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Effect of different sowing dates on growth and yield performance of Chickpea (*Cicer arietinum* L.) varieties in the gird agro-climatic zone of Madhya Pradesh

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Abstract

A field experiment was conducted during the *Rabi* season of 2025–26 at the Agriculture Research and Development Centre, Vikrant University, Gwalior, Madhya Pradesh. Entitled on “Performance of chickpea varieties under different sowing dates in the Gird agro-climatic zone”. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The treatments consisted of three sowing dates viz., 15 October, 1 November and 15 November along with three chickpea varieties namely Subhra, RVKG-151 and RVG-202. Observations on growth parameters, yield attributes and yield were recorded at different crop stages. The results revealed that sowing date significantly influenced the growth and productivity of chickpea. Early sowing on 15 October recorded higher plant height (52.32 cm), number of branches plant⁻¹ (9.52), dry matter accumulation (22.67 g) and seed yield (2113.77 kg ha⁻¹). Among the varieties, RVKG-151 produced taller plants (49.89 cm) and higher test weight (322.78 g), whereas RVG-202 recorded superior dry matter accumulation (22.73 g), pods plant⁻¹ (51.88), seeds pod⁻¹ (2.1), harvest index (42.01%) and seed yield (2487.83 kg ha⁻¹). The interaction effect between sowing dates and varieties significantly influenced. The results revealed that maximum number of branches plant⁻¹ (10.16) was recorded in RVKG-151 sown on 15th October, while RVG-202 sown on 15th November recorded the maximum number of pods plant⁻¹ (54.00), highest seed yield (2574.22 kg ha⁻¹) and maximum straw yield (3552.00 kg ha⁻¹). The study concluded that timely sowing and suitable varietal selection play an important role in improving chickpea productivity under Gird agro-climatic conditions of Madhya Pradesh.

Keywords: Chickpea, sowing dates, varieties, growth, yield, Gird agro-climatic zone

Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop of India and is commonly known as gram or Bengal gram. It occupies a prominent place among pulse crops due to its high nutritive value and ability to improve soil fertility through symbiotic nitrogen fixation. Chickpea grains contain a high amount of protein, carbohydrates, minerals and vitamins and therefore form an important part of the vegetarian diet (Ali *et al.*, 2018) ^[1]. In India, it is mainly grown in the states of Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh, etc. India is the largest producer of chickpea in the world and Madhya Pradesh contributes a major share in total chickpea area and production. In India, chickpea covers about 9.12 million hectares with a production of 11.11 million tonnes and an average productivity of 1218 kg/ha. Madhya Pradesh alone contributes nearly 19% of national production with a productivity of 1558 kg/ha, higher than the national average (Agricultural Statistics at a Glance, 2024). Sowing date is a critical factor influencing chickpea performance. Timely sowing ensures favorable temperature and moisture during flowering and pod formation, whereas delayed sowing exposes the crop to terminal heat stress, leading to poor seed development and reduced yield. Varietal differences in growth duration, drought tolerance and yield potential further contribute to variability. The interaction between sowing date and variety significantly affects growth attributes and yield (Neenu *et al.*, 2017) ^[13]. Chickpea (*Cicer arietinum* L.) is highly sensitive to environmental conditions, particularly temperature and moisture during the reproductive stage. Optimum sowing time plays a vital role

in ensuring proper vegetative growth, flowering and pod development. Timely sowing helps the crop to utilize favorable climatic conditions, whereas delayed sowing exposes the crop to terminal heat stress during grain filling stage, resulting in poor seed filling and reduced yield. In addition, different chickpea varieties exhibit variable responses under different sowing environments due to differences in their growth duration, adaptability and yield potential. Therefore, identification of suitable sowing dates along with appropriate varieties is essential for achieving higher productivity and stable yield under changing climatic conditions. Several researchers have reported significant effects of sowing dates and varietal interaction on growth and yield attributes of chickpea (Neenu *et al.*, 2017; Richards *et al.*, 2020) [13, 18].

