

Original Research Article

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## Correlation and Path Analysis in Pigeonpea [*Cajanus cajan* (L.) Millsp.]

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### ABSTRACT

#### Keywords

Pigeonpea,  
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Correlation between yield and yield attribute component traits in ninety three genotypes of pigeon pea revealed that single plant yield had positive and highly significant association with pod weight per plant, number of pods per plant and shelling percentage. The selection criteria can be done based on these characters for seed yield will give successful results for yield improvement in pigeon pea. Path coefficient analysis of different traits on single plant yield recorded that traits *viz.*, pod weight per plant, number of pods per plant and shelling percentage showed highest positive direct effect. Hence selection on these studied characters might be useful in Pigeon pea yield improvement.

### Introduction

Pigeon pea is the second most important protein rich pulse crop after chickpea in India and fifth most important crop in the world. Pigeon pea or red gram (*Cajanus cajan*) 2n=2x=22 is globally covered and grown in India. In India it occupies an area of about 5.39 m ha with an annual production of 4.60 million tonnes with the productivity of 913 kg /ha. (FAOSTAT (2018)). Pigeon pea is the main source of protein for Indian vegetarians and it contains 20-21 % of proteins. Seeds are used as green peas, split peas and whole grain. The world health organization recommended

that the per- capita consumption of protein around 80g/ day whereas the per-capita availability of protein in the country is about 28 g/ day leads to malnutrition for the growing population.(Saroj *et al.*, (2013)). To meet out the protein needs and to overcome from the biotic and abiotic stresses, genetically stable genotypes having high yield potential are mandatory.

Yield is a complex character which is controlled by polygenes. For enhancing the yield, better understanding of contributing character is essential and keeping this view the present study was carried out to find the inter-

relationship among the yield and its contributing traits and also their direct and indirect effect contribution to yield.

## Materials and Methods

The present experiment comprised of ninety three genotypes of Pigeon pea obtained from the Department of pulses, TNAU, Coimbatore during the year 2018-19. The experiment was conducted by Augmented Completely Randomized Design I. Four checks were replicated four times randomized, throughout the experimental area irrespective of blocks. The observations were recorded on five competitive randomly selected plants in each plot for the traits *viz.*, plant height, number of branches per plant, number of pods per plant, pod length, number of seeds per pod, 100 seed weight, grain yield per plant, days to 50% flowering and days to maturity.

The phenotypic correlation coefficients were computed using the formula suggested by Falconer (1964). The Path-coefficient analysis was conducted as described by Dewey and Lu (1959). Data obtained were subjected to correlation and path co-efficient analysis using statistical software TNAU STAT statistical package (Natarajan and Manivannan, 2014).

## Results and Discussion

Correlation between single plant yield and other traits were presented in the Table 1 for ninety three germplasm at phenotypic level. Single plant yield had positive and highly significant association with pod weight per plant (0.727), number of pods per plant (0.947) and shelling percentage (0.446). Negative and highly significant relationship was noticed with plant height (-0.342) and pod bearing length (-0.331). Number of primary branches per plant (0.039), raceme number (0.186), number of seeds per pod (0.130) and

hundred seed weight (0.091) had positive but non-significant association with single plant yield. Whereas days to fifty per cent flowering (-0.050) and days to maturity (-0.171) exhibited negative and non-significant association with single plant yield. The single plant yield had highly significant and positive association with pod weight per plant, number of pods per plant and shelling percentage.

Pushpavalli *et al.*, (2017), Pal *et al.*, (2018) and Prasad *et al.*, (2013) reported the similar results for the trait number of pods per plant. Sarsamkar *et al.*, (2008), Thanki and Sawargaonkar (2010) and Narayanan *et al.*, (2018) corroborated similar findings. Linge *et al.*, (2010), Kumara *et al.*, (2014), Nethravathi and Patil (2014), Vanisree and Sreedhar (2014) also reported similar results. Similar research proof were given by Kesh *et al.*, (2017) and Pal *et al.*, (2018) for the trait number of seeds per pod. The significant and negative association was noticed for single plant yield through plant height and pod bearing length. Similar research outcome was reported by Chandirakala and Subbaraman (2010) for plant height. Prasad *et al.*, (2013) reported for pod bearing length. Days to fifty per cent flowering showed highly significant and positive correlation with days to maturity, while positive and significant association with number of primary branches per plant and raceme number.

The same results were corroborated by Vanisree and Sreedhar (2014), Sodavadiya *et al.*, (2009) and Mahajan *et al.*, (2007) for number of branches per plant and Chandana *et al.*, (2014), Vanisree and Sreedhar (2014), Kumara *et al.*, (2014), Linge *et al.*, (2010) for days to maturity. Narayanan *et al.*, (2018) and Pal *et al.*, (2018) reported the similar research outcome for number of pods per plant. Days to maturity exhibited positive and significant correlation with number of primary branches per plant and raceme number.

