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Isha Baxla
PG Scholar, D.K.S. College of
Agriculture & Research Station,
Bhatapara, Chhattisgarh, India

Dr. Panch Ram Mirjha
Assistant Professor (Agronomy),
D.K.S. College of Agriculture &
Research Station, Bhatapara,
Chhattisgarh, India

Effect of sowing dates on growth performance of Indian mustard (*Brassica juncea* L.) varieties in the Chhattisgarh plains

Isha Baxla and Panch Ram Mirjha

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Abstract

A field experiment was conducted during the *rabi* season of 2023–24 at the Instructional Farm, Dau Kalyan Singh College of Agriculture and Research Station, Bhatapara, Chhattisgarh. The experiment was laid out in a split-plot design with four sowing dates (1 November, 15 November, 1 December and 15 December) and four mustard varieties (CG Sarson-1, DRMR 150-35, Black Gold and Bahubali). Sowing dates significantly influenced all growth attributes. Delayed sowing progressively reduced growth performance, with the lowest values recorded at 15 December sowing. Early sowing on 1 November produced the highest plant height, plant dry matter accumulation (g plant⁻¹) and total number of branches plant⁻¹, whereas delayed sowing on 15 December resulted in a marked reduction in vegetative growth. Among the varieties, Bahubali exhibited superior growth performance and remained statistically at par with CG Sarson-1 for most parameters. The interaction between sowing dates and varieties was non-significant, indicating a stable varietal response across different sowing environments. The study demonstrated that sowing mustard during the first fortnight of November provides favourable conditions for optimum growth in the Chhattisgarh plains.

Keywords: Chhattisgarh plains, Indian mustard (*Brassica juncea*), Growth, Sowing date, Variety

Introduction

Indian mustard (*Brassica juncea* L.) is the major rapeseed-mustard species cultivated in India and contributes significantly to the country's edible oil economy. It occupies 8.66 million ha with a production of 12.67 million tonnes and an average productivity of 1463 kg ha⁻¹ (Anonymous, 2025) ^[1]. Mustard productivity is highly sensitive to environmental conditions, particularly temperature and sowing time.

Climate change has emerged as a major challenge for sustainable crop production owing to increasing temperature variability, erratic rainfall and frequent occurrence of extreme weather events. Oilseed crops, including mustard, are particularly sensitive to temperature fluctuations during flowering and seed-filling stages. According to IPCC (2023) ^[6], rising temperatures are expected to adversely affect crop productivity in tropical and subtropical regions, necessitating the development of climate-resilient production strategies.

Among various agronomic practices, sowing date is a critical factor governing crop growth, phenological development and productivity. Appropriate sowing time enables the crop to utilize favourable temperature and radiation regimes, whereas delayed sowing often exposes plants to terminal heat stress during reproductive growth, resulting in reduced biomass accumulation and yield (Shekhawat *et al.*, 2012) ^[10]. Under changing climatic conditions, identification of optimum sowing windows has become increasingly important for sustaining mustard productivity.

Varietal selection is another important component of climate-smart agriculture. Open-pollinated varieties (OPVs) are generally characterized by wider adaptability and stable performance across environments, whereas hybrids possess higher vigour and yield potential due to heterosis. However, differences in growth duration, thermal requirements and adaptation mechanisms may influence their response to varying sowing environments. Therefore, evaluation of OPVs and hybrids under different sowing dates is essential for identifying suitable genotype–environment

Corresponding Author:
Dr. Panch Ram Mirjha
Assistant Professor (Agronomy),
D.K.S. College of Agriculture &
Research Station, Bhatapara,
Chhattisgarh, India

combinations capable of maintaining productivity under changing climatic scenarios.

Information on the comparative performance of open-pollinated and hybrid mustard varieties under different sowing windows in the Chhattisgarh plains is limited. Therefore, the present investigation was undertaken to assess the effect of sowing dates on the growth performance of mustard varieties and to identify suitable sowing windows and genotypes for enhancing productivity under changing climatic conditions.

