

COMPARISON OF OPEN POLLINATED VARIETIES AND NEWLY DEVELOPED HYBRIDS FOR YIELD AND YIELD CONTRIBUTING TRAITS IN MAIZE

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ABSTRACT: Eighteen hybrids and 13 open pollinated varieties of maize were evaluated at the National Agricultural Research Centre, Islamabad during *kharif* 2007. Significant differences were observed for days to 50% tasseling and silking, plant height, ear height, number of kernel rows per ear, number of grain per row, 100 grain weight, grain moisture and grain yield. The hybrids NT-6622 and NT-6651 ranked top and second in grain yield by producing 7842 and 7759 kg ha⁻¹, respectively. Generally the hybrids produced more grain yield than the open pollinated varieties. Days to 50% tasseling ranged from 47.33 (EV-1098) to 64 (NT-6632) while for silking varied from 47.67 (EV-1098) to 63.33 (30-K-95). The variety Soan-3 (149 cm) was the shortest and hybrid 30-K-95 (202.3 cm) was the tallest amongst all the varieties and hybrids. Ear height ranged from 70.33 (Soan-3) to 107 cm (NT-6651) while number of kernel rows per ear varied from 12 (NT-6622, 30-K-95, 2512 and 2514) to 18 (R-2207). The hybrid P-30-25 produced the maximum number of grains (51) Grast-8288 produced the lowest (29). One hundred grain weight ranged from 23g (EV-6098) to 39g (2512).

Key Words: Zea mays; Hybrids; Varieties; Agronomic Characters; Yield; Pakistan.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops of the world. It is primary staple food in many developed countries and third most important cereal in Pakistan after wheat and rice. It is a multi purpose crop and being used as human food, animals feed and industrial raw material. It is commercially used in manufacture of corn starch, corn oil, dextrose, corn syrup, corn flakes, gluten, lactic acid, acetic acid, alcohol and acetone. It is also used in poultry feed industry, textile and distilleries. Maize is also good source of polyunsaturated fatty acids which are cure to cardiac problem in human beings. It is estimated that demands of maize in 2020 will go up 3.6 million tonnes implying growth rate of 3-4% per annum (Rajaram et al., 1998).

In Pakistan maize is grown over 1.118 mha with annual production of 3088.4 thousand tonnes. The average yield of maize grain is 3037 kg ha⁻¹ (GoP, 2006-07). Only 10% of maize is planted from hybrid maize

seed and 80% of hybrid seed sold in Pakistan is marketed by multinational companies that have developed their hybrids in other countries like Thailand and USA. The rest comes from Rafhan and public sector breeding programmes. On the other hand all the improved open pollinated varieties planted by farmers come from public sector programme. No doubt hybrids in maize are high yielder. However hybrid seed is costly as compared to the seed of open pollinated varieties (OPVs). Improved OPVs are considerably important in countries where seed industry is not well developed. High yielding OPVs still have potential for common farmers who cannot afford hybrid seed.

Aziz et al. (1992) conducted an experiment to establish the potential of maize hybrids against standard open pollinated varieties and revealed that some hybrids excelled in grain yield. They also found that check variety Sarhad White produced better yield than many hybrids. Anwar (1993) conducted study on six inbred lines of maize in a diallel crossing system. He reported

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highly significant effects for number of days to tasselling and silking, plant height, number of kernels per row, 100 kernel weight and yield per plant. Tariq et al. (1995) compared the performance of six promising lines of maize along with local check and found that cultivar EV-6085 produced the maximum grain yield with medium plant height. Kashmir Gold was reported to be an early maturing line. Venkatesh and Sarma (1999) made single cross hybrids using ten diverse half diallel fashion and studied their performance against standard hybrid. They revealed that three crosses were the highest yielding and significantly out yielded the check hybrid. Mehmood et al. (2004) conducted experiment to ascertain the genetic potential of five hybrids and five open pollinated varieties. They recorded sufficient variability among the genotypes for days to tasseling, silking and yield related traits. Ahmed et al. (2004) evaluated the performance of 21 maize hybrids for certain agronomic characters and reported that hybrid NCML-13 out yielded all the other entries producing grain yield of 4151 kg ha⁻¹.

