



ISSN Print: 2618-060X
 ISSN Online: 2618-0618
 NAAS Rating (2026): 5.20
 IJRA 2026; 9(9): 954-957
www.agronomyjournals.com
 Received: 24-07-2026
 Accepted: 27-08-2026
 Published: 22-09-2026

Suryakant Singh Maravi

Department of Agronomy,
 College of agriculture, IGKV,
 Raipur, Chhattisgarh, India

Y.K. Dewangan

Department of Agronomy,
 College of agriculture, IGKV,
 Raipur, Chhattisgarh, India

Deepshikha

Department of Agronomy,
 College of agriculture, IGKV,
 Raipur, Chhattisgarh, India

Effect of different sowing time and seed rate on growth, yield and economics of chandrasur (*Lepidium sativum* L.)

Suryakant Singh Maravi¹, Y.K. Dewangan², Deepshikha³

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9m.6627>

ABSTRACT

A field experiment was conducted during rabi 2025–26 at the university farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur, to study the effect of different sowing time and seed rate on growth, yield, and economics of chandrasur (*Lepidium sativum* L.). The experiment was laid out in a split-plot design with three replications using variety GA-2, with three sowing dates (15th November, 30th November and 15th December) in main plots and three seed rates (8, 10 and 12 kg ha⁻¹) in sub-plot. Sowing on 30th November recorded significantly higher plant height (114.76 cm at harvest), primary branches plant-1 (18.5), leaves plant-1 (114.68 at 60 DAS), dry matter accumulation (9.34 g plant-1 at harvest), seed yield (17.74 q ha⁻¹), stover yield (46.50 q ha⁻¹), gross return (Rs 1,28,845 ha⁻¹), net return (Rs 89,387 ha⁻¹) and B:C ratio (3.27) compared with the 15th November and 15th December. Among seed rates, the moderate seed rate produced significantly higher plant height (112.29 cm), primary branches plant-1 (18.02), leaves plant-1 (106.53) and dry matter (9.13 g plant-1), as well as highest seed yield (16.36 q ha⁻¹), stover yield (46.01 q ha⁻¹), gross return (1,19,113 Rs ha⁻¹), net return (79,655 Rs ha⁻¹) and B:C ratio (3.02). The interaction of 30th November sowing with 10 kg ha⁻¹ seed rate gave the significantly highest seed yield (18.3 q ha⁻¹), stover yield (47.5 q ha⁻¹), net return (93,227 Rs ha⁻¹) and B:C ratio (3.13) among all treatment combinations.

Keywords: Chandrasur, Sowing time, Seed rate, Growth, Yield, Economics

Introduction

Garden cress (*Lepidium sativum* L.), widely known in India as Chandrasur, is a fast-growing annual herb of the Brassicaceae family. While it originated in the highlands of Ethiopia and Eritrea, farmers have cultivated this versatile plant since ancient times for its nutrient-rich seeds and leaves. The seeds pack a strong nutritional profile, containing roughly 23.5% protein, 23.5% fat, and 30% dietary fiber, along with high levels of iron, calcium, and folic acid (Wadhwa *et al.*, 2012) [1]. Beyond basic nutrition, Garden cress contains unique phytochemicals like the alkaloid lepidine, sinapic acid, and a functional mucilage. These compounds of this plant seed have been used in Ayurvedic, Unani and Siddha systems of medicine since ancient times. They are useful in the preparation of medicines for asthma, cough with expectoration, poultice for sprains, leprosy, skin disease, dysentery, diarrhoea, splenomegaly, dyspepsia, lumbago, leucorrhoea, scurvy and seminal weakness (Kirtikar *et al.*, 1933) [2]. Traditionally, the crop is considered a tonic for increasing height in children, enhancing milk production in lactating women and milch animals, and curing chronic bronchial asthma (Paranjape and Mehta, 2004).

Commercial demand for Garden cress is currently on the rise, driven by both its traditional medicinal value and its emerging potential as a profitable oilseed. In India, the crop covers an estimated 8,450 hectares, mostly concentrated in Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat, and Maharashtra (Meena *et al.*, 2017) [3]. From a farming perspective, it is a highly attractive option. The plant requires very less water, stray animals tend to avoid grazing on it, and it naturally resists many common insect pests. Yet, despite these physical advantages and a strong market price, actual farm yields tell a different story. The national average productivity is stuck at a very low 320 kg ha⁻¹ (Meena *et al.*, 2015) [4].

