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STUDIES ON GENETIC VARIABILITY AND INTER-RELATIONSHIP BETWEEN GRAIN YIELD AND ITS COMPONENTS IN FOXTAIL MILLET (*SETARIA ITALICA*)

JYOTHSNA S., PATRO T.S.S.K.*, SANDHYA RANI Y., ASHOK S., NEERAJA B. AND TRIVENI U.

A.N.G.R Agricultural University, Agricultural Research Station, Vizianagaram – 535 001, A.P.
*Corresponding Author: Email-ars.vzm@gmail.com

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Abstract- An investigation was carried out to assess the genetic parameters like variability, heritability and genetic advance, character association and path analysis for five yield component characters *viz.,* plant height, number of productive tillers per plant, days to 50% flowering, days to maturity and grain yield per plot in 23 genotypes of Foxtail millet (*Setaria italica*). The genotypic coefficients of variation for all the characters studied were lesser than the phenotypic coefficients of variation indicating the interaction of genotypes with environment. High heritability coupled with high genetic advance was observed for grain yield per plot indicating the importance of additive gene action in governing the inheritance of these traits. Hence, simple selection is effective to improve the respected trait. Association studies revealed that, four out of five characters exhibited highly significant positive correlation with grain yield per plot both at phenotypic and genotypic levels. However, the traits plant height, number of productive tillers per plant, days to 50% flowering and days to maturity were found to possess significant association in desirable direction with grain yield per plot at both genotypic and phenotypic levels. Path analysis studies revealed that plant height, number of productive tillers per plant showed true relationship by establishing significant positive association and direct effect on grain yield per plant both at genotypic and phenotypic levels and days to maturity at phenotypic level.

Keywords- Genetic variability, Heritability, Genetic advance, Character association, Path analysis, Foxtail millet, direct and indirect effects.

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Introduction

Foxtail millet *(Setaria italica*) is the second-most widely planted species of millet and the most important in East Asia. Foxtail millet is high in carbohydrates, which serves as an excellent source of energy. It is a food rich in dietary fibre and minerals such as copper and iron. Knowledge on heritability and genetic advance of the character indicate the scope for the improvement of a trait through selection. Heritability estimates along with genetic advance are also helpful in predicting the gain under selection [5].Grain yield being a complex character is very difficult to improve by selecting the genotypes for yield *per se*, therefore identifying the characters which are closely related and have contributed to yield becomes highly essential. The estimates of correlation coefficients mostly indicate the inter-relationships of the characters whereas path analysis permits the understanding of the cause and effect of related characters [10]. The path analysis reveals whether the association of characters with yield is due to their direct effect on yield or is a consequence of their indirect effects via other component characters. Therefore, the present study was conducted in foxtail millet to study the genetic parameters like variability, heritability and genetic advance, correlation and path coefficient effects of different yield components on grain yield.

MaterialsandMethods

The field experiment was conducted at Agricultural Research Station, Vizianagaram during *Kharif* 2014. The design adopted was Randomised Block Design with three replications. Each plot consisted of ten rows of 3 m length with a spacing of 22.5 x 10 cm. The fertilizer dose of 60:40:30 kg NPK/ha (50% N in + Full P & K at the time of sowing) was applied at the time of sowing seed and seeds were sown by hand dibbling. The remaining 50% N was applied after three weeks of sowing. Standard pest management measures were taken during the crop growth period as and when required. Observations were recorded on five plants for five yield component characters *viz.,* plant height, number of productive tillers per plant, days to 50% flowering, days to maturity and grain yield per plot. The data was subjected to statistical analysis and estimates of correlation coefficients were worked out [8], direct and indirect effects of yield components on yield were calculated as suggested by [3].

