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COMBINING ABILITY, SUPERIORITY AND LATE WILT DISEASE RESISTANT IN NEW YELLOW MAIZE INBRED LINES *VIA* DIALLEL MATING DESIGN

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ABSTRACT

A half diallel (8 x 8) analysis using eight new yellow maize inbred lines, which derived from geographical regions by the National Maize Breeding Program at Sids, Giza, Sakha and Gemmeiza Agricultural Research Stations were evaluated to estimate combining abilities of the eight new yellow maize inbred lines & their crosses of them, identify the superior crosses exceeded high yielding with resistant of late wilt disease & estimate the relation-ship between grain yield and its attributes. The 28 crosses along with two yellow check hybrids; (SC-168 and Pioneer SC-3444) were evaluated at three locations; Sids, Sakha and Nubaria Agricultural Research Stations. Results showed significant differences among the three locations (Loc) for all the studied traits, except days to 50% silking (DTSE). Furthermore, mean squares of genotypes (G), crosses © and their interaction with locations were significantly differences for all traits except ear height (EHT) and ear position% (EP%) of G x Loc and C x Loc. Variances of general combining ability (GCA) and specific combining ability (SCA) were highly significant for all the studied traits, indicating that the importance of additive as well as non-additive types of gene effects in this study. Inbred lines P1, P2 and P5 were the best general combiner for grain yield (GY) and late wilt resistant disease% (LWRD%) toward high yielding and lodging resistant. Three lines; P4, P6 and P8 were the best general combining ability for DTSE, plant height (PHT) and EHT traits toward earliness, short plant and lower ear placement. Two crosses; P1 x P7 and P3 x P4 had SCA effects positive and significant for GY ard. fed.$^{-1}$ and LWRD% traits toward high yielding and lodging resistant, respectively. Also, P1 x P3 and P6 x P8 possessed SCA effects positive (desirable) toward short plant, short ear height and lower ear placement toward lodging resistant. In the same vein, cross P6 x P8 had SCA effects negative (desirable) for DTSE toward earliness. Three crosses; P1 x P5, P1 x P7 and P2 x P7 were positive and significantly superiority% relative to the check SC-168 for GY, where scored (5.88*), (13.44**) and (8.74**) in respectively. While, two crosses; P1 x P7 (4.48) and P2 x P7 (0.15) were superiority% positive and not significant relative to the highest yield check SC-3444. These crosses could be recommended to use

in maize breeding programs to produce a promising hybrids with high yielding ability and lodging resistant.

Key Words: Maize, combining ability, correlation, diallel analysis, late wilt and superiority

INTRODUCTION

Maize is known as the "Queen of cereals" worldwide due to its highest genetic yield potential among cereals. Globally maize is the third most popular cereals after wheat and rice crops due to wider adaptability and high yielding potential. **Hallauer and Miranda (1988)**, reported that, the final evaluation of lines can be estimated by crosses performances. Also, **Vacaro *et al.,* (2002)**, showed that, the values of any population depends on its potential and its combining ability in hybrids. The concept of combining ability has become increasing important in all the breeding programs for all crops not only maize, which provide a rule information for the lines selection in terms of hybrid performance. The performance of inbred lines in its their cross combination is defined as general combining ability (GCA) and specific combining ability (SCA) clarify that based on average performance some cross combination showed superior performance than expected results **(Sprague and Tatum, 1942)**. Diallel mating design gives breeders the useful knowledge to choose the most efficient selection method and its allowing them to determine the different genetic parameters **(Verhalen and Murray, 1967)**. Plant breeders can understand about gene action inheritance, which controlled in the studied traits in early filial generations by using the diallel approach set **(Griffing 1956)**. Many diseases infected the maize crops and make loses in grain yield between them Late wilts disease (LWD). LWD caused by *Cephalosporium maydis* which considering, as one of the major disease affecting maize grain yield and its attributes in Egypt. Several researchers work on late wilt disease and provide the breeders by the information about gene action inheritance which controlling in this disease between them, (**El-Itriby *et al.,* 1984 , Amer *et al.,* 2002, Mosa *et al.,* 2010 and Aly *et al.,* 2022 & 2023**). The main objectives of this investigation were to, estimate combining abilities of new yellow maize inbred lines & their crosses of them & their interactions with locations, identify the superior crosses exceeded high yielding ability with resistant of late wilt disease to be used in the National Maize Breeding Programs & find the relation-ship between grain yield and its attributes using correlation coefficient.

MATERIALS AND METHODS

Plant material and its sources.

