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Effect of time of growth retardant application on growth of cotton plant under high density planting system

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ABSTRACT : Field experiment was carried out at Cotton Research Station, Srivilliputtur during October 2017 to February 2018 to find out the optimum schedule of mepiquat chloride application under high density planting system (HDPS) for mechanised cotton production. The experiment was conducted in Randomized Block Design with three replications using the pre release cotton compact culture TCH 1819. The treatments comprised of a mepiquat chloride application schedule at 1000 ml/ha once during square formation, flowering, boll development, twice during square formation and flowering , flowering and boll development, square formation and boll development and thrice at square formation, flowering and boll development stages. These were compared with control and nipping on 15th node control and nipping on 15th node. The results revealed that application of mepiquat chloride reduced the height of cotton and recorded significantly higher bolls/plant only when applied twice than control, once or thrice application. Mepiquat chloride application during square formation and boll development stages registered the highest seed cotton yield of 2062 kg/ha followed by that of square formation and flowering stages (2014 kg/ha) and both were significantly higher than control. Higher gross income, net income and benefit cost ratio were also associated with application of mepiquat chloride during square formation and boll development stages. It is concluded that application of mepiquat chloride at the rate of 1000 ml / ha during square formation and boll development stages was optimum for higher seed cotton yield and economic benefits under high density planting system in cotton

Key Words *:* Cotton , growth retardant, mepiquat chloride, seed cotton yield and economics

Cotton is the most important fibre and commercial crop of India and also Tamil Nadu state as well. The contribution of India to global cotton fibre and edible oil production is 44 and 10 per cent respectively during 2014-2015. Though India has the largest area (12.66 M ha, 26 per cent) of cotton in the world (Gacche and Gokale, 2018), yet due to its lower productivity the share to the total world cotton production is only 12 per cent. In order to meet the demand to satisfy the native mill requirement of cotton, the productivity of cotton needs to be increased. In Tamil Nadu, cotton was cultivated in an area of 1.48 lakh ha during 2017-2018 with production of 2.80 lakh bales and productivity of 599 kg/ ha which was below the world average yield of 788 kg/ ha (Anonymous, 2018). High Density Planting System (HDPS) is recently considered as an alternate production system having a potential for improving the productivity and profitability, increasing input use efficiency, reducing input costs and minimizing the risks associated with the current production system in India (Venugopalan *et al.*, 2013). 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 growth retardant. Mepiquat chloride is one such growth retardant used to suppress the excessive vegetative growth by decreasing plant height, number of nodes, branch lengths and leaf area (Stuart *et al.*, 1984). It is mainly used to maintain the balance between vegetative and reproductive growth that in turns regulate the cotton yield (Yang *et al.*, 2014). As the effect of mepiquat chloride application depends on environmental conditions, investigation of optimum time of application is essential. With this back ground, the present study was, therefore, undertaken to optimize the time of mepiquat chloride application under HDPS cotton.

MATERIALS AND METHODS

Field experiment was carried out at Cotton Research Station, Srivilliputtur during October 2017 to February 2018 under irrigated condition to find out the optimum time of mepiquat chloride application under HDPS to facilitate mechanised cotton production. The experiment was conducted in Randomized Block Design with three replications. The treatments consisted of a control (S_1) and nipping on 15th node (S_2), mepiquat chloride application during square formation (S_3), flowering (S_4), boll development (S_5), twice at square formation and flowering (S_6) , flowering and boll development (S_7), square formation and boll development (S_8) and thrice at square formation, flowering and boll development stages (S_9) . The pre release cotton culture TCH 1819 was used in the experiment with a spacing of 100 x 10 cm and a fertilizer dose of 100: 50: 50 kg NPK /ha was applied for all the treatments. The mepiquat chloride (4.2%) at 1000 ml / ha was sprayed as per treatment schedule. The method of sowing was beds and channel and weeding was carried out by power tiller during 25 and 45 days after sowing followed by earthing up. The left over weeds around the cotton plamt was controlled by hand hoeing. The biometric observation on plant height, yield attributes and seed cotton yield were recorded and economics were also worked out.

