EFFECTS OF VARIOUS MEPIQUAT CHLORIDE-BASED FORMULATIONS ON COTTON GROWTH AND YIELD

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Abstract

Mepiquat chloride-based commercial plant growth regulators are used extensively to in cotton. This practice is effective for controlling plant height, but effects on yield have been inconsistently variable. A study was conducted in 2009 to evaluate the effects of foliar applications of various mepiquat chloride-based formulations on cotton growth and yield. The various mepiquat chloride-based formulations evaluated were Arysta LIfeScience's commercial products, PIXPlus (MC+) and PIX/Mepichlor (MC) and the new dry Arysta formulations of MC 90WDG (90% wettable dry granule) and MC 90WDG Plus. Results from this one-year, one-location study indicate that 1) the four formulations tested were equally effective in regulating plant height, 2) the addition of Plus (*Bacillus Cereus*) prevented the decrease of main stem nodes but did not prevent the reduction of the number of harvestable bolls per unit area, and 3) all four formulations had no effect on earliness and lint yield.

Introduction

Mepiquat chloride-based commercial plant growth regulators are used extensively to in cotton. This practice is effective for controlling plant height, but effects on yield have been inconsistently variable across locations in the cotton belt. Mepiquat chloride is most commonly formulated as a 4.2 percent concentration of nitrogen, Ndimethyl-piperidinium (or mepiquat) chloride salt. Various formulations are commercially available, including liquid and dry formulations and *Bacillus cereus* additives.

A study was conducted in 2009 to evaluate the effects of foliar applications of various mepiquat chloride-based formulations on cotton growth and yield. The various mepiquat chloride-based formulations evaluated were Arysta LIfeScience's commercial products, PIXPlus (MC+) and PIX/Mepichlor (MC) and the new dry Arysta formulations of MC 90WDG (90% wettable dry granule) and MC 90WDG Plus. This poster presents data on plant growth, earliness, and lint yield.

Materials and Methods

The study was conducted at the Texas AgriLife Research and Extension Center in Corpus Christi. Soil type at the experimental site is Victoria Clay (VcA). Cotton cultivar Deltapine 141B2RF was planted on April 15, 2005 to a plant population of 50,000 in 38' row spacing with a 4-row Monosem NG+ vacuum precision planter on March 18, 2008. General production management practices followed recommendations from the Texas AgriLife Extension Service. Fertilizer and a selective herbicide for pre-emergence control of annual grasses and broadleaf weeds were applied broadcast and incorporated in the topsoil before planting. Fertilization rate was 44 lbs ac^{-1} of P_2O_5 and 110 lbs ac^{-1} of N. Because of an exceptionally dry weather since early fall in 2008, irrigation was applied before planting and during the growing season. A total post-planting irrigation amount of 13.39 inches was applied using an aboveground drip system in 10 events ranging from 0.72 to 1.82 inches from May 6 through August 2. The season was exceptionally dry (19% of normal) with a total of 1.6 inches from planting to August 2. Primary phenological dates were as follows: emergence on April 19, first square on May 9, first bloom on June 11, and first open boll on July 18.

The various mepiquat chloride-based formulations evaluated were Arysta LIfeScience's commercial products, PIXPlus (MC+) and PIX/Mepichlor (MC) and the new dry Arysta formulations of MC 90WDG (90% wettable dry granule) and MC 90WDG Plus. The experimental treatments consisted of low rate, multiple applications of these formulations starting at MHS and continuing at nine (9) day intervals for a total of four (4) applications to mimic as closely as possible normal usage of these plant growth regulators. Application rates were determined by a computer program based on an earlier model developed by J.A. Landivar for managing mequiquat chloride applications in cotton (Landivar et al. 1992). This computer program estimates the proper rate of mepiquat for optimum vegetative to reproductive growth for the next 10 days using plant height and number of main stem nodes

as primary inputs. Treatments were applied at a volume rate (water plus product) of 20 gallons acre^{-1} with a four-row plot sprayer (Model 3220-GC 2wd Lee Spyder Spray-Trac, Lee Company, Inc., Idalou, TX). Treatment application dates and growth status are shown in Table 1. Treatments, including an untreated check (UTC), were arranged in a randomized complete block design with four replications. Experimental plots were four rows wide and 75 ft long.

Plant growth variables, such as plant height and number of main stem nodes were measured prior to each application (Table 1). A week prior to defoliation, percent open boll was measured to determine earliness differences among treatments. Plot lint yields were obtained by hand-harvesting 1/1000 acre. Data collected at harvest included: number of plants per plot, number of harvested bolls per plot, and seedcotton per plot. Average seedcotton boll mass was calculated as seedcotton per plot divided the number of harvested bolls. Harvested seedcotton was then ginned to calculate lint turnout and lint yield.

Experimental data was organized and processed using Microsoft Excel X for Mac® software (1985-2001 Microsoft Corporation). Statistical analyses of data, including analysis of variance, Fisher's Protected Least Significant Difference (LSD) at 1, 5, and 10% levels of probability, and contrast of means to test the probability (P) of wrongly rejecting the null hypothesis of the difference between a treatment and the untreated check, were performed using SuperANOVA® software version 1.11 (1989-1991 Abacus Corporation, Inc., Berkeley, CA).

