

Evaluation of Growth, Yield and Quality of Conventional Cotton (*Gossypium hirsutum* L.) Hybrids in Comparison to Bt Hybrids

Key words : Conventioanl cotton, Evaluation of growth, Hybrids and Yield.

The first transgenic crop permitted for commercial cultivation in India was cotton in the year 2002-03 and within short span of time Bt Cotton occupied 86% of total area of 11 million hectares under cotton (Mayee, 2011). Introduction of alien gene into elite genetic background may alter the agronomic performance as all the donor DNA from the originally transferred line is not eliminated. Further, host factors related to the transformation process and the background genotype may contribute to the altered transgenic expression and agronomic performance (Showalter *et al.*, 2009). In this context, it is necessary to evaluate growth, yield attributes and quality parameters of Bt cotton hybrids vis-à-vis their counterparts (conventional hybrids) for formulating better management practices and sustainable yields.

A field experiment was conducted during *Kharif* 2009-10 at Regional Agricultural Research Station, Warangal (18°03'N latitude 79° 22' E' longitude and 270 m above MSL), Andhra Pradesh on sandy loam soil having pH of 7.2, organic carbon (0.4%). The soil was low in nitrogen (260.5 kg ha⁻¹), medium in P₂O₅ (43.5 kg ha⁻¹) and high in K₂O (515.4 kg ha⁻¹). The experiment consisted of cultivating cotton hybrids viz., Brahma, Bhaskar 9 and Mallia Non-Bt vis-à-vis their Bollgard I and Bollgard II counterparts.

The nine cotton hybrids were sown on 8-7-2009 adopting a spacing of 90x60cm in 3 replications. During the crop growth period, mean maximum and minimum temperatures recorded were 30.2°C and 21.6°C respectively and rainfall of 407 mm was received in 32 rainy days. The plot size was 7.2 m x 4.8m and the design adopted was R.B.D with 3 replications.

In the experimental field, phosphorus was applied basally in the form of single super phosphate to supply 60 kg ha⁻¹. Nitrogen (120 kg ha⁻¹) and potash (60 kg ha⁻¹) were applied in the form of urea and muriate of potash in three equal splits

between 20 and 80 days after sowing depending upon rainfall/irrigation. The crop was given two protective irrigations during boll development stage. To check weed growth, pendimethalin was sprayed @ 1.5 kg a.i/ha as pre emergence, subsequent weed growth was checked by inter cultivation and manual weeding. As dry weather conditions prevailed during the crop growth period, sucking pests especially jassids were above economic threshold levels which were checked by spraying of Acephate (1.5 g/litre) and Monocrotophos (1.6 ml/litre).

Growth and Development

Boll number /plant was significantly influenced by various genotypes under test (Table1). Boll number per plant was significantly influenced by genotypes as well as with Bt technology. Significantly higher boll number (38.5/plant) was recorded in Brahma BG. This hybrid recorded 23.1% higher boll number compared to its non Bt counterpart (29.6/plant). Bhalerao *et al.* (2012) also reported higher boll number per plant of Bt cotton hybrid over its non Bt counterpart. Lowest boll number (23.3/plant) was recorded in Mallika BG-II. Surprisingly, this boll number was 28.3% less than its Mallika non Bt counterpart (32.5/plant). Boll weight of 4.8 g was recorded in Brahma BG, where as it was maximum in Mallika BG (5.33g) which was not significantly influenced by genotypes.

Seed cotton yield

Picking wise seed cotton yield are presented in Table 2. Seed cotton yield at certain pickings and total seed cotton yield was significantly influenced by genotypes and bollgard technology.

Very conspicuously in all the non Bt genotypes, the seed cotton yield realized from first two pickings was around 30% as against 60% in their Bollgard counter parts. In the last picking

Table 1. Plant height, monopodia, sympodia, boll number and boll weight as influenced by Bt and non Bt hybrids.

Hybrid	Plant height (cm)	No. of monopodia/plant	No. of sympodia/plant	Boll number/plant	Boll weight (g)
Brahma Bollgard	104.6	2.20	16.00	38.5	4.80
Brahma Bollgard-II	108.0	2.47	16.93	37.6	5.13
Brahma NonBt	115.6	1.67	17.00	29.6	4.93
Bhaskar 9 Bollgard	114.3	2.47	18.43	32.1	5.06
Bhaskar 9 Bollgard-II	98.0	2.33	16.33	27.5	5.02
Bhaskar Non Bt	111.3	2.53	16.66	26.6	4.86
Mallika Bollgard	109.6	2.33	17.27	32.8	5.33
Mallika Bollgard-II	97.3	2.20	16.27	23.3	5.20
Mallika Non Bt	109.0	1.73	15.73	32.5	4.93
SEm ±	5.3	0.23	0.80	2.4	0.24
CD (P=0.05)	NS	NS	NS	7.3	NS
C.V. (%)	8.4	6.8	7.9	9.5	5.2

Table 2. Picking wise seed cotton yield (kg ha⁻¹) as influenced by Bt and non Bt hybrids.

