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SELECTION AMONG S_3 MAIZE LINES (*Zea mays* L.) USING TESTCROSSES

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ABSTRACT

Nineteen white maize lines (S_3) derived from different exotic hybrids in the disease nursery field were crossed to each of two elite inbred tester lines Sd 7 and Sd 34 in 1998 season. The resultant 38 testcrosses along with two check commercial hybrids SC.10 and SC.124 were evaluated in field trials at Sakha, Gemmeiza and Sids Agric. Res. Stations during 1998 season. Data for grain yield//fed, days to mid silking, plant height and ear placement (%) were recorded to estimate combining ability effects, type of gene action and select the most superior lines and crosses. Combined data over locations indicated that highly significant differences were detected among lines, testers and their crosses for all studied traits, except days to mid silking for testers and lines x testers interaction. The best general combiner of parental lines were L-5, L-6 L-7, L-10, L-13 and L-14 for high yielding ability, L-5 for high yielding ability and earliness to silking, and L-6 and, L-13 for high yielding ability and short plant statues. The most superior cross (L-14 x Sd.34) possessed highly significant and positive SCA effects and manifested significantly out yielded (36.77 ard/fed) the best commercial hybrid SC.10 (34.51 ard/fed) by 6.5 %. Also, this cross was insignificantly different from SC.10 for the other studied traits. Non-additive was more important than additive gene action in the inheritance of grain yield, whereas, additive gene action was comprised most of the genetic variance of other studied traits. Non-additive gene action was affected more by environmental conditions than additive gene action for all studied traits.

Key words: ***Maize, Test cross, Combining ability, Type of gene action, Selection.***

INTRODUCTION

To increase maize production in Egypt, the National Maize Research Program, ARC exerts great efforts for developing high yielding maize hybrids and continuously find better inbreds higher in combining ability to replace those in currently used hybrids. The standard procedure currently followed by the program is to use the best available commercial inbreds as testers to screen newly developed inbred starting from F_3 inbreeding generation. Hallauer (1975) indicated that a suitable tester should include simplicity in use, provide information that correctly classifies the relative merit of lines and maximize genetic gain. Russell *et al* (1973), Walejko and Russell (1977), Zambezi *et al* (1986), Mahgoub *et al* (1996), Al-Naggar *et al* (1997) and Soliman (2000) indicated that inbred testers are effective for estimating both general and specific combining ability effects. Inbred testers offer definite advantages over broad-base genetic testes as pointed out by Zambezi *et al* (1986).

The current investigation was carried out with the objective of:

1- Evaluating general (GCA) and specific (SCA) combining ability effects and type of gene action involved in the manifestation of grain yield and some other traits of 18 S_3 lines selected for a high level of resistance to late wilt.
2- Identify the most superior lines to be utilized in a hybrid program and/or in creating a new synthetic for further inbred development.

MATERIALS AND METHODS

Nineteen (S_3) white maize inbred lines, derived from different South Africa crosses in the disease nursery field at Sids Agric. Res. Station, were used for the purpose of this study. These lines were top crossed to each of two elite inbred line testers, Sd.7 and Sd.34 at Sids Agric. Res. Station during 1998 summer season. These two inbred testers have high combining ability and are used in seed production of some commercial hybrids. The resultant 38 test crosses along with two experimental check commercial hybrids (SC.10 and SC.124) were evaluated in field trials grown at three locations i.e. Sakha, Gemmeiza and Sids Agric. Res. Stations during 1999 summer season.

A Randomized Complete Block Design with three replications was used at each location. Plots were single ridges, 6 m. long and 80 cm apart. Seeds were sown 25 cm. along the ridge, providing a normal population density of 21000 plants per feddan (fed = 4200 m^2). All recommended cultural practices were done at the proper time. Data were recorded for number of days to 50% silking, plant height, ear placement %, and grain yield adjusted to 15.5% moisture.

The regular analysis of variance was performed for each location and the combined data according to McIntosh (1983) and followed by Kempthorne (1969) procedure to provide information about combining ability and to estimate types of gene action controlling the inheritance of the studied traits.