The present study was conducted to compare the performance of open pollinated varieties and newly developed hybrids of maize for yield and yield contributing traits under rainfed conditions of Islamabad.

MATERIALS AND METHOD

Eighteen hybrids (Grast 8288, Hi-corn-II, R-2303, R-2210, R-2207, R-2313, NT-6622, NT-6632, NT-6651, 32-W-86, 30-D-55, 31-R-88, 30-Y-87, 30-K-95, P-30-25, 2512, 2514 and YH-399) and 13 open pollinated varieties of maize (EV-5098, Agaiti-2002, Sahiwal-2002, PSEV-3, Chandni, EV-1097, EV-1098, EV-6098, Sadaf, EV-4020, EV-3001, Margalla, Soan-3, including a check variety namely Sahiwal 2002) were planted at National Agricultural Research Centre, Islamabad in a randomized complete block design with three replications during *kharif* season 2007. Each plot consisted of two rows of five meter length with a row to row distance of 75 cm and plant to plant distance of 25 cm within each row. Nitrogen

and phosphorus fertilizers were applied @ 60 and 90 kg ha⁻¹ respectively at sowing. Hoeing and weeding were carried out manually twice during the cropping season. Data on number of days taken to 50% tasselling, number of days taken to 50% silking, plant height, ear height, number of kernel rows per ear, number of grains per row, 100 grain weight and grain yield per hectare were recorded from each plot in three replications.

Grain yield per hectare was calculated in kg by following mathematical relation.

$$G.Y = \frac{FW \times (100 - MC) \times 0.8 \times 10000}{\text{Plot area} \times 85}$$

where GY= Grain yield (kg ha⁻¹)

FW= Fresh weight of ear per plot

MC= Moisture content (%)

Likewise 0.8 is shelling percentage, 10,000 represent the area in m² for one hectare and 85 is the factor for grain stored at 15% moisture content.

Analysis of variance for all the plant traits recorded was done by using methods given by Steel and Torrie (1980) to estimate the statistical difference among the mean values of all genotypes. Duncan's Multiple Range Test (DMRT) was applied to compare the mean values of all genotypes.

RESULTS AND DISCUSSION

Number of Days taken to 50% Tasselling

Mean differences among genotypes regarding days taken to 50% tasseling were highly significant. The hybrids NT-6632 and NT-6622 took maximum days to tasseling i.e. 64, and 62.67, respectively whereas 31-R-88 and Grast 8288 took the minimum number of days 57.33 and 56.33, respectively. The mean values of all the hybrids did not differ statistically among themselves (Table 1).

Check variety Sahiwal-2002 and PSEV-3 were late in tasseling and took 59.00 and 57.33 days respectively. However Soan-3 and EV-1098 exhibited minimum number of days 51.33 and 47.33, respectively. Anwar (1993) and Mehmood et al. (2004) also found sufficient genetic variability for days to tasselling in maize.

YIELD CONTRIBUTING TRIATS IN MAIZE

Number of Days taken to 50% Silking

Mean differences for days taken to 50% silking were significant. Maize hybrids 30-K-95 and NT-6622 took maximum days to silking i.e., 63.33 and 63, respectively while Grast-8288 (58.33 days) was the earliest hybrid to silk which was also early in tasselling (Table 1).

In varieties EV-6098 (60.67 days) and check variety Sahiwal-2002 (60 days) took maximum number of days to silk while EV-1098 (47.67 days), Soan-3 (51.33 days) and Chandni (52 days) were the earliest varieties to silk. These results are in conformity with those of Anwar (1993) and Mehmood et al. (2004).

Plant Height

Differences among mean values of genotypes for plant height were significant. The tallest plants were observed from hybrid 30-K-95 and NT-6622 with 202.3 cm and 201.7 cm height while short statured hybrids were 2512 (171 cm) and R-2303 (167.9 cm) respectively (Table 1).

In open pollinated varieties, EV-5098 and Sadaf produced the maximum plant height of 181.3 cm and 179.3 cm, respectively while Soan-3 (149 cm) and Margalla (159.7 cm) were the shortest varieties. Genetic variability regarding plant height was also reported by Anwar (1993).

