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# Influence of plant growth regulators in cotton under HDPS

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**Abstract**
Growth and yield attributes of cotton were evaluated with the application of varying doses of plant growth regulators during *kharif* 2020. The experiment was laid out in Randomized Block Design and replicated thrice, conducted at Agricultural College Farm, Bapatla. The treatments comprised of $T_1$: control, $T_2$: Mepiquat chloride 50 ppm at 45 DAS; $T_3$: Mepiquat chloride 50 ppm at 75 DAS; $T_4$: Maleic hydrazide 30ppm at 45 DAS; $T_5$: Maleic hydrazide 30ppm at 75 DAS; $T_6$: Cycocel 60ppm at 45 DAS; $T_7$: Cycocel 60ppm at 75 DAS; $T_8$: Mepiquat chloride 50 ppm at 45 DAS and 75DAS; $T_9$: Maleic hydrazide 30ppm at 45 DAS and 75 DAS; $T_{10}$: Cycocel 60ppm at 45 DAS and 75 DAS. The results indicated that the highest drymatter accumulation at harvest and stalk yield were recorded in control plot. Maximum number of bolls plant$^{-1}$, number of picked bolls plant$^{-1}$ and seed cotton yield were noticed in Mepiquat chloride 50 ppm at 45 + 75 DAS which was on par with $T_9$: Maleic hydrazide 30 ppm at 45 DAS and 75 DAS; $T_{10}$: Cycocel 60 ppm at 45 DAS and 75 DAS.

**Keywords:** Cotton, growth regulators, bolls and seed cotton yield

## Introduction
Cotton is the most important fibre and commercial crop of India. It is a crop of global significance playing a significant role in the agricultural and industrial economy. Though India has the largest area (12.66 M ha) of cotton in world (Gacche and Gokale, 2018) [3], yet due to its lower productivity the share to the total world cotton production is only 12 percent. In Andhra Pradesh, it was grown in 5.63 lakh ha during 2019-20 with a production of 32 lakh. (All India Co-Ordinated Cotton Improvement Project-Annual Report, 2019-2020).
High Density Planting System (HDPS) in cotton is a highly technical system and practicing this system needs careful planning, timely planting, vigorous monitoring, and timely interventions. The HDPS leads to excessively taller plants and more vegetative growth and hence production of cotton under HDPS requires careful consideration of several management strategies including use of plant growth regulators.
Plant growth regulators (PGR) are the substances when added in small amounts modify the growth of plant usually by stimulating or inhibiting part of the natural growth regulation. They are considered as new generation of agrochemicals after fertilizers, pesticides and herbicides. PGRs may enhance yield by increasing the retention of photosynthates into developing bolls. They have the potential to enhance crop earliness, improve retention of reproductive structures like squares, flower buds and higher retention of developing bolls, increase uptake of essential nutrient elements and keep vegetative and reproductive growth in perfect harmony so as to improve the seed cotton yield and quality. Keeping all these points in view an experiment was conducted to evaluate Influence of plant growth regulators in cotton under high density planting system.

## Material and Methods
A field experiment was conducted at Agricultural College Farm, Agricultural College, Bapatla during kharif, 2020. LHDP-1 (Pre-release variety) was seeded on clay soil with a spacing of 60 cm × 10 cm in a Randomised Block Design with three replications. The soil of the experimental plot was clay in texture, low in organic carbon, low in available nitrogen, medium in available phosphorus and high in available potassium and neutral in reaction. The experiment consisted of ten treatments *viz*., T1: control, T2: Mepiquat chloride 50 ppm at 45 DAS; T3: Mepiquat chloride 50 ppm at 75 DAS; T4: Maleic hydrazide 30ppm at 45 DAS; T5: Maleic hydrazide 30ppm at 75 DAS; T6: Cycocel 60ppm at 45 DAS; T7: Cycocel 60ppm at 75 DAS; T8: Mepiquat chloride 50 ppm at 45 DAS and 75DAS; T9: Maleic hydrazide 30ppm

at 45 DAS and 75 DAS; T10: Cycocel 60ppm at 45 DAS and 75 DAS. Fertilizers @ 120 kg N, 60 kg P2O5 and 60 kg K2O ha-1 were applied uniformly in the form of urea, single super phosphate and muriate of potash. Entire quantity of phosphorus was applied basally. Nitrogen and potassium were applied in three splits at 30, 60 and 90 DAS. Recommended cultural practices and plant protection measures were taken throughout the cropping season.

