

Per Se performance of parents and hybrids in maize for grain yield characters

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Abstract : *per se* performance of 90 hybrids that resulted from 10 parents crossed in a diallel fashion was studied for eight characters. Maximum grain yield per plant was recorded by the cross Prabhat - 1 x UMI 492. The cross which included UMI 760 and Prabhat - 1 as parents showed significant increase in grain yield, plant height, number of grain rows per cob, cob weight and starch content. (**Key Words :** *Maize, per se performance, Grain yield*)

The success of any crop breeding programming depends on the choice of parents based on *per se* performance. The selected genotypes can be used either for the exploitation of heterosis or recombination breeding. Parents with good *per se* performance are exposed to yield desirable recombinants in the segregating generation and the potentiality of such genotypes will also reflect in the performance of hybrids. Because of the above advantages certain maize genotypes and their resultant hybrids were evaluated based on mean *per se* performance.

Materials and Methods

Ten maize inbreds viz. UMI 492, UMI 561, UMI 743, UMI 760, UMI 805, Kesri-1, Prabhat-1, Pratap-1, Sartaj-1 and JM 3181 were crossed in a diallel fashion and the resultant 90 hybrids along with the parents were raised in a randomised block design in two replications. Five plants for each genotype from each replication were selected at random for recording observations on eight quantitative characters viz. plant height, number of grain rows per cob, number of grains per row, cob weight, days to 50% silk, hundred grain weight, grain yield per plant and starch content. The data were subjected to analysis of variance to assess the treatment difference for the various characters (Panse and Sukhatme, 1961).

Results and Discussion

Analysis of variance for eight quantitative characters is given in Table 1. There is a significant difference between the genotypes (parents and hybrids) for all the characters studies. The mean performance of parents and hybrids are given. Plant height in the parents ranged from 166.60 cm (UMI 492) to 123.50 cm (UMI 743). Among the hybrids Prabhat - 1 X UMI 492 recorded the maximum height (189.70 cm.). The parental mean was 150.19 cm while that of the hybrids was 157.54 cm. As

many as 36 hybrids recorded significant increase in grain yield over the hybrid mean. Among the parents, a wide variation for number of grain rows per cob was observed, the range being 15.62 (Sartaj-1) to 10.97 (UMI 494). The hybrid (Kesri - 1 x Prabhat - 1) recorded the maximum number of grain rows per cob (18.42) which exceeded the hybrid mean (13.93).

Number of grains per cob is another important character which contributes much to the grain yield (Satovic, 1975 and Mahajen et al, 1991). The parental value ranged from 28.26 (Kesri -1) to 21.75 (JM 3181). The cross Prabhat - 1 X UMI 760 had the maximum number of grains per cob (31.01). Cob weight is also one of the important characters which contributes much to the grain yield. There was a high degree of variation for this character among the parents. The parental mean ranged from 143.00g (Kesri - 1) to 83.82 Kg (UMI 760). Among the hybrids the cross Kesri - 1 x UMI 492 recorded the maximum cob weight of 180.25 g. Crop duration is an important component while effecting selection pressure. Early duration hybrids are more advantageous in case of maize. For days to 50 per cent silking, the parental mean values ranged from 63 days (UMI 760) to 54 days (UMI 561). The hybrid Kesri - 1 x JM 3181 flowered at the earliest (54 days) among all the cross combinations. the range of 100 grain weight among the parents was wide. It ranged from 28.10 g (UMI 80) to 21.10 G (Kesri - 1). Among the hybrids the cross Kesri - 1 x UMI 805 recorded the maximum 100 grain weight of 29.70 grams. Grain yield per plant is an important character in maize for commercial exploitation of maize. The parents showed wide variation for this characters, the range being 95.33g (UMI 805) to 60.74 (UMI 760). The hybrid Prabhat - 1 x UMI 492 recorded the highest grain yield among the cross combinations studied.

Maize starch is used in the manufacture of synthetic polymers, in production of glucose,

Table 1. Analysis of variance for eight characters in tests of 10 x 10 diallel cross in maize

Source due to	d.f.	Mean Squares							
		Days to 50% silk	No. of grain rows/cob	No. of grains/row	Cob Weight	Plant height	100 grain weight	Grain yield /plant	Starch Content
Replication	1	8.820	4891	8.169	20.167	2.753	0.589	0.644	2.000
Entries	99	9.502**	4.034**	15.502**	1231.241**	265.348**	12.489**	409.757**	119.483**
Error	99	0.234	1.269	4.992	19.734	13.186	1.002	6.080	1.303
SE		0.484	1.127	2.234	4.442	3.631	1.001	2.466	1.141
CD at 5%		0.960	2.236	4.432	8.813	7.204	1.986	4.893	2.264
CD at 1%		1.271	2.960	5.866	11.663	9.535	2.629	6.476	2.996