The plant materials of this investigation consisted of eight new yellow maize inbred lines, which derived from four geographical regions in the National Maize Breeding Program at Sids, Giza, Sakha and Gemmeiza

Agricultural Research Stations, Field Crops Research institute, Agricultural Research Center. These lines namely; Sd-13 (P_1), Sd-3118 (P_2), Sd-3134 (P_3), Sd-3180 (P_4), Gz-658 (P_5), Gm-6042 (P_6), Sk-5010 (P_7) and Sd-2/2020 (P_8).

Experimental sites and growing seasons.

In the growing season 2022, at Sids Agric. Res. Station, all possible combinations without reciprocal crosses among them were made in a half diallel mating to obtain 28 single crosses. However, in the growing season 2023, the 28 crosses along with two yellow check hybrids; (SC-168 and Pioneer SC-3444) were evaluated at the three locations; Sids, Sakha and Nubaria Agricultural Research Stations.

Experimental design and its Management.

Randomized Complete Blocks Design (RCBD) with three replications was used at each location. Plot size was one row, 6 m long and 0.8 m apart. Planting was made in hills spaced at 0.25 m along the row at the rate of two kernels hill^{-1}, which thinned to one plant hill^{-1} after 21 days from planting date. For experimental management, the field trials were kept clean of weeds throughout the growing cycle, whereas all agricultural practices were applied as recommended.

Data recorded and statistical analysis.

Date were recorded for grain yield (GY ard. fed^{-1}), were adjusted to 15.5% grain moisture, late wilt disease resistant (LWRD%), number of days to 50% silking Emergency (DTSE, day), plant height (PHT, cm), ear height (EHT, cm) and ear position% (EP %). The data collected were analyzed using general linear model (GLM) procedure in SAS **(SAS institute, version 9.2, 2008)**. Means for all maize combinations adjusted for block effects through locations were analyzed according to **Snedecor and Cochran (1989)**. Combining ability analysis was performed for traits that showed statistical differences among crosses. Griffing's Method-4, Model-1 **(Griffing's 1956)** was employed to determine general and specific combining abilities and their interaction effects with locations. Relative superiority% of the 28 single crosses was estimated according to **Singh *et al.*, (2004)**, expressed as the % deviation of the mean performance of F_1 than the best check hybrid.

RESULTS AND DISCUSSION

Analysis of variances.

Results of variances and mean squares of the genotypes for six studies traits combined across three locations are presented in Table 1. The results showed a significant or highly significant differences between the three locations for all studied traits except DTSE trait, indicating that the locations differed in the environmental conditions from location to another. These findings are in agreement with those reported by other researchers, (**Mousa and Aly ,2008, Aly and Mousa ,2011, Mosa *et al.*, 2023 and Abd El-**

Azeem *et al.* , 2024). Genotypes and crosses mean squares and their interactions with locations were significant or highly significant for all studied traits except each of EHT cm and EP% traits for G x Loc and C x Loc. These results indicate that, the presence of genetic variation among these materials can be used to develop hybrids which is characterized by high yielding potential and the performed these materials differently from one location to another. These findings meaning that the tested genotypes influenced by varying environmental conditions. Several researchers obtained similar results; **Ünay *et al.,* (2004)** for GY; **Motawei *et al.,* (2010)** for DTSE, GY and LWDR%. **Onejeme *et al.,* (2020)** for DTSE, PHT, EHT and GY; **Yadav and Gangwar (2021)** for DTSE and PHT and **Aly *et al.,* (2025)** of C & C x Loc for DTSE, PHT, EHT, EP% and GY traits.

Table 1: Analysis of variances for six studied traits across three locations.

sov	df	GY (ard. fed.$^{-1}$)	LWDR %	DTSE (day)	PHT (cm)	EHT (cm)	EP %
Loc	2	615.05**	3587.11**	1.62	57052.48**	11277.62**	104.10*
Rep/Loc	6	27.244	9.587	10.718	1027.040	613.143	17.680
Genotypes (G)	29	152.897**	151.918**	41.807**	1031.740**	627.754**	31.083**
crosses (C)	27	135.395**	154.582**	36.262**	1029.229**	633.319**	30.005**
G x Loc	58	26.576**	152.360**	4.855**	185.535*	101.436	7.556
C x Loc	54	26.898**	156.198**	4.928**	178.427*	90.878	6.676
Error	174	9.567	19.517	1.774	126.461	82.133	7.364

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

GY = grain yield ard. fed.$^{-1}$ LWDR% = Late Wilt Resistant Disease% DTSE = days to 50% silking emergency (days)

