*The Journal of Rural and Agricultural Research Vol. 16 No. 2, 35-39 (2016)*
*Received August 2016; Acceptance November 2016*

# Genetic variability and stability analysis for seed yield and its components in chickpea (*Cicer arietinum* L.)

MUKESH KUMAR*, SITARAM KUSHWAHA[1] AND V K DWIVEDI[2]
*J.V. College, Baraut, Bagpat U.P. India- 250611*

**Abstract**

*Chickpea is the prime pulse crop of India, India has the distinction of being the largest chickpea producer and accounts for about 64 to 68 per cent of its total area and production in the world, respectively (Anonymous, 2004). Chickpea is grown on about 7.5 m ha area producing 6.1 m tonnes of grain, which represents 33 and 47 per cent of the national pulses acreage and production, respectively. The variability and stability was maximum for the character viz., days to 50% flowering, Days to maturity, Plant height (cm), No. of branches, N o. of pods per plant, No. of seeds per pods, 100 seed wt. (g), Biological yield per plant (g), Seed yield per plant (g), Harvest index (%) and Protein content (%). The seed yield the genotypes viz, BG-1107, Pusa-261, Pusa-244, GB-1024, AT-2-1113, Pusa-1053, were found to be stable and suitable for high fertility environments. Genotypes Pusa- 362, Pusa-261, BG-1094, AT-1113, BG-1094, BG-1065 and BGD-112 were found to be most suitable for both western and Bundelkhand region of U.P.*

Key worlds: Biological yield, Seed yield, genotypes, Protein, Harvest index

## Introduction

The fact that pulses play a predominant role in our food and farming is well recognized and needs no emphasis. Pulses not only provide high nutritive food, but they are also good source of nutritive green fodder and rich feed for our livestock. Pulses are unique by virtue of their inbuilt capacity of fixing atmospheric nitrogen through *Rhizobium* bacteria present in their root nodules. Thus, they meet substantially their own nitrogen requirement in the soil and leave nitrogen in the soil for use by the succeeding crops. The production of pulses did not keep pace with the population growth in the last two decades, resulting that the per capita per day availability of pulses declined from 69 gram during 1961 to 37 gram during 2004. The Indian council of Medical research (ICMR) has recommended 50gram per day per capita requirement of pulses but presently we consume less due to short fall in total pulses production in the country.

In India, the productivity of pulse crops including chickpea is low because of several constraints like inadequate availability of quality seed of improved varieties, cultivation of pulses on the poor and marginal lands under rainfed conditions without recommended input application and moreover, there is lack of high yielding and stable varieties of this crop in our country.

The breeding approaches and crop improvement programme have been initiated by government of India and state agricultural universities to improve the productivity of chickpea through development of high yielding plants types and other improved production technologies. It's also important to improve resistance to biotic and abiotic stresses, yield potential and stability of available cultivars. The breeding efforts are being made to improve genetic base of different cultivars. Most of the available varieties of chickpea generally produce excessive vegetative growth with poor economic yield. Therefore, there is an urgent need for identifying chickpea genotypes with higher productivity, responsiveness to inputs and consistent yield under various condition as has been emphasized by various research workers (Lather, 1999).

Genetic variability is very important for the improvement of crop plants. More the variability in the population, the greater are the chances for producing desired plant types. Heritability estimates and genetic advance in a population provides information about the

[1]Division of Plant Physiology, Indian Agricultural Research Institute, New Delhi – 110012
[2]J.V. College, Baraut, Bagpat U.P India- 250611
*Present address- Krishi Vigyan Kendra, Pilibhit U.P India- 262305

expected gains in the following generations.

## Materials and Methods

The present investigation was carried out using 40 chickpea (*Cicer arietinum* L.) genotypes were conducted using Randomized Block Design with three replications during rabi seasons of 2003 and 2004 at the Research Farm of J.V. (P.G.) College, Baraut (Baghpat) and Research Farm of Bundelkhand University, Jhansi under rainfed and restricted irrigation conditions. Thus, the genotypes were evaluated under eight following environments: $E_1$=Irrigation only before flowering stage at Baraut in 2003, $E_2$=Rainfed at Baraut in 2003, $E_3$=Irrigation only before flowering stage at Jhansi in 2003, $E_4$=Rainfed at Jhansi in 2003, $E_5$=Irrigation only before flowering stage at Baraut in 2004, $E_6$=Rainfed at Baraut in 2004, $E_7$=Irrigation only before flowering stage at Jhansi in 2004 $E_8$=Rainfed at Jhansi in 2004. The row to row and plant to plant spacing were 40 cm and 20 cm respectively and row length four meters. The various genetic parameter viz. genotypic and phenotypic coefficients of variation, heritability estimate in broad sense and expected genetic advance were estimated and selection indices were formulated as suggested by Burton *et al*. (1952). Stability is the ability of a certain variety to maintain stable yield under changing environmental conditions and assessed through several stability parameters. Among them, regression coefficient (bi) and deviation from regression ($S^2$di) proposed by Eberhart and Russell (1966) have extensively been used in multi-environment trials.

