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THE INFLUENCE OF CLIMATIC CONDITIONS ON THE GROWTH STAGES OF SEVERAL MAIZE HYBRIDS IN THE OSMANCEA - CONSTANȚA AREA

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Abstract

Maize occupies about 46% of Romania's arable land, which is why it has been constantly in the attention of researchers who try to maximize production by various agrophytotechnical methods adapted to the climatic conditions so different in recent years. The aim of the research is to determine the influence of precipitation and temperatures on the growth stages of maize depending on the hybrid. To achieve the research objectives, a 3 x 3 x 3 three-factor experiment was established, sown in three repetitions according to the method of subdivided plots, with the following study factors: factor A - tillage system (a_1-ploughing; a_2-tiger; a_3-disc), factor B - fertilization formula (b_1-N0P0K0; b_2-N90P40K40; b_3- N90P40K40 + Greenstart (N4P10Mg0.5S1.25Zn0.5) and factor C - hybrid (c_1-Mas 40 F; c_2-Dartone; c_3-P9911). The growth stages of maize are largely influenced by the climatic conditions of the study years. The influence of climatic conditions is also reflected in the level of production/yield. The amount of water in precipitation is used differently depending on the tillage, fertilization formula and hybrid used. Of the hybrids tested in the 3 years of experimentation, the P9911 hybrid is the most productive.

Key words*: production/yield, maize, fertilizers, hybrids, tillage, temperature, precipitation.*

INTRODUCTION

Sustainable, conservative agriculture seeks to meet the needs of the present times without compromising the ability of future generations to meet their own needs. For this, solutions must be found for the rational exploitation of resources and for reducing the degradation of the environment (Guș et al., 2011; Rusu et al., 2009).

Tillage produces physical, chemical, mechanical changes in its mass, influencing the development of chemical and biological processes. Applied correctly, they favour self-restoration processes and the increase of the productive potential of the soil (Ankwe MA, 2007).

Excessive tillage of agricultural land, with various mechanical equipment and first of all the basic work, the ploughing, which mobilizes the soil in depth, in addition to penetration, destruction of diseases and pests also has negative effects through greater water loss, a weaker mineralization of vegetation residues, the creation of the hardpan, the rupture of the continuity of the capillarity, and if the ploughing on sloping lands is done along the line of the highest slope, it will favour erosion (Bogdan et al., 2007; Cociu, 2011; Ibanez et al., 2008; Moraru and Rusu, 2010; Pop et al., 2013).

When choosing the soil tillage system, the long-term consequences must be taken into account. In this respect, the system of minimal works has multiple advantages and it must be applied in its different variants, depending on the pedoclimatic conditions of the area (Jităreanu G., 1998).

The unconventional tillage system means the total or periodic abandonment of ploughing with the overturning of the furrow, the rationalization of the number of works and the keeping on the surface of the soil of at least 15-30% of the total vegetal residues, the aim being to reduce energy consumption, soil and water conservation, organization of adequate crop rotation, environmental protection, reduction of soil erosion and compaction (Marin et al., 2012).

The quantitative and qualitative growth of production at the level of current requirements is not possible without the use of chemical fertilizers (Mihăilă et al., 1996; Bîlteanu, 1998).

The multitude of factors that influence the effectiveness of fertilizers create difficulties when it comes to determining the doses, all the more so as some factors are more difficult to control, such as large variations in weather conditions from year to year.

Also, Cociu I. Al. (2011) confirms that traditional agriculture, based on intensive tillage by ploughing with the overturning of the furrow and removal of plant remainings followed by numerous secondary works, has the disadvantage of high cost and disproportionate distribution of inputs from crop technology in relation to expected efficiency, high consumption energy and labour, low productivity as well as major risks of soil degradation and environmental pollution.

In the context of global warming soil conservation works are different depending on the possibilities of mechanization and increase along with the increase in the capacity of tractors and agricultural machinery and diversification of loosening, tillage and sowing equipment. The use of fertilizers for profitable production and soil conservation must be made on the basis of realistic forecasts, which take into account local soil and climatic conditions, the productive potential of crops and the technological level. In this respect, the system of minimal works has multiple advantages and it must be applied in its different variants, depending on the pedoclimatic conditions of the area (Guş, 2004).