Results and Discussion

The analysis of variance revealed significant difference among the genotypes for all the five characters studied [Table-1]. In the present study, the variation among genotypes was estimated as coefficient of variation and the phenotypic coefficient of variance (PCV) was slightly higher in magnitude than genotypic coefficient of variance (GCV) for all the characters studied indicating the interaction of genotypes with environment [Table-2]. High PCV and GCV were recorded for number of productive tillers per plant and grain yield per plot, indicating sufficient variation among the genotypes studied. Heritability is a measure of genetic relationship between parents and progeny. In the present study, heritability estimates were high for days to 50% flowering (94.70%), days to maturity (94.10%) and grain yield per plot (71.30%). High heritability alone is not sufficient enough to exercise selection unless the information is accompanied with substantial amount of genetic advance. Thus, genetic advance is another important selection parameter, which is exploited along with heritability to predict the genetic advance of the trait. High heritability coupled with high genetic advance was observed for number of productive tillers and grain yield per plot indicating the importance of additive gene action in governing the inheritance of these traits. These results were in accordance with findings [2,4,6,9]

Genotypic correlations were higher than the corresponding phenotypic correlations, low phenotypic correlations can be explained due to masking or

modifying effects of environment on genetic association between characters. Plant height, number of productive tillers per plant, days to 50% flowering and days to maturity were found to possess significant association in desirable direction with grain yield per plot at both genotypic and phenotypic levels [Table-3]. These results were in accordance with the findings of [1,2,4,6,7]. This suggests selecting for the characters with high positive correlation would improve the grain yield in foxtail millet.

Path analysis revealed that plant height, number of productive tillers per plant and days to maturity were showed true relationship by establishing significant positive association and positive direct effect on grain yield per plot [Fig-1,2] [Table-4]. These results were in accordance with findings [1,2,4,6,7]. Considering the nature and magnitude of character association and their direct and indirect effects, it can be inferred that improvement of grain yield per plot is possible through simultaneous manifestation of number of productive tillers per plant and days to 50% flowering and days to maturity.

Table-1 *Analysis of variance (mean sum of squares) for yield and yield component characters in Foxtail Millet (Setariaitalica).*

Source of variations	d.f.	Plant height	Number of productive tillers per plant	Days to 50% flowering	Days to maturity	Grain yield
Replications	2	260.299	0.296	1.087	1.348	1.377
Genotypes	22	416.203**	0.670**	49.521**	71.291**	1.872**
Error	44	95.468	0.194	0.905	1.469	0.221

**Significant at 1% level.

Table-2 *Estimates of variability, heritability and genetic advance as per cent of mean for grain yield and yield components in Foxtail Millet (Setariaitalica).*

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	Plant height	144.881	112.800	160.600	9.819	7.137	52.80	10.686
2.	Number of productive tillers per plant	1.785	1.000	2.467	33.258	22.319	45.00	30.856
3.	Days to 50% flowering	42.913	34.000	48.333	9.639	9.381	94.70	18.806
4.	Days to maturity	71.783	58.333	77.667	6.930	6.721	94.10	13.427
5.	Grain yield	2.609	0.667	3.910	33.665	28.436	71.30	49.480

Table-3 *Phenotypic and genotypic correlation coefficient in 23 genotypes of Foxtail millet (Setariaitalica).*

