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Effect of sowing dates and irrigation levels on growth and yield of chickpea (*Cicer arietinum* L.) varieties

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Abstract

A field experiment was conducted at agricultural college, Jabalpur during *Rabi*, 2023-24 to evaluate the effect of dates of sowing and irrigation levels in chickpea varieties. The experiment was laid out in split-split plot design with 18 treatment combinations replicated thrice. The treatment includes three dates of sowing viz., 25th November, 10th December and 25th December as main plot treatments, three sub plot treatments as irrigation management viz., Rainfed (no irrigation), two irrigations scheduled each at 50% branching and pod development stage and three irrigations at 50% branching, flowering and pod development stages and two sub-sub plot treatments as varieties viz., JG-18 and JG-52 in sandy clay loam soil. Results revealed that, 25th November recorded significantly higher plant height (61.60 cm), number of branches plant⁻¹ (16.14), number of pods plant⁻¹ (48.96), seed yield (1527 kg ha⁻¹) and stover yield (2481 kg ha⁻¹). Irrigations scheduling at 50% branching, flowering and pod development stages recorded significantly higher plant height (55.01 cm), number of branches plant⁻¹ (14.78), number of seeds plant⁻¹ (1.38) but seed yield (1278 kg ha⁻¹) was higher for Irrigation scheduling at 50% branching and pod development stage. Among the varieties JG 18 showed higher plant height (53.97 cm), 100 seed weight (30.07 g) and seed yield (1183 kg ha⁻¹) but number of branches plant⁻¹ (13.59) and number of pod plant⁻¹ (46.51) were highest for JG 52 variety.

Keywords: Chickpea, irrigation, varieties and seed yield

Introduction

Chickpea (*Cicer arietinum* L.) is an important cool-season legume widely cultivated in semi-arid regions and plays a vital role in nutritional security and sustainable agriculture. India contributes nearly 70% of global chickpea production, cultivating the crop over 10.19 million ha with a production of 12.16 million tonnes and an average productivity of 1193 kg ha⁻¹, while Madhya Pradesh leads nationally in area and production (Indiastat.com., 2023-24) [5]. Despite its significance, chickpea productivity remains highly vulnerable to climatic variability, particularly terminal heat and moisture stress during reproductive stages (Ryan, 1997) [20]. In rainfed agroecosystems, narrow sowing windows, residual soil moisture dependence, and inadequate irrigation further intensify yield instability.

Chickpea, a drought-tolerant and photoperiod-sensitive C₃ crop that originated in the region of Turkish Kurdistan (Lev-Yadun *et al.*, 2000) [9], is typically grown during winter under residual soil moisture conditions, where rising temperatures and soil moisture deficits toward maturity restrict yield potential. Flowering initiation and crop phenology are strongly governed by photothermal conditions, and exposure to stress during reproductive stages severely impairs pollination, pod formation, and grain filling (Krishnamurthy *et al.*, 2011; Basu *et al.*, 2009) [6, 2]. Adjusting sowing time is therefore a critical agronomic strategy to synchronize crop phenology with favorable environmental conditions and minimize terminal stress.

Sowing time plays a decisive role in determining crop phenology, growth duration, and exposure to environmental stresses. Timely sowing ensures synchronization of flowering and pod development with favorable temperature and moisture conditions, while delayed sowing often subjects the crop to terminal heat and moisture stress, reducing biomass accumulation and yield (Basu *et al.*, 2009) [2]. Likewise, irrigation management is critical for chickpea, as adequate soil

moisture during key growth stages especially flowering and pod filling enhances nutrient uptake, canopy development, and assimilate partitioning toward grain formation (Krishnamurthy *et al.*, 2011) ^[6]. Both deficit and excessive irrigation can adversely affect crop performance and resource-use efficiency. Genotypic performance varies across environments due to strong genotype $\times$ environment interactions (Eberhart and Russell, 1966) ^[4], necessitating the identification of suitable varieties for specific sowing windows and agro-climatic conditions to achieve stable and higher yields (Perkins and Jinks, 1968) ^[17]. A better understanding of varietal response to sowing time, temperature, and moisture regimes is essential for achieving stable and higher productivity. Hence, optimizing sowing time, irrigation scheduling, and genotype selection is crucial for aligning crop development with resource availability and enhancing chickpea resilience under changing climatic conditions.

