

## DEVELOPING SUITABLE AGRONOMY FOR RULING Bt COTTON HYBRIDS OF SCARCE RAINFALL ZONE OF ANDHRA PRADESH

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**Abstract:** A field experiment was conducted at Regional Agriculture Research Station, Nandyal, Andhra Pradesh during *kharif* 2015-16 on vertisols to find out the suitable agronomic practices for popularly grown Bt cotton hybrids in scarce rainfall zone of Andhra Pradesh for maximizing the productivity under rainfed condition. The experiment was laid out in randomized block design with seven treatments and replicated thrice. Significantly higher seed cotton yield (1586 kg ha<sup>-1</sup>) number of bolls per square meter (61.1) and sympodia per plant (24.2) was recorded with Bhakthi BG-II sown at 90 cm x 45 cm with application of 150 N + 75 P<sub>2</sub>O<sub>5</sub> + 75 K<sub>2</sub>O ha<sup>-1</sup> with soil application of Zn SO<sub>4</sub> @ 20 kg ha<sup>-1</sup> and recommended foliar sprays of 2 % KNO<sub>3</sub> and 1 % Mg SO<sub>4</sub>.

**Keywords:** Bt cotton, seed cotton yield, planting geometry, foliar spray.

### Introduction

Cotton (*Gossypium hirsutum* L.) is a very important commercial crop of India; it sustains the cotton textile industry which is perhaps the largest segment of organized industries in the country. India has the largest area in the world under cotton at 12.18 M ha and is the second largest producer in the world with 35.32 M bales. However, India's average cotton productivity is 493 kg lint ha<sup>-1</sup> combining both irrigated and rainfed areas and is low when compared to other countries (*cotcrop.gov.in*). Maximum yield potential of Bt cotton hybrids can only be realised with suitable agronomic practices like plant geometry and balanced fertilizer application over the years. Bt cotton hybrids have shown changes in vegetative and reproductive characteristics specifying to develop agronomic management practices. Most often, soils in rainfed areas are not only thirsty but also hungry (Dehua *et al.* 2004). It is a well established fact that adequate quantities of nutrients are to be supplied for achieving higher yields. The nutrient management in cotton is a complex phenomenon due to its long duration and indeterminate growth habit where simultaneous production of vegetative and

reproductive structures during the active growth phase takes place. Cotton plant being a heavy feeder, needs proper supply of plant nutrients for its successive cultivation (Tayade and Dhoble, 2010). In this direction, research conducted on optimum planting geometry and nutrient management for popularly grown Bt cotton hybrids in scarce rainfall zone of Andhra Pradesh for maximizing the productivity under rainfed condition.

### **Material and Methods**

A field study was carried out during *kharif* 2015-16 at Regional Agriculture Research Station, Nandyal situated in scarce rainfall zone of Andhra Pradesh at 15° 29' N latitude and 78° 32' E longitude with an altitude of 203 meters above the mean sea level. The soil was deep black, moderately alkaline with a pH 8.2, low in available nitrogen (189 kg ha<sup>-1</sup>), high in available phosphorous (70 kg ha<sup>-1</sup>) and potassium (413 kg ha<sup>-1</sup>). The experiment was laid out in randomized block design with seven treatments and replicated thrice. The seven treatments comprised of Control (non Bt hybrid-Bunny with planting geometry of 120 cm x 60 cm (T<sub>1</sub>); Bt hybrid-Bhakthi BG II with planting geometry of 120 cm x 60 cm (T<sub>2</sub>); Bt hybrid-Bhakthi BG II with planting geometry of 90 cm x 45 cm (T<sub>3</sub>); T<sub>3</sub>+125 % of Rec. Nutrients (150 N + 75 P<sub>2</sub>O<sub>5</sub> + 75 K<sub>2</sub>O ha<sup>-1</sup>) (T<sub>4</sub>); T<sub>4</sub> + recommended foliar spray of 2 % KNO<sub>3</sub> (T<sub>5</sub>), T<sub>5</sub>+ Soil application of Zn SO<sub>4</sub> @ 20 kg ha<sup>-1</sup> (T<sub>6</sub>); T<sub>6</sub>+ location specific measures for control of reddening with 1 % Mg SO<sub>4</sub> (T<sub>7</sub>). The plot size was 7.2 x 5.4 m. Sowing was done on 16-07-2015 by dibbling method. Fertilizers were applied as per the treatments. 100 per cent P was applied as basal. The recommended N and K were applied in 4 splits at 20 days interval starting from 20 DAS. All other recommended package of practices was followed during the crop season. Pendimethalin, the pre-emergence herbicide was applied just after sowing. Regarding agronomic characters, ten competitive plants were randomly selected from each plot and observations on Plant height, number of monopods and sympods plant<sup>-1</sup>, bolls m<sup>-2</sup>, boll weight and seed cotton yield were recorded. Whereas, seed cotton yield obtained from the net plot area at each picking was recorded and expressed in kg ha<sup>-1</sup>. The experimental data obtained were subjected to statistical analysis by adopting Fisher's method of analysis of variance as outlined by (Gomez and Gomez, 2010). The level of significance used in 'F' test was at 5 per cent.

