International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(6): 2679-2682

Received: 05-09-2018
Accepted: 10-10-2018

Hardikkumar N Patel
P.G. Student, C.P. College of Agriculture, S.D. Agril. University, Sardarkrushinagar, North, Gujarat, India

Ashvinbhai M Patel
Associate Professor, Seed Spices Research Station, S.D. Agricultural University, Jagudan, Gujarat, India

Jigeeshaben M Patel
P.G. Student, C.P. College of Agriculture, S.D. Agril. University, Sardarkrushinagar, North, Gujarat, India

Nandkishor I Patel
Associate Research Scientist, AICRPDA, CNRM, S.D. Agril. University, Sardarkrushinagar, North, Gujarat, India

Correspondence
Hardikkumar N Patel
P.G. Student, C.P. College of Agriculture, S.D. Agril. University, Sardarkrushinagar, North, Gujarat, India

Character association analysis for yield, its component traits in pigeonpea [*Cajanus cajan* (L.) Millspaugh]

Hardikkumar N Patel, Ashvinbhai M Patel, Jigeeshaben M Patel and Nandkishor I Patel

Abstract
Forty five genotypes of pigeonpea were used to investigate the nature and magnitude of association of seed yield with major agronomic characters *viz.,* days to flowering, days to maturity, plant height (cm), number of branches per plant, number of pods per plant, pod length (cm), number of seeds per pod, seed yield per plant (g), test weight (g), harvest index (%), leaf area (cm^2) and protein content (%).This research also focussed on finding the direct and indirect effect of the various yield contributing characters on seed yield by path coefficient analysis. Correlation studies, revealed the positive and significant relationship of number of pods per plant, leaf area, plant height, test weight, number of branches per plant, harvest index, pod length and days to flowering with seed yield. The path coefficient analysis indicated that characters *viz*., number of pods per plant, days to maturity, pod length, protein content, leaf area, harvest index and test weight should be considered as selection indices in seed yield improvement programme as they recorded high direct effects on seed yield per plant.

Keywords: redgram, pigeonpea, genotypic and phenotypic correlations, path co-efficient

Introduction
Pigeonpea [*Cajanus cajan* (L.) Millspaugh] is often cross-pollinated crop which belong to family *Fabaceae* and sub family *papilionaceae* with chromosome number 2n=2x=22. The name "Pigeonpea" probably originated in Africa. It is widely grown in Indian subcontinent which accounts for almost 90 per cent of the world's crop. Pigeonpea main use as dhal, its tender green seeds are used as vegetables, crushed dry seeds as animal feed, green leaves as fodder, stem as fuel wood and to make husts, baskets etc. and plants are also used to culture Lac producing insects. The high protein genotypes also contain higher (about 25 %) sulphur-containing amino acids, namely methionine and cysteine (Singh *et al.* 1990) [18]. Seed contains about 57.3 to 58.7 per cent carbohydrate, 1.2 to 8.1 per cent crude fibre and 0.6 to 3.8 per cent lipids (Sinha, 1977) [19]. It is a good source of dietary minerals such as calcium, phosphorus, magnesium, iron, sulphur and potassium. It is also a good source of soluble vitamins especially thiamine, riboflavin, niacin and chlorine.
A complete understanding of the correlation between yield and yield components is a must for a plant breeder towards the improvement of any crop. Similarly path analysis determines the direct and indirect effects of these characters towards the yield. As emphasized by Pandey *et al.,* (2015) [14] the optimum combination of yield contributing traits can be accumulated in a particular genotype only by understanding the inter relationships of various traits using correlation and path coefficients. Seed yield is a dependant character and whenever plant breeder goes for selection for yield it always misleads because it depends on various characters and to some extent to the environmental conditions (Bal Chinmayee, 2016) [2]. An attempt has been made in this study to know the relationship between yield and different yield attributing characters and their direct and indirect effects on yield in pigeonpea.

