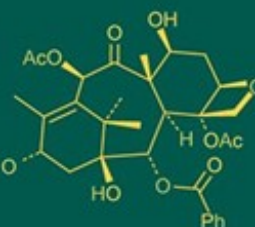
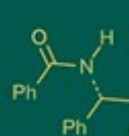
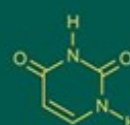


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Genetic assessment of correlation and path coefficient analysis for yield traits in chickpea (*Cicer arietinum* L.)

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ABSTRACT

Seed yield in chickpea is influenced by several quantitative traits and their interactions. Knowledge of the association among these traits is useful for identifying characters that can be considered during selection. The present study was carried out during rabi 2025–26 to determine the phenotypic association among growth and yield traits in chickpea genotypes. A total of 110 chickpea genotypes were evaluated at Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriyur, Karnataka, in an Alpha-lattice design with two replications. Observations were recorded for days to 50% flowering, plant height, primary branches per plant, pods per plant, 100-seed weight, days to maturity and seed yield. Phenotypic correlation coefficients were estimated and path coefficient analysis was carried out by considering seed yield as the dependent variable. Seed yield showed significant positive association with pods per plant ($r = 0.253$), 100-seed weight ($r = 0.187$) and days to maturity ($r = 0.215$). Days to 50% flowering, plant height and primary branches per plant showed negative and non-significant associations with seed yield. Path analysis revealed positive direct effects of days to maturity (0.344), pods per plant (0.292) and 100-seed weight (0.157) on seed yield, while days to 50% flowering, plant height and primary branches per plant showed negative direct effects. The results indicated that pods per plant, 100-seed weight and days to maturity were associated with seed yield and may be considered along with other selection criteria in chickpea improvement.

Keywords: Chickpea, Correlation, Path coefficient, Seed yield, Yield components

Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop cultivated in semi-arid and subtropical regions. Seed yield is a complex quantitative character influenced by several morphological and developmental traits. Therefore, selection based solely on seed yield may not provide sufficient information about the contribution of individual yield-related characters.

Correlation analysis is widely used in plant breeding to determine the direction and magnitude of associations among yield and its component traits. Studies in chickpea have reported associations among traits such as days to flowering, plant height, branches per plant, pods per plant, seed weight and seed yield (Babbar *et al.*, 2012; Kumar *et al.*, 2016; Roy *et al.*, 2016; Tiwari *et al.*, 2016) [1, 2, 3, 4]. Other investigations have examined the relationships among yield-contributing traits under different growing conditions, including late-sown and rainfed environments (Malik *et al.*, 2017; Samyuktha *et al.*, 2017; Singh *et al.*, 2017; Agrawal *et al.*, 2018) [5, 6, 7, 8].

However, correlation analysis alone cannot distinguish the direct contribution of a trait from its indirect association through other characters. Path coefficient analysis helps partition correlation coefficients into direct and indirect effects, providing additional information for interpreting relationships among traits. Several studies have applied this approach to chickpea yield and its components (Kumar *et al.*, 2016; Tiwari *et al.*, 2016; Samyuktha *et al.*, 2017; Mohan *et al.*, 2019; Pravalika *et al.*, 2024) [2, 4, 6, 9, 10]. More recent studies have also used correlation and path analysis to characterize yield-related traits in chickpea genotypes (Yadav *et al.*, 2025) [11].

Materials and methods**Experimental material and field evaluation**

The experiment was conducted during rabi 2025–26 at the Zonal Agricultural and Horticultural Research Station (ZAHRS), Babbur Farm, Hiriyur, Karnataka, India. A total of 110 chickpea genotypes were evaluated in an alpha-lattice design with two replications. The experiment consisted of ten blocks in each replication, with 11 entries per block. Genotypes were sown in single 3 m rows at a spacing of 30 cm × 10 cm.

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Observations were recorded for days to 50% flowering (DFF), plant height (PH), primary branches per plant (PB), pods per plant (PPP), 100-seed weight (HSW), days to maturity (DTM) and seed yield (SY). Five randomly selected plants from each genotype in each replication were used for recording plant-based traits. Seed yield was obtained from the net plot and expressed in kg ha⁻¹.

Statistical analysis

Phenotypic correlation coefficients among the seven characters were estimated following the approach described by (Weber and Moorthy) [12]. Seed yield was considered the dependent variable for path coefficient analysis, while days to 50% flowering, plant height, primary branches per plant, pods per plant, 100-seed weight and days to maturity were considered independent variables. Path coefficients were obtained by partitioning the correlation coefficients into direct and indirect effects, following (Wright) [13]. The analysis was carried out using R statistical software.

Results and discussion

Phenotypic correlation among growth and yield traits

The phenotypic correlation analysis showed significant associations among several of the traits studied. Seed yield showed a positive and significant correlation with pods per plant ($r = 0.253$), 100-seed weight ($r = 0.187$) and days to maturity ($r = 0.215$). The association of seed yield with days to 50% flowering ($r = -0.023$), plant height ($r = -0.128$) and primary branches per plant ($r = -0.008$) was negative and non-significant.

Days to 50% flowering showed a significant positive association with days to maturity ($r = 0.608$) and primary branches per plant ($r = 0.287$), while it showed a significant negative association with 100-seed weight ($r = -0.333$). Plant height showed a significant positive correlation with pods per plant ($r = 0.303$). Primary branches per plant showed a significant negative association with 100-seed weight ($r = -0.271$). Days to maturity and 100-seed weight were also negatively associated ($r = -0.196$).

