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Correlation and Path Coefficient Analyses in Pigeonpea (*Cajanus cajan* (L.) Millsp.) for Seed Yield and Yield Contributing Characters

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ABSTRACT

An investigation on genetic divergence in pigeonpea [*Cajanus cajan* (L.) Millsp.] was carried out during *kharif* 2010-11 at Regional Agricultural Research Station, Lam, Guntur with 41 genotypes to elicit the information on character association and path analysis. Observations were recorded on thirteen characters *viz*., plant height (cm), days to 50% flowering, days to maturity, 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, shelling percentage, 100 seed weight (g), seed yield per plant (g), grain protein content (%) and harvest index. The correlation study indicated that the plant height, number of secondary branches per plant, number of pods per plant, number of seeds per pod and harvest index had significant positive association with seed yield and simultaneous improvement of these characters along with seed yield is possible. Path coefficient analysis revealed that harvest index, plant height, number of primary branches per plant and 100 seed weight had positive direct effects on seed yield per plant and due weightage should be given for them for yield enhancement.

Key words : Correlation, Path Coefficient Analysis, Pigeonpea.

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is one of the important pulse crops and its yield improvement is pertinent to vegetarians, in particular. Seed yield is a complex character and therefore, the knowledge of association and cause and effect relationship of yield component traits with yield would help in formulation of effective selection schemes. Selection on the basis of component characters has been considered to be more useful as compared to selection of yield *per se* (Grafius, 1956). Correlation studies indicate the associations between various yield components and their influence on yield which will help the plant breeder to develop effective selection index to isolate potential genotypes. Present investigation was taken up to study the nature and extent of association of yield and yield components through correlation coefficients and direct and indirect effects through path analysis.

MATERIAL AND METHODS

Forty one genotypes of pigeonpea [*Cajanus cajan* (L.) Millsp.] were sown in randomized block design with three replications at the Regional Agricultural Research Station, Lam, Guntur, during *kharif*, 2010-11. Each genotype was represented by six rows of four meter length in each replication with a spacing of 90 cm between rows and 20 cm within row. Crop was managed as per recommendations. Observations were recorded on ten randomly selected plants without border effect of each genotype in each replication and the average values were subjected for statistical analysis except for days to 50% flowering, days to maturity, 100 seed weight and grain protein content which were recorded on plot basis. The data recorded on various characters were subjected to the statistical analysis using the software package Windostat version 8.6. (Vasantha Rao, *et al*, 2010).

RESULTS AND DISCUSSION

The phenotypic and genotypic correlation coefficients between seed yield and other yield component characters and among themselves were given in Table 1. Genotypic correlations in general were higher than phenotypic correlations. This may be due to relative stability of genotypes as majority of them were subjected to certain amount of selection (Johnson *et. al.* 1955). The correlation study indicated that the plant height, number of

secondary branches per plant, numbers of pods per plant, no of seeds per plant and harvest index had significant positive association with seed yield at both phenotypic and genotypic levels. So improvement in seed yield is possible by taking above characters as criteria in selection scheme.

Days to 50% flowering recorded significant positive association with days to maturity and pod length whereas significant negative association with seeds per pod. Days to maturity showed significant positive association with protein content whereas significant negative association with harvest index, pod length and seeds per pod. Plant height (cm) showed significant positive association with primary branches per plant, pods per plant, seeds per pod, shelling percentage and seed yield per plant while significant negative association with protein content was observed. Number of primary branches per plant showed significant positive association with shelling percentage whereas significant negative association with harvest index was recorded. Number of secondary branches per plant showed significant positive association with number of pods per plant and seed yield per plant whereas significant negative association was recorded with pod length and protein content. Number of pods per plant showed significant positive association with seeds per pod, harvest index and seed yield per plant whereas significant negative association with protein content. Pod length (cm) showed significant positive association with seeds per pod and harvest index. Number of seeds per pod showed significant positive correlation with seed yield per plant and significant negative correlation with shelling percentage**.** Shelling percentage showed significant positive association with harvest index and significant negative association with grain protein content. Hundred seed weight (g) showed positive non significant association with seed yield per plant. Harvest index showed significant positive association with seed yield per plant and shelling percentage and significant negative association with grain protein content. Grain protein content (%) showed significant negative association with seed yield per plant. Positive correlation indicates possible simultaneous improvement as reported by Anuradha *et al.,* (2007), Baskaran and Muthiah (2007), Vasantha Rao *et al*. (2010), Bhanu Prakash (2011).

