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Impact of growth retardant and de topping on seed cotton yield of *Bt* cotton under semi arid conditions

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Abstract : The study was undertaken in the *kharif* season of 2023 to investigate the application of integrated crop management approaches for maximising the production of seed cotton in Bt cotton crops in semi-arid conditions. The experiment was conducted in well drained sandy loam soil having medium levels of nitrogen, phosphorous and potassium. The experiment was designed in randomized block design consisting of eleven treatments with three replications which includes different combinations of crop management techniques. T1: Conventional practice, T2 cotton in closer spacing 90x30 cm, T3: T2+ De-topping at 100 cm, T4: T2+ Pruning of monopodia at 45 DAS, T5: T2+Two sprays of Mepiquat Chloride @ 25 g a.i at 45 and 60 DAS. T6: T3+T4, T7:T3+T5, T8:T4+T5, T9:T3+T4+T5, T11:T10+Straw/crop residue mulch @ 5 t/ha, T12: T9+Polymulch. All package and practices of *Bt* cotton were followed and different treatments were imposed. RCH 777 BG II was sown on 05/05/2023. The total amount of rainfall received throughout the planting season was 242.5 millimetres. The seed cotton yield increased by 25.67% when using a closer spacing of 90x30 cm, de topping at 100 cm, and applying mepiquat chloride at 45 and 60 DAS. This increase was statistically similar to the yield obtained with closer spacing, but significantly greater compared to the control. Yield attributing characters like sympodial length and boll weight was significantly higher when using closer spacing (90x30 cm), de-topping at 100 cm and application of mepiquat chloride at 45 and 60 DAS as compared to control.

Keyword: *Bt* cotton, De topping, mepiquat chloride, poly mulch

Cotton is the major cash crop of India and accounts for 65 per cent of the fibre used in the textile industry. The cotton production in India during 2023-2024 is estimated to produce 323.11 lakh bales of 170 kg from 124.69 lakh hectares with a productivity of 441 kg lint/ha as estimated by the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, New Delhi. The area under cotton in the current year in the country decreased by 3.67 per cent and cotton production decreased by 4.18 per cent compared to last year. In the world cotton scenario, Current year China is the leading producer of cotton with 56.00 lakh tones equivalent to 329 lakh bales of 170 kg. India is the second largest producer of cotton with 53.85 lakh tones equivalent to 316 lakh bales of 170 kg. India's cotton productivity (436 kg/ha) is still below the global average (Annymous, 2023). Cotton is morphologically indeterminate and is very sensitive to agronomical and environmental changes. Refinement of agronomic practices along with the use of high yielding hybrids can be a tool to enhance the cotton productivity. Under ideal growing conditions, cotton produces an excessive amount of vegetative biomass, which is frequently linked to a decrease in yield. A vigorous vegetative growth pattern causes premature abscission of developing fruiting bodies, as well as delayed maturity, reduced yield and resulted in boll rot due to shedding (Chaudhary *et al.*, 2022). Thus, the plant needs to maintain equilibrium between vegetative and reproductive development in order to provide enough carbohydrate supply for fruit development, rather than profuse vegetative growth that impede the development of fruiting bodies (Bons *et al.*, 2015). Hallikeri *et al.*, (2010) reported that de topping, decrease plant height and number of sympodial branches plant-1 but has a non-significant effect on boll weight and percent lint. However, the increase in seed cotton

yield by de topping over no de topping was reported by Shwetha *et al.*, (2009).

The study was undertaken in the *kharif* season of 2023 to investigate the application of integrated crop management approaches for maximising the production of seed cotton in *Bt* cotton crops in semi arid conditions. The experiment was conducted in well drained Sandy loam with pH (7.91), EC (0.12 dSm-1), having medium levels of Organic Carbon (0.46 %) Available nitrogen (300.7 kg/ha), phosphorous (24.6kg/ha) and potassium (337kg/ha). The experiment was designed in randomized block design consisting of eleven treatments with three replications which includes different combinations of crop management techniques. T_1: Conventional practice, T_2 cotton in closer spacing 90x30 cm, T_3: T_2+ De-topping at 100 cm, T_4: T_2+ Pruning of monopodia at 45 DAS, T_5: T_2+Two sprays of Mepiquat Chloride@ 25 g a.i at 45 and 60 DAS. T_6: T_3+T_4, T_7:T_3+T_5, T_8:T_4+T_5, T_9:T_3+T_4+T_5, T_{10}: Straw/crop residue mulch @ 5 t/ha, T_{11}: T_9+Polymulch. The total amount of rainfall received throughout the planting season was 242.5 millimetres. All agrometeorological data during the crop predicted in fig.1. All package and practices of *Bt* cotton were followed, and different treatments were imposed. RCH 777 BG II was sown on 05/05/2023. Sowing was done by dibbling method. Height of five tagged plants in each plot was measured at harvest. It was measured from the main stem to the tip of fully opened leaf at the top and expressed in cm. Data of yield attributing characters was recorded from five tagged plants of each plot and seed cotton yield of each plot was recorded and converted into kilogram/ hectare.

