

Research Article

Performance of sesamum (*Sesamum indicum* L.) varieties under different sowing windows

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Abstract

Sesame (*Sesamum indicum* L.) is an important oilseed crop valued for its high oil content, nutritional quality, and adaptability to varied agro-climatic conditions. To enhance productivity and support self-sufficiency in edible oil, the present study was conducted at Regional Agricultural Research Station, Tirupati, Acharya N. G. Ranga Agricultural University, during 2021–22 and 2022–23 to evaluate the performance of sesame varieties under different sowing windows. The treatment paper on the website of sowing windows were three sowing windows viz., II Fortnight (FN) of December, I FN of January and II FN of January as main plots and three varieties of sesame (Madhavi, Swetha and YLM-66) of sesame as sub-plots in split plot design and replicated thrice. The study results during both the years revealed that days to attain different phenological stages, heat units, growth parameters (plant height, number of branches plant⁻¹, dry matter production), yield attributes (number of capsules plant⁻¹, number of seeds capsules⁻¹, 1000 seed weight) and yield (930.9 and 832.0 kg ha⁻¹) of sesame were statistically higher with II FN of January sown crop but the least values of recorded parameters were with II FN of December sown crop. Similarly, the variety YLM-66 resulted in maximum growth, yield attributes and yield of sesame whereas Swetha variety recorded the least of above parameters. Non-significant variation was noted with respect to days to attain different phenological stages of sesame and heat units due to varieties. Based on the above results, it was concluded that sesame produces higher yield when sown during II FN of January with the variety YLM-66.

Key words: Growth characters, Heat units, Sowing windows, Varieties, Yield

INTRODUCTION

Oilseeds serve as a primary source of fat and protein, especially for vegetarians. India ranks among the larg-

est vegetable oil economies globally, following the USA, China, Brazil, and Argentina (Aroma *et al.*, 2025).

The country contributes approximately 13–15% of the global oilseed cultivation area, 8-9% of total oilseed

production, and 10–11% of worldwide vegetable oil consumption. India is currently facing a major shortage of edible oil, driven by rapid population growth, rising living standards, and growing demand from oil-reliant industries. To meet this demand, the country partly relies on oils such as soybean, sunflower, and palm oil. Given this scenario, there is a pressing need to achieve self-sufficiency in oil production to cater the growing requirements of both consumers and industries. In this context, the cultivation of sesame is gaining traction as a means to help close the gap in domestic oilseed production (Kalyani *et al.*, 2025).

Sesame is a significant edible oilseed crop in India, ranking after groundnut and rapeseed-mustard. Known commonly as gingelly or til, it is the oldest cultivated oilseeds, with a history of domestication dating back nearly 3,000 years. India is the world's third-largest producer of sesame, following Myanmar and China. Nationally, sesame is grown on approximately 1.56 million hectares, yielding around 0.78 million tonnes annually, with a productivity of 502 kg/ha (Aroma *et al.*, 2025). In Andhra Pradesh, sesame cultivation covers about 0.61 lakh hectares, producing 0.2 lakh tonnes with a productivity of 321 kg/ha (Sujatha *et al.*, 2023). Among oilseed crops, sesame stands out for having the highest oil content, ranging from 46% to 52%, along with about 25% protein. Its oil contains powerful antioxidants such as sesamol and sesamolins, which help prevent rancidity, receiving it the title "Queen of Oilseeds." Sesame seeds are rich in linoleic and oleic acids, which play a prominent role in determining oil quality. Due to its excellent nutritional profile, sesame is commonly referred as the "poor man's substitute for ghee." Additionally, sesame seeds contain all essential amino acids, vital vitamins like pantothenic acid and vitamin E, and significant amounts of minerals about 1450 mg of calcium and 570 mg of phosphorus per 100 grams (Ahmed *et al.*, 2009). Beyond its use as an edible oil, sesame is also an ingredient in the usage of soaps and paints, and due to its synergistic properties, it is utilized in the pyrethrum-based insecticide industry.

