



Character associations between seed yield and its components traits in cowpea [*Vigna unguiculata* (L.) Walp.]

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ABSTRACT

A field experiment was conducted during *kharif* season 2013 to estimate the correlations and path coefficients for ten quantitative characters among 72 cowpea germplasm. Seed yield per plant had positive significant correlation with days to 50% flowering, plant height, primary branches per plant, pods per plant, pod length, seeds per pod and 100-seed weight at both genotypic and phenotypic levels. Path coefficient analysis revealed that primary branches per plant and 100-seed weight had high direct positive effect on seed yield per plant at both genotypic and phenotypic levels. Pod length, days to maturity, 100 seed weight and pod wall proportion had high positive direct effects on seed yield per plant at only genotypic level. Correlation and path analysis indicated that for increasing seed yield in cowpea direct selection should be carried out for higher values of primary branches per plant, pods length, days to maturity and 100 seed weight.

Key words: Correlations, Cowpea, Path analysis.

INTRODUCTION

Cowpea is grown in India particularly for dry seed as pulse in the northern drier tracts while some forms of cowpea are also grown as fodder crops in the semi-arid western regions and in the humid tropic regions. Cowpea is by and large grown for vegetable purpose. Seed yield of cowpea is a complex trait, highly variable and is strongly associated with a number of component characters (Ullah *et al.*, 2011). The knowledge of character association *i.e.* genotypic and phenotypic correlation between yield and its component characters is essential for yield improvement through selection programme (Fraser and Eaton, 1983). Cause-effect analysis provides an effective means of partitioning the correlation coefficients into direct and indirect effects of the component characters on yield based on which crop improvement programme can be logically devised (Rao *et al.*, 1997). Therefore, an attempt was made to identify important component traits influencing seed yield of cowpea, moreover the analysis also revealed better genotypes that can be utilized as parents in hybridization programme for the improvement of seed yield in cowpea.

MATERIALS AND METHODS

The experimental materials consisted of 72 genotypes of cowpea received from AICRP on Arid Legume,

Jodhpur and Department of Plant Breeding and Genetics, S.K.N. College of Agriculture, Jobner, Rajasthan. These genotypes were evaluated in a randomized completely block design with three replications during *kharif* season 2013. Each genotype was grown in a single row plot of 4 m length. The row to row distance and plant to plant distance was kept at 30 cm and 10 cm, respectively. Observations were recorded from 10 randomly selected plants from each genotype in each replication for all the characters *viz.*, plant height, primary branches per plant, pods per plant, pod length, seeds per pod, 100-seed weight, pod wall proportion and seed yield per plant except days to 50% flowering and days to maturity which were recorded on plot basis.

Replication wise data for each character were subjected to analysis of variance. The genotypic and phenotypic correlation coefficients were calculated from the genotypic and phenotypic component of variances and covariance as described by Singh and Choudhary (1995) and as per formula given by Johnson *et al.*, (1955). The direct and indirect effects were calculated according to path analysis as suggested by Wright (1921) and elaborated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Phenotypic correlation is directly proportional to genotypic and environmental correlations. On the other hand, a positive genetic correlation between two desirable traits

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makes selection easy for improving both the traits simultaneously while the reverse is the case for negative correlation. In the present study, genotypic correlation coefficients were higher than corresponding phenotypic correlation coefficients, indicating greater contribution of genotypic factor in expression of these traits association.

Significantly positive phenotypic correlation were found for seeds per pod ($r_p = 0.39^{**}$), pod length ($r_p = 0.32^{**}$), plant height ($r_p = 0.29^{**}$), primary branches per plant ($r_p = 0.26^{**}$), 100-seed weight ($r_p = 0.23^{**}$), pods per plant ($r_p = 0.22^{**}$) and days to 50% flowering ($r_p = 0.15^*$) with seed yield per plant (Table 1).

Days to 50% flowering had significant positive correlation with days to maturity ($r_p = 0.65^{**}$), pod length ($r_p = 0.47^{**}$), seeds per pod ($r_p = 0.41^{**}$), primary branches per plant ($r_p = 0.28^{**}$) and 100-seed weight ($r_p = 0.27^{**}$) while, significant negative correlation with pods per plant ($r_p = -0.33^{**}$). Days to maturity had significant positive correlation with pod length ($r_p = 0.34^{**}$), seeds per pod ($r_p = 0.29^{**}$) and 100-seed weight ($r_p = 0.16^{**}$) while, significant negative correlation was observed with pods per plant ($r_p = -0.14^*$). Plant height had significant positive correlation with pod length ($r_p = 0.30^{**}$) and seeds per pod ($r_p = 0.27^{**}$). Primary branches per plant had significant positive correlation with pod length ($r_p = 0.19^{**}$) and seeds per pod ($r_p = 0.16^*$). Pods per plant had significant positive correlation with pod wall proportion ($r_p = 0.18^{**}$) while, significant negative correlation with 100-seed weight ($r_p = -0.28^{**}$), pod length ($r_p = -0.23^{**}$) and seeds per pod ($r_p = -0.21^{**}$). Pod length had significant positive correlation with seeds per pod ($r_p = 0.85^{**}$) and 100-seed weight ($r_p = 0.44^{**}$). Seeds per pod had significant

