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COMBINING ABILITY AND TYPE OF GENE ACTION FOR GREEN FODDER YIELD AND IT'S COMPONENTS IN SOME TEOSINTE MAIZE HYBRIDS.

Sakr, H. O.
Forage Research Program, FCRI, ARC, Egypt.

ABSTRACT

Although there are many forage crops valid in our country but the forage yield of maize (*Zea mays L.*) a fodder crop popular because of its earliness succulence and high yield. It could be increased if the tillering habit of teosinte (*zea mexican*) transferred to maize through hybridization breeding program. In this, investigation three lines of teosinte, which were derived from selection among segregating generations of three crosses. The three lines of teosinte were crossed by three genotypes of maize, inbred line 34 , inbred line 63, from National Maize Research Program and single cross 30k8 (commercial) to produce nine crosses at Serw Agricultural Research station in 2007 growing season. The nine crosses and their parents were evaluated during 2008 and 2009 seasons at Serw Agricultural Research. The studied traits were number of tillers per plant, number of leaves per plant, plant height, leaves weight to stems weight ratio, green fodder yield per plant, dry fodder yield per plant and digestible protein percentage. The data were subjected to biometrical analyses and the obtained results could be summarized in the following:

Significant mean squares for crosses and tester (maize) for all studied traits were observed. Mean squares of line (teosinte) is not significant for all studied traits except for L/S ratio and green fodder yield in the first cut. In addition, mean squares of lines x testers interactions were significant and highly significant in most occasions for all studied traits except for number of tillers per plant and L/S ratio. Years, crosses by years, tester (maize) x years and L x T x Y interaction were significant in most occasions. There was no specific parents exhibited highest mean through the three cuts with respect to most of studied traits. However, line-3 of teosinte , was the best parent for number of tillers per plant , L/S ratio, numbers of leaves per plant , green fodder yield and dry fodder yield per plant through the three cuts. On the other hand, the cross L_1xT_1 followed by L_3xT_1 were the best combinations for green fodder yield per plant as a total of three cuts. In general, the over all means of crosses exceeded their parents except for number of tillers per plant and number of leaves per plant. The parental inbred lines that exhibited desirable general combining ability (GCA) effects were L_1 for number of leaves per plant, L/S ratio and dry fodder yield per plant. In addition, L-2 for dry fodder yield per plant and digestible protein and L-3 for dry fodder yield per plant. Generally, these inbred lines could be recommended for advanced stage of evaluation by teosinte and teosinte x maize program. Line 34(tester-1) was good general combiner for green fodder yield per plant, dry fodder yield per plant and digestible protein percentage while line 63(tester-2) was a good general combiner for number of tillers per plant, number of leaves per plant, green fodder yield per plant, dry fodder yield per plant and digestible protein percentage. The highest SCA effects were observed in the crosses L1xT3, L2xT1, L2xT3 and L3xT1 for dry fodder yield per plant and L1xT1 and L2xT2 for digestible protein percentage. Estimation of general combining ability (σ2GCA) for maize (tester) higher in magnitude than those of (σ2GCA) for teosinte (line) for all studied traits. So that the contribution of maize were higher than the contribution of teosinte for all studied traits. General combining ability variance components (σ2GCA) was larger than that of specific combining ability variance (σ2SCA) for all studied traits indicating that additive genetic variance played the major role than non-additive gene action in the inheritance of these traits. The variance of general combining ability interaction with years (σ2GCA x Y) was higher than the variance of specific combining ability interaction with years (σ2SCA x Y) for most traits these indicating that additive type of gene action was more affected by environmental conditions than non-additive effects. Significant positive correlations were observed among all studied traits. Therefore, the selection for one of these traits will be associated with the improvement of the other traits during the selection program. In conclusion, from the previous results, it could be recommended that, the best crosses with highest SCA effects should be used as started materials for selection breeding program to important fodder yield components.

INTRODUCTION

Successful development for improving high fodder yield, high percentage of digestible protein, high branches along summer season is based mainly on accurate evaluation of inbred lines under selection and that is a major aim in the national forage research program. In fact, the forage yield of maize a fodder crop popular because of its earliness , succulence and high yield , could be increased if the tillering habit of teosinte could be transferred to maize by hybridization (Chaudhuri and Prasad 1968). Maize is an important cereal fodder crop with high photosynthetic efficiency and fodder becomes available in a short duration, where as teostine is along duration high yielding fodder crop and ability to produce more tillers. Thus to combine the important characteristics of maize and teosinte , hybridization program between these two cereal crops was started in early thirty's India. (Jill and Patil 1985). Maizente is the hybrid of maize and teosinte and as stated it is more succulent, leafy and branched annual having 2-3.5 m height and tillers may range from 3 to 5 and can be planted from March on wards for forage program (Singh, 1975).

On the basis of per day production for green fodder yield maizente (maize x teosinte hybrid) recorder higher production as compared to teosinte entries and maize (Gill and Patill 1985).

