 120 days after the emergence, on the 13 July 2007. At harvest biometrical measurements, agrochemical characteristics were made, to characterize the quality and quantity of the crop.

The analyses performed were agrochemical, regarding nitrates, phosphorus and potassium. The methodology used was standard, i.e. STAS 11581-83 for nitrates, phosphorus and potassium. The crop was then registered, and statistical interpretation was made.

RESULTS AND DISCUSSION

At the beginning of the experiment, soil was sampled from the solarium, and the main agrochemical indicators were determined, as follows: pH, soluble salts, macro elements and heavy metals contents as well as pesticides that could affect the crop quality. The results obtained showed that the soil had an average content of nitrogen, and low contents of phosphorus and potassium (table 1).

Table 1

Analysis of soil agrochemical indices before sowing

Specification	pH	Soluble salts (%)	Content (ppm)			
			$N\text{-}NH_4^+$	$N\text{-}NO_3^-$	$P\text{-}PO_4^{3-}$	K^+
Soil	6.20	0.065	2.8	27.3	29.3	102

The heavy metals contents were within normal limits because Romanian soils record Cu element in normal limits of 50 ppm, Zn between 100-300 ppm, Pb-20 ppm and Cd between 3-5 ppm. Pesticide content was low (table 2).The organic fertilizers used in experiment were analyzed (table 3).

The biometric measurements regarding the development of carrot plants show the influence of nutritive element contents of the soil exceeding the carrot size and length (table 4), as well as the quantity of crop g/plant.

Table 2

Analysis of heavy metals at the beginning of culture

Specification	Heavy metals content (ppm)				Pesticides content (µg/kg)	
	Cu	Zn	Pb	Cd	DDT	HCH
Soil	27.3	76.2	5.6	0.13	undetectable	undetectable

Table 3

Analysis of organic fertilizers used in the experiment

No.	Specification	N (%)	P (%)	K (%)
1	Cow manure	0.61	0.17	0.59
2	Chichen manure	1.12	0.87	0.35

In the intermediary phase of vegetable culture, carrot lengths (mm) vary between 115.5 mm in the control and 164.16 mm in variant 3 fertilized with 8 kg cow manure/m^2. The effect of organic fertilizers could be shown on the average carrot length because the value of the control was under the values of the other experimental variants fertilized with cow and chicken manures. The same was also observed in the case of medium size of the carrots, which were between 13.63 mm in the control and 18.10 mm in variant 2 fertilized with 4 kg cow manure/m^2.

From the results, it can be observed that fertilization with cow manure has a more favorable influence upon the development of carrot size and lengths in variants 1, 2, 3.

The average weights of the pencil-sized carrots varied between 6.68 g/roots in the control and 13.43 g/root in variant 2 fertilized with 4 kg cow manure/m^2. It can be noticed that the best carrot weights were obtained in variant 2 and 3 fertilized with 6 and 8 kg cow manure/m^2.

Final harvest was recorded on 13 July 2007. The average root lengths were over the control value (178.3 mm), with the exception of the variant fertilized with 4 kg cow manure/m^2 (178.1 mm); the longest carrots were recorded in the variant fertilized with 8 kg cow manure/m^2 (239.5 mm).The average root diameter at the end of harvest varied between 7.6 mm in the control and 13.02 mm in the variant 4 fertilized with 2 kg chicken manure/m^2. In all variants, the average diameter of carrot roots was over the average diameter of the control variant.

Table 4

Carrot root sizes

Variant		Average values					
		L (mm)		Φ (mm)		Weight (g/plants)	
Harvest in intermediary vegetation stage (pencil-sized carrots) – 08.06.2007							
		L (mm)	Dif. +/-	Φ (mm)	Dif. +/-	g/plant	Relative values (%)
1	Ct	115.50	-	13.63	-	6.68	100.00
2	V1-4 kg cm*/m^2	152.66	+37.16	15.16	+1.53	6.88	102.99
3	V2-6 kg cm*/m^2	147.33	+31.83	18.10	+4.47	13.43	201.04
4	V3-8 kg cm*/m^2	164.16	+48.66	17.38	+3.75	10.17	152.24
5	V4 -2 kg chm**/m^2	130.33	+14.83	15.08	+1.45	7.31	109.43
6	V5-3 kg chm **/m^2	131.50	+16.0	16.46	+2.83	9.81	146.85
7	V6-4 kg chm **/m^2	142,66	+27,16	15,33	+1,70	7,95	119,01
Final harvest – 13.07.2007 -							
		L (mm)	Dif. +/-	Φ (mm)	Dif. +/-	g/plant	Relative values (%)
1	Ct	178.3	-	7.60	-	15.48	100.00
2	V1-4 kg cm*/m^2	178.1	-0.2	8.59	+0.99	14.95	96.57
3	V2-6 kg cm*/m^2	212.5	+34.2	10.25	+2.65	24.27	156.78
4	V3-8 kg cm*/m^2	239.5	+61.2	12.84	+5.24	33.19	214.40
5	V4 -2 kg chm **/m^2	232.1	+53.8	13.02	+5.42	21.96	141.86
6	V5-3 kg chm **/m^2	234.5	+56.2	10.90	+3.3	28.80	186.04
7	V6-4 kg chm **/m^2	233.6	+55.3	10.50	+2.9	31.19	201.48

*cow manure-cm, **chicken manure - chm

The average weight carrot varied between 14.95 g/root in the variant 2 fertilized with 4 kg cow manure/m^2 and 13.19 mm in the variant 3 fertilized with 8 kg cow manure/m^2.

Analyses regarding the carrot quality for consumption are presented in the table below (table 5). Nitrates present a restricting factor for quality, as carrot is a species that accumulates nitrates in its root; in humans, the accumulation of high quantities of nitrates can cause health problems, especially in children and old persons.

Nitrates absorption had a high intensity from the intermediary phase of analysis, the contents in nitrates varied between 115 ppm in the control to 173 ppm in V6 fertilized with 4 kg chicken manure/m^2. The level of nitrates in carrots was under the admissible limits presented in literature, i.e. 400 ppm content [1].

During the final harvest, the nitrates content in carrots had values between 107 ppm in variant 1 fertilized with 4 kg cow manure/m^2 and 308 ppm in variant 6 fertilized with 4 chicken manure/m^2. In that phase, the content was high but fertilization with organic fertilizers determined the metabolization of nitrates into proteins, and thus the nitrate contents were under the admissible value presented by the „Ordonanța Autorității Naționale pentru Protecția Consumatorilor nr. 1 din 3 ianuarie 2002 pentru legume şi fructe proaspete”[3], i.e. 400 ppm, respectively.

Table 5

Contents in unmethabolised nutrients in carrots

Variant		Content (ppm)		
		NO_3^-	**$P\text{-}PO_4^{3-}$**	**K^+**
Harvest in intermediary vegetation phase (pencil-sized carrots) – 08.06.2007				
1	Ct	115	64.4	2020
2	V1-4 kg cm */m^2	117	108.0	2300
3	V2-6 kg cm */m^2	151	110.0	2220
4	V3-8 kg cm */m^2	126	92.8	2140
5	V4 -2 kg chm **/m^2	154	86.8	1860
6	V5-3 kg chm **/m^2	158	71.2	2060
7	V6-4 kg chm **/m^2	173	64.8	2100
Final harvest – 13.07.2007				
1	Ct	141	313.6	2340
2	V1-4 kg cm */m^2	107	385.2	2980
3	V2-6 kg cm */m^2	167	387.6	3440
4	V3-8 kg cm */m^2	187	312.8	2220
5	V4 -2 kg chm **/m^2	183	292.4	2660
6	V5-3 kg chm **/m^2	166	298.8	1880
7	V6-4 kg chm **/m^2	308	176.8	1600

*cow manure-cm, **chicken manure - chm

The phosphorus content of carrot in the intermediary phase of harvest varied between 64.4 ppm (control) and 110.0 ppm in variant 2 fertilized with 6 kg cow manure/m^2. Until the final harvest, phosphorus absorption was intense, varying between 176.8 ppm in variant 6 and 387.6 ppm in variant 2.

Potassium content was high in the two stages of harvest, which influenced the period of carrot maintenance.

Carrot crop was very significantly influences by fertilization with 6 and 8 kg cow manure/m^2.

Table 8

Statistical interpretation of carrots crop

Variant	Average crop/variant (kg/m^2)	Differences +/-	Crop increase (%)	Significance
Mt	2.301	Mt	100	-
V1	2.582	0.281	112.21	ns
V2	2.987	0.686	129.81	***
V3	3.021	0.720	131.29	***
V4	2.564	0.263	111.43	ns
V5	2.651	0.350	115.21	ns
V6	2.321	0.020	100.87	ns

DL 5%=0.39 kg/m2 DL 1% =0. 53 kg/m2 DL 0.1%=0.62 kg/m2

CONCLUSIONS

1. The highest average roots length was registered in variant 3 fertilized with 8 kg cow manure/m^2 (239.4 mm). In all variants, the average roots diameter of the variants exceeded the average diameter of the control.
2. The nitrates contents in carrots in all variants was under the maximum admissible limits of 400 ppm presented by the" Ordonanța Autorității Naționale pentru Protecția Consumatorilor nr. 1 din 3 ianuarie 2002"[3].
3. The carrot yields were significantly influenced by the culture fertilization with 6 and 8 kg cow manure/m^2.

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PREVENTION AND THE CORRECTION OF MICRONUTRIENTS DISORDERS IN MAIZE AND SUNFLOWER PLANTS

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Keywords: *micronutrients, maize, sunflower*

Abstract

The paper presents the research concerning the elaboration and testing of an unconventional fertilization technology for maize and sunflower crops, which will prevent and correct the nutrition disorders in plant, especially in Zn.The two new foliar fertilizers have a complex composition: mineral macronutrients (N, P, K), micronutrients (Cu, Fe, Mn, Mo, Zn) and physiologically active substances (aminoacids, peptides).

The agrochemical testing of the two foliar fertilizers was carried out in the greenhouse of ICPA Bucharest, with maize and sunflower crops. The soil was Vermic Chernozems from Fetesti, with the following properties: weak alkaline reaction and excesive phosphorous status, these being the potential conditions for zinc deficiency in soils.

The applications of these foliar fertilizers ensured important yield increases of dry matter, on both crops. Also, the foliar fertilizers assured the increases of the micronutrients (Mn, Zn) content in the dry matter of plants.

INTRODUCTION

The foliar fertilizers with mineral nutrients and organic physiologically active substances belong to the unconventional means of fertilization. These fertilizers are applied to plants in order to stimulate and correct nutrition deficiencies or optimize the nutrient contents in the seeds.

According to the durable agriculture concept, these unconventional means of fertilization must be applied together with the classical (conventional) ones; the first insure the environment protection against the chemical pollution, due to increasing the degrees of productive nutrient use from soil and the others insure the agrochemical stabilization of the soil by compensating the nutrient losses from crop exports.

MATERIAL AND METHODS

The agrochemical testing of the two foliar fertilizers was carried out in the greenhouse of ICPA Bucharest in 2008. The tested plants were maize (Talman hybrid) and sunflower (Justin hybrid).

The soil was Vermic Chernozems from Fetesti with the following properties: humus: 3.44%; pH (H_2O):7.67; total N: 0.13%; mobile P: 113.53 ppm; mobile K: 106.66 ppm. The contents of mobile micronutrients (Cu, Zn, Fe, Mn) were over the susceptibility limit.

The experiment was organized in Mitscherlich pots with 20 kg of soil per pot and was treated as a monofactorial experiment with 3 replications. All the variants, excepting control - unfertilized in soil, received 100 mg N/kg soil, 100 mg P_2O_5/kg soil, 100 mg K_2O/kg soil – for the maize crop and 50 mg N/kg soil, 50 mg P_2O_5/kg soil, 50 mg K_2O/kg soil – for the sunflower crop, as a 15-15-15 complex fertilizer.

The foliar fertilizers have been applied three times as diluted solutions with 1% and 1.5% concentrations (30 ml/pot for each treatment). The plants have been harvested after seven days from the last application of the foliar fertilizers.

The new foliar fertilizers have a complex composition: mineral macronutrients (N, P, K), micronutrients (Cu, Fe, Mn, Mo, Zn) and physiologically active substances (aminoacids, peptides). Each foliar fertilizer has two compositions variants: V1, V2 for the maize crops and V3, V4 for the sunflower crops.

The experimental data have been processed by the variance analysis method (Student-Newman-Keuls test) and have been compared with the two controls: unfertilized in soil and fertilized in soil.

RESULTS AND DISCUSSION

The results obtained on the maize crop (Talman hybrid) are presented in table 1.

Table 1

Data regarding the effect of the foliar fertilizers on maize plant (Talman hybrid, 2008)

Variants	**Dry matter yields, g/plant**	**Cu**	**Zn**	**Fe**	**Mn**
		ppm			
Control 1	18.27 b	6 c	10 d	92 c	29 c
Control 2	23.17 b	12 a	18 c	199 a	42 b
V1 (1%)	43.61 a	11 ab	21 b	93 c	55 a
V2 (1.5%)	46.00 a	9 b	32 a	113 b	53 a

Both compositions of the foliar fertilizers, V1 and V2, assured yield increases of the dry matter between 25.34 g/plant and 27.73 g/plant as compared with the control unfertilized in soil and between 20.44 g/plant and 22.83 g/plant as compared with the control fertilized in soil. Regarding the effect of the tested foliar fertilizers on the micronutrient content it can be observed an increase of the Zn and Mn content as compared with the controls.

With sunflower crop (Justin hybrid), the tested fertilizer (V3 and V4) assured yield increases of the dry matter as compared with the controls (table 2).

Similar to the maize crop, the content of Cu and Fe in the sunflower dry matter decreased, but the content of these elements was at the higher limit of the optimum range. The Mn and Zn contents (which were under the limit of the optimum range) increased after the application of the foliar fertilizers.

Table 2

Data regarding the effect of foliar fertilizers on sunflower plants (Justin hybrid, 2008)

Variants	Dry matter yields, g/plant	Cu	Zn	Fe	Mn
		ppm			
Control 1	16.64 b	16 a	14 b	98 a	26 b
Control 2	21.61 ab	17 a	18 ab	61 c	30 ab
V3 (1%)	23.50 ab	8 b	19 ab	88 a	31 ab
V4 (1.5%)	28.77 a	9 b	22 a	73 b	33 a

CONCLUSIONS

1. The application of the tested foliar fertilizers had determined an increase of the maize and sunflower dry matter as compared with the controls.
2. The content of Zn and Mn in the plants dry matter increased, thus the tested fertilizers can be used to prevent and to correct the micronutrient deficiencies often met on the soils with alkaline reaction.

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THE INFULENCE OF FOLIAR AND CHEMICAL FERTLIZERS ON THE GROWING AND DEVELOPMENT OF PEASE IN THE AREA OF BOTHANICAL GARDEN, CRAIOVA

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Keywords: *protein, carbon hydrates, lecithin, vitamins*

Abstract

Origin from Asia Minor and Central Asia, the pea (Pisum sativum L.) was cultivated in antiquity by Greek and Romans in the south of Europe, where afterwards was spread on the entire continent, and in our country was brought in the XVIIth century.

The pea is cultivated on large surfaces for its seeds rich in protein (23-28%), carbon hydrates (46-50%), lecithin, vitamins and mineral salts of calcium, phosphor, potassium etc. These are used as food for human and as concentrate forage for animals.

The pea helps to establish the level of sugar in the blood, it is situated among the aliments richest in B1 vitamin, and the pea consumption helps to reduce the risk of apparition of heart diseases.

MATERIAL AND METHODS

The main goal of this study was the investigation of the behavior of Garden Pease species, Kelvedon Wonder (Italy) soil, towards knowing its adaptability on natural conditions from the study area.

For this purpose, during vegetation period, there have been made observations concerning: moment of sprouting, emerging of first real leaves, first internodes, date of flowering period, medium number of grains in the hull, medium length of the hull, length of the plants.

The experience was positioned at the Botanical Garden of the University of Craiova, in 5 variants, according to the randomised blocks, positioned in 3 repetitions.

Variants:

1. Witness;
2. Variant 2 - fertilized with Amofos (Russia), N12%, P_2O_5 52%;
3. Variant 3 - fertilized with Azomures NPK 15%, 15%, 15%;
4. Variant 4 - fertilized with Bionat (foliar fertilization);

5. Variant 5 - fertilized with Kelpak (foliar fertilization).

The planting was realized at 14.03.2008, in a soil with pH 6.08, after in autumn was prepared by deep tillage (20 cm) and levelled for maintenance, and during spring was minced before plantation, and the soil temperature was of 3.4^{0}C.

The plantation depth was of 7 cm, and the distance between rows is of 12 cm.

The chemical fertilization was realized in two stages, before dissemination and after springing. The foliar fertilization was made in 2 stages (the 5 cm stage and three weeks after it).

RESULTS AND DISCUSSION

After the determination of the chemical characteristics in the soil from the area of study have been obtained the following information (figure 1).

Table 1

Chemical characteristics of the experimented soil from the Botanical Garden, Craiova

Var.	N (%)	P_2O_5	K_2O	H (%)	Ah	SB	pH
1	0.195	16.32	6.5	3.48	0.52	34	6.08
2	0.259	24.96	9.0	4.2	0.87	30	6.04
3	0.266	30.4	8.0	4.68	0.87	32	6.02
4	0.252	31.36	6.5	4.59	0.52	24	6.01
5	0.250	31.30	6.3	4.56	0.51	22	6.01

Morphological and phenological observations

The sprouting of pease took place on 29.03.2008. The first real leaves have appeared after 6 days (V3), after 7 days (V2), after 8 days (V4 and V5) and after 10 days (V1) from sprouting. The first internodes were formed between 8 and 12 days after sprouting. The least internodes have been recorded at variant I unfertilized. Regarding the average length of the hull, this has varied from 5.68 cm (V1) to 6.32 cm (V4). The number of grains in the hull was comprised between 4.1 (V2) and 5.0 (V5). The height of plants was registered between 65-70 cm (V1) and 90-95 cm (V4).

During April month, took place the formation of the stem, of the vegetative mass and of the root that starts to be pivoting, with numerous lateral ramifications on which will be found nodes.

It is observed that the complex fertilizers give better results, in the first stages of vegetation, towards the foliar ones.

Table 2

The main phonologic information depending on used fertilizers

No.	Seeding	Raising moment	Fertilized	Moment of apparition of first leaves	First intercallus	Total intercallus	Date of the blossom period	Average length of the hull	Height of the plant
Var. 1	14.03.	29.03	Control	07.04	10.04	13	17.04	4 cm	65/70 cm
Var. 2	14.03.	29.03	Amofos	05.04	07.04	16	15.04	5 cm	80 cm
Var. 3	14.03.	29.03	Azomureş	04.04	06.04	16	14.04	6 cm	80/85 cm
Var. 4	14.03.	29.03	Bionat	06.04	08.04	17	13.04	6 cm	90 cm
Var. 5	14.03.	29.03	KelpaK	06.04	08.04	16	13.04	5-6 cm	85/90 cm

Number of beans on the hull: 4, 5, 6, 6, 5-6.

Fig. 1. The first phenofase observations once with the administration of the fertilization dressing

Fig. 2. Variants of peas fertilized with Azomures and Amofos

Under the aspect of dynamics of increasing in height, we can observe that this assessed slowly at the beginning of the vegetation, especially at the foliar fertilised variants (15-30 April), and at 7th May, date that corresponds to a number of 38 days from planting, the plants reached a height of 40 cm.

During the second intense growth that is developed during a period of 32 days, it was necessary the administration of a herbicide Pivot 0.7 l/ha, being prevent the Môn dicotyledonous and dicotyledonous.

The stems from variants 4 and 5 reached the height of 90 cm, and variant 2-3 at 80 cm. The leaves are green and of ovoid form, the flower is white, their opening starting at the basis of the plant, the pollen was released from the opening of the flowers.

Fig. 3. Variants of peas fertilized with Bionat and Kelpak

At this type, the flowers opened between hours 9 and 18, remaining open for a period of 3 days. The blooming period is of 10 - 22 days, and the hull are a little curved, with lumpish edge of 6 and respective 5 cm, that contain 4-5 beans, that are small, round, even and of green colour.

A special particularity is that of the roots, for all variants, that developed up to a depth of 45 cm and the lateral roots exceeded 50-60 cm, being covered with nodosities. These nodosities have been spread more on the lateral roots of first order and towards the basis of the root.

Fig. 4. Pea plants reached in the period of inflorescence at all variants

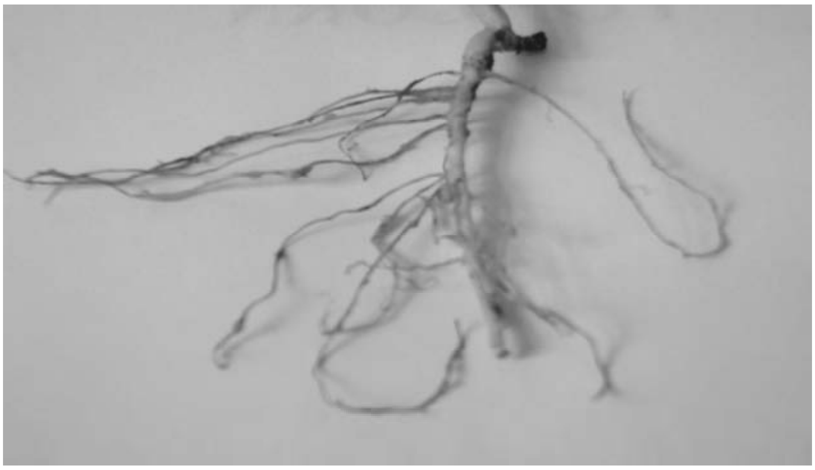

Fig. 5. Root when the plant was in the period of formation of blossom

When 75% of the hulls reached full maturity (10th June), pea plants have been harvested.

CONCLUSIONS

1. In the study zone it is recommended early pease culture, because it gives good results before the arrival of high temperatures.
2. The Kelvedon Wonder (Italy) soil, untimely soil has adapted to the existing
3. climatic and soil conditions, being indicated for cultivation extension in this area.
4. The application of foliar fertilizers Bionat and Kelpak, has lead to a growth
5. of the average length of hulls, of the number of grains in the hull, and of the height of plants.
6. The replacement of chemical fertilizers with foliar ones, represents one of the concerns of lasting agriculture, towards achieving ecological products. In case of pease this thing is possible.

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PEDOLOGICAL AND AGROCHEMICAL ASPECTS REGARDING AGRICULTURAL FIELDS OF S.C. CELCO S.A. GREENHOUSES, CONSTANTA COUNTY

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Keywords: *greenhouse, soil, pedological and agrochemical aspects*

Abstract

The present scientific paper has as objective the characterization of the agrarian land from S.C. Celco S.A. greenhouses, Constanta county, in terms of its principal nutrients supply, soil reaction and soluble salts total content, in order to apply a rational and distinctive fertilization for each greenhouse crop. As the purpose was achieved, it required a few itineracies to the greenhouses location, necessary for collecting environmental data and for establishing the position of the settlement in according with all influence factors; also, protected crop areas have been identified, soils have been morphologically described through open soil profiles, agrochemical and pedological samples have been prevailed and laboratory analysis were made; then, results have been estimated and appreciated in accordance with the specific methodology.

INTRODUCTION

The fields as part of S.C. Celco S.A greenhouses are located in Constanta city limitrophe area, at West - North West part, covering a surface which once belong to Constanta county and later on has been bought by S.C. Celco S.A agrary unit. The new arranged surface has 3600 square meters and is represented by greenhouse I and greenhouse II (G I and G II). Entire pedological and agrochemical analysis was based on a study contract between Agrary Science Department from Ovidius University of Constanta and S.C. Celco S.A. unit.

MATERIAL AND METHODS

The study consisted of two stages: preliminary stage and field stage. During preliminary stage, information provided by previous studies regarding the researched area has been consulted and also, topographic materials and pedologic maps have been used, in order to characterize relief, ground water, parental material and climate. During field stage greenhouses landing position was identified and, in the same time, plots for prevailing samples were set up, everything with the acceptance of the contract beneficiary. For each of the two greenhouses, a pedologic profile has been opened, respectively profile 1 (P 1) at greenhouse I and profile 2 (P 2) at greenhouse II, which have been described until

125-130 cm depth. Also, a number of 9 samples at G II and 6 samples at G I have been prevailed (prevailing was made at arable layer level). Some of soil samples analysis were made at Pedology and Agrochemistry Laboratory from Ovidius University of Constanta and the rest at Agrochemistry and Plant Nutrition Laboratory from ICPA Bucharest. Soils samples analysis first consisted of drying, crumbling and sifting processes, necessary before any other determination. Determinations consisted of:

a. soil reaction (pH) - potentiometric determination in water suspension;
b. determination of humus content (H%) using Wakley Black method (with modified elements by Gogoasa);
c. total nitrogen content (N tot);
d. determination of phosphorus and potassium soil content – in ammonium acetate extract using Egner-Riehm-Domingo method;
e. determination of soluble salts total content (electric conductivity);
f. determination of soluble salts structure (HCO^{3-}, SO^{4-}, Cl^{-}, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}).

RESULTS AND DISCUSSION

The field stage has reliefied that agrary fields from S. C. Celco S. A. are characterized by an accentuated human modification, due to some constructive assembles destinated for storage and agrary using, a fact which required the necessity of human intervention through alingments and access road arrangements. Soils parental material is represented by loess deposits until 10 meters depth, followed by a clay-loamy-clay complex, with reddish clay insertions. As for mineral composition, the researched layer is loamy, loamy-clay until the parental material. Ground water is located at 4.3-5.1 m depth, influencing pedogenetic processes. As for climate, the collected data indicate 11,3ºC annual medium temperatures and 400 mm medium rainfalls/year. As climate special phenomenon the dew effect can be mentioned, manifested during warm season through a pluvial supply of 50 mm per year. Secondary, meteorological risk phenomenon may appear (like hail, storms, aridity-last of them shall lead to increased demineralization of soils).

Soils of the two protected spaces (G I and G II) belong to Cernisols Class, coresponding to fertile and very fertile soils domain. At first greenhouse G I, a soil profile was opened until 130 cm depth and its morpfologic features have been described (table 1). The soil is chernozem type, with soil formula **CZ K3 S2 l/l**. At G II greenhouse, the soil profile has been studied until 125 cm depth. Its morphologic features indicated that soil type is chernozem, cambic subtype, with soil formula **CZ cb K4 S2 la/l** (table 2).

Table 1

Morphologic description of CZ K3 S2 l/l soil profile

Horizon	Depth (cm)	Morphologic characteristics
Ap	0-20	soil material with plants input brought up after the land alignment (the alignment was husing 40 soil cm and land was completed with other 20 cm input), loamy-loamy dust texture (LL-LP), dark colour
Am	20-39	loamy texture (LL), 10YR 3/3 colour, molic nuance, soil material is less compact, gradual passing to the next soil horizon
Amca	39-54	loamy texture (LL), 10YR 3/3 colour, calcium carbonate spots can be observed under first 50 cm of soil, spongy material, moderate humidity, gradual passing
A/Cca	54-70	loamy texture (LL), 10YR 3,5/3,5 colour, partly crumbly, spongy and wet material, increased efervescence at soil horizon base, less compact soil layer, gradual passing
C_1ca	70-90	loamy texture (LL), 10YR 4,5/4 colour, numerous whitish spots have been identified covering soil structural elements, sulfury traces, wet, crumbly material, gradual passing
C_2ca sc	90-110	loamy texture (LL), 10YR 4/3,5 colour, wet, crumbly, whitish material, with sulfury traces, small and moderate $CaCO_3$ accumulations, gradual passing to parental material
C	110-130	loamy texture, loessic material

Table 2

Morphologic description of CZ cb K4 S2 la/l soil profile

Horizon	Depth (cm)	Morphologic characteristics
Ap	0-21	material with vegetable soil input brought after land alignment, loamy-dusty-loamy-clayey texture (LP-LA), dark colour, 10 YR 3/2, wet, plastic and adherent, with humidity due to dropping irrigation, gradual passsing
Am	21-39	loamy-dusty-loamy-clayey texture (LP-LA), 10YR 3,5/3 colour, compact, without any structure soil material, gradual passing to the next soil horizon
A/Bv	39-61	loamy texture (LL), 10YR 3/3 colour, small angular blocky structure, wet soil material, gradual passing
Bv (sc)	61-85	loamy-dusty-loamy-clayey texture (LP-LA), 10YR 3,5/3,5 colour, wet material, on soil agregates isolated whitish sulphury accumulations can be observed, gradual passing
Bv/Cca sc	85-105	loamy texture (LL), 10YR 4/4 colour, carbonates accumulation in horizon superior part, low traces of sulphatic salts to horizon base, increased efervescence
Cca sc	105-125	loamy texture (LL), 10YR 5/4 colour, dry, $CaCO_3$ accumulation
C	peste 125	loamy texture, loessic parental material

In the laboratory stage a few of the agrochemical indicators have been determined, all in accordance with analysis methodology provided by ICPA Bucharest. Thus, in order to estimate the type of soil salinization, the ratio between Cl^- and SO_4^{2-} ions was calculated (m.e./100 soil g). At the first greenhouse G I the ratio is 3.75 m.e./100 soil g (Cl^-/SO_4^{2-} = 2.33/0.49 = 3.75). At second greenhouse G II the ratio Cl^-/SO_4^{2-} = 2.61 m.e./100 soil g. The calculations reliefy that soil salinization type is gypsium chloride at both greenhouses.

Exchangeable Na content at sample susceptible to salinization collected from greenhouse I (0-20 cm depth) is 15.2 mg/100 soil g (appreciated as very high). At G II, profile 2, at 0-20 cm depth, exchangeable Na content is 70.2 mg/100 soil g (extremely high). Alkalinity content estimated based on HCO_3 value, at sample susceptible to salinization collected from greenhouse I is 0.65 m. e./100 soil g. At sample collected from G II, P 2, alkalic content estimated based on HCO_3 value is medium, respectively 2.62 m.e./100 soil g, on 0-20 cm depth.

At G I and G II, soil pH has values between 8.33 – 8.86, reflecting this way the soil alkalinity (table 3 and figure 3). Humus content at G I, P1 (on 0-20 cm depth) is between 3.1-3.3% (appreciated as medium) and 17.2% (appreciated as very high) at mineral-organic material from G II, P2.

Table 3

Analytical data corresponding to S.C. CELCO S.A.

Pedologic profile Greenhouse G I			Pedologic profile Greenhouse G II		
Depth (cm)	**pH**	**Soluble salts [S/cm**	**Depth (cm)**	**pH**	**Soluble salts [S/cm**
0-20	8.86	313 (low salinizated)	0-20	8.46	2260 (accentuated salinization)
25-35	8.33	263 (low salinizated)	20-35	8.36	301 (low salinizated)
40-60	8.64	205 (low salinizated)	40-50	8.63	319 (low salinizated)
75-85	8.26	240 (low salinizated)	60-70	8.65	399 (low salinizated)
90-105	8.64	198 (low salinizated)	70-90	8.60	419 (low salinizated)
110-125	8.68	266 (low salinizated)	90-110	8.73	356 (low salinizated)
-	-	-	110-130	8.75	339 (low salinizated)

Macronutrients supply can be presented as follows:

- total nitrogen (N_{tot}) has medium values at G I, P 1 (0.156-0.166%) and very high values at mineral-organic soil material from G II, P2, on 0-20 cm depth (figure 1);
- P_2O_5 varies from 17 ppm (low) to 48-38 ppm (high) on the two soil horizons (0-20 and 25-35 cm) from G I, profile 1; at mineral-organic soil material from G II, P 2 it is 284 ppm (appreciated as very high) and 6 ppm (appreciated as very low) at 25-35 depth of the same soil profile (figure 2);

- K_2O values are high and very high at each analysed sample (values from 280 to 442 ppm); also, we have determined here an extremely high value of K_2O content (5285 ppm) at P 2 sample, greenhouse II, collected from 0-20 cm depth (where mineral-organic material lies) (figure 2).

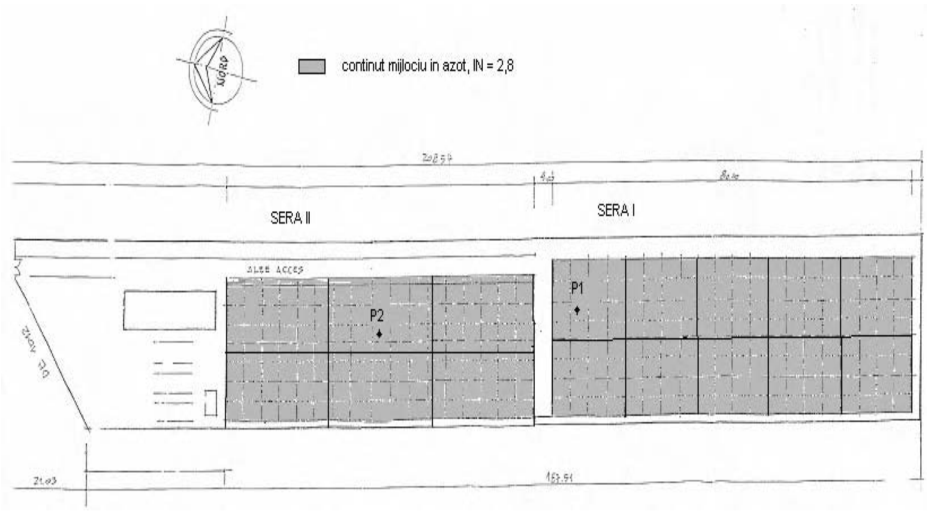

Fig. 1. Soil nitrogen supply (G I and G II)

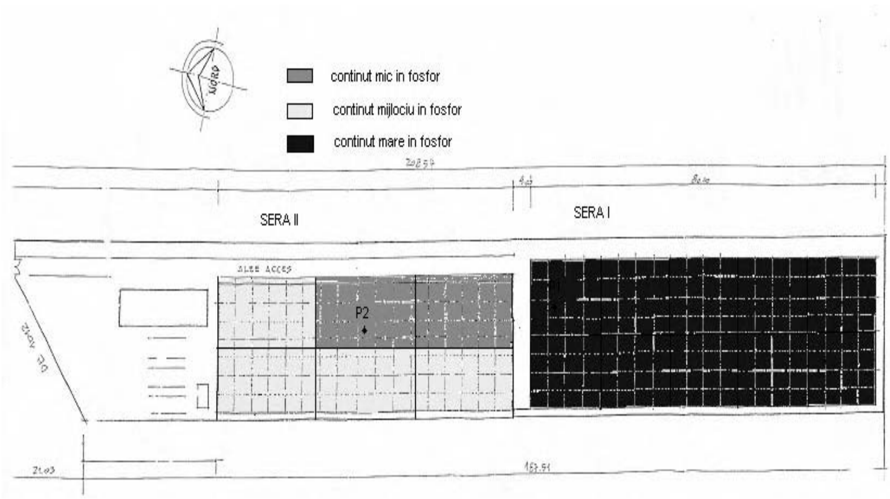

Fig. 2. Soil mobile phosphorus supply (G I and G II)

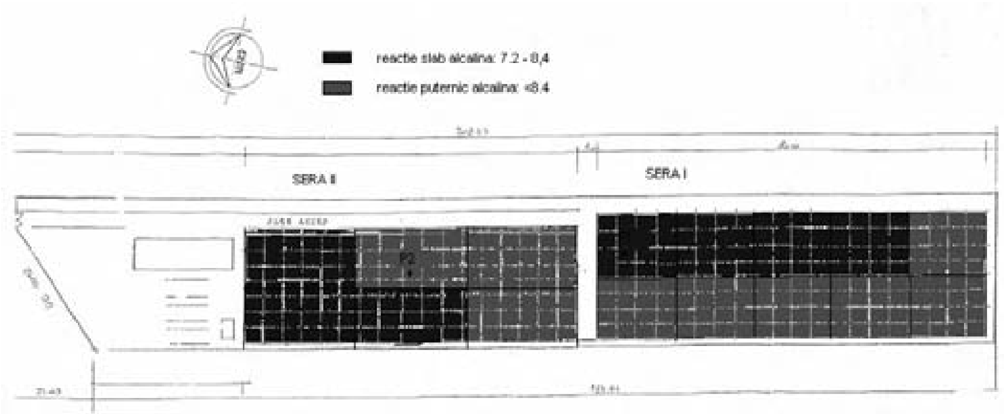

Fig. 3. Soil reaction at the two greenhouses

In order to emphasize the analysis results, the surface on which soil samples were prevailed has been divided in uniform agrochemical plots, according to figures 1-3; for each uniform plot, agrochemic synthetic situation have been elaborated and results were framed in classes of agrochemic indicators estimation.

CONCLUSIONS

1. The results reliefy that both greenhouses fields are affected by salinization; the salinization is chloride type, with low intensity syptoms at soil level.
2. Exchangeable Na has high and extremely high values on 0-20 cm depth for both greenhouses.
3. Soil pH according to profiles 1 and 2 varies from low to medium alkaline.
4. Soil nitrogen supply, characterized by NI (nitrogen indicator) is medium on 100% surface.
5. Soil mobile phosphorus supply is low on 10%, medium on 30% and high on 60% of surface.
6. Soil mobile potassium supply is very good on 100% of the whole surface.

ACKNOWLEDGEMENTS

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INFLUENCE OF FERTILIZATION ON MAIZE YIELD AND QUALITY UNDER CONDITIONS OF SUSTAINABLE AGRICULTURE ON ARGIC CHERNOZEM FROM SCDA CARACAL

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Keywords: *maize yields, nitrogen, phosphorus, yield's quality*

Abstract

Modernization of agricultural structures is an essential factor to ensure food security worldwide, with differentiation from area to area, depending on the level achieved economic progress and the general concept of sustainable development and implementation of systems of production.

Romania has special problems in the materialization of a sustainable agriculture, whereas large areas of agricultural technology are extensive, with limited resources, relying on a low degree of mechanization on human labor, and sometimes even animal traction. In most cases, the technologies are applied on small agricultural land of 1-2 ha, and where they are used as intensively in farms with large areas, are not always harmonize with local particularities and requirements of plants grown.

INTRODUCTION

The objectives of sustainable development must be harmonized with the intensive development, but to protect the environment and achieve high quality products.

The modern concept of sustainable management of soil resources should be based on the old urge to say, it must leave to future generations of agricultural land in a better shape based on the concept "*uses, improves, restores*".

MATERIAL AND METHODS

The experiment was made at Agricultural Research and Development Station Caracal during the 2006 – 2008 years on argic chernozem soil with good natural fertility. The experience has two factors:

- different phosphorus levels of P_0, P_{40}, P_{80}, P_{120};
- different nitrogen levels of N_0, N_{60}, N_{120}, N_{180}, N_{240}.

The experimented maize hybrid was OLT, sown at a density of 50000 plants/hectare. As control we use the average/agro found variant.

RESULTS AND DISCUSSION

During the experimental period of 2006 – 2008 years the climate conditions were different as favorability for corn culture as follow: the 2006 year was very favorable, the 2007 was unfavorable year due the high temperature from the period of maize vegetation (figure 1) and the 2008 was considered as medium favorable for corn crop in the Caracal Plain.

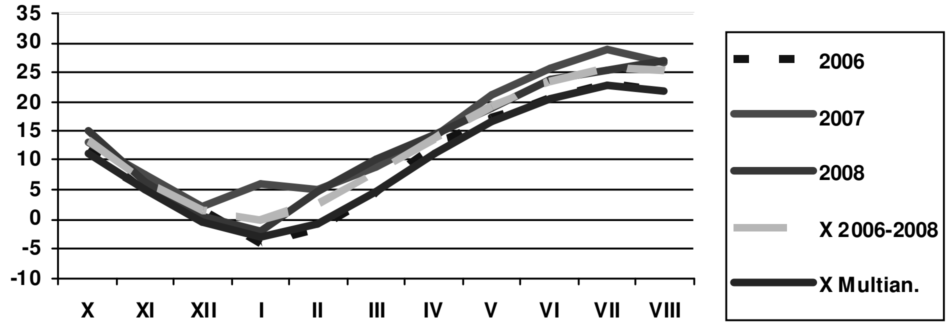

Fig. 1. Temperature during the 2006 – 2008 years

Improving the technology of maize cultivation has contributed to the optimization of growth factors, are achieving new levels of production. With this increased amount of nitrogen and exported with the harvest, this is causing the use of higher doses of nitrogen.

Related to this aspect the standard seed yields obtained at maize crop has registered great amplitude between the years with different plus productions in comparison with the witness (table 1).

In 2006 the recorded average yields varied between 82.7 q/ha on the agro found of P_0 and 91.8 q/ha on the agro found of P_{120}. The influence of the applied phosphorus is clear in the levels of yields, those increasing for every level of fertilization. The nitrogen applied conduct to very significant increases in production on every agro found with phosphorus, but the most valuable variants proved to those with high doses of N_{180} and N_{240} which realized yields over 98 q/ha and respectively 102 q/ha.

In 2007 the level of productions was smaller than the previous year and varied between 21.3 q/ha at the unfertilized variant from the level of P_0 and 30.7 q/ha at the variant with N_{240} on the last agro found of P_{120}. The yields average of every tested agro found was between 25.8 q/ha and 30.4 q/ha, well below the potential production for maize in this area.

Table 1

The influence of the interaction of nitrogen and phosphorus to the maize yield

Factors		Yield (q/ha)			Yield 2006-2008 (q/ha)	Differences		Signif.
		2006	**2007**	**2008**		**q/ha**	**%**	
P 0	N 0	68.3	21.3	34.8	41.4	-12.7	76.5	ooo
	N 60	75.7	26.3	49.3	50.4	-3.7	93.1	-
	N 120	84.2	29.2	53.4	55.6	+1.5	102.7	-
	N 180	90.0	26.4	62.9	59.8	+5.7	110.5	**
	N 240	95.3	26.0	68.8	63.3	+9.2	117.0	***
Average/agro found		**82.7**	**25.8**	**53.8**	**54.1**	**St**	**100**	**St**
P 40	N 0	72.7	24.3	40.2	45.7	-12.7	72.2	ooo
	N 60	81.7	29.0	52.1	54.2	-4.2	92.8	o
	N 120	91.7	31.2	60.9	61.2	+2.8	104.7	-
	N 180	96.4	29.7	64.8	63.6	+5.2	108.9	**
	N 240	102.5	29.2	71.2	67.6	+9.2	115.7	***
Average/agro found		**89.0**	**28.6**	**57.8**	**58.4**	**St**	**100**	**St**
P 80	N 0	75.0	26.1	41.4	47.5	-12.1	79.6	ooo
	N 60	83.5	30.3	53.3	55.7	-3.9	93.4	-
	N 120	93.0	32.2	61.9	62.3	-2.7	104.5	-
	N 180	98.1	30.4	65.7	64.7	+5.1	108.5	*
	N 240	102.6	30.2	71.5	68.1	+8.5	114,2	***
Average/agro found		**90.4**	**29.8**	**58.7**	**59.6**	**St**	**100**	**St**
P 120	N 0	77.1	26.5	42.0	48.5	-11.9	80.2	ooo
	N 60	84.9	31.0	53.6	56.5	-3.9	93.5	-
	N 120	94.3	32.8	62.0	63.0	+2.6	104.3	-
	N 180	98.7	31.3	65.9	65.3	+4.9	108.1	*
	N 240	104.4	30.7	72.0	69.0	+8.6	114.2	***
Average/agro found		**91.8**	**30.4**	**59.1**	**60.4**	**St**	**100**	**St**
DL 5%		4.3	2.9	4.7	4.0			
DL 1%		5.8	3.8	6.1	5.2			
DL 0.1%		7.5	5.1	8.6	7.1			

In 2008 the contribution of phosphorus fertilization is highlighted by increases in production to yields obtained. As in previous years are recorded significant production increases at all variants which was given to nitrogen, differences are very significant in the face of the unfertilized variants per each agro found. The values of the recorded yields varied between 53.8 q/ha on P_0 agro found and 59.1 q/ha on high level of phosphorus of P_{120}.

In average 2006 – 2008 the production of grain maize grown in the conditions of SCDA Caracal varied as follows:

- *On the P_0 agro found* – we recorded values of 41.4 q/ha at unfertilized variant to 63.3 q/ha at the N_{240} variant. Unilateral application of nitrogen increases the production to ensure only the N_{180} and N_{240} variants in comparison with the average/agro found of 54.1 q/ha;
- *On the P_{40} agro found* – application of a moderate dose of phosphorus increased yields which were between 45.7 q/ha in N_0 variant and 67.6 q/ha in variant N_{240}. Related to the witness – the average/agro found – with distinct significant increase in production at the N_{180} variant which registered a plus production of 8.9%.
- *On the P_{80} agro found* – increasing the dose of phosphorus at 80 kg/ha active substances does not conduct to considerable increases, the difference compared to previously level being only 1.2 q/ha. It can be observed nearly identical increases in doses of nitrogen applied to the N_0 variant.
- *On the P_{120} agro found* – we observe almost the same situation than the previous one, with small increase of 2.6 q/ha at the N_{120} variant and 8.6 q/ha at the N_{240} variant.

The agro found with high level of phosphorus of P_{120} ensure increases that are not economic for those applied doses.

From the quality point of view we made analysis to maize seed to determinate the content of nitrogen, phosphorus and potassium.

On a constant phosphorus level (figure 2), applying a dose of nitrogen increased the nitrogen content in maize seed. The higher nitrogen content (1.87%) is found in variant $P_{40}N_{240}$.

On a constant nitrogen agro found the content of phosphorus in maize seed increase on unfertilized variant as increasing quantities of phosphorus administration, reaching maximum level at N_0P_{120} (0.285%). In variants fertilized with N_{120} and N_{240} is increased up to P_{80}, after which it is observed a decrease in content of phosphorus application dose P_{120} (figure 3).

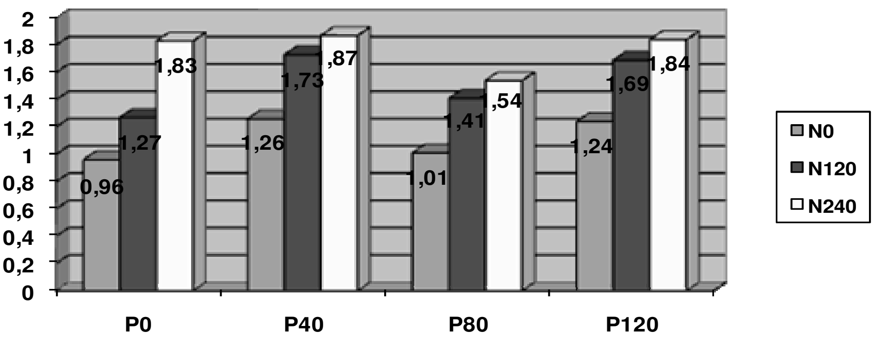

Fig. 2. Nitrogen content (%) of maize seed depending of fertilization with phosphorus and nitrogen

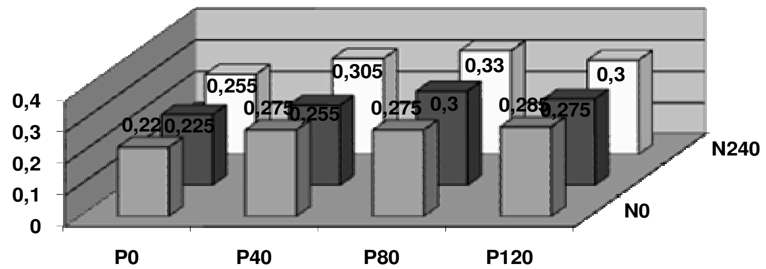

Fig. 3. Phosphorus content (%) of maize seed depending of fertilization with phosphorus and nitrogen

On a constant nitrogen agro found (figure 4), the highest potassium content was observed in a $N_{240}P_{120}$ variant of 0.410%.

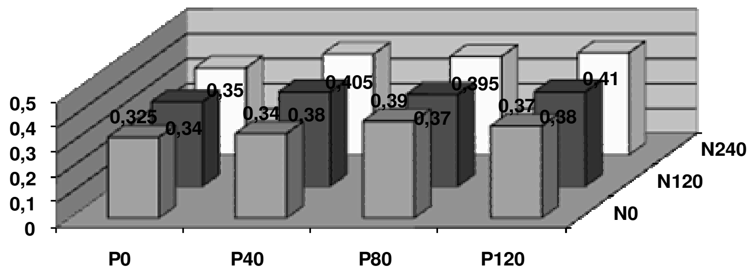

Fig. 4. Potassium content (%) of maize seed depending of fertilization with phosphorus and nitrogen

CONCLUSIONS

Regarding the influence of fertilization on the quantity and quality of the maize yield may hold some important issues, as follows:

1. The maize cropped in the climatic conditions of Agricultural Research and Development Station Caracal has proven to be a culture able to capitalize on good conditions of climate and soil of this area and to generate large grain yield which varied between 41.4 q/ha at P_0N_0 variant to over 69 q/ha at $P_{120}N_{240}$ in average on the three experimented years.
2. The most valuable yields, economical point of view, were obtained on the variants with nitrogen of N_{120}, N_{180} and N_{240} on the P_{40} level of phosphorus.
3. The combination of nitrogen fertilization with phosphorus has allowed more efficient recovery of nitrogen from the soil by increasing the nitrogen content of corn beans. The highest levels were determined in samples from plants fertilized with $N_{120}P_{40}$ and $N_{240}P_{40}$.
4. Doses supplementation of phosphorus leads to an increased content of phosphorus in maize grains. From this standpoint, maize has proved to be able to respond to the intake of phosphorus in the growing medium.

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RESEARCH REGARDING THE EFFECT OF NITROGEN FERTILIZERS ON CONSTANT BACKGROUND OF PHOSPHORUS ON SUNFLOWER PRODUCTION IN THE CONDITION OF SOIL DIFFERENT TILLAGE

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Keywords: *nitrogen doses, tillage, sunflower yield*

Abstract

This paper presents the experimental results obtained from the sunflower crops, cultivated on the chernozem from ARDS Caracal in conditions of nonirrigated regime and different soil tillage. The fertilization with different doses of nitrogen on constant background of phosphorus lead to smaller productions for the three methods of soil tillage: working with chisel at normal depth had as result productions between 793 – 3691 kg/ha, working with normal plow produced between 673 – 4091 kg/ha and the use of chisel at 8 – 10 cm depth produced 713 – 3488 kg/ha.

INTRODUCTION

Cultivated as oily plant, sunflower was introduced in Romania towards the end of XIXth century, becoming the most important plant for extracting oil. In order to obtain higher and constant productions it is necessary to organize a crop rotation in which the percent of sunflower cannot pass beyond 17% (Vranceanu A.V., 1974).

Although sunflower is considered a plant relatively resistant to drought, in droughty years sunflower production is much diminished, and even partially or totally compromised (Vannozi G. P. et al., 1988).

The research, made in Romania on sunflower cultivated on chernozem, have shown that fertilizers determined small increases of production (Hera C., 1968).

MATERIAL AND METHODS

Sunflower crop that was analyzed took part of a wheat – corn – sunflower rotation of a polifactorial experiment located on the chernozem from SCDA Caracal after the subdivided plots method.

The experimental field has comprised the following factors:

The A factor – tillage with three graduations:

- a_1 – plowing at 22-25 cm + harrowing and two disking for the seedbed preparation;

- a_2 – chisel at 22-25 cm + harrowing and two disking for the seedbed preparation;
- a_3 – chisel at 8-10 cm + harrowing as a basis tillage and chisel at 8-10 cm for the seedbed preparation.

The factor B – nitrogen fertilization on a constant background of phosphorus P_{80} with 4 graduations:

- b_1 – N_0
- b_2 – N_{40}
- b_3 – N_{80}
- b_4 – N_{120}.

The phosphorus fertilizers have been applied in autumn (as simple superphosphate with 20% P_2O_5) before plowing and the nitrogen as ammonium nitrate (33.5% N) in the established quantities, after drilling.

The soil where the experiment was located is a chernozem that has in the arable layer a moderate acid reaction. This soil can be considered as average supplied with nitrogen and the available phosphorus content is higher that the total nitrogen and is reduced on the soil profile from 44.9 to 20.9 ppm.

As regards the available potassium, the SCDA Caracal chernozem is good supplied with this element, the first two horizons recording a variations between 224.5 and 252.8 ppm.

The climatically conditions differed as thermal regime and rainfall, less favorable being the first two experimental year, the following year, approximate normal and the last experimental year has recorded an usual thermal regime and higher rainfall.

The yield was calculated at the moisture of 11% on each variant with the three replication and then was made an arithmetical average on each treatment.

RESULTS AND DISCUSSION

Analyzing the effect of basic tillage in comparison with a mineral fertilizers that were applied, the differences of production obtained on sunflower crops were obvious.

The determination of average sunflower yields in the last 3 years of experimentation, function of the studied factors, indicates a different reaction of the plants and different values of the yields.

Sunflower is genetically resistant to drought.

Cultivating sunflower in the established rotation in nonirrigated regime, as it was expected, lead to obtaining the smallest production, the 3 tools used in different quantities had the same effect for every system of soil tillage.

In the case where we used plow at 22-25 cm + harrow for the seedbed preparation in the 3 years of experiments and function of the nitrogen doses, the production of seeds increased from 673 to 1087 kg/ha in the first year, from 974 to 2447 kg/ha in the second year and from 2268 to 4031 kg/ha in the last year of experiment (table 1). The growth of sunflower production obtained through mineral fertilization has pointed out that this plant uses less fertilizers than other plants, especially in conditions of drought; in this case we recommend moderate doses of nitrogen.

The replacement of usual plow with the chisel and keeping the depth has determined higher productions in 2003 corresponding to the applied nitrogen doses; in 2004 the production was even higher for N_0 and N_{40} but in the last year of experiments the productions were smaller for all the fertilizing variants (table 1).

The execution of the seedbed preparation with chisel, but at a smaller depth (8-10 cm) lead to obtaining smaller productions, intermediate ones as level between those realized in the case of using the plow and the chisel at the same depth, from 713 kg/ha in nonfertilized variant in the first year to 3488 kg/ha in 2005 when there were applied 120 kg/ha nitrogen (table 1).

The insufficient water in the 3 years of experiments, different in what concerns the rainfalls, had manifested differently on the sunflower productions for all the nitrogen doses (N_{80} and N_{120} doses had a small effect because they were not properly used by the plants).

CONCLUSIONS

The research carried out during three years at ARDS Caracal, regarding the importance of tillage systems in different conditions of fertilization, in nonirrigating regime, on the results of sunflower production lead to the following conclusions:

1. The cultivation in nonirrigate regime of sunflower has determined small productions for the three methods of soil tillage: the chisel at normal depth has produced 793 - 3691 kg/ha, the usual plough, 673 - 4091 kg/ha and the chisel at 8 - 10 cm between 713 - 3488 kg/ha.
2. The effect of mineral fertilization was more reduced in sunflower crops that in other crops for the doses of 80 and 120 kg N/ha, especially in conditions of low water supply. In this situation we recommend moderate quantities which plants use properly.
3. The results obtained, present sunflower as a culture with high capacity of using properly the depth of tillage of the seedbed preparation without turning up the furrow, of the bigger possibilities to retain water and to maintain it in the soil for a longer period of time and also to increase the effect of the fertilization with progressive doses of nitrogen.

4. We have to notice the efficiency of moderate doses of fertilizers (the roots of the plant has the capacity to extract the nourishing elements), in this way we reduce the costs and also other possibilities of pollution with nitrates by leaching them on the soil profile.

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Table 1

Influence of soil tillages and nitrogen fertilization on constant background of P_{80} in conditions on the sunflower yield (2003-2005)

Tillage system	N fertilization	2003				2004				2005			
		(kg/ha)	Rel. val. (%)	Abs. dif. (kg/ha)	Sem.	(kg/ha)	Rel. val. (%)	Abs.dif. (kg/ha)	Sem.	(kg/ha)	Rel.val. (%)	Abs. dif. (kg/ha)	Sem.
Plow at 22-25 cm + harrowing	N_0	673	100	0 (mt)		974	100	0 (mt)		2268	100	0 (mt)	
	N_{40}	853	127	+ 180	xxx	1756	180	+ 782	xxx	3174	140	+ 906	xxx
	N_{80}	983	146	+ 310	xxx	2234	229	+1260	xxx	3258	144	+ 990	xxx
	N_{120}	1087	161	+ 414	xxx	2447	251	+1473	xxx	4031	178	+1763	xxx
Chisel at 22-25 cm + harrowing	N_0	793	100	0 (mt)		1315	100	0 (mt)		2195	100	0 (mt)	
	N_{40}	883	111	+ 90	xxx	1859	141	+ 544	xxx	3002	137	+ 807	xxx
	N_{80}	1080	136	+ 287	xxx	1996	152	+ 681	xxx	3374	154	+1179	xxx
	N_{120}	1150	145	+ 357	xxx	2224	169	+ 909	xxx	3691	168	+1496	Xxx
Chisel at 8 -10 cm + harrowing	N_0	713	100	0 (mt)		810	100	0 (mt)		2707	100	0 (mt)	
	N_{40}	800	112	+ 87	xxx	1572	194	+762	xxx	3020	112	+ 313	xxx
	N_{80}	973	136	+ 260	xxx	2124	262	+1314	xxx	3402	126	+ 695	xxx
	N_{120}	1080	151	+ 367	xxx	2324	287	+1514	xxx	3488	129	+ 781	xxx

DL 5% = 35 Kg/ha DL 5% = 61 Kg/ha DL 5% = 58 Kg/ha
DL 1% = 48 Kg/ha DL 1% = 84 Kg/ha DL 1% = 80 Kg/ha
DL 0.1% = 65 Kg/ha DL 0.1% = 114 Kg/ha DL 0.1% = 113 Kg/ha

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MOISTURE DYNAMICS FOR A SLOPY SOIL UNDER MAIZE, BETWEEN 2006 AND 2008 AND ITS INFLUENCE ON SOIL EROSION

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Key words: *biometric measurements, soil loss, cover degree*

ABSTRACT

The research was carried out in Slanic catchment, Buzau county on agricultural lands used in two systems of use: fruit tree plantation in pasture system and arable land with different crops and slope categories (15%-20%). Soil moisture dynamics was monitored by taking soil samples in the growing season every fifteen days. The data from the measurements were corroborated with the values of the main soil hydro-physical indices which helped to determine soil water supply.

INTRODUCTION

This paper presents both biometric data and the antierosional protection degree given to soil under maize.

During the study period the following were monitored: dynamics of annual precipitations, the amount of surface flow (mm), soil loss (t/ha), cover degree and plant growth.

MATERIAL AND METHODS

There are 12 control parcels in the station (figure 1) sited in 2 arrays: the first comprises 6 parcels, each with a surface of 100 square metres (25 m x 4 m) and a slope of 20%; the second comprises 6 parcels, each with a surface of 40 square metres (10 m x 4 m) and a slope of 15%.

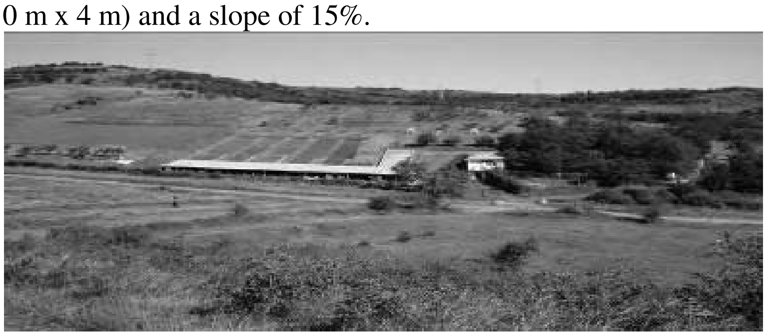

Fig. 1. Soil Erosion Control Station, Valea cu Drum catchment, Aldeni-Buzau

The data regarding maize plant growth (figure 2, 3) were given by randomly measuring plants in the control parcels, in growing stages, in two repetitions (upper and lower third of each parcel).

The influence of crop on soil erosion is highlighted by the amount of surface flow and the amount of soil washed off by torrential rains on control parcels, fitted with intake devices downstream.

Fig. 2. Parcel cultivated with maize at first growing stages, 2007

Fig. 3. Maize crop parcel V6, 2008

RESULTS AND DISCUSSIONS

The analysis of total average precipitation values in the study period highlight a decrease in 2007 by 40.5% compared to 2006 and by 68.6% in 2008 compared to 2006. The influence of soil moisture, given as water storage (mm), on plant growth for maize cultivated on parcels with different slopes (15% and 20%), was monitored each year during the study period.

In the 15% slope parcel (figure 4), the highest precipitation and water storage values were recorded in July on the 0-40 cm depth. In comparison to July, soil water storage decreased by 70.2%, but precipitations increased by 90.1 mm

In the 20% slope parcel (figure 5) the highest amount of soil water was recorded in August, 7.9 mm higher that the value recorded on the 15% slope parcel, but plant height was 21 cm smaller.

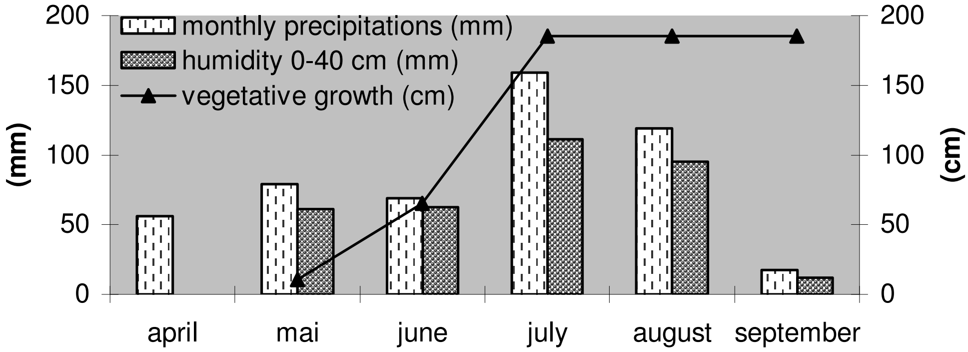

Fig. 4. Dynamics of monthly precipitations, soil moisture and plant growth on 15% slope parcels in 2006

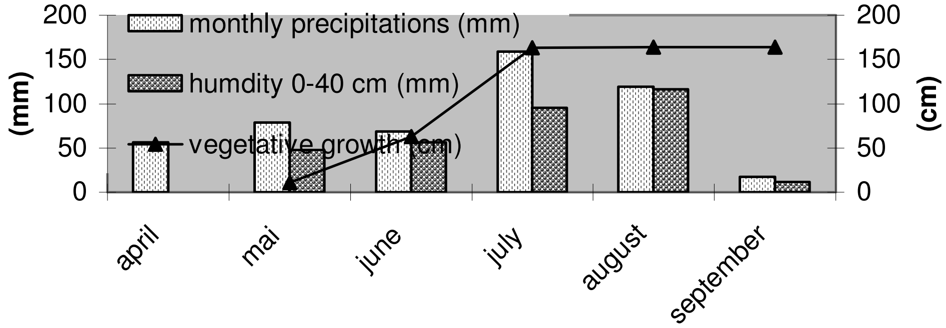

Fig. 5. Dynamics of monthly precipitations, soil moisture and plant growth on 20% slope parcels in 2006

In the 15% slope parcel (figure 6) the highest soil moisture was recorded in August when there was the largest rainfall. In comparison with the previous year, soil moisture is 19.7 mm lower in August and 75.4 lower in July. The recorded decrease influenced plant growth in such a way that plant height was of 125.1 cm in August.

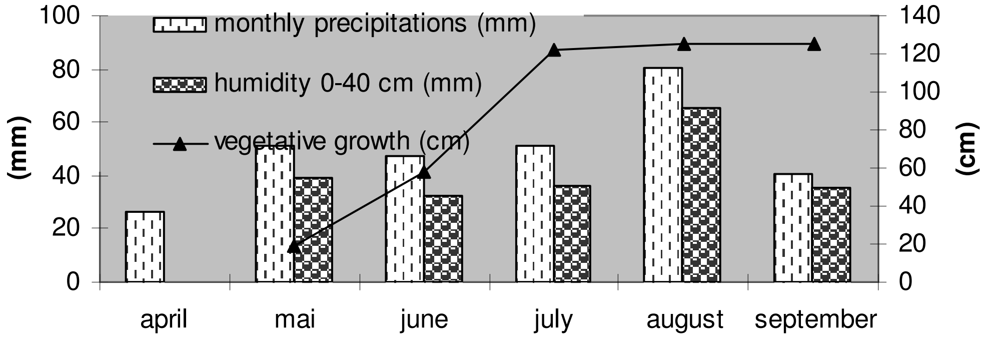

Fig. 6. Dynamics of mean monthly precipitations, soil moisture in the first 40 cm and maize plant growth on 15% slope parcels in 2007

In the 20% slope parcel (figure 7) plant height was approximately uniform in July, August and September and by 16.8 cm smaller than that of plants in the 15% slope parcel, even if soil moisture was almost the same.

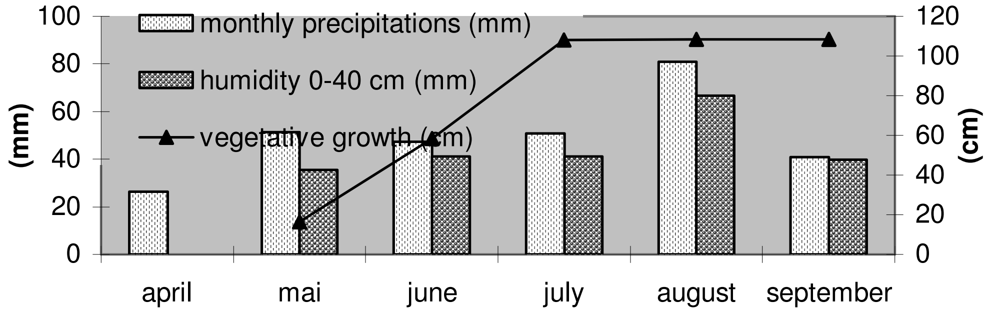

Fig. 7. Dynamics of mean monthly precipitations, soil moisture in the first 40 cm and maize plant growth on 20% slope parcels in 2007

In 2008 maize was sown in the parcel V6, following winter wheat and it began to emerge on May 14th.

In the 15% slope parcel (figure 8) the lowest soil moisture value was recorded in May, when there was the largest amount of water from precipitations. August was very scarce in moisture because there was only 1.4 mm water from precipitation. Despite that the maximum maize plant height was of 223 cm.

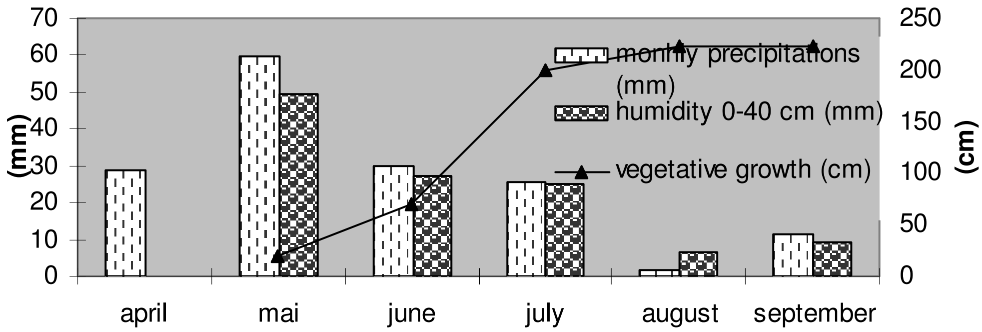

Fig. 8. Dynamics of mean monthly precipitations, soil moisture in the first 40 cm and maize plant growth on 15% slope parcels in 2008

The same goes for the 20% slope parcel (figure 9) with a 45 cm difference in plant height.

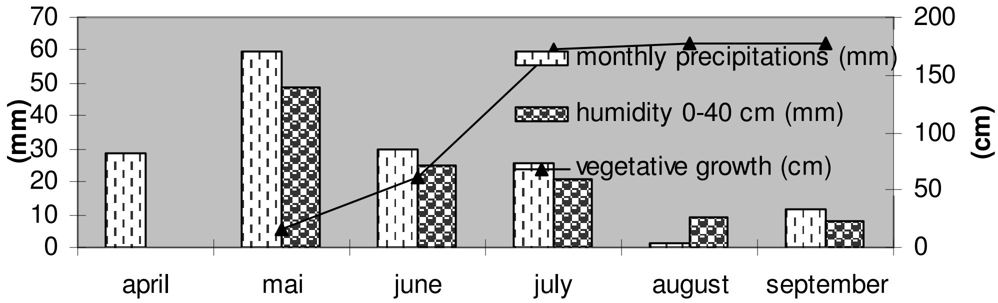

Fig. 9. Dynamics of mean monthly precipitations, soil moisture in the first 40 cm and maize plant growth on 20% slope parcels in 2008

CONCLUSIONS

1. The difference in height between the plants cultivated on 15% slope and 20% slope parcels was of 21.3 cm.
2. Under total precipitations of approximately 300 mm in the growing season, recorded in 2007, the water storage in the first 40 cm of soil wasn't over 70 mm.
3. The amount of water stored in soil in the beginning of the growing season has a decisive role on the evolution of corn plants, even if August and September are dry.

4. Between 2006 and 2008 on the parcels cultivated with corn, water loss was much lower than water amount stored in soil.