** Significant at 1% level * Significant at 5% level

Table 2. Mean performance of parents and first generation hybrids in 10 x 10 diallel set of crosses for eight quantitative characters

Entries	Pl. ht (cm)	No. of grain rows per cob	No. of grains per row	Cob. wt (g)	Days to 50% silk	Hundred grain weight (g)	Grain yield per plant (g)	Starch Content (%)
UMI 492 (P ₁)	166.60	10.97	24.50	104.00	56.50	25.96	71.00	64.00
UMI 561 (P ₂)	145.30	12.17	23.56	110.00	54.00	26.57	67.33	63.00
UMI 733 (P ₃)	123.50	11.27	23.16	98.00	62.00	25.49	66.53	62.00
UMI 760 (P ₄)	156.50	12.05	22.85	83.82	63.00	22.06	60.74	66.50
UMI 805 (P ₅)	163.25	13.20	25.69	131.67	57.50	28.10	95.33	66.50
Kesri - 1 (P ₆)	160.00	12.73	28.26	143.00	58.50	21.10	74.88	69.00
Prabhat - 1 (P ₇)	164.70	13.40	22.08	130.50	61.00	26.55	76.25	72.50
Pratap - 1 (P ₈)	149.50	11.20	23.67	86.12	59.50	25.31	67.10	68.00
Sartaj - 1 (P ₉)	137.25	15.66	22.48	99.50	55.50	21.95	75.29	68.00
JM 3181 - (P ₁₀)	135.25	13.27	21.75	127.00	57.50	22.35	63.44	68.00
(P ₁) x (P ₂)	172.55	13.30	27.15	160.00	56.50	23.69	82.39	52.50
(P ₁) x (P ₃)	157.95	13.75	22.00	80.00	59.00	20.78	66.49	65.50
(P ₁) x (P ₄)	164.95	13.00	22.38	88.75	57.00	23.94	102.35	61.50
(P ₁) x (P ₅)	163.85	14.00	22.44	49.00	56.50	19.62	61.66	71.50
(P ₁) x (P ₆)	172.45	12.48	23.27	104.75	56.50	21.35	61.58	75.50
(P ₁) x (P ₇)	170.45	13.70	24.50	124.75	56.50	23.27	73.69	52.50
(P ₁) x (P ₈)	157.30	13.25	22.00	115.25	56.00	22.72	64.67	55.50
(P ₁) x (P ₉)	162.95	14.75	23.00	103.85	59.50	23.04	75.15	63.00
(P ₁) x (P ₁₀)	166.00	13.50	26.33	127.75	54.50	23.97	84.15	66.50
(P ₂) x (P ₃)	162.45	13.60	24.50	113.25	59.00	20.06	68.00	53.50
(P ₂) x (P ₄)	163.20	13.75	30.40	151.75	56.50	22.02	90.65	65.60
(P ₂) x (P ₅)	166.50	13.50	25.77	92.50	59.00	21.01	72.18	63.00
(P ₂) x (P ₆)	159.60	12.90	23.96	93.25	54.50	18.29	70.67	60.50
(P ₂) x (P ₇)	164.75	13.77	24.62	108.00	55.50	20.62	71.63	57.00
(P ₂) x (P ₈)	160.45	14.06	26.51	97.75	56.50	22.58	83.13	55.00
(P ₂) x (P ₉)	176.15	13.40	29.17	98.75	54.50	20.86	82.40	74.50
(P ₂) x (P ₁₀)	161.25	16.35	23.49	162.50	56.50	22.89	85.10	55.00
(P ₃) x (P ₄)	152.00	13.60	20.65	129.79	57.50	20.81	59.28	66.00
(P ₃) x (P ₅)	160.80	13.90	23.42	127.75	57.00	23.98	78.65	63.50
(P ₃) x (P ₆)	154.60	13.10	21.76	125.75	57.50	27.56	78.90	57.50
(P ₃) x (P ₇)	159.90	14.66	22.04	100.00	59.50	22.74	72.44	56.00

Table 2 contd....

