International Journal of Theoretical & Applied Sciences, 8(1): 31-36(2016)

ISSN No. (Print): 0975-1718
ISSN No. (Online): 2249-3247

Character Association and Path analysis of Seed Yield and its Yield Components in Green gram (*Vigna radiata*)

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(Received 19 November, 2015 accepted 29 January, 2016)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: An experiment was carried out to estimate the genetic parameters like variability, heritability and genetic advance, character association and path analysis for seven quantitative characters *viz.*, days to 50% flowering, plant height, number of branches per plant, number of pods per plant, number of seeds per pod, length of the pod and seed yield in 14 genotypes of green gram (*Vigna radiata*). 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 number of pods per plant 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, number of pods per plant shows significant positive correlation with seed yield per plot at genotypic and phenotypic levels and number of seeds per pod shows significant positive correlation with seed yield per plot at genotypic level and plant height, number of seeds per plant and length of pod shows positive association with seed yield at phenotypic level. Path analysis studies revealed that number of pods per plant showed true relationship by establishing positive association and direct effect on seed yield both at genotypic and phenotypic levels and plant height and length of pod at phenotypic level and number of seeds per pod at genotypic level.

Key words: Genetic variability, Heritability, Genetic advance, Character association, Path analysis, Green gram, Direct and indirect effects.

I. INTRODUCTION

Green gram (*Vigna radiata*) is regarded as quality pulse due to its excellent digestibility and rich protein (25-28%), especially when combined with cereals (Thirumaran & Seralathan 1988) [4]. It is an important source of readily available proteins in cereal-based diet of the people of Pakistan, South Asia and Southeast Asian countries. It is also consumed as boiled dry beans. Moreover, it is regarded as fodder for livestock and also incorporated in soil for enriching organic matter. To improve such important pulse crop through breeding, study on genetic variability of important traits responsible for seed yield. 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 (Johnson *et al.*, 1955) [2]. Seed 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 (Wright, 1921) [5]. 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 Green gram to study the genetic parameters like variability, heritability & genetic advance, correlation and path coefficient effects of different yield components on seed yield.

II. MATERIAL AND METHODS

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 meters length with a spacing of 30 ×10 cm. The fertilizer dose of 25:50:25kg 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 six quantitative characters *viz*., plant height, number of branches per plant, number of pods per plant, number of seeds per pod, length of the pod and seed yield. The data was subjected to statistical analysis and estimates of correlation coefficients were worked out as per Snedecor and Cochran, (1967) [3], direct and indirect effects of yield components on yield were calculated as suggested by Dewey and Lu (1959) [1].

III. RESULTS AND DISCUSSION

The analysis of variance revealed significant difference among the genotypes for all the six characters studied (Table 1).

Table 1: Analysis of variance (mean sum of squares) for yield and yield component characters in Green gram (*Vigna radiata*).

Source of variations	d.f.	Days to 50% flowering	Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Length of pod	Seed yield
Replications	2	2.452	2.907	0.651	22.275	3.963	0.030	0.010
Genotypes	13	10.147	713.899	1.385	80.094	0.618	0.274	0.018
Error	26	0.504	14.279	0.728	8.325	0.634	0.095	0.004

**Significant at 1% level.

Table 2: Estimates of variability, heritability and genetic advance as per cent of mean for seed yield and yield components in Green gram (*Vigna radiata*).

S.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	Days to 50% flowering	33.952	29.333	36.000	5.679	5.280	86.50	10.114
2.	Plant height	104.919	82.133	132.733	14.994	14.555	94.20	29.106
3.	Number of branches per plant	8.400	6.733	9.200	11.586	5.568	23.10	5.512
4.	Number of pods per plant	15.476	11.400	27.267	36.694	31.604	74.20	56.074
5.	Number of seeds per pod	9.786	9.067	10.667	8.100	0.742	8.00	-0.140
6.	Length of pod	5.983	5.467	6.400	6.565	4.084	38.70	5.233
7.	Seed yield	0.416	0.259	0.556	23.281	16.183	48.30	23.173

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 seed yield 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 plant height (94.20%), days to 50% flowering (86.50%) and number of pods per plant (74.20%). 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 pods per plant and moderate heritability with moderate genetic advance shown by seed yield indicating the importance of additive gene action in governing the inheritance of these traits.

