

RESEARCHES ON SOME BIOLOGICAL AND ECOLOGICAL CHARACTERISTICS OF SWEET CORN

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Abstract. Sweet corn is a stenothermal plant that endures limited temperature variations requiring also adequate levels of humidity. Many farmers assume some risks in this direction, but they can sometimes compromise a significant percentage of culture. So many times to reach the phrase "first on market gets high-prices" is to resort to sowing too early and not to purchase early hybrids. Objective of this paper was to elucidate some aspects regarding behavior of certain hybrids of sweet corn with regard to certain attributes of production under Transylvanian Plateau conditions. Also, for growing surfaces cultivated with sweet corn, the biological material was also analyzed in terms of adaptability to mechanized harvesting. Delicious hybrid is distinguished by the lowest values of the coefficient of variation in the two years, indicating a good uniformity of cob insertion and the possibility of mechanized harvesting.

Keywords: Sweet corn, weight, diameter, insertion height, stability

INTRODUCTION

Sweet corn (*Zea mays* L., *saccharata* Körn) is one of the most popular and appreciated vegetable crops in the United States and Canada (Ştefan, 1967). In recent years, there has been an increasing spread in the Pacific Ocean (Olsen, 1990, 1993). Main destination of corn in our country and most European countries is consumption in boiled form, a small portion being used in the food industry as a raw material for canning. Corn is also used in cooking various dishes, cream soup, garnish in steaks (Vâlceanu, 1982). In United States, distribution of sweet corn production mainly follows the following trails: 57% of sweet corn production for fresh consumption, 25% is preserved in different products, and 18% is frozen (www.ers.usda.gov). Together with the genetic factor and crop technology, strict adherence to the specific requirements of climate and soil are decisive factors in obtaining quality and profitable crops. Lately, the involvement of the genetic factor in climate change response equation is of major importance. Next, we will present some specific requirements of corn, towards pedoclimatic factors on which the success of crops and their profitability depend to a great extent.

Sowing early may have positive results if some minimum soil temperature limits and meteo forecasts are considered for the following days. Although it is a short day plant, it is less pretentious at photoperiod compared to other subspecies. Temperature and precipitation are determinant factors for plant growth and increase in maize production. For a rapid and uniform rising, plants require temperatures above 10° C. Lower temperatures and insufficient supply of soil water, can cause a prolongation in plant rising and a decrease in plant density. High soil moisture causes rotting of germinated seeds in both low and high temperature conditions. Optimal plant growth temperature from sunrise to blooming phenophase is 21-27° C. In post and antecedent phenophases, temperatures above 30° C,

associated with a low level of water supply in the soil, have negative repercussions in determining the production (Orłowski, 2000; Jughenheimer, 1976).

In conclusion, a major limiting factor in sweet corn culture is temperature. However, it is mentioned in literature that soil frost phenomena, frequently encountered in countries with a typical continental climate in Europe, occurring during the germination period, delay growth of young plants without causing them to wilt. Besides hybrid, the duration of vegetation period is mainly influenced by: air temperature, sunshine, rainfall, sowing date and soil fertility. For example, in cooler areas with predominance of cloudy and dry days, the vegetation period may be extended from a few days to about 10 to 15 days, compared to hot, sunny and humid weather years (Kunicki's 2001; Kunicki 2003; Yumaguchi, 1983).

Between emergence and the appearance of third leaf, requirements of sweet corn from the average minimum temperatures are around 13°C. Until the occurrence of panicle, minimal temperatures should be between 16-18°C, optimal being 20-22°C. Besides, during sweet corn vegetation period, temperature requirements are not uniform. In the first half of the vegetation period (emergence - panicle formation), plants have higher temperature requirements, while in the second half (from bloom to technological maturity) the cooler climate ensures normal growth and development, but also delay of harvest time (Voichița Has, 1999). A number of authors (Olsen et al., 1993; Sims et al., 1971) have argued that the temperatures at which maize growth and development are slowed or even stopped are between 27 and 32°C. For example, at 30°C, almost half of the sugars contained in grain are lost in 24 hours, and high temperature variations can cause endosperm cracking and pathogenesis (Michaels and Andrew, 1986).

