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GENETIC IMPROVEMENT THROUGH MASS SELECTION IN MAIZE (Zea mays L.)

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ABSTRACT

Ten open pollinated maize (Zea maize L.) population along with the original population were tested at the Post Graduate Research Station PARC University of Agriculture, Faisalabad. During spring and summer 1989. Mass selection proved superior for grain yield and other related characters, although number of leaves per plant and plant height showed no interaction of selected over original population. Selected, original and combined analysis of variance was also non-significant for the above two characters. And there were, 1.59 and 0.64 percent decrease for number of leaves and plant height respectively. Significant interaction between selected x original population for number of ears per plant, number of kernel rows per ear and number of kernels per row were indicated. Selection for number of ears, number of kernel rows per ear, number of kernels per row were non significant among each other, but the selection, original, combined were highly significant among each population. Percent increase for number of ears per plant (13.15) , number of kernel rows per ear (4.79), number of kernels per row (2.70) and grain yields 4.93 percent was promising. Grain yield per plant gave highly significant increase and interaction by mass selected. The maximum increase (114.43 gm over 103.93 gm) was exhibited by IZ/13 selection as compared with a base population.

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Introduction

Maize (Zea mays L.) is the world second important cereal crop after wheat with respect to area and production and grown extensively in the temperate, subtropical and tropical zones. In Pakistan maize is cultivated annually on an area of 853.9 thousand hectares with an annual production of 1126.9 thousand tons (Government of Pakistan 1988). European traders, who came through land routs, introduced maize in indo-Pak sub continent during the beginning of the 16th century. Cultivation of maize is more common in northwest parts of Pakistan. The major maize growing areas include Peshawar, Hazara, Malakand, and DIKhan Division of NWEFP and Rawalpindi, Faisalabad, Multan and Sarghoda division of Punjab Province.

Maize being a short duration cereal crop and possessing maximum grain yield potential per acre as compared to other cereals, can contribute significantly to the over all food production in the country and provides good returns to the growers in a relatively lesser time.

Unfortunately in Pakistan the average yield of maize per unit area is low as compared to other countries of the word. The main reasons of low yield are growing of local open pollinated varieties, lack of proper cultural

practices and production technology. We are lagging for behind the world average yield potential this indicates the ample economical scope of enhancing maize production in Pakistan.

Maize improvement is urgently needed to satisfy the ever increasing world demand for food selection criteria that would allow maximum progress in a short time are critically important because resources are limited and food needs are growing..

Mass selection is used both as a method for maintaining existing varieties and for developing new varieties. Many productive and adopted varieties of open pollinated corns have been developed by mass selection.

The purpose of the present study was to improve the yield through mass selection and to increase the proportion of superior genotypes in a short time. Mass selection is useful in adopting varieties to new production areas.

Khan et al.. (1983) Who observed that all the population developed by mass selection was lower then original population. Maticic et.al.(1987) found plant height is the most useful indicator characters for assessing homogeneity through selection. . Torregroza et al.(1974) presented 39 percent increase in prolificacy by mass selection than the original population. Thompson et al. (1983) reported increase in number of ears per plant by mass selection. Maticic et al. (1987) reported that the most useful indicator character for assessing homogeneity through selection was number of grain rows. The present finding also supported the conclusion already by Backtash et al. (1986) who reported that number of grain per row increased significantly through mass selection.. Gracia et al. (1984) and Jasa-Vega (1985) reported increase in grain yield by mass selection.

Material and Methods

The present research was carried out in the experimental area of the Post Graduate Research Station PARC University of Agriculture Faisalabad during the year 1989. The material under study comprised of the following ten maize population. IZ/8, IZ/9, IZ/10, IZ/11, IZ/12, IZ/13, IZ16, IZ/17, IZ/19, IZ/31. The above mentioned ten maize population were sown each in tow separate plots during summer and spring, 1989. In one plot 30 vigorous and diseased free plant were selected on the basis of phenotypes for desirable characters to practice the mass selection and in the other plot the seed of original populations was developed in each time by open pollination

During the next growing season, i.e. summer 1989 the seed s of selected materials along with original population were sown in a trial, according to Randomized Complete Block Design with three replication. The sowing was done with the help of dibblers in 4.5-meter long rows, keeping 60-cm row to row and 30cm plant to plant distances. Identical cultural practices were carried out uniformly.

Data were recorded for number of leaves per plant, plant height, number of ears per plant, number of kernel, rows per ear, number of kernels per row, grain yield per plant. The data recorded for each character was subjected to analysis of variance techniques (steel and Torrie 1980).

