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EFFECT OF NAA ON MORPHO-PHYSIOLOGICAL PARAMETERS AND YIELD IN HYBRID BT COTTON *(Gossypium hirsutum L.)*

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ABSTRACT

A field experiment was conducted on Cotton Research Station, JAU, Junagadh during kharif 2010 to evaluate the impact of foliar application of the growth regulator naphthalene acetic acid (NAA) on morpho-physiological growth parameters and yield in irrigated Bt hybrid cotton. The experiment was comprised of total ten treatments with control (water spray) and laid out in randomized block design with three replications. Cotton plants were sprayed with the growth regulator NAA @ 20, 30 and 40 ppm concentrations, once 50 days after planting (DAP), or twice (50 and 70 DAP) or three times (50, 70 and 90 DAP), during the square, flowering and boll initiation stage. The results revealed that SLW was found significantly minimum (342.79 mgdm-2)at 150 DAS, where as chlorophyll content (28.79) at 75 DAS, total no. of boll(56), average boll weight(4.49 g) and seed cotton yield (3043 kg/ha), were recorded significantly highest at harvest and in spray of NAA (30 ppm) at 50 & 70 DAS as compared to control.

Keywords :- Chlorophyll, growth regulator, specific leaf weight, squares, sympodia.

Introduction

Cotton (*Gossypium hirsutum* L.) is an important cash crop, major source of foreign exchange earnings and plays an important role in agriculture, industry and economic development of the country. Presently, India is the second largest producer of cotton in the world having the largest acreage, which is 1/$_3$rd of the world's cotton area. In India cotton is cultivated in an area of 110 lakh hectares with a production of 325 lakh bales (170 kg/bale) and an average productivity of 516 kg of lint ha^{-1} against the world average productivity of 759 kg lint ha^{-1} (Anonymous, 2010). 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). Growth promoting substances have been more extensively used for the control of reproduction growth (boll) on cotton. Plant growth regulators have positive effects on chlorophyll contents and fruiting nodes in cotton (Norton et al., 2005).

Plant growth regulators viz., promoters, play an important key role in control physiological mechanism of plant growth. Plant growth regulators are capable of increasing yield up to 10 - 15 per cent in the field conditions (Kiran Kumar, 2003). The present investigation was conducted to study the effect of NAA on morpho-physiological parameters and their relationship with seed cotton yield.

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 three replications. Cultural practices and plant protection measures were undertaken as the recommendations. The experiment consisted of following ten treatments : T_1 – NAA (20 ppm) at 50 DAS, T_2 – NAA (20 ppm) at 50 & 70 DAS, T_3 – NAA (20 ppm) at 50, 70 & 90 DAS, T_4 – NAA (30 ppm) at 50 DAS, T_5 – NAA (30 ppm) at 50 & 70 DAS, T_6 – NAA (30 ppm) at 50, 70 & 90 DAS, T_7 – NAA (40 ppm) at 50 DAS, T_8 – NAA (40 ppm) at 50 & 70 DAS, T_9 – NAA (40 ppm) at 50, 70 & 90 DAS, T_{10} – 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. Leaf dry weight was used furtherer for computing specific leaf weight (SLW). Top fully expanded (second from top) leaf was used for measuring the chlorophyll content by using chlorophyll content meter (Model CCM -200 Plus) at 75 & 95 DAS. 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

All other physiological growth parameters of cotton viz., chlorophyll content, SLW, plant height, sympodial length and dry matter production (DMP) were significantly influenced by the application of plant growth regulator NAA. In the present study, application of NAA (30 ppm) sprayed at 75 DAS was recorded significantly highest total chlorophyll content (28.79) in T_5, it was at par with T_6 their after it was remain constant in T_5 but it was increased in all other treatments at 95 DAS. The total chlorophyll content determines the photosynthetic capacity of the cotton genotypes and influences the rate of photosynthesis, dry matter production and the yield (Reddy et al., 1996). Specific leaf weight was significantly decline maximum from 120 DAS to 150 DAS in T5 (342.79 mgdn-2) as compare to control (T_{10}) that is due to translocation of photosynthate from vegetative to reproductive organs. IAA increased chlorophyll content and it enhancing source sink relationship and stimulate the translocation of photosynthate towards sink (Reena Tagade et al., 1998). Application of NAA @ 30 ppm at 50 & 70 DAS was significantly increased the maximum plant height (137.33 cm), sympodial length (42.33 cm), total number of squares per plant

(106) in T_5 as compare to control T_{10}, where as dry matter production (DMP) was accumulated significantly maximum (6.662 t ha^{-1}) in T_5 and it was at par with T_6(6.533 t ha^{-1}) presented in Table 1. This was due to NAA, which mainly attributed to its physiological role in stimulation of stem elongation, cell elongation and promotion of cell division. This is in conformity with the findings of Pothiraj et al., (1995); Copur, et al., (2010); Avtar and Dargan (1963); Reddy et al.,(1996) ; Norton et al., (2005) and Kiran kumar et al.,(2003).

