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Character Association among Vegetative, Pre-yield and Yield Parameters in Finger Millet (*Eleusine coracana* L.)

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ABSTRACT

*The present experiment was carried out with the objective to study character association among various vegetative, pre-yield and yield parameters in the finger millet genotypes under rainfed conditions in Kharif 2016-17. Days to 50% flowering recorded significant positive correlation with days to maturity (0.9700***), fingers per ear (0.4290**) and finger length (0.2932*) and a positive non significant correlation with plant height (0.2772), fodder weight per plant (0.2342), tillers per plant (0.1536) and grain yield per plant (0.1439). Productive tillers per plant exhibited phenotypic positive correlation with grain yield per plant (0.2448), fingers per ear (0.1453), fodder weight per plant (0.0730) and test weight (0.0583) and recorded negative correlation with flag leaf area (-0.1096) and finger length (-0.0882). The character, fingers per ear exhibited significant phenotypic positive correlation with fodder weight per plant (0.3781**) grain yield per plant (0.2855*) and exhibited non significant positive association with finger length (0.1171). Fingers per ear correlated negatively with test weight (-0.3608*) and flag leaf area (-0.2873*). Fodder yield per plant exhibited significant positive correlation with grain yield per plant (0.3191*), non significant positive correlation with test weight (0.0432) and showed negative correlation with flag leaf area (-0.0608). Flag leaf area recorded non significant positive association with test weight (0.1244) and showed negative association with grain yield per plant (-0.1751). The results of correlation analysis indicated that yield had positive correlation with fingers per ear productive tillers per plant, finger length, fodder yield per plant, test weight; days to 50% flowering and days to maturity. Hence, these characters could be considered as criteria for selection for higher yield as these were associated with grain yield.*

Key words: *Correlation, Flag leaf, Fodder yield, Finger millet.*

INTRODUCTION

Finger millet (*Eleusine coracana* (L.) Gaertn), also known as birds foot millet, ragi or African millet, is an annual plant widely grown as an important food crop in the arid and semi arid areas of Africa and South Asia. Finger millet (*E. coracana* L. subsp. *coracana*) and its wild relatives are the members of Chloridoidea, one of the primary subfamilies of the grass (Poaceae) family.

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The cultivated finger millet is a tetraploid species with 36 chromosomes (2n = 4x = 36) derived from wild ancestor *E. coracana* subsp. *Africana*[10]. East Africa is recently reported as the center of origin and diversity of finger millet. Finger millet ranks third in importance among the millets after sorghum and pearl millet in India[20]. It is a hardy crop that can be grown in diverse environments from almost at sea level in south India to high lands of Himalayas (altitudes of 1850 to 2300 meters) and from poor soils on hill slopes to rich soils in the Indogangetic plains. The crop provides food grain as well as straw, which is valued animal feed especially in rainfed areas. Finger millet is one of the important food crops and largely grown in southern states of India.

The efficiency of selection for grain yield mainly depends on the direction and magnitude of association between yield and its components and among themselves. Correlation studies provides information about the nature and magnitude of association of different component characters with grain yield, which is regarded as highly complex and in which the breeder is ultimately interested in[15]. The correlation between characters may exist due to various reasons such as pleiotropy, genetic linkage and association of loci or blocks of loci, governing variability for different characters located on same chromosomes. It has been generally accepted that correlation between different characters represents a coordination of physiological and biochemical processes which is often achieved through linkage[22]. Keeping in view the above background, present study was undertaken to find out and interpret, character association among various vegetative, pre-yield and yield parameters in the finger millet genotypes under rainfed conditions.

MATERIAL AND METHODS

The experiment was undertaken in S. G. College of Agriculture and Research Station, Jagdalpur with 33 genotypes in *Kharif* 2013. The test materials were obtained from Project Coordinate, Small Millets under All India Coordinated Small Millet Improvement Project. The trireplicated trial was laid out with agronomically standardized planting geomatry. Sowing was done by onset of monsoon and completely rainfed treatment was maintained to assess suitability of genotypes in farmer's field. Eight quantitative traits viz., plant height, number of productive tillers per plant, main ear length, number of fingers per ear, days to 50 percent flowering, days to maturity, fodder yield and grain yield were recorded with respective standards. To interpret trait inheritance, Karl Pearson's correlation and path coefficient statistics were deployed on phenotypic and genotypic basis, calculated for all possible comparisons, using the formula suggested by[1]. The correlation coefficients were partitioned into direct and indirect effects, using the path coefficient analysis according[7]. The raw data was processed by Windostat Version 9.2 from indostat services, Hyderabad Licensed to Plant Breeding Division Sugarcane Breeding Institute Coimbatore.

