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Research Article

COMPETITIVE ABILITY OF MIXTURES OF COMMERCIAL MAIZE HYBRIDS OF TELANGANA STATE

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ABSTRACT

Six medium-season commercial maize (*Zea mays* L.) hybrids were evaluated in RCBD with three replications, as sole crop as well as all possible half diallel mixture combinations by mixing equal quantity of seed, during kharif, 2015 at college farm, College of Agriculture, Rajendranagar. The hybrids comprises of both public as well as private sector. Data were recorded for grain yield and its components. Among 15 combinations, two hybrid mixtures viz., DHM-117 + NMH-1247 and DHM-121 + NMH-1247 recorded high *per se* of 8-20 % and significant competitive ability over the sole high yielding genotype. The hybrids that yielded highest in pure stands contributed more to a mixture than would be expected based on their pure stand yield and the lower yielding hybrids contributed less than expected. Cross-pollination boost to seed yield is greater from two hybrids that have different parentage or sources.

INTRODUCTION

The idea of blending seeds from different varieties or hybrids has been around for a quite some time. The theory is that two hybrids planted together in the same field might be able to produce a yield superior to what the varieties would on their own. This theory is based on two main ideas (i) two hybrids may use the resources of light, nutrients and water in patterns that complement each other; another way of understanding this concept is to imagine the possibility that two plants from different hybrids are less competitive with each other than two plants from the same hybrid, (ii) the potential to stimulate hybrid vigour in the seed, the one being advanced most recently; when pollen of hybrid A pollinates the ear of hybrid B, there is potential for increased vigour due to larger kernel size than if hybrid B received its own pollen.

An understanding of the ways in which genotypes interact is essential for the intelligent design and development of heterogeneous populations, whether for breeding or production purposes. Much information can be obtained by studying the effects of blending two or more genotypes in simple mixtures. Considerably less work has been done on mixtures in cross-pollinated crops and the pattern is less clear than in self-pollinated crops. Mixtures of maize hybrids have not differed in grain yield from the mid-component means (Eberhart, 1964, Funk and Anderson, 1964). However, Doney *et al.*, (1965) noted increased tuber production in two component mixtures of potatoes (*Solanum tuberosum* L.). Roy (1965) established superiority of certain mixtures over the mean of components and occasionally exceeded those of better performing component. In the present investigation we have studied mixtures of maize hybrids to determine the relative yields of mixtures compared to sole crops.

MATERIALS AND METHODS

Six maize hybrids viz., DHM-117, DHM-121, GK-3063, GK-3153, NMH-1247 and NMH-713 were selected based on similar maturity and yield potential. They were physically mixed in a half-diallel manner to generate fifteen hybrid mixture combinations. Each mixture involved equal number of seed from the 2 hybrids. Each genotype was grown in four row plot of four meters length with 75 × 20 cm spacing in a randomized complete block design (RCBD) with three replications during 2015 *kharif* at college farm, College of Agriculture, PJTSAU, Rajendranagar. The trial was conducted in a red soil. All the recommended agronomic practices were

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followed to raise a normal crop. Data were recorded on ten randomly selected plants in each treatment for ten characters viz., plant height, ear height, ear length, ear girth, number of kernels per row, number of kernel rows, shelling % and grain yield per plant. Data were analyzed for combining ability following model I, method 2 (Griffing 1956) using windostat 8.0 (Indostat Services, Hyderabad).

RESULTS AND DISCUSSION

Based on *per se* performance (Table 1), the hybrid sole crop NMH-1247 recorded high mean for -, kernel rows, kernels/ear, shelling % and Grain yield/hectare. The sole crop DHM-121 recorded high mean for ear height whereas the hybrid DHM-117 exhibited high mean for plant height. The hybrid mixture combination DHM-117 + NMH-1247 exhibited high *per se* for grain yield/hectare, shelling%, kernels/ear, and ear length whereas the hybrid mixture combination DHM-121 + NMH-1247 recorded second highest mean value for grain yield/hectare, kernel rows, ear girth and and third highest in shelling%, kernels/ear.

The genotypic differences for grain yield and its seven component characters except shelling % were significant indicating the presence of enough variation among the genotypes.

The further partitioning of competitive ability revealed significant variation either due to general or due to specific competitive ability for all traits except shelling percentage. However, general competitive ability (GCA) mean squares were highly significant for plant height, ear length, ear girth, kernel rows, kernels per ear and grain yield/hectare, whereas specific competitive ability was highly significant for ear height, and shelling% (Table 2).

The hybrid NMH-1247 had recorded higher *per se* and highly significant positive general competitive ability effects for yield and the yield contributing characters like kernels/ear and kernel rows (Table 3). Hence this parental hybrid can be used to develop high yielding hybrid mixture combinations and as a base population for further improvement.