**Table.1** Correlation coefficient between thirteen quantitative characters in pigeon pea germplasm

	<b>DF</b>	<b>PH</b>	<b>DM</b>	<b>NPB</b>	<b>RN</b>	<b>PBL</b>	<b>PL</b>	<b>PWPP</b>	<b>NSPP</b>	<b>NPPP</b>	<b>HSW</b>	<b>SP</b>	<b>SPY</b>
<b>DF</b>	1	-0.098	0.860**	0.210*	0.207*	-0.082	-0.006	0.067	-0.086	-0.156	-0.018	-0.107	-0.050
<b>PH</b>		1	0.008	0.076	-0.044	0.939**	0.072	-0.202	-0.155	-0.349**	-0.087	-0.294**	-0.342**
<b>DM</b>			1	0.256*	0.209*	0.033	-0.036	0.022	-0.008	-0.264*	-0.099	-0.226*	-0.171
<b>NPB</b>				1	0.685**	-0.018	-0.173	0.140	-0.092	-0.073	-0.137	-0.043	0.039
<b>RN</b>					1	-0.079	-0.164	0.284**	-0.057	0.101	0.063	-0.003	0.186
<b>PBL</b>						1	0.143	-0.190	-0.131	-0.327**	-0.053	-0.281**	-0.331**
<b>PL</b>							1	-0.031	-0.024	-0.132	0.044	-0.143	-0.130
<b>PWPP</b>								1	0.115	0.669**	0.041	-0.228*	0.727**
<b>NSPP</b>									1	0.186	0.148	-0.011	0.130
<b>NPPP</b>										1	.111	0.434**	0.947**
<b>HSW</b>											1	0.070	0.091
<b>SP</b>												1	.446**
<b>SPY</b>													1

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

<b>DF</b>	<b>Days to fifty per Cent flowering</b>	<b>PBL</b>	<b>Pod bearing length (cm)</b>	<b>HSW</b>	<b>Hundred Seed weight (g)</b>
<b>PH</b>	<b>Plant height (cm)</b>	<b>PL</b>	<b>Pod length (cm)</b>	<b>SP</b>	<b>Shelling percentage</b>
<b>DM</b>	<b>Days to maturity</b>	<b>PWPP</b>	<b>Pod weight / plant (g)</b>	<b>SPY</b>	<b>Single Plant yield (g)</b>
<b>NPBPP</b>	<b>Number of primary branches / Plant</b>	<b>NSPP</b>	<b>Number of seeds / pod</b>		
<b>RN</b>	<b>Raceme number</b>	<b>NPPP</b>	<b>Number of pods / plant</b>		

**Table.2** Direct (Diagonal) and indirect effects of thirteen character on single plant yield in pigeon pea

Characters	DFE	PH	DM	NPBPP	RN	PBL	PL	PWPP	NSPP	NPPP	HSW	SP	SPY
<b>DFE</b>	0.0378	-0.0095	-0.0056	0.0045	-0.0058	0.0054	0.0001	0.0349	0.0001	-0.0711	0.0001	-0.0404	-0.0498
<b>PH</b>	-0.0037	0.0969	-0.0001	0.0016	0.0012	-0.0623	0.0001	-0.1047	0.0001	-0.1597	-0.0002	-0.1115	-0.3422
<b>DM</b>	0.0325	0.0008	-0.0065	0.0055	-0.0058	-0.0022	-0.0001	0.0112	0.0011	-0.1205	-0.0002	-0.0857	-0.1709
<b>NPBPP</b>	0.0079	0.0074	-0.0017	0.0215	-0.0191	0.0012	-0.0003	0.0725	0.0001	-0.0335	-0.0003	-0.0165	0.0391
<b>RN</b>	0.0078	-0.0043	-0.0014	0.0147	-0.0279	0.0053	-0.0003	0.1467	0.0126	0.0464	0.0001	-0.0011	0.1861
<b>PBL</b>	-0.0031	0.0909	-0.0002	-0.0004	0.0022	-0.0664	0.0003	-0.0983	0.0001	-0.1494	-0.0001	-0.1065	-0.3309
<b>PL</b>	-0.0002	0.007	0.0002	-0.0037	0.0046	-0.0095	0.002	-0.0158	0.0470	-0.0604	0.0001	-0.0544	-0.1302
<b>PWPP</b>	0.0025	-0.0196	-0.0001	0.003	-0.0079	0.0126	-0.0001	0.5174	-0.0001	0.3059	0.0001	-0.0866	0.7272
<b>NSPP</b>	-0.0033	-0.015	0.0001	-0.002	0.0016	0.0087	0.0001	0.0592	-0.0008	0.0851	0.0003	-0.0041	0.1299
<b>NPPP</b>	-0.0059	-0.0338	0.0017	-0.0016	-0.0028	0.0217	-0.0003	0.3463	-0.0001	0.4571	0.0002	0.1646	0.9471
<b>HSW</b>	-0.0007	-0.0084	0.0006	-0.0029	-0.0018	0.0035	0.0001	0.0212	-0.0001	0.0509	0.002	0.0266	0.0911
<b>SP</b>	-0.004	-0.0285	0.0015	-0.0009	0.0001	0.0186	-0.0003	-0.1181	0.0001	0.1983	0.0001	0.3794	0.4462