Water recovery by plants can be assessed by indicators that express the use by the plant of the entire amount of water consumed or only the efficiency of recovery of irrigation water (Domuţa, 2009). In the Romanian specialized literature, the indicators for assessing water recovery are approached from two perspectives: one that highlights the production, showing the amount of main yield obtained from consumption or use.

Water recovery is different from one crop to another, being influenced by soil and climatic conditions (Grumezan et al., 1989; Grumezan and Kleps, 2005) and by elements of technology: crop rotation, variety or hybrid, density, tillage, fertilization, control of weeds, diseases and pests, the degree of water supply.

Minimum tillage has many advantages, including: the soil is better protected from erosion, soil aggregates are more stable, organic matter increases, fertility levels and biodiversity increase, soil compaction decreases. There is also a better water retention in the soil. This is due to the reduction of temperature, by up to 6 °C, in the surface layer due to the thermoregulatory capacity and the high degree of reflection of the sun's rays by the plant residues retained on the soil surface (Phillips, 1984).

We must not lose sight of the hybrid used as a technological measure, knowing that the choice of the hybrid is a technological measure that does not generate costs, but can contribute by about 30% to the achievement of expected results.

Sin Gh., (2007) specifies that by replacing the ploughing with the disc harrowing at 10-12 cm, for 1-2 years in maize, the production is not significantly affected, but there is an increase in the number of weeds, especially perennials.

Long-term experiences play a key role in understanding complex plant x soil x climate interactions and their effect on plant productivity. At the same time, it provides data on changes that occur as a result of fertilizer application, constituting a rich source of scientific information on agronomic conditions over a long period of time (Petcu et al., 2003).

MATERIALS AND METHODS

To achieve the research objectives, a 3 x 3 x 3 three-factor experiment was established, sown in three repetitions based on the method of subdivided plots, with the following study factors: factor A - tillage system (a_1-ploughing; a_2-tiger; a_3-disc); factor B - fertilization formula (b_1-$N_0P_0K_0$; b_2-$N_{90}P_{40}K_{40}$; b_3-$N_{90}P_{40}K_{40}$ + Greenstart ($N_4P_{10}Mg_{0.5}S_{1.25}Zn_{0.5}$) and factor C - hybrid (c_1-Mas 40 F; c_2-Dartona; c_3-P9911).

The main purpose of the paper was the study of the influence of precipitation and temperatures on the growth stages of maize depending on the

hybrid, reflected in the level of production obtained in the Osmancea - Constanța area.
The forerunner was autumn wheat (*Triticum aestivum L.*). The tillage of the germination bed was carried out by disc harrowing one day before the sowing day at a depth of 5-6 cm.
The sowing was carried out on 2.04.2017, 3.04.2018 and 2.04.2019, respectively, at a depth of approximately 5-6 cm, at a density of 63,000 germinating grains /ha.
Before using herbicides as a technological method, it is necessary to know the structure of crops in crop rotation and the rotation thereof, the main weed species and the establishment of doses, epochs and methods of application thereof (Geoffroy et al., 2013; Vasileiadis et al., 2013).
Weed control in maize crop was carried out by pre-emergent application of the commercial product Wing P (212.5 g/l *Dimethenamid*-P and 250 g/l *Pendimethalin*), at a dose of 3.5 l / ha. In the 4-6 leaf stage to control weeds, maize was treated with herbicides using the REKOR package (Callam®: *tritosulfuron* and *dicamba* and Samson® Extra 6 OD: 60 g/l nicosulphuron) + DASH adjuvant.
Phenological observations were made from spurting to panicle emergence (vegetative phenophases until entering the generative phase), following the thermal gradient achieved from spurting to each phenophase, as well as the thermal gradient recorded for each phenophase. The calculation and interpretation of the production results was made based on the analysis of the variance of the experiments placed in the subdivided plots (Săulescu and Săulescu, 1967).

RESULTS AND DISCUSSIONS:

Analysing the agricultural years 2017-2019 from the point of view of the evolution of temperatures and precipitations we can characterize the experimental years as follows:

- agricultural year 2017 - very warm and normal in terms of rainfall;
- agricultural year 2018 - very hot and rainy;
- agricultural year 2019 - excessively hot and rainy.

