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NEW CHARACTERS OF EARLY MAIZE COBS

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ABSTRACT

The current study of the variability (Fasoula & Fasoula, 2002; Duvick & Cassman, 2009) of the main morphological characters (Tolleaar et al., 2004), could offer some new directions in the improvement of maize (Tolkanidis & Koutroubas, 2004; Haș et al., 2010). With a wide genetic diversity (Schnable et al., 2009), the plant is closely related to growing conditions (Doebley, 2004; Verheye, 2010). In the present study, two early maize hybrids were compared: SV.255-18 and Viking, which are recommended for their performance in certain cultural conditions. In both hybrids some new directions have been found, these being recently improved, namely by improved morphological characters. In the comparison between the two hybrids, the cobs had an average length of 17 cm at SV.255-18 and 19 cm at Viking. In the same order the thickness of the cob was 3.7 cm to 4.2 cm and weighted between 128 g and 198 g. The number of grains on the cob was 432 in SV.255-18 and 484 in Viking, they weighted 107 g to 165 g, and the mass of one thousand grains was 252 g to 342 g. The grain percent of both cobs was 83-84%. The grains of these hybrids were 9.8 to 12.1 mm long, 7.9 to 8.9 mm wide and 4.6 to 4.2 mm thick. Positive correlations were obtained between the analyzed characters, more accentuated at SV.255-18. Grains percent was positively correlated with most characters in the first hybrid- SV.255-18, and equally negatively in the second hybrid- Viking, grain thickness was positively correlated with the other traits in the first hybrid, being mostly negative in the second hybrid. These two cultivated hybrids have demonstrated good adaptability to existing conditions.

INTRODUCTION

Globally, maize (Zea mais L.) is one of the most important crops (Byerlee, 2000). The area on which it is cultivated is remarkable, given the genetic gains that continue to improve (Eberhart & Russel, 1966). The rich content of grains in the nutrients gives it its use in animal feed, in industry, as well as in the human diet, in the form of maize-type flours. Lately, the plant has evolved through various new characters (Osorno & Carena, 2008), which ensures the achievement of better and better productive levels. The plant has evolved from ancient times until today, thus proving a very important genetic tolerance. It all started with a rustic species from Mexico, which produced small cobs with a single grain 25 mm long. At one point there was an evolution by cultivation interspersed with *Zea mays mexicana*, or *teosinte*. From that period there are currently three species of *Zea*, namely: *Z. mays* ordinary maize, *Z. diploperennis* teosinte perennial form and *Z. mays mexicana*

teosinte annual form. Maize is expressed in the world both by maize, originating from *mahiz* (Spanish, and by corn which in some parts means cereal crop, with expression and in a culinary context. Elsewhere, maize was developed from Indian corn= maize, referring to the multicolored *flint horn*, used for decorations (cobs with differently colored grains and woven and hung sheets). The diploid plant contains 2n= 2x (2x10)= 20 chromosomes, fixes the carbon on the C4 type, having an increased efficiency of water recovery. Being a unisexual monoecious species, maize has female flowers grouped in a spike- like inflorescence, with a much thickened axis (spadix). The maize spikelet has a long stigma with a role in capturing pollen grains, an ovary from which specific grains, awns and paleas develop at the base. The mature cob has lengths of 3-50 cm and a diameter of 1.5-6 cm, being cylindrical, cylindrical- conical of fusiform. Their weight is between 50 and 500 g, 8-20 rows of grains and formed on a cob. The bean is a caryopsis with a great variability in shape, size and color. The literature shows maize grains 2.5-22 mm long, 3-19 mm wide and 2.7-8 mm thick, and a mass of one thousand grains of 30-1200 g. the studied hybrids SV.255-18 and Viking have cobs of size medium, with red spadix and reddish yellow berries. Hybrids belong to the form *Zea mays indurata* (flint corn). The research carried out to observe the variation of some characters of corn cobs included: i0 total length, diameter in the central portion, absolute weight, total number of grains, number of rows, weight of grains/cobs, TGW, grain percent/cob, the length, width and thickness of the grains.

