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CONTRIBUTIONS TO THE ESTABLISHMENT OF THE FERTILIZATION SYSTEM WITH MINERAL NITROGEN FOR AUTUMN CROPS RAPE AND WHEAT - IN THE SPECIFIC ENVIRONMENT OF BULBUCATA GIURGIU

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Abstract

The experiment was initiated in the crop year of 2013 – 2014 and analysed the influence of the commercial product on winter wheat and autumn rape on the final crops. It was used the Glosa C1 wheat variety and Extec rape hybrid; the used mineral fertilizers were as follows: D.A.P., 15:15:15, EUROFERTIL TOP 38, UreeEgipt (Egypt Urea), Nitrocalcar (ammonium nitrate), Sulfammo 30 N-PROCESS. During the fall, it was provided a general background of P_{60} and part of the nitrogen and in the spring, the nitrogen was applied in a fractionated manner. Following the climatic conditions in the crop year of 2013 - 2014, it was noticed that the rainfall favourably influenced both the crop productions of rape and winter wheat and the phytopathogenic agents and pests' multiplication that had a more aggressive manifestation than in the years with normal conditions. The highest rape crops were obtained by applying a dose of $N_{150}P_{60}K_{60}$with a production of 44.20q/ha,and the application of $N_{150}P_{60}$ dose to the winter wheat resulted in the production of 79.0 q/ha.

Key words: *climatic conditions, fertilizers, rape, winter wheat.*

INTRODUCTION

Setting up the fertilization system in modern technology farming for field plants has been a major concern for scientists and practitioners. Some of these very important field plants are rape and wheat. The differentiation of fertilizer dose issues from Liebig`s theories (mineral nutrition and the law of the minimal)and becomes more conclusive after the works of: Barlog et al., 2004; Bell, 1970; Bilsborrow et al., 1993; Borlan et Hera, 1973, 1984, 1996; Davidescu et Hera, 1964; Hera et al., 1994.

A modern approach of the soil`s fertility state in the system will contribute to the rise of its productive ability, to obtaining safe and stable production of high quality performance and of great economic efficiency (Hera, 1980; Walker et Booth, 2001).

Optimizing the supplying state with fertilizing elements intends to satisfy the autumn rape`s requirements to a higher degree against the presence of nutrient substances of certain concentration and proportion which amplifies the growth and development of this plant and this proves that applying nitrogen to rape fields has brought a harvest increase as compared to those which are not chemically fertilized (Hera, 1964; Grant et Bailey, 1990; Plank, 2000; Risnoveanu, 2011; Dincă et al., 2012). Aimed at highlighting the difference in autumn crops, rape and wheat production influenced by fertilizer, the necessary fertilization and capitalization of the current kind of fertilizers by plants.

The main goals were: determining the dose and range of commercial products, the influence it has over efficiency and elements of efficiency (productivity elements) in pedo-climatic areas of Bulbucata, west of Romanian Plain, on chromic luvisoil and, in perspective establishing commercial product influence on

the production of rapeseed, of knowledge and correlation between applying mineral nitrogen fertilizers, NPK imbalance in the soil, soil acidity and organic matter.