## Results and Discussion

The estimates of habitability were generally high for most of the traits particularly for seed weight, number of pods per plants, seed yield. In environments I, 100-seed weight recorded highest heritability (99.60%) followed by number of pods per plant (99.20%). Biological yield (99.90%), harvest index (99.90) and 100-seed weight noted higher value of heritability in environments II, 100-seed weight (99.9%), number of pods per plant (99.40) and number of branches per plant (99.60%) in environment III, and number of branches per plant (99.70%), 100-seed weight (99.90%) and biological yield per plant (99.90%) in environments in IV. The traits like 100-seed weight, number of pods per plant and number of braches per pant recorded higher heritability in other environments. The low heritability estimates recorded for days to 50% flowering. Similar findings have been reported by various other workers for these different characters (Wahid and Ahmad, 1998, Nimbalkar, 2000, Singh *et al.*, 2002, Muhammad *et al.*, 2003 and Parshurand *et al.*, 2003). High genetic

Table 1: Summary of $h^2$bs and GA % for all characters in chickpea under all the environments studies

| S. No. | Characters | Heritability ($h^2$bs) | | | | | | | | Genetic advance as percentage of mean GA (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $E_1$ | $E_2$ | $E_3$ | $E_4$ | $E_5$ | $E_6$ | $E_7$ | $E_8$ | $E_1$ | $E_2$ | $E_3$ | $E_4$ | $E_5$ | $E_6$ | $E_7$ | $E_8$ |
| 1. | Days to 50% flowering | 74.10 | 93.80 | 88.50 | 58.50 | 70.30 | 67.00 | 68.50 | 55.40 | 3.03 | 3.16 | 3.20 | 2.08 | 2.95 | 2.55 | 2.74 | 1.90 |
| 2. | Days to maturity | 90.70 | 96.40 | 82.80 | 99.10 | 77.20 | 77.70 | 79.60 | 82.70 | 4.20 | 4.29 | 4.07 | 4.60 | 3.72 | 3.61 | 3.98 | 4.56 |
| 3. | Plant height (cm) | 98.00 | 98.60 | 97.80 | 98.70 | 97.80 | 97.20 | 97.50 | 96.60 | 13.41 | 13.36 | 12.61 | 12.78 | 13.07 | 13.31 | 12.17 | 11.81 |
| 4. | No. of branches | 99.80 | 99.70 | 99.60 | 99.70 | 99.70 | 99.90 | 99.90 | 99.70 | 31.86 | 32.77 | 30.09 | 32.67 | 30.96 | 32.05 | 29.29 | 31.76 |
| 5. | No. of pods/plant | 99.20 | 99.20 | 99.40 | 99.00 | 99.40 | 99.30 | 99.10 | 99.40 | 21.82 | 21.12 | 20.25 | 20.94 | 21.46 | 19.65 | 20.15 | 19.96 |
| 6. | No. of seeds/pods | 94.60 | 96.80 | 98.80 | 97.40 | 93.90 | 96.50 | 89.70 | 92.30 | 6.25 | 6.20 | 7.03 | 6.98 | 7.58 | 10.45 | 6.06 | 6.82 |
| 7. | 100 seed wt. (g) | 99.90 | 99.90 | 99.90 | 99.90 | 99.70 | 99.70 | 99.70 | 99.70 | 40.93 | 40.99 | 40.84 | 41.38 | 40.38 | 39.84 | 43.04 | 39.43 |
| 8. | Biological yield/plant (g) | 99.80 | 99.90 | 99.30 | 99.90 | 98.80 | 99.40 | 98.70 | 99.30 | 24.02 | 31.77 | 22.51 | 30.55 | 21.48 | 29.54 | 19.67 | 27.46 |
| 9. | Seed yield/plant (g) | 99.40 | 99.60 | 99.50 | 99.80 | 99.50 | 99.40 | 99.40 | 99.40 | 28.95 | 30.02 | 26.93 | 29.36 | 28.49 | 28.50 | 25.57 | 26.98 |
| 10. | Harvest index (%) | 98.80 | 99.90 | 98.30 | 99.80 | 94.60 | 98.60 | 96.90 | 98.30 | 15.31 | 35.36 | 21.89 | 34.53 | 15.80 | 33.23 | 19.30 | 31.33 |
| 11. | Protein content (%) | 98.20 | 97.90 | 97.90 | 98.30 | 98.20 | 99.40 | 99.20 | 98.10 | 12.69 | 12.47 | 13.11 | 12.78 | 12.61 | 12.37 | 12.64 | 12.93 |

