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Original Research Article

Study of Association for Seed Yield and Yield and Yield Attributing Characters in F2 Population of Cowpea (*Vigna unguiculata* (L.) Walp.)

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A B S T R A C T

Grain yield is a complex trait and is influenced by many other important yield contributing characters controlled by polygenes and environmental factors. Any breeding program aiming at increasing yield consider the association between yield and its attributes through estimation of genotypic and phenotypic correlation, which help in a great deal in formulating selection indices to aid crop improvement programs. An investigation was carried out in F_2 population of cross IT-38956-1 and CP-12and their parents to understand the association among the yield components and their direct and indirect effects on the seed yield. Grain yield per plant recorded significant and positive correlation with days to fifty percent flowering, primary braches per plant, pods per plant, pod length and seeds per pod and significant negative association with days to maturity and plant height, among them plant height recorded the highest significant association with the seed yield.

Keywords

Correlation, Cowpea, Path analysis and segregating population

Introduction

Cowpea (*Vigna ungiculata* (L).Walp) belongs to the family leguminoceae, sub family papilinoceae having chromosome number 2n=22. The cultivated species in cowpea is sub divided in to three sub species *i.e.* cowpea (sub species *ungi-culata*), catjung (sub species *catjung)* and yard long bean (sub species *sesquiepedalis*). Cowpea is an important versatile legume grown in tropics, sub tropics of Asia, Africa, central and southern America, parts of the southern Europe and Asia. In India, cowpea is grown as a sole crop, inter crop, mixed crop and in agroforestry combinations.

Cowpea cultivated as pulse and vegetable crop which is good source of protein (22.24 %), carbohydrate (56.66 %), crude fiber (5.9-7.3 %), fat (1.3-1.5 %), phosphorous (0.14 to 0.6 %), calcium (0.076 to 0.104 %) and iron (0.005 %). Cowpea seed is used as a nutritious component in human diet, cheap livestock feed, and the matured pods are used as a vegetable. The seeds also contain small proportion of β-carotene, thiamin, riboflavin, vitamin -A, niacin, folic acid and ascorbic acid.

Development of cultivars with early maturity, acceptable grain quality, resistance to some important diseases and pest has significantly increased the yield and cultivated area of cowpea (Ehlers and Hall, 1996). Grain yield is a complex trait and is influenced by many other important yield contributing characters controlled by

polygenes and environmental factors. Correlation analysis is a handy technique which provides information that selection for one character results in progress for other positively correlated characters. The importance of correlation studies in selection pro-grammes is appreciable when highly heritable characters are associated with the important character like yield. Correlation coefficients, although, very useful in quantifying the size and direction of trait associations can be misleading if the high correlation between two traits is a consequence of the indirect effect of other traits (Bizeti*et al.,* 2004). Path coefficient is an excellent means of studying direct and indirect effects of interrelated components of a complex trait. Path-coefficient analysis measures the direct influence of one variable on another (Dewey and Lu, 1959). By determining the inter-relationships among grain yield components, a better understanding of both the direct and indirect effects of the specific components can be attained (Chaudhary and Joshi, 2005).

Materials and Methods

The present experiment was carried out at Dry Land Agriculture Project, Gandhi Krishi Vignana Kendra, GKVK campus of the University of Agricultural Sciences, Bangalore. Two diverse cowpea genotypes/varieties *viz.*, IT-38956-1 and CP-12 were selected and used as parents for hybridization and then advanced to the F2 generation to study the association between the seed yield and yield attributing characters. The observation was recorded for ten quantitative characters like Days to first flowering, Days to maturity, Plant height (cm), Primary branches per plant, Secondary branches per plant, Number of pods per plant. Pod length (cm), Seeds per pod, Seed yield per plant (g) and Hundred seed weight (g).

Results and Discussion

The results of correlation among ten characters were presented in Table 1. In the present study,seed yield per plant exhibited significant and positive correlation with pod length (0.855), seeds per pod (0.791), pods per plant (0.362), days to first flowering (0.275) and primary braches per plant (0.225)These results are in close agreement with earlier workers Alege and Mustapha (2007) and Khadre *et al.*, (2014). Hence, simultaneous selection based on these characters could be suggested for improvement of yield in segregating populations.

Although yield is principal goal of many crop breeding programs, but multiple traits package determines varietal/cultivar acceptability by cowpea farmers and/or primary consumers. Yield is a complex trait, governed by many traits, morphological characters that associated with higher seed yield or which make a significant contribution to yielding ability would be useful in the improvement of seed yield. Among the seed yield and its attributing characters in the cross, positive and significant association of days to first flowering with days to maturity, plant height, biomass, secondary branches per plant, pods per plant, pod length and test weight; days to maturity with plant height, secondary branches per plant, pods per plant, seeds per pod and test weight; plant height with secondary branches per plant, pod length, pods per plant and hundred seed weight; primary branches per plant with secondary branches per plant, pod length, seeds per pod and hundred seed weight; secondary branches per plant with pod length, seeds per pod and hundred seed weight; pod length with seeds per pod and hundred seed weight; seed per pod with hundred seed weight.

