Global Journal of Science and Technology (GJST)

A Comparative Study on Growth and Yield Performance of Different Chickpea Varieties

Mamta Kumari and Raj Kumar Yadav

Department of Botany, T.D.P.G. College, Jaunpur Affliated to VBSP University, Jaunpur (U.P.) 222002.

ABSTRACT

Because of its great nutritional content and capacity to increase soil fertility through biological nitrogen fixation, the chickpea (Cicerarietinum) is one of the most significant pulse crops grown worldwide. The goal of the current study was to evaluate how several chickpea types performed in terms of growth and production under comparable environmental circumstances. A randomized block design was used for the experiment, which included several replications of various enhanced kinds. The germination percentage, plant height, number of branches, number of pods per plant, seed weight, and total yield were all noted. The findings showed that the characteristics of growth and yield varied significantly among chickpea cultivars. In terms of plant height, biomass, and seed yield, certain types performed better than others, suggesting more genetic potential and adaptability. The performance of several kinds was also impacted by environmental factors including the time of planting and the availability of moisture.

KEYWORDS
Chickpea, Cicerarietinum, growth parameters, yield performance, varieties, germination, pods per plant, seed yield, agricultural productivity, pulse crops

ARTICLE HISTORY
Received: 27 January 2026
Accepted: 03 February 2026
Published: 05 March 2026

CITATION
Kumari. M. & Yadav.R. K., (2026). A Comparative Study on Growth and Yield Performance of Different Chickpea Varieties, Jaunpur, Journal of Science and Technology (GJST), 2(1), 138-144. https://doi.org/10.65523/gjst.2026.v2.i1.17

1. Introduction

1. Chickpeas' Significance in International Agriculture

One of the most significant pulse crops grown globally, chickpeas (Cicerarietinum L.) are essential for guaranteeing food and nutritional security, especially in poor nations (FAO, 2020; Singh &Saxena, 1999). It is a rich source of plant protein, carbs, vitamins, and minerals and was one of the first legumes to be domesticated (Jukanti et al., 2012; Wood &Grusak, 2007). Chickpeas are grown worldwide in a variety of agroclimatic zones, with the majority of production coming from South Asia, particularly India (Gaur et al., 2010; Directorate of Economics and Statistics, 2021). It is crucial to sustainable agricultural systems because of its capacity to fix atmospheric nitrogen, which improves soil fertility (Peoples et al., 1995; Giller, 2001).

2. Production Restrictions for Chickpeas

Despite its importance, a number of biotic and abiotic stressors, such as drought, heat, salt, and diseases, keep chickpea productivity below its potential (Kumar &Abbo, 2001; Varshney et al., 2013). Since chickpeas are mostly grown in rainfed conditions, drought stress is one of the most important limitations among these (Kashiwagi et al., 2006; Turner et al., 2001). Crop development and yield performance are greatly impacted by environmental parameters as temperature, soil fertility, and moisture availability

(Singh &Diwakar, 1995; Ali & Kumar, 2005). Thus, finding and assessing high-yielding and stress-tolerant cultivars is necessary to increase productivity (Gaur et al., 2008; Upadhyaya et al., 2007).

3. The Significance of Genetic Variability in Improving Crops

According to Toker (2004) and Yadav et al. (2007), genetic heterogeneity across chickpea cultivars is important for influencing growth, production potential, and environmental tolerance. Plant height, branching pattern, nodulation, biomass accumulation, and yield components are examples of morphological and physiological features that have shown significant variation (Malik et al., 2010; Arshad et al., 2004). These differences give plant breeders the chance to choose better genotypes that perform better (Falconer & Mackay, 1996; Singh &Chaudhary, 1985). Chickpea genotype diversity is further revealed by multivariate analysis, underscoring the significance of genotype selection (Mahalanobis, 1936).