MATERIALS AND METHODS

The research was conducted by experiments performed under field conditions, the land belonging to the company "AgroMads Crop SRL", the Bulbucat avillage, Giurgiu County.
Placing experiences in the field was done by randomized block method and experimental data processing was done by analysis of variance. When fitting experience in the field, samples of soil were collected and agrochemical analyzes were done using methods practiced in specialized laboratories for analysis series. The type of soil that was experimented on is typical of Bulbucata, Giurgiu area, chromic luvosoil and the pedo-climatic conditions of the area are favorable for autumn crops studied, wheat (Glosa C1) and rape (Extec).
Production unit requirement were considered in establishing experimental variants, the current fertilizer assortment was used and applied in autumn and in the beginning of spring.
Variety of fertilizer used:
In autumn complex fertilizers were used, respectively DAP(18:46:0) or 15:15:15 and Eurofertil Plus PHOS 38 which contains 8%N, 30%P_2O_5, 8%SO_3, 15%CaO, 2%MgO, 0.15%Br, 0.15%Zn.
During the growing period were used: uree, NAC nitrocalcar, Sulfamo30 (NPK 30:0:0) which contains 30% N, 15%SO_3, 7%CaO, 3% MgO.
Fall fertilizer application was made on the background of P 60 kg/ha and the remaining doses were administered to prepare the ground for seeding by incorporating with schemer.
The doses of commercial product given in fall were differentiated at experimental variants, namely 130 kg/ha for 18:46:0; 400 kg/ha and 200 kg 15:15:15 /ha for EurofertilPlus 38 PHOS.
Fertilization for vegetation was done with differentiated doses at experimental variants, namely urea 100 kg/ha and 160 kg/ha, NAC 100 kg/ha and 185 kg/ ha and Sulfamo 30 doses of 122 kg/ha, 150 kg/ha and 280 kg/ha.
The number of variants was 10 with the same differentiation .in both crops as much for the doses as for the range of commercial products used.

RESULTS AND DISCUSSIONS

Preliminary results of production in the crop year 2013-2014.
Results on the development of vegetation in the given climatic conditions, treatments and interventions in crop technology.
Climatic conditions, namely the average monthly temperature of ^oC and monthly rainfall recorded since 2013 to 2014 and the annual average of the area are presented in Figure 1 and Figure 2.
The agricultural year of 2013-2014 can be considered favorable for winter crops wheat and rape. Annual average rainfall exceeding 90 mm over the entire crop year and higher temperatures satisfied the requirements of a good vegetation development.
In autumn, during the third decade of October, the vegetation went so well that rape plants had around 2-3 leaves per plant and by mid November they had 5-7 leaves per plant and they were prepared for winter. Wheat plants have also vegetated normally providing a number of normal wheat ears.

Table 1. Comments upon the phases of vegetation up to entry in the winter at the rape of autumn (Extec)

Dose kg/ha	Fertilizer	Kg/ ha N a.s.	Kg/ ha P_2O_5	Kg/ ha K_2O	Date					
					26 -X- 2013		2 –XI- 2013		16-XI- 2013	
					Plants/ m^2	Leaves/ Plant	Plants/ m^2	Leaves/ Plant	Plants/ m^2	Leaves/ plant
0	-	-	-	-	33	2.82	33	4.31	29	5.76
130	D.A.P. (18:46:0)	23.4	60	0	26	3.60	26	5.08	26	7.37
200	Eurofertil Plus PHOS 38	16	60	0	27	2.15	33	3.31	33	4.58
400	15:15:15	60	60	60	27	3.19	27	4.28	26	6.65

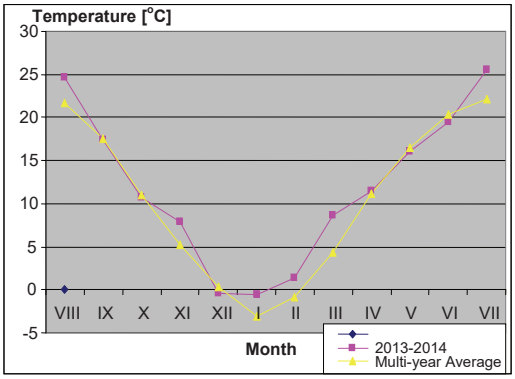

Figure1. Climatic conditions - temperature 2013-2014

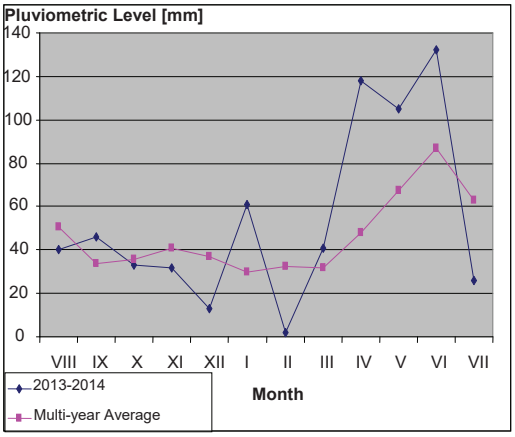

Figure 2. Climatic conditions- rainfall 2013-2014

An earlier beginning of spring allowed an early resumption of the vegetation, the application of fertilizers, with differentiated assortment and doses according to the graduation of experimental variants. This happened on 13 February 2014 and for wheat on February 27, 2014.

