



# International Journal of Research in Agronomy

E-ISSN: 2618-0618  
P-ISSN: 2618-060X  
© Agronomy  
NAAS Rating (2026): 5.20  
[www.agronomyjournals.com](http://www.agronomyjournals.com)  
2026; SP-9(4): 37-40  
Received: 21-01-2026  
Accepted: 25-02-2026

**Krishna Ambhure**  
Subject Matter Specialist, SSM's  
Krishi Vigyan Kendra, Sagroli,  
Nanded, Maharashtra, India

**Prabhudas Udtewar**  
Young Professional, II Special  
Project on Cotton, Krishi Vigyan  
Kendra, Sagroli, Nanded,  
Maharashtra, India

**Balaji Chandapure**  
Young Professional, I Special  
Project on Cotton, Krishi Vigyan  
Kendra, Sagroli, Nanded,  
Maharashtra, India

**Corresponding Author:**  
**Krishna Ambhure**  
Subject Matter Specialist, SSM's  
Krishi Vigyan Kendra, Sagroli,  
Nanded, Maharashtra, India

## Comparative analysis of closer spacing and traditional method of cotton cultivation in Nanded district, Maharashtra

**Krishna Ambhure, Prabhudas Udtewar and Balaji Chandapure**

**DOI:** <https://www.doi.org/10.33545/2618060X.2026.v9.i4Sa.5339>

### Abstract

Cotton (*Gossypium hirsutum* L.) productivity in India remains lower than the global average despite occupying the largest cultivated area. Adoption of High Density Planting System (HDPS) or closer spacing has been promoted to enhance yield per unit area. The present study evaluated the comparative performance of Closer Spacing (CS: 90 × 30 cm) and Traditional Method (TM: 120 × 45 cm) of cotton cultivation in Nanded district of Maharashtra by Sanskriti Samvardhan Mandal's Krishi Vigyan Kendra, Sagroli Dist. Nanded during Kharif 2024–25 under the NFSM-supported project in collaboration with ICAR-Central Institute for Cotton Research. Twenty-five on-farm observations were analyzed for growth attributes, pink bollworm (PBW) incidence, and seed cotton yield. Results indicated that TM recorded significantly higher plant height (167.5 cm) and bolls per plant (26.53) compared to CS (124.1 cm and 20.83, respectively). However, CS produced higher boll density per square meter (74.56 vs. 47.49), greater boll weight (4.21 g vs. 3.36 g), and lower PBW damage (3.58% vs. 4.66%). The average seed cotton yield under CS (12.42 q acre<sup>-1</sup>) was 63% higher than TM (7.62 q acre<sup>-1</sup>). The findings demonstrate that closer spacing enhances productivity through increased plant population and optimized canopy architecture, making it a viable strategy for improving cotton productivity under rainfed conditions of Maharashtra.

**Keywords:** High density planting system, plant geometry, seed cotton yield, pink bollworm, Mepiquat chloride, Maharashtra

### Introduction

Cotton (*Gossypium hirsutum* L.) is an economically important fibre and cash crop cultivated in more than fifty countries worldwide. In India, cotton constitutes a major component of the agricultural sector and textile industry, contributing approximately 60% of the total fibre production. India is the largest cotton-producing country, with an area of 13.4 million hectares and an annual production of 36.2 million bales; however, the national average productivity is only 510 kg ha<sup>-1</sup>, which is considerably lower than the global average of 778 kg ha<sup>-1</sup>. Maharashtra, one of the leading cotton-producing states in India, exhibits similar yield constraints. During the 2023–24 cropping season, the area under cotton cultivation in Maharashtra was 42.22 lakhs ha. of which 1.17 lakhs ha were located in Nanded district (Government of Maharashtra, 2024) [10].

The low productivity of cotton in India is primarily attributed to rainfed cultivation, intense weed competition, declining soil fertility, continuous monocropping, pest and disease incidence, and suboptimal fertilizer management. To overcome these limitations, improved agronomic interventions such as closer spacing (CS) have been introduced to enhance crop productivity. Closer spacing increases plant population density, thereby improving yield potential. Plant geometry plays a critical role in determining cotton productivity by influencing light interception, canopy architecture, air circulation, and competition for nutrients and moisture.

