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Research article

STUDIES ON SELECTION INDICES IN PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP]

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ABSTRACT: Success of any breeding programme depends on the efficiency of selection. Hence, the knowledge of nature of association of various traits among themselves and with seed yield is quite important for devising an effective selection criterion for yield. The present study was carried out to assess the nature and extent of interrelationship among component traits affecting seed yield in pigeonpea (*Cajanus cajan* (L.) Millsp). Forty nine genotypes from different states Andhra Pradesh, Karnataka and Maharastra were evaluated in a randomized block design with three replications and the data recorded on 12 traits were subjected to statistical analysis. The correlation studies revealed the positive and significant association of seed yield with number of pods per plant, number of secondary branches per plant, number of primary branches per plant and plant height. Path analysis revealed that the number of pods per plant was important in formulating selection criteria for improvement of seed yield in pigeonpea.
Keywords: Character association, direct and indirect effects.

INTRODUCTION

Pigeonpea or redgram or arhar (*Cajanus cajan* (L.) Millsp) is the second most important pulse crop grown mostly in the semi arid tropics. It is cultivated in more than 25 tropical and sub-tropical countries either as a sole crop or as an intercrop. It is a diploid (2n=22) with diversified uses as food, feed, fodder and fuel. Sonia Varshney *et al.* (2003) reported that the dry beans of pigeonpea were rich in proteins, ranging from 14 to 29%. Hence, it is recognized as a valuable source of protein particularly in the developing countries where the majority of the population depends on low priced vegetarian food for meeting dietary requirements. It also plays an important role not only in sustaining soil productivity by fixing atmospheric nitrogen but also enriching the soil fertility through its fallen leaves. Inspite of vast genetic resources in pigeonpea, the crop did not experience major break through in seed yield. Moreover, the crop suffers heavy yield losses from various biotic and abiotic stresses. Yield is a complex character and is the sum total of all the effects of several traits which are quantitatively inherited. Correlation analysis provides the information on nature and magnitude of association of different component traits with seed yield. Yield is a complex character and is determined by many component characters. The identification of important characters and their interrelationship would be useful for developing improved genotypes. Thus effective improvement in yield may be brought through selection based on yield component characters. Correlation studies give an idea about the contribution of different characters towards seed yield and it reveals the nature and magnitude of association between yield components with yield and among themselves. Knowledge of inter-relationships existing among yield components is essential when selection for improvement is to be effective. Path analysis identifies the yield components which directly and indirectly influence the yield (Dewey and Lu, 1959). Hence, the present research work was carried out to study the correlation coefficients and path coefficients in order to formulate the selection criteria for evolving high yielding genotypes in pigeonpea.

MATERIALS AND METHODS

Forty-nine genotypes of pigeonpea collected from Guntur, Hyderabad, Tirupati and Warangal of Andhra Pradesh, Karnataka and Maharastra were evaluated in randomized block design with three replications, during late *kharif*, 2008-09 at Dryland farm, RARS, Tirupati. Each genotype was sown in two rows of 3 m length with a spacing of 90 cm between rows and 20 cm between plants. Five competitive plants were selected randomly in each genotype in each replication and observations for ten characters *viz.*, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, pod length (cm), number of seeds per pod, 100-seed weight (g), protein content (%) (Lowry *et al.* 1951), phenol content (%) (Sadasivam and Manickam, 1961) and seed yield per plant (g) were recorded on selected plants.

Observations on days to 50 per cent flowering and days to maturity were recorded on per plot basis. The genotypic and phenotypic coefficients of correlation were calculated using the method given by Johnson *et al.* (1955) and path coefficient analysis were worked as suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance revealed the existence of significant differences among the genotypes for all the characters. The data on all the twelve characters which showed significant differences among the entries were subjected to statistical analysis. Yield is a complex character influenced by several genetic factors interacting with environment. Hence, a thorough understanding of the association/relationship of yield component characters with yield and among themselves is essential for successful crop improvement programme. Phenotypic and genotypic correlation coefficients were computed in order to assess the direction and magnitude of association existing among seed yield and its component characters and the inter-correlation among different traits (Table 1).

Table 1: Phenotypic (r_p) and Genotypic (r_g) correlation coefficients among seed yield and its components in pigeonpea.