RESULTS AND DESCUSSIONS

Character association between yield and vegetative parameters

The vegetative phase is an critical in contributing to yield since vegetative growth, this phase eventually determines the end product. The vegetative parameters studied in this experiment included days to 50% flowering, days to maturity and plant height. Days to 50% flowering recorded significant positive correlation with days to maturity (0.9700***), fingers per ear (0.4290**) and finger length (0.2932*) and a positive non significant correlation with plant height (0.2772), fodder weight per plant (0.2342), tillers per plant (0.1536) and grain yield per plant (0.1439) (Table 01). A negative

phenotypic correlation with flag leaf area (-0.2136) and by test weight (-0.0452) was observed. These results are in accordance with the findings of Bezaweletaw *et al.*[4,] and Haradari *et al*[9]. Days to maturity recorded positive association with grain yield per plant (0.1155), because the genotypes studied in the experiment were early to medium maturing thus escaped moisture stress conditions. Significant positive correlation of days to maturity was found with fingers per ear (0.4617***) and fodder weight per plant (0.3152*). It showed positive non significant correlation with finger length (0.2700), plant height (0.2608), tillers per plant (0.1603), negative correlation with flag leaf area (-0.2312) and test weight (-0.0408). These results were in accordance Wolie and Dessalegn[23] for positive grain yield per plant and negative test weight; Lule *et al*.,[18] for positive plant height and negative test weight; Shinde *et al.*[21] positive plant height and grain yield per plant and negative test weight at phenotypic levels[21]; and for fodder yield per plant and grain yield per plant[12]. In contrast to the present findings, negative correlation of days to maturity with grain yield per plant was reported by Bezaweletaw *et al.*[4] mainly due to late maturity genotypes grown in area where moisture stress was prevalent and terminal drought laid the adverse effect on grain yield. The growing period was not as long as required for late maturing varieties. Plant height recorded positive association with grain yield per plant (0.2531), finger length (0.5879***) fingers per ear (0.2684) and productive tillers per plant (0.0377). Whereas, negative correlation was noted with flag leaf area (-0.1099), fodder weight per plant (-0.0788) and test weight (-0.0342). The results are in conformity with previous reportings for finger length, and test weight[4]; for finger length and fingers per ear and grain yield per plant and for test weight[18 ,23] and for grain yield per plant[12]. All the vegetative parameters i.e. days to 50% flowering, days to maturity and plant height showed positive association with grain yield per plant. Blooming space or flowering time stands for pre reproduction stage where plant attains optimum vegetative growth to support the source sink balance in grains. But whenever terminal drought occurs plant doesn't get sufficient time to utilize the vegetative source and therefore it regulates its crop cycle to termination. Further in case of extreme water scarcity yield is declined severely while, early maturing accessions escaped moisture stress in rainfed conditions and thus increased the yield[14].

Character Association between grain yield and pre yield parameters

The pre yield parameters studied in this experiment includes productive tillers per plant, fingers per ear and finger length. These characters play an important role in contribution to yield. Genotypes possessing more productive tillers along with more number of fingers per ear and longer fingers showed higher yield. Productive tillers per plant exhibited phenotypic positive correlation with grain yield per plant (0.2448), fingers per ear (0.1453), fodder weight per plant (0.0730) and test weight (0.0583) and recorded negative correlation with flag leaf area (-0.1096) and finger length (-0.0882) (Table 01). The increase in productive tiller will give many fingers thus contributing to grain yield but tillers might have smaller flag leaf area and finger length thus negatively correlated to flag leaf area and finger length. In contrary to the present results, Anuradha *et al*.,[2] reported negative significant association of productive tillers per plant with number of fingers per ear was reported by and seed yield. Ulagnathan and Nirmalakumari[22] also negative finger length with positive significant grain yield and test weight in support of the present experiment. The character, fingers per ear exhibited significant phenotypic positive correlation with fodder weight per plant

(0.3781**) grain yield per plant (0.2855*) and exhibited non significant positive association with finger length (0.1171). Fingers per ear correlated negatively with test weight (-0.3608*) and flag leaf area (-0.2873*). Similar results were also reported by Lule *et al*.,[18] for grain yield per plant and test weight and for grain yield per plant and finger length[11]. With the increase in finger per ear, the grain yield increase due to more grains per ear but due to negative flag leaf area association, the grain mass might be reduced contributing possibly to negative association with test weight[6]. Finger length exhibited positive non significant correlation with fodder weight per plant (0.0871) and flag leaf area (0.0445), while correlated negatively with grain yield per plant (-0.0022) and test weight (-0.1306). Similar results were reported by Wolie and Dessalgn[23] for test weight and Dhamdheere *et al*.,[8] with flag leaf area and test weight. In any crop species, the leaves and other green tissues are the original source of assimilates. The flag leaf is considered to be the inter determinant with higher photosynthetic capacity hence, forms the closest source of grain yield. The character may be influenced by agro climatic conditions, nutritional stress and due to genetic affect[17, 19].

