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A Path Coefficient Analysis of Yield and Yield Components in Proso Millet (*Panicum miliaceum* Linn.)

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Twenty selections of diverse origin were tested for heritability and genetic association of different characters. A path coefficient analysis for yield was also carried out. Grain yield was found to be significantly correlated with plant height, number of tiller, panicle length and 1000 grain weight. The path analysis showed that 1000 grain weight is the most important yield contributing factor followed by number of grains per tertiary branch.

Proso millet (*Panicum miliaceum* Linn.) popularly know as *Panivaragu* is a quick yielding dryland cereal grown all over the world for its food as well as feed value. The crop is one of those which are raised in extremely poor soils with high moisture stress. The importance of breeding for high yield in crops such as proso millet has only been recently realised.

Although the species is replete with variability, obtaining useful recombinants through artificial hybridisation is very difficult because of its very small and delicate flowers. Handling of the floret without demage to the ovary is a very tedious process. So much so, crop improvement in *Panivaragu* is mainly carried out till recently though conventional selection from prevailing types. A knowledge of the extent of genetic variability in metrical traits, their association and relative contribution towards yield will be of great help to the breeders in evolving potentially high yielding genotypes. However, no report has been made on such aspects so far in *Panivaragu*. Therefore, an attempt was made to study the extent of genetic variability in yield components in this crop and their relationship to yield and the present paper reports the results of such an investigation.

MATERIALS AND METHODS

Twenty selections of diverse origin were selected for the study and were sown in a randomised block design with three replications. The experiment was conducted during the monsoon season under protective irrigation. The soil was fertilised with 40 kg N and 20 kg P_2O_5 per hectare besides a basal application of 12.5 tonnes of cattle manure.

Each selection was sown in a single row of 4 m. length adopting a spacing of 25 cm x 15 cm. Five plants were randomly selected and

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observations on the plant height, number of productive tillers, panicle length, number of grains per tertiary branch, 1000 grain weight and grain yield per plant were recorded. The mean values were subjected statistical analysis. Heritablity and genetic advance were estimated by the method of Comstock and Robinson (1952). Genetic coefficient of variability was calculated as given by Burton (1952). Path analysis was done by the method of Dewey and Lu (1959).

RESULTS AND DISCUSSION

(i) **Components of variance :** The mean, range, variability and heritability and genetic advance in respect of all the characters studied are presented in Table I. There was significant difference between varieties for various characters studied. It was observed that the genotypic coefficient of variability was the highest in the number of productive tillers per plant followed by the number of grains per branch and grain yield per plant. Variability observed in the panicle length was the least.

Among the six characters investigated, 1000 grain weight had the highest heritable value of 86.81 per cent followed by plant height and and number of grains per branch. The genetic advance calculated as percentage over the mean was the highest in number of grains per branch followed by seed weight and number of tillers. Other characters except panicle length also registered, fairly large amount of genetic advance.

(ii) **Phenotypic and Genotypic correlation :** The phenotypic and

TABLE I. Mean, Range and Variability Estimates of some Quantitative Traits

Character	Mean	Range	Phenotypic variance	Genotypic variance	Phenotypic coefficient of variability	Genotypic coefficient of variability	Heritability	Genetic advance	Genetic advance as percentage of mean
1. Plant heighr (cm)	83.05	57.1—103.0	79.90	63.23	10.69	9.57	79.13	14.49	17.44
2. Numbe of rproductive tilller/plant	21.86	5.4— 36.0	54.97	19.95	33.89	20.40	36.29	5.53	25.29
3. Panicle length (cm)	25.90	21.0— 31.7	5.84	1.03	9.30	3.90	17.64	0.87	3.35
4. Number of grains per branch	66.23	42.2—115.8	242.51	168.89	23.40	19.61	69.64	22.23	33.56
5. 1000 grain weight (mg)	528.55	380.0—675.0	5606.32	4857.26	14.20	13.24	86.81	133.94	25.34
6. Grain yield per plant (gm)	10.03	2.7— 21.6	20.14	3.18	43.68	17.74	15.78	1.46	11.46

TABLE II. Genotypic and phenotypic correlation coefficients for different characters

Characters	Number of productive tillers/plant	Panicle length	Number of grains/ branch	1000 grain weight	Grain yield/ plant
Plant height	(-) 0.0456	0.6625**	0.2090	0.7198**	0.9376**
	0.3075	0.3630	0.2503	0.3202	0.3911
Number of productive tillers/plant		(-) 0.4003	(-) 0.5549**	0.6779**	0.5581**
		(-) 0.0524	(-) 0.1206	0.3382	0.5150**
Panicle length			0.6821**	0.2693	0.6908**
			0.4285	0.0338	0.1590
Number of grains per branch				(-) 0.4627*	(-) 0.0510
				(-) 0.4407	0.1669
1000 grain weight					0.7395**
					0.3586

Top Row : Genotypic correlation

Bottom row: Phenotypic correlation

* Significant at 5 per cent level

** Significant at 1 per cent level

genotypic correlation coefficients are presented in Table II.

