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STUDY OF AGRONOMIC CHARACTERISTICS OF SOME CORN LINES CREATED AT SCDA LOVRIN

Marinel Nicolae HORABLAGA[1, 2], Codruța CHIȘ[1], Ștefan Laurențiu BĂTRÎNA[1], Ilinca Merima IMBREA[1], Adina HORABLAGA[1], Florin IMBREA[1]

[1]University of Life Sciences "King Mihai I" from Timisoara, 119 Calea Aradului Street, Timisoara, Romania
[2]Lovrin Agricultural Research and Development Station, 200 Principala Street, Lovrin, Romania

Corresponding author email: codrutachis@gmail.com

Abstract

The aim of this research was to analyse the agronomic characteristics of a maize variety consisting of 20 inbred lines, which are used as germplasm sources for hybrid maize production at SCDA Lovrin. The statistical analysis and interpretation of the results were carried out using IBM SPSS software. Descriptive statistics, including mean, median, standard deviation, minimum, and maximum values, were calculated. To evaluate the significance of the differences, ANOVA and Duncan's multiple range tests, as well as Kruskal-Wallis and Mann-Whitney U tests, were performed. Pearson correlation coefficients and regression lines were determined to study the relationships between variables. The results indicate significant differences between the studied traits, such as leaf color, leaf orientation, anther color (tassel), silk color, ear position (degree), total number of leaves, number of leaves up to the main ear, and number of tassel branches. Additionally, a linear correlation was observed between the number of growing degree days (GDD) to flowering/silking and the total accumulated GDD until flowering/silking.

Key words*: maize inbred line, agronomical traits.*

INTRODUCTION

Maize (*Zea mays* L.) is an important and versatile crop, serving as a primary source of food for both humans and animals and as a vital raw material for various industrial sectors (Troyer, 2000). With its widespread use, maize has become the third most extensively cultivated crop globally. In Romania, maize is a major crop, covering an estimated area of approximately 3 million hectares annually (Sarca, 2004).

The current climate change scenario has posed significant challenges for maize growers, particularly with regard to water and heat stress (Nagy, 2004; Musteata et al., 2005). To address these challenges, maize breeders must develop new hybrids with improved stress tolerance (Roman et al., 1973; Troyer, 1999; Suteu et al., 2013). Therefore, studies that analyse the agronomic traits of maize inbred lines that serve as the foundation for developing new hybrids are of great importance (Has, 1999; Has et al., 1999, Troyer, 1999).

Moreover, the importance of identifying and developing maize germplasm adapted to specific environmental conditions has become increasingly vital, particularly in areas where there are recurrent climatic disturbances (Cabulea et al., 1975; Roman, 1976; Duvick, 1984). Therefore, the identification of new maize hybrids tolerant to such conditions will be critical in maintaining and increasing maize productivity in these areas (Grecu, 1962; Grecu and Has, 2001; Musteata et al., 2005).

MATERIALS AND METHODS

The material subjected to analysis consisted of 20 inbred lines from SCDA Lovrin, used as germplasm source in the breeding process. The experiment was conducted using a comparative culture method, on a cambic chernozem soil with a shallow water table, wet and weakly saline (under 100 cm), with moderate alkalization, low decarbonatization, on sandy loam soils with sand parent material and water table depth at 2-5 m. Analytical data of the soil profile from Lovrin Agricultural Research and Development Station, where the research was conducted, are presented in Table 1.

Figure 1 displays the average decadal, monthly, and annual temperatures, the multi-year averages, as well as the decadal and monthly precipitation amounts during the experimental period.

Regarding the multi-year averages for precipitation accumulated during the vegetation period, a deficit of 44.6 mm was observed in 2019, a deficit of 49.2 mm was observed in 2020, while an excess of 78 mm/ha was recorded in 2021. Notably, in 2021, which was the most favourable year for maize cultivation, the amount of precipitation accumulated in June exceeded the monthly average by 26.9 mm/ha, and in August, the accumulated precipitation exceeded the multi-year monthly average by 10.9 mm/ha. It is important to highlight that the annual average temperature exceeded the multi-year average by 1.7°C in all three experimental years, by 1.6°C in 2020, and by 1.4°C in 2021.

Table 1. The main features of cambic chernozem, phreatic moist, in Lovrin

Characteristics	Ap	Am	A/C	Ccaac	C/CaGoac
Depths (cm)	0-26	26.47	47-49	79-123	123-200
Coarse sand (2.0-0.2 mm)%	1	0.9	0.5	0.6	0.3
Fine sand (0.2-0.02 mm)%	34.3	36.4	35.2	38.5	24.7
Dust (0.02-0.002 mm)%	27.7	26.5	28.9	31.3	42.6
Clay (< 0.002 mm)%	37	36.2	35.4	29.6	32.4
Physical clay (< 0.01 mm)%	51.8	51.7	51	46.8	57
Specific density(D g/cm^3)		2.55	2.56	2.63	
Apparent density (DA g/cm^3)		1.4	1.33	1.27	
Total porosity (PT %)		45	48	50	
Aeration porosity (PA %)		9	13	16	
Coefficient of higroscopicity (CH%)		8	7.8	7	
Coefficient of withering (CO %)		12	11.7	10.5	
Field capacity (CCA)		26	26	25.4	
Useful water capacity(CU%)		14	14.3	14.8	
Total capacity for water(CT %)		32.2	36.1	37.9	
PH in H_2O	6.9	7.2	8.45	9.4	9.45
Carbonates ($CaCO_3$%)		0.4	9.8	19.3	16
Hydraulic conductivity(K = mm/h)		11.9	10.3	12.8	
Humus (%)	3.47	3.28	2.73		
Nr. of bacteria mil/100 g dry soil	772				
C: N	13.7	13.9	13.7		
Total nitrogen (%)	0.171	0.159	0.12		
Mobile phosphorus (ppm)	75.7	31.7	8.7		
Mobile potassium (ppm)	205	202	163		
Bases of exchange (SB me la 100 g sol)	27.6	27.6	20.3		
Hydrogen exchange (Sh me la 100 g sol)	4.35				
Cation exchange cap. (T me la 100 g sol)	32	27.6	21.9		
Degree of saturation in bases (V%)	86.4	100	100	100	100
EC mmho/cm	0.78	0.57	1.68		
Na^+ (me per 100 g soil)	0.04	0.1	0.66		
Na^+ exchangeable (% of T)	0.6	0.5	3.5	13.1	13