Drymatter accumulation (kg ha-1) was obtained by taking five plants from the second row, they were dried first in shade and then in a hot air oven at 600C till a constant weight was obtained. Then dry weights were recorded and drymatter was expressed in kg ha-1. The total number of bolls from the five tagged plants of the net plot area were counted at harvest and averaged as bolls plant-1. The number of unopened bolls plant-1 were calculated by counting the total number of unopened bolls from the five tagged plants at harvest and averaged. The number of picked bolls harvested per plant were calculated by counting the total number of bolls picked from total number of bolls of the five tagged plants at harvest and averaged. The ratio between the number of picked bolls per plant to the total number of bolls was calculated and expressed as boll opening percentage. Seed cotton was picked from the plants in the net plot area and weighed. The yield obtained from five tagged plants was also added to this and expressed as seed cotton yield in kg ha-1. Stalk yield obtained from the net plot was sun dried thoroughly, weighed and the stalk yield obtained from five tagged plants was also added to the net plot yield and expressed in kg ha-1.

All the data recorded in the study were subjected to statistical analysis using Panse and Sukhatme (1978) [8] adopted in this study. Statistical significance was tested by applying F-test at 0.05 level of probability and critical differences were calculated for those parameters, which were found significant ($p< 0.05$) to compare the effects of different treatments.

## Results and Discussion

### Growth and Yield

Drymatter production is the precursor of plant growth, development and yield. Application of the plant growth regulators had significant influence on the drymatter accumulation. Among all the treatments tried, maximum drymatter accumulation (5806 kg ha-1) at harvest was recorded in control which was significantly superior over all other treatments (Table-1). Drymatter accumulation was reduced by 29.6, 25.0 and 25.9 percent in T8 (Mepiquat chloride 50 ppm at 45 DAS + 75 DAS), T9 (Maleic hydrazide 30 ppm at 45 DAS + 75 DAS) and T10 (Cycocel 60 ppm at 45 DAS + 75 DAS), respectively compared to control. This reduction in drymatter accumulation might be due to reduced plant height and also due to the disturbance in source sink relationship due to application of different PGR's. Similar trend was reported by Kataria and Khanpara (2011).

Number of bolls plant-1 (Table 1) recorded at harvest were found to be significantly influenced by various plant growth regulators. The maximum number of bolls plant-1 (46.5) were recorded with application of Mepiquat chloride 50 ppm at 45 DAS + 75 DAS (T8) which was on par with maleic hydrazide 30 ppm at 45 + 75 DAS (T9-44.0) and cycocel 60 ppm at 45 + 75 DAS (T10-43.0). The lowest number of bolls plant-1 were however, observed in control (T1-28.5). The highest number of bolls plant-1 with mepiquat chloride spray might be due to reduction in the abscission of buds and bolls. In addition, mepiquat chloride might have completely counteracted the effect of abscisic acid and thus reduced the shedding of reproductive structures compared to control. (The results are in conformity with the findings of Uma Maheswari *et al*. 2019) [10].

Number of unopened bolls plant-1 was significantly influenced by application of different plant growth regulators. Higher number of unopened bolls plant-1 were recorded in control (T1) which was significantly superior over all other treatments. The lowest number of unopened bolls plant-1 was observed in mepiquat chloride 50 ppm at 45 DAS + 75 DAS (T8).

Number of picked bolls plant-1 as influenced by various plant growth regulators treatments presented in table-1. inferred that maximum number of picked bolls plant-1 were recorded in mepiquat chloride 50 ppm at 45 DAS + 75 DAS (T8), which was on par with Maleic hydrazide 30 ppm at 45 + 75 DAS (T9) and Cycocel 60 ppm at 45 + 75 DAS (T10) and significantly superior over all other treatments. Similar results were reported by Paslawar *et al*. (2015) [9].

The boll opening percentage of cotton at harvest was not significantly influenced by application of different plant growth regulators. However, numerically highest boll opening percentage was observed in mepiquat chloride 50 ppm at 45 DAS + 75 DAS (T8).

Application of plant growth regulators at different stages had a significant influence on total seed cotton yield (Table-2). Maximum seed cotton yield (1063 kg ha-1) was obtained with application of mepiquat chloride 50 ppm at 45 DAS + 75 DAS (T8) which was on par with maleic hydrazide 30 ppm at 45+75 DAS (968 kg ha-1) (T9) and cycocel 60 ppm at 45 DAS + 75 DAS (929 kg ha-1) (T10) and significantly superior over all other treatments tested. However, lowest seed cotton yield was obtained in control plot (T1) with 600 kg ha-1. Similar results were reported by Khetre *et al*. (2018) [5].

