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Effect of modified morphoframe (by square removal treatment) on economic and fibre quality parameters in cotton

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Abstract : A field experiment was carried out using five hybrids of cotton (RCH 2 *Bt*, JKCH 99 *Bt*, NCEH 2R *Bt*, Mallika *Bt* and non *Bt* G.Cot.Hy.10) and two concentrations of ethylene (30 and 45 ppm) and one time hand removal of squares besides untreated control. Square removal treatments were applied at square initiation (45-50 DAS). The result indicated that *Bt* hybrid JKCH 99 recorded significantly higher yield than other *Bt* hybrids and non *Bt* hybrid. Significantly higher seed and lint index were obtained with 45 ppm ethylene and mechanical removal of squares. Ginning per cent was not significantly influenced by square removal treatments. Quality parameters like uniformity ratio, maturity coefficient, micronaire and SFI were found to be significant due to square removal treatments, while 2.5 per cent span length and fibre strength did not show any significant effect.

Key words : Cotton, economical characters, fibre quality parameters, square removal

Cotton is called "White Gold" and it is one among few crop species that were domesticated both in old and new world having importance as a multipurpose crop that supply five basic products lint, oil, seed meal, hulls and linters. It ranks second in production of seed cotton, but the production/unit area is low as compared to other countries. *Bt* hybrids retain more bolls at early growth stage because of better insect control over their non *Bt* counterparts. Developing bolls have a greater demand for photosynthates. Thus plants with higher boll load not only have a greater demand for photosynthate but also a greater inter organ competition for photoassimilates. This higher fruit load appears to be a major factor which causes slow growth of flowering and a decreased boll retention later in *Bt* cotton. A good plant frame would provide sufficient space for holding and catering the needs of the reproductive parts during the later part of growth. Under Indian conditions, the crop experiences initial water logging followed by sucking pests. Both these stresses cause considerable damage to the plant leading to stunted growth. This leads the plants either to premature death/forced maturity or to reduced boll load. Relatively little is known about hormonal control of cutout. Various growth regulators *viz.* auxin, gibberellins, retardants etc have been applied in cotton in attempt to set more bolls, limit vegetative growth or terminate fruiting. When boll load is limited by carbohydrate availability, exogenous modification of hormonal balance to increase boll set may be futile More bolls may be set, but will be of smaller size and plant growth is terminated prematurely. Therefore, a plant type with a good morphoframe would sustain more boll load with synchronous boll development and boll burst. This will help in enhanced yield and effective harvesting in one or two picking. Thus, it is important in view of fact that in *Bt* cotton, the plant frame doesn't develop fully due to early switch over to reproductive phase.

A field experiment was carried out at Main Cotton Research Station, Navsari Agricultural University, Surat during *kharif* 2008-2009 to study the effect of modified morphoframe (by square removal treatments) on economic and fibre quality parameters in cotton**.** Twenty treatments, consisting of five hybrids of cotton (RCH 2 *Bt*, JKCH 99 *Bt*, NCEH 2R *Bt*, Mallika *Bt* and non *Bt* G.Cot.Hy.10) and two concentration of ethylene (30 and 45 ppm at square initiation) and one time hand removal of squares besides untreated control in factorial randomized block design (FRBD) with three replications. The experimental soil was fertilized with 10 t FYM/ ha uniformly at the time of land preparation. The chemical fertilizer was applied @ 240:00:00 kg NPK/ha in the form of urea at 25 to 30 days interval starting from 20 DAS. All the necessary plant protection measures were taken as and when required for the control of insect pests. The data on cotton seed 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 fibre quality was evaluated in the Cotton Institute for Research in Cotton Technology (CIRCOT). Regional Station, Surat using fully automatic HVI machine at R.H. 65±2 and temp 27.2^{0}C.

Seed cotton yield : The result indicated that (Table 1) all *Bt* hybrids recorded higher seed cotton yield than non *Bt* hybrid, Patil *et al.*, (2009) also reported higher seed cotton yield in *Bt* cottons as compared to non *Bt* JKCH 99 *Bt* recorded highest seed cotton yield (2156 kg/ha). However, other *Bt* hybrids (NCEH 2R *Bt*, RCH 2 *Bt* and Mallika *Bt*) were statistically *at par*. Minimum seed cotton yield was observed in G.Cot.Hy. 10 (1445 kg/ha).

A perusal of the results further indicated that (Table 1) modification of morphoframe through square removal by application of 45 ppm ethylene and mechanical removal increased seed cotton yield by significant margin over untreated control. Similar findings were reported by Bednarz and Roberts (2001) and Stewart *et al.,* (2001).

Table 1. Effect of square removal on economic character and seed cotton yield in cotton

	Economic character			Seed cotton yield (kg/ha)
	Ginning (%)	Seed index	Lint index	
A. Variety (V)				
RCH 2 *Bt*	38.9	8.66	5.47	1876
JKCH 99 *Bt*	40.1	9.11	6.09	2156
NCEH 2R *Bt*	38.5	8.47	5.30	1903
Mallika *Bt*	38.3	8.43	5.20	1845
G.Cot.Hy. 10	37.9	7.46	4.60	1445
S. Em. ±	1.21	0.26	0.21	118
P=0.05	NS	0.73	0.60	339
B. Tretments (T)				
No spray (Control)	37.9	7.87	4.92	1641
Ethylene (30 ppm)	38.6	8.37	5.11	1750
Ethylene (45 ppm)	39.6	8.90	5.82	2028
Mechanical removal of squares	38.8	8.56	5.46	1959
S. Em. ±	1.08	0.23	0.19	106
P=0.05	NS	0.66	0.54	303
C. Interaction (V x T)				
S. Em. ±	2.42	0.51	0.42	237
P=0.05	NS	NS	NS	NS
C.V.(%)	10.84	10.53	13.59	22.2

Economic characters

Ginning percentage : It was evident from the data presented in Table 1 that ginning per cent did not significantly differ either amongst the hybrids or due to square removal treatment. Neverthless JKCH 99 *Bt* (40.1) and 45 ppm ethylene (39.6) recorded highest ginning percentage.