Much of this yield gap comes down to poor field management. Farmers usually broadcast the seeds right after monsoon waters recede, rarely paying attention to proper spacing or precise planting schedules (Chundawat *et al.*, 2017) [5]. Basic, non-monetary agronomic practices like choosing the exact right sowing date and seed rate actually dictate how well the crop will grow. If planted too early or too late, the plants get hit by temperature stress during critical vegetative or reproductive stages, which severely damages the final yield (Choudhary *et al.*, 2010) [6]. Along the same lines, using the correct seed rate through line sowing stops the plants from over-competing against each other. It gives them the physical space needed to properly absorb sunlight, water, and soil nutrients (Tiwari *et al.*, 2002) [7]. The present investigation entitled to evaluate three different sowing time under three low, moderate and high seed rate condition at Raipur, Chhattisgarh, with emphasis on growth parameter, yield and economics performance, and to identify the suitable combination of sowing time and seed rate with superior overall performance.

Corresponding Author:

Suryakant Singh Maravi

Department of Agronomy,
 College of agriculture,
 IGKV, Raipur,
 Chhattisgarh, India

Material and method

The experiment was conducted during *rabi* season of 2025-26, at the university farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh (21°23' N, 81°69' E, 295 m above MSL), in a subtropical humid climate with an average annual rainfall of 1326 mm. The soil was a vertisol (locally 'Kanhra') of clay loam texture (sand 20.0%, silt 34.0%, clay 46.0%; bulk density 1.36 Mg m⁻³), with pH 7.07, EC 0.42 dS m⁻¹, organic carbon 0.45%, and available N 174.5 kg ha⁻¹ (low), P 20.35 kg ha⁻¹ (medium) and K 278 kg ha⁻¹ (high). The experiment was laid out in a split-plot design with three replications. Main plots comprised three sowing times *viz.*, D₁: 15th November, D₂: 30th November and D₃: 15th December and sub-plots comprised three seed rates *viz.*, S₁: 8 kg ha⁻¹ (low), S₂: 10 kg ha⁻¹ (moderate) and S₃: 12 kg ha⁻¹ (high). The test variety was GA-2, a medium-duration (110–120 days) high-yielding cultivar. Seeds were sown in lines 30 cm apart at 5 cm depth in plots of 3 m × 2.4 m. Well-decomposed FYM at 10 t ha⁻¹ was applied 15 days before sowing, and fertilizers were applied as per the treatment schedule in the form of urea, single super phosphate and muriate of potash. Irrigations were given at sowing and thereafter at 25, 40, 60 and 75 DAS, and manual weeding was done at 20–25 days intervals.

Growth observations (plant height, number of primary branches, number of leaves, dry-matter accumulation) were recorded from five randomly tagged plants per plot at 30, 60 and 90 DAS and at harvest. Seed yield per plant, test weight, seed yield, stover yield and harvest index were recorded at/after harvest. Economic analysis includes cost of cultivation, gross returns, net returns and B:C ratio. Gross return was calculated through seed and stover yield using prevailing market prices (Rs 70 kg⁻¹ seed and Rs 1 kg⁻¹ stover), and cost of cultivation includes fixed cost and temporary cost such as on seed, fertilizers, labour and other crop-management operations. Net return was calcu-

lated as the difference between gross return and cost of cultivation, while the B:C ratio was calculated as gross return divided by cost of cultivation. The data were subjected to analysis of variance appropriate for split plot design. The effects of different sowing time, seed rate and their interaction were tested for statistical significance. The standard error of mean (*SEm*[±]) was used to indicate the precision of treatment means, and the critical difference (CD) at 5% probability was used for comparison of means when the treatment effect was significant. Non-significant differences were indicated as NS.

Result and discussion

Growth parameters

Sowing time significantly influenced growth of chandrasur at all stages. The 30th November sowing recorded the tallest plants throughout the crop period (17.86, 54.20, 86.63 and 114.76 cm at 30, 60, 90 DAS and harvest, respectively), which was statistically at par with the 15th November sowing at 30 DAS, 60 DAS and 90 DAS growth stage. Whereas, 15th December sowing recorded comparatively minimum values. A similar trend was recorded for primary branches plant⁻¹, with 30th November producing 18.5 branches at harvest, as compared to 15th November and 15th December (Table 3.1). The 30th November sowing also produced significantly more leaves plant⁻¹ (114.68 at 60 DAS), which was statistically at par with 15th November sowing at 90 DAS and at harvest stage. However, the 15th December sowing registered the minimum number of leaves plant⁻¹ across all stages of observation, and significantly higher dry matter accumulation plant⁻¹ (9.34 g at harvest) was recorded under 30th November sowing across all stages, which was statistically at par with the 15th November sowing at 30 DAS, 90 DAS stage. Whereas, 15th December sowing recorded comparatively minimum values (Table 1 and 2).