Table 1.- Information on treatment applications regarding date, growth status, and rate.

Product	Growth status and rate	First application (5/29/09)	Second application (6/9/09)	Third application (date)	Fourth application (6/29/09)
MC 90WDG Plus	Height (inches)	9.53	13.55	15.8	16.7
	Nodes	9.1	11.2	14.4	14.6
	Rate (oz/ac)	15.1	3.9	3.9	0.6
Pix Plus	Height (inches)	9.53	13.3	15.7	16.8
	Nodes	9.1	11.4	14	14.5
	Rate (oz/ac)	10.9	2.8	2.5	0.8
MC 90WDG	Height (inches)	9.53	12.45	15.3	15.4
	Nodes	9.1	11.4	14.4	14.6
	Rate (oz/ac)	15.1	3.5	4	0.3
Pix	Height (inches)	9.53	14.3	15.3	16.6
	Nodes	9.1	11.6	13.3	14.3
	Rate (oz/ac)	10.9	3.3	1.4	1.2

Results and Discussion

All four mepiquat chloride-based formulations significantly decreased plant height (Fig. 1), and their individual effects on plant height were not significantly different. On average, the various formulation decreased plant height 20%.

The final number of main stem nodes per plant was significantly decreased only by the liquid and dry formulations containing only mepiquat chloride, namely, Pix and MC 90WDG (Fig. 2). There was no significant difference between the individual effects of these two formulations on the number of main stem nodes. On average, these two formulations decreased 11% the number of main stem nodes.

All four formulations significantly decreased the number of harvestable bolls per unit area (Fig. 3). The formulations MC 90WDG Plus and Pix decreased the number of boll per unit area 13% on average, while MC 90WDG and Pix Plus decreased it only 7%. The differential effect between the Plus and non-Plus formulation was only marginally significant in both liquid and dry formulations. There was no significant differential effect on bolls per unit area between MC 90WDG Plus and Pix Plus, but the differential effect of the non-Plus formulations was significantly different, with MC 90WDG decreasing the number of bolls per unit area less than Pix.

Earliness (data not shown) and lint yield (Fig. 4) were not significantly affected by any of the four formulations.

Results from this one-year, one-location study indicate that 1) the four formulations tested were equally effective in regulating plant height, 2) the addition of Plus (*Bacillus Cereus*) prevented the decrease of main stem nodes but did not prevent the reduction of the number of harvestable bolls per unit area, and 3) all four formulations had no effect on earliness and lint yield. More studies are needed to confirm these results.

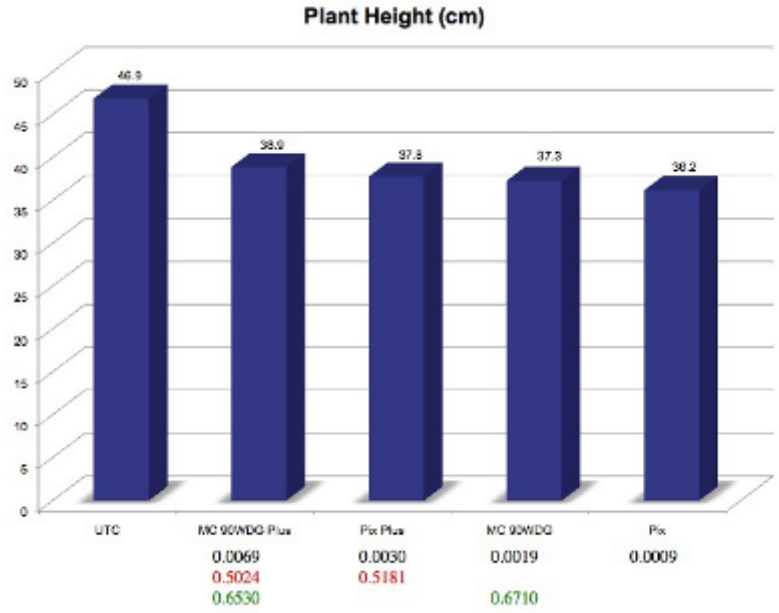

Figure 1. Effects of mepiquat chloride-based formulations on final cotton plant height (cm). *Note*: Numbers below treatment labels are the probability (P) of wrongly rejecting the null hypothesis of the difference between two treatments. Black numbers are contrasts against UTC. Red numbers are contrasts between Plus and non-Plus formulations. Green numbers are contrasts between dry and liquid formulations.

