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Megha Chandra

M.Sc. Scholar, Department of
 Agronomy, COA, Raipur (C.G)
 Indira Gandhi Krishi
 Vishwavidyalaya, Raipur,
 Chhattisgarh, India

Ambika Tandon

Professor, Department of
 Agronomy, College of
 Agriculture Raipur (C.G)
 Indira Gandhi Krishi
 Vishwavidyalaya, Raipur,
 Chhattisgarh, India

GP Banjara

Professor, Department of
 Agronomy, College of
 Agriculture Raipur (C.G)
 Indira Gandhi Krishi
 Vishwavidyalaya, Raipur,
 Chhattisgarh, India

Prabharani Choudhary

Professor, Department of
 Agronomy, College of
 Agriculture Raipur (C.G)
 Indira Gandhi Krishi
 Vishwavidyalaya, Raipur,
 Chhattisgarh, India

Corresponding Author:

Megha Chandra

M.Sc. Scholar, Department
 of Agronomy, COA, Raipur
 (C.G) Indira Gandhi Krishi
 Vishwavidyalaya, Raipur,
 Chhattisgarh, India

Effect of different sowing dates on growth and yield performance of chickpea varieties under Chhattisgarh plains

Megha Chandra¹, Ambika Tandon², GP Banjara³, Prabharani Choudhary⁴

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ABSTRACT

A field experiment was conducted during the rabi season of 2025–26 at the Instructional-cum-Research Farm, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications, comprising three dates of sowing [30 November (D_1), 10 December (D_2) and 20 December (D_3)] and four chickpea varieties [Indira Chana-1 (V_1), C.G. Akshay Chana (V_2), C.G. Lochan Chana (V_3) and C.G. Chana-2 (V_4)], resulting in twelve treatment combinations. The experimental soil was Vertisol. The study on the effect of different sowing dates and chickpea varieties revealed that 30 November sowing (D_1) recorded significantly superior growth and yield compared with delayed sowing. It produced the highest plant height (16.32, 34.51, 49.95 and 50.74 cm at 30, 60, 90 DAS and at harvest, respectively), maximum dry matter accumulation (26.08 g plant⁻¹ at harvest), and the highest nodule dry weight (198.52 mg plant⁻¹ at 60 DAS). It also exhibited superior crop growth rate and relative growth rate. Among the yield attributes, 30 November sowing recorded the maximum number of pods plant⁻¹ (28.57), seed yield (1535.46 kg ha⁻¹) and stover yield (3043.43 kg ha⁻¹), indicating the advantage of timely sowing over delayed sowing.

Keywords: Chickpea (*Cicer arietinum* L.), Sowing date, Varieties, Growth, Yield, Quality, Productivity, Phenology, FRBD

Introduction

Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops and plays a significant role in the Indian agricultural economy. It is popularly known as "Gram" or "Bengal gram" and serves as an excellent source of protein, carbohydrates, vitamins and minerals, thereby improving the nutritional quality of human diets (Singh, 1997; Gaur *et al.*, 2010) [1]. India is the largest producer as well as the largest cultivator of chickpea in the world. During 2023–24, chickpea occupied about 10.56 million hectares with a production of 11.23 million tonnes and an average productivity of 1063 kg ha⁻¹ in India (Directorate of Economics and Statistics, 2024).

Chickpea is a cheap and important source of protein for those people who cannot afford animal protein or who are largely vegetarian. Furthermore, chickpea is also a good source of minerals (calcium, phosphorus, magnesium, zinc and iron), unsaturated fatty acids, fibre and β -carotene). Chickpea also plays an important role in maintaining soil fertility by fixing nitrogen at rates of up to 140 kg/ha/year (Flowers *et al.*, 2010). Therefore, this crop requires relatively low inputs of nitrogen as it derives 70% of its N through symbiotic N₂ fixation and benefits other cereal crops as well (Siddique *et al.*, 2005).