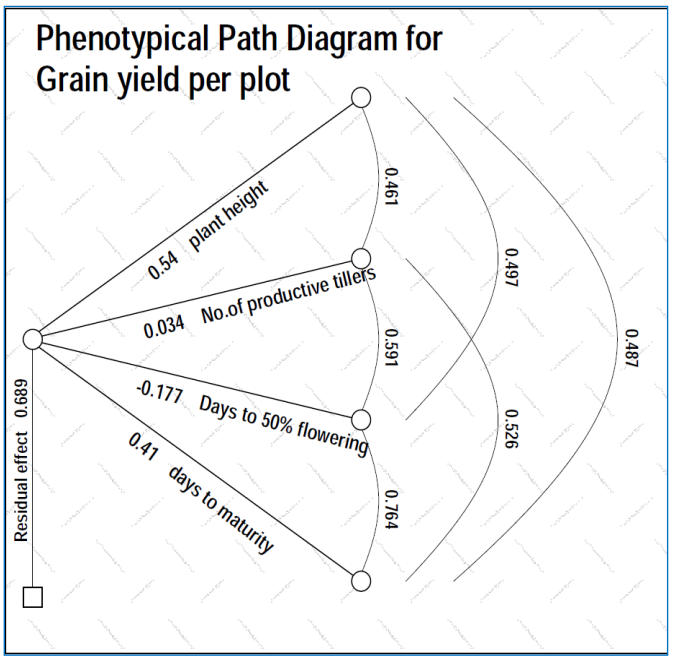
S. No	Characters		Plant height	Number of productive tillers per plant	Days to 50% flowering	Days to maturity	Grain yield
1.	Plant height	r_p	1	0.461**	0.497**	0.487**	0.667**
		r_g	1	0.693**	0.743**	0.735**	0.837**
2.	Number of productive tillers	r_p		1	0.591**	0.526**	0.393**
		r_g		1	0.830**	0.876**	0.763**
3.	Days to 50% flowering	r_p			1	0.765**	0.424**
		r_g			1	0.797**	0.588**
4.	Days to maturity	r_p				1	0.555**
		r_g				1	0.694**
5.	Grain yield	r_p					1
		r_g					1

r_p = Phenotypic correlation coefficient. *Significant at 5% level
r_g = Genotypic correlation coefficient. **Significant at 1% level

Table-4 *Path coefficients of yield and yield components of Foxtail millet (Setariaitalica)*

S. No	Characters		Plant height	Number of productive tillers per plant	Days to 50% flowering	Days to maturity	Grain yield
1.	Plant height	P	0.539	0.249	0.268	0.263	0.667**
		G	0.811	0.562	0.602	0.596	0.837**
2.	Number of productive tillers	P	0.016	0.034	0.020	0.018	0.393**
		G	0.557	0.809	0.667	0.704	0.763**
3.	Days to 50% flowering	P	-0.088	-0.105	-0.177	-0.136	0.424**
		G	-0.405	-0.452	-0.544	-0.434	0.588**
4.	Days to maturity	P	0.199	0.215	0.313	0.409	0.555**
		G	-0.126	-0.151	-0.137	-0.172	0.694**

Bold are direct effects P: Phenotypic path coefficient
Residual effects (P): 0.689 G: Genotypic path coefficient (G): 0.385



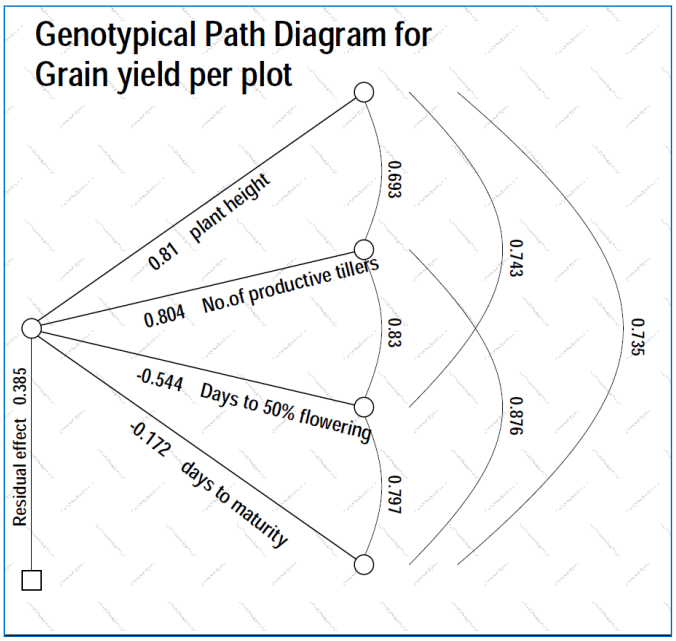


Fig-1&2 Phenotypic and genotypic path diagrams showing cause-effect relationship of yield components with grain yield per plot of Barnyard millet

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Conflict of Interest: None declared

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