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THE EFFECTS OF AMELIORATIVE TILLAGE APPLIED IN COMPLEX ON YIELDS IN „CROVUL" LACU SARAT, BRAILA

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Keywords: *saline soils, ameliorative practices, yields increases*

Abstract

The management of saline soils requires a combination of agricultural practices depending of the atent investigations of soil characteristics, water quality and local conditions including climate, crops, economical, social, political, and cultural conditions of the environment, as well as the existent farm systems. There is not a single way to control the salinity, especially for irrigations.

The main ameliorative measures taken into account are the drainage, levelling and shaping for applying removing salts watering, the ammendation (usually, in Romania is used the phosphogypsum – a reziduual product from phosphorus nutrients plants), the levigation, the deep loosening (with or without soil material inverting), ameliorative organic or/and mineral fertilization, mulcing, the selection of crop tolerant to salinity and alcalinity, crop rotation, etc.

Yield results for the 4 studied crops in field for agricultural years: 1998 – 1999, 1999 – 2000, 2002 – 2003, 2003 – 2004 are presented as a comparison with the benckmark variant = 100, identified as the variante with the minimmum ameliorative practices (only chemical fertilization, tillage using paraplaw and amendation), due to the lack of a real benckmark variant (without ameliorative interventions).

To highlight the whole effect of ameliorative practices applied in different fields variants, the obtained yields are presented as absolut values, as well as relative values (% from the benckmark variant = V8a).

INTRODUCTION

By applying the amelioration technics for saline soils, these are diminishing continuous the soluble salts content and the percent of exchangeable natrium, therefore they evolve to unsaline soils [3]. They are still sensible to salinity process, therefore, if the amelioration or prevention technology is not followed, or if the maintenence of draining-drainage network, these soils become relatively fast saline soils again.

MATERIAL AND METHODS

The field researches have been done on saline chernozems (week to strong) from Braila Plain, in a depressionary area. The natural conditions, including the soils from the experimental field, have been presented in two precedent papers [1,2].

In this paper, the effects of ameliorative practices on yields are presented and discussed.

To highlight the effect of ameliorative practices on yields for main crops, the yields for agricultural years 1998–1999, 1999–2000, 2002–2003, 2003–2004 are presented in comparison to benckmark variant = 100, which is subject to fewer ameliorative practices (only chemical fertilization, soil tillage with paraplaw and amendment), due to the lack of a real benckmark variant (without ameliorative interventions).

The ameliorative practices on each treatment variant are the following:

V1 - Drainage with 20 m between drain lines + Deep loosening + Ameliorative irrigation + Organic fertilization + Chemical fertilization + Plough without soil material inverting + Amendment.

V2 - Drainage with 20 m between drain lines + Deep loosening + Ameliorative irrigation + Chemical fertilization + Plough without soil material inverting + Amendment.

V3 - Drainage with 20 m between drain lines + Deep loosening + Ameliorative irrigation + Chemical Fertilization + Plough with soil material inverting + Amendment.

V4 - Drainage with 20 m between drain lines + Ameliorative irrigation + Chemical fertilization + Plough without soil material inverting + Amendment.

V5 - Drainage with 20 m between drain lines + Deep loosening + Chemical fertilization + Plough without soil material inverting + Amendment.

V6 - Drainage with 20 m between drain lines + Deep loosening + Chemical fertilization + Plough without soil material inverting + Mulcire + Amendment.

V7 - Drainage with 40 m between drain lines + Deep loosening + Ameliorative irrigation + Chemical fertilization + Plough without soil material inverting + Amendment.

V8 - Without drainage + Deep loosening + Ameliorative irrigation + Chemical fertilization + Plough without soil material inverting + Amendment.

V8a - Without drainage + Chemical fertilization + Plough with soil material inverting + Amendment.

RESULTS AND DISCUSSION

To highlight the whole effect of applied ameliorative measures in the various technological variants from the experimental fields, the yields have been discussed in absolute and relative values (% from the benckmark variant = V8a).

For the first variant (V1) with most ameliorative works, the increase yields are very larger, from 115 – 208% (yields 215 – 308%), except the sorghum, the wheat and the maize green matter, where the increases are only 50 – 56%. Sunflower had a relatively constant yield in the 4 studied years between 215 – 253%.

In the second variant (V2), quite similar to the foregoing variant, but without organic fertilization, there are yields increases between 43 – 157% except the sorghum and the wheat where the increases are 19 – 54%. One has also to notice that sunflower yields are closely, being in a range of 205 – 241%, different to V1 with about 10 – 12%, the differences that could be determinated by the application of the organic fertilizers.

For the third variant (V3), where soil tillage uses paraplaw (without soil material inverting), the increase yields are between 18 – 111%, with noting that the largest increases appear to sunflower, with yields between 198 – 208%.

In the fourth variant (V4), without organic fertilizers and deep loosening, the increase yields are between 53 – 132%, excepting the sorghum, wheat and maize green matter in one year, with yields increases of only 18 – 47%.

In the fifth variant (V5), due to the lack of ameliorative irrigation, the yields increases are between 39 – 141%, except the sorghum and the wheat where the increases are only 26 – 46%. The sunflower yield are between 185 – 214%.

For the sixth variant (V6), the yields vary between 72 – 107%, except the sorghum, wheat and maize green matter in a year with increase yields of 16 – 25%. The sunflower yields are between 175 – 207%.

In the seventh variant (V7), the moderat drainage leads to yields increases of 15 – 80%, for the sunflower the yields varying between 135 – 180%, and for maize between 139 – 163%.

For the eighth variant (V8) (without drainage + deep loosening + ameliorative irrigation + chemical fertilization + soil tillage with soil material inverting + amendment), the increase yields are smaller, between 2 – 55%, but for the sunflower the yields are larger, between 105 – 155%, while for the maize the yields being between 124 – 132%.

CONCLUSIONS

After the ameliorative measures applied in complex, one can conclude that:

1. The yields increase continuously with the intensification of the drainage from weak (without drainage D = 0 m) to moderat (D = 40 m) and intensively (D = 20 m).
2. The yields are also influenced by ameliorative irrigation, with pozitiv effects especially for sunflower, sudan grass and maize green matter; but with no significant effects for sorghum and wheat.
3. On the other hand, the lack of deep loosening, the paraplaw plough and mulcing, lead to small yields increases (insignificant).
4. The variant with organic fertilization has the larger increase of yileds for all studied crops and for all studied years.

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THE INFLUENCE OF TILLAGE SYSTEMS ON HYDRIC STABILITY OF STRUCTURAL AGGREGATES, IN WINTER WHEAT CROP DURING 2006-2007

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Keywords: *soil structure, hydric stability, soil tillage*

Abstract

The experience was carried out in the Eastern part of Romania, in the Didactic Station of the USAMV Iasi, Ezareni Farm, during 2006-2007, on a cambic chernozem with a clay loamy texture, 7 pH units and 2.7% humus content, middle provided in N and P_2O_5 and agreeably in K_2O. The purpose of this review was to evaluate the influence of tillage systems on soil structure. Tillage systems modify some of the structure proprieties of soil such as aggregate stability and size distribution.

Morphologically, the structure according with the genetic of the soil, is different from a level to another, significant difference appear in arable layer as consequence of tillage applied. Structural stability indices are empirical and comparisons among treatments, soil properties, and/or processes have significance only when similar procedure are used.

INTRODUCTION

An agricultural soil with poor quality, may not possess all of the attributes required for good agricultural production, or it may be prone to environmental degradation [9]. Due to the extreme complexity of the soil environment, agricultural soil quality is often segmented into soil physical quality, soil chemical quality, soil biological quality, these components interacting. Numerous researchers [1, 2, 5, 6, 7, 8] notice the favourable function of tillage systems in increasing soil fertility (increasing the humus content). Soil physical quality is important for the entire crop rooting zone which is approximately the top 1m of the soil profile. The top 10 cm of soil is particulary important because it controls many critical agronomic and environmental processes such as seed germination, aggregation tillage impacts, surface crusting, aeration, infiltration [4].

MATERIAL AND METHODS

The experience was carried out in the East part of Romania, in the Didactic Station of the USAMV Iasi, Ezareni Farm, during 2006-2007, on a cambic chernozem with a clay loamy texture, 7 pH units and 2.7% humus content, middle provided in N and P_2O_5 and agreeably in K_2O. Experiments were set up in split plots design, AxBxC type, and plots covered surface was 18 m^2. Factor A - is indicated by the tillage system, factor B - cultivated plant and factor C - chemical fertilizer dose. Conventional tillage system was ploughed at 30 cm and unconventional tillage systems were: disk harrow, chisel and paraplow.

Tillage systems:

-Conventional: V_1-plough

-Unconventional: V_2-paraplow+vertical rotary harrow (VRH)
V_3-paraplow+horizontal rotary harrow (HRH)
V_4-chisel
V_5-disk harrow

The preparation of seedbed was effectuated with shallow tillage; ploughed at 30 cm treatment received one pass with seedbed cultivator Lemmkeen; paraplow treatment received one pass with vertical rotary harrow; paraplow and chisel treatment received one pass with horizontal rotary harrow and for disk harrow treatment we have used Lemmkeen cultivator. The samples were collected from 0-10 cm, 10-20 cm and 20-30 cm depth, for distribution and stability of macrostructural, the procedure of Tiulin- Erikson was used.

RESULTS AND DISCUSSION

The influence of tillage systems on hydric stability of structural aggregates

Following the variation of different categories of hydrostabil aggregates, we observed that the percentage of aggregate with diameter between 1-5 mm is smaller at the surface and becomes bigger in the layer 0-30 cm, while the percentage of aggregate with diameter between 1-0.5 cm and between 0.5-0.25 cm is smaller.

From emergence to harvesting is certifiable an increment in percentage of aggregate with diameter higher than 5 mm and between 1-5 mm and a diminution of aggregates with diameter between 1-0.5 mm and between 0.5-0.25 mm. In chisel treatment are dominant the aggregate with diameter between 1-5 mm and >5 mm, in entire soil profile (40.7%) and in each growing stage (63.7%).

Contrary is disk harrow treatment where the percentage of 1-5 mm ranged from 17.4% to 44.4%. The uses of rotary harrow treatment in seedbed preparation lead the aggregate diameter smaller than 1.00 mm forming the hydrosolubil aggregate. In unconventional tillage system, in 0-10 cm depth, the percentage of aggregate <1mm is higher compared with the conventional variant (9.6%). On vegetation stage in all three depths the values of hydric stability are recording increments in all of the tillage system. At harvesting in disk harrow treatment only the aggregate with diameter between 1-5 mm (44.4%) are modified. In 20-30 cm layer from emergence to harvesting the proportion is favourable for aggregate with 1-5 mm size.

In plough treatment at 30 cm depth, the aggregate with diameter between 0.25-0.5 mm and 0.5-1 mm are present in a higher percentage than in other variants. With the increments in depth (20-30 cm layer) the paraplow (68.9-68.3%) and chisel variant oversie the value of plough variant (65.1%).

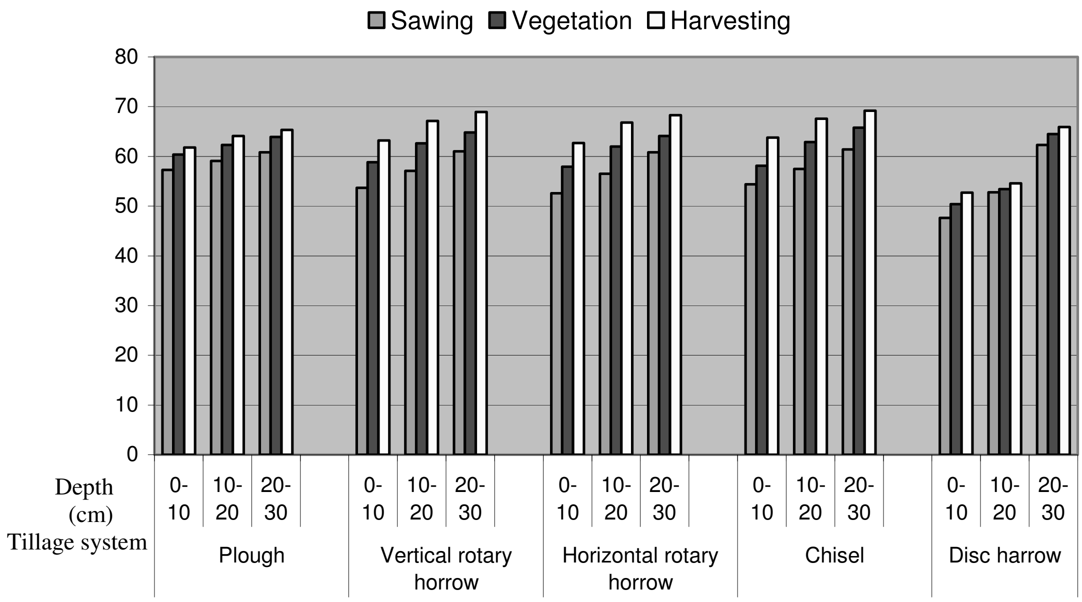

Fig. 1. Hydric stability of structurale aggregates in winter wheat crop during 2006-2007

The hydric stability of structural aggregates in all vegetation stages or tillage variants are increasing with depths. In 0-10 cm layer the values were 47.6-57.3% at emergence, 50.4-59.4% on vegetation and 52.7-63.8% at harvesting. The same phenomena has been observed on 10-20 cm layer where the values of hydric stability are increasing from 52.8 to 59.1% at emergence and from 54.6 to 67.6% at harvesting. On 20-30 cm depth the values were smaller, between 60.8-62.3% at emergence and between 65.3-69.2% at harvesting. In superficial layer 0-10 cm, the structure suffer an pronounced degradation by reason of mechanical action, in preparing the seedbed by direct and negative influence of rain and environmental factors. All these effects are attenuating with the depth.

Table 1

The influence of tillage systems on hydric stability of structurale aggregates in winter wheat crop (%)

Depth (cm)	Tillage	Growing stage											
		Emergence				Vegetation				Harvesting			
		>5	5-1	1-0.25	Total	>5	5-1	1-0.25	Total	>5	5-1	1-0.25	Total
0-10	Plough	9.9	34.8	12.6	57.3	10.3	35.7	13.4	59.4	13.1	37.3	11.4	61.8
	Paraplow +F.v	11.3	28.2	14.2	53.7	12.5	32.4	13.9	58.8	15.9	35.8	11.5	63.2
	Paraplow +F.o	11.3	27.1	14.2	52.6	15.2	28.1	14.6	57.9	16.7	35.9	10.1	62.7
	Chisel l	12.3	28.4	13.7	54.4	16.7	28.9	12.5	58.1	18.7	34.1	11	63.8
	Disk	2.7	17.4	27.5	47.6	5.9	24.4	20.1	50.4	6.2	29.2	17.3	52.7
10-20	Plough	13.4	35.3	10.4	59.1	14.9	38.4	9	62.3	15.2	39.9	9	64.1
	Paraplow +F.v	13.1	33.3	10.7	57.1	15.5	38.7	8.4	62.6	19.7	40.1	7.3	67.1
	Paraplow +F.o	12.8	32.5	11.2	56.5	16.4	38.1	7.6	62.1	18.8	40.8	7.2	66.8
	Chisel	13.8	29.3	14.4	57.5	17.9	39.3	5.7	62.9	20.3	41.4	5.9	67.6
	Disk	3.1	25.9	23.8	52.8	6.7	27.6	19.1	53.4	9.5	33.1	12	54.6
20-30	Plought	13.9	36.3	10.6	60.8	16.3	39.3	8.3	63.9	19.8	40.1	5.4	65.3
	Paraplow +F.v	17.4	35.8	7.9	61.1	17.4	41.4	6	64.8	20.4	43.8	4.7	68.9
	Paraplow +F.o	17.9	34.9	8	60.8	18.1	41.7	4.3	64.1	20.3	42.3	5.7	68.3
	Chisel	18.5	33.1	9.8	61.4	18.6	43.9	3.3	65.8	21.3	42.4	5.5	69.2
	Disk	17.3	39.2	5.8	62.3	17.2	44.8	2.5	64.5	19.2	44.4	2.3	65.9

Table 2

Hydric stability in winter wheat crop - average values on treatment, depth and growing stages

Treatment	Hydric stability		Differences (%)	Statistical signification
	Percentage (%)	% comparasion with control variant		
Chisel	62.2	100.97	0.6	
Paraplow + VRH	61.9	100.49	0.3	
Plought 30 cm	61.6	100.00	0.0	Control variant
Paraplow + HRH	61.3	99.51	-0.3	
Disk harrow	56.0	90.91	-5.6	oo
$LSD_{5\%} = 2.6$ %	$LSD_{1\%} = 3.8\%$	$LSD_{0.1\%} = 5.7\%$		

It was demostrated a season variation in all depths, the values of hydric stability becaming bigger from emergence to harvest, in all tillage systems. In plough treatment (0-10 cm) the values of hydric stability are smallest 61.8% comparated with paraplow treatment (62.7-63.2%) and chisel treatment (63.8%). At this depth the disk harrow treatment has the smallest value 52.7%. The effect of tillage system on hydric stability (table 2), reveal a negative statistically significant difference at disk harrow variant compared with control, where the values are statistically assured, there are also differences between V_4 and V_2 compared with V_1 where the values are statistically unassured.

CONCLUSIONS

1. Variants vertical and horizontal rotary harrow produce a degradation of soil structure on 0-10 cm depth, where the percentage of aggregate is 14.2%.
2. In chisel variant the values of hydric stability 69.2% are aproximately equaly with the paraplow variant 68.3-68.9% and higher than plough 65.3% and disk harrow variant 65.9%.
3. The tillage system has influence on the quality of soil structure by the changes in hydric stability of structural aggregates, indifferent of growing stage and profile depth.
4. Untill harvesting, the hydric stability increased in all the depths, with a maximum in 20-30 cm layer in chisel variant, followed by paraplow variant.

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THE INFLUENCE OF REDUCED TILLAGE SYSTEMS ON PHYSICAL PROPERTIES OF A CAMBIC CHERNOZEM FROM MOLDAVIAN PLATEAU

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Keywords: *bulk density, aggregate stability, penetration resistance*

Abstract

The experiment carried out during 2006-2007, was located in the Eastern part of Romania, ($47^o07`$ N, $27^o30`$ E), on a cambic chernozem with a clay-loamy texture and 2.7% humus content. Bulk density (BD) had the lowest values at the seeding time on 0-10 cm depth (1.12-1.20 g/cm^3). The highest values have been provided by plough at 20 cm, paraplow and disc harrow variants on 20-30 cm layer. The disk harrow variant resulted in the highest values of penetration resistance (PR) on all analyzed layers (1.14 at the surface to 2.45 MPa at 40-50 cm), which would limit the ability of crop roots to expand into deep zones of moisture availability. As regards the water stable aggregates (WSA) at the sowing time, we had the highest average value at the chisel + rotary harrow variant (77.08%) and the smallest one at disk harrow treatment (69.44%).

INTRODUCTION

Agricultural tillage practices have changed in Romania over decades. Soil conservation tillage, which intend to leave residues on the soil surface and may include reduced till (using disks or chisel plough, for example) or no-till, has become a popular practice recently, in Romania. Continuous ploughing at the same depth leads to the formation of a hard pan in the lower layers over a period of time [1, 12], which hinders the deeper penetration of roots into soil and a direct negative influence on yield. Knowing the soil structure as an essential element of soil fertility has a great importance [8], because it influences not only the physical conditions, aeration and food regime, but also the accessibility of nutrients for plants, degradation of organic material in soil and microbiological activity [13].

MATERIAL AND METHODS

The experiment was initiated in 2005 and sited at the Experimental Farm of the Agricultural University of Iasi in the Eastern side of Romania ($47^o07`$ N latitude, $27^o30`$ E longitude), on a cambic chernozem (SRTS-2003, or haplic chernozems according WRB-SR, 1998), with a clay-loamy texture, 6.8 pH units, 2.7% humus content and a medium level of fertilization. The experimental site has an annual average temperature of 9.4^{0}C and precipitation of 587 mm. The experimental design was in a "split plots design" with three replications. Plots covered area of 60 m^2, in a rotation of soybean, winter wheat and maize, with the current experiment in winter wheat (*Triticum aestivum* L.) followed by maize. Each set of plots received yearly the following treatments:

– conventional tillage: ploughed at 20 cm and ploughed at 30 cm;

– reduced tillage: disk harrow, chisel followed by rotary harrow, paraplow.

All the other agronomic practices were kept as normal and uniform for all the treatments.

The purpose of this study was to evaluate the influence of conventional and unconventional tillage systems on bulk density (BD), penetration resistance (PR), and water stable aggregates (WSA) in the area of the Moldovian Plateau.

Soil bulk density was determined on an oven-dry basis by the core method [3]. Soil penetration resistance was measured after sowing, during the growing period, and at harvesting, using a digital Eijkelkamp penetrologger. Ten penetration resistance measurements were taken from each plot from the soil surface to a soil depth of 50 cm. The penetrologger had a 30^0 cone and 1 cm base area. For water stable aggregates, the procedure of Kemper and Rosenau (1986) was used.

RESULTS AND DISCUSSION

Soil bulk density is a useful parameter in the studies of soil and crop responses to machinery traffic in agriculture [5, 15] and is also considered to be a measure of soil quality due to its relationships with other properties (eg., porosity, soil moisture, hydraulic conductivity etc.)

As regards soil BD in winter wheat (*Triticum aestivum* L.), this indicator had the lowest value of the seeding time at 0-10 cm depth (1.12-1.20 g/cm^3). The values increased on 10-20 cm layer, recording the greatest intensity in the disk harrow variant (1.37 g/cm^3). The highest values have been provided by plough 20 cm, paraplow and disc harrow variants on 20-30 cm layer (table 1). At the growing period, the plough 30 cm and chisel + rotary harrow variant displayed the smallest values (1.22 and 1.24 g/cm^3). At harvesting, under unconventional tillage, the BD had the biggest values on all the three layers with a maximum at the disk harrow variant at 20-30 cm depth (1.55 g/cm^3). BD becomes once with the increasing of depth for all treatments and from sowing to harvesting. Other studies show that bulk density is increasing when reduce tillage practices are adopted [2, 6, 4].

Table 1

The influence of tillage systems on bulk density in winter wheat crop (2006-2007)

Treatment	Depth (cm)	Bulk density (g/cm^3)		
		Sowing	Growing period	Harvesting
Disk harrow	0-10	1.20	1.32	1.42
	10-20	1.37	1.46	1.47
	20-30	1.42	1.53	1.55
Paraplow	0-10	1.14	1.26	1.30
	10-20	1.28	1.40	1.42
	20-30	1.42	1.46	1.47
Chisel+ Rotary harrow	0-10	1.12	1.24	1.33
	10-20	1.23	1.35	1.37
	20-30	1.35	1.43	1.43
Plough 20 cm	0-10	1.14	1.24	1.26
	10-20	1.21	1.34	1.37
	20-30	1.40	1.43	1.45
Plough 30 cm	0-10	1.13	1.22	1.30
	10-20	1.20	1.30	1.40
	20-30	1.24	1.38	1.41

Table 2

Bulk density in winter wheat crop (2006-2007) - average values of treatment depth and growing stages

Treatment	Bulk density (g/cm^3) – average (%)	Comparison with control variant (%)	Differences to the control variant (%)	Statistical significations
Disk harrow	1.41	105.68	0.076	xx
Paraplow	1.35	100.97	0.013	ns
Average	1.34	100.00	0.00	Control variant
Plough 20 cm	1.32	98.50	-0.020	ns
Chisel	1.32	98.50	-0.020	ns
Plough 30 cm	1.29	96.26	-0.050	o

(The control variant is the average value of the indicator for all the five treatments; ns=insignificant)

LSD 5%= 0.043% LSD 1%= 0.063% LSD 0.1%=0.094%

The mean values of soil bulk density recorded during 2006 and 2007 show statistically significant differences between disk harrow variant and the control treatment (in this case an average value between all the five treatments), indicating a high compactation degree (table 2).

A negative difference was also identified at the conventional tillage variant – plough at 30 cm. This treatment recording the smallest value (1.29 g/cm^3).

Penetration resistance measurements showed similar trends in the three samplings at different stages of the growing season. PR was determined when soil moisture content below 0.15 m depth was close to field capacity; measurements were averaged every 10 cm. The disk harrow variant resulted in the highest values on all the layers analyzed (1.14 MPa at the surface to 2.45 MPa at 40-50 cm), which would limit the ability of crop roots to expand into deep zones of moisture availability. As average values on 0-50 cm, the smallest penetration resistance has been observed in the conventional tilled variant, plough at 30 cm (1.38 MPa). At soil surface the smallest value was recorded in chisel + rotary harrow variant (0.60 MPa). For all the five tillage treatments PR increased in soil with depth.

The most widely approaches used to characterize soil fragments include mean weight diameter [14], water stable aggregates [11] and others.

The water stable aggregates for all the five tillage treatments showed an increasing trend from sowing to harvesting period (table 3). Thus, at the sowing time, we had the highest average value at the chisel + rotary harrow variant (77.08%) and the smallest one at disk harrow treatment (69.44%), a normal value as a matter a fact. At the same period, on the layer 0-10 cm, the variant plough at 30 cm had the highest value, because of bringing the stable aggregates from 30 cm depth simultaneously with tillage operation. On the next two layers 10-20 and 20-30 cm, the values had the tendency to decrease slightly. Contrary, at the disk harrow variant, the tendency is to increase from 71.43% at 0-10 cm layer to 80.10% on 20-30 cm layer at the growing period, and from 72.30% to 84.80% at harvesting. Arshad et al. (1999) point out that aggregates >0.25 mm were by 60% higher in no tillage than in conventional tillage at a depth of 0–5 cm, but showed no difference at depth of 12.5–20 cm.

Ghuman and Sur (2001) indicate that reduced tillage did not make any appreciable change in the aggregation status of soil compared with conventional tillage. Contrary to these results, some authors reported that the stability was smaller under reduced tillage compared to other tillage practices [9].

However, the effect of tillage system on WSA reveal a negative statistically significant difference at the disk harrow variant compared with control treatment.

Table 3

The evolution of WSA (%) in winter wheat (average of 2006-2007)

No.	Treatment		Sowing period 2006	Growing period 2007	Harvesting 2007
1	Disk harrow	0 - 10 cm	69.58	71.43	72.30
2		10 - 20 cm	63.92	70.45	75.50
3		20 - 30 cm	74.83	80.10	84.80
Average			**69.44**	**73.99**	**77.53**
4	Paraplow	0 - 10 cm	75.42	79.90	85.10
5		10 - 20 cm	71.58	74.50	77.90
6		20 - 30 cm	74.92	81.67	85.60
Average			**73.97**	**78.69**	**82.89**
7	Chisel + rotary harrow	0 - 10 cm	79.92	82.67	85.40
8		10 - 20 cm	76.25	78.39	81.60
9		20 - 30 cm	75.08	77.45	80.91
Average			**77.08**	**79.50**	**82.64**
10	Plough 20 cm	0 - 10 cm	71.50	76.90	86.32
11		10 - 20 cm	72.17	73.68	76.34
12		20 - 30 cm	77.50	79.67	80.61
Average			**73.72**	**76.75**	**81.08**
13	Plough 30 cm	0 - 10 cm	77.50	79.83	80.59
14		10 - 20 cm	71.92	75.67	82.82
15		20 - 30 cm	73.58	75.80	77.65
Average			**74.33**	**77.10**	**80.35**

The chisel variant is also statistically assured, being with 2.4% higher that the control treatment (table 4).

Table 4

WSA (%) in winter wheat (2006-2007) - average values on treatment, depth and growing levels

Treatment	Macrostructural hydrostability Degree-average (%)	Comparison with control variant (%)	Differences to the control variant (%)	Significations
Chisel	79.7	103.10	2.4	**xx**
Paraplow	78.5	101.55	1.2	ns
Plough 30 cm	77.3	100.00	0.0	ns
Average	77.3	100.00	-	Control variant
Plough 20 cm	77.2	99.87	- 0.1	ns
Disk harrow	73.7	95.34	-3.6	ooo

(The control variant is the average value of the indicator for all the five treatments. ns=insignificant)

LSD 5%= 1.4% LSD 1%= 2.1% LSD 0.1%= 3.1%

CONCLUSIONS

1. The disk harrow variant resulted in the highest values on all the layers analyzed, which would limit the ability of crop roots to expand into deep zones of moisture availability.
2. BD becomes bigger once with the increasing of depth for all treatments and from sowing to harvesting.
3. At the sowing time, we have found the highest average value of WSA at the chisel + rotary harrow variant (77.08%) and the smallest one at disk harrow treatment (69.44%).

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INFLUENCE OF CROP ROTATION UPON WEED DEVELOPMENT ON CORN, WHEAT AND SOYBEAN CROPS

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Keywords: *crop rotation, weed suppression, herbicides*

Abstract

In every type of culture or group of cultures we can observe specific weeds. These weeds are adapted to the particular biological characteristics of the cultivated plant and at the specific technological issues. Monoculture or short crop rotations fulfill this mentioned above conditions for a longer period of time infesting the soil with weed seeds. On the other hand, long crop rotation leads to a proper development of technological changes for each type of crops. This aspect is obvious at corn and soy bean where the crop rotation for two years leads to a weed development of 110-116% compared with the four year crop rotation. The differences are reduced at the three year crop rotation, with a weed development level of 13-64% higher compared with the four year crop rotation.

In the four year crop rotation compared with the two year one, the structure of weed development on the wheat culture involves significant modifications. The frequency of the following weeds was reduced: Centaurea, Adonis, Thlaspi, Sinapis, Vicia, Viola, Matricaria, Galeopsis şi Raphanus. On the other hand, the intensity of appearance with perennial weeds is: Agropyron repens, Cirsium arvense, Convolvulus arvensis and Symphitium officinale.

INTRODUCTION

Crop rotation is considered one of the most important technological measures for increasing soil fertility, suppress weeds, and fight against weed development, pest and diseases. Nowadays crop rotations are considered crucial for sustainable agriculture, seen as prime objective for accomplishing optimum yields without negative effects upon the ecological balance and environment stability. During 1985-2003 [1, 2, 3], in the experimental plots focused on crop rotation on different types of soils and different structures of crops the agrotehnical protocols where followed for the improvment of technological aspects. Good results where obtained by conducting a four year crop rotation (soy bean-autumn wheat-potato-corn) for soil tillage, fertilizers usage, herbicides usage, with optimum conditions for suppressing perennial weeds.

MATERIAL AND METHODS

The research objectives consisted in the determination of crop rotation influence upon weed development on a corn, wheat and soy bean crop.

The present results where obtained in the experimental plots of the Agricultural Faculty from Cluj-Napoca, Soil Science Department on a Faeoziom soil, with a humus content of 4.72 % a pH of 6.8 sandy-loam texture (43-45% loam in the Ap horizon) (V-74%), medium content of nitrate (0.204%), good content of potassium (149 ppm) and good content of phosphorus (18 ppm). The state of hidrostability on the soil depth 0-20 cm is 75-80%. The apparent density is 1.20-1.22 g/cm^3, and the total porosity 54.81%.

From the climatic point of view the experimental plot area is characterized by multi annual precipitation with values between 550-650 mm. The thermal regime has values between 8.0-8.2^{0}C.

The experiment was conceived as a monofactorial one.

Experimental factor A (soil rotation) with 3 graduations:

a_1 - 2 years (corn - wheat);

a_2 - 3 years (soy bean - corn - wheat);

a_3 - 4 years (soy bean - corn - wheat - sun flower).

RESULTS AND DISCUSSION

Between cultivated plants and weeds is a constant competition for fertilizers, water, light, space etc.

The crop rotation influences the weed appearance intensity. An alternate option between large varieties of crops with different technological needs combined with chemical weed control represents the key to success. It seems that crop rotation represents the best solution for weed control, diseases and pests. These aspects are based upon the obtained results in table 1. It is scientifically proved that on a wheat crop it's reduced the weed development before applying herbicides and after harvest once with the enlargement in time of the crop rotation. At the 2 year crop rotation (alternation between cereals and harrow plants) the no. of weeds is situated between 305-365/m^2, on the 4 year crop rotation it is reduced at 213-236 weeds/m^2. In any crop or group of crops with specific technological aspects are existing specific weeds. These weeds are adapted at biological particularities of the cultivated plant and at specific technology.

Monoculture and short crop rotation maintain the possibilities of weed infestation in the terrain. This aspects are observed at corn and soy bean crop (table 2), when the 2 year crop rotation leads to a weed development of 110-116% higher than the 4 year crop rotation. The differences are reduced at the 3 year crop rotation, with a weed development rate of 13-64%, higher compared with the 4 year crop rotation.

Table 1

Influence of crop rotation upon weed development on a wheat crop

Crop rotation duration	Before herbicide applying		At harvest	
	No. of weeds/m^2	Dry mass of weeds (kg/ha)	No. of weeds/m^2	Dry mass of weeds (kg/ha)
2 year crop rotation	305	311	164	365
3 year crop rotation	287	276	152	344
4 year crop rotation	213	143	107	236

Table 2

Weed development rate in corn and soy bean crops influenced by crop rotation period

Species	No. of weeds/m^2			No. of weeds/m^2		
	Corn in a 2-3-4 years crop rotation			Soy in a 2-3-4 years crop rotation		
	2	3	4	2	3	4
Echinochloa crus-galli	17	14	10	14	13	7
Setaria sp.	103	76	56	128	104	59
Agropyron repens	30	4	28	24	12	12
Amaranthus retroflexus	4	2	6	8	6	10
Atriplex patula	-	2	-	2	4	-
Chenopodium album	8	6	4	10	8	6
Xanthium strumarium	12	7	3	14	12	10
Galeopsis tetrahit	2	-	2	4	2	-
Polygonum aviculare	2	2	2	-	-	-
Polygonum convolvulus	2	4	2	6	12	2
Polygonum lapathyfolium	84	12	10	52	16	10
Raphanus raphanistrum	-	2	2	-	6	-
Stellaria media	2	2	-	18	16	12
Viola arvensis	2	2	-	-	-	2
Daucus carota	-	2	2	-	-	-
Cirsium arvense	3	2	1	4	4	2
Convolvulus arvensis	8	10	4	14	12	6
Total weeds/m^2	**279**	**149**	**132**	**298**	**227**	**138**
Total weeds (%)	**211**	**113**	**100**	**216**	**164**	**100**

From the adopted research, it is obvious that on the wheat crop frequently appear annual weeds like: *Polygonum convolvulus*, *Papaver rhoeas*, *Centaurea cyanus*, *Veronica* sp., *Matricaria* sp. and many others and on the corn and soy bean crop like: *Setaria* sp., *Digitaria sanguinalis*, *Echinochloa crus-galli* and others. The mentioned above weeds appear later when the soil is warmer. By a proper crop rotation decreases the no. of specific weeds.

When the wheat and corn crop alternates, the specific weeds of wheat (with autumn germination and winter dormancy) cannot develop, because after the wheat harvest the soil is tilled, and is maintained free of weeds till spring when the corn is seeded. So, through the specific soil tillage works for the corn crop, we can reduce the development of autumn germination weeds that can resist in the winter time.

It is known that every cultivated species reduces the number of weeds and the succession of the agricultural crops reduces the weed development. In the 4 year crop rotation, compared with the 2 year crop rotation, the weed development on wheat is different.

It has been reduced especially the weed development for the following species: *Centaurea, Adonis, Thlaspi, Sinapis, Vicia, Sonchus* and others, but has been raised the development of the following weeds (*Stellaria, Viola, Veronica, Matricaria, Galeopsis* and *Raphanus*). The perennial weeds development has been raised for weeds like: *Agropyron repens, Cirsium arvense, Convolvulus arvensis* and *Symphitium officinale*.

It is remarkable that every annual weed species that have a proper development are autumn weeds, or early spring weeds. For the corn crop the weed development on the 4 year crop rotation decreases compared with the same crop on the 2 year weed development.

This fact is based on crop rotation period, tillage technology that are maintaining the weed development.

In the second part of the vegetation period, it is more obvious the influence of crop rotation, because after the soil tillage are developing weeds with late germination as: *Echinochloa crus-galli, Convolvulus arvensis, Digitaria sanguinalis, Setaria* sp. etc.

In the 2 year crop rotation with the same usage of herbicides and the same soil tillage works, are created favorable conditions for certain weed development especially weeds resistant to the used herbicides.

In the wheat crop propagated monocotiledonated weeds like: *Apera spica venti*, *Avena fatua* and others.

Crop rotation is also in this case the most efficient way of reducing the perennial weed development (*Cirsium arvense, Convolvulus arvensis*, *Symphytum officinalis*) and especially for the sun flower and soy bean crop that don't have homologated selective herbicides that can't control this problem weeds.

CONCLUSIONS

1. On the wheat crop it is showed that the weed development is reduced before herbicide applying, and after harvest, once with the enlargement of the crop rotation. If on the 2 year crop rotation (the alternate between wheat and corn) the no. of weeds is 305-365/m^2 on the 4 year crop rotation it is reduced at 213-236 weeds/m^2.
2. The relation between crop rotation and weed development has been obvious on the corn crop, and on the soy bean crop, where the 2 year crop rotation leads to a weed development higher than 110-116% compared with the experimental plots where the 4 year crop rotation has been adopted.
3. In the 3 year crop rotation the weed development is lower compared with the 2 year crop rotation, but higher with 13-64% compared with the 4 year crop rotation.
4. The crop rotation technology must be looked as a prior measure for controlling the weed development in any kind of crops.
5. The period of crop rotation contributes significantly to the reducing of weed development; in the 4 year crop rotation compared with the 2 year crop rotation. The structure of weed development is significant with decreasing values for: *Centaurea, Adonis, Thlaspi, Sinapis, Vicia,* and *Sonchus*.
6. The soil tillage specific for the corn crop significant contributes at reducing the level of weed development; especially the weeds with autumn germination witch can persist through the winter period of time.
7. The agro technical works proper established, and crop rotation influences the intensity of weed development from the wheat crops and soy bean crops.
8. During the crop rotation for maintaining a balanced development of weeds we must be concerned about herbicide alternation for avoiding the usage of a single herbicide witch determine through time resistance of the weeds.

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INFLUENCE OF AGRICULTURAL TECHNOLOGY TILLAGE ON HYDRO STABILITY STRUCTURAL SOIL

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Key words: *fertility, chernozem, dispersion, structure soil*

Abstract

Soil is considered the most valuable natural resource used by humans to obtain necessary products, plant survival and harmonious development and the most important medium for biomass production. In applying differential systems technology, to conserve soil resources, preserving fertility and its "physical quality" should be considered some of acquiring land in connection with the plants, among them structural hydro stability.

Evolution of the acquisition may cause a multitude of effects which are reflected in the nutrition of the plants and the potential fertility of soil.

INTRODUCTION

In applying differential systems technology, to conserve soil resources, preserving fertility and a "physical quality" of it, should be considered some of acquiring land in connection with the plant. Evolution of the acquisition may cause a multitude of effects which are reflected in the nutrition of the plants and the potential fertility of soil.

The paper presents results of research carried out in order to highlight the characteristics of physical changes in the soil under the influence of culture and technology to identify measures to avoid the potential for reduction of soil fertility, knowledge produced by the effect of long application of various systems work the soil, a type soil mold from SCDA Marculesti.

MATERIAL AND METHOD

Analysis and observations that are the subject of this work are performed in the Experimental Station of the Research - Agricultural Development Marculesti located in South Baragan and located on a soil type mold in a state of experiment with a single factor (soil tillage), with four soil tillage system, established as randomized blocks.

The methodology for determining the structural hydro stability wet sifting consists of aggregates with sizes ranging from 2 - 0.25 mm, using a device with one screen and separation by dripping a micro-aggregates less than 0.01 mm, dispersed in the suspension resulting from sifting wet. Evolution of the acquisition may cause a multitude of effects which are reflected in the nutrition of the plants and the potential fertility of soil. The aggregate fluid stable in diameter between 2 and 0.25 mm and the particle diameter below 0.01 mm, called dispersion (% D), are the main parameters for characterization of fluid stability of soil structure.

Relation between dispersion and content aggregate fluid stable represents **structural instability index (ID)** and the rapport of dispersion and particle content of the same size, resulting in grain size analysis, is the correction factor (K0,01%).These parameters are derived from the calculation of fluid stability of the soil.

RESULTS AND DISCUSSION

The hydro stability structural assessment, a mold that is placed experiences, was made by the following parameters: content large aggregates at the structural water, structural small aggregates stable or fine fraction (dispersion) and the index of structural instability. Evolution of the acquisition may cause a multitude of effects which are reflected in the nutrition of the plants and the potential fertility of soil.

Following the observations, the large aggregates of fluid stability presents the lowest value on the surface soil, in return tillage through capsizing soil (1%), while maintaining the same depth and in very small, which indicates a high dislocation structure that this method of work of soil is possible occurrence of natural processes of degradation by hydro stability structural loss, and what has been observed in some experimental plots.

During investigations of crust formation was observed, in shows, because the germination bed processing disk and combinator with a switch so that the soil has been requested due to abundance and rainfall, this crust has a thickness of more than 2 cm (figure 1).

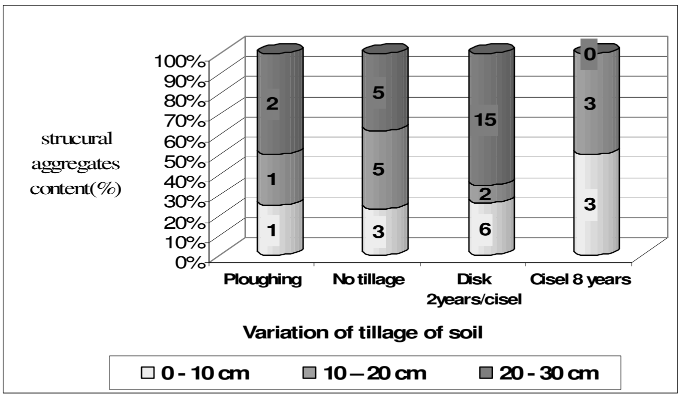

Fig. 1. Large aggregates at the structural water content of soil, 2007

Dispersion, the lowest values were recorded in a disk worked, especially in the superficial layer of 0-10 cm, because then the layer 20-30 cm to reach the values considered extremely high. The values of the increased dispersion in the surface soil were recorded in the conventional variant tillage capsizing soil return, which in the deep layer of 10-30 cm, decreases as close as a discussion variant (9%w/w).

To tillage with brush and uncultivated in a dispersion values are extremely high throughout the depth profile (figure 2).

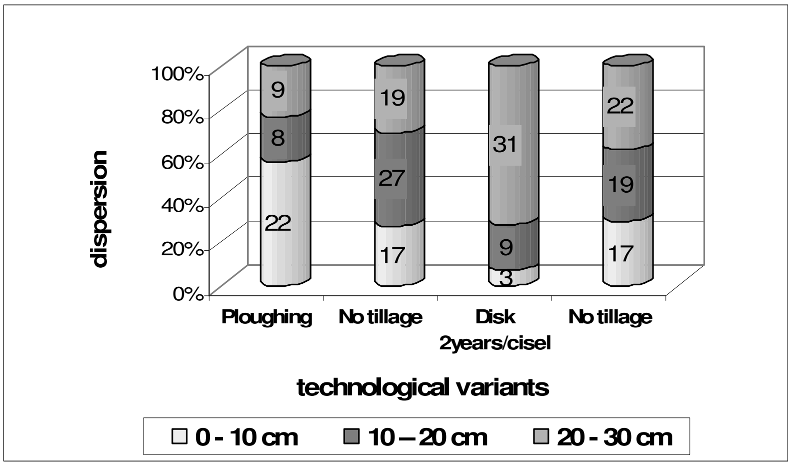

Fig. 2. Influence of tillage on soil dispersion, 2007 (%)

The index of structural instability. This was very high in whole experimental field, very high. In all experimental variants, the values are above 2, except the variant soil was processed with the disk, where the surface soil indicates lower values (medium) 0.52 (figure 3).

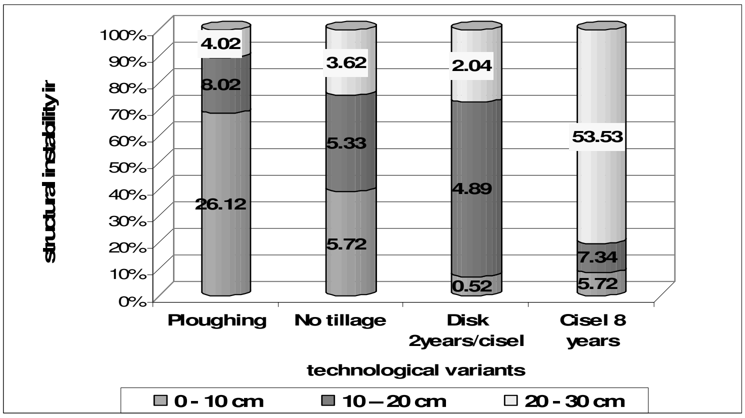

Fig. 3. Changes in structural instability index, 2007

CONCLUSIONS

1. The application of intensive farming pressure exerted by the soil tillage and weight of soil aggregates and machinery has increased the apparent density and structural hydro stability reduction, accelerating the physical degradations processes.
2. The proportion of soil aggregates hydro stable is lower in a show and worked repeatedly with superficial machine tillage the soil with disk for fragments of large soil and granulation higher in alternate versions worked through disk/chisel and uncultivated.
3. The values of dispersion and structural instability index correlated directly with each other, with lower values in variants with reduced soil tillage.

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MAIZE CULTIVATION IN NO-TILLAGE SYSTEM BY USING THE REGINA MODEL OF THE GASPARDO SOWING MACHINE

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Keywords: *conventional, no-tillage, Gaspardo, Regina model*

Abstract

Maize one of is the main plant for the economy of Romania. Many researchers from various countries such as the USA, Italy, Spain, former Yugoslavia, Hungary, Russia and Bulgaria approached the issue of weed control for the specific weeds affecting maize crops.

Studies were also performed in Romania on control of annual and perennial weeds for the no-tillage system and numerous articles were published on this issue at various national and international symposiums by Sarpe and his collaborators (1968, 1970, 1984, 1993, 2000, 2005, 2008).

The results obtained in the specific conditions of the Flood Plain of the Danube river indicate that the maize grain yields recorded have been practically equal for the two systems, conventional and no-tillage. However, big differences have been recorded in terms of fuel consumption. The fuel consumption per hectare amounted to 86 litres in the conventional system, while it went down to a mere 6 litres per hectare in the no-tillage system. The expenses incurred in the conventional system for the mechanical works and manual hoeing sessions amounted to RON 1,305.00/hectare and to only RON 50.00/hectare in the no-tillage system.

INTRODUCTION

I believe that when MAN became a "farmer", he used "at the beginning" the "no-tillage system" in unploughed land and without any other soil tilling. In order to sow the wheat and maize grains he used rudimentary tools made of sharpened stone, flint stone and animal bones. This is why we can assert that the PRIMITIVE no-tillage system is 10,000 or even 20,000 years old. In his book entitled "**Cultivated plants**", Mr. Balteanu Gheorge (1979) says that "*it is estimated that the maize (zea mays) was cultivated as early as **4,400-5,000 years before J.C.***" At that time, of course, the maize was already cultivated in ploughed land, which is by applying the conventional method, and weed control was performed by manual hoeing.

"Minimum tillage" is the method by which the plough is no longer used, it being replaced by the chisel (which mobilizes the soil 15-18 cm deep). This operation is obviously cheaper than ploughing and in our country it has been applied (and it is still used) in wheat cultivation, especially when autumns are droughty.

Plant cultivation **without ploughing**, as well as without any other soil tilling work was developed by English specialists back in the 1930s, based on using the Reglone herbicide as total herbicide, before the wheat or barley is sowed in unploughed land.

The modern method of the no-tillage system spread around rapidly, being applied on millions of hectares in the USA and Latin America only after 1957, when the Swiss company Geigy synthesized the herbicide atrazin, which is super selective for maize cultivation.

Why did the Americans and the English have the IDEA of cultivating plants in unploughed land? Well, the answer is: the no-tillage system appeared **not as a fashion** but as an **economic necessity** for the following issues to be tackled:

- reduction of fuel consumption;
- reduction of investments in agricultural machines and equipment;
- reduction of human and mechanical labour;
- increased labour efficiency;
- prevention of soil erosion;
- reduction of production costs;
- increase of net profit per cultivated hectare.

Since 1965, the no-tillage system has been studied and many studies were published in specialized magazines, national and international symposiums (Sarpe et al.: 1968, 1970, 1974, 1984, 1986, 1993, 2000, 2004, 2005, 2008).

RESULTS AND DISCUSSIONS

The experiments were performed in the specific conditions of the Flood Plain of the Danube River, at the company named SC Agrofam-Holding, Fetesti, Ialomita County. The results regarding selectivity of used herbicides are presented in Table 1 hereinafter.

Analyzing the data listed in table 1, one can notice that the herbicide Gardoprim Plus Gold 500 SC applied in a dose of 5.0 liters/ha was very selective as far as the maize plants are concerned. Throughout the entire period of vegetation, starting from the springing phase until plant coming into ears, no phytotoxicity symptoms were recorded.

The herbicide Ceredin was applied in the 4-5-leaf stage of the maize plant. Considering the data listed in table 1, we can notice that it was scored with the 1.0 EWRS grade, which means that the maize plants tolerated very well the Ceredin herbicide. The herbicide Mistral Turbo was also applied in the 4-5-leaf stage of the maize plant. Applied in doses of 1.5 and 3.0 liters/ha, this herbicide was also tolerated well by the maize plants. The land where the respective experiment was carried out was infested mainly by perennial species such as *Sorghum halepense, Cirsium arvense, Senecio vulgaris* and *Polygonum hydropiper*.

Table 1

Selectivity of the herbicides applied to maize crop
SC Agrofam Holding, Fetesti, 2005-2008

Applied herbicides	Rates (l/ha)	Time of application	EWRS grades
I. Conventional System			
1. Mechanical hoeing (hoed 3 times)	—	—	1.0
2. Not hoed	—	—	1.0
II. No-tillage system			
3. Untreated	-	-	1.0
4. Gardoprim Plus Gold 500 SC	5.0	preem.	1.0
5. Gardoprim Plus Gold 500 SC +	5.0	preem.	1.0
Ceredin EC	1.0	postem.	1.0
6. Gardoprim Plus Gold 500 SC +	5.0	preem.	1.0
Ceredin EC + Mistral Turbo	1.0 + 1.5	postem.	1.0
7. Gardoprim Plus Gold 500 SC +	5.0	preem.	1.0
Ceredin EC + Mistral Turbo	1.0 + 3.0	postem.	1.0
EWRS Grades = 1.0 without any phytotoxicity symptom 9.0 The ratio in which the plants are destroyed amounts to 90-95% plants are destroyed			

The results regarding the level of chemical weed control are presented in table 2.

The level of weed control recorded in the no-tillage system depended on the herbicides applied. In variant number 4 treated with Gardoprim Plus Gold 500 SC, only the annual weeds were controlled, and all the perennial weeds proved to be resistant to the respective herbicide. That is why the level of chemical control recorded in variant number 4 was of only 52%. However, in variant 5, when the Ceredin herbicide was added, which controlled very well the perennial dicotyledonous species such as *Cirsium arvense* and *Polygonum hydropiper*, the level of weed control went up to 75%, no control being recorded in *Sorghum halepense.* In variant number 6 the herbicide Mistral Turbo was applied postemergently at the same time with the herbicide Ceredin. Because of the fact that the Mistral Turbo was applied in a small rate of only 1.5 liters/ha, *Sorghum halepense* was controlled only partially – the control level amounting to 82%. In this variant, *Sorghum halepense* **regenerated** – new viable offshoots and rhizomes appeared.

Table 2

Chemical weed control recorded in maize crop
SC Agrofam Holding, Fetesti, 2005-2008

Dominant weed species			
1. Sorghum halepense *2. Echinochloa crus-galli* *3. Chenopodium altum* *4. Abutilon theophrasti*	*5. Senecio vernalis* *6. Cirsium arvense* *7. Amaranthus retroflexus* *8. Polygonum hydropiper*		
Applied herbicides	**Rates (l/ha)**	**Time of application**	**Weed control (%)**
I. Conventional system			
1. Mechanical hoeing (hoed 3 times)	—	—	93
2. Not hoed	—	—	0
II. No-tillage system			
3. Untreated	-	-	0
4. Gardoprim Plus Gold 500 SC	5.0	preem.	52
5. Gardoprim Plus Gold 500 SC + Ceredin EC	5.0 1.0	preem. postem.	75
6. Gardoprim Plus Gold 500 SC + Ceredin EC + Mistral Turbo	5.0 1.0 + 1.5	preem. postem.	82
7. Gardoprim Plus Gold 500 SC + Ceredin EC + Mistral Turbo	5.0 1.0 + 3.0	preem. postem.	100

In the no-tillage system, the best control rate of all the weeds including *Sorghum halepense*, that is a 100% rate, was recorded in variant number 7, in which three herbicides were applied: Gardoprim Plus Gold 500 SC in a rate of 5.0 liters/ha, Ceredin 1.0 liter/ha + Mistral Turbo in a rate of 3.0 liters/ha – the last one destroying totally the *Sorghum halepense*.

In table 3 hereinafter we present the grain yield recorded.

Analyzing the data from table 3, we can see that the conventional system, in variant number 1, the grain yield recorded amounted to 9,980 kg/ha – the annual and perennial weeds being destroyed by 3 mechanical hoeing operations between the rows and 3 manual hoeing operations on the maize row. As for the 2nd variant, which was not hoed, because of the weeds, only an insignificant yield of maize grains of 1,397 kg/ha was obtained.

In the no-tillage system, in the 3rd variant, which was not treated with herbicides, the maize grain yield recorded was very low, namely 1,396 kg/ha. The grain yield recorded in the variant number 4, treated only with Gardoprim Plus Gold 500 SC was of only 5,109 kg/ha, as the respective herbicides does not control the perennial weed species such as *Cirsium arvense, Polygonum hydropiper, Sorghum halepense*, etc. In the variant number 5, which beside the Gardoprim was also treated postemergently with Ceredin, the grain yield amounted to 7,484 kg/ha. The grain yield was even higher, namely to 8,483 kg/ha in the variant number 6, treated with the herbicides Gardoprim + Ceredin + Mistral Turbo. However, in the no-tillage system the highest grain yield was recorded again in the 7th variant, which was treated with 3 herbicides: Gardoprim Plus 500 SC in a rate of 5.0 liters/ha + Ceredin CE in a rate of 1.0 liter/ha + Mistral Turbo in a rate of 3.0 liters/ha. We must mention that pursuant to the application of these three herbicides, al the annual and perennial weeds, including *Sorghum halepense* were completely, meaning 100% destroyed.

Table 3

Yield of maize grains
SC Agrofam Holding, Fetesti, 2005-2008

Applied herbicides	**Rates (l/ha)**	**Time of application**	**Weed control (%)**	
			kg/ha	**%**
I. Conventional system				
1. Mechanical hoeing (hoed 3 times) 2. Not hoed	— —	— —	9.980 1.397	100 14
II. No-tillage system				
3. Untreated	-	-	1.396	14
4. Gardoprim Plus Gold 500 SC	5.0	preem.	5.189	52
5. Gardoprim Plus Gold 500 SC + Ceredin EC	5.0 1.0	preem. postem.	7.485	75
6. Gardoprim Plus Gold 500 SC + Ceredin EC + Mistral Turbo	5.0 1.0 + 1.5	preem. postem.	8.483	85
7. Gardoprim Plus Gold 500 SC + Ceredin EC + Mistral Turbo	5.0 1.0 + 3.0	preem. postem.	10.279	103

When calculating the economic efficiency of the two technological systems: conventional and no-tillage, only the mechanical works were taken into account. Herbicide application was not taken into account, as the respective herbicide application operations were executed equally in both technological systems. Weed control in the conventional system was achieved by performing 3 mechanical hoeing rounds and 3 manual hoeing rounds. In the minimum and the no-tillage system, weed control was performed by chemical means, namely by application of the herbicides Gardoprim Plus Gold 500 SC, Ceredin EC and Mistral Turbo.

The fuel consumption recorded is presented in table 4 hereinafter. Analyzing the data thereof, we shall see that the consumption recorded in the conventional system for the various mechanical works performed (ploughing, disking etc.) amounted to 86 liters of diesel fuel per hectare.

The lowest fuel consumption was recorded in the no-tillage system. For the sowing round performed by the Regina model of Gaspardo sowing machine, a low consumption of only 6 liters per hectare was recorded. In conclusion, 80 liters of fuel were saved in the no-tillage system as compared to the conventional system.

Table 4

Fuel consumption at two technological systems
SC Agrofam Holding, Fetesti, 2005-2008

Conventional system		**No-tillage system**	
Mechanical works performed	Consumption (litres/ha)	Mechanical works performed	Consumption (litres/ha)
1. Autumn ploughing + harrowing	30.0	1. ------------------	—
2. Springtime harrowing	14.0	2. -----------------	—
3. Springtime disking + harrowing	14.0	3. ------------------	—
4. Springtime disking + harrowing	5.0	4. -------------------	—
5. Laboured by combinator	6.0	5. -------------------	—
Mechanical works performed	Consumption litres/ha	Mechanical works performed	Consumption litres/ha
6. Sowed by SPC 8	5.0	6. Sowed by Gaspardo Regina	6.0
7. 1st mechanical hoeing round	4.0	7. -------------------	—
8. 1st manual hoeing round	-	8. -------------------	—
9. 2nd mechanical hoeing round	4.0	9. -------------------	—
10. 2nd manual hoeing round	-	10. -------------------	—
11. 3rd mechanical hoeing round	4.0	11. -------------------	—
12. 3rd manual hoeing round	-	12. -------------------	—
Total consumption	**86.0**	**Total consumption**	**6.0**

The data presented in table 5 and regarding the expenses incurred with the mechanical and manual works in the two technological systems are even more important from an economical point of view. Analyzing the information provided in table 5, we can see that the expenses made for the mechanical and manual works in the conventional system amounted to an aggregate of RON 1,305.00/hectare.

A dramatic diminution of the expenses was achieved in the no-tillage system, where they amounted to a mere RON 50.00/hectare, which is RON 1,255.00 /hectare less as compared to the conventional system.

Table 5

Cost of mechanical and manual works performed at the two technological systems SC Agrofam Holding, Fetesti, 2005-2008

Conventional system		**No-tillage system**	
Mechanical works performed	RON/ha	Mechanical works performed	RON/ha
1. Autumn ploughing + harrowing	250.00	1. ------------------	—
2. Springtime harrowing	30.00	2. -----------------	—
3. Springtime disking + harrowing	60.00	3. ------------------	—
4. Springtime disking + harrowing	60.00	4. -------------------	—
		5. -------------------	—
5. Laboured by combinator	35.00	6. Sowed by Gaspardo Regina	50.00
6. Sowed by SPC 8	48.00		
7. 1st mechanical hoeing round	24.00	7. -------------------	—
8. 1st manual hoeing round	250.00	8. -------------------	—
9. 2nd mechanical hoeing round	24.00	9. -------------------	—
10. 2nd manual hoeing round	250.00	10. -------------------	—
11. 3rd mechanical hoeing round	24.00	11. -------------------	—
12. 3rd manual hoeing round	250.00	12. -------------------	—
Total expenses	**1,305.00**	**Total expenses**	**50.00**

CONCLUSION

1. Compared to the conventional system, in the no-tillage system there is a significant reduction in terms of fuel consumption, 80 liters of Diesel fuel per hectare being saved.
2. Any agricultural company can buy a Regina sowing machine (or almost two sowing machines of the said type) with the money saved by using less fuel if they sow 1,000 hectares of maize and soybean in one single year.

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CENTAUREA CYANUS L. - A WEED WITH MEDICAL FEATURES

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Keywords: *weeds, new concept, herbicides, Centaurea*

Abstract

During 47 years (1960-2007) there were carried out profound and multilateral studies of the weeds in the Republic of Moldova. It was established that there were over 500 species of weeds, 10-20 of which dominated in crops. Their degree of hazard to the agricultural cultures is different. Some species (C. cyanus L.) when spread at a low weeds level, increased the wheat and rye crops. C. cyanus L. is part of genus Centaurea, which includes 550 species, 26 of which are spread on the territory of the Republic of Moldova. Different species of this genus (C. cyanus L., C jacea) are very important for folk medicine while are less important for the scientific one. Generally, the studies carried out in the field of chemistry demonstrated that the therapeutic actions of species were various and very fragmented and further thorough scientific research is necessary. From this point of view, the weeds must not be totally destroyed, but should be maintained at a low level of negative influence over the agricultural cultures (biological threshold of danger), protected and even cultivated for the medical purposes.

INTRODUCTION

The environmental role of the weeds conflicts with the traditional attitudes of the scientists studying herbs. They asess the presence of the *C. cyanus* L. weed and of other dominating species as exclusively negatively affecting the agricultural crops and insist on their complete destruction by means of herbicides [12,13,15].

The new concept (Susu Gh.) provides for an in-depth study of the weeds spieces [6] and of the grade of their aggressivness [9,18] towards the crops, their maintenance (but not the total distruction) at a very low level of the negative impact (biological threshold of danger) [9,19]. In some literature sources it is mentioned that a small amount of *C. cyanus* L. plants in the out of wheat and rye increases the crops. *C. cyanus* L. is a weed with the medical features [3,6]. From this point of view, some of the non-aggressive weed species shall be protected and even cultivated for the medical purpose.

The objectives of the work

- Study of the weed species in the Republic of Moldova during 48 years (1960-2008);
- Study of the species of the *Centaurea* genus of medical importance spread

on the country's territory.

MATERIAL AND METHODS

Identification of the levels of weeds in the crops in the Republic of Moldova was carried out during 1960-2008 in the field crops (SuSu Gh.); while during 1981-1988 weeds' mapping on the entire territory of the country was carried out under methotodological instructions by I. Liberştein and G. Susu. The final results had been systematized by the special electronic programme "Glia" by the programme coordinators from Moscow [12, 15]. All the data obtained experimentally in compliance with the single methodology for all 15 republics of the former USSR had been processed manually and electronically and formed a rich database at the State Agrarian University of Moldova and a branch of TINAO that submitted these results annually to Moscow [12, 15].

The behavior of all weed species in all kinds of crops in the Republic of Moldova had been analyzed in correlation with the temperature and rainfalls in different years, soil texture, soil types, main systems of soil processing, applied systems of herbicides, crop rotation, the management of fertilizers etc. In this way the species that were dominant in crops, the degree of their hazard, possibilities for segetal species' adaptation to the diverse climate and soil conditions etc., had been studied from the agronomic, ecological, economic and energy points of view [6,9,18,19].

The plant species from the *Centaurea* genus have been studied under different aspects: morphologic, area of spread in the Republic of Moldova, and use in medicine.

RESULTS AND DISCUSSION

In the Republic of Moldova have been identified more than 500 weed species [6], in Romania – 711, in Ukraine – 1800 [4]. The weeds represent a great hazard for the agriculture. Because of this in the former USSR the scientific research in the area of herbs study was directed towards their complete destruction from crops by herbicides [12, 15]. Intensification and especially over-chemicalisation of the agriculture resulted in a reduction in numbers of weeds and of the wild birds [10]. A change of the old concept of the total combating of weeds for a new concept of an in-depth study of the relationship between spontaneous and cultivated plants in the Republic of Moldova (Susu Gh. 1991, 1996) for a strict ecological monitoring of the weeds (ecological management) is not possible without a detailed knowledge of the degree of their hazard [6].

The experimental data for the Republic of Moldova for 1960-2008 years, partially summarized by the "Glia" programme in Moscow in 1981-1988, demonstrate that *C. cyanus* L. specie, as a dominant weed had been found only in cereal crops (wheat, rye, barley, oats) and corn for silage. In the autumn wheat and rye crop it became a specialized weed [12, 15].

On the basis of identification of weeds species for each particular crop in 15 republics of the former USSR Isaev V. (1990) had systematized this material of the scientific value for the first time on the most modern for those times electronic machinery and suggested to destroy all the dominant weed species from each particular crop only with herbicides, planning, in this way, a long list of herbicides in maximum dozes [12]. For example, for the complete destruction of *C. cyanus* L. alongside with other 8 species from those dominant in the spring wheat corps had been recommended 14 herbicides in dozes up to 12 kg/ha; in the autumn wheat corps – 11 herbicides in dozes up to 12 kg/ha; for barley – 10 herbicides in dozes up to 6 kg/ha; for rye – 6 herbicides in dozes up to la 4 kg/ha; for oats – 9 herbicides in dozes up to 10 kg/ha; for grain maize – 16 herbicides in dozes up to 10 kg/ha; for corn for silage – 13 herbicides in dozes up to 10 kg/ha [12]. This anti-environment system that had been compulsory in all 15 republics of the former USSR and that led to a complete danger for the human, animal and soil microorganisms health, had been replaced in the Republic of Moldova by a new environmentally balanced system [18, 19]. The experimental data from 1986 demonstrate that in Moldova the wheat fields had not contained much weeds and there was no need to process 97% of crops with herbicides. At the same time, in other republics the level of weeds had been high, while it was suggested to process with herbicides: only 52% in Russia, in Belarus – 56%, and in Ukraine – 58% [12, 15]. This strict and compulsory planning had been imposed by the rapid growth of herbicides production (that had yet a military significance: in the former USSR in 1960 had been produced – 3 thousand tones of herbicides, in 1970 – 47 thousand tones, in 1980 – 113 thousand tones, in 1987 – 155 thousand tones, while in the USA in 1986 272 thousand tones of herbicides had been produced).

The experimental (1960-2008) by Susu Gh. demonstrate that the abusive use of herbicides led to the environment pollution and to a speedy growth of species resistant to these substances. The composition of weeds in the territory of the Republic of Moldova has significantly changed and new species completely resistant to the triazine herbicide group appeared (*Panicum capillari* L.). Some species disappeared. *C. cyanus* L. specie can be rarely found in wheat crops, especially in the dry years, while in those wet it becomes a dominant plant in some crops with the primitive processing. It shall be mentioned that *C. cyanus* L. in 1974-1999 years was the 21st species from those 30 dominating in Ilfov county of Romania, while in 2000-2001 it cannot be found on this list [5]. Currently this plant is not included into the list of dominating in the crops weeds in the Republic of Moldova, but could be found spontaneously throught the whole territory of the country [11].

Up to now more intensively *C. cyanus* L. species is being studies [14], but it is necessary to consolidate the scientific research on other species of this genus. *Centaurea* genus belongs to the *Asteraceae* family, that originates from the temperate regions of Europe, America, North Africa and Asia. It includes more than 550 species of the annual, biannual and perennial plants, spread in Eurasia, Africa, America, Australia (1 specie). In the Republic of Moldova there are identified 26 species [2,7,8,11], from which:

- Spread throughout the country's territory (solitary or in associations), 10 species: *C. solstitialis, C. diffusa, C. orientalis, C. cyanus, C. trinervia, C. stenolepis, C. jacea, C. rhenana, C. besseriana, C. bieberstenii*;
- Spread throughout the country's territory, but rarely met, 8 species: *C. stereophylla, C. scabiosa, C. apiculata, C. pseudophrygia, C. substituta, C. pseudomaculosa, C. arenaria, C. adpressa;*
- Very rarely met, only in some localities, 6 species: *C. adamii, C. iberica, C. trichocephala, C. caprina, C. marschilliana, C. pannonica;*
- On the way to disappear, included into the Red Book of the Republic of Moldova, 2 species: *C. thirkei, C. angelescui.*

Evidence of the medical qualities of yet other species of *Centaurea* genus would speed up not the total destruction, but cultivation of these plants on the large areas. In order to pass to the cultivation of the medical species of this genus it is needed to examine in detail the dependence of the chemical composition of their biology and ecology. It is well known from the specialized literature that all the plants are adaptable to a particular environment that is being characterized by a particular combination of the environmental factors [3, 6, 9]. For example, some species (*C. solstitialis*, *Amaranthus blitoides*, *Aristolochia clematitis*, etc.) have high requirements towards the temperature, while others – lower requirements towards the temperature (*C. cyanus*, *Chenopodium album*, etc.). Perennial hemicryptophyte species *C. spinulosa* have their regeneration gemmas underground close to the surface, perennial geophytes (*Aristolochia clematitis*, *Elymus repens* etc.) have their regeneration gemmas at great depths in the soil, xerophyte plants (*C. solstitialis*, *Amaranthus blitoides*, *Cynodon dactylon* etc.) are adapted to survey through relatively long dry periods [3, 6]. Such plants, as *C. cyanus, Thlaspi arvense* indicate the soil saturated by the nitrogen in medium quantities, while *Chenopodium album, Amaranthus retroflexus* strongly develops only in the over fattened and very rich with the nitrogen soils. It is obvious that the therapeutic action of the same *Centaurea* specie in different climate, soil and agrotehnic conditions will be different. Depending on the locality the content of toxic alkaloids significantly changes: *Hyoscyanus niger* in Moghilev region contains 0,013% of toxic alkaloids, while in Saratov region (dry climate) – 0,173%. *Centaurea repens* (A*croptilon repens*) in the steppe zone of Ural is not a toxic plant for animals, while in swamp zones of Uralului – extremly toxic. *C. cyanus* L. is a Mediterranian and submediterranian plant, while *C. diffusa* – Black Sea - Balkan species [3]. Extension of the weeds areas is being favored by two major factors:

1. the possibility to adapt segetal species to very different soil and climate conditions (the extension is more rapid when the genetic features of the specie allow an easier adaptation to the specific environment factors);
2. commercial exchanges that rapidly extend the area of specie's spread (in case the country quarantine system is weak).

