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Economics and Quality of HDPS Cotton with different Plant Growth Regulators in Coastal Andhra Pradesh

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ABSTRACT

Plant growth regulators are used in cotton production to balance vegetative and reproductive growth, as well as to increase seed cotton yield and lint quality. Field experiment was conducted during *kharif*, 2020 to determine the effect of plant growth regulators on quality and economics of HDPS cotton in coastal Andhra Pradesh. It was conducted at Agricultural College Farm, Bapatla in Randomised Block Design (RBD) and replicated thrice. The experiment consisted of ten treatments. 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 30 ppm at 45 DAS; T_5: Maleic hydrazide 30 ppm at 75 DAS; T_6: Cycocel 60 ppm at 45 DAS; T_7: Cycocel 60 ppm at 75 DAS; T_8: Mepiquat chloride 50 ppm at 45 DAS and 75DAS; T_9: Maleic hydrazide 30 ppm at 45 DAS and 75 DAS; T_{10}: Cycocel 60 ppm at 45 DAS and 75 DAS. The results indicated that application of Mepiquat chloride 50 ppm at 45 DAS and 75 DAS recorded the maximum number of picked bolls plant^{-1}, boll weight, boll opening percentage and seed cotton yield. The quality parameters viz., seed index, harvest index, lint index, ginning percentage did not show any significant response with plant growth regulators application. Application of Mepiquat chloride 50 ppm at 45 DAS and 75 DAS recorded the higher gross returns, net returns and returns per rupee investment.

Keywords:
Cotton, Plant growth regulators, seed cotton yield

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INTRODUCTION

Cotton is one of the most important commercial crops of India grown under diverse agro-climatic conditions. India has 13.40 mha under cotton accounting for more than one third of the World's area of 32.94 mha (AICCIP. 2019). However, productivity is only 487 kg ha^{-1} which is far below the world's productivity of 775 kg ha^{-1}. One of the methods to bridge this gap is High density planting system (HDPS), accommodating a greater number of plants per unit area. Plant growth regulators (PGRs) are considered as an alternate production system for improving productivity and profitability in cotton. PGR's have the potential to enhance earliness in crop, with retention of bolls and also with increase in uptake of essential nutrients leading to improved seed cotton yield.

MATERIAL AND METHODS

The field experiment was conducted at Agricultural College Farm, Bapatla, situated in coastal region of the Krishna Agro-climatic Zone of Andhra Pradesh at 15^{0}55'N latitude and 80^{0}30'E longitudes, and at an altitude of 4.29 m above Mean Sea Level (MSL). It is about 8 km away from the Bay of Bengal. The experiment was laid out in a Randomised Block Design with three replications during *kharif* 2020, consisting of ten treatments i.e., 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 30 ppm at 45 DAS; T_5: Maleic hydrazide 30 ppm at 75 DAS; T_6: Cycocel 60 ppm at 45 DAS; T_7: Cycocel 60 ppm at 75 DAS; T_8: Mepiquat chloride 50 ppm at 45 DAS and 75 DAS; T_9: Maleic hydrazide 30 ppm at 45 DAS and 75 DAS; T_{10}: Cycocel 60 ppm at 45 DAS and 75 DAS. LHDP-1 was sown on clay soil with a spacing of 60 cm×10 cm on 31.8.2020. Recommended dose of 120 kg N and 60 kg K_2O ha^{-1} were applied in three splits in the form of urea and muriate of potash at 30,60 and 90 DAS. Phosphorus @ 60 kg P_2O_5 was applied basally in the form of SSP. Plant protection measures were taken as per requirement. Five tagged plants from each treatment were selected randomly and tagged for recording various observations on growth parameters and yield components periodically and at harvest. The weather conditions prevailed during the crop growth were congenial. Statistical analysis was carried out following the procedure of Panse and Sukhatme (1985). Economics were worked out based on the prevailing market price.

