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# Resource Use Efficiency, Productivity and Profitability of *Bt* Cotton (*interspecific*) as Influenced by Crop Geometry and Drip Fertigation

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## ABSTRACT

**Background:** Cotton is one of the important commercial crops cultivated in India for fibre and oil. The average cotton productivity of India is lower compared to other countries. Among the improved agronomic practices, important yield contributing agro techniques are crop geometry and fertilizer application. Drip irrigation and use of water soluble fertilizers (WSF) by drip system is a recommended practice to increase both water and nutrient use efficiency. Taking this aspect, a field investigation was carried out to find the resource use efficiency, productivity and profitability of inter specific Bt cotton hybrid with different levels crop geometry and drip fertigation.

**Methods:** A field experiment was conducted at TNAU, Coimbatore during 2013 and 2014 for two consecutive years. The experiment was laid out in a strip plot design with three replications. The treatments in main plot consisted of four crop geometry levels (120 x 60 cm, 120 x 90 cm, 150 x 60 cm and 150 x 90 cm) and sub plots consisted of four nutrient levels *viz*., 75%, 100%, 125% of recommended dose as water soluble fertilizer (WSF) through drip system and as conventional practice. Resource use efficiency (water, nutrient), seed cotton yield and profitability of the system were recorded.

**Result:** The experiment revealed that the fertilizer use efficiency and the efficiency of individual nutrient (partial factor productivity) for the crop geometry of 120 x 90 cm and 75% RDF were higher in both the years. The crop geometry of 120 x 90 cm in combination with 125% RDF effectively utilized the water as indicated by its water use efficiency and comparable results was also obtained with 100% RDF. The mean (2012-13 and 2013-14) seed cotton yield of 2,713 kg ha$^{-1}$ in 120 x 90 cm kg ha$^{-1}$ for 125% RDF was 41.5 per cent higher compared to their lower counterpart. Their interaction was significant, consequently the treatment $M_2S_3$ (120 x 90 cm and 125% RDF) recorded higher mean (both years) seed cotton of 3,176 kg ha$^{-1}$ which was nearly 93.7 per cent increase over conventional irrigation and fertilizer application ($M_4S_4$). Here $M_1S_2$ could be considered as alternate option as it maintained similarity with the best treatment. The gross and net return was estimated to be higher with spacing of 120 x 90 cm with 125% RDF and however the benefit cost ratio was higher with 120 x 90 cm with 100% RDF followed by 120 x 60 cm with 100% RDF.


**Key words:** Crop geometry, Profitability, Resource use efficiency, Seed cotton yield.

## INTRODUCTION

Cotton is one of the important commercial crops cultivated in India for fibre and oil. It occupies predominant position among all cash crops in India and has retained its unique fame as 'king of fibre'because of its higher economical value among all cash crops. Cotton, the "White Gold" is cultivated in different agro-climatic conditions in India constituting about 62% of the raw material requirement of Indian textile industry. 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) Kakade *et al*. (2017). 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 agro techniques are crop geometry and fertilizer application. Increased and efficient use of nutrients is one of the options for increasing cotton productivity. Drip irrigation and use of water soluble fertilizers (WSF) by drip system is a recommended practice to increase both water and nutrient use efficiency. Drip fertigation provides an efficient method of fertilizer delivery and the availability of soil moisture and nutrients at root zone of the crops influences the uptake and yield of the crop with minimum losses of nutrients through volatilization, leaching and fixation in the soil. As there is good interaction crop geometry and applied fertilizer especially under drip fertigation opportunities exit for enhancing the productivity of Bt cotton through light interception and dry matter partitioning (Baskar, 2015).

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Taking this aspect into consideration, a field investigation was carried out to find the resource use efficiency, productivity and profitability of inter specific Bt cotton hybrid with different levels crop geometry and drip fertigation.

## MATERIALS AND METHODS

A field experiment was carried out during 2013 and 2014 at Tamil Nadu Agricultural University, Coimbatore to study the resource use efficiency, productivity and profitability of Bt (interspecific) 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 percent of the $P_2O_5$ as basal and remaining 25 percent $P_2O_5$ 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 $m^{-1}$ having pH 8.4. The interspecific hybrid cotton RCHB 708 was sown in the experiments and plant population was maintained in all the plots by necessary gap filling and thinning as per treatment requirement.

