THE STUDY OF THE BEHAVIOR OF SOME CORN HYBRIDS FOR THE OPTIMIZATION OF THE CULTIVARS STRUCTURE UNDER IRRIGATION CONDITIONS IN IASI COUNTY

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Abstract

Commercial corn hybrids have a very high yield potential, with valuable features of adaptation to more or less favorable growing conditions. In the particular conditions of technology applied in a certain farm and in particular climatic conditions of the crop year, the production and the efficiency can approach more or less the yield potential of these hybrids, through their comparative testing being able to obtain information to determine the best assortment. Evaluation of the results obtained following the testing of three semi-early corn hybrids, from three different companies, at SC Semtop Group in Iași county, at sowing plots of 80,000 and 70,000 germinable grains/m^2, respectively, and under conditions of optimal assurance of the necessary irrigation water allowed to highlight the hybrids that behave best in the respective conditions.

Key words: assortment optimization, commercial hybrids, maize

Through its multiple ways of use, and through its high productivity (Wang J., Hu X., 2021) corn has become an indispensable crop for man. Although from 1960 until now, breeders have succeeded in significantly improving the productive and adaptive potential of maize hybrids (Nanda D., 2020), high and economic yields at the farm level directly depend on the appropriate selection of cultivars in relation to with environmental conditions and the available level of cultivation technology (Butts-Wilmsmeyer C. *et al*, 2019). As at the global level, agricultural crops in Romania are also facing increasingly obvious climate changes, with a negative impact on yield (Haș V. *et al*, 2021). Testing the behavior of cultivars in real on farm conditions can make the choosing the most suitable assortment easier. The results of such tests carried out by Haș V *et al* (2021) at Turda, over a period of four years (2017-2020) highlights the fact that, for certain areas in Romania, including the north-eastern area of the country, semi-early hybrids, selected for lower sensitivity to high temperatures and drought during grain filling will determine their ability to overcome problems due to climate change. Also, the yield per area unit depends to a very high extent on the sowing area and the effective harvesting area (da Silva E.E. *et al*, 2021), a fact for which the most accurate information can beeobtained through direct testing in the individual conditions of the farm.

MATERIAL AND METHOD

The biological material tested was represented by three semi-early maize hybrids, from the FAO 350-390 group, respectively DKC 4943 (Dekalb), Kashmir (KWS) and Rulexx (RAGT), which were sown on a 5-ha plot each, in the last decade of April 2021, for all three the same culture technology was applied, the only difference being the sowing rate. DKC 4943 and Kashmir hybrids were sown at the rate of 80,000 germinating grains/ha, and Rulexx hybrid at 70,000 germinating grains/ha. The previous crop was barley, the autumn fertilization was carried out by applying 200 kg/ha complex fertilizer NPK 16:16:16, the autumn plowing was carried out at a depth of 35 cm, the preparation of the germinal bed was carried out in the third decade of April, with the combiner at a depth of 7-8 cm, after which sowing was carried out simultaneously with the application of 120 kg/ha complex fertilizer NPK 20-20-0+0.20% Zn. For weeds control, pre-emergence herbicide Adengo (0.4 l/ha) and post-emergence herbicide Laudis (2.25 l/ha) were applied, in the latter case a foliar fertilizer was also added (Foliar Extra, 1.5 l/ha). A few weeks after weeding, a mechanical grid was made, together with the applying of 150 kg/ha of ammonium

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nitrate. Irrigation, by aspersion, consisted in the application of three waterings with a rate of 30 l/m^2, after sowing, at the start and at the end of flowering. During the vegetation period and at harvest, determinations were made on ten plants for the evaluation of several parameters. Were determined: the height of the plants; the degree of development of the female inflorescence, the width and length of the cobs, the number of rows of grains per cob and the number of grains per row, as well as the productivity of the tested hybrids, expressed by the average weight of a cob, the weight of grains/cob, grain yield and average production (t/ha). At harvest, the plant density was determined, expressed by the number of plants/ha, compared to the seeding density, to evaluate its influence on the average production of the hybrids.