Conventionally, cotton is planted at a spacing of 120 × 45 cm however, recent agronomic research indicates that closer spacing of 90 × 30 cm can significantly enhance plant population and seed cotton yield. Several cotton-producing countries, including Brazil, China, and Australia, have successfully adopted CS systems, achieving seed cotton yields ranging from 15 to 20 q ha<sup>-1</sup>. Successful implementation of CS requires early-maturing, compact plant types and

efficient canopy management, often supplemented by the application of plant growth regulators such as mepiquat chloride. Closer spacing has been reported to improve water-use efficiency, suppress weed growth, reduce labour requirements, and enhance economic returns. Additionally, CS cotton facilitates partial escape from pink bollworm infestation due to shortened crop duration and permits the cultivation of a subsequent crop after cotton harvest within the same season. Therefore, closer spacing represents a promising agronomic strategy for improving cotton productivity and sustainability under Indian agro-climatic conditions.

### Research Methodology

The study aimed to evaluate the performance of the Closer spacing (CS) system compared to traditional method of cultivation in Nanded district. A descriptive research design was used to analyse the factors influencing cotton production. Data collection was carried out using a structured interview schedule, with 25 farmers purposively selected from three villages lalwandi and Manjram from Naigaon cluster and bavalgaon from Biloli cluster of Nanded district. These farmers were chosen based on their involvement in either CS and traditional cotton cultivation, ensuring a representative sample. The data were analysed using frequency and percentage analysis to understand the adoption levels, benefits, and challenges of CS in enhancing cotton productivity.

### Treatments:

- T<sub>1</sub>: Traditional Method (120 x 45 cm)
- T<sub>2</sub>: Closer Spacing (90 x 30 cm)

### Parameters Recorded:

- Plant height (cm)
- Number of bolls per plant
- Boll weight (g)
- Seed cotton yield (kg/ha)

### Canopy management

#### Monopodia cutting – 45 DAS

Monopodia removal in cotton is the process of pruning unproductive vegetative branches (monopodia) to enhance growth and yield. This involves cutting off the monopodia at around 40-45 days after sowing to redirect the plant's energy toward fruiting branches (sympodial). This practice helps manage the plant's growth, ensuring better light penetration, better boll retention and air circulation, which can lead to higher productivity and improved quality.

#### Detopping – 90 DAS

De-topping, also known as topping, is a practice in cotton cultivation where the terminal top portion of plant growth is removed after attaining targeted sympodial branch number and crop age/stage. De-topping helps in preventing apical dominance, vegetative growth and promote the development of fruiting branches. The primary goals are to improve the plant's structure, enhance air circulation, and increase sunlight penetration, which can lead to better boll setting and higher yields. Typically, de-topping is performed in cotton plant when it attains a height of 120 cm (4 feet) and top 10 to 15 cm terminal growing part is removed with sharp scissors or garden secateurs to ensure the best outcomes for cotton production. Depending on season, crop age for de-topping in general is around 90 days after good boll set on plants.

## Results and Discussion

The experimental data revealed clear and consistent differences between the two treatments (CS and TM) across all measured growth, yield attributes, and productivity parameters of cotton.

### 1. Growth Parameters

The mean plant height under TM (167.54 cm) was substantially higher than CS (123.97 cm), indicating a significant enhancement in vegetative growth. Increased plant height under TM suggests improved early vigor, possibly due to better nutrient mobilization or physiological stimulation.

Similar enhancement in plant height under improved management or treatment practices has been reported in cotton by several researchers, who attributed increased vegetative growth to enhanced nutrient uptake efficiency, improved root proliferation, and better hormonal balance.

However, increased plant height alone does not necessarily guarantee higher yield, as excessive vegetative growth may lead to competition for assimilates between vegetative and reproductive sinks.

### 2. Yield Attributes

#### A. Number of Bolls per Plant

TM recorded a higher mean number of bolls per plant (26.54) compared to CS (20.82), representing a substantial increase in reproductive sites. Enhanced boll formation suggests better flowering retention and reduced abscission under TM. (Hemalatha *et al.* 2024) <sup>[3]</sup> also found that treatments enhancing nutrient efficiency, maintaining hormonal balance, and improving stress tolerance in cotton significantly increased the boll retention percentage, which ultimately resulted in a higher number of bolls per plant and improved yield performance. The findings of (Zhi *et al.* 2016) <sup>[9]</sup> indicated that increasing plant density significantly improved boll density.

#### B. Number of Bolls per Square Meter

Similarly, TM recorded 47.51 bolls m<sup>-2</sup>, while CS recorded 74.52 bolls m<sup>-2</sup>. (Note: Based on the dataset structure, CS showed higher boll density per square meter.) Higher boll density per unit area is often a critical determinant of yield, particularly when plant population is uniform. (Prasad *et al.* 2023) <sup>[5]</sup> also found that the objective of enhancing plant density and improving yield potential can be achieved through the adoption of closer spacing in cotton cultivation. In the closer spacing system, a spacing of 90 × 30 cm is maintained, which is considerably narrower than the traditional cotton spacing of 120 × 45 cm, thereby enabling higher plant population and better utilization of available resources. (Rossi *et al.* 2004) <sup>[8]</sup> reported that increasing plant density is one of the strategies to improve cotton yield and enhance net profitability.

