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EFFECTS OF MEPIQUAT CHLORIDE ON NATURAL PLANT RESISTANCE TO TOBACCO BUDWORM IN COTTON[1]

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Abstract

The effects of mepiquat chloride (1,1-dimethyl-piperidinium chloride) (Pix®) on natural plant resistance to the tobacco budworm (TBW), (*Heliothis virescens* F.) in cotton (*Gossypium hirsutum* L.) was studied in 1984 and 1985. A split plot randomized complete block experimental design with six replications was used. 'Stoneville 213' was grown in two row plots (2 × 13.7 m) in a two-planted one-skip row pattern on a Marietta sandy loam (fine-loamy, siliceous, thermic Fluvaquentic Eutrochrepts) soil at Mississippi State, MS. Main plot treatments were with and without TBW and subplot treatments were three levels of mepiquat chloride (0, 50, and 100 g a.i. ha^{-1}). The 100 g a.i. ha^{-1} level was split into 50 g at the recommended time of application and 50-g 14 days later. Mepiquat chloride treatments caused significant yield increases at first harvest, but not in total yield, suggesting the typical induced earliness with this plant growth regulator. In the presence of an artificial infestation of TBW, no significant differences in yield were recorded either year among mepiquat chloride levels, indicating no increased plant resistance to artificial infestations of TBW.

Additional index words: **Plant growth regulator, *Heliothis virescens* F., *Gossypium hirsutum* L.**

CONTROLLING insect pests is one of the major problems affecting cotton (*Gossypium hirsutum* L.) production. In the South, the tobacco budworm (*Heliothis virescens* F.) (TBW) is usually the principal economic problem. Alternate methods of insect control are being researched because insecticides are costly, harmful to natural predators or parasites, and adversely affect the environment.

Plant growth regulators (PGR) may be effective in reducing pest populations by altering the morphological and biochemical characteristics of cotton. Various PGRs have been shown to increase physical barriers or cause early termination of vegetative and reproductive parts, thus denying the insect food and shelter. They may also affect the plants natural resistance by either increasing or decreasing the biosynthesis of certain secondary plant constituents harmful to insects.

The PGR, mepiquat chloride (1,1-dimethyl-piperidinium chloride) (MC), was introduced into U.S. cotton production in 1974. This PGR produces shortened internodes, often resulting in significantly decreased plant height and canopy width. Treated plants typically produce a darker green foliage, increased leaf thickness, and decreased leaf area. Decreased yields with no effect on earliness to significant yield increases with earlier boll opening have been reported (Walter et al., 1980).

Zummo et al. (1984) reported that MC, applied at the recommended rate for the control of excessive vegetative growth, increased the cotton plant's natural resistance to cotton bollworm [*Heliothis zea* (Boddie)] (CBW). This effect was attributed to increased tannin and terpenoid production, which induced resistance to the CBW. Pfrimmer (1984), however, showed significantly more CBW injury to fruiting forms in MC-treated plots. Mulrooney et al. (1985) showed that growth rates of second and third stage TBW larvae increased slightly when grown on leaves treated with MC at either the recommended or twice the recommended rate. He concluded from larval growth studies in the laboratory that MC does not enhance cotton's resistance to second stage TBW larvae, and may actually increase larval growth and decrease natural resistance during an ideal growing season. Jenkins et al. (unpublished data) failed to find a significant and consistent increase in levels of allelochemics useful for TBW control when MC was applied to three strains of cotton.

The objective of this study was to determine if MC applied at rates recommended to control excessive vegetative growth in cotton would also affect resistance to artificially induced uniform infestations of TBW under field conditions in Mississippi.

Materials and Methods[3]

'Stoneville 213' was planted in early May in 1984 and 1985 in two-row plots (2 × 13.7 m) in a two-planted one-skip row pattern on a Marietta sandy loam (fine-loamy, siliceous, thermic Fluvaquentic Eutrochrepts) soil at Mississippi State, MS. The experimental design was a split plot randomized complete block with six replications. Main plot treatments were with and without TBW larvae. Tobacco budworm plots were artificially infested twice per week for 4 weeks with 8 to 10 first instar larvae 30 cm^{-1} of row applied in the plants' terminal (Jenkins et al., 1982). Insects were controlled with weekly applications of azinphos-methyl {*0,0*-Dimethyl *S*-[(4-oxo-1,2,3-benzotriazin-3(4*H*)-yl) methyl] phosphorodithioate} and fenvalerate [cyano (3-phenoxyphenyl) methyl 4-chloro-alpha-(1-methylethyl) benzeneacetate] in all plots except for 1 week prior to larval application and 1 week following the last larval application. Tobacco budworm free plots were treated weekly with these insecticides to prevent insect damage. Subplot treatments were three levels of MC (0, 50, and 100 g a.i. ha^{-1}) applied according to state recommendations. The 50 g a.i. ha^{-1} was applied in one application. The 100 g a.i. ha^{-1} was split into 50 g a.i. ha^{-1} at first application (two blooms m^{-1}) and 14 days later a second application of 50 g a.i. ha^{-1} was applied.

All insecticide and MC applications were applied using a

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[3] Names of products are included for the benefit of the reader and do not imply endorsement or preferential treatment by the USDA.

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Table 1. Mean lint yield and boll sample data of Stoneville 213 treated with three rates of mepiquat chloride, and with and without tobacco budworm (TBW) at Mississippi State, MS, in 1984 and 1985.

Mepiquat chloride	Without TBW			Lint yield			
				With TBW		Without TBW	
	Lint %	Boll size	Seed index	1st harvest	Total yield	1st harvest	Total yield
g ha^{-1}	%	g		kg ha^{-1}			
0	40.0a*	6.2a*	10.9a*	843a*	1438a*	1106a*	1858a*
50	39.5b	6.2a	10.9a	809a	1365a	1206b	1869a
100	39.0b	6.1a	11.0b	850a	1391a	1184b	1807a

* Means followed by different letter within a column are significantly different at the 0.05 probability level with Duncan Bonner range test.

Hahn Highboy® (Hahn, Evansville, IN). All plots were cultivated twice and one application of DSMA (disodium methanearsonate) and linuron [3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea] was postdirected for weed control. Plots were harvested twice with a spindle picker. A 50-boll sample was harvested from each plot for lint percentage, boll size, and seed index determinations.

Results and Discussion

Mepiquat chloride treatments at 50 and 100 g a.i. ha^{-1} produced typical shorter (24 cm), dark green plants. They also significantly reduced lint percentage but had no significant effect on boll size, while slightly increasing seed index. These results are in agreement with those of Cathey and Meredith (1984).

Mepiquat chloride caused a significant increase in earliness as measured by significantly higher yields at first harvest when insects were controlled (Table 1). However, no significant differences were found among MC levels for total yield.

When TBW larvae were added, no significant differences were found among MC levels at first or in total harvest (Table 1), suggesting no increase in the natural resistance of the plants to TBW larvae. These data disagree with those reported by Zummo et al. (1984), who found that MC applied to 'Tamcot CAMD-E' increased the plants natural resistance to CBW. While our results with artifically induced, essentially uniform, TBW infestation are in agreement with those of natural infestation of *Heliothis* spp. (Pfrimmer, 1984), they indicate that MC increased earliness, but did not increase yields or natural resistance to the TBW larvae on Stoneville 213 in this Mississippi environment. These contrasting results could be due to *Heliothis* spp., cultivar differences, infestation levels, or differences in environments.

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