The origin of maize is reviewed under the headings (1) corn as product of speciation by domestication, (2) teosinte: an ancestor and probable progenitor of corn (by a-2 stage domestication resulting in multicentres), and (3) isolating mechanisms (Galinat *et al*, 1988)

Shieh *et al* (1995) studied on the tillering, ratooning and some agronomic characteristics in maize, teosinte and their hybrids they found the hybrids had fewer tillers than the teosinte, also maize unable to re grow after being cut while the teosinte and the hybride had the best ratooning ability.

Abd El-maksoud *et al* (1998) revealed that both general and specific combinig ability mean squares were highly significant in most occasions, indicating that both additive and non additive gene action were important in the expression of studied traits in teosinte.

The information about "maizente" (maize x teosinte hybrid) has been given by several authors (Smith *et al* 1984, Abdel-Twab and Rashed 1985, Aulicino and Magoja 1991, Sohoo *et al* 1993, Alan and Sundberg 1994, Jode and James 1996) but all the available information has contributed to the relationships among teosintes and between teosinte and maize in addition to the characterization of teisinte for agronomic traits. Todorova and Lidanski (1985) found that additive, dominance and epistatic effects were involved in control of the characters in the hybrids from maize and teosinte.

Virtually few data exist on the nature of gene action for fodder yield of maizente (maize x teosinte hybrid). Therefore, this investigation has been done to 1- gather information on the genetic behavior of fodder yield component traits , 2- determine the most important mode of gene action that control traits under study , i.e. number of tillers per plant, number of leaves per plant, plant height(cm), leaves weight to stemes weight ratio(L/S ratio), green fodder yield per plant (GFY/P), dry fodder yield per plant (DFY/P) and digestible protein percentage (DP%), 3- Define the superior topcrosses to be used for improving and developing genotypes for highly production of fodder yieled.

MATERIALS AND METHODS

Three teosintes inbred lines derived through selection from segregating generations of three crosses (local teosinte with central plateau , race local tesosinte with Balsas race , central plateau race with Balsas race) were used in this investigation. These lines were crossed with three entries of maize i.e., inbred line 34 and inbred line 63 from National Maize Research Program, FCRI,ARC, and single cross 30k8 (commercial) at Serw agricultural research station during 2007 , growing season. The seeds production were divided to evaluate at Serw Agricultural Research Station in two years; 2008 and 2009. The experiment was arranged in a randomized complete blocks design with three replications. Plot size was one row , 6m long and 80 cm apart. Seeds was planted in hills eventy spaced at 25cm along the row at the rate of three kernels per hill. Seedling was thinned to one plant per hill after 21 day from planting. All agronomic field practices were applied as recommended. Data recorded on 10 guarded plants, which were chosen randomly from each row in three cuts at two seasons for the following forage traits: number of tillers per plant(NT/P), number of leaves per plant(NL/P), plant height(PH cm), leaves weight to stems weight ratio(L/S ratio), green fodder yield per plant (GFY/P), dry fodder yield per plant (DFY/P) and digestible protein percentage (DP%). Digestible protein (DP) were calculated by, DP = (CP% * 0.929) - 3.48, according to Wheeler and Mochrie(1981). Where CP% are crude protein percentage which was determined by using the Micro-Keldahl Method according to Chapman and Prott,(1961). The first cut was taken after 45 days from the day of sowing, and then the entries of maize (T1,T2,T3) became absent but the other entries which include the parent of teosinte (L1,L2,L3) and nine hybrid were taken the second cut after 30 days from a day of the first cut and the third cut was taken after 30 days from a days of the second cut.

Statistical analysis were performed for each year, then the combined data over years subjected to analysis of variance according to steel and torrie (1980). The combining ability analysis was estimated using the line X tester procedure suggested by kempthorne(1957). Combined analysis among the two years was done on the based of homogeneity test.

RESULTS AND DISCUSSION

The results of combined analysis of variances over both years and cuts for all studied traits, i.e. number of tillers per plant (NT/P), number of leaves per plant (NL/P), plant height(PH cm), leaves weight to stems weight ratio (L/S ratio), green fodder yield per plant (GFY/P), dry fodder yield per plant (DFY/P) and digestible protein percentage (DP%), are shown in Table 1. Results revealed that , mean squares due to crosses (C) and their partitions ; lines (L), testers(T), and L x T interactions were significant for most of studied traits, especially in the first cut except L x T for number of tillers per plant (NT/P) and L/S ratio which were not significant in any cut. These results indicated that both inbred lines and testers were significantly differed in their performance. Significant L x T interaction suggests that inbred lines of teosinte may have different combining ability patterns and performed differently in crosses depending on the type of tester (maize).

While years, crosses by years, tester by years and L x T x Y interaction were significant in most occasions. This indicates that these crosses gave different performances at different environmental conditions. This finding agree with the results obtained by Abd El-Maksoud *et al*.,(2004) in teosinte , Parvez *et al*. (2007) in maize.