The positive association between seed yield and pods per plant observed in the present study is consistent with earlier reports on chickpea yield components (Roy *et al.*, 2016; Agrawal *et al.*, 2018; Meena *et al.*, 2021) [3, 8, 14]. Agrawal *et al.* [8] and Meena *et al.* [14] also investigated associations involving important yield-contributing characters in chickpea. Differences in the strength and significance of correlations among studies may be related to the genetic material evaluated and the environmental conditions under which the experiments were conducted.

Path coefficient analysis

Path analysis was carried out to further understand the contribution of the traits associated with seed yield. Days to maturity recorded the highest positive direct effect (0.344) on seed yield, followed by pods per plant (0.292) and 100-seed weight (0.157). In contrast, plant height (-0.240), days to 50% flowering (-0.188) and primary branches per plant (-0.047) showed negative direct effects.

The positive direct effect of pods per plant was in accordance with its positive correlation with seed yield. Pods per plant also had small positive indirect effects through 100-seed weight and days to maturity. Similarly, the positive direct effect of 100-seed weight contributed to its positive association with seed yield. Days to maturity showed the highest positive direct effect among the traits studied, while its association with seed yield was also influenced by indirect effects through other characters.

Days to 50% flowering had a negative direct effect but showed a positive indirect effect through days to maturity. Plant height also recorded a negative direct effect, with a positive indirect contribution through pods per plant. Primary branches per plant showed a small negative direct effect. The use of path analysis to separate direct and indirect effects of yield-related traits has also been reported in chickpea (Kumar *et al.*, 2016; Meena *et al.*, 2021; Singh *et al.*, 2023) [2, 14, 15]. The residual effect was 0.887, indicating that the traits included in the path analysis did not account for the complete variation in seed yield.

Conclusion

The present study revealed the nature and extent of phenotypic associations among important growth and yield traits in chickpea genotypes. The results demonstrated that seed yield was positively and significantly associated with pods per plant, 100-seed weight and days to maturity, indicating the importance of these traits in determining yield performance. Path coefficient analysis further revealed positive direct effects of days to maturity, pods per plant and 100-seed weight on seed yield, suggesting their potential value as selection criteria in chickpea improvement programmes. Among these traits, pods per plant and 100-seed weight are particularly relevant because they contribute directly to yield formation and can be considered during the selection of superior genotypes. The observed associations also emphasize the need to evaluate several yield-related characters simultaneously rather than relying on a single trait for selection. Therefore, the findings provide useful information for identifying promising genotypes and developing effective selection strategies aimed at improving seed yield in chickpea.

Table 1. Phenotypic correlation coefficients among growth and yield traits in chickpea genotypes during rabi 2025–26

Traits	DFF	PH	PB	PPP	HSW	DTM	SY
DFF	1.000	-0.084	0.287**	0.007	-0.333**	0.608**	-0.023
PH	-0.084	1.000	-0.113	0.303**	0.101	-0.040	-0.128
PB	0.287**	-0.113	1.000	0.165	-0.271**	0.176	-0.008
PPP	0.007	0.303**	0.165	1.000	0.157	0.052	0.253**
HSW	-0.333**	0.101	-0.271**	0.157	1.000	-0.196*	0.187*
DTM	0.608**	-0.040	0.176	0.052	-0.196*	1.000	0.215*
SY	-0.023	-0.128	-0.008	0.253**	0.187*	0.215*	1.000

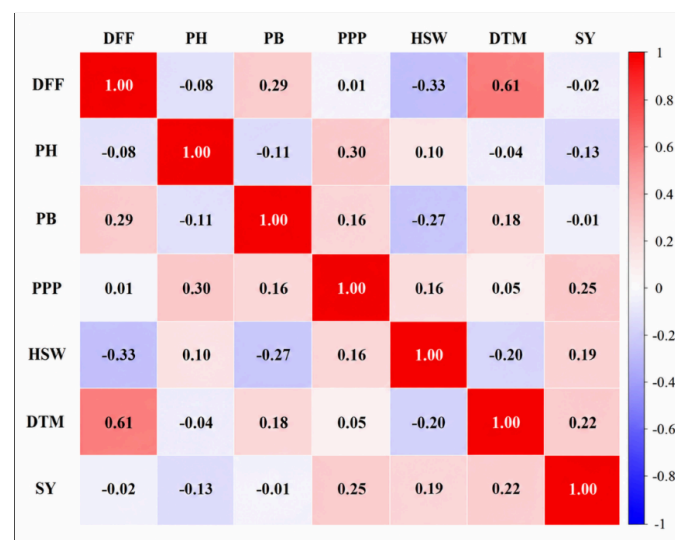
Note: *Significant at $P \leq 0.05$; **Significant at $P \leq 0.01$. DFF = days to 50% flowering; PH = Plant height; PB = Primary branches per plant; PPP = Pods per plant; HSW = 100-seed weight; DTM = Days to maturity; SY = Seed yield.

(continued on next page)

Table 2. Direct and indirect effects of growth and yield traits on seed yield in chickpea genotypes

Trait	Direct effect	DFF	PH	PB	PPP	HSW	DTM	SY (r)
DFF	-0.188	—	0.020	-0.014	0.002	-0.052	0.209	-0.023
PH	-0.240	0.016	—	0.005	0.089	0.016	-0.014	-0.128
PB	-0.047	-0.054	0.027	—	0.048	-0.043	0.061	-0.008
PPP	0.292	-0.001	-0.073	-0.008	—	0.025	0.018	0.253
HSW	0.157	0.063	-0.024	0.013	0.046	—	-0.067	0.187
DTM	0.344	-0.115	0.010	-0.008	0.015	-0.031	—	0.215

DFF = days to 50% flowering; PH = Plant height; PB = Primary branches per plant; PPP = Pods per plant; HSW = 100-seed weight; DTM = Days to maturity; SY = Seed yield.

**Figure 1.** Phenotypic correlation coefficients among growth and yield attributing traits in chickpea genotypes.

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