Ear Height

Differences of ear height among the genotypes were significant. Ears in hybrid NT-6651 and 30-K-95 were produced at the height of 107 and 105.7 cm, respectively. Hybrids R-2207 and R-2303 possessed minimum values for ear height i.e., 83.67 and 81 cm, respectively (Table 1).

Among varieties, Sadaf and EV-1097 indicated maximum ear height i.e., 97.67cm and 92.17cm, respectively while EV-1098 and Soan-3 showed the minimum values for ear height i.e., 77.33 cm and 70.33 cm, respectively. These findings are in accordance with Anwar (1993) and Tariq et al. (1995) who also reported the presence of variability in plant stature.

Number of Kernel Rows per Ear

Analysis of variance revealed highly significant differences among the mean values of genotypes for number of kernel rows per ear. Hybrids 2207 and 30-D-55 contained maximum number of rows per ear i.e., 18 and 16, respectively while hybrid 2512 and 2514 contained the minimum number of rows i.e., 12 amongst all genotypes (Table 1).

Variety EV-3001 (17.33) contained maximum number of kernel rows per ear followed by EV-1098 and Agaiti-2002 each having 15.33 kernel rows per ear. Anwar (1993) also observed significant heterotic effects for number of kernel rows per ear.

Number of Grains per Row

Mean differences for number of grains per row were highly significant. The hybrids P-30-25 (51.00) contained maximum number of grains per row followed by R-2303 and R-2210 each having 49.0 grains per row. Check, Sahiwal-2002 (46.00) possessed the maximum number of grains per row closely followed by Sadaf (45) while EV-6098 and Soan-3 contained minimum number of grains per row i.e. 30 each (Table 1). Anwar (1993) and Mehmood et al. (2004) reported significant variability for this parameter.

100 Grain Weight

Differences for 100 grain weight among the genotype were highly significant. The hybrid 2512 produced maximum 100 grain weight of 39 g closely followed by Hi-Corn II⁺ (38 g) while R-2303 and P-30-25 produced the minimum grain weight i.e., 29 g each (Table 1). Amongst the varieties PSEV-3 (37.33 g) produced the maximum 100 grain weight closely followed by EV-1098 (37 g) while minimum EV-6098 (23 g) produced the minimum 100 grain weight followed by Margalla (25 g). Anwar (1993) and Mehmood et al. (2006) revealed similar results regarding existence of significant genetic variability for 100 grain weight.

Table 1. Comparison of open pollinated and newly developed hybrids for yield and yield contributing traits in Maize at NARC, Islamabad during kharif 2007

