



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(7): 385-389
Received: 02-04-2026
Accepted: 08-05-2026

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Performance of Chickpea (*Cicer arietinum* L.) varieties under late sown conditions

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i7f.5953>

Abstract

A field experiment was conducted during *rabi*, 2025-26 at Agricultural College, Mahanandi, Andhra Pradesh with the objective of evaluating improved chickpea varieties under late sown conditions. Results revealed that timely sowing (November 1st FN) significantly improved growth, yield attributes and yield of chickpea. Sowing during November 1st FN (D₁) recorded the highest drymatter accumulation (5959 kg ha⁻¹), number of branches plant⁻¹ (7.8), leaf area index (1.97), pods plant⁻¹ (49.2), seed yield plant⁻¹ (10.3g), seed yield (2036 kg ha⁻¹), stover yield (3310 kg ha⁻¹) and harvest index (38.0%). Delayed sowing progressively reduced crop growth and yield, with December 2nd FN sowing (D₄) recording the lowest seed yield (1027 kg ha⁻¹). Among the varieties, NBeG-776 exhibited superior performance by producing higher drymatter accumulation (5359 kg ha⁻¹), number of branches plant⁻¹ (7.4), pods plant⁻¹ (42.0) and seed yield (1731 kg ha⁻¹), followed by NBeG-49. The interaction effect revealed that sowing NBeG-776 during November 1st FN resulted in superior growth and yield performance.

Keywords: Chickpea, sowing time, phenology, growth, yield attributes

1. Introduction

Chickpea (*Cicer arietinum* L.) is one of the most important *rabi* pulse crops cultivated in India belonging to family Fabaceae, and serves as a major source of protein (18-22%), carbohydrates, vitamins and essential minerals. India is the largest producer as well as consumer of chickpea, contributing nearly 70-75 per cent of global production. During 2021-22, chickpea occupied 10.91 million ha with a production of 13.75 million tonnes and an average productivity of 1260 kg ha⁻¹, accounting for nearly 50 per cent of the total pulse production of the country (DES, 2023; IIPR, 2024) [6, 9]. In Andhra Pradesh, chickpea is an important *rabi* pulse crop cultivated predominantly under rainfed conditions.

Climate change has emerged as a major challenge to chickpea production due to rising temperatures and erratic rainfall patterns. Exposure of the crop to terminal heat and moisture stress during flowering and pod development accelerates phenological development, reduces pod set and seed filling duration and ultimately lowers yield (Gaur *et al.*, 2015; Devasirvatham and Tan, 2018) [6, 3]. Hence, the present investigation was undertaken to evaluate the performance of chickpea varieties under varying sowing dates and identify suitable genotype-environment combinations for higher productivity.

2. Materials and Methods

A field experiment was conducted during *rabi*, 2025-26 at Agricultural College, Mahanandi, Nandyal, Andhra Pradesh. The soil of the experimental site was sandy loam in texture, neutral in soil reaction (pH 7.4), low in organic carbon (0.42%), low in available nitrogen (140.2 kg ha⁻¹), medium in available phosphorus (24.8 kg ha⁻¹) and high in available potassium (556.3 kg ha⁻¹). The treatments comprised of four times of sowing viz., November 1st FN (D₁), November 2nd FN (D₂), December 1st FN (D₃) and December 2nd FN (D₄) as main plot treatments and three chickpea varieties viz., NBeG-49 (V₁), NBeG-776 (V₂) and JG-11 (V₃) as sub plot treatments. There were twelve treatment combinations, each replicated thrice, and the experiment was laid out in a split-plot design.

Sowing was carried out in four intervals as D₁ on 01-11-2025 and harvested on 11-02-2026, D₂ on 16-11-2025 and harvested on 24-02-2026, D₃ on 01-12-2025 and harvested on 07-03-2026 and D₄ on 16-12-2025 and harvested on 18-03-2026. Seed rate @ 50 kg ha⁻¹ was adopted and sown in the open furrows made with the help of hand hoe. The seeds were dropped to a depth of 5 cm and covered thoroughly. The optimum plant population was maintained by gap filling. Normal cultural operations and plant protection measures were carried out as and when required.