#### C. Boll Weight

A contrasting trend was observed in boll weight. CS recorded higher mean boll weight (4.21 g) compared to TM (3.35 g). This indicates that although TM produced more bolls per plant, the individual boll mass was reduced. (Dilip Monga, 2025) <sup>[2]</sup> also observed that closer spacing plant sowing method shown increased boll weight compared to traditional method.

This inverse relationship between boll number and boll weight has been widely documented in cotton research. Increased sink number (more bolls) may reduce assimilate availability per boll, leading to smaller boll size. Source-sink competition is a common physiological explanation for such trends.

### 3. Pink Bollworm (PBW%)

The Traditional Method (TM) recorded a higher Pink Bollworm (PBW) infestation of 4.67%, whereas the Closer Spacing (CS) method showed a comparatively lower infestation level of 3.57%, indicating relatively reduced PBW incidence under the closer spacing system. (Rajasekhar *et al.* 2025) [4] also reported similar findings.

### 4. Seed Cotton Yield

Despite TM showing superior vegetative growth and higher boll number per plant, the final seed cotton yield was significantly higher under CS (12.43 qtl/acre) compared to TM (7.61 qtl/acre). (Naresh *et al.* 2025) [1] founds that Dense plant population increased the cotton yield. (Paslawar *et al.* 2015 and Parlawar *et al.* 2017) [7, 6] also reported that higher seed cotton yields were obtained under closer planting geometry, indicating that increased plant population per unit area can significantly enhance overall cotton productivity.

#### This indicates that

- Boll weight had a stronger influence on final yield than boll

number.

- Higher boll density per unit area under CS likely contributed to greater cumulative yield.
- TM may have induced excessive vegetative growth, leading to reduced partitioning efficiency toward reproductive organs.

Similar findings have been reported in cotton where treatments enhancing vegetative growth did not necessarily translate into yield advantage due to poor assimilate partitioning, increased shedding, or smaller boll size.

#### The data suggest a classical physiological trade-off:

- TM enhanced vegetative growth and increased reproductive structures (bolls per plant).
- CS maintained better boll size and higher boll density per area.
- Final yield was more closely associated with boll weight and effective boll density rather than plant height or boll number alone.

**Table 1:** Comparison between Closer Spacing and Traditional Method of sowing

| Package and practice                        | CS Method          | Traditional Method        |
|---------------------------------------------|--------------------|---------------------------|
| Soil type                                   | Medium             | Black/Heavy               |
| Rainfed/ irrigated                          | Rainfed            | Rainfed                   |
| Seed rate (Packets/acre)                    | 4                  | 2                         |
| Plant Population                            | 14400              | 8000-10000                |
| Date of sowing                              | June End           | June End                  |
| Spacing (cm)                                | 90 x 30 cm         | 120 x 45 cm / 105 X 45 cm |
| Plants per meter row length                 | 3                  | 1                         |
| Sowing method adopted                       | Manual             | Manual                    |
| Spraying of PGR (Mepiquat Chloride)         | Yes                | No                        |
| Avg. No. Of monopodial branches             | 1-2                | 1-2                       |
| Avg. No. Of sympodial branches              | 8-10               | 10-12                     |
| Major insect pests noticed above ETL        | Aphids, Whiteflies | Pink bollworm             |
| Number of pickings                          | 2                  | 3-4                       |
| Crop duration                               | 150 days           | 180 days                  |
| Possibility of Second Crop                  | Yes                | No                        |
| Growth habit                                | Compact, erect     | Spreading                 |
| Average boll weight (g boll <sup>-1</sup> ) | Higher             | Lower                     |
| Yield potential                             | Higher             | Lower                     |

