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Selection of best germplasm on the basis of selection parameters (Heritability, genetic advance & correlation) in maize (*Zea Mays* L.)

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Abstract
Estimates of heritability was found for grain yield per plant, 100 kernel weight, cob height, plant height and no. of grain rows per cob. The character grain yield per plant show moderate heritability with high genetic advance over mean. The economic trait grain yield per plant show positive significant association with the characters namely; days to 50% tasseling, days to 50% silking, days to 75% dry husk, cob height, cobs per plant, grain rows/ cob, grains per row, cob weight, 100 grain weight and grain weight per cob.

Keywords: Correlation, genetic advance, heritability and selection parameters

1. Introduction
Maize *(Zea mays* L.) is third most important cereal crop of the world after wheat and rice. It belongs to grass family and important to human being because of their role as staple food in many areas of the world. It is also used to produce animal feed, oils, starch, flour, sugar, syrup, processed foods, malt, alcoholic beverages and renewable energy. Approximately 50% of the world's calories are provided by rice, wheat and maize, but in many parts of Africa and Asia, people really depends on grains such as sorghum or millet. Maize, is also utilized in USA in brewing industry and ethanol production. The primary centre of origin of maize is Central America and Maxico. The studies indicated that maize was important crop in Maxico about 5000 year ago or perhaps earlier. American Indian grew and selectively improved maize from 3400 BC to 1500 AD. Maize was first grown in Europe then spread in Spain later on it spread from Spain to southern France and Italy. In India it introduced probably in the beginning of seventeen century. In India, total maize are grown in an areas of 9400 mha with production of 23000 MT and productivity of 2500 kg/ ha. (Annonymous 2015-16) [1]. Maize is a major source of starch. Corn starch (maize flour) is a major ingredient in home cooking and in many industrialized food products. Maize is also a major source of cooking oil (corn oil) and of maize gluten. Maize starch can be hydrolyzed and enzymatically treated to produce syrups, particularly high-fructose corn syrup and a sweetener; and also fermented and distilled to produce grain alcohol. Grain alcohol produced from maize is traditionally the source of Bourbon whiskey. Maize is sometimes used as the starch source for beer industry. Within the United States, the usage of maize for human consumption constitutes about 1/4 th of the total amount grown in the country. In the United States and Canada, maize is mostly grown as feed for livestock, forage, silage (made by fermentation of chopped green corn/stalks), or grain. Maize meal is also a significant ingredient of some commercial animal food products, such as dog food. Maize is also used as a fish bait, called "dough balls". It is particularly popular in Europe for coarse fishing.

2. Materials and Methods
The experimental material consists for present investigation was 9 parents diallel crosses (excluding reciprocals) under taken during Rabi Season 2013-14. Among the 9 parents all possible crosses (excluding reciprocals) were made in diallel fashion. Sufficient amount of seed of all 45 treatments (9 inbreds and 36 crosses) were harvested during Kharif. The final experiment was laid out in Randomized Complete Block Design with three replications at Oilseed Research Farm, Kalyanpur, Kanpur. Each parent and cross was planted in 5m single row length spaced at 60 x 25 cm between rows and plants, respectively. All the recommended package of practices were adopted according to the recommended by agronomical practices.

Data were recorded on five randomly selected plants in each treatment and replication for following 13 characters viz., days to 50% tasseling, days to 50% silking, days to 75% dry husk, plant height (cm), cob height (cm), number of cobs per plant, number of grain rows per cob, number of grains per row, cob weight (g), 100-grain weight (g), grain weight per cob (g), grain yield per plant (g) and shelling percentage (%), etc. Heritability in narrow sense was calculated by the following formula suggested by Crumpacker and Allard (1962) [2]. The genetic advance was calculated as per formula is given by Robinson *et al.* (1949) [3].

3. Results and Discussion

The results of heritability and genetic advance are presented in table-1. The results showed that heritability estimates varies for different characters. None of these characters exhibited high heritability. The traits with moderate heritability were days to pant height, cob height, no. of grain rows per cob, 100 grain weight, grain yield per plant and shelling percentage. Remaining traits exhibited the low heritability. The economically important character grain yield per plant showed 10.78 %, 33.63% heritability and genetic advancement over mean value respectively. It showed that proportion of additive alleles respond to selection. So the improvement can be made by selection for the trait grain yield per plant. The results were in parity with the pre-concluded results of Debnath (1987) [4] and Gul *et al*. (2000) [5].

