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# Character association and path coefficient of yield and yield related traits in pigeonpea (*Cajanus cajan* (L) Millsp.)

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**Abstract**
The investigation on "Character association and Path coefficient studies of yield and yield related traits in Pigeonpea (*Cajanus cajan* (L) Millsp.)" was conducted on 25 genotypes of pigeonpea to know the interrelationship among yield and its components, their direct and indirect effects on yield of various Pigeonpea genotypes. The present investigation was undertaken during the *kharif*, 2025 season at Pulse Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in a Randomized Block Design with three replications, and observations were recorded on nine quantitative traits, including days to 50% flowering, days to maturity, plant height (cm), No. of primary branches per plant, No. of secondary branches per plant, No. of pods per plant, No. of seeds per pod, 100 seed weight and yield per plant. The estimates of genotypic correlations, in general were slightly higher than phenotypic correlation, indicating little masking or modifying effects of environment on the expression of character. The yield per plant exhibited positive and significant correlation with days to 50% flowering, days to maturity, plant height, No. of primary branches per plant, no. of secondary branches per plant, No. of pods per plant, No. of seeds per pods and 100 seed weight per plant. Among the different traits under path analysis study pigeonpea exhibited maximum direct effect on yield per plant followed by No. of pods per plant, days to maturity, 100 seed weight, plant height (cm), No. of secondary branches per plant while days to 50% flowering followed by no. of primary branches per plant, no. of seeds per pod had negative direct effects on yield per plot.

**Keywords:** Pigeonpea, *Cajanus cajan* (L) Millsp., Correlation, Path analysis, Yield

## Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp.), commonly known as red gram, tur or arhar, is an important grain legume crop belonging to the family Fabaceae. It is widely cultivated in tropical and subtropical regions, particularly in India, which is one of the major producers and consumers of pigeonpea. It is a diploid crop ($2n = 22$), predominantly self-pollinated, with natural cross pollination facilitated by insects. Pigeonpea is well adapted to semi-arid and rainfed conditions due to its deep root system and drought tolerance. Among the various pulse crops grown in World, Pigeonpea ranks second in area India (42.80 lakh tonnes), Malawi, Myanmar, Tanzania and Haiti. In India, major redgram cultivating states are *Karnataka* 15.83 lakh ha (39.12 lakh acres), Maharashtra 12.17 lakh ha (30.07 lakh acres), Madhya Pradesh 3.61 lakh ha (8.92 lakh acres), Uttar Pradesh 3.15 lakh ha (7.78 lakh acres), Gujarat 2.27 lakh ha (5.61 lakh acres) and Telangana 2.02 lakh ha (4.99 lakh acres). Considerable variation exists among pigeonpea genotypes in plant height, branching pattern, flowering and maturity duration, pod and seed characteristics, and grain yield, providing opportunities for crop improvement.

Genetic variability and diversity are essential for the development of high-yielding and genetically stable pigeonpea varieties. The assessment of genetic parameters, including genotypic and phenotypic coefficients of variation, heritability and genetic advance, helps determine the potential for improvement through selection. Correlation and path coefficient analyses are useful for understanding the relationships among yield-contributing traits and identifying characters with direct and indirect effects on grain yield. Furthermore, Mahalanobis' $D^2$statistic is an important tool for assessing genetic divergence and selecting genetically diverse parents for hybridization and heterosis breeding. Morphological characterization also helps identify and distinguish genotypes and maintain varietal purity during seed production. Therefore, the systematic evaluation of genetic diversity, variability and associations among yield-related traits is important for identifying superior pigeonpea genotypes and developing improved varieties with higher productivity and better adaptation to diverse agroclimatic conditions.

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## Material and methods

The investigation of 25 genotypes which were obtained from the Pulse Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was evaluated in a Randomized Block Design (RBD) with three replications. The experimental materials of studies comprised of 25 Pigeonpea (*Cajanus cajan* (L.) Millsp.) genotypes. The experiment was laid out in Randomized Block Design (RBD), with plot size of single row of 4m length (6 rows), spacing 60 x 20 cm having three replications. The observations were recorded on five randomly selected plants from each treatment in each replication for nine characters *viz*., days to 50% flowering, days to maturity, plant height, no. of primary branches per plant, No. of secondary branches per plant, No. of pods per plant, No. of seeds per pod, 100 seed weight (g), yield per plant. The data collected on individual characters were subjected to the method of analysis of variance commonly applicable to the randomized block design (Panse and Sukhatme, 1967). The correlations between different characters at genotypic (g) and phenotypic (p) levels were worked out between characters as suggested by Searle (1961) [1]. To establish a cause and effect relationship, the genotypic correlation were partitioned into direct and indirect effects by path analysis as suggested by Dewey *et al.* (1959) [2].

