Correlation Studies for Grain Yield Components and Nutritional Quality Traits in Pearl Millet (*Pennisetum glaucum* (L.) R. Br.) Germplasm

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Abstract: Before selecting genotypes for nutritional quality characters (protein, oil and micronutrients content) and anti-nutritional factor (phytic acid), it is important to know how much selection is likely to affect yield. Using a diverse range of genotypes, relationships between quality traits with yield and yield attributes in pearl millet were investigated. The number of productive tillers, panicle length, panicle girth, days to maturity, 100-grain weight were most important traits for maximizing grain yield owing to their high significant positive association with grain yield. Phytate phosphorus and total phosphorus were significantly positive correlated and it is therefore inferred that simple selection against phytate phosphorus is unlikely to lower phosphorus concentration in pearl millet. No correlation between grain yield and protein content. These suggested that, there is possibility of selection for increased protein content without detrimental effect on grain yield.

Key words: Correlation % Genotypes % Nutritional traits % Pearl millet

INTRODUCTION

Pearl millet (*Pennisetum glaucum* (L) R. Br.) is the most drought tolerant of all domesticated cereals and soon after domestication it is become widely distributed across the semi arid tropics of Africa and Asia. It is the principal food crop across sub-Saharan Africa and northwestern India. It is considered as nutritious cereal crop in providing high quality grain both for human and animal consumption will continue to play an important role in the Indian economy [1-2]. This crop grown in harsh environments where other crops fail to grows well. Improvement in production, availability storage, utilization and consumption of this crop will significantly contribute to the food and nutrition security of the inhabitants of these areas.

Though pearl millet is the staple cereal supplying 80 to 90% of the calories for many millions of the poor people in semi arid regions [3], the nutritive value of this crop has not received extensive attention and as a result the data available are limited [4]. Grain quality of pearl millet divided into two categories, the evident quality character based on appearance and cooking quality and the cryptic quality characters based on nutritional value [5]. In general, pearl millet breeding program, a strong emphasis is placed on selection for evident quality characters. For the cryptic quality characters, the research effort is focused on improving nutritional quality traits.

Before placing strong emphasis on breeding for nutritional quality characters the knowledge on the association between yield and yield attributes and also interrelation between yield and nutritional quality traits will enable the breeder for simultaneous improvement of yield with nutritional traits. The correlation coefficient may help to identify characters that have little or no importance in the selection programme. The existence of correlation may be attributed to the presence of linkage or pleiotropic effect of genes or physiological and development relationship or environmental effect or in combination of all. The relationship among seven nutritional quality traits; grain yield and yield attributes were investigated on a diverse range of genotypes.

MATERIALS AND METHODS

The experimental material consisting of 61 genotypes, were grown in randomized block design (RBD) with three replications, each genotype represents by a four rows of 5 m length with a spacing of 45 cm between row and 15 cm between plants. Five plants per treatment were randomly

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selected for each replication in middle of the two rows. The outer rows were rejected; since, it may be have some border effect. Observations were recorded for morphological traits such as days to 50% flowering, plant height, number of productive tillers, panicle length, panicle girth, days to maturity 100-grain weight and grain yield per plant. Selfed grains were homogenized for quality and mineral elements analysis in the laboratory. Quality analysis such as protein content was analyzed using microkjeldahl method [6]. Soxhlet apparatus using petroleum ether extractant estimated crude oil content. Estimation of phytic acid was based on the method of Wheeler and Ferrel [7]. Mineral estimation schuss as Calcium was estimated following veresenate nitration method [8]. Phosphorous was determined as per vanadomolybdo phosphoric yellow colour method of Piper [9] and A.O.A.C [10]. Zinc and iron content was estimated by using atomic absorption spectrophotometer [8]. The correlation coefficients were estimated according to the formula given by Al-Jibouri *et al*. [11].

RESULTS AND DISCUSSION

The results of genotypic correlation for the yield and nutritional quality characters were presented in Table1.

The number of productive tillers, panicle length, panicle girth, 100-grain weight, days to maturity and crude oil were significant and positively associated with grain yield and this was accordance with findings of Poongodi and Palanisamy [12], Hepziba *et al*. [13] and Anarase *et al*. [14]. The crude oil content had positive correlation with grain yield. Therefore, it may be possible to improve grain yield with high crude oil in pearl millet. Most of the grain quality characters were not associated with grain yield per plant and hence, it may be difficult to combine grain quality with yield, crude protein, phytate phosphorus, phosphorus calcium, iron and zinc had non-significant association with grain yield. This was conformity with the findings of Deosthale *et al.* [15]. It could be inferred that selection for high yield would be effective through the selection of these positively associated traits with grain yield.