RESULTS AND DISCUSSION

Among all the treatments tried, maximum drymatter accumulation (5806 kg ha^{-1}) at harvest was recorded in control which was significantly superior over all the other treatments (Table 1). The lowest drymatter accumulation was observed in T_8 (Mepiquat chloride 50 ppm at 45 DAS + 75 DAS), T_9 (Maleic hydrazide 30 ppm at 45 DAS + 75 DAS) and T_{10} (Cycocel 60 ppm at 45 DAS + 75 DAS). This 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). Maximum number of picked bolls plant^{-1} were recorded in mepiquat chloride 50 ppm at 45 DAS+75 DAS (T_8), which was on par with Maleic hydrazide 30 ppm at 45+75 DAS (T_9) and

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Table 1: Yield attributes and drymatter accumulation of cotton (kgha^{-1}) at harvest as influenced by different plant growth regulators

Treatments	Drymatter accumulation (At harvest) kg ha^{-1}	Number of picked bolls plant^{-1}	Boll weight (g)	Boll opening percentage (%)
T_1: Control	5806	24.0	3.3	84.2
T_2: Mepiquat chloride 50 ppm at 45 DAS	4619	32.3	3.5	91.9
T_3: Mepiquat chloride 50 ppm at 75 DAS	5017	33.5	3.5	86.9
T_4: Maleic hydrazide 30ppm at 45 DAS	4665	35.0	3.5	91.7
T_5: Maleic hydrazide 30ppm at 75 DAS	5037	33.3	3.4	90.9
T_6: Cycocel 60 ppm at 45 DAS	4509	33.4	3.5	92.9
T_7: Cycocel 60 ppm at 75 DAS	5028	34.2	3.4	90.5
T_8: Mepiquat chloride 50 ppm at 45 DAS+75DAS	4087	44.3	3.8	95.3
T_9: Maleic hydrazide 30ppm at 45 DAS+75DAS	4350	41.3	3.5	93.8
T_{10}: Cycocel 60 ppm at 45 DAS+75 DAS	4298	39.8	3.4	92.6
SEm±	237.2	2.5	0.25	4.7
CD (P=0.05)	759	8.2	NS	NS
CV %	8.6	12.6	13.0	9.1

Cycocel 60 ppm at 45+75 DAS (T_{10}) and significantly superior over all the other treatments. Similar results were reported by Paslawar *et al*. (2015). Application of different plant growth regulators had no significant effect on boll weight and boll opening percentage of cotton (Table 1). However, numerically highest boll weight (3.8 g) and boll opening percentage (95.3%) of cotton was recorded with Mepiquat chloride 50 ppm at 45 DAS+75 DAS (T_8) among all the treatments.

Foliar application of plant growth regulators significantly increased the seed cotton yield (Table 2). Maximum seed cotton yield was obtained with application of mepiquat chloride 50 ppm at 45 DAS +75 DAS (T_8) which was on par with maleic hydrazide 30 ppm at 45+75 DAS (968 kg ha^{-1}) (T_9) and cycocel 60 ppm at 45 DAS + 75 DAS (929 kg ha^{-1}) (T_{10}) and significantly superior over all other treatments tested.

Table 2: Seed cotton yield, Stalk yield, Harvest index, Seed index of cotton as influenced by different plant growth regulators

Treatments	Seed cotton yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	Harvest index (%)	Seed index (g)
T_1: Control	600	3436	14.3	8.5
T_2: Mepiquat chloride 50 ppm at 45 DAS	840	2835	22.9	8.6
T_3: Mepiquat chloride 50 ppm at 75 DAS	894	3006	22.9	8.6
T_4: Maleic hydrazide 30ppm at 45 DAS	879	2855	23.5	8.5
T_5: Maleic hydrazide 30ppm at 75 DAS	863	3144	21.5	8.6
T_6: Cycocel 60 ppm at 45 DAS	674	2855	19.1	8.5
T_7: Cycocel 60 ppm at 75 DAS	851	3017	22.1	8.4
T_8: Mepiquat chloride 50 ppm at 45 DAS+75DAS	1063	2393	30.8	8.8
T_9: Maleic hydrazide 30ppm at 45 DAS+75DAS	968	2647	26.8	8.7
T_{10}: Cycocel 60 ppm at 45 DAS+75 DAS	929	2745	25.3	8.6
SEm±	45.3	155.9	2.04	0.57
CD (P=0.05)	145	498.7	6.54	NS
CV (%)	9.1	9.33	15.3	11.4

Table 3: Quality parameters of cotton as influenced by different plant growth regulators