From the point of view of the attack by pests at the two crops, wheat and rape in the autumn array may be presented as follows:

Wheat has been found for the presence of the pest *Zabrus tenebrioides*, but the attack was filed under the PET (pest economic threshold) both in the autumn of 2013 and in the spring of 2014. but

Because of unfavorable climatic conditions from May 2014, average level of sun pest (*Eurygaster* spp.) adults from wheat crops were low, between 0.25 and 1.0 insect/sqm.

At rape crop (colza) it has recorded rodents attack. Higher attack intensity was observed, especially in first two decades of November (first 20 days of November). Rodents activity start again in second decade of January, as result of the high temperatures registered in that period.

As result of unfavorable climatic conditions from autumn of the year, flea attack (*Phyllotreta* spp. and *Psylliodes chrysocephala)* has low values.

It has ascertained moderate attack of the *Athalia rosae* larvae when colza plants are at 3-4 leaf stage (BBCH 13-14).

Results regarding the efficiency of autumn crops rapeseed the Exrec hybrid, and wheat, Glosa variety under the influence of nitrogen fertilizers from 2013 to 2014 year in Bulbucata-Giurgiu.

Preliminary production results from the experimental field located on a red preluvosoil from Bulbucata-Giurgiu, for rape and winter wheat crops in the year 2013-2014 are summarized in Tables 4, 5 and 6. An overview of these results show a fairly high level of production from both studied crops and significant differences between the versions.

Generally, favorable climatic conditions allowed a better use if this area`s potential, of the soil and hybrid used, of technology and nutrient elements from fertilization adapted to the plants` needs.

It also highlights the importance of nitrogen applied in substance P (s.a. P_2O_5 60 kg/ha), pointing out the great influence of nitrogen dose and the assortment over production - commercial product adapted to the specific climatic Bulbucata-Giurgiu area.

Therefore, at autumn crops from 2013-2014 productions of over 70 q/ha for wheat and over 40 q/ha for rape were carried out which was increased as compared to the unfertilized one with over 50% more for wheat and over 100% for rape and a production increase for both crops, 7-14 kg/ha for wheat or rape/kg. NPK fertilizer applied.

These preliminary results point to the importance of fertilization for winter crops wheat and rapeseed and the need to continue the research which started in 2013/2014.

Results on the influence of nitrogen fertilization on rapeseed crops Extec hybrid, in 2013-2014.

From this table it can be seen that in all the 9 variants with doses and assortment of fertilizers –commercial products – significant increases were recorded for the unfertilized one as well as between variants with different doses of nitrogen or different kinds of fertilizer used.

Production increases between 9.50 and 29.10 q/ha respectively 62 to 192% were recorded as Compared to unfertilized variant and a rise 7.92 to 14.56 kg per kg rape brought s.a. NPK fertilizer used.

The contribution of nitrogen on rapeseed crop is remarkable, the productions was significantly increased as the dose increased from 60 kg/ha N et al Up to 100 kg/ha et al the fund to P60 and N150 kg/ha et al P60K60 the fund.

On P60 fund and dose increasing from N to 100 led to average significant increases of 11.9 q/ha, and increasing the dose to N150 kg/ha has not led to increased production, it actually decreased it with 4.50 q/ha very significantly from N100.

Very significant increases were obtained on P60K60 fund when dose of N N100-N150 was increased. The recorded production increase is 9.80 q/ha compared to N60 to N100 and reaches 14.30 q/ha for N150 dose compared to N100, meaning rapeseed production increase with N150 compared to N100 is significant, being 4.50 q/ha.

