

# Research on the Behavior of Some Maize Hybrids (*Zea Mays*) under the Influence of Technological Links at Fundulea, Călărași Country

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## ABSTRACT

The main aim of this research theme is to determine the best maize hybrids (*Zea mays* L. convar. *Dentiformis*) suitable for the southern area of Romania, that in terms of applying the most appropriate technological links to determine the achievement of high and stable harvests. Plant cultivation has been achieved in optimal technology, specific to the site culture in not irrigated variant, the studied genotypes consisting in two Romanian hybrids: Partizan and Opal. The experiment was located on a uniform land considering the fertility and landscape, on a chernozem soil, in an experimental field belonging to NARDI Fundulea. The experimental results were statistically processed using the method of variance analysis. Conclusions consist of analysis of variance on the influence of soil tillage, fertilization and use of hybrid in maize harvest in terms of the climate in 2012.

**Keywords:** harvest, technological links, *Zea mays*.

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## INTRODUCTION

Plant of maize (*Zea mays*) is the most surprising system nature has for energy storage. From a seed weighs about one third of a gram, rise and develop in about 10 weeks a plant 2 meters high, and after only eight weeks it will produce 600-1000 grains. Due to the chemical composition of all its parts, maize is of great agricultural significance, being basic forage in feed and a valuable raw material for human nutrition.

Succeeding maize crops implemented in obtaining reliable quantitative and qualitative harvests is dependent on ensuring and compliance with all technological links (Bîlteanu, 1989). The main technological parameters are:

- location of culture;
- fertilizer application;
- irrigation;
- soil tillage;

- seed and sowing (planted hybrid, optimum density, sowing period);
- maintenance of cultures (control of weeds, pests and diseases).

The experiments were mainly aimed the behavior research on maize hybrids under the influence of various technological sequences, in the soil and climate conditions from southern Romania. To determine the optimal technology of maize cultivation was investigated how it reacts to different tillage methods, on different fertilization agro funds, different hybrids, as well as these factors interaction.

It has also been pursued how the maize crop behaves from the point of view of quality and efficiency index.

## MATERIALS AND METHODS

Observations and determinations were performed in the experimental field of agricultural

technology from NARDI Fundulea, Călărași County, in not irrigated system. Given the importance of maize and local climatic conditions, has been organized a group for the study the experimental maize crop productivity and quality in natural conditions. The experiment was located on a uniform land in terms of fertility and landscape, on a chernozem soil.

The total area of experience was of 7,056 m<sup>2</sup>, the surface of a parcel experiment was 168m<sup>2</sup>, and the harvested area was 112 m<sup>2</sup>. Influencing factors and variations of these factors were the following:

A. soil ground tillage

- A1 – autumn plowing;
- A2 – spring plowing;
- A3 – disking.

B. nitrogen and phosphorus fertilization

- B1 – N0P0;
- B2 – N120P70.

C. studied hybrid

- C1 – Partizan;
- C2 – Opal.

The experimental module was three factorial, placed according to subdivided parcels method in three repetitions 3 x 3 x 2.

The experimental results obtained were statistically processed using the variance analysis method.

The location of culture was done within 4-year crop rotations, ensuring in this way a significant reduction of harmful pathogens and weed infestation hardly controlled (Sin *et al.*, 1975).

For that purpose they have been organized plots sized to provide the efficient use of mechanization and the diversification of rotation with higher possibilities to adapt to any changes in cropping patterns.

In crop rotation, maize followed wheat crop.

In the experience it has been used biological material consisting of Romanian maize hybrids, both made at NARDI Fundulea. These hybrids meet the culture area and new technologies, being well known the use of genotypes without an accurate technology cannot provide production and quality performance, and without a valuable genotype best part is lost in the effectiveness of new technologies implementation. Romanian hybrids under analysis were Partizan and Opal, having the following features:

» Partizan. Simple hybrid, semi-erected leaves, red rachis, yellow grains, a middle vegetation period, approved and registered in 1998.

Zoning: is suitable for cultivation in the plains of the south and west of the country, in plateau or hilly areas surrounding them.

Vegetation period: from sowing to maturity is 130 days, falling within FAO 470 – 480 maturity group.

Description: The plant is robust, relatively high with an average height of 245 cm and 101 cm from maize cob insertion from the ground surface.

Cob is well developed with 18 cm length, 4.3 cm in diameter in the middle, 14 to 16 rows of grains, an average weight of 188 grams and a grains yield of 84%. Grains are dentate, 1000 Grain Weight of 280 g and average protein content on 10,36% , starch 71,97 %, and 4,32 % fat, good for the fast drying (\*Varieties/hybrids Official catalog of Romania, 2010).