advance has been reported by above workers for pod number, 100-seed weight, seed yield per plant. In the present investigation also, the estimates of genetic advance for these traits were high.

The heritability values gave a useful indicator of the relative value of the importance of selection in material in hand, but to arrive at more reliable conclusion, heritability and genetic advance should be jointly considered. In the present material, high genetic grain accompanied with high values of heritability was observed for 100-seed weight, seed yield per plant, number of pods per plant which may probably be due to high additive genetic effect.

These values of genetic advance were higher specifically for the traits like 100- seed weight, number of branches seed yield and biological yield as compared to all other traits in all the environments. It is pointed out that the estimates of genetic advance for Harvest index were generally high under in rain fed condition at both the locations. It was evident that the values of estimates of genetic advance as percent of mean were also high for all above traits as compared to other characters when these estimates were worked out based on the mean data over eight environments.

***Stability analysis***

The highest seed yield per plant was recorded for genotype BG 1094 (16.00) in environment VII and lowest for genotype BG 1086 (7.52 g) and in environment IV (Table 2). On the basis of pooled analysis, the mean value for grain yield per plant was observed highest in Pusa 261 (13.22 g) followed by Pusa 362 and Pusa 1090 (11.86 g) whereas the genotype AT-2-1185 (8.35 g) recorded lowest grain yield per plant, indicating the presence of ample genetic variability in experimental material for this trait and general mean was 10.55 g.

*Number of pods per plant*

The showed that eight varieties viz., Pusa-362, BG 1095, Pusa-261, BG 1106, BG 390, AT-2-1184, BG 1094, and BG 391 had more than sixty pods per plant which were higher than all other varieties. Seventeen varieties had $b^i$ values near to unity (b=1) and hence these were responsive to medium environmental conditions, while seventeen varieties were responsive to better environmental conditions as these had $b^i$ values higher than one (b>1). Six varieties had bi values less than unity (b<1) and hence these were responsive to poor environmental conditions. Thirty three varieties were found to be stable as the estimates of the their $S^2$di values were non-significant whereas the remaining eight varieties were unstable as their mean square deviation were high and significant. Taking into account all the three stability parameters, the most promising genotypes were BG 1091, Pusa-261, BG 1106, AT-2-1184, BG 1094 and BG 391.

*100-seed weight*

Highest 100-seed weight was recorded in genotypes BG 2002 (31.67 gm) followed by BG 1106 and BG 1107. Eleven varieties had regression coefficient ($b^i$) equal to unity (b=1) revealing that these genotypes were moderately responsive to environments, whereas eighteen genotypes had $b^i$ values higher than one (b > 1) and hence these genotypes were more suited to the better environments. Remaining eleven varieties were poor in response (b<1) to the environments as these had $b^i$ values less than unity (b<1) and hence these were most suited to poor environments. The estimates of mean sum of squares of deviation ($S^2$di) for various genotypes showed that two varieties were unstable as these had higher values of $S^2$di while remaining thirty-eight varieties had very less and negligible values for $S^2$di indicating that these were stable in performance for 100-seed weight. Taking into account all the three parameters viz. X, $b^i$ and $S^2$di it was obvious that BG 1107, BG 1108, BG 1116, BG-1092, BGD-112, BG-1098, BG 1063, genotypes like BG 1090, BG 1094, Pusa-209 and AT-2-1139 were most promising genotypes.