PHT = plant height (cm) EHT = ear height (cm) EP% = ear position%

General and specific combining abilities (GCA and SCA) variances and their interaction with locations for the six studied traits across three locations are illustrated in Table 2. Results showed that the GCA and SCA variances were highly significant for all investigated traits, indicating that the importance both of additive and non-additive gene effects in the inheritance of these traits. Furthermore, the magnitude of GCA was more than that of SCA for all studied traits, meaning that, the additive genes are responsible for most of the genetic variation for these traits. These results were confirmed by the findings detected by **Mousa & Aly (2008) and Aly & Mousa (2011)** for GY, DTSE, PHT, EHT and EP%; **Abd El-Azeem *et al.,* (2021 & 2024) and Mosa *et al.,* (2023)** for GY, DTSE, PHT and EHT traits; as well as by **Auzum *et al.,* (2024)** for PHT and **Ünay *et al.,* (2004)** for GY trait. On the other hand, GCA x Loc and SCA x Loc were highly significant for all studied traits except of EHT and EP% traits for both of them and of PHT for SCA x Loc. The interaction of GCA x Loc was higher than SCA x Loc for all studied traits except EP%. This indicating that, the additive gene effects were more interacted with location than non-additive for these traits. This finding was confirmed by **Aly *et al.,* (2022)** of GCA x

Loc and SCA x Loc for GY, DTSE, PHT, EHT and EP%; **Mosa *et al.*, (2023)** of GCA x Loc for GY, DTSE, PHT and EHT and SCA x Loc for GY; **Abd El Azeem *et al.*, (2024)** of GCA x Loc and SCA x Loc for GY, DTSE, PHT and EP%; **Aly and Mousa (2011)** of SCA x Loc for GY, DTSE, PHT, EHT and EP% traits.

Table 2: General (GCA) and specific (SCA) combining abilities variances and their interaction with locations for six studied traits across three locations.

sov	df	GY (ard. fed.$^{-1}$)	LWDR %	DTSE (day)	PHT (cm)	EHT (cm)	EP %
GCA	7	287.613**	414.138**	104.778**	2393.330**	1654.670**	69.321**
SCA	20	82.119**	63.738**	12.282**	551.790**	275.850**	16.245**
GCA x Loc	14	33.775**	412.677**	5.028**	283.210**	116.310	3.519
SCA x Loc	40	24.491**	66.430**	4.892**	141.750	81.980	7.781
Error	162	9.411	20.583	1.812904	126.99	84.03998	7.6525

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

GY = grain yield ard. fed.$^{-1}$ LWDR% = Late Wilt Resistant Disease% DTSE = days to 50% silking emergency (days)
PHT = plant height (cm) EHT = ear height (cm) EP% = ear position%

Mean performance of the 28 crosses and the two check hybrids; SC-168 and SC-3444 for six studied traits across three locations are summarized in Table 3. Results showed that, crosses for GY ard fed^{-1} ranged from 17.17 for crosses P3 x P6 and P6 x P7 to (30.81 ard fed^{-1}) for cross P1x P7 ard fed^{-1}). These results revealed that, one cross; P1 x P7, which possessed 30.81 ard. fed.$^{-1}$ was out yield and significant compared with the check SC168 (27.16 ± 2.86 ard. fed.$^{-1}$). While, 5 out 28 crosses were did not differ significantly compared with the check SC-168; P1 x P2 (28.10), P1 x P5 (28.76), p2 x p5 (28.04), P2 x P7 (29.53) and P5 x P7 (28.72). On the other hand, two crosses; P1 x P7 (30.81 ard. fed.$^{-1}$) and P2 x P7 (29.53 ard. fed^{-1}) were not differ significantly than those the highest check SC-3444 (29.49 ard. fed.$^{-1}$). For LWDR trait, three crosses; P1 x P2, P2 x P5 and P2 x P8 recorded 100% resistant for disease and most of crosses did not differ significantly compared with the two checks. For DTSE trait, crosses ranged from 57.33 days for cross P6 x P8 to 65.89 days for cross P1 x P2. Twenty-two crosses out 28 crosses were significantly earlier than the check SC168 (65.211 ±1.23 days). In the same direction, 26 crosses out 28 crosses were significantly earlier than the check SC-3444 (66.11 ±1.23 days). For PHT trait, crosses ranged from 205.67 for cross P6 x P8 to 252.67 cm for cross P1 x P2. 14 crosses out 28 crosses were significantly less than the shorter check SC-168 (238.11± 10.39 cm). On the other hand, 18 crosses out 28 crosses were significantly less than the check SC-3444 (240.22 ± 10.39 cm). Regarding EHT trait, crosses ranged from 103.11 for cross P6 x P8 to 141.00 for cross P1 x P2. Results revealed that, seven crosses; P2 x P3, P2 x P4, P3 x P7, P3 x P8, P4 x P6, P5 x P6 and P6 x P8 were significantly less than the check hybrid SC-3444 (124.89 ± 8.37 cm) toward shorter ear height and 18 crosses out 28 crosses were significantly than those the check hybrid SC168 (134.22 ± 8.37