The individual density per an area unit is determined by the optimum temperature and rainfall for each particular specie. Due to this the study of the therapeutic effect shall be carried out in parallel with an in-depth study of the environmental requirements. Weeds with the medical features shall be "healthy", not attacked by diseases and pests, not treated by herbicides and other pesticides, not to be in the Cernobyl affected zone. Only after the implementation of the above listed limitations the spontaneous plants can be used in medicine after a detailed scientific analysis.

The mostly well-known *Centaurea* species that are used for medical purposes are included into the following table:

Table 1

Best-known *Centaurea* species used for medical purposes

Plant name	***C. cyanus***			***C.diffusa***	***C. jacea***		***C. solstitialis***			***C. iberica***	
Parts used / **Therapeutic effects**	**herba**	**folia**	**flores**	**herba, folia**	**radix**	**flores**	**radix**	**flores, folia**	**flores**	**radix, folia, fructus**	**herba**
diuretic	+		+			+				+	
anti-inflammatory	+										
antibacterial	+		+	+				+			+
wound healing activity		+									

Plant name	C. cyanus			C.diffusa	C. jacea		C. solstitialis			C. iberica	
Parts used / Therapeutic effects	herba	folia	flores	herba, folia	radix	flores	radix	flores, folia	flores	radix, folia, fructus	herba
desinfectant			+								
the CNS stimulant			+								
analgesic			+								
laxative			+								
antifungal				+							
antipyretic			+		+		+		+		
GIT diseases	+		+				+				
headache	+		+			+					
liver diseases			+								
kidney diseases			+								

CONCLUSIONS

1. It is necessary to pass from the old concept about the complete destruction of the weeds from crops and other places to the environment management and their maintenance in crops at the biological hazard threshold. This will lead to the systematic monitoring and management of the relations between weeds and cultivated plants that will allow preserving their genetic wealth for the future generations.
2. An in-depth and multi-aspect study of the *Centaurea* genus will allow using the therapeutic features of the weeds in the Republic of Moldova in the traditional medicine. The import of these weeds' species from other countries will lead to the cases of intoxication or absence of the curative

effect due to the ecology of the weeds.

3. A future mapping of the territory of the Republic of Moldova with the objective to identify the most important weeds with the medical features will allow the State to assume a strict control over harvesting of these species by random people. In this way it will be possible to make of the transfer to population from the chemical very toxic medicine to biological medicine.

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PHYTOCHEMICAL STUDY OF *CENTAUREA CYANUS* L.

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Keywords: *Centaurea cyanus L., phenolic compounds, quantitative and qualitative determination*

Abstarct

In this work it was proposed to undertake the study of phenolic compounds present not only in the species of Centaurea cyanus L. with blue flowers (which are used in medicine), but also with the flowers of other colors (red, pink), which are not valued until now. By qualitative determination, using chemical reaction and chromatography, some groups of phenolic compounds were established: phenilpropanic substances, flavonoids, anthocyanins and tannins. The total of phenilpropanic compounds, flavonoids and anthocyanins was determined spectrophotometrically, the total of tannins – using titration. These analysis have clarified the differences between the concentration of active principles in the blue flowers and those of another color. It was determined that anthocyanins, the main metabolites that confer a C. cyanus L. its pharmacological effects - diuretics, antiinflamateur, healing and so on, are more concentrated in red inflorescences (4-5 times more anthocyanins then in blue inflorescences). Other phenolic compounds also have a higher amount in the red flowers then in the blue.

INTRODUCTION

Centaurea cyanus L. (cornflower) is one of the species of *Asteraceae* that has not been the subject of many investigations. It is an annual plant, growing to a height of 1-1.5 m, with strong stems and grayish slightly furry leaves, with small clusters of bright blue flowers [5]. Cornflower is native to Europe, where it is a weed in fields. It is considered to be a good companion, in small quantities, for cereal crops, though another report says that its greedy roots deprive the cultivated plants of nutrients and its tough stem dulls the reaper's sickle. However, it is also used as an ornamental plant because of its intense blue flowers, which are often used in dried-flower arrangements because they retain their color well [2]. Cornflower has a long history of herbal use, though it is seldom employed nowadays. Externally it is used as an anti-inflammatory and astringent herb for eye ailments and skin cleansing. An eye wash made with cornflower blossoms is used for conjunctivitis as well as to relieve strained, tired or puffy eyes. Blue blossoms infused in water have both curative and calming action for nervous disorders. Eye wash is reputed to strengthen weak eyes. Traditionally it is said to work best on blue eyes. The dried flowers are antipruritic, antitussive, astringent, weakly diuretic, emmenagogue, ophthalmic, very mildly purgative, and tonic. An infusion can be used in the treatment of dropsy, constipation, or as a mouthwash for ulcers and bleeding gums. This infusion is also taken as a bitter tonic and stimulant, improving the digestion and possibly supporting the liver as well as improving resistance to infections. Water distilled from the marginal flowers was formerly in repute as a remedy for weak eyes and a soothing lotion for conjunctivitis. The seeds are used as a mild laxative for children. Cornflower leaves are used to create a cleansing facial steam for dry sensitive skin. A decoction of the leaves is antirheumatic. These effects are determined by the presence of the phenolic compounds (flavonoids, tannins, caffeic and chlorogenic acids), which are very poorly studied in *C. cyanus* L. [9].

Phenolic compounds are ubiquitous constituents of higher plants found in a wide range of commonly consumed plant foods such as fruits, vegetables, cereals and legumes. They are diverse in structure but are characterized by hydroxylated aromatic rings. These compounds are secondary metabolites of plants generally involved in defense against ultraviolet radiation or aggression by pathogens. They have been the subject of a great number of chemical, biological, agricultural and medical studies. Plant phenolics have received considerable attention because of their potential antioxidant activity as well as hepatoprotective, hypoglycemic and antiviral activities. Human consumption of antioxidants has many alleged health benefits, including protection against cardiovascular diseases, and, most recently, cancer [1, 4]. Therefore the studies of the plants, which are sources of phenolic compounds represent a great actuality.

MATERIAL AND METHODS

Plant materials (aerial parts, inflorescences, marginal and disc flowers) were collected during the flowering period from the South of Basarabia in June, 2008. After powdering, these materials have been exposed to physico-chemical analysis.

The phenilpropanic compounds were identified by thin-layer chromatography [7]. 1 g of plant material was extracted by refluxing with 10 ml methanol and concentrated to 4 ml. Operating conditions were as follows:

- mobile phase: ethyl acetate–acetic acid–formic acid–water (100:11:11:26);
- stationary phase: silica gel plate;
- etalon solutions: caffeic and chlorogenic acids;
- identification in visible and UV specter.

The total of the phenilpropanic compounds in blue and purple inflorescences, in aerial parts with blue an purple inflorescences of *C. cyanus* L., was determined using spectrophotometric analysis, at 500 nm wavelength (caffeic acid as reference substance) [7]: 4.0000 g powdered plant material with 80 ml ethylic alcohol 50% is put in a bottle, weighted and extracted in reflux during 30 min. After cooling, the bottle is restored to the initial weight with ethylic alcohol 50% and filtrated (solution A). 5 ml of solution A is diluted in a 50 ml marked bottle with ethanol 50%. To 1 ml of this solution are added: 1 ml chlorhydric acid 0.5 n, 1 ml Arnow reactive, 1 ml NaOH 1 n and it's filled with water till the 10 ml mark in a marked bottle (resulting a red solution). After 10 min the absorbance is determined in comparison with the following solution: 0.5 ml solution A, 1 ml HCl 0.5 n, 1 ml NaOH 1 n and water till 10 ml mark.

For the quantitative determination of tannins (in aerial parts and blue inflorescences), was employed the titrimetric method [3], based on its oxidation with potassium permanganate: 2 g of plant materials with 50 ml boiling water are warmed up. After 30 min the solution is filtrated in a bottle with 250 ml volume. The extraction is repeated until tannins reaction (with ferric alum) is negative. The bottle containing the cold solution is filled with water to the marked level (250 ml) and is transferred in a 1 l bottle, 750 ml water and 25 ml acid indigosulphonic solution are added. Then it is titrated with potassium permanganate 0.1 n until the solution becomes yellow. Similarly the control probe (25 ml indigosulphonic acid in 750 ml water) is titrated. The total quantity of tannins is calculated using the formula:

$$x = \frac{(V_1 - V_2)K \cdot D \cdot V \cdot 100 \cdot 100}{mV_3(100 - \omega)}$$

V_1 – used volume of potassium permanganate 0.1 n, ml; V_2 – used volume of potassium permanganate 0.1 n for the titration of the control probe, ml; K – the correction to the titer (via oxalic acid); D – the coefficient of tannin; V – the total volume of the extract, ml; m – the exact mass of plant material, g; V_3 – volume of extract used for titration, ml.

RESULTS AND DISCUSSION

By qualitative determination, using chemical reaction and chromatography, some groups of phenolic compounds were established: phenilpropanic substances [7], flavonoids [6, 10], anthocyanins [6, 8] and tannins [3] (reaction with ferric alum proves that tannins are condensated). The caffeic and chlorogenic acids were determined qualitatively in blue and purple inflorescences, in aerial parts with blue an purple inflorescences of *C. cyanus* L., using thin–layer chromatography.

The results of quantitative analysis, obtained in our actual and previous studies [6], are listed in table 1.

In the scientific medicine only the blue flowers of *C. cyanus* L., but not others exemplars (with purple, pink or white inflorescences), are employed. Strikingly, these exemplars generally are ignored and not studied, their unique utilization is as ornamental plants. According to our investigations in the purple flowers the content of active agents is higher than their level in the blue flowers (table 1). In this case the obtained pharmaceutical products from purple flowers of *C. cyanus* L. can be more economically (efficiently). Sure is the fact that additional studies are needed.

Table 1

Results of quantitative analysis

Plant material		**Anthocyanin (%)**	**Phenilpropanic compounds (%)**	**Tannins (%)**	**Flavonoids (%)**
Inflorescences	purple	1.3574	0.360		0.206
	blue	0.2418	0.150	0.291	0.193
	pink	0.0700			0.218
Disc flowers	purple	2.2534			0.212
	blue	0.4916			0.175
	pink	0.1909			0.193
Marginal flowers	purple	3.6313			0.218
	blue	0.6716			0.112
	pink	0.2330			
Aerial parts	purple		0.240		0.262
	blue		0.313	4.656	0.218
radix					0.093
fruits					0.112

CONCLUSIONS

Our investigations prove that:

1. A great importance in the content of active principles makes the colour of the flowers:
   - the highest concentration of flavonoids are determined in purple flowers (0.21 – 0.22%), next – pink flowers (0.19%) and the lowest – in blue flowers (actually used in medicine); in pink – 0.22%, purple – 0.2% and blue inflorescences – 0.17%;
   - anthocyanins highest concentration is in purple (1.36 – 3.63%), in blue – (0.24 – 0.67%) and in pink flowers and inflorescences – (0.07 – 0.23%);
   - in purple inflorescences the concentration of phenilpropanic compounds is higher (0.36%) than in blue inflorescences (0.15%), but in aerial parts with purple inflorescences is lowest (0.24%) than in aerial parts with blue inflorescences (0.31%).

2. Also has an importance the part of the plant:
   - the total of flavonoids in aerial parts is the highest (0.22 – 0.26%), followed by inflorescences (0.19 – 0.21%), marginal and disc flowers (0.11 – 0.22% and 0.17 – 0.21% respectively), fruits (0.11%) and radix (0.09%);
   - the total of tannins in aerial parts from the exemplars with blue inflorescences is higher than only in inflorescences (4.656% and 0.291% respectively).

These results stimulate us to continue our investigations, to make better the elaborating and standardization of new pharmaceutical products.

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THE MANAGEMENT OF SOIL QUALITY IN AGRICULTURAL EXPLOITATIONS FROM THE SOUTHERN PART OF DOLJ DISTRICT

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Keywords: *management, indicators, structure, erosion, retention of nutrients*

Abstract

The paper was realised having as departure point the map of soils from the South of Oltenia, processed with the aid of SIG. The South area of district Dolj, though its geographical position it is situated under the influence of an excessive natural ground with annual average temperatures that are high enough, average annual precipitation of 400-500 mm and the value of the small aridity index is considered to be one of the most predisposed areas at the process of soil degradation due to phenomena of drought – aridity – desert. Work of improvement and preservation of the soils must be advisable realised.

INTRODUCTION

The management of soil quality refers to the selection of the adequate agricultural practices, correspondent to the modality of usage the agricultural field, depending on soil types for the territory of each agricultural exploitation. The evaluation of the management of the soil quality represents the process of measuring the changes that took place in the quality of the soil, as a result of the agricultural practices adopted for the improvement of the economical performances obtained for the same field surface.

For the identification of the properties or the key attributes of soil, sensible to exchange the function of the soil will be recommended the research of a minimum set of indicators, of primordial interest for the farmer.

Indicators selected for evaluation of the management of soil quality must show which are the present performances of the soil and how can be preserved and improved their functions for future usage. The selected indicators can refer to physical, chemical, biological characteristics or at processes that took place at the level of the soil. In table 1 is presented a set of indicators regarding the main characteristics of the health status of the soil.

Table 1

Indicators of the soil quality

Indicator	Relationship with the main characteristics of the soil status health
Organic mater from the soil	Fertilization of the soil, structure, erosion, retention of nutrients.
Physical: structure of the soil, capacity of infiltration of the water, capacity of durable maintenance of the water, apparent density.	Retention and transportation of the soil and the nutrients; compaction degree, porosity, hob of the plough, depth at which can be plough
Chemical: pH, electrical conductance, supply with nutrient elements.	Available level of fertility, degrees regarding the requirements of the main cultures regarding the reaction of the soil, threshold of biological and chemical activity.
Biological: High degree of ensuring with N, the degree of the soil.	Measuring the microbiological activities, productivity of the soil and the degree of satisfaction with N.

Processing according to Larson and Pierce, 1994 and Seybold 1994

MATERIAL AND METHODS

The paper was realised having as departure point the map of soils from the South Oltenia, processed with the aid of SIG.

Fig. 1. Aspects on the sandy soils (ploughing in autumn) on the South zone in Dolj County

The drought is a natural phenomenon that in the past affected periodically the S-W and S-E of Romania, being able to mention the period of severe drought: 1894-1905; 1942-1945; and the most recent 1981-2001. The South area of district Dolj is not an exception regarding these drought phenomena. Though its geographical position it is situated under the influence of an excessive natural ground with annual average temperatures that are high enough, average annual precipitation of 400-500 mm and the value of the small aridity index is considered to be one of the most predisposed areas at the process of soil degradation due to drought phenomenon of drought – aridity – desert.

Fig. 2. The distortion of sandy soils under the tractors wheel action

The process of degradation of the soil, due to this phenomenon is defined as the actual or potential loss of productivity or the utility of the soil of the natural and atrophic factors.

Fig. 3. The affectation of strawberry crop, in winter because of the wind and frost

The main processes that can aid the development of the phenomenon of degradation – desert can be identified in:

- biological degradation through the loss of organic substance;

Fig. 4. The effect on using mulch in the folio and the wind on the sandy soils

- physical degradation due to structure

Fig. 5. Rests of folio on the surface of pouching soil

The degradation of the soil through the reduction of the content of organic substance has as main factors that can be identified: excessive use of the agricultural works or of others measures of agro-techniques measures, accelerated erosion of the soil, due to long periods of activity of the wind in this area, excessive and inadequate application of other measures of agro techniques, the accelerated erosion of the soil due to long periods of activity of the wind in this area, excessive and inadequate application of chemical fertilisers, herbicides and insecticides.

The massive content of organic matter can be associated with the intensive usage of the tillage, of leaving the uncultivated field during summer time, burning the stubble filed, etc. The influence of the texture on the processed of soil degradation is presented through at least 2 reasons:

- the size and the modalities of disposure of the soil particles that at vulnerable at the action of the wind and water;

Fig. 6. The action of spring wind on the sandy soils

- the modification of the potential of retention of the water, making possible surface drainages.

The main factors that are responsible for the degradation of the sandy soils from the South of Oltenia, can be considered:

- the uncontrolled and excessive tillage;

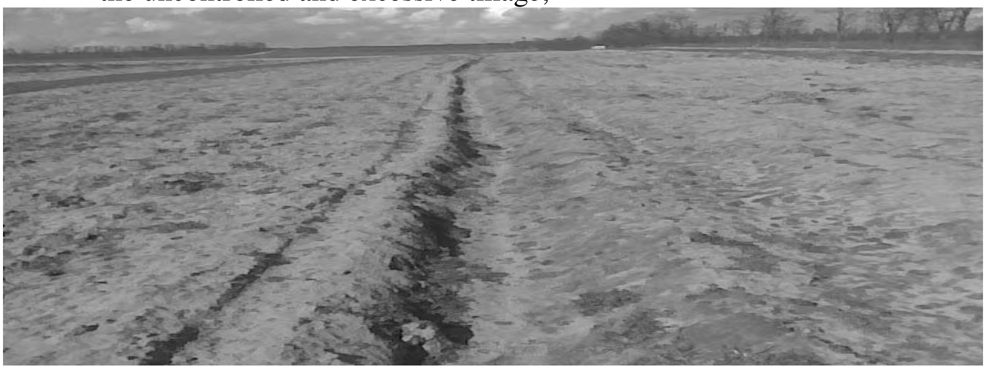

Fig. 7. Aspects of vegetation, on the spring, on the soil pouching in autumn

- using on a large scale of the breeding cultures that involve a high degree of mechanization of the culture technology;
- eolian deflation;
- soil contamination by excessive usage of the chemical fertilizers.

In the same time, the soil represents the main source of herbs in the cultures, due to the reserve of herbs seeds from the soil, reserve that can be used for the realization of the green areas, of protection of the cultures through eolian deflation, by application of some specific technologies in that area and leaving some unprocessed surfaces in which high herbs will be developed up to the blossom period, when will be destroyed.

Fig. 8. Foundation of protection bands trip, in the autumn, with sowing

The determination of the total reserve of seeds of grass in the soil on the layer of 0-10 cm, was realized taking into account the application of the basic works of the soil in the classical system and in the minimal system of works. The results obtained after the determination realized show that the reserve of seeds of grass from the soil is influenced by the system of applied works.

CONCLUSIONS

1. Work of improvement and preservation of the soils must be advisable realised.
2. It is imposed that a part of these fields, with reduced fertility capacity be passed in the forester filed and to facilitate the foundation of protection curtains.
3. From the agro technical point of view, grasses that will be developed on these soils can be used for the foundation of green areas for the protection of the cultures.
4. The results of the researches offer a support for the possibility of promotion of new - village technology, with an efficient management.

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DETERMINATION OF DISTRIBUTION UNIFORMITY FOR EEP-600 SPRAYER EQUIPED WITH IDK 120-02 NOZZLE

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Keywords: *distribution uniformity, EU norms, test equipments, sprayers*

Abstract

Nowadays, when Romania is a full member of the European Community, it is necessary to implement a system for testing and diagnose the spraying machines. In order to do this, there are special equipments that can tell to operator what is fault in a spraying machine. The parameters that the test stand can measure are: distribution uniformity which is tested for the whole width of the machine; the nozzle flow and all the correlations between the nozzles; the pump nominal pressure and flow. Using this state of the art equipment was possible to study the uniformity distribution for EEP-600 mounted sprayer, equipped with IDK 120-02 nozzle, for different working pressures and boom heights.

INTRODUCTION

The sustainable agriculture concept, in which the main condition represents the resource optimum management, promotes the rational use of agrochemicals in order to reduce the environmental impact together with optimum crop production. The analysis of different crop technologies shows that chemical method for pest and weed control is the most used because of its efficiency, but with a high environmental impact.

The use of systemic herbicides with low product residues in crop is a step forward to environment protection. The optimum treatment is obtained only if is assured a good distribution uniformity of agrochemicals, applied in the right moment depending on specific conditions and by using the minimum needed quantities.

The tools for herbicides application must realize good distribution uniformity on the boom working width, to obtain the droplet optimum dimensions for a better adhesion to plants and to reduce the liquid volume used on surface unit.

The herbicide application efficiency is influenced mainly by distribution uniformity on the working width of the sprayer. Following this we considered that it is important to analyze the main factors that have influence on distribution uniformity on the working width of the sprayer by using a certain nozzle type. The main variable factors that were considered for determination of distribution uniformity are:

- working pressure;
- boom height measured from target surface.

MATERIAL AND METHODS

For experiments was used a state of the art equipment, namely HERBST TEST 1000, which is developed for determination of distribution uniformity for spraying machines and it needs a PC with installed OWFB 1.0 software.

This testing equipment has the following main parts: movement frame (aluminum rails), mobile measuring system with ten glasses, a sloped platform for substance, a wireless system for PC real time communication, a plastic collector.

The main parts of HERBST TEST 1000 equipment are showed in figure 1.

Fig. 1. The main parts of HERBST TEST 1000 equipment
1-movement frame; 2-mobile measuring system; 3-sloped platform for substance; 4-measuring glasses; 5-wireless communication system

Fig. 2. The plastic collector (1) and the movement frame (2)

The main principle of HERBST TEST 1000 testing equipments is based on collection of test solution for each meter from the working width of the machine. This is made by the mobile measuring system, which starts to move from a chosen reference point with one meter at a time, until it reaches the chosen limit point depending on the working width of the sprayer.

After a complete measure, on the working width of the sprayer, the mobile measuring system returns automatically to the reference point.

The liquid is collected in glasses that have ultrasonic sensors used for liquid level measure. This value is then converted by the provided software (OWFB) in volume units. The measured data is sent via wireless communication system to a PC, which calculated the data needed for further analysis.

For the experiments, in laboratory conditions, we used the EEP-600 mounted sprayer equipped with IDK 120-02 nozzle type. Also, we adjusted the liquid pressure at 2 bar, 3.5 bar and 5 bar. The working height of the boom was adjusted at 30 cm, 50 cm and 70 cm.

The evaluation of distribution uniformity on the working width of the sprayer from statistical point of view is made by using the variation coefficient vk:

$$vk = \frac{S}{x} \cdot 100$$

where: S is standard deviation;

x – medium liquid volume in glass cylinders.

If variation coefficient vk is less than 7% the distribution uniformity is good, if it’s between 7-9% the distribution uniformity is acceptable and if it’s higher than 10% is not acceptable.

RESULTS AND DISCUSSION

First we consider the case in which the boom height is 30 cm and the three values for liquid pressure: 2 bar, 3.5 bar and 5 bar.

The results are shown in the graphs from figures 1, 2 and 3, in which is showed the distribution uniformity on the working width of the EEP-600 sprayer and also the variation coefficient for each situation (see statistic data, with symbol vk).

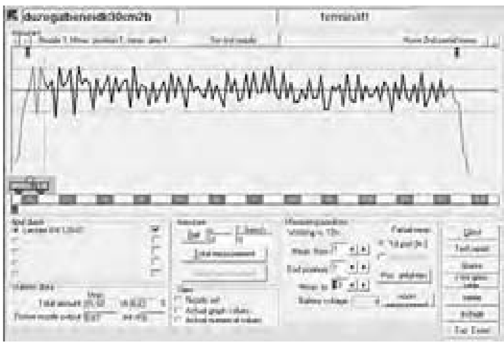

Fig. 1. The distribution uniformity graph for boom height by 30 cm and liquid pressure by 2 bar

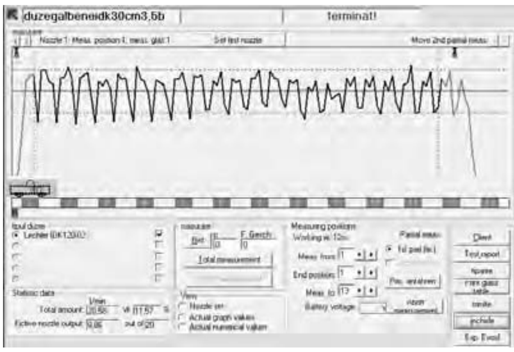

Fig. 2. The distribution uniformity graph for boom height by 30 cm and liquid pressure by 3,5 bar

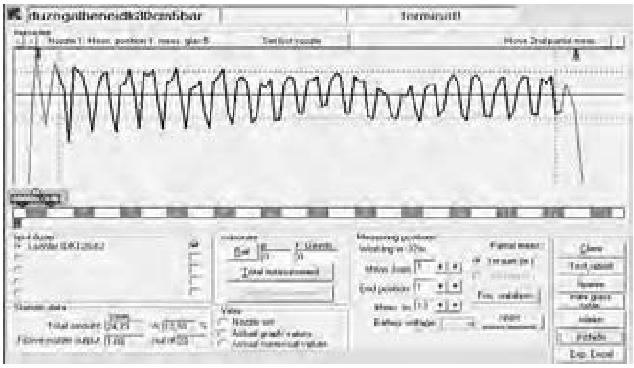

Fig. 3. The distribution uniformity graph for boom height by 30 cm and liquid pressure by 5 bar

From the showed graphs (figure1, figure 2 and figure 3) we can see that at a boom working height by 30 cm the optimum liquid pressure is 2 bar, case in which the variation coefficient for distribution uniformity is 8.62% (should be between 7-9%), which is acceptable for herbicide applications.

The second case that we consider is for the boom height by 50 cm for liquid pressure by 2 bar, 3.5 bar and 5 bar.

The results are shown in the graphs from figures 4, 5 and 6, in which is showed the distribution uniformity on the working width of the EEP-600 sprayer and also the variation coefficient for each situation (see statistic data, with symbol vk).

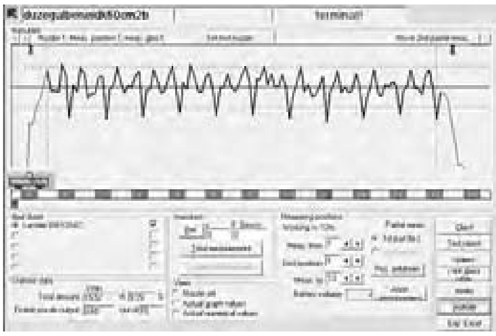

Fig. 4. The distribution uniformity graph for boom height by 50 cm and liquid pressure by 2 bar

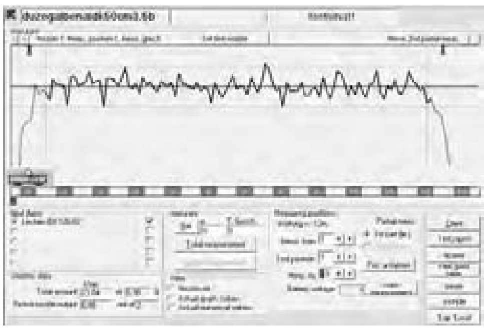

Fig. 5. The distribution uniformity graph for boom height by 50 cm and liquid pressure by 3,5 bar

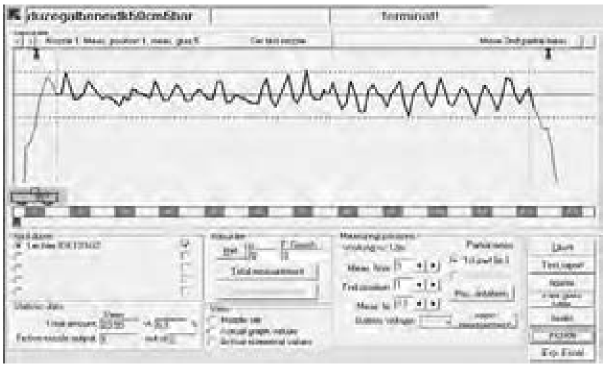

Fig. 6. The distribution uniformity graph for boom height by 50 cm and liquid pressure by 5 bar

From the showed graphs (figure 4, figure 5 and figure 6) we can see that at a boom working height by 50 cm the optimum liquid pressures are 3,5 bar and 5 bar, cases in which the variation coefficients for distribution uniformity are 5.95% and respectively 6.1%, situations in which the uniformity is very good, suitable for herbicide applications.
The third case that we consider is for the boom height by 70 cm for liquid pressure by 2 bar, 3.5 bar and 5 bar.

The results are shown in the graphs from figures 7, 8 and 9, in which is showed the distribution uniformity on the working width of the EEP-600 sprayer and also the variation coefficient for each situation (see statistic data, with symbol vk).

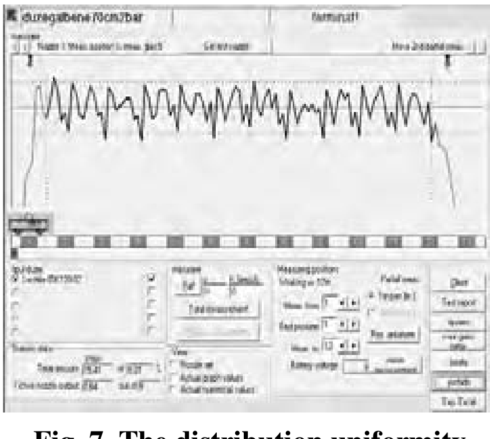

Fig. 7. The distribution uniformity graph for boom height by 70 cm and liquid pressure by 2 bar

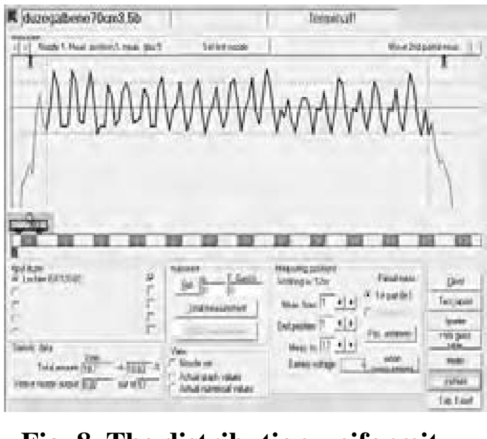

Fig. 8. The distribution uniformity graph for boom height by 70 cm and liquid pressure by 3,5 bar

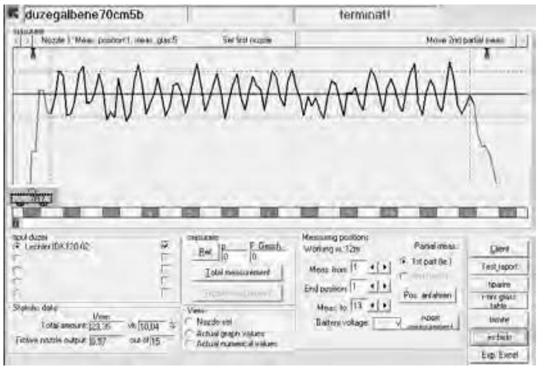

Fig. 9. The distribution uniformity graph for boom height by 70 cm and liquid pressure by 5 bar

From the showed graphs (figure 7, 8 and 9) we can see that at a boom working height by 70 cm the variation coefficients for distribution uniformity are higher than 9%, for each chosen liquid pressure, so this is a situation not suitable for herbicide applications.

CONCLUSIONS

1. From the analysis of data charts for distribution uniformity we can see that for a certain type of nozzle the distribution uniformity on the working width of the sprayer is influenced by the working pressure and by the boom working height (or boom distance regarded to target surface).
2. From the measured data we can conclude that for IDK 120-02 nozzle type, in order to get a good distribution uniformity it is necessary to adjust the boom height to 50 cm and liquid pressure by 3.5 bar and 5 bar, when the variation coefficient is 5.95 and respectively 6.1. For the boom working height by 30 cm and liquid pressure by 2 bar the distribution uniformity is acceptable, but in the other studied situations the distribution uniformity exceeds the required limits.

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RESULTS OF WORLDWIDE RESEARCH REGARDING MACHINES FOR SPRAYING HERBICIDES ON FIELD CROPS

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Keywords: *spraying heads, stirring system, oscillating system*

Abstract

Worldwide research lead to the conclusion that constant development is brought upon devices that are under construction or those from past generations, based on the idea of equipping them with parts which would ensure modern work technologies to be used, with less costs and lower aquisition prices, that would surely make them more attractive on the market.

The biological efficency is being ensured by introducing in the constituency of these devices of some elements that would provide the restriction of required doses of product per square meter, and the evenly spreading of this maintaining the initial concentration of the solution.

INTRODUCTION

In this paper result of some research, conducted by several companies, referring to the necessity of preservind the dose of product per square meter, to the influence of the uniformity of spraying over a required surface, to the shapes of the spraying nozzles and to the efficacity of the stirring system over these devices are presented.

RESULTS AND DISCUSSION

Important research concerning the devices and machines for spreading herbicides for a treatment with a variation coefficient (CV) of uniformity the lesser possible (6-9%) are developed. Subsequently, mechanical systems of assembling the spraying ramp on the machines used in this process are under study. The maintaining of the spraying ramps in a stable position, paralel with the surface of the ground, requires a shifting system, of different constructive forms, mounted on the machines for them. Along with the possibility of a paralel positioning, with the surface of the ground, of the spraying ramps, there is also the „geo-variabil" positioning. This constructive solution allows an independent adjustment of each side of the ramp, considering the ground.

In this way a better record of ground's indentations are taken into account, as it is the case with the works on hills and narrow valleys.

Another important problem, that effects the uniformity of the spreading of the solutions, is the necessary width of the machine used for spraying. Research have lead to the construction of foam marking devices. These devices includ a part for the producing of the foam, a tank for the depositing of the foaming solution and an electric group, compressor-engine, having the task of transporting the solution through some tubes to the foam launcher that are mounted at the ends of the ramp. The foam launchers produce the foam and spray it in points with the diameter 10-15 cm, at 1.2-2 m distance. While working the machine follows with one extremity of the ramps the foam points launched by the previous transport and the other extremity of the ramp launches other foam points.

The uniformity of the distribution of the solution on the treated surface is also controlled through some hydraulic circuits mounted on the spraying ramps. The assembly of these circuits can be with: classical circuit, simple solution circuit or double circuit. With the classical system the loss of pressure through the working circuit is uncontrolable which leads to variations of the flow capacity through the hoses, influencing directly the distribution of the solution. The double circuit has the advantage of diminishing the pressure loss, because the control over the working pressure is done at the returning of the solution into the tank, by calibrated capsules.

Considering the nature of the treatment and the weather conditions, spraying heads with nozzles with uncontrolled drifting, nozzles with limited drifting hoses with air injection and tangent nozzles with constant turbion chamber with a system of spraying with air input (Hardi-Twin system) are mounted. Analizing their construction here are some conclusions:

- spraying heads with nozzles with uncontrolled drifting are the classical type, to which the flow of liquid is controlled at lenticular orifice, and the size of the drops from the spraying cover a large range; the drops with the diameters within 100-150 μm are 30-40%, which results in their total movement, with the air currents, which appear during the treatment, and at the movement of the spraying machine;
- spraying heads with nozzles for limited drifting, have the control of the flow of liquid through the calibrated capsules;
- at the spraying heads with air injection, after the calibrated cylindrical orifice which limits the flow of solution, one or two orifices are drilled, through which air enters inside the spraying head; by the velocity of the flow of slolution through the calibrated orifice, the air is also moved inside and transported through the depressure zone into the mixing chamber where an emulsion forms, by combining the solution with air; through the nozzle an emulsion formed of drops containing air is sprayed, and so the size of these drops grows artificially and it becomes more difficult from them to be shifted away by the air currents; the air-containing drops, sprayed outside, at the impact with the targets explode and, as a result, cover a larger surface.

At the hydraulic spraying system with spraying heads with tangent nozzles and constant turbion chamber, with air imput (Hardi Twin), the spraying ramp is equipped with a hydraulic circuit with nozzles with turbion chamber, with constant volume and air circuit, given by an axial ventilator, through some barrels of air, all along the ramp; the tangent nozzles assembled at 25 cm, and the orifices for air distribution from the air barrels have 15-20 mm and drilled at a distance of 25 cm; the moving direction of the machine is with the hydraulic spraying in front of the barrels; the angle of protrusion of the drops flow in the air current can be changed; in the space between the two flows (air and liquid) a depressure is created, which produces a movement of the drops into the air current, this one stirrs the plants and allows the entering of the drops up to the base of these; the air current has also the role of reducing the drifting phenomenon by limiting the drops'movements.

In order to simplify the preparing of liquid herbicides, the machines, from all over the world, have been equipped with several working systems which allow this preparation and the filling up of the solution tank, in a time frame and at a presettled concentration.

At all the herbicide spraying machines worldwide, the solution preparing systems are includent in their construction, permanently assembled there or detachable.

The detachable systems are mainly used at towed machines in order to reduce their constructive mass.

The use of homogeneous solutions, for herbicide treatment have a negative influence over the efficacity of the work. Regardless of the conditioning method of the herbicides, there is always necessary to maintain them in a permanent state of stirring, by using high quality stirring systems mounted on the spraying machines.

The type of hydraulic stirring depends upon the solution's pressure, from the hydraulic system of the machine, and of the capacity of the solution tanks. The most recent spraying machines for field crops use ejector type stirring systems. This system is formed of one or more ejecting bodies. On the machine, one to eight ejectors can be mounted, directly fed with solution from the solution pump. They can be stuck to the tank walls, as in figure 1, or inside this, connected through a tube. The ejector's head diameter can range between one to three mm, considering the tank's capacity and the available flow from the stirring pump.

To enhance the efficacity of the stirring system with ejector, a contribution is due to the overflow that passes through the distribution body, at low pressure, and that ends, again in the tank.

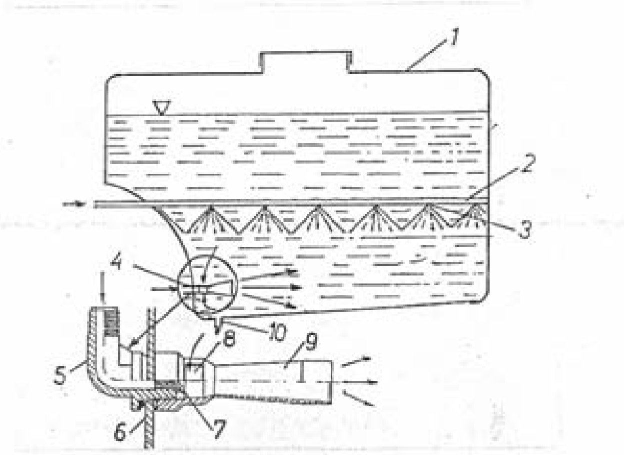

Fig. 1. Combined stirring system with only one ejector
1-solution tank; 2-fitting pipe for overflow from the safety valve; 3-calibrated orifices; 4-the positioning of the ejector inside the tank; 5-fitting for the hose; 6-tank wall; 7-nozzle; 8-orifices for tank solution entrance; 9-Venturi tube; 10-fitting pipe for pump admission

The efficacity of the stirring system, used in the construction of the spraying machines, is experimentely calculated by the BBA (German Federal Office of Plant Protection), and use a suspension oxiclorine of copper. For a high quality stirring system, the variation of the concentration in the tank must not be higher than ±5% from the preparing concentration.

An important issue for the quality assurance, in the process of herbicide spraying for the field crops, is the deciding of the spraying ramps mounting during the works of spraying. The uniformity of treatment at maximum values, is achieved by maintaining the spraying ramp, during spraying, at an equal distance from ground, or within admissable limits. Agrotechnical requirements settled that, at the end of the ramp, oscilation must be higher than ±10 cm from the initial position.

Different constructive solutions, regarding the articulated assembly of the spraying ramps, on the machines, are being developed worldwide.

Hardi company assembles, at the towed machine for herbicide spraying on the field crops, pendulating systems of different constructive options.

Figure 2 A presents a system with two oscilating points for a simple parallelogram, while in figure 3 B there is a more complex system.

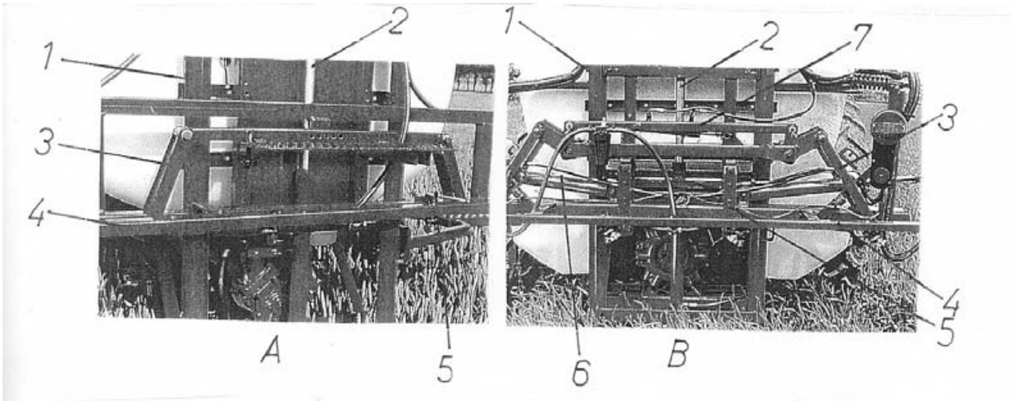

Fig. 2. Oscillating system mounted on HARDI-MASTER machines A-with two oscillating points; B-with double connecting rods and a square beam assembled articulated for stability reasons 1-steady frame; 2-hydraulic cylinder; 3-biels; 4-prop for the spraying ramps; 5-guildings; 6-hydraulic cylinder for the folding of the ramps; 7-hydraulic cylinder for directing the ramps according to the gradient of the slope

Kuhn company assembled the spraying ramps on the machine frame by two oscillating systems. A simple one, with two articulated connecting rods for working width up to 16 m and for width up to 21 m for the three dimensional ramps a pneumatic suspension is used, a variable parallelogram and a shock damper. The pneumatic damper system reduces the shocks which the machine transmits during working, due to ground uneveness, to the spraying ramps.

The Jacoby-Eurotrain uses for the two types of machines for the mounting of the spraying ramps, an oscillating system. The adjusting of the working height is done by use of a hydraulic cylinder and a pulley. The folding of the ramps is done hydraulicly.

Hardi produces towed machines for herbicide spraying in field crops using a new technique with hydraulic spraying with air input.

CONCLUSIONS

The air input spraying system, used with this machine, showed some advantages:

- it can be used successfully for treatments on medium height crops;
- increases the uniformity of the distribution of drops on plants, by the protrusion of the drops flow down to the bottom of the plants, due to the their stirring using air current;
- decreses the drops drifting through a protective air curtain;
- allows the speeding of the machine's movement while spraying.

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INTERMITTENT VIBRATION EFFECT IN THE SEPARATION WITH SIFTING OF MIX POLIDISPERSE SYSTEMS USED IN FOOD INDUSTRY AND ANIMAL SCIENCE

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Keywords: *processing raw materials, separation process, sieving machine, test sieve disk*

Abstract

In frequent technological processes of food industry or animal science, the use of classification, gradation, calibration or sifting operation becomes a necessity. Sifting is a mechanical operation realized through separation in granulometric factions of some polidisperse mixtures of granules and powder on the basis of particle shape and size. Sifting can be achieved as a stand-alone operation or as a preliminary operation for the preparation of raw materials for further processing operations. Sift method consists in locating the plates one in extension of another, the later having the dimensions of the orifices of the sieves arranged in ascending order. This method presents the advantage of using a small space from the sieving machine, a slight supervision and a good accessibility to perform proper maintenance operations. The vibration motion used in the separation operation can be an advantage only for some raw materials, while for the others it can be a disadvantage because of the congestion particle phenomenon on the plate surface.

INTRODUCTION

Much of the raw materials used in different branches of food industries (cereal crops, vegetables, fruits) and intermediate products or finished goods are solid-solid mix heterogeneous polidisperse systems [1, 3].

In many technological processes it becomes necessary to introduce classification, gradation, calibration or sieving operations.

Classification is the separation process of solid-solid mix heterogeneous polidisperse systems that belong to the same categories of material in granulometric factions or classes after certain criteria.

Factions (class material) used in gradation operations are differentiated in terms of granulometric point of view. In terms of physical principle applied, classification can be realized mechanical, pneumatic or hydraulic [1, 3].

Gradation is the operation of heterogeneous particle separation from mixed solid-solid components based on their belonging to a certain category of material (sorting by components).

Separation after the nature of the components can be done on the basis of differences between the physical or chemical constants values (density, color, magnetic susceptibility, solubility etc).

In terms of principle applied, gradation can be realized on the basis of shape differences of the particles (also called sorting), based on different magnetic susceptibility (also called magnetic separation) and based on color (called color sorting).

Calibration is the process of separation by size of various raw materials. It applies both to sort vegetables and fruits and seeds for various agricultural crops.

Sieving (sifting) is a mechanical operation realized through separation in granulometric factions of some polidisperse mixtures of granules and powder on the basis of particle shape and size. Separation is achieved through area separation in shape of metallic fabrics.

Within the technological processes of food industry, sifting can be achieved as a stand-alone operation or as a preliminary operation for the preparation of raw materials for further processing operations [2].

Depending on the purpose, the devices for the sifting operation are called: grates, sieves or plates. During sieving operation, the polidisperse granular mixture is divided into two granulometric categories: sieve residue or superior current and sift or inferior current [3, 4].

Sieving operation can be achieved by two methods: sift method and residue method.

Sift method consists in locating the plates one in extension of another, the later having the dimensions of the orifices of the sieves arranged in ascending order. In this way, every sieve plate receives the residue of previous plate and finally are achieved many sifts and one residue. This method presents the advantage of using a small space from the sieving machine, a slight supervision and a good accessibility to perform proper maintenance operations [3, 4].

The residue method consists in the overlapped location of the plates, one above the other, sieves being arranged in descending order of the sizes of the orifices of the sieves. In this way finally are obtained more residues and one sift. The advantage of this method consists in eliminating the top of the particles protecting large areas of separation of a rapid wear. Sift from the collector is the finest fractions obtained with this method [3, 4].

MATERIAL AND METHODS

In order to study the sieving operation four mix polidisperse granular materials were examined: corn, soya-bean groat (SH), sunflower groat (SH) and a mixture of them combined (used for feeding hens and having the following composition: corn

55.39 %, soya SH 20 %, sunflower SH 10 %, oil 1.5 %, starch 2.0%, monocalcium phosphate 1.2%, premix 2004 1.0%, metionyme 0.07%, salt 0.34%, calcium 8.5%). Each of these mixing components were milled in a 25 kW power milling machine from Tehnofavorit Bontida, in 30 min/ton of material (figure 1) samples of material, that are presented in figure 2 being drawn out.

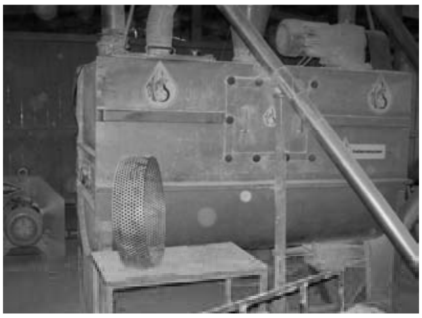

Fig. 1. Milling machine used for mix polidisperse granular material

Fig. 2. Samples for the study of sieving operation

For sifting the material samples was used a sieving machine AS 300 (figure 3) which was passed by an amount of 1.0 kg of each sample material, 10 transitions for each sample in 60 seconds.

On the top of the machine were placed 3 plates and the collector, the plates having mash size of 2.5, 1.25 and 0.63 mm. Machine working mode was set for each sample in part to be firstly continuously and secondly intermittently with an amplitude of vibration of 2.0 mm/g. The intermittent working mode means that the machine through programming would stop every 10 seconds for 2 seconds, afterwards the process being started again. In fig. 4 is shown an aspect of carrying out the sunflower SH sieving operation and in figure 5 an aspect of soy SH.

Fig. 3. Sieving machine AS300

Fig. 4. Sample of sunflower SH sieving

In figure 6 is shown the balance used to make calculations for mass residues for each sieve used and for the collector.

Fig. 5. Sample of soy SH sieving

Fig. 6. Weighing one mix sample

RESULTS AND DISCUSIONS

After conducting the sifting operation (10 determinations for each component) were obtained average values of sifts and residues shown in table 1.

Table 1

Raw material	Residue on plates 2.50 mm [g]	Residue on plates 1.25 mm [g]	Residue on plates 0.63 mm [g]	Sift on collector [g]	Total/ losses [g]	Observations
corn	62	226	266	442	996/4	continous
	53	229	317	396	995/5	intermittent
sunflower SH	18	100	295	582	995/5	continous
	15	96	318	564	993/7	intermittent
Soy-bean SH	4	60	344	589	997/3	continous
	3	50	347	596	996/4	intermittent
mixture combined	58	192	289	456	995/5	continous
	47	196	288	464	995/5	intermittent

Following the sifting operation, the separation efficiency can be determined. The mass flow of the material debit m_A that supplies the plates is divided through the sieving process in two elements: the sift mass flow m_C and residue mass flow m_R.

Balance equations regarding mass material flows that are entering and leaving the system and partial balance equations regarding the concentration of the particles that have smaller sizes than the mashes of the sieve are:

$$m_A = m_C + m_{R_1} + m_{R_2} + m_{R_3} \tag{1}$$

where m_{R_1}, m_{R_2} şi m_{R_3} are residues on the 3 plates.

$$m_A \cdot \varepsilon_A = m_C \cdot \varepsilon_C + m_{R_1} \cdot \varepsilon_{R_1} + m_{R_2} \cdot \varepsilon_{R_2} + m_{R_3} \cdot \varepsilon_{R_3} \tag{2}$$

where ε_A, ε_C and $\varepsilon_{R_{1\ldots3}}$ each represents the percentage of raw materials with smaller sizes than the mashes of the sieve from the initial mixture, sift and residue.

Sieving efficiency in sifting is defined as the ratio between the mass particles with sizes smaller than the size of the mashes of the sieve and that can be located in sifts and material mass flow:

$$\eta_C = \frac{m_C \cdot \varepsilon_C}{m_A \cdot \varepsilon_A},[\%] \tag{3}$$

where: m_C - sift mass flow, m_A -material mass flow, ε_A, ε_C the percentage of raw materials with smaller sizes than the mashes of the sieve from the sift and initial mixture.

Sieving efficiency in residue is defined as the ratio between the mass particles with sizes bigger than the size of the mashes of the sieve and that can be located in residue and material mass flow [3]:

$$\eta_R = \frac{m_R \cdot (100-\varepsilon_R)}{m_A \cdot (100-\varepsilon_A)},[\%] \tag{4}$$

where: m_R - residue mass debit, m_A -material mass debit, ε_R, ε_A the percentage of raw materials with smaller sizes than the mashes of the sieve from the residue and initial mixture.

Plate's total efficiency is the result between the separation efficiencies for sifting and for residue[3]:

$$\eta_T = \eta_C \cdot \eta_R,[\%] \tag{5}$$

The determination of the percentage content of the particles ε_A, ε_C and ε_R in residue or sift was done from each sample. Value of these sizes and parameters are shown in table 2.

Table 2

Material	Work mode	ε_C [%]	ε_A [%]	ε_T [%]	η_C [%]	η_R [%]	η_T [%]
corn	continous	92	70	80	58,1	36,9	21,4
	intermittent	90	70	85	50,9	29,9	15,2
sunflower SH	continous	95	85	89	65,0	30,2	19,5
	intermittent	93	85	86	61,0	40,0	24,4
Soy-bean SH	continous	91	86	88	62,3	34,9	21,75
	intermittent	94	86	89	65,1	31,4	20,4
mixture combined	continous	89	77	83	52,7	39,8	20,98
	intermittent	91	77	86	54,9	32,3	17,74

CONCLUSIONS

1. Due to the very similar quantities of the residues on the sieves and in the collector, the material nature has a low impact on the sieving operation even if vibrations in continuous mode or discontinuous mode were used; if on the first 2 plates the residue quantities are similar in both working modes, in the

collector and on the third plate a greater quantity will be noticed in the continuous mode as compared to the intermittent mode.

2. Tabular or needle shape of particles makes difficult the sifting process because even if their thickness allow their passage through the meshes of the sieve, they deposit in the top of raw materials being prevented from reaching in contact with the separation area. Also tabular shape particles that reach the surface of the plate can close the holes which has the effect of decreasing the capacity of separation.
3. Material granulometric factions affect plate efficiency and the capacity of the sieve in the process of separation. Hereby, particles with size less than 0.75 of mesh size pass easily through the meshes of the sieve; those particles with size larger than 1.35 of mesh size remain in residue. Particles that have size between 0.75…1.35 of the meshes of the sieve generate difficulties in the sifting process. If it is working with mixtures containing a high percentage of particles between these critical limits, it is advisable to work with sieves which have larger mesh size to 10 ... 15% higher.
4. Orifice shape can be adopted according to the geometric shape of the particles: for sphere particles, are recommended to be used plates with square or circular orifice shape; for irregular shapes can be used plates with oblong shape (rectangular).
5. The sizes of the orifices of plates influence the efficiency of the sifting operation, the efficiency decreasing as the size of the orifice is diminishing.
6. The vibration motion of the plates doesn't have a notable influence on the sifting efficiency; the vibration motion used in the separation operation can be an advantage only for some raw materials, while for the others it can be a disadvantage because of the congestion particle phenomenon on the plate surface.

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SOIL RESEARCH IN VIEW TO EXTEND AGRICULTURAL LANDS IRRIGATION IN CENTRAL BARAGAN PLAIN

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Keywords: *soil research, agricultural lands, irrigation, sustainable management*

Abstract

Climate data have been gradually changing due to progressive atmospheric warming resulting from the combined action of more factors natural and human, which determines both a reduction in precipitation amount at soil level and an increase in temperature. Extreme climate aspects are amplified by the current status of irrigation systems requiring both new technologies and the extension of tracts that can be irrigated, which is an instrumental measure to enhance physical and chemical features of soil units in Romanian dry-subhumid regions, covered to a large extent by Baragan Plain.

Agricultural potential increase in Baragan Plain focuses especially on irrigation extension, taking into account restraints related to wind erosion, surface erosion, salinization/acidification, soil texture etc., which may result in biodiversity enrichment both in agro-ecosystems and in ecosystems, provided its known dwindling trend in dry-subhumid areas, and at the same time it calls for the implementation of a sustainable management of soil resources in this area.

INTRODUCTION

According with the geographical position, Romania presents a pronounced variability concerning the distribution of precipitation quantities during a year, especially on summer. From the weather data between 1881-2000 in our country were registered four important dry periods (1894-1905; 1918-1920; 1942-1953; 1982-2000, the highest point being the drought from 2007 considered by the specialists the severe one from the last 60 years), but the duration of those drought periods were initially by 11-13 years, and lately by 20 years. The manifestation of severe drought phenomena affected many areas, the most important being in the South and East-Southern of Romanian Plain, respectively Oltenia and Bărăgan Plain, important agricultural areas of Romania.

The agriculture is a directly depending activity sector on water distribution in soil by crops establishment and de growth of agricultural plants. The development of the irrigation systems already existing or creating new ones have to consider also the local conditions regarding relief, morphological, physical and chemical characteristics of soil and crop type, these representing the base requirements to create a new sustainable agricultural management system.

MATERIAL AND METHODS

This study presents the soil pretability at irrigation from some parameters point of view (water erosion, wind erosion, alkalisation, salinization, gleization, stagnogleization, texture, skeleton, edafic volume etc) which have a high influence on soil resource behavior at irrigation.

Using the Methodology of elaboration pedological studies (ICPA 1987) was achieved the classification of agricultural lands by pretability to irrigation fitting out.

It was established the basic taxonomic unit -class- function with the pretability to irrigation fitting out, and with geographic information system (GIS) was achieved the irrigation pretability map of the land from Central Bărăgan Plain.

The formula structure for the general pedological studies (little and middle scale) is the following:

$III_{CZ}SD$ → III Land class
→ SD Land sub-class (given by the association of limitations)
→ CZ Symbol of representative soil type

Limitations and restrictions:

S Limitations because of soil salinity
- S salinization and/or alkalinisation

Y Limitations because of other soil chemical characteristics
- A acidity

X Limitations because of some soil physical characteristics
- N rough texture and wind erosion
- C fine texture
- O low carrying capacity
- V low edafic volume

J Limitations because of lands coverage or non-uniformity
- Z land coverage with rocks and stones
- U land non-uniformity

D Limitations because of humidity excess
- Q freatic humidity excess
- W stagnant humidity excess
- H outflow flooding

I Limitations because of erosion or sliding
- E land slope, erosion risk and surface erosion
- R depth erosion and F slidings or collapse

RESULTS AND DISCUSSION

Ameliorative land classes represent the highest classification level considering the biggest intensity of the restrictive factors or degradation risks (table 1, figure 1).

Table 1

Restrictive factors or degradation risks which affect the soil pretability

Code	Characteristics	Surface (ha)	Share (%)
	No restriction	102882.46	26
E	Land slope, erosion risk and surface erosion	53501.02	14
Q	Freatic humidity excess	108863.56	27
S	Salinization and/or alkalinisation	7863.38	2
W	Stagnant humidity excess	15557.51	4
C	Fine texture	98553.56	25
N	Rough texture and wind erosion	8905.19	2

It was established 5 classes of lands with different pretability at irrigation (table 2, figure 2).

Table 2

Lands agricultural classes with their pretability

No.	Class	Surface (ha)	Share (%)
1	Class I	102882.47	27.2
2	Class II	125341.91	32.7
3	Class III	126805.00	34.1
4	Class IV	18806.14	5.2
5	Class V	1340.05	0.8

First class, these are very good lands for irrigation fitting out, practically without degradation risks or agricultural use limitations (as arable); irrigable without restrictions. This class includes plane, horizontal or very weak inclined lands (slope under 2%), with deep soils having moderate or fine moderate texture, relative uniform on profile, with favorable permeability; natural drainage is good, and the hydrostatic level of groundwater is situated at depth higher than 5-6 m. Do not present erosion problems, humidity excess, salinization and/or alkalinisation, flooding etc. These lands are distributed especially in the East half from Central Bărăgan Plain (Strachinei Plain) and in the first third from Ialomiței meadow, but disseminated can be observed also in the centre of Pogoanele field and in the North part of Urziceni field. These are having a high density in the spatial distribution of the irrigable lands, being soils like Haplic Fluvisols (FLha), Eutric Fluvisols (FLeu), Calcaro-calcic Kastanozems (KCcc-ca), Calcic Chernozems (CHca) and Haplic Chernozems (CHha).

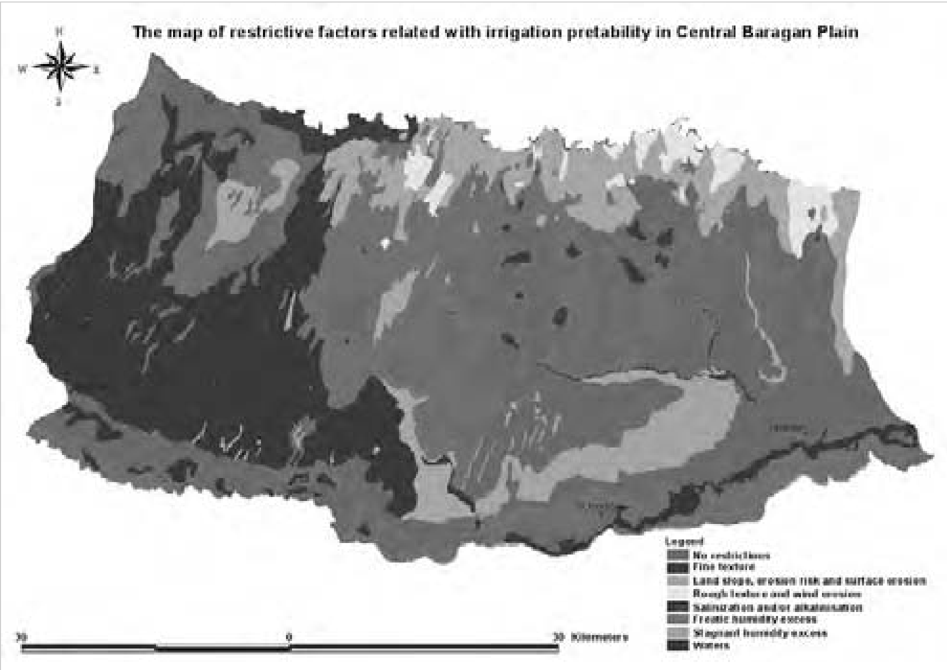

Fig. 1. The map of restrictive factors

Second class, there are good lands for irrigation fitting aut, with degradation conditions and/or low agricultural use limitations determined by one or more soil factors, rock, salinization, alkalinisation, relief, erosion, drainage, floodability; irrigable with low restrictions or some prevention works requirements. These lands do not put difficult fitting out problems and require low investments. There are distributed all along Central Bărăgan, but more in the central area, in the South part of Amara field and in the North of Mohreanu field. There are represented by few types of soils: Calcic Chernozems (CHca) and Haplic Chernozems (CHha).

Third class, there are moderate good lands for irrigation fitting out, with degradation risk and/or moderate agricultural use limitations because of one or more soil factors forementioned, irrigable with moderate restrictions or some prevention and improvement works requirements. These lands require relative difficult fitting out and exploitation problems and need considerable investments. The soils from these lands are represented by Haplic Fluvisols (FLha), Eutric

Fluvisols (FLeu), Calcic Chernozems (CHca), Haplic Chernozems (CHha), Eutric Arenosols (AReu) and Haplic Solonetz (SNha). The high area of these lands is situated in Padinei Plain, and occupies almost exclusive the South of Amara and Tătaru fields.

Fourth class, there are low favourable lands (marginal) for irrigation fitting out (irrigable in special conditions), with degradation risk or severe agricultural use limitations (as arable), irrigable with severe restrictions or some intensive improvement and prevention works requirements. These lands are not indicated for irrigation, excepting for some special crops (rice, legume, fruit trees, meadows etc.) or in some special fitting out conditions. Usually, there are necessary high investments and the fitting out requires difficult problems. It is characteristic especially for the half North of the Central Bărăgan Plain, with a high incidence in the east part of the Călmățui meadow and in the Ialomiței meadow, south of Țăndărei. Also, important areas occupied with these lands can be found around the lakes from the central and East part of Bărăgan. From the pedo-landscape point of view, these lands are represented by Haplic Chernozems (CHha), Gleyic Chernozems (CHgl), Eutric Gleysols (GLeu), Eutric Arenosols (AReu), Haplic Solonetz (SNha) and Haplic Solonchaks (SCha).

Fifth class, there are very low favorable lands for irrigation fitting out degraded or with very severe agricultural use limitations because of salinization and/or alkalinisation and drainage, non-arable in present, but after the fitting out and/or preliminary improvement could become arable. There are necessary high investments for fitting out and improvement and special technical and material efforts; sometimes necessitate supplementary studies and experiments to solve the improvement problems. There are especially along the river Valea Lată Sarata and in the Ialomita meadow. A narrow strip is presented in the East part of the Tataru field. These lands are represented by soils like: Calcaric Regosols (RGca) şi Eutric Gleysols (GLeu).

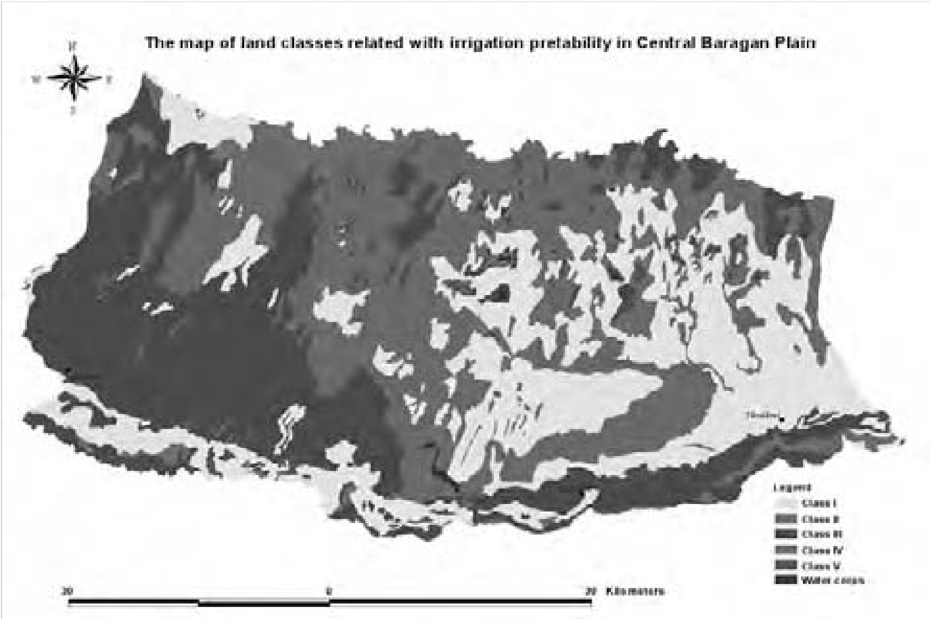

Fig. 2. The map of land classes related with irrigation pretability

CONCLUSIONS

1. It can be appreciated that the Central Baragan Plain are in urgent need of being prepared for irrigation, because are very arid and agricultural production is very powerfully affected by long periods of drought.
2. From the irrigation possibility point of view, this plain has a big land surface that can be exploited, especially if we think that the spatial representantion of pretability classes I and II is very large, but all of these can be made valuables only by the research of different methods and specific irrigating directions, adapted to area's caractheristics (clime, hydrography) and strictly connected with her territorial resources.
3. The soil types calcic chernozem and cambic chernozem represent aproximatively 80% from the pedological resources that constitute an important special element considering the soil quality in water deficit problems.
4. The introduction of irrigation in the affected area will make the land degradation trend to decrease because of existing water.

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RESEARCH ON THE MAIZE CROP ON THE LEVELLED AND NOT LEVELLED SANDY SOILS FROM LEFT RIVIER JIU (2004-2006)

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Keywords: *sandy soil, leveled, unleveled, irrigated, fertilization*

Abstract

With the corn crop, levelling has determined the decreasing of the yield over the not leveled soil. In this manner, the corn yield, in average on the three years of experimentation was 6,755 kg/ha with the not leveled soil and of 4,166 kg/ha with the leveled soil.

The chemical fertilization has influenced the yield in parallel with the increasing of the fertilizer doses the yield has progressively increased from 2,950 kg/ha with the not fertilized control to 6,750 kg/ha with the $N_{150}P_{80}K_{80}$ *dose.*

INTRODUCTION

In 1971 they were laid out at the same time on levelled and unlevelled field long time experience that were continued in the present time (more then 36 years), that fact infirming that enthusiasm of restoring the soil fertility, because the production made it on the leveled sandy soil represents only 50-60% from the ones realized on the unleveled sandy soil.

MATERIAL AND METHOD

Research was carried out on the typical sandy soil, irrigated by sprinkling from the Tamburesti D.S., from Dolj.

Experiments were made on leveled and unleveled sandy soil, stationary, with chemical fertilizers, on the autumn barley (with Vigna sinensis double crop as residual green fertilizer material) – corn crop rotation.

The experiments were carried out according to the blocks method, using 6 variants of fertilization in 4 replications on the leveled soil and 6 variants on the on the leveled soil.

In the 3 years of experience, they were sowing corn hybrids from FAO 400 vegetation group and the weeds control were made with Primextra 50 PU, 5.0 l/ha (preem).

RESULTS AND DISCUSSIONS

In average on the three years of experimentation, in function of A factor, (leveling soil), the corn yield obtained on leveling was only by 4,166 kg/ha, representing, 61.7%, from the unleveled one, that was 6,755 kg/ha.

dose (from 2,950 kg/ha until 6,750 kg/ha), achieving compare with the unfertilized control, a yield growth between 1,803 kg/ha and 3,800 kg/ha. The percent growth fluctuated between 61.1% and 128.8%.

It was remarked that, this growths such as values and also like percent values, are showing bigger, because of the smaller yield, recorded on the unfertilized control.

Regarding the interaction of the factors A and B (leveling x fertilization), it can be seen that, on all experimental variants the yield level on the unleveled is higher compare with the level experimental variants yield (table 1).

It was remarked that the yield of the unfertilized control from unleveled (3,623 kg/ha) was higher with 1,345 kg/ha, compare with the leveled one (2,278 kg/ha).

On the unleveled variants, the yield increased once with the growing of the fertilizers doses until the maximum dose, at 8,275 kg/ha on the fertilized variants, with $N_{150}P_{80}K_{80}$, compare with the leveled one witch was only by 5,225 kg/ha.

Table 1

The influence of the A (leveling) and B (fertilization) factors on the maize crop, on the irrigated sandy soil from Tamburesti - Dolj (average of 2004-2006)

Factors		**Yield**			**Signification**
A (Leveling)	**B (Fertilization)**	**kg/ha**	**%**	**d**	
a_1- Unleveled	b_1-$N_0P_0K_0$ (control)	3.623	100	-	
	b_2-$N_{30}P_{30}K_{30}$	6.025	166.3	2.402	x x
	b_3-$N_{60}P_{30}K_{30}$	6.984	192.8	3.361	x x x
	b_4-$N_{90}P_{60}K_{60}$	7.592	209.6	3.969	x x x
	b_5-$N_{120}P_{60}K_{60}$	8.034	221.7	4.411	x x x
	b_6-$N_{150}P_{80}K_{80}$	8.275	228.4	4.652	x x x
a_2- Leveled	b_1-$N_0P_0K_0$ (control)	2.278	100	-	
	b_2-$N_{30}P_{30}K_{30}$	3.481	152.8	1.203	
	b_3-$N_{60}P_{30}K_{30}$	4.137	181.6	1.859	x
	b_4-$N_{90}P_{60}K_{60}$	4.843	212.6	2.565	x x
	b_5-$N_{120}P_{60}K_{60}$	5.033	220.9	2.755	x x x
	b_6-$N_{150}P_{80}K_{80}$	5.225	229.4	2.947	x x x

DL 5%	1.463	kg/ha
DL 1%	1.927	kg/ha
DL 0.1%	2.578	kg/ha

On the unlevelled sandy soil, the yield growth compare with the unfertilized one- recorded values between 2,402 kg/ha and 4,652 kg/ha, and the percent growth were between 66.3% and 128.4%.

