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Correlation Coefficient and Path Coefficient Analysis in Cowpea (*Vigna unguiculata* (L.) Walp.)

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ABSTRACT

Forty two genotypes of cowpea were evaluated in a Randomized Block Design with three replications to study association of component traits and path coefficient analysis. Correlation coefficient analysis revealed that comparatively higher degree of genotypic correlation coefficients than their phenotypic correlation coefficients in most of the characters. The characters like number of clusters per plant, number of pods per cluster, number of pods per plant and number of seeds per pod showed highly significant positive correlation with seed yield per plant. Negative significant correlation was observed by days to 50 per cent flowering and days to maturity towards seed yield per plant. Path coefficient studies revealed that very high positive direct effect on seed yield per plant was revealed by number of pods per plant at both genotypic and phenotypic levels. High positive direct effect was revealed by number of primary branches per plant and number of seeds per pod at genotypic level and by pod length at phenotypic level towards seed yield per plant. Number of primary branches per plant, number of clusters per plant, number of pods per cluster and number of seeds per pod positively and indirectly contributed via number of pods per plant at both genotypic and phenotypic levels towards seed yield per plant. Therefore, plant breeder should focus his attention on above said characters in cowpea improvement programme.

Keywords: *Cowpea, Correlation, Path analysis*

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) autogamous leguminous crop of India belongs to family leguminosae (Mackie and Smith, 1935) with a chromosome number of 2n= 2x= 22. It is an important versatile food crop. It is one of the most ancient crops known to man. It is native to India (Vavilov, 1949) but tropical and central Africa is also considered as secondary centre of origin where wild races are found (Ng & Marechal, 1985). It has multifarious uses like as fodder, cover crop and green manure and provides high quality protein in the form of vegetable and pulse to human diet.

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In different parts of the world, it is known as Lobia, Southern pea, Blackeye pea, Chawalie, Yardlong bean, Catjang, Crowder pea and Mulatto-Gelato. It is a drought tolerant crop and thrives in warm weather (21- 35ºC) and well adapted to the drier regions of the tropics, where other food legumes do not perform well.

Bestowed with series of merits, cowpea is also known for some biological bottle necks of poor productivity due to inefficient plant types with less and slow conversion of dry matters to grain. Therefore, there is an urgent need to develop high yielding varieties in cowpea. The knowledge of correlation helps in determining the relative importance of compound characters influencing yield. The path analysis provides an effective means of partitioning direct and indirect causes of association. Keeping this view in mind the present study was under taken to access the importance of various components of seed yield in cowpea.

MATERIALS AND METHODS

Forty two genotypes were selected to access correlation coefficient and path analysis in cowpea. Randomized block design with three replications was used. The material was grown during summer 2018 at Pulses Research Station, Junagadh Agricultural University, Junagadh. A single row of 4 m length and plants were spaced at 45 x 10 cm. The recommended package of practices was followed for cultivation. In each replication, observations were recorded on five randomly selected competitive plants and their mean values were used for statistical analysis. The observations were recorded on 11 morphological characters *viz.*, days to 50 per cent flowering, days to maturity, plant height (cm), number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length (cm), number of seeds per pod, 100-seed weight and seed yield per plant. Days to 50 per cent flowering and days to maturity were recorded on plot basis.

The phenotypic and genotypic correlation coefficients of all the characters were worked out as per Al-Jibouri et al. (1958). The path coefficient analysis was carried out as per the method suggested by Dewey and Lu (1959). Genotypic and phenotypic correlation coefficients of ten variables with seed yield per plant were used to estimate the path coefficients for the direct effects of various independent characters on seed yield per plant.

RESULTS AND DISCUSSION

Phenotypic and genotypic correlation coefficient

The result on phenotypic and genotypic correlation coefficient (Table 1) revealed that seed yield per plant was found to be significantly and positively correlated with number of primary branches per plant (r_g = 0.4585 and r_p = 0.3913), number of clusters per plant (r_g = 0.5910 and r_p = 0.5753), number of pods per cluster (r_g = 0.4811 and r_p = 0.4301), number of pods per plant (r_g = 0.7081 and r_p = 0.7152) and number of seeds per pod (r_g = 0.5011 and r_p = 0.5142). These findings were in accordance with Palve *et al.* (2018) and Walle *et al.* (2018). Whereas, seed yield per plant showed negative and significant correlation with developmental characters like days to 50 per cent flowering (r_g = -0.3898 and r_p = -0.3813) and days to maturity (r_g = -0.4378 and r_p = -0.4290) and similar findings were in agreement with Aliyu and Makinde (2016), Jogdhande et al. (2017a) and Walle et al. (2018).