Character Association among yield parameters

The yield parameters undertaken were grain yield, fodder yield and test weight. The genotypes with greater grain and fodder yield per plant along with higher test weight are selected directly due to high heritability and genetic advance. Fodder yield per plant exhibited significant positive correlation with grain yield per plant (0.3191*), non significant positive correlation with test weight (0.0432) and showed negative correlation with flag leaf area (-0.0608) (Table 01). High and significant positive correlation with grain yield per plant in two environments as well as in pooled observations. Flag leaf area recorded non significant positive association with test weight (0.1244) and showed negative association with grain yield per plant (-0.1751) (Table 4.3). In contrary, flag leaf area showed positive association with grain yield per plant as reported by Dhamdheere *et al*.,[8]. As per traditional theory, flag leaf contribute maximum in photosynthesis and thereby more contribution of assimilates partitioning as compared to other leaves or green organ. However when genotypes are of same growth habit and environment conditions are favorable, the role of flag leaf becomes non recognizable[17]. Further, favourable environmental conditions also hide preferred expression of this critical leaf function, as expected under stress conditions.

In persistence with perception and previous reportings, test weight exhibited positive association with grain yield[3,11,22]. However when the higher test weight decreases the total number of grain or finger length, the yield association goes negative[4]. The results of correlation analysis indicated that yield had positive correlation with fingers per ear productive tillers per plant, finger length, fodder yield per plant, test weight; days to 50% flowering and days to maturity. Hence, these characters could be considered as criteria for selection for higher yield as these were associated with grain yield. While the characters such as flag leaf area and finger length had negative correlation with grain yield per plant therefore balance among these characters should be considered along with the other characters[8,19]. Grain yield is the end expression of genotype with respect to economic dry matter production which is a unique feature of genotype to produce some secondary genetic productivity factors (SPGFs) or component traits. Moreover genotype may have optimum SPFs but may not yield higher because of micro and macro environmental contributions and validate role of genetics and environment in determination of yield pathway[16].

Table 1: Phenotypic and genotypic correlation coefficient of 10 characters in finger millet

Character		Days to 50% Flowering	Days to Maturity	Plant Height (cm)	Productive Tillers/ Plant	Finger/ Ear	Finger Length (cm)	Fodder Weight/ Plant	Flag Leaf Area	100 Seed Weight	grain yield/ plant
Days to 50% Flowering	**P**	**1.0000**	0.9700***	0.2772	0.1536	0.4290**	0.2932*	0.2342	-0.2136	-0.0452	**0.1439**
	G	**1.0000**	0.9858	0.4480	0.1960	0.5240	0.3112	0.2490	-0.2699	-0.0576	**0.1908**
Days to Maturity	P		**1.0000**	0.2608	0.1603	0.4617***	0.2676	0.3152*	-0.2312	-0.0408	**0.1155**
	G		**1.0000**	0.3586	0.1993	0.5757	0.2700	0.3350	-0.2640	-0.0609	**0.1203**
Plant Height (cm)	P			**1.0000**	0.0377	0.2684	0.5879***	-0.0788	-0.1099	-0.0342	**0.2531**
	G			**1.0000**	0.0453	0.5349	0.8424	-0.0663	-0.0603	-0.1382	**0.0981**
Productive Tillers/ Plant	P				**1.0000**	0.1453	-0.0882	0.0730	-0.1096	0.0583	**0.2448**
	G				**1.0000**	0.2937	-0.1945	-0.0251	-0.0001	-0.0930	**0.2984**
Finger/ Ear	P					**1.0000**	0.1171	0.3781**	-0.2873*	-0.3608*	**0.2855***
	G					**1.0000**	0.1301	0.4602	-0.5572	-0.4110	**0.5360**
Finger Length (cm)	P						**1.0000**	0.0871	0.0445	-0.1306	**-0.0022**
	G						**1.0000**	0.0822	0.0637	-0.1678	**-0.0798**
Fodder Weight/ Plant	P							**1.0000**	-0.0608	0.0432	**0.3191***
	G							**1.0000**	-0.1316	0.0685	**0.3834**
Flag Leaf Area	P								**1.0000**	0.1244	**-0.1751**
	G								**1.0000**	0.1881	**-0.1090**
100 Seed Weight	P									**1.0000**	**0.0117**
	G									**1.0000**	**0.0021**
Grain Yield/ Plant	**P**										**1.0000**
	G										**1.0000**

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