# Performance of cotton (*Gossipiumhirsutum* L.) varieties under high density planting system in alfisols of Telangana


## ABSTRACT

**Aims:** Cotton productivity is lower in India than the global average due toinadequate soil moisture during boll formation stage due to cessation of south west monsoon. Cotton is mainly grown under rainfed conditions in marginal and shallow soils, cultivating short duration cotton varieties with high density could improve productivity in the rainfed regions. So this experiment is being proposed to evaluate the three cotton varieties and a hybrid under four high density spacings.

**Study design:**The experiment was laid out in split plot design and replicated thrice.

**Place and Duration of Study:**The field experiment was conducted for three years during Kharif 2014, 2015 and 2016 at Regional Agricultural Research Station, Palem, Nagarkurnool District of Telangana state, India.The experimental site was located at 16.51703° North latitude and 78.2469° East longitude and an altitude of 478 m above mean sea level.

**Methodology:**Treatments consisted of 4 spacings (45×10 cm, 60×10 cm, 75×10 cm and 90×10 cm) under main plots and 3 non bt cotton varieties (Suraj, WGCV-48 and ADB-39) and 1 Bt Cotton hybrid Jadoo was included as 4$^{th}$treatment under subplots during 2015 and 2016. The soil at the site was Alfisol with low organic carbon (0.24%) and N (210 kg ha$^{-1}$), high in available P (75 kg $P_2O_5$ ha$^{-1}$) and available K (455 kg $K_2O$ ha$^{-1}$). The crop was cultivated under rainfed conditions. Intercultivation and hand weeding was done and kept weed free. Gross plot size of 9 m × 3 m was maintained for each treatment. Nitrogen dose of 40 kg N ha$^{-1}$, 20 kg $P_2O_5$ha$^{-1}$ and 20 kg $K_2O$ ha$^{-1}$was applied. The single plant data was collected on five tagged plants in each plot of each treatment and yield data was collected from the net plot area.

**Results:**Seed cotton yield was significantly influenced by the spacing and the varieties. The pooled data of 3 years revealed that cotton crop under 90×10 cm spacing (2054 kg ha$^{-1}$) recorded significantly higher seed cotton yield than the crop under 75×10 cm (1854 kg ha$^{-1}$), 60×10 cm (1723 kg ha$^{-1}$) and 45×10 cm (1603 kg ha$^{-1}$). The pooled data of 3 years revealed that the seed cotton yield in hybrid Jadoo (2189 kg ha$^{-1}$) was significantly higher than the three varieties. The seed cotton yield in all the three varieties (Suraj, WGCV-48 and ADB-39) was on par with each other during all the years under study.

**Conclusion:**High density spacing of 90×10 cm, recorded significantly higher seed cotton yield than the other tested spacing. Among the varieties and the hybrid, cotton Jadoo outperformed all the cotton varieties and seed cotton yield of cotton varieties (Suraj, WGCV-48 and ADB-39) was on par with each other.



*Keywords: Cotton, crop geometry, HDPS, spacing, varieties.*


## 1. INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is an important commercial crop in India with an area of 13.29 Mha producing 35.25 MBales of cotton during 2020-21 [1]. Due to its high market demand and the remunerative market prices, it is also called as 'White Gold'. India is the world's leading producer of cotton contributing to 30 percent of total world's cotton

production [2]. Although yields in India are well below the global average with lint productivity of 451 kgha$^{-1}$ during 2020-21. In India, Maharashtra, Telangana and Gujarat are the major states cultivating cotton and contributes to 70 percent of area and 65 percent of production in India during 2020-21 [1].

Cotton is cultivated primarily under rainfed conditions in India. In India, rainfall commences in June and recedes by end of September [3]. Boll formation in long duration cotton varieties and hybrids starts in October and reaches a peak by the end of November. Thus low or inadequate soil moisture especially in shallow soils negatively affects the boll formation and retention resulting in low yields. Hence, in view of low productivity and inadequate soil moisture conditions, cultivating short duration varieties with high density for improving productivity in the rainfed regions is an option [4]. So this experiment is being proposed to evaluate the three cotton varieties under four high density treatments.

## 2. MATERIAL AND METHODS

A field experiment was conducted for three years during *Kharif* 2014, 2015 and 2016. at Regional Agricultural Research Station, Palem, Nagarkurnool District of Telangana state--509215 (India). Treatments consisted of 4 spacings (45 × 10 cm, 60 × 10 cm, 75 × 10 cm and 90 × 10 cm) under main plots and 3 non bt cotton varieties (Suraj, WGCV-48 and ADB-39) and 1 Bt Cotton hybrid Jadoo was included as 4$^{th}$ treatment under subplots during 2015 and 2016. The experiment was laid out in split plot design and replicated thrice. The experimental site was located at 16.51703° North latitude and 78.2469° East longitude and an altitude of 478 m above mean sea level. The soil at the site was Alfisol with low organic carbon (0.24%) and N (210 kg ha$^{-1}$), high in available P (75 kg $P_2O_5$ ha$^{-1}$) and available K (455 kg $K_2O$ ha$^{-1}$). The crop was cultivated under rainfed conditions. Intercultivation with guntaka and hand weeding was done and kept weed free. Gross plot size of 9 m × 3 m was maintained for each treatment. Nitrogen dose of 40 kg N ha$^{-1}$, 20 kg $P_2O_5$ ha$^{-1}$ and 20 kg $K_2O$ ha$^{-1}$ was applied. The single plant data was collected on five tagged plants in each plot of each treatment and yield data was collected from the net plot area. The data was analysed statistically duly following the technique of analysis of variance as suggested by [5].