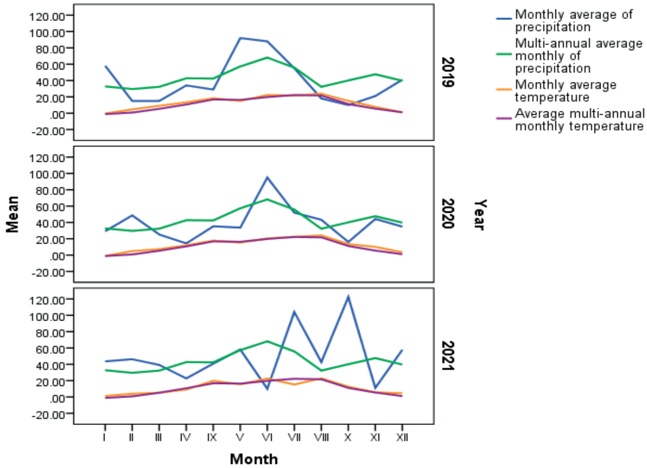

Figure 1. Temperature and precipitation evolution in 2019-2021 period

RESULTS AND DISCUSSIONS

The statistical analysis of the data was performed using IBM SPSS statistical software. Descriptive characteristics such as mean, median, standard deviation, minimum and maximum values were calculated.

To analyse significant differences, ANOVA and Duncan tests, as well as Kruskal-Wallis and Mann-Whitney tests were applied. For the study of relationships between variables, Pearson correlation coefficients and regression lines were determined

Regarding the leaf color, it was observed that 40% of the analysed lines (5013, 5027, 5071, 5104, 5174, 5178, 5186, and 5190) exhibit a light green colour, while 60% of the lines (5001, 5006, 5008, 5009, 5059, 5075, 50164, 5167, 5170, 5171, 5181, and 5216) show a dark green colour.

Analysing the leaf habit of the 20 selected lines, it was found that 90% of the lines have a semi-erect habit. Only two lines (5059 and 5216) exhibit an erect leaf habit, indicating their potential contribution to the creation of hybrids capable of withstanding higher densities and displaying increased resistance to drought due to a reduction in evapotranspiration surface area.

The positions of the cobs varied between 30° and 45°, being distributed as follows: 20% of the lines at 30°, 25% of the lines at 35°, 10% at 40°, and 45% of the lines at 45°.

The total number of leaves for the lines in the study ranged from a minimum of 9 leaves to a maximum of 15 leaves per line, with a minimum percentage of 5% for the lines with 9 and 10 leaves, reaching a maximum percentage of 25% for the lines with 11 and 12 leaves per line.

The minimum number of leaves to the main ear was for 5% of the lines, the maximum of 9 leaves was found in 10% of the lines, while the maximum percentage of 45% of the lines had 6 leaves to the main ear.

The average number of total leaves per plant is 12.3 ± 1.657, with a minimum of 9 leaves and a maximum of 15 leaves, while the average number of leaves to the main ear is 6.55 ± 1.316, with a minimum of 4 and a maximum of 9 leaves (Figure 2).

The number of cobs per plant was one cobin 85% of the lines, two cobs in 10% of the lines (5071, 5178), and only 5% of the lines had three cobs per plant (5014).

The total plant height varied from 92 cm in line 5174 to a maximum of 163 cm in line 5075. The average height of the experiment was 130 cm (Figure 3).

By applying ANOVA, significant differences were observed between the studied lines in terms of total plant height ($F=9.724$, $p=0.000$). Lines 5027, 5059, 5075, and 5167 showed significant positive differences compared to the field average.

Based on the Duncan test, significant differences were determined between all these lines (Table 2).

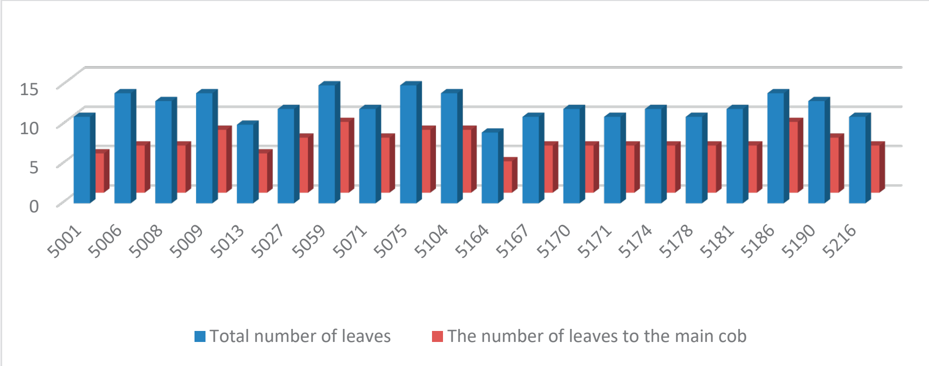

Figure 2. Total number of leaves, respectively the number of leaves to the main cob

