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# Yield and quality of *Bt* cotton (interspecific) in response to different levels of crop geometry and drip fertigation

P. BASKAR*
***Kumaraguru Institute of Agriculture, Sakthinagar, Erode – 641 003.***
****E-mail : agrobaskar@gmail.com***

**ABSTRACT :** A field experiment was conducted to study the productivity and quality of *Bt* cotton (interspecific) in response to different levels of crop geometry and fertilizer application for two years during *kharif* 2012-2013 and 2013-2014 at Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out in a strip plot design with three replications. The treatments in main plot consisted of four crop geometry levels ($M_1$-120 x 60 cm, $M_2$-120 x 90 cm, $M_3$-150 x 60 cm and $M_4$-150 x 90 cm) and sub plots consisted of four nutrient levels ($S_1$-75, $S_2$-100, $S_3$-125 per cent of recommended dose as water soluble fertilizer (WSF) through drip system and $S_4$-conventional practice). The average data revealed that the higher yield attributed and seed cotton yield were recorded with crop geometry of 120 x 90 cm and 125 per cent as water soluble fertilizer and it was comparable with 120 x 90 cm and 100 per cent as water soluble fertilizer. Cotton quality parameters *viz.,* seed index, lint index, ginning per centage, fibre length, maturity co efficient, bundle strength and fibre fineness did not showed any significantly influenced by crop geometry or drip fertigation during both the years.

**Key words:** Crop geometry, fertigation, quality parameters, seed cotton yield

Cotton is "White Gold" and it is one among few crop species that were cultivated both in old and new world having importance as multipurpose crop that will give five basic products lint, oil, seed meal, hulls and linters. It is the world's leading fibre crop and second most important oil seed crop. After introduction of *Bt* cotton under commercial scale, cotton growing area was increased to about 11.84 m ha in 2014-2015 (92% of total cotton area). Presently India is the second largest producer, consumer and exporter of cotton in the world (Anonymous, 2016). However, average cotton productivity of India is lower compared to other countries. Among the improved agronomic practices, important yield contributing agrotechniques are crop geometry and fertilizer application. Drip irrigation and use of water soluble fertilizers (WSF) by drip fertigation is found to increase the efficiency in the application of fertilizer and water besides reducing the quantity of fertilizer applied. Since there is good interaction between crop geometry and applied fertilizer, especially under drip fertigation, opportunities exits for enhancing the productivity of *Bt* cotton. Quality parameter is main characters which decide the *kapas* rate and income of the produce. Taking this aspect into consideration, a field investigation was carried out to study the productivity and quality of *Bt* cotton in response to different level of crop geometry and fertilizer application.

**Table 1.** Fertigation schedule for the *Bt* cotton (interspecific)

| Stage of the crop | Duration (DAS) | Splits (Number) | Total NPK supplied (kg/split/ha) | Total NPK supplied (kg/5 split/ha) |
|---|---|---|---|---|
| I stage | 1- 15 | 5 Split | N: 3.0 | N: 15.0 |
| | | | P: 0.76 | P: 3.8 |
| | | | K: 1.5 | K: 7.6 |
| II stage | 16-45 | 10 split | N: 4.5 | N: 44.8 |
| | | | P: 0.76 | P: 7.6 |
| | | | K: 2.3 | K: 22.5 |
| III stage | 46-75 | 10 split | N: 4.5 | N: 44.8 |
| | | | P: 0.76 | P: 7.6 |
| | | | K: 2.3 | K: 22.5 |
| IV stage | 76- 150 | 25 split | N: 1.8 | N: 45.3 |
| | | | K: 0.9 | K: 22.5 |

Hundred per cent recommended dose : 150:75:75 kg NPK/ha
As water soluble fertilizer : 150:18.75:75 kg NPK/ha
As basal application : 56.25 kg $P_2O_5$/ha (75% P) as single super phosphate

## MATERIALS AND METHODS

A field experiment was carried out during 2012-2013 and 2013-2014 at Tamil Nadu Agricultural University, Coimbatore to study the yield and quality parameters of *Bt* cotton as influenced by different levels crop geometry and fertigation through drip irrigation system. The experiment was laid out in a strip plot design with three replications. The main plot treatments consisted of four crop geometry levels *viz.,* $M_1$ - 120 x 60 cm, $M_2$ - 120 x 90, $M_3$ - 150 x 60 cm and $M_4$ - 150 x 90 cm. The sub plots consisted of four nutrient levels viz., $S_1$ (75%), $S_2$ (100%), $S_3$ (125%) water soluble fertilizer through drip system and $S_4$ - conventional method of irrigation and fertilizer application. Here, 75 per cent of the $P_2O_5$ as basal and remaining 25 per cent $P_2O_5$ as water soluble fertilizer and entire quantity of N and K as water soluble fertilizer were applied based on fertigation schedule in different split during different stages of crop (Table 1). The following is the quantity of fertilizer applied as water soluble and normal forms.

