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Correlation Coefficient and Path Analysis 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 2015 to estimate the correlations and path coefficients for ten quantitative characters among 30 cowpea germplasm. Number of pods per plant, number of flowers per plant, test weight, number of clusters per plant, harvest index and number of primary branches per plant due to their direct high positive association with seed yield. The trait days to maturity had negative and non-significant correlation with seed yield per plant. Path analysis revealed that, seed yield per plant can be improved practicing selection for harvest index, number of pods per plant, number of primary branches per plant, test weight and plant height as they contributed directly to the seed yield per plant as revealed from path analysis. It indicated the possibilities of simultaneous improvement of these traits by selection. This in turn, will improve the seed yield, since they are positively correlated with the seed yield.

Key words: *Cowpea, Kharif, Yield, Germplasm*

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp.) is widely grown for pulse, vegetable, green manure and fodder in many parts of the world. In India, cowpea is grown in almost all the regions except high altitude in hilly areas. The *V. unguiculata*ssp. *Unguiculata* and *V. Unguiculata*ssp. *biflora*types are predominantly cultivated for pulse purpose. However, *V. Unguiculata* ssp. *Sesquipedalis* (yard long bean) is grown on a small scale for green vegetable purpose in scattered regions particularly in India and South East Asia[20]. Cowpea (*Vigna unguiculata* L.) is comparatively a cheap source of quality protein, phosphorus, iron, vitamins and excellent substitute for meat, egg, and other protein-rich foods[1]. It is highly nutritious and provides superior and cheap source of protein for the resource-poor farmers in sub-Saharan Africa[1].Yield is the major breeding objective of any crop improvement programme. It represents the final product from physiological and developmental processes which occur from time of sowing to plant maturity[18]. From the crop production view point, yield is the sum total of all production efforts on the farm.

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It is always measured in terms of the quantity of desired crop part per unit area of land and it can be partitioned into several components that constitute physiological determinants of yield. Although yield is the universal breeding objective, cultivars gain acceptability as a package of various multiple traits. This is because a cultivar is more or less a complex biological system rather than simple collection of independent traits, and an effective breeding programme requires a proper understanding of the essential components of the system and the interrelationship among them. Knowledge of correlation between yield and its contributing characters are basic and for most endeavor to find out guide lines for plant selection. Partitioning of total correlation into direct and indirect effect by path coefficient analysis helps in making the selection more effective. 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.

MATERIAL AND METHODS

The present investigation was carried outduring Kharif 2015-16at the Research Farm of Plant Breeding and Genetics, Rajasthan college of Agriculture, MPUAT, Udaipur. This experiment material comprised of thirty diverse genotypes including three checks *viz.*,RC-101, RC-19 and RCV-7 of cowpea. The experimental material of cowpea were sown in randomized block design in three replications. Two rows of each genotype were sown in a plot of 4 m length. The row to row and plant to plant distance were kept at 30 cm and 10 cm, respectively. All the recommended package of practices were be followed to raise a healthy crop.

The observations were recorded for 10 characters *viz*, Days to 50% flowering, Number of flowers per plant, Days to maturity, Plant height, Number of primary branches per plant, Number of pods per plant, Number of clusters per plant, Test weight, Seed yield per plant and Harvest index on five randomly selected plants from each genotypes in all the replications while days to 50% flowering and days to maturity which were recorded on plot basis. The phenotypic and genotypic correlation coefficients of all the characters were worked out as per the procedure suggested by Fisher[9] and Al-Jibouri *et al.*[2], and the path coefficient analysis was carried out as per the method suggested by Dewey and Lu[5] at both phenotypic and genotypic level.

RESULTS AND DISCUSSION

Estimates of correlation coefficient at phenotypic and genotypic level are given in Table 1. Seed yield per plant exhibited significant positive correlation with number of pods per plant(0.448**),number of flowers per plant (0.425**), test weight (0.464**),number of primary branches per plant (0.340**),number of clusters per plant (0.331**) and harvest index (0.230*) respectively at genotypic level. Number of pods per plant (0.403**), test weight (0.451**), number of flowers per plant (0.387**), number of primary branches per plant (0.318**), harvest index (0.282**)and number of clusters per plant (0.266**) showed positive highly significant correlation with seed yield per plant, respectively at phenotypic level. The present findings are in accordance with the findings of Leelijiet *al.*[14], Padi*et al.*[19], Fana*et al.*[7], Kaveris*et al.*[11], and Manggoel*et al.*[15].