Materials and Methods

A field experiment was conducted during the *rabi* season of 2023–24 at the Instructional Farm, Dau Kalyan Singh College of Agriculture and Research Station, Bhatapara, Chhattisgarh, India (21.72° N latitude and 81.98° E longitude, at an altitude of 293.82 m above mean sea level). The experimental soil was clayey in texture (*Vertisols*) with a neutral reaction (pH 7.46), low in available nitrogen (112.6 kg ha⁻¹), medium in available phosphorus (12.64 kg ha⁻¹), and high in available potassium (384.0 kg ha⁻¹). The experiment was laid out in a split-plot design with four dates of sowing assigned to the main-plots and four mustard varieties allotted to the sub-plots. The treatments comprised four sowing dates, viz., 01 November (D₁), 15 November (D₂), 01 December (D₃), and 15 December (D₄), and four mustard varieties, viz., CG Sarson-1 (V₁), DRMR 150–35 (V₂), Black Gold (V₃), and Bahubali (V₄). Among the tested genotypes, CG Sarson-1 and DRMR 150–35 were open-pollinated varieties (OPVs), whereas Black Gold and Bahubali were hybrid mustard cultivars.

The crop was fertilized with the recommended dose of 100 kg N, 60 kg P₂O₅ and 30 kg K₂O ha⁻¹. The entire dose of phosphorus and potassium along with half of the nitrogen was applied as basal, while the remaining nitrogen was top-dressed after the first irrigation. Mustard was sown at a seed rate of 6 kg ha⁻¹ with a row spacing of 45 cm, and a plant-to-plant spacing of 15 cm was maintained through thinning. Weed management comprised hoeing at 25–30 DAS followed by manual weeding at 40–45 DAS. Two irrigations were applied, one at 50% flowering and the other at siliqua formation stage. Powdery mildew was managed by spraying Sulfex 80 WP @ 4 kg ha⁻¹ in 1000 litres of water at 10-day intervals, while mustard aphid was controlled through two sprays of Imidacloprid 17.8 SL.

Growth observations, viz. plant height, plant dry matter accumulation and number of branches plant⁻¹, were recorded at 30, 60 and 90 DAS and at harvest. Plant height was measured from the soil surface to the tip of the main shoot on five randomly selected and tagged plants in each plot and expressed in centimetres. Plant dry matter accumulation was determined through destructive sampling, and the samples were oven-dried at 60 ± 2°C until a constant weight was attained and expressed as g plant⁻¹. The total number of primary and secondary branches on the tagged plants was counted and expressed as branches plant⁻¹.

The experimental data were subjected to analysis of variance (ANOVA) appropriate for a split-plot design, and treatment means were compared using the critical difference (CD) test at the 5% level of significance following the procedure described by Panse and Sukhatme (1967) [8].

Results and Discussion

Plant height

Plant height increased progressively with advancement in crop age and was significantly influenced by sowing dates and varieties at all growth stages (30, 60, 90 DAS and harvest)

(Table 1). Among the sowing dates, crop sown on 1 November (D₁) recorded the maximum plant height of 19.92, 85.51, 162.4 and 183.3 cm at 30 DAS, 60 DAS, 90 DAS and harvest, respectively. At 30 DAS and 60 DAS, D₁ remained statistically at par with 15 November sowing (D₂), but significantly exceeded the later sowing dates (D₃ and D₄). The minimum plant height was recorded under 15 December sowing (D₄) with values of 15.27, 80.52, 151.9 and 163.3 cm at the respective growth stages. The reduction in plant height under delayed sowing was about 23.3, 5.8, 6.5 and 10.9% at 30 DAS, 60 DAS, 90 DAS and harvest, respectively, compared with D₁. These results indicate that delayed sowing adversely affected vegetative growth by shortening the growth duration and exposing the crop to comparatively higher temperatures during later developmental stages. Such conditions reduce cell division and elongation, photosynthetic efficiency and nutrient uptake, ultimately restricting plant growth.

Varietal differences were also significant throughout the crop growth period. Bahubali (V₄) produced the tallest plants (18.84, 85.83, 159.3 and 179.3 cm at 30 DAS, 60 DAS, 90 DAS and harvest, respectively) and remained statistically at par with CG Sarson-1 (V₁) at all stages. However, both varieties significantly outperformed DRMR 150–35 (V₂) and Black Gold (V₃). The lowest plant height was recorded in Black Gold (16.60, 80.59, 153.2 and 167.05 cm, respectively). The superior performance of Bahubali might be attributed to its higher genetic potential, vigorous growth habit and efficient utilization of available resources, resulting in enhanced vegetative development.

