The Significance of Multidisciplinary Research in Driving Innovations and Breakthroughs
ISBN Number: 978-93-95305-10-5

# IMPACTS OF SOWING DATES AND PLANTING GEOMETRY ON THE GROWTH AND YIELD OF RAPESEED (*Brassica campestris* L)

**N. Kobin[1], S. Chack[2], L Rina[3]**

[1]Department of Agriculture, Himalayan University, Itanagar, Arunachal Pradesh 791111

[2&3] Faculty of Agriculture, Himalayan University, Itanagar, Arunachal Pradesh 791111

**Corresponding author:** nanikobin@gmail.com

**Abstract**

This study evaluates the effect of sowing time and planting geometry on the growth and yield of rapeseed (*Brassica campestris L.*) under the agro-climatic conditions of Arunachal Pradesh, India. Conducted during the 2022–23 rabi season at the Agriculture cum Research Field of Himalayan University, the experiment was laid out in a randomized block design with ten treatment combinations and three replications. The treatments comprised three sowing times—first, second, and third weeks of November—and three planting geometries (35×10 cm, 40×15 cm, and 45×10 cm), with a control for comparison. Results revealed that the earliest sowing date (first week of November) coupled with the closest spacing (35×10 cm) significantly improved plant height, the number of leaves, branches, and overall yield. Treatment T1 (S1G1) produced the highest seed yield (792.67 kg/ha) and biological yield (3.06 t/ha), demonstrating the critical role of timely sowing and optimized planting geometry in enhancing rapeseed productivity.

**Keywords**: Rapeseed, sowing date, planting geometry, yield.

## Introduction

Rapeseed (*Brassica campestris L.*) is one of the most important oilseed crops in India, ranking third globally in production after Canada and China. It plays a pivotal role in meeting the country's edible oil demands and is a vital source of essential fatty acids and nutrients for human consumption. The crop contributes significantly to the Indian oilseed economy, with nearly 80% of oilseed production being derived from the rapeseed-mustard group. Its adaptability to diverse agro-climatic conditions has made it a crucial component of farming systems, particularly in the eastern states like Assam, Bihar, and West Bengal (Lakra et al., 2018). Despite its significance, optimizing agronomic practices such as sowing time and planting geometry remains critical to improving productivity and addressing challenges posed by climate variability and resource limitations.

ISBN Number: 978-93-95305-10-5

In Arunachal Pradesh, rapeseed is cultivated predominantly in the rabi season following the harvest of kharif rice. The region's unique agro-climatic conditions, characterized by a humid subtropical climate with low temperatures and ample sunlight during the rabi season, present an opportunity to study the crop's performance under varying sowing times and planting geometries. However, limited research has been conducted to tailor agronomic practices to these specific conditions. Factors such as delayed sowing and inappropriate spacing are known to reduce yields due to shortened vegetative phases and increased plant competition (Kumari et al., 2012; Lakra et al., 2018). Addressing these challenges through location-specific research is essential for maximizing rapeseed productivity in this region.

Previous studies have demonstrated the significant impact of sowing time and planting geometry on rapeseed growth and yield. Early sowing has been linked to longer growth periods and favorable conditions for seed development, resulting in higher yields (Iraddi, 2008; Manju et al., 2017). Similarly, optimal planting geometry ensures better resource utilization, reduced inter-plant competition, and improved yield components (Sonani et al., 2002; Satyendra et al., 2022). While these studies provide valuable insights, their applicability to Arunachal Pradesh's distinct agro-climatic conditions remains unexplored.

This study was undertaken to evaluate the combined effects of sowing time and planting geometry on the growth, yield, and productivity of rapeseed under the agro-climatic conditions of Arunachal Pradesh. The findings aim to provide region-specific recommendations that can enhance rapeseed cultivation practices, ensuring better yield and sustainability for farmers in this area.