Water requirements of sweet corn are high, in a relatively short period of vegetation, to technological maturity, and are about 400 mm high. Its well-developed radicle system, able to explore deep soil profiles, makes corn more tolerant to temporary water shortages compared to other plants. Water consumption of plants is different depending on vegetation phenophases, so the lowest consumption is (approximately 100 mm), and maximum consumption coincides with blooming phenophase and grain formation (150-200 mm). As grains mature, demand for water drops to between 50 and 100 mm (Szymanek et al., 2006). Sweet corn is not a plant with high demands on soil fertility. Most suitable are fertile soils, rich in humus, with high water capacity, warm and rich in nutrients, such as chernozems. Obtaining higher quality and quantity crops also depends on soil exposure, the most favorable ones are those with southern exposure, which heat up rapidly in spring. Sweet corn is characterized by a high tolerance to soil reaction, however, the highest yields are obtained on almost neutral soils (pH 6.0-6.5) (Apahidean 2000).

MATERIALS AND METHODS

To expand this culture, in the less typical areal of Transylvanian Plateau, we set up two crops with seven sweet corn hybrids in two locations Turda and Vișoara. Sweet corn hybrids used were represented by Prima, Estival, Deliciul de Vară, Dulcin, Delicios, Estival M (native) and a foreign one (Jubilee). The experience was carried out in 2016 and 2017. The main morphoproductive and technological characters that were considered for seven sweet corn hybrids are represented by: corn cob weight; corn cob diameter; corn cob insertion height.

Datas were processed using the polifact program and for the variability analysis the standard formulas of the variability parameters were used.

RESULTS AND DISCUSSIONS

Marketing of fresh cobs on the market is done with husks, but for industrialization they are interested in their weight without husks. The shelf life of corn cobs with husks increases considerably compared to keeping them without husks. To appreciate the reaction of the hybrids on this important direct component of production, we considered that the weight of huskless corncobs was much more eloquent.

Lowest weight of corn cobs was registered at Prima hybrid, showing distinctly significant negative differences, compared to hybrids average in the two locations. The strong point of this hybrid is precocity, requiring a relatively short time to reach technological maturity. Thus, quantitative losses can be offset by higher prices, being among the first hybrids on the market. This hybrid can also be recommended for areas with a more austere heat regime for growing corn. For many farmers, this hybrid can be a first source of income over an agricultural year. The first two places on this direct component of production are occupied by hybrids Deliciul Verii and Estival - the mother form. These two hybrids manage to make corn cob weights, superior to the witness, within 10-15 days after Prima hybrid. Compared to this, the registered weight gains are over 50g (Table 1).

Table 1
Hybrids behavior regarding average weight (g) of corn cobs in two years

No	Hybrid	Corn cob weight (cm)	(%)	Difference	Significance
	Average (control)	213.00	100	0.00	-
1.	Prima	172.00	81	-41.00	00
2.	Estival	220.00	103	7.00	-
3.	Deliciul Verii	235.00	110	22.00	-
4.	Dulcin	209.00	99	-4.00	-
5.	Delicios	202.00	95	-11.00	-
6.	Estival M	232.00	109	19.00	-
7.	Jubilee	219.00	103	6.00	-
	LSD 5 %	24			
	LSD 1%	32			
	LSD 0,1%	42			

It is unanimously accepted that this important element of production has a less pronounced genetic determinism, the phenotypic expression of this property being greatly influenced by biotic and abiotic factors. The differences between the values obtained in the two locations, even if they are quite close as location, are quite significant. Thus, all hybrids responded more favorably to the conditions of culture and to the favorable microclimate of the upper terrain of Arieş River, where SCDA Turda is located (Table 2). Prima hybrid records the lowest performance of corn cob weight. Higher corn cobs weight were obtained at Deliciul Verii and Estival M. By a more pronounced contribution of genotype in the formation of this attribute and consequently higher stability, Estival and Dulcin hybrids are noted, showing lowest oscillations of corn cob weight in the two locations. Most unstable hybrids to the influence of pedoclimatic conditions seem to be Estival M and Prima.

From the seven analyzed hybrids, Estival hybrid is distinguish with 4.9 cm corn cob diameter, statistically assured as distinctly significantly positive compared to average. Earliest hybrid, Prima, reacts negatively to the values of this attribute with significantly negative differences compared to control. Among the other hybrids there are no statistically

ensured differences in this attribute. However, Deliciul Verii hybrid can be remarked, with values exceeding control by about 2% (Table 3).