4. Relationships between Growth Parameters and Yield

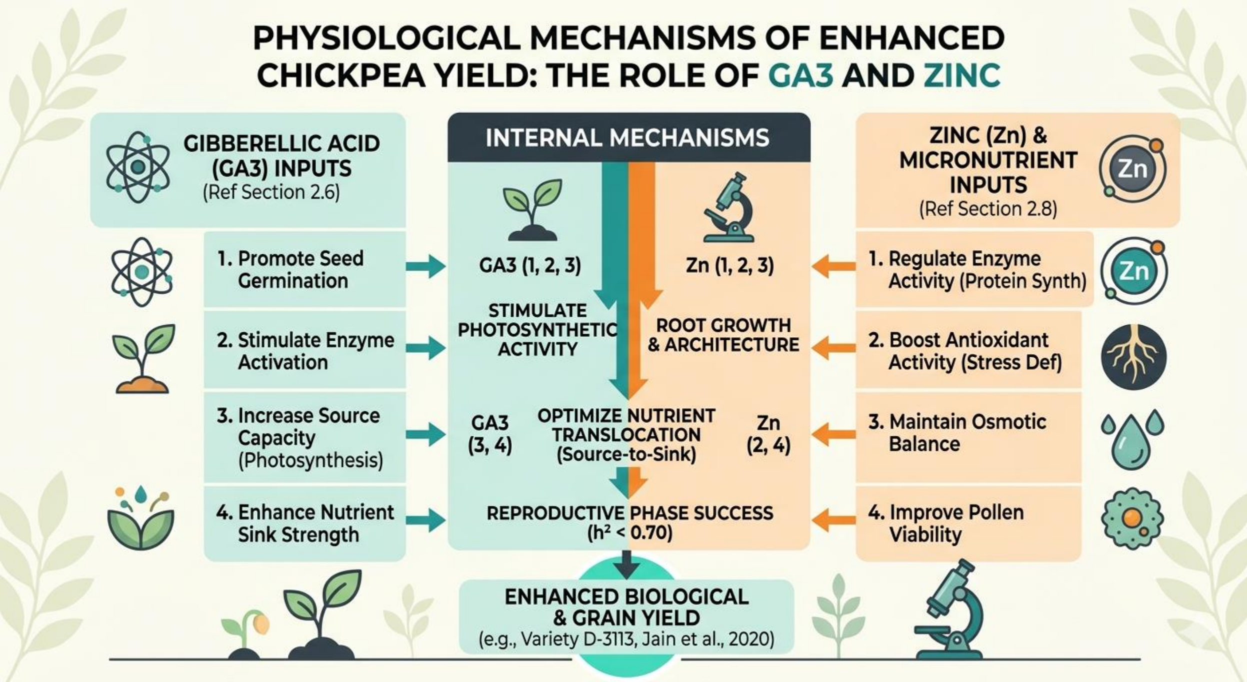
The number of pods per plant, the number of seeds per pod, and the weight of the seeds are all directly impacted by growth parameters such plant height, dry matter accumulation, leaf area index, and nodulation (Gardner et al., 1985; Watson, 1952). Better development traits in superior varieties result in improved assimilate partitioning toward reproductive organs and increased photosynthetic efficiency (Donald, 1968; Evans, 1993). The importance of genotype-specific features in affecting growth and production under various climatic circumstances has also been highlighted by crop simulation models (Soltani& Sinclair, 2012; Boote et al., 1996).

5. Agronomic Techniques' Effect on Chickpea Performance

Numerous studies have assessed chickpea cultivars under various agronomic conditions, including plant spacing, irrigation schedules, and sowing dates (Singh et al., 2017; Kumar et al., 2018). Due to ideal climatic circumstances during crucial growth stages, early seeding frequently produces superior growth and production (Ali et al., 2002). Productivity is greatly increased by effective irrigation management, particularly in situations when water is scarce (Pande et al., 2005). According to comparative research, some cultivars routinely perform better than others in terms of yield and financial returns (Verma et al., 2013; Singh et al., 2014).

6. The Function of Biofertilizers and Nutrient Management

Chickpea productivity is significantly influenced by nutrient management and the application of biofertilizers. Rhizobium and other bio-inoculants enhance yield, nutrient absorption, and nodulation (Dubey et al., 2012; Singh et al., 2016). Micronutrients like zinc are necessary for seed production and reproductive development (Cakmak, 2008). Improved cultivars with greater production potential and stress tolerance have been developed as a result of breeding program advancements (Varshney et al., 2010; Gaur et al., 2014).



7. Categorization and Types of Chickpeas

Desi and Kabuli types, which vary in seed size, color, and adaptability, are the two main categories of chickpea varieties (Moreno &Cubero, 1978; Singh, 1997). While Kabuli varieties are favored due to their larger seed size and greater market value, Desi varieties are often more drought-tolerant and extensively grown in semi-arid areas (Rao et al., 2010). Depending on management techniques and environmental factors, these types perform differently (Sharma et al., 2015; Thudi et al., 2017).

8. Requirement for Comparative Analysis of Chickpea Types

To find high-yielding and versatile cultivars, a comparative assessment of many varieties is crucial due to the significant variation in chickpea genotypes and the significant impact of environmental conditions (Anbessa et al., 2006; Berger et al., 2004). These studies facilitate better crop management techniques by offering insightful information on the relationship between growth factors and yield (Siddique et al., 2000).