The performances of the studied genotypes appeared to be varied from year to another as well as from cut to another with respect to their means for most of studied traits. Therefore , the means over both years would be more suitable to represent the data . The six parent of lines means from the combined data over both years were determined and the obtained results are presented in Table 2. In addition, mean performances of the crosses for all studied traits from the combined data over both years were determined for the first, second and third cuts and the obtained results are presented in Table 3. The means showed that, although, there was no specific parents exhibited highest mean through the three cuts with respect to most of studied traits, the line_3 was the best in number of tillers per plant (NT/P), LS ratio in the first and second cut with the means 5.85 and 1.45 respectively and 6.28 and 1.44 respectively, number of leaves per plant (NL/P) in the first and third cut with the means of 29.7 and 46.8 respectively and plant highest (PH), green fodder yield per plant(GFY/P), and dry fodder yield per plant (DFY/P) in the second and third cut with mean values 119.5cm, 487.83 gm and 68.4 gm, respectively and 169.16cm,1089.83 gm and 197.15 gm respectively. While the line-1 was the highest parent for green and dry fodder yield per plant in the first cut and digestible protein (dp %) in the second cut with mean values of116.85 gm, 18.95 gm and 13.67 respectively. The tester-3 was the highest parent for plant height (PH) in the first cut (126.4 cm) and the tester-2 followed by tester-3 were the best parent for digestible protein in the first cut (15.4 and 15.1%) respectively.

On the other hand, no specific hybrid showed superiority over other combinations through three cuts for all studied traits.

T1-2-3

However, the highest mean was observed in the combinations when involving the highest parent for most of studied traits. For instance, the best combination for green fodder yield per plant as total three cuts was the L1 x T1 followed by L3 x T1 with the means (451.1, 920.83 and 1127.5) and (791.65, 873.0 and 687.5 gm/plant) in first, second and third cut respectively .The best combination for dry fodder yield per plant (DFY/P) as total three cuts was L3 x T1 with the means 203.45, 139.03 and 107.6 in the first, second and third cut, respectively. The highest combination for number of tillers per plant and number of leaves per plant as total three cuts was L1 x T2 with the means (5.4, 4.03) and 3.36 and (35.4, 33.73 and 23.83) in the first, second and third cut, respectively.

In general, the overall means of crosses exceeded their parents except for number of tillers and number of leaves in most occasions similar results were reported by Gill and Patill (1985), Shieh *et al*. (1995) And Abd El-maksoud *et al.* (1998), and Abd El-maksoud *et al.* (2004) in teosinte.

The estimates of general combining ability (GCA) effects of the parental lines for the studied traits are presented in Table 4. Positive or negative estimates would indicate that a given inbred is much better or much poorer than the average of the group involved with it in the crossing. Comparison of the GCA effects of individual parent exhibited that the line-1 has positive and significant GCA effect for number of leaves per plant (NL/P) , leaves to stems ratio (L/S ratio) and dry fodder yield per plant (DFY/P) .

Table 4:General combining ability (GCA) effects for the three inbred lines (teosinte) and the three testers (maize) for all studied traits combined over both years in the three cuts.

		Tillers plant^{-1}	Leaves plant^{-1}	Plant height	Ls ratio	GFY plant^{-1}	DFY plant^{-1}	DP%
Line-1	I	0.42	2.60*	6.57	0.09*	8.73	-8.6*	0.33
	II	0.22	0.50	2.49	0.02	26.3	1.68	-0.38**
	III	0.06	0.39	1.33	0.00	3.00	19.66**	-0.67**
Line-2	I	-0.211	-3.8**	-9.49	0.08*	-89.24	-32.51**	-0.38*
	II	0.02	-0.22	-0.02	-0.03	-33.05	-31.75**	0.15
	III	0.00	-0.47	-0.4	0.00	-20.9	13.68**	0.32*
Line-3	I	-0.21	1.20	2.92	-0.16**	80.51	41.11**	0.04
	II	-0.24	-0.28	-2.47	0.01	6.75	30.07**	0.23
	III	-0.06	0.08	-0.93	0.00	17.9	-33.34**	0.35
Tester-1	I	-0.08	1.00	-3.77	-0.19**	133.68**	38.76**	0.69**
	II	-0.10	-4.11*	1.23	-0.03	-1.25	-6.01	0.79**
	III	-0.32	-1.51	3.74	-0.06	373.72**	70.85**	0.30*
Tester-2	I	0.62*	4.67**	7.7	0.01	54.15	-1.66	1.64**
	II	0.51	5.75**	5.12	-0.04	221.37**	38.65**	0.79**
	III	0.10	0.47	-5.06	-0.05	-247.5**	-51.49**	0.56**
Tester-3	I	-0.54*	-5.67**	-3.93	0.19**	-187.84**	-37.09	-2.33**
	II	-0.41	-1.64	-6.35	0.07*	-220.12**	-32.64**	-1.57**
	III	0.22	1.04	1.32	0.11**	-126.22**	-19.36**	-0.86**
LSD	$I^{0.05}$	0.52	2.11	7.78	0.08	89.4	8.06	0.31
	$I_{0.01}$	0.69	2.82	10.42	0.11	119.77	10.8	0.42
	$II^{0.05}$	0.52	3.29	11.15	0.067	114.32	8.87	0.24
	$II_{0.01}$	0.71	4.41	14.95	0.09	153.17	11.88	0.33
	$III^{0.05}$	0.45	3.2	18.93	0.09	93.46	8.59	0.29
	$III_{0.01}$	0.61	4.29	25.37	0.12	125.23	11.51	0.39

