



CORRELATION AND PATH ANALYSIS STUDIES IN PIGEON PEA (*Cajanus cajan*)

*Bal, C.P., Bhawe, S.G., Thaware, B.L. and Desai, S.S.

Department of agricultural botany, College of Agriculture, DBSKKV, Dapoli

*Corresponding author Email: chinmayee.bal05@gmail.com

ABSTRACT

Studies on correlation between yield and yield components in 34 genotypes of pigeon pea revealed that harvest index plant height, pod length, pod breadth, number of seeds per pod and number of pods per plant would be more appropriate than other characters. The selection criteria based on these characters for seed yield will give fruitful results for yield improvement in pigeon pea.

KEY WORDS: pigeon pea, correlation, path analysis, early generation, harvest index.

INTRODUCTION

Pigeonpea or red gram [*Cajanus cajan* (L.) Millsp.], ($2n=2x=22$) is the globally covered fifth and second rank after chickpea in India. It is a rain fed crop and provides food, fuel, wood and fodder. It is major pulse crop of sustainable agriculture in the tropical and sub-tropical regions in the world. To retrieve culture yielding superiorly with better nutrient value, utilization of diverse parents for introgression is essential. Yield is not independent character, it depends on various characters and environmental conditions that exist during crop growth. Thus, selection pressure given only on yield misleads many times. It is, therefore, essential to study association of characters among themselves and with yield of crop. This can be done by character association studies under a set of environment conditions. Genotypic correlation provides a measure of genotypic association between two characters and helps to identify more useful relationship between characters. Indirect associations become complex and important when a number of variables are included in the study of correlation. In such cases more refined technique as path coefficient analysis helps to find out direct and indirect causes of character association. Every component character has a direct effect on yield. The effects of an independent one on dependent traits via other independent trait are known as indirect effects. If correlation is due to direct effect, it reflects true relationship and selection is practiced for such a character for improving the yield. In case, if the effect is indirect through another component trait, the breeder has to select the latter trait through which indirect effect is exerted.

MATERIALS & METHODS

The present study comprised a set of selected 34 genotypes. These were sown during Rabi 2014-15 in randomized Block Design, with a spacing of about 30 x 20 cm in three replication and standard agronomic practices were followed. Five plants selected at random were tagged from each genotype and observations on thirteen

quantitative characters (plant height, days to initiation of flowering, days to 50% flowering, days to maturity, number of primary branches per plant, number of pods per plant, pod length, pod breadth, number of seeds per pod, hundred seed weight, grain yield per plant, straw yield per plant and harvest index) were recorded on these plants. Genotypic and phenotypic correlation coefficient and path analysis studies were carried out based on standard procedures with the help of indostat's softwares.

RESULTS & DISCUSSION

The correlation co-efficient and path analysis for grain yield per plant and its contributing characters for 34 genotypes at phenotypic and genotypic level are presented in Table 1, 2, 3 and 4 respectively. Seed yield per plant had positive and highly significant correlation with harvest index (0.963), plant height (0.347), pod length (0.344), pod breadth (0.272), number of seeds per pod (0.220) and number of pods per plant (0.197). However seed yield exhibited positive but not significant correlation with straw yield per plant (0.043), days to maturity (0.041) and days to 50 per cent flowering (0.028). Non-significant negative correlation noticed with hundred seed weight (-0.227), number of primary branches (-0.087) and days to initiation of flowering (-0.016). Salunke *et al.* (1995), Gowda *et al.* (1996) and Sharma *et al.* (2014) reported positive correlation of plant height with seed yield in pigeon pea. Aher *et al.* (1998) also reported positive association of 50% flowering with grain yield. Studies indicated highly significant positive association of number of pods per plant both at phenotypic and genotypic level with seed yield per plant. Gowda *et al.* (1996), Paul *et al.* (1996), Aher *et al.* (1998) and Bhadru *et al.* (2010) noted the positive and significant association of grain yield per plant with number of pods per plant. Straw yield per plant showed highly significant negative correlation with harvest index.

TABLE 1. Estimates of phenotypic correlation coefficient between different characters in pigeon pea

	Plant height (cm)	Days to initiation of flowering (cm)	Days to 50 per cent flowering	Days to maturity	No. of primary branches per plant	No. of pods per plant	Pod length (cm)	Pod breadth (mm)	No. of seeds per pod	Hundred seed weight (g)	Straw yield per plant (g)	Harvest index	Grain yield per plant (g)
Plant height (cm)	-	0.715**	0.738***	0.641**	0.650***	0.771**	0.009	0.697**	-0.103	0.257**	0.530**	0.214*	0.347***
Days to initiation of flowering (cm)	-	0.913**	0.790**	0.884**	0.779***	0.746**	-0.145	0.577**	-0.254**	0.421**	0.581**	-0.151	-0.016
Days to 50 per cent flowering	-	-	0.806**	0.884**	0.806**	0.814**	-0.104	0.637**	-0.245*	0.352**	0.671**	-0.125	0.028
Days to maturity	-	-	-	0.731**	0.731**	0.767**	-0.187	0.581**	-0.264**	0.213*	0.578**	-0.088	0.041
No. of primary branches	-	-	-	-	-	0.864**	-0.077	0.670**	-0.316**	0.430**	0.596**	-0.211*	-0.087
No. of pods per plant	-	-	-	-	-	-	-0.031	0.722**	-0.207*	0.330**	0.675**	0.044	0.197*
Pod length (cm)	-	-	-	-	-	-	-	0.256**	0.500**	-0.088	0.095	0.331**	0.344**
Pod breadth (mm)	-	-	-	-	-	-	-	-	-0.004	0.203*	0.554**	0.161	0.272**
No. of seeds per pod	-	-	-	-	-	-	-	-	-	-0.151	0.027	0.230*	0.220*
Hundred seed weight (g)	-	-	-	-	-	-	-	-	-	-	0.106	-0.244*	-0.227*
Straw yield per plant (g)	-	-	-	-	-	-	-	-	-	-	-	-0.200*	0.043
Harvest index	-	-	-	-	-	-	-	-	-	-	-	-	0.963**