Materials and Methods

The field experiment was conducted during the *Rabi* season of 2025–26 at the Agriculture Research and Development Centre, Vikrant University, Sakatpura, Gwalior, Madhya Pradesh. The experimental site is located in the Gird agro-climatic zone of Madhya Pradesh. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The treatments consisted of three sowing dates and three chickpea varieties (Shubra – V₁, RVKG-151 – V₂, RVG-202 – V₃) and three sowing dates (15th October – 42nd SMW, 1st November – 44th SMW, and 15th November – 46th SMW), making a total of nine treatment combinations. The treatments comprised: T₁ – Shubra + 15th October (42nd SMW), T₂ – RVKG-151 + 15th October (42nd SMW), T₃ – RVG-202 + 15th October (42nd SMW), T₄ – Shubra + 1st November (44th SMW), T₅ – RVKG-151 + 1st November (44th SMW), T₆ – RVG-202 + 1st November (44th SMW), T₇ – Shubra + 15th November (46th SMW), T₈ – RVKG-151 + 15th November (46th SMW), and T₉ – RVG-202 + 15th November (46th SMW). The crop was sown at row spacing of 30 cm and plant spacing of 10 cm. Recommended agronomic practices were followed uniformly for all treatments. Observations on growth parameters, yield attributes, and production were recorded at harvest from

randomly selected plants in each plot, and the data were statistically analyzed following the procedure suggested by Gomez and Gomez (1984).

Results and Discussion

Effect of Sowing Dates and Varieties on Growth Attributes

In the present experiment, observations on plant height, number of branches per plant and dry matter accumulation were recorded at different growth stages. These growth parameters showed a progressive increase with advancement in crop age and maximum values were recorded at harvest stage. The effect of sowing dates and varietal differences on growth parameters are presented in Tables 1, 2 and 3.

Plant height increased continuously with advancement in crop age and maximum height was observed at harvest stage. Among the sowing dates, significantly higher plant height was recorded under sowing on 15 October (D1), which produced 52.32 cm plant height at harvest. However, sowing on 1 November (D2) was found statistically at par with D1 at some stages. The lowest plant height (45.00 cm) was recorded under delayed sowing on 15 November (D3). The significantly higher plant height under early sowing might be due to favourable environmental conditions such as optimum temperature, better soil moisture availability and longer vegetative growth period, which enhanced cell elongation and vegetative development. Delayed sowing shortened the crop growth duration and exposed the crop to comparatively unfavourable temperature conditions during vegetative growth, thereby reducing plant height. Similar observations regarding the beneficial effect of timely sowing on chickpea growth were also documented by Bazvand *et al.* (2015) [2], Dhote *et al.* (2019) [4], Rathod *et al.* (2024) [16] and Krishna *et al.* (2025) [10]. Among the varieties, RVKG-151 recorded significantly higher plant height (49.89 cm at harvest) compared to Subhra and RVG-202. The superiority of RVKG-151 may be attributed to its genetic potential for vigorous vegetative growth and better adaptability under prevailing agro-climatic conditions. Similar varietal differences in plant height were also reported by Sikdar *et al.* (2015) [21].

Table 1: Effect of sowing dates and varietal differences on plant height

Treatment	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
Factor A: Sowing dates				
D ₁ – 15 Oct (42 nd MW)	16.8	28.76	51.81	52.32
D ₂ – 1 Nov (44 th MW)	14.97	27.43	47.31	48.13
D ₃ – 15 Nov (46 th MW)	13.51	24.58	43.68	45.0
SE(m)±	0.26	0.50	0.45	0.23
C.D. (p=0.05)	0.79	1.49	1.35	0.69
Factor B: Varieties				
V ₁ – Subhra	15.21	27.08	48.1	48.58
V ₂ – RVKG-151	15.75	27.88	48.69	49.89
V ₃ – RVG-202	14.32	25.81	46.02	46.98
SE(m)±	0.26	0.50	0.45	0.23
C.D. (p=0.05)	0.79	1.49	1.35	0.69
Interaction (A×B)				
SE(m)±	0.65	1.22	1.11	0.57
C.D. (p=0.05)	NS	NS	NS	NS

Number of branches per plant increased with crop growth and attained maximum values at harvest stage. Significantly maximum number of branches per plant was recorded under sowing on 15 October (D1), which produced 9.52 branches per plant at harvest. Delayed sowing on 15 November (D3) recorded the lowest number of branches per plant (8.25). The higher

number of branches under timely sowing might be due to favourable climatic conditions during vegetative growth, which promoted better canopy development and enhanced photosynthetic activity. Early sowing provided sufficient time for crop growth and branching, whereas delayed sowing restricted vegetative growth because of reduced crop duration

and comparatively lower temperature conditions. Similar results were reported by Husnain *et al.* (2015) ^[9]. Among the varieties, RVKG-151 recorded comparatively higher number of branches per plant (8.67) followed by Subhra, whereas RVG-202 remained lower during early growth stages but produced comparatively higher branches at harvest. The better performance of RVKG-151 may be due to its genetic ability for

vigorous vegetative growth and branching habit. Similar findings were also reported by Sikdar *et al.* (2015) ^[21] and Krishna *et al.* (2025) ^[10]. The interaction effect between sowing dates and varieties was found non-significant up to 90 DAS, whereas at harvest stage it became significant. The treatment combination RVKG-151 + 15 October sowing recorded the maximum number of branches per plant (10.16).