The specific competitive ability effects are highly valuable for discrimination of hybrid mixtures for their yielding ability. Among the 15 hybrid mixtures, three combinations *viz.,* DHM-117 + GK-3063, DHM-117 + NMH-1247 and DHM-121 + NMH-1247 exhibited significant positive specific competitive effects for yield (Table 4). In the hybrid mixtures, DHM-117 + NMH-1247 and DHM-121 + NMH-1247, one parent, NMH-1247, exhibited high *per se* and significant general competitive ability for grain yield.

Table 1 Mean performance of sole and hybrid mixtures of maize for yield and yield components

S. No.	Crosses	Plant Height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	Kernel rows	Kernels/ ear	Shelling %	Grain yield/hectare (tonnes)
1	DHM-117 + DHM-121	200	93	20	18	17	36	82	6.66
2	DHM-117 + GK-3063	197	88	19	17	15	38	81	7.33
3	DHM-117 + GK-3153	217	89	20	16	15	39	83	6.16
4	DHM-117 + NMH-1247	207	99	21	17	15	42	88	8.08
5	DHM-117 + DHM-121	215	117	20	16	16	38	79	6.25
6	DHM-121 + GK-3063	207	97	20	17	16	39	78	5.75
7	DHM-121 + GK-3153	209	103	20	16	15	38	82	6.00
8	DHM-121 + NMH-1247	192	90	21	17	16	39	84	8.00
9	DHM-121 + NMH-713	218	106	20	16	15	37	79	5.91
10	GK-3063 + GK-3153	211	100	19	16	14	37	87	5.41
11	GK-3063 + NMH-1247	211	101	19	17	15	39	84	6.08
12	GK-3063 + NMH-713	215	105	20	17	14	38	80	6.00
13	GK-3153 + NMH-1247	206	95	19	16	15	38	82	6.41
14	GK-3153 + NMH-713	207	96	19	16	15	36	81	5.66
15	NMH-1247 + NMH-713	228	107	21	18	17	40	82	5.91
16	DHM-117	245	109	19	15	14	35	82	5.50
17	DHM-121	218	110	19	15	15	35	84	6.50
18	GK-3063	215	104	19	15	15	38	84	6.50
19	GK-3153	207	100	19	17	15	37	85	6.33
20	NMH-1247	191	95	20	16	17	38	87	6.75
21	NMH-713	228	97	21	16	16	36	83	6.58
	General Mean	212	100	20	16	15	38	83	6.37
	SE ±	5	7.03	0.62	1	0.68	1.55	2.8	0.43

Table 2 ANOVA for diallel analysis of 8 characters for yield and yield components in maize

	DF	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	Kernel rows	Kernels per / ear	Shelling %	Grain yield/hectare (tonnes)
Replicates	2	371.372***	517.644**	0.273	2.413**	1.135	1.068	1.188	0.519
Genotypes	20	452.656***	172.634*	1.493**	1.855***	2.017**	7.637*	20.493	1.530**
Parents	5	1005.783***	122.066	1.777*	1.301*	3.774***	5.425	9.136	0.589
Hybrids	14	238.908***	192.248**	1.376*	0.771	1.517*	6.528	22.699	1.976**
Parents Vs Hybrids	1	679.496***	150.891	1.707	19.808***	0.237	34.221**	46.393	0.004
Error	40	37.582	74.308	0.592	0.441	0.708	3.615	11.798	0.571
GCA	5	222.000***	34.751	0.796**	0.759***	1.290***	3.330*	4.74	0.548*
SCA	15	127.180***	65.143**	0.398*	0.572***	0.467*	2.284	7.528	0.498**
GCA/SCA	0.33	1.745	0.533	2.00	1.326	2.762	1.457	0.629	1.100

Table 3 Estimates of general competitive ability of the six parents (Hybrids) for grain yield and yield components in maize

S. No.	Parents	Plant Height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	Kernel rows	Kernels/ ear	Shelling %	Grain yield/hectare (tonnes)
1	DHM-117	5.27***	0.36	-0.11	0.12	0.02	-0.13	-0.23	0.111
2	DHM-121	-1.84	1.35	0.06	-0.11	0.05	-0.79	-0.90	0.090
3	GK-3063	-0.69	-0.09	-0.38*	-0.19	-0.42*	0.18	-0.18	-0.128
4	GK-3153	-2.52*	-2.34	-0.29	-0.45***	-0.44**	-0.22	0.79	-0.285*
5	NMH-1247	-7.20***	-2.29	0.39	0.39	0.65***	1.15*	1.07	0.424**
6	NMH-713	6.98***	3.01	0.32	0.25	0.13	-0.19	-0.55***	-0.212
	gi at 95%	2.94***	4.13***	0.37***	0.32***	0.40***	0.91***	1.65***	0.140

Table 4 Estimates of specific competitive ability of 15 maize hybrid mixtures for grain yield and yield components.