Table 2. Numeric traits associated to plant height

Line	Mean (m)	SD	95% Confidence Interval for Mean		Min.	Max.	Diff.	Semnif.	p	Duncan test
			Lower Bound	Upper Bound						
Field average	1.3066	0.0447	1.2746	1.3385	1.23	1.37	0	-	-	defg
5001	1.262	0.1834	1.1308	1.3932	0.98	1.52	-0.0445	ns	0.3947	bcdef
5006	1.335	0.0756	1.2809	1.3891	1.22	1.47	0.0285	ns	0.5865	efgh
5008	1.39	0.1222	1.3026	1.4774	1.25	1.58	0.0835	ns	0.1117	ghij
5009	1.237	0.0721	1.1854	1.2886	1.15	1.37	-0.0695	ns	0.1845	bcdef
5013	1.346	0.134	1.2501	1.4419	1.1	1.57	0.0395	ns	0.4509	fghi
5027	1.452	0.0771	1.3968	1.5072	1.27	1.53	0.1455	**	0.0059	ijk
5059	1.426	0.0662	1.3786	1.4734	1.33	1.52	0.1195	*	0.0233	hijk
5071	1.204	0.0949	1.1361	1.2719	1.04	1.34	-0.1026	ns	0.051	bcd
5075	1.521	0.0684	1.4721	1.5699	1.45	1.63	0.2145	***	0.0001	1k
5104	1.388	0.1336	1.2925	1.4835	1.09	1.62	0.0815	ns	0.1205	ghij
5164	1.158	0.1657	1.0395	1.2765	0.97	1.37	-0.1486	00	0.0049	ab
5167	1.498	0.1603	1.3833	1.6127	1.25	1.74	0.1915	***	0.0003	jk
5170	1.31	0.1599	1.1956	1.4244	1.14	1.61	0.0035	ns	0.9474	defgh
5171	1.321	0.1436	1.2182	1.4238	1.04	1.45	0.0145	ns	0.7823	defgh
5174	1.059	0.0937	0.9919	1.1261	0.92	1.29	-0.2476	000	0.000	a
5178	1.235	0.082	1.1764	1.2936	1.12	1.33	-0.0715	ns	0.1723	bcdef
5181	1.174	0.0906	1.1092	1.2388	0.99	1.34	-0.1326	0	0.0119	bc
5186	1.292	0.1062	1.216	1.368	1.14	1.52	-0.0146	ns	0.7808	cdefg
5190	1.221	0.086	1.1595	1.2825	1.1	1.35	-0.0855	ns	0.103	bcde
5216	1.302	0.1527	1.1928	1.4112	1.11	1.53	-0.0045	ns	0.9307	defg

ns= Not significant. * The mean difference positive and is significant at the 0.05 level. ** The mean difference positive and is significant at the 0.01 level. *** The mean difference positive and is significant at the 0.001 level. 0 - The mean difference negative and is significant at the 0.05 level. 00 - The mean difference negative and is significant at the 0.01 level. 000 - The mean difference negative and is significant at the 0.001 level.

The data regarding the height of the main cob insertion point shows that it varied between 25 cm in line 5164 and 80 cm in line 5104. Lines 5008 and 5186 had a cob insertion height of 75 cm (Figure 3).

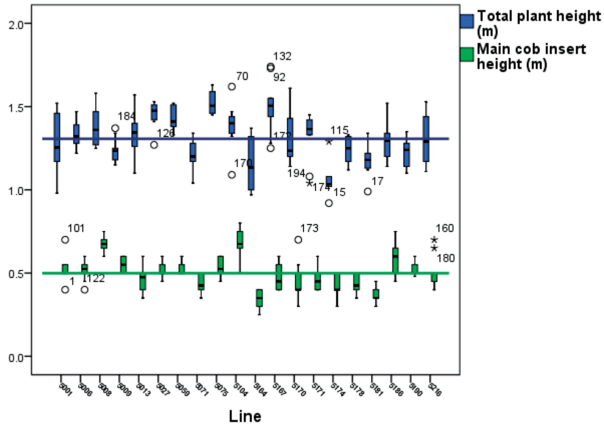

Figure 3. Box plots associated with the characteristics "Total plant height" and "Height of main cob insertion"

The lines differ significantly in terms of the variable "height of the main cob insertion point" (F = 16.290, p = 0.000). It can be observed that lines 5008, 5014, and 5186 are the ones that showed significant positive differences compared to the field average (Table 3). Based on the Duncan test, significant differences were determined between all of these lines (Table 3).