*Seed yield per plant[1]*

The estimates of parameters of stability for seed yield indicated that high yielding varieties were BG 1091, Pusa-261, BG 1107, BG 1108, BG 112, 3G-1024, BG 1098, AT-2-1113, BG 390, BG 72, Pusa-1090, BG 1094 and BG 1053. Fourteen genotypes had $b^i$ values equal to unity (b=1) and hence these genotypes were responsive to moderate environmental conditions. Fifteen genotypes had $b^i$ values more than unity (b>1) indicating thereby that all these genotypes were responsive to better environmental conditions. Eleven genotypes had $b^i$ values less then unity, therefore, these genotypes were responsive to poor environmental conditions. Thirty genotypes had low values of mean sum of squares for deviation and hence these genotype were stable for seed yield per plant whereas other ten genotypes were unstable as the values of their $S^2$di were comparatively higher. The genotypes viz, Pusa 362, Pusa, 261, BG 1107, BG 1092, BG112, BG 1024, AT-2-1113, Pusa 1090 and BG 1094, were found to be stable for grain yield. Therefore, the above-mentioned genotypes, which are stable in grain yield and few other characters, should be used in breeding programmes for developing high yielding and ideal plant types in chickpea.

Table 2: Performance of chickpea genotypes for Seed yield under different environments