RESULTS AND DISCUSSION

1. Analysis of variance

Mean squares for all studied traits in the combined analysis across three locations are presented in Table (1). The differences between locations were highly significant for all traits, indicating that the three locations differed from each other in environmental conditions. Highly significant differences were detected among crosses, lines, testers and test crosses for all studied traits, except number of days to mid silking for testers and lines x testers interaction. These results indicated wide diversity among each of lines and testers in their contribution to the performance of test crosses. In addition, the interactions of lines, testers and lines x testers with locations were highly significant for all traits, except days to mid silking and plant height for testers x locations interaction. These interactions with locations are mainly attributed to the different ranking of genotypes from one location to another. Similar results were obtained by El-Itriby *et al* (1990), Salama *et al* (1995), Soliman *et al* (1995) and Uhr and Goodman (1995). Mahgoub *et al* (1996), Shehata *et al* (1997) El-Zeir (1999), Soliman and Sadek (1999), El-Zeir *et al* (2000) and Soliman (2000).

Table 1. Mean squares for grain yield and other traits of 19 inbred lines topcrossed to two inbred testers, combined over three locations in 1999 season.

S.O.V	DF	Grain yield	Days to silking	Plant height	Ear Placement
Locations(Loc.)	2	1904.093**	855.544**	44635.486**	177.951**
Rep/(Loc).	6	3.272	15.167	118.275	9.858
Genotypes (G)	39	94.655**	9.251**	1187.870**	33.887**
Crosses (C)	37	92.602**	7.824**	1040.802**	35.455**
Checks (Ch)	1	125.083**	40.500**	5832.000**	9.680**
C *vs* Ch	1	140.192**	30.801**	1985.267**	0.438
Lines (L)	18	82.859**	11.662**	1672.157**	32.722**
Testers (T)	1	771.031**	7.906	913.687**	502.369**
L x T	18	64.654**	3.981	416.508**	12.249**
G x Loc	78	34.071**	4.083*	186.474**	12.081**
C x Loc.	74	34.616**	4.067	189.968**	12.510**
Ch x Loc.	2	0.053	1.500	71.167	6.620*
C *vs* Ch x Loc.	2	47.902**	7.269	172.526	1.652
L x Loc	36	29.812**	4.263	149.240**	10.920**
T x Loc	2	15.797**	0.757	106.284	34.587**
L x T x Loc	36	40.467**	4.054	235.345**	12.875**
Pooled Error	359	2.909	3.036	58.380	4.040
CV. %		5.85	2.76	2.61	3.64

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

2. Mean performance and combining ability effects

a) Grain yield

Mean performance (Table 2) and GCA effects (Table 3) confirmed that tester line Sd. 34 gave higher grain yield (30.52 ard/fed) and possessed desirable GCA effect (1.501**) over all parental lines than the tester line Sd. 7 (27.51 ard/fed and −1.501** GCA effect). This result indicated that tester line Sd. 34 have a high frequency of favorable dominant alleles that contributed significantly to the grain yield of the test crosses. The same trend for Sd. 34 was reported by Ragheb *et al* (1995), whereas Soliman (2000) found insignificant GCA effects for line Sd.7.

Table 2. Mean performance of 38 top crosses for grain yield and other traits, combined over three locations in 1999 season.