Result And Discussion

Number of leaves per plant

Presents interaction between selected x original population (Table- I) which shows non significant difference of selected over the original population because selected population in this case showed a decrease over the original population by (1.59) . However in case of combined population, the range of maximum mean of leaves were (12.07 - 13.07) for IZ/19 and IZ/13 respectively. (Table –2). It predicts that the number of leaves per plant is not responding to the mass selection as a base to be selected for higher yield. These finding agreed the Teich et al. (1966). Who reported that visual selection method had little effect on the agronomic characters.

Plant height (cm)

Analysis of variance for plant height (Table-1) original, selected combined and original verses selected population did not differ significantly form each other and the percent decrease in plant height (Table-2) of selected population was (o.64) percent and did not differ from original populations. Non significant interaction between original x sleeted population shows that plant height is better to understand for homogeneity than selection for high yield. The range of minimum, maximum means for original, selected and combined populations were IZ/19 (226.13) TO IZ/11 (230.37), IZ/8 (222.73) to IZ/17 (228.87) and IZ/8 (222.73) to IZ/11 (230.37) respectively.
The present finding supported the conclusions of khan et al.. (1983) who observed that all the population developed by mass selection was lower then the original population. Maticic, et al (1987) found plant height is the most useful indicator characters for assessing homogeneity through selection.

Number of ears per plant

Statistical analysis of data for original population and selected population revealed non significant differences, but significant in combined analysis (table-1), therefore, the interaction original x selected population was highly significant and showed (13.15) percent increase in number of ears per plant (table-2). Minimum and maximum means of ear per plant in case of original population for IZ/9 and IZ/11 ranged from (1.00 to 1.27) respectively, where as in selected population, minimum and maximum means ranged from (1.07 to 1.33) for Iz/13 and IZ/12, respectively. Through combined analysis means ranged were (1.00 to 1.33) for IZ/12, IZ/16, IZ/17 and IZ/19.

Torregroza et al.(1974). Presented 39 percent increase in prolificacy by mass selection than the original population. Thompson et al. (1983) reported increase in number of ears per plant by mass selection..

Number of kernel rows per ear

Analysis of variance mean square showed highly significant Interaction between original x selected populations variation in original and combined analysis were significant but within the selected population it was not significant. Which means that there was more uniformity in the selected lines for number of kernel rows per ear as compared to the original population (table-1). The present increase was (4.79) percent for selected population (Table-2) The means comparison test in original population indicated that the range of means were from (13.73 to 15.60) for IZ/9 and IZ/8, respectively. Where as in selected population minimum and maximum means ranged from (14.27 to16.53) for IZ12 and IZ/17, respectively. Through combined analysis means ranged were (13.73 to 16.53) for IZ/9, IZ/17. Maticic et al. (1987) reported that the most useful indicator character for assessing homogeneity through selection was number of grain rows per plant.

Number of kernels per row

Statistical analysis of the data according to the analysis of variance technique exhibited significant difference among treatment at 5 percent level of significance for number of kernels per row in original population and combined population, but in case of selected population non significant differences were noticed and differed significantly from original population. Significant interaction between original and selected population were observed (Table –1) and the present increase was (2.63%) for selected population (Table-2) the mean comparison test showed that in case of original population the means ranged from IZ/16 (31.33) to IZ/13 (35.80). In selected population the means ranged from IZ/16 (32.40) to IZ/13 (36.40) for the combined population the means ranged were IZ/16 (31.33) to IZ/13 (36.40), respectively.

The present finding supported the conclusion already by Backtash et al. (1986) that number of grain per row increased significantly through mass selection.

Grain yield per plant (gm)

Analysis of variance for grain yield per plant (Table-1) indicated that the differences among the treatment are highly significant in combine as well as both original and selected populations. The mean comparison has showed (table-2) that the mean values for yield per plant for original population varied from IZ/16 (95.27) to IZ/9 (106.73) The selected population differed significantly form each other with as yield range of IZ/8 (97.17) to IZ/31 (114.43) per plant. From the combined analysis both original and selected populations which were different form each other ranged from IZ/11 (95.27) to IZ/31 (114.43) per plant in gm). The present studies are in accordance with Gracia et al. (1984) and Jasa-Vega (1985) . They reported increase in grain yield by mass selection

REFERENCES

Backtash, F.Y (1986). Evaluation of modified mass selection and recurrent selection in corn. Egyptian Journal of Genetics and Cytology 15(2): 263-272. (Pl. Br. Abst.,58(5):3907:1988)

Gracia, J.C. and F.M. Sanchez (1984). Comparison of three techniques of mass selection in an early maize composites. Agrociencia, Mexico (58):45-48.(Pl.Br Abst. 36(2):913:1986).