On the levelled variants also the kernel corn yield increased once with the increasing of the fertilizer doses until 5,225 kg/ha, on $N_{150}P_{80}K_{80.}$ The adding on this variant of the K fertilizer didn't increase very much the yield.

The yield growth on the leveled sandy soil determined by the fertilizer doses were smaller as absolute values (1,203 kg/ha – 2,947 kg/ha), but ha percent values this ounces appear as being higher (52.8% - 129.4 %), because of the small level of the control yield unfertilized.

In this way, regarding the corn crops, the higher yield obtained on the leveled variant, fertilized with $N_{150}P_{80}K_{80}$ (5,225 kg/ha), represents only 86.7 % from the unleveled variants, fertilized with the minimum experimental dose $N_{30}P_{30}K_{30}$ (6,025 kg/ha).

The recorded yield on the kernel crops as effect of the leveling and the fertilization, are reflected by the determination during the vegetation period and on the harvest.

Before the harvest, they were determined the percents of plant with 2 corncobs, the sterility and the infection level with *Ustilago maydis* (compare with total no of plants on the 4 harvested rows). Just after the harvest, they were established the corncobs categories (completed, incomplete and small once), on percent, compare with the total no of corncobs on each variants.

In laboratories, they were determined the corn kernel efficiency, kernel humidity, the MTS, the 100 liters kernel mass and the harvest quality (the kernel contain in proteins, starch, total P and K).

The determinations of the yield elements reflected the yield level obtained on the 2 different sandy soil categories.

In this way, in function of A factor, (leveling) the percent of sterile plants recorded a higher value on the leveled variants (30.5%), compare with the unleveled one (15.7%).

The plants with 2 corn-cobs, and the categories with 2 completed corn-cobs recorded higher values on the unleveled variant, compare with the leveled one, while the incomplete corn-cobs and the small ones was higher on the leveled experiment. Also, the MTS and the 100 liters kernel mass were higher on the unleveled one compare with the leveled one.

In function of the B factor (fertilization), we can say that the percent of sterile plants recorded a diminution compare to the unfertilized control, as long the with the increasing of the fertilizer doses.

The corncobs categories shown also a differentiation, appertained to the experimental fertilizer doses. In this way, the completed corncobs percent increased from the unfertilized control, while increasing the fertilizer doses.

The MTS recorded higher values on all fertilized variants, compare with the unfertilized control. The 100 liters kernel mass, in average, in the 3 years of experimentation, recorded the highest values on the maximum fertilizer dose and the values were between 68.3 kg/hl on b_1 and 71.8 kg/hl on b_6.

The proportion of the yield elements increase with the increasing of the fertilizer dose, as well on the leveled and unleveled sandy soil. In counter part, of this index, the percent of sterile plants fluctuated; witch was higher on the unfertilized control.

The yield elements of the kernel corn crops, in function of the interaction of the 2 factors A (leveled) x B (fertilization), recorded a diminishing of the percent of sterile plants while increasing the doses of the fertilizers.

Regarding the yield quality, in the 3 years of experimentation, it results that the values of the determined elements (the protein, starch, P, K contain) fluctuated in function of research factors. As it was natural, there were recorded higher values on the unleveled variants and smaller on the leveled one, because of the reduced fertility of the sandy soil, while increasing the fertilizer doses the quality increase to.

CONCLUSIONS

1. Levelling by cutting the interdunes recrudescence the vegetation conditions for the crops, in the best case scenario only for a period of time, because of bringing into the surface of the unfertile sheet soil.
2. Unseeing the fertilizers mean a very important resource of increasing the yield corn crops, and others crops on this type of soil.
3. They do not diminishing the yield differences between leveled and unleveled or even accentuates it, because of the favorable interaction on the unleveled one, between fertilizers used and the existent humus.
4. The chemical fertilizers used every year, with all positive influence over the formation of the green cover of the plants, in the conditions of the sandy soil with hard texture, because of the powerful aeration, the humification of the very low residual material humification, the highest percent decomposing until the mineralisation.

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RESEARCH ON THE INFLUENCE OF PINCHING AND THINNING OUT ON THE PRODUCTION OF VIRGINIA TOBACCO, ON THE SOIL AND CLIME CONDITIONS OF MIRSANI - DOLJ

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Keywords: *sandy soil, tobacco, fertilization, productions, and irrigation*

Abstract

Through the work of flesh and thinning out try to give an answer to the question of how much increased production of leaves, after carrying out these works in the local environment.

Results obtained show that production to the method recommended to make the elimination inflorescences as early as possible: a_1 (the emergence of floral button), other variants, respectively a_2 (pinching at the beginning) and a_3 (pinching in full bloom), is different and somewhat illogical hard to explain.

Thus, for a_2 gives a less production of about 130 kg/ha, compared to variant witness, that deficit should be delayed on account of performing the work of pinching to start flowering, and a_3, when the delay was performing work and higher and should lead to a shortage of production as of late, has not won a minus but a plus yield producing 271 kg/ ha.

INTRODUCTION

Cultivation of tobacco type on the sands Virginia proved to be very profitable, with a large suitability under irrigation, which requires deeper research on which to determine the influence of works of pinching and baby food on the conditions soil and clime of sandy land left Jiu from Mirsani – Dolj.

MATERIAL AND METHOD

On sandy soil typical of Mirsani – Dolj has placed an experience with 3 factors as subdivided parcels, with four repetitions.

A factor (when performing pinching) with 2 sub factors: a_1=pinching from the appearance floral button (Mt.), a_2=pinching beginning thriving, a_3=pinching from inflorescence maximum.

Factor B (depth of pinching) with 2 sub factors: b_1=inflorescence plus 2 leaves, and b_2=inflorescence plus 4 leaves (Mt.).

Factor C (method of thinning out) with 2 sub factors: c_1=thinning out manually (Mt.) and c_2=chemical thinning out.

RESULTS AND DISCUSSION

Results of production (table 1) show that the elimination inflorescence as early as possible (the emergence floral button - a_1) in comparison with other options, namely: a_2 (pinching at the beginning blossom) and a_3 (pinching in full bloom), behave different and difficult to explain.

Table 1

Production of dried leaves according to the factor A (when performing pinching) in 2006

A factor (when performing pinching)	Production			Signifycation
	kg/ha	%	d	
a_1-pinching apparition floral button	2,009	100.0	Mt.	
a_2-sausage at the beginning blossom	1,879	93.5	-130	
a_3-pinching flourishing maximum	2,280	113.5	271	x

DL 5% 190 kg/ha
DL 1% 288 kg/ha
DL 0.1% 463 kg/ha

Thus while a_2 give a less production of about 130 kg/ha, compared to variant witness, that deficit should be delayed on account of performing the work of pinching to start flowering, to a_3, when the delay was performing work and large and should lead to a shortage of production as of late, has not won a minus, but even more production of 271 kg/ha.

We consider that a reason for getting more production of 271 kg/ha has uneven because in the vast land in terms of fertility and other characteristics of the soil.

The second factor taken in this study in depth experience and that of pinching (factor B) shows the production obtained (table 2), as land poor in nutrients above, pinching must be more profound, eliminating a larger number of top leaf with inflorescent.

Table 2

Dry leaves yield in function of the B factor (pinching depth) in 2006

B factor (pinching depth)	Production			Signification
	kg/ha	%	d	
b_1 - inflorescence plus 2 leaves	1,979	92.8	- 154	0
b_2 - inflorescence plus 4 leaves	2,133	100.0	Mt.	

DL 5% 150 kg/ha
DL 1% 216 kg/ha
DL 0.1% 318 kg/ha

The third factor (C) taken in the study is about how to eliminate thinning out (manual or chemical-c_1 with Royal 4% - c_2).

Results of production (table 3) shows that between the two methods of thinning out there are no differences, production were virtually equal, 2,046 – 2,066 kg/ha.

Table 3

Production of dried leaves according to the factor C (method of thinning out) in 2006

C factor (method of thinning out)	Production			Signification
	kg/ha	%	d	
b_1 - thinning out manually	2,046	100.0	Mt.	
b_2 - chemical thinning out	2,066	101.0	20	

DL 5% 123 kg/ha
DL 1% 186 kg/ha
DL 0.1% 235 kg/ha

But there is a difference regarding the amount of green mass eliminated by pinching (table 4) and the number of manual work to be done to eliminate thinning out.

Thinning out to such manual was required in three passages within a month (9 - July - Aug 12), and the amount of total mass of green has been eliminated big enough (3,189 – 3,486) kg/ha, compared with chemical variants thinning out, where it was needed only one paper (Aug. 12), and the amount of green mass eliminated was reduced to about one third (1,204 – 1,250 kg/ha).

CONCLUSIONS

1. Virginia-type tobacco planted on the sand in terms of irrigation and fertilization balanced not differentiate the production, following the works of pinching and thinning out.
2. Getting an extra production of 271 kg/ha through the work of pinching at their peak are flourishing because of uneven in the vast land in terms of fertility and other characteristics of the soil.
3. The quality of tobacco is not sensitively influenced by pinching and thinning out.
4. On sandy soil poor in nutrients pinching must be more profound, because by removing a larger number of top leaf with inflorescent, the lower leaf remained benefit from greater resources develop better.
5. Thinning out between manual and chemical thinning out there are no differences of harvest production were virtually equal.

Table 4

Amount of green mass eliminated by the works of pinching and thinning out in 2006

Factors investigation		Method of thinning out						
A (phase pinching)	**B (depth of pinching)**	**C_1 (thinning out manually – Mt.2)**			**kg/ha**	**C_2 (chemical thinning out)**		**kg/ha**
		9.07 I	**20.07 II**	**12.08 III**		**12.08**	% $Mt._2$	
a_1- apart from floral button ($Mt._1$)	b_1 inflorescent + 2 leaves	137	130	2,685	2,952	988	33.4	123
	b_2 inflorescent + 4 leaves	145	132	3,148	3,425	1,420	41.4	143
Media a_1		141	131	2,917	3,189	1,204	37.4	133
a_2 at the beginning of flowering	b_1 inflorescent + 2 leaves	11	128	2,716	2,955	576	19.5	260
	b_2 inflorescent + 4 leaves	145	130	3,220	3,495	659	26.4	270
Media a_2		128	129	2,968	3,225	617	23.0	265
a_3 in full flourish	b_1 inflorescent +2 leaves	169	135	2,376	2,680	1,219	45.5	469
	b_2 inflorescent + 4 leaves	219	126	3,948	4,293	1,281	38.9	543
Media a_3		194	130	3,162	3,486	1,250	42.2	506

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NECESSITY OF POLLINATION BY MELLIFEROUS BEES AT SUNFLOWER HYBRIDS ACTUALLY CULTIVATED IN ROMANIA

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Abstract

Within this paper there are presented the results of the researches carried out in the period 2002-2008 at an assortment of 34 sunflower hybrids with respect to the visit frequency of the pollination insects on the sunflower heads, the percentage of self-fertility and the gain in seed yield through pollination, compared to the yield obtained under self-fertility conditions. The experiments were carried out within the experimental farm belonging to the University of Agronomic Sciences and Veterinary Medicine of Bucharest, located on a reddish preluvosoil at Moara Domnească (15 km faraway from Bucharest on North-East direction). The results of researches show that the sunflower growers have to pay attention of bringing the beehives for pollinating the sunflower crops, in view to get a gain in seed yield up to 1390 kg per hectare, according to the hybrid. The melliferous bees are necessary especially for the hybrids with the highest gain in seed yield and small self-fertility percentage, but also for the other hybrids in view to be sure the pollination is assured under any climatic conditions.

INTRODUCTION

Sunflower seed yield is depending very much of pollination made by the melliferous bees and other spontaneous insects. The melliferous bees have the most important role in assuring pollination of the sunflower crops [1]. The sunflower grower has to know for each sunflower hybrid which is the percentage of self-fertility [2] and the gain in seed yield obtained through pollination carried out by insects. Thus, he will become aware of the importance of pollination of the sunflower crops, according to the cultivated hybrid, and will become concerned to assure the necessary beehives with melliferous bees for assuring the proper pollination of the sunflower crops.

MATERIAL AND METHODS

In the period 2002-2008, researches were carried out in field experiments for studying an assortment of 34 sunflower hybrids, among which 13 were Romanian hybrids (Favorit, Florom 350, Turbo, Performer, Splendor, Felix, Justin, Trajano, Select, Alex, Hercule, Festiv and Romina) and 21 were foreign hybrids (Huracan, Kasol, Lindor, Masai, Mateol, Podium, Saxo, Sunko, Fly, Rigasol, Rigasol OR, Fleuret OR, Arena, Melody, NK Armoni, Alexandra, NK Dolbi, NK Ferti, Opera PR, Sanay and Rocky). The 13 Romanian sunflower hybrids were studied in the years 2002, 2003, 2004 and 2005, among which 2002 was a drought year and 2004 was a favourable year for sunflower crops. The 21 foreign sunflower hybrids were studied in the years 2006, 2007 and 2008, among which 2007 was a very drought year and 2008 was a favourable year for sunflower crops.

The experiments were located on a reddish preluvosoil at 15 km faraway Northeastern from Bucharest, within the experimental farm Moara Domnească belonging to the University of Agronomic Sciences and Veterinary Medicine of Bucharest.

In view to establish the frequency visit of the pollination insects on the sunflower heads, observations and determinations were made at the 13 Romanian sunflower hybrids. The frequency visit of the pollination insects was determined by numbering the melliferous bees and other pollination insects that visited 4 neighbour sunflower heads in a time of 5 minutes. Also, for each pollination insects, it was determined the time of visits on the sunflower head. The observations and determinations were carried out in diferent 4 locations of each experimental plot.

In view to establish the number of seeds per sunflower head isolated from pollination insects and the number of seeds per sunflower head free-pollinated, determinations were performed for 10 Romanian sunflower hybrids and 21 foreign sunflower hybrids. This was made in view to calculate the degree of self-fertility and to establish the necessity of pollination. Also, there were performed yield determinations in view to calculate the seed yield obtained under pollination conditions and the gain in seed yield through pollination (compared to the yield obtained under self-fertility conditions).

In view to determine the self-fertility degree, five plants from each experimental plot (29.4 m^2 resulted from six plant rows at 0.7 m between rows and 7 m along the rows) were mull isolated ant their heads were analyzed at the maturity stage, parallel with another five heads free-pollinated. The percentage of self-fertility was estimated according to the following formula [3]:

$$\text{Self - fertility} = \frac{\text{average no of fertile achenes per isolated sunflower head}}{\text{average no of fertile achenes per freely pollinated sunflower head}} x100 \ \ (\%)$$

RESULTS AND DISCUSSION

The insects that were found on the sunflower heads and that have a role in the pollination process are the following: melliferous bees, lepidopterous (butterflies), dipterous (flies), hymenopterous (wasps, wild bees), heteropterous (bugs).

The melliferous bees represent the most important insects in pollination sunflower crops because they have the most important visit frequency on the sunflower heads. Thus, the average visit frequency on sunflower heads was of 82% for melliferous bees and 18% for the other insects from spontaneous fauna (figure 1).

The visit frequency on sunflower heads is different according to sunflower hybrid, which means that each sunflower hybrid has a different attractiveness for the pollination insects. The visit frequency on sunflower heads for the melliferous bees varied between 70% (e.g. Justin hybrid) and 100% (e.g. Florom 350 and Felix hybrids).

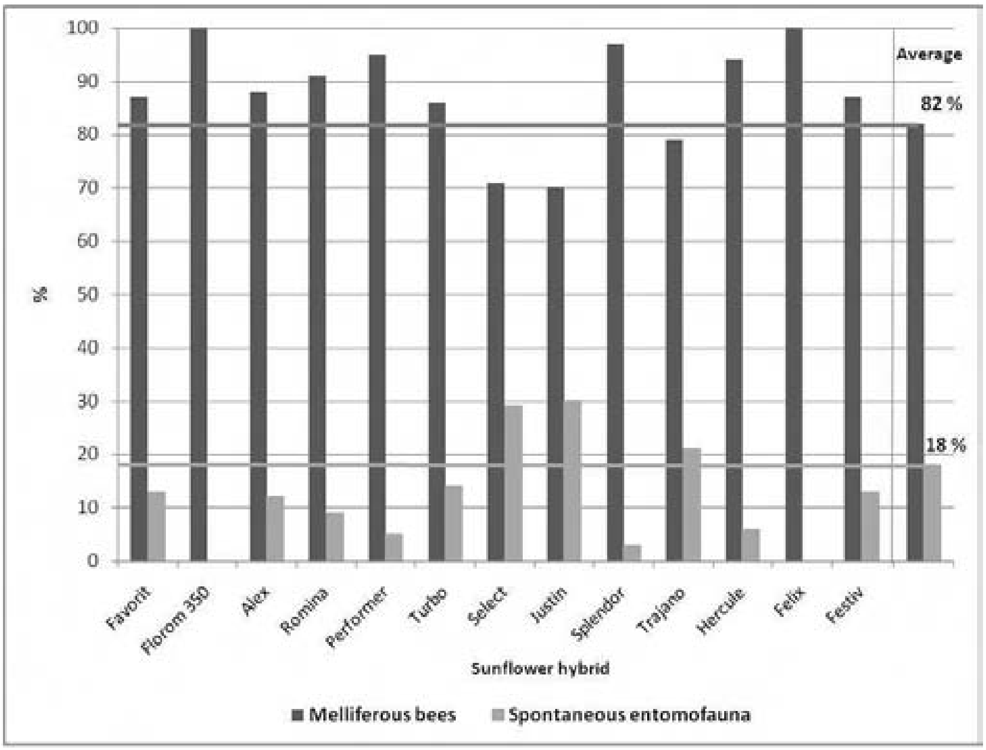

Fig. 1. Variation of the frequency visits of the pollination insects at different sunflower hybrids

Among the pollination insects from spontaneous fauna, the bumble bees are the most important pollinating insects for sunflower crops, with an average visit frequency on sunflower heads of 3%. Also, an important role for pollinating the sunflower crops is playing by the different species of butterflies, with an average visit frequency on sunflower heads of 3.4%.

During the period of determinations in the field, there were not observed any cases of abjections or competition among the insects visiting the sunflower heads. Very seldom, the buzz of a bumble bee has determined the melliferous bees to fly away on other sunflower head.

The percentage of self-fertility at the studied sunflower hybrids ranged from 18% (Romina and Select hybrids) to 98% (Performer and NK Armoni hybrids). The hybrids with the highest self-fertility percent under time (more than 70%, in all the studied years) were the following: NK Armoni, Melodi, Huracan, Sanay, Opera, NK Ferti, Rigasol OR, Masai and Saxo. The hybrids with the smallest self-fertility percent under time (less than 70%, in all the studied years) were the following: Romina, Festiv, Favorit, Splendor, Kasol, Fleuret OR and Rocky (table 1).

There are some sunflower hybrids with a relatively stable self-fertility percentage under time (e.g. NK Armoni, Melody, Huracan and Rigasol OR), while for the majority of the sunflower hybrids there are some significant differences during the time, and even for a few sunflower hybrids there are large differences from one year to another one, as for example for Select, Alex and Justin sunflower hybrids. The variation in time of the percentage of self-fertility is registered because this is affected by the climatic conditions.

If there is taken into consideration the average share of the spontaneous entomofauna and the gain in seed yield through pollination, then we can conclude that the presence of melliferous bees is not strictly necessarily for pollinating some sunflower hybrids (e.g. NK Armoni hybrid). There are some sunflower hybrids that do not need the presence of melliferous bees for pollinating in some years (e.g. Melodi, Huracan, Sanay, Opera PR hybrids). However, for the majority of the sunflower hybrids, the melliferous bees must be present in order to perform pollination and to insure increased seed production, and for some of them even been obligatory (e.g. Romina, Festive, Lindor, Fly and Arena hybrids).

The gain in seed yield through pollination, compared to the yield obtained under self-fertility conditions ranged from 10 to 1390 kg per hectare, according to the hybrid and climatic conditions of the year. Thus, sunflower growers must take into account the necessity of bringing the necessary beehives for pollinating the sunflower crops, especially for the hybrids with the highest gain in seed yield (Fly, Lindor, Kasol, Arena, Mateol, Romina, Festiv, Saxo hybrids), but also for the other sunflower hybrids in view to be sure that the pollination is assured and do not depend on the climatic conditions.

Seed yield obtained under pollination and currently technological conditions in South Romania for the studied sunflower hybrids varied from 760 to 4310 kg per hectare. The smallest yields were registered in the drought years 2002 and 2007, which were less favourable for the sunflower crops.

Table 1

Data regarding the limits of variation for the self-fertility and seed yields for an assortment of sunflower hybrids grown in Romania

Nr. crt.	Sunflower hybrid	Self-fertility (%)	Self-fertility plus the average share (18%) of the spontaneous entomofauna (%)	Gain in seed yield through pollination (compared to the yield obtained under self-fertility conditions) (q/ha)	Seed yield obtained under pollination and currently technological conditions (q/ha)
1.	Favorit	20 – 60	38 – 78	1.8*	17.9*
2.	Performer	61 – 98	79 – 100	1.1*	21.7*
3.	Splendor	47 – 69	65 – 87	1.7*	18.7*
4.	Felix	48 – 81	66 – 99	1.0*	20.8*
5.	Justin	46 – 97	64 – 100	6.3*	18.1*
6.	Select	18 – 93	36 – 100	6.0*	24.0*
7.	Alex	36 – 91	54 – 100	2.2*	16.8*
8.	Hercule	29 – 75	47 – 93	1.0*	17.7*
9.	Festiv	33 – 54	51 – 72	8.8*	20.5*
10.	Romina	18 – 47	36 – 65	9.1*	20.3*
11.	Huracan	88 – 94	100	2.6 – 5.3	19.4 – 30.3
12.	Kasol	50 – 64	68 – 82	1.5 – 12.9	7.6 – 36.6
13.	Lindor	52 – 73	70 – 91	4.0 – 13.6	9.6 – 40.9
14.	Masai	72 – 84	90 – 100	1.5 – 8.3	8.3 – 36.2
15.	Mateol	57 – 79	75 – 97	0.7 – 10.6	13.8 – 39.7
16.	Podium	66 – 91	84 – 100	0.1 – 5.4	9.7 – 40.6
17.	Saxo	70 – 83	88 – 100	2.9 – 9.5	10.3 – 43.1
18.	Sunko	56 – 85	74 – 100	1.1 – 6.0	9.8 – 29.3
19.	Fly	58 – 84	76 – 100	3.3 – 13.9	10.8 – 41.4
20.	Rigasol	61 – 80	79 – 98	0.6 – 7.3	12.9 – 30.7
21.	Rigasol OR	78 – 83	96 – 100	0.4 - 3.6	10.7 – 14.0
22.	Fleuret OR	51 – 62	69 – 80	3.7 – 6.7	10.6 - 34.0
23.	Arena	59 – 73	77 – 91	3.0 – 10.4	8.9 – 35.2
24.	Melody	87 – 90	100	1.9 – 6.8	10.6 – 35.8
25.	NK Armoni	93 – 98	100	0.6 – 1.3	8.5 – 29.2
26.	Alexandra	61 – 93	79 – 100	2.5 – 4.7	9.7 – 30.2
27.	NK Dolbi	55 – 86	73 – 100	5.5 – 7.5	12.7 – 32.9
28.	NK Ferti	70 – 81	88 – 99	2.7 – 6.2	19.9 – 34.7
29.	Opera PR	74 – 86	92 – 100	1.1 – 6.5	7.6 – 32.2
30.	Sanay	75 – 89	93 – 100	1.8 – 6.8	11.8 – 36.7
31.	Rocky	55 – 66	73 – 84	4.7 – 8.7	11.6 – 34.8
Limits of variation		18 – 98	36 – 100	0.1 – 13.9	7.6 – 43.1

** Average values for the studied years*

CONCLUSIONS

1. Melliferous bees represent the most important insects for pollinating sunflower crops, these having an average visit frequency of 82% from the total insects visiting the sunflower heads.
2. Among the pollination insects from spontaneous fauna, the bumble bees (3%) and different species of butterflies (3.5%) are the most important.
3. Percentage of self-fertility at the studied sunflower hybrids ranged from 18% (Romina and Select hybrids) to 98% (Performer and NK Armoni hybrids).
4. Among the studied sunflower hybrids, the highest self-fertility percentage under time (more than 70%) were obtained at NK Armoni, Melodi, Huracan, Sanay, Opera, NK Ferti, Rigasol OR, Masai and Saxo hybrids.
5. Among the studied sunflower hybrids, the smallest self-fertility percentage under time (less than 70%) were obtained at Romina, Festiv, Favorit, Splendor, Kasol, Fleuret OR and Rocky hybrids.
6. There are some sunflower hybrids with a relatively stable self-fertility percentage under time (e.g. NK Armoni, Melody, Huracan and Rigasol OR), while the majority of the sunflower hybrids registered significant differences during time, due to the influence of the climatic conditions.
7. For the majority of the sunflower hybrids, the melliferous bees must be present in order to perform pollination and to ensure increased seed yield.
8. The gain in seed yield obtained through pollination, compared to the yield obtained under self-fertility conditions, ranged from 10 to 1390 kg per hectare, according to the hybrid.
9. Sunflower growers have to pay attention of bringing the beehives for pollinating the sunflower crop, especially for the hybrids with the highest gain in seed yield, but also for the other sunflower hybrids in view to be sure the pollination is assured under any climatic conditions.

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RESEARCH ON MORPHOLOGICAL AND BIOLOGICAL PECULIARITIES OF *CAMELINA SATIVA* (L.) CRANTZ SPECIES UNDER THE CONDITIONS OF THE CENTRAL PART OF ROUMANIAN PLAIN

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Keywords: *camelina, morphology, biology*

Abstract

The main objective of the research was to study the morphology, biology and productivity of a less common species of agricultural crops - camelina (Camelina sativa), with the aim to evaluate the adaptability of the species on natural conditions in the Southern part of Romania and to the organic agriculture conditions.

The experiment was organized in the Moara Domnească Experimental Field, situated in reddish preluvosoil area from central part of Romanian Plain; it was organized based on the multi-stage block method with randomised variants in 4 replications.

Sowing took place on 10th of April 2008 and the sowing parameters were: 25 cm spacing between rows, with a density of 250 plants/m²; the sowing depth was of 1-2 cm.

Camelina sativa plants emerged 6 days after sowing, the beginning of inflorescences apparition was at 22nd of May, after 37 days from emergence, and the first seeds formed 57 days after emergence, and full maturity was attainig at 80 days after emergence.

Upon harvest, the plants had a height of 51.4 cm and a number of 121 fruits per plants which contained around 793.25 seeds, which means an average of 6.55 seeds/fruit. The average value of the 1000-seed weight was of 1.21 g and the yield was of 1534.9 kg/ha.

INTRODUCTION

Camelina sativa has been grown in Europe for centuries and in the Iron and Bronze ages was an important agricultural crop. From the Roman Empire to the discovery of gas and electricity, this oil was the favorite one used in oil lamps and also a common edible product. *Camelina sativa* belongs to the same family as oilseed rape, the *Cruciferae*, but is a different genus. Named in the past "Gold of Pleasure", *Camelina sativa* is an annual or over wintering herb originating in the Mediterranean to Central Asia. It has branched smooth or hairy stems that become woody at maturity and range from 25 to 100 cm high. Leaves are arrow-shaped, 5 to 8 cm long with smooth edges. Each stem bears many small yellow flowers each with 4 sepals and petals. The seeds, borne in pear shaped, are of 0.7-2.5 mm in diameter, orange to brown in colour, and result from self-pollination, although they can be cross pollinated by visiting insects. The plant is native to Eastern Europe and Southwest Asia where wild weedy forms survive. The plant appears very adaptable to climate and soil type, and it has been shown to be allelopathic. The crop is now being researched due to its exceptionally high levels (up to 45%) of omega-3 fatty acids, which is uncommon in vegetal sources. Over 50% of the fatty acids in cold pressed camelina oil are polyunsaturated. The major components are alpha-linolenic acid - C18:3 (omega-3-fatty acid, approx. 35-45%) and linoleic acid - C18:2 (omega-6 fatty acid, approx. 15-20%). The oil is also very rich in natural antioxidants, such as tocopherols, making this highly stable oil very resistant to oxidation and rancidity. It has 1-3% erucic acid. The vitamin E content of camelina oil is approximately 110 mg/100 g. It is well suited for use as cooking oil. It has an almond-like flavor and aroma. It may become more commonly known and become important food oil for the future. Camelina is also of interest for its very low requirements for tillage and weed control. This could potentially allow vegetal oil to be produced more cheaply than from traditional oil crops, which would be particularly attractive to biodiesel producers looking for a feedstock cheap enough to allow them to compete with petroleum diesel and gasoline.

MATERIAL AND METHODS

The main objective of the research was to study the morphology, biology and productivity of a less common species of agricultural crops – camelina (*Camelina sativa*), with the aim to evaluate the adaptability of the species on natural conditions in Southern part of Romania and to the organic agriculture conditions.

The experiment was organized in the Moara Domnească Experimental Field, situated in reddish preluvosoil area from Central part of Romanian Plain; it was organized based on the multi-stage block method with randomised variants in 4 replications.

Sowing took place on 10^{th} of April 2008, and the sowing parameters were: 25 cm spacing between rows, with a density of 250 plants/m²; the sowing depth was of 1-2 cm.

The cultural practices performed during the vegetation period concerned the manual weeding works, carried out as often as necessary.

During the vegetation period there were effected observations and measurements concerning: the emergence data; the dynamics of plants height; the dynamics of leaves, floral buds, flowers and seeds formation; the stages of maturity.

RESULTS AND DISCUSSION

Phenological observations. In our research, we sowed on 10^{th} of April and plants reached the harvest maturity after 86 days of vegetation, more specific on 5^{th} of July.

The inflorescence appeared across 22^{nd} of May, corresponding to a number of 36 days after emergence, the formation of seeds began after 29^{th} of May (43 days after sowing), and seeds maturity stage was attended at 5th of July, after 80 days from emergence.

Dynamics of plants height. Regarding the dynamics of plants height, it could find that plants evolved relatively slowly at the beginning of the growing season (April 18-May 15), so that on 15th of May, by a corresponding number of 35 days from sowing, plants reached 13.2 cm height, resulting an average growth rate of 0.45 cm/day (figure 1).

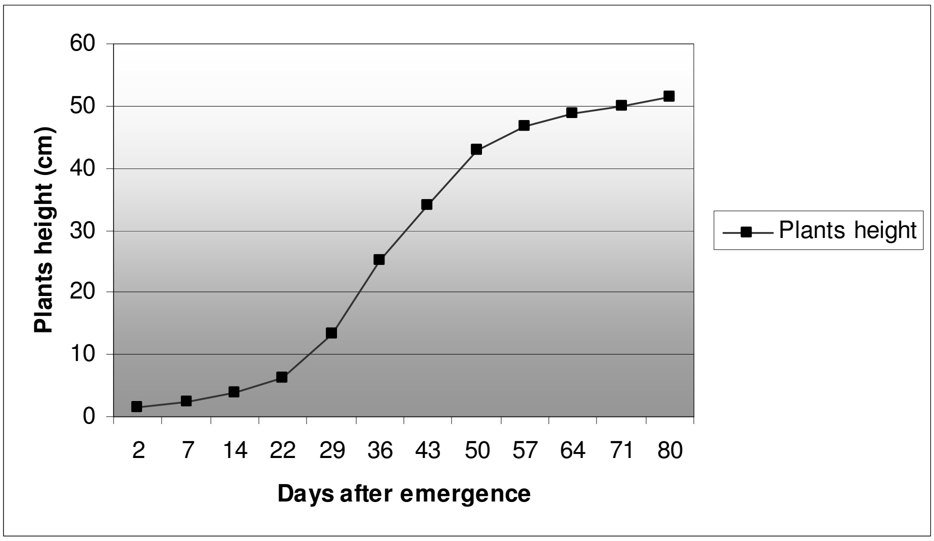

Fig. 1. Dynamics of plants height at *Camelina sativa*

In the second phase of the intense growth, carried out over a period of 29 days, between May 15 and June 12, camelina plants reached 46.8 cm height, therefore an increase of 33.6 cm, with an average of 1.15 cm/day. Finally, in the third stage, at the end of the vegetation, the increase was slower, so that over a period of 23 days, it was attended a height of 51.4 cm, with an increase of 4.6 cm over the entire period, and an average rate of 0.2 cm/day.

Dynamics of leaves growing. In the research conditions, the *Camelina sativa* plants formed on the main stem around 37 leaves. Leaves formation was conducted over a period of 72 days of vegetation, resulting an average rate of 2.11 days/leaf. The rate of leaves formation was slower in the first 14 days of growing season (April 18-April 30); at this stage were formed 8 leaves, with an average rate of 1.75 days/leaf. In the next phase of the intense height growth of the stem (April 30-May 29), leaves formation was more alert, so that over a period of 29 days were formed 26 leaves, with an average rate of 1.11 days/leaf (table 1).

Table 1

Dynamics of leaves growing at *Camelina sativa* species

Date	Number of leaves		Days	
	After emergence	From the apparition of the previous leaf	After emergence	From the apparition of the previous leaf
18.04.2008	2	0	2	0
23.04.2008	5	2	7	7
30.04.2008	8	3	14	7
08.05.2008	14	6	22	7
15.05.2008	22	8	29	7
22.05.2008	28	6	36	7
29.05.2008	34	6	43	7
05.06.2008	37	3	50	7
12.06.2008	32	0	57	0
19.06.2008	23	0	64	0
26.06.2008	13	0	71	0
05.07.2008	8	0	80	0

Dynamics of inflorescence, flowering and fruits formation. The inflorescence appeared at 36 days after emergence, the maximum flowering stage (50% flowered plants) being marked at 43 days after emergence; seeds formation began after the 12[th] of July and the maturity (considered at 8% humidity content) was attended at 37 days after flowering (table 2).

Table 2

Dynamics of inflorescence, flowers and fruits growing at *Camelina sativa* species

Date	Dimension of the main inflorescence (cm)	Phenophase	Days after emergence
22.05.2008	2.5	Apparition of inflorescence	36
27.05.2008	3.7	Beginning of flower opening	41
08.06.2008	5.1	Fruit apparition	53
12.06.2008	7.2	Beginning of seeds formation	57
19.06.2008	8.8		64
26.06.2008	9.1		71
05.07.2008	9.2	Full maturity	80

Upon harvest, plants had 51.4 cm height and a number of 121 fruits per plants which contained around 793.25 seeds, which means an average of 6.55 seeds/fruit. 1000 seeds weight had an average value of 1.21 g, and seed moisture was of 8.04% at harvesting (table 3). The seeds yield was evaluated of 1534.9 kg/ha.

Table 3

The moisture and 1000 seeds weight (TGW) at *Camelina sativa* seeds

Variant	TGW (g)	Moisture (%)	Dry matter (%)
V_1	1.21	8.13	91.87
V_2	1.19	7.92	92.08
V_3	1.23	8.05	91.95
Average	*1.21*	*8.04*	*91.96*

CONCLUSIONS

1. In the reddish preluvosoil area from Romanian Plain, camelina plants had a vegetation period of 86 days from sowing, and at maturity stage camelina plants were 51.4 cm tall, having an average growth rate of 0.59 cm/day and a number of 37 leaves.
2. The inflorescence appeared at 36 days after emergence, the maximum flowering stage (50% flowered plants) being marked at 43 days after emergence and the maturity (considered at 8% humidity content) was attended at 37 days after flowering.
3. Upon harvest, the plants had 51.4 cm height and a number of 121 fruits per plants which contained around 793.25 seeds, which means an average of 6.55 seeds/fruit. The average value of the 1000 seed weight was 1.21 g and the yield was of 1534.9 kg/hectare.

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RESEARCH ON BIOLOGICAL AND MORPHOLOGICAL CHARACTERISTICS AND YIELD QUALITY AT *FAGOPYRUM ESCULENTUM* MOENCH. SPECIES UNDER THE CONDITIONS OF THE CENTRAL PART OF ROMANIAN PLAIN

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Keywords: *buckwheat, biology, morphology, yield quality*

Abstract

The paper presents the results of the research made in 2004-2007 yiers at Moara Domneasca Experimental Field, regarding morphological and biological characteristics, chemical composition and yield quality of Fagopyrum esculentum Moench. species. In natural condition of reddish preluvosoil area, the duration of the vegetation period of buckwheat was of 80-90 days, excepting the year 2007, when due to drought and high temperatures, the duration reduced less then 70 days. In the same context, the maximum plants height varied between 37 and 52.2 cm, the values being lower in the year 2007. Buckwheat grains yields were around 6.4 q/ha in the year 2007, year less favourable to agricultural crops, and were about 15 q/ha in the other two experimental years (2004 and 2006). The chemical composition of buckwheat grains was the following: 10.05-11.99% moisture, 88.01-90% dry matter, out of which: 14.20-16.30% proteins; 62.91-67.92% starch; 3.14-4.12% lipids; 9.27-10.65% fibre; 2.04-2.80% ash. There are remarked the superior values of the protein content (in average 15.24%) and over 16% for the best variants, in comparison with cereals grains (10-14%).

INTRODUCTION

Common buckwheat (*Fagopyrum esculentum* Moench.) or „black wheat" is a crop which belongs of the *Polygonaceae* family. Since the chemical composition and use of grains in humen diet and feeding are similar to cereals, buckwheat is considered a pseudocereal. This species has been a crop of secondary importance in many countries but, at present, it is promoted as alternative crop in organic farming system. Buckwheat grains with the dehulled groats can cooked as porridge, and the flour used in the preparation of bread, biscuits, pancakes, mixed breakfast cereals, soups, cakes. Buckwheat proteins are of excellent quality and has higher content in essential aminoacid lysine, unlike common cereals. Small leaves and shoots are used as leafy vegetables, the flowers and green leaves are used for rutin extraction for medicine treatments. The presence of pollinators greatly increases the yield. The nectar of buckwheat flowers makes a dark colored honey with a high quality. The buckwheat grains have importance because that does not contain gluten, so they can be used as bakery products by persons suffering from celiac disease and having allergy to gluten. Buckwheat is a short season crop that does well on low-fertility or acidic soils, but the soil must be well drained. Too much fertilizer, especially nitrogen, will reduce yields. In hot climates, it can only be grown by sowing late in the season, so that it will bloom in cooler weather. Buckwheat is sometimes used as a green manure, as a plant for erosion control, or as wild fauna cover and feed.

MATERIAL AND METHODS

On period 2006-2007, in the Moara Domneasca Experimental Field were organized researches upon *Fagopyrum esculentum* species, where there was studied a biological material of different origin, respectively Moara Domnească cultivars collection but also the ones from Germany, Greece, Slovenia and Poland. The comparative crops were organized based on the multi-stage block method, with randomized variants in 4 replications. The distance between rows was of 25 cm and the sowing density was of 350 germinable grains/m². Chemical analyses were made in the Yield Quality Laboratory of the Field Crops Department, Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine Bucharest, with a spectrophotometer NIR, Instalab 600. This equipment uses the infrared technology for determination of different chemical compounds of cereals and pseudocereals grains. The calibration of spectrophotometer for buckwheat was effectuated by the Metron Group Laboratory from Novi Sad.

RESULTS AND DISCUSSION

In natural conditions of reddish preluvosoil area, the vegetation period of *Fagopyrum esculentum* Moench. species was of 80-90 days, excepting the year 2007, when due to the drought and high temperatures, the period reduced less than 70 days. In the Moara Domneasca Experimental Field conditions, according to the data from Table 1, buckwheat plants had between 76 and 95 days for sowing-maturity period, and between 63 and 88 days from emergence to maturity.

Regarding the phenology data, it can be observed that plants of Greak cultivars needed to emergence 8-12 days, and their from Germany and Poland, they needed 6-13 days. The apparition of first fruits was noted during 16-30 June, respectively, 41-55 days after emergence, dignifying Germany cultivar, as early in May with 12-19 days compared with the Greak cultivar. Flowering period was longer, in average, 22-25 days and the maturity was noted at 51-55 days after bloom, with small differences between variants. The stage of harvesting was noted during 10-31 July time interval, respectively 6-9 days after the apparition of first fruits (table 1).

In the same context, the maximum plants heights varied between 36.9 and 52.2 cm, the values being lower in the year 2007 (figure 1).

Table 1

Phenology data at *Fagopyrum esculentum* plants, depending on cultivars
(Moara Domneasca Experimental Field, 2004-2007)

Phenology data (limits)	Cultivars (provenience of seeds)			
	Romania	**Poland**	**Germany**	**Greece**
Sowing data	25-27 April	25-27 April	25-27 April	25-27 April
Emergence data	4 -7 May	3-8 May	3-8 May	5-7 May
Number of sowing/emergence days	7-12	6-13	6-13	8-12
Flowering data	31 May -2 June	29 May -2 June	28-30 May	3-4 June
Number of emergence/flowering days	24-31	27-30	20-27	22-31
Date of first fruits apparition	18-25 June	18-24 June	18 June	16-30 June
Maturity data (70% mature inflorescences)	13-27 July	10-23 July	10-23 July	14-31 July
Number of flowering/maturity days	43-54	42-53	43-54	41-55
Vegetation period (number of sowing/maturity days)	79-91	76-87	76-87	80-95
Vegetation period (number of emergence/maturity days)	67-84	63-81	63-81	68-88
Plants height at harvesting (cm)	42.3-51.3	37.2-46.5	36.9-49.2	38.8-52.2

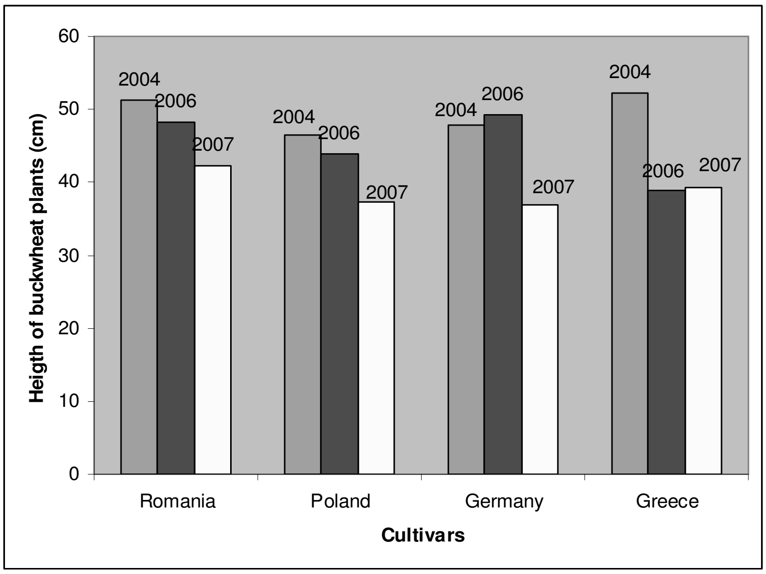

Fig. 1. *Fagopyrum esculentum* plants heigth, depending on cultivars (Moara Domneasca Experimental Field, 2004-2007)

The level of the Thousand Grains Weight (TGW) was about 22.3 g, and the yields, in average, of 15 q/ha. The highest value was obtained at German cultivars, of 19.60 q/ha (2006) and the smallest was obtained at Polish cultivars, of 6.40 q/ha (figure 2).

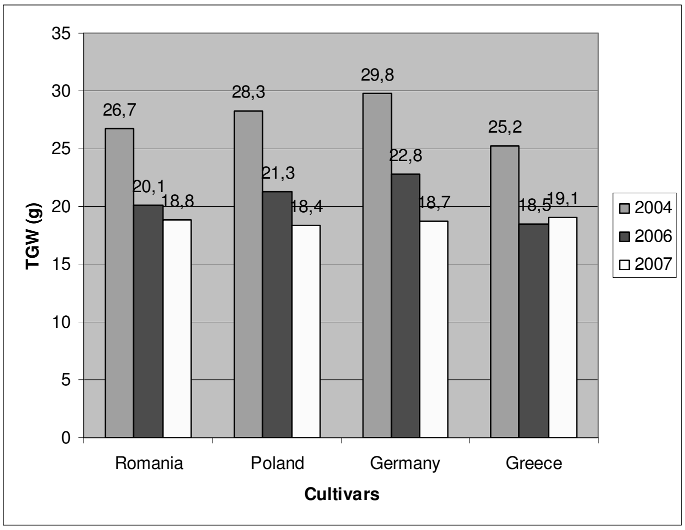

Fig. 2. TGW of *Fagopyrum esculentum* grains, depending on cultivars (Moara Domneasca Experimental Field, 2004-2007)

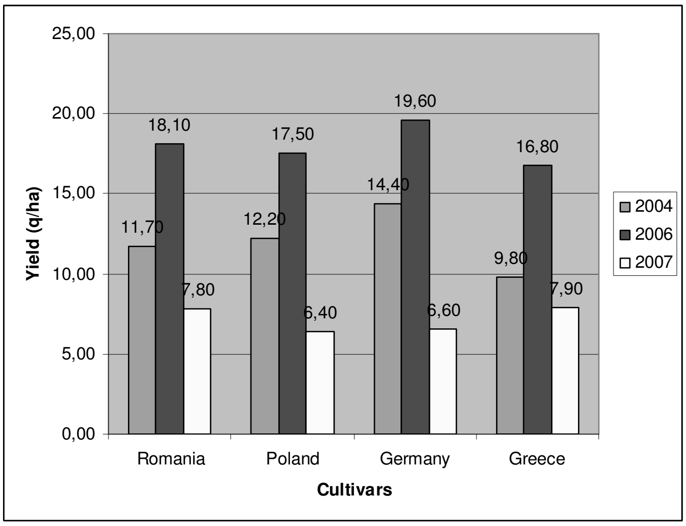

Fig. 3. Grains yields by *Fagopyrum esculentum*, depending on cultivars (Moara Domneasca Experimental Field, 2004-2007)

The chemical composition of grains was the following: 10.05-11.99% moisture, 88.01-90% dry matter, out of which: 14.20-16.30% proteins; 62.91-67.91% starch; 3.14-4.12% lipids; 9.27-10.65% cellulose; 2.08-2.58% ash (table 2).

There are remarked the higher values of protein content (in average 15.24%) and over 16% for the best variants, in comparison with cereals (10-14%). The chemical composition of buckwheat grains was strongly influenced by weather condition. So, in the case of 2004, a favourable year, the average protein content was of 15.37% and in the year 2007, the protein content increased to over 16%.

Table 2

Proteins, starch, lipids, fibre and ash contents of *Fagopyrum esculentum* grains (% d.m.), depending on cultivars

(Moara Domneasca Experimental Field, 2004-2007)

Cultivars (provenience of grains)	Proteins	Starch	Lipids	Fibre	Ash
Year 2004					
Romania	14.97	64.20	3.97	10.24	2.14
Poland	15.67	62.91	3.82	10.21	2.12
Germany	15.59	63.62	4.12	10.41	2.04
Greece	15.25	63.51	3.91	10.65	2.05
Average (2004)	**15.37**	**63.56**	**3.95**	**10.37**	**2.08**
Year 2006					
Romania	14,28	66.75	3.25	10.06	2.18
Poland	14,37	67.43	3.14	9.72	2.21
Germany	14,46	67.91	3.17	10.31	2.61
Greece	14,20	67.82	3.18	9.27	2.13
Average (2006)	**14,32**	**67.47**	**3.18**	**9.84**	**2.28**
Year 2007					
Romania	16.08	67.59	3.72	10.16	2.55
Poland	15.87	67.83	3.24	10.10	2.40
Germany	15.90	67.87	3.29	10.40	2.60
Greece	16.30	67.92	3.61	10.20	2.80
Average (2007)	**16.03**	**67.80**	**3.46**	**10.21**	**2.58**
Average (2004-2007)	**15.24**	**66.27**	**3.53**	**10.14**	**2.31**

CONCLUSIONS

1. In the natural condition of reddish preluvosoil area in the central part of Romanian Plain, the vegetation period of *Fagopyrum esculentum* species was of 80-90 days, excepting the year 2007, when due to drought and high temperatures, the period reduced to less than 70 days.
2. The maximum plants heights varied between 36.9 and 52.2 cm, the values being lower in the year 2007.
3. Buckwheat grains yields were about 6.4 q/ha in 2007, year less favourable to agricultural crops and there were about 15 q/ha in the other two experimental years (2004 and 2006).
4. There are remarked the superior values of the protein content (in average 15.24%) and over 16% for the best analyzed variants, in comparison with cereals (10-14%).
5. The buckwheat grains chemical composition was strongly influenced by weather condition. So, in the case of the year 2004, a favourable year, the average value for protein content was of 15.5% and in 2007, the value for protein content increased to over 16%.
6. As a consequence, it was issued the conclusion that *Fagopyrum esculentum* species find favourable conditions in the area of the reddish preluvosoil area from the central part of Romanian Plain.
7. This species, strongly promoted by scientific trends which support biodiversity and organic agricultural system may contribute to the diversification of agricultural crops and of agroalimentary products, with a source of aliments rich in proteins of high assortment quality.

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RESEARCH ON THE PRODUCTIVITY OF MAIZE INTERCROPPED WITH COMMON BEAN IN TWO SPATIAL ARRANGEMENTS, IN THE ORGANIC AGRICULTURE SYSTEM

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Keywords: *intercropping, organic agriculture, maize, common bean*

Abstract

Research was oriented towards studying the productivity and land equivalent ratio of maize and common bean in intercropping, in two spatial arrangements, in the organic agriculture conditions.The experiment was carried out in Moara Domneasca Experimental Field, on reddish preluvosoil, in randomised variants in 4 replications. The seed used in the experiment was obtained from ecological, material. It was sown a simple, early maize hybrid (Zea mays-DK 391) and common bean cultivar (Phaseolus vulgaris–Diva cultivar). Maize was sown at 70 cm between rows and 28.6 cm between plants per row, at a density of 5 plants/m^2. Bean was sown between maize plants at a density of 2 plants/m^2 or between maize rows at a density of 12 plants/m^2.

It was determined the productivity components, yields and land equivalent ratio, both for maize and for common bean.

INTRODUCTION

The consumers' interest in food security, respectively healthy food with high nutritional value and in the environment protection led to the development in the last decades of some concepts regarding the agricultural systems, especially the organic agriculture. One of the specific agricultural practices would be introducing of intercropping in the organic agriculture system. The main objective of intercropping is to have an additional crop without affecting the basic crop yield, or to obtain higher total economic returns.

Intercropping involves competition for light, water and nutrients. However, intercropping usually benefits from increased light interception, root contact with more soil, increased microbial activity and can act as a deterrent to pests and weeds of the other crop. In intercropping with a leguminous, a non-leguminous which needs nitrogen may benefit, since legumes will fix nitrogen in the soil (Portes, 1984; Carruthers K., 2000).

Intercropping maize with leguminous plants is an alternative to monoculture of maize (for example, maize-bean mixture represents an important production system for the organic agriculture due to the reduction of the cultivated land area, the increase of human population and the high protein content of the bean seeds.

MATERIAL AND METHODS

The experiment was conducted in the year 2008 in Moara Domnească Experimental Field, on redish preluvosoil, in randomised variants in 4 replications. The seeds used in the experiment were obtained from ecological materials. A simple, early maize hybrid (*Zea mays* - DK 391) was sown together with common bean cultivar (*Phaseolus vulgaris* – Diva cultivar). The maize was sown at 70 cm between rows and 28.6 cm between plants per row, at a density of 5 plants/m^2. The bean was sown between the maize plants at a density of 2 plants/m^2 or between the maize rows (one row of maize and two rows of bean) at 12 plants/m^2 and 40 cm distance between rows. The spatial arrangement was as shown below (figure 1).

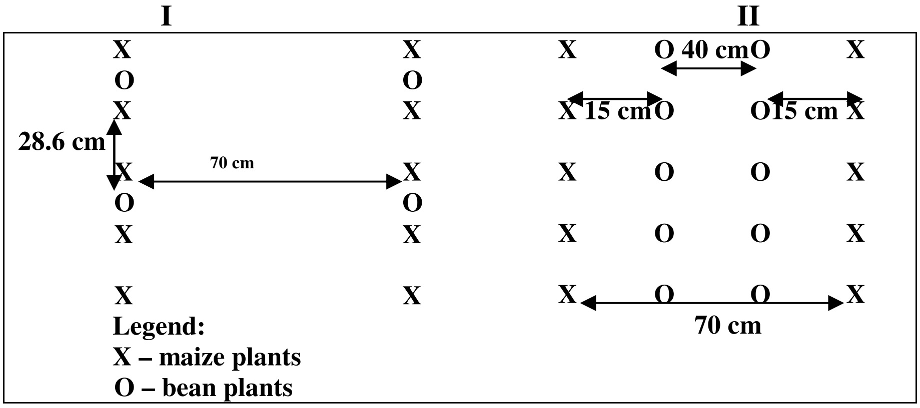

Fig. 1. The spatial arrangements for maize – common bean intercropping (I – first spatial arrangement; II – second spatial arrangement)

The observations determined the productivity components, the yield and the land equivalent ratio, both for maize and for common bean.

RESULTS AND DISCUSSION

A. Results for maize. The analysis of the productivity components of maize grown in monoculture and intercropped with bean in two spatial arrangements showed that, in monoculture, the cobs had an average length of 20 cm, with 14-16 rows of grain and 489.5 grains/cob. In monoculture, maize had a grain efficiency of approximately 82.1% and the TGW was 297.2 g. When the maize was intercropped with beans, in the first spatial arrangement, the cob was shorter, respectively 17 cm; the maize formed 14 rows of grains and their number was lower - 450 grains/cob. The grain efficiency was 81.7%, and TGW was of 290.7 g (table 1).

Compared to the first spatial arrangement, in the second arrangement the maize formed smaller cobs of 16 cm long and the number of grains rows on the cob was the same - 14. The maize cobs showed a smaller number of grains per cob, respectively 437.5, with fewer grains per row. The maize grains weight per cob was 124 g in this spatial arrangement, and the TGW was calculated to 283.4 g.

Table 1

Productivity components of maize grown in monoculture and intercropped with bean

Productivity components	*Zea mays* – maize (cobs)		
	Monoculture	Maize-bean intercropping (1st spatial arrangement)	Maize–bean intercropping (2nd spatial arrangement)
Cob length (cm)	20	17	16
Number of grain rows/cob	14-16	14	14
Number of grains/cob	489.5	450	437.5
Number of grains/row	32.6	32.1	31.25
Cob weight (g)	165	155.4	152.2
Grain weight/cob (g)	135.5	127.1	124
Grain efficiency (%)	82.1	81.7	81.4
1000-grain weight (TGW) (g)	297.2	290.7	283.4

Based on the productivity components and the sowing density, there were determined the yields, both for maize grown in monoculture and intercropped with bean, in the two spatial arrangements. The average grain yield of maize grown in monoculture was of 5044.22 kg/ha, higher than the yield of maize intercropped with bean from the first spatial arrangement, respectively 4537.8 kg/ha. In the second spatial arrangement there was obtained a lower yield, namely 4353.7 kg/ha (figure 2). Thus, in the first spatial arrangement, there was no growth of yield for the maize grown in monoculture, but the yield was 184.1 kg/ha higher compared to the maize yield from the second arrangement.

B. Results for bean. The analysis of the productivity components of bean grown in monoculture and intercropped with maize in two spatial arrangements showed that, in monoculture, the bean had an average height of 39 cm, i.e. 5 cm less than the bean intercropped with maize, in the first spatial arrangement and 1 cm less than the bean from the second arrangement.

In monoculture, the bean stems formed an average 7 fertile levels and around 12 pods per plant. On the contrary, in the first spatial arrangement of intercropping, the bean plants formed 8 levels with pods and 15 pods/plant, with 1.84 pods/level.

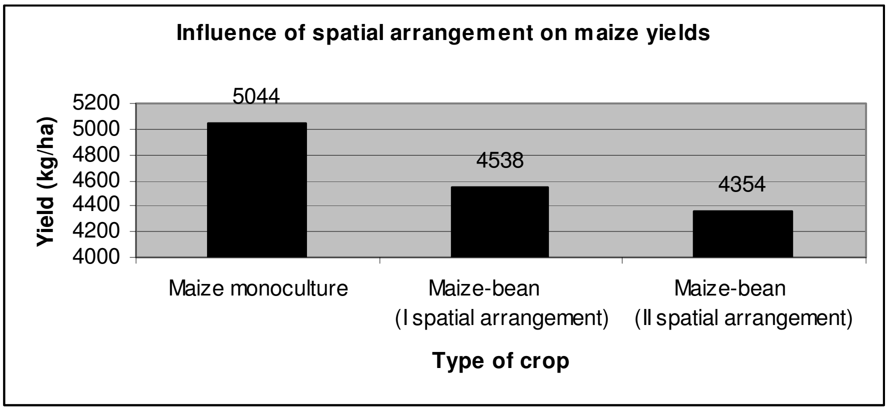

Fig. 2. The influence of intercropping on maize yields

As far as the number of seeds per plant is concerned, the bean plants formed 65 seeds when grown in monoculture, i.e. 15 fewer than when intercropped with maize, in the first spatial arrangement and 2 seeds more than in the second spatial arrangement. The number of seeds/pod at the bean plants grown in monoculture was of 5.4, with the seed weight per plant of 10.5 g. In the first spatial arrangement, the number of seeds/pod was 5.2, with the seed weight per plant of 14.25 g. In the second arrangement, the bean plants formed the same number of seeds per pod, the seed weight per plant being slightly smaller - 10.1 g. TGW in monoculture was of 161.53 g, in the first special arrangement, 182.69 g and in the second arrangement, of 160.31 g (table 2).

Table 2

Productivity components of bean grown in monoculture and intercropped with maize

Productivity components	*Phaseolus vulgaris* – common bean		
	Monoculture	Maize-bean intercropping (1st spatial arrangement)	Maize–bean intercropping (2nd spatial arrangement)
Plant height (cm)	39	44	40
Number of pod levels/plant	7	8	6.5
Number of pods/plant	12	15	12
Number of pods/level	1.71	1.87	1.84
Number of seeds/plant	65	78	63
Number of seeds/pod	5.4	5.2	5.25
Seed weight/plant (g)	10.5	14.25	10.1
1000 – seed weight (TGW) (g)	161.53	182.69	160.31

When grown in monoculture, the bean plants had an average yield of 1361 kg/ha; when intercropped with maize, in the first spatial arrangement they had a yield of 570 kg/ha and in the second spatial arrangement (one row of maize and two rows of bean), a yield of 1212 kg/ha (figure 3).

Thus, the bean plants from the first spatial arrangement had a yield lower by 791 kg than those grown in monoculture, due to the lower density of the crop, which were intercropped through maize plants. In the second spatial arrangement of maize-bean intercropping, the yield slightly decreased by 149 kg.

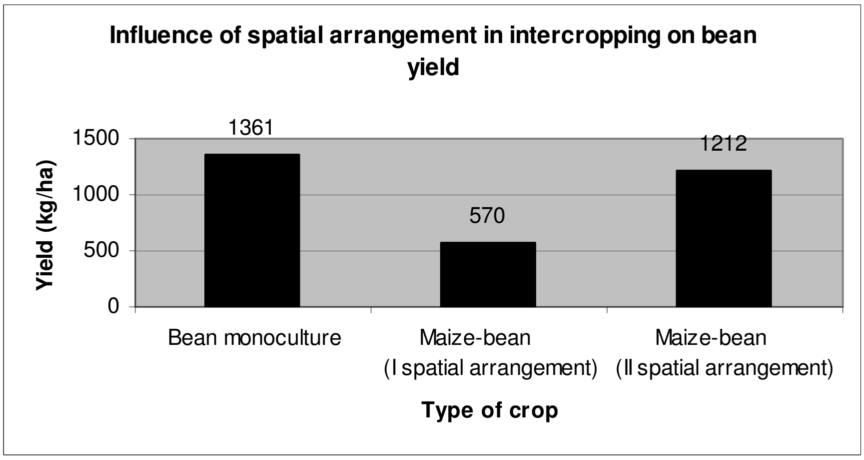

Fig. 3. The influence of intercropping on bean yields

The partial and total land equivalent ratio (LER) was also determined during the research. Thus, LER ranged between 1.3 for the first spatial arrangement of maize-bean intercropping and 1.75 for the second arrangement. These values show that there is a real advantage of intercropping beans with maize as compared to monoculture. For these two values, 30% respectively 75% extras land would be necessary to produce the combined yields of all crops if they were to be grown as pure stands (table 3).

CONCLUSIONS

1. When intercropped, the maize plants from the first spatial arrangement developed better than those from the second arrangement. This is due to the lower density of the bean crop and the lower competition for soil water and nutrients.
2. The average grain yield for maize grown in monoculture was 5044.2 kg/ha. In the first spatial arrangement, there was no growth of maize yield

compared to monoculture. Nevertheless, the yield was 184.1 kg/ha higher than in the second spatial arrangement.

3. The beans plants from the first spatial arrangement developed better than those from the other spatial arrangement and those grown in monoculture. This means that, although the bean plants were intercropped through the maize plants, they did not compete for water and nutrients.
4. When grown in monoculture, the beans plants had a yield of 1361 kg/ha. When intercropped with maize, in the first spatial arrangement, their yield was 791 kg lower than in monoculture, due to the lower density of crop and the maize shading. In the second spatial arrangement of maize-bean intercropping, the yield decreased by only 149 kg, which means that a higher crop density may result in higher yields.
5. The value of the land equivalent ratio (LER) ranged between 1.3 for the first spatial arrangement of the maize-bean intercropping and 1.75 for the second arrangement. Thus, intercropping lead to overall higher LER values, the land being better exploited when maize is mixed with bean.

Table 3

Land equivalent ratio for maize intercropped with common bean in two spatial arrangements

	Type of crop	Intercrop yield (kg/ha)	Monoculture yield (kg/ha)	Partial LER
(1st spatial arrangement)	**Maize**	4537.8	5044.22	0.89
	Bean	570	1361	0.41
Total LER	**-**	-	-	**1.3**
(2nd spatial arrangement)	**Maize**	4353.7	5044.22	0.86
	Bean	1212	1361	0.89
Total LER	-	-	-	**1.75**

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EXPERIMENTAL RESULTS CONCERNING TEMPORARY GRASSLANDS WITHIN SUSTAINABLE FARMING SYSTEM IN ROMANIAN PLAIN

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Keywords: *mixtures, fertilization, yield, botanical composition*

Abstract

Definitory elements of temporary grasslands sustainable cropping technology in Romanian Plain are: fertilization restrictive systems and the structure of graminaceae and perennial leguminous mixtures adjusted to this system.

For this purpose, it was founded an experimental station within the Didactical Farm Moara Domneasca of USAMV Bucharest, on reddish preluvosoil. There were studied 3 variants of mixtures, in different proportions, among the most adjusted varieties to the growing conditions in this area (Dactylis glomerata 40-50-60% and Medicago sativa 60-50-40%), as well as 3 variants of mineral restrictive fertilization with N 0-50-100 and P_2O_5-50.

As it results from the experimental data during 2006-2008, among the three years, there are essential differences concerning the achieved production. Thus, while the first two years production is 7-9 t/ha DM, during the third year the yield doubles itself (14-16 t/ha DM), as a consequence of the precipitations higher level and of their better distribution, especially during the first harvest.

On the basis of the obtained results in the system of sustainable agriculture in Romanian Plain, there are recommended mixtures with a share of minimum 50% Medicago sativa, with mixed use or only by harvesting, in the unirrigated crop, fertilized with only 50 kg/ha P_2O_5. For grazing, there are recommended mixtures where Medicago sativa's share is smaller than 50%, fertilized with 50 kg/ha N and 50 kg/ha P_2O_5. For both variants, there are obtained yields over 10 t/ha DM, of superior quality, effective as well from economic point of view as ecological one.

INTRODUCTION

In the future, in the system of sustainable agriculture, the importance of temporary grasslands in Romanian Plain, won't diminish, but on the contrary. As well on the areas with degraded permanent grasslands (rather narrow), but especially on the arable fields, the establishment of temporary grasslands becomes an extremelly necessary measure for all agricultural exploitations which owe herbivourous animals livestock.

One of the most difficult issues in temporary grasslands technology from plain areas is cropping in unirrigated regime, which becomes risky in the droughty years [1, 2, 3].

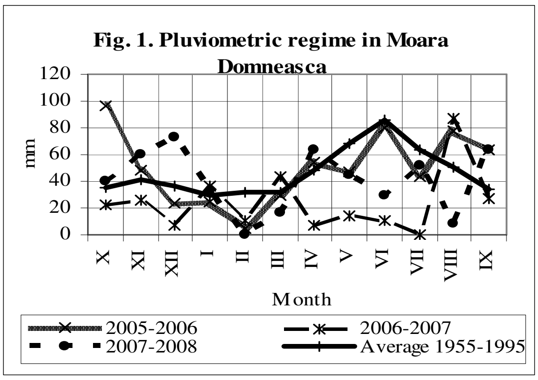
In the present work, there are presented the results obtained during 2006-2008 within an experiment with technological variants (mixtures and fertilization) conceived for a sustainable cropping system, with low inputs, accessible to most of the agricultural exploitations in Romanian Plain, especially to the ones from the area with reddish preluvosoil.

MATERIAL AND METHODS

Research was effected within the Experimental Didactic Farm Moara Domneasca, farm owed by the University of Agronomic Sciences and Veterinary Medicine Bucharest.

Soil. The representative soil for the experimental field and for oak area, from the South of the country, belongs to the preluvosoil kind, to reddish subtype, having the following characteristics: loamy-clayey texture, medium humus content in A horizon (2.77%) and relatively high in A/B (about 1.2%); slight neutral-acid reaction in A horizon (pH 6.29-6.64); phosphorus content, of 17 ppm P_{AL} (poorly - mediumly supplied); potassium content, of 184 ppm K_{AL} (well supplied).

Climate. As a multiannual average, in the area of the experimental field, precipitations sum up 556.1 mm. During the vegetation period (March-September), there is a waterfall of 380 mm as an average. Relative humidity of the air is of 78.6%, and during the vegetation year 73%. In comparison with the normal climate regime of the area where, the experimental field is situated, the research years characterized themselves, this way: 2006 was a normal year, but completely lacked of snow, 2007, an extremely droughty year and 2008, a most normal during the first half and droughty afterwards (figure 1).



Experimental factors. Factor A: Mixture: *Dactylis glomerata* - Poiana variety + *Medicago sativa* - Magnat variety.

a1 - *Dactylis glomerata* 40%+*Medicago sativa* 60%;
a2 - *Dactylis glomerata* 50%+*Medicago sativa* 50 %;
a3 - *Dactylis glomerata* 60%+*Medicago sativa* 40 %.

Factor B: Fertilization: b1-N-0 P_2O_5-50; b2-N-50 P_2O_5-50; b3-N-100 P_2O_5-50.

Fertilization system: P_2O_5-50 applied in the autumn; N-50 applied in the spring; N100, applied in fractions such as: N-50 in the spring + N-50 after the first harvest.

RESULTS AND DISCUSSION

Dry matter yields. On the basis of the data presented in table no.1, it is estimated that the average production of the 3 experimental years is very high for the conditions of unirrigated crops in Romanian Plain.

Table 1

Dry matter yields

Mixture	Fertilization variant	t/ha				%		
		2006	**2007**	**2008**	**Average**	**2006**	**2007**	**2008**
Dactylis glomerata 40% *Medicago sativa* 60%	N0P50	9.22	9.28	15.65	**11.38**	27	27	46
	N50P50	7.58	7.90	14.68	**10.05**	25	26	49
	N100P50	8.47	8.40	15.77	**10.88**	26	26	48
	Average	**8.42**	**8.53**	**15.37**	**10.77**	26	26	48
Dactylis glomerata 50% *Medicago sativa* 50%	N0P50	9.51	8.60	15.47	**11.19**	28	26	46
	N50P50	8.66	7.89	15.98	**10.84**	27	24	49
	N100P50	8.17	8.14	16.77	**11.03**	25	25	50
	Average	**8.78**	**8.21**	**16.07**	**11.02**	27	25	48
Dactylis glomerata 60% *Medicago sativa* 40%	N0P50	7.03	7.64	14.6	**9.76**	24	26	50
	N50P50	7.15	7.62	16.62	**10.46**	23	24	53
	N100P50	7.47	7.23	16.52	**10.41**	24	23	53
	Average	**7.22**	**7.50**	**15.91**	**10.21**	24	24	52

The reference potential level of graminaceae and perrenial leguminous mixtures, from unirigated areas in Romanian Plain, established by our research staff, during 2006-2008, on the basis of the experimental results, from the latest 20 years [4], reaches on average of 7 t/ha dry matter. Out of the data achieved during 2006-2008, it is acknowledged that for all the experimental variants, the dry matter yield surpassed this reference level, reacing up to 11.38 t/ha DM. The other fertilization variants achieved yields comprised between 10 t/ha DM and 11 t/ha DM.

Maximum yield (11.9-11.38 t/ha DM) was achieved with the mixtures of *Medicago sativa* in proportion of 50-60%, for the variant fertilized only with 50 kg/ha P_2O_5.

As it results from the experimental data, among the three years, there are essential differences concerning the achieved yield. Thus, while the production of the first two years is of 7-9 t/ha DM, the third year, the yield doubles itself (14-16 t/ha DM), as a consequence of the higher precipitations level and of their better distribution, especially during the first harvest. 2008 year raised the average production level over 3 years to 10-11 t/ha.