### **Results and Discussion**

Plant height differs significantly among treatments. Higher plant height (123.4 cm) was observed in T<sub>7</sub> and is on par with all other treatments except control (92.3 cm). There was no significant effect of different treatments on number of monopodia per plant (Table 1).

Significantly higher sympodia per plant was observed in T<sub>7</sub> (24.2) and is on par with all other treatments except control (15.5) and T<sub>2</sub> (17.9). Number of bolls per square meter differs significantly due to different treatments (Fig 1). Higher number of bolls per square meter (61.1) was observed in T<sub>7</sub> ( Bt hybrid sown at 90 cm x 45 cm with application of 125 % recommended nutrients with soil application of micro nutrient and recommended foliar sprays) and is on par with all other treatments except T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub>. Significantly lower number of bolls per square meter (21.2) was observed in control. Boll weight did not differ significantly due to different treatments. Significantly higher seed cotton yield (SCY) (1586 kg ha<sup>-1</sup>) was recorded with T<sub>7</sub> ( Bt hybrid sown at 90 cm x 45 cm with application of 125 % recommended nutrients with soil application of micro nutrient and recommended foliar sprays) and is on par with all other treatments except T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub>. Planting Bt cotton under wider spacings gave poor yields. Sankarnarayana (2004) also recorded higher seed cotton yields with closer plant geometry. The results revealed that planting Bt cotton at 90 cm x 45 cm with 150-75-75 kg NPK /ha gave higher kapas yield (Aruna and Sahadeva Reddy, 2009). Significantly lower seed cotton yield (493 kg ha<sup>-1</sup>) was observed in control. These results are in compliance with the findings of Bastia (2000) and Satyanarayana and Setty (2002) who reported significantly higher seed cotton yield due to application of higher level of recommended dose of fertilizers (RDF). Singh *et al.*, (2007) also reported significant improvement in SCY with increasing nitrogen levels among Bt cotton hybrids. Higher SCY due to better number of bolls per plant under elevated levels of nutrients was reported by Bhalerao *et al.*, (2010) and Sunitha *et al.*, (2010). Kumar *et al.* (2011) also observed increasing trend of nitrogen increasing trend in seed cotton yield with decreasing and increasing plant to plant spacing. Ravankar *et al.* (2001) also observed that lower doses of nutrients decreased the yields as well as nutrient uptake by the crops. Nitrogen supply through foliar spray also stated that nitrogen acts as promoter of vegetative growth of leaf, stem and other vegetative organs (Jadhao *et al.*, 2004). Brar *et al.* (2008) opined that foliar application of water soluble complex fertilizers will act as a source of all major and micro nutrients, which helps in increasing the seed cotton yield. Higher growth and growth attributes were reported in Bt cotton with three foliar application of micronutrient along with RDF by Ravikiran *et al.* (2012) and Rajendran *et al.* (2011). The application of 100 % RDF along with foliar spray of 1 % MgSO<sub>4</sub>/ 1 % KNO<sub>3</sub>/ 2 % DAP helped in reducing reddening of leaves in cotton, which was ultimately resulted in increasing the yield of cotton (Deshpande *et al.*, 2014).

## Conclusion

Bt cotton crop can be grown at planting geometry of 90 cm x 45 cm with application of 150 N + 75 P<sub>2</sub>O<sub>5</sub> + 75 K<sub>2</sub>O ha<sup>-1</sup> with soil application of Zn SO<sub>4</sub> @ 20 kg ha<sup>-1</sup> and recommended foliar sprays of 2 % KNO<sub>3</sub> and 1 % Mg SO<sub>4</sub> is recommended for getting higher yields in the scarce rain fall zone of Andhra Pradesh.