On average the differences in production is similar to that of fertilization with different doses of N on a P60 fund.

Potassium has a significant effect on P60K60 fund with the biggest productions for all levels of N. Potassium contribution to increasing rapeseed production is very significant, it is in average 6.19 q/ha compared to fertilization on P60 fund. Compared to P60 without K, P60K60fertilization obtains increases of 3.90-5.30 q/ha with N60P60K60 doses, 1.30-3.70 q/ha with N100P60K60 and reaches 8.80-14.20 q/ha with N150P60K60 doses, showing best rapeseed production in 2013/2014.

The variety of fertilizer used (commercial product) significantly influenced the rapeseed production, regardless of the N dose applied at sowing in autumn or in spring on vegetation, as outlined in Table 4.

In autumn, before planting, PK fund was secured using 3 types of fertilizers. Complex fertilizers like DAP; N18, P46, K0 and N15, P15, K15 as well as Eurofertil Plus 38 PHOS fertilizer were used before sowing.

Table 4 shows the biggest productions for all N doses used at fertilization in autumn with NPK complex fertilizers with a ratio of 15:15:15 (400 kg/ha of commercial product) which provided the P60K60 fund (the remaining N was completed in spring).

The production has diminished significantly when fertilizers that do not contain EurofertilPlus PHOS 38 or when complex NP complex fertilizers with N16:P48:K0 were used as compared to using 15:15:15 fertilizers. The losses recorded were 4.76 q/ha DAP 18:46:0 and 7.73 q/ha Eurofertil Plus 38 PHOS as compared to NPK 15:15:15 complex fertilization in autumn.

To reach the doses of each experimental variants, during spring vegetation, at the beginning of spring, the variant of nitrogen fertilizer consisted of three commercial products Urea, Sulfamo 30 and NAC, all of which proved very effective in 2014.

Therefore, the urea applied to the vegetation to complete the nitrogen dose to N100 kg/ha, with the use of complex fertilizers during autumn, led to high yields of 39.70 q/ha with NPK 15:15:15 and 38.40 q/ha NPK 18:46:0.

With these yields with no significant difference between them the increase in production reached more than 23-24 q/ha (23.30-24.60 q/ha) or 154-162% compared to the unfertilized one.

It is noted that compared to N60P60K60 variant, when applying urea in vegetation, there has been a very significant growth 9.60 q/ha and on complexes without K (NPK 18:46:0), using urea in total doses of N100 also brought a significant increase of 12.4 q/ha compared to N60P60 dose version with the use in vegetation of the commercial product Sulfamo 30.

The Sulfammo commercial product applied in vegetation for the fertilized variant with N60P60 led to equal productions for autumn fertilization with Eurofertil Plus PHOS 38 (24.60 q/ha) or complex type DAP 18:46:0 (26.0 q/ha). But Sulfammo 30 applied in autumn to fund of Eurofertil in order to raise the dose of N to N100P60 led to production of

36.0 q/ha, with a very significant increase of 11.4 q/ha compared to N 60P60 and 20.9 q/ha, respectively 138 % compared to unfertilized.
Urea and NAC applied together on NPK fund from NPK 15:15:15 complex was best harnessed allowed capitalization of high N doses up to N150P60K60.
The Maximum production for Rapeseed, of 44.20 q/ha, in fact, occurs at fertilization with N150P60K60 kg/ha variant dose, using NPK 15:15:15 complex fertilizer, 400 kg/ha, commercial product (kg N60P60K60 /ha) and at the beginning of spring with nitrogen fertilizers to complete the N dose to N150 kg N /ha using commercial products urea 135 kg/ha and 100kg NAC /ha commercial product.
One could say that the dose of N150 could be exploited by plants only in the presence of potassium K60 with phosphorus P60 from complexes with NPK 15:15:15.
With this method of fertilization a normal state of vegetation was ensured which allowed such production in Bulbucata area, Giurgiu.
Results related to wheat production are summarized in Table 2.