Physiological characteristics: Good resistance to drought, heat and grains shriveled, and to the fall and breaking of stems.

Specific agronomic requirements: optimal plant density is 50,000 plants/ha not irrigated and 70.000 plants/ha irrigated.

Economic efficiency: in normal culture conditions, the production of non-irrigated gave 7,200-10,350 kg/ha, and the irrigated 11,100-15,100 kg/ha, 3 years average harvest. The highest harvests were of 11,500 kg/ha not irrigated and 16,840 kg/ha irrigated.

» Opal. Simple hybrid, semi early, yellow-orange grains and smooth teem, homologated in 1994.

Zoning: is suitable for cultivation in the plains and plateau in the south and west and hilly areas south of the country.

Vegetation period: from sowing to maturity the period is 131 days, falling within FAO 420 – 430 maturity group.

Description: The plant is vigorous, relatively short, semi-erected leaves, red rachis, with an average height of 255 cm and 106 cm from maize cob insertion from the ground surface. Cob is large, cylindrical, with an average length of 20.5 cm, thickness of 4.2 cm, weight of 240 g, 14-16 layers of grains and grain yield of 84%. Grains are dentate, 1000 Grain Weight of 336 g and average protein content on 12.0%, starch 71.90 %, and

4.32 % fat, good for the fast drying (Sarca *et al.*, 1995).

Physiological characteristics: it has good resistance to drought, heat, stems falling and breaking at maturity, as well as against the attack of European Maize Borer (*Ostrinia nubilalis*).

Specific agronomic requirements: optimal density not irrigated is 50,000 plants/ha and 70,000 plants/ha for irrigation.

Economic efficiency: in normal culture conditions, not irrigated average grain harvest is of 10,000 kg/ha (plain area) and irrespectively 8,500 kg/ha (hilly area), and irrigated of 15,000 kg/ha.

## RESULTS AND DISCUSSION

Processing of primary data was performed in 2012, by weighing each variant harvest. It

consisted in the removal of studied repetitions, realizing the average per variant, then loss and impurities reduction and reporting at surface unit.

Concomitantly researching the influence of several factors on production experiences poly factorial allow to study both the influence of each factor separately, and their combined effect application (Gologan *et al.*, 1981).

So, the analysis of variance in the experience of the influence of soil tillage, fertilization and the maize hybrid harvest is shown in Table 1, from which can be seen both the significant differences for each of the three factors and the interaction between them, respectively tillage x hybrid, fertilization x hybrid and tillage x fertilizer x hybrid.

**Tab. 1.** Variance analysis at the poly factorial experience of 3x2x2 type on the influence of tillage, fertilization, and hybrid over the maize harvest

Variant	SP	GL	S <sup>2</sup>	F <sub>c</sub>	Ft		Signification
					5%	1%	
A	935.2	2	467.60	25195.0	6.94	18.00	**
E <sub>A</sub>	0.07	4	0.02				
B	1331.0	1	1331.0	*****	5.99	13.74	**
A x B	115.2	2	57.60	5892.1	5.14	10.92	**
E <sub>B</sub>	0.06	6	0.01				
C	69.7	1	69.70	6565.2	4.75	9.33	**
A x C	15.7	2	7.86	740.1	3.88	6.93	**
B x C	0.30	1	0.30	28.4	4.75	9.33	**
AxBxC	2.04	2	1.02	96.2	3.88	6.93	**
E <sub>c</sub>	0.13	12	0.01				

**Tab. 2.** Analysis of soil tillage influence on maize harvest (kg/ha)

Variant	Harvest	%	Difference	Signification
A <sub>1</sub> - Autumn plowing	4534	100		
A <sub>2</sub> - Spring plowing	3982	88	-553	ooo
A <sub>3</sub> - disking	3288	73	-1250	ooo
	DL5%=150	DL1%=260	DL0.1%=480	

**Tab. 3.** Analysis of fertilization influence on maize harvest (kg/ha)

Variant	Harvest	%	Difference	Signification
b <sub>1</sub> - not fertilized	3,327	100	Control	-
b <sub>2</sub> -N <sub>120</sub> P <sub>70</sub>	4,543	136	1,216	***
	DL5%=80	DL1%=120	DL0.1%=200	

Influence of soil tillage on maize harvest under the agricultural year 2012 can be found in Table 2.

Influence of fertilization on maize harvest in terms of 2012 is found in Table 3.