In this context, the present investigation was carried out to identify the optimum sowing time and irrigation schedule for chickpea varieties for higher productivity and profitability.

Materials and Methods

The investigation was carried out at research farm, Department of physics and agro-meteorology, college of agricultural engineering, Jawaharlal Nehru Krishi Vishwa Vidyalay, Jabalpur (M.P.) during *rabi* season of 2023-24. The experimental site lies between 23° 10' N latitude and 79° 59' E longitude and 411.78 m above mean sea level. It comes under "Kymore plateau and Satpura Hills" agro-climatic zone of M.P. The seeds were directly sown @ 75 kg ha⁻¹ by line sowing with row to row distance 30 cm manually with the help of kudali in rows. Seeds were treated with Imidacloprid @10 ml kg⁻¹ of seed for controlling pest infestation. Later, it was inoculated with *Rhizobium* Leguminosorum bacteria. All the fertilizers *i.e* Nitrogen (N), phosphorous (P₂O₅) and potassium (K₂O) were applied basally at the rate of 20, 60 and 20 kg ha⁻¹, respectively. Source for N, P₂O₅ and K₂O were Di-ammonium phosphate and muriate of potash respectively. One hand weeding was done at 30 DAS for each sowing dates to maintain weed free conditions in each plot. Irrigation was scheduled as per the sub plot treatments at 5 cm depth. Suitable plant protection measures were followed during the cropping season. Five plants were randomly selected in each net plot area for taking observations on growth and yield attributing parameters as per the schedule. The crop in each net plot was harvested separately as per treatment and the values were converted into hectare basis and expressed in kilograms per hectare. The data recorded during the investigation were compiled and analysed for statistical significance as per the analysis of variance for the split-split plot design. Statistically analysed by analysis of variance utilizing split-split plot design (Panse and Sukhatme 1978) ^[16]. Statistical difference (CD) will be tested by applying F-Test at 0.05 level of probability. Standard error of mean and coefficient of variability have been worked out for a set of observations under each character at P = 0.05 to interpret the significance.

Results and Discussion

Effect on growth parameters

Sowing chickpea on 25th November resulted in significantly higher plant height and number of branches at all the stages compared to 10th December and 25th December (Table 1 and Table 2). This might be due to the temperature and other climatological parameters were favourable for above growth characters. Trivedi and Vyas (2000) ^[27] reported that the values

of growth and yield attributes as well as yield were decreased with successive delay in sowing and also confirm those of Kumar *et al.* (2022) ^[7] and Sandeep *et al.* (2023) ^[21].

Among the different irrigation levels, three irrigations at 50% branch formation, flower, and pod development stages showed significantly highest plant height and number of branches at 90 DAS and harvest, compared to two irrigations (50% branching and pod development stage) and no irrigation (Table 1 and Table 2). All the growth parameters showed positive response to higher frequency of irrigation probably because of relative availability of soil moisture during the critical stages of crop development. Besides, due to increase in water availability the absorption of water and nutrients from the soil increases which might have resulted in better growth and development of crop. Similar results were reported by Reeta (2019) ^[19] and Lende and Patil, (2017) ^[8].

JG 18 variety recorded taller plants compared to JG 52 variety at all the growth stages but number of branches were higher for JG 52 variety (Table 1 and Table 2). The differences in growth parameters due to varieties may be attributed to their inherent characteristics and also due to staggered weather situation, as also reported by Mekonnen (2020) ^[10].

Effect on yield attributes

Number of pods per plant was significantly higher (48.96) in first date of sowing *i.e* 25th November compared to other dates of sowing. Number of seeds per plant and 100 seed weight were not significantly influenced by dates of sowing. Less number of yield attributes under delayed sowing may be due to exposed to higher temperature during the reproductive phase. Singh *et al.*, (2007) ^[25] reported that the highest number of pods plant⁻¹, seed weight g plant⁻¹ and seed index 100 seed weight were 225 observed with 30th November sowing. This may be due to better balance between vegetative and reproductive growth. Similar findings were obtained by Thombre *et al.* (2019) ^[26] and Sandeep *et al.* (2023) ^[21].