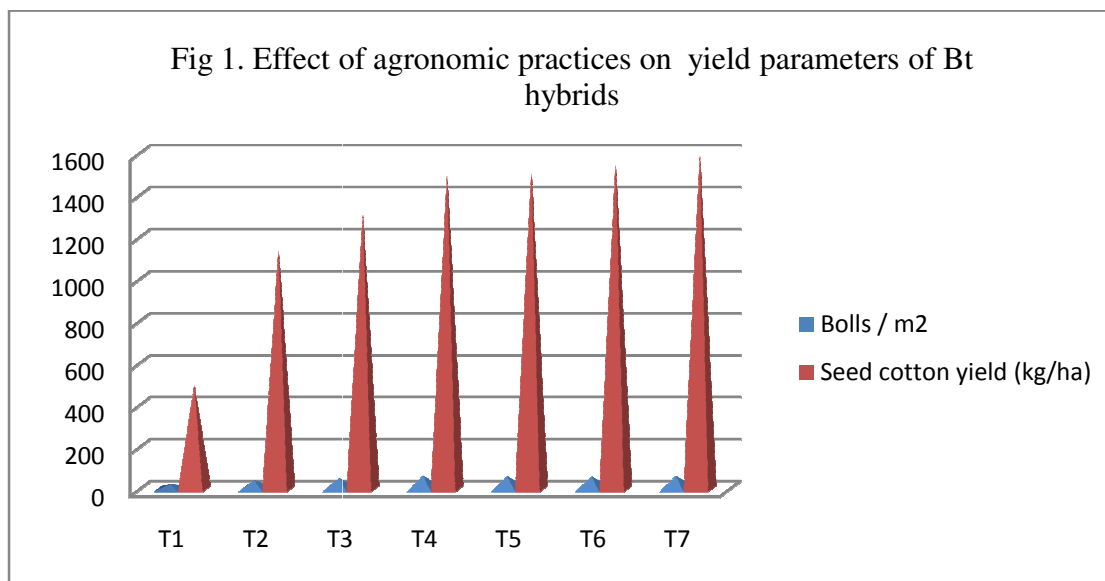
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## References

- [1] Anonymous, 2013. Indian Agricultural Database (2013).<http://www.cotcrop.gov.in>
- [2] Dehua, C.; Guoyou, Y.; Changquin, Y.; Yuan, C. & Yunkang, W. 2004. Effect after introducing *Bacillus thuringiensis* gene on nitrogen metabolism in Cotton. *Field Crop Res.*, 87 (2-3):235-244.
- [3] Tayade, A.S. & Dhoble, M.V. 2010. Effect of transgenic Bt-cotton hybrid, nutrient and pest management on seed cotton yield, nutrient uptake and status of available nutrient in the soil. *Indian J. Fert.*, 6(8): 34-40.
- [4] Gomez, K.A. & Gomez, A.A. 2010. Statistical procedures for agriculture research. Wiley Indian Pvt. Ltd., New Delhi, India.
- [5] Sankarnarayanan, K. 2004. Abstract presented In: International Symposium on “Strategies for Sustainable Cotton Production – A Global Vision “held on Nov 23-25, University of Agricultural Sciences, Dharwad .pp 248.
- [6] Aruna, E. & SahadevaReddy, B. 2009. Response of Bt cotton to plant geometry and nutrient combinations. *Indian J. Agric. Res.*, 43 (3): 206-210, 2009
- [7] Bastia, D.K. 2000. Integrated nutrient management in rainfed hybrid cotton. *Madras Agric. J.*, 87(7-9): 442-443.
- [8] Satyanarayana, R. & Setty, R.A. 2002. Response of hybrid cotton to levels and times of nitrogen and potash application under irrigated condition. *J. Cotton Res. Dev.*, 16(2): 188-189.
- [9] Singh, K.; Jindal, V.; Singh V. & Rathore, P. 2007. Performance of Bt cotton hybrids under different geometrical arrangements. *J. Cotton Res. Dev.*, 21:41-44.