The early sown crop results in excessive vegetative growth, poor setting of pods and greater weed competition, whereas in double cropping areas due to cultivation of long duration crop varieties, the sowing of chickpea is usually delayed. Under such situation, the crop has to be sown up to December. This late sown crop experiences very low temperature at initial stages of crop growth resulting in poor and slow vegetative growth, where as the early sown crop allows better yield and growth improvement. A study reported that number of fertile pods on the primary branch, grains per pod, weight of 100 grains, and grain yield per unit area were affected by planting date (Mohammadnejad and Soltani, 2005). Sowing time had a marked effect on yield of chickpea. Optimum sowing time provides more time for growth and development of plant which is favourable for higher yield whereas both early and late sowing hinder the growth and development with lowest yield potential. Timely sowing ensures optimum vegetative and reproductive growth, resulting in improved pod formation, seed yield, and overall productivity while late sowing adversely affects crop performance. Late sowing also results in lower yield, the growth is hampered and the seed development period is shortened. To reduce the yield losses of chickpea, seeds should be sown as early as possible, but sometimes delayed sowing may help to escape from diseases and unfavorable planting condition.

Materials and Methods

Experimental details

The present investigation entitled "Effect of date of sowing on growth, yield and quality of chickpea (*Cicer arietinum* L.) varieties" was carried out at Instructional cum Research Farm IGKV, Raipur, during *rabi* season of 2025–26. The experiment was carried out in Factorial Randomized Block Design with three replications. The experiment comprised twelve treatment combinations consisting of three dates of sowing, viz., 30 November (D_1), 10 December (D_2) and 20 December (D_3), and four chickpea varieties, viz., V_1 –Indira Chana-1, V_2 –C.G. Akshay Chana, V_3 –C.G. Lochan Chana and V_4 –C.G. Chana-2. The climate of the experimental area was suitable for the growth and development of the chickpea. The climate of the region is sub-humid to semi-arid. Weather conditions throughout the crop season were suitable for appropriate growth, development and seed yield of chickpea crop. The field experiment was conducted in vertisols, which had low level of nitrogen, medium level of phosphorus and high potassium content with normal pH.

Observations and analysis

Different observations on growth parameters viz., plant population, plant height, dry matter accumulation, number of branches, number of nodules and dry weight of nodule and yield attributes viz., number of pods plant⁻¹, number of seeds pod⁻¹, 100 seed weight, seed and stover yield were recorded. Also, nutrient content and uptake by seed and stover and protein content and protein yield were analyzed and calculated and economics of various genotypes were worked out. After statistical analysis of data, the results were interpreted.

Statistical analysis

The data found on several parameters of chickpea were tabulated and subjected to statistical analysis. The experiment was laid out in a Factorial Randomized Block Design (FRBD). The influence of dates of sowing (D), varieties (V) and their interaction ($D \times V$) was tested by 'F' test, wherever the 'F' test showed their significance, the treatment means were compared by critical difference (CD) at 5 per cent level of probability.

Results and Discussion

Growth parameters

Plant height

Plant height (cm) was recorded at 30 DAS, 60 DAS, 90 DAS and at harvest, and the data are presented in table 1. Plant height increased progressively and was significantly affected by both sowing dates and varieties. Among sowing dates, 30 November sowing (D_1) significantly taller plants was recorded at 30 DAS, 60 DAS, 90 DAS and at harvest (16.32 cm, 34.51 cm, 49.95 cm and 50.74 cm, respectively), whereas the lowest plant height was recorded under 20 December sowing (D_3). Among varieties, Indira Chana-1 (V_1) produced the taller plants at 30 DAS, 60 DAS, 90 DAS and at harvest (16.47 cm, 35.61 cm, 51.44 cm and 54.77 cm) throughout the crop growth period which was statically at par with C.G. Chana-2. The shortest plants were recorded in C.G. Akshay Chana. Similar results were also reported by Ali *et al.*, (2018) and Kumar and Singh (2020).

Dry weight of plant

Dry weight of chickpea (g plant⁻¹) was recorded at 30 DAS, 60 DAS, 90 DAS and at harvest, and was significantly influenced by date of sowing and varieties. Among the sowing dates, 30 November (D_1) sown crop recorded significantly higher dry weight (1.59, 11.81, 24.34 and 26.08 g plant⁻¹ at 30 DAS, 60 DAS, 90 DAS and harvest, respectively), which was statically at par with sowing date of 10 December (D_2) (1.47, 10.87, 21.91 and 24.35 g plant⁻¹) respectively at 30 DAS, 60 DAS, 90 DAS and at harvest. The lowest dry weight

was observed under 20 December sowing (D_3) (1.30, 9.67, 20.82 and 22.36 g plant⁻¹) at 30 DAS, 60 DAS, 90 DAS and at harvest. Among the varieties, Indira Chana-1 (V_1) recorded the highest dry weight (1.61, 11.82, 24.78 and 26.87 g plant⁻¹ at 30 DAS, 60 DAS, 90 DAS and harvest), which is statically at par with C.G. Chana-2 (V_4) (1.55, 11.49, 23.72 and 25.73 g plant⁻¹). The lowest dry weight was recorded in C.G. Akshay Chana (V_2) (1.24, 9.23, 19.03 and 20.69 g plant⁻¹) at 30 DAS, 60 DAS, 90 DAS and at harvest.

