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RESEARCH ARTICLE

Correlation and path analysis in vegetable cowpea (*Vigna unguiculata* L.)

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SUMMARY

The genotypic and phenotypic correlations of green pod yield with different components were estimated from 40 genotypes of vegetable cowpea. The genotypic and phenotypic correlations agreed closely with each other. Yield contributing character number of pods per plant had positive and highly significant association with green pod yield per plant at phenotypic level. Phenotypic interrelationship between days to 50 @ flowering and days to 1st pod picking was negatively significant with green pod yield. The genotypic and phenotypic path analysis revealed the high to moderate direct effect of green pod yield per plant with number of pods per plant and pod length. Therefore, number of pods per plant and pod length was important component for improving green pod yield in vegetable cowpea.

Key Words : Cowpea, Correlation, Path analysis

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Cowpea [*Vigna unguiculata* (L.) Walp.] is native of central Africa. It is grown as mainly as vegetable, for seed and to a lesser extent as a fodder crops. Cowpea contains 24 per cent protein, 60 per cent carbohydrate and 2 per cent fat besides being good sources of vitamins and phosphorus. Yield is a complex character which is influenced by a number of component traits. The knowledge of correlation helps in determining the relative importance of compound characters influencing yield, whereas the path analysis provides an effective means of partitioning direct or indirect causes of association, the present investigation was under taken to assess the importance of various component of green pod yield in vegetable cowpea.

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MATERIAL AND METHODS

Forty vegetable cowpea genotypes were selected for the present investigation. Randomized block design with three replications was used. The material was grown during summer season at Vegetable Research Station Junagadh, Agricultural University, Junagadh. A single row plot of 4.5 m length and plants were spaced at 60 x 30 cm, respectively. The recommended package of practices was followed for cultivation.

The main value of five plant of each genotypes selected at random were used for statistical analysis. The observations were recorded on 12 morphological characters *viz.*, days to 50 per cent flowering, days to first pod picking, number of primary branches per plant, plant height (cm), pod length (cm), pod width (cm), number of pods per plant, ten pod weight (g), number of fresh seeds per pod, 100 fresh seed weight (g), green pod yield per plant (g) and fresh pod crude protein content (%). The correlation co-efficient (Al-Jibouri *et al.*, 1958) and path co-efficient analysis (Dewey and Lu, 1959) were analysed.

RESULTS AND DISCUSSION

Correlation co-efficients at genotypic and phenotypic levels between paired characters, computed in all possible combinations are presented in Table 1. In general, genotypic correlations were greater than the phenotypic correlations, indicating the preponderance of genetic variance in expression of different characters. However, genotypic and phenotypic correlation agreed closely with each other. Positive and significant association of green pod yield per plant was observed with number of pods per plant and pod length. The present observations were in accordance with the finding of Sreekumar *et al.* (1996), Singh and Verma (1999) and Pal *et al.* (2004). However, days to 50% flowering and days to first pod picking exhibited a significant negative correlation with green pod yield per plants indicating early flowering which would help to minimize the crop duration and ultimately crop could be adjusted profitably in crop rotation. The results are in accordance with those of Singh *et al.* (1982).

Inter relationship between component traits exhibited that plant height and 100 fresh seeds weight were significant and negative relationship with green pod yield per plant.

Inter relationship between component traits exhibited that days to 50% flowering had significant and positive correlation with 100 fresh seed weight. While days to first pod picking was negatively correlated with number of pods per plant confirming result of Narayankutty *et al.* (2003). On the other hand, number of primary branches per plant had negative and significant correlation with pod width, 10 pod weight and 100 fresh seeds weight. The plant height had positive and significant correlation with pod width, 10 pods weight and 100 fresh seeds weight.

From the result number of pods per plant and pod length were the main characters through which improvement in green pod yield could be obtained.