<u>The influence of the mixture type</u>. In comparison with the mixture no. 2, formed of *Dactylis glomerata* 50% and *Medicago sativa* 50% (11.02 t/ha DM as an average, in the experimented fertilization variants) as a control element, only the mixture where the proportion of *Medicago sativa* variety decreases to 40% (mixture no. 3) achieves 7% lower yield (respectively 0.81 t/ha DM), significantly statistically assured (table 2).

Table 2

Mixture influence upon dry matter yields

Mixture	**Dry matter yield**		**Difference (t/ha)**	**Significance**
	t/ha	**%**		
Dactylis glomerata 40% *Medicago sativa* 60%	10.77	98	-0.25	-
Dactylis glomerata 50% *Medicago sativa* 50%	11.02	100	-	Mt.
Dactylis glomerata 60% *Medicago sativa* 40%	10.21	93	-0.81	0

LSD 5% = 0.59 t/ha LSD 1% = 0.89 t/ha LSD 0.1% = 1.43 t/ha

On vegetation years, a lower productivity of the mixture no. 3 was recorded only in 2006, first year of vegetation. The mixture with a bigger proportion of *Medicago sativa* (mixture no. 1) makes no significant difference during any of the research years. These results make us right to assert that in the given experimental conditions, between the two variants associated in the mixtures, the leguminous plants are the ones which differentiate the production potential of the vegetal layer, depending on their share in the mixture structure.

<u>Fertilization influence.</u> During 2006-2008, the azote fertilization led to a significant diminishment level of dry matter yield in comparison with the azote unfertilized variant, as an average, on mixtures, due to the alfalfa higher percent of participation to the flower composition (table 3).

Comparing the fertilization variants, depending upon the used mixture, it results that the unfertilized with azote variant is superior to other variants within mixtures no. 1 and 2 and makes no statistic difference for mixture no. 3.

Table 3

Fertilization influence upon dry matter yields

Fertilization variant	**Dry matter yield**		**Difference (t/ha)**	**Significance**
	t/ha	**%**		
N0P50	10.78	103	-	Mt.
N50P50	10.45	100	-0.33	00
N100P50	10.77	103	-0.01	-

LSD 5% = 0.18 t/ha   LSD 1% = 0.25 t/ha   LSD 0.1% = 0.34 t/ha

On the basis of the production results, one may estimate that the mixtures with a share of minim 50% *Medicago sativa* (mixtures no. 1 and 2) with mixed use or only by threshing, are recommended in the unirrigated crop in fertilization system with only 50 kg/ha P_2O_5. The mixture with thehigher than 50% participation of the variant *Dactylis glomerata* (mixture no. v3), especially used for grazing achieves yields close to the mixtures where *Medicago sativa* prevails, only within the variants fertilized with 50-100 kg/ha N together with 50 kg/ha P_2O_5. But we estimate, that even the mixture with 40% *Medicago sativa* may be cultivated without azote fertilization, however taking into account the high level of yield (10.21 t/ha DM), but especially the economic and ecological effectiveness, which is obtained in the the system of use in the animal feed by grazing.

Yield distribution on harvesting cycles. During the 3 research years, there were obtained 2 harvests in the first year and 3 harvests in the other years. Also, it resulted, that during all the years, neither the mixture kind, nor the fertilization variant significantly influences the gathering dymamics of dry matter during the vegetation period. For the normal regime, of 3 harvests per year, in conditions of irrigation shortage, for the first harvest, it was obtained between 53% and 70% out of the total production, for the second harvest 20-25%, and for the third harvest, 10-27%.

Botanical composition. Due to the strong challenging capacities of the alfa-alfa, which surpasses the one of the cocksfoot for the first harvesting cycle, alfalfa is prevailing in mixture no. 1 for all fertilization variants, and in mixture no. 2, for the variant N_0P_{50} (45-57%). In mixture no. 3, the dominant species is cocksfoot for all fertilization variants.

Species from other botanical families don't usually surpass 10-15% gravimetrical participation to either mixture and fertilization variant.

CONCLUSIONS

1. As it results from the experimental data during 2006-2008, in the climate conditions of the preluvosoil areas, nearby the capital, temporary grasslands may achieve average yields of 10-11 t/ha DM, using a simple technology (low inputs), without negative impact upon the environment and the primary (animal) and secondary (human being) consumer. At the same time, the experimented cropping system improves the natural soil fertility and it ensures sustainability of effective exploitation within the agriculture system practiced in the area.
2. In the circumstances of the acentuated lack of precipitations in the experimental period, it was demonstrated the adequate behaviour of analysed mixtures even in the unirigated crops.
3. The technological basic links for the sustainable crop of temporary grasslands in the unirrigated cropping in Romaninan Plain are: mixtures of perennial graminaceae and leguminous with mixed usage or only for by threshing, formed of *Dactylis glomerata* together with minimum 50% *Medicago sativa*, fertilized with only 50 kg/ha P_2O_5. For grazing, there are recommended the mixtures with the smaller than 50% involvement of *Medicago sativa*, fertilized with 50 kg/ha N and 50 kg/ha P_2O_5.
4. In the given experimental conditions, between the two varieties associated within the mixtures, *Medicago sativa* is the variety which diferentiates the production potential of the vegetal layer, depending on its share in the mixture structure.

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RESEARCH CONCERNING THE RESILIENCE CAPACITY OF MOUNTAIN GRASSLANDS

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Keywords: *resilience, grassland type, indicators, fertilization*

Abstract

In order to determine the resilience capacity, there was used the method elaborated by Gh. Motca (2005), according to which, the stability of the grassland natural ecosystem is emphasized by two indexes: the number of species in the vegetal layer and the share of other varieties from other botanical families (except graminaceae and leguminous). For fertilization and liming work, the field of resilience capacity is marked by the value of 20% variation coefficient for the first indicator and by 30% for the second.

For the derived ecosystem, the stability is expressed by two other indexes: share of dominant graminaceae (as a total) and share of each dominant graminaceae variety. The variation coefficient specific to the field of resilience capacity is of maximum 30% for both indicator.

In Poiana Brasov, the resilience capacity which ensures the stability of natural grasslands types extends in the field of fertilization variants with N 0-90, P_2O_5-80 K_2O-120, and in Blana- Bucegi is conditionned by the shortage of any fertilization and liming.

Variants which are allowed by the resilience of derived types are the ones with organic fertilization (paddocking), organic fertilization+liming (30-60% Ah),organic fertilization+ mineral fertilization (N-50, P_2O_5-50 K_2O-50), organic fertilization+(N-50, P_2O_5-50, K_2O-50)+liming and mineral fertilization (N-150, P_2O_5-50, K_2O-50) effected once in 3-5 years.

INTRODUCTION

Resilience capacity represents the tolerance of an ecosystem to the action of perturbing anthropic factors [3, 5, 6] or the variability field of some defining traits of the ecosystem, within the limits of its stability; for the grasslands it is about the influence factors subordinated to the improvement and exploitation technologies.

Knowledge of resilience capacity of mountain grasslands constitutes one of the most important factors for the application of technologies with minimum impact upon natural and semi-natural ecosystems extended on these surfaces.

In the field of applied ecology of grasslands applied to the grasslands vegetal layer [1, 2, 4], our experimental results bring original contributions to the perfectionning of technological management of grassland ecosystems and of enviromental management for preserving national and comunitary habitats.

MATERIAL AND METHODS

Resilince capacity determination was effected according to the method elaborated by Gh. Motcă, 2005 [3, 6], according to which the stability of the natural grassland ecosystem is emphasized by two indicators: the number of species from the vegetal layer and the share of species from other botanical families (except graminaceae and leguminous). For the fertilization and liming works, the field of resilience capacity is marked by the value of 20% variation coefficient (CV%) for the first indicator and 30% for the second indicator.

For the derived ecosystem, stability is expressed by indicators specific to natural ecosystems, to which, we add 2 aditional indicators: share of dominant graminaceae (as a total) and the share of each dominant graminaceae variety. The variation coefficient specific to the field of resilience capacity reaches a maximum of 30% for both additional indicators.

For the derived types, there are determined as well the *general resilience capacity*, which constitutes a general characteristic of derived kinds, as *specific capacity of resilience* for each derived type.

General resilience capacity of derived grasslands types was determined on the basis of two indicators: an indicator with common use, both for natural types as for derived ones (the total number of species) and an indicator used only for the derived types (total share of dominant graminaceae).

For the specific resilience capacity, it was taken into account only the share of dominant graminaceae which denominate the derived grassland type.

Results were obtained during 2005-2008 in the experimental stations Poiana Braşov (at 950 m altitude, spruce belt) and in Blana-Bucegi (subalpine belt, at 1800 m altitude) belonging to the Institute of Research-Develpment for Grasslands Brasov.

RESULTS AND DISCUSSION

Botanical composition. The natural type of grassland in the experimental stations is edified by the following dominant species: *Nardus stricta* (40%) + *Festuca rubra* (30%), in Poiana Brasov; *Nardus stricta* (40%), in Blana-Bucegi (tables 1 and 2).

Table 1

Botanical composition in the experimental variants from Poiana Brasov (synthesis)

Species groups and dominant species	Control	$N_{50}P_{50}K_{50}$+ Manure 20 t	CaO (30%Ah)	N50P50K50+ CaO (30%Ah)	N50P50K50+ G20+ CaO (30%Ah)	N50P50K50+ CaO(30%Ah)+ Paddocking (3 nights)	CaO(30%Ah)+ Paddocking (3 nights)	$N_{50}P_{50}K_{50}$+ Paddocking (3 nights)	Paddocking (3 nights)
Graminaceae	**94**	**97**	**70**	**96**	**86**	**70**	**56**	**96**	**91**
Nardus stricta	**40**	-	5	-	-	-	-	-	3
Festuca rubra	**30**	10	30	10	10	10	30	20	66
Agrostis capillaris	15	57	20	35	30	30	15	26	10
Poa pratensis	6	30	15	50	43	30	10	50	10
Leguminous	1	1	26	2	12	23	40	2	4
Different species	**5**	**2**	**4**	**2**	**2**	**7**	**4**	**2**	**5**

Table 2

Botanical composition in the experimental variants from Blana-Bucegi (synthesis)

Species groups and dominant species	Control	$N_{150}P_{50}K_{50}$ 2000-2002 (effect during the years 3-5)	Paddocking 2003 (effect during the years 3-5)+CaO (60% Ah) (effect during the years 10-13)	Paddo-cking 2004 (effect during the years 2-4)	Paddo-cking 2005 (effect during the years 1-3)
Graminaceae	**80**	**78**	**60**	**78**	**91**
Nardus stricta	**40**	5	-	8	8
Festuca nigrescens	+	15	12	12	18
Agrostis capillaris	+	18	22	2	12
Agrostis rupestris	12	13	-	15	8
Leguminous	8	7	15	12	3
Different species	**12**	**15**	**25**	**10**	**6**

At the altitude of 950 m, in Poiana Brasov, within the variants with low dosis of chemical fertilizers (N-50 P_2O_5-50 K_2O-50) together with organic fertilization (20 t/ha manure or paddocking with sheep for 3 nights) and with lime (30% Ah), it is established the derived type of *Agrostis capillaris* + *Poa pratensis*; in the absence of mineral fertilization, but with organic fertilization and with lime, the natural type is replaced with the derived type of *Agrostis capillaris* + *Festuca rubra*.

At the altitude of 1800 m, in the mountain Blana from the Bucegi Massif, the derived type is *Festuca nigrescens* + *Agrostis capillaris* + *Agrostis rupestris*, with the predominance of one or another from the three species, depending on the technological variant: *Festuca nigrescens* in the variant with paddocking, during the 1-3 effect years; *Agrostis capillaris*, variants with the effect of remnance during the years 3-5 of higher azote dosis (N-150 P_2O_5-50 K_2O-50) and of paddocking, as well as of liming (60% Ah) combination with paddocking; *Agrostis rupestris*, in the variant with paddocking, during the 2-4 effect years.

Resilience capacity. Depending on the experimented technological variants, the resilience capacity which ensures the stability of natural grasslands types extends in the field of fertilization variants with with N 0-90, P_2O_5-80 K_2O-120, in Poiana Brasov (figure 1) and it is conditionned by the shortage of any fertilization and liming in Blana-Bucegi.

General resilience capacity of the derived grasslands types from Poiana Brasov is framed in the variability field of 20-21% of the total number of species from the vegetal layer, as well as of the total share of dominant graminaceae (figure 2). Variants which are allowed by the resilience of the derived types are the ones with organic fertilization (paddocking), liming (30% Ah), organic fertilization (paddocking) + liming (30% Ah), paddocking + mineral fertilization (N-50, P_2O_5-50 K_2O-50), organic fertilization (20 t/ha manure or paddocking) + mineral fertilization + liming.

Fig. 1. Nardus stricta + Festuca rubra grasslands resilience capacity - Poiana Braşov

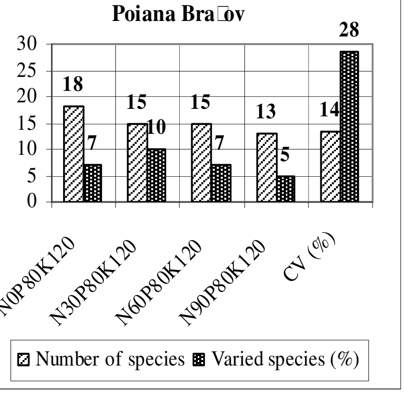
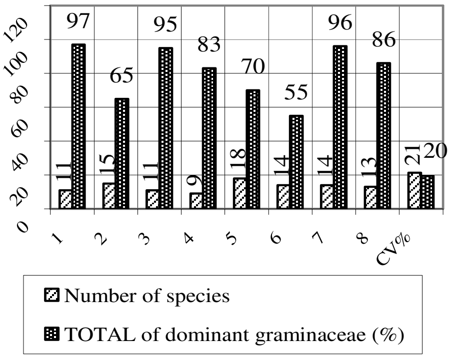
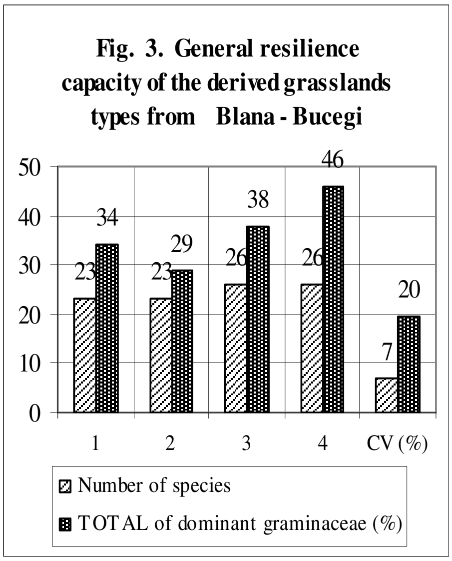
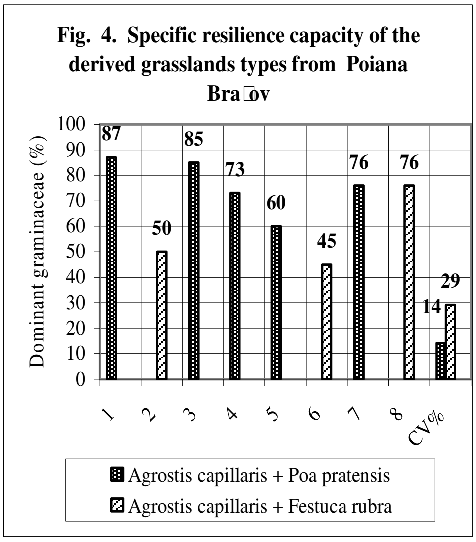


Fig. 2. General resilience capacity of the derived grasslands types from Poiana Braşov







In Blana-Bucegi (figure 3), technological variants harmonized with the resilience capacity are: paddocking (with remnant effect up to 5 years), the liming with calculated dosis for the correction of the soil reaction at the level of 60% Ah (with an effect up to 13 years) and dosis of 150 kg/ha N, on the framework of 50 kg/ha P_2O_5 and 50 kg/ha K_2O (applied once for 3-5 years).

Specific resilience capacity was better emphasized in Poiana Brasov than in Blana-Bucegi, due to the more important difference between the 2 derived grasslands types: *Agrostis capillaris* + *Poa pratensis* and *Agrostis capillaris* + *Festuca rubra*. The variation coefficient of dominant graminaceae share was of 14% for the first kind of grassland and of 29% for the second (figure 4).

Potential of feeding use in the field of resilience capacity. In their natural state, the mountain evergreen grasslands achieve between 1.87 t/ha DM and 2.48 t/ha DM, as an average on the whole year. In the fertilization system, allowed by the resilience capacity, the average annual yield increases up to about 3 t/ha DM. Derived types provide yields of 3.2-3.5 t/ha DM. But more important than the yield is its superior quality, on the basis of which, in the conditions from Blana-Bucegi, we may obtain up to 3600 l/ha milk from cattle in comparison with only 1100 l/ha milk from the natural non-improved grassland.

CONCLUSIONS

1. Resilience capacity represents the tolerance of one ecosystem to the action of perturbing anthropic factors. Knowing the resilience capacity of mountain grasslands represents an essential condition for the application of

technologies with minimum impact upon the stability of natural and derived ecosystems.

2. At the spruce belt (Poiana Brasov), the resilience capacity which assures the stability of natural grasslands types is framed in the field of fertilization variants with N 0-90, P_2O_5-80 K_2O-120, while in the subalpine belt (Blana-Bucegi) is conditionned by the absence of any fertilization and liming.
3. Technological variants which are allowed by the resilience of derived types are the ones with organic fertilization (paddocking), organic fertilization + liming (30-60% Ah), organic fertilization + mineral fertilization (N-50, P_2O_5-50 K_2O-50), organic fertilization+ mineral fertilization (N-50, P_2O_5-50, K_2O-50) + liming and mineral fertilization (N-150, P_2O_5-50, K_2O-50) effected once in 3-5 years.
4. In the field of the resilience capacity, comunity and national natural habitats may be preserved even in the conditions of vegetal layer exploitation for animals feeding. For the increase of the economic effectiveness of feed production, in the area of natural and semi-natural grasslands, on narrow areas, it is recommended to create derived types whose benefit, in the cattle milk yield (3600 l/ha) is at least of three times higher in comparison with the origin types.

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THE INFLUENCE OF THE STORAGE PERIOD AND STORAGE CONDITIONS ON THE GERMINATION OF *LOLIUM PERENNE* VARIETIES

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Keywords: *germination energy, seed, laboratory tests, storage conditions, quality*

Abstract

The value of the Lolium perenne seeds' germination is influenced by a large number of internal and external factors. The analyzed factors are: the variety, storage conditions and storage period of the varieties analyzed. Most of these factors can be influenced and controlled by humans. A great importance regarding maintaining the germination of the varieties of Lolium perenne seeds, during the storage period, is represented by the storage conditions. So, in proper conditions, the seed's germination is kept for a longer period than in inadequate conditions, when the loss of the germination happens in a short while, leading to speeded aging, and the value of the germination after 3 years decreases for most of the varieties, but differently from a variety to another.

INTRODUCTION

The germination of *Lolium perenne* seeds is represented by the totality of processes happening in the embryo while it passes from latent life to active life. It is known that only with a good quality seed, the result expected from this important forage plant can be obtained. In this project I have deepened the study of this quality parameter.

MATERIAL AND METHODS

For the study, 8 varieties of lolium perenne were used: Mara, Calibra, Kaiser, Lorentz, Marta, Magura, Summit and Tove. The seed of all the varieties studied was obtained from the year's 2005 production and the samples used were extracted from certified biological category seed lots.

A material as homogeneous as possible regarding the quality indexes was used, so that the biological purity had values higher than 96%, the percentage of foreign seeds was situated between the legal limits (less than 1.5%), and the initial humidity of the lots was situated between 11.6%-12.8%.

The 8 varieties were considered 8 variants. In the year 2005, laboratory tests were made to determine the initial germination (energy and germination capacity). Both the ensured conditions in the seeds growing period, and their evaluation were made according to the ISTA rules.

After making the tests in the vintage year, the samples were mixed and divided resulting two homogeneous sub-samples with the same weight, for each of the varieties studied. A set of sub-samples was kept in controlled environment (temperature under 10 degrees Celsius, and relative air humidity under 50%), and the other set of sub-samples was kept in uncontrolled environment, in a space in which the temperature and relative air humidity were changing depending on the season.

On both sets of sub-samples germination was determined (energy and germination capacity) for 3 years (2006, 2007, 2008).

When determining the germination for each variant, the laboratory test was made on 4 repeats of 100 seeds. The germination layer used was filter paper TP (paper layer), in temperature and light conditions of 20 degrees Celsius. The evaluation of the seeds was made in 5 days (germination energy) and 11 days (germination capacity).

RESULTS AND DISCUSSION

The germination energy had values between 37.63% (Kaiser variety) and 85.46% (Tove variety) irrespective of the keeping conditions and the number of keeping years. The report for Mara the control- variety, Kaizer, Calibra, Lorenz and Summit, has marked out very decreased values of the germination energy as following: 22.79%, 21.63%, 9.29% and 8.21%. For the Măgura variety, the decrease of the germination variety with the value of 2.54% was significant.

The Tove variety pointed out by increasing the germination energy of the control-variety with 25.04%, a very significant value. The Marta variety was the only one at the same level as the control- variety (figure 1).

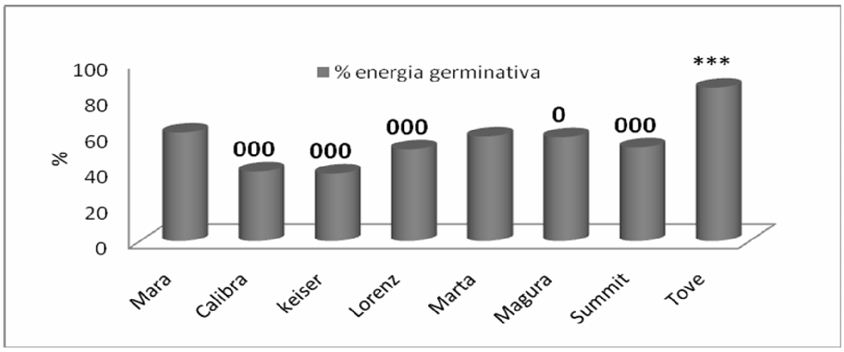

Fig. 1. The germination energy depending on the variety, and not depending on the storage conditions and number of storage years

Data interpretation from the interaction variety x storage conditions shows that Calibra, Keizer, Lorenz, Summit and Tove are the only varieties that keep the same report to the control-variety, both in controlled environment and uncontrolled environment (figure 2) with the observation that while the first 4 developed very decreased germination energy or distinctively significant (the Summit variety in controlled environment), at Tove variety the germination energy registered a very significant augumentation. The Marta variety is distinguished, with a pendulous behaviour (very significant increase in controlled environment referred to the control-variety, but a very significant decrease in uncontrolled environment) as a consequence of a very accentuated decrease of germination energy to 84% in controlled environment and 32.58% in uncontrolled environment. The same thing was observed in the case of Măgura variety, with the difference that in controlled environment the germination energy was at the control-variety's level and in uncontrolled environment the decrease was very significant (figure 2.)

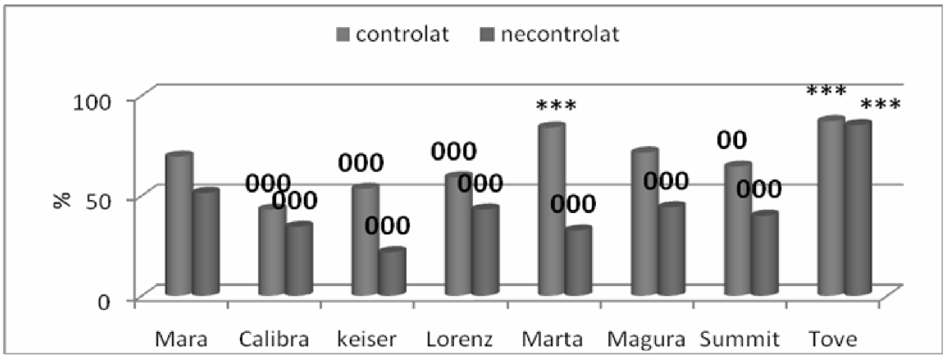

Fig. 2. The interaction variety x storage conditions

The interaction storage years x storage conditions shows that both in controlled environment and in uncontroled environment the germination energy decreases very significant with the years passing. Yet, in uncontroled conditions it decreases very significant compared to controlled conditions (figure 3).

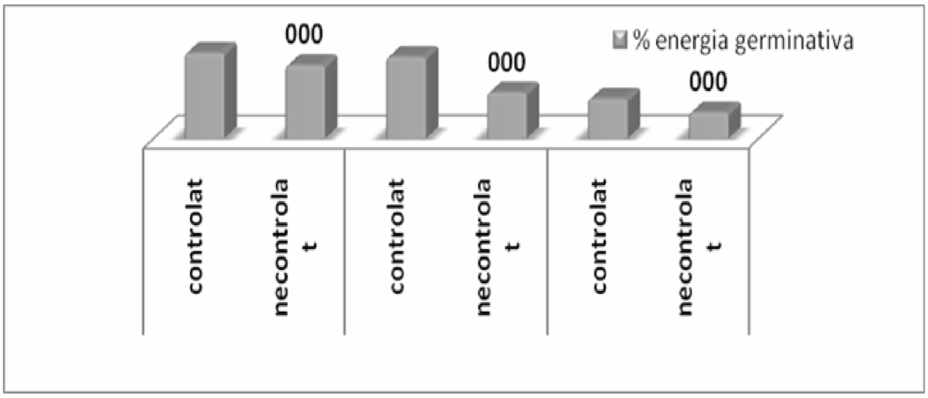

Fig. 3. The germination energy depending on the storage years and storage conditions

Whatever the storage conditions and storage years are, the germination capacity had values between 52.5% at Kaiser variety and 94.39% at Tove variety.

Reporting the values obtained for Marta variety, the control-variety, the Kaiser variety registered a distinctively significant decrease of the germination capacity of 22.75%, and the Calibra variety a 23.5% decrease. At the other varieties studied the differences towards the control-variety are not statistically ensured (figure 4).

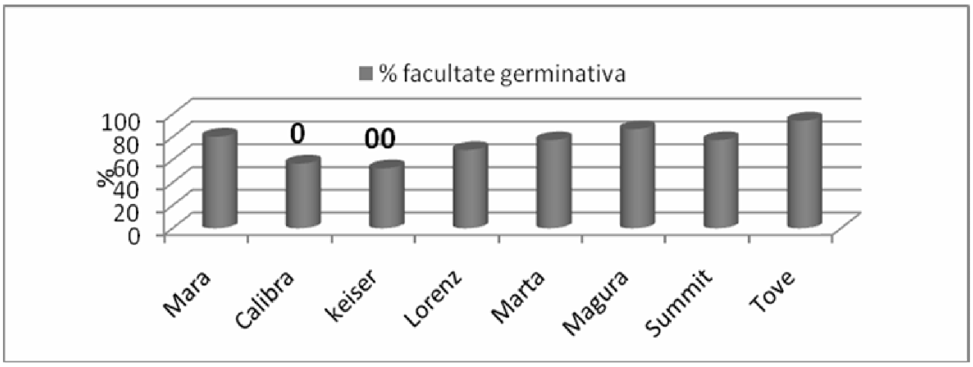

Fig. 4. The germination capacity depending on the variety and not depending on the storage conditions and storage years

The data from figure 5 shows that just Calibra and Kaiser varieties keep the same report towards the control-variety, registering distinctively significant decreases in controlled and uncontrolled environment. The Marta variety registers a significant decrease of the germination capacity in uncontrolled environment. The only variety that has unaffected germination capacity is Tove, in uncontrolled environment, having towards the control-variety, a significant increase (figure 5).

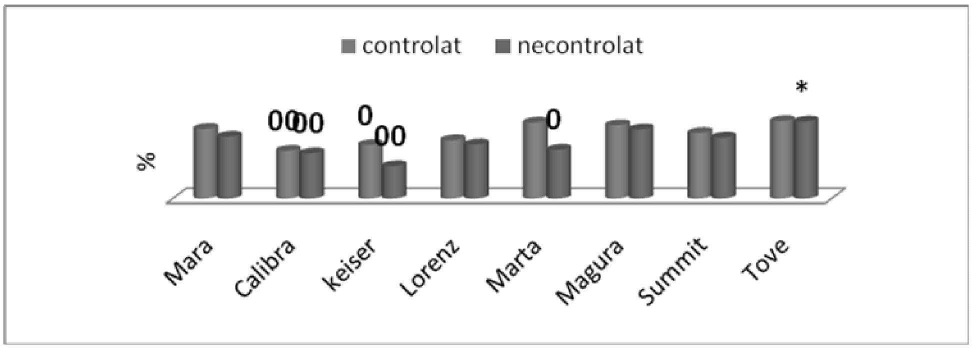

Fig. 5. The interaction variety x storage conditions

The interaction storage year x storage conditions show that both in controlled and uncontrolled environment the germination capacity decreases with the years passing. However, in uncontrolled conditions the germination capacity's value decrease significantly after 2 years of storage (figure 6).

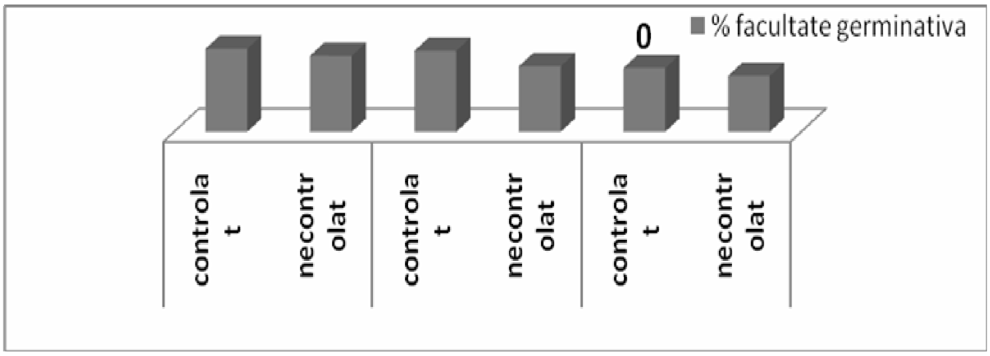

Fig. 6. The germination capacity depending on storage years and storage conditions

CONCLUSIONS

1. The germination energy and germination capacity have different values depending on the variety. If in the first year, not minding the storage conditions the values are close one to another, but in the next years they will be much more dispersed, the differences between varieties concerning germination energy and germination capacity accentuate in uncontrolled environment.
2. During the storage years, the germination energy and germination capacity decrease in most of the varieties independent of the storage conditions, a more accentuated decrease registering in uncontrolled storage conditions.
3. Decreasing the germination energy and germination capacity is more accentuated in the interval between the year 2 and 3, and after year 3.

4. The behavior of the varieties differ. The only variety that has the germination energy and germination capacity almost staid independent on the year and storage conditions is Tove. The Marta and Magura variety are pendulous having high values of germination energy and germination capacity in controlled environment and very low values in uncontrolled storage values. Some of the varieties have a constant decrease of germination energy no matter what are the conditions ensured during the storage years.

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ECOLOGICAL VEGETABLES BIOCHEMICAL PROPERTIES

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Keywords: *ecological vegetables, biochemical properties, nutritional quality*

Abstract

In an experiment carried out on a 15 years ecologically certified land, at SCDL Bacau, and at ICDLF Vidra, in a solarium, in organic agriculture conditions, the fact was noticed that the nutritional state of the vegetables grown here, described by the mineral elements content in the leaves, is normal, comparable to the vegetables grown in conventional agriculture conditions. Nutritional elements contents in the vegetables are not significantly different from the ones grown under conventional agriculture regime.

Under these conditions, the biochemical properties of the yield obtained at SCDL Bacau, on ecologically certified land, and at ICDLF Vidra, in solarium, under organic agriculture regime, describe mature full-grown vegetables, with good nutritional properties. A slight immaturity was noticed with tomatoes and capsicum, at SCDL Bacau, due to the early sampling, before the complete fruit maturation.

INTRODUCTION

Ecological vegetal products have intrinsic value, given by the obtaining technology and the adequate certification. However, taking into account the fact that the fertilizer inputs are lower than in the conventional agriculture, it's interesting to study their mineral nutrition and biochemical properties, as compared to those of the conventional products. Such researches were carried out wihtin the frame of a research project, at SCDL Bacau, on ecologically certified land, and at ICDLF Vidra, in solarium, comparing products obtained in a conventional manner, in organic regime (without chemical inputs), and an unfertilized control.

MATERIAL AND METHODS

Experiments were carried out at SCDL Bacau, on ecologically certified land, and at ICDLF Vidra, in solarium. The soils don't have a very good fertility. However, the exclusively organic fertilization, with compost, green manure and combinations, on ecologically certified land, at SCDL Bacau, for over 15 years, maintained the soil fertility properties at such a level that insures ecological vegetables yields. Fertilization with manure, in ICDLF Vidra solarium, insures adequate nitrates soil contents for the vegetables nutritional necesities and quality organic matter contents. The nutritional elements contents ensure a minimum supply for plants nutrition. The experiments were carried out on a very slightly and slightly alkaline soil, with a relatively high organic matter contents, the carbon/nitrogen ratio values are specific for a low and very low fertility [7, 8].

Tomatoes and green pepper were grown at ICDLF Vidra, in solarium, in three variants: a control to wich no fertilizers nore pest control products were applied, a conventional agriculture variant, and an organic one, namely without chemical inputs (fertilizers, pest control products).

At SCDL Bacau the experiments aimed to compare the effect of green manure to that of organically fertilized variants with compost, when growing tomatoes, capsicum, and egg plants. The following variants were experimented, for tomatoes: V_1 = unfertilized control; V_2 = green „winter" manure; V_3 = compost 40 t/ha on the whole surface; V_4 = compost 10 t/ha localized on rows; V_5 = „winter" green manure + compost 40 t/ha; V_6 = „winter" green manure + compost 10 t/ha. Capsicum were grown in four variants: V_1, control; V_2, fertilized with 10 t/ha compost; V_3, fertilized with 20 t/ha compost; V_4, fertilized with 40 t/ha compost. The variants for egg plants were the control (V_1) and fertilization with green manure (V_2).

RESULTS AND DISCUSSION

From the biochemical point of view, the tomatoes grown at ICDLF Vidra in solarium, in ecological system, have a dry content lower than the control by 11%, higher sugar content, and lower acidity (table 1).

The jus nitrates contents are much lower in the conventional and organic solariums, as compared to the control. So is the potassium level, while sodium contents are comparable, a bit higher. Nitrites are missing. The conclusion could be drawn that organically grown tomatoes have a higher quality than the control and the conventionally grown ones.

The green peppers grown in organic system don't significantly differ from those grown in conventional system (table 2).

The tomatoes grown at SCDL Bacau, on ecologically certified land, have a 92-95% water content (table 3), placed at the upper limit of the normal content interval [2, 10, 12], which indicates technological immaturity. It is possible that these vegetables have been harvested before they reached complete maturation.

Table 1

The main biochemical quality parameters of the tomatoes grown in solarium, at ICDLF Vidra

(a three determinations average)

Variant	**Average weight, g/fruit**	**Total dry matter (%)**	**Total sugar (%)**	**Acidity (%)**	**Ascorbic acid (mg/100 g)**	**Sugar/ acidity ratio**	**Pigments (Licopene) (mg/100 g)**
Control	110.57	4.80	2.93	0.34	9.61	8.62	4.04
Conventional agriculture	129.43	4.44	2.58	0.30	10.22	8.60	4.04
Organic agriculture	107.50	4.79	2.98	0.32	9.61	9.31	5.05

Variant	**NO_3 (mg/l jus)**	**NO_2 (mg/l jus)**	**K (mg/l jus)**	**Na (mg/l jus)**
Control	13	missing	138	2,5
Conventional agriculture	3	missing	101	3
Organic agriculture	4	missing	100	4

Table 2

The main biochemical quality parameters of the green peppers grown in solarium, at ICDLF Vidra

(a three determinations average)

Variant	**Average weight (g/fruit)**	**Total dry matter (%)**	**Total sugar (%)**	**Acidity (%)**	**Ascorbic acid (mg/100 g)**
Control	73.21	5.44	2.19	0.10	24.02
Conventional agriculture	118.57	4.90	1.92	0.10	28.83
Organic agriculture	112.86	5.04	1.92	0.09	28.83

Sugar/ acidity ratio	Pigments (Chlorophyll) (mg/100 g)	NO_3 (mg/kg)
21.90	2.53	3
19.20	2.05	16
21.33	2.03	15

Table 3

The biochemical properties of the tomatoes grown at SCDL Bacau, on ecologically certified land

Variants	Ds (%)	U (%)	Glu (%)	Cel (%)	Pect (%)	Acid (%)	Vit C (mg-% g)	Non-red. glucides	Red. glucides	Licopene (mg%g)
V_1	5.45	94.55	1.69	0.175	0.05	0.95	13.04	1.8	1.18	2.32
V_2	6	94.00	4.66	0.28	0.12	0.87	14.7	2.53	2.13	2.12
V_3	4.91	95.09	3.27	0.16	0.054	1.03	14.37	1.8	1.47	1.99
V_4	5.5	94.5	3.98	0.31	0.11	0.84	15.27	2.19	1.79	3.19
V_5	5.7	94.3	4	0.44	0.165	0.95	12.3	2.2	1.8	2.5
V_6	6.67	93.33	3.63	0.32	0.083	1.06	17.02	1.74	1.89	2.92

Reductive glucides vary between 1.18 and 2.13%. as compared to a normal average of 2.30%, thus indicating a physiological insufficiency due to immaturity in the unfertilized variant. The total glucides are situated over the 3.46% limit cited in the literature, except for the unfertilized variant. The best variant is that fertilized with green winter manure. The cellulose content is lower than the 0.68% cited in the literature, which certifies a high cellulolitic activity. Pectines are insignificant as related to the dry substance, which means that the fruits can't be processed. As a matter of fact, the products are ment to be consumed fresh. The acidity shows, through its high values, technological immaturity as compared to the average of the literature data which is 0.3-0.5%. Also, as compared to a 22.42 mg/100 g ascorbic acid the variants are with 30-50%, on an average, lower, indicating once more technological immaturity. As compared to a carotenoids (expressed as Licopene) contents average of 4.4 mg/100 g, the studied variants vary between 1.99 and 3.19 mg/100g, indicating immaturity.

Water contents in capsicum is within normal data cited in literature, namely 91.79% (table 4). The chlorophyl content describes a light colored material, suitable for marketing. The glucides content is higher than the normal content interval [4], which means the genetic material is good from this point of view. The acidity, 0.077-0.083% malic acid, designs physiological immaturity. The variant fertilized with the maximum compost dose (40 t/ha) reaches the average value cited in the literature for Vitamin C (192.1 mg/100 g). As compared to the literature data, the 24.3 mg/100 g capsatine content is very low, showing an obvious technological immaturity. The average chlorophyl contents is 4 mg/100 g or higher, in the compost fertilized variants, as comapred to a 0.75 mg/100 g average.

Table 4

The biochemical properties of the capsicum grown at SCDL Bacau, on ecologically certified land

Variant	Dry matter (%)	U (%)	Total glucides (%)	Reductive glucides (%)	Non-reductive glucides, (%)	Pectine (%)	Acidity (%)	Vit C (mg/100 g)	Chlorophyll (mg/100 g)	Capsantine (mg%g)
V_1	8.63	91.37	6.7	3.72	2.98	0.991	0.083	101	6.5	14.07
2	8.49	91.51	7.07	3.82	3.25	0.799	0.083	123.7	5.8	15.39
3	7.64	92.36	6.19	3.54	2.65	0.695	0.077	154.8	7.1	11.05
4	8.28	91.72	6.77	3.69	3.08	0.699	0.077	193	5.9	13.77

In the literature, water contents in egg plants is 91.64-93.60% [1, 3, 5]. The studied egg plants are in the lower part of this interval (table 5).

Table 5

The biochemical properties of the egg plants grown at SCDL Bacau, on ecologically certified land

Variant	Weight (g)	Su (%)	U (%)	Glu (%)	Cel (%)	Acid (%)	Pect (%)	Chl (%)
V_1	161.58	8.46	91.54	5.18	1.59	0.25	0.393	2.99
V_2	204.84	8.02	91.98	3.78	1.59	0.30	0.57	3.75

Regarding glucides, the normal sugars content, mentioned in the literature, is 2.13-4.00% and it consists of glucose, fructose, saccharose, and less galactose. The data obtained for the studied plants are in the upper part of this interval and describe a valuable edible material.

The normal soluble pectine contents vary between 0.38 nd 0.58% and the cellulose contents vary between 0.73 and 1.51%. The data corresponding to the studied vegetables are within normal limits for pectine and at the upper limit for cellulose, and describe a physiologically mature material.

CONCLUSIONS

1. The biochemical properties of the vegetables grown at ICDLF Vidra, in solarium, in organic agriculture regime, and at SCDL Bacau, on ecologically certified land, describe full/grown vegetables, with good nutritional value. The slight immaturity noticed with tomatoes and capsicum grown at SCDL Bacau is due to sampling before full maturation.

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STORED PRODUCTS PROTECTION WITH SOME NON-TOXIC METHODS

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Keywords: *stored products, non-toxic methods, insect pests*, *Plodia interpunctella, Acanthoscelides obtectus*

Abstract

The paper presents the results carried out in laboratory trials by non-toxic methods to control the Indian-meal moth (Plodia interpunctella Hb.) and bean weevil (Acanthoscelides obtectus Say), among the main pests of the stored seeds. Thus, the effect of the low temperatures on Plodia interpunctella larva was evaluated; inert dusts (bentonite, talc, silica gel, tricalcium phosphate) were used to protect the stored bean seeds by the Acanthoscelides obtectus attack.

The used methods had regarded good results; they can be recommended like alternatives to chemical control of the stored products protection.

INTRODUCTION

It is well known that the stored seeds are affected by different insect pests; so, Indian meal moth (*Plodia interpunctella* Hb.) feeding with embryos (one larva destroys 27.7 wheat embryos average during his life [5] and the weevils that feed with the endosperm of the grain are among the main stored products pests. In the same time, the infestation with these pests facilitates the developing of the pathogens like *Aspergillus* sp. that produce toxigens fungi [12].

The losses of the stored products caused by the insect pests used to diminish using pesticides, especially fumigant Methyl Bromide (MB), known to be a major contributor to the destruction of the ozone layer. As a consequence, phase-out of MB (since January 2002 for field application and January 2005 for closed space fumigation, according the OG nr. 89/1999, approved by Law nr. 159/2000, issued in Romania as a requirement of Montreal Protocol on Ozone-Layer depleting chemicals) was decided. The loss of MB has a devastating effect to the post harvest agricultural industry, especially to milling grains and stored beans and nuts, affecting both food safety and food security.

That way, finding the non-toxic, environmental friendly alternatives for the protection of the stored products is an imperative goal.

There are many papers that show the results of the studies about alternative methods to control stored products; thus, we can note a large range of papers with inert dusts [3, 7, 11], microbiological products based on *Bacillus thuringiensis* [8, 9], synthetic pheromones [4, 14, 15].

In Romania there were some trials in this field even many years ago [1, 2]; in the last years, the studies on the alternatives in stored products protection were the main concern of the researchers [6, 13].

This paper presents the latest results on the use of the non-chemical alternatives to protect the stored products.

MATERIAL AND METHODS

a) In order to evaluate the effect of the low temperatures on the Indian-meal moth (*Plodia interpunctella)* larva, two trials in the controlled conditions were carried out. Last age larva were exposed at low temperature (+ 8^{o}C and – 9^{o}C) for 2, 4, 8, 16 and 24 hours (the variants of the experiences); a variant has 4 replications with 10 larva each, placed in plastic boxes covert by a thickly sieve; the mortality after each exposure period and afterwards over 24 hours were evaluated.

b) To prevent the infestation of stored beans by the bean weevil (*Acanthoscelides obtectus* Say), inert dusts (bentonite, talc, silica gel, tricalcium phosphate) were used. Variants formed by 200 grams bean seeds treated with different doses (30, 50 and 100 g/q) for each product set up in 4 replications (800 ccm. jars). The compounds were applied onto the seeds and mixed 10 minutes, than 50 *Acanthoscelides obtectus* adults put into each jar. After 10 days the insects were extracted and percentage of mortality recorded. Monthly, the progenies at the treated variants and at the control were followed; at the interval of 3 months reinfestation was done. The experiences were carried out in the controlled conditions (25^{o}C and 55 ± 5% RH).

RESULTS AND DISCUSSION

a) The effect of the low temperatures on the Indian-meal moth (*P. interpunctella)* larva is presented in table 1. A temperature of + 8^{o}C (under the lower limits of species development) have been chosen; at such low temperature, a stress is imposed on adult moths, causing an increase in adult mortality and surviving adults exhibited decreased egg production and those eggs laid had lower viability [10]. The results presented (table 1) show that after 2 hours from the exposure, the larva had any mortality; after 24 hours from the exposure, the mortalities range between 0 and 17.4%. Following the evolution of the surviving larva, one found that after 2 hours from exposure 36.7% died, 13.6% entered in diapause, 16.7% died like a pupa and 33% became adults; after 4 hours exposure 87.7% surviving individuals transformed in adults; after 8 hours exposure resulted 81.5% moths; after 16 hours 80.3% adults appeared and after 24 hours 46% individuals became moths. It can

observes that even after 24 hours, the adults appeared recorded enough amount to continue the development, so the infestation.
At the exposure of - 9 ^{o}C of the Indian-meal moth (*Plodia interpunctella)* larva (table 1) 100% mortality was recorded for all the variants, just after exposure.

To be efficient, it is recommended to expose the stored infested products to below 0 ^{o}C temperatures.

Table 1

The effect of low temperatures on *Plodia interpunctella* last stage larva

Temp. (^{o}C)	Exposure time (hours)	Mortality (%)		Evolution of the larva exposed			
		Just after exposure	After 24 hours from exposure	Dead larva (%)	Diapaused larva (%)	Dead pupa (%)	Adults (%)
+8^{o}C	2	0	0	36.7	13.6	16.7	33.0
	4	0	5.6	6.7	-	-	87.7
	8	0	7.2	-	1.3	6.7	81.5
	16	0	13.0	3.3	3.4	-	80.3
	24	0	17.4	20.0	6.6	10.0	46.0
-9^{o}C	2	100	-	-	-	-	-
	4	100	-	-	-	-	-
	8	100	-	-	-	-	-
	16	100	-	-	-	-	-
	24	100	-	-	-	-	-

b) The graphics from 1-4 figures present the results of the inert dusts (silica gel, bentonite, talc and tricalcium phosphate) to protect the stored bean seeds by the *Acanthoscelides obtectus* attack.

It can observe that silica gel (figure 1) had good effect even at 30 g/q assuring protection of the seeds almost 400 days; at 50 g/q dose any weevil appeared from the beginning to almost 2 years.

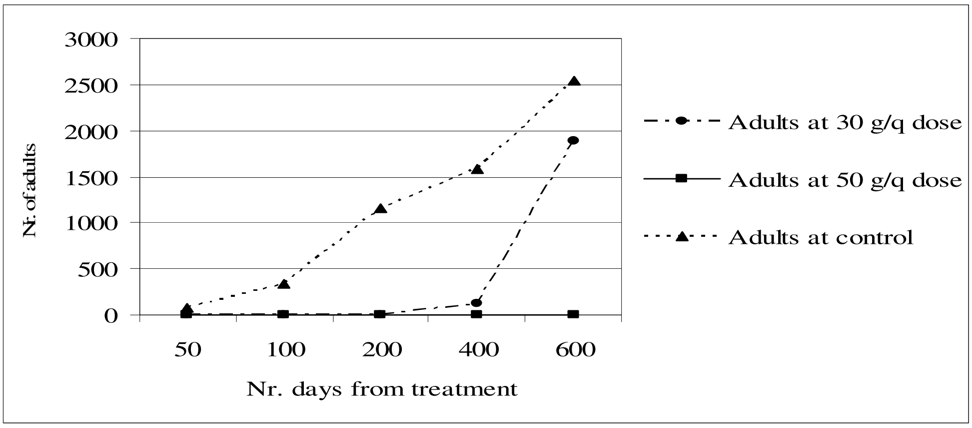

Fig. 1. The effect of silica gel on bean weevil *Acanthoscelides obtectus*

The bentonite (figure 2) was inefficient at 50 g/q dose; at 100 g/q assured the protection 200 days, than the population became to recover.

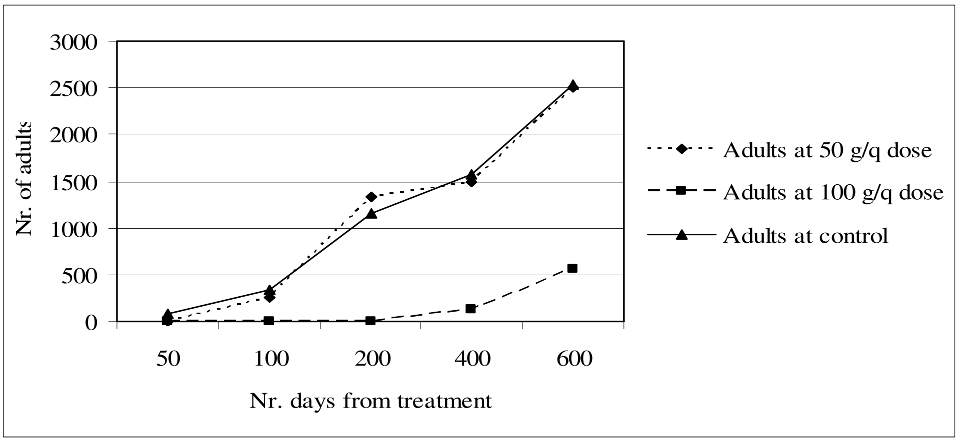

Fig. 2. The effect of bentonite on bean weevil *Acanthoscelides obtectus*

The talc (figure 3) recorded inefficient results for the protection of the stored bean seeds against bean weevil *Acanthoscelides obtectus,* the population of the pest recovering after 50 days from treatment, the same like in control variant.

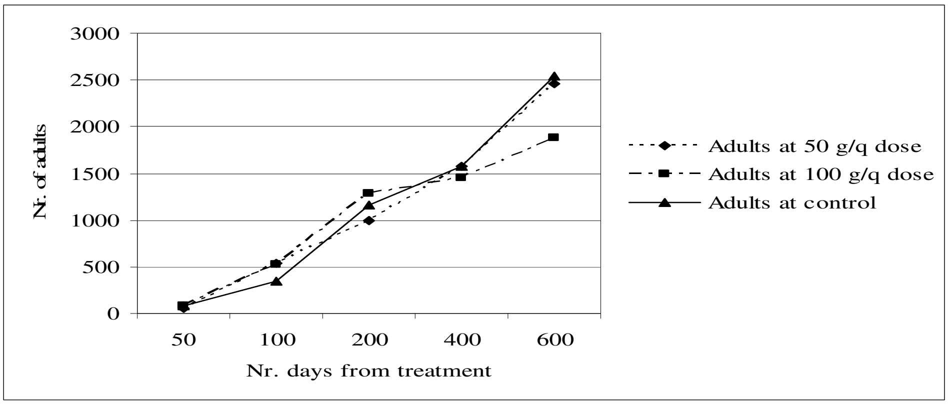

Fig. 3. The effect of talc on bean weevil *Acanthoscelides obtectus*

The treatment with tricalcium phosphate (figure 4) protected the stored bean seeds at 100 g/q dose for almost 400 days; 50 g/q dose were inefficient.

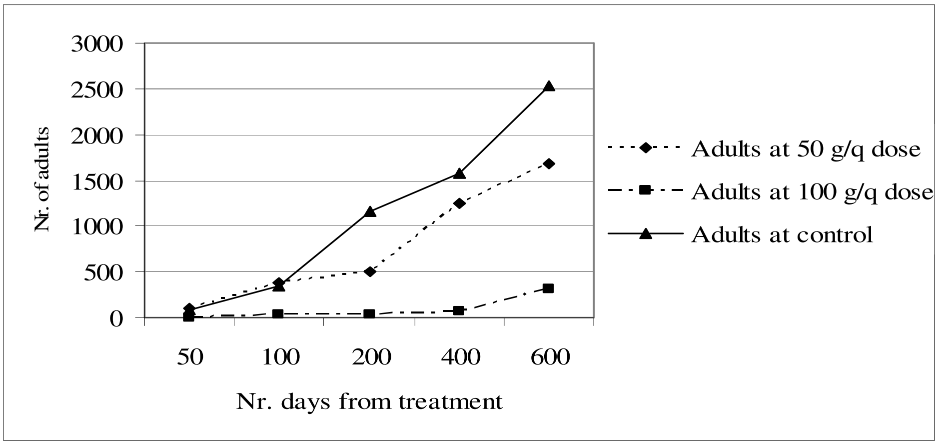

Fig. 4. The effect of tricalcium phosphate on bean weevil *Acanthoscelides obtectus*

CONCLUSIONS

1. The exposure to low temperatures of the stored products infestated with Indian-meal moth (*Plodia interpunctella)* can diminish the losses.
2. The exposure of - 9 ^{o}C was totally lethal just after exposure; at + 8^{o}C, even after 24 hours from the exposure the adults appeared recorded enough amount to continue the development of the population, so the infestation.

3. To be efficient, it is recommended to expose the stored infested products to below 0 °C temperatures.
4. The use of natural products to control various stored-product insects, including bean weevil is an alternative to chemical treatments and fumigation.
5. The results on the inert dusts (silica gel, bentonite, talc and tricalcium phosphate) used to protect the stored bean seeds by the *Acanthoscelides obtectus* attack show the following: silica gel had good effect even at 30 g/q dose; bentonite at 50 g/q assured the protection 200 days; talc recorded inefficient results, the population of the pest recovering after 50 days from treatment; tricalcium phosphate protected the stored bean seeds at 100 g/q dose for almost 400 days.

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ANTIFUNGAL ACTIVITY OF THE NATURAL PRODUCT AMBRUTICIN VS4 AGAINST *ALTERNARIA BRASSICICOLA*

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Keywords: *ambruticin, myxobacteria, Alternara brassicicola, antifungal activity*

Abstract

Increased concern for health and environmental hazards associated with the use of fungicides has resulted in the need for greater sustainability in agriculture. Naturally occuring molecules represent an important source of antifungal agents that may be used for the synthesis of new compounds.

Myxobacteria are known as excellent and prolific producers of a variety of bioactive secondary metabolites including antibacterial and antifungal compounds. The ambruticin, a natural poliketide originating from the myxobacterium Sorangium cellulosum constitute attractive leads for antifungal drug development.

We have analyzed the effect of ambruticin on different Alternaria brassicicola isolates, an economically important seed-borne fungal pathogen of Brassicaceae species. Several isolates, sensitive and highly resistant to dicarboximides (iprodione), were tested for their susceptibility to ambruticin in vitro.

In vitro assays investigated the responses of Alternaria brassicicola isolates towards ambruticin VS4 by evaluating the potential toxic effects on mycelial growth. Our results show that the polyketide drug ambruticin VS4 exerted antifungal activity against Alternaria brassicicola, mycelial growth being strongly affected.

INTRODUCTION

Naturally occurring molecules represent an important source of antifungal agents that may be used as starting points for the synthesis of new compounds [4]. The ambruticins, another class of natural antifungal polyketides originating from the myxobacterium *Sorangium cellulosum* [4], were reported to have no significant adverse effect on animals [2, 8] and therefore constitute attractive leads for antifungal drug development.

Here we have analyzed the effect of ambruticin VS4, one of the N-methylated forms of ambruticin, on the growth of different genotypes of *Alternaria brassicicola*, an economically important seed-borne fungal pathogen of *Brassicaceae* species. Parallel experiments were also conducted with the model fungus *Neurospora crassa*.

MATERIALS AND METHODS

Fungal isolates. All *A. brassicicola* strains used in this study and listed in table 1 have previously been described [1, 6]. All the strains were purified by monospore isolation and maintained on malt agar medium at 4^{0}C. All *N. crassa* strains were obtained from the Fungal Genetics Stock Center (University of Kansas Medical Center, Kansas City) and grown on agar-solidified Vogel's medium N at 25°C .

Table 1

List of *Alternaria brassicicola* and *Neurospora crassa* strains used in experiments

Strain	Phenotype[a]	Genotype	Source or reference
A. brassicicola			
43	DCF^{S}	WT	[1, 6]
12 RO	DCF^{S}	WT	
CM	DCF^{S}	WT	
40	DCF^{R}	Ab*NIK1*^{753K}	
43M	DCF^{R}	Ab*NIK1*^{Q343NS}	
7407	DCF^{R}	Ab*NIK1*^{W634NS}	
41	DCF^{R}	Ab*NIK1*$^{\Delta CA}$	
NikΔ3	DCF^{R}	Ab*NIK1::hph*	
N. crassa			
FGSC 988	DCF^{S}	WT	Fungal Genetics Stock Center
FGSC 824	DCF^{LR}	*Os1*$^{Q388S\text{-}A578V}$	
FGSC 2432	DCF^{R}	*Os1*$^{G580R\text{-}L582M}$	
FGSC 4494	DCF^{R}	*Os1*^{Q308NS}	
FGSC 4576	DCF^{R}	*Os5*^{K307FS}	

a. DC, dicarboximides; R, resistant; S, susceptible; LR, low resistance.

Fungicides. The effect of fungicides and ambruticin on mycelial growth and spore germination were tested as described [6]. Antifungal activities of the phenylpyrrole fludioxonil (Syngenta, Agro SAS, Switzerland) and the polyketide ambruticin (Kosan Biosciences, California) on *A. brassicicola* isolates was tested *in vitro*. Mycelium from wild type (WT) isolates and Ab*NIK1* mutants of *A. brassicicola* was exposed to either fludioxonil or ambruticin at various concentrations (0.01 to 100 mg/liter). For each condition, the reduction in radial growth was expressed as a percentage relative to the control (no fungicide or dimethyl sulfoxide). The solvent concentration in both controls and assays never exceeded 1% (v/v). Growth of *A. brassicicola* strains was scored after 4 days of incubation at 25°C. The growth of *N. crassa* isolates was monitored after 24 h of incubation at 25°C on agar-solidified Vogel's medium supplemented with fludioxonil, ambruticin or not supplemented - control (Co).

Results are expressed as the percentage of inhibition in treated samples compared to the control (values are the means of three replicates) and as effective concentration EC50 (the concentration which reduced mycelial growth by 50%).

RESULTS AND DISCUSSIONS

In vitro assays investigated the responses of *Alternaria brassicicola* isolates towards ambruticin VS4 by evaluating the potential toxic effects on mycelial growth and. This growth parameter was strongly affected by ambruticin, with almost complete inhibition at 0.1 mg/liter for all wild-type (WT) strains tested in this study (table 2, figure 1).

Irrespective of the growth parameter studied, the toxicity of fludioxonil to *A. brassicicola* was always lower than that of ambruticin. When conidia from WT strains were germinated in the presence of ambruticin, only short germ tubes with a tendency to swell were observed (data not shown), similar to what was previously observed with DCF^S [1].

For most of the strains, i.e., the Ab*NIK1*-null mutants and the Abra40 substitution mutant, the mycelial growth was not or only slightly affected in the presence of high concentrations (up to 10 mg/ liter) of ambruticin or fludioxonil as compared to control conditions.

We showed here that previously characterized *A. brassicicola* Ab*NIK1*-null mutants expressing high resistance to the dicarboximide iprodione [6] were also highly resistant to the phenylpyrrole fludioxonil as well as to ambruticin. Such cross-resistance was also observed for the *N. crassa os1*- null mutant FGSC4494 (table 3, figure 2).

Table 2

Effects of ambruticin and fludioxonil on *A. brassicicola* isolates

Strain	Phenotype[a]	Genotype	EC50 [mg/l]	
			Ambruticin	Fludioxonil
43	DCF^S	WT	0.006	0.44
12 Ro	DCF^S	WT	<0.01	0.51
CM	DCF^S	WT	<0.01	0.47
40	DCF^R	Ab$NIK1^{753K}$	<0.01	>100
43M	DCF^R	Ab$NIK1^{Q343NS}$	>10	>100
nikΔ3	DCF^R	Ab*NIK1:hph*	>1	>100
7407	DCF^R	Ab$NIK1^{W634NS}$	2.96	>100
41	DCF^R	Ab$NIK1^{\Delta CA}$	2.87	>100

Table 3

Effect of ambruticin on *N. crassa* isolates

Strain	Phenotype[a]	Genotype	Fungal growth inhibition [%]			
			Fludioxonil	Ambruticin VS4		
			25 (mg/l)	0.1 (mg/l)	1 (mg/l)	10 (mg/l)
FGSC 988	DCF^{S}	WT	100	88	100	100
FGSC 824	DCF^{LR}	$Os1^{Q388S\text{-}A578V}$	100	72.38	85	100
FGSC 2432	DCF^{R}	$Os1^{G580R\text{-}L582M}$	0	0	0	0
FGSC 4494	DCF^{R}	$Os1^{Q308NS}$	9.52	0	40	88.1
FGSC 4576	DCF^{R}	$Os5^{K307FS}$	0	0	0	0
FGSC 988	DCF^{S}	WT	0	0	0	0

Recently, it has been demonstrated that, like phenylpyrroles, ambruticin interferes with osmoregulation in filamentous fungi, targets group III HK phosphorelay signaling systems in these two filamentous fungi and, at least in *N. crassa*, exhibits fungicidal activity through improper activation of the HOG-related pathway [3].

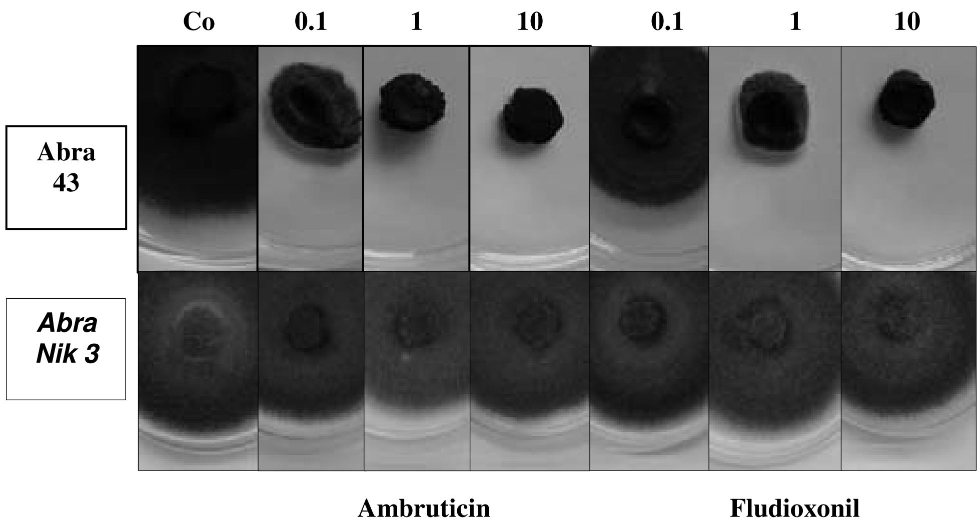

Fig. 1. Effects of ambruticin and fludioxonil [mg/l] on the mycelium radial growth of *A. brassicicola* isolates

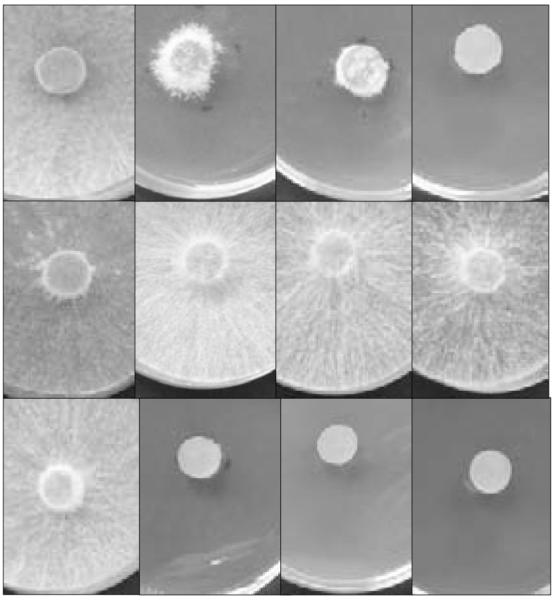

Fig. 2. Effects of ambruticin and fludioxonil [mg/l] on the mycelium radial growth of *N. crassa* isolates

Naturally occurring molecules represent an important source of antifungal agents that may be used as starting points for the synthesis of new compounds. Phenylpyrrole fungicides (fludioxonil) are derived from the natural bacterial antibiotic pyrrolnitrin produced by *Pseudomonas pyrrocinia*. The ambruticins is another class of natural antifungal polyketides originating from the myxobacterium *Sorangium cellulosum*. They were reported to be active against a variety of pathogenic fungi, including *Histoplasma capsulatum, Coccidioides immitis*, and *Blastomyces dermatitides*, as well as the dermatophytic filamentous fungi. Moreover, they are active against *Aspergillus* species that have a high incidence in chronic respiratory infections in humans.

Ambruticins have also been tested successfully *in vitro* against at least one important crop pathogen, i.e., *Botrytis cinerea* [7].

CONCLUSIONS

1. In this study, we demonstrated that the polyketide drug ambruticin exerted antifungal activity against *Alternaria brassicicola*, an economically important seed-borne fungal pathogen of *Brassicaceae* species.

2. The high toxicity of this bacterial metabolite for this fungus was well illustrated by the very low concentrations that were found to significantly inhibit *in vitro* the mycelial growth of several WT isolates.
3. *A. brassicicola* Ab*NIK1*-null mutants expressing high resistance to the DCF iprodione were also highly resistant to the phenylpyrrole fludioxonil as well as to ambruticin.

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RESEARCH REGARDING THE INFLUENCE OF TEMPERATURE, ATMOSPHERIC HUMIDITY AND LIGHT UPON THE BIOLOGY OF THE *STIGMINA CARPOPHILA* FUNGUS

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Keywords: *Stigmina carpophila*, *pathogen, biology*

Abstract

The Stigmina carpophila (Lev.) B. Ellis (sin. Cotyneum beijerinckii Ouedem, Clasterosporium carpoplilum (Lev.) Adelhold), teleomorf a Ascospora beijerincki Vuill., fungus produces diseases to the plant's leaves and stains the fruit of the pits, which attack with different intensities the peach, the apricot, the sour cherry tree, the cherry and the plum.

Depreciating quality of the fruit are the first symptoms of the disease, then, through the growth of the attack degree, early defoliation appears, which leads to the trees' weakness and in the end to their decline.

In Romania, this fungus is quite outspread, being very common in less attended meadows, if they are not protected from this fungus. This pest causes great losses in the years with favorable weather conditions.

An important aspect is researching the biological parameters of this fungus.

The biological material used was typified by the leafs, shoots, fruit, flowers and buds of the kernel species.

The pathogen's isolation was made on a crop area formed of potato-corn syrup -agarCGA).

INTRODUCTION

In our country's weather conditions the fungus survives each year in burgeons, in the bark's holes and in wounds, which makes infections appear easier in early spring, immediately after the temperature exceeds 2°C, and the atmospherical humidity is high, over 80%, very close to saturation.

Infections are strong in April-June, when frequent rains are recorded. During summer, when temperature exceeds 30°C, the fungus is inactive, and the infections stop. In autumn, after temperature decrease and beginning of rains, new infections of the branches appear, which last also in winter if temperatures do not drop below 2°C. Therefore, the critical time of burgeons and branches infections is autumn until the beginning of winter and also in spring, when trees start to form leaves.

MATERIAL AND METHODS

The main abiotic factors which influence the fungus's development were established in laboratory conditions, closely following the Tuite method (1968).

Temperature

Stigmina carpophila fungus was moved on CGA environment, in Petri pots, with an 8 cm diameter and then put in thermostat, at 2 – 40°C temperatures. Each 3 days, we observed an increase in their diameter of the colonies. Our observations subsisted 15 days.

In order to study the temperature's influence upon the *Stigmina carpophila* fungus, the Petri pots were held for 24 hours and at a 2 hours interval the *Stigmina carpophila* fungus's germination was examined, for each and every variant.

The air's relative humidity

In the exicators different humidity values were created, from 15% up to 100%, using overstrengthened solutions of some salts (tables 1 and 2).

The Petri pots, with CGA environment, in which the fungus was moved, were inserted in the exicator and held for 21 days without the Petri's top. The colonies' diameter was jotted down and the fructifications formation was closely studied.

The light acted differently upon the *Stigmina carpophila* fungus's colonies development, as a result of the crop's constant exposure to permanent light, permanent darkness and also light/darkenss alternation 8/16 or 12/12. The final observations were made after 15 days, when the increase and fructification of the fungus was estimated and assessed.

RESULTS AND DISCUSSION

Temperature

The increase and the fructification of the *Stigmina carpophila* fungus colonies are influenced by the termical values.

The minimum temperature for the colonies to be formed was 2ºC, under the shape of a flexible body, of light brown color, and the obverse yellowish; the fructifications were absent. The aspect was maintained the same despite 4ºC temperatures, and 6ºC temperatures. The 8ºC temperature induces a better growth and development of the colonies, so that the body is compact, with a silky aspect, of a yellowish-brown color, with a light brown obverse; the reproductive organs' presence was noted, which are very rare at the body's surface. At 12ºC and 14ºC the colonies showed the same characteristics, but from 16ºC and higher, the colonies formed a vegetative mass, multiplying very well.