Number of flowers per plant exhibited highly significant and positive correlation with number of pods per plant (r_g 0.944** andr_p 0.855**), number of clusters per plant (r_g 0.823** andr_p 0.689**). However, it was also exhibited highly significant negative correlation with days to 50% flowering (r_g-0.355** and r_p-0.279**). The present findings are in accordance with the findings of Veeraswamy *et al.*[26], and Vange *et al.*[25]. Harvest index also showed highly significant and negative correlation with number of primary branches per plant (r_g -0.235* andr_p -0.229*) and days to maturity also showed significant and negative correlation with harvest index (r_g -0.227*). The present results are also find out by Fikru *et al.*[8], and Kaveris *et al.*[11]. Test weight exhibited significant and positive correlation with number of primary branches per plant (r_g 0.302** andr_p 0.298**), days to maturity (r_g 0.209**) by[7,8,11].Number of clusters per plant exhibited highly significant and positive correlation with number of pods per plant (r_g0.928** and r_p0.789**). However, it was also exhibited highly significant negative correlation with days to 50% flowering (r_g-0.370** and r_p-0.210*) and days to maturity (r_g-0.357** and r_p-0.277**). The present results are also finding out by Kumar *et al.*[12], and Nakawuka *et al.*[17], and Diriba Shanko *et al.*, Pods per plant was exhibited highly significant and negative correlation with days to 50% flowering (r_g -0.294** and r_p -0.243*), days to maturity (r_g-0.213*) by[27].Number of primary branches per plant exhibited highly significant and positive correlation with plant height (r_g0.437** and r_p0.428**), days to maturity (r_g0.268* and r_p0.253*). The present findings are in accordance with the findings of Leleji[14] and Kumar *et al.*[12]. Days to maturity exhibited highly significant positive correlation with days to 50% flowering (r_g0.778** and r_p0.567**). The present findings are in accordance with the findings of Nakawuka *et al.*[17]. It can be concluded from these experiment findings that main yield contributing traits are number of pods per plant, number of flowers per plant, test weight, number of clusters per plant, harvest index and number of primary branches per plant due to their direct high positive association with seed yield. It indicated the possibilities of simultaneous improvement of these traits by selection. This in turn, will improve the seed yield, since they are positively correlated with the seed yield.

The direct and indirect effects of ten dependent characters on seed yield per plant as independent character was obtained in path coefficient analysis using genotypic correlation coefficient are presented in Table 2. The highest positive direct effect on seed yield per plant was exhibited by pods per plant (3.927) followed by primary branches per plant (0.745), test weight (0.133), whereas plant height (-0.296), days to maturity (-0.835), number of flowers of plant (-1.543), number of clusters per plant (-2.269) were contributed negative direct effect on seed yield. The present findings are also with the similar trends of result reported by Singh *et al.*[22], Kutty *et al.*[13], and Diriba Shanko *et al.*, Number of flowers per plant (3.707) followed by number of clusters per plant (3.644) and harvest index (0.424) exhibited considerable positive indirect effect on seed yield per plant via number of pods per plant. Such similar results were also reported by Uguru[24], and Nakawuka and Adipala[17]. Days to 50% flowering (0.840) followed by days to maturity (0.810) and plant height (0.467) exhibited considerable positive indirect effect on seed yield per plant via number of clusters per plant by[23,21,3]. Days to 50% flowering (0.548) followed by days to maturity (0.316) and plant height (0.177) exhibited considerable positive indirect effect on seed yield per plant via number of flowers per plant by[10,4]. Plant height (0.326) followed by test weight (0.225) and days to maturity (0.200) exhibited considerable positive indirect effect on seed yield per plant via number of primary branches per plant by[23,3,16]. Number of clusters per plant (0.298) followed by harvest index (0.190) and number of pods per plant (0.178) exhibited considerable positive indirect effect on seed yield per plant via days to maturity by by[24,13]. Number of primary branches per plant (0.166) followed by days to maturity (0.115) exhibited considerable positive indirect effect on seed yield per plant via test weight by[10,4]. The component of residual effect of path analysis was 0.421 low residual effect indicated that character for path analysis were adequate and appropriate.

The direct and indirect effect of ten dependent characters on seed yield per plant as independent character was obtained in path coefficient analysis using phenotypic correlation coefficient are presented in Table 2. Path coefficient analysis revealed that the maximum positive direct effect was observed for pods per plant (0.472) followed by test weight (0.397), harvest index (0.287), number of primary branches per plant (0.233), number of flowers per plant (0.095) plant height (0.091) on seed yield per plant by[22,13].

Number of flowers per plant (0.404) followed by number of clusters per plant (0.373) had considerable positive indirect effect on seed yield per plant via number of pods per plant by[23,21,3].Number of primary branches per plant (0.118) followed by days to maturity (0.078) and plant height (0.062) had considerable positive indirect effect on seed yield per plant via test weight by[10,4].Number of pods per plant (0.082) followed by number of clusters per plant (0.066) had considerable positive indirect effect on seed yield per plant via number of flowers per plant by Uguru[24], and Nakawuka and Adipala[17]. Days to maturity (0.054) followed by days to 50% flowering (0.041) and plant height (0.035) had considerable positive indirect effect on seed yield per plant via number of clusters per plant by[23,21]. The component of residual effects of path analysis was 0.682 low residual effect indicated that character for path analysis were adequate and appropriate.