Treatments	Lint index (g)	Ginning percentage (%)
T_1: Control	5.8	41.0
T_2: Mepiquat chloride 50 ppm at 45 DAS	6.1	42.3
T_3: Mepiquat chloride 50 ppm at 75 DAS	5.7	40.0
T_4: Maleic hydrazide 30ppm at 45 DAS	5.7	40.7
T_5: Maleic hydrazide 30ppm at 75 DAS	5.8	41.3
T_6: Cycocel 60 ppm at 45 DAS	5.7	40.3
T_7: Cycocel 60 ppm at 75 DAS	6.0	42.3
T_8: Mepiquat chloride 50 ppm at 45 DAS+75DAS	6.2	42.7
T_9: Maleic hydrazide 30ppm at 45 DAS+75DAS	6.0	41.3
T_{10}: Cycocel 60 ppm at 45 DAS+75 DAS	6.1	41.7
SEm±	0.38	2.61
CD (P=0.05)	NS	NS
CV (%)	11.3	11.0

However, lowest seed cotton yield was obtained in control plot (T_1) with 600 kg ha^{-1}. Similar results were reported by Khetre *et al*. (2018). 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). The stalk yield presented 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}) due to more drymatter accumulation and it was on par with T_5, T_7 and T_3 treatments. The lowest stalk yields were obtained in T_8 (Mepiquat chloride 50 ppm at 45 DAS +75 DAS) because of decreased plant height along with low dry matter accumulation. The harvest index was significantly influenced by application of different plant growth regulators. The highest harvest index of 30.8 was obtained in (T_8) Mepiquat chloride 50 ppm at 45 DAS+75 DAS which was on par with T_9, T_{10} treatments, but significantly superior over all the other treatments (Table 2). The lowest harvest index was obtained in control (T_1). The seed index presented in Table 2 could not reach the level of significance. However, numerically higher seed index of 8.8 g was noticed in Mepiquat chloride 50 ppm at 45 DAS+75 DAS (T_8).

The quality parameters in cotton viz., lint index and ginning percentage of presented in Table 3 revealed that the differences were not statistically significant. However, higher seed index (6.2 g) and ginning percentage (42.7) was noticed in Mepiquat chloride 50 ppm at 45 DAS+75 DAS (T_8).

Among the treatments imposed, application of Mepiquat chloride 50 ppm at 45 DAS +75 DAS (T_8) recorded the higher gross returns (Rs. 58446 ha^{-1}), Net returns Rs.25,532 ha^{-1} and returns per rupee investment (1.7). However, it was on par

Table 4: Economics of cotton as influenced by different plant growth regulators

Treatments	Cost of cultivation (Rs ha^{-1})	Gross Returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	Returns per rupee investment
T_1: Control	31414	33000	1586	1.0
T_2: Mepiquat chloride 50 ppm at 45 DAS	32164	46200	14036	1.4
T_3: Mepiquat chloride 50 ppm at 75 DAS	32164	49170	17006	1.5
T_4: Maleic hydrazide 30ppm at 45 DAS	31477	48345	16868	1.5
T_5: Maleic hydrazide 30ppm at 75 DAS	31477	47465	15988	1.5
T_6: Cycocel 60 ppm at 45 DAS	31510	37062	5552	1.1
T_7: Cycocel 60 ppm at 75 DAS	31510	46823	15313	1.4
T_8: Mepiquat chloride 50 ppm at 45DAS+75DAS	32914	58446	25532	1.7
T_9: Maleic hydrazide 30ppm at 45 DAS+75DAS	31540	53240	21700	1.6
T_{10}: Cycocel 60 ppm at 45 DAS+75 DAS	31606	51095	19489	1.6
SEm±	-	2495.5	2495.5	0.07
CD (P=0.05)	-	7983	7983	0.2
CV (%)	-	9.1	28.2	9.1

with Maleic hydrazide 30 ppm at 45 DAS+ 75 DAS (T_9) and Cycocel 60 ppm at 45 DAS + 75 DAS (T_{10}) (Table.4). Higher economic benefits due to mepiquat chloride application were the reflection of corresponding increase in the seed cotton yield. Similar results were reported by Veeraputhiran and Gunasekaran (2020).

CONCLUSION

Based on the results of the present study, it can be concluded that application of Mepiquat chloride 50 ppm at 45 DAS +75 DAS (T_8) recorded the maximum growth, yield attributes, seed cotton yield and economics in cotton LHDP-1 under HDPS.

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