Character		Days to Maturity	Plant height	No. of primary branches/ plant	No. of secondary branches /plant	No. of Pods/ plant	Pod Length	No. of Seeds/ Pod	100-seed Weight	Protein content	Phenol content	Seed yield/plant
Days to 50% Flowering	r_p	0.7194**	0.0999	0.0030	0.3160**	0.0530	-0.1089	-0.2228**	-0.1359	-0.0098	-0.0494	0.1093
	r_g	0.7305**	0.1018	-0.0003	0.3193**	0.0535	-0.1098	-0.2269**	-0.1370	-0.0091	-0.0502	0.1118
Days to Maturity	r_p		0.2001*	-0.0609	0.2969**	0.1518	-0.2705**	-0.2705**	-0.3501**	-0.0458	0.0975	0.1133
	r_g		0.2031*	-0.0663	0.3005**	0.1533	-0.2724**	-0.2762**	-0.3533**	-0.0462	0.0983	0.1151
Plant height	r_p			0.4579**	0.5988**	0.7167**	-0.2175**	-0.0645	-0.2796**	0.0008	0.2091*	0.5621**
	r_g			0.4701**	0.6019**	0.7185**	-0.2182**	-0.0651	-0.2803**	0.0001	0.2096*	0.5638**
No. of primary branches/ plant	r_p				0.6007**	0.4902**	0.0753	-0.0787	-0.2013*	-0.1642*	-0.0914	0.5715**
	r_g				0.6137**	0.5045**	0.0783	-0.0804	-0.2062*	-0.1670*	-0.0945	0.5885**
No. of secondary branches/ plant	r_p					0.6630**	-0.1362	-0.2765**	-0.4004**	-0.0058	-0.0122	0.6124**
	r_g					0.6657**	-0.1367	-0.2786**	-0.4014**	-0.0059	-0.0122	0.6153**
No. of pods/ plant	r_p						-0.2704**	-0.3105**	-0.5286**	0.0729	0.2064*	0.7589**
	r_g						-0.2707**	-0.3122**	-0.5290**	0.0728	0.2065*	0.7604**
Pod length	r_p							0.6596**	0.5574**	-0.2623**	-0.1875*	-0.0201
	r_g							0.6632**	0.5577**	-0.2631**	-0.1876*	-0.0198
No. of seeds/ pod	r_p								0.3929**	-0.2181**	-0.1157	-0.2004*
	r_g								0.3952**	-0.2187**	-0.1164	-0.2012*
100-seed weight	r_p									0.0038	-0.2113*	-0.2558**
	r_g									0.0038	-0.2113*	-0.2562**
Protein content	r_p										0.2051*	-0.0758
	r_g										0.2055*	-0.0756
Phenol content	r_p											0.0771
	r_g											0.0773

* Significant at 5% level ** Significant at 1% level

In the present study, the characters pods per plant (r_p= 0.7589**, r_g=0.7604**), secondary branches per plant (r_p= 0.0.6124**, r_g=0.6153**), primary branches per plant (r_p= 0.5715**, r_g=0.5885**) and plant height (r_p= 0.5621**, r_g=0.5638**) exhibited positive and significant association with seed yield per plant (Table 2). Further, a positive and significant association was also observed among these individual components. These results were in accordance with the findings of Dahat *et al.* (1997), Deshmukh *et al.* (2000), Anuradha *et al.* (2007). Thus, it indicates that seed yield per plant could be increased whenever there is an increase in number of pods per plant, number of secondary branches per plant, number of primary branches per plant and plant height. Hence, simultaneous selection based on these characters could be suggested for improvement in yield. Path coefficient analysis facilitates the partitioning of the correlation coefficients into direct and indirect effects of various characters on yield. Thus, the information on the direct and indirect effects contributed by each character to yield will be an added advantage for improvement of a crop. Correlation in combination with path analysis can provide a better insight into the cause and effect relationship between different pairs of characters.

In the present investigation number of pods per plant (P= 0.7573, G= 0.7594) exerted high positive direct effect on seed yield. This is in agreement with the findings of Santhosh Gupta and Madrap (2007) and Jogendra Singh *et al.* (2008). The characters primary branches per plant (P= 0.1990, G= 0.2178) and 100 seed weight (P= 0.1912, G= 0.1959) had moderate and low positive direct effects on seed yield respectively. These results were in accordance with the findings of Santhosh Gupta and Madrap (2007). However, negligible positive direct effects were exhibited by days to 50 per cent flowering, days to maturity, secondary branches per plant, pod length and phenol content. Number of pods per plant also had high indirect effects on seed yield via plant height, number of primary branches per plant and number of secondary branches per plant.

Table 2: Phenotypic (P) and genotypic (G) path coefficients among seed yield and its components in pigeonpea.