Lines	Grain yield (ard/fed)			Number of days to mid silking			Plant height (cm)			Ear placement (%)		
	Sd.7	Sd. 34	Average	Sd.7	Sd. 34	Average	Sd.7	Sd. 34	Average	Sd.7	Sd. 34	Average
L-1	26.54	32.23	29.39	63.0	65.0	64.0	292.1	294.1	293.1	52.9	54.0	53.5
L-2	25.82	29.90	27.86	63.2	62.0	62.6	278.8	288.2	283.5	54.0	54.6	54.3
L-3	22.83	33.22	28.03	63.3	63.3	63.3	290.8	287.3	289.1	52.7	57.2	55.0
L-4	23.24	27.46	25.35	63.1	62.1	62.6	284.1	282.1	283.1	55.1	59.0	57.1
L-5	29.53	31.63	30.58	61.7	63.1	62.4	297.4	290.2	293.8	55.1	55.5	55.3
L-6	26.62	33.04	29.83	64.0	64.4	64.2	279.6	297.0	288.3	54.5	57.6	56.1
L-7	29.47	33.08	31.28	62.3	62.8	62.6	297.1	293.2	295.2	52.8	56.9	54.8
L-8	28.96	24.48	26.72	63.0	63.0	63.0	297.8	285.8	291.8	53.2	58.2	55.7
L-9	27.81	31.17	29.49	64.0	65.3	64.7	290.3	284.1	287.2	55.0	57.1	56.1
L-10	30.76	33.69	32.23	64.0	63.7	63.8	316.4	312.9	314.7	54.6	54.7	54.6
L-11	24.40	26.82	25.61	62.6	61.9	62.2	274.6	260.7	267.6	52.9	53.9	53.4
L-12	29.92	28.07	28.99	63.6	64.1	63.8	309.2	291.4	300.3	55.2	58.3	56.8
L-13	30.79	32.20	31.50	63.4	64.3	63.9	293.4	278.4	285.9	52.9	57.0	54.9
L-14	28.88	36.77	32.83	64.0	64.0	64.0	304.7	305.3	305.0	54.6	55.6	55.1
L-15	27.15	31.90	29.53	61.4	62.6	62.0	298.6	293.9	296.2	54.2	57.6	55.9
L-16	23.05	29.52	26.29	63.7	64.4	64.1	279.1	292.9	295.0	51.2	55.0	53.1
L-17	29.04	25.83	27.43	62.2	62.6	62.4	288.6	305.7	297.1	53.5	53.2	53.4
L-18	28.40	30.82	29.61	64.6	63.1	63.8	301.6	291.3	296.4	57.3	59.1	58.2
L-19	29.52	27.94	28.73	62.4	63.6	63.0	297.6	292.9	295.2	54.5	57.3	55.9
Average	27.51	30.52	29.01	63.1	63.4	63.3	294.2	290.9	292.6	54.0	56.5	55.2
Checks												
SC.10		34.51			63.4			302.3			54.4	
SC. 124		29.24			60.4			259.0			55.9	
LDS	5%		1%	5%		1%	5%		1%	5%		1%
Lines	1.11		1.46	1.14		1.50	5.0		6.6	1.3		1.7
Testers	0.36		0.48	NS		NS	1.6		2.1	0.4		0.6
Crosses & checks	1.58		2.07	1.61		2.12	7.1		9.3	1.9		2.4

Table 3. Estimates of general combining ability ($\hat{g}_i$) effects of 19 inbred lines and two testers for traits combined over locations in 1999 season.

Lines	Grain yield	Days to mid silking	Plant height	Ear placement
L-1	0.374	0.713	0.552	-1.734**
L-2	-1.153**	-0.675	- 9.058**	-0.890
L-3	-0.988*	0.047	- 3.503	-0.251
L-4	-3.665**	-0.675	- 9.447**	1.838**
L-5	1.565**	-0.898*	1.275	0.121
L-6	0.814*	0.936*	- 4.281*	0.849
L-7	2.262**	-0.731	2.608	-0.368
L-8	-2.293**	-0.287	- 0.781	0.482
L-9	0.477	1.380**	- 5.336*	0.838
L-10	3.214**	0.547	22.108**	-0.568
L-11	-3.406**	-1.064**	-24.947**	-1.823**
L-12	-0.021	0.547	7.775**	1.544**
L-13	2.482**	0.602	- 6.614**	-0.290
L-14	3.815**	0.713	12.442**	-0.134
L-15	0.512	-1.287**	3.664*	0.694
L-16	-2.725**	0.769	2.442	-2.106**
L-17	-1.581**	-0.898*	4.553*	-1.829**
L-18	0.599	0.547	3.886*	2.977**
L-19	-0.283	-0.287	2.664	0.649
Testers				
Sd.7	-1.501**	-0.152	1.634**	-1.212**
Sd. 34	1.501**	0.152	- 1.635**	1.212**
SE				
Lines $\hat{g}_i$	0.402	0.411	1.801	0.474
$\hat{g}_i - \hat{g}_j$	0.568	0.581	2.547	0.670
Testers $\hat{g}_i$	0.130	0.133	0.584	0.154
$\hat{g}_i - \hat{g}_j$	0.184	0.188	0.826	0.217