Fertilizer use efficiency (FUE) was calculated for each treatment, which is the ratio of yield of the crop in kg $ha^{-1}$ and total nitrogen, phosphorus and potassium fertilizers applied in kg $ha^{-1}$. Water requirement for the crop period was calculated and expressed as ha cm [WR = Total water used + Effective rainfall (mm)]. Quantity of water applied through drip and surface method at each irrigation for different treatments was summed up to estimate total irrigation water applied and expressed in mm. Water use efficiency (WUE) is the economic yield that can be produced from a given quantity of water. It was worked out by using the following formula and expressed as kg $ha^{-1}$ $mm^{-1}$.

$$\text{WUE}= \frac{\text{Yield of crop (kg ha}^{-1}\text{)}}{\text{Total water used (mm)}}$$

The cost of installation of drip system for one hectare was worked out based on current market rates and the life of the drip system was assumed to be seven years. Prevailing market price of drip components from a standard firm and interest on capital investment (9 percent) was used for estimating the annualised cost of the system. Eventually the benefit cost ratio (BCR) was worked out by Gross return $ha^{-1}$/ Cost of cultivation $ha^{-1}$. The data were statistically analysed by the analysis of variance method as suggested by Gomez and Gomez (2010).

## RESULTS AND DISCUSSION

### Fertilizer use efficiency (FUE)

The fertilizer use efficiency was significantly influenced by the crop geometry and drip fertigation (Table 2, 3, 4). Crop geometry of 120 x 90 cm had higher fertilizer use efficiency and it was comparable with 120 x 60 cm. The enhanced growth and yield attributes of cotton in this favourable crop geometry might have helped in increasing the fertilizer use efficiency.

The fertilizer use efficiency was considerably increased in drip fertigation compared to surface irrigation with soil application of fertilizer nutrient (Venkadeswaran and Sundaram, 2016). This could be attributed to the regular

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

| | | |
|---|---|---|
| 100 percent recommended Dose | : | 150:75:75 kg of NPK/ha |
| As water soluble fertilizer | : | 150:18.75:75 kg of NPK/ha |
| As basal application | : | 56.25 kg of $P_2O_5$/ha (75% of P) as single super phosphate |

| Stage of the crop | Duration | No. of splits | Total NPK supplied (kg/split/ha) | Total NPK supplied (kg/5 split/ha) |
|---|---|---|---|---|
| I stage | 1- 15 DAS | 5 Split | N: 3.0<br>P: 0.76<br>K: 1.5 | N: 15.0<br>P: 3.8<br>K: 7.6 |
| II stage | 16-45 DAS | 10 split | N: 4.5<br>P: 0.76<br>K: 2.3 | N: 44.8<br>P: 7.6<br>K: 22.5 |
| III stage | 46-75 DAS | 10 split | N: 4.5<br>P: 0.76<br>K: 2.3 | N: 44.8<br>P: 7.6<br>K: 22.5 |
| IV stage | 76- 150 DAS | 25 split | N: 1.8<br>K: 0.9 | N: 45.3<br>K: 22.5 |

**Table 2:** Influence of crop geometry and drip fertigation on resource use efficiency and seed cotton yield (kg ha$^{-1}$) of Bt cotton (pooled mean of two year).

| Treatments | NUE | PUE | KUE | FUE | WUE | Seed cotton yield (kg ha$^{-1}$) |
|---|---|---|---|---|---|---|
| $M_1$ | 17.5 | 35.1 | 35.1 | 3.14 | 4.8 | 2569 |
| $M_2$ | 18.5 | 37.0 | 37.0 | 3.32 | 5.1 | 2713 |
| $M_3$ | 15.5 | 31.0 | 31.0 | 2.77 | 4.2 | 2274 |
| $M_4$ | 12.9 | 25.8 | 25.8 | 2.30 | 3.6 | 1903 |
| **SEd** | 0.7 | 1.4 | 1.4 | 0.12 | 0.19 | 101 |
| **CD (P = 0.05)** | 1.7 | 3.3 | 3.3 | 0.30 | 0.47 | 246 |
| $S_1$ | 19.8 | 39.5 | 39.5 | 3.61 | 4.4 | 2223 |
| $S_2$ | 17.3 | 34.6 | 34.6 | 3.17 | 5.1 | 2592 |
| $S_3$ | 14.5 | 28.9 | 28.9 | 2.65 | 5.3 | 2711 |
| $S_4$ | 12.9 | 25.8 | 25.8 | 2.10 | 3.0 | 1932 |
| **SEd** | 0.7 | 1.4 | 1.4 | 0.13 | 0.20 | 102 |
| **CD (P = 0.05)** | 1.7 | 3.3 | 3.3 | 0.30 | 0.50 | 251 |
| **Interaction** | S | S | S | S | S | S |

NUE-Nitrogen Use Efficiency, PUE- Phosphorus Use Efficiency, KUE- Potassium Use Efficiency, FUE-Fertilizer Use Efficiency, WUE-Water Use Efficiency.