**Materials and method**

A field experiment was conducted at the Agriculture cum Research Field, Himalayan University, Jollang, Itanagar, Arunachal Pradesh during the rabi season of 2022–23 to study the effect of sowing time and planting geometry on the growth and yield of rapeseed (*Brassica campestris L.*) var. M-27. The experimental soil was loamy in texture, moderately acidic with a pH of 5.1, containing medium available nitrogen, high organic carbon, and low phosphorus, potassium, and sulfur content. The experiment was laid out in a Randomized Block Design (RBD) with ten treatment combinations replicated three times. The treatments consisted of three sowing dates [First week of November (S1), Second week of November (S2), and Third week of November (S3)] and three planting geometries [35 × 10 cm (G1), 40 × 15 cm (G2), and 45 × 10 cm (G3)], along with a control. Sowing was done, and spacing was maintained as per the treatments. Uniform basal application of 60:60:50 kg NPK $ha^{-1}$ was

ISBN Number: 978-93-95305-10-5
applied. Thinning, gap filling, and weeding were performed to ensure optimal plant growth. Irrigation was provided twice, during the flowering and pod-filling stages.

**Results and discussions**

**Plant height**

Plant height of rapeseed gradually increased up to 60 DAS thereafter a slower rate of increase was recorded up to harvest. Delay in sowing caused a significant reduction in plant height. The fall of temperature with delayed sowing causes early, and delayed inflorescence which affect the growth of plant. Significant variation was observed on the plant height of Rapeseed at 30, 45, 60 DAS to varied sowing time and planting geometry. Result from the experiment observed that the tallest plant (43.13, 91.93, 107.4 cm at 30, 45, 60 DAS) was achieved from the $T_1$ ($S_1G_1$). On the otherhand, the shortest plant (27.27, 80.46, 95.6 cm and 33.80, 82.13, 98.6 at 30,45, 60 DAS respectively) was observed from $T_{10}$ (control) followed by $T_9$ ($S_3G_3$). The result of our investigation also coincided with the findings of Bhuiyan *et al.* (2008) who reported that significantly higher plant height under 10th November sowing (115 cm) as compared to 30th October (105 cm), 20th November (104 cm), 20th October (100 cm), 30th November sowings. Gogoi *et al.* (2017) also found that plant height decreased with delay in sowing date. Raghuvansi *et al.* (2019) reported that significantly greater plant height (cm) was recorded with planting geometry of 30 cm × 10 cm. The results agreed with the findings of Lakra *et al.* (2018) and Gawariya *et al.* (2015).

**Number of Leaves plant$^{-1}$:**

There was a gradual increase of leaves plant$^{-1}$ of rapeseed observed up to 60 DAS. Sowing time and geometry showed significant variation on leaves plant$^{-1}$ in the whole growing period. The highest leaves plant$^{-1}$ (18.73, 26.66, 33.13 at 30, 45, 60 DAS, respectively) was recorded from the $T_1$ ($S_1G_1$) and the lowest leaves plant$^{-1}$ (11.33, 21.13, 28.2 and 10, 20, 27.13 at 30, 45, 60 DAS, respectively) was recorded from the treatments $T_{10}$ followed by $T_9$ ($S_3G_3$). The result of the experiment coincided with the findings of Alam *et al.* (2015) who reported that number of leaves plant$^{-1}$ showed significant influence due to different sowing times. Ahamed *et al.* (2019) revealed that the maximum number of leaves plant-1, branches plant$^{-1}$, dry matter weight plant$^{-1}$, siliqua plant$^{-1}$ and seed silliqua$^{-1}$ were recorded from the treatment line to line space 30 cm

**Number of branches plant$^{-1}$:**

ISBN Number: 978-93-95305-10-5

Primary and secondary branches plant$^{-1}$ of rapeseed was gradually increased up to harvest. Sowing time and planting geometry had significant effect on total number of branches plant$^{-1}$ in the whole growth period. The results of the experiment revealed that, the maximum number of branches plant$^{-1}$ (3.8, 5.26, 7.4 at 30, 45, 60 DAS, respectively) was observed in $T_1$ ($S_1G_1$) and the minimum ones (2.6, 3.73, 5.6 and 2.8, 4, 5.8 at 30, 45, 60 DAS, respectively) was observed in $T_{10}$ (control), followed by $T_9$ ($S_3G_3$). The findings of the experiment were similar with the findings of Lakra *et al.* (2018) who reported that sowing on 27th October recorded significantly higher number of branches, seeds per siliquae, siliquae per plant, 1000 seed weight, and seed yield than that on 07th November, 17th November and 27th November. $S_1$= Sowing on 25th October, $S_2$= Sowing on 10th November and $S_3$= Sowing on 30th November. Similar trend was observed by Lakra *et al.* (2018) who revealed that number of branches plant$^{-1}$ significantly higher on the planting geometry 30 × 10 cm. Mottalebipour and Bahrani (2006) found the similar result and they reported that increasing row spacing significantly increased the values of almost all yield attributes but it had no significant effect on number of branches plant$^{-1}$.