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

Respecting parental lines, Tables (2 and 3) indicated that the preferable general combiner (significantly positive GCA effects) for high yielding ability were L-5, L-6, L-7, L-10, L-13 and L-14. Also, these lines produced the highest grain yield over testers (from 29.83 to 32.83 ard/fed for L-6 and L-14, respectively). Other parental lines had significantly negative GCA values in direction of low yielding ability.

Regarding testcrosses, Table (2) revealed that grain yield ranged from 22.83 to 36.77 ard/fed for crosses (L-3 x Sd.7) and (L-14 x Sd.34), respectively. However, Tables (2 and 4) showed that testcrosses to the tester line Sd.34 produced in most cases higher relative grain yield (%) as compared to crosses with tester line Sd.7. Moreover, none of the test crosses to tester line Sd.7 significantly exceeded the best commercial SC.10 (34.51 ard/fed). On the other hand, eleven test crosses i.e. L-1, L-3, L-5, L-6, L-7, L-9, L-10, L-13, L-14, L-15 and L-18 crossed with Sd.34 significantly outyielded the check hybrid SC.124. However, the test cross (L-14 x Sd.34) produced the highest grain yield (36.77 ard/fed) and outyielded SC.10 by 6.5 % and SC.124 by 25.8%. Comparison of SCA effects, Table (5) indicated that significantly positive estimates were detected for 9 out of 38 test crosses. The two crosses (L-3 x Sd.34) and (L-6 x Sd.34) gave grain yield (33.22 and 33.04 ard/fed, respectively) not significantly different from the best check hybrid SC.10 (Tables 2 and 4). Testcrosses which rank highest for SCA effects in a certain trait and in the same time ranks best in its mean performance for the same trait are considered to be good breeding material to improve this trait. Thus, the cross (L-14 x Sd.34) appeared to be a promising single cross, since it had highly significant and positive SCA effects (2.443**) and significantly outyielded the best commercial SC.10.

Table 4. Grain yield of 38 testcrosses in percent of the single cross check hybrids, combined over locations, in 1999.

Lines	% of SC. 10		% of SC. 124	
	Sd. 7	Sd. 34	Sd. 7	Sd. 34
L-1	76.9	93.4	90.8	110.2**
L-2	74.8	86.6	88.3	102.3
L-3	66.2	96.2	78.1	113.6**
L-4	67.3	79.6	79.5	93.9
L-5	85.6	91.7	101.0	108.2**
L-6	77.1	95.7	91.0	113.0**
L-7	85.4	95.9	100.8	113.1**
L-8	83.9	70.9	99.0	83.7
L-9	80.6	90.3	95.1	106.6*
L-10	89.1	97.6	105.2	115.2**
L-11	70.7	77.7	83.4	91.7
L-12	86.7	81.3	102.3	96.0
L-13	89.2	93.3	105.3	110.1**
L-14	83.7	106.5**	98.8	125.8**
L-15	78.7	92.4	92.9	109.1**
L-16	66.8	85.5	78.8	101.0
L-17	84.1	74.8	99.3	88.3
L-18	82.3	89.3	97.1	105.4*
L-19	85.5	81.0	101.0	95.6

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

Table 5. Estimates of specific combining ability ($\hat{s}_i$) effects for19 inbred lines and two testers for traits combined over locations, in 1999.