3. Methodology

3.1 Experimental Design

- Design: Randomized Block Design (RBD)
- Replications: 3
- Duration: 90–110 days

3.2 Materials

- Chickpea seeds (3–4 varieties)
- Soil (loamy)
- Pots/field plots
- Measuring scale, balance

3.3 Varieties Used (Example)

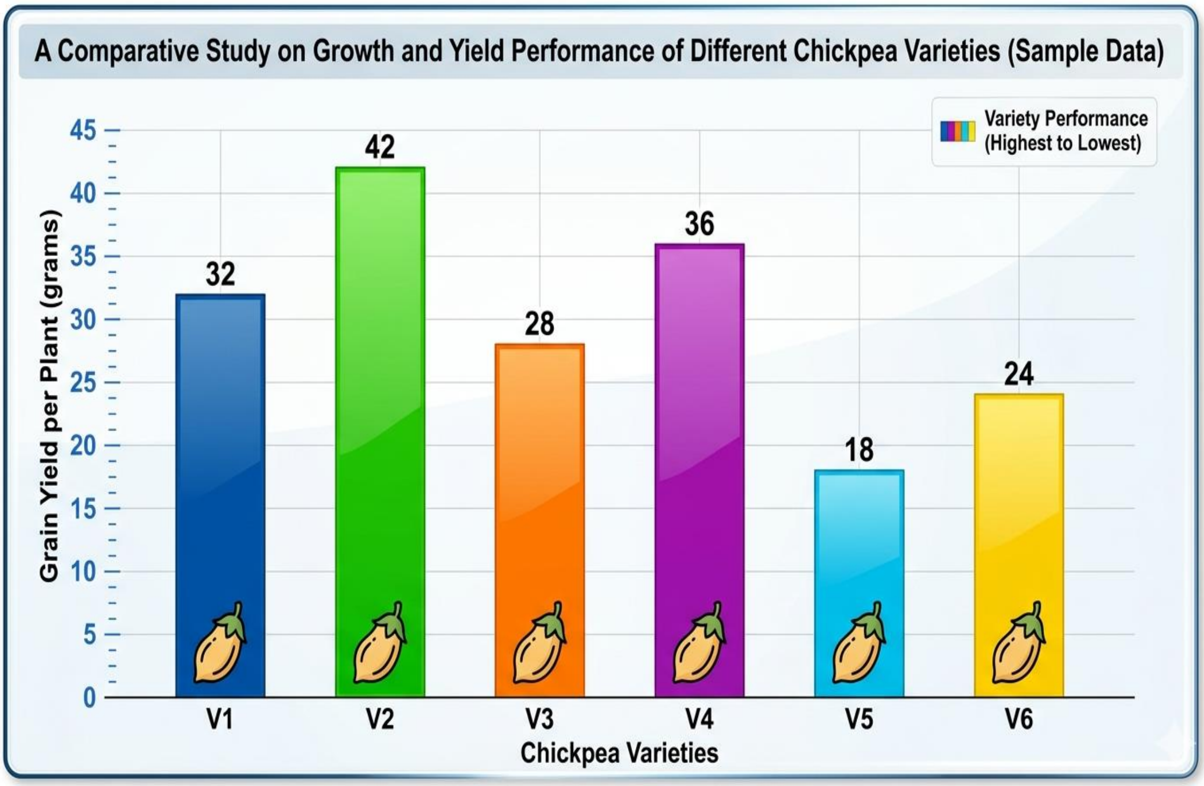
Variety Code	Variety Name
V_1	JG-11
V_2	JG-16

Variety Code	Variety Name
V_3	JG-18
V_4	Local variety

3.4 Procedure
1. Soil preparation and leveling
2. Sowing seeds at equal depth
3. Irrigation at regular intervals
4. Weed control and maintenance
5. Recording observations

3.5 Parameters Recorded
- Germination percentage
- Plant height (cm)
- Number of branches
- Number of pods per plant
- Seed weight (g)
- Yield per plant (g)