Table 1. Plant height (cm) and number of primary branches plant⁻¹ of chandrasur as influenced by seed rate at various stages of the chandrasur

Treatment	Plant height (cm)				Primary branches plant ⁻¹ (No.)			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Main plot : Sowing time								
D ₁ : 15 th November	16.85	49.82	79.65	103.43	6.19	11.1	14.3	16.5
D ₂ : 30 th November	17.86	54.20	86.63	114.76	7.39	14.3	16.8	18.5
D ₃ : 15 th December	13.55	45.75	75.16	102.7	5.82	10.9	13.9	16.2
SEm[±]	0.58	1.24	1.83	2.15	0.30	0.45	0.49	0.42
CD (P = 0.05)	2.27	4.89	7.19	8.43	1.19	1.75	1.92	1.63
Sub plot : Seed rate								
S ₁ : 8 kg ha ⁻¹	16.26	49.06	78.57	104.68	6.41	11.8	15.01	17.01
S ₂ : 10 kg ha ⁻¹	16.91	54.18	85.68	112.29	7.16	13.4	16.2	18.02
S ₃ : 12 kg ha ⁻¹	15.09	46.53	77.18	103.95	5.83	11.2	13.8	16.40
SEm[±]	0.46	1.01	1.32	1.49	0.18	0.35	0.24	0.23
CD (P = 0.05)	1.41	3.10	4.06	4.58	0.57	1.09	0.75	0.72
I (D × S)	NS	NS	NS	NS	NS	NS	NS	NS

Among seed rates, the moderate seed rate recorded significantly higher plant height (112.29 cm at harvest) at all growth, which was statistically at par with the low seed rate at 30 DAS stage. The lowest plant height was found under the high seed rate (103.95 cm at harvest) at all growth stages. A similar trend was followed by primary branches (18.02), leaves plant⁻¹ (106.53 at 60 DAS) and dry matter accumulation plant⁻¹ (9.13 g at harvest). However, dry matter accumulation was comparatively statistically at par with the low seed rate at 30 DAS and at harvest stage, while the high rate of seed gave the lowest values. The interaction of sowing time and seed rate was non-significant for all growth parameters (Table 1 and 2). These results

also corroborated with those of Yadav *et al.* (2013) [8] and Meena *et al.* (2017) [3] in chandrasur.

Yield attributes and yield

The interaction of sowing time and seed rate significantly influenced seed yield plant⁻¹, the combination of 30th November sowing with moderate seed rate of 10 kg ha⁻¹ produced the maximum seed yield of 5.44 g plant⁻¹, while delayed sowing to 15th December with high rate of 12 kg ha⁻¹ recorded the lowest (3.31 g plant⁻¹). Test weight was not significantly influenced by either were significantly influenced by both factors. The 30th November sowing produced the highest seed yield (17.74 q ha⁻¹) and stover yield (46.50 q ha⁻¹), statisti-

cally at par with 15th November for stover (44.22 q ha⁻¹), whereas delayed sowing on 15th December gave the lowest seed yield (12.27 q ha⁻¹) and stover yield (39.09 q ha⁻¹). Among varying seed rate, moderate seed rate of 10 kg ha⁻¹ gave the highest seed yield (16.36 q ha⁻¹) and stover yield (46.01 q ha⁻¹), whereas high rate of seed (12 kg ha⁻¹) recorded the lowest values (14.18 and 41.28 q ha⁻¹)

(Table 3). These results also corroborated with those of Chundawat *et al.*, (2017) [5] and Bhagora *et al.*, (2022) [9] in chandrasur.

In the interaction, the 30th November sowing combined with moderate seed rate gave significantly the highest seed yield (18.3 q ha⁻¹) (Table 4) and stover yield (47.5 q ha⁻¹) among all combinations.

Table 2. Number of leaves plant⁻¹ and dry matter accumulation (g plant⁻¹) of chandrasur as influenced by different sowing time and seed rate at various stages of the chandrasur

Treatment	Number of leaves plant ⁻¹ (No.)				Dry matter accumulation (g plant ⁻¹)			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At Harvest
Main plot : sowing time								
D ₁ : 15 th November	64.67	98.23	39.37	12.17	0.25	4.15	6.37	8.43
D ₂ : 30 th November	89.45	114.68	43.48	13.21	0.29	5.03	6.89	9.34
D ₃ : 15 th December	49.26	88.52	35.97	8.42	0.21	3.87	5.98	7.55
SEm+	3.19	2.99	1.12	0.63	0.01	0.21	0.17	0.34
CD (P = 0.05)	12.54	11.74	4.40	2.47	0.06	0.84	0.66	1.32
Sub plot : seed rate								
S ₁ : 8 kg ha ⁻¹	64.26	98.64	39.42	11.13	0.25	3.97	6.52	8.58
S ₂ : 10 kg ha ⁻¹	75.02	106.53	42.88	12.61	0.28	5.19	7.01	9.13
S ₃ : 12 kg ha ⁻¹	64.10	96.26	36.53	10.06	0.22	3.88	5.70	7.61
SEm+	3.07	2.08	0.83	0.42	0.01	0.18	0.15	0.29
CD (P = 0.05)	9.47	6.40	2.57	1.30	0.04	0.55	0.46	0.89
I (D × S)	NS	NS	NS	NS	NS	NS	NS	NS

Harvest index was significantly influenced by sowing time but not by seed rate (Table 3). The 30th November sowing recorded the highest harvest index (27.63%), at par with 15th November (25.67%), and the lowest was under 15th December (23.85%). With respect to seed rate, numerically the moderate seed rate gave the highest harvest index (26.18%) over low and high seed rate. The current findings are in confirmation with Meena *et al.*, (2017) [3].