MATERIAL AND METHODS

Variants have been cultivated in recent years with SV.255-18 and Viking hybrids, both early (FAO 200-250). The experience was set up according to the block method, with variants of 25 m^2 in 4 repetitions. The technology used was the one recommended by the resort. At full maturity, 25 cobs were randomly selected from each repetition (a total of 100), cut and brought to the laboratory. The 100 cobs were measured and determined: total length, thickness in the central area, weight, total number of grains, total weight of grains, mass of one thousand grains, grain length, grain width and grain thickness. The obtained morphological characters were analyzed by the method of histograms (frequency polygons), In their expression, the class intervals established according to the specific sequence of values obtained were used. The study highlighted several aspects, namely: modal values (dominant frequencies), limits of the intervals of variability of variability of the studied characters and the specifics of each character of the maize ecotype in the analyzed area. The correlations were established between the analyzed characters, with the help of which their tendencies within the studied ecotypes could be observed. Excel was used to express values. The significance of the correlation coefficients was obtained by comparing with the r_{max} values for the levels of 5%, 1% and 0.1% of the transgression probabilities. In the statistical calculation of all the values obtained, the analysis of variance (anova test) on the variation strings was used. Statistical parameters were calculated using the formulas: $\bar{a} = \Sigma x/n$, where $\bar{a}$ = mean, x = the values, S^2 (variance) = $1/n-1.[\Sigma x^2-(\Sigma x)^2/n]$, S (standard error) = $\sqrt{S^2}$ and S % (variation coefficient) = $s/\bar{a}.100$.

RESULTS AND DISCUSSIONS

Variability of maize cobs. The appearance and dimensions of the cob of the two maize hybrids were characteristic. Thus, their length was between 12 and 19 cm at SV.255-18 and between 12 and 22 cm at Viking. They dominated the lengths of 16-17 cm (26-33%) for the first hybrid and 19 cm (26%) for the second hybrid (figure 1). Cobs of 18 cm (12%) and 18-20 cm (20-21%) respectively, followed the first ones in descending order. The longest cobs, 19 cm constituted 8% of the total for the first hybrid and those of 22 cm 1% for the second hybrid. From these data it emerged that there was a difference between the two hybrids in terms of length, these being characteristic (figure 2). The width (thickness) of the cob in the central portion had limits between 3.2 cm and 4.4 cm for the hybrid SV.255-18 and between 3.8 cm and 4.6 cm for the Viking.

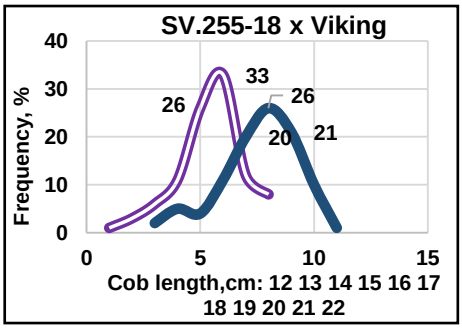

Figure 1. Frequencies of cob length

Figure 2. Cobs of SV.255-18 (left) and Viking

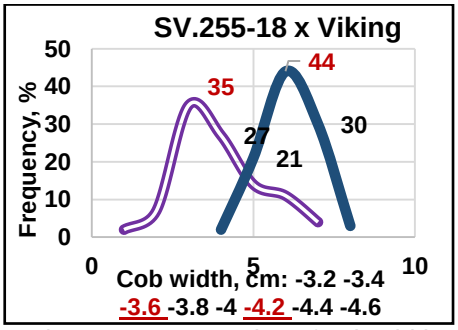

Figure 3. Frequencies of cob width

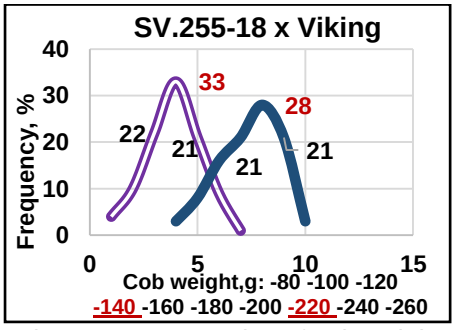

Figure 4. Frequencies of cob weight

The cobs with a thichness of 3.6 cm (35%) in the first hybrid and 4.2 cm (44%) in the second hybrid dominated. These dimensions were followed by the dimensions of 3.8 cm (27%) for the first hybrid and 4.4 cm (30% for the second hybrid, respectively. Smaller and larger thicknesses together constituted 5-6% in both hybrids (figure 3). The weight of the cobs ranged from 80 g to 200 g for the first hybrid and from 140 to 260 g for the second hybrid. In the case of the hybrid SV.255-18, the cobs whose weight was 140 g (33%) dominated, and in the case of Viking, the cobs dominated with 220 g (28%). The cobs with lower weights constituted 3-4%, and the ones with higher, of 200- 260 g 1-3% of the total (figure 4).