Lines	Grain yield		Days to mid silking		Plant height		Ear placement	
	Sd.7	Sd. 34	Sd.7	Sd. 34	Sd.7	Sd. 34	Sd.7	Sd. 34
L-1	-1.344*	1.344*	-0.848	0.848	- 2.635	2.635	0.645	-0.645
L-2	-0.541	0.541	0.763	-0.763	- 6.357*	6.357*	0.934	-0.934
L-3	-3.690**	3.690**	0.152	-0.152	0.088	- 0.088	-1.038	1.038
L-4	-0.608	0.608	0.652	-0.652	- 0.635	0.635	-0.738	0.738
L-5	0.451	-0.451	-0.570	0.570	1.977	- 1.977	1.012	-1.012
L-6	-1.709**	1.709**	-0.070	0.070	-10.357**	10.357**	-0.349	0.349
L-7	-0.307	0.307	-0.070	0.070	0.310	- 0.310	-0.844	0.844
L-8	3.739**	-3.739**	0.152	-0.152	4.365	- 4.365	-1.260	1.260
L-9	-0.181	0.181	-0.515	0.515	1.477	- 1.477	0.129	-0.129
L-10	0.036	-0.036	0.318	-0.318	0.143	- 0.143	1.134	-1.134
L-11	0.292	-0.292	0.485	-0.485	5.310*	- 5.310*	0.701	-0.701
L-12	2.425**	-2.425**	-0.126	0.126	7.254**	- 7.254**	-0.366	0.366
L-13	0.796	-0.796	-0.292	0.292	5.865*	- 5.865*	-0.855	0.855
L-14	-2.443**	2.443**	0.152	-0.152	- 1.968	1.968	0.701	-0.701
L-15	-0.874	0.874	-0.404	0.404	0.699	- 0.699	-0.527	0.527
L-16	-1.734**	1.734**	-0.237	0.237	0.477	- 0.477	-0.727	0.727
L-17	3.106**	-3.106**	-0.015	0.015	-10.190**	10.190**	1.351*	-1.351*
L-18	0.292	-0.292	0.874	-0.874	3.477	- 3.477	0.279	-0.279
L-19	2.293**	-2.293**	-0.404	0.404	0.699	- 0.699	-0.182	0.182
SE								
S_{ij}	0.568		0.581		2.547		0.670	
$S_{ij} - \hat{s}_{kl}$	0.804		0.821		3.602		0.948	

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

b) Number of days to mid silking

Tables (2 and 3) revealed insignificant differences between the two testers in mean performance and GCA effects. Over testers, parental lines L-5, L-11, L-15, and L-17 induced earlier silking dates (62.4, 62.2, 62.0 and 62.4 days, respectively), and exhibited significant GCA effects in direction of earliness. Appositely, parental lines L-6, and L-9 recorded the latest silking date (64.2 and 64.7 days, respectively) and significant positive GCA effects.

For testcrosses, Table (2) shows that only two crosses (L-5 x Sd.7) and (L-51 x Sd.7) exhibited significantly earlier silking date than the check hybrid SC.10. In addition, none of the testcrosses induced significantly earlier silking date as compared with the check hybrid SC.124. However, insignificant SCA estimates were found for all testcrosses (Table 5).

c) Plant height

Average performance (Table 2) revealed that tester line Sd.34 induced shorter plants over all parental lines, and had significant negative (desirable) GCA effects than the tester line Sd.7 (Table 3). This result indicated that Sd.34 had favorable dominant genes for shortness. In this connection, Diab *et al* (1994), Ragheb *et al* (1995), Amer *et al* (1998) El-Zeir (1999) and Soliman (2000) found significant positive GCA effect on plant height for line Sd. 7. The best general combiner among lines (negative GCA effects) were L-2, L-4, L-6, L-9, L-11 and L-13 (Table 3), which produced the shortest plants (Table-2) ranging from 267.6 to 288.3 cm for L-11 and L-6, respectively. Meanwhile, other parental lines gave the tallest plants (ranging from 296.2 to 314.7 cm for L-15 and L-10, respectively) and poorest GCA effects (significantly positive estimates).