| S.No. | Genotypes | Environments | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $E_1$ | $E_2$ | $E_3$ | $E_4$ | $E_5$ | $E_6$ | $E_7$ | $E_8$ | |
| 1. | Pusa 362 | 14.21 | 12.57 | 12.82 | 12.61 | 14.70 | 13.00 | 13.22 | 13.11 | 13.05 |
| 2. | AT-2 1185 | 8.74 | 7.43 | 9.41 | 7.82 | 9.20 | 7.83 | 9.91 | 8.22 | 8.35 |
| 3. | BG 1095 | 10.31 | 9.51 | 11.47 | 9.66 | 10.83 | 10.10 | 11.97 | 10.10 | 10.24 |
| 4. | BG 1091 | 12.40 | 10.31 | 11.82 | 10.44 | 12.90 | 10.90 | 12.22 | 10.22 | 11.24 |
| 5. | BG 1105 | 9.11 | 7.82 | 9.52 | 8.21 | 10.11 | 8.30 | 10.02 | 8.81 | 8.67 |
| 6. | Pusa 261 | 14.74 | 11.40 | 15.30 | 11.43 | 15.20 | 11.90 | 15.80 | 12.23 | 13.22 |
| 7. | BG 1079 | 10.30 | 8.71 | 11.41 | 8.75 | 10.80 | 9.20 | 11.91 | 9.53 | 9.79 |
| 8. | BG 1107 | 13.10 | 10.31 | 13.80 | 10.64 | 13.50 | 10.83 | 14.22 | 11.24 | 11.96 |
| 9. | Pusa 391 | 9.74 | 8.11 | 9.75 | 8.13 | 10.50 | 8.50 | 10.25 | 8.83 | 8.93 |
| 10. | Pusa 244 | 11.72 | 9.02 | 11.75 | 9.12 | 12.50 | 9.40 | 12.25 | 9.62 | 10.40 |
| 11. | BG 1108 | 12.31 | 10.41 | 13.05 | 10.43 | 13.00 | 10.33 | 13.55 | 10.93 | 11.55 |
| 12. | BG 1106 | 11.51 | 9.27 | 11.61 | 9.28 | 12.10 | 9.83 | 12.11 | 10.18 | 10.42 |
| 13. | BG 1100 | 9.82 | 8.23 | 10.30 | 8.24 | 10.30 | 8.53 | 10.90 | 8.84 | 9.15 |
| 14. | BG 1092 | 9.52 | 8.47 | 9.67 | 8.49 | 10.20 | 9.00 | 10.67 | 9.24 | 9.04 |
| 15. | BGD 112 | 12.47 | 11.71 | 13.47 | 11.12 | 13.40 | 12.20 | 14.47 | 11.82 | 12.19 |
| 16. | BG 1024 | 13.11 | 10.11 | 13.74 | 10.13 | 14.00 | 10.90 | 14.50 | 10.53 | 11.77 |
| 17. | BG 1098 | 12.52 | 9.52 | 12.53 | 9.53 | 13.10 | 10.00 | 12.30 | 10.23 | 11.03 |
| 18. | Pusa 93 | 9.54 | 7.52 | 9.56 | 7.53 | 10.20 | 7.90 | 10.26 | 8.13 | 8.54 |
| 19. | AT-2 1113 | 13.20 | 10.30 | 13.30 | 10.41 | 14.00 | 10.80 | 14.10 | 10.91 | 11.80 |
| 20. | Pusa 267 | 11.40 | 8.11 | 11.90 | 8.21 | 11.90 | 8.71 | 12.30 | 8.81 | 9.90 |
| 21. | BG 390 | 13.40 | 10.20 | 12.90 | 9.90 | 14.00 | 10.72 | 13.50 | 10.40 | 11.60 |
| 22. | Pusa 1063 | 9.14 | 7.40 | 10.20 | 8.20 | 9.89 | 7.90 | 10.90 | 8.70 | 8.73 |
| 23. | Pusa 372 | 11.40 | 9.50 | 10.90 | 9.40 | 11.50 | 10.00 | 11.80 | 9.90 | 10.30 |
| 24. | BG 2001 | 10.20 | 8.11 | 12.40 | 8.13 | 10.70 | 8.71 | 12.90 | 8.83 | 9.71 |
| 25. | Pusa 256 | 11.40 | 8.74 | 11.40 | 8.74 | 11.90 | 9.31 | 11.80 | 9.54 | 10.07 |
| 26. | BG 1086 | 10.80 | 7.52 | 10.70 | 7.52 | 11.20 | 8.12 | 11.50 | 8.12 | 9.13 |
| 27. | BGD 72 | 12.10 | 10.10 | 12.70 | 10.11 | 12.80 | 10.70 | 13.50 | 10.81 | 11.25 |
| 28. | Pusa 1090 | 12.40 | 11.07 | 12.90 | 11.08 | 12.60 | 11.77 | 13.50 | 11.88 | 11.86 |
| 29. | AT-2-1184 | 10.80 | 8.70 | 11.40 | 8.90 | 11.10 | 9.50 | 11.90 | 9.89 | 9.95 |
| 30. | BG 1094 | 14.50 | 12.30 | 15.00 | 12.40 | 15.10 | 12.80 | 16.00 | 12.84 | 13.55 |
| 31. | BG 391 | 11.50 | 9.80 | 9.54 | 9.90 | 12.50 | 10.30 | 10.32 | 9.89 | 10.18 |
| 32. | BG 372 | 8.75 | 7.84 | 11.61 | 7.85 | 9.00 | 8.40 | 12.30 | 8.85 | 9.01 |
| 33. | Pusa 209 | 11.52 | 10.31 | 10.38 | 10.43 | 11.54 | 10.90 | 11.18 | 10.93 | 10.66 |
| 34. | AT-2-1133 | 10.41 | 9.74 | 9.47 | 9.83 | 10.69 | 10.30 | 10.30 | 10.43 | 9.86 |
| 35. | BG 1065 | 9.51 | 11.50 | 9.82 | 12.40 | 9.70 | 12.10 | 10.52 | 12.84 | 10.81 |
| 36. | BG 1077 | 9.52 | 8.72 | 11.20 | 8.76 | 9.82 | 9.30 | 11.80 | 9.26 | 9.55 |
| 37. | BG 1088 | 10.33 | 9.52 | 11.47 | 9.66 | 10.45 | 10.12 | 12.27 | 10.26 | 10.25 |
| 38. | Pusa 1080 | 11.41 | 10.12 | 12.82 | 10.14 | 11.56 | 10.92 | 13.52 | 10.84 | 11.12 |
| 39. | Pusa 1053 | 12.81 | 11.40 | 11.74 | 11.50 | 13.00 | 11.70 | 12.57 | 12.00 | 11.86 |
| 40. | BG 2002 | 11.44 | 10.82 | 11.74 | 10.93 | 11.58 | 11.13 | 12.54 | 11.83 | 11.23 |
| | Mean | 11.33 | 9.56 | 11.66 | 9.64 | 11.83 | 10.07 | 12.28 | 10.23 | 10.55 |
| | CD | 0.194 | 0.136 | 0.172 | 0.102 | 0.180 | 0.182 | 0.190 | 0.174 | 0.078 |

## References


Anonymous, (2004). Hindu Survey of Agriculture in India.

Burton, G.W. (1952). Quantitative inheritance in grasses. In: Proc. 6th Int. Grassland Congress **7:** 273-283

Eberhart, S.A. and Russell, W.A. (1966). Stability parameters for comparing varieties. *Crop Sci.,* **6**: 36-40.