The interaction effect between sowing dates and varieties was found non-significant at all growth stages, indicating that the relative performance of mustard varieties for plant height remained stable across different sowing environments. This suggests that varietal differences were primarily governed by their genetic potential rather than by differential responses to changes in sowing time. The absence of a significant interaction further indicates that the influence of sowing dates on plant height was similar across all tested varieties.

The superior plant height observed under timely sowing could be attributed to the availability of favourable temperature, radiation and photoperiodic conditions during the vegetative phase, which promoted cell division, cell elongation and biomass production. In contrast, delayed sowing exposed the crop to relatively higher temperatures during later growth stages, shortening the vegetative period and thereby restricting plant growth. Similar findings were reported by Dinda *et al.* (2015) [3], who observed greater plant growth and yield of rapeseed–mustard under optimum sowing conditions in the Gangetic plains of West Bengal. Likewise, Gogoi *et al.* (2017) [4] reported enhanced vegetative growth in timely-sown toria under rice-fallow conditions of Assam. Patel *et al.* (2017) [9] also recorded significantly higher plant height in mustard varieties sown at optimum dates compared with late sowing, attributing the response to favourable environmental conditions during crop growth.

Plant dry matter accumulation (g plant⁻¹)

Plant dry matter accumulation (g plant⁻¹) increased progressively with crop age and was significantly influenced by sowing dates at all growth stages (Table 2). Among the sowing dates, 1 November sowing (D₁) recorded the highest dry matter accumulation of 2.74, 25.81, 59.62 and 79.24 g plant⁻¹ at 30 DAS, 60 DAS, 90 DAS and harvest, respectively. However, at 30 DAS, 90 DAS and harvest, D₁ remained statistically at par with 15 November sowing (D₂). The lowest dry matter

accumulation at 30 DAS, 90 DAS and harvest was recorded under 15 December sowing (D_4), with values of 1.82, 51.08 and 71.37 g plant⁻¹, respectively. At 60 DAS, 1 December sowing (D_3) recorded the lowest dry matter accumulation (21.06 g plant⁻¹). At 60 DAS, 1 December sowing (D_3) recorded the lowest dry matter accumulation (21.06 g plant⁻¹). Compared with D_4 , D_1 produced 50.55, 16.72 and 11.03% higher dry matter accumulation at 30 DAS, 90 DAS and harvest, respectively, while at 60 DAS D_1 recorded 22.55% higher dry matter accumulation than D_3 , demonstrating the pronounced adverse effect of delayed sowing on biomass production.

Varietal differences were significant only at 60 DAS. Bahubali (V_4) accumulated significantly higher dry matter (25.15 g plant⁻¹) and remained statistically at par with CG Sarson-1 (V_1) (22.98 g plant⁻¹). Bahubali recorded 16.47% and 14.16% greater dry matter accumulation than Black Gold (V_3) and DRMR 150-35 (V_2), respectively, at 60 DAS. However, varietal differences at 30 DAS, 90 DAS and harvest were non-significant, indicating comparable biomass accumulation among the tested genotypes during later growth stages.

The interaction effect between sowing dates and varieties was found non-significant at all growth stages, suggesting that varietal response for dry matter accumulation remained consistent across different sowing environments. The higher dry matter accumulation under early sowing may be attributed to favourable temperature and photoperiodic conditions, longer crop duration, enhanced leaf area development and efficient interception of solar radiation, which collectively promoted photosynthetic activity and assimilate production. In contrast, delayed sowing shortened the vegetative growth period and exposed the crop to less favourable thermal regimes during reproductive growth, thereby reducing biomass accumulation. The superiority of Bahubali at 60 DAS may be attributed to its vigorous growth habit, greater canopy development and efficient assimilate production associated with hybrid vigour.

These findings are in close agreement with those of Patel *et al.* (2017) [9] and Keerthi *et al.* (2017) [7], who reported significantly higher dry matter accumulation under timely sowing compared with delayed sowing. Similarly, Singh *et al.* (2002) [11] observed that dry matter accumulation in Brassica declined significantly with delayed sowing due to exposure of the crop to elevated temperatures (36.0–41.5°C) during the reproductive phase, resulting in reduced biomass production. Hundal *et al.* (2003) [5] also reported a progressive decline in dry matter accumulation with delay in sowing from the second week of October to the first week of December, attributing the reduction to less favourable thermal conditions and shortened crop growth duration.