Materials and Methods
In the present investigation 45 genotypes of pigeonpea procured from the Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar were evaluated in Randomized Block Design (RBD) with three replications for different quantitative characters at Agronomy Instructional Farm, C. P. College of Agriculture, SDAU,

Sardarkrushinagar during kharif season of 2017. Each genotype sown in single row of 4 m length with spacing 60 cm between row and 20 cm between plants. Data were recorded for five selected competitive plants per genotype for characters Plant height (cm), Number of branches per plant, Number of pods per plant, Pod length (cm), Number of seeds per pod, Seed yield per plant (g), Test weight (g), Leaf area (cm^2), Harvest index (%) and Protein content (%) in each replication and averages was worked out for statistical analysis. For the characters like days to flowering and days to maturity observation were recorded on per plot basis. The data were subjected to statistical analysis *viz*., correlation and path analysis as per the standard procedure. The co-efficients of phenotypic and genotypic variations were calculated by formula suggested by Burton (1952) [4]. The estimation of direct and indirect contribution of various seed yield contributing characters, showing high genotypic correlation co-efficient with seed yield in individual analysis, was carried as suggested by Wright (1921) [24] and elaborated by Dewey and Lu (1959) [6].

Results and Discussions

Yield is a complex character and it is multiplicative end product of other quantitative traits as components of the yield (Whitehouse *et al.* 1958) [23]. Hence, the selection of superior genotypes based on yield as such would not be more effective, but several yield contributing characters have to be handled together. Improvement in yield potential would be more reliable, if indirect selection is made based on the traits correlated with yield. Thus, for rational improvement of yield and its components, the understanding of correlation of yield with different yield contributing characters has been very useful. This association should be at genotypic level by eliminating the environmental influence from the phenotypic values.

In general the values for genotypic correlation were slightly higher than their phenotypic counterparts. This indicated that though there was a high degree of association between two variables at genotypic levels, but its phenotypic expression was deflated by the influence of environment. Characters like number of pods per plant, leaf area, plant height, test weight, number of branches per plant, harvest index, pod length and days to flowering showed significant positive correlation with seed yield per plant at both genotypic and phenotypic levels (Table 1). Such positive interrelationship between seed yield and its attributes have also been reported in pigeonpea by several researchers *i.e.* Thanki and Sawargaonkar (2010) [21], Arbad *et al*. (2014) [1], Kothimbire *et al.* (2015) [9] and Pandey *et al.* (2016) [13]. Thus, these attributes were more influencing the seed yield in pigeonpea and they can serve as important yield contributing traits for improvement in seed yield. On other hand seed yield per plant showed non-significant and negative association with days to maturity (r_g = -0.0145 and r_p = -0.0198) at both genotypic and phenotypic levels, whereas, protein content (r_g = -0.0017) at genotypic level. Similar results were also obtained by Gohil R.H. (2000b) for days to maturity and protein content and Mausumi *et al.* (2007) [11] for days to maturity.

In order to achieve a clear picture of interrelationship of various component characters with seed yield at genotypic level, direct and indirect effects of various characters on seed yield were calculated using path co-efficient analysis (Table 2). In present investigation, eleven characters were considered as causal variable of seed yield. It was observed that large positive direct effects on seed yield were caused by number of pods per plant, days to maturity, pod length, protein content, leaf area, harvest index and test weight (Fig 1). These seven characters were thus important yield contributing traits in the present population. These seven characters were also found important in path co-efficient analyses carried out by Shoram (1992) [15, 16], Gupta and Madrap (2007) [8], Sodavadiya *et al.* (2009) [20], Bhadru (2010a) [3], Chandirakala and Subbaraman (2010) [5], Mittal *et al*. (2010) [12], Thanki and Sawargaonkar (2010) [21] and Arbad *et al*. (2014) [1] in pigeonpea. Among these traits, the number of pods per plant is of more importance because; it showed the highest positive direct effect on seed yield along with significant correlation co-efficient. Thus number of pods per plant should be the vital tool for increasing seed yield in the present population. This trait may be an important feature of an ideal plant type in pigeonpea. Overall picture of path analysis in the present study revealed that selection through number of pods per plant, days to maturity, pod length, protein content, leaf area, harvest index and test weight may bring positive contribution to seed yield. Hence, it would be rewarding to lay more emphasis on these characters in selection programme for improvement of seed yield (Table 2). Though the direct effect of test weight and leaf area was not very high, but these traits affected the yield positively and indirectly through other traits. The number of pods per plant influenced the yield indirectly through number of branches and plant height. In the same manner the days to maturity influenced the yield via plant height and test weight.