3. Results and Discussion

Time of sowing did not significantly influence plant height, whereas varieties differed significantly at all growth stages (Table 1). NBeG-776 (V₂) recorded significantly taller plants than NBeG-49 (V₁) and JG-11 (V₃). Numerically higher plant height under early sowing might be due to favourable temperature and moisture conditions during vegetative growth, while delayed sowing restricted plant growth because of higher temperatures and reduced moisture availability. Similar findings were reported by Kumar *et al.* (2022) ^[11] and Nivedita *et al.* (2022). The interaction effect was non-significant.

Drymatter accumulation was significantly influenced by time of sowing and varieties. Drymatter accumulation increased with crop age but declined with delayed sowing. November 1st FN (D₁) recorded the highest drymatter production at harvest (5959 kg ha⁻¹), while December 2nd FN (D₄) recorded the lowest (3351 kg ha⁻¹). Early sowing provided a longer growth duration and favourable weather conditions, resulting in greater biomass accumulation. Among the varieties, NBeG-776 (V₂) recorded the highest drymatter production, whereas JG-11 (V₃) recorded the lowest. Similar results were reported by Thombre *et al.* (2019) ^[18] and Sujathamma and Nedunchezhiyan (2025) ^[16].

Number of branches plant⁻¹ was significantly affected by time of sowing and varieties. November 1st FN (D₁) recorded the highest number of branches, followed by November 2nd FN (D₂), while delayed sowing reduced branching. Among the varieties, NBeG-776 (V₂) produced significantly more branches than NBeG-49 (V₁) and JG-11 (V₃). The superior branching under early sowing was attributed to exposure to optimum temperatures during crop growth (Kiran and Chimmad, 2018) ^[10].

Leaf area index (LAI) was significantly influenced by both sowing time and varieties. The highest LAI was recorded with November 1st FN (D₁) sowing, while the lowest was observed under December 2nd FN (D₄). Delayed sowing exposed the crop to less favourable weather conditions, adversely affecting leaf development. Among the varieties, NBeG-776 (V₂) recorded the highest LAI and was on par with NBeG-49 (V₁), whereas JG-11 (V₃) recorded the lowest values. Similar findings were reported by Hembram *et al.* (2025) ^[8].

Effect on yield attributes

Time of sowing and varieties significantly influenced the number of pods plant⁻¹ at 60 DAS and harvest (Table 2). November 1st FN (D₁) recorded the highest number of pods plant⁻¹, which may be attributed to greater drymatter accumulation and favourable weather conditions during crop growth. Among the varieties, NBeG-776 (V₂) produced significantly more pods plant⁻¹ and was on par with NBeG-49 (V₁), while both were superior to JG-11 (V₃). The interaction effect at harvest was significant, with D₁V₂ recording the highest number of pods plant⁻¹. Similar findings were reported by Sujathamma and Nedunchezhiyan (2025) ^[16] and Sekhar *et al.* (2015) ^[14].

Seed yield plant⁻¹ was significantly affected by sowing time and varieties, whereas the interaction effect was non-significant.

November 1st FN (D₁) recorded the highest seed yield plant⁻¹ and was on par with November 2nd FN (D₂), but superior to later sowings. Among the varieties, NBeG-776 (V₂) produced significantly higher seed yield plant⁻¹, while JG-11 (V₃) recorded the lowest. The reduction in seed yield plant⁻¹ under delayed sowing was also reported by Sikdar *et al.* (2015) ^[15].

Number of seeds pod⁻¹ was not significantly influenced by sowing time, varieties or their interaction. Similarly, test weight was not significantly affected by sowing time, although numerically higher values were recorded under November 1st FN (D₁). Among the varieties, NBeG-49 (V₁) recorded the highest test weight, while JG-11 (V₃) recorded the lowest, indicating varietal differences due to genetic makeup. Similar results were reported by Chaitanya and Chandrika (2006) ^[2]. The interaction effect for seeds pod⁻¹, seed yield plant⁻¹ and test weight was non-significant.