positive correlation with 100-seed weight ($r_p = 0.38^{**}$). 100-seed weight had significant negative correlation with pod wall proportion ($r_p = -0.26^{**}$) at phenotypic level (Table 1).

Significantly positive genotypic correlation were found for seeds per pod ($r_g = 0.46^{**}$), primary branches per plant ($r_g = 0.43^{**}$), pod length ($r_g = 0.39^{**}$), plant height ($r_g = 0.34^{**}$), 100-seed weight ($r_g = 0.27^{**}$), days to maturity ($r_g = 0.25^{**}$), days to 50% flowering ($r_g = 0.21^{**}$) and pods per plant ($r_g = 0.20^{**}$) with seed yield per plant (Table 1).

Days to 50% flowering had significant positive correlation with days to maturity ($r_g = 0.84^{**}$), pod length ($r_g = 0.73^{**}$), seeds per pod ($r_g = 0.64^{**}$), primary branches per plant ($r_g = 0.43^{**}$) and 100-seed weight ($r_g = 0.37^{**}$). Days to maturity had significant positive correlation with seeds per pod ($r_g = 0.59^{**}$), pod length ($r_g = 0.57^{**}$), primary branches per plant ($r_g = 0.21^{**}$) and 100-seed weight ($r_g = 0.20^{**}$). Plant height had significant positive correlation with pod length ($r_g = 0.34^{**}$), seeds per pod ($r_g = 0.31^{**}$) and primary branches per plant ($r_g = 0.14^*$). Primary branches per plant had significant positive correlation with pod length ($r_g = 0.28^{**}$), seeds per pod ($r_g = 0.24^{**}$) and 100-seed weight ($r_g = 0.16^*$). Pods per plant had significant positive correlation with pod wall proportion ($r_g = 0.28^{**}$). Pod length had significant positive correlation with seeds per pod ($r_g = 0.97^{**}$) and 100-seed weight ($r_g = 0.48^{**}$). Seeds per pod had significant positive correlation with 100-seed weight ($r_g = 0.43^{**}$). 100-seed weight had significant negative correlation with pod wall proportion ($r_g = -0.27^{**}$) at genotypic level (Table 1).

Significant and positive genotypic correlation coefficients are an indication that selection of genotypes

TABLE 1: Genotypic (r_g) and phenotypic (r_p) correlation coefficient between different characters in cowpea

Characters		Days to maturity	Plant height	Primary branches/plant	Pods plant	Pod length	Seeds/pod	100-seed weight	Pod wall proportion	Seed yield/plant
Days to 50% flowering	r_g	0.84**	0.12	0.43**	-0.45**	0.73**	0.64**	0.37**	0.00	0.21**
	r_p	0.67**	0.09	0.28**	-0.33**	0.47**	0.41**	0.27**	-0.01	0.15*
Days to maturity	r_g		0.06	0.21**	-0.27**	0.57**	0.59**	0.20**	-0.06	0.25**
	r_p		0.01	0.12	-0.14*	0.34**	0.29**	0.12	-0.03	0.12
Plant height	r_g			0.14*	0.12	0.34**	0.31**	0.08	0.09	0.34**
	r_p			0.10	0.09	0.30**	0.27**	0.08	0.08	0.29**
Primary branches/plant	r_g				-0.07	0.28**	0.24**	0.16*	-0.10	0.43**
	r_p				-0.02	0.19**	0.16*	0.10	-0.06	0.26**
Pods/plant	r_g					-0.35**	-0.32**	-0.39**	0.28**	0.20**
	r_p					-0.23**	-0.21**	-0.28**	0.18**	0.22**
Pod length	r_g						0.97**	0.48**	-0.02	0.39**
	r_p						0.85**	0.44**	-0.02	0.32**
Seeds/pod	r_g							0.43**	0.04	0.46**
	r_p							0.38**	0.02	0.39**
100-Seed weight	r_g								-0.27**	0.27**
	r_p								-0.26**	0.23**
Pod wall proportion	r_g									0.04
	r_p									-0.08

* Significant at the $p = 0.05$ and ** Highly Significant at the $p = 0.01$

TABLE 2: Genotypic (G) and phenotypic (P) path coefficients of various characters on seed yield per plant