Seed index : It is indicated from the results (Table 1) that all *Bt* hybrids recorded significantly higher seed index as compared to non *Bt* hybrid. *Bt* hybrid JKCH 99 *Bt* (9.11) recorded significantly higher seed index. Patil *et al.,* (2009) found higher seed index in *Bt* compared to non *Bt* cottons. A significantly higher seed index in 45 ppm ethylene (8.90) and mechanical removal (8.56) can be ascribed to greater boll weight and biomass due to modified morphoframe of plant.

Lint index : It is evident from the data presented in Table 1 that lint index was significantly differed amongst cotton hybrids. *Bt* hybrid JKCH 99 recorded highest lint index (6.09) which was *at par* with RCH 2 *Bt* (5.47). Such differences amongst genotypes are reported earlier also (Pettigrew, 2004). Square removal by 45 ppm ethylene (5.82) and by hand (5.46) significantly increased lint index over control. A bolder seed and overall better growth and environment due to modification of morphoframe resulted in higher lint index.

Fibre quality parameters : Fibre quality parameters as delineated in Table 2 showed that the hybrids significantly varied in 2.5 per cent span length, uniformity ratio, maturity coefficient, micronaire, fibre strength (fineness) and SFI. All the hybrids fell in long staple category (27.5-32.5 mm) with good maturity coefficient (0.81-0.90). However, uniformity ratio was excellent in JKCH 99 *Bt* (48.7), Mallika and G.Cot.Hy. 10, good in NCEH 2R *Bt* and average in RCH 2 *Bt*. In term of fineness, RCH 2 *Bt*, NCEH 2R *Bt* and Mallika yielded fine fibre whereas JKCH 99 *Bt* and G.Cot.Hy.10 were average in fineness. All *Bt* hybrids were average in strength (21-24 g/tax) whereas non *Bt* G.Cot.Hy. 10 was good (25-28 g/tax). RCH 2 *Bt* and JKCH 99 *Bt* recorded high SFI as compared to others. Square removal

Table 2. Effect of square removal (either mechanical or chemical) on fibre quality parameters in cotton

	Fibre quality parameters					
	2.5 per cent span length	Uniformity ratio (%)	Maturity coefficient	Micronire (mv)	Fibre strength (g/tax)	SFI
A. Variety (V)						
RCH 2 *Bt*	29.8	44.8	0.814	3.49	22.5	10.4
JKCH 99 *Bt*	27.8	48.7	0.839	4.48	22.0	10.2
NCEH 2R *Bt*	29.7	47.0	0.832	3.83	23.9	8.73
Mallika *Bt*	30.2	47.6	0.827	3.78	23.7	7.86
G.Cot Hy 10	29.5	48.2	0.849	4.33	25.0	8.18
S. Em. ±	0.33	0.44	0.003	0.09	0.34	0.42
P=0.05	0.94	1.2	0.009	0.26	0.97	1.20
B. Tretments (T)						
No spray (Control)	29.9	48.3	0.843	4.23	23.9	8.01
Ethylene (30 ppm)	29.3	46.9	0.832	3.97	23.5	9.32
Ethylene (45 ppm)	29.2	47.0	0.828	3.87	23.1	9.56
Mechanical removal of squares	29.2	46.9	0.827	3.87	23.2	9.38
S. Em. ±	0.29	0.39	0.003	0.08	0.30	0.37
P=0.05	NS	1.1	0.008	0.23	NS	1.07
C. Interaction (V x T)						
S. Em. ±	0.65	0.87	0.006	0.18	0.67	0.84
P=0.05	NS	NS	NS	NS	NS	NS
C.V. (%)	3.87	3.21	1.37	7.89	5.0	16.0

treatments had no significant bearing on span length, strength of the fibre and the fibre in all treatment including control were long (27.5-32.5) and average in strength (21-24 g/tax). Interestingly, the fibres in control treatment were excellent whereas in square removal treatments were good in uniformity ratio. This is amply indicated from maturity coefficient which declined due to square removal treatment, although all of them displayed good maturity. In contrast to uniformity ratio and maturity coefficient, the fineness of fibre improved due to square removal *vis-à-vis* control which was average in fineness. The short fibre index (SFI) increased due to square removal treatment which can be understood in light of the fact that the treatments had adverse effect on uniformity ratio, maturity coefficient and even strength. It is probably because of more immature fibre that the micronaire was high in square removal treatment.

CONLUSION

Thus, manipulation of *Bt* plant morphoframe through application of 45 ppm ethylene at square initiation or mechanical removal of squares significantly improved seed cotton yield, ginning percentage, seed index as well as lint index increased by significant margin due to these two treatments without affecting span length and strength of the fibres. Maturity coefficient and uniformity ratio were reduced due to square removal which, in turn, improved fineness but increased short fibre index. Despite these differences in quality parameters, the category of fibre quality, by and large, remained unaffected.

All *Bt* hybrids were superior to non *Bt* hybrid with respect to yield. Amongst the four *Bt* hybrids, JKCH 99 *Bt* was highest yielding.

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