The grain yield was found to be highly and significantly correlated at genotypic level with plant height, seed weight, panicle length and number of productive tillers per plant in that order. At phenotypic level however, the correlation between number of productive tillers and grain yield was alone found to be significant and nearly equal to genotypic correlation coefficient indicating the importance of the environment influencing the magnitude of association of all the component characters with yield at phenotypic level. Number of grains per branch was not associated with grain yield either at genotypic or at phenotypic level.

Among the yield attributes, plant height had a significant genotypic correlation with panicle length as well as with 1000 grain weight. Number of productive tillers was found to be positively associated with 1000 grain weight. The number of grains per branch, however, had a negative genotypic correlation with the number of productive tillers per plant as well as with 1000 grain weight.

(iii) **Path analysis :** The results of path analysis are presented in Table III and discussed below.

Although there was a significant positive correlation between plant height and yield its direct effect was highly negative. Such a high pos-tive total correlation between these two characters inspite of large nega-

TABLE III. Direct and indirect effects of various charocters on yield of grain

Variables associated with yield	Plant height	Effects via Productive tillers	Panicle length	Number of grains per branch	1000 grain weight	Total correl-tion yield
Plant height	(-0.6072)	0.0271	-0.3951	0.2548	1.6580	0.9376
Productive tillers	0.0277	(-0.5933)	0.2387	-0.6785	1.5615	0.5581
Panicle length	-0.4022	0.2375	(-0.5964)	0.8361	0.6203	0.6908
Number of grains per branch	-0.1269	0.3292	-0.4068	(1.2192)	-1.0657	-0.0510
1000 grain weight	-0,4370	-0.4022	-0.1606	-0.5641	(2.3034)	0.7395

Residual effect : 0.4872

Figures in parantheses indicate direct effects

tive direct effact and indirect effects of panicle length was mainly due to substantial positive indirect influence exerted through 1000 grain weight and number of grains brance,

Inspite of the positive correlation that existed between number of productive tillers and yield, this character possessed large negative direct effect upon yield. The indirect effect through 1000 grain weight was the largest as in the previous case. There was a large negative effect of tillers upon yield through number of grains per branch. The effect through panicle length was positive but small.

Consistent with the trends observed for the first two variables, the estimate for the direct effect of panicle length on yield was also negative inspite of the existence of significant genotypic correlation between panicle length and yield. Its indirect effect through plant height was also negative. However, positive indirect effects through number of grains per branch, 1000 grain weight and number of productive tillers per plant out weighed the above negative effects resulting in overall positive association at the genotypic level.

Although number of grains per branch was found to be uncorrelated with yield, its direct effect on yield was very large and positive. However, the negative indirect effects of 1000 grain weight, panicle length and plant height nearly nullified the inherently high direct influence of the number grains on yield.

The direct effect of seed weight on yield was not only positive but it excelled in its magnitude the direct and indirect effects of all other components influencing yield in the present investigation. Its indirect effects upon yield through all other characters were negative.

The considerably large residual effect suggests that there are probably

more traits viz. total number of tertiary branches and number of grains per panicle which also influence the yield.

The foregoing discussion being the first of its kind in this crop, indicates that 1000 grain weight is the most important among the various components affecting yield. Apart from the large direct effect of this character upon yield, three other characters, plant height, number of productive tillers and panicle length appear to influence the yield indirectly through 1000 grain weight. Number of grains per tertiary panicle branch was the second most important character that influenced the association of other characters with yield as seen from its large direct effect. Obviously in any selection scheme for the yield improvement in this crop, 1000 grain weight and the number of grains per tertiary branch have to be given the primary importance. However, the observed, inverse association between these two important constituents of yield might restrict the degree of expected selection resource due to mutual compensation. This is evident from the apparently negligible association recorded between grain number per branch and yield despite its high positive influence. The studies highlight the importance of giving proper weightage to these components to avoid such limitations.

REFERENCES

DEWEY, D. R. and K. H. LU. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.* 51: 515-18.

BURTON, G. W. 1952. Quantitative inheritance in grass. Proc. Sixth International Grasslands Congr. I: 277-83.

COMSTOCK, R. E. and H. F. ROBINSON. 1952. Genetic parameters, their estimation and significance. Proc. Sixth International Grasslands Congr. 1: 284-91.