Among the effective agronomic practices, the timing of sowing and choice of varieties are key factors influencing the crop's yield potential (Chaitanya *et al.*, 2022). Sowing at the optimum time is crucial for maximizing grain production, as it ensures favorable growth conditions and supports a consistent improvement in yield of sesame (Yisa *et al.*, 2023). Most farmers currently cultivate indeterminate sesame varieties with shattering capsules. These types have limited adaptability and are sensitive to temperature and light (thermo-photo sensitive) (Saju Adhikary *et al.*, 2021). Therefore, the present study aimed to identify and promote sesame varieties (Madhavi, Swetha and YLM-66) with broader adaptability that can be cultivated across a wider range of regions and seasons, hence, the present study was under

taken to evaluate the performance of sesame (*Sesamum indicum* L.) varieties under different sowing windows.

MATERIALS AND METHODS

An experimental study was carried out at the RARS (Regional Agricultural Research Station), Tirupati, under Acharya N. G. Ranga Agricultural University during 2021–22 and 2022–23 years. The experimental soil was sandy loam which was estimated by Bouyoucos Hydrometer method (Piper, 1966), and neutral soil in reaction with a pH of 6.9 measured using a glass electrode pH meter (Jackson, 1973). The organic carbon content was low (0.26%), estimated by the wet digestion method (Walkley and Black, 1934). The available nitrogen content was low (162 kg ha⁻¹) determined by the alkaline potassium permanganate method (Subbiah and Asija, 1956). The available phosphorus content was medium (16.0 kg ha⁻¹) and was estimated using Olsen's method (Olsen *et al.*, 1954). The soil was medium in available potassium (215.6 kg ha⁻¹), which was determined by flame photometry following the procedure of Stanford and English (1949). The experiment followed a split-plot design, with three sowing times *viz.*, II FN (Fortnight) of both the December, I FN of January, and II FN of January assigned to the main plots. Three sesame varieties *viz.*, Madhavi, Swetha, and YLM-66 were allotted to the subplots and replicated thrice. The weather during the crop growth period of 2021-22 was normal with 71.0 mm rainfall in 5 rainy days with mean minimum temperature of 19.6 °C and mean maximum temperature of 32.7 °C. The weather during the crop growth period of 2022-23 was also normal with 123.2 mm rainfall in 7 rainy days with mean minimum temperature of 17.6 °C and mean maximum temperature of 32.2 °C. Nitrogen was supplied at 60 kg/ha using urea in two equal splits: one at sowing and the other at 30 days after sowing (DAS). Phosphorus at 30 kg/ha (as diammonium phosphate) and potassium at 15 kg/ha (as muriate of potash) were applied as basal doses uniformly across all treatments.

Phenological stages *viz.*, days to germination, days to vegetative stage, days taken to flowering and days taken to complete maturity were recorded. During the crop season, the daily data on prevailed temperature and bright sunshine hours were collected from Agro-climatic Research Centre, RARS, Tirupati. The details of the day length were obtained from Rastriya Panchang (Anonymous, 2021-23) published by Positional Astronomy Centre, IMD, Kolkata. The heat units were calculated as follows:

$$GDD = \sum_{i=1}^n \frac{[T_{max} + T_{min}]}{2} - T_b \quad (\text{Iwata, 1984})$$

$$HTU = \sum_{i=1}^n GDD \times BSSH \quad (\text{Rajput, 1980})$$

$$PTU = \sum_{i=1}^n GDD \times \text{Day length} \quad (\text{Major } et al., 1975)$$

Where, GDD (Growing degree days), HTU (Helio thermal units), PTU (Photo thermal units), Tmax (Maximum temperature (°C)), Tmin (Minimum temperature (°C)), Tb (Base temperature = 10 (°C)), BSSH (Bright sunshine hours)

Statistical analysis

The experimental data were statistically analyzed for the differential effect of treatments by applying ANOVA for split plot design by using OPSTAT analysis software. Wherever the differences between the treatments were found significant, critical difference at 5 per cent level of probability was worked out and the values are given. Differences between the treatments that were statistically non-significant were represented by NS.