**Table 2:** Comparative Performance of Cotton Crop under Closer spacing and Traditional methods Treatments for Growth, Yield Attributes, and Productivity

| No. of farmer | Plant Height (cm) |       | No. of bolls (Per plant) |       | No. of bolls (per sq mt) |       | Boll weight (gm) |      | PBW (%) |     | Yield (qtl/acre) |     |
|---------------|-------------------|-------|--------------------------|-------|--------------------------|-------|------------------|------|---------|-----|------------------|-----|
|               | CS                | TM    | CS                       | TM    | CS                       | TM    | CS               | TM   | CS      | TM  | CS               | TM  |
| 1             | 121.7             | 159.0 | 19.00                    | 24.67 | 68.02                    | 44.15 | 4.2              | 3.2  | 3.5     | 5.5 | 11.5             | 6.5 |
| 2             | 128.0             | 166.0 | 19.67                    | 26.67 | 70.41                    | 47.73 | 4.3              | 3.5  | 4       | 4.5 | 12               | 8   |
| 3             | 114.3             | 162.3 | 22.00                    | 24.67 | 78.76                    | 44.15 | 4.2              | 3.3  | 4       | 3.5 | 12               | 7   |
| 4             | 115.0             | 170.0 | 20.67                    | 26.67 | 73.99                    | 47.73 | 4.4              | 3.4  | 4.5     | 4.5 | 13               | 8   |
| 5             | 123.3             | 167.7 | 19.67                    | 24.67 | 70.41                    | 44.15 | 4.1              | 3.2  | 4       | 5.5 | 11               | 6   |
| 6             | 127.0             | 160.3 | 20.33                    | 25.67 | 72.79                    | 45.94 | 4.2              | 3.2  | 3.5     | 4   | 12               | 7   |
| 7             | 125.0             | 159.0 | 21.33                    | 27.33 | 76.37                    | 48.93 | 4.1              | 3.3  | 3.5     | 4   | 12               | 8   |
| 8             | 125.0             | 167.7 | 20.67                    | 25.67 | 73.99                    | 45.94 | 4                | 3    | 3       | 3.5 | 11               | 6   |
| 9             | 112.3             | 167.0 | 21.00                    | 28.33 | 75.18                    | 50.72 | 4.1              | 3.5  | 3       | 4.5 | 12               | 8   |
| 10            | 127.0             | 167.0 | 20.00                    | 28.00 | 71.60                    | 50.12 | 4.1              | 3.45 | 4       | 5.5 | 12               | 9   |
| 11            | 124.7             | 170.3 | 20.33                    | 25.67 | 72.79                    | 45.94 | 4.2              | 3.3  | 3       | 4   | 12               | 7   |
| 12            | 126.3             | 169.7 | 21.33                    | 27.00 | 76.37                    | 48.33 | 4.2              | 3.4  | 3       | 6   | 13               | 8   |
| 13            | 121.3             | 161.3 | 21.67                    | 27.67 | 77.57                    | 49.52 | 4.2              | 3.5  | 4.5     | 4   | 13.5             | 9   |
| 14            | 117.7             | 171.3 | 21.67                    | 27.33 | 77.57                    | 48.93 | 4.4              | 3.4  | 4       | 4.5 | 14               | 8   |
| 15            | 132.3             | 174.3 | 22.33                    | 27.67 | 79.95                    | 49.52 | 4.4              | 3.5  | 2.5     | 4   | 14               | 9   |
| 16            | 123.7             | 167.0 | 21.67                    | 25.67 | 77.57                    | 45.94 | 4.1              | 3.3  | 4       | 4   | 12               | 7   |
| 17            | 131.7             | 171.3 | 21.00                    | 26.33 | 75.18                    | 47.14 | 4.1              | 3.5  | 3.5     | 6   | 12               | 8   |

|         |       |       |       |       |       |       |      |      |      |      |       |      |
|---------|-------|-------|-------|-------|-------|-------|------|------|------|------|-------|------|
| 18      | 125.3 | 166.7 | 20.67 | 25.33 | 73.99 | 45.35 | 4.1  | 3.3  | 4.5  | 4.5  | 12    | 7    |
| 19      | 124.7 | 174.0 | 20.33 | 27.67 | 72.79 | 49.52 | 4.4  | 3.4  | 2.5  | 4    | 13.5  | 8    |
| 20      | 124.3 | 171.7 | 21.67 | 26.33 | 77.57 | 47.14 | 4.2  | 3.5  | 3    | 4.5  | 13    | 8    |
| 21      | 124.3 | 168.7 | 20.67 | 26.67 | 73.99 | 47.73 | 4.2  | 3.25 | 4.5  | 6    | 12    | 7    |
| 22      | 132.7 | 167.0 | 19.33 | 28.67 | 69.21 | 51.31 | 4.15 | 3.5  | 3    | 5    | 12    | 8    |
| 23      | 123.0 | 176.7 | 20.67 | 25.33 | 73.99 | 45.35 | 4.2  | 3.35 | 3.5  | 3.5  | 12    | 7    |
| 24      | 125.7 | 168.3 | 21.67 | 28.33 | 77.57 | 50.72 | 4.35 | 3.4  | 4    | 5.5  | 14    | 9    |
| 25      | 125.7 | 163.7 | 21.33 | 25.33 | 76.37 | 45.35 | 4.3  | 3.3  | 3    | 6    | 13    | 7    |
| Max     | 132.7 | 176.7 | 22.33 | 28.67 | 79.95 | 51.31 | 4.4  | 3.5  | 4.5  | 6    | 14    | 9    |
| Min     | 112.3 | 159.0 | 19.00 | 24.67 | 68.02 | 44.15 | 4    | 3    | 2.5  | 3.5  | 11    | 6    |
| Average | 124.1 | 167.5 | 20.83 | 26.53 | 74.56 | 47.49 | 4.21 | 3.36 | 3.58 | 4.66 | 12.42 | 7.62 |

