HYBRID X MINERAL FERTILIZATION LEVEL INTERACTION ON SWEET CORN PRODUCTION

Claudia Ramona AVRAM,Florinel IMBREA
Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from TimisoaraFaculty of Agriculture, 300645, Aradului Street 119, Timisoara
**Corresponding author's e-mail: florin_imbrea@usab-tm.ro*

Abstract.

The study presents the results of sweet corn production4 autochthonous hybrids (Estival, Dulcin, Prima and Deliciul Verii), depending on their interaction with the level of mineral fertilization and the specific climatic conditions of the researched area.The research was carried out on the territory of Ramna commune, located in the north-west part of Caraș Severin county,on a eutric-gleic alluvial type soil, moderately glaciated, extremely deep, medium loam/coarse sandy loam, developed on medium (clay) non-carbonate fluvial deposits.The obtained results show that the production of sweet corn has an upward trend from the Estival hybrid to the Dulcin hybrid, a downward trend from the Dulcin hybrid to the Prima hybrid and an upward trend again from the Prima hybrid to the Deliciul Verii hybrid. The production values of sweet corn varied between 14340 kg/ha and 15740 kg/ha. The lowest production of sweet corn was obtained at a1[Estival], and the highest at a2[Dulcin]. The differences between the hybrids are highly significant [p<0.001].

Depending on fertilization, the production of sweet corn has an upward trend depending on the level of fertilization. The values vary between 14074 kg/ha and 16290 kg/ha. The differences between fertilization levels are highly significant [p<0.001]. Sweet corn production increases with the level of fertilization. The highest production values are obtained on the N160P90K90 agrofund, and the lowest on the N120P90K90 agrofund, regardless of the tested hybrid. If we compare the hybrids, we can see that the highest production is obtained in hybrid 2[Dulcin], and the lowest production in hybrid 1[Estival], regardless of the level of fertilization.

Keywords*:sweet corn, production, climatic conditions, mineral fertilization*

INTRODUCTION

Sweet corn (Zea mays L. Saccharata Sturt) is an important food grain and the second largest processing crop, second only to tomatoes. It is consumed in the form of fresh, frozen or canned corn on the cob, also representing an important source of minerals, vitamins and proteins. (Lykhovyd, PV 2020) In addition to food use, sweet corn plants are also usable as animal feed and raw materials for the animal feed industry (Tangendjaja and Wina, 2011).

In the last decade we have seen an increase in consumer demand for fresh sweet corn between June and September, especially in the United States, where the vast majority of the world's acreage is grown, but also among consumers in Europe and Asia. Sweet corn has also become an important large-scale cash crop for export to Europe and other major world markets in temperate zones. (WALKER,, Smuleac et al. 2020)

The production of sweet corn for the fresh market can be a profitable option for growers with small acreage, provided they can secure a good market and use their own labor. (Imbrea, 2014).

MATERIALS AND METHODS

The biological material used in the study of the influence of mineral fertilization in relation to the pedoclimatic conditions in the researched area and the average of the field, was represented by 4 autochthonous sweet corn hybrids (Estival, Dulcin, Prima and Deliciul Verii) and included in the Catalog of cultivated plant varieties.

The experiment was of bifactorial type, laid out according to the method of randomized blocks, with the following grading of the experimental factors:

- Factor A, the cultivated hybrid, with 4 grades:
  - a1 - Summer;
  - a2- Dulcin;
  - a3 – First;
  - a4 - Delight of Summer.
- Factor B, the level of mineral fertilization, with three gradations:
  - b1 – N120P90K90;
  - b2 – N140P90K90;
  - b3 – N160P90K90.

From each hybrid, 6 rows were sown, over a length of 20 linear m/repetition, the number of repetitions being 3. To calculate the production of cobs depending on the level of mineral fertilization and climatic conditions, the cobs were harvested from the length of 10 linear m /repetition/experimental year from rows 3 and 4, removing cobs from the first two plants at the beginning of each repetition.