With reference to test crosses, average plant height (Table 2) ranged from 260.7 to 316.4 cm for crosses (L-11 x Sd.34) and (L-10 x Sd.7), respectively. However, Table (5) shows that six out of the 38 test crosses i.e. (L-2 x Sd.7), (L-6 x Sd.7), (L-17 x Sd.7), (L-11 x Sd.34), (L-12 x Sd.34) and (L-13 x Sd.34) exhibited desirable SCA effects (significantly negative estimates). These crosses showed significant the shortest testcrosses as well as highly significantly shorter plant than the check hybrid SC.10 (302.3 cm).

d) Ear placement

Results presented in Tables (2 and 3) illustrate that the tester line Sd. 7 showed more favorable effect on ear placement than tester line Sd. 34, since it exhibited significantly lower average ear placement and highly significant negative GCA effects. These results are supported the finding of Ragheb *et* *al* (1995) for line Sd. 34. Regarding tested lines, the best general combiner over testers were L-1, L-11, L-16 and L-17, which possessed the lowest ear placement (ranged from 53.1 % for L-16 to 5.35 % for L-1). They also had highly significant and negative GCA effects. On the other hand, the worst lines were L-4, L-12 and L-18, which produced the highest average ear placement of 57.1, 56.8 and 58.2 %, respectively, and showed highly significant and positive GCA effects.

Considering the testcrosses, Table (2) shows that average ear placement ranged from 51.2 to 59.1% for test crosses (L-16 x Sd. 7) and (L-18 x Sd. 34), respectively. In general, all test crosses involving tester line Sd. 7 showed lower ear placement than those involving the tester line Sd. 34. The difference between the two checks, SC.10 (54.4 %) and SC.124 (55.9 %) was insignificant. However, only one test cross (L-16 x Sd. 7) exhibited significantly lower ear placement (51.2 %) than SC.10. On the other direction, 11 out of the 38 test crosses manifested significantly higher ear placement than SC.10. For SCA effects, Table (5) confirmed that only two test crosses (L-17 x Sd. 7) and (L-17 x Sd. 34) expressed highly significant positive and negative estimates, toward high and low ear placement, respectively.

3. Type of gene action effects.

Estimates of general (σ^2gca) and specific (σ^2 sca) combining ability variances and their interaction with locations (σ^2gca x Loc. and σ^2 sca x Loc.) for both parental lines and testers are given in Table (6).

For parental lines, the ratio of σ^2gca/σ^2sca was lower than unity for grain yield. Therefore, non-additive gene action appears to be more important than additive gene action in inheritance of grain yield in the tested lines. These results are supported with the finding of Nawar and El-Hosary (1984), El-Hosary (1985), El-Zeir *et al* (1993), Abdel-Aziz *et al* (1994), Amer *et al* (1998), El-Zeir *et al* (2000) and Soliman (2000). On the contrary, additive gene action (σ^2gca/σ^2sca) exceeding unity comprised most of genetic variance of other studied traits. These results are in concordance with the results of El-Itriby *et al* (1990), El-Zeir *et al* (1993) Soliman *et al* (1995), El-Zeir (1999), Soliman and Sadek (1999) and Soliman (2000).

Respecting parental testers, non-additive gene action was more important than additive gene action in controlling the inheritance of all studied traits except ear placement

The estimates of σ^2gca x Loc. interactions for both lines and testers were either negative or smaller than σ^2 sca x Loc. for all studied traits. These results indicated that non-additive gene action was more affected by environmental conditions than additive gene action.

Table 6. Estimates of general (σ^2gca) and specific (σ^2 sca) combining ability variances and their interaction with locations for grain yield and other traits, combined over locations, in 1999.

Variances		Grain yield	Days to silking	Plant height	Ear Placement
Lines	σ^2gca	1.011	0.427	69.782	1.137
Testers	σ^2gca	4.131	0.023	2.907	2.866
Crosses	σ^2 sca	6.861	0.105	39.792	0.912
Lines	σ^2gca x Loc.	-1.776	0.035	-14.351	-0.326
Testers	σ^2gca x Loc.	-0.433	-0.058	- 2.265	0.381
Crosses	σ^2 sca x Loc.	12.519	0.339	58.988	2.945

Negative estimates are considered equal to zero (Robinson *et al.* 1955).