Grafius, J.E. (1956). Components of yield in oats : A geometrical interpretation . *Agron. J.,* **48**: 419-423.

Lather, V.S. (1999). Genetic improvement for yield in chickpea. Plant ideotype approaches. In: Food Security and Crop Science, SSARM, Hisar, pp. 207-211.

Mishra, R., Rao, S.K. and Kouto, G.K. (1988). Genetic variability, correlation studies and their implication in selection of high yielding genotypes of chickpea. *Indian J. Agric. Res.,* **22**: 51-57.

Muhammad, A., Bakhsh, A., Zubair, M. and Abdul, G,

Table 3: Mean performance and stability for seed yield and its components in chickpea under all the environments

| S. No. | Genotypes | Pods plant-1 ( X) | bi | $S^2di$ | 100-seed weight (g) ( X) | bi | $S^2di$ | Seed yield plant-1 (g) ( X) | bi | $S^2di$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Pusa 362 | 61.35 | -2.15 | 14.67* | 21.79 | 0.35 | 0.08 | 13.28 | 0.43 | 0.45* |
| 2. | AT-2 1185 | 47.28 | 1.48 | 1.59 | 22.96 | 0.23 | 0.01 | 8.57 | 0.81 | 0.03 |
| 3. | BG 1095 | 57.15 | 0.73 | 1.01 | 25.87 | 0.79 | 0.15 | 10.49 | 0.75 | 0.13 |
| 4. | BG 1091 | 68.22 | 0.45 | 1.169 | 22.99 | 0.94 | 0.38 | 11.40 | 0.89 | 0.24* |
| 5. | BG 1105 | 57.67 | -0.31 | 3.12* | 27.29 | 0.95 | -0.01 | 8.99 | 0.77 | 0.06 |
| 6. | Pusa 261 | 68.05 | 1.21 | 0.22 | 16.53 | 1.43 | 0.10 | 13.50 | 1.78 | 0.07 |
| 7. | BG 1079 | 46.38 | 0.93 | 0.35 | 20.99 | 3.00 | 0.26 | 10.08 | 1.11 | 0.08 |
| 8. | BG 1107 | 56.07 | 1.68 | 0.26 | 30.69 | 0.88 | 0.05 | 12.20 | 1.48 | 0.05 |
| 9. | Pusa 391 | 51.92 | 0.62 | 1.71 | 28.90 | 1.51 | 0.64 | 9.23 | 0.87 | 0.05 |
| 10. | Pusa 244 | 49.30 | 0.96 | 0.23 | 23.80 | 2.73 | 0.19 | 10.67 | 1.38 | 0.11 |
| 11. | BG 1108 | 56.20 | 0.52 | 0.39 | 27.39 | 1.55 | 0.03 | 11.75 | 1.26 | 0.06 |
| 12. | BG 1106 | 69.45 | 1.10 | 0.13 | 31.24 | 2.62 | 0.39 | 10.74 | 1.13 | 0.03 |
| 13. | BG 1100 | 49.81 | 0.57 | 0.18 | 23.91 | 1.46 | 0.11 | 9.40 | 0.99 | 0.00 |
| 14. | BG 1092 | 54.80 | 0.72 | 0.56 | 28.92 | 1.55 | 0.01 | 9.41 | 0.70 | 0.05 |
| 15. | BGD 112 | 53.07 | 0.90 | 0.58 | 27.56 | 0.75 | 0.06 | 12.58 | 0.98 | 0.16 |
| 16. | BG 1024 | 56.58 | 0.66 | 0.51 | 24.24 | 1.06 | 0.05 | 12.13 | 1.74 | 0.07 |
| 17. | BG 1098 | 58.12 | 1.56 | 3.15* | 29.07 | 1.14 | 0.01 | 11.22 | 1.36 | 0.26* |
| 18. | Pusa 93 | 51.49 | 0.50 | 1.27 | 22.57 | 0.24 | 0.04 | 8.83 | 1.09 | 0.03 |
| 19. | AT-2 1113 | 49.70 | 0.45 | 1.00 | 26.99 | -2.29 | 2.16* | 12.13 | 1.54 | 0.07 |
| 20. | Pusa 267 | 48.68 | 1.00 | 0.99 | 18.93 | 2.27 | 1.57* | 10.17 | 1.72 | 0.09 |