The direct and indirect effects of different yield components on seed yield worked out through path analysis at phenotypic and genotypic levels (Table 2). Path diagram showing cause effect relationship of direct effects with seed yield is given in Figure 1. Path coefficient analysis revealed that harvest index, number of primary branches per plant, 100 seed weight and plant height showed maximum positive direct effect together with strong positive correlation on seed yield per plant revealing their true relationship and direct selection for them will result in yield improvement. The correlation coefficients were positive but the direct effect were negative for number of secondary branches per plant, number of pods per plant, pod length, number of seeds per pod and shelling percentage indicating the indirect effects to be cause of positive correlation. In such situations, the indirect causal factors are to be considered simultaneously for selection. Contrary to the fore mentioned situation, Correlation coefficients were negative but the direct effect was positive for days to 50% flowering, days to maturity and protein content. Under these circumstances, a restricted simultaneous selection model is to be followed i.e. restrictions to be imposed to nullify the undesirable indirect effects in order to make use of the direct effect (Singh & Choudhary, 1977). These results are in agreement with the previous reports of Marekar and Nerkar, 1987; Anuradha *et al.,* 2007; and Vasantha Rao *et al*., 2010.

In plant breeding, it is very difficult to have complete knowledge of all component traits of yield. The residual effect permits precise explanation about the pattern of interaction of other possible components of yield. In other words, residual effect measures the role of possible independent variables which were not included in the study of dependent variable. In the present study the residual effect values were {0.4060 and SQRT (1-1.5893)} at phenotypic and genotypic levels, respectively. This clearly shows the importance of inclusion of some more characters for clear partition of the direct and indirect effects among the yield components and seed yield per plant.

Character association studies indicated that plant height, number of secondary branches per plant, numbers of pods per plant, number of seeds per pod and harvest index had significant positive

