THE USE OF PLANT MONITORING TECHNIQUES AS AN AID IN DETERMINING MEPIQUAT CHLORIDE RATES IN RAIN-FED COTTON

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Abstract

Five Pix treatments were applied at seven locations across the Coastal Plain. The five treatments consisted of a check receiving no Pix, a low rate multiple approach receiving four applications of 292 ml ha^{-1} of Pix at 10-14 day intervals beginning at first square (LRM), a low rate multiple approach with Pix application based on a plant monitoring point system (LRM-PM), an early bloom approach receiving eight ounces at early bloom (EB) and a modified early bloom approach based on a plant monitoring point system (EB-PM). No yield responses were observed due to Pix at any locations due to the drought, the lack of value associated with earliness this year due to the drought and lack of excessive moisture at any location. All locations had good plant growth until about two weeks prior to early bloom. One location received almost no rainfall for the remainder of the season and the other six locations had limited rainfall capable of producing 800 to 1500 kg of lint ha^{-1}. No location received what might be considered any where close to excessive rainfall. The LRM-PM system seemed to do a good job of recognizing the change in the crop prior to early bloom and called for lower Pix rates than the standard LRM. The EB-PM system appeared to be too aggressive and called for higher rates of Pix at than the standard EB approach at some locations. No significant yield reductions due to Pix treatments were observed.

Introduction

The likelihood of responses to mepiquat chloride applications has been related to several factors such as planting date, cultivar, fruit retention, plant population and plant height or vigor. Cathy and Meredith (1988) reported that yield responses to mepiquat chloride were more likely as planting dates are delayed. This response was related to increased earliness caused by mepiquat chloride applications. Increased earliness was observed by York (1983) in six out of seven locations in North Carolina. Differential responses to mepiquat chloride applications by cultivars have been observed by several researchers (Feaster *et al.*, 1980; Hoskinson and Krueger, 1982; York, 1983).

Variable yield responses to mepiquat chloride has been related to environmental conditions by several researchers (Briggs, 1980; Crawford, 1981). Yield increases have been observed more frequently under high rainfall conditions, while yield decreases have been observed in drought situations (Willard *et al.*, 1977; Crawford, 1981; Hoskinson and Krueger, 1982). York (1983) reported that responses to mepiquat chloride could be attributed to amount of rain during the growing season in some locations but not all locations. Regressions of rainfall and heat units with mepiquat chloride responses were not significant, suggesting that a variety of factors are probably involved with mepiquat chloride responses.

Research conducted in Arizona by Lewis *et al.* (1992) suggested that initiating mepiquat chloride applications in response to measurable plant parameters was preferable to pre-determined mepiquat chloride treatment programs. In addition, a preliminary study conducted in North Carolina (Guthrie, 1990) suggested that grower measurements of crop growth may improve mepiquat chloride application decisions at early bloom. Previous research has compared predetermined schedules and rates of mepiquat chloride. The two major application schedules

tested in the United States are an early bloom (EB) approach and a low rate multiple approach (LRM). The EB approach simply calls for a given rate (usually 585 to 1169 ml ha^{-1}) of mepiquat chloride at early bloom. Producers with large acreage often have larger plants than desired if they encounter rains that keep them from being timely with this EB application. If this happens it is often difficult to get plant height under control. The LRM approach calls for four applications of a given rate (usually 146 to 292 ml ha^{-1}) of mepiquat chloride made at ten to 14 day intervals beginning at first square. Although research using the LRM approach has used predetermined rates of mepiquat chloride, the principle behind this concept was to evaluate the cotton at four times and make a decision whether mepiquat chloride is needed, and if so at what rates. Two of the systems evaluated in this study were developed in an attempt to overcome the short comings of the standard approaches described above. These systems employ plant monitoring techniques to evaluate plant vigor (height potential) and earliness to determine mepiquat chloride applications and rates compared to currently used pre-determined treatments.

Methods

Five mepiquat chloride treatments were applied at seven locations across the Coastal Plain. Each location had four replicates. Plots were four rows wide (3.85 m) and 15.2 m long. The five treatments consisted of a check receiving no mepiquat chloride, a low rate multiple approach receiving four applications of 292 ml ha^{-1} of mepiquat chloride at 10-14 day intervals beginning at first square (LRM), a low rate multiple approach with mepiquat chloride application based on a plant monitoring point system (LRM-PM), an early bloom approach receiving 584 ml ha^{-1} at early bloom (EB) and a modified early bloom approach based on a plant monitoring point system (EB-PM). The point systems used for the plant monitoring based treatments were specific for stages of growth (Tables 1, 2). Each point accumulated resulted in the application of 73 ml of mepiquat chloride ha^{-1}. Eight plants per treatment (two per plot) were selected for plant monitoring measurements to be used to determine mepiquat chloride rates with the point system charts listed in Tables 1 and 2. Plant monitoring observations include soil moisture, plant height, planting date, date of first bloom, variety, fruit retention, prior mepiquat chloride applications, nodes above white bloom, internode length and prior history of stalk height. An average stalk height was defined as within 10% of row width.