Table.1 Correlation co-efficients for seed yield per plant and yield attributing characters in F_2 generation of cowpea cross IT-38956-1 × CP-12

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	**1.000**	0.488**	0.910**	0.416**	0.456**	0.231*	0.291*	0.402**	-0.171*	**0.275****
X_2		**1.000**	0.467**	0.333**	-0.016	0.155	0.332**	0.406**	-0.042	**-0.308****
X_3			**1.000**	-0.566**	-0.367**	-0.056	-0.538**	-0.540**	-0.317**	**-0.609****
X_4				**1.000**	0.604**	0.272*	0.287*	0.222*	-0.176	**0.225****
X_5					**1.000**	-0.198	0.784**	0.453**	-0.8220	**0.188***
X_6						**1.000**	-0.761**	-0.511**	-0.355**	**0.362****
X_7							**1.000**	0.985**	0.117	**0.855****
X_8								**1.000**	0.070	**0.791****
X_9									**1.000**	**0.103**
X_{10}										1.000

*- Significance at 0.05 **- Significance at 0.01

X_1: Days to first flowering
X_2: Days to maturity
X_3: Plant height (cm)
X_4: Primary branches per plant
X_5: Secondary branches per plant
X_6: Pods per plant
X_7: Pod length (cm)
X_8: Seeds per pod
X_9: Hundred seed weight (g)
X_{10}: Yield per plant (g)

Table.2 Direct and indirect effects of component characters on seed yield/plant in F_2 generation of cowpea cross IT-38956-1 × CP-12

Character	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	'r' Seed yield per plant
X_1	**0.2331**	-0.225	0.2166	0.0002	0.0215	0.0236	0.0572	-0.0406	-0.0108	0.275**
X_2	-0.1267	**-0.3046**	0.0066	-0.0002	0.0024	0.0303	0.0443	0.0503	-0.0104	-0.308**
X_3	-0.1297	-0.3877	**-0.2084**	0.0031	0.0132	0.0309	0.0314	0.0481	-0.0108	-0.609**
X_4	0.0061	-0.0001	-0.0121	**0.0703**	0.0198	-0.0284	0.0246	0.1498	-0.0049	0.225**
X_5	-0.0793	-0.0304	0.0059	-0.0024	**0.0412**	-0.0152	0.0087	0.2618	-0.0022	0.188*
X_6	-0.0681	-0.1561	0.5151	0.0271	-0.0127	**0.1051**	-0.0488	0.0008	0.0005	0.362**
X_7	-0.0671	-0.3127	0.1528	-0.0587	0.1369	-0.0024	**0.9012**	0.1146	-0.0088	0.855**
X_8	-0.1467	-0.3006	0.2006	-0.0841	0.1365	-0.0256	0.0012	**1.0151**	-0.0052	0.791**
X_9	-0.0346	-0.0021	0.1003	-0.0031	0.0144	-0.0007	0.0346	-0.0184	**0.0127**	0.103

Residual effect= 0.071 * Significant at P = 0.05 **Significant at P = 0.01

X_1: Days to first flowering
X_2: Days to maturity
X_3: Plant height (cm)
X_4: Primary branches per plant
X_5: Secondary branches per plant
X_6: Pods per plant
X_7: Pod length (cm)
X_8: Seeds per pod
X_9: Hundred seed weight (g)

These findings are in conformity with the report of Khadre *et al.,* (2014), Jana *et al.*, (1983), Vardhan and Savithramma (1998) and Vidya and Oomen (2002).). Contrary to association of days to flowering and number of seeds per pod recorded negative direct effect were reported by Venkatesan (2003) and Kharde *et al.,* (2014).

Although yield is principal goal of many crop breeding programs, but multiple traits package determines varietal/cultivar acceptability by cowpea farmers and/or primary consumers.

Yield is a complex trait, governed by many traits, morphological characters that associated with higher seed yield or which make a significant contribution to yielding ability would be useful in the improvement of seed yield. Among the seed yield and its attributing characters in the cross, positive and significant association of days to first flowering with days to maturity, plant height, biomass, secondary branches per plant, pods per plant, pod length and test weight; days to maturity with plant height, secondary branches per plant, pods per plant, seeds per pod and test weight; plant height with secondary branches per plant, pod length, pods per plant and hundred seed weight; primary branches per plant with secondary branches per plant, pod length, seeds per pod and hundred seed weight; secondary branches per plant with pod length, seeds per pod and hundred seed weight; pod length with seeds per pod and hundred seed weight; seed per pod with hundred seed weight.

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Selection based on the traits viz., secondary branches per plant, pods per plant, pod length and seeds per pod, improve the grain yield in cowpea.

The correlation coefficients were inadequate to interpret the cause and effect relationships. However, Partitioning of the total correlation into direct and indirect effects would provide actual information on the contribution of traits and thus form the basis for selection to improve grain yield (Table 2).

Among the seed yield and its attributing characters in the cross, positive and significant association of days to first flowering with days to maturity, plant height, biomass, secondary branches per plant, pods per plant, pod length and hundred seed weight; days to maturity with plant height, secondary branches per plant, pods per plant, seeds per pod and test weight; plant height with secondary branches per plant, pod length, pods per plant and hundred seed; primary branches per plant with secondary branches per plant, pod length, seeds per pod and hundred seed weight; secondary branches per plant with pod length, seeds per pod and hundred seed weight; pod length with seeds per pod and hundred seed weight; seed per pod with hundred seed weight were observed. The similar results were reported by Idahosa *et al.,* (2010), Manggoel *et al.,* (2012) and Nwosu *et al.,* (2013). While the pod length exerted high positive indirect effect via plant height followed by seeds per pod and secondary branches per plant

The days to maturity showed the indirect high positive effect towards the seed yield per plant. These results are in accordance

with the earlier reports of Venkatesan (2003), Alege and Mustapha (2007), Abadyomi and Abidoye (2009) and Kharde *et al.*, (2014). Indirectly selection of this character through other yield component characters will help in selecting better genotypes.

It is obvious from the present study that selection on the basis ofprimary branches per plant, secondary branches per plant, pods per plant, pod length and seeds per pod and seed yield per plant in segregating populations of cowpea will be more effective in the development of promising genotypes.

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