Table 3. Numeric traits associated to height of the main cob insertion point

Line	Mean	SD	95% Confidence Interval for Mean		Min.	Max.	Diff.	Semnif.	p	Duncan test
			Lower Bound	Upper Bound						
Field media	0.4993	0.0137	0.4895	0.5090	0.47	0.52	0	ns		**defg**
5001	0.5200	0.0753	0.4661	0.5739	0.4	0.7	0.021	ns	0.4784	bcde
5006	0.5200	0.0633	0.4748	0.5652	0.4	0.6	0.021	ns	0.4784	efgh
5008	0.6750	0.0425	0.6446	0.7054	0.6	0.75	0.1758	***	0.000	fgh
5009	0.5500	0.0408	0.5208	0.5792	0.5	0.6	0.051	ns	0.084	bcde
5013	0.4600	0.0738	0.4072	0.5128	0.35	0.6	-0.039	ns	0.1807	efgh
5027	0.5250	0.0486	0.4902	0.5598	0.45	0.6	0.026	ns	0.3792	h
5059	0.5250	0.0425	0.4946	0.5554	0.5	0.6	0.026	ns	0.3792	gh
5071	0.4350	0.0530	0.3971	0.4729	0.35	0.5	-0.0643	0	0.0291	bc
5075	0.5350	0.0530	0.4971	0.5729	0.45	0.6	0.036	ns	0.2226	i
5104	0.6750	0.0858	0.6136	0.7364	0.5	0.8	0.1758	***	0.000	efgh
5164	0.3450	0.0550	0.3056	0.3844	0.25	0.4	-0.1543	000	0.000	a
5167	0.4750	0.0825	0.4160	0.5340	0.4	0.6	-0.024	ns	0.4076	i
5170	0.4500	0.1106	0.3709	0.5291	0.3	0.7	-0.049	ns	0.0935	defgh
5171	0.4600	0.0615	0.4160	0.5040	0.4	0.6	-0.039	ns	0.1807	efgh
5174	0.4200	0.0675	0.3717	0.4683	0.3	0.5	-0.0793	00	0.0073	a
5178	0.3900	0.0928	0.3917	0.1172	0.4	0.35	-0.0643	0	0.0291	bcd
5181	0.3620	0.0434	0.3309	0.3931	0.3	0.45	-0.1373	000	0.000	b
5186	0.5850	0.0944	0.5175	0.6525	0.45	0.75	0.0858	*	0.0037	bcdef
5190	0.5180	0.0368	0.4917	0.5443	0.48	0.6	0.019	ns	0.5218	bc
5216	0.5150	0.0914	0.4496	0.5804	0.4	0.7	0.016	ns	0.5904	cdefg

ns = Not significant. * The mean difference positive and is significant at the 0.05 level. ** The mean difference positive and is significant at the 0.01 level. *** The mean difference positive and is significant at the 0.001 level. 0 - The mean difference negative and is significant at the 0.05 level. 00 -The mean difference negative and is significant at the 0.01 level. 000 - The mean difference negative and is significant at the 0.001 level.

The length of the leaves of the main cob (Figure 4) ranged from 42 cm in line 5181 to 75 cm in line 5059, with line 5059 having the highest average length of leaves (Figure 5). Analysis of the length of leaves of the main cob shows significant differences between the analysed lines (F = 18.504, p = 0.000) and compared to the field average. Lines 5008, 5027, 5059, 5075, 5014, and 5017 differ significantly in a positive sense compared to the field average (Table 4).

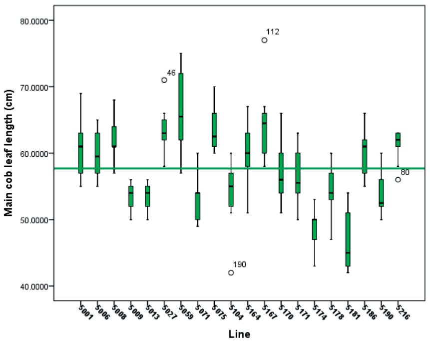

Figure 4. Boxplot Diagram associated with the characteristic of the main cob leaf length

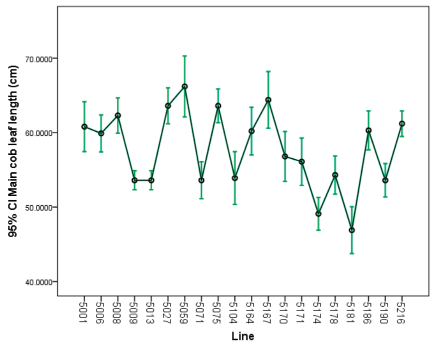

Figure 5. Averages and confidence intervals for variable Cob leaf length main cob

Table 4. Numeric characteristics associated with the main cob leaf length

Line	Mean (cm)	SD	95% Confidence Interval for Mean		Min.	Max.	Diff.	Semnif.	P	Duncan test
			Lower Bound	Upper Bound						
Field mean	57.7	0.8062	57.123	58.277	56.4	59.2				**cde**
5001	60.8	4.6857	57.448	64.152	55	69	3.1	ns	0.0698	bc
5006	59.9	3.4785	57.412	62.388	55	65	2.2	ns	0.1972	def
5008	62.3	3.3015	59.938	64.662	57	68	4.6	**	0.0074	fg
5009	53.6	1.7764	52.329	54.871	50	56	-4.1	0	0.0168	b
5013	53.6	1.7764	52.329	54.871	50	56	-4.1	0	0.0168	efg
5027	63.6	3.3731	61.187	66.013	58	71	5.9	***	0.0006	fgh
5059	66.2	5.7116	62.114	70.286	57	75	8.5	***	0.000	fg
5071	53.6	3.4705	51.117	56.083	49	60	-4.1	0	0.0168	b
5075	63.6	3.1693	61.333	65.867	60	70	5.9	***	0.0006	h
5104	53.9	4.9542	50.356	57.444	42	60	-3.8	*	0.0266	efg
5164	60.2	4.492	56.987	63.413	51	67	2.5	ns	0.1431	a
5167	64.4	5.3166	60.597	68.203	58	77	6.7	***	0.0001	gh
5170	56.8	4.6857	53.448	60.152	51	66	-0.9	ns	0.5972	def
5171	56.1	4.4585	52.911	59.289	50	63	-1.6	ns	0.3479	def
5174	49.1	3.0714	46.903	51.297	43	53	-8.6	000	0.000	a
5178	54.3	3.5917	51.731	56.869	47	60	-3.4	0	0.0469	b
5181	46.9	4.4083	43.746	50.054	42	54	-10.8	000	0.000	b
5186	60.3	3.653	57.687	62.913	55	66	2.6	ns	0.1279	bc
5190	53.6	3.134	51.358	55.842	50	60	-4.1	0	0.0168	b
5216	61.2	2.3944	59.487	62.913	56	63	3.5	0	0.0409	bcd