Irrigation levels did not show significant effect on number of pods plant⁻¹ and 100 seed weight. But number of seeds plant⁻¹ was significantly influenced by irrigation with three irrigations (50% branching, flowering and pod development stages) recorded higher number of seeds plant⁻¹ (1.38) which was statistically similar to two irrigations (50% branching and pod development stage). This may be due to increased water availability resulted in absorption of water and nutrients from soil which gives ultimately vigorous growth and reproductive capacity of chickpea plants. These findings are in line with Singh *et al.* (2017) ^[24]. Lowest number of seeds plant⁻¹ (1.19) was observed in no irrigation treatment.

Highest number of pods plant⁻¹ (46.51) and seeds plant⁻¹ (1.35) was found in JG 52 variety compared to JG 18. However, 100 seed weight (30.07) was more for JG 18 variety. This may be due to genetic character of the chickpea varieties as well as environmental factors. These findings are also close to findings of Ulemale *et al.* (2013) ^[28] and Mekonnen (2020) ^[10].

Effect on yield

The results revealed that, first date of sowing (25th November) significantly improved seed yield (1527 kg ha⁻¹) and stover yield (2481 kg ha⁻¹) over other dates of sowing. The higher seed and stover yield in 25th November sown crop may be attributed to better plant growth leading to significantly more plant height, number of branches plant⁻¹, number of pods plant⁻¹ and better partitioning of photosynthesis compared to delayed sowing dates. Sharma and Sharma (2002) ^[23] reported highest seed yield

was obtained during 25th November sowing crop and delayed sowing by 30 days resulted in decrease in grain yield up to 6.5 kg ha⁻¹ day⁻¹. Similar results were found by Abdullah *et al.* (2024) [1] and Ray *et al.* (2025) [18].

Seed yield was higher (1278 kg ha⁻¹) for the irrigation treatment with 50% branching and pod development stage than the other treatments. The seed yield was significantly superior under two irrigation levels probably due to increased water availability resulted in absorption of water and nutrients from soil which gives ultimately vigorous growth and reproductive capacity of chickpea plants. These findings are nearby with Chandu *et al.* (2024) [3] and Mhaske *et al.* (2019) [11].

JG 18 recorded higher seed yield (1183 kg ha⁻¹) compared to JG 52 variety. This may be due to genetic character of the chickpea types as well as environmental factors and yield attributing characters. These findings are also close to findings of Muruiki *et al.* (2018) [15] and Mohammed *et al.* (2020) [13].

Table 1: Plant height of chickpea varieties as influenced by sowing dates and irrigation levels at different time intervals

Treatments	30 DAS	60 DAS	90 DAS	Harvest
Main plot treatments (sowing dates)				
25 NOV	17.45	40.54	56.39	61.60
10 DEC	14.96	32.82	45.87	47.14
25 DEC	14.01	32.64	41.13	41.37
S.Em ±	0.30	0.80	1.85	2.00
CD (P = 0.05)	1.16	3.14	7.25	7.85
Sub plot treatments (Irrigation levels)				
No irrigation	15.79	35.46	44.99	46.67
Two irrigations (50% branching and pod development stage)	15.30	35.13	46.72	48.43
Three irrigations (50% branching, flowering and pod development stages)	15.32	35.42	51.69	55.01
S.Em ±	0.31	0.72	0.60	1.05
CD (P = 0.05)	NS	NS	1.86	3.24
Sub sub plot treatments (Varieties)				
JG 18	19.03	38.59	51.25	53.97
JG 52	11.92	32.09	44.35	46.10
S.Em ±	0.25	0.52	0.56	0.65
CD (P = 0.05)	0.73	1.54	1.67	1.92

Table 2: Number of branches of chickpea varieties as influenced by sowing dates and irrigation levels at different time intervals