Variability of maize grains. The nuimber of grains on a cob was generally between 310 and 610 (figure 5). The SV.255.-18 hybrid formed between 340 and

550 grains per cob, while the Viking formed 310 and 610 grains. Of these, the cobs with 430 grains (29%) dominated the first hybrid, followed by those with 460 grains (22%) and those with 490 grains (18%). The second hybrid was dominated by cobs with 490- 520 grains (both dominated by 24%), followed by those with 550mgrains (17%). The weight of the berries on a cob was between 60 and 160 g in the hybrid SV.255-18. They dominated the cobs whose grains weighted 120 g (20%), followed by those with 110 g (15%). The Viking hybrid formed grains weighing 110 and 210 g. The modal value was 180 g/cob (19%), followed by grains weighing 160-170 g and those with 189 g (17%) (figure 6).

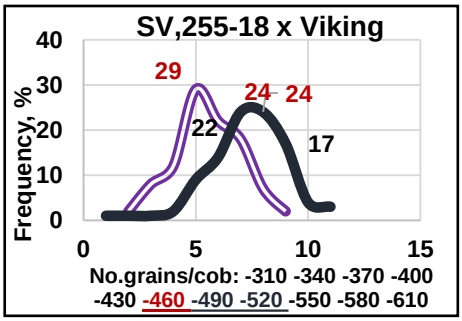

Figure 5. Frequencies of no. grains/cob

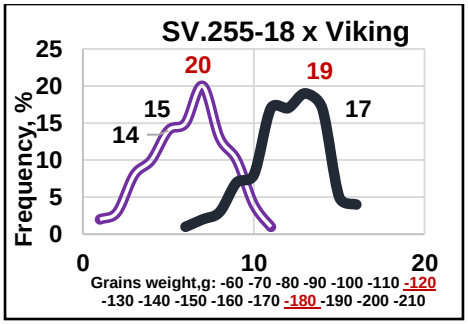

Figure 6. Frequencies of grains weight/cob

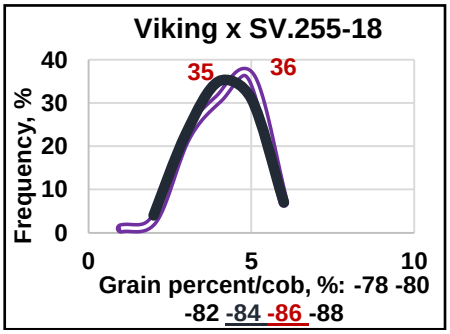

Figure 7. Frequencies of grain %/cob

Figure 8. Viking grains aspect

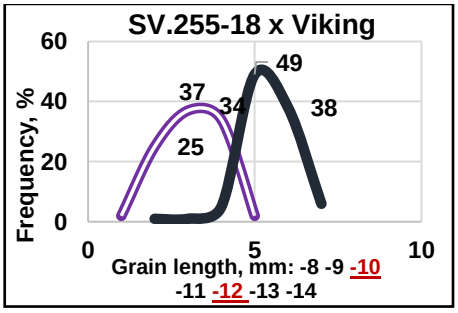

Figure 9. Frequencies of grain length

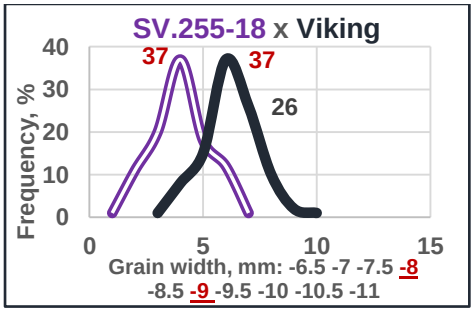

Figure 10. Frequencies of grain width

The degree of filling of the cobs with grains is characterized by an output (%) also specific. It was erected and characterizes the early creations researched.

Thus, for the hybrid SV.255-18 this parameter was between 78 and 88%. There dominated the cobs with 84-86% (35-31%) grains percent (with a modal value of 31-36%). In the Viking hybrid the variability of the grains percent of the cobs was between 80 and 88%. The cobs dominated with 84-86% (35-31%) (figure 7). The graph shows that the hybrid SV.255-18 had quite a higher grain percent of the cobs. The appearance of grains in early SV.255-18 has a specific character (figure 8).