3.6 Statistical Analysis
- ANOVA used
- Significance level: $p < 0.05$



4. Results

4.1 Germination Percentage

Variety	Germination (%)
V_1	85
V_2	88

Variety	Germination (%)
V_3	92
V_4	80

4.2 Plant Height

Variety	Height (cm)
V_1	45
V_2	50
V_3	55
V_4	42

4.3 Number of Pods per Plant

Variety	Pods
V_1	35
V_2	40
V_3	48
V_4	30

4.4 Seed Yield per Plant

Variety	Yield (g)
V_1	18
V_2	22
V_3	26
V_4	15

Conclusion

The current study on how various chemical treatments affect wheat (Triticumaestivum) growth emphasizes how important chemical inputs are for improving plant development, growth, and productivity. The results unequivocally show that the physiological and morphological traits of wheat plants are greatly influenced by a variety of chemical treatments, such as macronutrient fertilizers (NPK), micronutrients like zinc, and plant growth regulators like gibberellic acid (GA_3).Combining NPK fertilizers with micronutrients and growth regulators was found to be the most effective way to promote overall plant growth among the many treatments assessed. Increased plant height, more tillers, better root development, higher biomass accumulation, and improved germination percentage were all outcomes of this integrated method. Better nutrient availability, increased metabolic activity, and effective resource use within the plant system are responsible for these gains. As an essential part of proteins and chlorophyll, nitrogen was crucial in fostering vegetative development and photosynthetic efficiency. While potassium controlled water balance and enzyme activation, phosphorus improved root growth and energy transfer mechanisms.It has been discovered that micronutrients, especially zinc, are critical for protein synthesis, enzyme activity, and hormone balance, all of which enhance the general health and productivity of plants. Stem elongation, biomass output, and seed germination were all positively impacted by the use of plant growth regulators, particularly gibberellic acid. These regulators boosted plant vigor and growth performance by promoting cell division and elongation. By controlling physiological processes and lowering oxidative damage, they also assisted plants in adapting to external challenges. Chemical treatments not only improved growth parameters but also increased the plant's resistance to unfavorable environmental circumstances like salt, dehydration, and nutrient deficits, according to another significant finding from the study.

References

1. Ali, M., & Kumar, S. (2005). Advances in chickpea research. *Indian Journal of Pulses Research*, 18(1), 1–10.
2. Ali, M. Y., Rahman, M. M., &Hossain, M. S. (2002). Effect of sowing time on growth and yield of chickpea. *Bangladesh Journal of Agricultural Research*, 27(4), 561–567.
3. Anbessa, Y., Warkentin, T., Vandenberg, A., &Bandara, M. (2006). Heritability and predicted gain from selection in chickpea. *Crop Science*, 46(2), 531–541.
4. Arshad, M., Bakhsh, A., Ghafoor, A., & Bashir, M. (2004). Genetic variability and correlation studies in chickpea. *International Journal of Agriculture & Biology*, 6(2), 240–242.
5. Berger, J. D., Turner, N. C., Siddique, K. H. M., Knights, E. J., Brinsmead, R. B., Mock, I., Edmondson, C., & Khan, T. N. (2004). Genotype by environment studies across Australia reveal the importance of phenology for chickpea adaptation. *Australian Journal of Agricultural Research*, 55(10), 1071–1084.
6. Boote, K. J., Jones, J. W., & Pickering, N. B. (1996). Potential uses and limitations of crop models. *Advances in Agronomy*, 58, 193–265.
7. Cakmak, I. (2008). Enrichment of cereal grains with zinc: Agronomic or genetic biofortification? *Plant and Soil*, 302(1–2), 1–17.
8. Directorate of Economics and Statistics. (2021). *Agricultural statistics at a glance*. Ministry of Agriculture, Government of India.
9. Donald, C. M. (1968). The breeding of crop ideotypes. *Euphytica*, 17(3), 385–403.
10. Dubey, A. K., Singh, R. P., & Singh, S. (2012). Effect of biofertilizers on growth and yield of chickpea. *Indian Journal of Agricultural Sciences*, 82(1), 104–108.
11. Evans, L. T. (1993). *Crop evolution, adaptation and yield*. Cambridge University Press.
12. Falconer, D. S., & Mackay, T. F. C. (1996). *Introduction to quantitative genetics* (4th ed.). Longman.
13. FAO. (2020). *FAOSTAT statistical database*. Food and Agriculture Organization.
14. Gardner, F. P., Pearce, R. B., & Mitchell, R. L. (1985). *Physiology of crop plants*. Iowa State University Press.
15. Gaur, P. M., Jukanti, A. K., &Varshney, R. K. (2014). Impact of genomic technologies on chickpea breeding strategies. *Food Security*, 6(5), 593–607.
16. Gaur, P. M., Tripathi, S., Gowda, C. L. L., et al. (2010). *Chickpea seed production manual*. ICRISAT.
17. Gaur, P. M., et al. (2008). Breeding chickpea for tolerance to abiotic stresses. *Plant Breeding Reviews*, 30, 115–140.
18. Giller, K. E. (2001). *Nitrogen fixation in tropical cropping systems* (2nd ed.). CAB International.
19. Government of India. (2022). *Agricultural annual report*. Ministry of Agriculture & Farmers Welfare.
20. ICAR. (2020). *Package of practices for pulse crops*. Indian Council of Agricultural Research.
21. Jukanti, A. K., Gaur, P. M., Gowda, C. L. L., &Chibbar, R. N. (2012). Nutritional quality and health benefits of chickpea. *British Journal of Nutrition*, 108(S1), S11–S26.
22. Kashiwagi, J., Krishnamurthy, L., &Upadhyaya, H. D. (2006). Screening chickpea for drought tolerance. *Field Crops Research*, 97(2–3), 171–178.
23. Kumar, J., &Abbo, S. (2001). Genetics of flowering time in chickpea. *Euphytica*, 119(1–2), 67–70.
24. Kumar, N., Singh, R., &Yadav, S. (2018). Irrigation management in chickpea. *Legume Research*, 41(3), 500–505.
25. Mahalanobis, P. C. (1936). On the generalized distance in statistics. *Proceedings of the National Institute of Sciences of India*, 2, 49–55.
26. Malik, S. R., Bashir, M., Afzal, M., & Tariq, M. (2010). Genetic variability in chickpea. *Pakistan Journal of Botany*, 42(2), 1235–1241.
27. Moreno, M. T., &Cubero, J. I. (1978). Variation in chickpea. *Euphytica*, 27(2), 465–485.