Total number of branches plant⁻¹

The number of branches plant⁻¹ increased progressively with crop age and was significantly influenced by sowing dates at all stages of observation (Table 3). Among the sowing dates, 1 November sowing (D_1) recorded the highest number of branches plant⁻¹ (4.70, 11.86, 15.44 and 17.33 at 30 DAS, 60 DAS, 90 DAS and harvest, respectively). At 30 DAS, D_1 remained statistically at par with 15 November sowing (D_2) (4.68 branches plant⁻¹), whereas at subsequent stages D_1 significantly outperformed all later sowing dates. The lowest number of branches plant⁻¹ was recorded under 15 December sowing (D_4), with values of 3.80, 9.33, 10.58 and 13.18 at 30 DAS, 60 DAS, 90 DAS and harvest, respectively. Compared with D_4 , D_1 produced 23.68, 27.12, 45.94 and 31.49% more branches plant⁻¹ at 30 DAS, 60 DAS, 90 DAS and harvest, respectively, indicating the detrimental effect of delayed sowing on branch development.

Varietal differences were non-significant at 30 DAS; however, significant variation was observed from 60 DAS onwards. At 60 DAS, CG Sarson-1 (V_1) recorded the maximum number of branches plant⁻¹ (11.74), which remained statistically at par with Bahubali (V_4) (10.87). At 90 DAS and harvest, Bahubali recorded 14.58 and 16.62 branches plant⁻¹, respectively, and remained statistically at par with CG Sarson-1 (13.96 and 16.93 branches plant⁻¹, respectively). Both varieties significantly surpassed DRMR 150-35 (V_2) and Black Gold (V_3). At harvest, CG Sarson-1 and Bahubali produced 28.45 and 26.10% more branches plant⁻¹, respectively, than Black Gold.

The interaction effect between sowing dates and varieties was found non-significant at all growth stages, indicating that the relative performance of varieties for branch production remained consistent across different sowing environments. The higher branching observed under timely sowing may be attributed to prolonged vegetative growth; favourable temperature and photoperiodic conditions, greater assimilate availability and enhanced development of axillary buds. Delayed sowing shortened the vegetative phase and exposed the crop to comparatively higher temperatures during later growth stages, thereby restricting branch initiation and development. The superior branching behaviour of CG Sarson-1 and Bahubali might be associated with their favourable genetic constitution, greater resource-use efficiency and enhanced capacity for secondary shoot production. These findings corroborate the results of Dinda *et al.* (2015) [3], who reported significantly higher branching in mustard under timely sowing than delayed sowing. Bhagat *et al.* (2022) [2] also observed a progressive reduction in the number of branches plant⁻¹ with delay in sowing.

Table 1: Effect of sowing dates and varieties on plant height (cm) of mustard

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
Date of sowing				
1 November	19.92	85.51	162.4	183.3
15 November	18.30	84.09	156.2	175.7
1 December	16.70	81.64	153.3	168.2
15 December	15.27	80.52	151.9	163.3
S.Em±	0.56	0.88	1.15	1.59
CD (P=0.05)	1.94	3.06	4.01	5.50
Variety				
CG Sarson 1	17.89	83.84	157.1	175.2
DRMR 150-35	16.87	81.50	154.3	168.9
Black Gold	16.60	80.59	153.2	167.05
Bahubali	18.84	85.83	159.3	179.3

S.Em±	0.55	0.87	1.53	1.75
CD (P=0.05)	1.63	2.56	4.48	5.12
Interaction				
S.Em±	1.94	1.75	3.07	3.51
CD (P=0.05)	NS	NS	NS	NS

Table 2: Effect of sowing dates and varieties on plant dry matter accumulation (g plant⁻¹) of mustard