From this table one can see that all the 9 variants with doses and types of fertilizers – commercial products- have recorded significant increases in production compared to the unfertilized variant but also between variants with different doses of N or different kinds of fertilizers used.
The contribution of nitrogen on wheat crops is considerably good, production significantly increasing with increasing dose from 60 kg/ha N a.s. to N100 kg/ha-150 kg/ha a.s. on P60K60 fund.
On a P60 fund increasing the dose from 60 kg N/ha a.s. to 100 kg/ha s.a. brought very significant production increases of 4.00-7.00 q/ha and on P60K60 fund increases of 6.00 q/ha.
Increasing the dose of N to 150 N a.s. in regard to N100 led to very significant increases of 4-9 q/ha, only for the autumn fertilization with complexes.
As for potassium with wheat compared to rape did not bring any increase in production regardless of the level of fertilization with N.

Table 2 The influence of the fertilizing purposes with nitrogen on the production of rape EXTEC hybrid in the year 2013-2014 on chromic luvisoil from Bulbucata-Giurgiu

Variant	Dose kg/ha			Yield q/ha	Difference			Increase Yield/kg a.s.
	NPK s.a	Commercial product			q/ha	%	Semnification	
		Autumn kg/ha	Spring kg/ha					
V1	N0P0K0	Unferilized		15.10	Blank			-
V2	N60P60	130kg DAP	122kg Sulfa-mo30	26.00	10.90	72	xxx	9.08
V3	N100P60	130 kg 18:46:0	160 kg Uree	38.40	23.30	154	xxx	14.56
V4	N150P60	130 kg 18:46:0	160kg Uree and 185kg NAC	35.40	20.30	134	xxx	9.67
Average				33.27	18.17	120		11.10
V5	N60P60K60	400kg 15:15:15	-	29.90	14.80	92	xxx	8.22
V6	N100P60K60	400kg 15:15:15	100kg Uree	39.70	24.60	162	xxx	11.18
V7	N150P60K60	400kg 15:15:15	100kg NAC and 135 kg Uree	44.20	29.10	192	xxx	10.78
Average				37.93	22.83	151		10.06
V8	N60P60	200kg Eurofertil Plus PHOS 38	150kg Sulfamo 30	24.60	9.50	62	xxx	7.92
V9	N100P60	200kg Eurofertil Plus PHOS 38	280kg Sulfamo 30	36.00	20.90	138	xxx	13.06
V10	N150P60	200kg Eurofertil Plus PHOS 38	100kg Uree and 280kg Sulfamo 30	30.00	14.90	98	xxx	7.09
Average				30.20	15.10	100		9.36

LSD 5% = 2.02 q/ha LSD 1% = 2.74 q/ha LSD 0.1% = 3.66 q/ha

Table 3. The influence of the fertilising purposes with nitrogen on the production of durum wheat , Glosa variety in the year 2013-2014 on chromic luvisoil from Bulbucata-Giurgiu