| 21. | BG 390 | 62.83 | 2.08 | 7.73* | 19.92 | 0.33 | 0.04 | 11.88 | 1.54 | 0.30 |
| 22. | Pusa 1063 | 49.60 | 1.89 | 0.72 | 26.89 | 1.40 | 0.44 | 9.04 | 1.09 | 0.14 |
| 23. | Pusa 372 | 54.62 | 2.63 | 3.60* | 24.15 | -0.03 | 0.45 | 10.55 | 0.87 | 0.06 |
| 24. | BG 2001 | 50.65 | 1.69 | 0.63 | 19.12 | 1.18 | 0.04 | 10.00 | 1.66 | 0.44* |
| 25. | Pusa 256 | 55.90 | 1.24 | 0.23 | 19.62 | 0.48 | 0.65 | 10.35 | 1.28 | 0.07 |
| 26. | BG 1086 | 52.52 | 1.13 | 0.40 | 22.11 | 0.60 | 0.03 | 9.44 | 1.62 | 0.09 |
| 27. | BGD 72 | 51.58 | 1.50 | 2.27* | 17.14 | 1.23 | 0.04 | 11.60 | 1.24 | 0.04 |
| 28. | Pusa 1090 | 57.77 | 1.23 | 0.12 | 29.21 | 1.51 | -0.01 | 12.15 | 0.78 | 0.05 |
| 29. | AT-2-1184 | 60.75 | 1.47 | 1.25 | 16.61 | 0.32 | 0.08 | 10.27 | 1.10 | 0.03 |
| 30. | BG 1094 | 64.47 | 1.84 | 1.88 | 29.79 | 1.44 | -0.01 | 13.87 | 1.34 | 0.02 |
| 31. | BG 391 | 62.07 | 0.95 | 0.07 | 21.70 | 0.40 | 0.04 | 10.47 | 0.44 | 0.94* |
| 32. | BG 372 | 55.92 | 2.34 | 3.12* | 23.34 | 2.43 | 0.01 | 9.33 | 1.28 | 1.14* |
| 33. | Pusa 209 | 53.06 | 0.76 | 0.29 | 28.60 | 0.69 | 0.04 | 10.90 | 0.28 | 0.18 |
| 34. | AT-2-1133 | 52.28 | 0.82 | 0.34 | 26.08 | 1.37 | 0.01 | 10.15 | 0.12 | 0.18 |
| 35. | BG 1065 | 49.58 | 0.83 | 0.30 | 21.79 | 0.38 | 0.08 | 11.05 | -0.99 | 0.74* |
| 36. | BG 1077 | 51.57 | 0.70 | 0.38 | 13.14 | 0.50 | 0.16 | 9.80 | 0.91 | 0.37* |
| 37. | BG 1088 | 52.57 | 0.58 | 0.42 | 17.13 | 0.85 | 0.18 | 10.51 | 0.74 | 0.26* |
| 38. | Pusa 1080 | 53.95 | 0.86 | 0.05 | 23.97 | 1.66 | 0.07 | 11.42 | 1.03 | 0.30* |
| 39. | Pusa 1053 | 56.27 | 0.96 | 0.11 | 18.09 | 1.69 | 0.03 | 12.09 | 0.45 | 0.17 |
| 40. | BG 2002 | 51.65 | 0.714 | 0.68 | 31.67 | 0.32 | 0.05 | 11.50 | 0.42 | 0.12 |
| | Mean | 54.977 | | | 23.82 | | | 10.83 | | |
| | CD | 0.455 | | | 0.262 | | | 0.167 | | |
| | S.E. of b | 0.352 | | | 0.658 | | | 0.156 | | |

(2003). Genetic variability and correlation studies in chickpea (*Cicer arietinum* L.). *Pakistan J. of Bot*.,. **35** (4): 605-611.

Nimbalkar, R.D. (2000). Genetic variability and heritability studies and scope for improvement in chickpea. *J. Maharashtra Agril. Univ.,* **25**(1): 109-110.

Singh, N.P., Ram, R., Krishna, R and Singh, A.P. (2002). Assay on direct selection parameters in chickpea (*Cicer arietinum* L.). *Prog. Agric.,* **2** (2): 169-170.

Wahid, M.A. and Ahmed, R. (1998). Genetic variability, correlation studies and their implication in selection of high yielding genotypes in chickpea (*Cicer arietinum* L.). *Sarhad J. Agric.,* **15**(1): 25-28.