In the three years of experiments, the monthly averages were higher as compared to the multiannual average of the reference area, regardless of the year of experimentation, as this is the trend of recent years. The sum of the average monthly temperatures for the studied agricultural years exceeds the multiannual average for 77 years (4174.1°C) by 609.6°C in 2017, by 524.5°C in 2018, the record being held by 2019 (+ 1030.7°C), which demonstrates the arid trend of the south-eastern area of Romania.
The largest positive deviations of the average monthly temperatures as compared to the multiannual average are registered in the months: June 2019 (+ 5.5°C), October 2019 (+ 5.1°C), November 2019 (+ 5.0°C), March 2019 (+4.4°C), March 2017 (+ 4.1°C), June 2018 (+ 3.7°C), December 2017 (+ 3.6°C), September 2017 (+ 3.5°C), December 2019 and October 2018 (3.4°C), August 2019 and August 2018 (3.3°C), February 2019 (+ 2.9°C), May 2018 (+ 2.8°C), and January and September 2018 (+ 2.6°C) (Figure 1).

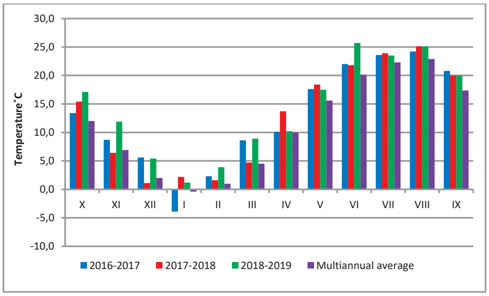

Figure 1. The evolution of the average monthly temperatures in the experimental years at Osmancea - Constanța

From a rainfall point of view, only 2017 differs, which can be considered a normal year in terms of accumulated rainfall, 28.5 mm less than the multiannual average (433.8 mm). The years 2018 and 2019 exceed the multiannual average (433.8 mm) by 289.1 mm, respectively 255.3 mm, but the distribution of precipitation is unevenly distributed compared to the requirements of the maize plant.
Thus, in 2018, compared to the multiannual average, the months with excess precipitation alternated (+52.4 mm in March, +34.2 mm in May, +88.2 mm in June, +71.1 mm in July) with dry months (-31.2 mm in April, -36.6 mm in August, -25.7 mm in September and -34.0 mm in October). In 2019, the alternation of rainy and dry months was more prominent. Thus, in March they recorded +53.1 mm,

followed by April -31.2 mm, excess rainfall in June (+88.2 mm) and July (+71.1 mm), followed by August when there was no rainfall (-36.6 mm = value of the multiannual average) and September (-25.7 mm) (Figure 2).

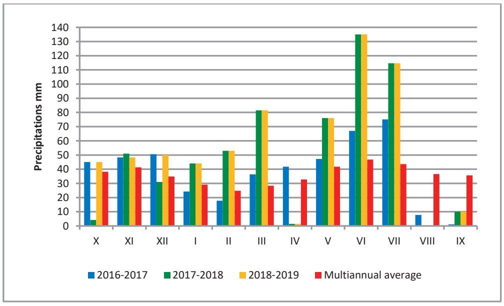

Figure 2. The evolution of precipitation in the experimental years at Osmancea - Constanța

To trigger the processes of germination and emergence, maize needs certain requirements of temperature (8-10^{0}C) and humidity (grains need at least 27-34% water by weight), correlated so as to ensure a good emergence of plants.
In addition to ensuring the optimal conditions of temperature and humidity at the time of sowing, the applied agrophytotechnical measures (soil tillage system, fertilization formula and hybrid) also play an important role.
If the soil moisture is sufficient for germination, the emergence of maize takes place in 16-20 days at temperatures of 10-12°C, in 13-15 days at temperatures of 12-15°C, in 8-10 days at temperatures of 15-18°C and in 5 -6 days at a temperature of 21°C.
In 2017, maize was sown on 2.04. and the emergence took place 23-25 days after sowing, the tested hybrids having the best reaction to the fertilization formula $N_{90}P_{40}K_{40}$ + Greenstart ($N_4P_{10}Mg_{0.5}S_{1.25}Zn_{0.5}$), regardless of the tillage system.
In 2018, maize was sown on 3.05. and the emergence took place 12-13 days after sowing, and the tested hybrids reacted similarly as in 2017 in terms of the fertilization formula.
In 2019, maize was sown on 2.04. and emergence took place 19-21 days after sowing. The influence of the application of the fertilization formula $N_{90}P_{40}K_{40}$ + Greenstart ($N_4P_{10}Mg_{0.5}S_{1.25}Zn_{0.5}$) is relevant regardless of the tillage system and the tested hybrid.