Yield attributes and yield

The number of squares $plant^{-1}$ (42.33) and number of bolls $plant^{-1}$ (56) were found significantly higher in T_5 as compare to control T_{10}. Photosynthate was transported maximum toward the bolls development and plant attained significantly height boll weight (4.49 g) in T_5. There was non significant difference in 50% flowering initiation, where as 50% boll opening found one week earlier in all the treatments except T_9. Cotton crop was matured near one week earlier than control (T_{10}) except T_7 and T_9. Lint yield (1134 kg ha^{-1}) and seed cotton yield (3043 kg ha^{-1}) were significantly registered height with the application of NAA @30 ppm at 50 & 70 DAS (T_5) data presented in table 1. Actually, such result may be attributed to the promoting effect of NAA on numerous physiological processes to attained highest seed cotton yield (Avtar and Dargan, 1963). The NAA is a growth promoter, known to enhance the production of squares and flowers and reduces the abscission of plant parts thus favorably retained more bolls $plant^{-1}$ and diversion of higher proportion of photosynthate to reproductive organs and to the delayed senescence of leaves, which helped in increasing the photo-assimilate supply for an extended period (to reproductive sink). This is in conformity with the findings of Patel (1993); Brar et al., (2001); Sawan et al., (1998); Jadhav and Kalbhor, (1981).

Conclusion

From present investigation it can be concluded that the application of NAA positively affects on morpho-physiological parameter and yield of cotton. Application of NAA @ 30 ppm concentration twice at 50 and 70 days after sowing during squares and boll initiation stage to realized the most efficient effects on improving yield and yield components of irrigated Bt cotton. Hence, this is considered to be a suitable agro-technique for realizing higher economic yield of cotton.

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

Treatment	Plant Height (cm)	Sympodial Length (cm)	Total Squares $plant^{-1}$	Days to 50% Flowering	Days to 50% Boll Opening	Chlorophyll Content Index at 75 DAS	Chlorophyll Content Index at 95 DAS	Specific Leaf weight - SLW (mg/dm2) at 120DAS	Specific Leaf weight - SLW (mg/dm2)at 150 DAS	Days to Maturity	No. of bolls $plant^{-1}$	Av. Boll wt. (g)	Seed cotton yield (Kg/ha)	DMP (t/ha)
T_1	122.67	37.84	89	69	180	22.87	30.39	436.56	387.18	231	42	3.73	2387	5.041
T_2	131.00	39.50	98	72	178	23.80	31.34	369.11	367.18	231	49	3.94	2859	5.273
T_3	122.00	36.00	89	73	180	22.90	28.77	396.04	407.70	231	40	3.88	2409	4.784
T_4	120.00	35.02	92	70	177	26.41	33.43	423.67	407.09	229	43	3.67	2127	4.552
T_5	137.33	42.33	106	77	175	28.79	29.87	383.14	342.79	230	56	4.49	3043	6.662
T_6	119.67	37.17	88	72	180	27.60	30.70	399.72	372.09	230	43	3.56	2428	6.533
T_7	122.33	35.33	93	71	176	22.87	34.11	427.35	403.40	233	42	3.66	2422	4.810
T_8	122.33	39.46	98	71	176	25.33	31.18	394.02	360.25	231	48	3.25	2726	4.990
T_9	130.33	37.93	86	72	184	23.19	32.17	401.56	400.07	233	43	3.59	2404	5.144
T_{10}	118.67	34.73	87	76	187	20.05	31.16	423.67	412.61	236	41	3.55	2371	5.221
S.Em.±	3.86	1.535	4.015	1.448	2.379	1.65	1.57	26.436	15.252	1.18	3.21	0.21	173.69	0.456
CD at 5%	11.46	4.561	11.929	NS	7.068	4.90	NS	NS	45.318	3.50	9.53	0.62	516.07	1.354
CV %	5.36	7.08	7.51	3.47	2.30	11.73	8.69	11.29	6.84	0.88	12.43	9.67	11.95	11.49

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