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INFLUENCE OF PLANT GROWTH REGULATORS ON MORPHO-PHYSIOLOGICAL TRAITS AND YIELD IN BT COTTON *(Gossypium hirsutum* L.*)*

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ABSTRACT

Plant growth regulators (PGR) are used in cotton (Gossypium hirsutum L.) production to balance vegetative and reproductive growth, as well as to increase seed cotton yield and lint yield. Field experiment was conducted to determine the influence of mepiquate chloride (MC) and cycocel (CCC) on morpho-physiological components and yield in cotton using cv. 'NHH 44 Bt. The study was conducted at Cotton Research Station, JAU, Junagadh during Kharif 2010. The experiment was comprised of total nine treatments with control (water spray) and laid out in randomized block design with four replications. Cotton plants were sprayed with the growth regulator MC @ 50 and 70 ppm, once at 60 days after planting (DAP) or 90 DAS and CCC @ 40 and 80 ppm once at 60 DAP or 90 DAS. The results showed that the applied Cycocel @ 40 ppm at 90 DAS had significant positive effects on the total number of squares (108), number of bolls(58), lint index (5.25), seed index(9.45), highest seed cotton yield (3091 kgha-1) and decreased the plant height. Therefore, PGR might be considered a component of cotton growth management to provide higher seed cotton yields.

Keywords :- Growth regulators, squares, cotton, yield.

Introduction

Cotton or 'white gold' is the principal fibre crop of the world. It plays an important role in Indian agriculture, industrial development and contribution to the national economy. India has the largest area of 11.0 M ha with a production of 32.5 M bales and an average lint yield of 516 kg ha-1 (Anonymous, 2010). Globally, India ranks first in acreage, third in overall production after China and USA. Cotton has an indeterminate growth habit and it is very responsive to environmental changes and management. Excessive vegetative growth results in shade within the plant canopy, increased fruit abscission and reduced yield (Guinn, 1974). A cotton plant can abscise up to 60% of its young squares and bolls (Oosterhuis and Robertson 2000). Young squares and bolls are more susceptible to shedding. Seed cotton and lint yield are strongly correlated with final number of bolls produced (Guinn et al., 1981) therefore retention of square and boll abscission along with enhancement of boll opening is highly desirable. The application of plant growth regulators have been shown to reduce the shedding of fruiting bodies (Sharma and Dungarwal, 2004). PGRs modify plant growth and divert energy allocation within the plant, promote crop earliness, improve square, flower and boll retention and keep harmony between vegetative and reproductive growth, thus, improving lint yield and quality. Growth retardants, like mepiquate chloride (MC) and cycocel (CCC) reduce internode length, thereby, reducing plant height and stimulating the translocation of photosynthates towards sink (Prakash and Prasad, 2000). MC 50 ppm sprayed at 90 days after sowing resulted in significantly higher yield (11.9 %) over control (Kumar et al., 2006). The objective of this study was to determine the effects of MC and CCC application at different concentrations and number of applications during square and bolling stage on yield and yield attributes of the Bt cotton.

Materials and Methods

A field experiment was conducted at the Cotton Research Station, Junagadh Agricultural University, Junagadh during ***Kharif* 2010**. NHH-44 Bt hybrid was seeded on medium black soil with a spacing of 120 X 45 cm in a RBD with four replications. Cultural practices and plant protection measures were undertaken as the recommendations. The experiment consisted of nine treatments : T_1 – MC (50 ppm) at 60 DAS, T_2 – MC (50 ppm) at 90 DAS, T_3 – MC (70 ppm) at 60 DAS, T_4 – MC (70 ppm) at 90 DAS, T_5 – CCC (40 ppm) at 60 DAS, T_6 – CCC (40 ppm) at 90 DAS, T_7 – CCC (80 ppm) at 60 DAS, T_8 – CCC (80 ppm) at 90 DAS, T_9 –Control (water spray).

Five plants from each treatment were selected randomly and tagged for recording various observations on morphological, growth, physiological parameters & yield components at periodically and at harvest. Seed cotton yield was worked out based on the mean of two cotton row's yield and expressed as Kg ha^{-1}. Statistical analysis was carried out following the procedure of Panse and Sukhat (1985).

Results and Discussion

Growth parameters

Plant height is an important vegetative factor affecting seed cotton yield. High plant height is associated with a higher number of nodes and sympodia. However, application of MC and CCC applied in different concentrations and times were decreased plant height in all the treatments. This decrease was caused by reduced Gibberellic acid concentration in the plant (Yang *et al*.,1996). Kumar et al., (2006) conducted a field experiment in Karnataka on hybrid cotton (DDH-11) and found that MC (mepiquate chloride) 50 ppm sprayed at 90 DAS was most effective in reducing plant height and significantly resulted in higher yield (11.9 %). These PGRs are particularly recommended to inhibit vegetative growth, particularly in case of excessive fertilization. The experiment result shown that number of sympodia and sympodial length were found non significant. It was observed that the differences found in dry matter production (DMP) with application of both PGR. The

lowest dry matter produced(5.526 t ha^{-1}) in treatment T_1 due to inhibitory effect on vegetative growth by application of MC @ 50 ppm at 60 DAS and higher DMP shown in treatments T_5 (6.349 t ha^{-1}) and T_6(6.295 t ha^{-1}) compared to the control (T_9). There was statistically significant differences obtained in production, the highest total number of square was obtained in T_6 (108) with application of CCC @ 40 ppm at 95 DAS. It was reported that squares and bolls on cotton plants treated with PGRs have larger photosynthetic sinks for carbohydrates and other metabolites that increased cotton yield than control plot bolls (Zhao and Oosterhuis, 1999).