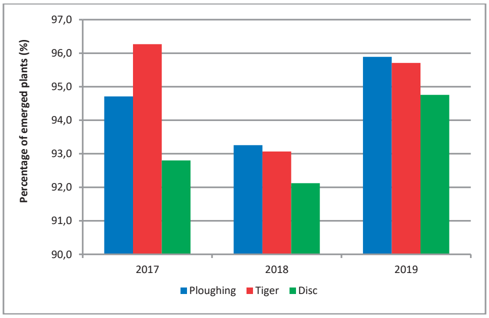

Figure 3. Percentage of plants emerged on average on tillage in experimental years

The evolution of climatic conditions after sowing and the tillage system influence the percentage of emerged plants. The highest percentage of emergence was recorded in the work performed with tiger in 2017 (93.3%), when maize benefited from temperature and humidity at the level of specific crop requirements (Figure 3).
In 2018 and 2019, the best percentage of emergence is registered in the tillage system by ploughing (93.3%, 95.9%), (Figure 4) a phenomenon explainable by the higher storage capacity of precipitation during the winter compared to the tiger or disc tillage system, when the soil is less modified in depth.
In addition to the influence of the climatic conditions of the experimental years, the percentage of emerged plants was also influenced by the fertilization formula.

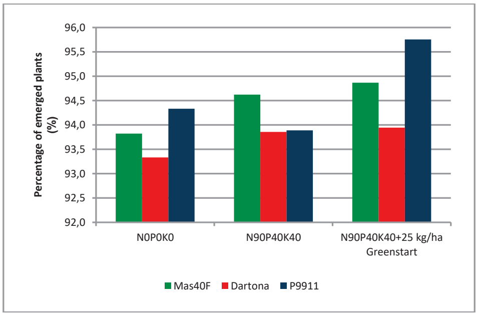

Figure 4. Percentage of plants emerged on average per hybrid depending on the fertilization formula

In 2017, the largest emergence process was recorded by the hybrid P9911, when the fertilization formula $N_{90}P_{40}K_{40}$ + Greenstart ($N_4P_{10}Mg_{0.5}S_{1.25}Zn_{0.5}$) was applied. Hybrid P9911 behaved similarly in 2018 (Figure 5).

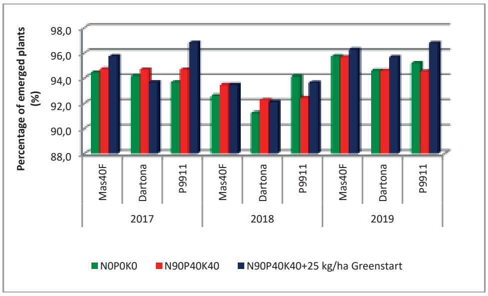

Figure 5. Percentage of plants emerged on average per hybrid depending on the fertilization formula and the experimental year

In 2019, when sowing was carried out very late, in May due to the absence of soil moisture, a higher percentage of emergence is recorded in case of hybrid P9911 for the non-fertilized, which can be explained by the inability of the applied fertilizers to mobilize.

Phenological observations made in the vegetative phase of maize per years of experimentation show that the tillage and fertilization formula do not significantly influence their duration and the sum of the temperature degrees required for the development of phenophases (Table 1).

Table 1. The growth stages of maze in the experimental years, Osmancea

Phenophase	2017			2018			2019		
	Date	Number of days	$\sum t^0$	Date	Number of days	$\sum t^0$	Date	Number of days	$\sum t^0$
Emergence	26.04	24	242.4	15.05	12	220.8	22.04	20	204.0
2 leaves	4.05	8	140.8	20.05	5	92.0	29.04	7	71.4
4 leaves	11.05	7	123.2	5.06	16	293.0	7.05	10	248.8
6 leaves	17.05	6	105.6	11.06	6	130.8	12.05	6	110.4
8 leaves	29.05	13	228.8	17.06	6	130.8	24.05	12	210.0
Panicle emergence	30.06	32	695.2	9.07	24	520.3	27.06	33	812.9

