SHORT COMMUNICATIONS

VARIABILITY AND CHARACTER ASSOCIATION STUDIES AMONG MICROMUTANTS OF FORAGE RICE BEAN

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SUMMARY

Genetic variability, coefficient of variation, genetic advance and character association for 10 characters were studied in 36 micromutants of forage rice bean variety Tikabali Local developed by induced mutagenesis of EMS, NG, MH and Gamma- rays. Significant variability was observed for all the 10 characters. The heritability estimate was high for days to flowering, branches per plant, branch length, leaf weight and dry matter per plant. Green fodder yield had positive and significant correlation with days to flowering, main stem length, branches/plant, branch length, leaves/ plant, leaf weight and stem weight both at phenotypic and genotypic level. Path coefficient analysis revealed that leaves/plant and days to flowering had high positive direct effect on fodder yield while branches/plant and branch length had moderate direct effect. Therefore while formulating selection criteria for improvement of green fodder yield in rice bean characters like days to flowering, main stem length, branches/plant, leaves/plant, leaf weight and stem weight should be given preference.

Key words : Mutagenesis, variability, correlation, path coefficient and rice bean

Rice bean (*Vigna umbellata* Ohwi and Ohashi) is an important food and fodder legume grown in diversified climate for diversified usage. Ricebean as fodder at vegetative stage contains high amount of protein (14-19%) which is at par with cowpea and blackgram. The fodder is also rich in calcium, phosphorus and iron. Green fodder yield is a very complex character and dependent upon a number of component characters. The knowledge of association of these economically important characters with fodder yield and among themselves would be quite useful in effective selection. Path coefficient analysis provides an in depth picture of such associations by determining direct and indirect causes. The present study was therefore undertaken to estimate correlations and path coefficients for important forage characters in rice bean.

The present investigation was carried out at the experimental field of AICRP on Forage Crop, OUAT, Bhubaneswar. The seeds of rice bean variety Tikabali local were administered with twelve mutagenic treatments. The twelve mutagenic treatments comprised of 0.2, 0.4, 0.6% of ethyl methane sulphonate (E_1, E_2, E_3), 0.005, 0.010, 0.015% of nitrosogunidine (N_1, N_2, N_3), 0.005, 0.010, 0.015% of maleic hydrazide (M_1, M_2, M_3) and 20, 40, 60 KR of gamma-rays. The seeds of M_1 generation was harvested in bulk and M_2 generation was raised. Nine (10%) of the 90 M_2 plants observed per treatment population were selected on the basis of higher fodder yield and raised in M_3 generation. Then 33% of the M_3 progenies were selected on the basis of progeny forage yield and 36 micromutants were selected for M_4 generation. In M_4 generation, thirty six micromutants were grown alongwith parent variety in randomized block design with three replications. Each culture was grown in a plot of 3 rows of 3.6 m length with a spacing of 40 cm x 15 cm. Observation on days to flowering was taken on plot basis and main stem length, branches/plant, average branch length, leaves/plant, leaf weight, stem weight, leaf: stem ratio, fodder yield/plot and dry matter/ plant were recorded on ten randomly selected plants from each entry. The genotypic and phenotypic coefficients of variation for characters were estimated

according to Burton (1952). The genotypic and phenotypic correlations were computed according to Al-Jibouri *et al.,* (1958). The phenotypic correlation coefficient of the five component traits viz. days to flowering, main stem length, branches/plant, average branch length, leaves/plant with fodder yield/plant were used for carrying out path coefficient analysis.

Wide range of variability was observed for all the characters (Table 1). Phenotypic coefficients of variability (PCV) and genotypic coefficients of variability (GCV) were high for branches/plant, leaves /plant, stem weight and moderate for main stem length, branch length,

leaf weight, dry matter /plant and fodder yield /plant and less for days to flowering and leaf: stem ratio. This indicates that induction of micromutations was relatively in high frequency for traits like branches/plant, leaves/ plant, leaf weight, stem weight, fodder yield/plant and dry matter /plant. The heritability was high for days to flowering, branches/plant, branch length, leaf weight and dry matter/plant and moderate for main stem length, leaves/plant, stem weight and fodder length/plant. The expected genetic advance (GA) was high for branches/ plant, leaves/plant, leaf weight, stem weight, dry matter/ plant and fodder yield/plant.

TABLE 1
Genetic parameters of quantitative traits in mutant cultures of Tikabali local in M_4 generation

S. No.	Character	Range	Mean	PCV (%)	GCV (%)	h^2 (%)	GA (5%)	GA (% of Mean)
1.	Days to flowering	86.7 - 94.0	90.46	2.29	2.13	86.46	3.692	4.08
2.	Main stem length	101.6 -137.0	121.15	7.30	5.84	63.99	11.656	9.62
3.	Branches/plant	3.5 - 7.3	4.75	17.67	14.97	71.80	1.241	26.13
4.	Branch length	60.6 - 82.0	71.60	7.45	6.31	71.71	7.888	11.02
5.	Leaves/plant	40.5 - 73.3	50.43	14.40	11.71	66.18	9.897	19.63
6.	Leaf weight	39.3 - 66.3	51.62	13.02	10.87	69.67	9.646	18.69
7.	Stem weight	45.7 - 75.3	56.97	14.91	11.36	58.03	10.153	17.82
8.	L : S ratio	0.76 - 1.08	0.92	6.38	3.98	39.03	0.047	5.13
9.	Dry matter yield	23.0 - 36.3	28.06	13.67	11.62	72.28	5.709	22.35
10.	Fodder yield	86.0 - 143.7	108.58	13.48	10.96	66.07	20.35	18.35