The technology applied for the experience with testing the response to the level of mineral fertilization was established with autumn wheat as the predecessor plant, the land preparation works consisted of plowing at 28 cm, immediately after harvesting the predecessor plant, and in the spring before the preparation of the germinal bed s - they applied complex fertilizers of the 15:15:15 type. The difference in nitrogen until the achievement of the three fertilization reports was achieved by applying urea, together with the mechanical grid.

Sowing was carried out in the last decade of April, at a density of 55,000 bg/m2. Weed control was carried out by pre-emergent weeding with Stomp Aqua, in a dose of 3 l/ha.

To combat the cob worm (Ostrinia nubilalis) a treatment was carried out usinga mixture of 1.5 kg/ha Affirm + 100 ml Fastac, applied together. During the experimental period, it was not necessary to carry out treatments against diseases.

RESULTS AND DISCUSSIONS

The results of sweet corn cob production according to the climatic conditions of the experimental year 2021 are presented in table 1 and figures 1 and 2.

Comparing the production of the experienced hybrids, it is observed that compared to the control production (the average of the experience15104.86 kg/ha), only the Estival hybrid achieved a lower production, respectively 14257 kg/ha, the difference of 851 kg/ha, being statistically assured as very significant in the negative sense. The same situation was obtained with the Prima hybrid, the difference compared to the witness of the experience of77.48 kg/ha, being statistically assured as very significant in the negative sense.

The highest productions of cobs were obtained with the Dulcin and Deliciu Verii hybrids, the production increases of 553 kg/ha, respectively 376.70 kg/ha above the field average, i.e. they exceeded the experience average by 3.6%, respectively 2.5%, being ensured statistically as very significant.

Sweet corn production has an upward trend from the Estival hybrid to the Dulcin hybrid, a downward trend from the Dulcin hybrid to the Prima hybrid and an upward trend again from the Prima hybrid to the Deliciul Verii hybrid. The production values of sweet corn varied between 14340 kg/ha and 15740 kg/ha. The lowest production of sweet corn was obtained at a1[Estival], and the highest at a2[Dulcin]. The differences between the hybrids are highly significant [$p<0.001$].

Table 1

Sugar maize yield for each factor and interaction [mean and standard error, range ±95%]

Experimental factors	Factor levels	**Production kg/ha**	Std.Err.	-95.00%	+95.00%
AFactor [hybrid]	a1 – Summer.	14340.16	351.1995	13530.29	15150.02
	a2 – Sweet.	15744.74	316.7806	15014.25	16475.24
	a3 – First	15113.00	301.1906	14418.45	15807.55
	a4 – Summer Delight	15568.26	310.4965	14852.25	16284.27
BFactor [Fertilization level]	b1 – N120P90K90	14074.46	175.0278	13689.22	14459.69
	b2 – N140P90K90	15210.33	171.2655	14833.38	15587.28
	b3 – N160P90K90	16289.83	146.1684	15968.12	16611.55
AxB interaction					
A Factor B Factor					
a1 – Summer	b1 – N120P90K90	13138.40	13.84839	13078.82	13197.99
	b2 – N140P90K90	14311.29	7.05331	14280.94	14341.63
	b3 – N160P90K90	15570.78	10.90135	15523.87	15617.68
a2 – Sweet	b1 – N120P90K90	14632.00	9.00160	14593.27	14670.73
	b2 – N140P90K90	15776.52	11.17787	15728.43	15824.62
	b3 – N160P90K90	16825.71	12.10705	16773.62	16877.80
a3 – First	b1 – N120P90K90	14053.30	6.77902	14024.13	14082.47
	b2 – N140P90K90	15147.03	14.24737	15085.73	15208.33
	b3 – N160P90K90	16138.67	16.80506	16066.36	16210.98
a4 – Delight of the summer	b1 – N120P90K90	14474.13	5.45117	14450.67	14497.58
	b2 – N140P90K90	15606.48	5.23479	15583.96	15629.00
	b3 – N160P90K90	16624.18	8.13531	16589.17	16659.18

.Depending on the fertilization level, the production of sweet corn cobs in the second year of experimentation varied between 13995 kg/ha in the Estival hybrid and 16194 in the Deliciul Verii hybrid.