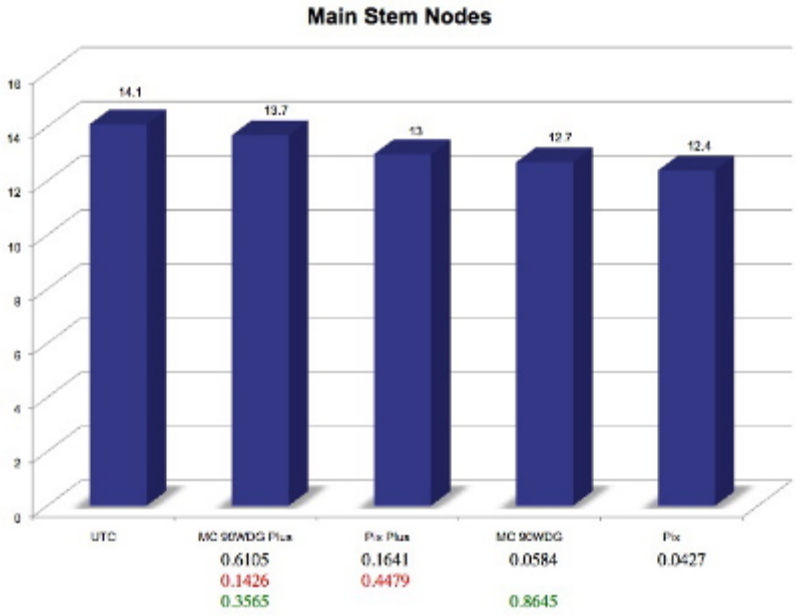

Figure 2. Effects of mepiquat chloride-based formulations on final number of main stem nodes per plant.

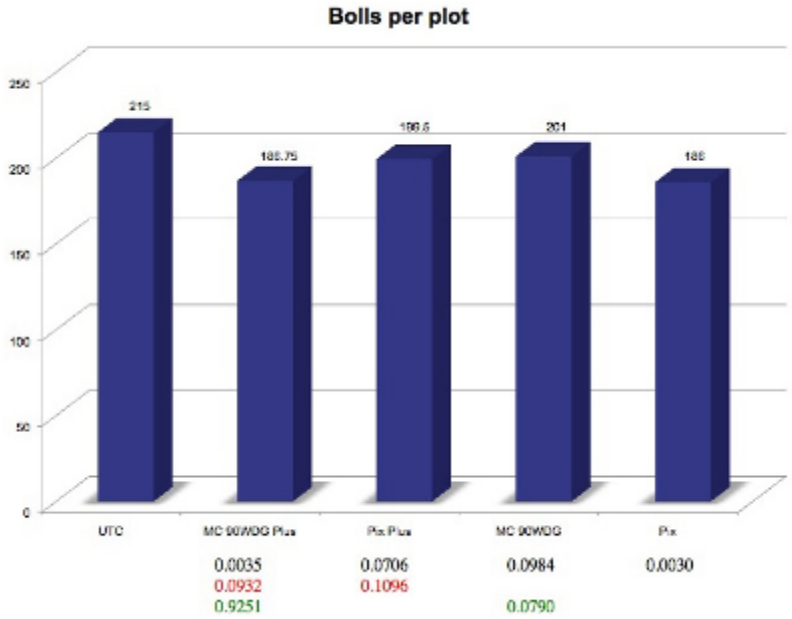

Figure 3. Effects of mepiquat chloride-based formulations on final number of harvested bolls per plot (1/1000 ac).

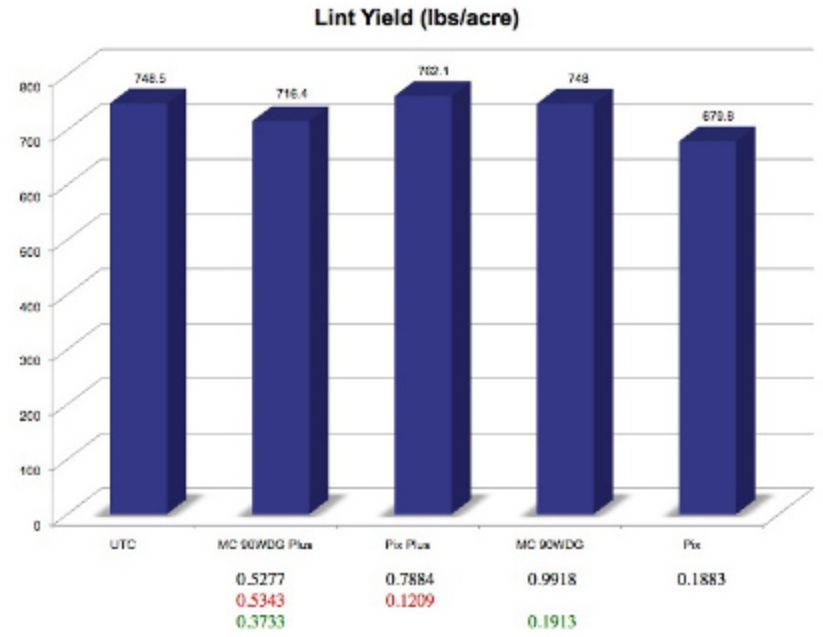

Figure 4. Effects of mepiquat chloride-based formulations on final lint yield.

References

Landivar, J.A., S. Zypman, D.J. Lawlor, J.Vasek, and C.Crenshaw. 1992. The Use of and Estimated Plant PixConcentration for the Determination of Timing and Rate of Application. Proc. Beltwide Cotton Conf. 1047-1049.

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