Date of sowing: 2.04.2017; 3.05.2018; 2.04.2019

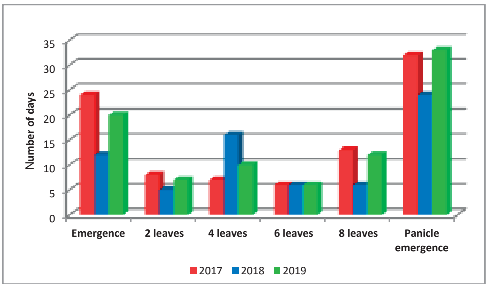

Figure 6. Number of days spent by maize hybrids on growth phenophases

Regarding the number of days necessary for the development of vegetative phenophases, it can be mentioned that (Figure 6):

- the emergence took place the latest in 2017 (24 days);
- the 2-leaf phenophase was registered 5-8 days after emergence, regardless of the years of experimentation;
- the 4-leaf phenophase took place 7 days after the emergence of the 2nd leaf in 2017, 10 days in 2019 and 16 days in 2018;
- 6-leaf phenophase, regardless of the experimental year, the hybrids needed 6 days to move to this phenophase;
- 8-leaf phenophase - the hybrids needed 6 days in 2018, 12 days in 2019 and 13 days in 2017, to reach this phenophase;
- the panicle emergence took place the fastest in 2018 at only 24 days from the previous phenophase, and in 2017 and 2018 at 32-33 days.

Regardless of the number of days from sowing to emergence, the hybrids needed on average over the experimental years a sum of temperatures of 224.4°C (Figure 7).

In order to go through the growth stages, the maize hybrids reacted differently in the years of experimentation regarding the accumulation of the thermal gradient necessary for each phenophase and in close connection with the presence or absence of precipitations in the analysed period. A solid example is the year 2018, when at the 4-leaf stage it was necessary to accumulate 293°C in 16 days from the previous phenophase, a period in which 76.0 mm of precipitation fell, which negatively influenced the growth of maize plants.

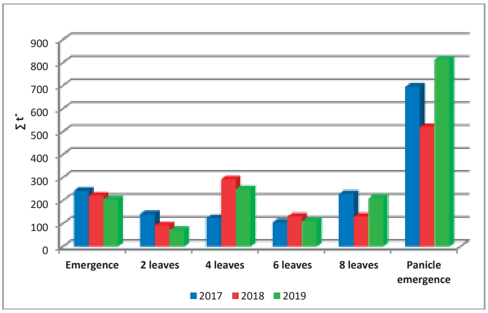

Figure 7. The sum of the temperatures achieved by maize hybrids on the growth phenophases

The influence of climatic factors (temperature and precipitation) on the vegetative phase of maize was also reflected in the yields obtained.
On average for the experimental years, in 2017, a normal agricultural year in terms of rainfall compared to the multiannual average (-27 mm), the level of yield was higher (10804 kg/ha) than in other experimental years.
Analysing the influence of climatic conditions on the yields of maize hybrids on average on tillage, it is observed that the highest yields are obtained for the tillage performed with tiger in 2017 and 2018 (11719 kg/ha and 11189 kg/ha respectively). The lowest productions were obtained in 2019. In the conditions of extreme drought of 2019, the yields obtained for the tested maize hybrids were higher in case of the ploughed tillage (5394 kg/ha) (Table 2).
On average during the three experimental years, the highest yields in case of tested maize hybrids were obtained by using the fertilization formula $N_{90}P_{40}K_{40}$ + Greenstart ($N_4P_{10}Mg_{0.5}S_{1.25}Zn_{0.5}$) regardless of the tillage system (9704 kg/ha).
In 2017, on average on tillage systems, hybrid P9911 is highlighted in case of the fertilization formula $N_{90}P_{40}K_{40}$ + Greenstart ($N_4P_{10}Mg_{0.5}S_{1.25}Zn_{0.5}$) (12306 kg/ha).
On average over experimental years, the highest yields are obtained by the hybrid P9911 in case of all fertilization formulas. The highest production is obtained by the Mas40F hybrid in 2017 for the tiger tillage system.
Analysing the average yields on the fertilization formula obtained for the hybrids tested in the three years of experimentation in all tillage systems, we can conclude:

- in case of ploughing, the highest yield is obtained by the hybrid P9911 (10682 kg/ha);
- in case of Tiger the highest yield is obtained by the hybrid Mas40F (10780 kg/ha);
- in case of disc the highest yield is obtained by the hybrid P9911 (7975 kg/ha);

