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Correlation Coefficient Analysis for Seed Yield and its Component Traits in Chickpea (*Cicer arietinum*, Fabaceae)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was carried out at Chamelty Agriculture Farm of M.S. Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Bajhol, Solan, *Himachal Pradesh* (H.P.) to examine the quantitative traits of chickpea germplasm and their relationship to seed yield. Seed yield per plant exhibited positive and highly significant correlations with biological yield per plant, harvest index, number of seeds per pod and number of pods per plant. The positive non- significant correlations of seed yield per plant were found with plant height (cm), primary branches per plant, 100-seed weight (g), days to 50 per cent flowering, days to flower initiation and days to maturity. These characters emerged as most important factors in influencing seed yield in chickpea.

Keywords: Chickpea; germplasm; harvest index; correlations.

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1. INTRODUCTION

Chickpea (*Cicer arietinum* L.*)* is a self-pollinated crop and belongs to kingdom Plantae, order Fabales, family Fabaceae (Leguminosae), genus *Cicer* and species *arietinum* with a chromosome number 2n= 16. The crop is grown traditionally in semi-arid zones of Middle-East, Pakistan and India. According to Vavilov [1] there are two primary centers of diversity of chickpea namely South-West Asia and Mediterranean center whereas; Ethiopia was designated as secondary center. Legumes have been cultivated for human consumption since ancient times. The largest producer and consumer of pulse crops worldwide is India. For people all across the world, pulses are the main source of carbs, proteins, fats, vitamins, and minerals [2]. When combined with cereals, pulses enhance the nutritional value and bioavailability of nutrients. About twice as much protein as wheat and three times as much as rice is found in pulses (22-24%). Pulses are one of the least expensive sources of protein and are crucial for meeting nutritional needs in emerging and underdeveloped nations. Legumes are therefore recommended for glycemic-influenced treatment of diabetes. Broadly, there are two types of chickpeas; large seeded *kabuli* chickpea and small seeded *desi* chickpea. Chickpea is also known as Bengal Gram, Garbanzo bean and *Chana* in different chickpea producing areas of the world.

"The degree of genetic diversity contained in the breeding material and the degree to which yield and quality traits are passed down from generation to generation are the two key factors that determine how well a crop may be genetically improved. Estimates of genotypic and phenotypic coefficient are required to comprehend how certain characteristics are affected by environment" (Anusha et al., [3] The degree of heritable and non-heritable variation in the expression of the traits, as well as their nature and quantity in relation to one another, determined how far plant breeding had advanced. Like other crops, the chickpea had a very complicated character when it comes to seed output. Given that seed yield is the result of multiplicative interactions between different yield components, components rather than yield as a whole were found to be better in understanding the genetic architecture of seed yield.

2. MATERIALS AND METHODS

The present investigation was carried out at Chamelty Agriculture Farm of M.S. Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Bajhol, Solan (H.P.), India to examine the quantitative traits of chickpea germplasm and their relationship to seed yield. The collections of fifty-one genotypes of chickpea (*Cicer arietinum*) germplasm (Table 1) consisting of indigenous as well as two check varieties, constituted the experimental materials for this study. These genotypes exhibiting wide spectrum of variability for various agronomic and morphological characters were obtained and studied in our present investigation. The experimental material was evaluated in Augmented Block Design during *rabi* (2022). The experimental field was divided into 4 blocks of equal size. Fifteen entries including 3 checks were accommodated in each block. Each plot consisted of a single row of 5 m length, inter and intra–row spacing of 30 cm and 10 cm respectively. To avoid the border effects the experimental plot was surrounded from all sides by non-experimental rows. Suitable cultivation practices were followed to raise a good crop. Five competitive plants from each plot were randomly selected for the recording of observations on twelve characters.

3. RESULTS AND DISCUSSION

The estimate of simple correlation coefficient among 12 characters under study is presented in Table 1. Days to flower initiation showed positive and highly significant correlations with days to 50 per cent flowering. Pods per plant exhibited positive and highly significant associations with seed yield per plant (g), harvest index (%), biological yield per plant (g) and 100-seed weight (g). Seeds per pod showed positive and highly significant correlations with seed yield per plant (g), biological yield per plant (g), harvest index (%) and number of pods per pod. Plant height showed positive correlations with biological yield per plant (g), harvest index (%), seed yield per plant (g), number of seeds per pod, number of pods per plant, primary branches per plant and days to flower initiation. Biological yield per plant showed positive and highly significant correlations with seed yield per plant (g) and number of seeds per pod, number of pods per plant and harvest index (%). 100-seed weight showed positive and highly significant correlations with number of pods per plant. Harvest index showed positive and highly significant correlations with seed yield per plant, pods per plant (g), biological yield per plant (g) and number of seeds per pod. Seed yield per plant exhibited positive and highly significant

Table 1. Estimates of simple correlation coefficients between 12 characters in chickpea genotypes