Table 2: Effect of sowing dates and varietal differences on number of branches per plant

Treatment	No. of branches (plant ⁻¹)			
	30 DAS	60 DAS	90 DAS	At harvest
Factor A: Sowing dates				
D ₁ – 15 Oct (42 nd MW)	3.52	7.0	8.94	9.52
D ₂ – 1 Nov (44 th MW)	2.97	6.1	8.16	8.52
D ₃ – 15 Nov (46 th MW)	2.54	5.61	7.24	8.25
SE(m)±	0.15	0.19	0.27	0.21
C.D. (p=0.05)	0.45	0.56	0.81	0.63
Factor B: Varieties				
V ₁ – Subhra	3.03	6.11	8.1	8.69
V ₂ – RVKG-151	3.13	6.83	8.2	8.67
V ₃ – RVG-202	2.87	5.76	8.06	8.94
SE(m)±	0.15	0.19	0.27	0.21
C.D. (p=0.05)	0.45	0.56	0.81	0.63
Interaction (A×B)				
SE(m)±	0.37	0.46	0.67	0.52
C.D. (p=0.05)	NS	NS	NS	1.10

Table 3: Effect of sowing dates and varietal differences on dry matter accumulation per plant

Treatment	Dry matter accumulation plant ⁻¹ (g)			
	30 DAS	60 DAS	90 DAS	At harvest
Factor A: Sowing dates				
D ₁ – 15 Oct (42 nd MW)	2.9	11.02	22.81	22.67
D ₂ – 1 Nov (44 th MW)	2.6	9.75	21.40	22.48
D ₃ – 15 Nov (46 th MW)	2.3	8.61	20.37	21.93
SE(m) ±	0.06	0.11	0.30	0.33
C.D. (p=0.05)	0.20	0.33	0.89	1.00
Factor B: Varieties				
V ₁ – Subhra	2.52	9.67	21.31	22.03
V ₂ – RVKG-151	2.90	10.9	21.42	22.33
V ₃ – RVG-202	2.36	8.81	21.85	22.73
SE(m) ±	0.06	0.11	0.30	0.33
C.D. (p=0.05)	0.20	0.33	0.89	1.00
Interaction (A×B)				
SE(m) ±	0.17	0.27	0.73	0.82
C.D. (p=0.05)	NS	NS	NS	NS

Dry matter accumulation per plant increased progressively with crop growth and maximum dry matter accumulation was observed at harvest stage. Among the sowing dates, significantly higher dry matter accumulation (22.67 g plant⁻¹) was recorded under 15 October sowing (D₁), whereas the lowest dry matter accumulation (21.93 g plant⁻¹) was observed under delayed sowing on 15 November (D₃). Higher dry matter accumulation under early sowing might be due to favourable temperature and moisture conditions during crop growth period, which enhanced photosynthesis and biomass production. Timely sowing ensured better establishment and longer crop duration, resulting in greater assimilate accumulation. In contrast, delayed sowing reduced crop duration and vegetative growth, thereby decreasing dry matter production. Similar observations were reported by B Neenu *et al.* (2017) ^[13] and Dubey *et al.* (2024) ^[6]. Among the varieties, RVKG-151 recorded comparatively higher dry matter accumulation during initial stages, whereas RVG-202 recorded slightly higher dry matter accumulation at harvest stage (22.73 g plant⁻¹). The superiority of RVG-202 at later stages may be due

to its better biomass production and efficient assimilate translocation. Similar findings were also reported by Sikdar *et al.* (2015) ^[21].

Response of Sowing Dates and Varieties on Yield Attributes and Yield

The results presented in Table 4 clearly indicate that sowing dates and varietal performance had a significant influence on yield attributes and yield of chickpea.

Number of pods per plant was significantly influenced by sowing dates and varieties. Significantly maximum number of pods per plant (52.11) was recorded under 15 October sowing (D₁), whereas delayed sowing on 15 November (D₃) recorded comparatively lower number of pods per plant (50.89). Higher number of pods under timely sowing might be due to favourable environmental conditions during flowering and pod formation stages, which enhanced reproductive growth and pod setting. Delayed sowing exposed the crop to comparatively unfavourable temperature conditions during reproductive stage, thereby

reducing pod formation. Similar findings were also reported by Husnain *et al.* (2015) ^[9], Kumar *et al.* (2022) ^[11] and Gopichand *et al.* (2025) ^[7]. Among the varieties, RVG-202 recorded significantly maximum number of pods per plant (51.88), which may be attributed to its superior genetic potential and better reproductive efficiency. Similar varietal differences in pods per plant were also reported by Sikdar *et al.* (2015) ^[21] and Pokhrel *et al.* (2025) ^[14].