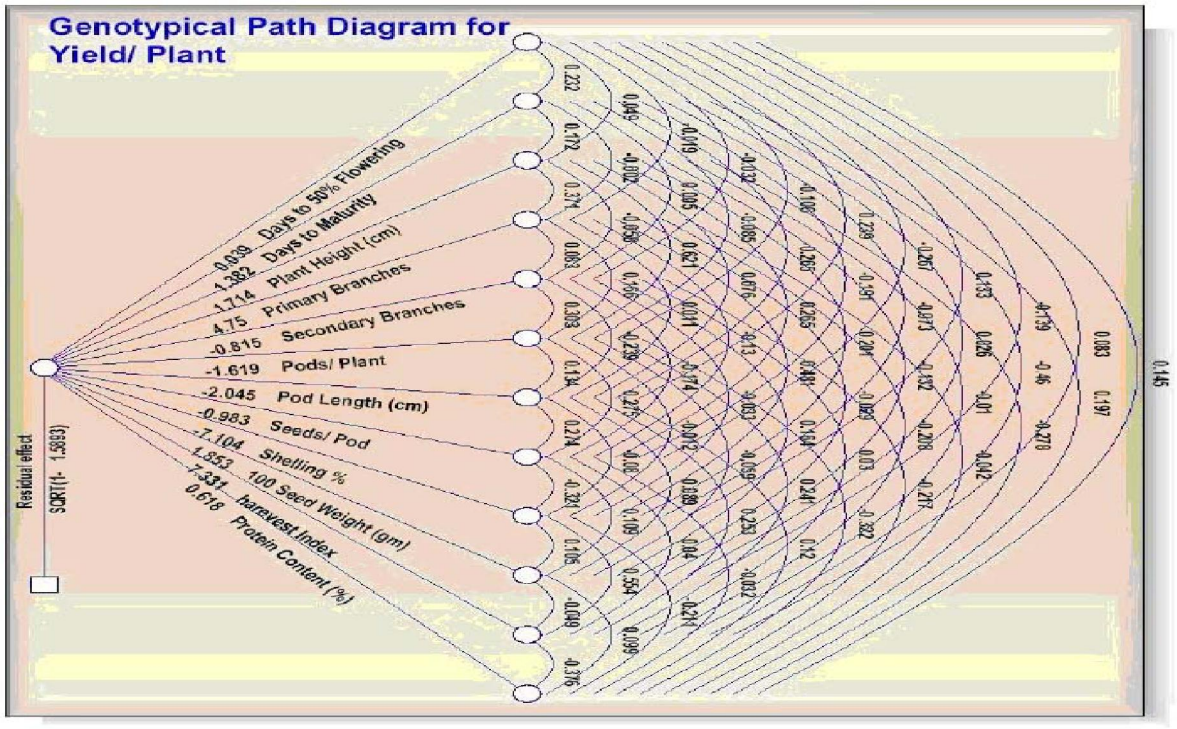
Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlations for 13 characters in 41 pigeonpea {*Cajanus cajan* (L.) Millsp.}genotypes.

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches/ plant	Secondary branches/ plant	Pods/ plant	Pod length (cm)	Seeds/ pod	Shelling Percent-age	100 seed weight (g)	Harvest index (%)	Grain protein content (%)	Seed yield/ plant (g)
Days to 50% flowering	1.0000	0.1846*	0.0273	-1.0160	-0.0078	-0.0948	0.1856*	-0.0753	0.0839	-0.0472	0.0577	0.1363	-0.1669
Days to maturity	0.2320**	1.0000	0.1455	-0.0609	-0.0369	-0.0602	-0.1273	-0.1411	-0.0036	0.0553	-0.3336**	0.1471	-0.1281
Plant height (cm)	0.0493	0.1725	1.0000	0.3558**	-0.0873	0.5927**	0.0451	0.1296	0.0673	-0.1312	-0.0240	-0.2572**	0.4005**
Primary branches/ plant	-0.0186	-0.0015	0.3714**	1.0000	0.0915	0.1506	0.0013	-0.0044	0.1990*	-0.0714	-0.1170	-0.0379	0.1181
Secondary branches/ plant	-0.0323	0.0047	-0.0581	0.0826	1.0000	0.2784**	-0.1624	-0.0505	-0.0384	0.1267	0.0599	-0.1960*	0.2551**
Pods/plant	-0.1061	-0.0854	0.6214**	0.1657	0.3026**	1.0000	0.0893	0.1502	-0.0154	-0.0478	0.2032*	-0.3111**	0.8442**
Pod length (cm)	0.2390**	-0.2651**	0.0759	0.0113	-0.2394**	0.1341	1.0000	0.1135	0.0186	-0.0139	0.1657	0.1019	0.0859
Seeds/pod	-0.2667**	-0.1906*	0.2646**	-0.1303	-0.1737	0.2749**	0.2736**	1.0000	-0.1185	0.0414	0.0705	0.0009	0.2539**
Shelling percentage	0.1325	-0.0732	0.2009*	0.4809*	-0.0334	-0.0121	-0.0800	-0.3207**	1.0000	0.0035	0.2184*	-0.1371	0.0066
100 seed weight (g)	-0.1394	0.0257	-0.1315	-0.0293	0.1635	-0.0592	0.0887	0.1094	0.1045	1.0000	0.0035	0.0847	0.1366
Harvest index (%)	0.0835	-0.4602**	-0.0103	-0.2082*	0.0303	0.2407**	0.2526**	0.0404	0.5544**	-0.0488	1.0000	-0.3518**	0.4061**
Grain protein content (%)	0.1452	0.1968*	-0.2776**	0.0416	-0.2169*	-0.3221**	0.1196	-0.0324	-0.2109*	0.0994	-0.3763**	1.0000	-0.3502**
Seed yield/ plant (g)	-0.1708	-0.1418	0.4256**	0.1303	0.2823**	0.8620**	0.1488	0.4722**	0.0826	0.1527	0.4597**	-0.3693**	1.0000