- [10] Bhalerao, P.D.; Patil, B. R.; Ghatol P.U. & Gawande. P.P. 2010. Effect of spacing and fertilizer levels on seed cotton yield under rainfed condition. *Indian J. Agric. Res.*, 44:74-76.
- [11] Sunitha,V.; Chandrasekhar, K. & Veeraraghavaiah, R. 2010. Performance of Bt cotton hybrids at different nitrogen levels. *J. Cotton Res. Dev.*, 24:52-55.
- [12] Kumar, M.; Pannu, R.K.; Nehra, D.S. and Dhaka, A.K. 2011. Effect of spacing and fertilizer on growth, yield and quality of different cotton genotypes. *J. Cotton Res. Dev.* 25(2): 236-239.
- [13] Ravankar, H.N.; Sujata, P. A. & Hadole, S.S. 2001. Distribution of organic matter in vertisols under long term fertilization to sorghum-wheat cropping sequence. *PKV Research Journal*, 25(1): 16-19.
- [14] Jadhao, J.G.; Jadhao, S.D.; Ghodpage, R.M. & Ingole, A.S. 2004. Effect of different chemical sprays on reddening and morphological characters in cotton. *PKV Research Journal*, 28(2):225-228.
- [15] Brar, M.S.; Gill, M.S.; Sekhon, K.S.; Sidhu, B.S.; Sharma, P. & Singh, A. 2008. Effect of soil and foliar application of nutrients on yield and nutrient concentration in Bt cotton. *J. Res., Punjab Agric. Univ.*, 45(3&4): 126-131.
- [16] Ravikiran, S.; Halepyati, A. S.; Pujari, B.T.; Koppalakar, B.G. & Narayanarao, K. 2012. Effect of macro and soluble micronutrients on yield, uptake of nutrients, quality and economics of Bt cotton (*Gossypium hirsutum* L.) under irrigation. *Karnataka J. Agric. Sci.*, 25(4): 418-422.
- [17] Rajendran, K.; Palchamy, A.; Sankaranarayanan, K.; Prabakaran, K. & Bhararhi, K. 2011. Enhancing productivity of summer irrigated cotton through plant growth regulator and foliar nutrition. *Madras Agric. J.*, 98(7-9): 248-250.
- [18] Deshpande, A.N.; Masram, R.S. & Kamble, B.M. 2014. Effect of fertilizer levels on nutrient availability and yield of cotton on Vertisol at Rahuri, District Ahemadnagar, India. *Journal of Applied and Natural Science* 6 (2): 534-540



**Table 1. Effect of agronomic practices on growth and yield parameters of ruling Bt hybrids**

<b>Treatment</b>	<b>Plant height (cm)</b>	<b>No of monopodia</b>	<b>No of sympodia</b>	<b>Bolls / m<sup>2</sup></b>	<b>Boll weight (gm)</b>	<b>Seed cotton yield (kg/ha)</b>
T <sub>1</sub> - Control (non Bt hybrid) (120 cm x 60 cm)	92.3	1.1	15.5	21.2	3.61	493
T <sub>2</sub> - Bt hybrid (120 cm x 60 cm)	109.9	1.2	17.9	41.1	4.23	1134
T <sub>3</sub> - T <sub>2</sub> +Closer spacing (25% less than Rec.) (90 cm x 45 cm)	111.7	1.3	20.6	50.7	3.85	1305
T <sub>4</sub> - T <sub>3</sub> +125 % of Rec. nutrients (150 N + 75 P <sub>2</sub> O <sub>5</sub> + 75 K <sub>2</sub> O ha <sup>-1</sup> )	113.4	1.3	21.8	61.7	3.85	1491
T <sub>5</sub> - T <sub>4</sub> + recommended foliar spray (2 % KNO <sub>3</sub> )	117.3	1.3	22.3	59.5	3.92	1507
T <sub>6</sub> - T <sub>5</sub> + micro nutrients (Soil application) (Zn SO <sub>4</sub> @ 20 kg ha <sup>-1</sup> )	115.0	1.4	23.3	58.3	4.00	1544
T <sub>7</sub> - T <sub>6</sub> + location specific measures for control of reddening (1 % Mg SO <sub>4</sub> )	123.4	1.5	24.2	61.1	4.06	1586
SEm ±	4.9	0.10	1.3	3.1	0.31	85
CD (p=0.05)	15.1	NS	4.0	9.6	NS	261
CV (%)	7.6	13.8	10.7	10.7	13.4	11.3