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Influence of modification of morphoframe through detopping, ethrel and maleic hydrazide on growth and yield of *Bt* cotton hybrid

G. K. KATARIA*, M. G. VALU, V. L. KIKANI AND L. K. DHADUK
Cotton Research Station, Junagadh Agricultural University, Junagadh-362 001
**E-mail: gkkataria@jau.in*

ABSTRACT : Field experiments were conducted at Cotton Research Station, Junagadh during 3 consecutive *kharif* 2013 to 2015 to evaluate the influence of modification of morphoframe through detopping and foliar application of growth regulators on growth, yield and yield attributes of *Bt* cotton. The experiment was laid in randomized block design replicated thrice. There were total 9 treatments with control. Detopping of cotton plants were done at 60 and 75 DAS. Foliar application of maleic hydrazide (30ppm) and ethrel (40ppm) were done at 60 DAS and this PGR sprayed at 80 and 90 DAS with combination of detopping at 60 and 75 DAS. The pool results revealed that significantly highest seed cotton yield of 3923 kg/ha was obtained with detopping at 75 DAS + application of MH@30ppm at 90 DAS and it was *at par* with detopping at 75 DAS(3728 kg/ha). The increase in yield was primarily due to increase in length and sympodial branches and increased bolls/plant. This increase in seed cotton yield over control varied from 15.1 to 21.1 per cent.

Key words : Boll, detopping, plant growth regulator, sympodia, yield

Cotton (*Gossypium spp* L.) as "King of Fiber" is one of the most ancient and important cash crop next to food grains in India and playing a pivotal role in agriculture, industrial development and employment generation in India and national economy. It is cultivated on about 30.9 million ha across the world. India has the distinction of having the largest area under cotton cultivation in the world ranging between 11-12 million ha. It accounts for about 38 per cent of the global cotton area and contributes 26.7 per cent (26.8 million bales) of the global cotton produce and rank first. The yield/ha is however low *i. e.* 494 kg/ha against the world average 705 kg/ha. In India, Gujarat is the largest producer of cotton having 2.7 million ha under cotton cultivation, producing 9.78 million bales and ranks first in production. (Anonymous, 2016).

Cotton is an indeterminate growth habit, very responsive to climatic changes and management. Many attempts have been made to alter the growth habit of the crop (through mechanical and chemical means) so as to improve productivity and to bring about some more amenability for cultural manipulations. Literature abounds with several reports on ethylene and MH triggered/enhanced physiological reactions and a series of growth processes leading to greater main stem node and sympodial branches, squares, bolls and enhance seed cotton yield. These results are in conformity with earlier works of Nawalkar *et al.*, (2014), Kumari and George (2012). Keeping these facts in mind, the present investigation was carried out to investigate the influence of modification of morphoframe through detopping, ethylene and MH on growth and yield of cotton.

MATERIALS AND METHODS

Field experiments were carried out at Cotton Research Farm, Junagadh Agricultural University, Junagadh during the 3 consecutive *kharif* 2013 to 2015 on irrigated cotton. Cotton genotype Vikrum 5 BG II was sown after rainfall with a spacing of 120 x 45cm in medium black soil. The cotton plant growth controlled by detopping (removal of 6-10 cm apical bud) the plant and by spray of growth inhibitors (maleic hydrazide (MH) and ethrel) and with its combinations. There were 9 treatments *viz.,* T1-Control, T2-Detopping at 60 DAS, T3- Detopping at 75 DAS, T4-ethrel@40ppm at 60 DAS, T5-MH@30ppm at 60 DAS, T6-Detopping at 60 DAS + ethrel@40ppm at 80 DAS, T7- Detopping at 60 DAS + MH@30ppm at 80 DAS, T8- Detopping at 75 DAS + ethrel@40ppm at 90 DAS and T9-Detopping at 75 DAS + MH@30ppm at 90 DAS. All recommended agronomical and plant protection measures were carried out in time to keep the crop in healthy condition.

Five plants from each treatment were selected randomly and tagged for recording various observations on morpho physiological growth parameters and yield attributes at periodically and at harvest. Seed cotton yield was worked out from the net plot basis and expressed as kg/ha. Statistical analysis was carried out.

RESULTS AND DISCUSSION

Plant height (cm) : The plant height was observed significantly minimum in treatment T_3 (81 cm) detopping at 75 DAS and followed by T_9 (82 cm) detopping at 75 DAS with application of MH at 90 DAS as compare to control (Table 1). The plant height was minimum due to detopping the plant and application of growth inhibitor MH and ethrel that inhibit stem inter node length (Kumari and George, 2012 and Darrin, *et al.,* 2010).

Number and length of sympodia (cm) : Significantly highest number and length of sympodia was produced in treatment T_9 followed by T_3. The increase in sympodia may be due to increased nodes on main stem. The MH and detopping inhibited vertical plant growth and subsequently promoted lateral growth including branching. These results are in conformity with the findings of Kumari and George,(2012) and Nawalkar *et al.,* (2014).

Boll opening and maturity (Days) : One week early 50 per cent boll opening and crop maturity were observed in the treatments T_9 followed by T_3 (Table 1). Application of growth retardants and detopping restricted the vegetative growth (plant height) and enforce plant toward reproductive stage and early maturity. Similar result has been reported by Nawalkar *et al.,* (2014).