The increase in seed cotton with various plant growth regulators might be due to increased chlorophyll formation in plants leading to increased carbohydrate synthesis, proteins and sugars. This might have resulted in increasing boll number and ultimately in seed cotton yield as reported by Oosterhuis and Robertson (2000) [7].

The stalk yield presented in Table-2 indicated that application of different plant growth regulators significantly influenced stalk yield in cotton. The highest stalk yield was observed in control (3436 kg ha-1) because more drymatter accumulation and it was on par with T5 (Maleic hydrazide 30 ppm at 75 DAS) (3144 kg ha-1), T7 (Cycocel 60 ppm at 75 DAS) (3017 kg ha-1) and T3 (Mepiquat chloride 50 ppm at 75 DAS) (3006 kg ha-1). The lowest stalk yields were obtained in T8 (Mepiquat chloride 50 ppm at 45 DAS + 75 DAS) because of decreased plant height along with low drymatter accumulation. Similar results were reported by Bhorage (2016) [2].

## Conclusion

Based on the above results and discussion it can be concluded that among the plant growth regulators tested, mepiquat chloride 50 ppm at 45 DAS and 75 DAS resulted in increased growth and yield parameters of LHDP-1 under HDPS. However, it was on par with maleic hydrazide 30 ppm and cycocel 60 ppm applied at 45 DAS and 75 DAS.

**Table 1:** Dry matter accumulation (At harvest), number of bolls plant-1, number of unopened bolls plant-1, number picked bolls plant-1, boll opening percentage of cotton as influenced by different plant growth regulators

| Treatments | Drymatter accumulation (at harvest) kg ha-1 | Number of bolls plant-1 | Number of unopened bolls plant-1 | Number of picked bolls plant-1 | Boll opening percentage (%) |
|---|---|---|---|---|---|
| T1: Control | 5806 | 28.5 | 4.5 | 24.0 | 84.2 |
| T2: Mepiquat chloride 50 ppm at 45 DAS | 4619 | 35.2 | 2.9 | 32.3 | 91.9 |
| T3: Mepiquat chloride 50 ppm at 75 DAS | 5017 | 38.5 | 5.0 | 33.5 | 86.9 |
| T4: Maleic hydrazide 30ppm at 45 DAS | 4665 | 38.2 | 3.2 | 35.0 | 91.7 |
| T5: Maleic hydrazide 30ppm at 75 DAS | 5037 | 36.7 | 3.4 | 33.3 | 90.9 |
| T6: Cycocel 60 ppm at 45 DAS | 4509 | 35.9 | 2.5 | 33.4 | 92.9 |
| T7: Cycocel 60 ppm at 75 DAS | 5028 | 37.8 | 3.6 | 34.2 | 90.5 |
| T8: Mepiquat chloride 50 ppm at 45 DAS + 75 DAS | 4087 | 46.5 | 2.2 | 44.3 | 95.3 |
| T9: Maleic hydrazide 30ppm at 45 DAS + 75 DAS | 4350 | 44.0 | 2.7 | 41.3 | 93.8 |
| T10: Cycocel 60 ppm at 45 DAS + 75 DAS | 4298 | 43.0 | 3.2 | 39.8 | 92.6 |
| S.Em± | 237.2 | 2.45 | 0.2 | 2.5 | 4.7 |
| CD (P = 0.05) | 759 | 7.8 | 0.7 | 8.2 | NS |
| CV% | 8.6 | 11.0 | 12.2 | 12.6 | 9.1 |

**Table 2:** Seed cotton yield and stalk yield of cotton as influenced by different plant growth regulators

| Treatments | Seed cotton yield (kg ha-1) | Stalk yield (kg ha-1) |
|---|---|---|
| T1: Control | 600 | 3436 |
| T2: Mepiquat chloride 50 ppm at 45 DAS | 840 | 2835 |
| T3: Mepiquat chloride 50 ppm at 75 DAS | 894 | 3006 |
| T4: Maleic hydrazide 30ppm at 45 DAS | 879 | 2855 |
| T5: Maleic hydrazide 30ppm at 75 DAS | 863 | 3144 |
| T6: Cycocel 60 ppm at 45 DAS | 674 | 2855 |
| T7: Cycocel 60 ppm at 75 DAS | 851 | 3017 |
| T8: Mepiquat chloride 50 ppm at 45 DAS + 75 DAS | 1063 | 2393 |
| T9: Maleic hydrazide 30 ppm at 45 DAS + 75DAS | 968 | 2647 |
| T10: Cycocel 60 ppm at 45 DAS + 75 DAS | 929 | 2745 |
| S.Em± | 45.3 | 155.9 |
| CD (P=0.05) | 145 | 498.7 |
| CV (%) | 9.1 | 9.33 |

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