cm) in the same toward. For EP% trait, six crosses; P1 x P3, P1 x P6, P3 x P7, P4 x P5, P5 x P6 and P6 x P7 did not differ significantly those the check SC-3444 (52.17% ± 2.51 and 13 crosses out 28 crosses did not differ significantly those the check SC-168 (56.60% ± 2.51) toward lower ear placement. From the previous results, four crosses had the good mean performances and were significantly or did not differ significantly than the checks for GY and LWRD% traits; P1 x P6, P2 x P5, P2 x P7 and P3 x P5. Also, ten crosses; P1 x P4, P3 x P4, P3 x P5, P3 x P7, P3 x P8, P4 x P6, P4 x P8, P5 x P6, P6 x P7 and P6 x P8 had the good mean performances and were significantly than the check toward earliness, short plant, low ear height and lower ear placement toward lodging resistant.

Table 3: Mean performance of the 28 crosses and the two checks hybrid SC-168 and SC-3444 for six studied traits across three locations.

Cross	GY (ard. fed.$^{-1}$)	LWDR %	DTSE (day)	PHT (cm)	EHT (cm)	EP %
P1 x P2	28.10	100.00	65.89	252.67	141.00	55.84
P1 x P3	21.26	97.33	64.00	219.33	113.33	51.71
P1 x P4	18.38	90.67	60.11	214.00	115.00	53.71
P1 x P5	28.76	99.56	64.44	238.00	131.56	55.32
P1 x P6	27.09	98.22	61.00	239.00	123.44	51.72
P1 x P7	30.81	99.56	63.78	243.44	136.22	56.06
P1 x P8	24.61	98.22	61.11	228.56	127.33	55.71
P2 x P3	21.90	98.22	62.33	224.22	121.67	54.31
P2 x P4	23.40	95.11	60.00	230.78	124.89	54.33
P2 x P5	28.04	100.00	64.11	234.22	131.00	56.01
P2 x P6	24.26	96.00	61.11	230.67	123.56	53.57
P2 x P7	29.53	99.56	64.33	248.78	138.22	55.64
P2 x P8	18.27	100.00	63.22	222.89	126.22	56.66
P3 x P4	23.02	94.67	61.67	225.33	120.44	53.29
P3 x P5	26.28	96.89	62.56	224.67	120.67	53.84
P3 x P6	17.17	96.00	60.00	220.00	119.33	54.20
P3 x P7	22.41	90.67	61.89	228.00	116.33	51.27
P3 x P8	20.92	92.89	60.00	213.89	114.33	53.44
P4 x P5	24.30	93.78	62.67	220.44	124.00	56.26
P4 x P6	20.32	93.78	60.44	227.89	114.78	50.40
P4 x P7	25.68	85.33	61.89	237.78	126.33	53.19
P4 x P8	23.32	84.44	58.89	223.11	120.67	54.21
P5 x P6	19.40	96.89	60.33	220.00	113.00	51.66
P5 x P7	28.72	98.67	65.00	237.44	129.67	54.63
P5 x P8	25.00	97.33	63.11	228.33	128.67	56.40
P6 x P7	17.17	97.78	62.33	217.56	116.89	53.63
P6 x P8	19.82	96.44	57.33	205.67	103.11	50.31
P7 x P8	23.40	91.11	60.22	226.11	123.44	54.71
SC-168	27.16	98.67	65.11	238.11	134.22	56.60
SC-3444	29.49	100.00	66.11	240.22	124.89	52.17
LSD 0.05	2.86	4.08	1.23	10.39	8.37	2.51
LSD 0.01	3.76	5.36	1.62	13.66	11.01	3.30

GY = grain yield ard. fed.$^{-1}$ LWDR% = Late Wilt Resistant Disease% DTSE = days to 50% silking emergency (days)
PHT = plant height (cm) EHT = ear height (cm) EP% = ear position%

General combining ability effects of the eight new yellow maize inbred lines for six studied traits across three locations are presented in Table 4. Results revealed that, four inbred lines; P1, P2, P5 and P7 had positive & highly significant values (desirable) for GY toward high yielding. Meaning that these lines were good general combiner for high yielding ability. Three inbred lines; P1, P2 and P5 showed the good general combiner for LWDR% toward lodging resistant. Three inbred lines, P4, P6 and P8 had the good general combiner negatively and significantly (desirable) for DTSE trait toward earliness. For PHT & EHT traits, four inbred lines; P3, P4, P6 & P8 had the negative & highly significant (desirable) GCA effects toward shorter plant and low ear height, which help the plant against lodging. Two maize inbred lines; P3 and P6 had negative and highly significant GCA effects toward lower ear placement. The present results revealed that the inbred line P2 had the best GCA effects for high yielding and lodging resistant. While, two inbred line; P6 and P8 had the best general combiners for earliness, shorter plant and short ear height. The differences between inbred lines for GCA effects of different traits obtained by many researchers, **Aly and Mousa (2011), Saeid *et al*., (2019) and Abd EL-Azeem *et al*., (2021), Aly *et al*., (2022) and Abd EL-Azeem *et al*., (2024)**.