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## 3. RESULTS AND DISCUSSION

### 3.1 Plant height

Perusal of the data from table 1 revealed that plant height at harvest was not significantly influenced by the spacings during the three years under study. However, among the varieties the plant height was significantly different. The findings were contradictoy with the findings of [6] and [7]. During 2014, the plant height of WGCV-48 (127.5cm) was significantly higher than that of Suraj and ADB-39 varieties. During 2015, the plant height of hybrid Jadoo (121.3 cm) was significantly higher than the varieties and followed by WGV-48 (104.6cm), Suraj (101.5cm) and ADB-39 (86.4cm). Lowest plant height was recorded in ADB-39 variety. During 2016, the plant height of WGCV-48 was significantly higher than that of remaining varieties and also the hybrid Jadoo. WGCV-48 was followed by ADB-39, Jadoo and Suraj. The height of cotton hybrid Jadoo during 2016 was lesser than that of varieties was due to the low available soil moisture during crop period due to less rainfall. This showed that the hybrids are less tolerable to stresses than the varieties. The pooled data of

3 years revealed that WGCV-48 (111.5cm) recorded significantly higher plant height than that of Suraj (98.8cm) and ADB-39 (95.9cm) but on par with that of hybrid Jaddo (106.8cm). All the varieties have performed in a similar trend under tested spacings. Hence the interaction affect was found non-significant.

**Table 1: Plant height (cm) and Number of harvested bolls per plant as influenced by different spacings and varieties**

| | Plant height (cm) | | | | Number of harvested bolls per plant | | | |
|---|---|---|---|---|---|---|---|---|
| | **2014** | **2015** | **2016** | **Pooled** | **2014** | **2015** | **2016** | **Pooled** |
| **Spacing** | | | | | | | | |
| **S1-45 × 10 cm** | 111.2 | 96.5 | 88.3 | 98.7 | 7.11 | 7.23 | 8.42 | 7.59 |
| **S2-60× 10 cm** | 112.3 | 98.3 | 94.4 | 101.7 | 7.66 | 8.40 | 9.10 | 8.39 |
| **S3-75 × 10 cm** | 116.9 | 93.6 | 94.2 | 101.6 | 8.22 | 8.13 | 10.6 | 8.98 |
| **S4-90× 10 cm** | 121.6 | 102.2 | 95.1 | 106.3 | 10.8 | 8.75 | 11.1 | 10.22 |
| **S.Em±** | 5.8 | 6.4 | 3.0 | 4.8 | 0.76 | 0.21 | 0.46 | 0.28 |
| **C.D at 5%** | NS | NS | NS | NS | 2.64 | 0.64 | 1.24 | 0.91 |
| **Varieties** | | | | | | | | |
| **V1-Suraj** | 111.2 | 101.5 | 83.8 | 98.8 | 9.00 | 8.94 | 9.62 | 9.28 |
| **V2-WGCV-48** | 127.5 | 104.6 | 102.4 | 111.5 | 7.75 | 8.12 | 9.20 | 8.66 |
| **V3-ADB-39** | 107.8 | 86.4 | 93.4 | 95.9 | 8.66 | 8.33 | 10.20 | 9.27 |
| **V4-Jadoo** | - | 121.3 | 92.3 | 106.8 | - | 12.60 | 14.40 | 13.50 |
| **S.Em±** | 2.7 | 2.9 | 1.9 | 2.5 | 0.59 | 0.73 | 0.84 | 0.81 |
| **C.D at 5%** | 8.2 | 9.6 | 5.7 | 7.8 | NS | 2.78 | 2.90 | 2.24 |

### 3.2 Number of harvested bolls per plant

The number of harvested bolls per plant was significantly influenced by the spacings during all the years under study (Table 1). However, the varieties recorded significantly different number of harvested bolls per plant. During 2014, cotton crop under 90×10 cm spacing recorded significantly higher number of harvested bolls per plant than that of the rest of treatments. During 2015, crop under 90×10 cm spacing recorded significantly higher number of harvested bolls per plant than that of crop under 45×10 cm but on par with the crop under 60×10 cm and 75×10 cm. During 2016, crop under 90×10 cm spacing recorded significantly higher number of harvested bolls per plant than that of crop under 45×10 cm and 60×10 cm but on par with the crop under and 75×10 cm. The pooled data of 3 years revealed that cotton crop under 90×10 cm spacing recorded significantly higher number of harvested bolls per plant than that of the rest of treatments. Similar results were reported by [8] and [9]. The number of bolls per plant in all the three varieties was on par with each other during all the years under study. However, the number of bolls per plant in hybrid Jadoo was

significantly higher than the three varieties during 2015 and 2016. The pooled data of 3 years revealed that the number of bolls per plant in hybrid Jadoo (13.50) was significantly higher than the three varieties.