Regarding the characteristics of the maize kernel, determinations were made for length, width and thickness. The first character- the length of the grain, generally had values between 8 and 14 mm in both hybrids. SV.255-18 had lengths between 8 and 12 mm. They dominated the grains with lengths of 10-11 mm (37-34%). Viking formed grains with lenghts between 9 and 14 mm. They dominated the lengths of 12 mm (49%) (figure 9). The second grain size, width, was generally between 6.5 and 11 mm (figure 10). The grains of the hybrid SV.255-18 had widths between 6.5 and 9.5 mm. The grains woth widthsof 8 mm (37%) dominated, followed by those with 7.5 mm and 8.5 mm (20% and 18% respectively). The Viking hybrid formed grains with widths between 7.5 and 11 mm. The grains with a width of 9 mm (37%) dominated. The third dimension of the grain, the thickness had values between 3.6 mm and 5.3 mm, in both hybrids. SV.255-18 had grain thicknesses between 3.9 and 5.3 mm, of which 5 mm (30%) dominated (figure 11). The Viking hybrid had grains with thicknesses between 3.6 and 5.3 mm. The grains with a thickness of 4.1 mm (32%) of these values dominated. The mass of one thousand grains (TGW- thousand grains weight) experienced great variability, with values between 130 and 430 g (figure 12). The first hybrid had values grouped between 130 g and 450 g. They dominated the grains with a mass of 250 g (35%) followed by those with 290 g (19%). The second hybrid formed grains whose absolute weight was between 290 g and 410 g. They dominated the grains with 370 g (58%).

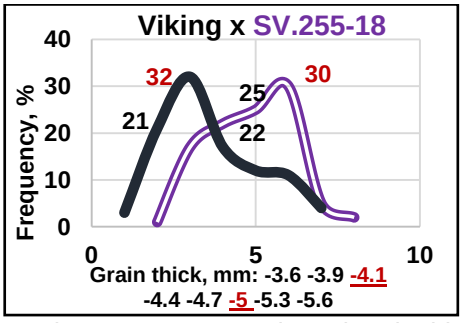

Figure 11. Frequencies od grain thick

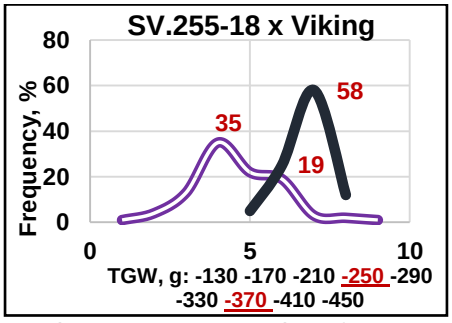

Figure 12. Frequencies of TGW

Correlations between main characters. If we analyze the whole set of correlations between all the analyzed characters, we find both positive and negative situations. Very obvious positive correlations were observed between the characteristics of the cob: length, thickness, weight, total number of grains, total weight of the grains, mass of one thousand grains and the respective length and width of the grains. Insignificant positive correlations were observed between the grain length and the width, respectively the grain thickness, as well as between the TGW with the number of grains per cob. Negative correlations were observed to a greater extend in the Viking hybrid (table 1). The cause may be the adaptation of this hybrid to the cultivation ecology. TGW correlated negatively with grain weight and grain percent per

cob in the same Viking hybrid. Also in this hybrid, the width of the grain was negatively correlated with the thickness of the cob and the length of the grain.

Statistical analysis of the variability of morphological characters in maize. The results obtained in the morphological analysis of some characters in the two maize hybrids showed specific aspects. Thus, the length of the cob measured 16.5 cm in SV.255-18 and 18.6 cm in Viking. The variability showed small coefficients (less than 1-%). The thickness of the cob measured 3.73 cm to 4.17 cm, with an equally small variation (4-7%), and its weight was 127.9 g at 198.4 g (both with average variation). The average number of grains on a cob was 432 to 484 (small variability in both hybrids), and the weight of grains on the cob was 101.1 g to 165.3 g, with medium to high variability.