The differences and the statistical assurance compared to the control – the average of the experience, at the 3 levels of fertilization, were presented as follows:

- significantly, at b2 [N140P90K90], the difference is 18.80 kg/ha;
- very significant at b3[N160P90K90] and b1[N120P90K90], it should be noted that at b1[N120P90K90], a lower production was obtained than the average of the experience, the difference is -1117 kg/ha, being statistically ensured in a negative sense
- the production obtained at b3[N160P90K90], exceeds the experience average by 1098.3 kg/ha, or in other words, it exceeded the experience average with a 7.2% increase, very significant.

The production results for the interaction of the experimental factors hybrid x level of mineral fertilization are presented as follows:

- at a1 [Estival] statistically guaranteed differences were obtained as follows: very significant at all 3 levels of fertilization, but at b1[N120P90K90] and b2[N140P90K90], the production of sweet corn is below the average of the experience;
- at a2 [Dulcin], increases were obtained at all 3 levels of fertilization, very significant differences, it should be noted that at b1[N120P90K90], the production is below the average of the experience;

- at a3 [Prima] statistically guaranteed differences were obtained as follows: very significant at b1[N120P90K90], respectively b3[N160P90K90], and at b2[N140P90K90] a significant difference. It should be noted that at b1[N120P90K90] and b2[N140P90K90] the productions are below the experience average.
- at a4 [Deliciu Verii] statistically guaranteed differences were obtained as follows: very significant at all 3 levels of fertilization, but at b1[N120P90K90], the production of sweet corn is below the average of the experience.

The production of sweet corn has an upward trend depending on the level of fertilization. The values vary between 14074 kg/ha and 16290 kg/ha. The differences between fertilization levels are highly significant [p<0.001].

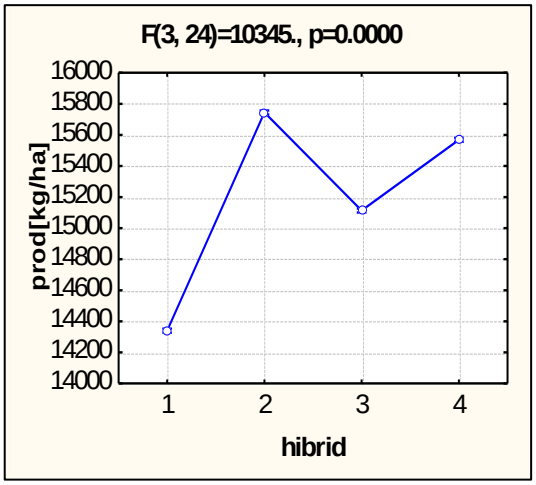


Figure 1 Variation in sweet corn yield by hybrid

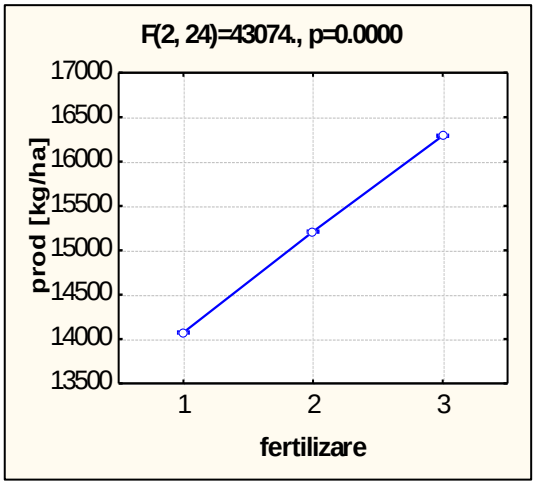
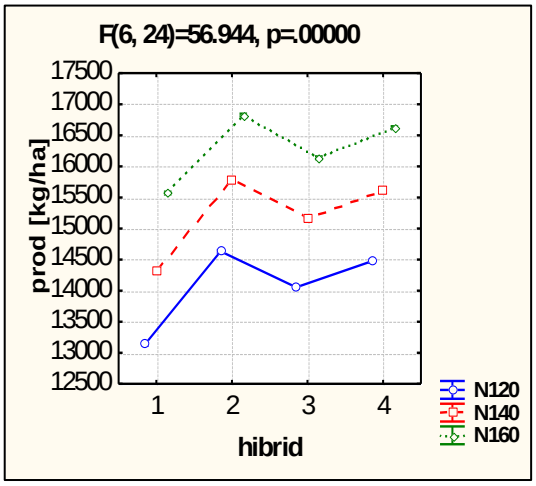