ns = Not significant. * The mean difference positive and is significant at the 0.05 level. ** The mean difference positive and is significant at the 0.01 level. *** The mean difference positive and is significant at the 0.001 level. 0 - The mean difference negative and is significant at the 0.05 level. 00 -The mean difference negative and is significant at the 0.01 level. 000 - The mean difference negative and is significant at the 0.001 level.

The diagram referring to the width of the main cob leaf, presented in Figure 6, recorded values between 5 cm and 9 cm. The average of the measurements was 6.85 cm. The width of the main cob leaf differs significantly from both the field average and the lines considered in the study ($F = 15.490$, $p = 0.000$). Lines 5001, 5006, 5013, 5075, and 5170 show significant positive differences compared to the field average (Table 5).

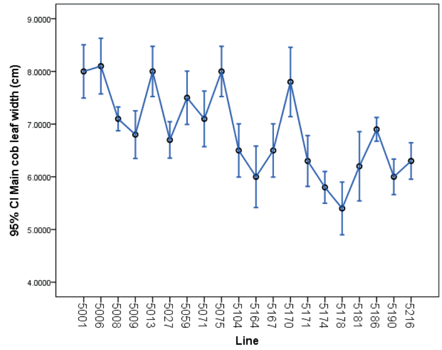

Figure 6. Mean and 95% CI for the main cob leaf width

Table 5. Numeric characteristics associated with the width of the cob leaf main

Line	Mean	Std. Deviation	95% Confidence Interval for Mean		Min.	Max.	Diff.	Semnif.	p	Duncan Test
			Lower Bound	Upper Bound						
Field mean	6.85	0.143	6.75	6.95	7	9				**cde**
5001	8	0.707	7.49	8.51	7	9	1.15	***	0.0001	bc
5006	8.1	0.738	7.57	8.63	7	9	1.25	***	0.000	def
5008	7.1	0.316	6.87	7.33	7	8	0.25	ns	0.388	fg
5009	6.8	0.632	6.35	7.25	6	8	-0.05	ns	0.8628	b
5013	8	0.667	7.52	8.48	7	9	1.15	***	0.0001	efg
5027	6.7	0.483	6.35	7.05	6	7	-0.15	ns	0.6042	fgh
5059	7.5	0.707	6.99	8.01	6	8	0.65	*	0.0256	fg
5071	7.1	0.738	6.57	7.63	6	8	0.25	ns	0.388	b
5075	8	0.667	7.52	8.48	7	9	1.15	***	0.0001	h
5104	6.5	0.707	5.99	7.01	5	7	-0.35	ns	0.2273	efg
5164	6	0.816	5.42	6.58	5	7	-0.85	00	0.0037	a
5167	6.5	0.707	5.99	7.01	6	8	-0.35	ns	0.2273	gh
5170	7.8	0.919	7.14	8.46	6	9	0.95	**	0.0012	def
5171	6.3	0.675	5.82	6.78	5	7	-0.55	ns	0.0585	def
5174	5.8	0.422	5.5	6.1	5	6	-1.05	000	0.0004	a
5178	5.4	0.699	4.9	5.9	5	7	-1.45	000	0.000	b
5181	6.2	0.919	5.54	6.86	5	7	-0.65	0	0.0256	b
5186	6.9	0.316	6.67	7.13	6	7	0.05	ns	0.8628	bc
5190	6	0.471	5.66	6.34	5	7	-0.85	00	0.0037	b
5216	6.3	0.483	5.95	6.65	6	7	-0.55	ns	0.0585	bcd

ns = Not significant. * The mean difference positive and is significant at the 0.05 level. ** The mean difference positive and is significant at the 0.01 level. *** The mean difference positive and is significant at the 0.001 level. 0 - The mean difference negative and is significant at the 0.05 level. 00 - The mean difference negative and is significant at the 0.01 level. 000 - The mean difference negative and is significant at the 0.001 level.

The analysis shows that there are significant differences in the number of branches on the panicle between the studied lines (χ^2 = 46.924, p = 0.001, Kruskal Wallis test). By applying the Mann-Whitney test, significant differences were found compared to the field mean, specifically for lines 5006 (p = 0.0462), 508 (p = 0.0463), 5059 (p = 0.0461), 5216 (p = 0.0463).
The total plant height is moderately positively correlated with the height of the insertion of the main cob (R = 0.554, p = 0.000), positively correlated with the length of the main cob leaf (R = 0.437, p = 0.000), and weakly positively correlated with the width of the main cob leaf (R = 0.264, p = 0.000) (Figure 7).
The height of the insertion of the cob is weakly positively correlated with the length of the cob leaf (R = 0.208, p = 0.000) and weakly positively correlated with the width of the main cob leaf (R = 0.165, p = 0.020). There is a weak positive correlation between the length and width of the main cob leaf (R = 0.398, p = 0.000) (Figure 7).

