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# Correlation, path and principal component analysis of few agronomical traits in few elite lines of chickpea (*Cicer arietinum* L.)

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**Abstract**
Chickpea (*Cicer arietinum* L.) one the important *Rabi* season legume crops ranked third after common bean and field pea. For better yield improvement in chickpea, trait variability, genetic relationship and genetic diversity need to be known for possible yield improvement. Basing on this, the present investigation was carried out to know the effect of various traits on yield. The experimental material comprised of four elite chickpea genotypes grown in alpha lattice design with three replications during *Rabi* 2020-21. The data of five quantitative traits were analyzed for correlation, path coefficient and principle component analysis in four different elite lines of chickpea. The present study has led to the understanding of interrelation and the direct and indirect effect of various traits with yield. This may help in finding out the traits that need a better focus in-order to improve the yield of the crop. This may provide guidelines in the selection of chickpea genotypes for development of high yielding varieties.

**Keywords:** Path, few agronomical traits, few elite lines, *Cicer arietinum* L.

## Introduction
Chickpea (*Cicer arietinum* L.), commonly called Bengal gram, is the 3rd most important grain legume in the world. The crop had its origin in Indo-Burma region with *C. reticulatum* & *C. echinospernum*, in its primary and secondary gene pool respectively as wild progenitors. It is a diploid self-pollinating crop with 2n=2x=l6 chromosomes belonging to Leguminosae family with a genome size of about 750Mbp. Its grain provides 18-21% protein, 4-10% fat, 50-60% carbohydrate, 10-20% fiber and minerals and vitamins. Globally, chickpea is grown in an area of about 13 million hectares in 56 countries. Seed yield, an important economic trait is complex and polygenic in nature which manifests multiplicative interaction with its component traits and environments (Singh *et al*., 2014) because of which direct selection for yield may not be effective. The degree and extent of trait variability, relationship and genetic diversity in promising chickpea genotypes should be known for possible yield improvement (Upadhyaya *et al*., 2007a) [13]. The magnitude of variability can determine the genetic improvement through selection or hybridization followed by selection. Basing on this view, the present investigation was carried out to measure the correlation, path and principal component analysis for various yield component traits in few elite lines of chickpea for yield improvement in chickpea breeding programme.

## Materials and Methods
Our experiment was conducted to know the effect of various agronomic traits on yield in chickpea elite lines using correlation, path and principal component analysis. The genotypes Phule vikram, RVG 204, NBeG 47, JG 14 were collected from different parts of India. The experiment was carried out in the fields of ICRISAT in alpha lattice design with three replications. The genotypes were planted during 2nd week of November, 2020 and harvested during the third week of March, 2021. Each entry was planted in 4m row with a spacing of 30 x 15 cm. Data were recorded on five different agronomic characters like days to first flowering, days to fifty percent flowering, days to maturity, plant height and seed yield per plant. Five plants from each replication were randomly selected from each genotype for recording observations for all the traits. The correlation, path coefficient and principal

component analysis were analyzed using SPSS (Anon. 2001) statistical software programs in order to know the direct and indirect impacts of the agronomic traits on yield given by Dewey and Lu. 1959 [14].

**Results and Discussions**

The data from the elite lines were analyzed for correlation and path coefficient analysis. From correlation analysis seed yield recorded positively association with plant height (0.130) at 5% level of significance whereas with the other traits no association was recorded. When analyzed for path analysis, seed yield had recorded positive association with days to maturity and plant height with values ranging as 0.635 and 0.456 respectively whereas for days to fifty percent flowering there is a negative association ranging as -0.99. The respective figure of path analysis was depicted in Fig 1. A negative non significant correlation was reported between days to fifty percent flowering and days to maturity. This case was reported previously by Atta *et al*., 2008 [2].