Treatments	Plant dry matter accumulation (g plant ⁻¹)			
	30 DAS	60 DAS	90 DAS	At harvest
Date of sowing				
1 November	2.74	25.81	59.62	79.24
15 November	2.36	23.16	54.98	76.61
1 December	1.91	21.06	52.84	73.38
15 December	1.82	21.56	51.08	71.37
S.Em±	0.17	0.68	1.42	1.45
CD (P=0.05)	0.61	2.37	4.94	5.02
Variety				
CG Sarson 1	2.24	22.98	53.42	75.62
DRMR 150-35	2.18	21.85	55.03	74.39
Black Gold	2.07	21.61	52.82	72.74
Bahubali	2.34	25.15	57.24	77.85
S.Em±	0.18	0.92	1.62	2.08
CD (P=0.05)	NS	2.70	NS	NS
Interaction				
S.Em±	0.36	1.85	3.19	4.16
CD (P=0.05)	NS	NS	NS	NS

Table 3: Effect of sowing dates and varieties on total number of branches plant⁻¹ of mustard

Treatments	Total number of branches plant ⁻¹			
	30 DAS	60 DAS	90 DAS	At harvest
Date of sowing				
1 November	4.70	11.86	15.44	17.33
15 November	4.68	10.47	12.65	15.12
1 December	4.07	9.93	12.39	15.20
15 December	3.80	9.33	10.58	13.18
S.Em±	0.16	0.29	0.37	0.56
CD (P=0.05)	0.57	1.005	1.30	1.97
Variety				
CG Sarson 1	4.62	11.74	13.96	16.93
DRMR 150-35	4.13	9.83	11.62	14.10
Black Gold	4.13	9.14	10.92	13.18
Bahubali	4.37	10.87	14.58	16.62
S.Em±	0.16	0.36	0.67	0.60
CD (P=0.05)	NS	1.05	1.96	1.76
Interaction				
S.Em±	0.33	0.72	1.34	1.21
CD (P=0.05)	NS	NS	NS	NS

Conclusion

Sowing date significantly influenced the growth performance of Indian mustard under the Chhattisgarh plains. Early sowing on November resulted in superior plant height, dry matter accumulation and branching, whereas delayed sowing progressively reduced vegetative growth. Among the tested varieties, Bahubali and CG Sarson-1 exhibited better growth performance and adaptability across different sowing environments.

References

- Anonymous. Agricultural statistics at a glance. New Delhi: Economics, Statistics and Evaluation Division, Department of Agriculture and Farmers Welfare, Government of India; 2025. p. 96-97.
- Bhagat R, Singh M, Sharma BC. Growth and productivity of gobhi sarson (*Brassica napus*) cultivars under diverse sowing environments. Indian Journal of Agricultural Sciences. 2022;92(10):1202-1207.
- Dinda NK, Ray M, Sarkar P. Effect of sowing date vis-a-vis variety of rapeseed and mustard on growth, yield and aphid infestation in Gangetic plains of West Bengal. The Ecoscan. 2015;9:21-24.
- Gogoi B, Kurmi K, Thakuria K, Ojha NJ, Dutta S. Influence of crop management practices on late sown toria (*Brassica rapa*) under rainfed rice-fallow situation of Assam. Journal of Oilseed Brassica. 2017;8:168-174.
- Hundal SS, Kaur P, Malikpuri SDS. Agroclimatic models for predicting growth and yield of Indian mustard (*Brassica juncea*). Indian Journal of Agricultural Sciences. 2003;73(3):142-144.
- Intergovernmental Panel on Climate Change. Climate change 2023: synthesis report. Geneva: IPCC; 2023.
- Keerthi P, Pannu RK, Dhaka AK. Effect of sowing dates

- and nitrogen levels on total dry matter and its partitioning at different growth stages and yield of Indian mustard (*Brassica juncea* L.). *Agricultural Science Digest*. 2017;37(1):27-31.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. 2nd ed. New Delhi: Indian Council of Agricultural Research; 1967.
 9. Patel A, Singh AK, Singh SV, Sharma A, Raghuvanshi N, Singh AK. Effect of different sowing dates on growth, yield and quality of various Indian mustard (*Brassica juncea* L.) varieties. *International Journal of Current Microbiology and Applied Sciences*. 2017;6(4):71-77.
 10. Shekhawat K, Rathore SS, Premi OP, Kandpal BK, Chauhan JS. Advances in agronomic management of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson]: an overview. *International Journal of Agronomy*. 2012;2012:1-14.
 11. Singh R, Rao VUM, Singh D. Biomass partitioning in Brassica as affected by sowing dates. *Journal of Agrometeorology*. 2002;4(1):59-63.