## Results and discussion

### *Correlation*

Correlation coefficient analysis revealed that seed yield per plant in pigeonpea had a highly significant positive association with all eight quantitative traits at both genotypic and phenotypic levels. The strongest positive correlations were observed with number of seeds per pod ($r_g$ = 0.986, $r_p$ = 0.896) and number of pods per plant ($r_g$ = 0.974, $r_p$ = 0.953), indicating that these traits are the major contributors to seed yield. Seed yield also showed strong positive correlations with number of secondary branches per plant, primary branches per plant, plant height and 100-seed weight. Moderate positive correlations were observed with days to maturity and days to 50% flowering. In most cases, genotypic correlation coefficients were higher than phenotypic coefficients, suggesting that environmental factors partially influenced the expression of these relationships.

Among the yield component traits, days to 50% flowering and days to maturity exhibited the strongest positive association ((r_*g* = 0.997, r_*p* = 0.995). Plant height was positively correlated with secondary branches, seeds per pod and 100-seed weight, while primary branches showed positive associations with secondary branches and pods per plant. Similarly, secondary branches were strongly correlated with pods per plant (r_*g* = 0.831, r_*p* = 0.785) and seeds per pod (r_*g* = 0.895, r_*p* = 0.777). The number of pods per plant was also highly correlated with seeds per pod ($r_g$ = 0.961, $r_p$ = 0.839). Overall, the findings suggest that number of pods per plant, number of seeds per pod, number of secondary branches per plant and 100-seed weight are important selection criteria for improving seed yield in Pigeonpea. The earlier researchers, Patel *et al.* (2011) [3]. Niranjana *et al.* (2014) [4], Verma *et al.* (2018) [5], Tharageshwari *et al.* (2020) [6], Chauhan *et al.*, (2021) [7]

### *Path analysis*

Correlation coefficient appears to be inadequate measure in selection as it does not provide sufficient information to decide the breeding procedure to be adopted or making simultaneous selection for crop improvement. Therefore, the path coefficient analysis as proposed by Dewey *et al.* (1959) [2] was adopted to estimate the direct and indirect contributions. Path coefficient analysis was carried out to determine the direct and indirect effects of eight quantitative characters on seed yield per plant in pigeonpea. The results revealed that number of pods per plant exhibited the highest positive direct effect (0.909) on seed yield, followed by 100-seed weight (0.213), plant height (0.195), days to maturity (0.639) and number of secondary branches per plant (0.016). Among these traits, days to maturity and number of pods per plant showed positive direct effects along with positive genotypic correlations with seed yield, indicating their importance in yield improvement. In contrast, days to 50% flowering (-0.742), number of primary branches per plant (-0.069) and number of seeds per pod (-0.374) showed negative direct effects. Despite its negative direct effect, number of seeds per pod exhibited a very high positive genotypic correlation (0.986) with seed yield, suggesting that its overall association was influenced by indirect effects through other characters.

Overall, the findings of path coefficient analysis indicated that number of pods per plant was the most important trait for improving seed yield in pigeonpea, owing to its high positive direct effect and strong positive correlation with yield. Days to maturity, plant height and 100-seed weight were also important traits because of their positive direct contributions to seed yield. The residual effect was reported as 0.0969, indicating that the traits included in the analysis accounted for approximately 99.06% of the variation in seed yield, while about 0.94% remained unexplained. Therefore, selection based on number of pods per plant, days to maturity, plant height and 100-seed weight may be useful for improving seed yield in pigeonpea. The earlier researchers, Sinha *et al.* (2005) [8], Kalaimagal *et al.* (2008) [9], Thanki *et al.* (2010) [10].