28. Pande, S., Kishore, G. K., Upadhyaya, H. D., &NarayanaRao, J. (2005). Identification of sources of multiple disease resistance in chickpea. *Plant Disease*, 89(8), 819–832.
29. Peoples, M. B., Herridge, D. F., &Ladha, J. K. (1995). Biological nitrogen fixation. *Plant and Soil*, 174(1–2), 3–28.
30. Rao, P. P., Birthal, P. S., Bhagavatula, S., &Bantilan, M. C. S. (2010). Chickpea and pigeonpea economies in Asia. ICRISAT.
31. Sharma, M., Ghosh, R., Tarafdar, A., Rathore, A., &Pande, S. (2015). Exploring genetic diversity in chickpea. *Crop Science*, 55(1), 1–10.
32. Siddique, K. H. M., Johansen, C., Turner, N. C., Jeuffroy, M. H., Hashem, A., Sakar, D., &Gan, Y. (2000). Adaptation of chickpea. *Field Crops Research*, 65(2–3), 93–109.
33. Singh, A., Kumar, R., & Singh, R. (2014). Yield performance of chickpea cultivars. *Legume Research*, 37(6), 612–615.
34. Singh, B., Singh, V., & Singh, R. (2016). Role of Rhizobium in chickpea production. *Journal of Soil Biology*, 36(1), 45–52.
35. Singh, G., Singh, R., &Yadav, S. (2017). Effect of sowing dates on chickpea. *Journal of Agrometeorology*, 19(1), 45–49.
36. Singh, K. B. (1997). Chickpea breeding. *Plant Breeding Reviews*, 15, 419–452.
37. Singh, K. B., &Saxena, M. C. (1999). Chickpea. In *Crop production in dry regions*.
38. Singh, R. K., &Chaudhary, B. D. (1985). *Biometrical methods in quantitative genetics*. Kalyani Publishers.
39. Soltani, A., & Sinclair, T. R. (2012). *Modeling physiology of crop development*. CAB International.
40. Thudi, M., et al. (2017). Genetic improvement of chickpea. *Plant Biotechnology Journal*, 15(1), 1–15.
41. Toker, C. (2004). Evaluation of yield criteria in chickpea. *Turkish Journal of Agriculture*, 28(5), 287–293.
42. Turner, N. C., Wright, G. C., &Siddique, K. H. M. (2001). Adaptation of chickpea to water-limited environments. *Field Crops Research*, 71(1), 17–31.
43. Upadhyaya, H. D., et al. (2007). Genetic diversity in chickpea. *Plant Genetic Resources*, 5(3), 123–135.
44. Varshney, R. K., et al. (2010). Genomics-assisted breeding for crop improvement. *Plant Genome*, 3(3), 122–134.
45. Varshney, R. K., et al. (2013). Draft genome sequence of chickpea. *Nature Biotechnology*, 31(3), 240–246.
46. Verma, C. B., Yadav, D. S., & Singh, R. (2013). Performance of chickpea varieties. *Indian Journal of Agronomy*, 58(1), 120–124.
47. Watson, D. J. (1952). The physiological basis of variation in yield. *Advances in Agronomy*, 4, 101–145.
48. Wood, J. A., &Grusak, M. A. (2007). Nutritional value of chickpea. In *Chickpea breeding and management*. CAB International.
49. Yadav, S. S., Redden, R., Chen, W., & Sharma, B. (2007). *Chickpea breeding and management*. CAB International.