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Research Article

ASSESSMENT OF GENETIC VARIABILITY IN PARENTS, F_1 AND F_2 GENERATIONS AND YIELD CONTRIBUTING CHARACTERS IN MAIZE (*Zea mays* L.)

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Abstract: Analysis of variance were found out for all sixteen characters *viz*. days to 50% tasseling, days to 50% silking, physiological maturity, plant height (cm), cob length (cm), cob diameter (cm), kernel rows per cob, kernels per row, 100 seed weight (g), germination (%), seedling length (cm.), seed vigour index, harvest index (%), biological yield, grain yield per plant and shelling (%). Highly significant differences were observed among the treatment for all sixteen characters. The treatment variance was further partitioned into its components *viz*. parents, F1s, F2s, parents vs F1s and parents vs F2s highly significant differences were observed among them except seedling length and seed vigour index in parents vs F2s. It's indicated that more variability observed base material of different traits as well as all possible combination of generated materials.

Keywords: *F1s, F2s generation, Variability*

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Introduction

Maize (*Zea mays* L.) is one of the most merging crops having wider adaptability under different agro-climatic conditions. Maize is one of the most important tropical cereals with a rich grain of protein and necessary amino acid. Therefore, breeders need to assess genetic analysis (gene action, heritability, hybrid vigor and inbreeding depression) of different traits to improve yield and yield components under varied environments. The response to selection is influenced by the genetic variability, heritability and selection intensity.

A selection program depends on heritability of suitable characters also owning to the association among various yielding component of characters and their association with grain yield. The presence of variability in plant breeding program depends on the genetic variability and selection skill of plant breeder. Selection is effective if the parent population has significant amount of variability present. Phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) provides significant magnitude of variability present of population and heritability shows the component of a character transmitted to future generations. To reach this goal, the basic requirements are to have adequate information on the extent of variability, heritability, expected genetic gain and degree of genetic association among the different characters [1-10].

Materials and Methods

The breeding material is used 10 inbreeds lines *viz*. CIMMYT (K-13), TSK-44, TSK-27, TSK-29, TSK-109, TSK-110, TSK-10, TSK-79, TSK-99 and TSK-39 along with three checks (SURAJ GOLD, DECALD and AZAD UTTAM). They were taken on the basis of morphological differences for various characters, from the genetic stock of maize, which was maintained by breeder at AICRP plan of the university inbred lines were maintained by selfing them for several generations in maize improvement scheme at Oilseed Research Farm, Kalyanpur of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Each treatment was sown in CRBD (Completely Randomised Block Design) single row of 4m length along with row to row and plant to plant spacing of 60 cm and 25 cm, respectively.

Analysis of variance were found out for all sixteen characters *viz*. days to 50% tasseling, days to 50% silking, physiological maturity, plant height (cm), cob length (cm), cob diameter (cm), kernel rows per cob, kernels per row, 100 seed weight (g), germination (%), seedling length (cm.), seed vigour index, harvest index (%), biological yield, grain yield per plant and shelling (%). Highly significant differences were observed among the treatment for all sixteen characters. The treatment variance was further partitioned into its components *viz*. parents, F1s, F2s, parents' vs F1s and parents vs F2 shighly significant differences were observed among them except seedling length and seed vigour index in parents vs F2s. It's indicated that more variability observed base material of different traits as well as all possible combination of generated material [11-17].

Results and discussion

The mean value of the parents, F1s and F2s in respect of various characters under study are presented in appendix I. The range of mean performance of the parents, F1s and F2s generation for all the sixteen characters are presented in the [Table-2]. The variation among the parents, F1s and F2s generation was found to be high for all the characters but its magnitude varied from character to character.

The wide range of variability were observed among the parents for days to 50% tasseling (54.66 to 64.33) followed by days to 50% silking (60.00 to 70.00), days to physiological maturity (79.33 to 96.66), plant height (162.93 to 206.86), cob length (13.53 to 22.86), cob diameter (3.40 to 5.26), kernel rows per cob (10.50 to 14.00), kernel per row (30.00 to 40.00), 100-seed weight (22.53 to 27.86), grain yield per plant (84.18 to 126.75), biological yield per plant (166.66 to 391.84), harvest index (28.36 to 56.26), germination % (79.33 to 93.00), seedling length (15.73 to 25.73), seed vigour index (1305.73 to 2392.53) and shelling % (65.30 to 80.06) of strains.