Jasa-Vega, P.J. (1985) divergent mass selection for line two synthetic reported in a maize (Zea mays L.) population Disser. Abst. International 45 (11): 3422B. (Pl. Br. Abst. 56(1): 176:1986).

Khan .M.S.(1983) Improvement of a population of maize (Zea mays L.) for Pakistan. Disser. Abst. International 43(7): 2072B.(Pl.Br.Abst., 53(6):4695; 1983).

Maticic, T.Z. and Rozman. (1987). Testing the variability and homogeneity of selected genotypes of maize (Zea mays L.). Zbornik-Biothnisk. (49): 6-90.(Pl.Br. Abst., 58(5): 3906;1988).

Thompson, S.A. (1983). Mass selection for prolificacy in corn at high and low plant densities: Cycle means and genotypic variances. Disser Abst. 43 (8): 2414B.(Pl. Br. Abst., 53(8):61281; 1983).

Torregroza, C. M. (1974) Eight cycle of divergent mass selection for ears per plant in a synthetic maize variety. Agronomia Medellin 29(2): 3-24. (Pl. Br. Abst., 47(1):265;1977).

Teich, A.H. (1966). Maize selection by inbred line appearance and test cross performance in high and low plant densities. Dies. Abst. (26): 4922-23(Pl..Br. Abst. 27(3): 4159; 1967).

TABLE: 1

ANALYSIS OF VARIENCE (MEAN SQUARE) OF COMBINED, ORIGINAL, SELECTED AND ORIGINAL VS SELECTED POPULATION FOR YIELD AND YIELD COMPONENT IN MAIZ

ANOVA

S.O.V	D.F	NO OF LEAVES PER PLANT	PLANT HEIGHT (CM)	NO OF EARS PER PLANT	NO OF KERNEL ROWS PER EAR	NO OF KERNEL PER ROW	GRAIN YIELD (GM) PER YIELD
REPLICATION	2	0.025	13.98	0.005	0.283	3.905	65.106
GENOTYPE	19	0.24 NS	9.94 NS	0.028 NS	1.682 *	5.615 *	121.50 **
ORIGIONAL	9	0.198 NS	5.58 NS	0.024 NS	1.230 *	6.987 *	63.767 **
SELECTED	9	0.236 NS	12.45 NS	0.015 NS	1.461 NS	3.512 NS	152.337 **
ORIG:XSELECT	1	0.68 NS	26.59 NS	0.170 **	7.77 **	12.28 *	363.59 **
ERROR	38	0.344	29.81	0.015	0.695	2.639	6.674

NS= Non significant
* = Significant
**= Highly significant

TABLE: 2

CALCULATION OF PERCENT INCREASE OR DECREASE OF GRAIN YIELD OR YIELD COMPONENTS IN SELECTED POPULATION OVER ORIGINAL POPULATION

Maize Population	Number of leaves per plant		Plant height (cm)		No. of ears/plant		No. of kernel rows per ear		No of kernel per row		Grain yield (gm) per plant	
	Original	Selected	Original	Selected	Original	Selected	Original	Selected	Original	Selected	Original	Selected
IZ/8	12.87	12.60	226.90	222.73	1.13	1.13	15.60	15.00	31.53	33.87	95.57	97.17
IZ/9	12.67	12.60	228.40	227.43	1.07	1.20	13.73	16.07	34.47	34.87	106.73	113.83
IZ/10	12.67	12.47	227.20	227.83	1.13	1.20	14.53	15.40	32.00	33.27	96.20	98.97
IZ/11	12.73	12.27	230.37	228.77	1.27	1.20	13.80	14.67	33.07	33.47	95.27	98.23
IZ/12	13.07	12.73	226.93	226.63	1.07	1.33	14.73	14.27	32.07	33.67	100.60	100.37
IZ/13	13.07	12.33	226.57	224.80	1.00	1.07	14.33	14.93	35.80	36.40	102.07	108.87
IZ/16	12.93	12.07	227.37	226.63	1.07	1.33	15.20	15.60	31.33	32.40	95.90	101.90
IZ/17	12.27	12.60	228.43	228.87	1.07	1.33	15.07	16.53	32.87	34.40	105.57	113.30
IZ/19	12.40	12.07	226.13	224.87	1.07	1.33	14.00	14.73	35.07	33.47	95.27	99.27
IZ/31	12.80	12.73	228.87	224.23	1.07	1.27	13.93	14.67	32.39	34.27	103.93	114.43
	12.75	12.55	227.72	226.28	1.10	1.24	14.49	15.19	33.12	34.01	99.71	104.63
Percentage Increase 4.93		**-1.59**			**-0.64**		**+13.15**		**+4.79**		**+ 2.70**	