The association analysis (Table 2) indicated that green fodder yield had significant positive correlation with days to flowering, main stem length, branches/ plant, branch length, leaves/plant, leaf weight and stem weight both at phenotypic and genotypic levels. It indicates that genotypes having higher values for these traits will produce more green fodder. The correlation of leaf: stem ratio with fodder yield/plant was of very low magnitude and negative in most cases indicating absence of any influence of this character on fodder yield. These results were in broad agreement with reports of Chakrabarty and Bhattacharya (2005), Singh *et al.,* (2006) and Katoch *et al.,* (2007) in fodder rice bean.

Effect of a character on yields is often modified by other traits. Path coefficient analysis helps in this regard. The path analysis based on phenotypic correlation coefficient (Table 3) showed that leaves/plant had the highest positive direct effect followed by days to flowering while branches/plant and branch length had moderate positive direct effect on fodder yield. The correlation estimates of leaves/plant and branch length with fodder yield were largely explained by their higher

direct effects and indirect effects via other traits. Days to flowering had low direct effect but the total correlation with fodder yield was significantly high because of high indirect effect via leaves/plant. Main stem length though had very low direct effect; its correlation with fodder yield was significant because of higher indirect effect via days to flowering. Branches/plant though had low direct effect, had significant correlation with fodder yield because of high indirect effects via leaves/plant and days to flowering. High positive direct effects of branches/ plant, plant height, days to flowering and leaf weight with fodder yield have been reported by Aravindan and Das (1995) and Borah and Khan (1999) in fodder cowpea.

Considering the studies on variability, heritability, genetic advance and the association of characters among each other and with fodder yield, it could be concluded that in fixing a selection criteria for improving fodder yield in rice bean due emphasis need to be given for phenotypic selection of character like days to flowering, main stem length, branches/plant, leaves/plant, leaf weight and stem weight.

TABLE 2

Phenotypic correlation (r_p) and genotypic correlation (r_g) among the quantitative traits in mutant cultures of Tikabali local in M_4 generation

S. No.	Characters	Correlation	Main stem	Branches/ plant	Branch length	Leaves/ /plant	Leaf weight	Stem weight	L:S ratio	Dry matter	Fodder yield
1	Days to flowering	r_p	0.668**	0.603**	0.455**	0.639**	0.755**	0.778**	-0.184	0.716**	0.798**
		r_g	0.851**	0.696**	0.534**	0.799**	0.922**	0.999**	-0.238	0.829**	0.966**
2	Main stem length	r_p		0.368*	0.546**	0.192	0.424**	0.469**	-0.216	0.315	0.461**
		r_g		0.269	0.668**	0.008	0.375*	0.376*	-0.084	0.195	0.377*
3	Branches/ plant	r_p			0.041	0.715**	0.702**	0.682**	-0.112	0.598**	0.716**
		r_g			-0.005	0.685**	0.669**	0.595**	0.129	0.512**	0.639**
4	Branch length	r_p				0.094	0.331*	0.389*	-0.209	0.336*	0.368*
		r_g				0.012	0.326*	0.458**	-0.306	0.361*	0.392*
5	Leaves/ plant	r_p					0.860**	0.731**	0.076	0.779**	0.818**
		r_g					0.863**	0.738**	0.342*	0.779**	0.807**
6	Leaf weight	r_p						0.881**	0.039	0.913**	0.965**
		r_g						0.982**	0.165	0.961**	1.000**
7	Stem weight	r_p							-0.426	0.876**	0.974**
		r_g							-0.169	0.897**	0.992**
8	L:S ratio	r_p								0.094	-0.219
		r_g								0.189	0.004
9	Dry-matter yield	r_p									0.920**
		r_g									0.934**

*Ssignificant at 5% level   ** significant at 1% level

TABLE 3

Direct and indirect effects of component traits on their phenotypic correlation with fodder yield in mutants of Tikabali Local

Character	Days to flowering	Main stem length	Branches/ plant	Branch/ length	Leaves/ plant	r_p with fodder yield/plant
Days to flowering	**0.294**	0.005	0.113	0.081	0.306	0.798
Main stem length	0.197	**0.007**	0.069	0.097	0.092	0.461
Branches/ plant	0.177	0.003	**0.187**	0.007	0.342	0.716
Branch length	0.134	0.004	0.008	**0.178**	0.045	0.368
Leaves/ plant	0.188	0.001	0.133	0.017	**0.479**	0.818

R^2 = 82.884 %   Residual effect = 0.414

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