The obtained data were used to calculate the average values ($\bar{X}$), the amplitude of variation (A) and the coefficients of variability (s%) for each character and each hybrid separately.

RESULTS AND DISCUSSIONS

The average height of the plants (*table 1*) varied very little from one hybrid to another and, although in all three hybrids small values of the coefficient of variability resulted, in the hybrid DKC 4943 it was at least double (9.91 %) compared to the values of the other two hybrids. This aspect resulted as a result of the large amplitude of plant height variation (of 1.00 m) in the mentioned hybrid.

The average cob length (*table 2*) was between 18.99 cm in the Kashmir hybrid and 20.91 cm in the DKC 4943 hybrid, for the latter also resulting in the largest amplitude of variation, of 12.1 cm, as well as the highest coefficient of variability, of 15.84%. The lowest value of the amplitude of variation (2.9 cm) and the coefficient of variability (4.27 %) were recorded in the case of the Kasmir hybrid.

Cob diameter (*table 3*) ranged from 5.11 cm in the DKC 4943 hybrid to 4.58 cm in the Kashmir hybrid, and the highest uniformity was recorded in the Rulexx hybrid. For all three hybrids, the variability of this character was small.

The average number of grain rows per cob (*table 4*) was between 16.2 in the Rulexx hybrid and 17.0 in the Kashmir hybrid, for the latter the smallest amplitude of variation was also determined, of four grain rows, of the other two hybrids, with an amplitude of variation of six grain rows. Character variability was medium till low for all three hybrids.

Regarding the number of grains per row (*table 5*), the Rulexx hybrid recorded the highest value, 40.3 grains, with the other two hybrids being almost identical. The lowest values of the amplitude of variation and the coefficient of variability led to the highlighting of the Kashmir hybrid as the most stable from this point of view.

The highest value of the average weight of a cob (*table 6*), of 180.02 g, was determined in the Rulexx hybrid, compared to the Kashmir hybrid, with the lowest value, of 146.05 g. However, for the last hybrid, the amplitude of variation and the coefficient of variability highlight the highest stability of this character. The three hybrids behave according to a similar pattern also regarding the weight of grains on the cob (*table 7*).

The grain yield, calculated as the ratio between the cob weight and the weight of grains per cob (*table 8*), places the Kashmir hybrid in first position, closely followed by the DKC 4943 hybrid.

The ranking of the three hybrids according to the yield (*table 9*) places the hybrids DKC 4943 (with 11.25 t/ha) and Kashmir (with 10.79 t/ha) on the first two places, in direct correlation with the tenth of high sowing, of 80,000 germinating grains/ha, in third place being the Rulexx hybrid, where the maximum recommended sowing rate was a maximum of 70,000 germinating grains/ha.

Table 1

Variability of plant height

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean ($\bar{x}$)± S.E.(m)	3.055 ± 0.10	2.888 ± 0.04	2.959 ± 0.04	2.97
The amplitude of variation (m)	1.00	0.46	0.39	0.62
The coefficient of variability (s%)	9.91	4.83	3.83	6.19

Table 2

Variability of cob lenght

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean ($\bar{x}$)± S.E.(cm)	20.91 ± 1.05	18.99 ± 0.26	20.90 ± 0.68	20.27
The amplitude of variation (cm)	12.10	2.90	6.40	7.13
The coefficient of variability (s%)	15.84	4.27	10.27	10.12

Table 3

Variability of cob diameter

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean (x̄)± S.E.(cm)	5.11 ± 0.13	4.58 ± 0.11	4.81 ± 0.05	4.83
The amplitude of variation (cm)	1.50	1.10	0.50	1.03
The coefficient of variability (s%)	8.27	7.34	3.46	6.36

Table 4

Variability of the number of rows of grains on the cob

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean (x̄)± S.E.(nr.)	16.80 ± 0.53	17.00 ± 0.54	16.20 ± 0.63	16.67
The amplitude of variation (nr.)	6.00	4.00	6.00	5.33
The coefficient of variability (s%)	10.04	10.00	12.28	10.77