The application dose of  $N_{120}P_{70}$  fertilization in maize, it leads to a harvest of 4,543 kg/ha comparing to the not fertilized control variant where it was obtained a harvest of 3,327 kg/ha. Nitrogen and phosphorus fertilizer application resulted in obtaining a production increase of 1,216 kg/ha, considered as very significant.

## CONCLUSION

From analyzing the data collected and presented in the climatic conditions of 2012, highest production of 4,534 kg/ha was obtained from version where has been used as basic ground work the autumn plowing.

Replacing this variant with spring plowing has reduced production by 553 kg/ha, the difference

being highly significant. Also, the disking applied as a technologic link instead of autumn plowing caused a harvest decrease of 1,246 kg/ha, difference being considered very significant.

A summary of results concerning the influence of soil tillage over maize harvest depending on fertilizing and used hybrid, is shown in tables 4 and 5.

Comparing averages factor A graduations (soil tillage), not fertilized or fertilized, this being studied in the case of two hybrids (Partizan and Opal), results that the highest harvests are obtained in autumn plowing, fertilized (5,330 kg/ha, irrespectively 5,157 kg/ha).

By using the technological link of spring plowing and fertilization with  $N_{120}P_{70}$ , in condition of 2012, average harvests obtained were lower than those of autumn plowing.

From the data submitted we observe a decrease in harvest in both hybrids (Partizan and

**Tab. 4.** Analysis of soil tillage on maize production depending on fertilizer and hybrid (kg/ha)

Variant	$b_1$ - not fertilized				$b_2 - N_{120}P_{70}$ kg a.s./ha			
	Harvest kg/ha	Diff.	%	Signification	Harvest kg/ha	Diff.	%	Signification
$C_1$ - Partizan								
$A_1$ - Autmnploving	3,830	Control	100		5,330	Mt	100	
$A_2$ - Spring plowing	3,410	-420	89	oo	4,933	-396	92	oo
$A_3$ - disking	3,130	-700	81	ooo	3,810	-1,520	71	ooo
$C_2$ - Opal								
$A_1$ - Autmnploving	3,820	Mt	100		5,157	Mt	100	
$A_2$ - Spring plowing	3,037	-783	79	ooo	4,547	-610	88	ooo
$A_3$ - disking	2,733	-1086	71	ooo	3,480	-1,676	67	ooo
DL 5%=220				DL 1%=340	DL 0.1%=570			

**Tab. 5.** Average harvests obtaines (kg/ha)

Variant		$C_1$ - Partizan	$C_2$ - Opal	Harvest
$A_1$ - Autmnploving	$B_1$ - not fertilized	3,830	3,820	3,825
$A_2$ - Spring plowing	$B_2 - N_{120}P_{70}$	5,330	5,157	5,243
$A_3$ - disking	$B_1$ - not fertilized	3,410	3,037	3,223
$A_1$ - Autumnplowing	$B_2 - N_{120}P_{70}$	4,933	4,547	4,740
$A_2$ - Spring plowing	$B_1$ - not fertilized	3,130	2,733	2,931
	$B_2 - N_{120}P_{70}$	3,810	3,480	3,645
Harvest (average)		4,073	3,795	3,934

**Tab. 6.** Comparisons between the experimental factors under analysis variations

Interaction of the experimental factors	D.L. values		
	5%	1%	0.1%
Comparisons between the variations of factor A	150	250	480
Comparisons between the variations of factor B	80	120	200
Comparisons between the variations of factor C	70	110	150
Comparisons between the variations of factor A at the same variant of factor B	180	300	530
Comparisons between the variations of factor A at the same variant of factor B	110	160	240
Comparisons between the variations of factor A at the same variant of factor C	180	280	490
Comparisons between the variations of factor A at the same variant of factors B and C	220	340	570

Opal) in the variants of spring plowing and disking, by comparison with the control (autumn plowing) with statistical provided values as distinct and very significant ranging from 420 to 1370 kg/ha (Tab. 5, Tab. 6).

Noteworthy is the experimental version concernig the ground soil tillage (disking), recording the highest loss of production compared to the control, ranging from 1530 to 1660 kg/ha. Concerning the hybrids output concerning the interaction of the studied factors, we can see a similar behavior of both hybrids, the harvests being comparable.

In conclusion, given a relatively droughty year, due to uneven distribution of rainfall associated with high temperatures, maize culture technology in relation to the studied variations consists of seedbed preparation after autumn plowing as basic work, crop fertilizing with  $N_{120}P_{70}$  and use of the Partizan hybrid.

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