

Research Article**Path coefficient analysis in pigeonpea (*Cajanus cajan* L. Millsp.)**

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Abstract

Path coefficient analysis (genotypic and phenotypic) revealed that number of pods per plant, 100-seed weight and harvest index made maximum direct contribution towards seed yield per plant. Correlations of number of pods per plant and harvest index were also significant and positive which were reflected in path analysis as high direct effects. In addition to this, number of branches per plant and plant height contributed indirectly via number of pods per plant towards seed yield per plant.

Key words: Path coefficient analysis, correlation coefficient, *Cajanus cajan*

Introduction

The information on nature and magnitude of correlation coefficient help breeders to determine the selection criteria for simultaneous improvement of various characters along with seed yield. A study on correlation alone is not enough to give an exact picture of relative importance of direct and indirect influence of each of component characters on seed yield. In this context, path coefficient analysis is an important tool for plant breeder in partitioning the correlation coefficients into direct and indirect effects of independent variables on dependent variable i.e. seed yield

Materials and methods

The present study on Path coefficient analysis in pigeonpea (*Cajanus cajan* L. Millsp.) under varying spacings was under taken at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *kharif* 2005. The experimental material comprised of 28 different genotypes of pigeonpea, which includes promising lines as well as randomized varieties. The genotypes were sown in a three different environments were made available by three spacings at 60, 90 and 120 cm.

Each genotype was grown in single row plot of 3.0 m length. The plant to plant distant was kept 15 cm in all the above environments.

Results and Discussion

The phenotypic as well as genotypic correlation coefficients between seed yield and different characters were subjected to path coefficient analysis separately for partitioning these values into direct and indirect effects. The results obtained for direct and indirect effects of different characters and seed yield are summarized in Table 4.6.

Days to flowering had negative and non-significant association ($r_p = -0.211$) with seed yield per plant at phenotypic level. It's direct effect was also negative and of moderate magnitude (-0.113). While direct path value (genotypic) of this character was high and positive (0.783) towards seed yield. This character did not contributed much more indirectly through other yield components at phenotypic level.

Genotypic ($r_g = -0.225$) as well as phenotypic (-0.131) associations were also negative. Looking to the phenotypic path coefficient analysis, all the yield components showed low/negligible indirect effects either positive or negative except number of pods per plant. This character had negative and moderate (-0.141) indirect effect towards seed yield per plant. In case of genotypic path analysis, besides the direct contribution of days to maturity (-0.595), pod length

(-0.321), harvest index (-0.182) and number of pods per plant (-0.175) also contributed indirectly. Positive indirect contribution (0.688) of this character through days to flowering was also considerable.

Non-significant positive phenotypic correlation of plant height with seed yield per plant ($r_p=0.362$) resulted in moderate and positive direct effect (0.107) to seed yield. Direct effect (-0.030) was very low in case of genotypic path analysis. Genotypic association of plant height and seed yield (0.597) was also not very strong. This character indirectly contributed mainly via number of pods per plant as reflected by moderate indirect effects (0.368; 0.261) towards seed yield per plant.

Both direct effects (-0.173 and -0.075) of this character were in negative direction. But genotypic ($r_g=0.615$) and phenotypic ($r_p=0.311$) correlations were positive with seed yield per plant. This character also played indirect role in increasing seed yield through number of pods per plant at genotypic path (0.661) and phenotypic path (0.414) analysis. Indirect effect of this character via pod length (0.439) was also appreciable in genotypic path analysis but it was negligible (-0.002) in phenotypic path analysis.

Negative and non-significant (-0.105) inter-relationship between pod length and seed yield per plant resulted in low positive direct effect (0.011) in phenotypic path analysis. Weak genotypic association (-0.152) reflected in negative high direct effect (-0.915) in genotypic path analysis. Results of both path analysis indicated that, this character indirectly contributed largely through number of seeds per pod (0.621 and 0.055) and 100-seed weight (0.264 and 0.085) to seed yield per plant.

Positive and significant phenotypic correlation and very strong genotypic correlations were perfectly reflected in high direct effects (0.747 and 0.861). This character did not show its indirect contribution through other yield components in phenotypic path analysis. But number of pods per plant played indirect role via pod length (0.404) and harvest index (0.322) towards seed yield per plant.

In spite of non-significant phenotypic correlation ($r_p=-0.052$) weak and negative genotypic correlation ($r_g=-0.090$) between number of seeds per plant with seed yield per plant, the direct effects were positive (0.703 and 0.092). Most of the characters showed considerable indirect contribution in desired direction in both the analysis.

But this character had appreciable (0.162) indirect effect via 100-seed weight and days to flowering (0.357) in genotypic path analysis only.

Significant and positive phenotypic correlation ($r_p=0.599$) of this character with seed yield per plant resulted in moderate and positive direct effect (0.122) in phenotypic path analysis. Strong positive genotypic correlation ($r_g=0.831$) also reflected in considerable direct effect (0.445) in genotypic path analysis. Harvest index especially indirectly contributed through number of pods per plant towards seed yield per plant as indicated by its higher indirect effects (0.542 and 0.412) in both the analysis.

Though the phenotypic correlation of 100-seed weight with seed yield per plant (0.101) was non-significant. Its direct effect (0.227) was found of considerable magnitude. Similarly genotypic association (0.091) was weak, but genotypic path analysis revealed moderate direct effect (0.469). This character played indirect role via number of seeds per plant as evident by genotypic (0.243) and phenotypic (0.027) indirect effects.