Table 2. Yields obtained in case of maize hybrids at the 3x3x3 multifactorial experiment, Osmancea, Constanța 2017-2019

Tillage	Fertilization formula	Hybrid	Year of experimentation			Hybrids average
			2017	2018	2019	
Ploughing	$N_0P_0K_0$	Mas40F	8706	9197	4093	7332
		Darton	8246	9373	3897	7172
		P9911	9103	9223	4070	7465
	N90P40K40	Mas40F	10812	10577	5813	9067
		Darton	11086	9923	5713	8907
		P9911	11504	11043	6073	9540
	N90P40K40 + Greenstart (N4P10Mg0.5S1.25Zn0.5)	Mas40F	13401	11973	6533	10636
		Darton	12922	12793	6017	10577
		P9911	13638	12070	6337	10682
Average on plough			**11046**	**10686**	**5394**	**9042**
Tiger	$N_0P_0K_0$	Mas40F	9166	9537	4000	7568
		Darton	8560	9997	4083	7547
		P9911	9047	9993	4053	7698
	N90P40K40	Mas40F	13236	12070	5057	10121
		Darton	13259	11967	5147	10124

		P9911	12854	11550	5077	9827
	N90P40K40 + Greenstart (N4P10Mg0.5S1.25Zn0.5)	Mas40F	13208	13208	5923	10780
		Darton	12717	12717	5647	10360
		P9911	13102	13102	5923	10709
Average on tiger			**11719**	**11189**	**4744**	**9217**
Disc	$N_0P_0K_0$	Mas40F	7739	7493	3317	6183
		Darton	7495	7433	3670	6199
		P9911	7973	6890	3360	6074
	N90P40K40	Mas40F	11048	8237	3927	7737
		Darton	11329	7980	4073	7794
		P9911	11284	8320	4097	7900
	N90P40K40 + Greenstart (N4P10Mg0.5S1.25Zn0.5)	Mas40F	9578	9223	4343	7715
		Darton	10191	9047	4480	7906
		P9911	10178	9320	4427	7975
Average on disc			**9646**	**8216**	**3966**	**7276**
Average per experimental years			**10804**	**10030**	**4701**	

In order to highlight the role of precipitation in crop formation, the precipitation recovery coefficient was determined (yield kg /precipitation mm), relating the yield obtained to the amount of precipitation during the vegetation period of maize.

The technological elements can influence the way water from precipitations is recovered, and in order to determine the influence of the studied experimental factors (tillage, fertilization formula and hybrid) the precipitation recovery coefficients were calculated according to each factor.

In recent years there are growing problems regarding drought, so it is necessary to conserve water from the soil, and the choice of equipment and technology has the most important role (Rusu et al., 2014). Limiting the effects of drought can also be achieved through agro-phytotechnical measures for the accumulation, conservation and efficient recovery of rainwater.

By analysing Table 3, it can be observed that in 2017 the highest precipitation recovery coefficient is registered in case of the ploughing tillage system (Control). When working with the tiger and the disc, the difference from the control is negative in both cases, which leads us to the conclusion that in years with moderate rainfall, water is best used by plants when the soil is ploughed.

Table 3. Precipitation recovery coefficient according to tillage
Osmancea, Constanța 2017-2019

Tillage system	Precipitation recovery coefficient kg / mm			%			Dif. ± Control kg / mm			Significance		
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Ploughing	56.8	31.7	26.6	100			Control					
Tiger	48.7	34.3	24.6	85.7	108.2	92.5	-8.1	2.6	-2	000	*	-
Disc	40.2	24.4	19.6	70.8	77.0	73.7	-16.6	-7.3	-7	000	00	00
DL 5%							2.0	3.4	2.9			
DL 1%							3.4	5.6	4.9			
DL 0.1							6.3	10.4	9.2			

In 2018, a rainy year (+100 mm as compared to the multiannual average), the rainwater was best used for the tillage performed with the tiger, this one being significant.

2019 is characterized by a water deficit of 34 mm as compared to the multiannual average, the rainfall being very unevenly distributed as compared to the maize moisture requirements (0 mm in August and only 10 mm in September). Under these conditions, the highest precipitation recovery coefficient is recorded in case of the ploughed tillage (Control), due to the capacity of the plants to use the water reserve accumulated in the deeper layers of the soil (Table 3).