The optimal temperature necessary for the colonies to grow and develop is between 20ºC and 24ºC, when a 50 mm diameter of the colonies was registered, with a silky, thick, dense, brown color aspect, and with a light brown obverse. The fructification was very good; the number of the reproductive organs was big.

Over 24ºC the colonies' development was weaker, likewise the number of the reproductive organs formed.
The maximum temperature threshold can be accounted at 32ºC. The colonies formed have a frail aspect, and the fructifications weren't formed anymore.

Regarding the temperature's influence upon the reproductive organs (figure 1), studies showed that this is possible starting with a 2ºC, temperature, 16 hours being absolutely necessary, this temperature being the minimum threshold.

After 8 hours, at 10-24ºC temperatures, the reproduction organs' germination was of 20-25%, and after 24 hours it was of 53-85%.

The optimal temperature can be considered between 20-26ºC.

The maximum temperature was noted to be of 32ºC.

The lethal temperature was identified to be 34ºC.

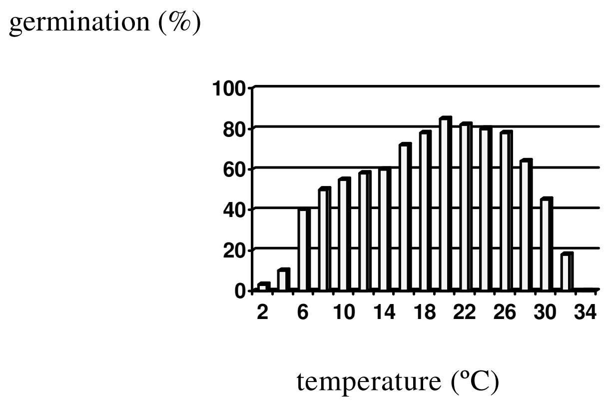

Fig. 1. Reproductive organs' germination depending on temperature

Relative atmospheric humidity represents an important factor in the fungus's evolution.

Table 3 we can see that at 15% values the colonies did not develop.

At atmospheric humidity of over 36.8%, the formed body was flexible, and the reproductive organs were not formed. At 66-72% values, the formed colonies had a tough and callous aspect, of light brown color with white edges, and the fructifications were not formed. From over 75.6% values, the reproductive organs formation was pointed out; they developed at the colonies' surface. The higher the value of the relative atmospherical humidity is, the better the colonies development is, and the vegetative mass is dense, thick, of brown color, and the fructifications are sometimes abundant.

Table 1

Attaining some values of relative atmospherical humidity in controlled areas

Satiated solution of salts	Atmospheric relative humidity achieved (%)
Lithium chloride	15
Calcium chloride	35
$Mg (C_2 H_3 0_2)_2 .H_2 0$	65
Ammonium sulphate	81
Sodium phosphate acid $Na_2 HP0_4 . 2H_2 0$	95

Table 2

Attaining some values of relative atmospherically humidity in controlled areas under sodium chloride's influence

Satiated solution of sodium chloride	Atmospheric relative humidity achieved (%)
5.2 mol = 0304 gr sodium chloride	76
4.5 mol = 262 gr sodium chloride	80
3.6 mol = 210 gr sodium chloride	85
2.5 mol = 147 gr sodium chloride	90
1.5 mol = 88 gr sodium chloride	95
0.75mol = 44 gr sodium chloride	98
0.3 mol = 17.5 gr sodium chloride	99
0.1 mol = 6.0 gr sodium chloride	100

Table 3

Atmospheric relative humidity's influence upon the colonies' development

Atmosphérique relative humidité RH (%)	The colonies' diameter after 12 days	Observations
15	0	Colonies are not formed
36.8	20	Weak growth
43	32	Mv ±; Fr 0
56	37	Mv ±; Fr 0
66	50	Mv ++; Fr 0

72	50	Mv ++; Fr 0
75.6	50	Mv ++; Fr +
78.6	50	Mv +++; Fr ++
82.9	50	Mv +++; Fr +++
88.5	50	Mv +++; Fr +++
90	50	Mv +++; Fr +++
92.7	50	Mv +++; Fr +++
96.1	50	Mv +++; Fr +++
98.5	50	Mv +++; Fr +++
99	50	Mv +++; Fr +++

Mv ± - very weak vegetative mass
Mv + - weak vegetative mass
Mv ++ - good vegetative mass
Mv +++ - very good vegetative mass
Fr 0 - the fungus did not fructify
Fr + -weak fructification
Fr ++ - good fructification
Fr +++ - abundant fructification

Regarding light, the *Stigmina carpophila* fungus's colonies developed well in its presence, as it can be seen in table 4.

In permanent light or alternating light, the vegetative mass of the formed colonies was rich, the body was tough, of brown colour, and the multiplication was abundent.

Permanent darkness, throughout the whole experiment, led to colonies formation, but with a very weak vegetative mass, and the reproductive organs rarely appeared at the body's surface.

Table 4

Light's influence upon the fungus's growth

Light	**Colonies development**
Light 24 hours	Rich vegetative mass, tough body, of brown colour, good multiplication
Light/darkness alternation 12/12 hours	
Light/darkness alternation 8/16 hours	
Permanent darkness	Very weak vegetative mass, sporadical fructifications

CONCLUSIONS

1. The growth and fructification of the *Stigmina carpophila* fungus's colonies are influenced by the termic values, relative atmospherical humidity and light.
2. The minimum temperature of colonies formation was of 2ºC, the optimal temperature can be considered to be between 20-26ºC, and the maximum is 32ºC, and the lethal temperature was identified to be 34ºC.
3. At atmospherical humidity between 36.8% and 72%, the reproductive organs are not formed. At over 75.6% values, formation of the reproductive organs was noted, and, as the relative atmospherical humidity values grow, the colonies' development is better.
4. Concerning light, the *Stigmina carpophila* fungus's colonies grew very well in its presence; permanent darkness determines colonies formation which have a very weak vegetative mass and very few reproductive organs at the body's surface.

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RESEARCH REGARDING THE PH INFLUENCE, ENERGETIC SOURCES AND SOME CROP ENVIRONMENTS UPON THE *STIGMINA CARPOPHILA* FUNGUS BIOLOGY

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Keywords: *Stigmina carpophila, fungus, nitrogen sources*

Abstract

Stigmina carpophila (Lév.) is a fungus which induces a certain disease, which destroys the leafs and stains the fruit.

This disease is displayed on the leaves, fruit and young scions, but the most important damage is provoked on the tree branches, this being a reason for which the gardeners are forced to pick out whole branches every year, so that, after 7-10 years, in that specific tree only a few branches remain, with weak growth and minimum fruit production.

It is often met in all trees which make fruits, and the largest losses are ecountered in apricot and peach.

The intense attacks appear in rainy springs, which follow after gentle and soft winters, when the reproductive organs resisted in a very high number.

In this project we observed the Stigmina carpophila fungus behaviour under the pH influence, growing on certain crop environments and the transformation of some carbon and nitrogen sources.

The biological material used was displayed by the leaves, the scions, fruit, flowers and burgeons of the tree species.

Isolation of the pathogen was made on a crop field which was frequently used, formed of potato-glucose-agar (CGA).

INTRODUCTION

The pH values' influence upon the fungus colonies development which was taken into study was made by using the CGA environment crop on which we modified the pH value, by using NaOH or HCl, for each variant.

In order to closely follow the way in which the fungus transforms the carbon and nitrogen source from different sources on which it develops, the Czapek was used, and the carbon source was replaced with different monozaharides and polizaharides, and the nitrogen source with organic and anorganic substances. The Czapek environment was less favorable to the fungus growth, therefore it was improved and amended by adding yeast, which favoured growth and fructification.

MATERIAL AND METHODS

The fungus was moved on crop mediums with pH values between 3 and 11. The colonies diameter was measured at a 3 days interval, and at the same time the fructifications appearance was closely tracked. This experiment was made on a 15 days period.

Also, after 15 days, while the fungus was kept under observation and at a 22ºC temperature, on other different crop environments the formation of a vegetative mass and the fructifications appearance were noted.

RESULTS AND DISCUSSION

The pH values of the substratum on which the fungus grows influence the development and the fructification.

From table 1 we can observe that there is a large spectrum, the colonies forming a good vegetative mass, with the reproductive organs' appearance on pH 3 values; these are optimal values, because they are contained in between 4 and 7. Along with the environment alcaline substances, the fungus was developed with a weaker vegetative mass, but continued to fructify very well.

Table 1

pH values influence upon the *Stigmina carpophila* fungus development

pH Values	Colonies' diameter (mm)
3	45 (mv ++, fr. ++)
4	50 (mv +++, fr. +++)
5	50 (mv +++, fr. +++)
6	50 (mv +++, fr. +++)
7	50 (mv +++, fr. +++)
8	40 (mv ++, fr. ++)
9	40 (mv ++, fr. ++)
10	40 (mv ++, fr. ++)
11	25 (mv ++, fr. ++)

legend: mv ++ - good vegetative mass
mv +++ - very good vegetative mass
fr. ++ - good fructification
fr. +++ - abundent fructification

The energetic sources are determiners in the *Stigmina carpophila* fungus's colonies development.

From table 2 it can be seen that the fungus transforms very well the carbon from the monosaccharides: glucose, dextrose, levuloză, maltose, manose, arabinose, levulose and ribose.

On a substratum which has an amount of polysaccharides,with more celulose, the development of the fungus colonies is weak, and the transformation of carbon from starch is relatively good.

These prefferences of the fungus prove that this species capacity of producing a disease on the green organs (leafs and fruits), but also on wood, is more powerful in autumn when the leafs fall, when natural gates of infection are created, knowing that a wound stays open for 46 days.

From table 3 it can be seen that the fungus easily transforms the nitrogen from the anorganic substances, such as potasium nitrogen and rarely the amonyum nitrogen and also the monyum phosphate. This proves that the potasium nitrogen's presence which was managed into the soil makes the infections produce easier. The infections are produced by the *Stigmina carpophila* fungus. The same happens with the urea from which the fungus slowly tranforms the nitrogen.

Table 2

Colonies growth on different carbon sources

Carbon sources	**Colonies' development of the *Stigmina carpophila* fungus**
Monosaccharides	
Glucose	Rich vegetative mass, tough body of brown colour, good multiplication
Dextrose	
Levulose	
Maltose	
Manose	
Arabinose	
Levulose	
Sorbose	Very weak vegetative mass, without fructifications
Ribose	Rich vegetative mass, tough body of brown colour, good multiplication
Polysaccharides	
Celulose	Weak vegetative mass, body developed in the substratum, weakly pigmented in yellow-brown, weak multiplication, towards the colony's center
Starch	Weakly developed body, in concentric circles, very weak pigmentation, good multiplication, the reproductive organs are set in a concentric way

Table 3

Colonies growth on different nitrogen sources

Nitrogen source	Colonies development of the *Stigmina carpophila* fungus
Inorganic substances	
Potasium nitrogen	Rich vegetative mass, silky body, of brown-yellowish colour, very good multiplication
Amonyum nitrogen	Limited growth, weak vegetative mass, harsh, of brownish-wellowish colour, weak fructification
Amonyum phosphate	Limited growth, poor vegetative mass, harsh aspect, of brown-yellow colour, not uniform, the reproductive organs are not formed
Organic substances	
Urea	Rich vegetative mass, tough body, of brown-wellow colour, not uniform, with yellow areas, irregular edges, good multiplication
Aspargine	Abundant vegetative mass, tough body, of brown-yellow colour, good multiplication

From table 4 we can see that the environments which have a content of oat, wheat, barley determined a very good growth of the vegetative mass and the abundent formation of reproductive organs.

Table 4

***Stigmina carpophila* fungus development on different crop environments**

Crop environment	Colonies development after 15 days
Natural environments	
Oat flower	Rich vegetative mass, abundent number of reproductive organs
Wheat flower	
Barley flower	
Semi-synthetic environments	
CGA	Rich vegetative mass, very good fructification
Malt extract	
Synthetic environments	
Czapek	Very weak vegetative mass (35 mm), did not fructify
Leonian	

The semi-synthetic CGA crop environments and malt 2% favoured the colonies formation, which have a morphological aspect, specific to the fungus, and a very good fructification.

The synthetic environments Czapek and Leonian stopped the vegetative development of the fungus, and the fructifications were absent.

CONCLUSIONS

1. The fungus presents a large area of development on substratum with pH values from acid to strong alcaline, with an optimal growth on substratum with weak acid or neutral pH.
2. Urea fertilisation and potasium nitrogen will be avoided, because they favour infections with *Stigmina carpophila*.
3. *Stigmina carpophila* develops extremly well on natural crop environments.

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THE OVERSEE OF MYCOTICAL ROTS AND CHEMICAL INFLUENCE ON THEIR ATTACK ON SUNFLOWER

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Keywords: *sunflower, mycotical rots, effectiveness*

Abstract

The attack of some pathogens which produce mycotical rots in sunflower can have special effects on production, especially when they occur in favorable phase of vegetation and in conditions which ensure the expression of specific pathogens involved. The pathogens affecting sunflower crop, producing mycotical rots in different vegetation phases, are:

- in the phase of germination- rising: Plasmopara helianthi, pathogen responsible for of sunflower manna, Sclerotinia sclerotiorum- fungus which produce sunflower white rot, Botrytis cinerea – pathogen agent which causes sunflower's grey mold;

- in phases of vegetation starting with 2-4 leaves until can produce mycotical rots at harvest: Sclerotinia sclerotiorum- leaves white rot, mild-stalks rot and head rot; Diaporthe helianthi- brown spot and breaking strain; Phoma macdonaldi- black spot; Alternaria helianthi- leaf blight; Botrytis cinerea - head gray rot.

To eliminate production losses caused by pathogens that produce mycotical rots in the vegetation phases presented, it is imperative to combine essential links of the integrated protection with positive consequences of obtaining a superior harvest both qualitatively and quantitatively.

The intervention of some elements of integrated protection, in assurance of sunflower crops from the attack of pathogens which are producing mycotical rots at seeds and in vegetation, is dependent on the parasite biology, his way of live with host plant, burden of infectious, on the resistance of biological material, climate conditions. According to the mentioned, some technological links can interfere in reducing the attack.

MATERIAL AND METHODS

The studies had followed determining effectiveness of chemical intervention using some active principles in preventing and combating some sunflower specific pathogens.

Chemical intervention is used in stopping the attack of pathogens responsible for mycotical rots like: *Sclerotinia sclerotiorum, Botrytis cinerea, Plasmopara helianthi* and *Diaporthe helianthi,* which in favorable conditions may compromise the crops.

Experiences were made at ICDPP Bucharest, Mycology Laboratory and arranged by randomized blocks scheme. For the experience regarding efficiency of the seed treatments against manna, a sunflower static field and Favorit hybrid had been used.

The experience regarding *Sclerotinia sclerotiorum* and *Botrytis cinerea's* attack consisted in the testing of the effectiveness of administering some products at seeds and in vegetation, recognized as antibotritics. F-206 hybrid had been used.

The infection was done by incubation of the mycelium on the autoclave oat seed. For protecting the sunflower against *Phomopsis helianthi* systemic fungicides and products which contain in their composition systemic and contact substances had been used. The biological material used was the hybrid Florom 328. Products were applied in recommended doses and concentrations and after sunflower treatment's intervention scheme.

For every variant the frequency was noted and the efficacy of treatment was calculated.

The dates obtained were compared with the witness (untreated variant) and were analyzed from a statistical viewpoint.

RESULTS AND DISCUSSION

The research regarding testing chemicals applied on sunflower seed against manna attack (*Plasmopara helianthi*) at primary infection, showed a high frequency of the attack at witness, with a value F= 30.1%. Products based on active principles with specific action and products combined with another substance had been tested (table 1).

The data from Table 1 show that the product based on metalaxil, conditioned as pasta had reduced attack frequency at 1.8% comparing with untreated variant with F= 30.1%. Metalaxil in powder form (Apron 35 SD) decreased the frequency of the attack at 2.1%. A similar reduction was recorded at imazalil (Magnate 50 ECNA) with F= 2.1%. Between product based on oxadixil, the product Ostenal C75 PTS, 4 kg/t had been nodded, with a severe reduction of the frequency until 0.3%.

A higher value of the attack frequency, comparing with other variants, was registered at Ostenal MT (oxadixil 28%+metiltiofanat 47%) with F = 2.9%.

Calculating the effectiveness of the treatment, the dates for the table show the correlation between attack frequency and effectiveness of the substances. The most effective products were those with a low frequency. Ostenal C 75 PTS showed the higher effectiveness, E= 98%.

Statistically analyzing, the data regarding manna attack frequency, it had been seen that at all variants, was significantly negative, which means that attack value was very reduce comparing with the witness.

Table1

Effectiveness of some fungicides used in sunflower seeds treatment against *Plasmopara helianthi* attack

Name	Active substance	Dose (kg(l)/t)	Attack frequency (%)	Signif.	Effectiveness (%)
Apron 35 SD	metalaxil 35 %	4.0	2.1	000	93.0
Apron XL 350 SD	metalaxil M 350 g/l	3.0	1.8	000	94.0
Galben 35 SD	benalaxil 35 %	4.0	2.2	000	92.6
Magnate 50ECNA	imazalil 500 g/l	2.0	2.1	000	93.0
Apron FI 225 FS	metalaxil 175 g/l+fenpiclonil 50 g/l	10.0	2.3	000	92.3
Galben Super SD	benalaxil 37%+mancozeb 23%	5.0	2.5	000	91.6
Ostenal MT	oxadixil 28%+metiltiofanat 47%	4.0	2.9	000	90.3
Ostenal C75 PTS	oxadixil 25%+ carbenadazim 75%	4.0	0.3	000	99.0
Witness	-	-	30.1	-	-

DL 5% = 0.101325; DL 1% = 0.152162; DL 0.1% = 0.242375

In Table 2 are listed the data regarding *Sclerotinia slerotiorum* and *Botrytis cinerea* attack on sunflower seed.

The attack frequency in the witness was 36.1%, value considered high. The frequency of the attack in the treated variants had values between 2.8 at procimidon 2 l/t (Sumilex 50 FL) and 5.2 % at metiltiofanat (Metoben 70 PU). Low values comparing with witness were calculated at variants: carbendazim (Derosal 50 WP) with F = 3.6%, procimidon (Sumilex 50WP) with F= 3.5%, carbendazim with F = 3.6%., Rovral TS with a frequency of 3%. The highest value of the frequency were recorded at metiltiofanat 2 kg/t (F=5.2 %), benalaxil +mancozeb with F = 5.1%, metiltiofanat +tiuram 2.5 kg/t with F = 4.9%. Due to the calculus on the efficacy of treatment, the highest value were observed at Sumilex 50 FI with E = 92.3%. In variants Derosal, Rovra TS, Sumilex 50 WP effectiveness was 90%. The lower value of effectiveness was recorded as Galben Super SD with E = 86.1%.

Table 2

Effectiveness of some fungicides used in sunflower seed treatment against *Sclerotinia sclerotiorum* and *Botrytis cinerea* attack

Name	Active substance	Dose (kg(l)/t)	Attack frequency (%)	Signif.	Effectiveness (%)
Sumilex 50 WP	procimidon 50%	1.0	3.5	000	90.3
Sumilex 50 FI	procimidon 50%	2.0	2.8	000	92.3
Tiramet 60 PTS	metiltiofanat 20%+tiuram 40%	2.5	4.9	000	86.4
Benlate 50 WP	benomil 50%	2.0	4.4	000	87.8
Galben Super SD	benalaxil 37%+mancozeb 23%	5.0	5.1	000	85.6
Ostenal MT	oxadixil 28%+ metiltiofanat 47%	4.0	4.9	000	86.4
Rovral TS	iprodion 35%+ carbendazim17.5%	2.0	3.0	000	91.7
Bavistin 50 WP	carbendazim 50%	2.0	4.4	000	87.8
Metoben 70 PU	metiltiofanat 70%	2.0	5.2	000	85.6
Ronilan 50WP	vinclozonil 50%	2.0	4.8	000	86.7
Derosal 50 WP	carbendazim 50%	2.0	3.6	000	90.0
Witness	-	-	36.1	-	-

DL 5% =0.1999583; DL 1% =0.356325; DL 0.1% =0.492816

Against the attack of *Sclerotinia sclerotiorum* and *Botrytis cinerea* the influence of some substance applied in vegetation was followed. Products based on procimidon, carbendazim, iprodion, vinclozonil, fusilazol, fenpromimorf (Table 3).

The attack frequency value at mycotical rots produced by *Sclerotinia sclerotiorum* and *Botrytis cinerea* at witness was 41.8%. At tested products a low value of attack frequency in comparing with untreated variant was recorded at Konker SC with F = 3.6%, followed by iprodion cu F= 3.9% and procimidon 50WP with F = 4 %. The highest value of attack frequency was observed at Corbel EC 1 l/ha with F = 6%.

Due to the attack frequency results, the highest effectiveness value were obtained at Konker SC 1.25 l/ha with E = 92.9% and Rovral 50WP 1 kg/ha with E = 90.6%.

Table 3

Influence of fungicide used in vegetation over *Sclerotinia sclerotiorum* and *Botrytis cinerea* at sunflower

Name	**Active substance**	**Dose (kg(l)/t)**	**Attack frequency (%)**	**Signif.**	**Effectiveness (%)**
Sumilex 50 WP	procimidon 50%	1.0	4.0	000	90.4
Sumilex 50 FI	procimidon 50%	2.0	4.5	000	89.2
Ronilan 50WP	vinclozonil 50%	1.0	5.0	000	88.0
Rovral 50WP	Iprodion 35%	1.0	3.9	000	90.6
Bavistin 50 DF	carbendazim 50%	1.0	4.3	000	87.3
Bavistin FI	carbendazim 50%	1.5	5.0	000	88.0
Sportack 45 EC	procloraz 450 g/l	1.0	6.0	000	85.6
Corbel EC	fenpropimorf 750 g/l	1.0	4.3	000	89.7
Alert	fusilazol 125g/l+ carbendazim 250g/l	0.4	5.2	000	87.6
Calidan SC	iprodion 17.5% + carbendazim 8.75%	0.6	5.3	000	87.3
Konker SC	vinclozolin 250g/l+ carbendazim 165g/l	1.25	3.6	000	91.4
Alto Combi 420	ciproconazol 120g/l+ carbendazim 300g/l	0.5	5.0	000	88.0
Witness	-	-	41.8	-	-

DL 5% =0.265153; DL 1% =0.478461; DL 0.1% = 0.591615

Table 4

Influence of fungicide used in vegetation on the attack of *Diaporthe helianthi*

Name	**Active substance**	**Dose Kg(l)/t**	**Attack frequency (%)**	**Signif.**	**Effectiveness (%)**
Bavistin FL	carbendazim 50%	1.5	2.4	000	96.1
Baycore 300 EC	bitertanol 300g/l	2.0	3.4	000	94.0
Benlate 50 WP	benomil 50%	1.5	3.5	000	93.8
Corbel SC	fenpropimorf 750 g/l	0.4	8.0	000	85.8
Impact 125 SC	flutriafol 125 g/l	1.5	3.4	000	94.0
Mirage 45 EC	procloraz 45%	1.0	3.5	000	93.8
Punch 40 EC	fusilazol 40%	0.4	3.0	000	94.7
Trimidal 9 EC	nuarimol 90 g/l	1.5	3.1	000	94.5
Trifmine 30 WP	trifumizol 30%	1.0	3.5	000	93.8
Alto Combi 420	ciproconazol 120 g/l+carbendazim 300g	0.5	3.0	000	94.7
Konker SC	vinclozonil 250 g/l + carbendazim 165 g/l	1.25	3.2	000	94.3
Ronilan 50 WP+ Bavistin 75	vinclozolin 250 g/l+ carbendazim 75	0.5+ 0.75	2.5	000	95.6
Witness	-	-	56.7	-	-

DL 5% = 0.169461; DL 1% = 0.272358; DL 0.1% = 0.401615

The data from Table 4 render the effectiveness of some fungicides on the *Diaporthe helianthi* attack. Monitoring the influence of various substances on the attack frequency of brown steam canker was establish that, comparing with untreated variant which had a frequency of 56.7%, at treated variants the attack decreased at carbendazim 50% (Bavistin 1.5 l/ha) and Rovral 50WP+ Bavistin 75 0.5 +0.75 kg/ha) reaching 2.4% and F = 2.5%. At those variants has been also determined the highest value of effectiveness, over 95%. A lower influence over the attack frequency was obtained by fenpropimorf (Corbel EC 0.4 l/ha), F = 8% and the effectiveness was E = 85.8%. In other variants the value of attack frequency was close, between 3 and 4.5%.

CONCLUSIONS

1. For pathogens that are transmitting through the soil, the attack is influenced by the inoculums, the compliance of agrophytotehnical measure and by the preventive treatment applied at seed.
2. Seed treatment against the infection produced by *Plasmopara helianthi* has severely reduced the attack frequency. The product based on metalaxil and oxadixil plus carbendazim had the highest effectiveness.
3. The attack produced by *Sclerotinia sclerotiorum* and *Botrytis cinerea* at sunflower seed was decreased by treating the seeds with products based on procimidon (E = 92.3%) and the complex iprodion and carbendazim (E = 91.7%).
4. The presence of fungus like *Botrytis cinerea* and *Sclerotinia sclerotiorum* in vegetation can be controlled if we apply products based on viniclozolin and carbendazim (effectiveness 91.4% - Konker SC-1.25 l/ha), procimidon (effectiveness 90.4% - Sumilex 50 WP - 1 l/ha).
5. The most effective products used to control *Diaporthe helianthi* were Bavistin FL- 1.5 l/ha with effectiveness 96.1% and the combination Ronilan 50WP + Bavistin 75 0.5+0.75 kg/ha with effectiveness 95.6% and Konker SC- 1.25 kg/ha with E= 94.3%.
6. Konker can be recommended in vegetation for controlling the fungus which are producing mycotical rots in sunflower.

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TECHNOLOGICAL SEGMENTS WITH LOW POLLUTION DEGREE TO CONTROL THE PATHOGEN AGENTS, PESTS AND WEEDS IN THE GARDEN BEANS CROP

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Keywords: *pathogen, pest, garden beans, control*

Abstract

In this study are presented the results of the research concerning the low degree pollution technology for the garden beans, referring to the following technological flow: choosing a beans variety with tolerance to the characteristic pests; the beans variety with yellow pod Sonests has this quality; the optional possibility of using herbicides on the location that will be planted with this vegetable species as follows: preemergent with Dual 960 Gold and postemergent with Fusilade forte; prevention and control of the pathogen agents and pests using foliar treatments with pesticides (fungicides, insecticides and miticides)"friendly" for the plants and with low risk for the environment, user and consumer; ensuring production increases through root fertilization with biostimulation, mostly vegetable, applied at intervals of 7-10 days. By applying this low degree pollution technology a beans production of 2.880-2.950 kg/m^2 was obtained.

INTRODUCTION

In realizing increased garden beans productions (field culture or succesive culture), efficient measures for plants protection are necessary meant to maintain below the "damage and tolerance limit" the specific pathogenic agents, pests and weeds.

It is known the fact that in preventing and controlling the pathogenic agents, the pests and the weeds conventional products are used, which often need a longer break after the treatments are made. We also need to mention the fact that species - known as test plant - is very sensitive to pesticides, many times appearing fitotoxicity effects that can sometimes lead to compromise the culture.

In this paper are presented the experimental results regarding a technology with low pollution degree that protects the beans culture from the specific pathogenic agents, pests and weeds, by using several pesticides "friendly" to this species and with a low risk for the environment, user and consumer.

MATERIAL AND METHODS

The work was done using Sonesta garden beans variety.

The monitored experimental variants were the following:

V1 = technological variant with low pollution degree, comprising the following technological links:

a. for preventing and controlling the pathogenic agents, 6 treatments with Bouille bordelaise 0.75% were made, at intervals of 7-10 days, the first treatment at the appearance of the first trifoliary leaf;

b. for preventing and controlling the pests, 5 treatments were applied: 1 treatment with Chess 0.04%, 2 treatments with Mospilan 0.04% and 2 treatments with Milbeknock 0.075%;

c. weekly root fertilization with:

- Kendal 0.3% + Megafol 0.3%, at the phenological stage, plants at the first trifoliary leaf, then at intervals of 7 days as follows:
- Cropmax 0.1% + Agroleaf high P 0.3%;
- Kendal 0.3% + Brexil combi 0.3%;
- Cropmax 0.1% + Agroleaf total 20-20-20 0.3%;
- Megafol 0.3% + Plantafol 20-20-20 0.3%;
- Cropmax 0.1% + Agroleaf total 20-20-20 0.3%;

d. erbicides formula: before Dual 960 Gold 1.0 litres/ha. And after Fusilade forte 0.8 litre/ha.

V2 = idem **V1,** without erbicides.

V3 = variant with conventional treatments as follows:

- in order to prevent and control the pathogenic agents, 6 treatments were made with Dithane M 45 0.2% + Topsin 0.1%;
- in order to prevent and control the pests, 5 treatments were made with: Confidor 70 WG 0.02% (1 treatment), Confidor energy 0.1% (2 treatments) and Sanmite 0.075% (2 treatments).

V4 = variant without treatments.

Observations were made regarding:

- structure of the weeds, the pathogenic agents and the pests;
- frequency and intensity of the attack using scales specific to pathogenic agents and pests;
- dynamics of the harvesting.

The plant population in the technology of the culture was respected.

Also we mention that the irrigation was made by dripping and for fertilization 100 kg/ha Complex fertilizer was administered weekly 20-20-20.

RESULTS AND DISCUSSION

The climatic conditions in our country influence the appearance and evolution of diseases and pests at the garden beans variety.

After surveys made in diferent areas of the country it was established that the bacterium *Axonopodis campestris pv. phaseoli,* synonymous with *Xanthomonas phaseoli,* that causes the common burn of the beans creates the biggest problems of this crop in the field. The following pathogenic agents manifested a lower frequency of the attack in the beans cultures: *Pseudomonas syringae pv. phaseolicola, Colletotrichum lindemuthianum* and *Sclerotinia sclerotiorum*.

Concerning the pests, it was observed that the red spider *Tetranychus urticae* was the main species; the black lice *Aphis fabae* was also monitored but with a lower frequency.

Concerning the structure of the weeds the following species were monitored: *Echinochloa crus-galli* and *Sorghum halepense* among the monocotiledons (24.1%) and *Amaranthus retroflexus, Capsella bursa-pastoris, Hibiscus trionum, Convolvulus arvensis, Galinsoga perviflora* and *Polygonum oleraceea* among the dicotiledons (75.9%).

The experimental results of the year 2008 for this vegetable species are presented in tables 1 and 2.

From table 1 results the fact that for the variants using treatments during the vegetation period and also for the variant without treatments (untreated witness), there were no pathogenic agents observed in the culture, except some sporadic attacks on the pods with *Sclerotinia sclerotiorum* (below 1%).

From table 2 results that in the culture of garden beans the pests *Tetranychus urticae* and *Aphis fabae* were present.

On the 15^{th} of July, for the variant without treatments there were present 122.50 individual/leaf with *Tetranychus urticae* and an intensity of 88.71%, for the technology with low pollution degree were observed 61.18 individuals/leaf, with an intensity of 19.30%, and for the variant with conventional treatments 86.72 individual/leaf, with an intesity of 21.71%.

In what concerns the pest *Aphis fabae*, the average number of colonies/plant monitored on the 15^{th} of July 2008 was of 4.28 colonies/plant for the technology with low pollution degree, 5.14 colonies/plant for the variant with conventional treatments and 5.71 colonies/plant for the variant without treatments.

It needs to be mentioned the fact that the recorded results concerning the pests were influenced by the presence in the culture of the useful and auxiliary fauna that includes: *Coccinellidae* (*Coccinella 7-punctata, Adonia variegata*), eggs of *Chrysopidae*, adults of *Nobis* spp., *Pyrrhocoris apterus*, *Forficula auricularia* and *Syrphus* spp.

Table 1

Results concerning the technology with low pollution degree for preventing and controlling the pathogenic agents, pests and weeds in the garden beans culture, Sonesta variety

Specification	Pathogenic agents observed	Pests observed on the 15th of July 2008	Weeds present in the culture	Pods production (kg/m^2)
Technology with low pollution degree Without erbicides With erbicides	Insignificant attack caused by *Sclerotinia sclerotiorum* on the pods	-*Tetranychus urticae* cu 61.18 individuals/leaf F(%) = 100.00 I(%) = 19.30 -*Aphis fabae* cu 4.28 colonies/plant	**Monocotiledons ($14/m^2$):** *Echinochloa crus-galli* (10), *Sorghum halepense* (4) **Dicotiledons ($44/m^2$):** *Amaranthus retroflexus* (14), *Capsella bursa – pastoris* (4), *Hibiscus trionum* (6), *Galinsoga perviflora* (8), *Polygonum oleracea* (12) Eficacity 86%	2,950 2,880
Technology using conventional products	Insignificant attack caused by *Sclerotinia sclerotiorum* on the pods	-*Tetranychus urticae* 86.22 individuals/leaf F(%) = 100.00 I(%) = 21.71 -*Aphis fabae* cu 5.14 colonies/plant	**Monocotiledons ($14/m^2$):** *Echinochloa crus-galli* (10), *Sorghum halepense* (4) **Dicotiledons ($44/m^2$):** *Amaranthus retroflexus* (14), *Capsella bursa – pastoris* (4), *Hibiscus trionum* (6), *Galinsoga perviflora* (8), *Polygonum oleracea* (12)	2,250
	Insignificant attack caused by *Sclerotinia sclerotiorum* on the pods	-*Tetranychus urticae* cu 122.50 individuals/leaf F(%) = 100.00 I(%) = 88.71 -*Aphis fabae* cu 5.71colonies/plant	**Monocotiledons ($14/m^2$):** *Echinochloa crus-galli* (10), *Sorghum halepense* (4) **Dicotiledons ($44/m^2$):** *Amaranthus retroflexus* (14), *Capsella bursa – pastoris* (4), *Hibiscus trionum* (6), *Galinsoga perviflora* (8), *Polygonum oleracea* (12)	2,070

Table 2

Pests observed in the beans crop

Date	*Aphis fabae* (average number of colonies/plant)	*Tetranychus urticae*			Useful and auxiliary fauna
Technology with low pollution degree					
		average number of individuals/leaf	**F (%)**	**I (%)**	
10.06.2008	0.71	0.00	0.00	0.00	*Coccinellidae* (*Coccinella 7-punctata, Adonia variegata*), eggs of *Chrysopidae*, adults of *Nabis* spp., *Pyrrhocoris apterus* and *Forficula auricularia* were observed
17.06.2008	0.85	3.57	7.12	3.25	
24.06.2008	0.89	6.71	26.23	6.23	
01.07.2008	1.14	14.22	59.21	7.86	
08.07.2008	4.00	34.22	100.00	12.25	
15.07.2008	4.28	61.18	100.00	19.30	
Technology with conventional treatments					
Date	***Aphis fabae*** (average number of colonies/plant)	***Tetranychus urticae***			Useful and auxiliary fauna
		average number of individuals/leaf	**F (%)**	**I (%)**	
10.06.2008	0.89	1.14	3.12	2.34	One species was present – *Coccinella 7-punctata*
17.06.2008	1.12	14.22	11.24	5.56	
24.06.2008	1.37	21.71	32.14	6.45	
01.07.2008	4.28	34.22	64.12	9.12	
08.07.2008	4.57	59.18	100.00	16.23	
15.07.2008	5.14	86.22	100.00	21.71	
Variant without treatments					
Date	***Aphis fabae*** (average number of colonies/plant)	***Tetranychus urticae***			Useful and auxiliary fauna
		average number of individuals/leaf	**F (%)**	**I (%)**	
10.06.2008	2.03	6.21	28.57	7.00	*Coccinellidae* (*Coccinella 7-punctata, Adonia variegata*), eggs and adults of *Chrysopidae*, adults of *Nabis* spp., *Pyrrhocoris apterus, Forficula auricularia* and *Syrphus* spp. were observed
17.06.2008	3.00	12.24	57.14	7.42	
24.06.2008	4.14	36.21	71.42	13.71	
01.07.2008	4.28	87.72	85.71	36.85	
08.07.2008	5.42	102.11	100.00	51.71	
15.07.2008	5.71	122.50	100.00	88.71	

Concerning the achieved production, from table 1 it results that for the technology with low pollution degree (with and without herbicides), 2.880 – 2.950 kg/m^2 were obtained, while for the technology with conventional treatments 2.250 kg/m^2 were obtained, compared to 2.070 kg/mp for the variant without treatments.

CONCLUSIONS

1. The technology with low pollution degree that we suggest protects the garden beans cultures against the specific pathogenic agents, pests and weeds and reffers to the following technological flow:
   a. choosing a beans variety with tolerance against the specific pathogenic agents, with economical value for this culture; we mean mainly the tolerance against the two bacterias with high frequency at the beans cultures in our country: *Xanthomonas axonopodis* pv. *phaseoli* that causes the common burn of the beans and *Pseudomonas phaseolicola* that causes the halo burn of the beans. Against these bacterias the Sonesta variety has allways been tolerant;
   b. the facultative possibility to use erbicides on the places that will be grown with this species, as follows:
      - before, with Dual 960 Gold 1.0 litre/ha;
      - after, with Fusilade forte 0.8 litre/ha;
   c. for preventing and controlling the pathogenic agents, 6 treatments were made with Bouille bordelaise 0.075% at intervals of 7-10 days, the first one at the appearance of the first trifoliary leaf;
   d. for preventing and controlling the pests, 5 treatments were applied with the following insecticides: Chess 0.04% (1 treatment), Mospilan 0.04% (2 treatments) and Milbeknock 0.075% (2 treatments); root fertilizations with biostimulators like: Kendal 0.3% + Megafol 0.3%, beginning with the phenological stage of the plants at the first trifoliary leaf and then at 7 days intervals: Cropmax 0.1% + Agroleaf high P 0.3%, Kendal 0.3% + Brexil combi 0.3%, Cropmax 0.1% + Agroleaf total 0.3%, Megafol 0.3% + Plantafol 20:20:20 – 0.3%, Cropmax 0.1% + Agroleaf total 0.3%.
2. The technological flow with low pollution degree for the beans culture, Sonesta variety, has lead to a production of 2.950 kg/m^2 pods.

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PRELIMINARY STUDY REGARDING IMPORTANCE OF SPECIES *HELICOVERPA ARMIGERA* Hb. FOR MAIZE CULTURE IN ROMANIA

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Keywords: *Helicoverpa armigera Hb.,attack percentage, attack intensity*

Abstract

Helicoverpa armigera Hb., is a pest which has the tendency to become one of the most dangerous pest in Romanian maize fields, it is known under different names from which the most common is fruit worm of tomatoes or worm of maize ear etc. Species is pollyphagous and a major pest for more than 120 species. At maize, larvae eat initially silk and after that grain in milk stage from top of ear, creating empty places in distal zone of ear, being situations in which larva bored the middle of ear. Characteristic for this pest, in Romania, is attack of maize cultures, especially in warm and dry years when Helicoverpa armigera is manifested through attack on leaves, ears, silk and grains. After this attack many of ears were infected with different moulds, increasing possibilities of infestation with mycotoxins. Romania, with 3 millions hectares of maize, is the most important country affected by Helicoverpa armigera Hb. in Europe. It was registered percentage of ears attack and the intensity of attack and results shows a different attack depending on area, hybrids and type of hybrids. It wasn't a correlation between Helicoverpa attack and production. Frequency of attacked plants attend, at Timisoara 82.3%, and attack note 1.73. It is discussed the importance of pest.

INTRODUCTION

Helicoverpa armigera Hb., is a pest which has the tendency to become one of the most dangerous pest in Romanian maize fields; it is known under different names from which the most common is fruit worm of tomatoes or worm of maize ear etc. Species is pollyphagous and major pest for more than 120 species. At maize, larvae eat initially silk and after that grain in milk stage from top of ear, creating empty places in distal zone of ear, being situations in which larva bored the middle of ear. Characteristic for this pest, in Romania, is attack of maize cultures, especially in warm and dry years when *Helicoverpa armigera* (figure 1 a and b) is manifested through attack on leaves, ears, silk and grains (figure 1 c). After this attack many of ears were infected with different moulds (figure 1 d), increasing possibilities of infestation with mycotoxins.

A B C D

Fig. 1. ***Helicoverpa armigera*** **Hb. A-adult moth; B larvae; C-silk attack with resulting missing of grain; D-mold after attack**

The European maize borer (*Ostrinia nubilalis* Hb.) together with *Helicoverpa armigera* Hb., seems to became the most dangerous pests in Romanian maize fields, after panicle apparition, being spread throughout the cropping zones in the country [1], taking into considerations that other two major maize pest in Romania, maize weevil (*Tanymecus dilaticollis* Gyll.) and western maize rootworm (*Diabrotica virgifera virgifera* LeConte) could be maintained under control by culture rotation or in the worst case by chemical treatments.

MATERIAL AND METHODS

Observations and determination regarding *Helicoverpa armigera* were done in 3 areas in different fields during 2008, at Bucharest, Timisoara, and Nadlac. Observations and determination were done during October, taking into consideration percentage of plants (ears) attacked by *Helicoverpa armigera*. Attack intensity of *Helicoverpa armigera* was noted on a scale from 1 to 3, where 1 means larvae attack only on the tip of the ear and on the silk, 2 means *Helicoverpa* spp, attacked ear was destroyed in tip (0.5-1.5 cm), 3 means that *Helicoverpa* spp. larvae have destroyed (by tunneling) till 1/3 from distal area of ear.

RESULTS AND DISCUSSION

At Timisoara in respect of *Helicoverpa* attack, in late maize hybrids, where registered an ear attack between 81.75% and 82.31% in different hybrids and a note attacks from 1.36 to 1.83. At Nadlac *Helicoverpa* percentage of ear attack was less visible, in respect of *Helicoverpa* attack, between 2.75% to 3.0% and with note attacks from 0.5 to 1.0. At Bucharest from 0.75 to 2.25 and with note attacks from 0.25 to 1.0. It wasn't a correlation between *Helicoverpa armigera* attack and grain production. In the future, through the study on the factors which determine the existence of mycotoxins producing fungi in maize crops (conventional or Bt), the economic impact of the study will determine their reduction by applying modern technologies, followed by the identification of ways to reduce the maximum level of fumonisine, towards the EU proposal of 0.5 mg/kg (FSA, 2003), or of alfatoxins in food of 4 ppb (µg/kg) and B1 alfatoxins of 2 µg/kg.

CONCLUSIONS

1. *Helicoverpa* attack could be a serious problem referring maize cultivation in some years.

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EXPERIMENTAL RESULTS REGARDING SPECIFICITY OF PHEROMONES FOR *DIABROTICA VIRGIFERA VIRGIFERA* LECONTE

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Keywords: *Diabrotica virgifera virgifera, pheromones, specificity*

Abstract

Immediately, after identification of pest, Western Corn Rootworm (Diabrotica virgifera virgifera LeConte) in Europe, involved countries have asked assistance from F.A.O. and international cooperation starting immediately an international cooperation regarding pest monitorising in East and Central Eastern countries by using pheromones traps. Traps are of different types, but recommended and most spread in this purpose are of type Csalomon, from Hungary. In order to verify efficacy of different types of traps and pheromones lures in order to decrease cost price of operations connected with monitorising we decide to try in field pheromones lures and traps especially for cussing the most suitable for Republic Moldova, the country in which the pest wasn't present but the situation have to be under control. Results obtained show us that pheromone lure from Republic Moldova is suitable for forecast and warning WCR and that in the same time Csalomon type trap is the most adequate to this purpose.

INTRODUCTION

The WCR (*Diabrotica virgifera virgifera*) was first observed in Europe in the vicinity of Surcin airport, near Belgrade, (Yugoslavia), on a small maize plot (0.5 ha) in July 1992. With the largest area of maize grown in the Central and Eastern Europe area, over the last years (more or less than 3,000,000 ha) and the detection of the pest 10 years ago, closed to Hungary and Yugoslavia, *Diabrotica* in Romania is the pest well established in the South-Western and Western part of the country and after 13 years, from the first registration, the pest is present in almost more than half of the country. It is considered that, in Romania, now, continuous maize is cultivated on ±50% of the area cultivated with maize. This area is greater for small farmers (1-2 ha) which have almost 50-55% of the land, generally in hills and mountain area or either in the plains. The survey of the pest till now it was done with Csalomon type trap + Hungarian lure (C_u), but it is possible to be done with other traps type as ICRR-CN (Institute of Chemistry Raluca Ripan-Cluj Napoca) (figure 1), and Romanian lures, made in Romania for different purposes.

Permanent surveying of pest in GTFS/RER/017/ITA, Regional Program on IPM for WCR in Central and Eastern Europe, in corn monoculture has shown that area of economic pest activity, was limited, on small fields with maize monoculture, especially in South-Western of Romania, in counties Arad, Timis and Caras-Severin [1, 2, 3, 4]. The pest is under Romanian reglementations regarding WCR, Low no. 37/1 March, 2006 – referring to the reorganization of plant protection and phytosanitary quarantine activities and Ministerial Order (M.A.P.D.R.), no. 102/February 21, 2006 - referring to emergency measures to prevent spreading, in Romania of the pest *Diabrotica virgifera* Le Conte. Romania applies the rules of EPPO in which WCR is listed in Annex IAI of the EC Directive 2000/29/EC and as an EPPO A2 pest, in Romania was included on Quarantine list and EU Commission directive 2003/766.

In order to verify efficacy of different types of traps and pheromones lures in order to decrease cost price of operations connected with monitorising we decide to try in field pheromones lures and traps especially for cussing the most suitable for Republic Moldova, the country in which the pest wasn't present but the situation have to be under control.

MATERIAL AND METHODS

Experience was done at Pesac (county Timiş), in an area with large pest population, in a monoculture maize field. During the experiment there were used the following variants: Csalomon type trap + Hungarian lure (C_h); Csalomon type trap + lure from Republic Moldova (C_m); trap type ICRR-CN + Hungarian lure (R_h); and trap type ICRR-CN + lure from Republic Moldova (R_m). In trial was used two types of traps:

a) Type Csalomon, Hungarian product, recommended by F.A.O. for monitorising WCR pest in Europe.
b) Type I.C.R.R. Cluj - Napoca, traps used in warning and forecast network in Romania.

In order to establish daily flight of pest adults, recording of captures were done 3 times/day, during a week, in maximum flight period of pest. Traps were situated at departure of 50 m one from other in each monitorising points. For interpreting results was calculated report of capture between those two types of traps and lures regarding number of adults registered in a certain time period.

RESULTS AND DISCUSSION

After 6 hours, it was obtained the following results: at C_u were caught 224 adults, at C_m 178 adults, at R_m 126 adults and at R_r 60 adults. Results obtained regarding captures registered during a week of registering captures with specificity of pheromones lures are presented in table 1.

Csalomon type trap + lure from Republic Moldova (C_m) has captured 838 adult/all period, Csalomon type trap + Hungarian lure (C_h) has captured 740 adult/all period, trap type ICRR-CN + Hungarian lure (R_h) has captured 311; and trap type ICRR-CN + lure from Republic Moldova (R_m) 207.

Result obtained show us that pheromone lure from Republic Moldova is suitable for forecast and warning WCR and that in the same time Csalomon type trap is the most adequate to this purpose.

A B

Fig. 1. **Pheromone traps types: A-Csalomon; B-ICRR-CN**

Table 1

Specificity pheromones for *Diabrotica virgifera virgifera*

Data	Variant (C_h)	Variant (C_m)	Variant (R_m)	Variant (R_h)	TOTAL
13 VII 2007	226	178	60	124	588
14 VII 2007	292	350	61	90	793
16 VII 2007	137	195	43	68	443
17 VII 2007	50	33	20	15	118
18 VII 2007	11	44	13	9	77
19 VII 2007	24	38	10	5	77
TOTAL	**740**	**838**	**207**	**311**	**2096**

CONCLUSIONS

1. Pheromones lure conditioning from Republic Moldova is the most efficient.
2. Csalomon trap type is the most adequate purposed scope.

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DAMAGES AND LOSSES MADE BY *ACYRTHOSIPHON PISUM* HARR. IN GREEN PEA CROP

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Keywords: *pea, damages, losses*

Abstract

Acyrthosiphon pisum Harr. is a cosmopolite species and is found all around the world.

The aphid develops its life on green pea, lucerne, clover, Vicia sativa L. Vicia faba L. Lens culinaris, sweet wood, being encountered almost entirelly on vegetables.

The main plants struck by the green pea louse, according to our research, are shown.

As it is seen on the 9 types of plants which were struck by this aphid, the most common ones are the in the green pea family (Pisum spp.). Rarely the aphid has struck species like Medicago spp. and Trifolium spp. On Vicia sativa L. the attack's frequence was low and without a pattern.

As it can be seen in the same chart, vegetables are the basic and only plants the aphid feeds on. From these vegetables, the green pea, as well as the garden soils, which derive and come from the field pea and it is closely related to fodder pea (Pisum arvense), originating from Asia and from regions near the Mediterranean Sea, represent the main host plants.

During the research which carried out in different countries, it was proved that the green pea aphid's (Acyrthosiphon pisum Harr.) affinities differ from one soil to another. This state is actually debt to the different biochemical structure of the vegetable's parts which were damaged (flowers, leaves, stalks).

INTRODUCTION

On green pea, as a result of the intense pea leaf louse attack, the crop production can be significantly smaller, the losess varying between 20 - 80%.

The damages caused by the aphids are direct, because the plants are drained of sap, and the vegetal tissue is altered and the aphid's saliva is toxic for the plants. Usually, along with the attack, there is also a sugared secretion called “honey dew”, on which, later on, different bacteria can appear.

The pest brings important damages also through its role of transmitting viruses to the green pea (in the pea's nervous system - *Pisum virus 1*; in its whole internal structure - *Pisum virus* 2; leaf twisting - *Pisum virus* 8; the colour is a little changed - *Pisum virus* 9).

MATERIAL AND METHODS

The attack degree depends on the climatic conditions from that specific year, but also on the green pea soil's sensitivity.

On green pea, *Acyrthosiphon pisum* Harr. causes attacks which have an anual frequence forming crowded colonies on stalks, offshoots, leafs, flowers and young pods. The larvas, as well as the adults like to live especially on the upper side of the plant, especially on the young pods, and they suck the sap from the tissues. The aphids influence the normal growth and development of the plants. The more intense the attack is, the lower and poor the yield is.

As a result of the aphid's attack, the leaves begin to fade and become yellow and then they whither up. The buds don't open anymore, the flowers cannot produce new buds anymore, thus the pods production is smaller.

RESULTS AND DISCUSSION

During 3 years of study (2000, 2001, 2002), we wanted to see the numerical abundance of *Acyrthosiphon pisum* Harr. on each of the plant's upper parts (stalks, leafs, and pods).

From Table 1 analysis we can see that the young pods were the most populated (figure 1). The aphid's powerful attack is the most important factor because it decreases the peas production and at the same time the best time to use chemical treatments against the aphid.

Table 1

Damages made on the upper parts of green pea, by aphid (*Acyrthosiphon pisum* Harris, *Aphididae – Homoptera*) at USAMVBucharest, between 2000 – 2002

Year	Leaf louse									
	Total number of aphids		Out of which:							
	No.	%	Stalks		Leaves		Flowers		Pods	
			No.	%	No.	%	No.	%	No.	%
2000	180	100	4	2.2	11	6.1	117	65.0	48	26.7
2001	198	100	5	6.3	5	6.3	131	66.2	57	21.2
2002	220	100	9	4.1	27	12.3	142	64.5	42	19.1

Fig. 1. Aphid attack on green pea at USAMV Bucharest (original)

On the field, the aphid generates large attacks, especially in the warm years with some rain-showers. The numerical density reaches maximum worths in June and July.

In 2000 - 2002 the flowers' infection degree with aphids in comparison with the plant's other organs was of 64.5-66.2%.

From our research carried out during the 3 years of study, we noticed that the production losses (%), according to the witness (without any treatments), were of 9.1%, at an attack degree of 61.2% in 2000, of 17.7% at an attack degree of 92.0% in 2001 and of 21.3% at and attack degree of 100% in 2002 (table 2). The information we gained confirm other author's results, which insist that during the years with few light rain, the damages made by the green pea aphid can rise up to 10-20%.

Table 2

Yields losses on green pea crops due to the green pea aphid attack (*Acyrthosiphon pisum* Harris, *Aphididae - Homoptera*) at USAMV Bucharest, in years 2000 – 2002

Year	Number of aphids on:				Attack frequence (%)	Attack Intensity (%)	Attack degree (%)	Yiled losses (%) without any treatments
	Leaves	Stalks	Flowers	Growing pods				
2000	18	2	124	42	90	68	61.2	9.1
2001	27	7	162	61	100	92	92.0	17.7
2002	32	11	180	53	100	100	100.0	21.3

CONCLUSIONS

1. The research was carried out in the experimental field of USAMV Bucharest.
2. The attack degree depends on climatic conditions, from that specific year but also on the sensitivity of the type of pea which is present in the crop.
3. From the research carried out during the 3 study years, it's shown that the production losses, related to the untreated plants, were of 9.1% at an attack degree of 61.2% in 2000, of 17.7% at an attack degree of 92.0% in 2001 and of 21.3% at an attack degree of 100% in 2002.

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STUDY REGARDING THE BEHAVIOUR OF SOME NEW RAPE CULTIVARS IN THE BANAT PLAIN ZONE

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Keywords: *behaviour, varieties, fertilization, autumn rape*

Abstract

Research has been made on a salt-sodium gleic chernozem soil type in Banat Plain.

There have been studied seven cultivars of rapes, cultivated on two levels of fertilization ($N_0P_{80}K_{80}$, $N_{150}P_{80}K_{80}$).

The studied biological material is represented by the cultivars: Valesca, Orkane, Ader, Potomac, LG, Belin, Milena.

The average highest production on the experimented fertilization levels, was registered on Valesca cultivar, 2500 kg/ha. Note that on this cultivar, the fund fertilized with $N_{150}P_{80}K_{80}$, *yield exceeded 3100 kg/ha. Average yield of over 1900 kg/ha, were registered on varieties Milena and Potomac too.*

Nitrogen fertilizers have influenced favourable the yield up to 69% at the variant fertilized with N_{150} *on the same constant fund of* $P_{80}K_{80}$.

The obtained yields of 2500-3100 kg / ha and the oil content between 44.6 and 51.2%, lead to the conclusion that the reference area is favourable to cultivate this crops.

INTRODUCTION

The autumn rapeseed cultivars presently cultivated in the pedo-climatic area specific to the Banat Plain are unconvincing under the aspect of seed production and respectively of oil production, for which consideration it is imposed the testing of other cultivars cultivated in countries with pedo-climatic conditions similar to those in our country, following to introduce them into production and to optimize some technological links to obtain economical and high quality yields.

Cultivars for industrialization, in particular to obtain biofuels (known as the green Diesel, biodiesel, etc.), for using in diesel engines, must have a high oil content, to have high production capacity and to be resistant to frost, disease and falls.

MATERIAL AND METHODS

Cultivars taken into the study were: Valesca, Orkan, Ader, Potomac, LG, Belin, Milena.

The method of disposing the experiences along the experimental cycle, was in strips, with three replications. The precursory plant crop was winter wheat.

The base work of the soil was made with the disk harrow (GD-3.2), which made a good aeration of the soil without reversing the furrow.

Sowing was done in the last decade of September with 80 germinabile seeds/m^2. The distance between rows was 12.5 cm and sowing depth was 2 cm.

Phosphorus fertilization in dose of P_{80}, was made before the land preparation and fertilization with nitrogen dose of N_{150}, was made in two stages, the first on frozen soil in February, and the dose difference in the second half of March.

The weeds combating was made by preemerging erbicidation with Treflan 480 EC-2 l ha, on germinative soil preparation and postemerging with Lontrel 300 - 0.4 ml/ha in March.

The pests combating was made with Carbendazin 500 SC-1 l/ha, together with Karate Zeon, 150 ml/ha.

In the experimental field were made determinations towards plant height variation, ramification grade variation, variation of the siliqua number on the plant, the variation of the seeds number from the siliqua, the seeds yield, content and oil production.

Determinations were performed on variants, samples were collected from all the three repetitions and every variant was mixed.

The oil content determination was made by the method Sooxlet. The oil production was calculated on the base of the oil content and seeds production.

RESULTS AND DISCUSSION

The yield results from the experimental cycle are shown (table 1).

Note that on two of the experimented cultivars the medium yield per cycle exceeded 2000 kg/ha. Thus, Valesca cultivar was placed first with 2501 kg/ha followed by Potomac cultivar, with 2031 kg/ha.

With yields between 1550-2000 kg/ha were the cultivars: Milena (1994 kg/ha), Orkane (1950 kg/ha), Ader (1736 kg/ha), and Belini (1554 kg/ha).

Table 1

Synthesis of crop yields obtained in the experimental cycle 2005-2007 in Checea area

Variety	Yield (kg/ha)	%	Difference (kg/ha)	Significance
VALESCA	2501	100		
ORKANE	1950	78	-551	000
ADER	1736	69	-765	000
POTOMAC	2031	81	-470	000
LG	1450	58	-1050	000
BELINI	1554	62	-946	000
MILENA	1994	80	-507	000

DL 5% = 52 kg/ha
DL 1% = 70 kg/ha
DL 0.1% = 100 kg/ha

In figure 1 there are presented the synthesis results of the experimental cycle 2005-2007 regarding the variation of the oil content on the seven cultivars of rapeseed cultivated on the two agrofunds: $N_0P_{80}K_{80}$, $N_{150}P_{80}K_{80}$.

At the level of the factors taken in study the amplitude variation situated between the extreme limits of 44.6% (Orkane cultivar $N_{150}P_{80}K_{80}$ fertilizer with 51.2%) and the Milena cultivar $N_0P_{80}K_{80}$ fertilizer.

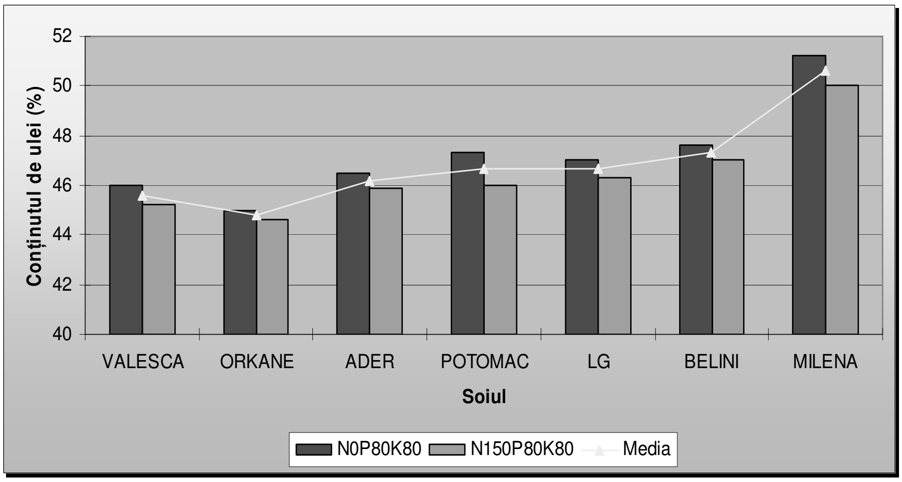

Fig. 1. The variation of oil content (%), depending on the cultivarand the fertilization variant

In table 2 there is presented the oil production synthesis recorded in the experimental cycle on the seven cultivars.

Table 2

Oil production obtained from the experimental cycle 2005-2007 in Checea area

Variety	Yield (kg/ha)	%	Difference (kg/ha)	Significance
VALESCA	1060.4	100.0		
ORKANE	798.5	75.3	-262	000
ADER	766.8	72.3	-294	000
POTOMAC	907.4	85.6	-153	000
LG	649.0	61.2	-411	000
BELINI	676.4	63.8	-384	000
MILENA	955.9	90.1	-105	000

DL 5% = 19 kg/ha
DL 1% = 25 kg/ha
DL 0.1% = 33 kg/ha

It results that the only variety in which the oil production exceeded 1000 kg/ha was Valesca. With yields close to it, respectively productions of over 900 kg/ha were Milena and Potomac cultivars. The other cultivars taken into the study, situated in the conditions of this less favourable period, between 650-800 kg/ha.

CONCLUSIONS

1. The highest seed crops in Checea area, part of Banat Plain, were obtained from cultivars Valesca, Potomac, Milena, for which we consider that they can be expanded in culture.
2. The highest oil content was registered at the cultivars Milena, Belini, Potomac.
3. The oil production had the highest values at cultivars Valesca, Milena, Potomac.
4. Analyzing the influence of nitrogen fertilization on fund $P_{80}K_{80}$ is noteworthy that although the nitrogen fertilizers decreased their oil content they have a favorable influence on the oil production, due to favorable influence on the seeds crop.

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ASSESSMENT OF GENETIC DIVERSITY IN LENTIL (*LENS CULINARIS* MEDIK.) AS REVEALED BY RAPD MARKERS

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Keywords: *Lens culinaris, RAPD markers, genetic diversity*

Abstract

The genetic diversity in nine varieties of lentil (Lens culinaris Medik.) - six cultivars obtained from ICARDA, Syria, one cultivar developed in Romania and two landraces from Germany and France - was evaluated using RAPD (Random Amplification Polymorphic DNA) markers. Ten primers were assayed and among them only a few (4) have presented the polymorphic bands. Genetic distances were calculated using Nei&Li (1979) similarity coefficient, displayed in a dendrogram (UPGMA method). Cluster analysis based on RAPD amplification products divided genotypes in two main groups according to their geographical origin and their maturity. The similarity values found were higher than 70%, suggesting that genetic diversity between lentil genotypes analyzed are relatively low.

INTRODUCTION

Lentil is a self-pollinated diploid (2n = 14 chromosomes) annual cool season grain legume, with a relatively large genome of 4,063 Mpb (Arumuganathan and Earle 1991). Lentil seeds are valued as a food source of both high quality plant proteins and fiber, in addition, the remaining plant residues can be used as animal feed and fodder. This ancient pulse crop was domesticated in the Fertile Crescent where it has been cultivated since at least the seventh century B.C. (Ladizinky, 1979), and its cultivation area expanded around the Mediterranean Basin, Middle East, Ethiopia and the Indian Subcontinent.

The International Centre for Agriculture in Dry Areas (ICARDA) has a global mandate for research on lentil improvement. As such, ICARDA houses the world collection of *Lens*, totaling 10,509 accessions.

The ICARDA collection includes 8789 accessions of cultivated lentil from 70 different countries, 1146 ICARDA breeding lines, and 574 accessions of 6 wild *Lens* taxa representing 23 countries.

A comprehensive understanding of the genetic variation within any lentil breeding program is important for the efficient selection of parents, for introgresion o genetic material into superior cultivated lines and for the implementation of an effective genetic conservation program for the cultivated species.

The genetic diversity of *Lens culinaris ssp. culinaris* has been studied with many DNA-based molecular marker systems including: restriction fragment length polymorphism (RFLP) analysis of nuclear DNA (Havey&Muehlbauer, 1989) and chloroplast DNA (Muench et al., 1991; Mayer and Soltis, 1994), amplified fragment length polymorphism (AFLP) analysis (Sharma et al., 1996) and random amplified polymorphic DNA (RAPD) analysis (Abo-Elwafa et al., 1995; Sharma et al., 1995; Ford et al., 1997).

The objective of this research was to evaluate the level of genetic diversity in the lentil genotypes, using random amplified polymorphic DNA (RAPD) analysis.

MATERIAL AND METHODS

Plant material and DNA extraction

The study was conducted in greenhouse and Molecular Genetics laboratory from University of Agronomic Sciences and Veterinary Medicine Bucharest, Romania in 2008. The materials used in this work are presented in Table 1. They include seven improved varieties and two landraces.

The genomic DNA was isolated from young leaves of greenhouse – grown plants according to the CTAB procedure (Saghai-Maroof et al.,1984) with minor modifications.

Table 1

Characteristics of lentil varieties used in the study

No.	Varieties	Origin / Pedigree	Phenotypic seed color	Type varietal ***	Maturity
1	Idlib 1	Siria-ICARDA*	Gray	m	Early
2	Idlib 2	Siria-ICARDA/ Single-plant selection from a Jordanian landrace, 74TA14	Reddish	m	Early
3	Idlib 3	ILL 99♀Moroccan landrace x ILL5588♂ elite line from Jordanian landrace population	Brown with patterns in black spots	m	Early
4	Idlib 4	Siria-ICARDA / ILL5879♀ x ILL5714♂	Gray	m	Early
5	Hurani	Siria -ICARDA / local cultivar	Brown	m	Early
6	Kurdi	Siria- ICARDA / local cultivar	Gray	M	Late
7	Oana	USAMV** Iasi Romania / Mutagenesis and selection from local landrace	Gray	m	Late
8	Lt m	Germany /landrace	Gray	M	Late
9	Lt n	France / landrace	Black	m	Late

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***m – microsperma (small to medium-sized seed); M – macrosperma (large seed)

Random amplified polymorphic DNA (RAPD) analysis

The DNA obtained was amplified by the RAPD procedure with 4 decamer random primers from "Operon Technologies" (California, USA), that identified polymorphisms: OPA-17, OPA-12, OPG-05, OPG-06.

Polymerase Chain Reaction (PCR) were achieved in a final volume of 25 µl, containing: 25 ng DNA, 0.1 mM of each dNTP, 2.0 mM $MgCl_2$, 10 mM Tris-HCl, pH 8.3, 50 mM KCl, 0.4 mM of one primer decamer and one unit of Taq DNA polymerase (Williams et al., 1990). The amplification was performed using a M.J. Research thermal cycler, programed for 45 cycles, each consisted of: one denaturation step at 94°C for 1 min., one annealing step at 36°C for 1 min and one extension step at 72°C for 2 min. The extension step in the last cycle was 7 min at 72°C. RAPD amplification products were separated on 1.2% agarose stained with ethidium bromide and scored for presence or absence of bands.

Statistical analysis

RAPD markers were scored as present (1) or absent (0). Distance genetics was computed after Nei&Li (1979) formula, using TREECON 1.3 b software package. A cluster analysis was performed using the unweighted pair-group method using arithmetic average (UPGMA) and the dendogram was obtained in order to visualize the relationship among lentil cultivars. The genetic similarity (Sij) was estimated using the Nei & Li coefficient (1979), by the expression: $Sij = 2 N_{ij} / (N_i + N_j)$, where N_{ij} - the number of bands in common between accessions i and j; N_i and N_j - the number of bands for accession i and j, respectively.

RESULTS AND DISCUSSION

RAPD analysis

Four decamer random primers were used to differentiate between the nine lentil varieties (Tables 2). A total of 43 bands were amplified in lentil genotypes taken in study. Of the total bands 27 (P = 62.7%) were polymorphic. On the average, each primer amplified 10.75 bands, of which 6.75 were polymorphic. The percentage polymorphic loci varied from 58.3% (OPG – 06) to 69.2% (OPA-17) with an average of 62.5% bands / primer (Table 2).

Genetic distance and similarity

Pair–wise comparisons between the tested genotypes were used to calculate the genetic similarity (table 3). The highest similarity value (99.1%) was recorded between the lentil cultivars Idlib 3 and Idlib 4, indicating that these were closely related to each other (genetic distance = 0.090). Meanwhile, the lowest similarity value (70.4) was found between Idlib 1 and landraces Lm and Ln, indicating that these were distantly related genotypes (genetic distance = 0.296).

Table 2

Primers used in RAPD analysis of *Lens culinaris*, the number of scored and polymorphic loci

S/ No.	Primer name	Nucleotide sequence 5'- 3'	No. of loci		P*
			Total	Polymorphic	
1	OPA - 17	CACCGCTTGT	13	9	69.2
2	OPA - 12	TCGGCGATAG	10	6	60.0
3	OPG - 05	CTGAGACGGA	8	5	62.5
4	OPG - 06	GTGCCTAACC	12	7	58.3
	Average		10.75	6.75	62.7
	Total		43	27	62.7

*P – percentage of polymorphic loci

Table 3

Genetic similarity (below diagonal) and genetic distance values (above diagonal) in lentil varieties

Variety	Idlib 1	Idlib 2	Idlib 3	Idlib 4	Hurani	Kurdi	Oana	Lt m	Lt n
Idlib 1	***	0.143	0.067	0.067	0.134	0.173	0.215	0.296	0.296
Idlib 2	85.7	***	0.072	0.072	0.143	0.120	0.231	0.200	0.200
Idlib 3	93.3	92.8	***	0.090	0.134	0.104	0.143	0.186	0.186
Idlib 4	93.3	92.8	99.1	***	0.134	0.104	0.143	0.186	0.186
Hurani	86.6	85.7	86.6	86.6	***	0.173	0.286	0.260	0.260
Kurdi	82.7	88.8	89.6	89.6	82.7	***	0.112	0.077	0.077
Oana	78.5	76.9	85.7	85.7	71.4	88.8	***	0.120	0.120
Lt m	70.4	80.0	81.4	81.4	74.0	92.3	88.0	***	0.084
Lt n	70.4	80.0	81.4	81.4	74.0	92.3	88.0	91.6	***

The high similarity values found between the lentil genotypes tested indicate that the genetic diversity between them is narrow and due to their common origin in the breeding program. Similar results were also found by Sharma et al. (1996) used AFLP and RAPD marker techniques to evaluate and study the diversity and phylogeny of 54 lentil asscessions.