Table 4: General combining ability effects of the eight new yellow maize inbred lines for seven studied traits across three locations.

Parental lines	GY (ard. fed.$^{-1}$)	LWDR %	DTSE (day)	PHT (cm)	EHT (cm)	EP %
P1	2.278**	2.296**	1.148**	6.551**	4.435**	0.344
P2	1.361**	3.185**	1.259**	8.088**	7.546**	1.393**
P3	-2.063**	-0.519	-0.167	-6.708**	-5.861**	-0.991**
P4	-1.152**	-5.333**	-1.296**	-2.727*	-2.528*	-0.437
P5	2.528**	2.222**	1.463**	1.236	2.880*	1.019**
P6	-3.352**	0.889	-1.815**	-5.819**	-7.861**	-2.087**
P7	2.065**	-1.185*	1.000**	7.236**	4.306**	0.187
P8	-1.665**	-1.556**	-1.593**	-7.856**	-2.917**	0.572
S.E. gi	0.394	0.562	0.170	1.431	1.154	0.345
LSD 0.05	0.772	1.102	0.332	2.806	2.261	0.677
0.01	1.014	1.449	0.437	3.687	2.972	0.890

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

GY = grain yield ard. fed.$^{-1}$ LWDR% = Late Wilt Resistant Disease% DTSE = days to 50% silking emergency (days)
PHT = plant height (cm) EHT = ear height (cm) EP% = ear position%

Estimates of specific combining ability effects of 28 crosses for six studied traits across three locations are illustrated in Table 5. Results showed that, seven crosses; P1 x P6, P1 x P7, P2 x P6, P2 x P7, P3 x P4, P3 x P5 and P4 x P8 had SCA effects positive and significant for GY ard. fed.$^{-1}$ trait toward high yielding. Five crosses; P1 x P7, P2 x P8, P3 x P4, P4 x P6 and P6 x P7 had the good combiner of SCA effects for LWRD% trait toward lodging resistant. The desirable crosses had the desirable SCA effects negative and significant were; P1 x P4, P2 x P4, P3 x P7, P5 x P6, P6 x P8 and P7 x P8 for earliness; P1 x P3, P1 x P4, P6 x P7 and P6 x P8 for short plant height; P1 x P3, P1 x P4, P3 x P7, P5 x P6 and P6 x P8 for short ear height and P1 x P3, P3 x P7 and P6 x P8 for lower ear placement. The above crosses might be utilized in maize breeding programs for different desirable traits.

Table 5: Specific combining ability effects of 28 crosses for six studied traits across three locations.

Cross	GY (ard. fed.$^{-1}$)	LWDR %	DTSE (day)	PHT (cm)	EHT (cm)	EP %
P1 x P2	0.842	-1.164	1.561**	10.071**	5.979*	0.106
P1 x P3	-2.578**	-0.127	1.098**	-8.466**	-8.280**	-1.644*
P1 x P4	-6.367**	-1.979	-1.661**	-17.780**	-9.947**	-0.198
P1 x P5	0.331	-0.646	-0.087	2.257	1.201	-0.042
P1 x P6	4.544**	-0.646	-0.254	10.312**	3.831	-0.537
P1 x P7	2.849**	2.762*	-0.291	1.701	4.442	1.522*
P1 x P8	0.379	1.799	-0.365	1.905	2.775	0.793
P2 x P3	-1.017	-0.127	-0.680	-5.114	-3.058	-0.092
P2 x P4	-0.428	1.577	-1.884**	-2.540	-3.169	-0.624
P2 x P5	0.537	-1.090	-0.532	-3.058	-2.466	-0.402
P2 x P6	2.627**	-3.757**	-0.254	0.442	0.831	0.260
P2 x P7	2.488**	1.873	0.153	5.497	3.331	0.063
P2 x P8	-5.049**	2.688*	1.635**	-5.299	-1.447	0.689
P3 x P4	2.618**	4.836**	1.209**	6.812*	5.794*	0.715
P3 x P5	2.194*	-0.497	-0.661	2.183	0.609	-0.185
P3 x P6	-1.038	-0.053	0.061	4.571	10.016**	3.276**
P3 x P7	-1.210	-3.312	-0.865*	-0.484	-5.151*	-1.931**
P3 x P8	1.031	-0.720	-0.161	0.497	0.071	-0.139
P4 x P5	-0.695	1.206	0.579	-6.021	0.608	1.672*
P4 x P6	1.207	2.540*	1.635**	8.479**	2.127	-1.078
P4 x P7	1.146	-3.831**	0.265	5.312	1.516	-0.563
P4 x P8	2.520**	-4.349**	-0.143	5.738	3.071	0.074
P5 x P6	-3.395**	-1.905	-1.235**	-3.373	-5.058*	-1.278
P5 x P7	0.511	1.947	0.616	1.016	-0.558	-0.574
P5 x P8	0.518	0.984	1.320**	6.997*	5.664*	0.808
P6 x P7	-5.165**	2.392*	1.228**	-11.818**	-2.595	1.532*
P6 x P8	1.220	1.429	-1.180**	-8.614**	-9.151**	-2.176**
P7 x P8	-0.619	-1.831	-1.106**	-1.224	-0.984	-0.050
SE sij	0.871	1.245	0.375	3.168	2.553	0.764
LSD 0.05	1.708	2.439	0.735	6.209	5.004	1.498
0.01	2.245	3.206	0.967	8.161	6.577	1.969