**Table 1:** Correlation coefficients for different agronomic traits in chickpea

| | Days to 50% flowering | Days to maturity | Plant height | Seed yield | Days to first flowering |
|---|---|---|---|---|---|
| Days to 50% flowering | 1 | 0.24 | -0.48 | -0.41 | 0.79 |
| Days to maturity | | 1 | 0.61 | 0.31 | 0.05 |
| Plant height | | | 1 | 0.13* | -0.20 |
| Seed yield | | | | 1 | -0.87 |
| Days to first flowering | | | | | 1 |

*5% level of significance

Among the traits considered in the study, direct effect was observed for the plant height with seed yield as the association between them was positive both in correlation and path analysis whereas for the remaining traits like days to first flowering, days to fifty percent flowering and days to maturity indirect effect is observed. Basing on this, direct selection of the trait plant height can be recorded for an improved seed yield. But further studies at various locations and with the inclusion of much more genotypes is recommended in-order to have a clear cut idea about the effect of agronomic traits on seed yield. Kalyan *et al*., 2021 [15] recorded direct effect of plant height on seed yield in chickpea. Both the traits plant height and days to maturity recorded a positive direct effect on seed yield stating the direct selection of these traits will help in increasing the yield. These observations are in concordance with Ningwal *et al*., 2023 [9], Babbar *et al*. (2012) [3], Shrivastava *et al*., (2012) [11] and Jain *et al*., (2022) [4], Janghel *et al*., 2020 [5].

Principal component analysis (PCA) reduces the dimensionality of the data having large number of interrelated variables, while retaining maximum variation in the data set. This is possible by transforming the data into a new set of variables ie., the principal components (PCs), which were uncorrelated and ordered so that the starting variables retain the maximum variation present in the original variables of the data set (Jolliffe, 2002) [6]. The analyzed results of PCA are represented in Table 2 and graphically in Fig 2. A total of two components having eigen value more than one were recorded form the data which account for 81% of the total cumulative variance for grain yield. Results showed that PC1 is correlated with days to first flowering, days to fifty percent flowering whereas PC2 is correlated with plant height and days to maturity. Data in Table 2 shows that PC1 accounts for about 51% of the variability whereas PC2 accounts for 30%. Therefore, days to first flowering, days to fifty percent flowering, days to maturity and plant height can be considered as important parameters for increasing the seed yield. These results are in support with the reports of Rekha *et al*., (2013) [10], Amrita *et al*., (2014) [1] and Mahendra *et al*., (2015) [8].