Urea, mono ammonium phosphate and potassium nitrate were used as water soluble fertilizer for N, P and K, respectively. The soil of the experiment field was sandy clay loam in texture, low in available nitrogen (192 kg/ha), medium in phosphorus (14.8 kg/ha) and high in potassium (429 kg/ha) with EC 0.31 dS/m having pH 8.4. The interspecific hybrid cotton RCHB 708 was sown in the experiment and plant population was maintained in all the plots by necessary gap filling and thinning as per treatment requirement. Quality parameters *viz.,* ginning percentage, lint index and seed index was determined. Moreover fibre length, maturity coefficient, bundle strength and fibre fineness were measured. The data on seed cotton yield was recorded on the basis of plot area and the whole plot pertaining to the crop was picked three times in each treatment. The data were statistically analysed by the analysis of variance method as suggested by Gomez and Gomez

(2010).

## RESULTS AND DISCUSSION

**Quality parameters** : Crop geometry and drip ferigation levels did not exert any significant improvement in most of the quality parameters of fiber in *Bt* cotton. The seed index, lint index, ginning percentage, fibre length, maturity co efficient, bundle strength and fibre fineness were not significantly influenced by crop geometry or drip fertigation since, most of the quality characteristics are governed genetically to a larger extent rather than to the management factors (Table 1). The levels of inputs that had been tested might not be sufficient to produce significant changes in the quality characters of cotton. However seed index, lint index, ginning percentage was influenced significantly due to fertigation levels as compared to conventional method of irrigation and fertilizer application. There was no significant variations were observed regarding quality parameters in *Bt* cotton. The results are in conformity with those obtained earlier by Jadhav *et al.,* (2015). Bharathi *et al.,* (2012) also stated that quality of *Bt* cotton was not influenced by the planting geometry and nutrient combination. Jadhav *et al.,* (2015) also reported that the quality characters were not influenced by narrow range of variation in plant spacing and nutrients supply.

**Table 1.** Influence of crop geometry and drip fertigation on quality parameters of *Bt* cotton (Pooled data of 2012-2013 and 2013-2014)

| Treatments | Ginning percentage | Seed index | Lint index | Fibre length (mm) | Micro-naire ($10^{-6}$/inch) | Fibre strength (g/tex) | Uni-formity | Seed cotton yield (kg/ha) |
|---|---|---|---|---|---|---|---|---|
| **Crop geometry** | | | | | | | | |
| **$M_1$** | 30.2 | 10.4 | 4.9 | 36.8 | 3.3 | 24.2 | 45.8 | 2569 |
| **$M_2$** | 31.5 | 11.1 | 5.2 | 37.1 | 3.4 | 24.5 | 47.4 | 2713 |
| **$M_3$** | 30.5 | 10.6 | 5.2 | 37.2 | 3.4 | 24.5 | 46.2 | 2274 |
| **$M_4$** | 32.0 | 11.2 | 5.4 | 37.3 | 3.5 | 24.7 | 47.4 | 1903 |
| SEd | 0.5 | 0.3 | 0.2 | 0.7 | 0.1 | 0.6 | 0.5 | 101 |
| CD (p = 0.05) | NS | NS | NS | NS | NS | NS | NS | 246 |
| **Fertilizer level** | | | | | | | | |
| **$S_1$** | 31.1 | 10.8 | 5.2 | 37.3 | 3.4 | 24.4 | 46.6 | 2223 |
| **$S_2$** | 31.5 | 11.0 | 5.4 | 37.4 | 3.4 | 24.5 | 47.1 | 2592 |
| **$S_3$** | 31.9 | 11.3 | 5.5 | 37.7 | 3.4 | 25.1 | 47.6 | 2711 |
| **$S_4$** | 30.2 | 10.1 | 4.7 | 36.5 | 3.3 | 24.0 | 45.5 | 1932 |
| SEd | 0.55 | 0.35 | 0.2 | 0.65 | 0.2 | 0.4 | 0.55 | 102 |
| CD (p = 0.05) | 1.4 | 0.8 | 0.45 | NS | NS | NS | 1.4 | 251 |
| Interaction | NS | NS | NS | NS | NS | NS | NS | S |

**Crop Geometry Fertilizer level**

$M_1$ – 120 x 60 cm $M_2$ – 120 x 90 cm $M_3$ – 150 x 60 cm $M_4$ - 150 x 90 cm$S_1$ – (75 % RDF as WSF (75 % P applied as basal) $S_2$ – (100 % RDF as WSF (75 % P applied as basal)$S_3$ – (125 % RDF as WSF (75 % P applied as basal) $S_4$ – (Conventional irrigation and fertilizer application).