In F1s generation wide range of variability were observed for days to 50% tasseling (51.66 to 65.33) followed by days to 50% silking (55.33 to 71.00), days to physiological maturity (78.66 to 97.33), plant height (171.73 to 226.80), cob length (17.53 to 25.33), cob diameter (3.33 to 5.33), kernel rows per cob (10.50 to 14.00), kernel per row (33.00 to 41.33), 100-seed weight (20.53 to 27.46), grain

Table-1 Analysis of variance for 16 characters in 10 parents of diallel crosses in maize

Source of variation	d. f.	Days to 50% tessling	Days to 50% silking	Days to physiological maturity	Plant height (cm)	Cob length (cm)	Cob diameter (cm)	Kernel row/cob	Kernel /row
Replication	2	0.11	0.77	0.24	18.97	0.09	0.02	0.20	0.90
Treatment	99	39.93**	59.11**	83.08**	723.28**	20.54**	0.77**	3.41**	16.48**
Parents	9	28.08**	40.68**	103.79**	774.16**	33.14**	1.46**	5.51**	38.55**
F1s	44	39.11**	58.44**	74.29**	528.22**	13.43**	0.66**	2.77**	10.53**
F2s	44	39.32**	57.09**	73.17**	678.79**	14.00**	0.56**	2.36**	8.46**
Parents vs crosses (F_1 s)	1	40.77**	50.68**	0.00	7522.77**	291.08**	2.49**	5.84*	108.24**
Parents vs crosses (F_2 s)	1	315.49**	517.71**	616.36**	3548.52**	123.48**	1.10**	37.56**	142.69**
Error	198	1.46	1.4	1.32	24.48	1.06	0.05	0.73	1.47

Source of variation	d. f.	100-seed weight (g)	Grain yield / plant (g)	Biological yield / plant (g)	Harvest index	Germination %	Seedling length (g)	Seed vigour index	Shelling %
Replication	2	0.29	3.03	68.19	1.18	0.43	0.09	1391.85	0.98
Treatment	99	10.65**	551.06**	18409.44**	202.10**	81.06**	37.99**	339290.97**	73.74**
Parents	9	9.90**	477.01**	18581.72**	293.72**	68.90**	40.77**	301825.26**	81.28**
F1s	44	12.07**	692.96**	15309.76**	131.87**	86.44**	37.54**	359691.60**	48.82**
F2s	44	7.28**	406.35**	13881.10**	106.56**	82.31**	38.44**	341372.99**	90.22**
Parents vs crosses (F_1 s)	1	22.67**	2136.12**	237640.84**	2653.51**	31.94**	26.39**	359251.30**	182.23**
Parents vs crosses (F_2 s)	1	98.29**	422.99*	131710.43**	3396.11**	57.70**	0.46	4477.81	200.90**
Error	198	1.15	73.89	5741.81	2.19	2.28	0.58	5451.34	3.26

Table-2 Mean performance of parents, F1s and F2s for 16 characters in maize

Source	Days to 50% tessling				Days to 50% silking				Days to physiological maturity			
	Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross
Parents	54.66	TSK-44	64.33	TSK-109	60.00	CIMMYT(K)13	70.00	TSK-27	79.33	TSK-39	96.66	TSK-79
F_1s	51.66	TSK-44 X TSK-39	65.33	CIMMYT(K)13 X TSK-29	55.33	TSK-44 x TSK-109	71.00	CIMMYT(K)13 X TSK-29	78.66	TSK-44 x TSK-109	97.33	CIMMYT(K)13 X TSK-29
F_2s	56.33	TSK-10 X TSK-39	70.33	CIMMYT(K)13 X TSK-29	62.33	TSK-44 X TSK-109	77.00	CIMMYT(K)13 X TSK-29	83.66	TSK-44 X TSK-109	102.33	CIMMYT(K)13 X TSK-29

Source	Plant height (cm)				Cob length (cm)				Cob diameter (cm)			
	Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross
Parents	162.93	TSK-10	206.86	CIMMYT(K)13	13.53	TSK-110	22.86	TSK-10	3.40	TSK-29	5.26	CIMMYT(K)13
F_1s	171.73	TSK-44 x TSK-29	226.80	TSK-110 x TSK-79	17.53	TSK-29 x TSK-79	25.33	CIMMYT(K)13 X TSK-99	3.33	TSK-79 x TSK-99	5.33	TSK-27 x TSK-110
F_2s	166.13	TSK-29 X TSK-39	225.03	TSK-110 X TSK-79	16.06	TSK-29 X TSK-79	24.70	TSK-27 X TSK-99	3.53	TSK-44 X TSK-79	5.10	TSK-27 X TSK-110

Source	Kernel row / cob				Kernel / row				100-seed weight (g)			
	Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross
Parents	10.50	TSK-99	14.00	TSK-110	30.00	TSK-110	40.00	TSK-99	22.53	TSK-79	27.86	TSK-99
F_1s	10.50	TSK-79 x TSK-99	14.00	CIMMYT(K)13 X TSK-44	33.00	TSK-27 x TSK-39	41.33	TSK-79 x TSK-39	20.53	TSK-44 x TSK-27	27.46	TSK-110 x TSK-99
F_2s	11.33	TSK-79 x TSK-99	14.00	TSK-110 x TSK-79	33.00	TSK-29 x TSK-79	37.33	TSK-27 X TSK-109	20.70	TSK-44 X TSK-27	25.96	TSK-29 X TSK-10