RESULTS AND DISCUSSION

Phenophase development

There existed a significant difference among phenophase development of sesame during both 2021-22 and 2022-23 years due to sowing windows (Table 1). Sowing windows failed to exert significant differences on days to germination and vegetative stage during both the years. The crop sown during II FN of January during both the years took more calendar days to attain flowering (33.22 and 33.00 days, respectively) and maturity stage (92.33 and 89.11 days respectively) of sesame over other sowing windows tried. This might be due to the fact that II FN of January sown crop experienced better temperature and photoperiod than other FN sown crop that might have speed up cell differentiation, lengthens the photosynthetic process, accumulation and translocation of photosynthates which have eventually took more calendar days to attain each developmental stage of sesame. In contrast, Aroma *et al.* (2025) reported that delay in sowings from February to March shortens the maturity of sesame (*Sesamum indicum* L.) crop as the late sown crop encountered higher temperature during vegetative period, resulted in shortening the duration of the crop. During both the years, the days taken to attain different phenophases of sesame (days to attain germination, vegetative, flowering and maturity) did not differ statistically due to different varieties and also due to interaction between sowing windows and varieties.

Heat units

Heat units *viz.*, GDD (growing degree days), HTU (helio thermal units), PTU (photo thermal units) required to complete crop period of sesame varied due to different sowing windows tested (Table 2) during both the years. The crop sown during II FN of January, 2021-22 required higher heat units to attain maturity of sesame when compared to other sowing windows tried. This might be due to favourable climate with balanced nutrients that leads to a lengthier period for all phenological stages in turn increased the heat units of sesame. II FN of December sown crop experienced low air temperatures during the crop period compared to other late sown crop eventually recording lower heat units. Similar trend of results was noted during 2022-23 year also. In contrast, Rathore *et al.* (2019) recorded higher heat units of quinoa (*Chenopodium quinoa*) with early sown crop than late sown since the crop experienced longer growing period of quinoa coupled with high mean temperatures. No significant disparity was noted with regard to heat units of sesame due to different varieties and interaction between sowing windows adopted and varieties during both (2021-22 and 2022-23) the years.

Growth parameters

Growth parameters (plant height, number of branches plant⁻¹, dry matter production) differed significantly as influenced by sowing windows and varieties but not by their interaction (Table 3). Among the adopted sowing windows, the late sown sesame crop *i.e.* II FN of January during both 2021-22 and 2022-23 years recorded statistically higher plant height (104.3 and 100 cm respectively), number of branches plant⁻¹ (5.2 and 4.9 respectively), drymatter production (2417.8 and 2338.8 kg ha⁻¹ respectively) when compared to other treatments. Longer vegetative phase of II FN of January sown crop have provided favourable conditions of utilizing the growth resources for longer period of time leading to enhanced growth parameters. These above results are in accordance with Saju Adhikari *et al.*, (2021). Similarly, Sondarva *et al.* (2014) reported higher yields of sesamum indicum with late sown sesame crop compared to early sown crop. The lowest growth parameters (plant height, number of branches plant⁻¹, dry matter production) of sesame during both (2021-22 and 2022-23) the years were with early sown crop *i.e.* II FN of December.

