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Genetic variability and selection parameters in fodder maize (*Zea mays* L.)

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Abstract

Thirty strains of Maize (*Zea mays* L.) were evaluated for eight forage characters namely, days to flowering, plant height (cm), number of leaves / plant, leaf length (cm), leaf breath (cm), stem girth (cm), green fodder yield/ plant (g) and dry fodder yield/plant (g) during kharif season at Kanpur. These genotypes showed wide range of variability for green fodder yield, leaf length and leaf breadth. Days to flowering and plant height showed high estimates of heritability. However, genetic advance was high for green and dry fodder yield.

Path co-efficient analysis revealed that plant height, leaf breadth and green fodder yield have positive direct effect on dry fodder yield while leaf length and days to flowering showed negative direct effects. Number of leaves/plant showed negative direct effect on dry fodder yield but positive and high indirect effects *via* plant height, leaf breadth, stem girth and green fodder yield. Stem girth also had negative direct effect on it but positive and high indirect effects *via* days to flowering, plant height, leaf breadth and green fodder yield.

Key words : Genetic variability, Maize, Selection parameters, Yield, *Zea mays*

Maize (*Zea mays* L.) being an important forage crop is suitable for staggered sowings to ensure regular supply of green fodder. The fodder is highly palatable, free from HCN, succulent and nutritious for cattle health. The production of baby corn from forage maize is an additional advantage over other forage crops. Magnitude of variability, association of characters among yield attributes, direct and indirect effects of different traits on fodder yield are useful tools to chalk out the effective breeding programme for this valuable crop. Breeding work on maize as grain crop have lot of attention but as forage maize it is extremely limited. Thus in present investigation, an attempt has been made to study the nature and magnitude of different characters, their association, the nature of transmissibility and the improvement expected per cycle of selection for enhancing the forage yield.

Materials and Methods

Thirty diverse strains of maize were evaluated in a randomized block design with three replications during kharif season of 2003-04 at experimental research station, Kalyanpur of C. S. Azad University of Agriculture & Technology, Kanpur. All the recommended agronomical practices were adopted to raise a good crop. Observations were recorded on days to flowering, plant height (cm), number of leaves/ plant, leaf length (cm), leaf breadth (cm), stem girth (cm), green fodder yield/ plant (g), and dry fodder yield/ plant (g). Genotypic and phenotypic coefficient of variability was calculated according to Burton (1952), heritability in broad sense and expected genetic advance in percent of mean were estimated as per formula given by Burton and deVane (1953), correlation coefficient analysis was done according to Miller *et al.* (1958) and path analysis as per Dewey and Lu (1959).

Results and Discussion

The maximum amount of genetic variability was recorded for green fodder yield followed by dry fodder yield (Table 1). This showed that enough genetic variability is available for effective selection. These results are in conformity with Singh and Singh (2000) and Shivay *et al.* (2002).

Phenotypic coefficient of variability (PCV) was higher than genotypic coefficient of variability (GCV) for all the traits under study (Table 1). Highest PCV was observed for dry fodder yield per plant (25.88%) and green fodder yield per plant (25.47%), while it was lowest for days to flowering (4.26%). The highest GCV was observed for green fodder yield (13.11%) and lowest for stem girth (3.13%). Maximum differences between these two were observed for dry

Table 1: Mean, range, coefficient of variability, heritability and genetic advance for eight characters in fodder maize

Characters	Mean	Range	Coefficient of variability (%) Phenotypic	Coefficient of variability (%) Genotypic	Heritability (%) (BS)	Genetic Advance	Genotypic Advance in % of mean
Days to 50% flowering	49.30	47.00-53.00	4.26	3.16	54.80	2.38	4.83
Plant height (cm)	143.84	117.66-158.26	8.35	5.36	41.20	10.24	7.12
Number of leaves/plant	9.79	8.00-10.67	8.69	3.79	19.10	0.33	3.37
Leaf length (cm)	65.24	55.93-71.76	9.11	4.89	28.80	3.53	5.41
Leaf breadth (cm)	6.93	5.50-8.04	12.24	7.13	33.90	0.59	8.51
Stem girth (cm)	4.55	3.69-5.25	14.80	3.13	18.50	0.32	7.03
Green fodder yield/plant(g)	394.58	249.66-589.33	25.47	13.11	26.50	54.89	13.91
Dry fodder yield/plant(g)	114.88	71.75-168.64	28.88	11.00	18.10	11.07	9.64

Table 2 : Phenotypic (P) and genotypic (G) correlations among eight characters in fodder maize.