RESULTS AND DISCUSSION

Growth attributes : The maximum height was observed in the treatment which received no mepiquat chloride spray (Table 1). The plant height was reduced significantly where mepiquat chloride was sprayed during square formation stage, twice (square formation and flowering, flowering and boll development and square formation and boll development stages) and also during three stages *viz.*, square formation, flowering and boll development than without application. However mepiquat chloride application did not show any significant effect on number of sympodial branches of cotton. The shorter plants under mepiquat chloride applied treatments were due to more compact culture and smaller leaf size (Reddy *et al.,* 1990). Alexander *et al.* (2001) found that height to node ratio, mainstream nodes and node above white flower were reduced by the application of mepiquat chloride and this could be the reasons for reduced plant height. Similar effect of reduction in plant height and decreased shoot length due to mepiquat chloride application was also realized by Steve *et al. (*2003) and Xiaoming *et al.* (2013).

Table 1. Effect of mepiquat chloride application schedule on growth and yield of cotton

Treatment	Plant height at harvest (cm)	Sympodia/ plant	Bolls/ plant	Boll weight (g)	Seed cotton yield (kg/ha)
S_1 – Control	99.4	13.1	13.6	4.12	1832
S_2 – Nipping on 15th node	94.5	13.1	15.2	4.15	1948
S_3 – MC at square formation	86.9	13.3	15.6	4.20	1972
S_4– MC at flowering	89.8	12.9	15.4	4.19	1968
S_5– MC at boll development	93.1	13.4	15.1	1.17	1959
S_6– MC at square formation and flowering	84.1	13.3	16.7	4.22	2014
S_7– MC at flowering and boll development	84.7	13.2	16.4	4.20	1988
S_8– MC at square formation and boll development	82.2	13.1	16.9	4.24	2062
S_9– MC at square formation, flowering and boll development	77.4	12.9	14.3	4.14	1875
SEd.	4.23	-	1.19	-	68.4
CD(p=0.05)	8.97	NS	2.52	NS	145.1

Yield attributes : Mepiquat Chloride application did not show any significant effect on boll weight of cotton (Table 1). However, application of mepiquat chloride recorded significantly higher bolls per plant only when applied twice than control, once or thrice application. Higher number of bolls per unit area and increased boll weight as reported by Xiaoming *et al.* (2013) was in conformity with the present investigation. A slight increase in boll weight in this experiment might be due to the reduction of carbohydrate production by changing carbohydrate portioning ration in favour of seed rather than fibre caused by decreased canopy size as observed by Xi *et al.* (1981). Reduction of biomass due to mepiquat application in cotton was reported by Shahbaz *et al.* (2018).

Seed cotton yield : The effect of mepiquat chloride application on seed cotton yield is furnished in Table 1. Among the treatments, application of mepiquat chloride during square formation and boll development stages registered the highest seed cotton yield of 2062 kg/ha followed by that of square formation and flowering stages (2014 kg/ha) and both were significantly higher than control.. Similar result of significant increase in seed cotton yield by the application of mepiquat chloride during early blooming and full blooming stages were noticed by Wenchao *et al.* (2017) and Mao *et al.* (2015). Significant improvement in seed cotton yield due to mepiquat chloride application during square formation and flowering stages (Xiaoming *et al.* 2013) and flowering stage (Steve *et al.*, 2003) were in accordance with the results of this present study.

Economics : The economic analysis revealed that higher gross income (Rs. 86646 / ha), net income (Rs. 31446 / ha) and higher benefit cost ratio of 1.57 were associated with application of mepiquat chloride during square

Table 2. Effect of mepiquat chloride application schedule on economics of cotton

Treatment	Cost of cultivation (Rs/ ha)	Gross income (Rs/ ha)	Net income (Rs/ ha)	Benefit Cost Ratio
S_1 – Control	50800	76944	26144	1.51
S_2 – Nipping on 15th node	52300	81816	29516	1.56
S_3 – MC at square formation	53000	82824	29824	1.56
S_4– MC at flowering	53000	82656	29656	1.56
S_5– MC at boll development	53000	82278	29278	1.55
S_6– MC at square formation and flowering	55200	84588	29388	1.53
S_7– MC at flowering and boll development	55200	83496	28296	1.51
S_8– MC at square formation and boll development	55200	86646	31446	1.57
S_9– MC at square formation, flowering and boll development	57400	78750	21350	1.37

formation and boll development stages. (Table 2). Higher economic benefits due to mepiquat application were the reflection of corresponding increase in the seed cotton yield.

Thus it is concluded from the study that application of mepiquat chloride at the rate of 1000 ml / ha during square formation and boll development stages was optimum for higher seed cotton yield and economic benefits under high density planting system in cotton

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