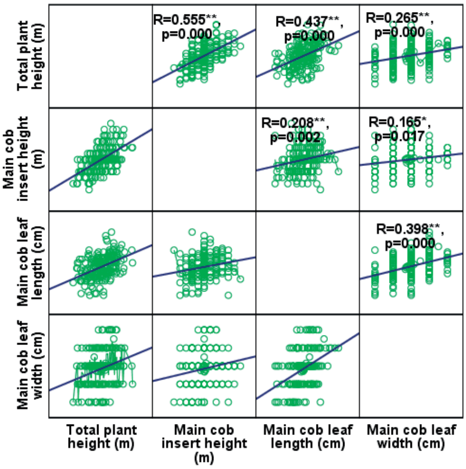

Figure 7. Matrix of correlations between variables
**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

The average number of days until emergence is 10.2 days with a standard deviation of 1.19 days, lines 5006, 5013, 5164, 5167, 5178, 5181, 5216 being those that sprung up after a minimum of 9 days, and the last lines that have sprung up are 5008, 5059, 5075, 5190 after a maximum number of days of 12, (Figure 8, Table 6). The median number of days until flowering is Me=10 days so that 50% of the lines (10) bloomed before 10 days.

Table 6. Descriptive numeric characteristics associated with the number of days until emergence/flowering/sweeping

Descriptive numeric characteristics	Mean	Median	SD	Min.	Max.	Percentiles	
						25(Q_1)	75(Q_3)
Date to plant emergence	10.2	10	1.1964	9	12	9	11
Days to flowering	78.7	78	1.9221	77	82	77	80.75
Days to silk	81.45	80.5	2.0895	79	85	80	83.75

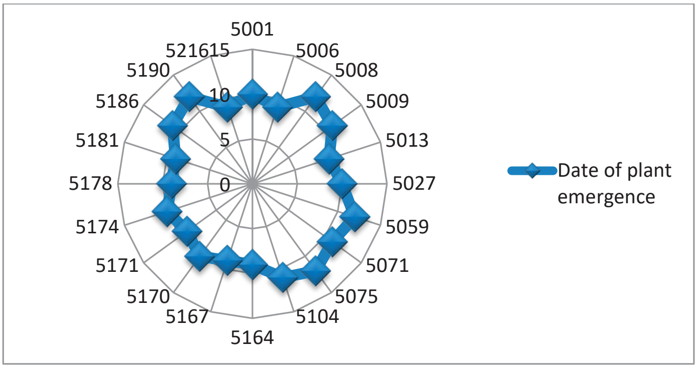

Figure 8. Number of days until sunrise by lines

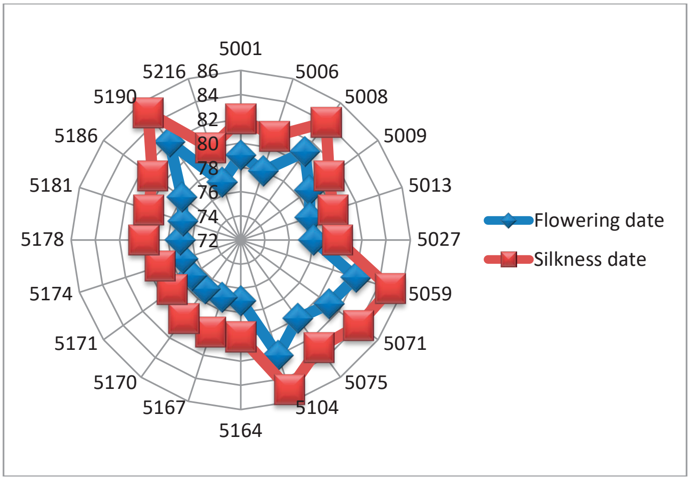

Figure 9. Number of days until flowering/silking by lines

Lines 5164, 5167, 5170, 5171, 5174, 5178, 5181, 5216, 5006, 5013, 5027 are those with a lower number of days until flowering/ sweeping (Figure 9).

The analysis of the correlation between the number of days to flowering and the number of days to silking shows a significant positive direct linear correlation. The number of days to flowering (NDF) is highly positively correlated with the number of days to silking (NDS), with an R value of 0.979 (p = 0.0000, correlation is significant at the 0.01 level).

The linear model was a good fit for the data (p = 0.000, F = 413.340), and the regression line obtained was y = 1.0641 x-2.2948 (t = 20.331, p = 0.000) (Figure 10). The mean of the accumulated thermal units until flowering was 17345.242 (degree Celsius)/hour, with a standard deviation of 692.2489 (degree Celsius) (Table 7).