Dry matter accumulation is the prerequisite for higher yields, which is an indication of the biosynthetic process associated with growth and development of the crop. With respect to different varieties tested, significantly taller plants and maximum dry matter production during 2021-22 was observed with YLM-66 than other varieties tested, while, the lower plant height and dry matter production was recorded with Madhavi (V1) This

Table 1. Effect of sowing windows and varieties on phenology of sesame varieties

Treatments	2021-22				2022-23			
	Days to germination	Days to vegetative stage	Days to flowering stage	Days to maturity stage	Days to germination	Days to vegetative stage	Days to flowering stage	Days to maturity stage
Main plot: Sowing windows								
S ₁ – II FN of December	4.00	26.55	30.66	87.66	3.88	25.00	29.67	85.44
S ₂ – I FN of January	4.33	27.88	32.11	89.11	4.00	26.88	31.46	87.11
S ₃ – II FN of January	4.88	28.11	33.22	92.33	4.55	27.88	33.00	89.11
SEm	0.22	0.44	0.25	0.29	0.27	0.20	0.28	0.29
CD (P=0.05)	NS	NS	1.00	1.19	NS	NS	1.12	1.18
Sub plot: Crop geometry								
V ₁ - Madhavi	4.66	27.11	31.88	89.88	4.44	26.44	31.22	87.33
V ₂ - Swetha	4.44	27.66	31.66	89.33	4.00	25.44	30.77	86.33
V ₃ – YLM-66	4.11	27.77	32.44	89.88	4.00	26.88	31.33	88.00
SEm	0.17	0.29	0.28	0.51	0.18	0.33	0.17	0.39
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Interaction absent

Table 2. Effect of sowing windows and varieties on heat units of sesame varieties

Treatments	2021-22			2022-23		
	Growing degree days (°C)	Helio thermal units (°C hrs)	Photo thermal units (°C hrs)	Growing degree days (°C)	Helio thermal units (°C hrs)	Photo thermal units (°C hrs)
Main plot: Sowing windows						
S ₁ – II FN of December	1364.7	10316.9	15768.4	1246.7	10071.4	14377.0
S ₂ – I FN of January	1450.9	11134.2	17098.6	1294.1	10442.3	15234.0
S ₃ – II FN of January	1485.9	11669.5	17651.2	1367.8	10852.3	16270.0
SEm	1.5	17.3	25.6	6.9	15.7	27.4
CD (P=0.05)	6.1	69.7	103.1	27.9	63.1	110.3
Sub plot: Crop geometry						
V ₁ - Madhavi	1437.3	11056.2	16871.1	1301.2	10494.7	15328.6
V ₂ - Swetha	1425.6	10975.2	16760.4	1286.9	10331.2	15094.7
V ₃ – YLM-66	1438.5	11088.4	16886.0	1320.4	10540.0	15459.2
SEm	2.0	25.3	37.4	9.5	29.3	43.4
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Interaction absent

Table 3. Effect of sowing windows and varieties on growth parameters of sesame varieties

Treatments	2021-22		2022-23			
	Plant height (cm)	No. of branches	Drymatter production (kg ha ⁻¹)	Plant height (cm)	No. of branches	Drymatter production (kg ha ⁻¹)
Main plot: Sowing windows						
S ₁ – II FN of December	90.2	3.6	2020.0	88.2	3.0	1951.0
S ₂ – I FN of January	98.4	4.5	2210.1	96.5	3.8	2149.8
S ₃ – II FN of January	104.3	5.2	2417.8	100.0	4.9	2338.8
SEm	1.0	0.2	45.8	0.9	0.2	47.2
CD (P=0.05)	4.2	0.8	184.7	3.6	0.8	190.3
Sub plot: Crop geometry						
V ₁ - Madhavi	96.6	4.3	2230.0	95.1	3.7	2128.0
V ₂ - Swetha	94.7	3.9	2052.8	92.1	3.3	2037.8
V ₃ – YLM-66	98.5	5.0	2365.4	97.6	4.3	2274.4
SEm	0.4	0.2	24.0	0.3	0.3	35.3
CD (P=0.05)	1.2	NS	74.7	1.0	NS	110.1

Interaction absent

was primarily attributed to the genetic differences among crop plants. Among the different varieties tested, higher plant height and dry matter accumulation of sesame were noticed with the variety YLM-66 than other varieties (Kalyani *et al.*, 2020). In present study, varieties failed to exert any significant difference on number of branches plant⁻¹ of sesame. Similar trend of results was reported during 2022-23 year also.