**Table 2.** Crop geometry and drip fertigation on yield attributes and yield of *Bt* cotton during (Pooled data of 2012-2013 and 2013-2014)

| Treatments | Sympodial branches/plant | | | | | Bolls/plant | | | | | Seed cotton yield (kg/ha) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | **Mean** | $M_1$ | $M_2$ | $M_3$ | $M_4$ | **Mean** | $M_1$ | $M_2$ | $M_3$ | $M_4$ | **Mean** |
| $S_1$ | 18.3 | 21.7 | 19.2 | 22.5 | **20.5** | 46.0 | 62.8 | 52.3 | 65.5 | **56.6** | 2396 | 2659 | 2138 | 1700 | **2223** |
| $S_2$ | 18.7 | 24.6 | 22.4 | 24.9 | **22.6** | 54.2 | 71.1 | 59.3 | 75.0 | **64.9** | 2955 | 2967 | 2441 | 2009 | **2593** |
| $S_3$ | 19.8 | 26.4 | 24.0 | 27.3 | **24.3** | 51.9 | 76.8 | 61.9 | 81.4 | **68.0** | 2831 | 3176 | 2572 | 2264 | **2711** |
| $S_4$ | 17.1 | 20.3 | 17.7 | 21.1 | **19.0** | 40.9 | 52.2 | 44.9 | 55.5 | **48.4** | 2096 | 2050 | 1943 | 1640 | **1932** |
| **Mean** | **18.5** | **23.2** | **20.8** | **24.0** | | **48.3** | **65.7** | **54.6** | **69.4** | | **2569** | **2713** | **2274** | **1903** | |
| | **M** | **S** | **M at S** | **S at M** | | **M** | **S** | **M at S** | **S at M** | | **M** | **S** | **M at S** | **S at M** | |
| $SE_d$ | 0.5 | 0.5 | 0.8 | 0.8 | | 2.1 | 2.6 | 2.8 | 2.6 | | 101 | 103 | 124 | 123 | |
| CD (p=0.05) | 1.1 | 1.2 | 1.4 | 1.7 | | 5.1 | 6.3 | 6.3 | 5.9 | | 246 | 251 | 282 | 281 | |

**Crop geometry fertilizer level**

**$M_1$** – 120 x 60 cm

**$M_2$** – 120 x 90 cm

**$M_3$** – 150 x 60 cm

**$M_4$** - 150 x 90 cm

**$S_1$** – (75 % RDF as WSF (75 % P applied as basal)

**$S_2$** – (100 % RDF as WSF (75 % P applied as basal)

**$S_3$** – (125 % RDF as WSF (75 % P applied as basal)

**$S_4$** – (Conventional irrigation and fertilizer application)

**Yield attributes and seed cotton yield :** The sympodial branches were higher when plant spacing increased to 90 cm. This could be attributed to the characters of long duration interspecific hybrids as tested in this experiment. The lesser number of sympodial branches plant$^{-1}$ recorded with 120 x 60 cm plant geometry might be due to the restricted horizontal space for production of more number of branches. This results are line with the finding of Majunatha *et al.,* (2010). Drip fertigation treatments produced higher sympodial branches plant$^{-1}$ as compared to surface irrigation with soil application of fertilizer. The wider crop geometry coupled with higher amount of nutrient likely produce more sympodial branches/plant (Bhalerao *et al.,* 2010).

Significantly higher number of bolls/plant was registered with crop geometry of 150 x 90 cm might be attributed to the fact that here plants were grown wide apart which made availability of more nutrients and ample space thus resulted in number of bolls. Maximum number of bolls recorded with wider plant spacing (150 x 90 cm) might be due to more light penetration coupled with good canopy growth and development than 120 x 60 cm . The results are conformity with earlier by Dong *et al.,* (2012). More number of bolls recorded under 125 per cent RDF as WSF with drip irrigation in this study might be due to the better square formation and boll retention as result of continuous supply of nutrient and moisture (Pawar *et al.,* (2013).

The plant spacing of 120 x 90 cm had higher seed cotton yield over closer and wider spacing. All the yield attributing characters were lesser with closer spacing though the plant population were higher under the 120 x 60 cm, reason might be due to significantly higher values of yield attributes under wider plant spacing which increased the yield of *Bt* cotton. This results conformity with the finding of Bhalerao *et al.,* (2010). Drip fertigation at 125 per cent RDF with WSF recorded significantly higher seed cotton and it was comparable with 100 per cent RDF as water soluble fertilizer. Pawar *et al.,* (2013) also reported that drip fertigation had greater advantages and increased seed cotton yield as compared to surface irrigation and broadcast application of fertilizer nutrients. The interaction of 120 x 90 cm crop geometry and application of 125 per cent RDF as water soluble fertilizer recorded higher seed cotton yield and the same was statistically comparable with 120 x 90 cm with 100 per cent RDF as water soluble fertilizers. This might be that sufficient inter and intra row spacing and nourished with higher amount of available nutrient enhanced the yield of interspecific hybrid *Bt* cotton. Lower yield recorded with 150 x 90 cm with conventional practices of irrigation and fertilizer application and it mainly due to could not compensate for the loss in number of plants/ha and thus recorded lower seed cotton yield/ ha. Similar results were observed by Hargilas and Saini (2018).

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