Variety hybrid	Days to 50% tasselling	Days to 50% silking	Plant height (cm)	Ear height (cm)	No. of kernels row per ear	No. of grains per row	100 grain weight (g)	Grain yield (kg ha ⁻¹)
NT-6622	62.67 AB	63 A	201.7 A	105 AB	12 G	46 C	35 CDE	7842 A
NT-6651	59 ABCD	59.67 AB	199 AB	107 A	14 DEF	38 J	30 HI	7759 A
31-R-88	57.33 ABCDE	59 AB	193.3 ABCD	96.33 ABC	14 DEF	48 B	36.67 ABC	7663 A
30-D-55	59 ABCDE	61A	188ABC	95ABC	16BC	38J	32FGH	7476A
NT-6632	64 A	62.67 A	200.5 AB	104.3AB	16BC	40HI	29I	7355ABC
30-K-95	61.67 ABC	63.33 A	202.3A	105.7AB	12G	38J	33EFG	7320ABC
YH-399	58.33 ABCDE	60 AB	177.7ABCDE	91.33ABCD	15.33CD	42FG	37ABC	7198ABCD
32-W-86	58 ABCDE	58.67 AB	196.3ABC	96ABC	14DEF	43EF	30HI	7087ABCD
30-RY-87	58.33 ABCDE	59 AB	190.3ABC	93.67ABCD	14DEF	41GH	30HI	6980ABCDEF
HI-Corn-II*	61 ABC	62.33A	185ABC	97ABC	16BC	40HI	38AB	6971ABCDEF
R-22105	61.33 ABC	62.67A	188.3ABC	89.33ABCD	14DEF	49B	33EFG	6850ABCDEF
R-2303	59 ABCDE	60.67 A	169.7ABCDE	81BCD	16BC	49B	29I	6842ABCDEF
GraSt-8288	56.33 ABCDE	58.33AB	176ABCDE	85.67ABCD	14DEF	29L	32FGH	6718ABCDEF
2514	59.33 ABCD	61.67A	180ABCDE	91ABC	12G	42FG	33EFG	6560ABCDEF
R-2207	60.33 ABC	62.33A	196.7ABC	83.67ABCD	18A	42FG	32FGH	6447ABCDEF
R-2213	60.33 ABC	61.33A	198.3AB	99ABC	16BC	45CD	36BCD	6418ABCDEF
P-30-25	58 ABCDE	60AB	184ABC	88ABC	14DEF	51A	29I	5683BCDEF
2512	60 ABC	61A	171ABCDE	98.33ABC	12G	42FG	39A	5682BCDEF
Sahiwal-	59 ABCDE	60AB	163.3CDE	84.33ABCD	12.67FG	46C	29.67HI	5561BCDEF
V2002 (CHECK)								
EV-3001	55.93 BCDE	57.67AB	168.3ABCDE	90ABC	17.33AB	34K	32FGH	5481CDEF
Agaiti-2002	56 BCDE	57.33 AB	178ABCDE	83.67ABCD	15.33CD	39IJ	32FGH	5341DEF
Sadaf	54.67 BCDE	56.33 AB	179.3ABCDE	97.67ABC	14.67CDE	45CD	32FGH	5202FGHIJ
EV-5098	53.93 BCDE	57.67AB	181.3ABCDE	91.67ABCD	14DEF	44DE	33.67DEFG	5144FGHIJ
PSEV-3	57.33 ABCDE	58.67AB	175ABCDE	89.33ABCD	14.67CDE	40HI	37.33ABC	4972GHIJ
EV-1097	55.67 BCDE	58.33AB	178.3ABCDE	92.67ABCE	13.33EFG	43EF	29I	4867HIJ
EV-4020	54.33 CDE	56.67AB	162CDE	77.67CD	15.33CD	30L	25.33J	4759IJ
EV-1098	47.33 F	47.67C	166.7BCDE	77.33CD	15.33CD	38J	37ABC	4725IJ
Margallah	56 BCDE	56AB	159.7DE	78CD	13.33EFG	43EF	25J	4651IJ
EV-6098	56 BCDE	60.67A	162.7CDE	91.33ABCD	14.67CDE	30L	23J	4278J
Chandni	52 DEF	52BC	163.3CDE	80.3BCD	12.67FG	40HI	34DEF	4270J
Soan-3	51.33 EF	51.67BC	149E	70.3D	12.67FG	30L	31GHI	4011J

Means followed by same letters do not differ significantly at $P \leq 0.05$

YIELD CONTRIBUTING TRIATS IN MAIZE

Grain Yield

Differences among all the genotypes for grain yield were highly significant. The hybrid NT-6622 and NT-6651 gave maximum grain yield i.e. 7842 and 7759kg ha⁻¹ respectively (Table 1). But the hybrids P-30-25 and 2512 produced lowest grain yield of 5683 and 5681 kg ha⁻¹ respectively. However, hybrids produced more grain yield than open pollinated varieties.

Amongst varieties the Check Sahiwal-2002 (5561 kg ha⁻¹) and EV-3001 (5481 kg ha⁻¹) possessed highest grain yield potential. These two open pollinated varieties were statistically at par with most of the hybrids and can successfully compete with the commercial maize hybrids. Chandni and Soan-3 produced the lowest grain yield of 4270 and 4011 kg ha⁻¹, respectively. These findings are in conformity with those of Aziz et al. (1992), Anwar (1993), Tariq et al. (1995) and Mehmood et al. (2004).

The results of the present study show that the commercial maize hybrids NT-6622, NT-6651, 31-R-88, 30-D-55, NT-6632, 30-K-95 and YH-399 possessed grain yield potential of more than 7000 kg ha⁻¹ and they could be considered for commercial cultivation. On the other hand Sahiwal-2002, EV-3001, Agaiti-2002, Sadaf and EV-5098 showed grain yield potential of more than 5000 kg ha⁻¹ so they can be considered for commercial cultivation where growers cannot afford the high price of commercial hybrids.

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