Residual effect = 0.1950

<b>DFE</b>	<b>Days to fifty per Cent flowering</b>	<b>PBL</b>	<b>Pod bearing length (cm)</b>	<b>HSW</b>	<b>Hundred Seed weight (g)</b>
<b>PH</b>	<b>Plant height (cm)</b>	<b>PL</b>	<b>Pod length (cm)</b>	<b>SP</b>	<b>Shelling percentage</b>
<b>DM</b>	<b>Days to maturity</b>	<b>PWPP</b>	<b>Pod weight / plant (g)</b>	<b>SPY</b>	<b>Single Plant yield (g)</b>
<b>NPBPP</b>	<b>Number of primary branches / Plant</b>	<b>NSPP</b>	<b>Number of seeds / pod</b>		
<b>RN</b>	<b>Raceme number</b>	<b>NPPP</b>	<b>Number of pods / plant</b>		

The results are in harmony with Vanisree and Sreedhar (2014), Mahajan *et al.*, (2007), Sodavadiya *et al.*, (2009) and Verma (2018) for number of branches per plant. Number of pods per plant had positive and highly significant correlation with single plant yield. This was supported by Vanisree and Sreedhar (2014). Raceme number expressed positive and highly significant association with pod weight per plant similar result was reported by Pandey *et al.*, (2016). Based on the correlation studies number of pods per plant, pod weight per plant and shelling percentage showed highly positive association with single plant yield. Hence these traits could be included while designing the selection index in yield enhancing breeding programme.

Path coefficient analysis was done to determine the direct and indirect contributions of different traits towards single plant yield. The results were presented in Table 2. Residual effect was found to be 0.195, which indicated that the characters under study were contributed to 80.50 % of total variation. Hence, selection on these studied characters might be useful in genetic improvement for yield. The direct effect of different traits on single plant yield revealed that the traits, pod weight per plant (0.5174), number of pods per plant (0.4571) and shelling percentage (0.3794) showed highest positive direct effect. Days to fifty per cent flowering (0.0378), plant height (0.0969), number of primary branches per plant (0.0215), pod length (0.002) and hundred seed weight (0.002) had negligible and positive direct effects on single plant yield. Negative and negligible direct effect on single plant yield was observed by the traits *viz.*, days to maturity (-0.0065), raceme number (-0.0279), pod bearing length (-0.0664) and number of seeds per pod (-0.0008) (Table 2). The high and positive direct effect on single plant yield was exhibited by the traits, *viz.*, pod weight per plant, number of pods per plant and shelling percentage.

Similar research proofs were reported by Vange and Egbe (2009) and Niranjana Kumara *et al.*, (2014). Considerable effect of shelling percentage on single plant yield was reported by Pandey *et al.*, (2016). Verma (2018) reported that number of pods per plant had positive direct effect on single plant yield. Days to fifty per cent flowering, plant height, number of primary branches per plant, pod length and hundred seed weight had negligible and positive direct effects on single plant yield. High direct effect of number of branches per plant on single plant yield was reported by Prasad *et al.*, (2013), Kesh *et al.*, (2017) and Pandey *et al.*, (2016). Negative and negligible direct effect on single plant yield was observed by the traits *viz.*, day to maturity, raceme number, pod bearing length and number of seeds per pod. Krishna Chaithanya *et al.*, (2014) and Pandey *et al.*, (2016) corroborated similar results. Singh *et al.*, (2013) reported similar research proof for days to maturity and plant height. The high indirect effect on single plant yield was imposed by number of pods per plant, pod weight per plant. Similar results were reported by, Nethravathi and Patil (2014), Pushpavalli *et al.*, (2017), Pal *et al.*, (2018) and Narayanan *et al.*, (2018).

Based on the correlation studies number of pods per plant, pod weight per plant and shelling percentage showed highly positive association with single plant yield. Hence these traits could be included while designing the selection index in yield enhancing breeding programme. Path coefficient analysis, the residual effect of path coefficient analysis was 0.1950 which is indicating the sufficiency of number of traits under consideration for crop improvement. It was inferred that the traits *viz.*, number of pods per plant, pod weight per directly contribute to single plant yield. Therefore, they can be considered in a breeding programme for improvement of single plant yield.

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