**Dry weight plant (g):**

Dry matter is the constant dry weight of a plant. It is one of the important parameters which determine the partitioning of the photosynthates of a plant during grain filling stage. There was a gradual increase of dry mater weight plant$^{-1}$ was observed from 30 DAS up to 60 DAS. Dry matter weight plant$^{-1}$ of Rapeseed significantly varied due to varied sowing time. Data revealed that, the maximum dry matter weight plant$^{-1}$ (5.1, 15, 23.1 g at 30, 45, 60 DAS, respectively) was scored by $T_1$ ($S_1G_1$) and the minimum one (3.88, 8.3, 19.1 g at 30, 45, 60 DAS, respectively) was scored by $T_{10}$ (control), followed by $T_8$ (S3G2). Similar results were observed by Singh *et al.* (2016) who reported that dry matter accumulation (g plant$^{-1}$) increased significantly under 25th October sowing. Sharif *et al.* (2016) revealed that the maximum total dry matter, leaf area index was obtained from the first sowing (30 November) with BINA Sharisha-5. Tripathi *et al.* (2021) revealed the similar trends of result. They revealed that varieties (10 November and Varuna) superior compare to rest of treatment. However, highest growth attributes (plant height, dry matter accumulation, Days taken to 50% flowering, number of tillers, LAI and yield and yield attributes (No. of siliqua per plant, length of siliqua (cm), test weight, seed yield (q ha$^{-1}$) grain yield, stover yield, biological yield, and harvest index) was recorded under 10 November and Varuna variety. The result of the investigation was also in coincidence with the findings of Gawariya *et al.* (2015) who reported that crop geometry of 30 × 20 cm recorded significantly higher seed yield with better utilization of space, nutrients, water and sunshine resulting in higher dry matter

ISBN Number: 978-93-95305-10-5
translocation to yield components as compared to 60 × 15, 45 × 15, 45 × 20, 45 × 25 and 30 × 25 cm crop geometry.

**Seed yield (kg ha$^{-1}$)**

Sowing time and planting geometry exerted significant variation on the seed yield. The $S_1$ sowing date produced the best results. Yield decreased as the time of sowing progressed to later dates. It showed that the right date of sowing is very important. The result of the investigation expressed that the higher seed yield (792.67 kg ha$^{-1}$) was recorded from $T_1$ ($S_1G_1$) whereas the lower one (477.3 kg ha$^{-1}$) was from $T_{10}$ (control) followed by $T_9$ ($S_3G_3$). The $S_1$ sowing date and $G_1$ geometry consistently brings the best results. Similar result was also observed by Lakra *et al.* (2018) who reported that seed yield decreased progressively with delay in planting. Sowing on 27th October was recorded significantly higher number of branches, seeds per siliquae, siliquae per plant, 1000 seed weight, and seed yield than that on 07th November, 17th November and 27th November. Shah and Rahman (2009) revealed that the seed yield was found remarkably higher with 25th September (3.6 tha$^{-1}$) sowing as compared to 5th October (2.8 t ha$^{-1}$), 15th October (2.3 t ha$^{-1}$), 15thSeptember (1.7 t ha$^{-1}$), 25th October (1.3 t ha$^{-1}$), 5th November (1.06 t ha$^{-1}$) and 15thNovember (0.5 t ha$^{-1}$) sowings. Sattar *et al.* (2013) also revealed that seed yield, protein and oil contents of all cultivars were decreased due to delayed sowing. Cultivar Zafar-2000 produced the maximum seed yield, protein and oil contents when planted earlier (15th October). It can be concluded that cultivar Zafar-2000 should be sown 15th October for attaining the maximum seed yield and oil contents under the sub-tropical climate of Pakistan. Ranabhat *et al.* (2021) also found the similar trends of result. They observed that in case of sowing dates, higher seed yield was obtained in October 4 sown crop (15.93 q ha$^{-1}$) followed by October 24 (7.47 q ha$^{-1}$) and November 14 (2.29 q ha$^{-1}$). The higher seed yield obtained in early sowing is due to shorter vegetative and longer reproductive phase. The comparison of mean values of the seed yield for interaction between variety and sowing date showed that variety Surkhet Local sown in October 4 plant had the highest seed yield (16.33 q ha$^{-1}$) followed by variety Unnati on same sowing date (15.54 q ha$^{-1}$).