Yield attributes

The yield attributes *i.e.* number of capsules plant⁻¹, number of seeds capsules⁻¹, 1000 seed weight) was considerably altered due to different sowing windows and varieties as well. Whereas, interaction effect was found non-significant in influencing the sesame yield attributes (Table 4).

During both 2021-22 and 2022-23 years, sesame sown during II FN of January recorded the highest (34.2 and 32.9, 53.2 and 49.0, 2.4 and 2.2 g) yield parameters (number of capsules plant⁻¹, number of seeds capsules⁻¹, 1000 seed weight) which was statistically superior over rest of the treatments. This was mainly due to congenial weather conditions during the crop period which might have resulted in production of more number of branches plant⁻¹ developing more sites for reproductive structure *i.e.* number of capsules plant⁻¹, number of seed capsule⁻¹ and 1000 seed weight. Chavhan *et al.* (2024) reported that sesame sown during 35th meteorological week might have provided the favourable weather conditions for production of higher yield attributes of

sesame. Similarly, Rakesh *et al.* (2025) recorded higher yield attributes of sesame when sown late (7th March) compared to early sown crop (21st February). More number of capsules plant⁻¹ (32.9 and 31.7), number of seeds capsules⁻¹ (51.2 and 47.7) and 1000 seed weight (2.3 and 2.1) during both 2021-22 and 2022-23 years was recorded with the YLM-66 (V₃) which was statistically superior over other varieties. Maximum yield attributes with YLM-66 might be due to the difference in genetic potential of the cultivar. During both (2021-22 and 2022-23) years the least values of above characters were noted with Swetha (V₂). These results were similar with those of Kalyani *et al.* (2025) who recorded higher yield attributes of sesame with the variety YLM-66.

Yield

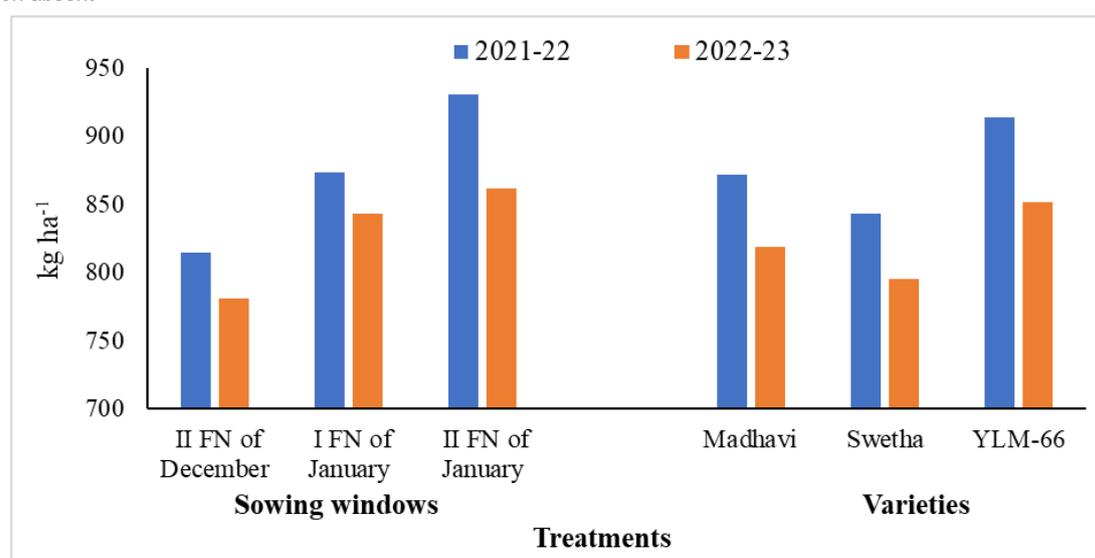
The yield data indicated that the differences in yield across sowing windows and varieties were statistically significant. However, the interaction effect between sowing windows and varieties was found to be non-significant (Fig.1).