Table 2. Estimates of direct and indirect effects (genotypic) between yield components in pigeonpea {*Cajanus cajan* (L.) Millsp.}

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches/ plant	Secondary branches/ plant	Pods/ plant	Pod length (cm)	Seeds/ pod	Shelling Percent-age	100 seed weight (g)	Harvest index (%)	Grain protein content (%)
Days to 50% flowering	0.0389	0.0090	0.0019	-0.0007	-0.0013	-0.0041	0.0093	-0.0104	0.0052	-0.0054	0.0032	0.0056
Days to maturity	0.3206	1.3817	0.2383	-0.0021	0.0065	-0.1180	-0.3663	-0.2633	-0.1011	0.0355	-0.6359	0.2719
Plant height (cm)	0.0845	0.2956	1.7143	0.6366	-0.0996	1.0653	0.1302	0.4537	0.3444	-0.2255	-0.0177	-0.4759
Primary branches/ plant	-0.0884	-0.0072	1.7639	4.7498	0.3924	0.7872	0.0537	-0.6191	2.2843	-0.1392	-0.9887	-0.1978
Secondary branches/ plant	0.0263	-0.0038	0.0474	-0.0673	-0.8150	-0.2466	0.1951	0.1416	0.0272	-0.1333	-0.0247	0.1768
Pods/plant	0.1718	0.1383	-1.0063	-0.2684	-0.4900	-1.6194	-0.2172	-0.4452	0.0196	0.0958	-0.3898	0.5216
Pod length (cm)	-0.4889	0.5422	-0.1553	-0.0231	0.4897	-0.2743	-2.0454	-0.5595	0.1637	-0.1815	-0.5166	-0.2446
Seeds/pod	0.2622	0.1873	-0.2601	0.1281	0.1708	-0.2702	-0.2689	-0.9830	0.3153	-0.1075	-0.0397	0.0319
Shelling percentage	-0.9414	0.5197	-1.4274	-3.4164	0.2375	0.0860	0.5684	2.2786	-7.1040	-0.7425	-3.9387	1.4981
100 seed weight (g)	-0.2582	0.0476	-0.2437	-0.0543	0.3030	-0.1096	0.1644	0.2026	0.1936	1.8528	-0.0905	0.1841
Harvest index (%)	0.6120	-3.3739	-0.0758	-1.5261	0.2223	1.7648	1.8516	0.2963	4.0647	-0.3580	7.3313	-2.7590
Grain protein content (%)	0.0897	0.1216	-0.1715	-0.0257	-0.1340	-0.1990	0.0739	-0.0200	-0.1303	0.0614	-0.2325	0.6178
Seed yield/ plant (g)	-0.1708	-0.1418	0.4256	0.1303	0.2823	0.8620	0.1488	0.4722	0.0826	0.1527	0.4597	-0.3693

Fig. Genotypic path diagram showing cause and effect relationship of yield components with seed yield per plant in pigeonpea {*Cajanus cajan* (L.) Millsp.}



association with seed yield and simultaneous improvement of these characters along with seed yield is possible. Path coefficient analysis revealed that harvest index, plant height, number of primary branches per plant and 100 seed weight showed maximum positive direct effects together with strong positive correlation on seed yield per plant revealing their true relationship.

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