Yield attribute

Number of boll is an important yielding characteristic affecting directly on seed cotton yield. The highest number of bolls (58) was significantly obtained from application of CCC @ 40 ppm at 90 DAS (T_6). The increased number of bolls in the plots, when plant growth regulators were applied, can result from an increased number of flowers and boll formation, depending on the increased photosynthetic activity (Sawan et al., 2006). The boll weight was found non significant with application of both PGR. As shown in table 1, the significantly highest seed cotton yield (3091 kg ha^{-1}) and lint yield (948 kg ha^{-1}) were obtained in application of CCC @ 40 ppm at 90 DAS (T_6) as compare to control (T_9). In case of ginning percentage there were no significant differences were found with application of MC and CCC on the Bt cotton. The yield enhancement with application of PGR is due to accelerate chlorophyll formation in the plants and increase vegetative sections, thereby, increase the synthesis of substances such as carbohydrates, protein, sugar, oil etc., and result in increased number of bolls and seed cotton yield (Kumar et al., 2006; Oosterhuis and Robertson 2000; Bhatt and Ramanujam, 1970). There was statistically significant differences were obtained in lint index and seed index are shown in Tab. 1. The highest seed index (9.45) was obtained in T_6 and it was at par with treatments T_2, T_4 and T_8 whereas same trend was resulted in case of lint index. PGRs significantly increased seed index and lint index compared with the control. It was reported that bolls on cotton plants treated with PGRs have larger photosynthetic sinks for carbohydrates and other metabolites than control plot bolls (Zhao and Oosterhuis, 1999).

Conclusion

This study showed that application of PGRs affected the plant height, number of squares, dry matter production, number of bolls, seed and lint index, seed cotton yield. The application of CCC @ 40 ppm at 90 DAS beneficial effect on the yield attributes and increased seed cotton yield. Therefore, this plant growth regulator (CCC -Cycocel) can be recommended to cotton producers to increase seed cotton yield. MC (Mepiquate chloride) and CCC application decreased plant height as compare to control. Hence, this is considered to be a suitable agro-technique for realizing higher economic yield of cotton.

Table-1: Effects of MC and CCC on morpho-physiological parameters, yield attributes and seed cotton yield.

Treatment	Plant Height (cm)	Sympodial Length (cm)	No. of Sympodia	Total Squares $Plant^{-1}$	No. of bolls $Plant^{-1}$	Av. Boll wt. (g)	Oil content (%)	Oil yield ($kgha^{-1}$)	Seed index (g)	Lint index (g)	G.P. (%)	Cal. lint yield ($kgha^{-1}$)	Seed cotton yield ($kgha^{-1}$)	DMP ($t.ha^{-1}$)
T_1	114	26.7	11.0	79	45	3.3	19.4	311.85	8.53	4.63	35.1	744	2474	5.526
T_2	107	27.9	11.1	87	47	3.3	19.4	327.31	9.15	5.13	35.9	806	2624	5.615
T_3	112	28.3	11.8	89	42	3.4	19.5	266.80	8.95	4.90	35.3	640	2116	5.681
T_4	110	26.4	11.4	94	49	3.3	19.5	320.66	9.38	5.18	35.7	784	2563	5.747
T_5	116	27.2	11.9	93	43	3.5	19.5	305.14	8.93	4.88	35.2	731	2420	6.349
T_6	110	26.0	12.5	108	58	3.7	19.5	386.67	9.45	5.25	35.8	948	3091	6.295
T_7	109	29.0	11.4	81	49	3.6	19.6	348.20	8.98	4.78	34.7	808	2724	5.837
T_8	108	29.7	11.7	80	48	3.4	19.5	340.96	9.30	5.00	35.0	812	2697	5.804
T_9	122	26.3	10.8	85	44	3.3	19.5	299.40	8.33	4.48	34.9	706	2358	5.808
S.Em.±	3.059	0.970	0.49	5.829	2.668	0.204	0.078	22.43	0.246	0.153	0.39	54.84	177.92	0.280
CD at 5%	8.928	NS	NS	17.015	7.788	NS	NS	NS	0.719	0.448	NS	160.08	519.33	0.817
CV %	5.470	7.05	8.45	13.19	11.28	11.98	0.80	13.89	5.48	6.24	2.24	14.15	13.88	6.33

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