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Short Communication

POSSIBILITIES OF COMBINING HIGH PROTEIN CONTENT WITH HIGH GRAIN YIELD IN FINGER MILLET

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The F_2 and F_3 populations of two finger millet crosses viz., WR 13 x GE 1409 and WR 13 x GE 1546 were grown during *Kharif* season of 1993 and 1994, respectively, along with parents at the experimental farm, GKVK, Bangalore. F_3 population was grown in two replications in Randomised Complete Block Design adopting a spacing of 22.5 cm between and 10.0 cm within row. Two hundred fifty F_2 plants from each cross selected at random and random five plants from each of the 100 F_3 families were studied for protein content, grain yield and yield components. For estimation of proteins, standard analytical procedures were followed [1]. Phenotypic correlations and path coefficients were estimated following the procedure of AL-Jibouri *et al.* [2].

The mean protein content, grain yield and yield components of parents and progenies of crosses revealed that the parents differed distinctly for all the characters studied (Table 1). The parent WR 13 is a high protein genotype than the other two parents (GE 1409; GE 1546). But, it is a poor yielder, poor in yield components, although excelled in number of productive tillers compared to other two parents. The mean protein content, yield and yield components both in F_2 and F_3 generations were in between the parents. The maximum and minimum values in the segregating populations exceeded parental limits on either side. This offered scope for selection keeping multiple characters in view.

The phenotypic correlations between protein content and grain yield showed large differences in the two generations (Table 2). The 'r' values were higher in F_3 compared to F_2 generation and high significant negative association between protein content and grain yield was observed in both generations of both crosses.These results are in agreement with the reported negative correlations between protein content and grain yield in finger millet [3, 4] in sorghum [5], in rice [6] and in wheat [7].

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Table 1. Mean values of protein content, yield and yield components among parents, F_2 and F_3 populations

Characters	Parents			Cross	Segregating population	
	WR13	GE1409	GE1546		F_2	F3
Protein content (%)	9.7	7.2	7.5	I	8.7 (6.1-11.1)	8.4 (6.1-10.9)
				II	8.9 (5.9-10.8)	8.5 (6.9-10.8)
Grain yield (g/plant)	26.0	41.0	35.0	I	11.1 (3.6-29.4)	23.3 (11.5-39.0)
				II	11.5 (4.2-26.5)	24.2 (12.2-39.0)
Productive tillers	5.1	2.3	2.2	I	2.4 (1.3-4.8)	2.5 (1.5-4.3)
				II	2.3 (1.4-3.9)	2.4 (1.3-3.7)
Fingers/ear	5.0	6.3	6.6	I	5.3 (3.0-9.0)	6.2 (4.6-7.7)
				II	5.6 (3.0-9.0)	6.4 (4.8-8.5)
Ear length (cm)	4.2	7.7	5.4	I	6.7 (3.0-11.0)	-
				II	5.6 (2.5-8.5)	-
Plant height (cm)	58.7	90.1	99.9	I	88.9 (57.0-119.0)	-
				II	88.5 (44.0-131.0)	-

Cross II WR13 × GE1409; Cross II: WR13 × GE1546; Figures in parenthesis indicates range values

The association of protein content with fingers per ear and productive tillers was negative but significant only in F_3 of the cross WR 13 × GE 1546, but not in the other populations. The 'r' values revealed non-significant association of protein content with plant height and ear length. The above results have revealed that the grain yield is largely influenced by factors not operative in protein synthesis. The yield components are more closely related to yield and they may have relatively small effect on the level of protein.

Table 2. Phenotypic correlation coefficients among protein content, yield and yield components in F_2 and F_3 generations

Characters	Cross	Protein content	
		F_2	F_3
Grain yield	I	- 0.413**	- 0.659**
	II	- 0.392**	- 0.660**
Productive tillers	I	- 0.019	- 0.014
	II	- 0.032	- 0.197*
Fingers/ear	I	- 0.040	- 0.061
	II	- 0.012	- 0.253**
Ear length	I	- 0.040	-
	II	- 0.012	-
Plant height	I	- 0.043	-
	II	- 0.008	-

Cross II : WR13 × GE1546; Cross I : WR 13 × GE1409; *,**Significant at P = 0.05 and 0.01 respectively

Breeding for higher productivity in finger millet has often been counter productive in so far as for the protein production is concerned because of inverse relationship that exist between these two characters. Therefore, breeders should give adequate attention to the nutritional quality in addition to yield and other agronomic characteristics. The significant negative correlations between protein content and grain yield would make it difficult to select for higher grain yield with desirable levels of protein content. Breeders would do well to compromise by attempting to select for an optimum balance between these components rather than going for extremes. Simultaneous improvement of grain yield and protein content has been obtained in some cultivars of wheat [8] and rice [6] suggesting that pleitropy may not control these traits. Improvements can be made for traits that are negatively correlated, if these traits can be selected simultaneously in large populations [9]. Biparental mating system has been demonstrated as an effective breeding procedure to break such undesirable associations in many crop plants [10, 11] and the same procedure could be adopted in finger millet too for combining high yield and high protein content. But, the difficulty in this is making large number of planned crosses. If the availability of genetic male sterility system in finger millet [12] is utilized, this difficulty could be overcome to recover useful recombinations.

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