Cluster analysis

The clustering obtained by UPGMA method is shown in Figure 1. Cluster analysis revealed two main groups of lentil genotypes studied. The first cluster included five lentil cultivars obtained from ICARDA, with early maturity and microsperma type: Idlib 3, Idlib 4, Idlib 1, Idlib 2 and Hurani, while the second cluster included genotypes with late maturity, from Europe except for Kurdi: Oana, Ltm, Ltn and Kurdi. RAPD analysis detected in the branch **A** other two categories grouping Idlib 3, Idlib 4, Idlib 1 and Idlib 2 improved lentil cultivars in **1** group and Hurani cultivar in **2** group (figure 1). Branch **B** is divided too in two categories, grouping romanian lentil cultivar – Oana in one group (**cluster 3**), and two lentil landraces Lt m, Lt n and Kurdi genotype in another group (**cluster 4**) (figure 1).

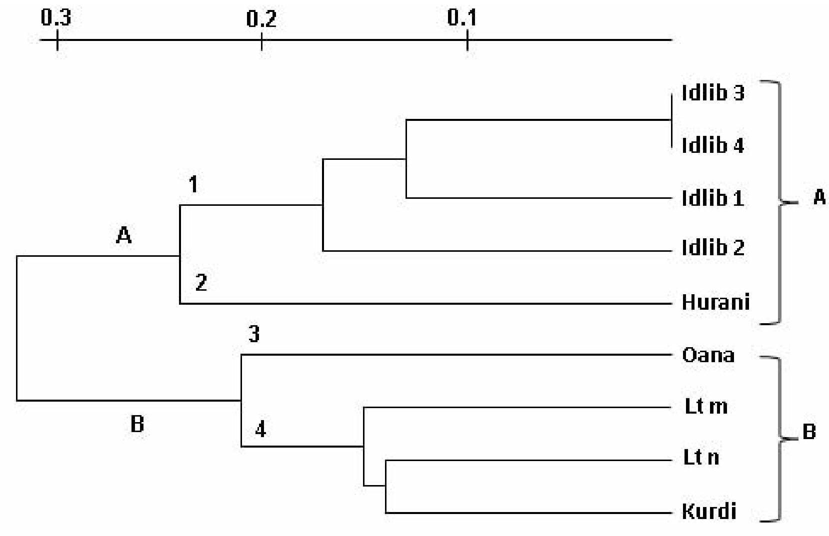

Fig. 1. Cluster analysis dendrogram of nine lentil genotypes (*Lens culinaris* Medik.) using RAPD data and UPGMA method

CONCLUSIONS

1. The analyses performed in this study indicate that investigated lentil accessions are genetically distinct. The nine lentil varieties formed two distinct groups. In the future breeding programs, crosses between lentil varieties from these two major groups (A and B) might lead to high heterosis, despite the theory that in autogamous species that have undergone evolution under domestication the dominant and additive alleles prevail, reducing the advances of F1 heteros
2. The RAPD technique contribute with a significant number of polymorphic markers wich could be useful in identifying lentil cultivars. It was concluded that RAPD markers could be exploited as alternative or supplementary tools to already established methods for the evaluation and classification of lentil genetic resources.

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APRICOT ADAPTABILITY UNDER THE ROMANIAN CLIMATIC CONDITIONS

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Abstract

Research on the adaptability of 665 apricot phenotypes from seven geographic areas, preserved in the genetic collections, 9000 hybrids and 35 variety created in Romania, have shown that, out of 27 seven years (1981-2007), seven years were unfavourable to apricot growing (of which four years were successive in the first decade of this century). Over the past four years, the short frost periods (-7^0C), sometimes lasting for only several hours, following longer warm periods at the end of February (+12^0C, +20^0C), affected the apricot phenotypes in their early budding or flowering stage. The damage resulted was 90-100% . The consequences of the climatic changes are significant with respect to the biological transformation of the fruiting and vegetative organs and, further on correlated to the biology of the most frequent pathogens, pests and predators in Romania.

INTRODUCTION

As a result of anthropic activities, the concentration in the most important greenhouse gases has increased in the last century, exceeding their natural replacement capacity either by "adsorption" on the Earth's surface or chemical reactions in the atmosphere.

In a first phase, climatic changes in general consist of increased annual average temperatures (1-2°C, i.e. 3.9-4.4°C in Southern Romania, according to Marica Adriana, 2000, [7] and decreased/increased annual rainfalls (5-20%, with variations from 47% to 81% in Sourthern Romania).

Under these conditions, the tendecy for aridization would intensify in the rainfall deficitary areas growing agricultural crops, resulting in less distinct differences between winter and spring, and "shortened" springs rapidly turning into summer.

The main objective of the paper "Apricot adaptability under the Romanian climatic conditions" is to sum up our 27-year research (1981-2007) on the biology of apricot adaptability to the climatic conditions of two Romanian areas: Campia Vlasiei (the Vlasia Plain) from the Romanian Plains, and the Valul lui Traian area on the Black Sea Coast, the Dobrudja area.

MATERIAL AND METHODS

The evaluation was focused on the impact of temperature fluctuations and climatic accidents on the apricot fruition phenopases and the eventual damage caused by the destruction of the flower organs, monitored over a period of 27 years (1981-2007).

Also, the evaluation was aimed at identifying the biology of the pathogen *Monilinia laxa*, the main pest that attacks the apricot during flowering and leaf growth.

The biological material used over the 27 years consisted in 665 apricot phenotypes preserved in the genetic collections, 9000 hybrids and 35 variety created in Romania.

RESULTS AND DISCUSSION

Areas delimited for apricot growing in Romania

Two areas were delimited for the apricot-tree growing in Romania a long time ago: the former is a 15 km strip of land along the Black Sea Coast, and the latter is a 4-5 km enclave along the Danube, where the rate of flower-bud damage is extremely low, i.e. 8-9 years of normal development (no loss) out of 10.

Getting farther from the two favourable micro-areas toward the Romanian Plain, the risk of losing flower buds or damage to full-flowering flowers is increasing as four out of 15 years are unfavourable to apricot growing, which consequently leads to reduced production [2].

Reduction is strictly correlated to the biological traits of the varieties that still exists in the plantations, as well as to their ecological plasticity.

One of our concerns is crop extension of some phenotypes of higher ecological plasticity allowing the eventual extension of the growing areas, together with the identification of the risk-free or minimum-risk areas and micro-areas under the present climatic changes.

Climatic characteristics of the areas growing the apricot phenotypes under study

Research was focused on two areas where apricot phenotypes were located, i.e. the Bucharest Plain and the Dobrudja area situated between the Danube and Black Sea. As subdivision of the Romanian Plain, the largest plain area in Romania, **the Bucharest Plain and, implicitly, the Vlasia Plain** borders the Danube on the East and South, and the Getic Plateau, Sub-Carpathians, and the Moldavian Plateau on the North (figure 1).

Fig. 1. Bucharest Plain location within the Romanian Plains

The Romanian Plain is marked by three types of influences: sub-Mediterranean in the Oltenia Plain (autumn rainfalls and mild winters), transition from oceanic and sub-Mediterranean influences to aridity in the central area (reduced rainfalls in the East and higher temperatures in winter), and aridity in Baragan (strong continentality, cold winters, warm even hot summers recently and drought) [7].

In the **Dobrudja area,** the main favourable area for apricot growing, the climatic factors are affected by the influence of the air currents between the Danube and the Black Sea, following the existent ground water sources, the influence of the lack of water upon the trees (both natural water-from rainfalls, and artificial-from irrigations), and particulalrly the regional and global climate change under the influence of the anthropogenic factor. Together with southern Banat and Oltenia, Dobrudja is considered a highly deserted area in Europe.

Flowering phases of apricot phenotypes over 28 years (1980-2008)

Passing through the fruit organ phenophases of the tree is the phenotypical externalization of some genetic codes, highly influenced by the environmental conditions reflecting the climatic particularities of every year [2, 4, 3]. The adaptability of all apricot phenophases studied in the two areas was reflected by their dependency on satisfying the needs of coldness and removing the dormance state on the one hand, and satisfying the needs of warmth in order to start vegetation (over the biological threshold of +6.5ºC). The research carried out over the 28 years on the numerous apricot phenotypes did not point out differences longer than 4-5 days in the beginning of the flowering phase, i.e. between “the earliest” and “the latest”.

No significant differences were recorded between the two areas with respect to the month when flowering began, either March or April, in any of the phenotypes under study; however, in Dobrudja, it always occurred 10-12 days earlier.

Nevertheless, high differences occurred between the years, resulting from extremely variable climatic conditions. The table 1 shows the years when flowering in both areas started earlier in March.

Table 1

The years when flowering in both areas started earlier in March

Area	1980-1989	1990-1999	2000-2008
Bucharest and Dobrudja*	1981, 1983	1995*	2000*, 2001, 2002, 2004, 2007, 2008

Over the 27 years of study, one and the same phenotype recorded differences of even 45 days in the beginning of flowering, and even differences from one year to another, irrespective of the phenotype.

The photosynthesis-respiration balance, both during the intensive growth of the shootlets and fruit, 15 May-15 June, and during the inactive phase (quiescence), pointed to the normal metabolism of the accumulated organic matter available for the vital activities, which reflected the physiological adaptation of the phenotypes selected as genitors, as well as their descendants, in the areas under study, i.e. the Romanian Plain and Dobrogea.

The genetical studies led to the following results: Genetic transgressions and cytoplasmic heredity were involved for the blooming time of apricot descendants $F_{1.}$

Behaviour under conditions of frost and wintering

There are numerous elements illustrating the resistance or susceptibility of the collection-preserved apricot-tree phenotypes, genitors and descendants in relation to low winter temperatures and fluctuating temperatures recorded at the end of winter and in spring time. Out of these elements, the determinations referred to: the free and bound water content and the carbon hydrate content, both in the dormant and vegetation stages, cryosusceptibility of malate dehydrogenase and peroxydase in the buds that were naturally exposed to frost during winter, and the percentage of dead flower buds.

The results from the genetic research data refer to the-heterosis of the content in carbon hydrates, free water and bound water present in the early shoots, expected in descendants F_1,-transgressive heredity, revealed for the frost resistance traits of descendants F_1,- correlation between the peroxidase cryoresistance of the genitors and the frost resistance of descendants $F_{1.}$

Damage caused by climatic accidents to the apricot flower organs

The seasons and years that recorded deviations from the normal situation, i.e. the flower organs of the apricot were damaged, were: the winters of 1982–1983, 1984–1985, 1986–1987 and springs of 1995*, 2000* (in Dobrudja*), 2001, 2002, 2005, 2007, and for some varieties – 2008.

If for 15 years (1981-1995), the climatic conditions of the springs posed no danger for the destruction of the flowering buds in the debudding or flower button phase, flowers before or after fecundation, or young fruit, the second period of time - 12 years (1995-2007) - recorded low-temperature springs in 1995, 2001, 2002, 2007, that is, precisely when apricot was fully flowering, which resulted in 95-100% damage.

The overall perspective on the years 1981-2008 shows that, out of the 7 years of climatic accidents, 4 years belong to the latter period, i.e. 33% risk factors, whereas the other 3 belong to the former period, i.e. 20% risk factors.

Consequences of climatic change upon the attack of the pathogen
Monilinia laxa (Aderhol et Ruhl., Honey et Whetzel). The pathogen *Monilinia laxa* hibernates as a resistant mycelium on various organs on the tree crown or soil surface, forming conidias at 10ºC. The minimum temperature (biological threshold) of development is around 4°C; thus the fungus has found favourable conditions of development every year when winter was mild and temperatures higher than the biological threshold were recorded. The incubation of the disease was 3-5 days, and even 8-10 days when drought occurred. Moniliasis was much influenced by the rainfalls occurring during the flowering phase, and inhibited when the apricot flowers were destroyed (table 2).

Table 2

Incubation of the *Monilinia laxa*

Monilinia laxa	**2006**	**2007**	**2008**
Identification	Beginning of April	Beginning of May	7-10 April
Offshoot incidence (%)	75	< 10	25

CONCLUSIONS

1. The last 7 years of the 18 years under analysis (2000-2008) have been enlightening for drawing conclusions on the dramatic climatic changes and significant damage caused by the risk factors.
2. Apricot flower organs are affected by every degree of negative temperature, even short termed (of hours, not days) that occurs in spring as a result of the continental climate specific to the Bucharest Plain and desertification of the Dobrudja area, as well as the cold fronts coming from the Arctic area.

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ASPECTS FROM THE VEGETATION OF THE ACCUMULATION LAKE MURANI-PISCHIA (TIMIS COUNTY)

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Keywords: *Pischia, aquatic and paludicolous vegetation, preservation resources*

Abstract

The accumulation Murani - Pischia was build in 1971, along the Magheruş brook. The initial purpose of the development was to diminish the flood effects. The area was declared Ornithological Natural Reserve (2743) "Murani - Pischia Swamps" (with the mention "Habitat specific for aquatic fauna - Ixobrychus minutus: Little Bittern"), through Law 5/2000, H. C. J. 19/1995. As a type of major habitat, the reserve is situated in the category of fresh water/humid areas habitats, turf moors (from the ecoregion Hungarian Plain). Our research consisted in several field trips in the lake area, at different times, in order to better observe the structure of the phytocoenoses. The data processing implied the identification of the vegetal associations, following the concentration and analysis of the vegetation samples collected on the field, performing the synopsis of the cenoetaxonomic units and the analysis of the vegetal associations, considering several points of view. The study is based upon the principles of the Central-European floristic phytocoenologic school. There have been identified and analyzed according to the mentions above 13 vegetal associations, some of which with a high conservative value.

INTRODUCTION

A long time ago, Banat used to be a swampy region. Following the vast hydro-improving works performed in time, a series of natural humid areas disappeared from the Banat territory, and other have considerably diminished their sizes. As these regions diminished, artificial developments have been created on considerable surfaces. In this context, in 1971, by building a dam on the course of the Magherus, the Murani-Pischia accumulation was formed. The accumulation is situated at the altitude of 130 m. The water volume is of 6.240 mil. m^3 and the surface of 200 ha. At present, the reserve is administered by the Local Council of Pischia Commune [2].

MATERIAL AND METHODS

The study of the vegetation of the accumulation lake Pischia was performed in the period 2004-2007. The research is based on the principles of the Central-European phytocoenologic school. We took into account the drawing up of the summary of cenoetaxonomic units and the analysis of the vegetal associations.

RESULTS AND DISCUSSION

The general aspect of the vegetal carpet with the reserve, is that of herbaceous mosaic, mainly representing aquatic and paludicolous communities [4]. In what follows it is presented the summary of the vegetation units and the vegetal associations, which are then briefly discussed.

Summary of the main cenoetaxonomic units [5, 6]:

Cls. LEMNETEA W. Koch et Tx. 1934
Ord. *Lemnetalia* W. Koch et Tx. 1954
Al. *Lemnion minoris* W. Koch et Tx. 1954
Lemnetum minoris (Oberd. 1957) Müller et Görs 1960
Cls. POTAMETEA Tx. et Prsg. 1942
Ord. *Potametalia* W. Koch 1926
Al. *Potamion* W. Koch 1926 emend. Oberd. 1957
Myriophyllo – Potametum Soó 1934
Al. *Nymphaeion* Oberd. 1957 emend. Neuhäusl 1959
Trapetum natantis Müller et Görs 1960
Cls. PHRAGMITETEA Tx. et Prsg. 1942
Ord. *Phragmitetalia* W. Koch 1926 emend. Pign. 1953
Al. *Phragmition* W. Koch 1926
Scirpo – Phragmitetum W. Koch 1926
Typhaetum angustifoliae (All. 1922) Pign. 1943
Glycerietum maximae Hueck 1931
Schoenoplectetum lacustris Eggler 1933
Iretum pseudacori Eggler 1933
Al. *Bolboschoenion maritimi continentale* Soó (1945) 1947 emend. Borhidi 1970
Eleocharidetum palustris Schennikow 1919
Ord. *Magnocaricetalia* Pign. 1953
Al. *Magnocaricion elatae* W. Koch 1926
Caricetum ripario-acutiformis Kobenza 1930
Cls. BIDENTETEA TRIPARTITI Tx., Lohm. et Prsg. 1950
Ord. *Bidentetalia tripartiti* Br. – Bl. et Tx. 1943
Al. *Bidention tripartiti* Nordh. 1940
Bidentetum tripartiti W. Koch 1926
Al. *Chenopodion fluviatile* (*rubri*) Tx. 1960
Echinochloo–Polygonetum lapathifolii (Ujvárosi 1940) Soó et Csűrös (1944) 1947
Cls. MOLINIO – ARRHENATHERETEA Tx. 1937
Ord. *Deschampsietalia caespitosae* Horvatič 1956
Al. *Alopecurion pratensis* Pass. 1964
Festucetum pratensis Soó 1938

The association of duckweed is frequent in Banat, just like in all aquatic pools in our country. This community presents a reduced cenoetaxonomic diversity (our phytocoenoses being constituted of only 2 species, *Lemna minor* and *Spirodela polyrhiza*), but an impressive number of individuals forming a compact bed on the surface of the water. It develops well in glades but also under the protection of reed, cane and water manna. It represents a food source for water birds. The locals use the biomass of the association also for feeding household birds.

The association of water milfoil and arrowgrass also has a low floristic diversity. In Pischia, the association is almost entirely comprised of *Potamogeton crispus*, its appearance in large quantity indicating a scarcity in oxygen and significant accumulations of organic matter. From the point of view of its importance, it represents shelter and food source for the fish.

The association of long-horned is well developed on clay substratum (and due to the abundant fructification and the displacement of many individuals), in pools in process of colmation. Due to water pollution and the damming performed, these phytocoenoses are endangered. In dry years, the species survives on swampy lands, facing well the oscillations in water levels. It is also the case of the phytocoenoses in Pischia, when the low water level makes the species to be highly present on the shore. Among the species characteristic for the association, we encounter in our phytocoenoses: *Lemna minor, Ceratophyllum demersum, Potamogeton crispus*. Concerning the importance, the long-horned seeds are edible, the leaves can be administered as fodder for animals. On the other hand, as an inconvenient, the species makes fishing difficult when it exaggeratedly develops at the surface of water, and the fruit is dangerous due to the fact that the persistent sepals, after blooming they intergrow and turn into thorns. Those who fish in the Pischia waters are often faced with this inconvenient.

The reed plots are present in most stagnant water accumulations in the country. In Banat they used to occupy considerable surfaces, today, due to the hydro-improving works performed in the area, they appear isolated and under greatly changed ecologic conditions [3]. Together with the edifying species, among the species characteristic for the association we have encountered: *Stachys palustris, Typha angustifolia, Lycopus europaeus, Iris pseudacorus, Calystegia sepium*. Considering the significance, the reed plots mainly insure the protection and consolidation of aquatic pool shores. It is also well known their capacity to concentrate heavy metals, being successfully used in ecological restoration activities through phytoimprovement. They are also used in the cellulose and paper industry and for some light constructions. In the situation analyzed by us, the reed is not economically exploited, but it represents a well protected shelter and nesting place for birds.

The reeds are very frequent in all country regions, with lush growths on lake and pond shores, along stagnant water channels. In the floristic composition of our phytocoenoses we encounter many species characteristic for the association, like: *Stachys palustris, Mentha aquatica, Bidens tripartita, Glyceria maxima, Rorippa* *amphibia, Lycopus europaeus, Calystegia sepium, Iris pseudacorus, Bolboschoenus maritimus*, which are joined by some coming from the shore vegetation. Considering the importance, the reed is rarely used in household industry, for knitting.

The edified phytocoenoses of manna grass generally grow on soils rich in nutrients, in areas where the water does not exceed 50 cm. They are disposed in the shape of stripes at the edge of reed, representing a bordering association towards the shore vegetation, a reason for which they have a quite heterogeneous structure. Among the characteristic species, there are present in our phytocoenoses: *Mentha aquatica, Lycopus europaeus, Iris pseudacorus, Butomus umbellatus, Schoenoplectus lacustris, Calystegia sepium*. The value of these phytocoenoses is reduced, sometimes the biomass is used as hay, but it has a low quality.

The bulrush is disposed in the shape of bands or clumps between reed plots and shore. The analyzed phytocoenoses has a weak composition, due to the stratum of dead stems from the previous years which hinder the development of other species. Only some examples of *Sparganium* and *Glyceria* manage to cross the bulrush thicket. Being very rich in proteins, it is recommended the use of the bulrush as fodder for birds. Due to the high content of NPK of twigs, it is used as fertilizer, as composite, in horticulture. Another use is for cellulose, paper and artificial silk manufacture. In the situation analyzed, the bulrush represents a shelter and nesting place for birds.

The sword flag grows in Pischia in pond areas, in clumps. These phytocoenoses are not very frequent in Banat, neither throughout the country (there is some signaling in Danube Delta and Moldova). Regarding the importance, the species is decorative for its flowers and it is cultivated as ornamental plant.

The spike rush phytocoenoses from the resort studied grow on the water shore, arranged in the shape of stripes and are almost exclusively formed of the edifying species. Economically, these pastures have a low quality, with importance only in the vegetation succession.

The sedge are very frequent in the country and in Banat. The grow on the shore, on humid soils, frequently flooded in spring. The floristic composition of the 5 phytocoenoses analyzed is rich and heterogeneous (with many ruderal and segetal species), among the species characteristics for the association, we encountered in our samples only: *Carex acutiformis, Scutellaria hastifolia, Iris pseudacorus, Stachys palustris, Mentha aquatica*. In two of the phytocoenoses analyzed, we identified the species *Eriochloa villosa*, a recently signaled invasive weed in our country flora, coming from the soy crops near the lake, which it had invaded. These pastures sometimes represent a refuge and nesting place for birds. From the point of view of its economic importance, the quality of the fodder is low.

The edified association of beggar-ticks in Pischia has a heterogeneous floristic structure, with many weed species characteristic for the humid lands but also with hydatophytes and very many mesophytes. It appears in the second part of summer, recording an optimal growth in autumn, when the dominant species fructifies. Although it does not present an economic importance, these phytocoenoses have a role in the vegetation succession.

The bristle grass and the smartwort form characteristic phytocoenoses which grow in areas where the water stagnates in spring and dries up in summer, moment when it records the optimal growth. The *Echinochloa* seeds can resist for a long time covered by water, without losing the germinative ability. The association represents a pioneering vegetation, colonizing free lands from the border of aquatic pools and which goes towards mesophilic weeds. Considering the importance, these pastures are valuable being exploited by pasturage and mowing, presenting the advantage of having a rapid recovery.

The fescue phytocoenoses analyzed was identified on dry land, on the side of the road. From this reason it is quite heterogeneous from the point of view of the floristic structure and the species in which it consists are especially xero-mesophilic, except for the edifying species, which is mesophilic. The economic importance of these pastures is related to the high fodder value, both in production and for the quality of the fodder, being mowed several times a year.

The vegetal associations identified and analyzed in the area of the Murani – Pischia accumulation confer this habitat kenotic, descriptive and economic characteristics. Regarding the preservation importance, we mention that the association *Trapetum natantis* has a high preservation value and the associations *Lemnetum minoris*, *Eleocharitetum palustris*, *Glycerietum maximae*, *Scirpo-Phragmitetum* and *Caricetum ripariae* are part of habitats with an average preservation value, with a tendency of becoming high, under the conditions of threat of becoming extinct for many species [1].

The authors can offer to the interested persons the synthetical tabel of the vegetal associations which is not included into the paper because of its dimensions.

CONCLUSIONS

1. The ecologic conditions from the area of the accumulation Pischia have favored the installation of a significant vegetation due to the fact that we encounter here phytocoenoses with a high preservation value and which also represent an island where many species of birds live.
2. The list of the cenoetaxonomic comprises 13 vegetal associations, most of which are hydrophilic and mesohydrophilic. We notice within the association *Caricetum ripariae* the presence of the species *Eriochloa villosa*, a new weed for Banat and Romania.

3. Due to the phytocenotic diversity, and the characteristic bird and fish fauna, we consider necessary the drawing up of a adequate management plan and, also, the careful monitoring of anthropic interventions, which endanger the originality of this habitat.

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PLANTS FROM BOTANICAL GARDEN: *BOTHRIOCHLOA BLADHII* (RETZ.) S.T.BLAKE (SYSTEMATICS, MORPHOLOGY AND BIOLOGY)

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Keywords: *Bothriochloa bladhii, taxonomy, stem, shoot and leaf anatomy*

Abstract

Classified in the Poaceae's family and Andropogoneae's tribe, Bothriochloa bladhii (Caucasian bluestem, Australian beardgrass) is widely distributed through Africa, Asia and Australia, in savannas, open forests and grasslands, often on alluviums. In the Romanian Flora (vol. XII) it is mentioned by its synonym – Bothriochloa intermedia (R.Br.) A.Camus. Subspontaneous spread in our botanical garden, B.bladhii is a perennial grass, with densely caespitosed stems on short stolons; inflorescence-panicle subdigitat; two uniflorous spikelets at the joint, one hermaphrodite, sessile, the other one pedicellate, sterile, with the awn arising from the sessile spikelet. In the internal structure of the culms, the hypoderm and the main part of the basic parenchyma are strongly sclerificated after flowering.

INTRODUCTION

In Romanian flora the genus *Bothriochloa* (*Andropogon*) is represented by two species: *B. ischaemum* (*A. ischaemum, A. angustifolius*) – spontaneous, perennial herbs, largely distributed on oligotrophic, rocky, barren, sandy, calcareous, sunny soils, ranging from plain to sub mountain regions [8] considerate without fodder value, at least indicate to stabilize barren slopes [1]; *B. intermedia* (*A. intermedius*) – perennial herbs too, it occurs subspontanous spread in lawn in the botanical garden of the University of Bucharest [8], and of the University of Agronomic Sciences and Veterinary Medicine of Bucharest [7].

In some works, *Bothriochloa* (*Andropogon*) genus is included in *Dicanthium* [5, 2] or these two geniuses are distinct [4]. There are, also, works with *Bothriochloa bladhii* which comprise *B.intermedia* (*A.intermedius*) [9]. The difficulties of the taxonomy of *Bothriochloa* genus arises from the large variability of their species. *Bothriochloa bladhii* is treated in a wide sense and include all the specimens with an elongate inflorescence [9].

In this article we present some aspects of the taxonomy, morphology, anatomy and biology of the *Bothriochloa bladhii* plants acclimatized in our botanical garden.

MATERIAL AND METHODS

This study was based on morphological and anatomical observations conducted on plants from Botanical garden of UASVM – Bucharest and on taxonomic data from an international bibliography.

For microscopic examination were used cross sections obtained from floriferous stem, young shoots and leaves. These were stained by alaun-carmine and jod-grun for study with a light microscope (BA 2500 with phase contrast); photos were taken with a digital camera (Panasonic DMC-LZ7).

RESULTS AND DISCUSSION

<u>The *Bothriochloa bladhii* taxonomy</u>

The genus *Bothriochloa* (*Poaceae, Andropogoneae*) is distinguished from the *Andropogon* by differential characters including the upper lema of the sessile spikelet (not cleft to *Botriochloa*, 2-lobed or 2-cleft to *Andropogon*) [4] or the inflorescence (1-many fragile racemes to *Dicanthium* (*Botriochloa*), paired or digitate fragile racemes to *Andropogon*) [2, 5].

There are 20 synonyms included in *B. bladhii* (Retz.) S.T.Blake – *Amphilopsis glabra* (Roxb.) Stapf, *Andropogon bladhii* Retz., *Andropogon caucasicus* Trin., *Andropogon glaber* Roxb., *Andropogon haenkei* Presl., *Andropogon intermedia* (R.Br.) Stapf, *Andropogon intermedius* R.Br., *Andropogon intermedius* var. *caucaica* (Trin.) Hack., *Andropogon odorata* (Lisboa) A.Camus, *Andropogon odoratus* Lisboa, *Andropogon punctatus* Roxb., *Bothriochloa caucasica* (Trin.) C.E.Hubbard, *Bothriochloa glabra* (Roxb.) A.Camus, *Bothriochloa haenkei* (Presl.) Ohwi, <u>*Bothriochloa intermedia*</u> (R.Br.) A.Camus, *Bothriochloa* var. *punctata* (Roxb.) Keng, *Bothriochloa odorata* (Lisboa.) A.Camus, *Dicanthium bladhii* (Retz.) Clayton, *Dicanthium intermediu* (R.Br.) DeWet&Harlan, *Sorghum caucasicum* (Trin.) Griseb [9]. In *B. bladhii* were included all the specimens with elongate inflorescence (lax, ovoid-elongated panicle), different from *B. ischaemum* inflorescence, composed of digitaly or subdigitaly arranged branches [8].

<u>The *Bothriochloa bladhii* morphology</u>

Perennial grass, with densely caespitosed stems on short rhizomes (figure 1); culms vigorously developed – 45 cm tall, erect to slightly geniculate (figure 2); blade linear, 7 mm wide; short ligulae – 1 mm long, with 2 lateral hairy tufts.

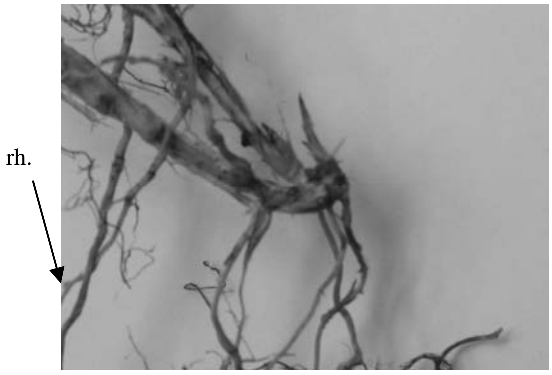

Fig. 1. Rhizome (rh) and culm's base

Fig. 2. The plant from botanical garden

Inflorescence-panicle subdigitat with two uniflorous spikelet at the joint, one sessile, hermaphrodite, the other one pedicellate, sterile, with awn arising from the sessile spikelet (figure 3).

Fig. 3. Spikelets

<u>The stem, shoot and leaf anatomy</u>

In the transection of the internodes of floriferous stem are visible the epidermis, the fundamental tissue and the vascular bundles (figure 4).

The epidermis consists of 1 cells row with strongly lignificated lateral and internal walls; the outer wall is thin and convex.

The fundamental tissue has become a sclerenchymatous one, composed by strongly lignificated cells, and only in the middle of the cross section it can be observed some parenchymatous tissue.

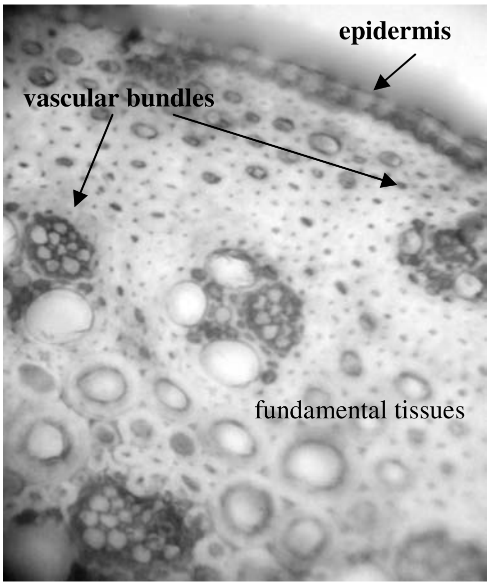

Fig. 4. The stem in cross section

The vascular bundles are distributed according to one of the herbaceous monocotyledon basic plans [3]. They are scattered throughout the transection, with smaller bundles densely arranged near periphery and larger bundles more widely spaced in the center. There are collateral bundles, enclosed in a sheath of sclerenchyma, distinct from the rest of the fundamental tissues.

In the cross section of the base of the shoot are observed the folded leaf and the protective sheath (figure 5). The form of the folded leaf is convoluted and the intern structure is the same as the active leaf.

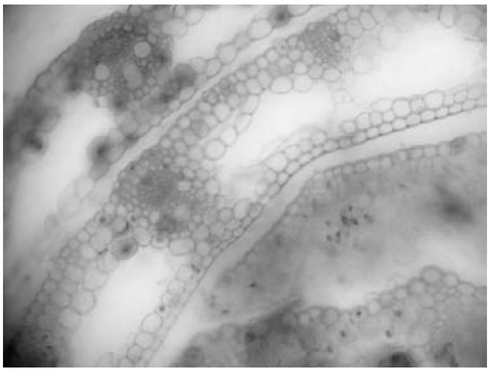

Fig. 5. The sheath (sh) and the folded leaf (leaf)

The outer epidermis of the protective sheath is composed of thin, cellulosic walled cells distributed in one row as in the inner epidermis. Between the two epidermises there is a spongy parenchyma, disorganized between vascular bundles. The vascular bundles are the collateral ones, with 2 sclerenchymatous arches, the outer bigger than the inner one and almost integrate in the outer epidermis.

The upper epidermis of the *Bothriochloa* leaf is composed of the epidermal cells, stomata and bulliform cells (figure 6), and the lower epidermis includes epidermal cells and stomata too - the leaf is amphistomatic type. The homogeneous mesophyll is prominent on the adaxial surface, in front of vascular bundles.

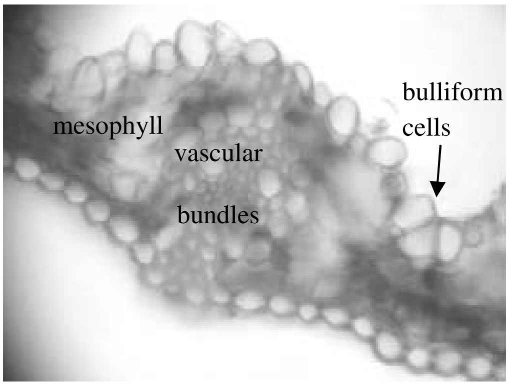

Fig. 6. The leaf in cross section

Bothriochloa bladhii plants from our botanical garden undergo manly a vegetative multiplication.

CONCLUSIONS

1. *Bothriochloa intermedia* (R.Br.) Camus is a synonym of *Bothriochloa bladhii* (Retz.) S.T. Blake.
2. In the floriferous stem structure there is a strongly sclerificated ground parenchyma and the vascular bundles are scattered throughout the transection.
3. The base of the shoot is made up of a protective sheath and a convoluted folded leaf.
4. The leaf is amphistomatic, with bulliform cells in upper epidermis and a homogeneous mesophyll.
5. Vegetative multiplication is the manly form of reproduction to plants from botanical garden.

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CHANGES IN LEAF STRUCTURE IN TWO SOYBEAN LINES INDUCED BY SOIL AND PLANT TREATMENTS

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Keywords: *soybean, leaf anatomy, plants reaction, Botrytis infection*

Abstract

Different changes in mesophyll and both epidermis tissues and cells dimensions were observed on two soybean line plants when treatments with fungicide and various extracts were applied on soil and plants. These experiments were created to emphasize plants reaction to the Botrytis infection; the used variants were: Botrytis resistant or sensible soybean plants, systemic or contact fungicides and 4 extracts types. Anatomically, the plants from the soybean lines M10 (Botrytis sensible) and B62 (Botrytis resistant) are different one from the other in the mesophyll thickness. When fungicide treatments on the soil were applied, plants from both lines have reacted by slowly increasing thickness at the epidermal cells level and by making up two cell layers palisade tissue. The same reaction was observed when the fungicide treatments were applied on plants. The four kinds of extracts used in this experiment have induced different kinds of reactions in plants either in soil or plant treatments.

INTRODUCTION

The leaf structure and morphology reflected the evolutionary adaptations of plants to different habitats [1].

As the vegetative organ with the greatest ecological plasticity, the leaf is a sensitive indicator of any changes in the environmental conditions. Many research papers treat the leaf structure with reference to ecology. The degrees of pollution [5], pathogen attacks [3], applied treatments [4] etc. are reflected in the biometrical characteristics of the epidermis and mesophyll tissues.

On the other hand, these leaves characteristics were used in different study of correlation between them and plants resistance to the pathogen attacks [2].

The results of such a study, conducted on soybean leaves, are presented in this paper, to point up the occurring changes in the structure of the blade when on the plants were applied different stress factors.

MATERIAL AND METHODS

The plant material consisted of leaves drawing from two lines of soybean plants - M10 (*Botrytis* sensible), B65 (*Botrytis* resistant) on which these treatments were applied:

- contact fungicides - Captan+Teldor, Captan+Batron (fine sprayings on plants);
- systemic fungicides - Topsin M+Rovral, Topsin M (introduced in soil);
- 4 extracts types - 1, 2, 3, 4 (applied on leaves or on soil);
- pathogen inoculation - *Botrytis* (applied on leaves or on soil).

For the microscopic observations and measurements, there were made cross sections in the middle blade zones or in parts of leaf with pathogen attack symptoms.

The sections examination was made with trinocular Novex microscope.

RESULTS AND DISCUSSION

Anatomically, the plants from the soybean lines M10 and B62 are different one from the other in the mesophyll thickness - B62 plants (*Botrytis* resistant) have higher values of the mesophyll than M10 (*Botrytis* sensible) plants (table 1).

Table 1

Structural characteristics of soybean lines plant blade

Drawing data	Soybean lines	Upper epidermis (µ)	Mesophyll (µ)	Lower epidermis (µ)
8.VII.08	**$PR_{91}M_{10}$**	10.00	92.00	10.00
8.VII.08	**$PR_{92}B_{62}$**	10.00	103.50	10.00

When fungicide treatments were applied on the soil, plants from both lines reacted by slow increasing in thickness at the epidermal cells level, excepting the lower epidermis of the B62 plants, and at the mesophyll level (table 2).

Table 2

Structural characteristics of the soybean lines plant blade - variants with antifungic treatments introduced in soil

Drawing data	Soybean lines	Upper epidermis (µ)	Mesophyll (µ)	Lower epidermis (µ)	Difference from untreated plants (µ)
8.VII.08	**$PR_{91}M_{10}$**	11.50	103.50	12.00	✓ +1.5 upper ep. ✓ +11.5 mesophyll ✓ +2.00 lower ep.
8.VII.08	**$PR_{92}B_{62}$**	12.00	117.50	9.50	✓ +2.00 upper ep. ✓ +14.00 mesophyll ✓ -0.50 lower ep.

Effects of the fungicide applied on plants treatments were the same with those when the fungicide was introduced in soil: the increasing in thickness of the epidermal and the mesophyll cells (table 3). The differences from untreated plants were bigger in M10 plant leaves than those in B62 plant leaves.

Table 3

Structural characteristics of the soybean lines plant blade - variants with antifungic treatments applied on plants

Drawing data	Soybean lines	Upper epidermis (µ)	Mesophyll (µ)	Lower epidermis (µ)	Difference from untreated plants (µ)
8.VII.08	**$PR_{91}M_{10}$**	13,50	112,50	14,50	✓ +2.5 upper ep ✓ +20.5 mesophyll ✓ +2.50 lower ep.
8.VII.08	**$PR_{92}B_{62}$**	14,00	112,50	11,00	✓ +2.00 upper ep. ✓ +9.00 mesophyll ✓ +1.00 lower ep.

The four kinds of extracts used in this experiment induced different kinds of reactions in plants either in soil (table 4) or plant treatments (table 5): increasing in leaf size was observed in the extracts number 2 and number 4 for M10 plants, respectively extracts number 3 and number 4 for B62 plants when these where applied on soil; the same soil treatments but with extracts 1 and 3 for M10 plants, respectively extracts 1 and 2 for B62 plants, have induced the decreasing of the leaves mesophyll size. Plant treatments with the four extracts lead to mesophyll size and epidermal cells increasing at M10 plants and extracts number 1, 2, and 4; mesophyll and lower epidermal cells thickness decreasing at M10 plants and extract no. 3; decreasing of the mesophyll thickness at B62 plants and all extracts, excepting extract no.4 and increasing of the epidermal cells size at all B62 plant variants.

Table 4

Structural characteristics of the soybean lines plant blade – variants with extract treatments applied on soil

Drawing data	Soybean lines	Upper epidermis (µ)	Meso-phyll (µ)	Lower epidermis (µ)	Difference from untreated plants (µ)
21.VII.08	**$PR_{91}M_{10}$** **Extract 1**	15.00	90.00	12.50	✓ +5,00 upper ep ✓ -2,00 mesophyll ✓ +2,50 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 2**	15.00	107.00	13.50	✓ +5.00 upper ep. ✓ +15.00 mesophyll ✓ +3.50 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 3**	12.50	85.50	12.50	✓ +2.50 upper ep. ✓ -6.50 mesophyll ✓ +2.50 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 4**	14.50	107.00	13.50	✓ +4.50 upper ep. ✓ +15.00 mesophyll ✓ +3.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 1**	13.00	83.50	11.00	✓ +3,00 upper ep.; ✓ - 20,00 mesophyll ✓ +1,00 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 2**	13.00	81.50	11.00	✓ +3,00 upper ep. ✓ - 22,00 mesophyll ✓ +1,00 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 3**	16.00	104.50	12.50	✓ +6.00 upper ep. ✓ + 1.00 mesophyll ✓ +2.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 4**	13.50	105.00	13.00	✓ +3.50 upper ep. ✓ + 1.50 mesophyll ✓ +3.00 lower ep.

Table 5

Structural characteristics of soybean lines plant blade – variants with extract treatments applied on plants

Drawing data	Soybean lines	Upper epidermis (µ)	Meso-phyll (µ)	Lower epidermis (µ)	Difference from untreated plants (µ)
21.VII.08	**$PR_{91}M_{10}$** **Extract 1**	13.50	121.50	13.50	✓ +3.50 upper ep. ✓ +29.50 mesophyll. ✓ +3.50 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 2**	14.00	127.00	13.00	✓ +4.00 upper ep. ✓ +35.00 mesophyll. ✓ +3.00 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 3**	12.50	78.00	9.75	✓ +2.50 upper ep. ✓ -14.00 mesophyll ✓ -0.25 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 4**	14.50	124.00	12.00	✓ +4.50 upper ep. ✓ +32.00 mesophyll ✓ +2.00 lower ep.

Drawing data	Soybean lines	Upper epidermis (μ)	Meso-phyll (μ)	Lower epidermis (μ)	Difference from untreated plants (μ)
21.VII.08	**$PR_{92}B_{62}$ Extract 1**	12.50	96.50	13.50	✓ +2.50 upper ep ✓ - 7.00 mesophyll ✓ +3.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 2**	13.00	96.50	12.50	✓ +3.00 upper ep. ✓ - 7.00 mesophyll ✓ +2.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 3**	15.50	101.00	12.00	✓ +5.5 upper ep. ✓ - 2.50 mesophyll ✓ +2.00 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 4**	13.0	115.00	12.50	✓ +3,00 upper ep. ✓ + 11,50mesophyll ✓ +2,50 lower ep.

Table 6

Structural characteristics of soybean lines plant blade – variants with *Botrytis* infection applied on soil

Drawing data	Soybean lines	Upper epidermis (μ)	Mesophyll (μ)	Lower epidermis (μ)	Difference from untreated plants (μ)
21.VII.08	**$PR_{91}M_{10}$ <u>Extract 1</u>**	9.05	92.00	11.00	✓ -0.50 upper ep. ✓ 0.00 mesophyll ✓ +1.00 lower ep.
21.VII.08	**$PR_{91}M_{10}$ <u>Extract 2</u>**	**13.00**	**86.50**	**12.00**	✓ **+3.00 upper ep.l** ✓ **- 5.5 mesophyll** ✓ **+2.00 lower ep.**
21.VII.08	**$PR_{91}M_{10}$ <u>Extract 3</u>**	**13.00**	**97.00**	**12.50**	✓ **+3.00 upper ep.l** ✓ **+5.00 mesophyll** ✓ **+2.50 lower ep.**
21.VII.08	**$PR_{91}M_{10}$ <u>Extract 4</u>**	11.50	90.5	11.00	✓ +1.50 upper ep.l ✓ -1.50 mesophyll ✓ +1.00 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 1**	13.00	85.00	11.50	✓ +3.00 upper ep.l ✓ - 18.50 mesophyll ✓ +1.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 2**	12.00	86.00	11.00	✓ +2.00 upper ep.l ✓ - 17.50 mesophyll ✓ +1.00 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 3**	12.50	109.50	10.00	✓ +2.50 upper ep.l ✓ + 6.00 mesophyll ✓ 0.00 lower ep.
21.VII.08	**$PR_{92}B_{62}$ Extract 4**	13.00	92.50	13.00	✓ +3.00 upper ep.l ✓ -1 1.00 mesophyll ✓ +3.00 lower ep.

The *Botrytis* soil infection has induced similar effects in M10 and B62 plants:

- cell dimensions reduction: in the upper epidermis - extract 1 plants variant; in the mesophyll - extract 2, 4 plant variants;

- cell dimensions increase: in the epidermis - extract 2, 3, 4 plant variants; in the mesophyll - extract 3 plants variant (table 6).

Applied on plants, the *Botrytis* infection has induced in M10 plants cells increasing in the mesophyll for the extract 2 and 4 variants and mesophyll cells reductions for the two others variants.

The same treatment has induced in B62 plants a reduction of the mesophyll cell dimensions for all four extract variants.

Table 7

Structural characteristics of soybean lines plant blade – variants with *Botrytis* infection applied on plants

Drawing data	Soybean lines	Upper epidermis (µ)	Meso-phyll (µ)	Lower epidermis (µ)	Difference from untreated plants (µ)
21.VII.08	**$PR_{91}M_{10}$** **Extract 1**	13.50	95.50	11.00	✓ +3.50 upper ep. ✓ +3.50 mesophyl; ✓ +1.00 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 2**	15.00	90.00	12.50	✓ +5.00 upper ep. ✓ -2.00 mesophyll ✓ +2.50 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 3**	14.00	84.00	13.50	✓ +4.00 upper ep. ✓ -8.00 mesophyll ✓ +3.50 lower ep.
21.VII.08	**$PR_{91}M_{10}$** **Extract 4**	12.50	100.00	12.50	✓ +2.50 upper ep. ✓ +8.00 mesophyll ✓ +2.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 1**	13	85	11.5	✓ +3.00 upper ep. ✓ - 18.50 mesophyll ✓ +1.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 2**	11.50	99.00	12.50	✓ +1.50 upper ep. ✓ - 4.50 mesophyll ✓ +2.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 3**	14.00	84.00	13.50	✓ +4.00 upper ep. ✓ - 19.5 mesophyll ✓ +3.50 lower ep.
21.VII.08	**$PR_{92}B_{62}$** **Extract 4**	13.50	92.50	13.00	✓ +3.50 upper ep. ✓ -11.00 mesophyll ✓ +3.00 lower ep.

CONCLUSIONS

1. The *Botrytis* sensibility is associated with thin mesophyll.
2. Treatments with fungicides increase the mesophyll dimensions in both soybean plant lines.
3. In the two soybeans plant lines, the effects on mesophyll dimensions of the four extract treatments are various.

4. The *Botrytis* infection applied on B62 plants induced a decreasing of the mesophyll dimensions in all four extract variants.

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THE STRUCTURE OF THE SECRETIVE TISSUES AND CONTENT OF THE VOLATILE OIL IN SOME SPECIES OF GYMNOSPERMS

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Keywords: *Pinus, Thuja, volatile oil, microscopic researches*

Abstract

Research has mentioned that Pinus sylvestris L. specie has more than 5 secretive channels. Abies alba Miller has two secretive channels, and Thuja orientalis L. has a single secretive channel.

The analysis of the volatile oil extracted from the leaves of these species revealed the presence, as priority compounds, of the following substances: α-pinen in volatile oil of Pinus sylvestris, bornile acetate, β-pinen, camphene and α-pinen, in that from Abies alba and α-pinen in the cold season and thujana, during summer, in volatile oil from Thuja orientalis.

INTRODUCTION

Secretive tissues in gymnosperm plants are mainly represented by the secretive channels [4, 9]. Toma a.o. (2003) carried out a comparative survey on secretive tissues, in eight species of *Pinus*, and further, Toma and Rugina (1998) studied the secretive channels in *Juniperus communis L.* Ivanescu a.o. (2007) investigated the histo-anatomical structure of some species of *Cupressaceae* and observed the presence of secretive channels in all studied species, with varied position, number and length.

Research carried out by Wales a.o. (1973) regarding the structure of secretive channels, observed that they are made up of a secretive epithelium, that in the middle delimitates an area where collected substances are gathered and it is covered at the outside by sclerenchimatic tissue.

Observations made by Charon a.o. (1987) shown that leucoplasts in the secretive cells in *Pinus* are surrounded by canalicles of the endoplasmic reticule, and during secretion period, the volume of leucoplasts and their surface increase very much.

The composition of the volatile oil extracted from the leaves of gymnosperm plants was analyzed by number of researchers: Latish a.o. (1984), Chalcat a.o. (1985), Carmo and Frazao (1986), Kubeczca and Schultze (1987), Burzo a.o. (2005), Kurose a.o. (2006), etc.

MATERIAL AND METHODS

Research was carried out on the following species of conifers: *Pinus sylvestris L.*, *Abies alba Miller*, and *Thuja orientalis L.*, originated from Bucharest USAMV Botanic Garden.

For histological analysis, the leaves of conifers were prefixed into a solution of glutaric aldehide in 2.7% concentration, in 0.1M phosphate tampon, pH 7.2 and dehydration for 30 minutes, into acetone solutions under increasing concentration of 50, 60, 70, 80 and 90%. In the end, the samples were included in Epon 812 epoxydic resin, they were semi fine sectioned under an ultra microtone Leica UC6 type, colored in toluidine blue and examined and digitally recorded with an optical microscope Olympus BX 51 type, provided with video camera.

Volatile oils were extracted from the conifer leaves by hydrodistillation, using a Cleverger type device in this purpose.

Separation of compounds was made by a chromatophore in AGILENT gaseous state, provided with a mass spectrometric detector, with quadrupole. A DB 5 type capillary route with a 25 m length and 0.25 mm diameter, using helium as driving gas, and the initial temperature in the oven was 50°C. 4 minutes isotherm and it increased up to 280°C, with a 4°C/minute gradient.

There were also used Kovats retention indices for confirmation of the exact position of the picks in chromatogram.

RESULTS AND DISCUSSION

Microscopic researches showed that in case of *Pinus silvestris L.* specie, in the foliar mesofile located around the dial, the presence of 5-12 secretive channels is observed, disposed on both sides of the leaf, close to the hypodermis. There can be seen in figure 1 that their lumen is surrounded by approximately 9 secretive cells, rich in cytoplasm.

The leaves of *Abies alba* specie have at the two side ends of the leaves, towards the abaxial side, immediately under the hypodermis, one secretive channel. This one has a big lumen, which is surrounded by approximately 18 secretive cells of smaller sizes (figure 2).

On the abaxial side of the leaves of *Thuja orientalis* a secretive channel, with small sizes and characteristic structure is found. Secretive cells, rich in cytoplasm, delimitate the channel lumen. These cells are covered on the outside by a layer of sclerenchimatic cells, flattened, with thickened walls (figure 3).

Quantity analysis of the volatile oil revealed the existence of a variation depending on the season and specie. The largest quantity of volatile oil was determined in summer, when biosynthetic activity is more intense. The quantity of volatile oil extracted from leaves varied depending on the same factors between 0.30 and 0.40

ml/100g of leaves, in *Pinus sylvestris*, between 0.24 and 0.20 ml/100g in *Abies alba*, between 0.09 and 0.25 ml/100g in *Thuja orientalis*.

The analysis of the volatile oil extracted from leaves of *Pinus sylvestris* allowed the identification of 48 compounds, out of which the majority was held by α-pinen, 76.5-80.1%, during spring and summer and by β-pinen (35.8%), in autumn.

The volatile oil extracted from *Abies alba* specie contained a number of 48 compounds, out of which the majority was held by bornile acetate (18.5-24.4%), camphene (16.8-19.6%), β-pinen (15.7-19.0%) and α-pinen (10.0-14.0%).

The highest number of compounds: 63, was determined in the volatile oil extracted from the leaves of *Thuja orientalis* (figure 4).

The main compound in the volatile oil was represented by α-pinen, which during the winter held 53.05% of the total compounds, along with the accumulation of thujone (56.27%).

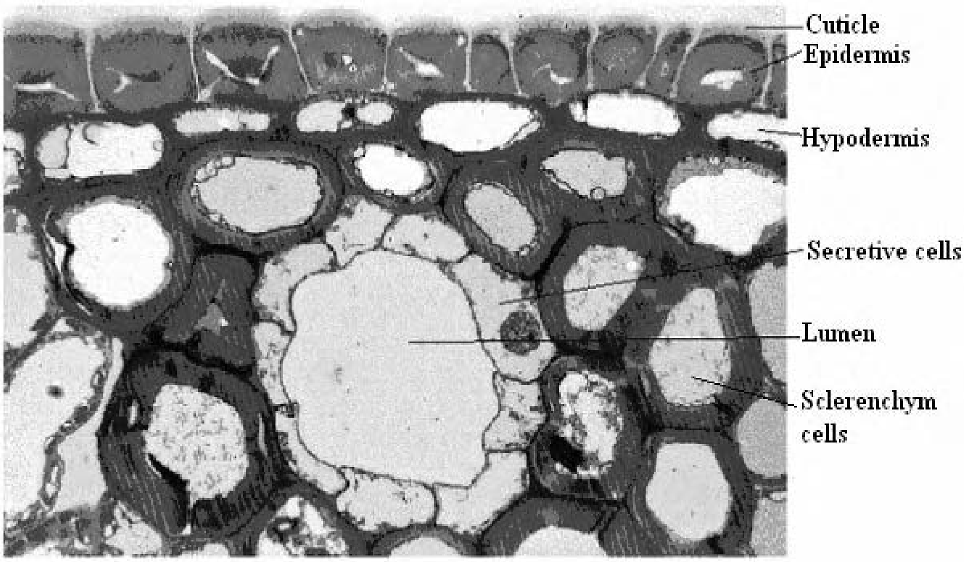

Fig.1 Secretive channel of Pinus sylvestris leaf

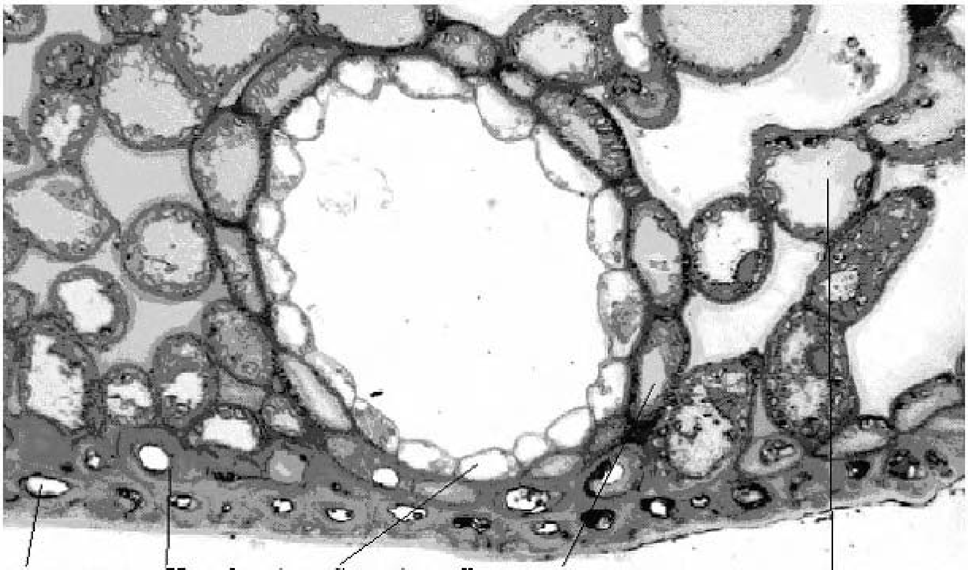

Fig.2 Secretive channel of Abies alba leaf

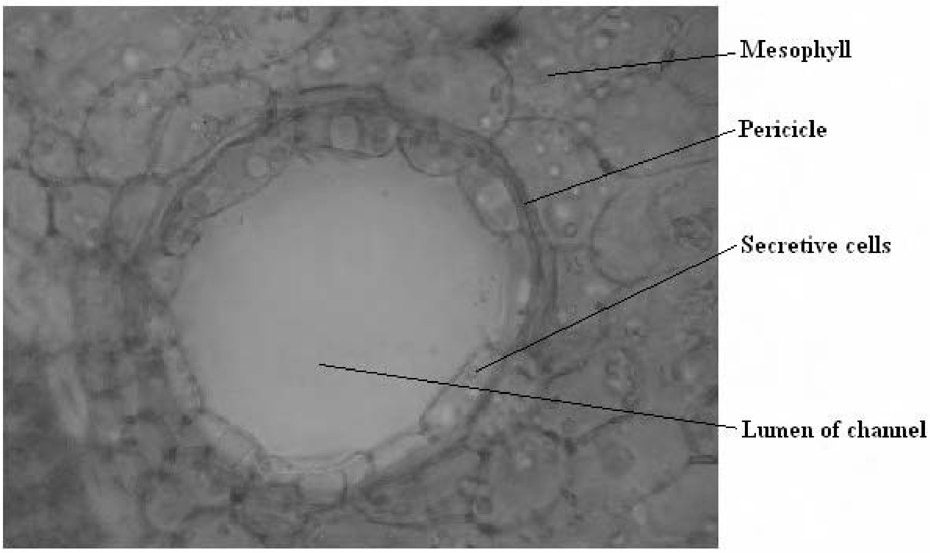

Fig. 3 Transversal section through secretive channel of Thuja orientalis leaves

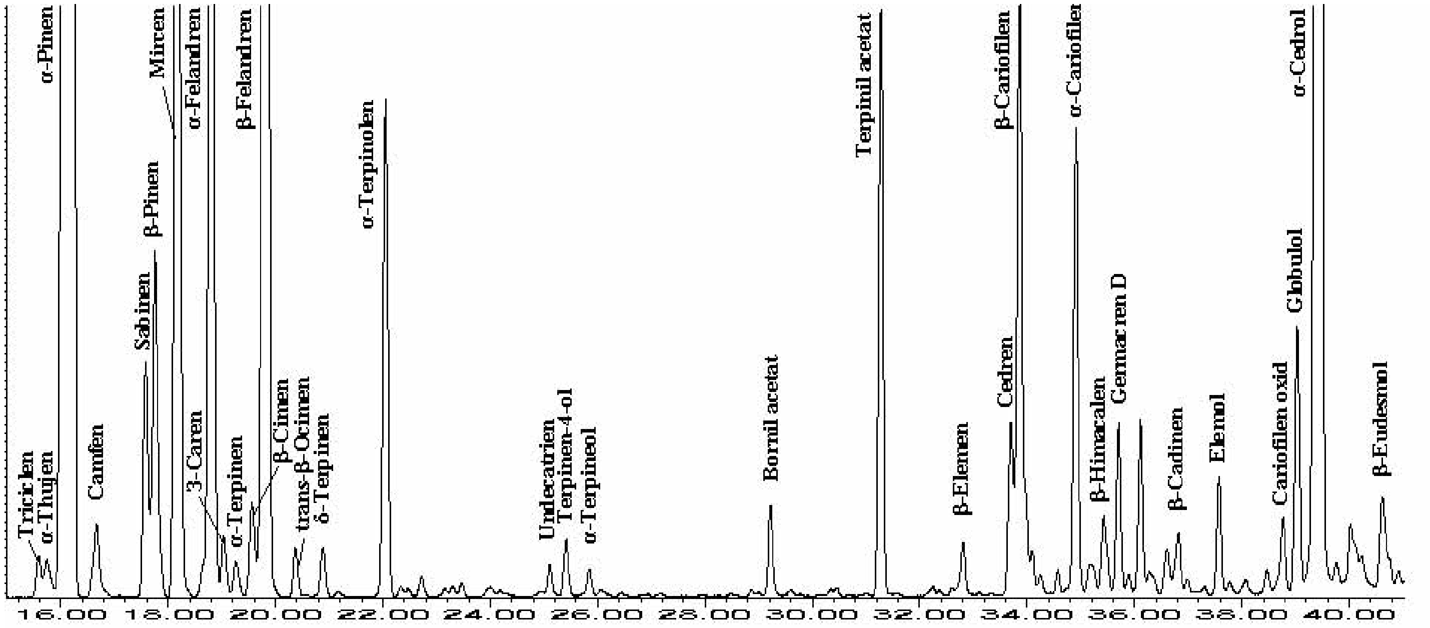

Fig. 4 Gas cromatogram of thuja orientalis

CONCLUSIONS

1. Research carried out showed that *Pinus sylvestris* has more that 5 secretive channels, *Abies alba Miller* has two secretive channels, and *Thuja orientalis L.* has a single secretive channel.
2. The quantity of volatile oil extracted from leaves varied depending on the same factors between 0.30 and 0.40 ml/100 g of leaves, in *Pinus sylvestris*, between 0.24 and 0.20 ml/100 g in *Abies alba*, between 0.09 and 0.25 ml/100 g in *Thuja orientalis.*
3. In *Thuja orientalis* the number identified in the volatile oil was 63, and the individual share varied depending on the season.
4. Priority compounds in volatile oil in *Pinus sylvestris* were represented by α-pinen in *Abies alba* by bornile acetate, β-pinen, camphene and α-pinen, and in *Thuja orientalis* by α-pinen in the cold season and thujone, during summer.

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HISTO-ANATOMICAL AND PHYSIOLOGICAL ASPECTS AT SOME PLANTS INDUCED BY BIOTIC FACTORS

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Keywords: *mesophyll, aphids, epiderm*

Abstract

Plants from USAMV Bucharest and from the areas surrounding the campus were studied. Finding and identifying the pests that attacked these plants were made inside the Genetics, Improvement and Plants' Protection Department, Entomology Section and the study of the morphological, histological and physiological changes that followed the attack of several pests were realised inside the Botanics and Plants' Physiology Department. The material was photographed with a digital camera. We mention that there are few data in the speciality literature regarding the morphological, histological and physiological modifications caused by the presented pests.

It was observed that changes concerning the aspect, anatomy and physiology of the diseased plants appear.

INTRODUCTION

Knowing the pests of the plants and the mutations caused by these is very important in order to limit the damage they cause. In all the developed countries it exists the preoccupation to create a microclimate favorable to human health, to embellish the exterior spaces and the constructed areas, to diminish the atmospheric pollution. That's why the parks, green areas, plantations of the traffic areas, decorative gardens represent an accomplishment of the modern development of the urban areas. Both the cultures of wooden species and the ornamental ones constitute the base skeleton of the green areas. The attack of several pests cause different mutations in what concerns the chemistry, morphology and physiology of the plants [1, 2]. From the speciality literature it is known that the pests can influence the reflectancy, depending on the attack degree of the leaf [7]. The diminution of the foliary surface leads to the reduction of the length and of the diameter of the wooden plants' stems, the reduction of the assimilation surfaces, the decrease of the wooden substance accumulation. It was observed that the intensity of the respiration in case of the atacked plants has higher values compared to the healthy plants, because ultrastructural modifications take place as a result of the deterioration of cellular walls and of the loss of partitions inside the cells. Also the carotin pigments are prevalent over the chlorophyll, therefore it takes place the senescence of the leaves before reaching maturity and later death [6]. Under the influence of the pests takes place the deterioration or the distruction of the plants' existing structures and also the perturbation of the plant's normal development. In the case of the ornamental wooden species it must be taken into account that creating a green area implies many waiting years in which the cultures need to be taken care of, substantial expenses and that their distruction by not offering the proper attention to these plants can be very fast. In this paper we will present several examples of plants attacked by various pests and the modifications caused by these.

MATERIAL AND METHODS

The observations were made in the green areas from USAMV Bucharest and in the surrounding areas, in the period 2007-2008. Transverse sections were made in the studied leaves inside the Botanics and Plants' Physiology Department, Botanics Section. The sections were cleared with chloral-hidrate for 24 hours [8]. The microscopical compounds were fixed with jellified glycerine and the observations and the photographs were realized with the optical microscope type MC-7, having attached a Sony digital camera. Observations were made regarding the anatomical structures of the healthy and diseased tissues, in order to emphasize the modifications caused by the respective pests. At some plants photosynthesis and perspiration determinations were also made, both for healthy plants and for those attacked by aphids and mites. These determinations were made using the portable gas analyser LCA - 4. The analysis were made between the hours 8-11, at a temperature between 25-33.5^{0}C. In order to survey the pests, observations were made and samples were taken for determination of the pests. The activity of tracing and identifying the pests was done inside the genetics, Improvement and Plants' Protection Department, Entomology Section. The collected material was photographed directly on the field or in the laboratory using a Sony digital camera.

RESULTS AND DISCUSSION

Plants like: *Fraxinus excelsior* L., *Juglans regia* L., *Catalpa bignonioides* Walter [5]. were studied. At *Fraxinus excelsior* L. attacked by *Meliarhizofagus fraxinifolii* Ryley, synonymous with *Prociphylus fraxinifolii* Ryley, it was observed that the leaves have leaflets severely twisted (figure 1) and rippled in the first stage of the aphids' attack, and later they turn yellow and present necrosis. From the histological point of view it can be observed that the attacked leaves have the secretory hairs distroyed or atrophied and a disorganised mesophyll with necrosis (figure 2). In the case of a healthy ashtree leaf, the entire transverse section measured 17,25 µm and in the case of an attacked leaf of *Meliarhizofagus fraxinifolii* Ryley the section was of 24.75 µm. The measurements were made with the objective of 40X. It was observed that the respiration intensity in case of the attacked plants has higher values compared to the healthy plants, because ultrastructural modifications take place as a result of the deterioration of cellular walls and implicitly of the loss of partitions inside the cells. At Fraxinus excelsior L. attacked by *Meliarhizofagus fraxinifolii*, the photosynthesis recorded negative values of -3.968 mycromoles $CO_2/m^2/s$ and the transpiration was 0.145 millimoles $H_2O/m^2/s$. The high value of the perspiration is caused by the vital activity of the aphids. At the healthy ashtree the photosynthesis was 1.635 mycromoles $CO_2/m^2/s$ and the perspiration was 0.093 millimoles $H_2O/m^2/s$.

At the plants of *Catalpa bignonioides* Walter a species of the *Aphis* family was found, that collonized both the leaves and the inflorescences (figure 3), reducing the ornamental value. When the attack takes place on the inflorescence in an early stage, the floral buds suffer an abortion [3, 4]. In figure 4 it can be observed the transverse section in the catalpa leaf attacked by aphids, the mesophyll and the epidermis of the leaf being severely necrosed. In the case of a healthy catalpa leaf, the entire transverse section measured 22.74 µm and in the case of a leaf attacked by aphis the section was of 24.25 µm. At the healthy *Catalpa bignonioides* Walter, at temperatures between 25- 26^{0}C, the photosynthesis was 1.44 mycromoles $CO_2/m^2/s$ and the perspiration was 0.04 millimoles $H_2O/m^2/s$. At the catalpa plant attacked by aphids the photosynthesis was 1.068 mycromoles $CO_2/m^2/s$ and the perspiration was 0.128 millimoles $H_2O/m^2/s$. At the walnut tree the eriophyid mite of the walnut tree was found - *Aceria erineus* (Nalepa). The attack manifests through the presence of felty formations of various sizes (figure5). The mesophyll is differentiated in palisade tissue with two layers and spongy tissue. After the mites attack these structures suffer mutations, the tector hairs get hypertrophied and elongated, the tissues from the mesophyll get necrosis, the tissues from the median vein get disorganized (figure 6), the leaves dry up. At the healthy walnut tree the photosynthesis was 1.207 mycromoles $CO_2/m^2/s$ and the perspiration was 0.098 millimoles $H_2O/m^2/s$. At *Juglans regia* L. attacked by mites the photosynthesis was -0.874 mycromoles $CO_2/m^2/s$ and the perspiration was 0.120 millimoles $H_2O/m^2/s$.

CONCLUSIONS

1. From the researches made it was observed that the aphids lead to the distruction of the cuticle and the necrosis of the epidermis, therefore this tissue stops performing its function, not allowing the regulation of perspiration and the gas exchange between the live tissues and the environment.

2. The assimillating tissues of the leaf (palisade and spongy tissue), because of the mutations produced under the attack of aphids and mites, stop performing their function of synthetysing organic substances through photosynthesis at normal capacity.
3. The aphids attack at catalpa plants led to the drying of the floral buds in the inflorescence or to the blooming of a small number of flowers, fact that determines an unaesthetic aspect of this ornamental plant.
4. For all the studied plants the values of photosynthesis are lower at diseased plants compared to healthy ones.
5. The perspiration had higher values at diseased plants compared to the healthy ones, for all analysed plants.