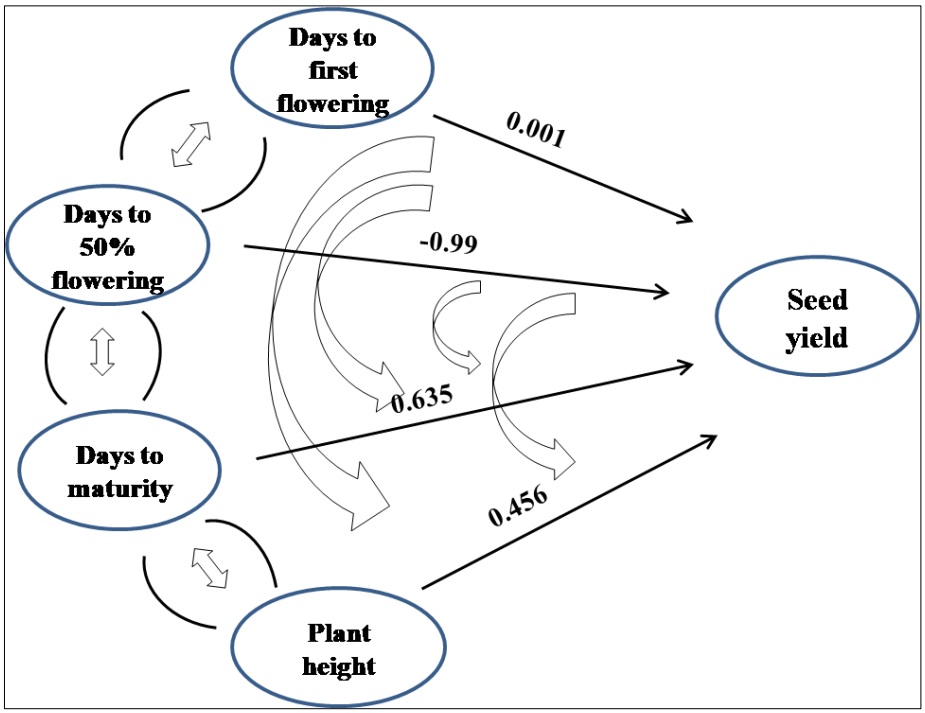


**Fig 1:** Diagrammatic representation of path analysis of different agronomic traits in chickpea

**Table 2:** Eigen value and the cumulative variance explained by principal component analysis

| Components | Eigen value | % of Variance | Cumulative variance % |
|---|---|---|---|
| 1 | 2.56 | 51.14 | 51.14 |
| 2 | 1.53 | 30.60 | 81.73 |
| 3 | 0.91 | 18.27 | 100.00 |
| 4 | 0.45 | 0.91 | 100.00 |
| 5 | -0.50 | -0.10 | 100.00 |

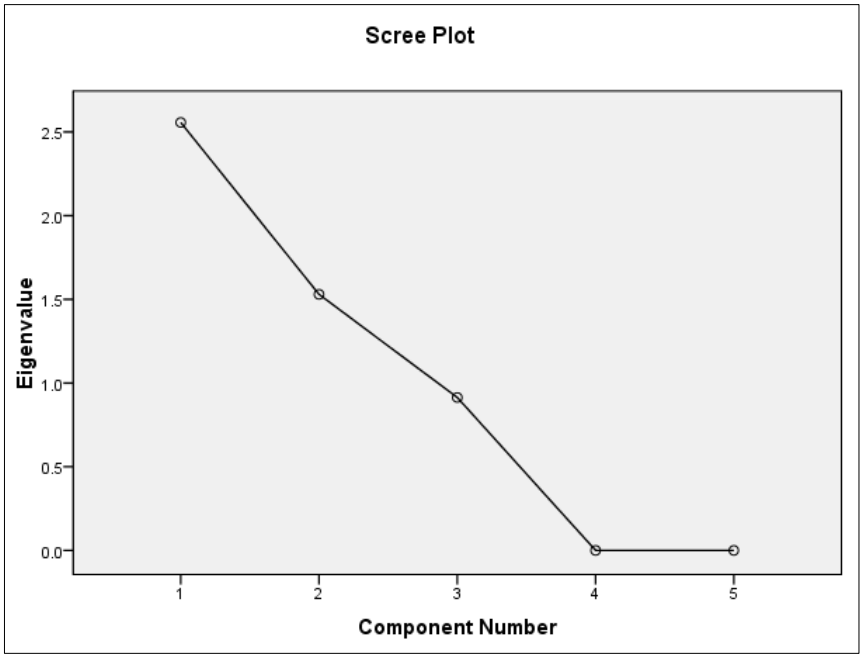


**Fig 2:** Scree plot for the principal component analysis

**Table 3:** Eigen value Component matrix for the characters in chickpea by principal components analysis.

| Character | PC 1 | PC 2 |
|---|---|---|
| Days to first flowering | 0.98 | 0.31 |
| Days to fifty percent flowering | 0.82 | 0.29 |
| Days to maturity | -0.22 | 0.93 |
| Plant height | -0.52 | 0.69 |

## Conclusion

The present study led to the understanding of the interrelated traits for seed yield which can help in the effective selection of genotypes. The positive significant correlation and direct effects on seed yield/ plant was recorded by plant height whereas with the other traits it is negotiable. These traits

exhibited a variation of around 81.73% in the four elite chickpea for five agronomical traits by PCA. Further analysis of these genotypes at different locations along with the inclusion of various other traits may help in obtaining better results which can be used in future breeding programmes.

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