Effect on seed and stover yield

Among the different times of sowing, chickpea sown during November 1st FN (D₁) recorded significantly higher seed yield (2036 kg ha⁻¹) and stover yield (3310 kg ha⁻¹), followed by November 2nd FN (D₂) (1792 and 3115 kg ha⁻¹, respectively). Further delay in sowing significantly reduced both seed and stover yields, with the lowest values recorded under December 2nd FN (D₄) sowing (1027 and 2209 kg ha⁻¹, respectively) (Table 3). The higher yields under early sowing were attributed to favourable growing conditions that promoted better growth, drymatter accumulation and assimilate partitioning, whereas delayed sowing exposed the crop to higher temperatures during reproductive stages, resulting in reduced biomass production and yield. Similar findings were reported by Suryakala *et al.* (2019) ^[17], Thombre *et al.* (2019) ^[18] and Dhote *et al.* (2019) ^[5].

Among the varieties, NBeG-776 (V₂) recorded the highest seed yield (1731 kg ha⁻¹) and stover yield (3072 kg ha⁻¹), which was on par with NBeG-49 (V₁) (1612 and 2912 kg ha⁻¹, respectively) and significantly superior to JG-11 (V₃) (1340 and 2526 kg ha⁻¹, respectively). The higher yields of NBeG-776 may be attributed to its superior growth and drymatter production potential. Similar results were reported by Sekhar *et al.* (2015) ^[14].

Harvest index was significantly influenced by time of sowing, whereas varieties and their interaction effect were non-significant (Table 3). Among the sowing dates, November 1st FN (D₁) recorded the highest harvest index, which was on par with November 2nd FN (D₂) and significantly superior to December 1st FN (D₃) and December 2nd FN (D₄). The decline in harvest index under delayed sowing may be attributed to heat stress during reproductive stages, resulting in reduced assimilate partitioning to seeds. Similar findings were reported by Chaitanya and Chandrika (2006) ^[2] and Goud *et al.* (2023) ^[7].

The non-significant effect of varieties indicated comparable drymatter partitioning efficiency among the tested genotypes. The interaction effect was also non-significant, suggesting a consistent varietal response across sowing dates. These results are in agreement with the findings of Ali *et al.* (2018) ^[1], Pokhrel *et al.* (2025) ^[13] and Goud *et al.* (2023) ^[7].

Thermal indices (GDD) and thermal use efficiency

Growing degree days (GDD) required to reach different phenological stages were significantly influenced by time of sowing, while varieties and their interaction effect were non-significant (Table 4). November 1st FN (D₁) accumulated significantly higher GDD from emergence (125 °C day) to harvest (2205 °C day), followed by November 2nd FN (D₂), whereas the lowest values were recorded under December 2nd FN (D₄). Higher

thermal accumulation under early sowing was mainly due to longer crop duration and favourable temperature conditions.

Thermal use efficiency (TUE) for drymatter and seed yield was significantly affected by sowing time and varieties, while their interaction effect was non-significant. Among the sowing dates, D₁ recorded the highest drymatter TUE (2.69 kg ha⁻¹ °C day⁻¹) and seed yield TUE (0.94 kg ha⁻¹ °C day⁻¹), whereas D₄ recorded the lowest values (1.80 and 0.54 kg ha⁻¹ °C day⁻¹, respectively). This

indicated more efficient utilization of accumulated heat units under timely sowing.

Among the varieties, NBeG-776 (V₂) recorded the highest drymatter TUE (2.58 kg ha⁻¹ °C day⁻¹) and seed yield TUE (0.83 kg ha⁻¹ °C day⁻¹), which were on par with NBeG-49 (V₁) and significantly superior to JG-11 (V₃). The higher TUE of NBeG-776 may be attributed to its greater biomass production and seed yield potential.

Table 1: Growth parameters of chickpea at different crop growth intervals as influenced by time of sowing and varieties during *rabi*, 2025-26