Planting geometry influenced significant variation on the seed yield of rapeseed. The $G_1$ planting geometry was found to be the best geometry with the highest biological yield. $G_3$ geometry performed the worst. Similar trends of the finding was also observed by Gawariya *et al.* (2015) who reported that crop geometry of 30 × 20 cm recorded significantly higher seed yield (1.8 t ha$^{-1}$) with better utilization of space, nutrients, water and sunshine resulting in higher dry matter translocation to yield components as compared to 60 × 15, 45 × 15, 45 × 20, 45 × 25 and 30 × 25 cm crop geometry. Lakra *et al.* (2018) revealed that planting geometry of 30 × 10 cm was found to be suitable for the Indian mustard

ISBN Number: 978-93-95305-10-5

production. Faraji (2004) observed that a decrease in row spacing resulted in the increase in number of siliqua plant$^{-1}$, number of seed siliqua$^{-1}$ and seed yield. Row spacing at 12 cm and the sowing rate of 6 kg seed ha$^{-1}$ produced the highest seed yield of 5044 kg ha$^{-1}$. Venkaraddi (2008) found the similar results and he reported that mustard seed yield (1326 kg ha$^{-1}$), oil yield (570.03 kg ha$^{-1}$), net returns (23107 Rs. ha$^{-1}$) and B:C ratio (3.12) were higher with variety Pusa Agram sown during II fortnight of September at 30 cm row spacing.

## Conclusion

It may be concluded that among the sowing times, the first week of November was the most optimum for sowing rapeseed, producing significantly superior yield and yield attributes compared to the second and third weeks of November. Among the planting geometries, 35×10 cm was identified as the most effective spacing for achieving better growth and yield. Wider spacing resulted in reduced growth and yield, emphasizing the importance of maintaining optimal planting geometry for maximizing rapeseed productivity.

## Acknowledgement

I extend my heartfelt gratitude to my supervisors, faculty and staffs at Himalayan University, Itanagar, for their continuous guidance and support. My sincere appreciation goes to my family for their unwavering encouragement throughout this research.

## Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

## Source of Funding

This research was fully funded by the author without any external financial support.

## References

- Alam, M. J., Ahmed, K. S., Mollah, M. R. A., & Tareq, M. Z. (2014). Effect of Sowing Date and Plant Density on Rapeseed Yield. *Journal of Agricultural Science*, 6(3), 234–245.
- Diepenbrock, W. (2000). Yield Analysis of Winter Oilseed Rape (*Brassica napus* L.): A Review. *Field Crops Research*, 67(1), 35–49.
- FAO (Food and Agriculture Organization) (2019). *FAO Production Yearbook*. Food and Agricultural Organization of the United Nations.

- Gogoi.A, Barbora A.C., Kakoti R.K., Bhattacharya D., Dutta S., Medhi B. and Saikia, J. 2018. Effect of Integrated Nutrient Management on Growth, Yield, Quality and Nutrient Content of Khasi Mandarin (Citrus reticulata) in Acidic Soil of Assam, India. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 1675-1680.
- Gawariya, S. C., Chopra, N. K., Chopra, N. and Harika, A. S. (2015). Effect of date of sowing and crop geometry on growth and yield parameters of forage mustard (var. *Chinese Cabbage*). *African J. Agril. Res.,* 10(33): 3292-3295.
- Kumari, M., Verma, S., & Singh, R. K. (2012). Impact of Sowing Time on Rapeseed Yield. *Agricultural Research Journal*, 4(2), 123–129.
- Lakra, R., Singh, H. K., & Sharma, P. (2018). Planting Geometry and Its Impact on Yield Attributes. *Journal of Oilseed Research*, 35(2), 87–94.
- Myers, R. H. (1995). The Benefits of Rapeseed and Mustard in Edible Oils and Feeds. *Journal of Oilseed Crops*, 23(1), 15–20.
- Panwar, R., Singh, P., & Meena, S. R. (2000). Influence of Sowing Date on Mustard Yield. *Indian Journal of Agronomy*, 45(4), 789–792.
- Singh, R., Kumar, S., & Gupta, P. K. (2002). Role of Sowing Date on Mustard Growth. *Indian Oilseeds Journal*, 12(2), 56–60.
- Sattar, A., Mumtaz, A., Cheema, Wahid, M. A., Saleem, F. M., Ghaffari, M. A., Hussain, S. and Arshad, M. S. (2013). Effect of sowing time on seed yield and oil contents of canola varieties. *J. Glob. Innov. Agric. Soc. Sci.,* 1(1): 1-4.