Number of primary branches per plant (r_g = 0.7007 and r_p = 0.6001), number of clusters per plant (r_g = 0.8504 and r_p = 0.8308) and number of pods per cluster (r_g = 0.7686 and r_p = 0.6823) showed positive significant correlation with number of pods per plant at both phenotypic and genotypic levels. It also showed negative and significant correlation with developmental characters like days to 50 per cent flowering (r_g = -0.6044 and r_p = -0.5867) and days to maturity (r_g = -0.4289 and r_p = -0.4272).

The path coefficient (Table 2) revealed that very high direct effect was observed by number of pods per plant both at genotypic

(1.8367) and phenotypic (1.0595) level towards seed yield per plant. The present results were in accordance with the findings of Diwaker et al. (2018) and Palve et al. (2018). Whereas, 100-seed weight exhibited moderate and positive effects on seed yield per plant at phenotypic (0.2122) level and high at genotypic (0.4271) level. These findings were in accordance with the results of Jogdhande et al. (2017).

Several characters like number of primary branches per plant, number of clusters per plant, number of pods per cluster and number of seeds per pod also contributed indirectly via number of pods per plant on seed yield per plant. So these traits were also important. These results were in agreement with those of Baranda et al. (2018) and Lal et al. (2018).

From the result number of pods per plant and 100-seed weight were the main characters through which improvement in seed yield could be obtained.

The residual effect was also found to be moderate to high indicating apart from characters studied there were also other characters which contributed towards seed yield.

Table 1: Genotypic (r_g) and phenotypic (r_p) correlation coefficients among various characters of cowpea

Characters		Days to maturity	Plant height	Number of primary branches per plant	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length	Number of seeds per pod	100- seed weight	Seed yield per plant
Days to 50 per cent	r_g	0.8157	0.5151	-0.7237	-0.6399	-0.6131	-0.6044	0.3240	-0.2179	0.1543	-0.3898
flowering	r_p	0.7727**	0.4794******	-0.6099**	-0.6228**	-0.5353**	-0.5867**	0.3001	-0.2105	0.1449	-0.3813*
Days to maturity	r_g		0.4235**	-0.4752	-0.4815	-0.4488	-0.4289	0.1126	-0.4330	0.0181	-0.4378
	r_p		0.3713**	-0.3893*	-0.4634**	-0.4278**	-0.4272**	0.0857	-0.3801*	0.0126	-0.4290**
Plant height	r_g			-0.4201	-0.3892	-0.5670	-0.2417	0.2698	0.1645	-0.0873	-0.0090
	r_p			-0.3775*	-0.3711*	-0.4662**	-0.2127	0.2799	0.1697	-0.0796	0.0095
Number of primary	r_g				0.8590	0.4710	0.7007	-0.2360	0.2062	-0.3110	0.4585
branches per plant	r_p				0.7296**	0.3817*	0.6001**	-0.2025	0.1883	-0.2648	0.3913*
Number of clusters	r_g					0.6204	0.8504	-0.5257	0.3431	-0.3942	0.5910
per plant	r_p					0.5561**	0.8308**	-0.4918**	0.2983	-0.3856*	0.5753**
Number of pods	r_g						0.7686	-0.6510	0.1844	-0.3791	0.4811
per cluster	r_p						0.6823**	-0.5297**	0.1504	-0.3254*	0.4301**
Number of pods	r_g							-0.6465	0.2166	-0.5280	0.7081
per plant	r_p							-0.5892**	0.2637	-0.5103**	0.7152**
Pod length	r_g								0.3082	0.4498	-0.1317
	r_p								0.3038	0.4392**	-0.0954
Number of seeds	r_g									-0.1524	0.5011
per pod	r_p									-0.1210	0.5142**
100- seed weight	r_g										-0.1887
	r_p										-0.1762

*, ** Significant at 5% and 1% levels, respectively

Table 2: Phenotypic and genotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on seed yield per plant in 42 genotypes of cowpea