Table 1: Genotypic and phenotypic correlation coefficient for different characters in pigeonpea

Characters		Days to maturity	Number of seeds per pod	Pod length (cm)	Number of pods per plant	Number of branches per plant	Plant height (cm)	Harvest index (%)	Test weight (g)	Leaf area (cm^2)	Protein content (%)	Seed yield per plant (g)
Days to flowering	r_g	0.9541**	0.1303	0.2644**	0.1920*	0.2654**	0.7898**	-0.6937**	0.5228**	0.3584**	-0.1238	0.1977*
	r_p	0.9396**	0.1196	0.2530 **	0.1820 *	0.2529 **	0.6178 **	-0.6303 **	0.4331 **	0.3298 **	-0.1175	0.1790*
Days to maturity	r_g		0.0940	0.1839*	-0.0243	0.2011*	0.6535**	-0.7295**	0.4453**	0.2485**	-0.2032*	-0.0145
	r_p		0.0720	0.1861 *	-0.0271	0.1908 *	0.5094 **	-0.6671 **	0.3743 **	0.2319 **	-0.1894 *	-0.0198
Number of seeds per pod	r_g			0.7005**	0.0054	-0.2889**	0.3066**	0.0166	0.2556**	0.0959	0.0723	0.0315
	r_p			0.5646 **	0.0096	-0.2301 **	0.2342 **	0.0008	0.1623	0.0467	0.0441	0.0182
Pod length (cm)	r_g				0.1596	-0.2613**	0.4177**	-0.1486	0.4199**	0.1097	-0.1873*	0.1952*
	r_p				0.1490	-0.2460 **	0.3228 **	-0.1395	0.3397 **	0.1010	-0.1662	0.1868 *
Number of pods per plant	r_g					0.3123**	0.3835**	0.1923*	0.3059**	0.5723**	-0.0099	1.0056**
	r_p					0.2912 **	0.3348 **	0.156	0.2560 **	0.5148 **	0.0134	0.9224 **
Number of branches per plant	r_g						0.2109*	-0.2118*	0.0559	0.5113**	0.0591	0.3056**
	r_p						0.2110 *	-0.2114 *	0.0877	0.4639 **	0.0542	0.3094 **

Plant height (cm)	r_g		-0.5798**	0.4747**	0.5182**	0.0297	0.3744**
	r_p		-0.4598 **	0.4118 **	0.4375 **	0.0162	0.3542 **
Harvest index (%)	r_g			-0.4667**	-0.0486	0.1800*	0.2130*
	r_p			-0.4230 **	-0.0619	0.1532	0.1897 *
Test weight (g)	r_g				0.2398**	-0.3145**	0.3184**
	r_p				0.2054 *	-0.2022 *	0.3518 **
Leaf area (cm^2)	r_g					-0.0431	0.5392 **
	r_p					-0.4141**	0.3524**
Protein content (%)	r_g						-0.0017
	r_p						0.0302

Table 2: Direct and indirect effects of yield component on seed yield in pigeonpea

Sr. no.	Character	Days to flowering	Days to maturity	Number of seeds per pod	Pod length (cm)	Number of pods per plant	Number of branches per plant	Plant height (cm)	Harvest index (%)	Test weight (g)	Leaf area (cm^2)	Protein content (%)	Seed yield per plant (g)
1	Days to flowering	-0.1286	-0.1227	-0.0168	-0.0340	-0.0247	-0.0341	-0.1016	0.0892	-0.0672	-0.0461	0.0159	0.1977*
2	Days to maturity	0.1755	0.1840	0.0173	0.0338	-0.0045	0.0370	0.1202	-0.1342	0.0819	0.0457	-0.0374	-0.0145
3	Number of seeds per pod	-0.0032	-0.0023	-0.0248	-0.0174	-0.0001	0.0072	-0.0076	-0.0004	-0.0063	-0.0024	-0.0018	0.0315
4	Pod length (cm)	0.0213	0.0148	0.0563	0.0804	0.0128	-0.0210	0.0336	-0.0120	0.0338	0.0088	-0.0151	0.1952*
5	Number of pods per plant	0.1940	-0.0245	0.0055	0.1613	1.0105	0.3156	0.3876	0.1943	0.3091	0.5783	-0.0100	1.0056**
6	Number of branches per plant	-0.0005	-0.0004	0.0005	0.0005	-0.0006	-0.0018	-0.0004	0.0004	-0.0001	-0.0009	-0.0001	0.3056**
7	Plant height (cm)	-0.0548	-0.0453	-0.0213	-0.0290	-0.0266	-0.0146	-0.0693	0.0402	-0.0329	-0.0359	-0.0021	0.3744**
8	Harvest index (%)	-0.0276	-0.0290	0.0007	-0.0059	0.0077	-0.0084	-0.0231	0.0398	-0.0186	-0.0019	0.0072	0.2130*
9	Test weight (g)	0.0129	0.0110	0.0063	0.0104	0.0076	0.0014	0.0118	-0.0116	0.0248	0.0059	-0.0078	0.3184**
10	Leaf area (cm^2)	0.0150	0.0104	0.0040	0.0046	0.0240	0.0214	0.0217	-0.0020	0.0100	0.0419	-0.0016	0.5914**
11	Protein content (%)	-0.0063	-0.0104	0.0037	-0.0096	-0.0005	0.0030	0.0015	0.0092	-0.0161	-0.0020	0.0511	-0.0017