Table 5

Variability of the number of grains per row

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean (x̄)± S.E.(nr.)	37.60 ± 1.74	37.30 ± 0.70	40.30 ± 1.61	38.40
The amplitude of variation (nr.)	16.00	6	17	13.00
The coefficient of variability (s%)	14.63	5.93	12.60	11.06

Table 6

Variability of cobs weight

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean (x̄)± S.E.(g)	161.03 ± 9.71	146.05 ± 3.42	180.02 ± 7.86	162.37
The amplitude of variation (g)	105.78	32.14	73.86	70.59
The coefficient of variability (s%)	19.08	7.41	13.81	13.43

Table 7

Variability of grain weight per cob

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean (x̄)± S.E.(g)	138.20 ± 8.13	125.67 ± 2.68	151.09 ± 6.87	138.32
The amplitude of variation (g)	87.18	23.93	61.5	57.54
The coefficient of variability (s%)	18.61	6.73	14.37	13.24

Table 8

Variability of shelling percentage - (grain weight / ear weight) x 100

Hybrids	DKC 4943	KASHMIR	RULEXX	Mean (control)
Mean (x̄)± S.E.(%)	85.89 ± 0.35	86.09 ± 0.40	83.87 ±0.34	85.28
The amplitude of variation (%)	3.63	3.96	3.4	3.66
The coefficient of variability (s%)	1.28	1.47	1.28	1.34

Table 9

The influence of the hybrid and the sowing thickness on corn yield

Hybrids	Plants per hectare				Yield	
	At sowing	At harvesting	The difference compared to the control, at harvest		t/ha	%
	No.	No.	No.	%		
DKC 4943	80000	77456	3062	104.12	11.25	104.85
KASHMIR	80000	76987	2593	103.49	10.79	100.56
RULEXX	70000	68739	-5655	92.40	10.16	94.69
Mean (control)	76667	74349	-	100.00	10.73	100.00

CONCLUSIONS

In the specific conditions of the farm, the highest productions were obtained in the hybrids DKC 4943 and Kashmir, in direct correlation with the sowing density.

Under identical technology conditions, at a 12.5% lower seeding rate used in the Rulexx hybrid, compared to a seeding rate of 80,000 germinating grains/ha used in the other two hybrids, the yield differences were 1,09 t/ha (compared to the DKC 4943 hybrid), respectively 0.63 t/ha (compared to the Kashmir hybrid).

From the analysis of the production yield, the same ranking is kept, so that, for the maximum utilization of the specific soil and technology conditions, it is recommended to cultivate those hybrids with a high potential to exploit the existing intensification opportunities at the farm level.

REFERENCES

Butts-Wilmsmeyer C., Seebauer J., Singleton L., Below F., 2019 - *Weather During Key Growth Stages Explains Grain Quality and Yield of Maize*. Agronomy. 9. 16. 10.3390/agronomy9010016.

da Silva E.E., Baio F.H.R., Kolling D.F. et al, **2021** - *Variable-rate in corn sowing for maximizing grain yield*. Sci Rep 11, 12711 (2021). https://doi.org/10.1038/s41598-021-92238-4.

Haș V., Tritean N., Copândean A., Vana C., Varga A., Calugăr R., Ceclan L., Șimon A., Russu F., 2021 - *Effect of climate change on the behavior of some released maize hybrids, created at ARDS Turda***.** AN. I.N.C.D.A. Fundulea, vol. LXXXIX.

Nanda D., 2020 - *7 factors important to corn growers in 1960 and today*. FarmProgress, accesed at https://www.farmprogress.com/corn/.

Wang J., Hu X., 2021 - *Research on corn production efficiency and influencing factors of typical farms: Based on data from 12 corn producing countries from 2012 to 2019*. PLoS ONE 16(7): e0254423. https://doi.org/10.1371/journal. pone.0254423.