Characters	Days to 50% flowering	Plant height (cm)	Number of leaves/plant	Leaf length (cm)	Leaf breadth (cm)	Stem girth (cm)	Green fodder yield/ plant (g)	Dry fodder yield/plant (g)
Days to 50%	P	0.090	0.082	-0.153	-0.000	0.071	0.008	0.326
flowering	G	0.257**	-0.012	-0.246**	0.197	-0.083	0.229*	0.379*
Plant height (cm)		P	0.247	0.478	0.317	0.327	0.298	0.281
		G	0.263**	0.835**	0.574**	0.899**	0.511**	0.616**
Number of leaves/plant			P	0.083	0.176	0.280	0.435	0.373
			G	0.391**	0.757**	0.670**	0.878**	0.875**
Leaf length (cm)				P	0.531	0.436	0.413	0.423
				G	0.522**	0.964**	0.425**	0.298**
Leaf breadth (cm)					P	0.610	0.579	0.605
					G	0.923**	0.540**	0.584**
Stem girth (cm)						P	0.409	0.450
						G	0.690**	0.511**
Green fodder yield/ plant (g)							P	0.915
							G	0.928**
Dry fodder yield/plant (g)								

* Significant at p = 0.05 ** Significant at p=0.01.

Table 3: Direct and indirect effects of different components on dry fodder yield in forage maize

Characters	Days to 50% flowering	Plant height (cm)	Number of leaves /plant	Leaf length (cm)	Leaf breadth (cm)	Stem girth (cm)	Green fodder yield/ plant (g)	Genotypic correlation with dry fodder yield
Days to 50% flowering	**-55.40**	21.66	0.35	21.27	5.66	0.99	5.83	0.3794**
Plant height (cm)	-14.24	**84.28**	-13.33	-72.37	16.46	-13.22	13.04	0.6161**
Number of leaves/plant	0.67	39.01	**-28.81**	-33.84	21.72	20.09	22.41	0.8750**
Leaf length (cm)	13.60	70.39	-11.25	**-86.65**	14.96	-11.59	10.83	0.2981
Leaf breadth (cm)	-10.92	48.37	-21.81	-45.19	**28.67**	-12.31	13.77	0.5815**
Stem girth (cm)	4.57	92.65	-48.12	-83.53	29.39	**-12.03**	17.60	0.5109**
Green fodder yield/ plant (g)	-12.66	43.09	-25.31	-36.79	15.46	-8.30	**25.51**	0.9276**

** Significant at p = 0.01 Bold values showed direct effects.

fodder yield, green fodder yield and stem girth indicating the role of environment for expression of these characters while minimum differences for remaining traits showed the stability of the traits (Table 1). In present set of material moderate to low heritability estimates (54.80% - 18.10%) were observed for all the traits under study (Table 1).

An advancement of 54.89 g in green fodder yield per plant was expected from single cycle of selection at K=2.06. Similarly an advancement of 11.07g in dry fodder yield per plant, 10.24 cm in plant height, 3.53 cm in leaf length and 2.38 days in days to flowering were expected per cycle of selection. Low genetic advance was observed for remaining traits. These findings are in accordance with earliar reports of Dawod and Mohamed (1989) and Umakanth *et al.* (2000). These results showed the preponderance role of both additive and non-additive gene effects in controlling these traits.

The genotypic and phenotypic correlations are given in table 2. The phenotypic correlations were not considered due to involvement of high environmental interaction hence only genotypic correlations are discussed which are of practical utility. Dry fodder yield/plant showed positive and significant association with number of leaves, leaf breadth, stem girth and green fodder yield both at the genotypic (0.915) and phenotypic (0.928) levels. Positive and significant associations were recorded between plant height and leaf length (0.835), number of leaves (0.463) and green fodder yield (0.616). Leaf length showed positive and significant association with leaf breadth (0.521), stem girth (0.964) and green fodder yield (0.425). Leaf breadth also showed a positive and significant association with stem girth (0.923) and green fodder yield (0.584). This indicated that there is a true genetic relationship between these component characters and selection pressure on one character affect the other characters in the positive direction. Palled *et al.* (1989) also observed similar results in sorghum. Days to flowering showed negative association with number of leaves (-0.012), leaf length (-0.246) and stem girth (-0.084). It indicates that early flowering in fodder maize reduced fodder yield as these traits are most important yield attributes. These traits showed negative relationship among themselves. Hence change in one character may also result in change of other characters in negative direction and *vice-versa*.

The direct and indirect effects of the important characters on dry fodder yield (Table 3) indicated that green fodder yield had the highest positive direct effect on dry fodder yield. It may be due to its high positive direct effect and indirect effects *via* plant height and leaf breadth. Days to flowering, number of leaves per plant, leaf length and stem girth showed negative direct effect on dry fodder yield while indirect effect through plant height, number of leaves, leaf length, leaf breadth, stem girth and green fodder yield were positive. Number of leaves and stem girth showed positive indirect effects *via* days to flowering, plant height, leaf breadth, stem girth and green fodder yield. Leaf length showed negative direct effect and positive indirect effect *via* days to flowering, plant height, leaf breadth and green fodder yield; leaf breadth had high positive direct effect and indirect effect *via* plant height and green fodder yield. Similar results have also been reported by Dawod and Mohamed (1989). The above findings indicated that selection on the basis of above component characters would be helpful in selecting superior genotypes in fodder maize which ultimately helpful in increasing the production of fodder need.

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