During the years, 2021-22 and 2022-23, the seed yield of sesame was higher (930.9 and 862.0 kg ha⁻¹ respectively) when the crop was sown during II FN of January which was statistically superior to that of I FN of January sown crop. Sesame sown during II FN of December produced significantly lesser yield. Sowing the crop during II FN of January resulted in higher yield over other times of sowing. The reason behind this might be

Table 4. Effect of sowing windows and varieties on yield attributes and yield of sesame varieties

Treatments	2021-22			2022-23		
	No. of capsules/plant	seeds/capsule	1000 seed weight (g)	No. of capsules/plant	seeds/capsule	1000 seed weight (g)
Main plot: Sowing windows						
S ₁ – II FN of December	26.8	40.4	1.8	25.0	35.8	1.6
S ₂ – I FN of January	29.8	48.2	2.1	28.4	43.7	2.0
S ₃ – II FN of January	34.2	53.2	2.4	32.9	49.0	2.2
SEm	0.5	1.1	0.0	0.5	1.0	0.0
CD (P=0.05)	1.9	4.3	0.1	2.0	3.9	0.1
Sub plot: Crop geometry						
V ₁ - Madhavi	30.8	47.2	2.1	29.2	42.6	1.9
V ₂ - Swetha	28.1	43.4	1.9	26.4	38.3	1.8
V ₃ – YLM-66	32.9	51.2	2.3	31.7	47.7	2.1
SEm	0.5	1.0	0.0	0.6	1.2	0.0
CD (P=0.05)	1.4	3.3	0.1	1.9	3.6	0.1

Interaction absent

**Fig. 1.** Effect of sowing windows and varieties on yield of sesame varieties

due to the fact that early sown crop took maximum calendar days up to harvest that have resulted in longer vegetative phase reflecting maximum growth and yield attributes that ultimately reflected on the yield. Sujatha *et al.* (2023) noticed higher seed yield of YLM-66, a variety of sesame (*S. indicum*) when sown during I and II FN of January compared to other sowing windows tried. Chaudhri *et al.* (2024) recorded higher seed yield Guj Til 5, a variety of sesame (*S. indicum*) when the crop was sown late (2nd week of March) than that of early sown crop (1st and 4th week of March).

During both 2021-22 and 2022-23 years, the sesame variety YLM-66 (V₃) recorded significantly higher seed

yield (914.2 and 851.6 kg ha⁻¹, respectively) of sesame when compared to that of other treatments. The variety Swetha (V₂) recorded the lower seed yield. The increase in yield could be mainly attributed to its genetic potentiality to utilize and translocate the photosynthates from source to sink more efficiently under given set of climatic conditions. Kalyani *et al.* (2025) recorded higher yield of sesame with YLM-66 (908 kg ha⁻¹) variety compared to YLM-17 (865 kg ha⁻¹), YLM-11 (794 kg ha⁻¹) and Madhavi (732 kg ha⁻¹). Such yield differences in the performance of genotypes are reported earlier also by Basavaraj *et al.* (2000) and Adebisi *et al.* (2005).

Conclusion

The present study clearly demonstrated that sowing time had a significant influence on the phenophase development, heat unit requirement, growth, yield attributes and seed yield of sesame during both 2021-22 and 2022-23. Among the different sowing windows evaluated, sowing during II fortnight of January consistently resulted in prolonged phenological duration, higher accumulation of heat units and enhanced growth and yield parameters of sesame. Among the varieties (Madhavi, Swetha and YLM-66) tested, YLM-66 outperformed Madhavi and Swetha by recording significantly higher growth and yield parameters during both years. Overall, it can be concluded that sowing sesame during the II fortnight of January coupled with the use of variety YLM-66 can be recommended for achieving higher productivity under the agro-climatic conditions of the Southern Zone of Andhra Pradesh.

Conflict of interest

The authors declare that they have no conflict of interest.

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