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Short Communication

Character association and path analysis in vegetable cowpea [*Vigna unguiculata* (L.) Walp.]

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Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the most important multipurpose crop grown for green vegetable, dry seeds, forage, green manure and cover crop under wide range of climatic conditions. Being a legume crop, it has the potential to fix atmospheric nitrogen to the tune of 240 kg/ha (Rachie 1985), and besides fulfilling its own nitrogen requirements, it leaves up to 60-70 kg/ha fixed nitrogen deposit in the soil for the succeeding crops. Further, as a drought tolerant crop, it is especially popular in semi-arid regions of the tropics. Being rich source of protein (23-30%), it provides complementary proteins to the cereal based diets. Its seed protein is rich in amino acids, particularly lysine and tryptophan as compared to cereal grains. Therefore, its seeds are valued as a nutritional supplement to cereals and an extender of animal proteins. Thus, among all the leguminous vegetables, the choice of cowpea as an important vegetable crop is mainly due to its being highly palatable, nutritious and relatively free of metabolites or other toxins. 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 component characters influencing yield, whereas, the path coefficient analysis provides an effective means of partitioning direct or indirect causes of association. Correlation and path analysis thus help in identifying the suitable selection criteria for improving the yield of vegetable cowpea. Keeping the meager information available on component analysis of vegetable cowpea in view, the present investigation was undertaken to assess the importance of various components of pod yield in vegetable cowpea.

The experimental material comprising 46 diverse genotypes of cowpea collected from different sources for the present investigation. All the 46 genotypes were sown in field during March, 2011 in a Randomized Block Design with three replications. Each genotype was grown in 3.0 m long paired rows following a spacing of 60 cm row to row and 15 cm apart from plant. All the recommended cultural practices were followed to raise the crop successfully. The observations were recorded on thirteen characters, mentioned in Table 1 and 2. The correlation coefficient (Al-Jibouri *et al*. 1958) and path coefficient analysis were analyzed as per Dewey and Lu (1959) method.

The correlation coefficients among the various characters at the genotypic level were greater than their corresponding phenotypic ones (Table 1), thereby indicating that inspite of a strong inherent association between the various traits studied, the phenotypic expression of correlation was lessened under the influence of environment. The total number of pickings and number of seeds per pod showed negative association with pod yield per plant. Pod length, pod breadth, number of pods per plant and pod weight exhibited positive and significant association with pod yield per plant. Similar observations were also made by Chattopadhyay *et al*. (1997) and Pal *et al*. (2004). The number of seeds per pod and plant height at final harvest recorded negative association with pod yield per plant. Tewari and Gautam (1989) had same finding for plant height. Days to first picking had significant and negative correlation with total number of pickings, which was supported by Kutty *et al.* (2003). A negative phenotypic correlation coefficient was also found between the number of pods per plant and length of pod, which was in accordance with earlier work done by Chattopadhyay *et al*. (1997).

Association of various characters with traits of major interest and economic importance like yield is the consequence of their direct and indirect effects. Therefore, it becomes essential to partition such association into direct and indirect effects of component character through path analysis. Pod weight and number of pods per plant had high positive and direct effect on pod yield per plant (Table 2). It was in accordance with

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Table 1: Phenotypic (above diagonal) and genotypic (below diagonal) correlations among various yield and yield attributing traits in cowpea

Traits	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
X1	**1.000**	-0.260**	0.736**	0.602**	-0.266**	0.231**	0.102NS	0.070NS	0.113NS	0.131NS	-0.168*	0.008 NS	0.044 NS
X2	-0.347*	**1.000**	0.297**	0.120NS	-0.169*	-0.001NS	0.095NS	-0.037NS	-0.087NS	-0.030NS	0.212*	0.158 NS	-0.006 NS
X3	0.790**	0.222**	**1.000**	0.662**	-0.412**	0.242**	0.144NS	0.049NS	0.018NS	0.113NS	-0.032NS	0.104 NS	0.025 NS
X4	0.817**	0.141 NS	0.950**	**1.000**	-0.225**	0.293**	0.227**	0.151NS	-0.076NS	0.155NS	-0.091NS	0.025 NS	0.055 NS
X5	-0.297**	-0.237**	-0.516**	-0.262**	**1.000**	-0.030NS	-0.033NS	-0.128NS	-0.092NS	-0.228**	-0.071NS	0.045 NS	0.034 NS
X6	0.249**	0.008 NS	0.287**	0.360**	-0.029NS	**1.000**	0.529**	0.236**	-0.161NS	0.246**	-0.365**	-0.048 NS	0.308**
X7	0.108	0.093 NS	0.155 NS	0.266**	-0.025NS	0.554**	**1.000**	0.411**	-0.030NS	0.361**	-0.467**	-0.284**	0.359**
X8	0.072 NS	-0.053NS	0.066 NS	0.193*	-0.129NS	0.262**	0.433**	**1.000**	0.109NS	0.867**	-0.276**	-0.200*	0.683**
X9	0.134 NS	-0.121NS	0.040 NS	-0.086NS	-0.093NS	-0.168*	-0.029NS	0.116 NS	**1.000**	0.356**	0.055NS	-0.016NS	0.205**
X10	0.153 NS	-0.034NS	0.153 NS	0.174*	-0.243**	0.258**	0.377**	0.887**	0.375**	**1.000**	-0.242**	-0.145 NS	0.759**
X11	-0.191**	0.264**	-0.043NS	-0.114NS	-0.077NS	-0.386**	-0.477**	-0.283**	0.063 NS	-0.252**	**1.000**	0.081 NS	-0.184**
X12	0.002 NS	0.193*	0.116 NS	0.044 NS	0.132 NS	-0.045 NS	-0.292**	-0.204*	-0.013 NS	-0.151 NS	0.080 NS	**1.000**	0.034 NS
X13	0.037 NS	-0.045 NS	0.008 NS	0.073 NS	0.024 NS	0.327**	0.372**	0.710**	0.220**	0.793**	-0.188**	-0.036NS	**1.000**