Entries	Pl. ht (cm)	No. of grain rows per cob	No. of grains per row	Cob. wt (g)	Days to 50% silk	Hundred grain weight (g)	Grain yield per plant (g)	Starch Content (%)
(P ₃) x (P ₁)	161.00	13.25	25.62	112.50	57.50	20.94	70.17	74.50
(P ₃) x (P ₉)	152.90	12.70	21.05	91.75	59.00	24.67	62.82	71.00
(P ₃) x (P ₁₀)	147.55	13.90	21.15	100.00	57.00	23.52	65.10	69.00
(P ₄) x (P ₃)	165.45	14.40	25.33	79.12	55.50	19.88	71.89	56.50
(P ₄) x (P ₆)	163.35	15.52	18.62	108.58	59.00	24.40	61.91	57.50
(P ₄) x (P ₇)	153.80	13.56	19.16	87.12	61.00	24.33	98.71	66.50
(P ₄) x (P ₈)	143.90	15.08	18.99	73.00	61.00	21.75	62.29	71.50
(P ₄) x (P ₉)	154.65	11.00	20.70	115.75	59.00	30.03	68.81	74.00
(P ₄) x (P ₁₀)	170.80	13.66	27.31	152.00	56.50	26.56	112.01	76.50
(P ₅) x (P ₂)	164.90	15.65	24.40	112.00	55.00	19.49	73.37	65.50
(P ₅) x (P ₇)	175.15	17.90	20.80	131.00	55.50	25.15	90.67	62.50
(P ₅) x (P ₈)	156.10	12.40	20.70	92.25	57.00	21.31	27.64	63.50
(P ₅) x (P ₉)	163.25	13.66	22.50	86.42	61.50	23.83	71.71	55.50
(P ₅) x (P ₁₀)	154.60	13.60	25.20	83.50	54.50	22.10	73.51	61.50
(P ₆) x (P ₇)	156.40	18.42	21.00	104.88	58.00	23.17	86.15	75.50
(P ₆) x (P ₈)	140.70	12.00	23.30	104.00	55.50	25.25	66.75	73.00
(P ₆) x (P ₉)	139.10	14.65	22.15	98.25	61.00	22.80	74.90	75.00
(P ₆) x (P ₁₀)	157.10	16.00	24.70	105.00	54.00	20.58	80.30	73.50
(P ₇) x (P ₈)	155.40	13.90	24.50	126.75	57.00	24.72	82.69	76.00
(P ₇) x (P ₉)	150.60	11.90	23.81	122.25	58.50	23.05	66.75	74.50
(P ₇) x (P ₁₀)	154.30	15.60	25.90	78.50	57.50	19.98	78.48	69.00
(P ₈) x (P ₉)	165.15	12.10	26.26	87.25	55.50	23.34	73.15	71.50
(P ₈) x (P ₁₀)	166.70	13.30	29.50	92.50	55.50	21.65	85.28	75.00
(P ₉) x (P ₁₀)	156.25	12.84	20.33	100.75	59.00	23.44	62.70	74.50
(P ₂) x (P ₁)	151.25	13.00	25.50	118.00	58.00	19.68	64.74	76.50
(P ₃) x (P ₁)	146.25	15.50	23.75	153.15	59.50	23.89	87.44	57.50
(P ₄) x (P ₁)	156.75	13.20	25.50	131.25	59.50	27.56	95.82	67.00
(P ₅) x (P ₁)	155.30	13.75	22.61	115.50	59.00	20.69	64.39	74.50
(P ₆) x (P ₁)	169.00	12.92	26.94	180.25	60.00	20.77	71.09	52.00
(P ₇) x (P ₁)	189.70	15.00	24.70	173.87	58.50	26.01	152.69	75.50
(P ₈) x (P ₁)	169.85	12.50	26.00	131.50	55.00	24.81	78.07	73.50
(P ₉) x (P ₁)	150.60	12.57	22.73	115.00	60.00	27.27	110.82	57.00
(P ₁₀) x (P ₁)	147.25	14.95	20.74	102.75	54.50	21.19	65.73	57.50
(P ₃) x (P ₂)	159.10	14.50	24.33	91.75	59.00	21.97	74.00	71.00
(P ₄) x (P ₂)	149.00	12.00	26.08	103.42	59.00	22.71	77.89	75.50
(P ₅) x (P ₂)	165.15	14.05	22.20	95.50	58.00	19.98	66.88	61.50
(P ₆) x (P ₂)	164.80	13.69	20.60	93.21	61.00	21.81	61.73	57.50
(P ₇) x (P ₂)	163.15	12.24	23.10	82.75	60.50	21.60	61.07	44.50
(P ₈) x (P ₂)	174.25	13.05	23.92	123.75	56.50	21.20	67.21	57.00
(P ₉) x (P ₂)	132.40	14.50	21.98	94.75	59.50	19.91	63.64	76.00
(P ₁₀) x (P ₂)	120.05	14.10	19.30	83.75	55.50	24.19	61.84	63.00
(P ₂) x (P ₃)	151.15	14.60	20.70	122.50	59.00	25.39	75.48	55.50
(P ₃) x (P ₃)	167.00	14.73	19.69	72.25	57.50	22.12	64.15	53.00
(P ₆) x (P ₃)	141.05	12.70	20.92	94.75	59.00	25.94	67.87	55.50
(P ₇) x (P ₃)	136.75	13.01	21.27	101.75	60.00	22.01	60.93	53.00
(P ₈) x (P ₃)	140.30	14.62	19.72	85.88	57.50	21.04	58.37	60.50

Table 2 contd....