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

supply of N and K combined with irrigation water in the active root zone of the crop that would have resulted in minimum loss of nutrients from the root zone. In contrast a lower FUE was recorded with increasing fertigation doses from 75% to 125% RDF with WSF. This revealed that optimum fertilizer dose was 75% RDF with WSF, beyond which seed cotton yield increase is not proportional to higher doses of fertilizer. Thus drip fertigation at 75% RDF had recorded 57.9 per cent increased FUE, over surface application of 100 per cent dose revealing possibility of 25 per cent saving of fertilizer by drip fertigation. Similar results were also reported by Jayakumar *et al.* (2014), who stated that application of nutrients through drip fertigation improved seed cotton yield by 43.0 per cent compared with conventional surface irrigation with soil surface application of fertilizers. These results are in conformity with the findings of Shukla *et al.* (2013).

### Water use and water use efficiency (WUE)

The quantity of irrigation water applied through drip was 412.1 and 401.6 mm during 2012-13 and 2013-14, respectively (Table 5). The effective rainfall received during the cropping period was 100.6 mm (2012-13) and 106.3 mm (2013-14). The total water used under the drip irrigation treatments was 512.6 mm and 507.9 mm during winter 2012-13 and 2013-14, respectively. Under surface irrigation, the quantity of water applied through irrigation was 450.0 and 500.0 mm during 2012-13 and 2013-14, respectively. An effective rainfall of 187.5 and 168.0 mm was received during the cropping period and total water applied inclusive of effective rainfall was 637.5 and 668.0 mm during 2012-13 and 2013-14 respectively.

Crop geometry of 120x 90 cm registered higher WUE values (5.18 and 5.44 kg ha$^{-1}$ mm$^{-1}$ during 2012-13 and 2013-14, respectively). It was on par with crop geometry of 120 x 60 cm. The lowest WUE was recorded with wider crop geometry of 150 x 90 cm during both the year of study. Fertilizer level treatment had marked variation on WUE. Application of 125% RDF as water soluble fertilizer recorded maximum WUE and it was on par with 100% RDF as WSF. The lowest value of WUE was registered under conventional irrigation and fertilizer application during both the year.

Significant interaction was noticed with crop geometry and fertilizer level practices. Crop geometry of 120 x 90 cm with application 125% RDF as water soluble fertilizer recorded higher WUE (5.98 and 6.47 kg ha$^{-1}$ mm$^{-1}$ during 2012-13 and 2013-14, respectively) and it was comparable with 120 x 90 cm with 100% RDF as WSF. The lowest WUE registered under wider crop geometry with conventional irrigation and fertilizer application. Kamla *et al.* (2016) also observed that WUE was lowest when irrigation was applied with flood method. The poor efficiency of conventional irrigation systems has not only reduced the anticipated outcome of investments towards water resource development, but has also resulted in environmental problems like water logging and soil salinity, thereby adversely affecting crop yields.

### Productivity of seed cotton

The plant spacing of 120 x 90 cm had higher seed cotton

**Table 3:** Crop geometry and fertigation interaction on nutrient use efficiency of Bt cotton (pooled mean of two year).