Figure 1 Variation of sweet corn production according to fertilization level



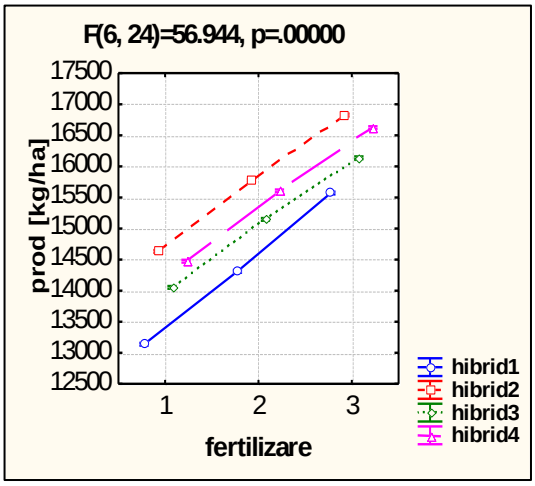


Figure 3 Variation of sweet corn yield as a function of AxB interaction

DUNCAN's test for each factor and the interaction

hybrid x level of mineral fertilization (AxB) in 2021

DUNCAN'S TEST for α5% - factor A DL 5% =17.99

Original data	Sister data
a1 1 = 14340. D	a2 2 = 15740. A
a2 2 = 15740. A	a4 4 = 15570. B
a3 3 = 15110. C	a3 3 = 15110. C
a4 4 = 15570. B	a1 1 = 14340. D

Following the 6 comparisons [C42], classes A – D were obtained. It should be noted that any of the 4 hybrids differs significantly from the other three hybrids [they belong to different homogeneity classes].

The highest production of sweet corn – 15740 kg/ha, was obtained at a2[Dulcin] – class A, which differs significantly from the other hybrids.

The lowest value 14340 kg/ha, was obtained at a1[Estival] – class D, it differs significantly from the other hybrids.

DUNCAN'S TEST for α5% - factor B DL 5% =16.45 kg

Original data	Sister data
b1 1 = 14070. C	b3 3 = 16290. A
b2 2 = 15210. B	b2 2 = 15210. B
b3 3 = 16290. A	b1 1 = 14070. C

Following the 3 comparisons [C32], classes A - C were obtained. It should be noted that any of the 3 levels of fertilization differs significantly from the other two [they are part of different homogeneity classes].

The highest production of 16290 kg/ha was obtained at b3[N160P90K90] – class A, which differs significantly from the other two fertilization levels.

The lowest value 14070 kg/ha, was obtained at b1[N120P90K90] – class C, it differs significantly from b3[N160P90K90] and b2[N140P90K90].

DUNCAN'S TEST for α5% - INTERACTION AxB DL 5% =32.32 kg

Original data	Sister data
Mean 1 = 13140. L	Mean 6 = 16830. A
Mean 2 = 14310. J	Mean 12 = 16620. B
Mean 3 = 15570. F	Mean 9 = 16140. C
Mean 4 = 14630. H	Mean 5 = 15780. D
Mean 5 = 15780. D	Mean 11 = 15610. E
Mean 6 = 16830. A	Mean 3 = 15570. F
Mean 7 = 14050. K	Mean 8 = 15150. G
Mean 8 = 15150. G	Mean 4 = 14630. H
Mean 9 = 16140. C	Mean 10 = 14470. I
Mean 10 = 14470. I	Mean 2 = 14310. J
Mean 11 = 15610. E	Mean 7 = 14050. K
Mean 12 = 16620. B	Mean 1 = 13140. L

Mean 1 – a1b1
Mean 2 – a1b2
Mean 3 – a1b3
Mean 4 – a2b1
Mean 5 – a2b2
Mean 6 – a2b3
Mean 7 – a3b1
Mean 8 – a3b2
Mean 9 – a3b3
Mean 10 – a4b1
Mean 11 – a4b2
Mean 12 – a4b3

Following the 66 comparisons [C122], classes A – L were obtained. It should be noted that any of the 12 combinations [AxB] differs significantly from all other combinations [they are part of different homogeneity classes].