Entries	Pl. ht (cm)	No. of grain rows per cob	No. of grains per row	Cob. wt (g)	Days to 50% silk	Hundred grain weight (g)	Grain yield per plant (g)	Starch Content (%)
(P ₉) x (P ₃)	139.15	13.30	21.90	113.75	60.50	24.88	71.35	53.00
(P ₁₀) x (P ₃)	149.05	15.76	25.90	154.38	64.50	26.26	103.26	52.50
(P ₃) x (P ₄)	134.43	16.39	30.79	100.50	60.50	21.15	121.25	76.50
(P ₆) x (P ₄)	141.75	14.50	19.40	97.75	61.00	25.99	97.09	67.00
(P ₇) x (P ₄)	154.75	13.00	31.01	126.00	58.50	26.89	104.50	55.00
(P ₃) x (P ₄)	156.40	15.80	22.25	76.50	55.50	18.60	66.82	65.50
(P ₉) x (P ₄)	160.85	104.00	24.40	13.00	61.50	26.24	86.13	69.50
(P ₁₀) x (P ₄)	144.70	16.50	24.48	101.54	59.50	20.34	81.68	67.50
(P ₆) x (P ₃)	170.25	13.70	26.40	155.50	61.50	29.70	96.29	52.50
(P ₇) x (P ₃)	164.70	14.95	26.75	124.10	55.50	25.05	99.20	60.50
(P ₄) x (P ₃)	162.85	12.00	19.75	86.17	57.50	26.06	61.04	74.50
(P ₉) x (P ₃)	165.05	14.63	23.88	142.00	59.50	19.09	67.25	75.50
(P ₁₀) x (P ₃)	153.90	14.50	21.17	104.38	57.50	23.65	74.24	68.50
(P ₇) x (P ₆)	162.75	17.19	26.80	146.86	59.00	22.05	114.46	66.50
(P ₈) x (P ₆)	161.40	14.55	18.55	100.75	55.50	22.31	61.00	60.50
(P ₉) x (P ₆)	143.30	11.38	21.27	72.00	58.50	23.26	57.32	65.00
(P ₁₀) x (P ₆)	150.25	16.50	20.83	150.50	59.00	23.99	81.82	67.50
(P ₃) x (P ₆)	176.95	14.74	19.16	113.75	60.00	22.69	64.10	68.50
(P ₉) x (P ₆)	150.50	12.40	22.62	167.50	60.50	27.45	109.60	68.00
(P ₁₀) x (P ₆)	159.05	19.92	30.43	178.25	60.00	22.31	112.07	68.50
(P ₉) x (P ₈)	167.60	11.61	22.06	69.75	60.50	25.17	108.02	77.90
(P ₁₀) x (P ₈)	148.35	14.09	24.27	93.00	57.00	17.67	60.48	69.50
(P ₁₀) x (P ₉)	144.95	15.23	27.62	149.25	57.50	23.25	96.82	68.00
Mean of Parents	150.19	12.59	23.80	111.36	58.50	24.55	71.79	66.75
Mean of Hybrids	157.54	13.93	23.93	112.26	58.03	25.17	78.56	67.84
SE	3.631	1.127	2.234	4.442	0.484	1.001	2.466	1.141
CD at 5%	7.204	2.236	4.432	8.813	0.960	1.986	4.893	2.264

dextrose and other chemicals, adhesives, preservatives, antiseptic agents and also find many other uses in industry. The parents showed a wide variation for this character, the range being 72.5% (Prabhat -1) to 62% (UMI 743). The hybrid Sartaj -1 x Prabhat -1 recorded the maximum starch content (77.9%) among the cross combinations studied.

Based on the number of times a genotype is occurring as one of the parents for the hybrid recording high values, those genotypes were identified as donors for different plant attributes. UMI 760 for grain yield and grain rows per cob, UMI 805 for grain yield, number of grains per row and cob weight, Prabhat -1 for grain yield, plant height, number of grain rows per cob, 100 grain weight and starch content. These genotypes can be used as parents in the hybridization programme for improving grain yield and other related characters.

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