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

GY = grain yield ard. fed.$^{-1}$ LWDR% = Late Wilt Resistant Disease% DTSE = days to 50% silking emergency (days)
PHT = plant height (cm) EHT = ear height (cm) EP% = ear position%

Simple correlation coefficient between six studied traits across three locations are showen in Table 6. Results revealed that the correlation coefficient were positive and significant between all the studied traits. The correlation between GY ard. fed.$^{-1}$ with all studied traits were positive and significant except with LWDR% trait which was positive and not significant, indicating that, increase in any trait led to increase the GY trait and vice versa. Correlation coefficient between

DTSE were significant positively with PHT, EHT and EP% traits. The correlation coefficient between PHT trait with EHT and EP% traits were positively and significant. These results are in agreement with the results reported by **Zarei *et al*., (2012)** for correlation between GY with PHT and DTSE and between PHT with DTSE; **Kwaga (2014) and Pandey *et al*., (2017)** between GY and PHT; **Yahaya *et al*., (2021)** between GY with PHT; **Aly *et al.*, (2023 & 2025)** between GY with PHT, EHT and EP% traits and **Aly *et al*., (2025)** between PHT with EHT and Ep% as well as correlation between EHT with EP% trait.

Table 6: Simple correlation coefficient between six studied traits across three locations.

	GY (ard. fed.$^{-1}$)	LWDR %	DTSE (day)	PHT (cm)	EHT (cm)	EP %
GY (ard. fed.$^{-1}$)	…..	0.265	0.598**	0.826**	0.780**	0.728*
LWDR %		…..	0.555**	0.299	0.373	0.317
DTSE (day)			…..	0.673**	0.739**	0.545**
PHT (cm)				…..	0.780**	0.408*
EHT (cm)					…..	0.889**
EP %						…..

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

GY = grain yield ard. fed.$^{-1}$ LWDR% = Late Wilt Resistant Disease% DTSE = days to 50% silking emergency (days)

PHT = plant height (cm) EHT = ear height (cm) EP% = ear position%

Superiority percentage of the 28 crosses relative to the two check hybrids; SC-168 & SC-3444 for GY, DTSE and some other traits related across three locations are illustrated in Table (7). For GY ard. fed.$^{-1}$, Superiority% of crosses ranged from (-36.79 and -41.79) for crosses P3 x P6 and P6 x P7 to (13.44 and 4.48) for cross P1 x P7 relative to SC-168 and SC-3444, in respectively. Three crosses; P1 x P5 (5.88*), P1 x P7 (13.44**) and P2 x P7 (8.74**) were positive and significantly superiority% relative to the check SC-168. While, two crosses; P1 x P7 (4.48) and P2 x P7 (0.15) were positively and insignificant superiority% relative to the highest check SC-3444. Results revealed that, all crosses except cross P1 x P2 was exhibited negative and significant superiority% relative to the check hybrid SC3444 and between them 24 crosses had negative and significant superiority% relative to the check hybrid SC168 toward earliness. For PHT, 20 out 28 crosses had negative and significant superiority% relative to the two check hybrids SC168 and SC-3444 toward short plant height, and the same this crosses had negative and significant superiority% relative to the SC-168 for EHT trait toward low ear height. On the other hand, 9 crosses were possessed negative and significant superiority% relative to the check SC-3444. For EP% trait toward lower ear placement, 19 and 2 out 28 crosses were negative and significant superiority percentage relative to the two check SC168 and SC-3444, respectively. From these results, these crosses can be recommended to use in maize breeding programs to produce promising hybrids with high yielding, early maturity and some other desirable related traits. **Onejeme *et al.*, (2020), Rehman *et al*., (2022) and Abd El- Azeem *et al*., (2024),** confirmed these results.