Table 1. Effect of growth retardant and de topping on growth and yield attributes of cotton

Treatments	Plant height (cm) at harvest	No. of monopodia at harvest	No. of sympodia at harvest	Sympodial length (cm)	No of bolls/ sqm	Boll weight (g)	Final plant population (no /net plot)	Seed cotton yield (kg/ha)
T1	223	3.67	22.67	58.56	100	4.51	137	2746
T2	220	2.33	29.67	52.72	128	4.09	205	3351
T3	227	2.67	29.00	66.59	94	4.05	201	2163
T4	133	2.67	31.00	61.09	109	4.31	202	2881
T5	102	2.67	25.33	36.96	112	4.33	199	3175
T6	67	2.67	24.67	52.64	113	4.44	200	3292
T7	97	2.67	23.00	46.37	115	4.60	209	3451
T8	168	2.67	33.67	47.12	88	4.29	201	2851
T9	115	2.33	35.33	48.80	86	4.40	204	2557
T10	100	2.33	34.33	53.17	100	4.46	200	2845
T11	83	2.67	34.00	57.24	100	4.52	205	3192
SEd	24.74	0.39	1.73	5.37	13.45	0.06	5.20	299.22
CD (5%)	51.13	NS	3.61	11.22	NS	0.13	10.85	624.55
CV	22.56	17.42	7.14	12.47	15.9	1.67	03.23	12.54

Table 2. Study of Economic of retardant and de topping treatment in cotton

Treatments	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit Cost Ratio
T1	120785	164760	43975	1.36
T2	129850	201060	71210	1.55
T3	116153	129780	13628	1.12
T4	131050	172860	41810	1.32
T5	132710	190500	57790	1.44
T6	141340	197520	56180	1.40
T7	140975	207060	66085	1.47
T8	136600	171060	34460	1.25
T9	135815	153420	17605	1.13
T10	153870	170700	16830	1.11
T11	157165	191520	34355	1.22