Characters		Days to 50% flowering	Days to maturity	Plant height	Primary branches/plant	Pods/plant	Pod length	Seeds/pod	100-seed weight	Pod wall proportion	Correlation with seed yield/plant
Days to 50% flowering	G	-2.21	1.26	0.01	0.35	0.04	1.72	-1.07	0.11	0.00	0.21**
	P	0.03	0.02	0.02	0.05	-0.11	-0.06	0.17	0.04	0.00	0.15*
Days to maturity	G	-1.85	1.51	0.00	0.17	0.02	1.34	-0.98	0.06	-0.02	0.25**
	P	0.02	0.03	0.00	0.02	-0.05	-0.05	0.12	0.02	0.00	0.12
Plant height	G	-0.26	0.09	0.05	0.11	-0.01	0.81	-0.51	0.02	0.04	0.34**
	P	0.00	0.00	0.16	0.02	0.03	-0.04	0.11	0.01	-0.01	0.29**
Primary branches/plant	G	-0.96	0.31	0.01	0.80	0.01	0.66	-0.4	0.05	-0.04	0.43**
	P	0.01	0.00	0.02	0.18	-0.01	-0.03	0.07	0.02	0.01	0.26**
Pods/plant	G	1.06	-0.41	0.01	-0.06	-0.09	-0.84	0.54	-0.12	0.12	0.20**
	P	-0.01	0.00	0.01	0.00	0.35	0.03	-0.09	-0.04	-0.02	0.22**
Pod length	G	-1.61	0.85	0.02	0.22	0.03	2.36	-1.63	0.15	-0.01	0.39**
	P	0.01	0.01	0.05	0.03	-0.08	-0.13	0.36	0.07	0.00	0.32**
Seeds/pod	G	-1.41	0.88	0.02	0.19	0.03	2.29	-1.68	0.13	0.02	0.46**
	P	0.01	0.01	0.04	0.03	-0.07	-0.11	0.43	0.06	0.00	0.39**
100-seed weight	G	-0.82	0.30	0.00	0.13	0.03	1.14	-0.72	0.30	-0.11	0.27**
	P	0.01	0.00	0.01	0.02	-0.10	-0.06	0.16	0.16	0.03	0.23**
Pod wall proportion	G	0.01	-0.09	0.00	-0.08	-0.02	-0.05	-0.06	-0.08	0.41	0.04
	P	0.00	0.00	0.01	-0.01	0.06	0.00	0.01	-0.04	-0.12	-0.08

Diagonal figures represent direct effects

Genotypic and Phenotypic residual effect= 0.49, 0.66, respectively

* Significant at the p= 0.05 and ** Highly Significant at the p= 0.01

for future breeding programme should be fundamentally based on the superiority of the genotypes alongside with their phenotypic expression. This implies that seeds per pod, primary branch per plant and pod length should be given high priority during selection in cowpea. Similar finding are also reported by Venkatesen *et al.*, (2003), Patil *et al.*, (2004), Kumawat and Raje (2005) and Manggoel *et al.*, (2012).

The direct and indirect effects of different characters on seed yield per plant were worked out using path coefficient analysis. Among the different contributing characters high positive direct effects on seed yield per plant were exhibited by pod length (2.36), days to maturity (1.51), primary branches per plant (0.80) and pod wall proportion (0.41) at genotypic level (Table 2) and positive direct effects on seed yield per plant were exhibited by seeds per pod (0.43), pods per plant (0.35), primary branches per plant (0.18) and 100-seed weight (0.16), days to maturity (0.03) and days to 50% flowering (0.03) at phenotypic level (Table 2). These results were also supported by the findings of Kalaiyarasi and Papanisamy (2001), Vineeta *et al.*, (2003) and Anbumalarmathi *et al.*, (2005).

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Seed yield per plant had significant positive correlation with days to 50% flowering, plant height, primary branches per plant, pods per plant, pod length, seeds per pod and 100-seed weight at both genotypic and phenotypic level. Among these traits seeds per pod, primary branches per plant and pods length had very high correlation and were also showing high positive indirect effects on seed yield per plant. Hence, these traits can be used for effective selection as well as breeding of superior genotypes for enhancing seed yield in cowpea. Residual effect in path analysis was found to be 0.49 for genotypic level and 0.66 for phenotypic level showing that there is maximum effect of the traits studied on seed yield in cowpea

CONCLUSION

The present study illustrated the phenotypic and genotypic correlations showing positive correlation of seed yield with important agro-morphological characters. Hence, improving one or more of these traits could result in high seed yield for cowpea. Primary branches per plant, pod length, days to maturity, 100 seed weight and pod wall proportion had high positive genotypic direct effects and correlation with seed yield per plant suggesting the possibility of improving seed yield through direct selection of these traits.

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