Estimation of nature and magnitude of correlation among different traits in chickpea (*Cicer arietinum* L.)

ABSTRACT

The present investigation aimed to study correlations among different traits in chickpea, specifically indicated that the traits —days to 50% blooming, days to maturity, harvest index (%), plant height (cm), number of primary branches per plant, number of pods per plant, number of seeds per pod, 100-seedweight (g), and seed output per plant. Compared to the matching phenotypic correlation coefficient, the estimations of genotypic correlation were greater. It could be the consequence of the environment's altering influence on the genotypic level of character association. Harvest index, number of seeds per pod, number of major branches per plant, number of pods per plant, biomass per plant, and 100-seed weight at the genotypic level all showed a statistically positive connection with the seed output per plant. At the phenotypic level, the following variables demonstrated a positive and significant correlation with seed yield per plant: harvest index, number of seeds per pod, number of major branches per plant, number of pods per plant, and 100-seed weight. These correlations showed that enhancing the aforementioned traits can increase seed output.

Keywords: Correlation, Chickpea, Plant height, Number of seeds per pod, 100-seedweight, Seed yield per plant, Harvestindex, seed yield,

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INTRODUCTION

In our nation, pulses are the main source of protein for vegetarian diets. They are an important part of sustainable agriculture because, in addition to being a great source of protein, they also help to maintain soil fertility by fixing nitrogen in the soil biologically. Approximately 45 percent of the pulses produced in India are chickpeas. Like other pulses, India is the world's largest producer of chickpeas, accounting for more than 75% of global output. Often referred to as Bengal gramme or gramme, the chickpea (Cicer arietinum L. 2n=16) is India's most significant rabi pulse.

Cross-pollination occurs infrequently—only 0% to 1% of chickpeas are known to be self-pollinated. This kind of pulse has two or three peas in a single seed pod. In the diets of the impoverished, chickpeas are a significant source of protein, especially for vegetarians. Additionally, its application as an alternative to animal protein is growing. Chickpeas are a good source of protein, folate, and zinc. They are a good source of carbs for those with diabetes or insulin sensitivity since they are also quite high in dietary fibre.

In India, chickpea accounts for about 45% of total pulses produced in the country. Similar to the case of other pulses, India is the major producing country for chickpea, contributing for over 75% of total production in the world.

Chickpea is the third most important pulse crop, after dry bean and peas, produced in the world. The Desi type chickpea contribute to around 80% and the Kabuli type around 20% of the total production. India is the world leader in chickpea production followed by Pakistan and Turkey. Among the top producers of chickpeas are Mexico, Pakistan, and India. With an area of 8.52 million hectares and a productivity of 1036 kg/ha, India is the greatest producer, with around 8.83 million

tonnes. Six nations—India, Australia, Turkey, Myanmar, Pakistan, and Ethiopia—account for almost 90% of global chickpea output, or around 70% of the total. India still imports chickpeas from other nations despite being the world's greatest producer. Given the growing demand for this legume crop, improving productivity and the area under cultivation while reducing stress on the crop plant are crucial. Any breeding program's progress is contingent upon the degree and kind of diversity present in the base population.

Therefore, selecting breeding stocks with adequate variety is essential to the success of any breeding effort. The ultimate objective of a breeding program, yield, is a very complicated trait that is influenced by a variety of environmental and genetic variables. Therefore, in order to create a selection strategy for indirect selection that leads to a greater yield, the breeder requires a few index features. Studies at the genetic level will assist the breeder in choosing the genetic improvement of yield if an improvement in one trait is inherited with a positive or negative change in another.

METHODS AND MATERIALS

The current chickpea correlation study was carried out during the Rabi season of 2023–2024 at the Organic Research Farm (HRF), Karguanji, Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Bundelkhand University, Jhansi. In each replication, five competitive plants were chosen at random to record observations for each of the quantitative characters: Days to 50% flowering, Days to maturity, Plant height (cm), Primary branches per plant, Number of pods per plant, Number of seeds per pod, 100-seedweight (g), Seed yield per plant (g), and Harvest index (%). The only two quantitative characters for which observations were recorded on a plot basis were Days to 50% flowering and Days to maturity.The phenotypic, genotypic and environmental correlation coefficients were calculated from the phenotypic and genotypic components of variances and co- variances as per the procedure suggested by Fisher (1954) and Al-Jibouri*et al*. (1958) and later on formula given by Singh and Choudhary (1979). The estimates of correlation were tested at 5% and 1% level of significance against the expected value from Fisher Table at (n-2) degree of freedom (Fisher and Yates, 1938).

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RESULTS AND DISCUSSION

Looking at Table 1, we found that, at the genotypic level, seed yield per plant showed a highly significant and significant positive correlation with the harvest index (0.790**), number of seeds per pod (0.675**), primary branches per plant (0.611**), number of pods per plant (0.401**), and 100-seedweight (0.330*). The phenotypic level revealed a positive, very significant, and significant association between the harvest index (0.670**), number of seeds per pod (0.415**), number of pods per plant (0.356**), principal branches per plant (0.400**), and 100-seed weight (0.298*) and seed yield per plant, respectively.