***, ** significant at 0.05 and 0.01 levels of probability, respectively**

In addition, line-2 has positive and significant values for dry fodder yield (DFY/P) and digestible protein (DP%) line-3 showed that it was positive and high significant for dry fodder yield per plant. Thus, it could be suggested that these lines (teosinte) posses favorable genes for improving hybrids and could be utilized in breeding program for improving these fodder yield component traits. Similar results were reported by Abd el- Maksoud ,*et al* (1998) in teosinte. Results showed that the favorable GCA effects were recorded when line 34 (tester-1) was used for green fodder yield per plant (GFY/P), dry fodder yield per plant (DFY/P) and digestible protein (DP %). While line 63 (tester-2) for number tillers per plant (NT/P) number of leaves per plant (NL/P), green fodder yield per plant (GFY/P), dry fodder yield per plant (DFY/P) and digestible protein percentage (DP %).

Estimates of specific combining ability effects (SCA) for nine crosses for all studied traits in the three cuts as a combined over both years are shown in Table 5. The results showed that the best SCA effects were obtained in the crosses L1 x T3 , L2 x T1 , L2 x T3, L3 x T1 and L3 x T2 for dry fodder yield per plant (DFY/P) as well as L1 x T1 and L2 x T2 for digestible protein (DP%).

Estimates of genetic variance components for all studied traits over both years and their interaction with locations are illustrated in Table 6. Results showed that estimates σ2GCA for lines (Teosinte) lower in magnitude than those of σ2GCA for testers (Maize) with respect to all studied traits , indicating that most of the total GCA variances were due to the maize genotypes and the contribution of maize were higher than the contribution of teosinte for all studied traits. General combining ability variance components (σ2GCA) was larger than those of the specific combining ability variance (σ2SCA) for all studied traits indicating that additive genetic variance played the major role than non additive gene action in the inheritance of these traits .These results in agreement with Todorova and Lidanski (1985) and Abd El-Maksoud *et al* (2004) in teosinte.

The variance interactions of σ2GCA x Y was higher than σ2GCA x Y for green fodder yield per plant (GFY/P), dry fodder yield per plant (DFY/P), and digestible protien (DP %), indicating that the GCA for genotypes of maize was affected more by environment than by genotypes of teosinte. Combined data revealed that the variance of GCA interaction with years (σ2GCA x Y) was higher than the variance of SCA interaction (σ2SCA x Y) for most of studied traits. These results indicated that additive type of gene action was more affected by environmental conditions than non-additive effects .These results agreement with Abd El-Maksoud *et al* (1998) in teosinte.

The information about the degree of association among different traits of teosinte maize hybrids is of great importance for breeders. The coefficient of correlation provide a measure of the genetic association between pairs of traits to identify the traits which could be used as indicator for improvement of other traits through the selection programs.

T5

The coefficient of correlation between each pair of studied traits were calculated for all crosses. Subsequently coefficient among all studied traits were estimated and the obtained results are shown in Table_7. Significant positive correlations were observed among all studied traits .

Table 6: Estimate of genetic variance components for all studied traits over both years and their interaction with years in the three cuts.