The highest sweet corn production of 16830 kg/ha was obtained at a2b3 [hybrid 2, fertilization level 3, i.e. at the Dulcin hybrid, fertilization level N160P90K90] – class A, values that differ significantly from the other combinations.

The lowest corn production 13140 kg/ha was obtained at a1b1[Estival on N120P90K90 agricultural land] – class L, it differs significantly from all other combinations.

CONCLUSIONS

Sweet corn production increases with the level of fertilization. The highest production values are obtained on the N160P90K90 agrofund, and the lowest on the N120P90K90 agrofund, regardless of the tested hybrid.

If we compare the hybrids, we can see that the highest production is obtained in hybrid 2[Dulcin], and the lowest production in hybrid 1[Estival], regardless of the level of fertilization.

BIBLIOGRAPHY

AXINTE M., ROMAN GH.V., BORCEAN I., MUNTEAN LS, 2006., Phytotechnology, "Ion Ionescu de la Brad" Publishing House, Iasi,

BÎLTEANU GH., 1998, Fitotehnie, vol I - Cereals and legumes for grains, Second Edition. Ceres Publishing House, Bucharest,

DAVID GH., PÎRSAN P., IMBREA FL., 2006, Technology of field plants. Cereals, legumes for grains and technical plants. Eurobit Timisoara Publishing House

IMBREAF., 2013 - Integrated technologies, Ed. Eurobit, Timisoara.

ION V.,2007, Phytotechnology, Publishing House "Agro-Silvică" Bucharest

NK FORGERY. 2016, The use of nutrients in crop plants. CRC press;. Apr 19. Jan T, Jan MT

FLORIN, I., 2011 - Optimizing current grain production systems in Banat and Western Plains, the subject of a public-private interdisciplinary research partnership at USAMVB Timișoara. Agrobulletin Agir Year III.

FLORIN, I., 2011 - Agricultural research projects in public-private partnership – management and financing challenges. Agrobulletin Agir Year III.

FLORIN, I., 2014 - Integrated technologies, Ed. Eurobit, Timișoara

Lykhovyd, PV 2020, Sweet Corn Yield Simulation Using Normalized Difference Vegetation Index and Leaf Area Index. J. Ecol. Eng. 21, 228–236.

MEHTA, BK; HOSSAIN, F.; MUTHUSAMY, V.; ZUNJARE, RU; SEKHAR, JC; GUPTA, HS 2017, Analyzing the role of sowing and harvest time as factors for selecting super sweet (^sh2sh2) corn hybrids. Indian J. Genet. Plant Breed.

ȘMULEAC, L., RUJESCU, C., ȘMULEAC, A., IMBREA, F., RADULOV, I., MANEA, D., PAȘCALĂU, R. (2020), Impact Of Climate Change In The Banat Plain, Western Romania, On The Accessibility Of Water For Crop Production In Agriculture. Agriculture, 10(10), 437

ȘMULEAC L, SILVICA ONCIA, ANIȘOARA IENCIU, R BERTICI, A ȘMULEAC, V MIHĂIESC, 2014, Influence of anthropic activities on ground water in Boldur, Timis County, Romania, Research Journal of Agricultural Science, Vol 46 (2)

TANGENDJAJA, B. ; WINA, E., 2011. Feeding value of low and high protein dried distillers grains and corn GLUTEN MEAL FOR LAYER. MEDIA PETERNAKAN, 34

WALKER, S. Home and market garden sweet corn production (Revised paper, Original author: George W. Dickerson, former Extension Horticulture Specialist). Cooperative Extension Service College of Agricultural, Consumer and Environmental Sciences, New Mexico State University. <http://aces.nmsu.edu/pubs/_h/h-223.