Character		Days to 50% flowering	Days to Maturity	Plant height	No. of primary Branches /plant	No. of secondary branches/ plant	No. of pods/ Plant	Pod Length	No. of seeds/ Pod	100-seed Weight	Protein Content	Phenol content	'r' with seed yield/plant
Days to 50% Flowering	P	**0.0467**	0.0264	-0.0058	0.0006	0.0221	0.0402	-0.0114	0.0167	-0.0260	0.0009	-0.0010	0.1093
	G	**0.0500**	0.0309	-0.0069	-0.0001	0.0193	0.0406	-0.0107	0.0158	-0.0268	0.0008	-0.0012	0.1118
Days to Maturity	P	0.0336	**0.0367**	-0.0117	-0.0121	0.0208	0.1150	-0.0283	0.0203	-0.0670	0.0041	0.0020	0.1133
	G	0.0366	**0.0424**	-0.0137	-0.0144	0.0182	0.1164	-0.0266	0.0192	-0.0692	0.0040	0.0023	0.1151
Plant height	P	0.0047	0.0073	**-0.0585**	0.0911	0.0419	0.5427	-0.0228	0.0048	-0.0535	-0.0001	0.0043	0.5621**
	G	0.0051	0.0086	**-0.0675**	0.1024	0.0364	0.5456	-0.0213	0.0045	-0.0549	0.0000	0.0050	0.5638**
No. of primary branches/ plant	P	0.0001	-0.0022	-0.0268	**0.1990**	0.0420	0.3712	0.0079	0.0059	-0.0385	0.0147	-0.0019	0.5715**
	G	0.0000	-0.0028	-0.0317	**0.2178**	0.0371	0.3831	0.0077	0.0056	-0.0404	0.0145	-0.0022	0.5885**
No. of secondary branches/ plant	P	0.0148	0.0109	-0.0350	0.1195	**0.0699**	0.5021	-0.0143	0.0208	-0.0766	0.0005	-0.0003	0.6124**
	G	0.0160	0.0127	-0.0406	0.1336	**0.0605**	0.5055	-0.0134	0.0194	-0.0786	0.0005	-0.0003	0.6153**
No. of pods/ plant	P	0.0025	0.0056	-0.0419	0.0975	0.0464	**0.7573**	-0.0283	0.0233	-0.1011	-0.0065	0.0042	0.7589**
	G	0.0027	0.0065	-0.0485	0.1099	0.0402	**0.7594**	-0.0264	0.0217	-0.1036	-0.0063	0.0049	0.7604**
Pod length	P	-0.0051	-0.0099	0.0127	0.0150	-0.0095	-0.2047	**0.1048**	-0.0496	0.1066	0.0235	-0.0038	-0.0201
	G	-0.0055	-0.0115	0.0147	0.0171	-0.0083	-0.2056	**0.0977**	-0.0461	0.1092	0.0229	-0.0045	-0.0198
No. of seeds/ pod	P	-0.0104	-0.0099	0.0038	-0.0157	-0.0193	-0.2351	0.0691	**-0.0751**	0.0751	0.0195	-0.0024	-0.2004*
	G	-0.0114	-0.0117	0.0044	-0.0175	-0.0168	-0.2371	0.0648	**-0.0695**	0.0774	0.0190	-0.0028	-0.2012*
100-seed weight	P	-0.0064	-0.0128	0.0163	-0.0401	-0.0280	-0.4003	0.0584	-0.0295	**0.1912**	-0.0003	-0.0043	-0.2558**
	G	-0.0069	-0.0150	0.0189	-0.0449	-0.0243	-0.4017	0.0545	-0.0275	**0.1959**	-0.0003	-0.0050	-0.2562**
Protein content	P	-0.0005	-0.0017	0.0000	-0.0327	-0.0004	0.0552	-0.0275	0.0164	0.0007	**-0.0896**	0.0042	-0.0758
	G	-0.0005	-0.0020	0.0000	-0.0364	-0.0004	0.0553	-0.0257	0.0152	0.0007	**-0.0869**	0.0049	-0.0756
Phenol content	P	-0.0023	0.0036	-0.0122	-0.0182	-0.0009	0.1563	-0.0196	0.0087	-0.0404	-0.0184	**0.0205**	0.0771
	G	-0.0025	0.0042	-0.0141	-0.0206	-0.0007	0.1568	-0.0183	0.0081	-0.0414	-0.0179	**0.0237**	0.0773

Phenotypic residual effect : 0.5656 Genotypic residual effect : 0.5609

* Significant at 5% level ** Significant at 1% level

In contrast, plant height and protein content exhibited negligible negative direct effect on seed yield. Similar kind of negative direct effects of plant height and protein content on seed yield were reported by Anuradha *et al.* (2007).

Critical analysis of results obtained from character association and path analysis indicated that number of pods per plant had strong positive correlation as well as high magnitude of positive direct effect on seed yield. It is therefore, suggested that preference should be given to number of pods per plant in the selection programme to isolate superior genotypes with high seed yield.

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