Hybrid	1 st picking (106 days)	2 nd picking (130 days)	3 rd picking (155 days)	4 th picking (180 days)	Total
Brahma Bollgard	135 (8.4)*	871 (54)	334 (21)	267 (16.7)	1608
Brahma Bollgard-II	167 (10.7)	598 (38.2)	487 (31.1)	312 (19.9)	1564
Brahma NonBt	128 (10.2)	254 (20.2)	300 (23.8)	578 (45.8)	1260
Bhaskar 9 Bollgard	228 (15.5)	550 (37.4)	303 (20.6)	289 (26.5)	1470
Bhaskar 9 Bollgard-II	145 (12.0)	469 (38.9)	328 (27.1)	267 (22.0)	1209
Bhaskar Non Bt	58 (4.9)	318 (26.7)	281 (23.6)	535 (44.8)	1194
Mallika Bollgard	154 (10.9)	610 (43.1)	316 (22.3)	334 (23.4)	1415
Mallika Bollgard-II	154 (15.4)	388 (38.8)	266 (26.6)	192 (19.2)	1001
Mallika Non Bt	77 (5.5)	485 (34.6)	363 (25.8)	479 (34.1)	1406
SEm ±	42	90	57	44	120
CD (P=0.05)	NS	268	NS	132	360
C.V. (%)	9.8	10.2	8.6	10.4	

* Figures in parenthesis indicate percentage to total yield.

(180 DAS), non Bt hybrids yielded 34.1 % (Mallika), 44.8% Bhaskar and 45.8% (Brahma). The trend clearly indicated early boll set in Bollgard hybrids in comparison to their non Bt counter parts. The synchronous boll developments made Bt hybrids early maturing and in general Bt hybrids matured 20-30 days earlier than their non-Bt counter parts (Venugopalan et al. 2009 and Hebber *et al*, 2007).

In second picking (130 DAS), highest seed cotton yield (871 kg ha⁻¹) was recorded in Brahma BG, which was at par with Mallika BG (610 kg ha⁻¹) but proved significantly superior to other genotypes.

At final picking (180 DAS), all the non Bt cotton hybrids Brahma, Bhaskar 9 and Mallika recorded significantly higher seed cotton yields 578, 535, 479 kg ha⁻¹ respectively, over their Bt counter parts.

Significantly higher seed cotton yield of 1608 kg ha⁻¹ was recorded in Brahma BG, however this was at par with BG-II Brahma (1564 kg ha⁻¹), Bhaskar-9 BG (1470 kg ha⁻¹), Mallika BG (1415 kg ha⁻¹). Lowest seed cotton yield (1001 kg ha⁻¹) was recorded with Mallika BG-II followed by Bhaskar-9 BG-II (1209 kg ha⁻¹) and Brahma non Bt (1260 kg ha⁻¹).

Table 3. Staple length, Uniformity ratio, Micronaire and Strength as influenced by Bt and non Bt hybrids.

Hybrid	Staple length (mm)	Uniformity Ratio (%)	Micronaire (10 ⁶ mm/inch)	Strength (g/tex)
Brahma Bollgard	29.71	47.7	3.56	24.36
Brahma Bollgard-II	29.49	48.2	3.42	24.06
Brahma NonBt	30.51	48.4	3.44	25.26
Bhaskar 9 Bollgard	29.81	48.1	3.16	24.16
Bhaskar 9 Bollgard-II	29.32	47.9	3.40	23.70
Bhaskar Non Bt	29.08	47.6	3.43	24.03
Mallika Bollgard	29.60	47.6	3.23	24.60
Mallika Bollgard-II	29.25	46.9	3.33	23.40
Mallika Non Bt	28.92	48.7	3.35	24.10
SEm ±	0.72	1.0	0.17	0.34
CD (P=0.05)	NS	NS	NS	NS
C.V. (%)	4.5	5.4	6.2	3.8

Quality parameters

The quality parameters viz., staple length, uniformity ratio, micronaire and strength were significantly not influenced by various genotypes as well as Bt technology (Table 3). Numerically higher staple length (30.51 mm) was recorded in Brahma non Bt followed by Bhaskar Bt (29.81 mm). Uniformity ratio ranged from 46.9 (Mallika BG-II) to 48.7 percent (Mallika Non Bt). Micronaire value was maximum (3.56) in Brahma Bt, whereas minimum (3.16) in Bhaskar 9 Bt. Numerically higher strength (25.26 g/tex) was noticed in Brahma Non Bt followed by Bhaskar 9 non Bt (24.60 g/tex). Similar non significant results on quality parameters by Bt were earlier reported by Patil et al (2011).

Thus, the present investigation can be concluded that synchronous boll development is the prime reason for early maturing and in turn early picking in Bt cotton hybrids compared to their non Bt counterparts. However, the quality parameters were not influenced by Bt technology.

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Rice Research Centre
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Hyderabad 500 030

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**P Raghu Rami Reddy
B Dileep Kumar**

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