Treatments	30DAS	60DAS	90 DAS	Harvest
Main plot treatments (sowing dates)				
25 NOV	5.37	12.62	15.48	16.14
10 DEC	3.87	10.89	13.51	14.18
25 DEC	3.59	6.09	8.01	8.67
S.Em ±	0.19	0.31	0.24	0.23
CD (P = 0.05)	0.74	1.23	0.95	0.91
Sub plot treatments (Irrigation levels)				
No irrigation	4.23	8.09	10.30	10.97
Two irrigations (50% branching and pod development stage)	4.30	10.56	12.58	13.25
Three irrigations (50% branching, flowering and pod development stages)	4.29	10.96	14.11	14.78
S.Em ±	0.14	0.56	0.39	0.39
CD (P = 0.05)	NS	1.72	1.19	1.20
Sub sub plot treatments (Varieties)				
JG 18	4.08	9.56	11.74	12.41
JG 52	4.47	10.17	12.92	13.59
S.Em ±	0.13	0.40	0.39	0.36
CD (P = 0.05)	0.38	NS	1.15	1.08

Table 3: Yield attributes of chickpea varieties as influenced by sowing dates and irrigation levels at different time intervals

Treatments	No. of pods plant ⁻¹	No. of seeds pod ⁻¹	100 seed weight (g)
Main plot treatments (sowing dates)			
25 NOV	48.96	1.49	23.89
10 DEC	41.94	1.29	23.00
25 DEC	34.02	1.18	22.67
S.Em ±	1.71	0.08	0.43
CD (P = 0.05)	6.70	NS	NS
Sub plot treatments (Irrigation levels)			
No irrigation	37.02	1.19	22.56
Two irrigations (50% branching and pod development stage)	45.09	1.38	23.78
Three irrigations (50% branching, flowering and pod development stages)	42.82	1.38	23.22
S.Em ±	2.29	0.05	0.33
CD (P = 0.05)	NS	0.17	NS
Sub sub plot treatments (Varieties)			
JG 18	36.77	1.29	30.07
JG 52	46.51	1.35	16.30
S.Em ±	1.93	0.05	0.34
CD (P = 0.05)	5.73	NS	1.02

Table 4: Seed yield and stover yield (kg ha⁻¹) of chickpea varieties as influenced by sowing dates and irrigation levels at different time intervals

Treatments	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)
Main plot treatments (sowing dates)		
25 NOV	1527	2481
10 DEC	1121	1883
25 DEC	706	1250
S.Em ±	82	127
CD (P = 0.05)	323	497
Sub plot treatments (Irrigation levels)		
No irrigation	1016	1635
Two irrigations (50% branching and pod development stage)	1278	1925
Three irrigations (50% branching, flowering and pod development stages)	1059	2055
S.Em ±	68	136
CD (P = 0.05)	209	NS
Sub sub plot treatments (Varieties)		
JG 18	1183	1983
JG 52	1053	1759
S.Em ±	38	92
CD (P = 0.05)	112	NS

Conclusion

Early sowing by 25th November was found effective in terms of growth and yield. Scheduling two irrigations at 50% branching and pod development stage of chickpea found to be beneficial in terms of yield. Among the varieties JG 18 found to be higher in growth and yield compared to JG 52.

References

- Abdullah SA, Ali VD, Salih RH, Abdulazeez SD, Kakarash SA. Journal of medicinal and industrial plants. J Med Ind Plants. 2024;2(3):9-15.
- Basu PS, Ali M, Chaturvedi SK. Terminal heat stress adversely affects chickpea productivity in Northern India-strategies to improve thermotolerance in the crop under climate change. In: W3 workshop proceedings: impact of climate change on agriculture. New Delhi: International