| Treatments | NUE | | | | | PUE | | | | | KUE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Mean | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Mean | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Mean |
| $S_1$ | 21.3 | 23.7 | 19.0 | 15.1 | 19.8 | 42.6 | 47.3 | 38.0 | 30.2 | 39.5 | 42.6 | 47.3 | 38.0 | 30.2 | 39.5 |
| $S_2$ | 19.7 | 19.8 | 16.3 | 13.4 | 17.3 | 39.4 | 39.6 | 32.6 | 26.8 | 34.6 | 39.4 | 39.6 | 32.6 | 26.8 | 34.6 |
| $S_3$ | 15.1 | 17.0 | 13.7 | 12.1 | 14.5 | 30.2 | 33.9 | 27.4 | 24.2 | 28.9 | 30.2 | 33.9 | 27.4 | 24.2 | 28.9 |
| $S_4$ | 14.0 | 13.7 | 13.0 | 11.0 | 12.9 | 28.0 | 27.3 | 25.9 | 21.9 | 25.8 | 28.0 | 27.3 | 25.9 | 21.9 | 25.8 |
| Mean | 17.5 | 18.5 | 15.5 | 12.9 | 0.0 | 35.1 | 37.0 | 31.0 | 25.8 | 0.0 | 35.1 | 37.0 | 31.0 | 25.8 | 0.0 |
| | **M** | **S** | **M at S** | **S at M** | | **M** | **S** | **M at S** | **S at M** | | **M** | **S** | **M at S** | **S at M** | |
| $SE_d$ | 0.7 | 0.7 | 0.9 | 0.9 | 0.0 | 1.4 | 1.4 | 1.8 | 1.7 | 0.0 | 1.4 | 1.4 | 1.8 | 1.7 | 0.0 |
| CD (P=0.05) | 1.6 | 1.7 | 2.0 | 2.0 | 0.0 | 3.3 | 3.3 | 4.0 | 3.9 | 0.0 | 3.3 | 3.3 | 4.0 | 3.9 | 0.0 |

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

**Table 4:** Crop geometry and drip fertigation interaction on FUE, WUE and seed cotton yield of Bt cotton (pooled mean of two year).

| Treatments | Fertilizer Use Efficiency (FUE) | | | | | Water Use Efficiency (WUE) | | | | | Seed cotton yield (kg ha$^{-1}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Mean | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Mean | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Mean |
| $S_1$ | 3.9 | 4.3 | 3.5 | 2.8 | 3.6 | 4.7 | 5.2 | 4.2 | 3.3 | 4.4 | 2396 | 2659 | 2138 | 1700 | 2223 |
| $S_2$ | 3.6 | 3.6 | 3.0 | 2.5 | 3.2 | 5.8 | 5.8 | 4.8 | 3.9 | 5.1 | 2955 | 2967 | 2441 | 2009 | 2593 |
| $S_3$ | 2.8 | 3.1 | 2.5 | 2.2 | 2.6 | 5.5 | 6.2 | 5.0 | 4.4 | 5.3 | 2831 | 3176 | 2572 | 2264 | 2711 |
| $S_4$ | 2.3 | 2.2 | 2.1 | 1.8 | 2.1 | 3.2 | 3.1 | 3.0 | 2.5 | 3.0 | 2096 | 2050 | 1943 | 1640 | 1932 |
| Mean | 3.1 | 3.3 | 2.8 | 2.3 | | 4.8 | 5.1 | 4.2 | 3.6 | | 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** | |
| $SE_d$ | 0.12 | 0.12 | 0.16 | 0.16 | | 0.19 | 0.20 | 0.25 | 0.24 | | 101 | 103 | 124 | 123 | |
| CD(P=0.05) | 0.29 | 0.30 | 0.36 | 0.36 | | 0.47 | 0.50 | 0.56 | 0.55 | | 246 | 251 | 282 | 281 | |

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

**Table 5:** Water requirement of cotton under drip and surface irrigation system (pooled mean of two year).

| Methods of irrigation | Water requirement (mm) | | | |
|---|---|---|---|---|
| | Irrigation requirement | Effective rainfall | Total water used | Water saving over control (%) |
| Drip irrigation | 407.1 | 103.5 | 510.3 | 27.9 |
| Surface irrigation | 475.0 | 177.8 | 652.8 | |