*, ** P≤ 0.05 and 0.01, respectively; NS= Not significant *Traits: X1= Days to 50% flowering, X2= Days taken to horticultural maturity, X3= Days to first picking, X4= Days to last picking, X5= Total number of pickings, X6= Pod length (cm), X7= pod breadth (cm), X8= Pod weight (g), X9= Number of pods per plant, X10 = Pod yield per plant (g), X11= Number of seeds per pod, X12= Plant height at final harvest (cm) and X13= Harvest index (%)

Table 2: Direct (diagonal) and indirect (off diagonal) effects of yield components on pod yield at genotypic level in cowpea

Traits	X1	X2	X3	X4	X5	X6	X7	X8	X9	X11	X12	X13	X10
X1	**-0.0700**	-0.0068	-0.3251	0.3660	0.0821	0.0100	-0.0104	0.0381	0.0389	0.0180	0.0000	0.0127	0.1535
X2	0.0244	**0.0194**	-0.0913	0.0632	0.0654	0.0003	-0.0090	-0.0282	-0.0352	-0.0249	-0.0026	-0.0157	-0.0342
X3	-0.0554	0.0043	**-0.4111**	0.4254	0.1425	0.0115	-0.0149	0.0346	0.0116	0.0041	-0.0015	0.0029	0.154
X4	-0.0573	0.0027	-0.3907	**0.4476**	0.0724	0.0145	-0.0257	0.1009	-0.0250	0.0107	-0.0006	0.0251	0.1746
X5	0.0209	-0.0046	0.2125	-0.1175	**-0.2757**	-0.0012	0.0024	-0.0679	-0.0271	0.0073	-0.0004	0.0082	-0.2431
X6	-0.0175	0.0002	-0.1180	0.1615	0.0080	**0.0401**	-0.0534	0.1371	-0.0489	0.0364	0.0006	0.1124	0.2585
X7	-0.0076	0.0018	-0.0637	0.1193	0.0069	0.0223	**-0.0964**	0.2266	-0.0086	0.0450	0.0039	0.1277	0.3772
X8	-0.0051	-0.0010	-0.0272	0.0864	0.0358	0.0105	-0.0418	**0.5225**	0.0338	0.0267	0.0027	0.2439	0.8872
X9	-0.0094	-0.0024	-0.0165	-0.0386	0.0257	-0.0068	0.0029	0.0608	**0.2902**	-0.0059	0.0002	0.0755	0.3757
X11	0.0134	0.0051	0.0180	-0.0511	0.0214	-0.0155	0.0460	-0.1479	0.0183	**-0.0942**	-0.0011	-0.0648	-0.2524
X12	-0.0002	0.0038	-0.0477	0.0199	-0.0088	-0.0018	0.0282	-0.1069	-0.0040	-0.0076	**-0.0132**	-0.0126	-0.1509
X13	-0.0026	-0.0009	-0.0034	0.0328	-0.0066	0.0131	-0.0359	0.3713	0.0638	0.0178	0.0005	**0.3432**	0.7931

Residual effect = 0.2915 *__Traits:__ X1= Days to 50% flowering, X2= Days taken to horticultural maturity, X3= Days to first picking, X4= Days to last picking, X5= Total number of pickings, X6= Pod length (cm), X7= pod breadth (cm), X8= Pod weight (g), X9= Number of pods per plant, X10 = Pod yield per plant (g), X11= Number of seeds per pod, X12= Plant height at final harvest (cm) and X13= Harvest index (%)

the findings of Chattopadhayay *et al*. (1997), Venkatesan *et al.* (2003) and Subbiah *et al*. (2003). The harvest index and days to last picking had high positive direct effect on yield and was in accordance with earlier work done by Sawant (1994).

Relationship between yield and yield contributing characters and path coefficients suggests that pod weight and number of pods per plant were the most important characters as they exhibited high direct effects on pod yield per plant along with significant positive correlation at genotypic and phenotypic levels. It is concluded that these characters should be given due importance in selection programme for yield improvement of vegetable cowpea.

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