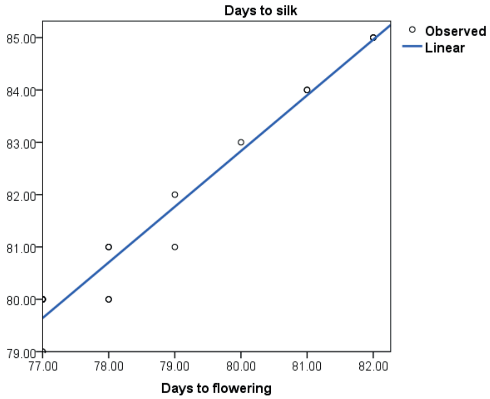

Figure 11. The regression line between the number of days to flowering (DF) and the number of days to silking (DS)

Table 7. Descriptive numeric characteristics associated with variables

Descriptive numeric characteristics	Mean	Median	SD	Min.	Max.
The sum of thermal degrees until flowering day(C)/Degrees hours	17345.242	17117.675	692.2489	16672.54	18567.72
The sum of thermal degrees until flowering day(C)/Degrees days	716.0715	706.27	29.56702	688.72	767.8
The sum of thermal degrees to silky day (C)/Degrees hours	18455.257	18164.175	635.14167	17504.55	19534.27
The sum of thermal degrees to silky day (C)/Degrees days	762.3185	749.93	27.11887	723.38	808.08

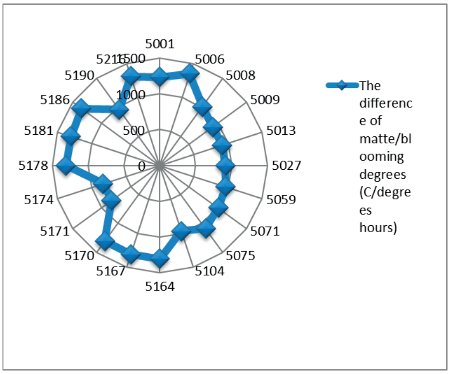

Figure 12. The difference of matte/blooming degrees (C/degrees hours)

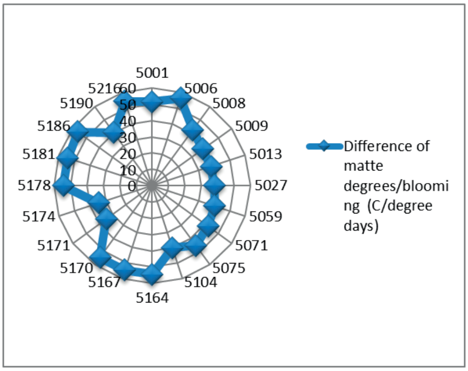

Figure 13. Difference of matte degrees/blooming (C/degrees days)

The sum of thermal degrees until the day of flowering (in Celsius) and degree hours show a direct linear correlation that is statistically significant with Days to flowering, with an R value of 0.975 (p = 0.000, indicating that the correlation is significant at the 0.01 level). The linear model fits the data well (F = 1643.611, p = 0.000), resulting in a regression line of y = 0.003x+30.799 (t = 40.541, p = 0.000) (Figure 14).

Similarly, the variables, the sum of thermal degrees until flowering day (in Celsius)/degree days and Days to flowering also show a significant direct correlation (R = 0.997, p = 0.000, indicating that the correlation is significant at the 0.01 level). The regression line obtained fits the data well (F = 2609.7, p = 0.000), resulting in y = 0.065x+32.307 (t = 51.085, p = 0.000) (Figure 15)

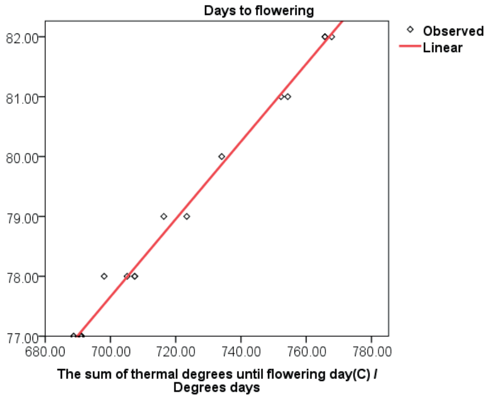

Figure 13. Regression line between The sum of thermal degrees until flowering day (C)/Degrees hours and the number of days to bloom (DF)

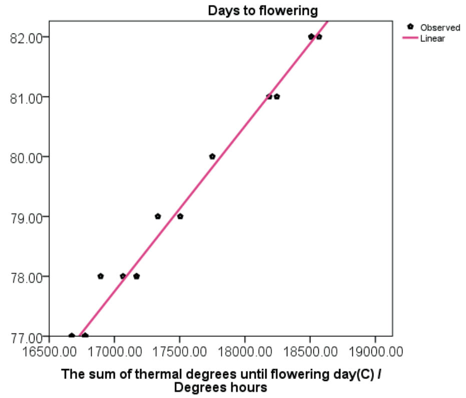

Figure 14. Regression line between The sum of thermal degrees until flowering day(C)/day hours and the number of days until flowering (DF)

The sum of thermal degrees until the day of flowering (in Celsius) and degree hours show a direct linear correlation that is statistically significant with Days to silk, with an R value of 0.977 (p = 0.000, indicating that the correlation is significant at the 0.01 level). The linear model fits the data well (F = 380.4917, p = 0.000), resulting in a regression line of y = 0.003x+30.292 (t = 19.506, p = 0.000) (Figure 15).

Similarly, the variables The sum of thermal degrees until flowering day (in Celsius)/degree days and Days to silk also show a significant direct correlation (R = 0.978, p = 0.000, indicating that the correlation is significant at the 0.01 level). The regression line obtained fits the data well (F = 393.3452, p = 0.000), resulting in y = 0.069x+31.966 (t = 51.085, p = 0.000) (Figure 17).