*, ** significant at 0.05% and 0.01% level of significance, respectively
Residual effect = -0.0175

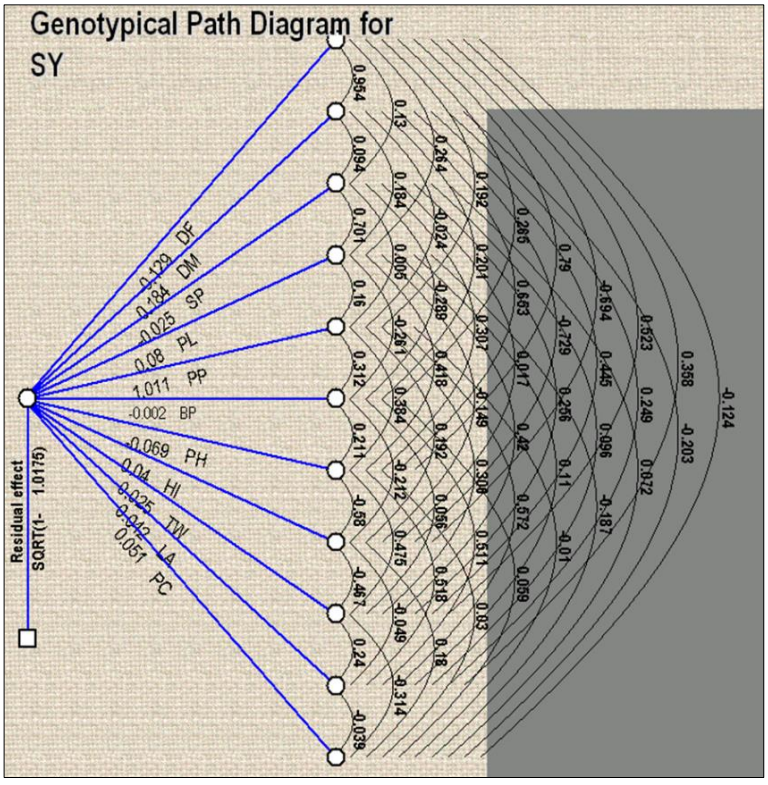

Fig 1: Genotypic path diagram for seed yield per plant

Where

DF = Days to flowering	DM = Days to maturity
SP = Number of seeds per per pod	PL = Pod length (cm)
PP = Number of pods per plant	BP = Number of branches per plant
PH = Plant height (cm)	SY= Seed Yield per plant
HI = Harvest index (%)	TW = Test weight (g)
LA = Leaf area (cm^2)	PC = Protein content

The path co-efficient analysis revealed the days to flowering, number of seeds per pod, number of branches per plant and plant height had negative direct effect on seed yield indicating their limited role in yield improvement. This study was in accordance with Veeraswamy *et al.* (1975) [22], Singh *et al.* (1982) [17], Malik *et al.* (1987) [10] and Shoram (1992) [15, 16].