*Significant at 5% level

**Significant at 1% level

TABLE 2. Estimates of genotypic correlation coefficient between different characters in pigeon pea

	Plant height (cm)	Days to initiation of flowering (cm)	Days to 50 per cent flowering	Days to maturity	No. of primary branches per plant	No. of pods per plant	Pod length (cm)	Pod breadth (mm)	No. of seeds per pod	Hundred seed weight (g)	Straw yield per plant (g)	Harvest index	Grain yield per plant (g)
Plant height (cm)	-	0.821**	0.852**	0.742**	0.685**	0.829**	0.138	0.759	-0.103	0.288**	0.605**	0.275**	0.397**
Days to initiation of flowering (cm)	-	0.985**	0.843**	0.931**	0.870**	0.823**	-0.127	0.653**	-0.343**	0.470**	0.709**	-0.138	0.016
Days to 50 per cent flowering	-	-	0.931**	0.871**	0.871**	0.871**	-0.110	0.700**	-0.327**	0.357**	0.793**	-0.113	0.062
Days to maturity	-	-	-	0.805**	0.805**	0.847**	-0.169	0.633**	-0.325**	0.221*	0.736**	-0.081	0.076**
No. of primary branches	-	-	-	-	-	0.872**	-0.099	0.686**	-0.445**	0.471**	0.650**	-0.228*	-0.094
No. of pods per plant	-	-	-	-	-	-	-0.047	0.738**	-0.290**	0.356**	0.740**	0.044	0.204*
Pod length (cm)	-	-	-	-	-	-	-	0.413**	0.530**	-0.116	0.156	0.403**	0.433**
Pod breadth (mm)	-	-	-	-	-	-	-	-	-0.012	0.224*	0.640**	0.164	0.285**
No. of seeds per pod	-	-	-	-	-	-	-	-	-	-0.212*	-0.031	0.341**	0.333**
Hundred seed weight (g)	-	-	-	-	-	-	-	-	-	-	0.118	-0.273**	-0.250**
Straw yield per plant (g)	-	-	-	-	-	-	-	-	-	-	-	-0.127	0.085
Harvest index	-	-	-	-	-	-	-	-	-	-	-	-	0.976**

*Significant at 5% level

**Significant at 1% level

TABLE 3. Path analysis for different characters at phenotypic level in Pigeon pea

	Plant height (cm)	Days to initiation of flowering (cm)	Days to 50 per cent flowering	Days to maturity	No. of primary branches per plant	No. of pods per plant	Pod length (mm)	Pod breadth (mm)	No. of seeds per pod	Hundred seed weight (g)	Straw yield per plant (g)	Harvest index	Grain yield per plant (g)
Plant height (cm)	0.042	0.01590	-0.02530	0.00044	-0.02064	-0.00146	-0.00002	-0.02920	0.00132	0.00089	0.14646	0.21688	0.347**
Days to initiation of flowering (cm)	0.02994	0.022	-0.03131	0.00054	-0.02473	-0.00141	0.00036	-0.02417	0.00325	0.00145	0.16052	-0.15261	-0.016
Days to 50 per cent flowering	0.03089	0.02030	-0.034	0.00061	-0.02557	-0.00154	0.00026	-0.02668	0.00312	0.00122	0.18538	-0.12617	0.028
Days to maturity	0.02684	0.01756	-0.03031	0.001	-0.02320	-0.00145	0.00047	-0.02433	0.00337	0.00074	0.15958	-0.08869	0.041
No. of primary branches	0.02723	0.01732	-0.02762	0.0005	-0.032	-0.00163	0.00019	-0.02805	0.00403	0.00148	0.16459	-0.21378	-0.087
No. of pods per plant	0.03226	0.01660	-0.02790	0.00053	-0.02741	-0.002	0.00008	-0.03025	0.00264	0.00114	0.18635	0.04451	0.197*
Pod length(cm)	0.00039	-0.00322	0.00357	-0.00013	0.00244	0.00006	-0.002	-0.01070	-0.000639	-0.000030	0.02611	0.33498	0.344**
Pod breadth (mm)	0.02919	0.01283	-0.02185	0.00040	-0.02126	-0.00137	-0.00064	-0.042	0.00005	0.00070	0.15288	0.16331	0.272**
No. of seeds per pod	-0.0043	-0.00565	0.00839	-0.00018	0.01002	0.00039	-0.00125	0.00015	-0.013	-0.00052	0.00744	0.23325	0.220**
Hundred seed weight (g)	0.01077	0.00937	-0.01208	0.00015	-0.01366	-0.00062	0.00022	-0.00851	0.00193	0.003	0.02940	-0.24764	-0.227*
Straw yield per plant (g)	0.02220	0.01292	-0.02302	0.00040	-0.01892	-0.00128	-0.00024	-0.02318	0.00034	0.00037	0.276	-0.20252	0.043
Harvest index	0.00896	-0.00335	0.00427	-0.00006	0.00670	-0.00008	-0.00083	-0.00675	-0.00294	-0.00084	-0.05520	1.013	0.963**