Variant	Dose kg/ha			Yield q/ha	Difference			Kg/kg s.a Increase production	Yield	
	NPK s.a	Commercial product			q/ha	%	Sem.		Nr. heads/ m^2	MH Kg/hl
		Autumn kg/ha	Spring kg/ha							
V1	N0P0K0	Unfertilized		47.80	Blank			-	450 Mt.	79.6
V2	N60P60	130kg DAP 18:46:0	122kg Sulfa-mo30	66.0	18.20	38	xxx	15.16	770	78.4
V3	N100P60	130 kg 18:46:0	160 kg Uree	70.0	22.20	46	xxx	13.87	774	80.8
V4	N150P60	130 kg 18:46:0	160 kg Uree and 185kg NAC	79.0	31.20	65	xxx	14.86	786	80.0
Average				71.67	23.87	50		14.63	776	79.7
V5	N60P60K60	400kg 15:15:15	-	62.00	14.2	30	xxx	7.89	724	78.8
V6	N100P60K60	400kg 15:15:15	100kg Uree	68.0	20.2	42	xxx	9.18	668	79.2
V7	N150P60K60	400kg 15:15:15	100kg NAC and 135 kg Uree	72.0	24.2	51	xxx	8.96	650	79.2
Average				67.33	19.53	41		8.68	680	79.1
V8	N60P60	200kg Eurofertil Plus PHOS 38	150kg Sulfamo 30	63.80	16.00	33	xxx	13.33	554	77.2
V9	N100P60	200kg Eurofertil Plus PHOS 38	280kg Sulfamo 30	71.00	23.20	48	xxx	14.5	660	80.8
V10	N150P60	200kg Eurofertil Plus PHOS 38	100kg Uree and 280kg Sulfamo 30	60.50	21.70	45	xxx	10.33	620	77.6
Average				68.10	20.30	42		12.72	611	78.5

LSD 5% = 1.65 q/ha LSD 1% = 2.09 q/ha LSD 0.1% = 2.67 q/ha

Of fertilizer – commercial product used for wheat and rapseed has significantly influenced the production, regardless of the dose of N applied before sowing or in spring on vegetation in the beginning of spring.

Urea and NAC in vegetation at the version with fund from complexes, the version with N150P60K60 or N150P60K0 doses (without K) were the best productions with the best increases over the unfertilized.

For the versions with N150P60K60 doses (fund 400 kg/ha complex 15:15:15) out of which in vegetation 135 kg/ha urea and 100 kg/ha NAC, the production of 72.0 q/ha ensure over the unfertilized an increase of 24.20 q/ha, meaning 51% and wheat 8.96 kg/kg of fertilizer each.

But the largest production of 79 q/ha was achieved on the version with N150P60 dose, with fund provided from autumn fertilization with 130 kg/ha complexes NPK 18:46:0 and in spring in vegetation completed the dose of nitrogen with 60 kg/ha urea together with 186 kg NAC. At this version compared to the unfertilized one there is an increase of 31.20 q/ha meaning 65% and 14.86 kg wheat per kg s.a. NP fertilizer used.

Fertilization in vegetation for wheat and rapeseed, the combination of urea and ammonium nitrate proves most suitable for the pedo climatic weather conditions in Bulbucata, Giurgiu.

CONCLUSIONS

Rape uses the nitrogen in large doses (N100 and N150), with K60 and P60.

At rape, Sulfammo 30 applied in autumn to fund of Eurofertil in order to raise the dose of N to N100P60 led to production of 36.0 q/ha, with a very significant increase of 11.4 q/ha compared to N60P60 and 20.9 q/ha, respectively 138 % compared to unfertilized.

Urea and NAC applied together on NPK fund from NPK 15:15:15 complex was best harnessed allowed capitalization of high N doses up to N150P60K60.

The mximum production for Rape, of 44.20 q/ha, in fact, occurs at fertilization with N150P60K60 kg/ha variant dose, using NPK15:15:15 complex fertilizer, 400 kg/ha, commercial product (kg N60P60K60 /ha) and at the beginning of spring with nitrogen fertilizers to complete the N dose to N150 kg N /ha using commercial products urea 135 kg/ha and 100kg NAC /ha commercial product.

One could say that the dose of N150 could be exploited by plants only in the presence of potassium K60 with phosphorus P60 from complexes with NPK 15:15:15.

With this method of fertilization a normal state of vegetation was ensured which allowed such production in Bulbucata area, Giurgiu.

As for potassium with wheat compared to rape did not bring any increase in production regardless of the level of fertilization with N.

The type of fertilizer – commercial product used for wheat and rapeseed has significantly influenced the production, regardless of the dose of N applied before sowing or in spring on vegetation in the beginning of spring.

Fertilization in vegetation for wheat and rapeseed, the combination of urea and ammonium nitrate proves most suitable for the pedo climatic weather conditions in Bulbucata, Giurgiu.

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