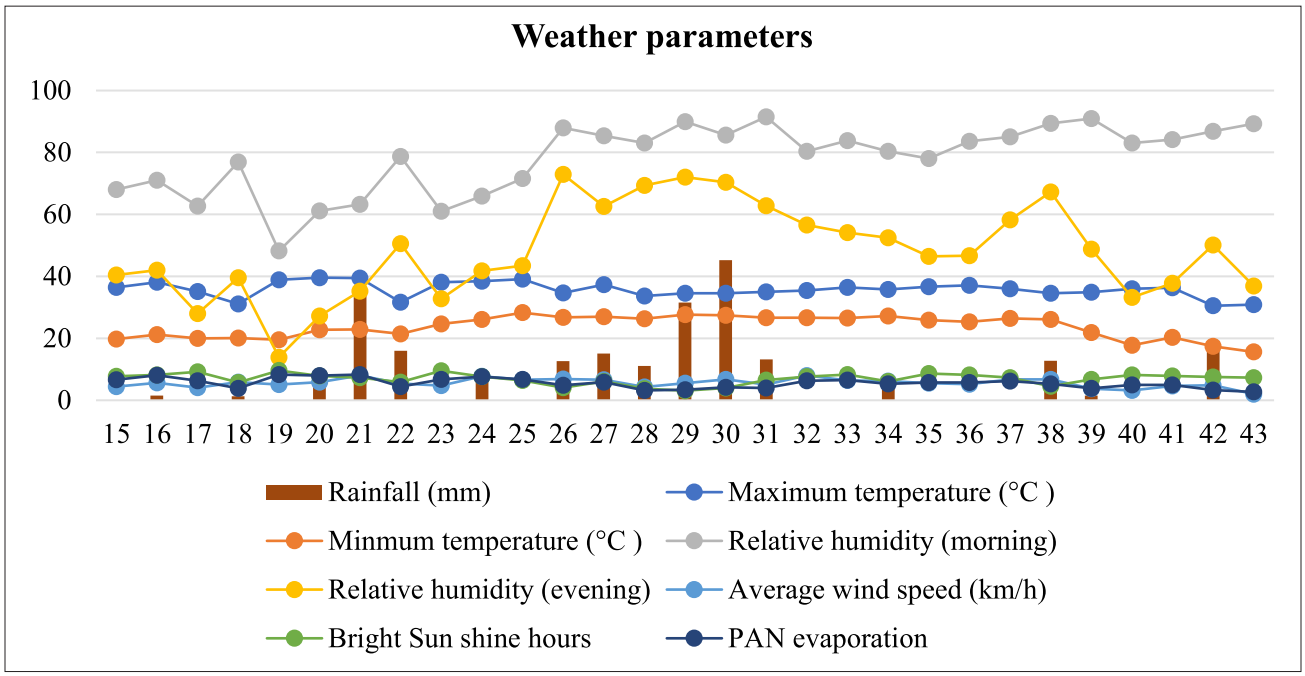

Fig. 1. Weekly mean meteorological data values throughout the *kharif* crop growing season of 2023.

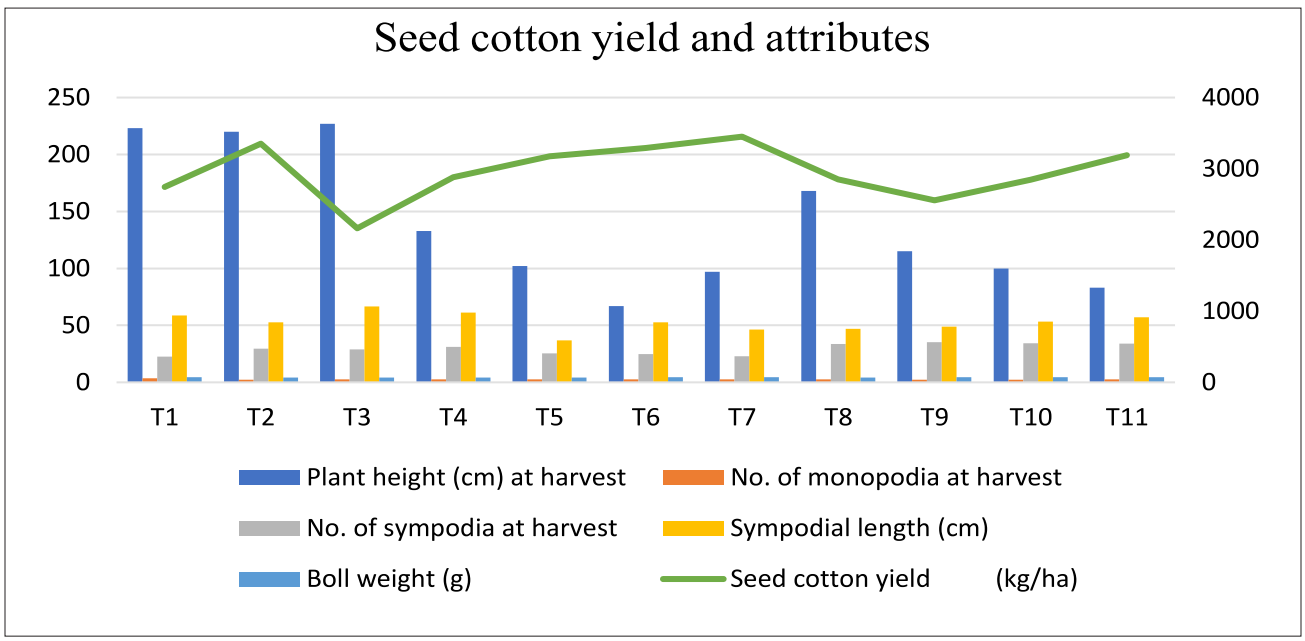

Fig. 1. Effect of different treatments on growth and yield attributes of cotton.