Results

No yield responses were observed due to mepiquat chloride at any locations due to the drought, the lack of value associated with earliness this year due to the drought and lack of excessive moisture at any location (Table 3). Data is presented averaged over locations due to a lack of a significant treatment location interaction. All locations had good plant growth until about two weeks prior to early bloom. One location (Lenoir county) received almost no rainfall for the remainder of the season and the other six locations had limited rainfall capable of producing 900 to 1500 kg of lint ha^{-1} (lint per cent was determined using a small gin with no lint cleaners which have higher lint turnout than commercial gins. A treatment yielding 1120 kg of lint ha^{-1} would yield about 170 kg ha^{-1} less with a normal gin.) No location received what might be considered anywhere close to excessive rainfall.

The LRM-PM system seemed to do a good job of recognizing the change in the crop prior to early bloom and called for lower mepiquat chloride rates than the standard LRM at all locations. The LRM-PM applied the lowest amount of mepiquat chloride of any of the mepiquat chloride treatments at all locations except the two late planted locations in Edgecombe county. In both of these locations the standard EB approach called for the lowest amounts of mepiquat chloride. The EB-PM system appeared to be too aggressive and called for higher rates of mepiquat chloride than

the standard EB approach at four of seven locations. No yield reductions due to mepiquat chloride treatments were observed. The standard early bloom approach yielded more than the standard LRM in Edgecombe county with EPL50 planted late. However, in the same test the LRM-PM did not yield lower than either early bloom approach.

More research needs to be conducted using plant monitoring techniques as a tool to aid with growth regulator application decision. The EB-PM system used here was too aggressive for the growing season. This was especially true for the late planted locations. This system is a less aggressive EB-PM system will be evaluated along with the LRM-PM system at various locations in the coming year. The less aggressive EB-PM system will allow longer internodes and give more credit to previous mepiquat chloride applications.

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Table 1. Point system for low rate multiple mepiquat chloride (MC) applications based on plant monitoring.

FIRST SQUARE				
	-1	0	1	2
Moisture		Fair	Excellent	
Prior history	Short	Average	Above average	Rank
Planting date		Early/on-time	Late	
Variety		Short/medium	Tall	
If score <2, don't apply mepiquat chloride.				
Do not exceed a total of 292 ml ha^{-1}.				
Do not apply if soil moisture is poor.				

10-14 DAYS AFTER FIRST SQUARE				
	-1	0	1	2
Moisture		Fair	Excellent	
Prior history	Short	Average	Above average	Rank
Retention		>75%	50-75%	
Prior MC		>219 ml	0-219 ml	
Height (cm)/node ratio	<3.5	3.5-4.3	>4.3	
If score <3, don't apply mepiquat chloride.				
Do not apply if soil moisture is poor.				

EARLY BLOOM				
	-1	0	1	2
Moisture	Fair	Good	Excellent	
Plant height	<51 cm	51-61 cm	>61 cm	
Retention		>75%	50-75%	<50%
Prior MC	>584 ml	365-584 ml	219-365 ml	None
Date of first bloom		Before July 10	July 10-20	After July 20
If score <3, don't apply mepiquat chloride.				
Do not apply if soil moisture is poor.				
Do not apply if NAWF <6.5.				

10-14 DAYS AFTER EARLY BLOOM					
	-1	0	1	2	4
Moisture	Fair	Good	Excellent		
NAWF		Decreasing	Same		Increasing
Retention		>75%	50-75%	30-50%	<30%
Prior MC	>584 ml	365-584 ml	219-365 ml	None	
Internode length	<3.8 cm	3.8-5 cm	5-7.6 cm	>7.6 cm	
If score <3, don't apply mepiquat chloride.					
Do not apply if soil moisture is poor.					
Do not apply if NAWF <5.					

Table 2. Point system for early bloom mepiquat chloride (MC) applications based on plant monitoring.

10-14 DAYS AFTER FIRST SQUARE				
	Plant height			
	<43.2 cm	43.2-50.8 cm	>50.8 cm	
Height/node ratio >4.3	292 ml	438 ml	584 ml	
Internode >5 cm	292 ml	438 ml	584 ml	
Do not apply if soil moisture is poor.				
EARLY BLOOM				
	Plant height			
	<61 cm	62-68.6 cm	68.6-76 cm	>76 cm
Plant height >61 cm	0 ml	584 ml	876 ml	1168 ml
Internode >5 cm	584 ml	584 ml	876 ml	1168 ml
Do not apply if soil moisture is poor.				
Do not apply if NAWF <6.5.				
10-14 DAYS AFTER EARLY BLOOM				
	Early bloom MC			
	> 584 ml	0-584 ml		
Internode <5 cm	0 ml	0 ml		
Internode 5-7.6 cm	584 ml	876 ml		
Internode >7.6 cm	876 ml	1168 ml		
Do not apply if soil moisture is poor.				
Do not apply if NAWF <5.				

Table 3. Lint yield and average mepiquat chloride (MC) applied averaged over seven locations in 1993.

Treatment	Average ml of MC applied					Lint yield
	First square	10-14 days after square	Early bloom	10-14 days after square	Total for season	kg ha^{-1}
Check	0	0	0	0	0	1062 A
LRM	292	292	292	292	1168	1031 A
LRM-PM	73	146	250	0	469	1044 A
EB	0	0	584	0	584	1074 A
EB-PM	0	271	626	125	1022	1083 A
LSD (0.05)						57.0