- Society for Photogrammetry and Remote Sensing; 2009. p. 189-193.
3. Chandu N, Mahesh N, Sampath O, Kumar RS. Effect of irrigation levels and foliar nutrition with nano fertilizers on growth and yield of zero till chickpea (*Cicer arietinum* L.). Int J Res Agron. 2024;7(9):846-850.
 4. Eberhart ST, Russell W. Stability parameters for comparing varieties. Crop Science. 1966;6(1):36-40.
 5. Indiatat.com. Chickpea area, production and yield statistics. 2023-2024.
 6. Krishnamurthy L, Gaur PM, Basu PS, Chaturvedi SK, Tripathi S, Vadez V, *et al.* Large genetic variation for heat tolerance in the reference collection of chickpea (*Cicer arietinum* L.) germplasm. Plant Genetic Resources. 2011;9(1):59-69.
 7. Kumar S, Verma CB, Kumar A, Singh M, Singh M. Effect of sowing dates and micronutrient on growth and yield of chickpea varieties (*Cicer arietinum* L.) under changing climatic conditions. Pharma Innov J. 2022;11:1071-1077.
 8. Lende N, Patil H. Irrigation management on growth, yield and quality of chickpea (*Cicer arietinum* L.). J Pharmacogn Phytochem. 2017;6(5):528-533.
 9. Lev-Yadun S, Gopher A, Abbo S. The cradle of agriculture. Science. 2000;288:1602-1603.
 10. Mekonnen L. Effects of water stress applied at different phenological phases of chickpea (*Cicer arietinum* L.). Int J Agric Res Innov Technol. 2020;10(1):13-21.
 11. Mhaske S, Agrawal KK, Bhan M. Growth, yield and economics of chickpea types as influenced by different thermal environment and irrigation. Pharma Innov J. 2019;8(9):401-403.
 12. Millan T, Clarke HJ, Siddique KH, Buhariwalla HK, Gaur PM, Kumar J, *et al.* Chickpea molecular breeding: new tools and concepts. Euphytica. 2006;147(1):81-103.
 13. Mohammed A, Bisetegn S, Misganaw A, Desale A, Alemnew T. Evaluation of desi type chickpea varieties for adapting under irrigation at Kobo. Agrotechnology. 2020;9:200.
 14. Munirathnum P, Sangita MS. Influence of sowing dates and irrigations on growth and yield of chickpea. Legume Research. 2009;32(3):209-211.
 15. Muruiki R, Kimurto P, Vadez V, Gangarao NVPR, Silim S, Siambi M. Effect of drought stress on yield performance of parental chickpea genotypes in semi-arid tropics. J Life Sci. 2018;12(3):159-168.
 16. Panse VC, Sukhatme PV. Statistical methods for agricultural workers.
 17. Perkins JM, Jinks JL. Environmental and genotype-environmental components of variability. Heredity. 1968;23(3):339-356.
 18. Ray M, Roul PK, Kapoor P, Yadav S, Kumari N, Mishra P. Effect of sowing dates and seed priming on agrometeorological indices and soil moisture regimes of chickpea in North Central Plateau Zone of Odisha. Legume Research. 2025;48(2):299-305.
 19. Reeta. Agro-physiological evaluation of chickpea (*Cicer arietinum* L.) genotypes under soil moisture stress. Hisar: Chaudhary Charan Singh Haryana Agricultural University; 2019.
 20. Ryan JG. A global perspective on pigeonpea and chickpea sustainable production systems: present status and future potential. In: Recent advances in pulses research. 1997. p. 1-31.
 21. Sandeep GS, Umesha C, Kiran VU. Effect of dates of sowing on growth and yield of chickpea varieties. Int J Environ Clim Change. 2023;13(10):834-838.
 22. Sekhar D, Kumar PP, Rao KT. Performance of chickpea varieties under different dates of sowing in high altitude zone of Andhra Pradesh, India. Int J Curr Microbiol Appl Sci. 2015;4(8):329-332.
 23. Sharma KC, Sharma BC. Effect of dates of sowing and row spacing on chickpea genotype under late sown conditions. Adv Plant Sci. 2002;15(2):517-523.
 24. Singh R, Kumar S, Kumar H, Kumar M, Kumar A, Kumar D. Effect of irrigation and integrated nutrient management on growth and yield of chickpea (*Cicer arietinum* L.). Plant Arch. 2017;17(2):1319-1323.
 25. Singh TP, Deshmukh PS, Kushwaha SR. Response of different sowing dates on seed protein content and productivity of chickpea (*Cicer arietinum* L.) genotypes. Indian J Agric Sci. 2007;77(9):607-608.
 26. Thombre SV, Goud VV, Darade GA, Saoji BV, Tupe AR. Effect of sowing dates on growth and yield of chickpea varieties under late sown condition. J Pharmacogn Phytochem. 2019;8(5):801-805.
 27. Trivedi KK, Vyas MD. Response of kabuli chickpea cultivars under different dates of sowing and row spacings. Crop Res Hisar. 2000;20(1):52-55.
 28. Ulemale CS, Mate SN, Deshmukh DV. Physiological indices for drought tolerance in chickpea (*Cicer arietinum* L.). World J Agric Sci. 2013;9(2):123-131.