Treatment	Plant height (cm)			Drymatter accumulation (kg ha ⁻¹)			Number of branches plant ⁻¹			Leaf area index		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Time of sowing (D)												
D ₁ : November 1 st FN	30.4	38.9	43.9	1920	4082	5959	4.3	5.8	7.8	0.38	2.93	1.97
D ₂ : November 2 nd FN	26.1	38.8	43.6	1626	3445	5034	3.8	5.1	6.8	0.32	2.36	1.72
D ₃ : December 1 st FN	25.1	36.7	42.5	1344	2835	4497	3.3	4.6	5.9	0.29	2.08	1.46
D ₄ : December 2 nd FN	22.5	36.7	39.0	1137	2387	3351	2.3	3.4	5.1	0.26	1.76	0.99
SEm ±	2.26	1.17	3.29	54	109	156	0.11	0.16	0.22	0.010	0.076	0.057
CD (P=0.05)	NS	NS	NS	165	384	551	0.4	0.5	0.7	0.03	0.19	0.20
Varieties (V)												
V ₁ : NBeG-49	25.5	35.1	36.9	1620	3450	5092	4.8	6.0	4.8	0.32	2.26	1.70
V ₂ : NBeG-776	27.8	41.1	48.1	1683	3568	5359	5.4	7.4	5.4	0.34	2.43	1.82
V ₃ : JG-11	24.8	34.3	35.6	1210	2543	3678	4.1	5.9	4.1	0.27	2.02	1.57
SEm ±	0.71	1.03	1.29	46	88	128	0.13	0.17	0.13	0.008	0.063	0.048
CD (P=0.05)	2.1	3.1	3.4	139	268	389	0.4	0.5	0.4	0.02	0.19	0.14
Interaction												
D × V												
SEm ±	2.41	4.06	3.26	192	181	262	1.10	0.27	0.36	0.017	0.128	0.096
CD (P=0.05)	NS	NS	NS	NS	581	839	NS	0.8	1.1	NS	NS	NS
V × D												
SEm ±	2.38	4.04	3.25	193	292	385	1.08	1.45	1.68	0.017	0.132	0.099
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Yield parameters of chickpea as influenced by time of sowing and varieties during *rabi*, 2025-26

Treatment	Number of pods plant ⁻¹		No. of seeds pod ⁻¹	Seed yield plant ⁻¹ (g)	100 seed weight (g)
	60 DAS	At harvest			
Time of sowing (D)					
D ₁ : November 1 st FN	37.0	49.2	1.18	10.30	31.23
D ₂ : November 2 nd FN	32.6	40.0	1.17	7.51	29.83
D ₃ : December 1 st FN	22.0	32.1	1.12	5.13	28.40
D ₄ : December 2 nd FN	19.6	28.6	1.07	4.12	26.76
SEm ±	1.00	1.18	0.037	0.180	0.932
CD (P=0.05)	3.5	4.1	NS	0.6	NS
Varieties (V)					
V ₁ : NBeG-49	34.2	40.1	1.15	7.44	32.55
V ₂ : NBeG-776	36.5	42.0	1.19	7.82	29.12
V ₃ : JG-11	18.2	30.3	1.06	5.61	25.50
SEm ±	0.83	0.97	0.091	0.151	0.776
CD (P=0.05)	2.5	2.9	NS	0.40	2.34
Interaction					
D × V					
SEm ±	3.20	1.98	0.063	0.298	1.572
CD (P=0.05)	NS	6.3	NS	NS	NS
V × D					
SEm ±	3.25	2.74	0.064	0.302	1.614
CD (P=0.05)	NS	NS	NS	NS	NS

Table 3: Yield (kg ha⁻¹) and harvest index (%) of chickpea as influenced by time of sowing and varieties during *rabi*, 2025-26

Treatment	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest index (%)
Time of sowing (D)			
D ₁ : November 1 st FN	2036	3310	38.0
D ₂ : November 2 nd FN	1792	3115	36.5
D ₃ : December 1 st FN	1394	2713	34.0
D ₄ : December 2 nd FN	1027	2209	31.7
SEm ±	53.4	86.5	0.33
CD (P=0.05)	188	305	1.0

Varieties (V)			
V ₁ : NBeG-49	1612	2912	35.2
V ₂ : NBeG-776	1731	3072	35.6
V ₃ : JG-11	1340	2526	34.2
SEm ±	45.2	73.2	1.00
CD (P=0.05)	136	221	NS
Interaction			
D × V			
SEm ±	91.1	147.6	2.03
CD (P=0.05)	291	472	NS
V × D			
SEm ±	192.4	212.5	2.08
CD (P=0.05)	NS	NS	NS