The sum of thermal degrees until the day of silk (in Celsius) and degree hours shows a direct linear correlation that is statistically significant with Days to silk, with an R value of 0.989 (p = 0.000, indicating that the correlation is significant at the 0.01 level). The linear model fits the data well (F = 824.3406, p = 0.000), resulting in a regression line of y = 0.003x+21.389 (t = 28.711, p = 0.000) (Figure 16).

Similarly, the variables The sum of thermal degrees until silk day (in Celsius)/degree days and Days to silk also show a significant direct correlation (R = 0.998, p = 0.000, indicating that the correlation is significant at the 0.01 level). The regression line obtained fits the data well (F = 1180.965, p = 0.000), resulting in y = 0.076x+23.158 (t = 34.365, p = 0.000) (Figure 18).

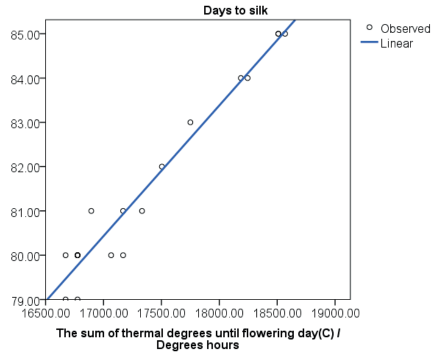

Figure 15. Regression line of the sum of thermal degrees until flowering day(C)/Degrees hours and days to silk

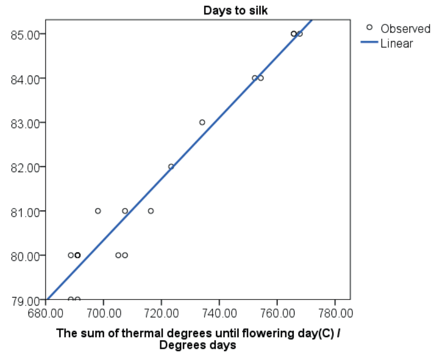

Figure 16. Regression line of the sum of thermal degrees until flowering day(C)/Degrees days and days to bloom (DF)

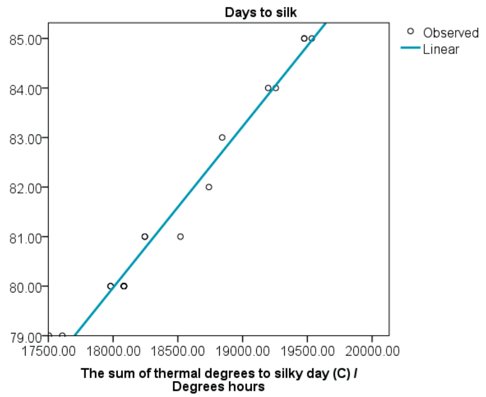

Figure 17. Regression line of the sum of thermal degrees until silky day(C)/Degrees hours and days to silk

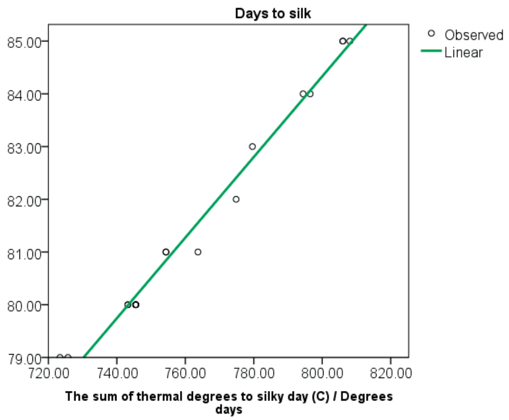

Figure 18. Regression line of the sum of thermal degrees until flowering day (C)/Degrees days and days to bloom

A regression model was also determined between the variable Number of days to silk (x), Panicle branches (y), and the variable Total number of leaves (z) ($R = 0.704$, $F = 8.359$, $p = 0.003 < 0.05$) using the equation: $z = 0.796x+0.315y+68.756$ (Figure 19).

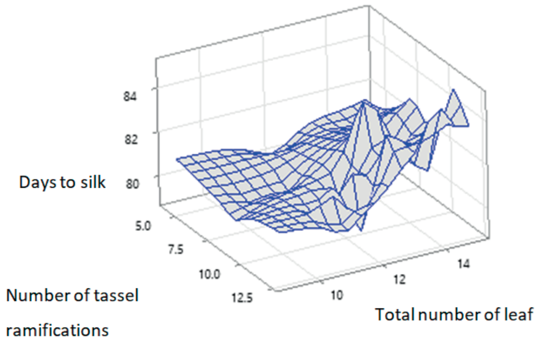

Figure 19. Surface plot of Day to silk vs. Total number of leaf and Number of tassel ramifications

CONCLUSIONS

The results obtained regarding the analysis of certain agronomic characteristics on 20 maize lines belonging to SCDA Lovrin confirm their exceptional value as a germplasm source for maize breeding and obtaining hybrids with valuable traits.

The average number of days to germination is 10.2 days with a standard deviation of 1.19 days, lines 5006, 5013, 5164, 5167, 5178, 5181, 5216 being those that germinated after a minimum of 9 days, while the last lines that germinated are 5008, 5059, 5075, 5190 after a maximum number of 12 days. The median of the number of days to flowering showed that 50% of the lines (10) flowered before 10 days.

The results regarding the number of days to flowering/silking, as well as the thermal requirement (sum of temperature degrees), provide a very clear picture of their earliness, very important information in the process of hybridization and obtaining hybrids in the current climatic context.

The total plant height is in a medium direct correlation with the height of the main cob insertion, with the length of the main cob leaf and a weak direct correlation with the width of the main cob leaf.

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