The results of correlation coefficient are presented in table-2. The results explained that the magnitude of genotypic coefficient of associations were higher than phenotypic coefficient of associations for almost all the trait combinations. Though the significance of genotypic correlation could not be tested as no suitable test is available. An phenotypic level significant positive coefficient values were recorded for 19 combinations. The economic trait grain yield per plant showed association with days to 50% tasseling, days to 50% silking, days to 75% dry husk, cob height, cobs/ plant, grain rows per cob, grains/ row, cob weight, 100 grain weight and grain weight per cob. In general the genotypic correlation was similar in direction as phenotypic ones but higher in magnitude which showed that the phenotypic association was highly influenced by the environmental factors. These observations were in conformity with the earlier results of Shalygina (1990) [7], Vidal-martinez (2001) [8] and Nazeeb *et al.* (2009) [9].

Table 1: Direct selection parameters (Heritability and Genetic Advance) in 9 parent's diallel cross set of maize (*Zea mays* L.).

S. No	Characters	Heritability (%) (Narrow sense)	Genetic advance	Genetic advance in percent over mean
1	Days to 50% tasseling	3.05	4.954	5.79
2	Days to 50% silking	5.11	4.774	5.34
3	Days to 75% dry husk	5.06	11.34	8.60
4	Plant height	14.32	21.25	14.47
5	Cob height	21.55	13.11	18.75
6	Cobs/plant	6.43	0.175	15.21
7	Cob weight at 15% moisture	9.99	41.18	34.00
8	No. of grain rows/ cob	13.23	1.898	13.75
9	No. of grains/ row	4.62	8.40	22.92
10	100 kernel weight (gm)	25.30	5.65	28.30
11	Grain yield/ cob(gm)	9.63	35.05	34.79
12	grain yield/ plant (gm)	10.78	38.81	33.63
13	Shelling percentage	13.28	1.60	1.93

Table-2: Genotypic (upper) and phenotypic (lower) correlation coefficients among 13 characters in P + F_1 generations of maize.

Characters	Days to 50% Tasseling	Days to 50% Silking	Days to 75% Dry Husk	Plant Height (cm)	Cob Height (cm)	Cobs/ Plant	Grain Rows /Cob	Grains/Row	Cob Weight (gm)	100 Grain Weight (gm)	Grain Weight/ Cob (gm)	Shelling %	Grain yield/ plant
Days to 50% Tasseling	ph^{r}g	0.9718	0.2202	0.1529	0.1024	0.0186	-0.2323	-0.6212	-0.4725	0.0615	-0.4749	-0.0923	-0.442
Days to 50% Silking	0.9296**	ph^{r}g	0.2164	0.0986	0.1496	0.0606	-0.2503	-0.5638	-0.4950	-0.0065	-0.4977	-0.1163	-0.440
Days to 75% Dry Husk	0.2048*	0.1948*	ph^{r}g	-0.0826	-0.0063	-0.0082	-0.1607	-0.4682	-0.3555	0.0114	-0.3669	-0.1545	-0.367
Plant Height (cm)	0.1429	0.0879	-0.0793	ph^{r}g	-0.0781	0.1113	0.1220	-0.0403	0.0264	-0.0138	0.0373	0.1860	-0.0003
Cob Height (cm)	0.0994	0.1433	-0.0077	-0.0778	ph^{r}g	0..2838	-0.1075	-0.2172	-0.2342	-0.0355	-0.2379	-0.1739	-0.1652
Cobs/ Plant	0.0181	0.0190	-0.0082	0.0919	0.2408**	ph^{r}g	0.0551	-0.0519	-0.1710	-0.1347	-0.1737	-0.0295	0.306
Grain Rows/Cob	-0.2084*	-0.2175*	-0.1563	0.1055	-0.0997	0.0203	ph^{r}g	0.3429	0.5540	-0.1217	0.5675	0.2531	0.562
Grains/Row	-0.5968**	-0.5339**	-0.4504**	-0.0394	-0.2142*	-0.0357	0.2847**	ph^{r}g	0.5002	-0.3753	0.5113	0.3115	0.479
Cob Weight (gm)	-0.4526**	-0.4622**	-0.3485**	0.0271	-0.2291**	-0.1430	0.5109**	0.4846**	ph^{r}g	0.5186	0.9975	0.1042	0.874
100 Grain	0.0699	0.0021	0.0083	-	-0.0333	-0.0897	-0.1396	-0.365**	0.5055**	ph^{r}g	0.5033	-	0.403

Weight (gm)				0.0122								0.2119	
Grain Weight/ Cob (gm)	-0.4526**	-0.4681**	-0.3608**	0.0374	-0.2346**	-0.1504	0.5165**	0.5005**	0.9897**	0.4938**	phᶠg	0.1826	0.871
Shelling %	-0.0194	-0.0444	-0.0916	0.1243	-0.1143	-0.0023	0.1457	0.2343**	0.0183	-0.1231	0.1263	phᶠg	0.11
Yield/ Plant (gm)	-0.4228**	-0.4128**	-0.3610**	-0.0005	-0.1617	0.2476**	0.5041**	0.4712**	0.8577**	0.3941**	0.8629**	0.0769	phᶠg

*significant at P= 0.05, **significant at P= 0.01

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