Seed index and lint index : The data presented in Table 1 clearly revealed that seed index (11.43 and 11.17) and lint index (5.73 and 5.54) were significantly shown higher in the treatments T_9 and T_3 respectively.

Bolls/plant and average boll weight : The bolls that a cotton hybrids bears at harvest or at maturity, is an important yield component having the greatest direct effect on yield. Detopping at 75 DAS with application of MH at 90 DAS (T_9) was recorded significantly highest bolls over control (Table 1) followed by detopping at 75 DAS (T_3). Increased bolls due to vertical growth inhibit and increased in numbers and length of sympodia and it was produced and retained more numbers of squares ultimately

Tabe 1. Effect of different treatments on yield, yielding characters and quality parameters of cotton (Pooled data of 3 years)

Treat-ments	Seed cotton yield (kg/ha)	Cal. lint yield (kg/ha)	G.P. (%)	Symp-odia/ plant	Sympo-dial length (cm)	Plant height (cm)	Days to maturity	Bolls/ plant	Boll weight (g)	Seed index (g)	Lint index (g)	Oil content (%)	Oil yield (kg/ha)
T_1	3239	1062	32.5	12.33	33.6	92	222	31.74	5.58	10.42	4.99	19.5	423.19
T_2	3191	1045	32.4	13.60	37.6	84	219	33.91	5.38	10.34	4.94	19.6	420.84
T_3	3728	1249	33.2	14.93	42.3	81	218	38.56	5.38	11.17	5.54	19.7	487.57
T_4	3301	1081	32.6	14.07	35.6	87	219	35.01	5.37	10.31	4.96	19.5	431.88
T_5	3138	1026	32.7	14.27	34.2	87	218	34.39	5.21	9.77	4.72	19.6	413.22
T_6	3383	1126	33.2	13.48	41.0	85	216	36.08	5.29	10.42	5.14	19.6	439.95
T_7	3439	1124	32.6	13.80	38.0	85	218	34.18	5.50	11.09	5.35	19.6	454.67
T_8	3293	1094	33.0	13.99	39.3	84	217	35.08	5.33	10.03	4.93	19.6	430.22
T_9	3923	1317	33.5	15.89	45.3	82	215	42.17	5.40	11.43	5.73	19.8	517.90
S. Em. +	122	40	0.2	0.4	1.3	1.0	0.8	1.2	0.1	0.2	0.1	0.1	16.2
CD (p=0.05)	347	115	0.7	1.1	3.7	3.0	2.2	3.3	NS	0.5	0.2	NS	46.1
CV (%)	11	11	2.2	8.4	10.2	3.7	1.1	9.7	6.0	5.0	4.9	1.0	10.9
Y													
S.Em.±	70	23	0.1	0.2	0.8	0.6	0.5	0.7	0.1	0.1	0.0	0.0	9.3
C.D. (p=0.05)	201	66	0.4	0.6	2.2	1.7	1.3	1.9	0.2	0.3	NS	0.1	26.6
Y X T													
S.Em.±	211	70	0.4	0.7	2.3	1.8	1.4	2.0	0.2	0.3	0.1	0.1	28.0
C.D. (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

plant attained more bolls. These results are in harmony with the finding of Nawalkar *et al.*, (2014) and Kumari and George (2012). There was no difference found among the different treatments in average boll weight (Table 1).

Oil percentage and oil yield : There was no significant difference found among the treatments in oil percentage but significantly highest oil yield was obtained in T9 (517.90 kg/ha) and it was *at par* with T3 (487.57 kg/ha) shown in Table 1. Nawalkar *et al.*, (2014) also reported similar finding.

Seed cotton and lint yield : The analyzed data presented in Table 1 indicated that treatment differences were found significant during all the years. Among all the treatments, detopping at 75 DAS + foliar spray of MH@30 ppm at 90 DAS (T_9) recorded the consistence and significantly higher seed cotton yield (3923 kg/ha) during all the experimental years and it was *at par* with T_3 (3728 kg/ha) detopping at 75 DAS. Same trend was found in case of lint yield and ginning percentage. The higher seed cotton yield obtained due to increase in numbers of sympodia and sympodial length, it produced and retained more numbers of squares ultimately plant attained more bolls. The effect of growth regulators and pruning in cotton crop found that boll number and seed weight increased significantly as a result of pruning studied by Shekar *et al.*, (2015). Application of MH also had positive effect on sympodia which was increased over control. The MH inhibited vertical plant growth and subsequently promoted lateral growth including branching and enhance seed cotton yield. These results are in conformity with the findings of Kumari and George (2012) Chase Samples *et al.*, (2015) and Buttar and Singh (2013).

CONCLUSION

Based on the present investigation, it can be concluded that the detopping of plant at 75 DAS with foliar spray of MH@30 ppm at 90 DAS or detopping of plant at 75 DAS is required in *Bt* cotton for realizing significantly higher seed cotton yield. The seed cotton yield increment was recorded from 15 to 21 per cent as compared to control. It was found to be most effective and economically viable technology for enhancing seed cotton yield of *Bt* cotton hybrids.

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