## Conclusion

The present investigation revealed substantial genetic variability among the twenty five pigeonpea genotypes, as indicated by significant differences for all characters. The estimates of genotypic correlation coefficients were generally higher than phenotypic correlations, suggesting stronger inherent genetic associations among the traits, with environmental factors influencing their phenotypic expression. Genotypic and phenotypic correlation analyses revealed strong positive associations between seed yield per plant and its contributing traits in pigeonpea. At the genotypic level, the highest correlations were observed with number of seeds per pod, number of pods per plant, and number of secondary branches per plant, followed by number of primary branches per plant, plant height and 100-seed weight. These findings highlight the importance of yield-contributing traits in selecting superior genotypes for improving pigeonpea productivity. Path coefficient analysis revealed that number of pods per plant had the highest positive direct effect on seed yield, followed by days to maturity, 100-seed weight and plant height. In contrast, days to 50% flowering and number of primary branches per plant showed negative direct effects. Overall, number of pods per plant, number of seeds per pod and number of secondary branches per plant are important selection criteria, while number of pods per plant is particularly valuable because of its high positive direct effect and strong correlation with seed yield.

**Table 1.** Analysis of variance for nine different characters in Pigeonpea.

| Sr. No. | Name of Characters | Mean sum of squares | | |
|---|---|---|---|---|
| | | Replication | Treatment | Error |
| 1 | Daysto 50%flowering | 5.37 | 1021.80** | 1.66 |
| 2 | Daystomaturity | 2.01 | 944.55** | 1.44 |
| 3 | Plantheight(cm) | 29.17 | 3118.03** | 172.06 |

(continued on next page)



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| Sr. No. | Name of Characters | Mean sum of squares | | |
|---|---|---|---|---|
| | | Replication | Treatment | Error |
| 4 | Numberofprimarybranches per plant | 0.04 | 1.10** | 0.05 |
| 5 | Numberofsecondarybranches per plant | 0.76 | 12.95** | 0.39 |
| 6 | Numberof podsperplant | 104.16 | 33125.50** | 384.74 |
| 7 | Numberof seedsperpod | 0.02 | 0.74** | 0.058 |
| 8 | 100seedweight(g) | 0.05 | 5.62** | 0.11 |
| 9 | Seedyield perplant (g) | 14.98 | 6461.09** | 16.30 |

**Table 2.** Estimates of Phenotypic (*P*) and Genotypic (G) correlations of different characters in pigeonpea.

| Character | | D50F | DM | PH | NPB | NSB | NPP | NSP | 100SW | YPP |
|---|---|---|---|---|---|---|---|---|---|---|
| D50F | G | 1.000 | 0.997** | 0.663** | 0.539** | 0.586** | 0.448** | 0.585** | 0.546** | 0.437* |
| | P | 1.000 | 0.995*** | 0.606*** | 0.502*** | 0.557*** | 0.439*** | 0.515*** | 0.531*** | 0.434** |
| DM | G | | 1.000 | 0.666* | 0.536** | 0.587** | 0.451** | 0.591** | 0.568** | 0.448* |
| | P | | 1.000 | 0.610*** | 0.497*** | 0.556*** | 0.442*** | 0.525*** | 0.552*** | 0.444** |
| PH | G | | | 1.000 | 0.499** | 0.688** | 0.541** | 0.757** | 0.630** | 0.612** |
| | P | | | 1.000 | 0.439*** | 0.621*** | 0.590*** | 0.605*** | 0.561*** | 0.564** |
| NPB | G | | | | 1.000 | 0.709** | 0.725** | 0.684** | 0.156 | 0.638** |
| | P | | | | 1.000 | 0.680*** | 0.667*** | 0.533*** | 0.109 | 0.590** |
| NSB | G | | | | | 1.000 | 0.831** | 0.895** | 0.411** | 0.801** |
| | P | | | | | 1.000 | 0.785*** | 0.777*** | 0.367** | 0.767** |
| NPP | G | | | | | | 1.000 | 0.961** | 0.462** | 0.974** |
| | P | | | | | | 1.000 | 0.839*** | 0.431*** | 0.953** |
| NSP | G | | | | | | | 1.000 | 0.644** | 0.986** |
| | P | | | | | | | 1.000 | 0.588*** | 0.896** |
| 100SW | G | | | | | | | | 1.000 | 0.608** |
| | P | | | | | | | | 1.000 | 0.594** |