Table 7: Superiority % of 28 crosses relative to the two checks SC-168 and SC-3444 for GY, DTSE and some other traits related across three locations.

Cross	GY (ard. fed.$^{-1}$)		DTSE (day)		PHT (cm)		EHT (cm)		EP %	
	SC-168	SC-3444	SC-168	SC-3444	SC-168	SC-3444	SC-168	SC-3444	SC-168	SC-3444
P1 x P2	3.46	-4.71	1.12*	-0.34	6.11**	5.18**	5.05**	12.90**	-1.34	7.05**
P1 x P3	-21.74**	-27.92**	-1.71**	-3.19**	-7.89**	-8.70**	-15.56**	-9.25**	-8.65**	-0.88
P1 x P4	-32.34**	-37.68**	-7.68**	-9.08**	-10.13**	-10.92**	-14.32**	-7.92**	-5.11**	2.96*
P1 x P5	5.88*	-2.49	-1.02	-2.52**	-0.05	-0.93	-1.99	5.34**	-2.27	6.05**
P1 x P6	-0.26	-8.14**	-6.31**	-7.73**	0.37	-0.51	-8.03**	-1.16	-8.63**	-0.86
P1 x P7	13.44**	4.48	-2.05**	-3.53**	2.24	1.34	1.49	9.08**	-0.97	7.45**
P1 x P8	-9.39**	-16.54**	-6.14**	-7.56**	-4.01**	-4.86**	-5.13**	1.96	-1.58	6.79**
P2 x P3	-19.37**	-25.74**	-4.27**	-5.71**	-5.83**	-6.66**	-9.35**	-2.58	-4.05**	4.11**
P2 x P4	-13.84**	-20.65**	-7.85**	-9.24**	-3.08*	-3.93**	-6.95**	0.000	-4.01**	4.15**
P2 x P5	3.26	-4.90	-1.54**	-3.03**	-1.63	-2.50	-2.40	4.89*	-1.05	7.37**
P2 x P6	-10.69**	-17.75**	-6.14**	-7.56**	-3.13*	-3.98**	-7.95**	-1.07	-5.37**	2.68
P2 x P7	8.74**	0.15	-1.20*	-2.69**	4.48**	3.56**	2.98	10.68**	-1.70	6.66**
P2 x P8	-32.74**	-38.06**	-2.90**	-4.37**	-6.39**	-7.22**	-5.96**	1.07	0.09	8.60**
P3 x P4	-15.24**	-21.93**	-5.29**	-6.72**	-5.37**	-6.20**	-10.27**	-3.56	-5.86**	2.15
P3 x P5	-3.25	-10.89**	-3.93**	-5.38**	-5.65**	-6.46**	-10.10**	-3.38	-4.88**	3.21*
P3 x P6	-36.79**	-41.79**	-7.85**	-9.24**	-7.61**	-8.42**	-11.09**	-4.45*	-4.25**	3.90**
P3 x P7	-17.49**	-24.00**	-4.95**	-6.39**	-4.25**	-5.09**	-13.33**	-6.85**	-9.43**	-1.73
P3 x P8	-22.97**	-29.05**	-7.85**	-9.24**	-10.17**	-10.96**	-14.82**	-8.45**	-5.58**	2.45
P4 x P5	-10.53**	-17.60**	-3.75**	-5.21**	-7.42**	-8.23**	-7.62**	-0.71	-0.62	7.84**
P4 x P6	-25.18**	-31.09**	-7.17**	-8.57**	-4.29**	-5.13**	-14.49**	-8.10**	-10.96**	-3.39*
P4 x P7	-5.46	-12.93**	-4.95**	-6.39**	-0.14	-1.02	-5.88**	1.16	-6.03**	1.96
P4 x P8	-14.13**	-20.91**	-9.56**	-10.92**	-6.30**	-7.12**	-10.10**	-3.38	-4.23**	3.92**
P5 x P6	-28.57**	-34.21**	-7.34**	-8.74**	-7.61**	-8.42**	-15.81**	-9.52**	-8.74**	-0.98
P5 x P7	5.75	-2.60	-0.17	-1.68**	-0.28	-1.16	-3.39	3.83	-3.48**	4.73**
P5 x P8	-7.95*	-15.23**	-3.07**	-4.54**	-4.11**	-4.95**	-4.14*	3.03	-0.36	8.11**
P6 x P7	-36.79**	-41.79**	-4.27**	-5.71**	-8.63**	-9.44**	-12.91**	-6.41**	-5.25**	2.81*
P6 x P8	-27.02**	-32.78**	-11.95**	-13.28**	-13.63**	-14.39**	-23.18**	-17.44**	-11.12**	-3.56*
P7 x P8	-13.84**	-20.65**	-7.51	-8.91**	-5.04**	-5.87**	-8.03**	-1.16	-3.35*	4.86**
LSD 0.05	1.71		0.74		6.21		5.00		1.50	
0.01	2.24		0.97		8.16		6.58		1.97	