The residual effect was found to be low (0.150) in phenotypic path analysis, while it was negligible (0.019) in genotypic path analysis.

When two or more variables are included in the correlation studies, it becomes difficult to determine which characters enhance the yield. The technique of path coefficient analysis overcomes this situation which partitions the forces of association and examine the relative contribution of direct and indirect effects of the independent variables on the dependent variable. In the present study, all the 9 characters were considered as causal variables of seed yield and genotypic and phenotypic correlation coefficients of these characters with seed yield were partitioned into the direct and indirect effects through path coefficient analysis.

Path coefficient analysis both at genotypic and phenotypic levels showed that number of pods per plant, 100-seed weight and harvest index made maximum direct contribution towards seed yield per plant. In all the above said case the genotypic path coefficients were of higher magnitude than their corresponding phenotypic path coefficients. Correlations of number of pods per plant and harvest index were also significant and positive at phenotypic

levels. At genotypic level association was also strong and positive. It clearly indicated that the importance of these two characters in selection programme. Such positive and high direct effect of these variables have also been reported by Yadvendra *et al.*, (1981), Balakrishnan and Natarajaratnam (1989a), Holkar *et al.* (1991), Dahiya and Singh (1994) and Paul *et al.* (1996). In addition to above said three yield components, number of seeds per pod was also identified as an important yield component as it had high direct effect (genotypic path) towards seed yield. Number of branches per plant contributed indirectly through number of pods per plant. The high indirect effects of number of branches per plant via number of pods per plant are the indication of its importance. Similar results were obtained by Marekar and Nerkar (1987) and Salunke *et al.* (1995). Indirect contribution of number of seeds per pod through number of pods per plant was negative and of moderate magnitude. It clearly indicated that increase in the number of seeds per pod resulted in decrease in the pod number. Such findings were earlier reported by Salunke *et al.* (1995). Plant height did not show any notable direct effect but it had indirect role via number of pods per plant towards seed yield. Both genotypic and phenotypic indirect effects were positive and moderate. Indirect importance of plant height via pods per plant was also noticed by Singh *et al.* (1982), Sidhu *et al.* (1985) and Dhameliya and Pathak (1998) in pigeonpea. Contrary to this, Shoran (1982) reported the negative indirect role of plant height. The residual effect on seed yield per plant was very low. It indicated that most of the yield contributing characters were included in the path analysis. Singh *et al.* (1982), Paul *et al.* (1996) and Lal and Raina (2002) also reported the low residual effect.

From the path analysis, again the number of pods per plant, harvest index and 100-seed weight were emerged as most important characters for the improvement of seed yield. Hence, due emphasis should be placed on these characters while breeding for high yield in pigeonpea.

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Table 1 Phenotypic (P) and Genotypic (G) path coefficient analysis showing direct and indirect effects of different characters on seed yield in 28 genotypes of pigeonpea (pooled basis of three spacings)

Characters		Days to 50 % flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Pod length (cm)	Number of pods per plant	Number of seeds per pod	Harvest Index (%)	100- seed weight (g)	Genotypic/ phenotypic correlation with seed yield per plant
Days to 50% flowering	G	0.783	-0.522	-0.003	0.000	-0.440	-0.157	0.321	-0.246	0.025	-0.240
	P	-0.113	0.045	0.009	0.000	0.003	-0.147	0.025	-0.044	0.011	-0.211
Days to maturity	G	0.688	-0.595	0.005	0.031	-0.321	-0.175	0.251	-0.182	0.073	-0.225
	P	-0.077	0.065	-0.001	0.004	0.002	-0.141	0.020	-0.033	0.030	-0.131
Plant height (cm)	G	0.075	0.096	-0.030	-0.046	-0.164	0.368	0.151	0.158	-0.009	0.597
	P	-0.010	-0.001	0.107	-0.021	0.001	0.261	0.006	0.016	0.002	0.362
Number of branches per plant	G	-0.001	0.105	-0.008	-0.173	0.439	0.661	-0.284	0.009	-0.134	0.615
	P	0.000	-0.003	0.030	-0.075	-0.002	0.414	-0.018	-0.005	-0.030	0.311
Pod length (cm)	G	0.377	-0.208	-0.005	0.083	-0.915	-0.330	0.621	-0.039	0.264	-0.152
	P	-0.034	0.013	0.013	0.013	0.011	-0.245	0.055	-0.015	0.085	-0.105
Number of pods per plant	G	-0.165	0.140	-0.015	-0.153	0.404	0.747	-0.262	0.322	-0.120	0.899
	P	0.019	-0.011	0.032	-0.036	-0.003	0.861	-0.023	0.058	-0.050	0.848**
Number of seeds per pod	G	0.357	-0.213	-0.007	0.070	-0.809	-0.278	0.703	-0.076	0.162	-0.090
	P	-0.030	0.014	0.007	0.015	0.007	-0.215	0.092	-0.009	0.067	-0.052
Harvest index (%)	G	-0.434	0.243	-0.011	-0.004	0.080	0.542	-0.121	0.445	0.090	0.831
	P	0.041	-0.018	0.014	0.003	-0.001	0.412	-0.007	0.122	0.033	0.599**
100-seed weight (g)	G	0.042	-0.092	0.001	0.050	-0.516	-0.191	0.243	0.086	0.469	0.091
	P	-0.005	0.009	0.001	0.010	0.004	-0.189	0.027	0.017	0.227	0.101

** Significant at 1 per cent level
 Bold values indicate direct effects

Residual effect R = 0.150 (Phenotypic path)
 Residual effect R = 0.019 (Genotypic path)