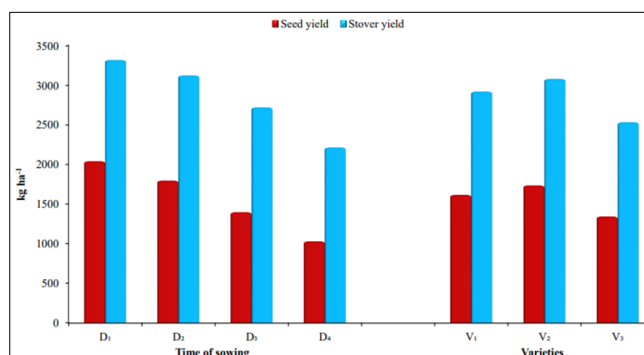


Fig 1: Seed yield and stover yield of chickpea as influenced by time of sowing and varieties during *rabi*, 2025-26

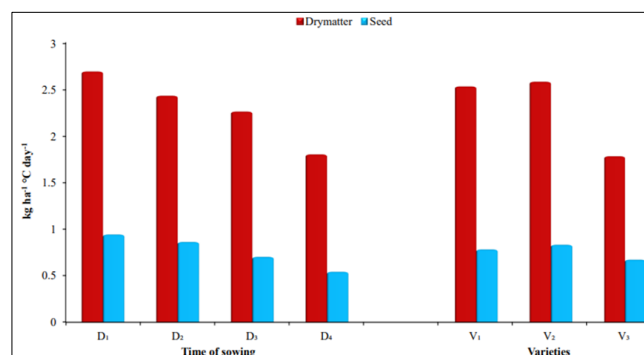


Fig 2: Thermal use efficiency of chickpea as influenced by time of sowing and varieties during *rabi*, 2025-26

Table 4: Thermal indices (GDD) and thermal use efficiency of chickpea as influenced by time of sowing and varieties during *rabi*, 2025-26

Treatment	Growing degree days (°C day)				Thermal use efficiency (TUE)	
	Emergence	50% flowering	Physiological maturity	Harvest	Drymatter (kg ha ⁻¹ °C day ⁻¹)	Seed (kg ha ⁻¹ °C day ⁻¹)
Time of sowing (D)						
D ₁ : November 1 st FN	125	889	2072	2205	2.69	0.94
D ₂ : November 2 nd FN	120	856	1973	2166	2.43	0.86
D ₃ : December 1 st FN	110	821	1968	1984	2.26	0.70
D ₄ : December 2 nd FN	97	714	1819	1857	1.80	0.54
SEm ±	3.7	12.0	16.3	10.2	0.075	0.019
CD (P=0.05)	13	37	46	31	0.26	0.06
Varieties (V)						
V ₁ : NBeG-49	112	821	1941	2022	2.53	0.78
V ₂ : NBeG-776	113	834	1958	2059	2.58	0.83
V ₃ : JG-11	113	819	1927	2001	1.78	0.67
SEm ±	3.2	17.9	21.3	17.2	0.063	0.026
CD (P=0.05)	NS	NS	NS	NS	0.19	0.07
D × V						
SEm ±	6.3	26.1	24.4	33.2	0.921	0.326
CD (P=0.05)	NS	NS	NS	NS	NS	NS
V × D						
SEm ±	6.9	26.4	25.1	33.7	0.925	0.331
CD (P=0.05)	NS	NS	NS	NS	NS	NS



(Sown during November first fortnight with variety NBeG-776)

Fig 3: Best performed treatment of chickpea during *rabi*, 2025-26

4. Conclusion

The findings indicate that timely sowing is a simple and cost-effective agronomic strategy for improving chickpea productivity under scarce rainfall environments. Sowing during the first fortnight of November provided favourable environmental conditions that enhanced crop growth, drymatter accumulation, yield attributes, and seed yield. Among the varieties evaluated, NBeG-776 exhibited superior growth performance and produced the highest seed yield, followed by NBeG-49. The combination of November 1st FN sowing and NBeG-776 recorded the best performance for most growth and yield parameters. Therefore, cultivation of chickpea variety NBeG-776 during the first fortnight of November can be recommended for achieving higher productivity in the scarce rainfall zone of Andhra Pradesh.

Acknowledgement

I express my sincere gratitude to my advisor Dr. K. Prabhakar and all the faculty members of the Department of Agronomy, Agricultural College, Mahanandi, Acharya N.G. Ranga Agricultural University (A.P), India for providing all necessary facilities to undertake the studies.

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