Table- 1 Genotypic and Phenotypic correlation (*and ** significance levels of 5% and 1% respectively)

No	Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches/ plant	Number of pods/plant	Number of clusters/ plant	Test weight (g)	Harvest index %	Number of flowers /plant	Seed yield/ plant (g.)
1	Days to 50% flowering	P	**1.000**	0.567**	0.063	-0.078	-0.243*	-0.210*	0.008	-0.070	-0.279**	-0.197
		G	**1.000**	0.778**	0.080	-0.114	-0.294**	-0.370**	0.010	-0.014	-0.355**	-0.233*
2	Days to maturity	P		**1.000**	0.074	0.253*	-0.199	-0.277**	0.197	-0.187	-0.158	-0.053
		G		**1.000**	0.079	0.268*	-0.213*	-0.357**	0.209*	-0.227*	-0.205	-0.059
3	Plant height (cm)	P			**1.000**	0.428**	-0.127	-0.179	0.156	-0.145	-0.107	0.169
		G			**1.000**	0.437**	-0.133	-0.206	0.156	-0.156	-0.115	0.175
4	Number of primary branches /plant	P				**1.000**	-0.005	-0.014	0.298**	-0.229*	0.100	0.318**
		G				**1.000**	-0.022	-0.025	0.302**	-0.235*	0.081	0.340**
5	Number of pods/ plant	P					**1.000**	0.789**	-0.078	0.087	0.855**	0.403**
		G					**1.000**	0.928**	-0.084	0.108	0.944**	0.448**
6	Number of clusters/ plant	P						**1.000**	-0.048	0.120	0.689**	0.266*
		G						**1.000**	-0.057	0.182	0.823**	0.331**
7	Test weight (g)	P							**1.000**	0.063	-0.055	0.451**
		G							**1.000**	0.067	-0.063	0.464**
8	Harvest index %	P								**1.000**	0.038	0.282**
		G								**1.000**	0.005	0.230*
9	Number of flowers / plant	P									**1.000**	0.387**
		G									**1.000**	0.425**

Table -2 Phenotypic and Genotypic path coefficient analysis

No	Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches/ plant	Number of pods/plant	Numbe r of clusters / plant	Test weight (g)	Harvest index %	Number of flowers/ plant	Seed yield/ plant (g.)
1	Days to 50% flowering	P	-0.025	-0.042	0.006	-0.018	-0.115	0.041	0.003	-0.020	-0.027	-0.197
		G	0.289	-0.650	-0.024	-0.085	-1.154	0.840	0.006	-0.002	0.548	-0.233*
2	Days to maturity	P	-0.014	-0.074	0.007	0.059	-0.094	0.054	0.078	-0.054	-0.015	-0.053
		G	0.224	-0.835	-0.023	0.200	-0.836	0.810	0.115	-0.030	0.316	-0.059
3	Plant height (cm)	P	-0.002	-0.005	0.091	0.100	-0.060	0.035	0.062	-0.042	-0.010	0.169
		G	0.023	-0.066	-0.296	0.326	-0.522	0.467	0.086	-0.021	0.177	0.175
4	Number of primary branches /plant	P	0.002	-0.019	0.039	0.233	-0.002	0.003	0.118	-0.066	0.010	0.318**
		G	-0.033	-0.224	-0.129	0.745	- 0.086	0.057	0.166	-0.031	-0.125	0.340**
5	Number of pods/ plant	P	0.006	0.015	-0.012	-0.001	0.472	-0.153	-0.031	0.025	0.082	0.403**
		G	-0.085	0.178	0.039	-0.016	3.927	-2.106	-0.046	0.014	-1.457	0.448**
6	Number of clusters/ plant	P	0.005	0.020	-0.016	-0.003	0.373	-0.194	-0.019	0.034	0.066	0.266*
		G	-0.107	0.298	0.061	-0.019	3.644	-2.269	-0.031	0.024	-1.270	0.331**
7	Test weight (g)	P	0.000	-0.014	0.014	0.069	-0.037	0.009	0.397	0.018	-0.005	0.451**
		G	0.003	-0.174	-0.046	0.225	-0.330	0.129	0.551	0.009	0.097	0.464**
8	Harvest index %	P	0.002	0.014	-0.013	-0.053	0.041	-0.023	0.025	0.287	0.004	0.282**
		G	-0.004	0.190	0.046	-0.175	0.424	-0.413	0.037	0.133	-0.008	0.230*
9	Number of flowers / plant	P	0.007	0.012	-0.010	0.023	0.404	-0.134	-0.022	0.011	0.095	0.387**
		G	-0.102	0.171	0.034	0.060	3.707	-1.868	-0.035	0.001	-1.543	0.425**

Phenotypic and Genotypic residual effect is 0.682 and 0.421 respectively.

CONCLUSION

Significant and positive correlations were observed between growth characters as well as between growth characters and seed yield of cowpea. When the correlationcoefficients were partitioned into direct and indirect effects. Highest positive direct effect on number of pods per plant (0.472) followed by test weight (0.397) and harvest index (0.278). While, high indirect effect on seed yield per plant was exhibited by number of flowers per plant (0.404) followed by number of clusters per plant (0.373) through numbers of pods per plant. It is concluded from the path analysis study that seed yield in cowpea can be improved by focusing on character harvest index and number of pods per plant.

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