Table 2

Average (g) corn cob weight (g) of the seven corn hybrids in the two locations

No.	Hybrid	Weight	Turda		Weight	Vișoara	
			Diff.	Signif.		Diff.	Signif.
1	Average (control)	215.00	0.00	-	210.50	0.00	-
2	Prima	182.52	-32.48	-	161.88	-48.62	00
3	Estival	220.10	5.10	-	220.05	9.55	-
4	Deliciul Verii	229.51	14.51	-	239.67	29.18	-
5	Dulcin	208.03	-6.97	-	210.90	0.40	-
6	Delicios	197.09	17.92	-	207.67	-2.82	-
7	Estival M	242.00	26.99	-	221.74	11.24	-
8	Jubilee	225.78	10.77	-	211.57	1.08	-
	LSD 5 %		34		LSD 5 %	34	
	LSD 1 %		45		LSD 1 %	45	
	LSD 0,1 %		59		LSD 0,1 %	59	

Table 3

Hybrids behavior regarding average diameter of corn cobs in the two years

Nr. crt.	Hybrid	Cob diameter (cm)	Selective value (%)	Difference	Signif.
1.	Average (control)	4.3	100.0	0,00	-
2.	Prima	4.07	91.9	-0.36	0
3.	Estival	4.90	110.6	0.47	**
4.	Deliciul Verii	4.54	102.4	0.11	-
5.	Dulcin	4.36	98.3	0.07	-
6.	Delicios	4.43	99.9	-0.01	-
7.	Estival M	4.43	99.9	-0.00	-
8	Jubilee	4.30	97.0	-0.13	-
	LSD 5 %	0,35			
	LSD 1 %	0,47			
	LSD 0,1 %	0,61			

In Turda conditions, Estival hybrid has significantly positive values, compared to control. In Vișoara, the same hybrid is ranked first, even if the differences are not statistically assured. In the second place on the highest values of this attribute are obtained at Deliciul Verii. Reduced differences in corn cob diameter of the two locations at the level of studied material indicate the pronounced stability of this attribute and a major involvement of genetic factor in the control of this attribute (Table 4).

Table 4

Average diameter of corn cobs (cm) at sweet corn hybrids in Turda and Vișoara

No.	Hybrid	Diameter	Turda		Diameter	Vișoara	
			Diff.	Signif.		Diff.	Signif.
1	Average (control)	4.48	0.00	-	4.39	0.00	-
2	Prima	4.20	-0.28	-	3.95	-0.44	-
3	Estival	5.06	0.58	*	4.75	0.36	-
4	Deliciul Verii	4.56	0.08	-	4.52	0.13	-
5	Dulcin	4.34	-0.14	-	4.38	-0.01	-
6	Delicios	4.42	-0.06	-	4.44	0.05	-
7	Estival M	4.50	0.02	-	4.36	-0.03	-
8	Jubilee	4.28	-0.20	-	4.32	-0.07	-
	LSD 5 %		0.50		LSD 5 %	0.50	
	LSD 1%		0.67		LSD 1%	0.67	
	LSD 0,1%		0.87		LSD 0,1%	0.87	

Table 5

Insertion height of main corn cob at studied hybrids

Insertion height Turda 2016							
Parameters of variability	Prima HS	Estival HT	Deliciul V HS	Dulcin HT	Delicios HS	Estival M HS	Jubilee HS
Average	54	62	73	85	91	70	68
Standard deviation	7.74	11	9.71	9.23	9.18	8.53	6.72
Rank	37	45	35	39	53	36	30
Minimum	31	45	60	66	48	50	50
Maximum	68	90	95	105	101	86	80
Coefficient of variability %	14.45	17.77	13.37	10.83	10.09	12.27	9.86
Insertion height Turda 2017							
Parameters of variability	Prima HS	Estival HT	Deliciul V HS	Dulcin HT	Delicios HS	Estival M HS	Jubilee HS
Average	34	37	51	57	65	48	51
Standard deviation	5.36	6.80	5.49	8	6.54	6.02	6.39
Rank	22	23	22	25	26	25	27
Minimum	20	24	40	45	55	35	40
Maximum	42	47	62	70	81	60	67
Coefficient of variability %	15.78	18.22	10.68	14	9.93	12.67	12.42

An important technological feature that reflects the adaptability of the hybrids to mechanized harvesting is the height of insertion of the first ear and, in particular, uniformity of this attribute. Recent technological advances have determined that this crop is totally mechanized, so in countries with farms where large areas of sweet corn are grown, harvesting is carried out mechanically. In order to reduce losses, an essential condition is uniformity of insertion height of the cobs. Table 5 shows the stability parameters of this property in the two years only for a single locality, namely Turda.

CONCLUSIONS

Reduced differences in corn cob diameter in two locations at the level of the studied material indicate the pronounced stability of this attribute and an important involvement of genotype in its control. Deliuciu Verii and Estival M hybrids are distinguished by the higher weights of cobs in both locations, therefore we strongly recommend the cultivation of these hybrids in the areas favorable to this culture in Transylvanian Plateau. Delicios hybrid is highlighted by the lowest values of coefficient of variability in the two years, indicating a good uniformity of cob insertion and the possibility of mechanized harvesting.

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