Soil fertilization presents an effective measure to minimize the consequences of pedological droughts by using moisture reserves by 20-25% more efficiently. This is because by ensuring a balanced fertilization ratio, with macroelements the efficiency of water recovery saving water /product unit increases (Săndoiu, 2012).

The precipitation recovery coefficients were influenced by the fertilization formula, 2017 being very statistically significant for the formula N90P40K40 and Greenstart (N4P10Mg0.5S1.25Zn0.5) for N90P40K40 (Table 4). The positive effect of the fertilization formula N90P40K40 + Greenstart (N4P10Mg0.5S1.25Zn0.5) is observed in 2018 when the application of Greenstart (N4P10Mg0.5S1.25Zn0.5) resulted in an increase in the precipitation recovery coefficient from significant to very significant statistically. In 2019, both fertilization formulas brought a distinctly significant increase in the precipitation recovery coefficient (table 4).

The application of fertilization formulas determines an optimal growth and development of plants, with a capacity to use on water from precipitation. The maize hybrids studied did not differ in terms of the manner of water recovery from precipitations in 2017 and 2018. In 2019, the hybrid P9911 registers a statistically significant recovery coefficient as compared to the control (average of tested hybrids), and Mas40F hybrid the lowest coefficient of water recovery from precipitations which indicates a sensitivity of the hybrid to drought (Table 5).

Table 4. Precipitation recovery coefficient according to the fertilization formula, Osmancea, Constanța 2017-2019

Fertilization formula	Precipitation recovery coefficient kg / mm			%			Dif. ± Control kg / mm			Significance		
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
$N_0P_0K_0$	35.5	26.1	18.9	100			Control					
N90P40K40	49.0	30.2	24.7	138.0	115.7	130.7	13.5	4.1	5.8	***	*	**
N90P40K40 + G *	50.4	34.1	27.2	142.0	130.7	143.9	14.9	8	8.3	***	***	**
DL 5%							2.6	2.5	3.2			
DL 1%							4.4	4.2	5.3			
DL 0.1							8.2	7.8	9.9			

* Greenstart (N4P10Mg0.5S1.25Zn0.5)

Table 5. Precipitation recovery coefficient according to tested hybrids, Osmancea, Constanța 2017-2019

Hybrid	Precipitation recovery coefficient kg / mm			%			Dif. ± Control kg / mm			Significance		
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Mas40F	44.9	30.2	18.9	99.8	100.1	80.3	-0.1	0.03	-4.7			
Darton	44.4	30.1	24.7	98.6	99.8	104.5	-0.6	-0.06	1.1			
P9911	45.7	30.2	27.2	101.6	100.1	115.3	0.7	0.03	3.6			*
Average (MT)	44.9	30.1	23.6	100			Control			-	-	-
DL 5%							8.8	1.6	3.1			
DL 1%							14.6	2.6	5.1			
DL 0.1							27.4	4.8	9.6			

CONCLUSIONS

The growth stages of maize are largely influenced by the climatic conditions of the study years while the influences due to the tillage method, the fertilization formula and the hybrid do not show significant differences.

The influence of climatic conditions is also reflected in the level of production.

On average, the highest yields on tillage are obtained for the one performed with tiger in 2017 and 2018 (11719 kg/ha and 11189 kg/ha, respectively).

The lowest yields were obtained in 2019. In the conditions of extreme drought of 2019, the yields obtained for the tested maize hybrids were higher in case of ploughed tillage (5394 kg/ha).

In the three experimental years, the highest yields of tested maize hybrids were obtained with the fertilization formula N90P40K40 + Greenstart (N4P10Mg0.5S1.25Zn0.5) regardless of the tillage system. Of the hybrids tested in the 3 experimental years, the P9911 hybrid is the most productive.

Rainwater is used differently by maize plants depending on the technology used. In years with lower rainfall, the plants make the best use of water when sown by ploughing, and in rainy years when sown with the tiger. Regardless of the amount of rainfall the precipitation recovery coefficient is higher when the plants receive additional fertilization.

Under normal water supply conditions, the differences between the precipitation recovery coefficients depending on the hybrid are not statistically assured, but in 2019, a year with accentuated water deficit, the P9911 hybrid stands out, which obtains a statistically significant difference as compared to the tested hybrid average.

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