**Table 3:** Yield Comparison between Closer Spacing and Traditional Method of sowing

| Particulars                   | CS Method | Traditional Method |
|-------------------------------|-----------|--------------------|
| Avg. Plant Height (cm)        | 124.1     | 167.5              |
| Avg. No. of bolls (Per plant) | 20.83     | 26.53              |
| Avg. No. of bolls (per sq mt) | 74.56     | 47.49              |
| Avg. Boll weight (gm)         | 4.21      | 3.36               |
| Avg. PBW Damage (%)           | 3.58      | 4.66               |
| Avg. Yield/acre (Qtl)         | 12.42     | 7.62               |

### Conclusion

The findings suggest that CS cotton offers significant potential for improving cotton productivity in India, particularly in Maharashtra. While CS cotton requires higher seed rates and closer spacing, it provides benefits such as higher plant density, faster maturity, reduced pink bollworm incidence, and the possibility of a second crop. However, the increased pest pressure from Jassids, aphids, and whiteflies may require more intensive pest management strategies. Traditional method of cultivation offers more branches and multiple pickings but is more vulnerable to bollworm infestations and requires longer crop durations. Ultimately, the decision to adopt CS or traditional method depends on farmers specific goals, such as optimizing yield potential, reducing pest risks, and enabling the possibility of a second crop.

- TM significantly improved vegetative growth and increased boll numbers.
- CS produced heavier bolls and higher overall yield.
- Yield advantage under CS was primarily due to better boll weight and effective boll density.
- Physiological balance rather than absolute growth enhancement determined final productivity.

### References

1. Naresh D, Adarsh D, Santhosh G. Performance of high-density planting system and closer spacing systems in cotton (*Gossypium hirsutum* L.) under Suryapet District. International Journal of Research in Agronomy. 2025;8(5):692-694.
2. Monga D. Cotton crop high density planting system in India - in retrospect and prospects. 2025 Apr 29;(5).
3. Hemalatha G, Nagabhushanam U, Veeranna G, Ramulu C. Performance of cotton under different spacings and fertilizer levels on growth, yield, nutrient uptake and economics in high density planting system. International Journal of Research in Agronomy. 2024;7(9S):860-866.
4. Rajasekhar N, Atchuta Raju K, Lakshmikala K, Siva Prasad PN, Jaswanth Reddy T, Venkata Reddy I, *et al.* Impact of closer spacing on sucking pests and pink bollworm infestation in cotton crop. Journal of Experimental Agriculture International. 2025;47(7):343-348.
5. Prasad YG, Venugopalan MV, Ramakrushna GI, Pande R,

Nagrale DT. High density planting system for cotton. CICR Technical Bulletin. 2023;(2):1-8.

6. Parlawar ND, Jiotode DJ, Khawle VS, Kubde KJ, Puri PD. Effect of planting geometry and varieties on morphophysiological parameters and yield of cotton. International Journal of Recent Biotechnology and Advanced Technology. 2017;5(2):429-436.
7. Paslawar AN, Deotalu AS, Nemade PW. High density planting of cotton variety AKH-081 under rainfed condition of Vidarbha. Plant Archives. 2015;15(2):1075-1077.
8. Rossi J, Novick G, Murray J, Landivar J, Zhang S, Baxevanos D, *et al.* Ultra narrow row cotton: global perspective. In: Proceedings of the Technical Seminar of the 63rd Plenary Meeting of the ICAC: How to Improve Yields and Reduce Pesticide Use; 2004 Nov 28; Mumbai, India.
9. Zhi X, Han YC, Li YB, Wang GP, Du WL, Li XX, *et al.* Effects of plant density on cotton yield components and quality. Journal of Integrative Agriculture. 2016;15:1469-1479.
10. Maharashtra Department of Agriculture. <https://krishi.maharashtra.gov.in>