		Tillers plant^{-1}	Leaves plant^{-1}	Plant height(ph)	LS ratio	GFY plant^{-1}	DFY plant^{-1}	DP%
$\sigma^2L=\sigma^2GCA$ (lines)	I	0.09	9.2	45.21	0.02	4661.3	682.8	0.07
	II	0.02	-0.15	3.42	0.00	365.23	797.68	-0.21
	III	-0.01	-0.21	-5.31	0.00	363.26	496.64	0.26
$\sigma^2T=\sigma^2GCA$ (Testers)	I	0.30	25.35	18.66	0.04	25446.3	712.8	4.24
	II	0.19	25.95	31.26	0.00	48182.4	1137.3	1.54
	III	0.07	1.4	14.01	0.00	108381.9	3677.32	0.5
$\sigma^2GCA=\sigma^2GCA$ (Aver.)	I	0.20	17.27	31.92	0.03	15053.8	697.8	2.15
	II	0.10	12.89	17.34	0.01	24273.8	967.5	0.67
	III	0.03	0.6	4.35	0.00	54372.6	2086.98	0.40
$\sigma^2LxT=\sigma^2$ SCA (Aver.)	I	0.03	4.65	55.2	0.00	4888.7	2159.3	0.12
	II	0.09	-2.91	-37.11	0.00	-3108.85	451.61	0.92
	III	-0.05	-2.53	-110.4	0.00	-3040.8	1010.55	0.21
σ^2GCA/σ^2 SCA σ^2GCA (aver.) $/\sigma^2GCA$ (L) x Y	I	7.56	3.71	0.58	-56.00	3.08	0.32	17.52
	II	1.13	-4.43	-0.47	0.00	-7.81	2.14	0.72
	III	-0.68	-0.23	-0.04	0.01	-17.88	2.07	1.77
σ^2L^2 x Y = σ^2GCA (T) x Y	I	0.34	21.34	177.14	-0.01	19160.8	46.6	-0.11
	II	0.22	1.96	-2.46	0.00	-2745.14	129.10	-0.01
	III	-0.01	0.02	3.3	0.00	578.36	-107.69	-0.03
σ^2Tx Y σ^2GCA (T) x Y	I	-0.12	-1.45	-37.75	0.00	516.3	168.76	0.28
	II	0.01	1.78	139.41	0.00	11414.2	695.84	0.14
	III	0.03	0.28	-11.39	0.00	12602.02	322.57	-0.04
$\sigma^2GCAxLoc=$ $\sigma GCA(T)x$ Y.	I	0.11	9.94	69.7	-0.02	9838.55	107.7	0.08
	II	0.11	1.87	415.77	0.00	4334.53	412.45	0.06
	III	0.01	0.15	-4.04	0.00	6590.19	644.64	-0.03
σ^2LxTx Y = σ^2SCA (aver.)Y	I	0.26	17.07	122.87	0.02	9106.93	151.44	0.30
	II	0.02	-6.26	-82.43	0.00	1442.4	49.93	0.03
	III	-0.13	-6.94	-202.43	0.00	-5924.46	419.7	0.07
Contribution of lines	I	23.75	26.3	42.53	33.5	17.92	32.75	2.78
	II	15.42	0.7	13.5	7.78	1.8	37.19	4.2
	III	3.7	6.73	3.92	0.00	0.351	15.16	31.64
Contribution of tester	I	61.27	63.90	26.61	63.70	69.24	33.45	94.85
	II	64.56	96.77	74.5	59.92	96.03	50.38	71.5
	III	77.94	64.53	58.35	97.55	99.56	72.40	53.26
Contribution of L X T	I	14.91	9.82	30.86	2.73	12.83	33.80	2.36
	II	20.10	2.53	12.00	32.3	2.17	12.43	24.3
	III	18.36	28.72	37.75	2.45	0.08	12.44	15.13

Table7: Simple correlation coefficient between for all studied traits combined over three cuts during the first and second years.

	Tillers plant^{-1}	Leaves plant^{-1}	Plant height(cm)	Ls ratio	GFY plant^{-1}	DFY plant^{-1}	DP%
Tillers plant^{-1}		0.98**	0.92**	0.88**	0.84**	0.81**	0.90**
Leaves plant^{-1}			0.96**	0.85**	0.88**	0.85**	0.94**
Plant height(cm)				0.86**	0.89**	0.88**	0.96**
Ls ratio					0.6*	0.59*	0.76**
GFY plant^{-1}						0.98**	0.92**
DFY plant^{-1}							0.91**
DP%							

***, ** significant at 0.05 and 0.01 levels of probability, respectively**

Therefor the selection for one of these traits will be associated with the improvement of the other traits during the selection program . These results are in agree with the results obtained by Abd El –Maksoud *et al* (2004); in teosint, Jha *et al* (1998); Singh and Dash (2000) in fodder maize. In conclusion, from the previous results, it could be recommended that, the best crosses with highest SCA effects should be used as started materials for selection breeding program to important fodder yield components.

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القدرة على الإئتلاف وطبيعة الفعل الجينى لصفة محصول العلف الأخضر ومكوناته لبعض الهجين النوعيه الناتجه بين الذرة الريانة و الذرة الشامية

حسام الدين عثمان صقر
قسم بحوث العلف- معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية

بالرغم من وجود عدد من محاصيل العلف لازالت الذرة الشامية تستخدم كمحصول علف على نطاق واسع بسبب أنها مبكرة وعالية المحصول الأخضر ، يمكن اللجوء إلى استعمال هجين يدخل فى تركيبة الذرة الشامية مع الذرة الريانة ليكمل بعض الصفات التى لا توجد فى الذرة الشامية المستخدمة كمحصول علف مثل صفة التفريغ وصفة تعدد الحش وحيث أن هذه الهجن عبارة عن شكل جديد تجمع صفات كل من الذرة الشامية والذرة الريانة فإن هذه الدراسة استهدفت ما يلى :

١- جمع معلومات عن السلوك الوراثى للصفات المكونة لمحصول العلف .
٢- تحديد طبيعة الفعل الجينى المتحكم فى صفات محصول العلف وهى عدد الخلف ، عدد الأوراق وطول النبات- نسبة وزن الأوراق للسيقان ، وزن المحصول الأخضر للنبات ، وزن المحصول الجاف للنبات ، نسبة بروتين الهضم.
٣- تحديد أفضل هجين حتى يمكن تحسينه كهجين فائق كمحصول علف فى برنامج التربية وقد هجنت ثلاث سلالات منتخبة من الذرة الريانة والتى انتخبت خلال الأجيال الإنعزالية لثلاث هجن ناتجين من التهجين بين طراز محلى من الذرة الريانة مع طراز central plateau ، الطراز المحلى مع طراز Balsas ، طراز central plateau × طراز Balsas ، ثم تهجين السلالات الثلاث مع ثلاث تراكيب من الذرة الشامية وهم سلالة ٣٤ ، وسلالة ٦٣ ،من