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

GY = grain yield ard. fed.$^{-1}$ DTSE = days to 50% silking emergency (days) PHT = plant height (cm)

EHT = ear height (cm) EP% = ear position%

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القدرة الائتلافية، التفوق ومقاومة مرض الذبول المتأخر في سلالات صفراء جديدة من الذرة الشامية من خلال نظام التزاوج النصف دائري

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تم تقييم ثمانية سلالات جديدة صفراء من الذرة الشامية مشتقة من مصادر جغرافية متباينة من خلال البرنامج القومي للذرة الشامية بأربعة محطات بحوث زراعية تمثلث من سدس، الجيزة، سخا والجميزة بطريقة التهجين النصف دائري لتقدير القدرة الإئتلافية للسلالات الجديدة الأبوية والهجن الناتجة منها وكذلك لتحديد النسبة المئوية لتفوق الهجن ذات المحصول العالى بالإضافة لصفة المقاومة لمرض الذبول المتأخر وأيضاً حساب معامل الإرتباط البسيط للوقوف على طبيعة العلاقة بين محصول الحبوب والصفات المرتبطة به. أظهرت النتائج وجود إختلافات معنوية بين المواقع المختلفة تحت الدراسة لجميع الصفات المدروسة فيما عدا صفة عدد الأيام حتى ظهور 50% من النورات المؤنثة. علاوة على ذلك أظهرت التراكيب الوراثية والهجن وكذلك تفاعلهما مع المواقع إختلافات معنوية لجميع الصفات المدروسة فيما عدا صفتى ارتفاع الكوز والنسبة المئوية للكوز على النبات. أظهرت كلاً من القدرة العامة والخاصة على التآلف تباينات عالية المعنوية لجميع الصفات مما يعكس أهمية الفعل الجينى الإضافى وغير الإضافى في وراثة تلك الصفات. إمتلكت السلالة–1، السلالة–2 و السلالة–5 أفضلية للقدرة

العامة على التآلف لصفات محصول الحبوب والمقاومة لمرض الذبول المتأخر ناحية المحصول العالى والمقاومة لرقاد النباتات. في حين إمتلكت السلالة–4، السلالة–6 والسلالة–8 أفضلية للقدرة العامة على التآلف لصفات التزهير، ارتفاع النبات وإرتفاع الكوز ناحية التبكير، قصر النبات وأفضلية موقع الكوز على النبات. سجلت الهجن (سلالة–1 x سلالة–7) و (سلالة–3 x سلالة–4) أفضلية للقدرة الخاصة على التآلف محققة قيماً موجبة ومعنوية تجاة المحصول العالى والمقاومة للرقاد. وعلى صعيد أخر حققت الهجن (سلالة–1x سلالة–3) و (سلالة– 6x سلالة–8) قيماً موجبة ومرغوبة للقدرة الخاصة على الإئتلاف لصفات قصر النبات وأفضلية لموقع الكوز على النبات تجاة مقاومة الرقاد. على الجانب الأخر إمتلك الهجين (سلالة– 6x سلالة–8) قدرة ائتلاف خاصة سالبة ومرغوبة ناحية صفة التبكير في النضج. أظهرت النتائج أيضاً تفوق ثلاثة هجن "سلالة–1 x سلالة–5 (5,88*) ، سلالة–1 x سلالة–7 (13,44**) و سلالة–2 x سلالة–7 (8,74**)" تفوقاً موجباً ومعنوياً بالنسبة لمحصول الحبوب مقارنة بهجين المقارنة هـ. ف. 168. بينما أظهر الهجينين "سلالة–1 x سلالة–7 (4,48) وسلالة–2 x سلالة–7 (0,15)" تفوقاً موجباً دون بلوغ مستوى المعنوية قياساً بأعلى هجين المقارنة المحصولية هـ. ف. 3444. وبناءً على ذلك أوصى الباحثين بضرورة إستخدام تلك الهجن في برامج تربية الذرة الشامية لإنتاج هجن مبشرة ذات قدرة محصولية عالية ومقاومة للرقاد.