Selection based only on correlation may be misleading because it measures only the mutual association between two variables, where the path co-efficient analysis specifies and measure the relative importance of different yield components. Hence, the phenotypic correlations were partitioned into direct and indirect effects to show the relative importance of yield

Table 1 : Genotypic (rg) and phenotypic (rp) correlation co-efficients among 12 characters of vegetable cowpea genotypes

Characters		Days to 50% flowering	Days to 1st pod picking (vegetable)	Number of primary branches per plant	Plant height (cm)	Pod length (cm)	Pod width (cm)	Number of pods per plant	10-pods weight (g)	Number of fresh seeds per pod	100-fresh seeds weight (g)	Fresh pod crude protein content (%)
Green pod yield per Plant (g)	rg	-0.482	-0.483	0.072	-0.382	0.376	0.088	0.668	0.001	0.086	-0.463	0.049
	rp	-0.445**	-0.384*	0.075	-0.333*	0.346*	0.043	0.677**	0.021	0.030	-0.390*	0.047
Days to 50% flowering	rg		1.009	-0.111	0.652	0.159	0.444	-0.772	0.664	0.206	0.773	-0.244
	rp		0.853**	-0.109	0.593**	0.114	0.349 *	-0.681**	0.605**	0.148	0.701**	-0.227
Days to 1st pod picking (vegetable)	rg			-0.177	0.630	0.068	0.483	-0.724	0.636	0.291	0.837	-0.220
	rp			-0.130	0.561**	0.083	0.359*	-0.573**	0.584**	0.210	0.720**	-0.196
Number of primary branches per plant	rg				-0.118	0.069	-0.460	0.085	-0.340	-0.157	-0.414	-0.220
	rp				-0.115	0.063	-0.369*	0.093	-0.322*	-0.128	-0.396*	-0.209
Plant height (cm)	rg					0.173	0.409	-0.703	0.486	0.272	0.678	-0.265
	rp					0.159	0.321*	-0.626**	0.466**	0.214	0.648**	-0.260
Pod length (cm)	rg						0.470	-0.275	0.621	0.007	-0.030	-0.017
	rp						0.386*	-0.224	0.579**	0.001	-0.011	-0.013
Pod width (cm)	rg							-0.368	0.763	0.340	0.623	-0.007
	rp							-0.276	0.629**	0.251	0.526**	0.005
No. of pods per plant	rg								-0.570	-0.063	-0.572	0.119
	rp								-0.493**	-0.050	-0.504**	0.110
10-pods weight (g)	rg									0.288	0.606	-0.039
	rp									0.241	0.571**	-0.038
No. of fresh seeds per pod	rg										0.278	-0.265
	rp										0.223	-0.259
100-fresh seeds weight (g)	rg											0.049
	rp											0.047

* and ** indicate significance of values at P=0.05 and 0.01, respectively for phenotypic (rp) correlation coefficient

Table 2 : Path co-efficient analysis showing direct (diagonal) and indirect (non-diagonal) effects of 11 characters on green pod yield in vegetable cowpea