قسم بحوث الذرة وهجين فردى ٣٠ك٨ (اتجارى) فى محطة بحوث السرو موسم صيفى ٢٠٠٧ وفى موسم ٢٠٠٨ وموسم ٢٠٠٩ تم تقييم الستة آباء + ٩ هجن فى محطة بحوث السرو تم تقدير الصفات التالية ، عدد الخلفات للنبات ، عدد الأوراق للنبات ، طول النبات ، نسبة وزن الأوراق للسيقان ، وزن المحصول الأخضر للنبات ، وزن المحصول الجاف للنبات ، ونسبة بروتين الهضم تم تحليل البيانات المتحصل عليها و يمكن تلخيص النتائج فى الأتى :

- وجدت اختلافات معنوية وعالية المعنوية بين الهجن القمية وجزيئاتها [الذرة الريانة (السلالات)و الشامية(الكشافات)] لمعظم الصفات المدروسة ، كما سجلت النتائج وجود اختلافات عالية المعنوية بين تفاعل الذرة الريانة والذرة الشامية بصفات عدد الأوراق ، طول النبات المحصول الأخضر للنبات ، والمحصول الجاف ونسبة بروتين الهضم بالإضافة إلى ذلك فإن السنين وتفاعل الهجن مع الستين وكذلك تفاعل الريانة والشامية مع الستين معنوى لبعض الصفات وهذا يدل على أن هذه الهجن تسلك سلوكاً مختلفاً مع الظروف البيئية المختلفة .

٤- أوضحت النتائج أن سلالات الذرة الريانة تمتلك قدرة عامة ومرغوبة على الإئتلاف حيث L-1 لصفات عدد الأوراق ونسبة الأوراق للسيقان ، محصول المادة الجافة للنبات والسلالة L-2الصفة محصول المادة الجافة للنبات ونسبة بروتين الهضم والسلالةL-3 لها قدرة إنتاجية ائتلافية عامة لصفة محصول المادة الجافة للنبات. أما تراكيب الذرة الشامية والتى تمثل كشافات فقد أظهرت السلالة T1 قدرة ائتلافية عامة لصفة محصول الأخضر للنبات ، محصول العلف الجاف للنبات ونسبة بروتين الهضم بينما السلالة رقم ٢ (T2) ذات قدرة ائتلافية لعدد الخلفات وعدد الأوراق ومحصول العلف الأخضر وصفته محصور العلف الجاف ونسبة البروتين.

- أشارت النتائج أن القدرة العامة للإئتلاف للذرة الريانة أقل من القدرة العامة الائتلافية للذرة الشامية وانعكس ذلك فى نسبة مشاركة الذرة الشامية والتى كانت عالية فى تكوين الهجن ، كما أوضحت النتائج إلى دور الفعل الجينى المضيف الذى يمثل الدور الرئيسى مقارنة بالفعل الجينى الغير مضيف فى توريث الصفات تحت الدراسة.
- كما أن تفاعل القدرة الائتلافية العامة والسنين لتراكيب الذرة الشامية أعلى من تفاعل القدرة الائتلافية العامة والسنين لتراكيب الذرة الريانة لصفة محصول العلف الأخضر للنبات ، محصول العلف الجاف للنبات ، نسبة بروتين الهضم.
- الفعل الجينى المضيف كان أكثر تأثر بالظروف البيئية من الفعل الجينى الغير مضيف لمعظم الصفات تحت الدراسة .
- كان هناك ارتباط وراثى معنوى بين كل الصفات تحت الدراسة مما يعنى أنه عند استخدام هذه الهجن كمصدر لانتخاب سلالات مميزة بقدرتها العالية على التآلف يمكن الاعتماد على أى صفة محل الدراسة وسوف يتبعه تحسين فى بقية الصفات .

قام بتحكيم البحث

أ.د / ممدوح محمد عبد المقصود	**كلية الزراعة – جامعة المنصورة**
أ.د / مظهر محمد فوزى عبد الله	**كلية الزراعة – جامعة القاهرة**

Table 1: Combined analysis of variance and mean squares over both years in three cuts for all studied traits.