Seeds per pod were significantly influenced by sowing dates and varieties, whereas interaction effect remained non-significant. Among sowing dates, significantly higher seeds per pod (1.44) were recorded under 1 November sowing (D2), while comparatively lower values were recorded under other sowing dates. The higher number of seeds per pod under optimum sowing time might be due to favourable temperature and moisture conditions during flowering and seed setting stages, which improved fertilization and seed development. Similar findings were reported by Rao *et al.* (2018) ^[15], Kumar *et al.* (2022) ^[11] and Goud and Karunakar (2023) ^[8]. Among the varieties, RVG-202 recorded significantly maximum seeds per pod (2.10), whereas RVKG-151 recorded minimum seeds per pod. The superiority of RVG-202 may be due to its better genetic potential and efficient assimilate translocation towards reproductive growth.

Test weight was not significantly influenced by sowing dates, whereas varietal differences significantly affected test weight.

Among the varieties, RVKG-151 recorded significantly higher test weight (322.78 g), followed by Subhra, whereas RVG-202 recorded minimum test weight (210.17 g). Variation in test weight among varieties might be due to inherent genetic differences in seed size and grain development capacity. Similar observations were reported by Thombre *et al.* (2019) ^[22] and Choudhary *et al.* (2023) ^[3].

Seed yield was significantly influenced by sowing dates, varieties and their interaction effect. Among sowing dates, significantly higher seed yield (2113.77 kg ha⁻¹) was recorded under 15 October sowing (D1), whereas the lowest seed yield (1949.34 kg ha⁻¹) was recorded under delayed sowing on 15 November (D3). Higher seed yield under timely sowing might be due to better crop establishment, favourable temperature conditions, improved vegetative growth and better pod development. Early sowing also ensured efficient utilization of available resources, resulting in higher biomass production and assimilate partitioning towards grain yield. Similar findings were reported by Seth *et al.* (2020) ^[20], Kumar *et al.* (2024) ^[12] and Gopichand *et al.* (2025) ^[7]. Among the varieties, RVG-202 recorded significantly higher seed yield (2487.83 kg ha⁻¹) compared to Subhra and RVKG-151. The higher yield of RVG-202 may be due to higher number of pods per plant, seeds per pod and better harvest index. Similar varietal differences in seed yield were also reported by Dubey *et al.* (2024) ^[6] and Pokhrel *et al.* (2025) ^[14].

Table 4: Effect of sowing dates and varietal differences on yield attributes and yield of chickpea

Treatment	No. of pods (plant ⁻¹)	Number of seeds (pod ⁻¹)	Test weight (g)	Seed yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Harvest Index (%)
Factor A: Sowing dates						
D ₁ – 15 Oct (42 nd MW)	52.11	1.38	277.91	2113.77	3188.33	39.76
D ₂ – 1 Nov (44 th MW)	51.00	1.44	277.44	2028.22	3100.89	39.35
D ₃ – 15 Nov (46 th MW)	50.89	1.41	277.59	1949.34	3006.67	38.97
SEm ±	0.47	0.05	0.22	31.76	53.22	0.001
C.D. (p=0.05)	1.41	0.15	0.68	94.37	158.13	0.004
Factor B: Varieties						
V ₁ – Subhra	51.33	1.10	300.0	1775.64	2929.11	37.71
V ₂ – RVKG-151	50.77	1.04	322.78	1827.86	2933.78	38.36
V ₃ – RVG-202	51.88	2.1	210.17	2487.83	3433.00	42.01
SE(m)±	0.47	0.05	0.22	31.76	53.22	0.001
C.D. (p=0.05)	1.41	0.15	0.68	94.37	158.13	0.004
Interaction (A×B)						
SEm ±	1.16	0.12	0.56	77.80	130.36	0.003
C.D. (p=0.05)	2.44	NS	NS	163.46	273.90	NS

Straw yield was significantly influenced by sowing dates and varieties. Among sowing dates, significantly higher straw yield (3188.33 kg ha⁻¹) was recorded under 15 October sowing, whereas delayed sowing recorded comparatively lower straw yield. Higher straw yield under timely sowing might be due to better vegetative growth, higher dry matter accumulation and efficient utilization of environmental resources during crop growth period. Similar findings were also reported by Tiwari and Meena (2014) ^[23], Neenu *et al.* (2017) ^[13] and Choudhary *et al.* (2023) ^[3]. Among the varieties, RVG-202 recorded significantly higher straw yield (3433.00 kg ha⁻¹) due to better vegetative growth and biomass accumulation.