On the other hand, at both the genotypic and phenotypic levels, the number of days until 50% blooming and the number of days until maturity showed a non-significant and negative connection with the amount of seed produced per plant. At the genotypic level, there was a highly significant and negative connection between the harvest index (-540**) and the number of pods per plant (-0.427**). A closer look at Table 1 revealed that, at the genotypic and

phenotypic levels, respectively, the number of seeds per pod showed a highly significant and substantial positive connection with the harvest index (0.643** and 0.280*). At the genotypic and phenotypic levels, the harvest index did, however, also exhibit a highly significant and negative connection with the days to maturity (-0.648** and -0.449**). At the genotypic level, there was a highly substantial and positive connection between principal branches (0.994**), number of pods per plant (0.574**), and plant height (0.358**). At the phenotypic level, there are 0.393** pods per plant. Days to 50 per cent flowering, days to maturity, number of seeds per pod and 100-seed weight were revealed non-significant but positive correlation with biomass per plant at both genotypic and phenotypic level. Plant height (0.240) also exhibited non-significant and positive association at phenotypic level. At the genotypic level, the 100-seed weight showed a highly significant and positive connection with the number of primary branches per plant (0.402**) and the number of days to maturity (0.376**). At the phenotypic level, it likewise showed a highly significant and positive connection with days to maturity (0.333**). The number of seeds per pod at the genotypic level exhibited a highly substantial and positive connection with both plant height (0.344**) and the number of pods per plant (0.359**). At both the genotypic and phenotypic levels, the number of pods per plant showed a very significant and positive connection with the number of primary branches per plant (0.909** and 0.489**) and plant height (0.726** and 0.477**).
At both the genotypic and phenotypic levels, the number of primary branches per plant exhibited a substantial and positive connection with plant height (0.559** and 0.255*). At the genotypic level, primary branches per plant likewise shown a strong and favourable association with days to maturity (0.316*). At the genotypic and phenotypic levels, it did, however, show a non-significant and negative connection with the number of days till 50% blooming. Plant height showed a highly substantial and positive connection with days to maturity at both the genotypic and phenotypic levels (0.448** and 0.337**). Nevertheless, it showed a negative and non-significant connection with days to 50%. Flowering at the phenotypic and genotypic levels (-0.110 and -0.030). At both the genotypic and phenotypic levels, days to maturity showed a non-significant and positive correlation with days to 50% blooming (0.165 and 0.151). The harvest index (0.790**), number of seeds per pod (0.675**), number of major branches per plant (0.611**), number of pods per plant (0.401**), and 100-seedweight (0.330*) all showed a positive, significant genotypic connection with the seed yield per plant.Accordingly, the correlation coefficient analysis showed that the key characteristics for crop development in chickpeas are the number of seeds per plant, harvest index, number of seeds per pod, number of major branches per plant, number of pods per plant, and 100-seed weight.

For seed yield per plant and the majority of the traits that contribute to yield, these findings about character association in chickpeas also align with similar trends of results reported by Bhavani et al. (2008), Vekariya et al. (2008), Vaghela et al. (2009), Yucel and Anlarsal (2010), Usman et al. (2012), Yadav et al. (2014), and Gaur et al. (2014).

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Table1:Genotypic(r_g)andphenotypic(r_p)correlationcoefficientsbetweendifferentcharactersinchickpea

Characters	R	Days to maturity	Plant height (cm)	Primary branches per plant	Number of pods per plant	Number Of seeds per pod	100-seed weight (g)	Harvest index(%)	Seed yield Per plant (g)
Days to 50%flowering	G	0.165	-0.110	-0.243	-0.016	-0.081	-0.240	-0.220	-0.225
	P	0.151	-0.030	-0.020	-0.010	-0.071	-0.220	-0.212	-0.185
Days to maturity	G		0.448**	0.316*	0.120	-0.025	0.376**	-0.648**	-0.206
	P		0.337**	0.107	0.005	-0.048	0.333**	-0.449**	-0.166
Plant height(cm)	G			0.559**	0.726**	0.344**	0.166	-0.138	0.153
	P			0.255*	0.477**	0.093	0.123	-0.093	0.042
Primary branches per plant	G				0.909**	0.136	0.402**	0.025	0.611**
	P				0.489**	0.227	0.176	-0.010	0.400**
Number of pods per plant	G					0.359**	0.002	0.112	0.401**
	P					0.246	-0.000	0.017	0.356**
Number of seeds per pod	G						-0.145	0.643**	0.675**
	P						-0.083	0.280*	0.415**
100-seedweight(g)	G							0.020	0.330*
	P							0.012	0.298*
Harvest index (%)	G							-0.040	0.493**
	P							-0.155	0.355**
									0.790**

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CONCLUSION

Because of their strong positive correlation with seed output, the current study proposes that the harvest index, number of seeds per pod, number of major branches per plant, number of pods per plant, 100-seed weight, and plant height are the essential variables that contribute to yield. There was a negative and non-significant correlation between seed output and the number of days until 50% blooming and days till maturity. As a result, these traits may receive the attention they deserve when choosing high-yielding genotypes of chickpea.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that no competing interests exist.

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