Conclusion

The current study suggests that:

1. Parental lines L-5, L-6, L-7, L-10, L-13 and L-14 are promising lines, showing significant GCA effects for high yielding ability. These lines would be utilized as replacements of presently used inbreds in the hybridization program to developing higher yielding hybrids. These lines could be inter-mated for at least three generations to form a synthetic variety for future development of inbred lines.
2. The best general combiners of parental lines were, L-5 for high yielding ability and earliness, and L-6 and, L-13 for high yielding ability and shortness of plants.
3- The most superior cross was (L-14 x Sd.34), since it possessed highly significant and positive SCA effects and manifested significantly outyielded (36.77 ard/fed) the best commercial hybrid SC.10 by 6.5 %. This cross was not significantly different from SC.10.for number of days to mid silking, plant height and ear placement. It should be further tested for possible commercial use.

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الانتخاب بين سلالات من الجيل الذاتي الثالث (S_3) باستخدام الهجن الاختبارية في الذرة الشامية

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برنامج بحوث الذرة الشامية – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

هجنت ١٩ سلالة من الذرة الشامية بيضاء الحبوب من الجيل الذاتي الثالث (S_3) من بعض الهجن المستوردة مع السلالتين الإختباريتين سدس-٧ و سدس-٣٤ وذلك بحقل الأمراض بمحطة البحوث الزراعية بسدس عام ١٩٩٨. تم تقيم الهجن الإختبارية الناتجة وعددها ٣٨ هجين بالإضافة إلى هجيني المقارنة الفرديين جيزة ١٠ وجيزة ١٢٤ في تجارب حقلية بمحطات البحوث الزراعية في سخا والجميزة وسدس خلال موسم ١٩٩٩. تهدف هذه الدراسة إلى تقدير القدرة على التآلف للسلالات وتأثير الفعل الجيني في وراثة صفات محصول الحبوب، عدد الأيام حتى ظهور ٥٠ % من الحرابر، ارتفاع النبات، موقع الكوز لانتخاب أفضل السلالات أو الهجن المبشرة.

أشارت نتائج تحليل التباين المشترك للثلاث جهات أن هناك فروقا عالية المعنوية بين كل من السلالات، السلالات الإختبارية وتفاعل السلالات x السلالات الإختبارية لجميع الصفات تحت الدراسة فيما عدا صفة عدد الأيام حتى ظهور ٥٠ % من الحرابر لكل من السلالات الإختبارية وتفاعل السلالات مع السلالات الإختبارية.

أظهرت النتائج أن السلالات أرقام ٥، ٦، ٧، ١٠، ١٣ و١٤ تفوقت معنويا في قدرتها العامة على التآلف للمحصول العالي والسلالة رقم ٥ للمحصول العالي والتبكير في ظهور الحرابر والسلالتين أرقام ٦ و١٣ للمحصول العالي والنباتات القصيرة.

أظهرت النتائج أن السلالات أرقام ٣ ، ٤ ، ٦ ، ٧ ، ٩ ، ١٢ و١٤ تفوقت معنويا في قدرتها العامة على التآلف. ولذلك توصى الدراسة باستخدام هذه السلالات في برنامج التربية للهجن عالية المحصول وفي تكوين مجتمع وراثي لعزل سلالات أكثر تفوقا.

يعتبر الهجين (سلالة ١٤ × سدس ٣٤) من أفضل الهجن الإختبارية حيث اظهر قدرة خاصة على التآلف عالية المعنوية وموجبة لصفة المحصول. كما تفوق (٣٦,٧٧ إردب/فدان) بفروق عالية المعنوية على أفضل الهجن الفردية التجارية جيزة ١٠ (٣٤,٥١ إردب للفدان) بمقدار ٦,٥ %. هذا وبدون فروق معنوية بين الهجينين لباقي الصفات المدروسة.

أوضحت النتائج أن التباين الوراثي غير المضيف كان أكثر تأثيرا من التباين الوراثي المضيف بالنسبة للسلالات في وراثة صفة المحصول. بينما كان العكس صحيحا لباقي الصفات. كان التباين الوراثي غير المضيف أكثر تأثرا بالظروف البيئية من التباين المضيف لجميع الصفات.

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