	Df	Tillers plant			Leaves plant-1			Plant height (cm)			LS ratio			GFY plant-1			DFY plant-1			DP%		
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Years (Y)	1	1.43	1.4	1.11	21.33**	0.01	30.45	1034.03**	2524.2**	701.3	0.01	0.19**	0.00	19278.0	87878.3	275.6	1010.8*	169.95	2.57	50.5	5.13	0.45
Reps / Y	4	0.29	6.02**	3.57**	5.97	173.2**	110.1**	2004.0**	2296.3**	15909.4**	0.13**	0.64**	0.01	86485.5**	349808.5**	273071.3**	239.4	180.1	66.6	0.52	0.27	0.23
Crosses ©	8	2.53**	1.52*	0.45	193.3**	122.3**	12.57	750.9**	205.4	159.83	0.26**	0.03**	0.04	182269.7**	228352.7**	490067.1**	19378**	11589.3**	25007.4**	20.4**	11.68**	4.87**
Lines (L)	2	2.41	0.94	0.07	203.2	3.44	3.38	1277.3	111.01	25.05	0.35**	0.01	0.00	130688.9	16462.7	6888.2*	25388.0	17240.12	15164.15	2.3	1.96	6.17
Testers (T)	2	6.21*	4.00	1.42*	494.0*	473.4**	32.4	799.4	612.1*	372.9	0.67**	0.07	0.02*	504819.7*	877171.2**	1951709.4**	25928.3	23353.4*	72416.3*	77.35**	33.42	10.39*
LinesXtester	4	0.75	0.61	0.16	37.94*	6.19	7.22	463.4*	49.35	120.6	0.01	0.02	0.00	46785.0*	9888.5	835.4	13097.8**	2881.8**	6224.5**	0.96**	5.68**	1.47**
C x Y	8	1.85**	0.64	0.12	105.7**	13.29	2.17	814.5**	332.82	157.5	0.08**	0.02	0.01	89047.1**	52374.2	30962.9	1080.9**	2179.4**	1903.8**	1.49**	0.51**	0.24
Line x Y	2	4.43	2.1*	0.02	252.9	22.5	1.74	2095.2	2.57	205.4	0.11	0.01*	0.00	217221.0	8162.5	6512.3	1015.8	1489.2	451.1	0.08	0.12	0.11
Testersx Y	2	0.26	0.22	0.33	47.84	20.91	3.82	161.13	1279.4**	73.15	0.07	0.04**	0.01	49420.7	135596.4	114725.2**	2115.1	6584.5**	4323.5	3.63	1.5*	0.07
L x T x Y	4	1.36	0.13	0.07	60.92**	4.88	1.57	500.8*	24.7	175.7	0.08**	0.002	0.01	44773.4*	32868.8	1307.1	596.3**	321.92	1420.3**	1.12**	0.22	0.39
Pooled error	32	0.59	0.64	0.45	9.72	23.66	22.4	132.2	272.00	783.0	0.02	0.01	0.02	17452.6	28541.6	19080.0	141.98	172.14	161.3	0.218	0.13	0.18

***, ** significant at 0.05 and 0.01 levels of probability, respectively**

Table 2: Mean performances of the lines (teosinte) and testers(maize) for all studied traits through the three cuts from the data combined over two years.

	Tillers plant-1			Leaves plant-1			Plant height			LS ratio			GFY plant-1			DFY plant-1			DP%		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Line-1	4.15	3.95	6.45	22.15	23.73	35.88	80.6	113.33	158.7	1.15	1.23	0.66	116.86	247.25	369.5	18.95	34.88	65.42	12.84	13.67	12.48
Line-2	3.0	6.05	7.18	16.18	36.68	40.02	81.5	118.33	164.5	1.4	1.42	0.60	88.7	261.67	748.5	15.00	32.03	136.33	11.35	11.46	11.06
Line-3	5.85	6.28	6.84	29.7	34.98	46.8	80.5	119.5	169.16	1.45	1.44	0.62	91.65	487.83	1089.83	15.9	68.4	197.15	12.45	13.40	12.63
Tester-1	1.0	-	-	8.0	-	-	94.75	-	-	0.75	-	-	80.3	-	-	11.00	-	-	14.7	-	-
Tester-2	1.0	-	-	7.9	-	-	79.65	-	-	0.7	-	-	61.65	-	-	8.55	-	-	15.4	-	-
Tester-3	1.0	-	-	8.9	-	-	126.4	-	-	0.85	-	-	98.6	-	-	15.4	-	-	15.1	-	-
$LSD_{0.05}$	0.68	1.69	1.72	3.09	5.87	4.71	11.37	6.53	16.58	0.24	0.45	0.14	19.52	114.16	175.8	2.92	11.06	33.21	0.98	0.83	0.40
$LSD_{0.01}$	0.94	2.45	2.51	4.22	8.54	6.85	15.51	9.5	24.12	0.33	0.66	0.21	26.63	166.07	255.78	3.98	16.10	48.31	1.34	1.21	0.57

Table 3: Mean performances of the crosses for all studied traits through the three cuts from the data combined over two years.