References

1. Arbad SK, Deosarkar DB, Kothimbire SS. Correlation and path analysis for grain yield and its attributing traits in pigeonpea [*Cajanus cajan* (L.) Millsp.]. Bioinfolet. 2014; 11(1 B):237-241.
2. Bal Chinmayee P. Evaluation of early genotypes of pigeon pea (*Cajanus cajan* (L.) Millsp.). M.Sc. Thesis. Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, 2016, 139.
3. Bhadru D. Studies on genetic parameters and interrelationships among yield and yield contributing traits in pigeonpea [*Cajanus cajan* (L.) Millsp.]. Legume Research. 2010a; 33(1):23-27.
4. Burton GW. Quantitative inheritance in grasses. Proceeding Sixth International Grassland Congress. 1952; 1:227-83.
5. Chandirakala R, Subbaraman N. Character association and path analysis for yield attributes in full sib progenies in Pigeonpea [*Cajanus cajan* (L.) Millsp.]. Electronic Journal of Plant Breeding. 2010; 1(4):824-827.
6. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal. 1959; 57:515-518.
7. Gohil RH. Genetic divergence in pigeonpea (*Cajanus cajan* (L.) Millsp.). Research on Crops. 2006b; 7(3):748-750.
8. Gupta S, Madrap IA. Correlation and path analysis studies in pigeonpea. Journal Maharashtra Agricultural Universities. 2007; 32(1):159-161.
9. Kothimbire SS, Seema KA, Choulwar SB. Character association and path analysis for seed yield and its components in pigeonpea (*Cajanus cajan* (L.) Millsp.). Trends in Biosciences. 2015; 8(6):1556-1559.
10. Malik BA, Malik MR, Khan LA. Correlation and path analysis of yield and its components in pigeonpea. Pakistan Journal of Scientific and Indus. 1987; 30:452-245.
11. Mausami DA, Biswas K, Dasgupta T. Association between yield and yield components in short duration pigeonpea (*Cajanus cajan* (L.) Millsp.). Indian Agriculture. 2007; 51(3&4):173-176.
12. Mittal VP, Singh P, Brar KS. Character association and path coefficient analysis for yield components in pigeonpea. Madras Agricultural Journal. 2010; 97:319-20.
13. Pandey P, Kumar R, Pandey VR. Genetic association studies for yield and yield related traits in pigeonpea [*Cajanus cajan* (L.) Millsp.]. Research on Crops, 2016, 189-193.
14. Pandey P, Pandey VR, Tiwari DK, Yadav SK. Studies on direct selection parameters for seed yield and its component traits in pigeonpea (*Cajanus cajan* (L.) Millsp.). African Journal of Agriculture Research. 2015; 10(6):485-490.
15. Shoram J. Path analysis in pigeonpea. Indian Journal Genetics and Plant Breeding. 1992; 41:319-321.
16. Shoram J. Path analysis in pigeonpea. Indian Journal Genetics and Plant Breeding. 1992; 41:319-321.
17. Singh SP, Reddy RK, Narsinghani VG. Path coefficient and selection indices in pigeonpea. Indian Journal of Agricultural Science. 1982; 52:558-560.
18. Singh U, Jambunathan R, Saxena KB, Subrahmanyan N. Nutritional quality evaluation of newly developed high-protein genotypes of pigeon pea [*Cajanus cajan* (L.) Millsp.]. Journal of Science Food and Agriculture. 1990; 50:201-209.
19. Sinha SK. Food legumes: Distribution, adaptability and biology of yield. In: FAO Plant Production and Protection. Food and Agriculture Organization (FAO), Rome, Italy, 1977, 1-102.
20. Sodavadiya PR, Pithia MS, Savaliya JJ, Pansuriya AG, Korat VP. Studies on characters association and path analysis for seed yield and its components in pigeonpea (*Cajanus cajan* (L.) Millsp.). Legume Research. 2009; 32(3):203-205.
21. Thanki HP, Sawargaonkar SL. Path coefficient analysis in pigeonpea (*Cajanus cajan* (L.) Millsp.). Electronic Journal of Rant Breeding. 2010; 1(4):936-939.
22. Veeraswamy R, Rathinaswamy R, Murugesan M. Path analysis in red gram (*Cajanus cajan* (L.) Millsp.). Madras Agricultura Journal. 1975; 62:166-168.
23. Whitehouse RN, Thompson JB, Riberino VM. Studies on the breeding of self pollinating cereals II. The use of diallel cross analysis in yield prediction. Euphytica. 1958; 7:147-169.
24. Wright SJ. Correlation and causation. Journal of agriculture Research. 1921; 20:557-585.