Traits	DFI	DF (50%)	DM	PB	SB	PP	SPP	PH (cm)	BYP	100SW(g)	HI (%)	Seed yield(g)
DFI	1.000	0.879**	0.113	-0.186	0.102	0.097	-0.009	0.057	-0.014	0.058	0.170	0.034
DF (50%)		1.000	0.159	-0.290*	0.104	0.068	0.012	-0.065	0.039	0.009	0.064	0.045
DM			1.000	-0.179	-0.199	-0.063	0.172	-0.071	0.063	-0.033	-0.073	0.032
PB				1.000	-0.035	-0.021	0.196	0.198	0.197	-0.047	-0.042	0.144
SB					1.000	0.173	-0.163	-0.015	-0.065	0.096	-0.193	-0.112
PP						1.000	0.283*	0.175	0.521**	0.370**	0.535**	0.593**
SPP							1.000	0.163	0.636**	-0.101	0.405**	0.650**
PH (cm)								1.000	0.103	-0.148	0.085	0.117
BYP									1.000	0.080	0.489**	0.965**
100 -Seed Weight										1.000	0.082	0.087
HI											1.000	0.696**
Seed yield(g)												1.000

Note: DFI= days initial flowering; DF= days flowering (50%); DM= days to maturity; PB= primary branches / plant; SB= secondary branches/ plant; PP= No. pods/plant; SPP= seeds per pod; PH= plant height in cm; BYP= biological yield/ plant; 100SW= 100 seed weight in grams; HI= harvest index (%); SY= seed yield in grams
**significant at 5% probability level*

correlations with biological yield per plant, harvest index, number of seeds per pod and number of pods per plant.

Similar results were reported by Qurban et al. [4]. In their findings, “seed yield per plant exhibited positive and highly significant correlations with biological yield per plant, harvest index, number of seeds per pod and number of pods per plant”. They exhibited negative non- significant associations of seed yield per plant with secondary branches per plant). These characters emerged as most important factors in influencing seed yield in chickpea. The strong positive correlation of seed yield with the characters mentioned above has also been reported earlier in chickpea [5-23].

Biological yield per plant showed positive and highly significant correlations with seed yield per plant (g) and number of seeds per pod, number of pods per plant and harvest index (%). “It showed positively non-significant correlations with primary branches per plant, plant height (cm), days to maturity, days to 50 per cent flowering and 100-seed weight (g), and negative non-significant correlation with days to flower initiation, secondary branches per plant. Such associations of biological yield per plant with the characters mentioned above looks logical as these traits are responsible for increasing either vegetative phase contributing straw yield or seed yield. Furthermore; plant height, primary and secondary branches per plant and pods per plant were also positively associated with each other and these traits add towards higher biomass”. (Lal et al., [24] Arora and Kumar [25] Rao et al*.,* [6] Naseem et al. [26] Ali and Tahir [7] Wahid and Ahmad [27] Singh et al. [8] Muhammad et al. [28] Muhammad et al*.,* [29] Rao and Rao, [11] Khan et al. [30] Singh [13] Singh and Sindhu, [14] Yucel et al. [17] Ojha et al., [18] and Singh and Shiva, [19] Aycicek and Babagil, [20] Hasan and Deb's, [22] and Kumar et al., [23].

Days to flower initiation showed positive and highly significant correlations with days to 50 per cent flowering. Days to 50 per cent flowering showed positive and highly significant correlation with flower initiation while it showed positive non-significant correlation with days to maturity, secondary branches per plant, number of pods per plant, seeds per pod, biological yield per plant (g), seed yield per plant (g) harvest index (%), and 100-seed weight (g). Days to maturity showed positive and non- significant correlation with flower initiation, days to 50 per cent flowering, number of seeds per pod, biological yield per plant (g) and seed yield per plant (g). Pods per plant exhibited positive and highly significant associations with seed yield per plant (g), harvest index (%), biological yield per plant (g) and 100-seed weight (g). Seeds per pod showed positive and highly significant correlations with seed yield per plant (g), biological yield per plant (g), harvest index (%) and number of pods per pod. 100-seed weight showed positive and highly significant correlations with number of pods per plant while its positively non-significant correlation was found with biological yield per plant (g), secondary branches per plant, days to flower initiation, days to maturity. Harvest index showed positive and highly significant correlations with seed yield per plant, pods per plant (g), biological yield per plant (g) and number of seeds per pod. Fortunately, the correlation coefficients between important yield components were positively significant bearing a few exceptions due to weather differences. This reveals a less complex situation in attaining a proper balance between yield and its important components in context of chickpea germplasm used in present study as compared to complexities that often arise due to existence of strong negative and positive associations among various characters in this crop as well as many other crops. Most of the correlation coefficients obtained in present study are broadly in conformity with previous reports in chickpea (Bhaduoria et al*.,* [9] Muhammad et al*.,* [29] Rao and Rao, [11] Yucel et al*.,* [31] Singh and Sindhu, [14] Yadav et al*.,* [16] Ojha et al*.,* [18] and Singh and Shiva, [19] Aycicek and Babagil, [20] Joshi and Yasin, [21] Hasan and Deb, [22] and Kumar et al., [23] Gulwane et al. [32] Neha et al. [33].

4. CONCLUSION

Seed yield per plant exhibited positive and highly significant correlations with biological yield per plant, harvest index, number of seeds per pod and number of pods per plant. The positive non-significant correlations of seed yield per plant were found with plant height (cm), primary branches per plant, 100-seed weight (g), days to 50 per cent flowering, days to flower initiation and days to maturity. These characters emerged as most important factors in influencing seed yield in chickpea. Fortunately, the correlation coefficients between important yield components were positively significant bearing a few exceptions. This reveals a less complex situation in attaining a proper balance between yield and

its important components in context of chickpea germplasm used in present study as compared to complexities that often arise due to existence of strong negative and positive associations among various characters in this crop as well as many other crops.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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