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. Length of the pod shows significant positive correlation with seed yield per plot at both genotypic and phenotypic levels and number of seeds per pod shows positive correlation with seed yield per plot at phenotypic level (Table 3). This suggests selecting for the characters with high positive correlation would improve the seed yield in green gram.

Table 3: Phenotypic and genotypic correlation coefficient in 14 genotypes of Green gram (*Vigna radiata*).

S. No	Characters		Days to 50% flowering	Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Length of pod	Seed yield
1.	Days to 50% flowering	r_p	1	-0.023	0.143	-0.032	-0.102	-0.042	-0.237
		r_g	1	-0.035	0.228	0.023	1.318**	-0.224	-0.570**
2.	Plant height	r_p		1	0.277	0.365**	-0.388**	-0.447**	-0.311**
		r_g		1	0.703	0.466**	4.173**	-0.803**	-0.508**
3.	Number of branches per plant	r_p			1	0.528**	-0.157	-0.238	-0.235
		r_g			1	0.592**	5.536**	-0.870*8	-0.891**
4.	Number of pods per plant	r_p				1	-0.087	-0.374**	-0.211
		r_g				1	3.161**	-0.737*8	-0.319**
5.	Number of seeds per pod	r_p					1	0.553**	0.166
		r_g					1	-2.103**	-4.286**
6.	Length of pod	r_p						1	0.183
		r_g						1	0.789**
7.	Seed 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 Green gram (*Vigna radiata*).

S. No	Characters		Days to 50% flowering	Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Length of pod	Seed yield
1.	Days to 50% flowering	P	**-0.230**	**0.005**	-0.033	0.007	0.023	0.009	-0.237
		G	**-0.283**	**0.010**	-0.065	-0.065	-0.373	0.063	-0.570**
2.	Plant height	P	**0.006**	**-0.256**	-0.071	-0.094	0.099	0.114	-0.311**
		G	**-0.008**	**0.230**	0.162	0.107	0.960	-0.185	-0.508**
3.	Number of branches per plant	P	-0.012	-0.024	**-0.087**	-0.046	0.014	0.021	-0.235
		G	-0.218	-0.672	**-0.956**	-0.565	-5.287	0.831	-0.891**
4.	Number of pods per plant	P	0.003	-0.029	-0.041	**-0.078**	0.007	0.029	-0.211
		G	0.009	0.184	0.233	**0.394**	1.244	-0.290	-0.319**
5.	Number of seeds per pod	P	-0.003	-0.009	-0.004	-0.002	**0.025**	0.014	0.166
		G	0.019	0.063	0.083	0.048	**0.015**	-0.032	-4.286**
6.	Length of pod	P	0.000	0.002	0.001	0.002	-0.003	**-0.005**	0.183
		G	-0.090	-0.373	-0.349	-0.296	-0.845	**0.402**	0.789**

Bold are direct effects, P: Phenotypic path coefficient, Residual effects (P): 0.909G: Genotypic path coefficient, (G):0.228