Harvest index was significantly influenced by sowing dates and varieties, whereas interaction effect remained non-significant. Among sowing dates, significantly higher harvest index (39.76%) was recorded under 15 October sowing, while delayed sowing recorded comparatively lower harvest index. Higher harvest index under timely sowing might be due to better

translocation of photosynthates towards economic yield under favourable climatic conditions. Richards *et al.* (2022) ^[18] reported that early sowing increased biomass but lowered harvest index due to reduced efficiency of biomass conversion into grain. In contrast, Choudhary *et al.* (2023) ^[3] found that timely sowing (5 November) in chickpea enhanced harvest index along with higher seed yield and economic returns, highlighting the importance of optimal sowing dates for better partitioning of assimilates into grain. Among the varieties, RVG-202 recorded significantly maximum harvest index (42.01%), indicating better partitioning efficiency of assimilates towards grain yield.

Interaction effect of sowing date and variety

The interaction between sowing dates and varieties showed significant variation in yield attributes and productivity of chickpea (Table 5). At harvest, the combination of RVG-202 with 15 November sowing produced the highest seed yield

(2574.22 kg ha⁻¹) and straw yield (3552.00 kg ha⁻¹), along with maximum pods per plant (54.00). In contrast, Subhra with 15 November sowing recorded the lowest seed yield (1622.14 kg ha⁻¹). Early sowing (15 October) generally enhanced branching, with RVKG⁻¹⁵¹ producing the highest number of branches (10.16), while RVG-202 remained lower (8.50). The results indicate that varietal performance varied across sowing windows, and optimum yield was obtained when suitable varieties were matched with appropriate sowing dates.

The significant interaction between sowing dates and varieties highlights the importance of synchronizing genotype with environmental conditions. The superior performance of RVG-202 under mid-November sowing suggests its adaptability to relatively cooler conditions, which favoured pod formation and yield accumulation. Similar findings were reported by

Rehman *et al.* (2015) [17] also noted that maturity duration and yield varied considerably depending on both sowing date and cultivar, supporting the present results.

The advantage of RVKG⁻¹⁵¹ under early sowing (15 October) for branching agrees with the observations of Sikdar *et al.* (2015) [21], who found that varietal response to sowing time significantly influenced growth and yield attributes. Likewise, Neenu *et al.* (2017) [13] and Ali *et al.* (2018) [1] reported that improved varieties performed better when sown at optimum time, while delayed sowing reduced yield potential. The present findings also resonate with Rathod *et al.* (2024) [16] and Sandeep *et al.* (2023) [19], who documented those specific varietal combinations with appropriate sowing dates resulted in higher seed yield, stover yield and economic returns.

Table 5: Interaction effect of sowing date and varieties on yield and yield attributes

Treatments	No. of branches per plant (at harvest)	No. of pods per plant	Seed Yield (kg/ha)	Straw yield (kg/ha)
Shubra + 15 th October (42 nd MW)	9.90	53.00	1931.61	3123.33
RVKG - 151 + 15 th October (42 nd MW)	10.16	53.33	1980.06	3088.33
RVG – 202 + 15 th October (42 nd MW)	8.50	50.00	2429.63	3353.33
Shubra + 1 st November (44 th MW)	8.33	51.33	1773.18	2953.33
RVKG - 151 + 1 st November (44 th MW)	8.40	50.00	1851.85	2955.67
RVG – 202 + 1 st November (44 th MW)	8.83	51.67	2459.62	3393.67
Shubra + 15 th November (46 th MW)	7.83	49.67	1622.14	2929.11
RVKG - 151 + 15 th November (46 th MW)	7.43	49.00	1651.66	2757.33
RVG – 202 + 15 th November (46 th MW)	9.50	54.00	2574.22	3552.00
SEm(±)	0.52	1.16	77.80	130.36
C.D. (p=0.05)	1.10	2.44	163.46	273.90

Conclusion

Based on the results of the present investigation, it may be concluded that sowing dates and varietal selection significantly influenced growth, yield attributes and yield of chickpea under the Gird agro-climatic zone of Madhya Pradesh. Early sowing on 15 October provided favourable environmental conditions, which resulted in superior vegetative growth, dry matter accumulation and higher yield. Among the tested varieties, RVKG⁻¹⁵¹ recorded superior plant height and test weight, whereas RVG-202 performed better with respect to pods per plant, seeds per pod, harvest index and seed yield. The interaction effect further revealed that RVG-202 maintained better productivity under different sowing dates and recorded the highest seed yield under 15 November sowing.

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