**Table 6:** Influence of crop geometry and drip fertigation on economics of Bt cotton (pooled mean of two year).

| Treatments | Cost of cultivation (` ha$^{-1}$) | Annualised drip cost (` ha$^{-1}$) | Total seasonal cost (` ha$^{-1}$) | Gross return (` ha$^{-1}$) | Net return (` ha$^{-1}$) | B:C ratio |
|---|---|---|---|---|---|---|
| $M_1S_1$ | 38951 | 19356 | 58307 | 131780 | 73473 | 2.26 |
| $M_1S_2$ | 43384 | 19356 | 62740 | 162498 | 99758 | 2.59 |
| $M_1S_3$ | 46531 | 19356 | 65887 | 155678 | 89791 | 2.37 |
| $M_1S_4$ | 48631 | 0 | 48631 | 115253 | 66622 | 2.38 |
| $M_2S_1$ | 38451 | 19356 | 57807 | 146218 | 88411 | 2.53 |
| $M_2S_2$ | 42384 | 19356 | 61740 | 163158 | 101418 | 2.64 |
| $M_2S_3$ | 48781 | 19356 | 68137 | 174680 | 106543 | 2.57 |
| $M_2S_4$ | 47631 | 0 | 47631 | 112723 | 65092 | 2.37 |
| $M_3S_1$ | 37951 | 16308 | 54260 | 117590 | 63330 | 2.17 |
| $M_3S_2$ | 42634 | 16308 | 58942 | 134255 | 75313 | 2.28 |
| $M_3$S3 | 48031 | 16308 | 64339 | 141460 | 77121 | 2.20 |
| $M_3S_4$ | 48636 | 0 | 48636 | 106865 | 58229 | 2.20 |
| $M_4S_1$ | 37951 | 16308 | 54260 | 93500 | 39240 | 1.72 |
| $M_4S_2$ | 42384 | 16308 | 58692 | 110468 | 51776 | 1.88 |
| $M_4S_3$ | 46531 | 16308 | 62839 | 124520 | 61681 | 1.98 |
| $M_4S_4$ | 47631 | 0 | 47631 | 90173 | 42542 | 1.89 |

*Data not statistically analysed.

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

yield over closer and wider spacing (Table 2,4). All the yield attributing characters were lesser with closer spacing though the plant population were higher under the 120 x 60, reason might be due to significantly higher values of yield attributes under wider plant spacing which increased the yield of Bt cotton. This result is in 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 percent RDF as water soluble fertilizer. Pawar *et al.* (2014) 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% RDF as water soluble fertilizer recorded higher seed cotton yield and the same was statistically comparable with 120 x 90 cm with 100% 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 as it could not compensate for the loss in number of plants per hectare and thus recorded lower seed cotton yield per hectare. Narayanamoorthy (2010) also reported that the benefits of micro-irrigation in terms of water saving and productivity gains are substantial in comparison to the same crops cultivated under flood method of irrigation.

**Profitability of the dip irrigation system**

The cost of installing drip fertigation system for Bt cotton was higher (` 82,016 ha$^{-1}$ and ` 69,103 ha$^{-1}$). Though the initial capital investment was higher in drip fertigation system, the benefits obtained would be greater considering the longer life of the drip system. Annualized cost of drip system was ` 19,356 and ` 16,308 for 120 and 150 cm lateral spacing, respectively, which included annual interest of 14.5 per cent (Table 6).

The maximum gross income was realized in crop geometry of 120 x 90 cm combined with drip fertigation at 125% RDF as WSF. However the benefit cost ratio were higher with $M_2S_2$ and $M_1S_2$. Though wider lateral spacing under drip fertigation increase yield plant$^{-1}$, it had not compensated the plant population ha$^{-1}$ under closer spacing and thus resulted in lower yield and attributed to the lower income.

Higher gross return, net return and B:C ratio under drip fertigation with 150% RDF as against surface irrigation with soil application of fertilizer. Drip fertigation with WSF registered higher seed cotton yield, gross income, water saving *etc*., compared to conventional method. Kavitha *et al.* (2007) also reported that though the yield was the highest with water soluble fertilizer, the benefit cost ratio was less mainly due to high cost of speciality fertilizer in drip fertigated crop. However, the yield and gross income was high in the fertigated plots, due to higher uptake and nutrient use efficiencies from the costly fertilizers, which obtained a very meager difference of B:C ratio when compared to conventional fertilizers. Thus the additional expenditure towards the drip fertigation system and water soluble fertilizers was well compensated through greater additional income.

It was concluded that from the analysis of two years experimentation adapting the crop geometry of 120 x 90 cm and applying 100 per cent recommended fertilizer (150:75:75 kg $ha^{-1}$) in water soluble form (for P 75% as basal and only 25% WSF) through drip irrigation system recorded net return of ` 99,200 and ` 1,03,635 resulted in benefit: cost ratio of 2.58 and 2.70 during 2012-13 and 2013-14, respectively. This can be recommended as viable management option for cultivating interspecific Bt cotton. Alternatively the spacing of 120 x 60 cm with 100 per cent recommended fertilizer as above can be suggested for achieving relatively better net return and benefit: cost ratio.

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