Characters		Days to 50% flowering	Days to 1st pod Picking (vegetable)	Number of primary branches per plant	Plant height (cm)	Pod length (cm)	Pod width (cm)	Number of pods per plant	10-pods weight (g)	Number of fresh seeds per pod	100-fresh seeds weight (g)	Fresh pod crude protein content (%)	Genotypic and phenotypic correlation with green pod yield per plant
Days to 50% flowering	G	0.518	-0.276	0.002	0.185	0.035	0.140	-0.823	0.186	0.006	-0.477	0.021	-0.482
	P	0.007	-0.041	0.000	0.101	0.034	0.019	-0.604	0.205	0.002	-0.183	0.015	-0.445**
Days to 1st pod picking (vegetable)	G	0.523	-0.274	0.004	0.179	0.015	0.152	-0.772	0.179	0.009	-0.516	0.019	-0.483
	P	0.006	-0.048	0.000	0.096	0.025	0.019	-0.508	0.198	0.002	-0.188	0.013	-0.384*
No. of primary branches per plant	G	-0.057	0.049	-0.021	-0.033	0.015	-0.145	0.090	-0.096	-0.005	0.255	0.019	0.072
	P	-0.001	0.006	0.001	-0.020	0.019	-0.020	0.082	-0.109	-0.001	0.103	0.014	0.075
Plant height (cm)	G	0.338	-0.173	0.002	0.283	0.037	0.129	-0.479	0.137	0.008	-0.418	0.023	-0.382
	P	0.004	-0.027	0.000	0.171	0.084	0.017	-0.555	0.158	0.002	-0.169	0.017	-0.333*
Pod length (cm)	G	0.083	-0.018	-0.001	0.049	0.215	0.148	-0.294	0.175	0.000	0.018	0.001	0.376
	P	0.001	-0.004	0.000	0.027	0.300	0.021	-0.199	0.197	0.000	0.003	0.001	0.346*
Pod width (cm)	G	0.230	-0.132	0.009	0.116	0.101	0.315	-0.392	0.214	0.010	-0.384	0.001	0.088
	P	0.003	-0.017	0.000	0.055	0.116	0.053	-0.245	0.213	0.003	-0.137	0.000	0.043
No. of pods per plant	G	-0.400	0.198	-0.002	-0.199	-0.059	-0.116	1.066	-.0160	-0.002	0.353	-0.01	0.668**
	P	-0.005	0.027	0.000	-0.107	-0.067	-0.015	0.887	-0.168	-0.001	0.131	-0.007	0.677
10-pods weight (g)	G	0.344	-0.174	0.007	0.138	0.134	0.240	-0.607	0.281	0.009	-0.373	0.003	0.001
	P	0.004	-0.028	0.000	0.080	0.174	0.033	-0.438	0.339	0.003	-0.149	0.002	0.021
No. of fresh seeds per pod	G	0.107	-0.080	0.003	0.077	0.002	0.107	-0.068	0.081	0.030	-0.171	-0.002	0.086
	P	0.001	-0.010	0.000	0.037	0.000	0.013	-0.044	0.082	0.011	-0.058	-0.001	0.030
100-fresh seeds weight (g)	G	0.401	-0.229	0.009	0.192	-0.006	0.196	-0.610	0.170	0.008	-0.617	0.023	-0.463
	P	0.005	-0.034	-0.001	0.111	-0.003	0.028	-0.447	0.194	0.002	-0.261	0.017	-0.390*
Fresh pod crude protein content (%)	G	-0.126	0.060	0.005	-0.075	-0.004	-0.002	0.126	-0.011	0.001	0.163	-0.088	0.049
	P	-0.002	0.009	0.000	-0.044	-0.004	0.000	0.097	-0.013	0.000	0.067	-0.065	0.047

Residual effect: -R=0.2293 (Phenotypic path) R=-0.1225 (Genotypic path)
* and ** indicate significance of values at P=0.05 and 0.01, respectively N.B. G=Genotypic path and P = Phenotypic path
Diagonal values (Bold letters) indicate direct effects of respective character

component towards green pod yield per plant (Table 2). Among the eleven yield traits, number of pods per plant showed direct and positive effect on green pod yields per plant followed by pod width, plant height, 10 pod weight and pod length. The present finding of positive and high to moderate direct effect of number of pods per plant and pod length find support from Chattopadhyay *et al.* (1997). However, the negative and significant correlation between plant height and green pod yield per plant while correlation between pod width and green pod yield per plant as well as between 10 pods weight and green pod yield per plant were negligible.

From the foregoing study, it is evident that improvement in green pod yield in vegetable cowpea could be through selection of component charactering number of pods per plant and pod length. Thus, maximum augmentation of green pod yield per plant would be derived if plant architecture redesigned having higher number of pods per plant and pod length. Such plant must be early maturing to fit well in the intensive cropping pattern.

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