**Table 3.** Direct (diagonal) and indirect effects for yield and yield components in pigeonpea.

| Genotypes | Days to 50% flowering | Days to maturity | Plant Height (cm) | No. of primary branches per plant | No. of secondary branches per plant | No. of pods per plant | No. of seeds per pod | 100 Seed weight (g) | Genotypic correlation with Yield per plant (g) |
|---|---|---|---|---|---|---|---|---|---|
| Days to 50% flowering | -0.742 | -0.740 | -0.492 | -0.400 | -0.435 | -0.332 | -0.434 | -0.405 | 0.437 |
| Days to maturity | 0.638 | 0.639 | 0.426 | 0.343 | 0.375 | 0.288 | 0.378 | 0.363 | 0.448 |
| Plant Height (cm) | 0.129 | 0.130 | 0.195 | 0.098 | 0.134 | 0.106 | 0.148 | 0.123 | 0.612 |
| Number of primary branches per plant | -0.037 | -0.037 | -0.034 | -0.069 | -0.049 | -0.049 | -0.046 | -0.011 | 0.638 |
| Number of secondary branches per plant | 0.010 | 0.010 | 0.011 | 0.012 | 0.016 | 0.014 | 0.015 | 0.006 | 0.801 |
| Number of pods per plant | 0.541 | 0.546 | 0.655 | 0.877 | 0.005 | 0.909 | 0.163 | 0.558 | 0.974 |
| Number of seed per pod | -0.219 | -0.221 | -0.283 | -0.256 | -0.335 | -0.359 | -0.374 | -0.241 | 0.986 |
| 100 Seed weight (g) | 0.116 | 0.121 | 0.135 | 0.033 | 0.088 | 0.098 | 0.137 | 0.213 | 0.608 |

Bold value denotes direct effect Residual value (*R*) = 0.0969

## References


1. Searle SR. Phenotypic, genotypic and environmental correlations. Biometrics. 1961;17:474-480.
2. Dewey DR, Lu K. A correlation and path-coefficient analysis of components of crestewheatgrass seed production 1. Agronomy Journal. 1959;51(9):515-518.
3. Patel JB, Acharya S. Genetic divergence and character association inIndo-African derivatives of pigeonpea [*Cajanus* cajan(L)Millsp.]J. FoodLegu. 2011;24(3):198-201.
4. Niranjana KB, Dharmaraj PS, Vijaya BW. Genetic diversity and variability studies of advanced breeding lines of Pigeonpea (*Cajanus* cajanL) IJAPBC. 2014;3(2):2277-4688.




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5. Verma SK, Bisht C, Gaur AK, Chandra D. Study on Some Genetic Parametersfor Yield and Related Traits in Pigeonpea [*Cajanus* cajan(L.) Millspaugh] Genotypes.ChemSci Rev Lett. 2018;7(25):70-76.
6. Tharageshwari LM, Thanga A, Hemavathy. Correlation and Path Analysis. Pigeonpea [*Cajanus* cajan(L.) Millsp.]Int. J.Curr.Microbiol.App.Sci. 2020;9(1):80-86.
7. Chauhan RM, *et al.* Correlation and path coefficient analysis in pigeonpea. Journal of Pharmacognosy and Phytochemistry. 2021;10:273–277.
8. Sinha SK, Singh MK. Genetic variability and character association analysis in pigeonpea [*Cajanus* cajan(L.) Millsp.] in northern hill Zone of Chhattisgarh.Abt. IFLRV - IV. 2005;18(22):143.
9. Kalaimagal T, Balu PA, Sumathi P. Genetic studies in segregatingpopulations of pigeonpea [*Cajanus* cajan(L.) Millsp.]. J. Crop Impr. 2008;35(1):31-34.
10. Thanki HP, Sawargaonkar SL. Path coefficient analysis in pigeonpea (*Cajanus* cajanL. Millsp.). 2010.
11. Panse VG, Sukhatme PV. Statistical methods for agril. Workers. ICAR, New Delhi. 1985. 4thEdn.

12. ** indicate significant at 1 per cent level, respectively.
13. D50F = Days to 50% flowering; DM = Days to maturity; PH = Plant height; NPB= No. of primary branches per plant;NSB= No. of secondary branches per plant; NPP= No. of pods per plant; NSP= No. of seeds per pod; 100SW = 100 Seed weight (g); YPP = Yield per plant.*and **- Significant at 5% and 1% level of significance, respectively.

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