Number of pods plant⁻¹

The number of pods plant⁻¹ is one of the most important yield-contributing characters in chickpea. The results revealed that the number of pods plant⁻¹ was significantly influenced by different dates of sowing as well as varieties, whereas their interaction was found to be non-significant. Among the different dates of sowing, 30 November (D_1) produced the highest number of pods plant⁻¹ (28.57), which was significantly superior to 20 December (D_3) (21.95) and remained statically at par with 10 December (D_2) (25.78). The lowest number of pods plant⁻¹ was recorded under delayed sowing (20 December). Among the varieties, Indira Chana-1 (V_1) recorded the maximum number of pods plant⁻¹ (29.06), which was significantly superior to the remaining varieties. It was followed by C.G. Chana-2 (V_4) (27.36) and C.G. Lochan Chana (V_3) (25.27), while C.G. Akshay Chana (V_2) recorded the minimum number of pods plant⁻¹ (20.04).

Number of seeds pod⁻¹

The data presented in table 1. indicate that the number of seeds pod⁻¹ was not significantly influenced by different dates of sowing. However, significant differences were observed among the varieties, whereas the interaction effect remained non-significant. Among the varieties, Indira Chana-1 (V_1) recorded the highest number of seeds pod⁻¹ (1.53), which was significantly superior to C.G. Akshay Chana (V_2) (1.32) and C.G. Lochan Chana (V_3) (1.37), and remained at par with C.G. Chana-2 (V_4) (1.42). The present findings are in agreement with those reported by Gaur *et al.* (2010) [1], who observed that the number of seeds per pod in chickpea is largely under genetic control and exhibits limited variation due to agronomic practices.

Seed yield

The Seed yield was significantly influenced by different dates of sowing and varieties, whereas their interaction was found to be non-significant. Among the different sowing dates, 30 November (D_1) recorded the higher seed yield (1535.46 kg ha⁻¹), which was significantly superior to 10 December (D_2) (1389.95 kg ha⁻¹) and 20 December (D_3) (1185.75 kg ha⁻¹). Similar findings were reported by Kumar *et al.* (2014), Meena *et al.* (2017), and Singh *et al.* (2018), who observed that optimum sowing time enhanced growth, yield attributes, and seed yield, whereas delayed sowing resulted in substantial yield reduction due to terminal heat stress. Among the varieties, Indira Chana-1 (V_1) produced the highest seed yield (1573.31 kg ha⁻¹), which was at par with C.G. Chana-2 (V_4) (1451.64 kg ha⁻¹) and C.G. Lochan Chana (V_3) (1327.93 kg ha⁻¹). The lower seed yield (1128.67 kg ha⁻¹) was recorded in C.G. Akshay Chana (V_2).

Stover yield

The data presented in table indicated that stover yield was significantly affected by different dates of sowing and varieties, whereas the interaction effect remained non-significant. The higher stover yield (3043.43 kg ha⁻¹) was recorded under 30 November sown crop, followed by 10 December (2832.40 kg ha⁻¹) and 20 December (2504.08 kg ha⁻¹). Among the varieties, Indira Chana-1 (V_1) recorded the maximum stover yield (3106.64 kg ha⁻¹), which was statically at par with C.G. Chana-2 (V_4) (2943.31 kg ha⁻¹). The minimum stover yield (2387.37 kg ha⁻¹) was observed in C.G. Akshay Chana (V_2). The findings of the present investigation are in close conformity with those reported by Ali *et al.* (2009) [2], who observed higher biological and stover yield in timely sown chickpea due to favourable growing conditions.