S. No.	Crosses	Plant Height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	Kernel rows	Kernels / ear	Shelling %	Grain yield/hectare (tonnes)
1	DHM-117 + DHM-121	-14.976***	-9.272	0.083	0.305	1.3**	-0.539	0.87	0.092
2	DHM-117 + GK-3063	-19.382***	-12.837*	0.197	0.492	0.439	0.108	-1.241	0.978*
3	DHM-117 + GK-3153	2.125	-9.336	0.495	1.081**	0.455	1.221	-0.607	-0.033
4	DHM-117 + NMH-1247	-2.697	0.527	1.024*	0.407	-0.628	3.187**	4.611*	1.176*
5	DHM-117 + DHM-121	-9.217*	13.896**	0.095	0.026	0.219	1.08	-2.959	-0.022
6	DHM-121 + GK-3063	4.126	-2.321	0.357	0.606	0.538	0.905	-3.098	-0.585
7	DHM-121 + GK-3153	1.16	3.844	0.115	0.428	-0.131	1.099	-0.837	-0.179
8	DHM-121 + NMH-1247	-10.829**	-9.547*	1.227**	0.667	-0.325	0.727	0.964	1.113*
9	DHM-121 + NMH-713	1.234	1.989	-0.401	0.076	-0.589	0.237	-2.373	-0.335
10	GK-3063 + GK-3153	2.504	2.049	-0.068	0.185	-0.103	-1.032	3.506	-0.543
11	GK-3063 + NMH-1247	6.765*	3.385	-0.593	0.498	-0.297	0.047	0.263	-0.585
12	GK-3063 + NMH-713	-2.835	2.007	-0.001	0.19	-0.783	0.717	-2.12	-0.033
13	GK-3153 + NMH-1247	4.023	-0.027	-0.534	-0.237	-0.726	-0.453	-2.089	-0.095
14	GK-3153 + NMH-713	-9.335**	-4.909	-0.496	-0.078	-0.434	-1.333	-1.959	-0.210
15	NMH-1247 + NMH-713	16.176***	5.871	0.062	0.672	0.483	1.019	-1.072	-0.668**
	Sij-at 95%	3.13	4.41	0.39	0.34	0.43	0.97	1.75	0.38

Kannenberg and Hunter (1972) opined that high yielding hybrids contributed more than would be expected relative to their pure stand yield and low yielding hybrids less than expected. On the contrary, Springfield (1958) opined that mixtures of either similar or dissimilar hybrids had any clear advantage or disadvantage when compared with averages of the contributing hybrids grown separately. Mark Westgate (1997) reported about a four bushel average gain in yield from mixing hybrids developed from different seed companies. In the present investigation also the hybrid, DHM-117 + NMH-1247 exhibited significant positive sca effect for ear length, kernel per ear and shelling percentage. The hybrid mixture, DHM-121 + NMH-1247 recorded significant positive sca for yield and ear length. Thus hybrid combinations of DHM-117 + NMH-1247 and DHM-121 + NMH-1247 gave higher yield of 8-20 % over high yielding sole crop. The increase in the grain yield may be attributed to synergetic and compatibility with respect to wider adaptability to soil and weather conditions. This suggests the cross-pollination boost to seed yield is greater from two hybrids that have different parentage and that this would be more likely when hybrids came from different sources.

Mumaw and Weber (1957) have obtained significant differences (+2.1%) for the yield of 20 paired mixtures of soybean varieties over their average performance in pure stand with the superiority for mixed stands ranging from-2.2% to +6.3% for individual mixtures. Similarly in rice, Kulkarni (1995) reported 12% superiority of the varietal mixture combinations over sole varieties. Roy (1965) has emphasized that one has to make choice between purity and productivity. Some basic demands like flowering, plant height for uniformity must be satisfied while selecting the hybrid for mixture combinations. This will give a balance between purity and also productivity.

CONCLUSION

Twenty one genotypes including fifteen two hybrid mixtures and six pure hybrids were tested at Rajendranagar. Three hybrid mixtures viz., DHM-117 + GK-3063, DHM-117 + NMH-1247 and DHM-121 + NMH-1247 exhibited significant positive specific competitive effects for grain yield recording 3-7% higher yield over their sole crops. Further evaluation with more combinations of hybrid mixtures to identify high yielding mixture combinations would be rewarding.

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