No correlation between crude protein content and grain yield. This result is in close agreement with those obtained by earlier workers Deosthale *et al*. [15] and Kumar *et al.,* [16]. This study concludes that selection for high grain yield and protein content could be done without detrimental effect on grain yield. Time to 50% flowering recorded non-significant positive correlation with plant height, significant negative correlation with

Table 1: Genotypic correlation co-efficient for the yield and nutritional quality characters in pearl millet genotypes

Character	Day to 50% flowering	Plant height (cm)	Number of productive tillers (cm)	Panicle length (cm)	Panicle girth (cm)	Days to maturity	100-grain weight (g)	Crude protein (%)	Crude oil (%)	Phytate phosphorus (mg)	Phosphorus (mg)	Calcium (mg)	Iron (mg)	Zinc (mg)	Grain yield per plant (g)
Day to 50% flowering	1.000	0.3565**	0.3019*	0.0223	0.0359	0.1385	-0.2625*	0.211	-0.1311	-0.1367	-0.0772	0.0964	-0.0694	0.0119	0.0707
Plant height (cm)		1.000	0.2472	0.2006	0.1018	0.3121*	0.0516	0.1638	0.1386	-0.1364	-0.0807	-0.0504	0.0048	0.1086	0.2381
Number of productive tillers			1.000	0.4932**	0.0595	0.2076	0.2775*	0.072	0.4238**	0.0443	0.0338	0.1853	0.0471	-0.0398	0.6617**
Panicle length (cm)				1.000	0.404**	0.3101*	0.283	0.2267	0.4365**	0.2805*	0.1068	0.0621	-0.0936	-0.1516	0.5892**
Panicle girth (cm)					1.000	0.1758	0.0519	0.392**	0.2554*	-0.166	-0.2765*	-0.1908	-0.1319	-0.0838	0.3239*
Days to maturity						1.000	0.4331**	0.1929	0.2314	0.1989	0.2221	0.0791	-0.0493	-0.0902	0.3103*
100 grain weight (g)							1.000	-0.2793*	0.7022**	0.0264	0.2017	0.1316	-0.0981	-0.1648	0.6469**
Crude protein (%)								1.000	-0.2270	0.0908	0.0685	-0.1046	-0.1283	-0.0617	0.1434
Crude oil (%)									1.000	0.0024	0.077	0.0739	0.146	0.0091	0.7139**
Phytate phosphorus (mg)										1.000	0.8366**	0.1316	-0.0972	-0.1598	0.0485
Phosphorus (mg)											1.000	0.2564*	-0.0444	-0.143	0.084
Calcium (mg)												1.000	0.0366	-0.1439	0.0919
Iron (mg)													1.000	0.8789**	0.0547
Zinc (µg)														1.000	0.0068
Grain yield per plant (g)															1.000

 * Significant at 5% probability level ** Significant at 1% probability level

100-grain weight and significant positive correlation with number of productive tillers. These results are in conformity with the findings of Balakrishnan and Vijendra Das [17]. Number of productive tillers showed non-significant positive correlation with earhead length and ear-head girth. Ear-head length had a strong positive correlation with earhead girth and non-significant correlation with 100-grain weight. These results are in accordance with the findings of Poongodi and Palanisamy [12].

Phytate phosphorus was positive and significantly associated with phosphorus content and it is therefore inferred that simple selection against phytate phosphorus is likely to lower phosphorus concentration in pearl millet. A downward trend in phosphorus concentration is undesirable because diets based on cereals usually require supplementation of inorganic phosphates. Therefore, the goal should be to lower the phytate phosphorus level, while maintaining the concentration of phosphorus [18]. The negative correlation between phytate phosphorus with iron and zinc showed enhanced bioavailability of iron/ or zinc in human diet. These changes in iron and zinc were significant and inversely correlated with change in phytate phosphorus content in pearl millet, suggested that availability of zinc and iron are more dependent on the phytate phosphorus concentration. This was in conformity with Udayasekhara Rao and Deasthale [19].

The positive correlation between zinc and iron and their negative association with phytate phosphorus indicating simultaneous selection for high zinc and iron and low phytate phosphorus would be desirable and highly rewarding. No significant association was observed between phytate phosphorus and crude protein content [20]. It can be concluded from the present study that, number of productive tillers, panicle length, panicle girth, days to maturity and 100-grain weight may be given due importance in the selection of surpassing genotypes as these traits have consistent positive associations and contribution to grain yield. Fascinatingly, most of the quality characters were not significantly correlated to grain yield. Therefore, it may possible to improve pearl millet grain for quality trait like protein and other mineral contents for better utilization.

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