Characters		Days to 50 per cent flowering	Days to maturity	Plant height	Number of primary branches per plant	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length	Number of seeds per pod	100-seed weight	Genotypic and Phenotypic correlation with seed yield per plant
Days to 50 per cent flowering	**G**	**0.3542**	0.0048	-0.2253	-0.4888	0.9610	0.4378	-1.1100	-0.1732	-0.2162	0.0659	-0.3898
	P	**0.1811**	-0.1066	0.0462	0.0590	-0.0309	-0.0207	-0.6212	0.1066	-0.0251	0.0308	-0.3813*
Days to maturity	**G**	0.2889	**0.0059**	-0.1853	-0.3210	0.7231	0.3205	-0.7878	0.0602	-0.4297	0.0077	-0.4378
	P	0.1400	**-0.1379**	0.0358	0.0376	-0.0230	-0.0166	-0.4526	0.0304	-0.0454	0.0027	-0.4290**
Plant height	**G**	0.1825	0.0025	**-0.4375**	-0.2837	0.5845	0.4049	-0.4439	-0.1442	0.1632	-0.0373	-0.0090
	P	0.0868	-0.0512	**0.0964**	0.0365	-0.0184	-0.0181	-0.2254	0.0994	0.0203	0.0169	0.0095
Number of primary branches per plant	**G**	-0.2564	-0.0028	0.1838	**0.6754**	-1.2901	-0.3363	1.2870	0.1261	0.2047	-0.1328	0.4585
	P	-0.1105	0.0537	-0.0364	**-0.0967**	0.0362	0.0148	0.6358	-0.0719	0.0225	-0.0562	0.3913*
Number of clusters per plant	**G**	-0.2267	-0.0028	0.1703	0.5802	**-1.5018**	-0.4430	1.5619	0.2810	0.3404	-0.1683	0.5910
	P	-0.1128	0.0639	-0.0358	-0.0705	**0.0496**	0.0215	0.8803	-0.1747	0.0356	-0.0818	0.5753**
Number of pods per cluster	**G**	-0.2141	-0.0027	0.2480	0.3181	-0.9318	**-0.7141**	1.4116	0.3480	0.1830	-0.1619	0.4811
	P	-0.0970	0.0590	-0.0450	-0.0369	0.0276	**0.0387**	0.7229	-0.1881	0.0180	-0.0691	0.4301**
Number of pods per plant	**G**	-0.2141	-0.0025	0.1057	0.4732	-1.2772	-0.5488	**1.8367**	0.3456	0.2150	-0.2255	0.7081
	P	-0.1063	0.0589	-0.0205	-0.0580	0.0412	0.0264	**1.0595**	-0.2093	0.0315	-0.1083	0.7152**
Pod length	**G**	0.1148	0.0007	-0.1180	-0.1594	0.7895	0.4649	-1.1875	**-0.5345**	0.3058	0.1921	-0.1317
	P	0.0544	-0.0118	0.0270	0.0196	-0.0244	-0.0205	-0.6243	**0.3552**	0.0363	0.0932	-0.0954
Number of seeds per pod	**G**	-0.0772	-0.0026	-0.0720	0.1393	-0.5152	-0.1317	0.3978	-0.1647	**0.9923**	-0.0651	0.5011
	P	-0.0381	0.0524	0.0164	-0.0182	0.0148	0.0058	0.2794	0.1079	**0.1195**	-0.0257	0.5142**
100-seed weight	**G**	0.0547	0.0001	0.0382	-0.2100	0.5920	0.2707	-0.9698	-0.2404	-0.1512	**0.4271**	-0.1887
	P	0.0263	-0.0017	-0.0077	0.0256	-0.0191	-0.0126	-0.5407	0.1560	-0.0145	**0.2122**	-0.1762

*, ** Significant at 5 and 1 % levels, respectively

Residual effect: R= 0.5203 (Genotypic), R= 0.5037 (Phenotypic)

CONCLUSION

Study of character association and path analysis indicated that the number of pods per plant was the most important yield contributing character. Number of primary branches per plant, number of clusters per plant, number of pods per cluster and number of seeds per pod traits were of secondary important yield components. Therefore, plant breeder should focus his attention on above said characters in cowpea improvement programme.

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