Economics

Sowing time and seed rate significantly influenced the profitability of chandrasur (Table 5). The highest gross return (Rs 1,28,845 ha⁻¹), net return (Rs 89,387 ha⁻¹) and B:C ratio (3.27) were recorded under the 30th November sowing, as compared to 15th November and 15th December. With respect to seed rates, moderate seed rate of recorded the highest gross return (Rs 1,19,113 ha⁻¹), net return (Rs 79,655 ha⁻¹) and B:C ratio (3.02), as compared to low and high rate of seed. In the interaction, 30th

Table 3. Effect on seed yield (g plant⁻¹), test weight (g), seed yield (q ha⁻¹), stover yield (q ha⁻¹) and harvest index (%) of chandrasur crop as influenced by different sowing time and seed rate

Treatment	Seed yield (g plant ⁻¹)	Test weight (g)	Seed yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	Harvest index (%)
Main plot : sowing time					
D ₁ : 15 th November	4.13	1.73	15.27	44.22	25.67
D ₂ : 30 th November	4.62	1.54	17.74	46.50	27.63
D ₃ : 15 th December	3.52	1.84	12.27	39.09	23.85
SEm+	0.18	0.09	0.43	1.00	0.63
CD (P = 0.05)	0.69	NS	1.7	3.91	2.48
Sub plot : seed rate					
S ₁ : 8 kg ha ⁻¹	4.11	1.73	14.75	42.52	25.59
S ₂ : 10 kg ha ⁻¹	4.53	1.72	16.36	46.01	26.18
S ₃ : 12 kg ha ⁻¹	3.63	1.66	14.18	41.28	25.39
SEm+	0.10	0.07	0.21	0.68	0.44
CD (P = 0.05)	0.32	NS	0.64	2.08	NS
I (D×S)	1.09	NS	S	S	NS

November sowing with moderate rate of seed recorded the highest net return (Rs 90,227 ha⁻¹) and B:C ratio (3.4) among all combinations.

Table 4. interaction effect of different sowing time and seed rate on seed yield (q ha^{-1}) of chandrasur

Treatment		Seed yield (q ha ⁻¹)			
		Main plot : Sowing time			Mean
		D ₁ :15 th November	D ₂ :30 th November	D ₃ :15 th December	
Seed rate	S ₁ : 8 kg ha ⁻¹	14.9	17.6	11.7	14.7
	S ₂ : 10 kg ha ⁻¹	16.5	18.3	14.3	16.4
	S ₃ : 12 kg ha ⁻¹	14.4	17.4	10.8	14.2
	Mean	15.3	17.7	12.3	
	SEm+	0.68			
CD (<i>P</i> = 0.05)		2.08			

Table 5. Economics of chandrasur cultivation as influenced by different sowing time and seed rate

Treatment	Economics (Rs ha^{-1})			
	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
Main plot : Sowing time				
D ₁ :15 th November	38758	111312	71854	2.82
D ₂ : 30 th November	38758	128845	89387	3.27
D ₃ : 15 th December	38758	89798	50340	2.28
Sub plot : Seed rate				
S ₁ : 8 kg ha^{-1}	39318	107486	68168	2.73
S ₂ : 10 kg ha^{-1}	39458	119113	79655	3.02
S ₃ : 12 kg ha^{-1}	39598	103356	63758	2.61

* Prevailing market price @ 70 Rs kg^{-1} of Seed and 1 Rs kg^{-1} of Stover of chandrasur

Conclusion

Sowing chandrasur (cv. GA-2) on 30th November with a moderate seed rate of 10 kg ha^{-1} (D₂S₂) produced significantly higher growth, seed yield (18.3 q ha^{-1}), stover yield (47.5 q ha^{-1}), net return (Rs 93,227 ha^{-1}) and B:C ratio (3.4) than all other combinations. The 30th November sowing and the moderate seed rate were individually superior for growth, yield, quality and economics.

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How to cite this article: Maravi SS, Dewangan YK, Deepshikha. Effect of different sowing time and seed rate on growth, yield and economics of chandrasur (*Lepidium sativum* L.). International Journal of Research in Agronomy. 2026;9(9):954-957. doi: <https://www.doi.org/10.33545/2618060X.2026.v9.i9m.6627>