RESULTS AND DISCUSSION

Significantly higher plant height was recorded in control as compared to all treatments except, T_2 and in T_3. Lowest plant (67cm) height was recorded in T_6. Number of monopods and number of bolls per sq m were not affected by different treatments. Number of sympodia in T_8, T_9, T_{10}, T_{10} and T_{11} recorded significantly higher as compared to other treatments, Sympodial length was recorded significantly higher in T_1, T_3 and T_4 as compared to other treatments, numerically highest in T_3 (66.69 cm) among three. Hallikeri *et al.*, (2010) reported that de topping, decrease plant height and number of sympodial branches/plant but has a

non-significant effect on boll weight and percent lint. However, the increase in seed cotton yield by de-topping over no de-topping was reported by Shwetha *et al.*, (2009). Final plant population was lower in T_1 as compared to all other treatments due to wider plant spacing as per treatment. Boll weight was recorded significantly higher in T_7 (4.60 gm) and comparable with T_{11} (4.52) and T_1 (4.51) as compared to other treatments. Seed cotton yield was recorded significantly higher in T_7 comparable in T_3, T_5, T_6, T_{10} and T_{11} as compared to other treatments (Table 1 and Fig.2). Plant growth retardants (PGRs) are a group of chemicals that are commonly used to regulate plant growth at different growth stages. PGRs have the potential to optimize the source sink relationship and enhance the movement of assimilates towards reproductive organs, consequently, helping in effective flower, fruit and seed development and ultimately enhanced productivity of the crops (Qin *et al.* 2023). Growth retardants like MC and MH hinders plants' ability to synthesise gibberellic acid, inhibit cell elongation, make plants shorter, increase chlorophyll content and diverts the assimilates from leaves and stem to developing fruits. Photosynthesis underpins the formation of photoassimilates; hence, enhancing plant photosynthetic efficiency is essential for augmenting cotton yield (Faralli and Lawson, 2020). Highest B:C was recorded in T_2 (1.55) followed by T_7 (1.47). Maximum net return was also followed the similar pattern as B:C . (Table 2).

CONCLUSION

Plant spacing (90x30 cm) in *Bt* cotton under semiarid conditions of Haryana along with de-topping at 100cm height and two sprays of Mepiquat Chloride @ 25 g *a.i.* at 45 and 60 DAS increases seed cotton yield by 25 per cent. More repetition of experiment is required for confirmation of results.

REFERENCES

Anonymous, Indiastat 2023. https://www.indiastat.com/table/total-foodgrains/season-wise-area-production-yield-foodgrains-oilse/1458684.

Bons, H.K., Kaur, N. and Rattanpal, H.S. 2015. Quality and quantity improvement of citrus: role of plant growth regulators. *International J. Agriculture, Environment and Biotechnology*, **8**: 433-47.

Chaudhary, S., Devi, P., Hanumantha Rao, B., Jha, U.C., Sharma, K.D., Prasad, P.V., Kumar, S., Siddique, K.H.M. and Nayyar, H. 2022. Physiological and molecular approaches for developing thermotolerance in vegetable crops: a growth, yield and sustenance perspective. *Frontiers in Pl. Sci.*, **13**: 1892.

Faralli, M., Lawson, T. 2020. Natural genetic variation in photosynthesis: an untapped resource to increase crop yield potential? *Plant J.* **101**, 518–528. doi: 10.1111/tpj.14568.

Hallikeri S.S., Halemani H.L., Patil V.C., Palled Y.B., Patil B.C., Katageri, I.S. Effect of nitrogen levels, split application of nitrogen and de-topping on seed cotton yield and fibre quality in *Bt* cotton. *Karnataka J. Agric. Sci.* 2010; **23**: 418-22.

Qin, A., Aluko, O.O., Liu, Z., Yang, J., Hu, M., Guan, L. and Sun, X. 2023. Improved cotton yield: Can we achieve this goal by regulating the coordination of source and sink Frontiers in Plant Sci., **14**: 1136636.

Shwetha N.S., Halepyati A.S., Pujari B.T. 2009. Effect of de-topping, removal of monopodia and plant spacings on nutrient uptake, quality parameters and economics of *Bt* cotton (*Gossypium hirsutum* L.). *Karnataka J. Agric. Sci.* 2009; **22**:892-93.

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