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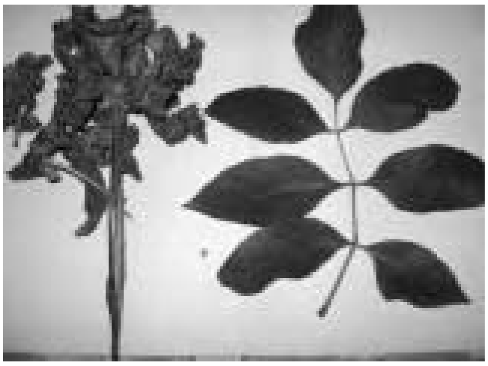

Fig. 1. Attacked ashtree leaf (left) and healthy leaf (right) (original)

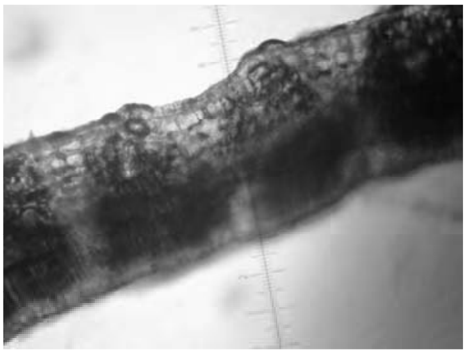

Fig. 2. Transverse section in the ashtree leaf attacked by aphids (original)

Fig. 3. Catalpa inflorescence attacked by species of the *Aphis* family (original)

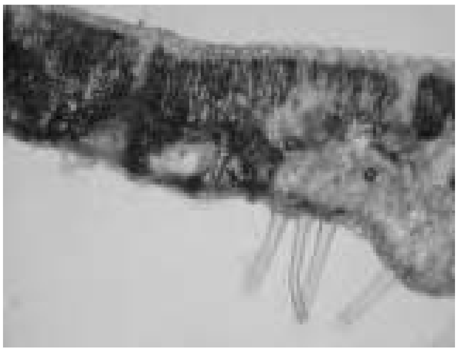

Fig. 4. Catalpa mesophyll and lower epidermis with necrosis caused by aphids (original)

Fig. 5. Attacked *Juglans regia* L. leaf by eriophyid mites (original)

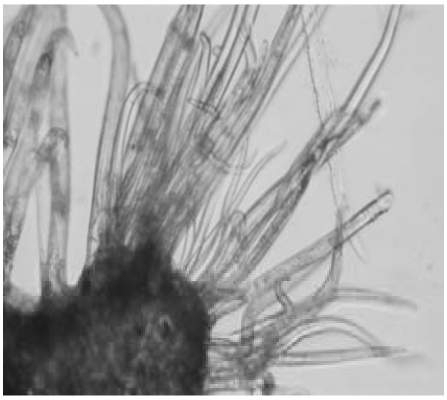

Fig. 6. Transverse section in the leaf of *Juglans regia* attacked by eriophyid mites (original)

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PLANT GALLS INDUCED BY SOME PESTS

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Keywords: *mesophyll, galls, epiderm*

Abstract

Plants were studied from the University of Agronomic Sciences and Veterinary Medicine Bucharest and from the forest around Ciolanu Monastery, Buzau district. Finding and identifying the pests that produced galls to these plants was the job of the Genetics, Improvement and Plants' Protection Department, the Entomology section and the study of the morphological and histological changes that followed the attack of these pests was made inside the Botanics and Plants'Physiology Department. The material was photographed with a digital camera. We mention that there is few data in the speciality literature concerning the anatomical mutations caused by the pests that are about to be presented. It was observed that histological changes appear in the organs of the attacked plants. The anatomy of these galls were examined by microscopy (MC7). The leaf gall cells were considerably larger than normal cells, lacked well-developed chloroplasts and with proeminent intercellular spaces.

INTRODUCTION

Galls are abnormal growth of plant tissue caused by microorganism, or feeding and egg-laying activity of some insects, mites, nematodes, viruses, fungi, bacteria [4]. The most common are leaf, stem and flower galls produced by insects and mites [2, 3].

Galls usually result from chemical secretion produced during feeding or egg laying. Once formed galls may remain on the plant for long time. Many insects make plant galls on woody plants [5]. The mechanism by which these chemicals induce cell division and morphogenesis is very complicated and varies with different types of plant tissue [6]. Eriophyid mites are plant parasites forming various galls on foliage or other part of their hosts which may caused physiological dysfunctions of the infested parts of the host plants and which is quite important in urban environment affecting the aesthetic features of trees [1].

MATERIAL AND METHODS

The observations and the samples were made on plants from University of Agronomic Sciences and Veterinary Medicine Bucharest and plants from the forest around Ciolanu Monastery, Buzau District, in the period 2007 – 2008. Transverse sections were made in the leaves of the studied plants inside the Botanics and Plants'Physiology Department, Botanics Section. The microscopical samples were analysed and photographed at the optical microscope type MC-7, having attached the Sony digital camera. Observations were made after studying the galls in transverse sections made in the leaves of the attacked plants.

RESULTS AND DISCUSSIONS

Plants like: *Gleditsia triacanthos* L. and *Tilia* spp. were investigated.

On the leaves of *Gleditsia triacanthos* L., there were observed galls produced by *Dasyneura gleditschiae* O.S. (figure 1). The attacked leaves have deformed leaflets (figure 2).

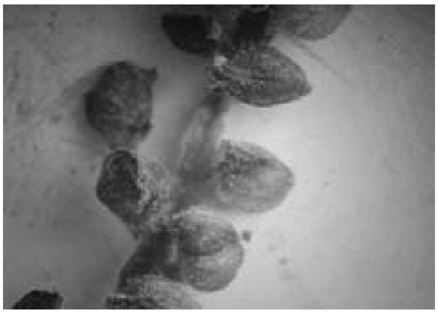

Fig. 1. Purple galls caused by *Dasyneura gleditschiae* O.S. on the leaflets of the *Gleditsia triacanthos* L. leaf (Orig.)

Fig. 2. Leaf deformity by *Dasyneura gleditschiae* O.S. (Orig.)

Dasyneura gleditschiae O.S. caused by the closure and subsequent distension of leaflets, of varying size and extent within each leaflet. The mesophyll of the gal tissue is not the same as in the normal mesophyll. The midge becomes active in late April or May at about the time locust start growth. Tiny yellow eggs are inserted among young leaflets and these hatch in just a day or two. Larval feeding on the inner surface of a leaflet stops its development, continued galling and repeated defoliation may caused the death of small branches. The leaf gall cells were considerably larger than normal cells, lacked well-developed chloroplasts and with proeminent intercellular spaces. At *Tilia* spp. were analized two types of galls produced by *Eriophyes tiliae* Pgst. and *Didymomyia reaumuriana* Loew. The galls produced by *Eriophyes tiliae* Pgst. are like a cone, often taller than 8 mm, usualy coloured in red (figure 3). Through the section made in this gall it can be observed the abnormal development of the tissues that normally constitute the leaf, in a way that the epidermis presents cells atypical for this tissue, the cuticule can no longer be observed and the mesophyll presents cells that are not differentiated in palisade tissue and spongy tissue. In the leaf with a gall, the entire transverse section measured 275 μm (but no differentiated measurements were possible). The measurements were made with the objective of 20X. Also there aren't any cells with ursines (figure 4).

Fig. 3. Galls caused by *Eriophyes tiliae* Pgst. (Orig.)

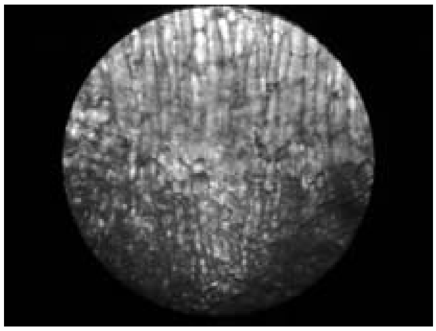

Fig. 4. Transverse section in the *Tilia* spp. Leaf through the gall produced by *Eriophyes tiliae* Pgst. (Orig.)

The galls produced by *Didymomyia reaumuriana* Loew. at the plants from *Tilia* family are small formations in a cylindrical-conical shape on the superior side of the leaf, yellow-green, with a central area more prominent than the rest of the gall, with a darker colour (figure 5). In time, the galls fall and the leaves remain perforated. Also, like in the previous case, by sectioning the gall it was observed the abnormal development of the epidermis and of the assimillating tissues from the leaf, the mesophyll not being differentiated in palisade tissue and lacunose tissue and the cells with ursines are missing (figure 6). It was noticed that in the case of the healthy leaf of *Tilia* sp., the entire transverse section measured 27.5 µm (the upper epidermis has 5 µm, the mesophyll has 20 µm and the lower epidermis has 2.5 µm). In the leaf with a gall produced by *Didymomyia reaumuriana* Loew. the entire transverse section measured 210 µm (but no differentiated measurements were possible).The measurements were made with the objective of 20X. In both cases of galls the tissues of plants present necrosis.

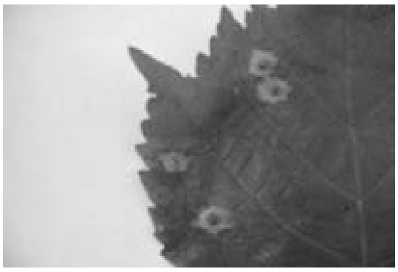

Fig. 5. Galls caused at *Tilia* spp. by *Didymomyia reaumuriana* Loew. (Orig.)

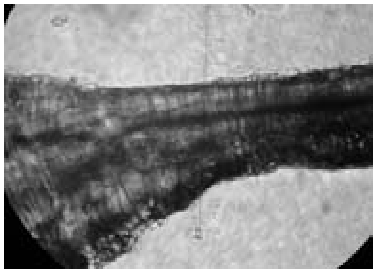

Fig. 6. Transverse section in the *Tilia* spp. leaf through the gall produced by *Didymomyia reaumuriana* Loew. (Orig.)

CONCLUSIONS

1. From the researches made, it was observed that the galls produced by *Dasyneura gleditschiae* O.S. on the leaflets of the *Gleditsia triacanthos* L. leaf cause the perturbance of the normal physiological activity of the leaf, because the assimillating tissues from the leaf are affected and the attacked leaflets fall prematurely.
2. In the galls caused by *Eriophyes tiliae* Pgst. the abnormal development of the tissues that normally constitute the leaf can be observed, in such a way that the epidermis and the mesophyll (the palisade tissue and the spongy tissue) are no longer differentiated and don't function anymore.
3. In the galls produced by *Didymomyia reaumuriana* Loew. the leaves have abnormally developed assimillating tissues and necrosis.
4. At both *Gleditsia triacanthos* L. and *Tilia* spp. the galls have an unaesthetic effect over the aspect of the attacked trees.

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COMPARATIVE ANATOMY OF THE VEGETATIVE ORGANS OF THE *HEDERA HELIX* L. *(ARALIACEAE)*

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Keywords: *epidermis, suber, mesophyll, secretive duct*

Abstract

The research made on the anatomy of the Hedera helix vegetative organs have highlighted some features characteristic of the epidermis, collenchymas and assimilator tissue of the leaves and fertile and sterile stems.

A thick cuticle covers the epidermis. Following the felogen activity, the epidermis is broken at the sterile stems comparative with the fertile stems. Tectorial multi-cell hairs are in the epidermis of both stem types.

The cortex is multi-layered and it can be differentiated in two zones: external and internal cortex. The external cortex has done by the 4-5 collenchymatous cell layers with calcium oxalate crystals in numerous cells. The internal cortex has done by 5-7 cell layers with thin walls and many secretive ducts close to the pericycle.

In the central cylinder were found 20-35 vascular bundles from open collateral type, with phloem outside and xylem inside.

The medulla made up of isodiametric cells with thin walls.

The leaves are hypostomatic type with tectorial hairs and the mesophyll is bifacial. Into the mesophyll are vascular bundles of collateral type with the xylem outside and phloem inside. In some cells of mesophyll leaves are crystals of calcium oxalate and secretive ducts into the median nervure.

INTRODUCTION

Hedera helix L. (Ivy) is from *Araliaceae* family (*Apiales, Magnoliopsida, Magnoliophytina, Spermatophyta* [1].

Ivy is a liana with adventives fixing roots with two stem types: fertile and sterile.

Leaves are alternate, dimorphe, palmate-lobed at the sterile stems and ovate with smooth margins at the fertile leaves. In all organs of plant are secretive ducts [3].

Ivy have certain anatomical features depending on the growing conditions [4] such as the type cells of the palisadic tissue or secretive ducts [2]. The ivy is ornamental and medicinal plant and some time it is an invasive species.

MATERIAL AND METHODS

Studies were conducted on leaves and stems of *Hedera helix* from the Botanical Garden of USAMV Bucharest during 2007-2008.

Transversal sections were provided in the leaves and fertile and sterile stems from young plants.

Sections have been clarified, according to the classical method, using the chlorine hydrate, for 24 hours and after that they were wash and colored with carmine alaunate and green iodine. After coloring, the sections were washed and fixed in glycerine gelatine.

The measurements and photos were made at the optical microscope MC-7 (ob. 40, oc. 10).

RESULTS AND DISCUSSION

Anatomy of stem

Comparing the anatomy of both stems (fertile and sterile), three zones were observed: epidermis, cortex and central cylinder.

Epidermis is formed by only one cells row with thin walls and average thickness of 11 μm, covered externally by a thick wax layer with about 7 μm (figure 1). In the epidermis were observed multi-cells tectorials hairs.

In sterile stems are areas where the epidermis is broken as a result of coming into activity of the felogen, which generate the secondary suber outer and feloderma inside (secondary cortex), unlike the fertile stems (figure 2).

The multi-layered cortex presents an average thickness of 381 μm at the fertile stem and 261 μm at the sterile stem. It is composed by outer and inner cortex. The outer cortex is composed of 4-5 collenchymatous cell rows with thickening walls. In some cells can be observed chloroplasts, others contain crystals of calcium oxalate (ursini). The inner cortex is composed of 5-7 rows of cells with thin walls. Close to the central cylinder were observed numerous secretive ducts with polygonal lumen, delimited by secretive cells.

The central cylinder is delimited by a fragmented sclerenchymatous pericycle at outer witch generate the adventives roots. The vascular bundles are collateral open type with phloem outside and xylem inside. Between the both vascular bundles type is the interfascicular cambium. Between phloem bundles is expanded parenchyma. Between the xylem bundles are the primary medullar radii. The phloem bundles have an average thickness of 165 μm to fertile stems and an average of 57 μm at sterile stems. The xylem bundles have a thickness of 283 μm at fertile stems and 114 μm at sterile stems protected by the sclerenchymatous rings, consisting of 2-4 rows of cells. The medullar zone has an average thickness of 1450 µm and is composed by the isodiametric cells with thin walls and with crystals of calcium oxalate into the cells.

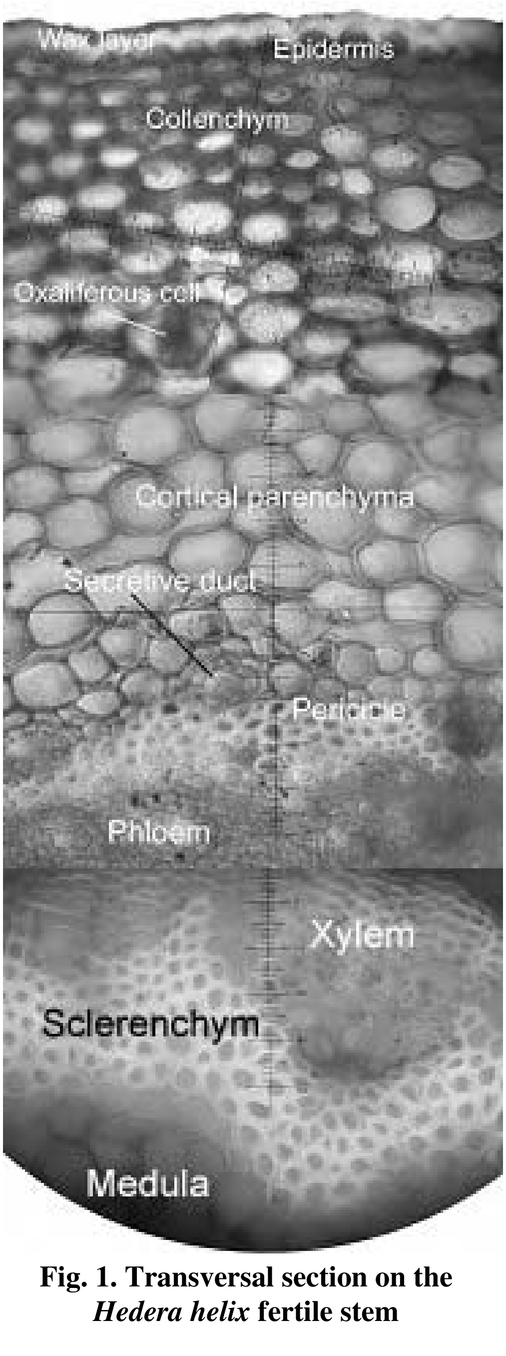

Fig. 1. Transversal section on the *Hedera helix* fertile stem

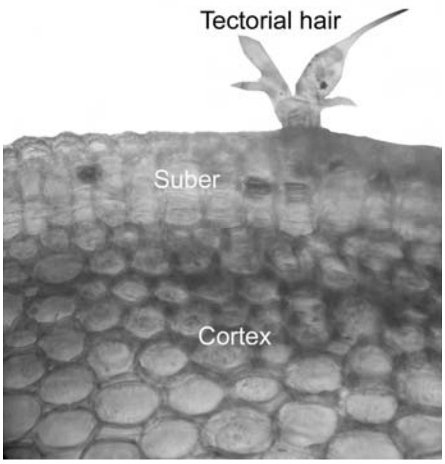

Fig. 2. Transversal section on the *Hedera helix* sterile stem

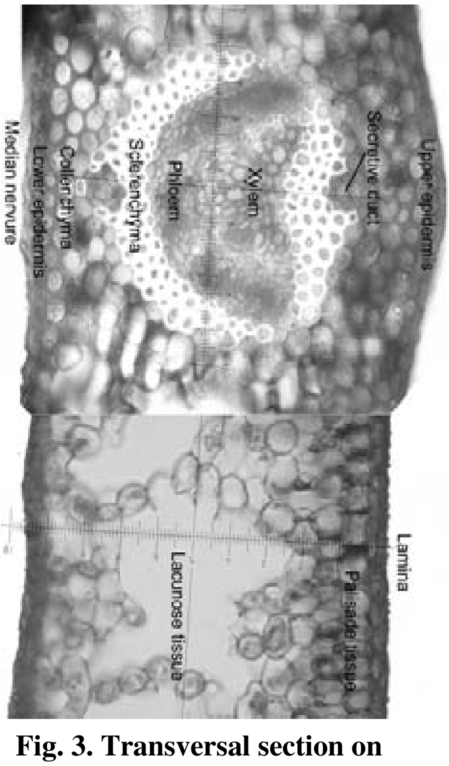

Fig. 3. Transversal section on the *Hedera helix* leaf

Anatomy of leaf

There are not any anatomical differences between leaves from fertile and sterile stems. Epidermis is made up of only one cells layer with polygonal cells with thin lateral walls and corrugated. The thickness average of epidermis is 11 µm and a thick wax layer with about 4 µm covers it. In the lower epidermis were observed tectorial hairs and stomata (figure 3). The leaves are hypostomatic type.

Leaves mesophyll have had values ranging from 258 µm at the leaves of fertile stems and 243 µm at the leaves of sterile stems. Leaf mesophyll is bifacial type with palisade tissue under upper epidermis, consisting of 2 layers with isodiametric cells and high content of chloroplasts. Lacunose tissue with large lacunae consisting of 5-6 layers of ovoid cells with lower content of chloroplasts there is under lower epidermis. In the mesophyll were observed collateral vascular bundles type with outer xylem and inner phloem and numerous cells with calcium oxalate. In median nervure of leaf is a great collateral vascular bundle in the form of arc, with outer xylem and inner phloem, covered by a sclerenchymatous tissue. Under the epidermis is the tabular collenchyma with two small opposite secretive ducts.

CONCLUSIONS

1. A thick wax layer covers epidermis of stem.
2. The phelogen generate the secondary suber only at the sterile stem.
3. The both types of stems have tectorial hairs.
4. There are not any structural differences between the leaves of the both stem types.
5. The palisade tissue is formed by the isodiametric cells not with prosenchymatic cells as usual it is.
6. In the cortex stems and mesophyll leaves are present crystals of calcium oxalate.
7. In stems and leaves are present secretive ducts.

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INFLUENCE THE DIFFERENT SUBMERGED MEDIA BY THE PRODUCTION OF YELLOW AND RED *MONSACUS SP.* PIGMENT

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Keywords: *Monascus sp.*, *pigments*

Abstract

The production of red and yellow pigments by Monascus sp. is influenced by the composition of culture media that determine the quantity and the quality of the colorant. The Monascus sp. strain was cultivated in submerged, shaken culture, using media containing different carbon and nitrogen sources. The optimal cultivation conditions for this strain require glucose and $NaNO_3$ to produce the highest quantity of red pigment.

INTRODUCTION

The production of synthetic colouring agents and other chemicals used as food additives is under increasing pressure due to a renewed interest in use of natural products in food formulation and the strong interest in minimizing the use of chemical processes to produce food ingredients. By fermentation it is possible to develop processes for the production of environmentally friendly colouring and dyes intermediates than can be used as food constituents. With the cultivation of different strains of *Monascus species*, it is possible to obtain coloured polyketide compounds in varying shades such as purple, red, orange and yellow [1, 2]. Pigment yields in submerged cultures are highly affected by the nitrogen and carbon sources [1]. In this work we report some of key parameters, which determine Monascus pigment production in submerged fermentation using different carbon and nitrogen as nutrient source

MATERIALS AND METHODS

Microorganism

Monascus purpureus Went was obtained from Politehnica University of Bucharest, Biotechnology and Bioengineering Department.

Culture media

Maintenance ($g \cdot L^{-1}$): meat extract 3; peptone 5; glucose 10; agar 20 (pH=5.5). Different carbon sources were added in quantity of 1% into culture media with the following composition: KH_2PO_4 0.1%; $MgSO_4 \bullet 7H_2O$ 0.05%, NaCl 0.05%, $FeSO_4 \bullet 7H_2O$ 0.01. As carbon sources was used glucose, fructose, galactose, mannose, lactose, zaharose, celobiose, maltose, gentiobiose. The effect of different N source was used in the same conditions, using the culture media which contain: glucose 1%; KH_2PO_4 0.1%; $MgSO_4 \bullet 7H_2O$ 0.05%; NaCl 0.05%; $FeSO_4 \bullet 7H_2O$ 0.01% and different nitrogen source added into this media in the quantity of 0.3%. As nitrogen source was used NH_4Cl, NH_4NO_3, diammonium citrate, $CO(NH_2)_2 \bullet HNO_3$, $NaNO_3$, casein and peptone.

Procedure

In 250 ml Erlenmeyer flask was added 50 ml culture media, which subjected to sterilisation. The inoculation was made with 5 ml conidosphores in sterile water, which contain $2x10^5$ spores/ml. The following operational condition were kept constant by means of shaker controllers: temperature 30^{o}C, agitation speed 300 rpm. The experiments was realized during 7 day.

Analytical methods

Dry cell weigh

Duplicate samples were weighed on an analytical scale, vacuum filter through pre-weighed membrane filters (cellulose ester membranes, 1.2 µm) washed with distilled water, dried in oven at 60^{o}C and cooled in a desiccators before weighing for dry cell weigh. The results were expressed in grams per litter.

Extra cellular pigments

Absorbance measurements were performed in the filtrate obtained from dry cell weight, with a scanning spectrophotometer (TD60 UV/VIS Spectrophotometer, USA). The absorbance value measured at 400 and 510 nm was referred as the yellow and red color of extracellular pigments.

Intra cellular pigments

A two step procedure was employed. a) Cell disruption by sonification: a given mass of cells separated through filtration was suspended in 50 ml of ethanol 70% (v/v) and subjected to sonification for 40 min at 120 W (Jasco) b) Extraction: the sonified suspension was placed in a water bath (60^{o}C) for 2 h and then, vacuum filtrated (cellulose ester membranes, 1.2 µm). The absorbance value of the filtrate between 400 and 510 nm was determined on a scanning UV-VIS spectrophotometer, multiplied by the dilution factor in ethanol 70% and referred as absorbance of intracellular pigments.

RESULTS AND DISCUSSION

Effect of carbon source of the pigment production

Measurement performed at 400 nm indicated no yellow pigment in the presence of different carbon sources. Productions of red pigments (measurement performed at 510 nm) are influenced by nitrogen and carbon source. Using a different monosaccharide sources revealed the possibilities of fugal strain to metabolised it, but the best results are obtained when the mould are developed in the presence of fructose and glucose (figure 1), except lactose, where under most results are obtained. Pigment production is under favour of disaccharides presence in the culture media, but after long time, due to both accommodated of microorganism to other source of carbon and production of other enzyme which are necessary to metabolised of the new source of carbon. During the monitoring trials the reduction of pigments produced was observed after 4-5 day.

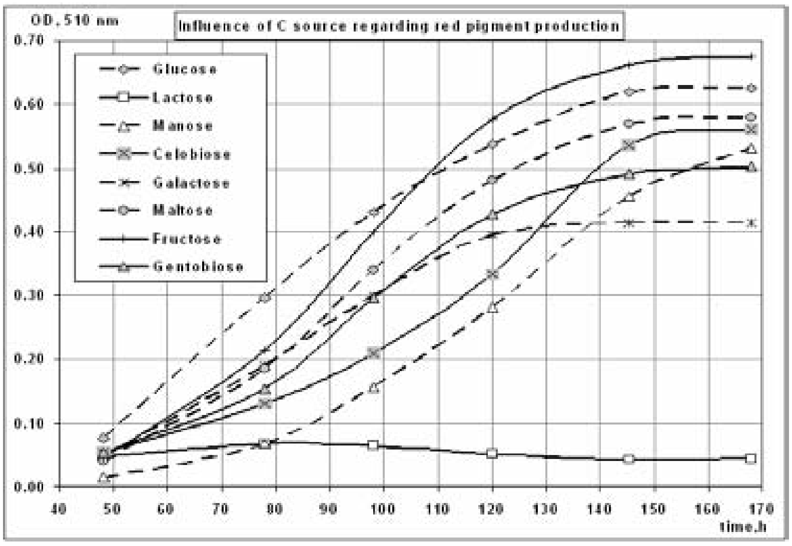

Fig. 1. Influence of different carbon source of the red pigment biosynthesis during 7 days (measurement made at 510 nm)

Get off the pigment from the inside microorganisms indicate that the best results are obtained when the moulds are developed in the medium containing glucose and fructose (figure 2); in the same time the biomass production is shrike in the following order: glucose > fructose > mannose > celobiose > gentobiose > galactose > maltose (figure 3).

Effect of nitrogen source of the pigment production

The best results regarding pigment production was obtained using $NaNO_3$ as single nitrogen source (figure 4 and 5), compound which favorised the formation of monascorubramine and rubropuntctamine [3].

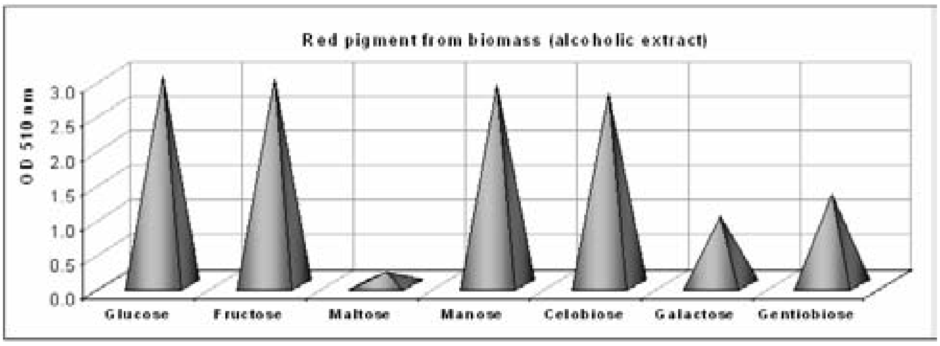

Fig. 2. Influence of different carbon sources regarding intracellular red pigment accumulation

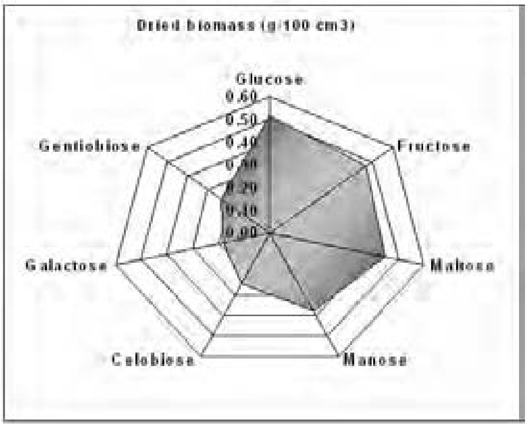

Fig. 3. Influence of different carbon sources regarding biomass accumulation

The pH of culture media is high influenced with ammonium compound by unbuffered culture media, when the pH has the value below 5. At this pH, orange pigments cannot react with ammino group in order to transform it into red pigments, but these are reduced to Monascin and Ankaflavin which represent in fact yellow pigments [3]. The measurement performed on dried biomass, indicate the positive effect regarding the biomass formation, when the greatest quantities of biomass are obtained when the casein and peptone are used as nitrogen sources (figure 6). At the same time in the presence of inorganic compound the biomass formation is slightly inhibited (figure 6). The value of alcoholic absorbance indicate the $NaNO_3$ induced the intracellular red pigment production (figure 7) and the casein and peptone induced the production of yellow pigment, whereas in the presence of the ammonium ions (nitrate of ureea) intracellular yellow pigments are mainly produced (figure 8).

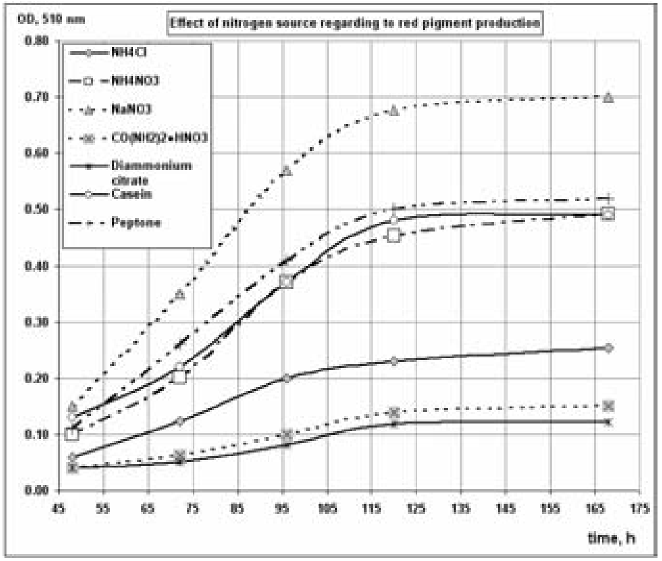

Fig. 4. Influence of different nitrogen sources regarding the production of red pigments

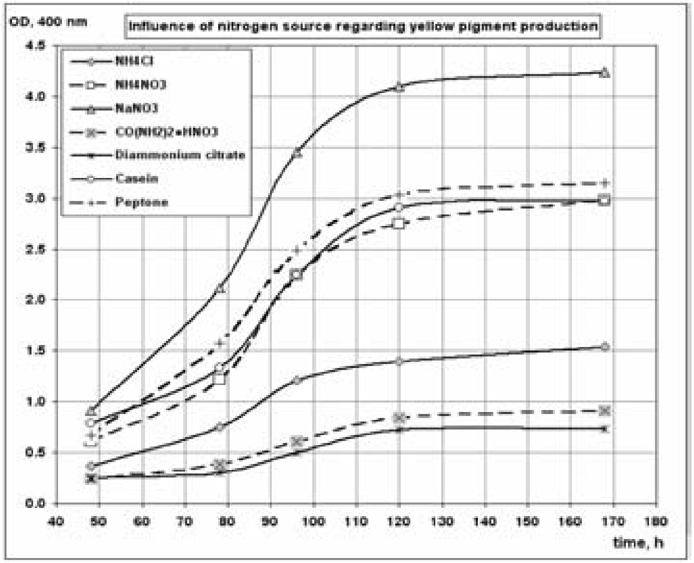

Fig. 5. Influence of different nitrogen sources regarding the production of yellow pigments

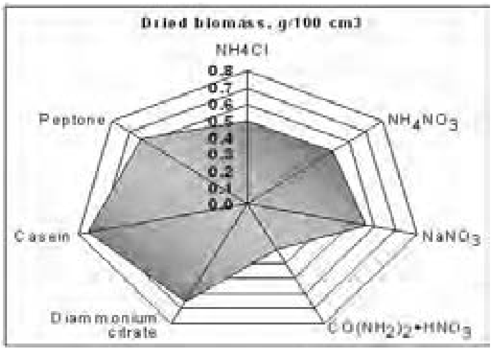

Fig. 6. Influence of different nitrogen sources regarding biomass production

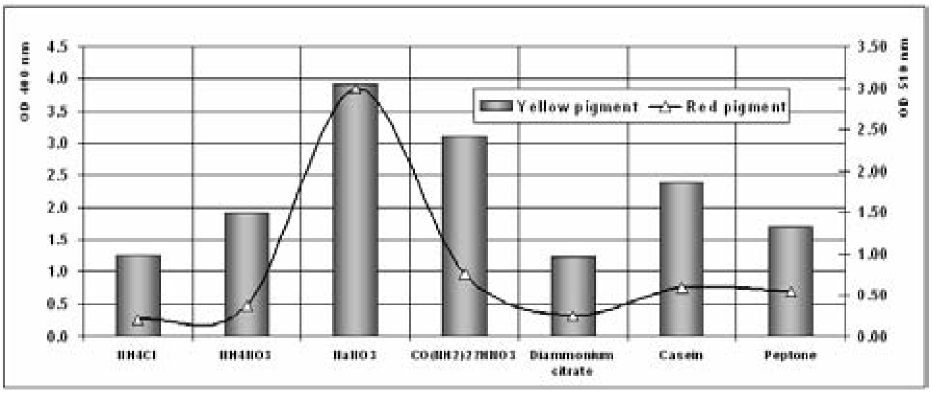

Fig. 7. Influence of different nitrogen sources regarding intracellular accumulation of red and yellow pigment

CONCLUSIONS

1. Influence of different sources of carbon and nitrogen regarding the red and yellow pigment production indicate that glucose is the best source for red pigment synthesis both extra or inside cell. The best nitrogen source for pigment production is $NaNO_3$ when the production of red pigments is favourised; in the same time, the ammonium ions favorised the yellow pigment production.

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CONTRIBUTION TO THE ZOOGEOGRAPHY OF THE GENUS OCTOMACRUM (MONOGENEA, PLATYHELMINTHES)

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Keywords: *octomacrids, distribution map, Octomacum europaeum, Romania*

Abstract

According to the latest specialist literature review, there are known six species of the genus Octomacrum, of which only one is European.

This paper presents the geographic distribution map for the octomacrids and also some original photos of Octomacrum europaeum species, recorded in the Romanian fauna.

INTRODUCTION

The primary freshwater category of monogeneans includes different taxa, some of them having a higher range and occuring strictly in the fresh water, but also some subfamilies strictly freshwater, even some genus of marine predominant families. The primary freshwater suborder *Octomacrinea* Khotenovsky, 1985 contains two families: *Octomacridae*, monotypic with holarctic distribution and *Diplozoidae* with euro-asiatic and afro-tropical distribution. The hole *Octomacrine*a suborder is more ancient in fresh water and hence has a higher significance than subfamilies such as *Dactylogyrinae* or *Ancylodiscoidinae* which are confined to fresh waters too, but are related to marine families [1].

The family *Octomacridae* Yamaguti, 1963 has a single genus, *Octomacrum,* with a range including North America and Central Europe.

This paper contributes to a better understanding the zoogeography of this genus, by introduction of all octomacrids species into a suggestive map.

MATERIAL AND METHODS

In our research we started from the list of monogeneans categories [1].

By consulting a reach specialty literature, we reunite knowledges regarding the way of the octomacrids spreading in the actual ranges, the phylogenetic specificity and the freshwater fish host category, and hence we sketch a distribution map (figure 1).

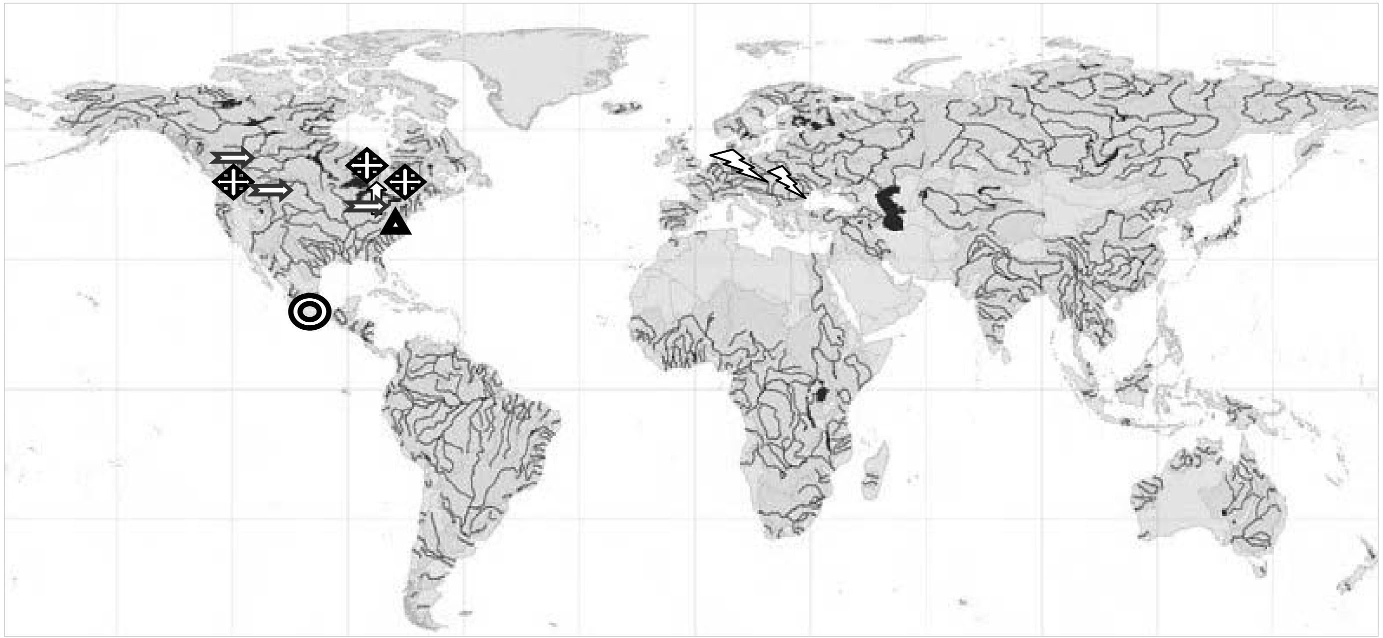
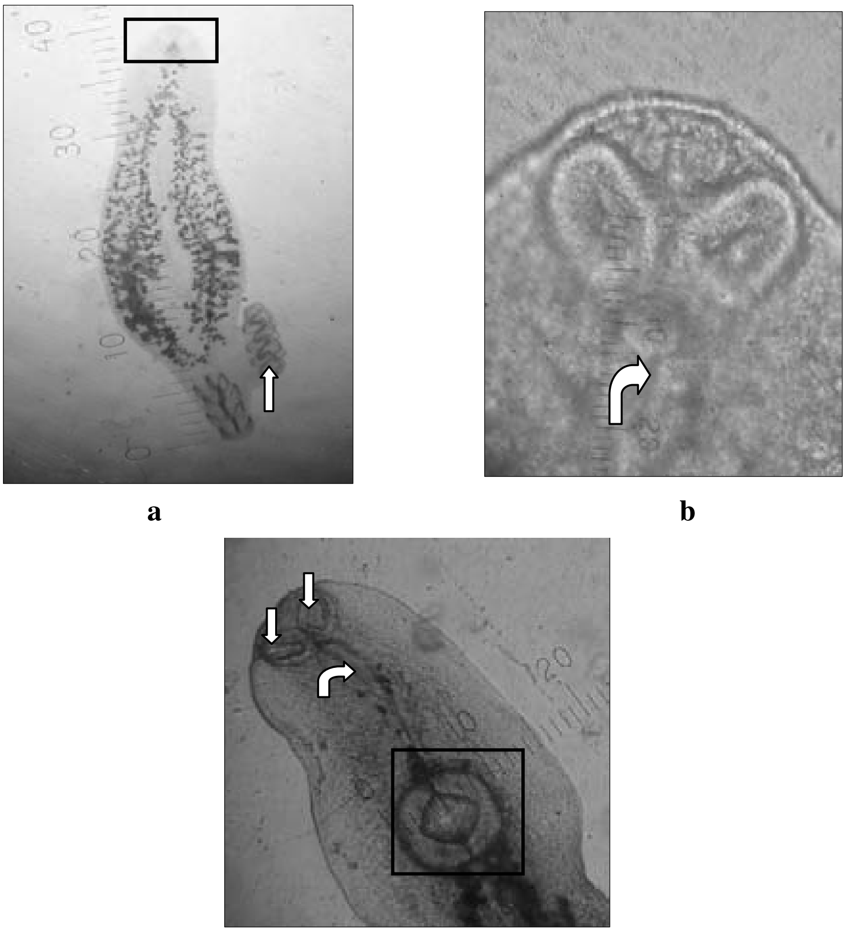


Fig. 1. Distribution map for the octomacrids: *Octomacrum mexicanum, O. spinum, O. microconfibula, O. lanceatum, O.semotili, O. europaeum*

(the original blank map is taken from [12])

We mentioned previously [11], the presence of the monogenean *Octomacrum europaeum*, find out into a phenomenon of competition manifested by negative interraction with *Paradiplozoon alburni*, in a sample of *Alburnoides bipunctatus* fish host.

Some aspects of this parasite species are captured here in the photos bellow (figure 2), made at trinocular microscope Novex Holland, with the help of the digital camera Panasonic Lumix DMC-LS60, 6 Mpx, 3x optical zoom.



a b

c

Fig. 2. *Octomacrum europaeum*: a. general aspect of the body, opisthaptor (arrow) and ventral suckers (frame) (one division = 36 μ); b. the ventral suckers and pharynx (arrow) (one division = 3,6 μ); c. the anterior part of this monogenean, with the two ventral suckers (vertical arrows), the pharynx (orizonthal arrow) and the genital sucker (frame) (one division = 3,6 μ).

The parasite biometry was recorded by the two micrometres proceeding, whith a preliminary calibration of the ocular micrometer for the each optical combination ocular-objective belonging to the microscope [10].

RESULTS AND DISCUSSION

There are known five species of the genus *Octomacrum*, with specificity for the *Catostomidae* and *Cyprinidae* host families [5]. But from the latest literature review, results the existence of six species, out of which only one is European: *Octomacrum mexicanum, O. spinum, O. microconfibula, O. lanceatum, O. semotili* and *O. europaeum.*

The restricted octomacrids range is included inside the *Diplozoidae*, that is a more apomorphic and more warm adapted sister familiy. Prooctomacrids would have appeared on the common ancestor of cyprinids and catostomids in South-Eastern Asia. The octomacrids reached North America together with the catostomids. The second wave of migration was represented by cyprinids, that reached North America by Beringia in the Miocene; this host group did not carry however the diplozoids, more competitive forms. Prooctomacrids migrated from East Asia to Europe and Siberia together with the cyprinids, but here these parasites have been eliminated by diplozoids. Although the cyprinids occured in Africa since the end of the Miocene, the octomacrids did not penetrate here being less warm-adapted forms [1].

Diplozoidae and *Octomacridae* are usually considered as sister families. Nevertheless, in 2002 a group of French researchers stated that the colonisation of primary freshwater teleosts by these two families could be independent. A molecular phylogeny was inferred by comparing newly obtained partial 28S and 18S r DNA gene sequences [9].

Athough *Octomacrum* lives in East and Central Europe only on the cyprinid *Alburnoides bipunctatus*, in nearctic things stay different. In North America were recorded five *Octomacrum* species, on catostomids and cyprinids fish [2].

Octomacrum lanceatum parazites on *Catostomus commersoni* (Canada, Erie Lake) sau *C. catostomus* (Colorado) [4]; *O. spinum*, on *Campostoma anomalum* (Virginia) [4]; *O. mexicanum* was recorded on *Algansea lacustris*, into a mexican river [8]; *O micronfibula* parasites *Notemigonus* and other three cyprinid genus from Canadian lakes, while *O. semotili* was find on *Semotilus* and *Chrosomus* genus [4].

O. europaeum is found in the Black Sea basin and was described for the first time in 1956 [7], on the branchae *Alburnoides bipunctatus*. Sice that moment, the parasite was recorded only the host cited before [2].

In Czech Republic, Lucký (1957) describes *O. europaeum* as *Discocotyle sagittata*, but two years later the author further revised his identification, establishing the truth identity. The presence of *Discocotyle* monogenean species in cyprinids specimens was doubtful, specially because the salmonids are known within their regular hosts. Matějusova and Koubková rediscovered in 2000 *Octomacrum europaeum*, in the River Dyje from Czech Republic [5]. *Octomacrum europaeum* was cited also in few rivers from Poland [7].

In Romania, the monogenean presence was recorded, after the discovery year by: Aioanei [2], Aioanei and Teodorescu [3], Stavrescu-Bedivan and Aioanei [11].

CONCLUSIONS

1. The present paper synthesizes by a map the zoogeographic data from specialty literature, regarding to *Octomacrum* species.
2. There are known so far in the global fauna, the following octomacrids: *Octomacrum mexicanum, O. spinum, O. microconfibula, O. lanceatum, O. semotili* and *O. europaeum.*
3. *Octomacrum europaeum* was recorded only on the cyprinid *Alburnoides bipunctatus.*

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RESEARCHES CONCERNING THE PRESERVATION OF PERISHABLE FRESH FRUITS SHELF-LIFE DURING THE STORAGE

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Keywords: *refrigeration, controlled atmosphere, strawberries, cherries, fruits*

Abstract

The study presents a comparison of the quality of fruits, evolution of some chemical components and the loss that the fruit suffer during the storage period in traditional, refrigeration and controlled atmosphere storage. There were gathered biochemical data for two Romanian strawberry varieties: Premial, Magic, and two cherry varieties: Stella and Daria, respectively a Canadian variety and a Romanian variety. The determined biochemical aspects were the following: total solids, total sugar, total acidity and ascorbic acid. The quality parameters measured was general aspect, firmness, and taste. The duration of shelf-life in three different storage conditions was measured in days for each variety selected for the survey. The refrigeration storage was better in comparison with the traditional storage, and the controlled atmosphere was better in comparison with the refrigeration storage, that being confirmed by the evolution of biochemical composition, total pointing and duration of storage. The lowest dehydration was for the strawberries and cherries stored in the controlled atmosphere cells. Function the storage method, at the cherries and strawberries varieties, the lowest loss was shown by Daria cherry variety and Magic strawberry variety. To keep the very perishable fresh fruits in optimum conditions, the genetic characteristics of each cultivar and the cultivar behavior to each storage method are required.

INTRODUCTION

The paper presents the experimental results obtained from researches developed with de purpose to prove the evolution of some fresh fruits quality parameters of two strawberry varieties and two cherry varieties multiplied in Romanian nurseries, in three different conditions of experimental storage: 1-chilly rooms; 2-refrigeration at 3°C; 3-controlled atmosphere: 3°C, 4% CO_2.

MATERIAL AND METHODS

The experimentation used fruits classified as commodities excessively perishable and very perishable, respectively: strawberries and cherries. The choice of trials is based on hypothesis that each variety from one specified species and each species give a different fruits responses on factors involved in quality assurance, during the storage.

In order to have relevant data concerning storage life for excessively perishable and very perishable fruits, there were selected as trials two varieties for each species of fruit: Romanian Magic and Premial varieties for strawberrier, and Canadian Stella variety and Romanian Daria variety for cherrier. These species and varieties are cultivated in the experimental collection of Didactic and Experimental Station "Moara Domneasca" and also are cultivated in small areas in East and South-Eastern part of Romania. Each trial consists in sample of 100 kg fresh fruits harvested in the stage of proper maturity for each variety, in the summer conditions of 2008.

Each trial was placed in three experimental conditions: 1-chilly room (V1, V4), 2-refrigeration (V2, V5), 3-controlled atmosphere (V3, V6). The V0 variant is the stage of fresh fruits, immediately after harvest, when the fruit is perfectly balanced for fresh consumption. Each experimental condition had an optimal number of days of storage, recommended by some previous scientific results and scientific papers. The storage conditions were programmed in order to maintain the level of hydro-thermo parameters and also the composition of atmosphere (table 1-4).

The storage hydro-thermo parameters were: 60-70% relative humidity, 25-27°C temperature. In refrigerated spaces the parameters for preserving trials were: 90% relative humidity, 3°C temperature. The third experimental condition, controlled atmosphere, had the following technical characteristics: 90% relative humidity, 3°C temperature, 4% CO_2 - as increased level of CO_2 in atmosphere.

Tasting appreciation was made using the taste grill, each variant being noted by 3 criteria: general aspect, texture and taste. The appreciation was made using the 100 points scale. The qualifying was established in correlation with the pointing level and according the classification where the taste appreciation is divided in four main groups: very good (80-100 points); good (60-79 points); acceptable (40-59 points); mediocre (20-39 points); improper (0-19 points).

For each trial, there were made specific determinations concerning: level of mass loss and depreciation, evolution of structural and textural firmness, evolution of main biochemical components of fruits (total solids, total sugar, total acidity and ascorbic acid) and also taste parameters (aspect, firmness and taste).

The evolution of total solids contents of fresh perishable fruits during the storage period, measured in percent, was made with ABBE refractometer. The content of total sugar of trials, measured in percent, was made using Bertrand. The evolution of total acidity from the moment of harvesting until last day of storage for each sample was determinate using volumetric method and results were measured in g malic acid/100g commodity.

The ascorbic acid content was determinate using the spectrophotometer by measuring the intensity of chloroform coloration (the extraction of the ascorbic acid was realized with oxalic acid solution and treatment with indophenolic stain extracted from chloroform). The results were measured in mg/100g commodity.

The results concerning the evaluation of the fruits quality parameters during the storage, for strawberry and cherry varieties, can be used as guidelines in proper selecting of the storage method in some specific conditions of the horticultural farms.

RESULTS AND DISCUSSION

1. Analyze of the shelf-life strawberry varieties after the storage period

There were measured seven quality parameters in order to analyze the evolution of strawberry fruits stored under the three experimental conditions. The selected duration of strawberry fruits storage, measured in days, for each experimental condition was: 3 days in chilly room; 7 days in refrigeration; 21 days in controlled atmosphere (table 1).

The highest mass losses during the storage period on strawberry fruits were noted on Premial variety (V4 -10.37%), after 3 days of storage in chilly rooms. The mass losses in the case of controlled atmosphere storage, after 21 days, were low for both strawberry varieties, being noted as significant at Magic variety, with 0.73% of mass loss.

The evolution of fruits firmness measured in penetrometer degree is appreciated as favorable for V2 and V5 variant, for both varieties, with a favorable difference for Premial variety in V5 variant (+23,2).

The general taste appreciation was marked as superior the 88 pointing for Magic variety, V2 variant. The pointing was low for both varieties stored 3 days in chilly rooms (V1- Magic variety 65.5 points and V6 - Premial variety 63.34 points).

The biochemical analysis was made in two moments of post-harvest life of strawberry fruits: first immediately after harvest and second on the 21st day of storage, for each variety and experimental condition and indicates that the storage method influence the evolution of some biochemical components of fruits (table 2).

The lowest modification of total solids content was noted on the case of highest duration of storage in controlled atmosphere condition, being indicated also by the differences calculated between V0 and V1-V6.

The total acidity has increased during the storage period for all variants with different values. The highest increasing for total acidity was recorded on Magic variety (V2 - 0.17%).

The increasing of total sugar content has noted as significant values on Magic variety (+1.39%) in the case of controlled atmosphere storage conditions on 21stday of storage. The content of total sugar for Premial variety indicates a lowest increase for all variants.

The content of ascorbic acid indicates a decrease with 4.89 mg/100g on Magic variety, from the harvest moment until the 21st day of the storage, and also for the same experimental variant, 3.09 mg/100g on Premial variety (table 2).

Table 1

Results concerning some quality parameters during the strawberry fruits storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Duration of storage (days)	Mass losses (%)	Firmness (penetrometrer degrees)		Taste appreciation (pointing)	
			Values	Difference by V_0	Values	Difference by V_0
Magic variety						
V_0-on harv.	0	0	146.2	0	89.67	0
V_1-chilly rms.	3	6.76	261.8	+115.6	65.50	-24.17
V_2-refriger.	7	7.59	193.2	+47	88.00	-1.67
V_3-contr. atm.	21	0.73	205.1	+58.9	70.50	-19.17
Premial variety						
V_0-on harv.	0	0	178.7	0	75.83	0
V_4- chilly rms.	3	10.37	348.6	+169.9	63.34	-12.49
V_5–refriger.	7	10.09	201.9	+23.2	80.40	+4.57
V_6–contr. atm.	21	0.93	238.3	+59.6	68.50	-7.33

Table 2

Results concerning the main biochemical components during the strawberry fruits storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Total solids (%)		Total acidity (g malic cid/100g)		Total sugar (%)		Ascorbic acid (mg/100g)		Duration of storage (days)
	Value	Difference by V_0	Value	Difference by V_0	Value	Difference by V_0	Value	Difference by V_0	
Magic variety									
V_0-on harv.	8.4	0	0.82	0	4.24	0	42.30	0	0
V_1-chilly rms.	9.9	+1.5	0.96	+0.14	5.38	+1.18	69.25	26.95	3
V_2-refriger.	9.9	+1.5	0.99	+0.17	5.50	+1.26	69.15	26.85	7
V_3-contr. atm.	8.3	-0.1	0.90	+0.08	5.63	+1.39	37.41	-4.89	21
Premial variety									
V_0-on harv.	8.4	0	0.84	0	4.49	0	43.80	0	0
V_4- chilly rms.	9.2	+0.8	0.85	+0.01	4.87	+0.38	60.10	16.3	3
V_5–refriger.	9.3	+0.9	0.88	+0.04	5.00	+0.51	59.20	15.4	7
V_6–contr. atm.	8.5	+0.1	0.90	+0.06	5.00	+0.51	40.71	-3.09	21

2. Analyze of shelf-life of cherry varieties after the storage period

The evolution of cherry fruits from varieties Stella and Daria, in selected experimental conditions was reflected by some quality parameters. The duration of cherry fruits storage, selected for each experimental condition was: 4 days in chilly room; 11 days in refrigeration; 30 days in controlled atmosphere.

The biggest mass losses during the storage period on strawberry fruits were noted on Daria variety (V4 - 9.58%), after 3 days of storage in chilly rooms. The mass loss in the case of controlled atmosphere storage after 30 days, were low for both strawberry varieties, being noted as significant Stella variety, with just 0.73% of mass loss.

The evolution of fruits firmness measured in penetrometer degrees is appreciated as favorable for V3 and V6 variant, for both varieties, with a favorable difference for Stella variety in V3 variant (+11,9).

The general taste appreciation has marked as superior the 88 pointing for Daria variety, V5 variant. The lowest pointed was noted on Daria variety stored 30 days in controlled atmosphere condition (V6 variant) (table 3).

Table 3

Results concerning some cherry fruits quality parameters during the storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Duration of storage (days)	Mass losses (%)	Firmness (penetrometrer degrees)		Taste appreciation (pointing)	
			Value	Difference by V_0	Value	Difference by V_0
Stella variety						
V_0-on harv.	0	0	327.2	0	88.14	0
V_1-chilly rms.	4	7.18	487.8	+160.6	90.50	+2.36
V_2-refriger.	11	6.67	379.2	+52	90.57	+2.43
V_3-contr. atm.	30	0.28	339.1	+11.9	79.00	-9.14
Daria variety						
V_0-on harv.	0	0	340.7	0	97.57	0
V_4- chilly rms.	4	9.58	430.6	+89.9	85.67	-11.9
V_5–refriger.	11	7.18	389.9	+49.2	92,86	-4.71
V_6–contr. atm.	30	1.27	363.3	+22.6	84.00	-13.57

The biochemical analysis was made in two moments, first immediately after harvest moment and second on the 30th day of storage period, for each variety and experimental condition and results suggest that the storage method influence the evolution of some biochemical components of cherry fruits (table 4).

The storage during 30 days in controlled atmosphere indicates the lowest modification of total solids content by making differences between V0 and V3, on Stella variety (V3).

The increasing of total acidity, comparing with V0 variant during the storage period was higher on Stella variety (+0.21%) for V3 variant. The increasing of total acidity was low on Daria variety (V2 - 0.17%) for all experimental variants.

The increasing of total sugar content noted significant values on Stella variety (+0.31%) in the case of controlled atmosphere storage conditions in 30th day of storage. The content of total sugar for Daria variety indicates a decrease for all variants, the higher decrease being recorded for V6 variant.

Content of ascorbic acid, indicates the higher decreasing (-6 mg/100 g) on Stella variety, from the harvest moment until the 30th day of the storage in controlled atmosphere, and 5.44 mg/100 g for the same experimental variant in the case of Daria variety (table 4).

Table 4

Results concerning the main biochemical components during the cheerry fruits storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Total solids (%)		Total acidity (g malic cid/100g)		Total sugar (%)		Ascorbic acid (mg/100g)		Duration of storage (days)
	Value	Difference by V_0	Value	Difference by V_0	Value	Difference by V_0	Value	Difference by V_0	
Stella variety									
V_0-on harv.	15.8	0	0.34	0	8.74	0	14.72	0	0
V_1-chilly rms.	14.75	-1.05	0.41	+0.07	8.74	0	12.57	-2.15	4
V_2-refriger.	14.60	-1.2	0.38	+0.04	8.99	+0.25	12.31	-2.41	11
V_3-contr. atm.	15.20	-0.6	0.55	+0.21	9.05	+0.31	8.72	-6	30
Daria variety									
V_0-on harv.	16.5	0	0.41	0	10.7	0	15.29	0	0
V_4- chilly rms.	17.3	+0.8	0.49	+0.08	9.12	-1.58	12.42	-2.87	4
V_5–refriger.	17.1	+0.6	0.46	+0.05	8.93	-1.77	10.97	-4.32	11
V_6–contr. atm.	17.2	+0.7	0.47	+0.06	9.62	-1.08	9.85	-5.44	30

CONCLUSIONS

1. The evolution of fruits quality parameters reflected by the differences of each experimental variant (3 days storage in chilly room, 7 days storage in refrigeration, 21 days storage in controlled atmosphere) and V_0 variant (immediately after harvest) can be appreciate as favorable for Magic, strawberry variety and Daria, cherry variety.

2. The storage during 21 days under refrigeration and controlled atmosphere (90% relative humidity, 3°C temperature, 4% CO_2 - as increased level of CO_2) preserve the fruits shelf-life of strawberry varieties.
3. The storage during 30 days under refrigeration and controlled atmosphere (90% relative humidity, 3°C temperature, 4% CO_2 - as increased level of CO_2) preserve the fruits shelf-life of cherry varieties.

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RESEARCH REGARDING THE PERFORMANCES OF THE REFRIGERATORY UNIT FOR PRESERVING THE WHEAT SEEDS

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Keywords: *frigorific unit, cold preservation, cereals, environmental protection*

Abstract

The research permit to analyze of performance the equipments used for cold preservation of cereals, specific consumes of electrical energy, ecological implication of use of electrical energy which has been produced into electrical power plant which uses as primary source of energy the fossils fuels, the influence of technical parameters to the quality of preservation process. The equipment for cold preservation of grains used for research has a frigorific machine and adequate tools for measurements and control.

The goal of research is to evaluate how the special technology used for cold preservation of grains complains the request about the quality of product, and also to evaluate the possibilities to extend that technology at the national level for preservation of cereals using low temperatures.

INTRODUCTION

The main preoccupations for storage of cereals are to prevent the self-heating phenomena. There have been proposed different preventives measures, among them, after cleaning of cereals, in top is placed the reducing of moisture content of cereals under critical level, and cooling of cereals bulk.

In the last period there is a growing emphasis on improving food safety and quality of ownership and germination of agricultural products, such as performance analysis and refrigeration facilities, at a minimum cost of energy.

In that way was proceeding at utilizations of cooling equipments for cereals for preservation and for control of post-harvest process.

MATERIAL AND METHODS

The experiments were made in the district of Călărasi. Two lots of wheat from the Josef and Capo cultivars were tested, from parcels where standard and unitary technologies for wheat crops were applied.

The researches have been carried out with a frigorific unit, namely Granifrigor KK 140 AHY, using the principle of cold compression machines. Work environment requires a safety, unpolluting, chlorine free, frigorific agent.

The first lot of wheat from the Josef cultivar was submitted to the cooling operation during the period July 18th - July 20th, 2008, for 42 hours. The cereals had an initial humidity of 13.6% and an initial average temperature of 34.1° Celsius. The seed quantity submitted to the cooling operation was of 156 t, the harvesting being made in one day, followed by the storage in a cell having the following dimensions: L = 9 m, l = 6 m and h = 4 m.

The seeds from the 2nd wheat lot from the Capo cultivar were cooled during the period July 25th - July 27th, 2008, for 53 hours. The cereals had an initial humidity of 10.7% and an initial average temperature of 33.8° Celsius. The seed quantity was of 159 t, the harvesting being made in one day, followed by the storing in a similar cell.

The laboratory analyses were made with the Infratec 1241 machine, of FOSS brand, with the help of which initial, intermediary and final determinations were made regarding the content in humidity, protein, gluten, Zeleny index and hectoliter mass of the agricultural products submitted to cooling. The cereals temperature was measured every hour, on three heights of the wheat layer, respectively on basis, at 150 cm height and at 300 cm height.

For the measurement of the electric energy consumption a three-phase counter has been used.

RESULTS AND DISCUSSION

Following the experiments it has been noticed that in the first lot of wheat from the Josef cultivar stored under cool conditions post-harvesting phenomena took place that led to the increase in humid gluten, thus leading to the increase in the wheat quality for bakery. The cereals humidity was reduced by 0.3% compared to the initial one and the other parameters analyzed were within the normal limits known from the specific literature.

The final temperature of the wheat from the Josef cultivar after 42 hours of cooling with the Granifrigor unit was of 16º Celsius at the basis of the cell, 17º Celsius at the height of 150 cm and 14º Celsius at the roof of the storage cell (figure 1). The electric energy consumption during the cooling of the first lot of wheat was of 6.4 kWh/t of agricultural product. This value falls within normal limits of consumption/tone of agricultural product which is specific for the areas with temperate climate as our country has, as well.

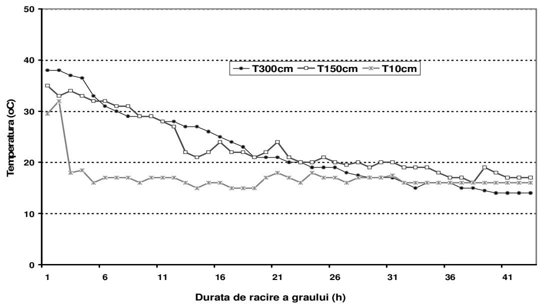

Fig. 1. Evolution of cereal temperatures during cooling of grains from Josef cultivar

The Capo wheat variety from the second storage cell was submitted to the cooling operation with the same frigorific installation. The cooling duration for the cereals was longer than in the first lot, this being due to the low humidity of the wheat measured, upon the reception.

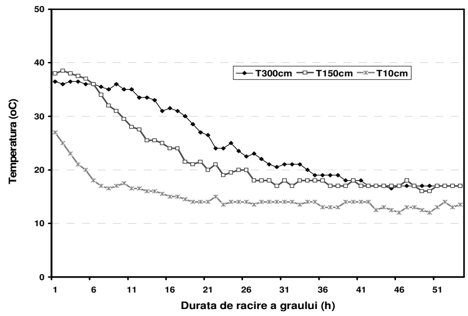

Fig. 2. Evolution of cereal temperatures during cooling of grains from Capo cultivar

The final temperature reached in the mass of the cereals after 53 hours of functioning of the frigorific installation was of 13.5º Celsius at the basis of the cell and 17º Celsius at heights of the wheat layer of 150 cm and 300 cm (figure 2). The electric energy consumption necessary for the conditioning of the wheat from the Capo cultivar through cooling process was higher, this being due to the low humidity of the cereals.

The laboratory parameters analyzed for the wheat from the Capo cultivar reached within the normal limits, proving that the method of cooling preservation keeps the physical-chemical composition of the stored cereals.

In table 1 there are presented the main results of cooling on the experiences of the two varieties of wheat, with aggregate Granifrigor type AHY-140.

Table 1

Results of parameters analysed in experiments

Parameters	Value	
	Josef cultivar	**Capo cultivar**
Moisture content at the beginning of storage, %	13.6	10.7
Moisture content after cooling, %	13.3	10.4
Temperature at the beginning of storage, °C	34.1	33.8
Temperature at the end of cooling, °C	15.6	15.8
Humid Gluten content of cereals at storage beginning, %	26.7	29.6
Humid Gluten content after cooling, %	27.2	28.9
Protein content at the beginning of storage, %	12.8	13.9
Protein content after cooling, %	13.3	14.2
Electrical energy consumed for preserve 1t of grain, kWh/t	6.4	8

Analyzed results recorded in table 1 is found that the cooling GRANIFRIGOR type AHY-140, preserve and even lead to improved nutritional qualities of agricultural products made in the analysis.

CONCLUSIONS

1. The electric energy consumption for cooling the cereals with the Granifrigor unit depends upon the exterior temperature, upon the humidity of the environmental air, upon the cereals humidity and temperature.
2. Humid cereals cooled with the Granifrigor installation can be more easily conditioned than very dry cereals.
3. The technology for cereals conditioning by cooling might represent an efficient method of environmental protection.

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CHANGES ON THE AGRICULTURAL PRODUCTIONS LEVEL AND EVOLUTION OF THE CONSUMPTION OF DIFFERENT SOCIAL CATEGORIES

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Keywords: *commercial exchanges, analyze, impact, Romania*

Abstract

The aim of this paper is to emphasize the changes which have been taken place at the agricultural productions level in Romania and meanwhile to do a comparison between similar situations existing in some European Union member states. Thus, we have been taken note of a vegetal sector majority in the whole agricultural sector of which implications on the associated sector have been shown in the present study.

We have been also intend to observe if there is a correlation between the trend of the agricultural productions in our country and the changes in the human food consumption. Especially, we wanted to analyze if these changes were supported maybe by the international trade with different countries in the European area.

INTRODUCTION

The agricultural sector asked many reforms in the transition countries. Thus, Romania has been also adopted some measures in order to improve its commercial sector and its trade reconsidering the goods exchanged. Even with these changes, Romania is still depending of its imports and we can explain this situation by an inefficient reconstruction of its economy and by the big proportion of the State enterprises which produces the products traded especially on the international markets.

The objective of the present paper was to make an analyse about the Romanian agricultural productions and the trade on agricultural products, in order to emphasize the structure of an agricultural sector, so here between the vegetal sector and the animal sector.

Thus to do so, we took tree vegetal products (wheat, maize and potatoes) and tree animal products (poultry meat, pork meat and beef meat). The time period in-between the analyze was done is from 1993 till 2008.

MATERIAL AND METHODS

For this paper, we have been gotten data from the Food Agricultural Organization, Eurostat database and the National Institute of Statistics. Based on that, we made our calculations, analyses and got results which are presented here below.

So we calculated the correlation coefficients between imports/exports and two other indicators: consumption and production prices, for the same products mentioned above and for four European countries.

Also, using the data on international trade we got the coverage degree of the imports by the exports, the opening degree of the economy (the imports and the exports related to the GDP), for the last 15 years and the Index of European geographical adjustment of foreign trade.

RESULTS AND DISCUSSION

The results have been shown in the following statements. It was observed that in Romania, the vegetal sector counts, in term of value, more or less tree times than the animal sector. We have taken note about a similar situation in the other European countries, but not with the same proportion because, in those countries, the agricultural services sector is more important than in Romania.

Concerning the Romanian trade for the six products, in the time period 1993-2008, these ones were relatively stable before 1997-1999; after that, a fluctuation has been noted. This statement is more important for the vegetal sector, where together with an increased area, the volume and the consumption have been increased too (with 7-10% during the mentioned period).

On the domestic market, we observed some changes in the structure of the goods consumption between two types of households: farmers and employees. Thus, the farmers consume now farm products from their own agricultural production less than 5-7 years ago (some 9-10% less in the last 3 years). For the employees, we sow the same trend; their consumption, from their own agricultural production is degreased with 7-8% in the last 3 years.

For the correlation coefficients between the indicators pointed out above, there was a positive and significant correlation between the exports and human consumption of the products considered in the study, except for the beef. The correlation coefficients between imports and consumption hadn't the same values. We have got positive and significant correlation for the beef and poultry, negative correlation for the pork meat, wheat and potatoes and no correlation for maize. Also, there is no correlation in our study for the production prices and exports for four (pork meat, wheat, maize and potatoes) of the six products considered here.

The coverage degree of the imports by the exports has confirm that the volume of imports is no cover by the exports, the index calculated being below 100% for all the four partners (France, Germany, Hungary and Poland) taken into account.

The opening degree of the economy gives results which lead to a quite closed level of the economy (between 0.6 and 3.1 points for the four countries, in the same order like here above).

The index of the European geographical adjustment of foreign trade is calculated for the last 6 years and for the same four countries, like above. This index could explain the added modifications of the imported /exported quantities between two consecutive periods, related to the import/export global with total volume corresponding to the previous period. In our case, the small values indicate an adjustment geographical of the foreign trade, observed with a quite stable level of the transactions after a certain number of time periods.

CONCLUSIONS

1. The Romanian productive orientation has been influenced the domestic internal consumption and the international trade.
2. There is a correlation between the exports and human consumption for the six products considered in the paper.
3. The coverage degree of the imports by the exports must be improved in the future period.
4. It was observed an adjustment of the foreign trade in the last years.

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