Table 1

Corrrelations between the main characters of studied maize hybrids

Correlations between the main characters of **SV.255-18 hybrid**									
Characters	Cob thick	Cob weight	No. grains	Grains weight	% grains	Grain length	Grain width	Grain thock	TGW g
Cob length, cm	**.305**	**.744**	**.569**	**.720**	**.160**	**.448**	**.380**	**.199**	**.498**
Cob width, cm	1	**.644**	**.358**	**.653**	**.394**	**.501**	-.010	**.176**	**.522**
Cob weight, g		1	**.530**	**.994**	**.459**	**.726**	.359	**.205**	**.766**
No. grains /cob			1	**.501**	.005	**.277**	-.139	.176	.009
Grains weight,g				1	**.545**	**.740**	**.362**	**.204**	**.789**
% prains/cob					1	**.484**	**.197**	.172	**.590**
Grain length,mm						1	.349	.014	**.637**
Grain width,mm							1	.0010	**.513**
Grain thick,mm								1	.177
TGW, g									1
Correlations between the main characters of **Viking hybrid**									
Characters	Cob thick	Cob weight	No. grains	Grains weight	% grains	Grain length	Grain width	Grain thock	TGW g
Cob length, cm	**.249**	**.806**	**.592**	**.789**	**-.494**	.173	**.357**	.037	**.527**
Cob width, cm	1	**.557**	**.528**	**.555**	**-.285**	**.521**	**-.254**	-.138	.195
Cob weight, g		1	**.780**	**.990**	**-.524**	**.389**	**.191**	-.075	**.581**
No. grains /cob			1	**.818**	-.123	**.434**	-.135	**-.217**	-.037
Grains weight,g				1	**-.402**	**.405**	.157	-.104	**.540**
% prains/cob					1	-.079	**-.281**	-.135	**-.544**
Grain length,mm						1	**-.212**	-.411	.042
Grain width,mm							1	.014	**.478**
Grain thick,mm								1	.173
TGW, g									1
LSD 5 % = .190 LSD 1 % = .250 LSD 0.1 % = .320									

Table 2

Statistical indices of early maize cobs morphological characters

Indices	Cob length cm	Cob thick cm	Cob weight g	No. grains /cob	Grain weight g	TGW g	% grains	Grain length mm	Grain width mm	Grain thick mm
HS SV.255-18, FAO 200-250										
Mean	**16,5**	**3,73**	**127,9**	**431,7**	**107,1**	**252,1**	**83,5**	**9,76**	**7,86**	**4,56**
Variance.s²	2,12	0,07	600,9	1841	474,9	2742	4,453	0,79	0,38	0,18
Std. dev.,s	1,45	0,26	24,5	42,90	21,8	52,4	2,110	0,89	0,62	0,42
Var. coeff, %	**8,81**	**7,01**	**19,16**	**9,93**	**20,35**	**20,78**	**2,53**	**9,08**	**7,87**	**9,22**
VIKING, FAO 200- 250										
Mean	**18,6**	**4,17**	**198,4**	**484,2**	**165,3**	**341,5**	**83,4**	**12,09**	**8,94**	**4,24**
Variance.s²	3,17	0,03	772,4	2781	465,2	674,3	3,26	0,54	0,36	0,17

Std. dev.,s	1,78	0,16	27,79	52,73	21,6	25,97	1,80	0,73	0,59	0,41
Var. coeff, %	**9,56**	**3,86**	**14,00**	**10,89**	**13,0**	**7,60**	**2,16**	**6,07**	**6,69**	**9,61**
LSD 5 % = .190 LSD 1 % = .250 LSD 0.1 % = .320										

The absolute mass of the grains was 252.1 g at 341.5 g with higher variation at SV.255-18 (table 2). The percent of grains from the cob was 83.5- 83.4% with little variation, and the grain sizes were 9.76- 12.09 mm in length, width 7.86- 8.94 mm, and thickness 4.56- 4.24 mm, all three with small coefficients of variability.

CONCLUSIONS

The morphological characteristics of the early maize cobs SV.255-18 and Viking were specific. Thus, in the same order, the average length of the cobs was 17 cm to 19 cm, and the thickness in the moddle portion was 3.7 cm and 4.2 cm. The cobs weighted 128 g to 198 g and formed 432 to 484 grains. The grains on the cobs weighted 107 g to 165 g and had a mass of one thousand grains of 252 g to 342 g. The grain percent of the cob was similar, 83%, significantly better at SV.255-18. The maize grain was 9.8 mm to 12,1 mm long, 7.9 mm to 8.9 mm wide and 4.6 mm to 4.2 mm thick.

Simple correlations were established between all the studied characters, with some differentiations. The correlations between the characters of the cobs were generally positive and significant. Negative correlations were observed between the grain percent of an cob with all the other characters. These aspects demonstrate that the cultivated SV.255-18 and Viking hybrids have demonstrated important productive possibilities in this cultivation area.

The statistical indices studied showed maize hybrids that form medium-sized cobs with many grains and a medium to high TGW. The grains to their indurata variety had differentiated dimensions, which highlights characters obtained in different breeding centers.

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