		Tillers plant-1			Leaves plant-1			Plant height (cm)			LS ratio			GFY plant-1			DFY plant-1			DP%		
		T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
Line-1	I	4.7	5.4	4.4	30.05	35.4	28.85	134.95	135.7	103.75	1.00	1.25	1.4	451.1	499.7	304.1	66.3	66.8	43.15	14.8	15.0	11.05
	II	3.63	4.03	3.1	30.5	33.73	28.56	186.37	182.9	196.63	0.61	0.61	0.68	920.83	901.9	763.05	127.85	136.5	110.63	14.54	12.52	10.73
	III	2.46	3.36	3.43	18.78	23.83	26.10	149.35	150.5	168.8	0.47	0.63	0.63	1127.5	553.17	623.5	179.4	77.1	102.0	11.2	10.45	9.83
Line-2	I	3.4	4.2	4.25	24.3	26.1	20.2	70.45	93.9	90.4	1.2	1.35	1.35	324.3	174.3	136.05	48.6	29.35	26.6	13.15	14.8	10.75
	II	4.3	5.5	3.17	26.2	41.4	26.65	173.6	178.3	172.6	0.88	0.85	1.07	489.83	796.16	342.83	84.71	135.7	54.3	13.1	14.77	11.5
	III	2.43	1.9	1.63	24.43	18.0	17.0	247.2	180.5	210.0	0.60	0.56	0.6	1073.83	227.0	430.66	225.1	34.55	80.9	11.4	12.5	10.6
Line-3	I	4.5	5.1	2.55	32.8	36.65	18.1	100.5	110.65	111.2	0.7	0.9	1.25	791.65	654.45	162.3	203.45	100.9	21.00	13.95	14.95	11.05
	II	2.62	2.8	3.3	19.6	30.7	28.71	209.5	219.9	177.4	0.43	0.45	0.50	873.00	1253.5	521.16	139.03	213.7	107.11	13.65	13.98	11.97
	III	1.4	2.29	2.83	12.42	19.77	20.2	118.1	157.21	128.5	0.54	0.45	0.89	687.5	245	334.83	107.6	33.4	58.53	11.85	12.23	10.46
LSD I	0.05	1.27			5.16			19.06			0.221			218.96			19.75			0.77		
	0.01	1.7			6.92			25.56			0.296			293.4			26.46			1.04		
LSD II	0.05	1.32			8.06			27.33			0.16			280.02			21.75			0.61		
	0.01	1.77			10.8			36.63			0.22			375.2			29.13			0.81		
LSD III	0.05	1.11			7.84			46.38			0.23			228.95			21.04			0.71		
	0.01	1.48			10.51			62.15			0.31			306.75			28.2			0.96		

Table 5: Specific combining ability effects for nine crosses from the data combined over two years in three cuts for all studied traits .

		Tillers plant			Leaves plant^{-1}			Plant height (cm)			LS ratio			GFY plant^{-1}			DFY plant^{-1}			DP%		
		T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
Line-1	I	-0.07	-0.02	0.05	-1.67	-0.53	2.2	6.28	4.83	-11.11	-0.05	0.00	0.05	-72.5	63.98	8.5	31.20**	9.73	21.5**	0.5	-0.23	0.25
	II	0.26	0.14	-0.4	0.00	1.1	-1.1	-2.1	-1.7	3.8	-0.01	-0.03	0.04	-25.35	-5.05	30.4	8.86	27.14**	18.28*	1.15**	0.86**	-0.29
	III	-0.01	0.11	-0.10	-0.96	0.21	0.75	-3.84	1.78	2.06	0.01	0.01	-0.02	9.22	-3.05	-6.17	-10.96	9.1	1.86	0.39	-0.59*	0.208
Line-2	I	-0.31	-0.01	0.32	0.14	-1.12	0.98	-4.83	-3.86	8.9	0.04	0.01	-0.05	-26.58	-36.71	63.29	25.02**	-3.84	28.85**	-0.43	0.25	0.17
	II	-0.22	0.00	0.22	-0.38	-0.44	0.82	0.77	1.21	-1.98	-0.05	0.05	0.00	4.82	38.15	-42.97	-0.84	5.47	-4.63	0.81**	0.86**	-0.06
	III	-011	-0.09	0.2	-0.4	0.1	0.3	1.2	2.84	-4.04	0.01	-0.02	0.01	-12.55	12.00	0.55	40.73**	-27.5	-13.26	-0.42	0.44	-0.02
Line-3	I	0.39	0.01	-0.38	1.52	1.66	-3.18	-1.44	-0.97	2.41	0.01	-0.01	0.00	99.06	-27.3	-71.8	56.22**	-5.89	50.33**	-0.06	-0.02	0.08
	II	-0.04	-0.14	0.18	0.38	-0.67	0.29	1.31	0.49	-1.8	0.06	-0.02	-0.04	20.53	-33.1	12.57	8.02	21.66**	-13.64	-0.34	-0.003	0.343
	III	0.13	-0.02	-0.11	1.36	-0.31	-1.05	2.64	-4.62	1.98	0.02	0.01	0.01	3.33	-8.94	5.61	29.76**	18.4*	11.4	0.03	0.157	-0.19
LSD I	0.05	0.9			3.65			13.47			0.15			154.83			13.96			0.55		
	0.01	1.21			4.89			18.05			0.2			207.46			18.71			0.73		
LSD II	0.05	0.94			5.7			19.32			0.11			198.00			15.37			0.43		
	0.01	1.25			7.63			25.9			0.15			265.3			20.59			0.57		
LSD III	0.05	0.78			5.54			32.79			0.16			161.89			14.88			0.5		
	0.01	1.05			7.43			43.94			0.22			216.91			19.94			0.67		

***, ** significant at 0.05 and 0.01 levels of probability, respectively**