Table 1. Effect of date of sowing and varieties on growth and yield attributes of chickpea

Treatment details	Plant height at harvest (cm)	Dry weight at harvest (g plant ⁻¹)	Pods plant ⁻¹	Seeds pod ⁻¹	100 seed weight (g)
Date of sowing					
D ₁ – 30 November	50.74	26.08	28.57	1.45	22.65
D ₂ – 10 December	47.70	24.35	25.78	1.41	21.09
D ₃ – 20 December	44.22	22.36	21.95	1.37	20.52
SE _m ±	1.34	0.69	0.70	0.04	0.60
CD (P = 0.05)	3.94	2.01	2.06	NS	1.75
Varieties					
V ₁ – Indira Chana-1	54.77	26.87	29.06	1.53	24.17
V ₂ – C.G. Akshay Chana	38.25	20.69	20.04	1.32	18.16
V ₃ – C.G. Lochan Chana	44.77	23.77	25.27	1.37	20.17
V ₄ – C.G. Chana-2	52.43	25.73	27.36	1.42	23.17
SE _m ±	1.55	0.79	0.81	0.04	0.69
CD (P = 0.05)	4.55	2.32	2.37	0.13	2.02

Economics

The cost of cultivation remained uniform (₹32,231 ha⁻¹) for all dates of sowing and chickpea varieties. The higher gross returns was recorded under 30 November sowing (D₁) (₹92,744 ha⁻¹), followed by 10 December (D₂) (₹84,019 ha⁻¹) and 20 December (D₃) (₹71,749 ha⁻¹). Among the varieties, Indira Chana-1 (V₁) recorded the highest gross returns (₹95,020 ha⁻¹), followed by C.G. Chana-2 (V₄) (₹87,736 ha⁻¹), C.G. Lochan Chana (V₃) (₹80,295 ha⁻¹) and C.G. Akshay Chana (V₂) (₹68,298 ha⁻¹). The higher net returns was recorded under 30 November sowing (D₁) (₹60,513 ha⁻¹), followed

by 10 December (D₂) (₹51,788 ha⁻¹) and 20 December (D₃) (₹39,518 ha⁻¹). Among the varieties, Indira Chana-1 (V₁) recorded the highest net returns (₹62,789 ha⁻¹), followed by C.G. Chana-2 (V₄) (₹55,505 ha⁻¹), C.G. Lochan Chana (V₃) (₹48,064 ha⁻¹) and C.G. Akshay Chana (V₂) (₹36,067 ha⁻¹). The higher benefit-cost (B:C) ratio was recorded under 30 November sowing (D₁) (2.88), followed by 10 December (D₂) (2.61) and 20 December (D₃) (2.23). Among the varieties, Indira Chana-1 (V₁) recorded the highest B:C ratio (2.95), followed by C.G. Chana-2 (V₄) (2.72), C.G. Lochan Chana (V₃) (2.49) and C.G. Akshay Chana (V₂) (2.1).

Table. Effect of sowing dates and varieties on seed yield, stover yield, harvest index and economics of chickpea

Treatment	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest index (%)	Cost of cultivation (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)	Benefit:Cost ratio
Date of sowing						
D ₁ – 30 November	1535.46	3043.43	37.67	32,231	60,513	2.88
D ₂ – 10 December	1389.95	2832.40	36.92	32,231	51,788	2.61
D ₃ – 20 December	1185.75	2504.08	35.86	32,231	39,518	2.23
SE _m ±	36.39	72.79	0.95	–	–	–
CD (P = 0.05)	106.74	213.47	NS	–	–	–
Varieties						
V ₁ – Indira Chana-1	1573.31	3106.64	37.64	32,231	62,789	2.95
V ₂ – C.G. Akshay Chana	1128.67	2387.37	35.99	32,231	36,067	2.12
V ₃ – C.G. Lochan Chana	1327.93	2735.89	36.63	32,231	48,064	2.49
V ₄ – C.G. Chana-2	1451.64	2943.31	37.00	32,231	55,505	2.72
SE _m ±	42.02	84.05	1.10	–	–	–
CD (P = 0.05)	123.25	246.50	NS	–	–	–

Conclusion

Sowing date and variety significantly influenced the growth, yield attributes, productivity and economic returns of chickpea. Among sowing dates, 30 November (D₁) recorded higher plant height, dry weight, pods plant⁻¹, seeds pod⁻¹ and 100-seed weight, along with the highest seed yield (1535.46 kg ha⁻¹), stover yield (3043.43 kg ha⁻¹), net return (₹60,513 ha⁻¹) and B:C ratio (2.88). Among varieties, Indira Chana-1 (V₁) recorded superior growth and yield attributes and the highest seed yield (1573.31 kg ha⁻¹), stover yield (3106.64 kg ha⁻¹), net return (₹62,789 ha⁻¹) and B:C ratio (2.95).

Overall, 30 November sowing with Indira Chana-1 resulted in better growth, yield performance and economic returns under Chhattisgarh conditions.

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