Source	Grain yield / plant (g)				Biological yield / plant (g)				Harvest index			
	Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross
Parents	84.18	TSK-109	126.75	CIMMYT(K)13	166.66	TSK-109	391.84	TSK-110	28.36	TSK-110	56.26	TSK-10
F_1s	91.83	TSK-109 x TSK-79	143.17	CIMMYT(K)13 X TSK-44	261.35	TSK-109 x TSK-10	568.34	TSK-110 x TSK-39	21.50	TSK-29 x TSK-99	44.73	TSK-109 x TSK-79
F_2s	80.33	CIMMYT(K)13 X TSK-39	127.15	TSK-44 x TSK-110	232.21	CIMMYT(K)13 X TSK-39	487.77	TSK-110 x TSK-39	20.41	TSK-10 x TSK-99	43.68	TSK-44 X TSK-79

Source	Germination %				Seedling length (cm)				Seed vigour index			
	Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross	Value	Strain/Cross
Parents	79.33	TSK-109	93	TSK-99	15.73	TSK-44	25.73	TSK-99	1305.73	TSK-44	2392.53	TSK-99
F_1s	77.67	TSK-44 x TSK-29	95.66	TSK-110 x TSK-10	15.07	TSK-44 x TSK-29	26.73	TSK-27 x TSK-39	1170.53	TSK-44 x TSK-29	2329.06	TSK-29 x TSK-110
F_2s	75.00	TSK-44 X TSK-29	92.00	TSK-44 X TSK-39	13.43	TSK-44 X TSK-39	25.66	TSK-10 x TSK-99	1231.20	TSK-109 x TSK-10	2238.36	TSK-109 x TSK-79

Source	Shelling %			
	Minimum		Maximum	
	Value	Strain/Cross	Value	Strain/Cross
Parents	65.30	TSK-110	80.06	TSK-109
F_1s	64.98	CIMMYT(K)13 X TSK-27	81.96	TSK-109 x TSK-99
F_2s	63.15	TSK-79 x TSK-39	82.97	TSK-109 x TSK-99

yield per plant (91.83 to 143.17), biological yield per plant (261.35 to 568.34), harvest index (21.49 to 44.73), germination % (77.66 to 95.66), seedling length (15.07 to 26.73), seed vigour index (1170.53 to 2329.06) and shelling % (64.98 to 81.96) of crosses.

In F2s generation wide range of variability were observed for days to 50% tasseling (56.33 to 70.33) followed by days to 50% silking (62.33 to 77.00), days to physiological maturity (83.66 to 102.33), plant height (166.13 to 225.03), cob length (16.06 to 24.70), cob diameter (3.53 to 5.10), kernel rows per cob (11.33 to

14.00), kernel per row (30.00 to 37.33), 100-seed weight (20.70 to 25.96), grain yield per plant (80.33 to 127.15), biological yield per plant (232.21 to 477.87), harvest index (20.41 to 43.68), germination % (75.00 to 92.00), seedling length (13.43 to 25.66), seed vigour index (1231.20 to 2238.36) and shelling % (63.15 to 82.97) of segregated crosses.

The range of F1 progenies is compared to parents were found to be higher for days to 50% tasseling followed by days to 50% silking, days to physiological maturity, plant height, cob length, cob diameter, kernel rows per cob, kernels per row, 100-seed weight, grain yield per plant, biological yield per plant, harvest index, germination %, seedling length, seed vigour index, shelling % except kernel row per cob characters. The range of F2 progenies is compared to parents were found to be higher for days to 50% tessling followed by days to 50% silking, days to physiological maturity, plant height, cob length, cob diameter, kernel per row, 100-seed weight, grain yield per plant, biological yield per plant, harvest index, germination %, seedling length, seed vigour index, shelling % except kernel row per cob characters.

Conclusion

Considering the range from both generations for the character days to 50% tasseling, days to 50% silking, days to physiological maturity, plant height, cob length, grain yield per plant, biological yield per plant, harvest index, seed vigour index and shelling % exhibited wider variability. The range of mean performance of F2 progenies was found slightly higher than F1 progenies for the character days to 50% tasseling, days to 50% silking, days to physiological maturity, plant height, cob length, kernel row per cob, germination %, seedling length, harvest index, seed vigour index and shelling %.

Application of research: Analysis of variance of different traits as well as all possible combination of generated materials

Research Category: Genetic variability

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Study area / Sample Collection: Oilseed Research Farm, Kalyanpur

Cultivar / Variety / Breed name: Maize (*Zea mays* L.)

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