*Significant at 5% level

**Significant at 1% level

Note : Bold figures indicate direct effects
Residual effect = 0.01237**TABLE 4.** Path analysis for different characters at genotypic level in Pigeon pea

	Plant height (cm)	Days to initiation of flowering	Days to 50 per cent flowering	Days to maturity	No. of primary branches per plant	No. of pods per plant	Pod length (cm)	Pod breadth (mm)	No. of seeds per pod	Hundred seed weight (g)	Straw yield per plant (g)	Harvest index	Grain yield per plant (g)
Plant height (cm)	-0.017	0.32697	-0.32234	0.07083	-0.08274	0.12495	0.00743	-0.03132	0.00079	-0.01164	0.11503	0.26987	0.397**
Days to initiation of flowering	-0.05796	0.398	-0.37279	0.08055	-0.10509	0.12397	-0.00681	-0.02694	0.00263	-0.01898	0.13466	-0.13584	0.016
Days to 50 per cent flowering	-0.06014	0.39284	-0.379	0.08889	-0.10524	0.13123	-0.00594	-0.02889	0.00251	-0.01442	0.15081	-0.11106	0.062
Days to maturity	-0.05237	0.33595	-0.35228	0.096	-0.09727	0.12758	-0.00910	-0.02609	0.00250	-0.00892	0.13996	-0.07931	0.076**
No. of primary branches	-0.04836	0.34654	-0.32972	0.07691	-0.121	0.13141	-0.00534	-0.02830	0.00342	-0.01899	0.12348	-0.22440	-0.094
No. of pods per plant	-0.05855	0.32770	-0.32962	0.08086	-0.10534	0.151	-0.00252	-0.03046	0.00223	-0.01435	0.14060	0.04299	0.204*
Pod length(cm)	-0.00974	-0.05040	0.04180	-0.01615	0.01200	-0.00707	0.054	-0.01704	-0.00407	0.00469	0.02959	0.39573	0.433**
Pod breadth (mm)	-0.05361	0.26015	-0.26511	0.06042	-0.08290	0.11129	0.02223	-0.041	0.00009	-0.00906	0.12158	0.16145	0.285**
No. of seeds per pod	0.00728	-0.13654	0.12361	-0.03102	0.05371	-0.04377	0.02853	0.00049	-0.008	0.00855	-0.00590	0.33539	0.333**
Hundred seed weight (g)	-0.02036	0.18740	-0.13522	0.02112	-0.05685	0.05360	-0.00626	-0.00926	0.00163	-0.040	0.02248	-0.26785	0.250*
Straw yield per plant (g)	-0.04274	0.28223	0.30033	0.07033	-0.07848	0.11148	0.00838	-0.02639	0.00024	-0.00477	0.190	-0.12476	0.085
Harvest index	-0.01940	-0.05509	0.04280	-0.00771	0.02760	0.00660	0.02168	-0.00678	-0.00262	0.01101	-0.02414	0.982	0.976**

*Significant at 5% level

**Significant at 1% level

Note : Bold figures indicate direct effects
Residual effect = 0.00175

Correlation does not provide exact picture of the direct and indirect causes of such association, which can be understood through path analysis. Direct selection of any character is useful when its direct effect is more or less the same magnitude as that of total effect and indirect selection is practiced when its indirect effect is responsible for bringing total effect. The character plant height had positive direct effect on yield per plant at phenotypical level. Sreelakshmi *et al.* (2010) reported plant height had maximum direct effect on grain yield per plant. Rao *et al.* (2013) reported days to flowering had negative direct effect on seed yield as in the present investigation. The character straw yield per plant showed positive direct effect on grain yield per plant at both phenotypic and genotypic level. It had positive indirect contribution via days to initiation of flowering, days to maturity, number of seeds per pod at phenotypic and genotypic level. Thanki and Sawargaonkar (2010) reported that the hundred seed weight had positive direct effect on grain yield per plant.

CONCLUSION & RECOMMENDATION

It is to be stated that, on the basis of correlation and path analysis studied, grain yield per plant could be improved through simultaneous selection harvest index, plant height, pod length, pod breadth, number of seeds per pod and number of pods per plant. It is desirable to give more weightage to these characters in selection programme for both seed yield and green pod yield per plant.

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