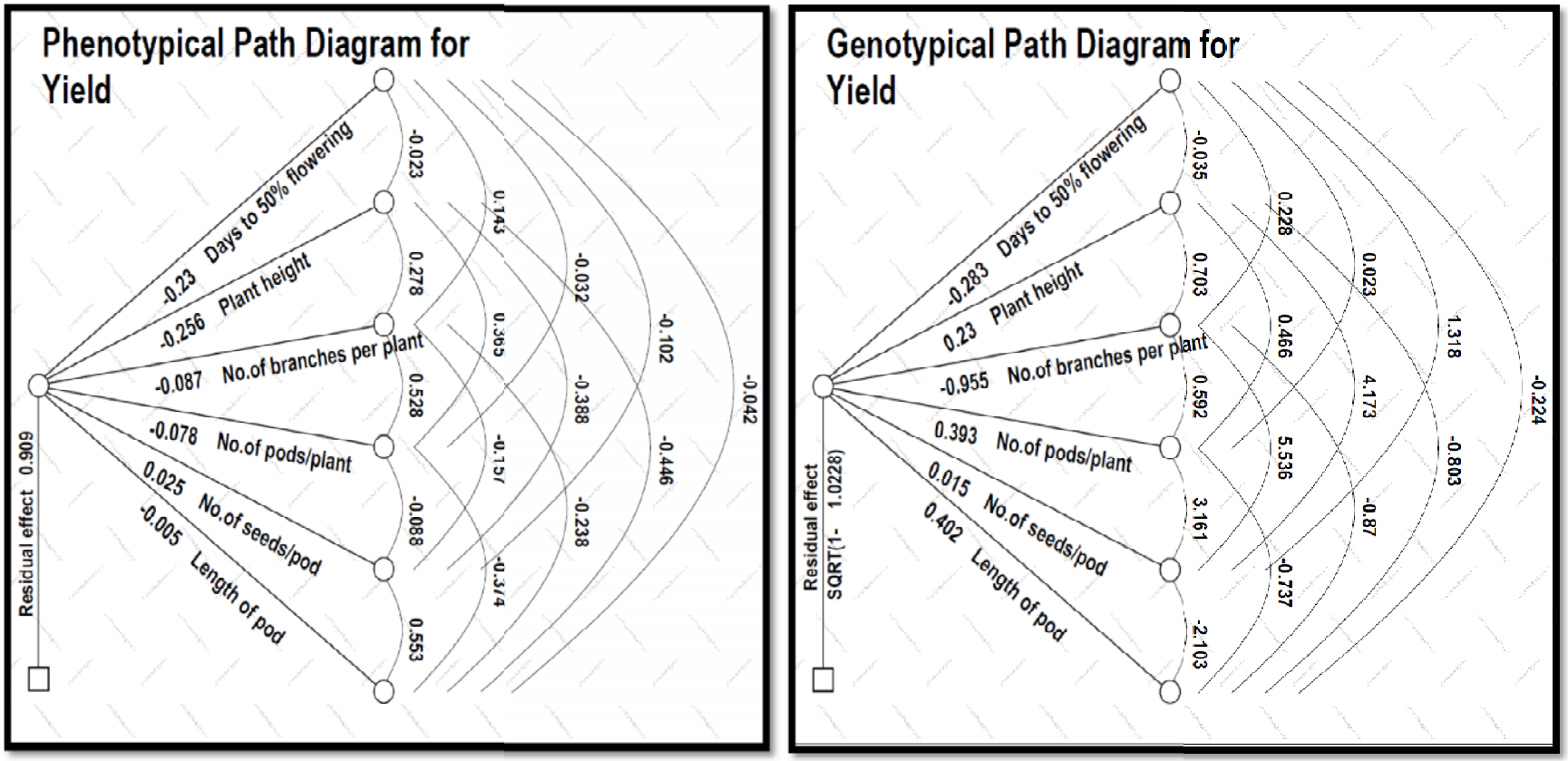

Fig. 1. Phenotypic and genotypic path diagrams showing cause-effect relationship of yield components with seed yield per plot of Green gram.

Path analysis revealed that number of seeds per podshowed true relationship by establishing positive association and direct effect on seed yield both at genotypic and phenotypic levels and plant height, number of pods per plant and length of pod at genotypic level (Table 4). Considering the nature and magnitude of character association and their direct and indirect effects, it can be inferred that improvement of seed yield is possible through simultaneous manifestation of number of seeds per pod, number of pods per plant, plant height, and length of pod.

ACKNOWLEDGEMENT

Necessary facilities provided by Agricultural Research Station, Vizianagaram are acknowledged. The work was carried out by utilizing the grants received from All India Coordinated Research Project on Small Millets, ICAR. GKVK Campus, Bengaluru.

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