ISBN Number: 978-93-95305-10-5

| Plant height (cm) | | Number of leaves plant$^{-1}$ | | | Number of branchesplant$^{-1}$ | | | Dry weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 45 DAS | 60 DAS | 30 DAS | 45 DAS | 60 DAS | 30 DAS | 45 DAS | 60 DAS | 30 DAS | 45 DAS | 60 DAS |
| 91.93 | 107.4 | 18.73 | 26.6 | 33.1 | 3.8 | 5.2 | 7.4 | 4.9 | 14.9 | 23.1 |
| 90 | 106.2 | 17.87 | 25.6 | 32.7 | 3.4 | 5.1 | 7.1 | 4.6 | 13.2 | 22.1 |
| 89.73 | 105.3 | 17.27 | 25.6 | 32.4 | 3.4 | 5 | 7.2 | 4.7 | 13.1 | 21.7 |
| 89 | 103.2 | 16.73 | 25 | 30.8 | 3.2 | 4.73 | 6.8 | 4.4 | 12.9 | 21.7 |
| 87.66 | 102.3 | 16 | 24.13 | 30.3 | 2.9 | 4.06 | 6.4 | 4.4 | 11.9 | 20.6 |
| 87.4 | 102 | 14.53 | 24.06 | 30.1 | 2.9 | 4.06 | 6.3 | 4.3 | 11.1 | 20.7 |
| 86 | 107.7 | 13.40 | 23.6 | 29.6 | 2.7 | 4.13 | 6.2 | 4.2 | 10.1 | 20.5 |
| 84.6 | 99.9 | 12.33 | 21.6 | 28.5 | 2.4 | 4.13 | 5.8 | 4 | 9.8 | 20.2 |
| 82.13 | 98.6 | 11.33 | 21.1 | 28.2 | 2.8 | 4 | 5.8 | 4 | 8.9 | 19.9 |
| 80.46 | 95.6 | 10 | 20 | 27.1 | 2.6 | 3.73 | 5.6 | 3.8 | 8.3 | 19.1 |
| 0.40 | 0.21 | 0.23 | 0.14 | 0.17 | 0.07 | 0.72 | 0.10 | 0.08 | 0.073 | 0.37 |
| 0.85 | 0.45 | 0.48 | 0.31 | 0.37 | 0.16 | 0.15 | 0.21 | 0.17 | 0.15 | 0.78 |

ISBN Number: 978-93-95305-10-5

| **Treatments** | 30 DAS |
|---|---|
| T1 | 43.13 |
| T2 | 41.80 |
| T3 | 40.93 |
| T4 | 40.20 |
| T5 | 40 |
| T6 | 39.40 |
| T7 | 37.93 |
| T8 | 36.27 |
| T9 | 33.80 |
| T10 | 27.27 |
| SEd (±) | 0.36 |
| CD (P = | 0.76 |

**Table 1. Growth parameters of rapeseed as influenced by different treatments**

**Table 2. Yield parameters of rapeseed as influenced by different treatments**

| **Seed yield ($kg\ ha^{-1}$)** |
|---|
| **792.67** |
| **743** |
| **728** |
| **699.3** |
| **676.3** |
| **625** |
| **593.3** |
| **580.6** |
| **526.6** |
| **477.3** |
| **7.08** |
| **14.8** |