### 3.3 Boll weight

Perusal of the data from table 2 revealed that boll weight was not significantly influenced by the spacings during the three years under study. Similar findings were reported by [10] and [8]. However, among the varieties the boll weight was significantly different. During 2014, among the varieties, Suraj (4.5 g) recorded significantly higher boll weight than ADB-39 (2.9 g) but on par with WGCV-48 (4.2g). During 2015 and 2016, cotton hybrid Jadoo recorded significantly higher boll weight than the three varieties. Among the varieties, Suraj recorded significantly higher boll weight than ADB-39 but on par with WGCV-48. From the pooled data of 3 years, cotton hybrid Jadoo (5.4g) recorded significantly higher boll weight than the three varieties. Among the varieties, Suraj (4.6g) recorded significantly higher boll weight than ADB-39 (3.2g) but on par with WGCV-48 (4.4g).

**Table 2: Boll weight (g) and Seed cotton yield (kg ha$^{-1}$) as influenced by different spacings and varieties**

| | Boll weight (g) | | | | Seed cotton yield (kg ha$^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|
| | **2014** | **2015** | **2016** | **Pooled** | **2014** | **2015** | **2016** | **Pooled** |
| **Spacing** | | | | | | | | |
| **S1-45 × 10 cm** | 3.7 | 3.8 | 4.7 | 4.0 | 1492 | 1515 | 1802 | 1603 |
| **S2-60× 10 cm** | 4.2 | 4.0 | 4.7 | 4.3 | 1578 | 1648 | 1944 | 1723 |
| **S3-75 × 10 cm** | 4.0 | 3.9 | 4.7 | 4.2 | 1780 | 1625 | 2156 | 1854 |
| **S4-90× 10 cm** | 3.6 | 4.1 | 5.0 | 4.2 | 1927 | 1861 | 2373 | 2054 |
| **S.Em±** | 0.1 | 0.2 | 0.2 | 0.2 | 26 | 28 | 71.6 | 38 |
| **C.D at 5%** | NS | NS | NS | NS | 90 | 88 | 112 | 101 |
| **Varieties** | | | | | | | | |
| **V1-Suraj** | 4.5 | 4.4 | 5.0 | 4.6 | 1683 | 1462 | 2180 | 1775 |
| **V2-WGCV-48** | 4.2 | 4.3 | 4.7 | 4.4 | 1745 | 1533 | 2207 | 1828 |
| **V3-ADB-39** | 2.9 | 2.9 | 3.8 | 3.2 | 1656 | 1501 | 2316 | 1824 |
| **V4-Jadoo** | - | 5.2 | 5.6 | 5.4 | - | 1683 | 2695 | 2189 |
| **S.Em±** | 0.1 | 0.2 | 0.2 | 0.2 | 49 | 36 | 85 | 61 |
| **C.D at 5%** | 0.4 | 0.5 | 0.6 | 0.5 | NS | 91 | 251 | 190 |

### 3.4 Seed cotton yield

Seed cotton yield was significantly influenced by the spacings and the varieties. During all the 3 years under study, cotton crop under 90×10 cm spacing recorded significantly higher seed cotton yield than that of under 45×10 cm, 60×10 cm and 75×10 cm. The pooled data of 3 years revealed that cotton crop under 90×10 cm spacing (2054 kg ha$^{-1}$) recorded significantly higher seed cotton yield than the crop under 75×10 cm (1854 kg ha$^{-1}$),

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60×10 cm (1723 kg $ha^{-1}$) and 45×10 cm (1603 kg $ha^{-1}$). The seed cotton yield in all the three varieties (Suraj, WGCV-48 and ADB-39) was on par with each other during all the years under study. However, the seed cotton yield in hybrid Jadoo was significantly higher than the three varieties during 2015 and 2016. The pooled data of 3 years revealed that the seed cotton yield in hybrid Jadoo (2189 kg $ha^{-1}$) was significantly higher than the three varieties. The seed cotton yield recorded by all the varieties were in a similar trend under tested spacings. Hence the interaction affect was found non-significant.

## 4. CONCLUSION

The present study on the performance of cotton varieties under high density planting system revealed that among the tested high density spacings, 90×10 cm spacing recorded significantly higher seed cotton yield than the other spacings. Among the varieties and the hybrid, cotton Jadoo outperformed all the cotton varieties (Suraj, WGCV-48 and ADB-39). However, among the varieties all the three varieties recorded seed cotton yield which was on par with each other and there was no significant difference between the varieties.



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