EVALUATION OF VARIABLE RATE PIX (MEPIQUAT CHLORIDE) APPLICATION BY SOIL TYPE

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Abstract

Growth variability, due to soil type, moisture or fertility differences, is common in many fields across the Cotton Belt. Pix (Mepiquat Chloride) is used for height control during the growing season. The objectives of this study were to evaluate the ability of a variable rate Pix application by growth areas to a) reduce variability in final plant height, b) increase yield, and c) reduce overall use of Pix in variable cotton fields. A split plot design was used with four Pix treatments: untreated, uniform rate, variable rate based on the rapid growth area, and variable rate based on the slower growth area. Both growth area specific variable rate treatments resulted in reduced variability in final height and plants within the ideal range on 32"-40". On the rapid growth soil type, the variable rate treatment resulted in higher Pix rates, yields, and boll retention than the other treatments for this soil type. When yield data were averaged over two locations, the VRT treatment in the rapid growth soil had a 65.8-pound advantage over the uniform Pix treatment. The VRT treatment in the growth limiting had a 45.3-pound lint advantage over the uniform rate. An economic analysis was performed and yield numbers were applied to a 45 acre variable field (approximately 75% rapid growth soil type, 25% growth limiting). In this situation more Pix would have been recommended by VRT than uniform; however the grower would have still found a yield advantage equivalent to $1540 through variable rate Pix use.

Introduction

Controlling excessive vegetative growth in cotton is an important management tool for increasing lint yields. Growers often use Pix Plant Growth Regulator to control height during the growing season. Growth variability is common in many fields across the Cotton Belt. Variability is often attributable to soil type, moisture or fertility differences in the field. Growth differences can lead to difficulty in recommending uniform rates of Pix (Mepiquat Chloride), timing of defoliation or beginning of harvest. Technology including variable rate controllers and geographic information systems offers cotton growers the ability not only to easily identify regions of fields with different growth patterns, but also to vary rates of Pix across the field. The objective of this study was to evaluate the ability of variable rate Pix applications to a) reduce variability in plant height, b) increase yield across the field and c) increase profits.

Materials and Methods

Two locations in Bertie County North Carolina with known soil variability were selected for study. Both fields had two distinct mineral soil types: a sandy loam that resulted in rapid cotton growth and a growth limiting clay type soil. Growth areas and soil types in fields were identified using aerial photography, DGPS scouting, digital soil surveys, and field histories. In each soil type, a randomized complete block design was implemented. The split plot design included location as the main plot factor, soil type as sub plot factor, and Pix treatments in a nested design. The factorial arrangement consisted of four Pix treatments: 1. Zero Pix applied, 2. Uniform rate: based on the average of 3 plots from each soil type, 3) Variable Rate Rapid Growth Soil (VRTS): based on average of 3 plots from the sandy rapid growth soil type, and 4) Variable Rate Growth Limiting Type Soil (VRTC): based on average of 3 plots from the clay soil type.

Five plants from each plot were randomly selected and monitored weekly for height, distance between the fourth and fifth nodes from terminal, average length of the top five internodes, and height-to-node ratio. Measurements began at first square and ended at cutout. The Early Bloom and Modified Early Bloom Strategies from the North Carolina Cotton Information Book (Edmisten 1998) were used to determine rates and timing of Pix application.

Results

Pix treatments were evaluated for ability to achieve final plant heights within an ideal range of 32" to 40" (on 36" row width). The irrigated Colerain, NC location was used to illustrate the reduction of height variability (Objective 1). Figure 1 shows the differences in final plant heights (taken prior to harvest) for each Pix treatment by soil type. The two variable rate treatments resulted in final plant heights in or nearest the ideal height range. In the rapid growth soil, the VRTS treatment resulted in 24 oz. total of Pix applied. All other treatments on the rapid growth soil received zero to 12 ounces of Pix. These treatments, as determined by the early bloom strategy, resulted in plants taller than ideal, ranging from 46-60". Considering both soil types, the two soil specific variable rate treatments (VRTC on clay and VRTS on the sand) had the least difference in plant height. Comparing the VRT to the uniform treatments, the uniform treatment on both soil types resulted in plants taller than ideal in rapid growth soil and shorter than ideal in the growth limiting soil.

Next, the treatments were evaluated for effects on lint yield and boll retention. At the Colerain location, all treatments on the growth limiting soil had higher whole plant boll retention than treatments on the rapid growth soil. When

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compared with the other treatments, the VRTS treatment on the rapid growth soil had the highest boll retention of the treatments on the rapid growth soil and was not significantly different from the growth limiting soil treatments. A similar trend was present with lint yields for this location. Recalling that the highest Pix rate, 24 oz., for the VRTS treatment was the only treatment in the rapid growth soil that controlled height within the ideal range, this treatment also resulted in the highest yield for this soil type. This demonstrates that height control in rapid growth situations is critical to high boll retention and yield in variable cotton fields.

Pix rate had a greater impact on boll retention and yield in the rapid growth soil than in the growth limiting soil, under irrigated conditions. Lint yields were significantly higher for all treatments in the growth limiting soil type than the treatments on the rapid growth soil. However, there was no significant effect of Pix rate on yield for the growth limiting soil.

Yield data over all locations, irrigated and dryland, were combined to get an accurate comparison of variable rate and uniform Pix treatments (Fig. 2). When both locations were combined, VRT Pix treatments in both rapid and growth limiting situations increased yields. The VRT in the rapid growth soil showed a 65.8-pound yield advantage over the uniform Pix treatment and a 45.3-pound advantage in the growth limiting soil.

To determine what impact the yield increases from the VRT Pix treatments might have had on overall returns, the field at Colerain was selected for a cost analysis. Spatial variability in height in this field was measured using DGPS. Growth areas were identified using contour maps. Using this contour map, 36.2 acres was identified as rapid growth type soil and 8.96 acres growth limiting. Based on the yield differences between VRT and uniform and $0.65 lb. price of cotton, VRT had a $29.45 per acre advantage in the growth limiting soil and a $42.77 per acre advantage in the rapid growth soil. In calculating the amount of Pix required for both soil types, the uniform Pix rate would have resulted in a total 4.23 gallons applied to the field at a cost of approximately $406.08. Ideal rates of 24 and 4 ounces were used resulting in 7.06 gallons of Pix needed to treat this field at varying rates. After subtracting the difference in Pix cost from the yield advantage of $1810.41 for this 45.12-acre field, variable rate treatment would have resulted in a gain of $1539.42 to the grower (Table 1).

Conclusions

Variable rate Pix treatments by soil type decreased height variability between soil types. When yield data are averaged over dryland and irrigated locations, a yield advantage to VRT Pix over uniform Pix rate application was observed. At the irrigated location, with a large percentage of the field in a rapid growth type soil, VRT resulted in more l Pix recommended. However, the increased cost of Pix in the VRT treatments was more than offset by the increased returns from higher lint yields, resulting in a profit of $34.12 per acre.

Reference

Edmisten, K.L. 1998. Suggestions for Pix Use. *In* 1998 Cotton Information. North Carolina Cooperative Extension Service, North Carolina State University, Publication No. AG 417, pp. 58-64.

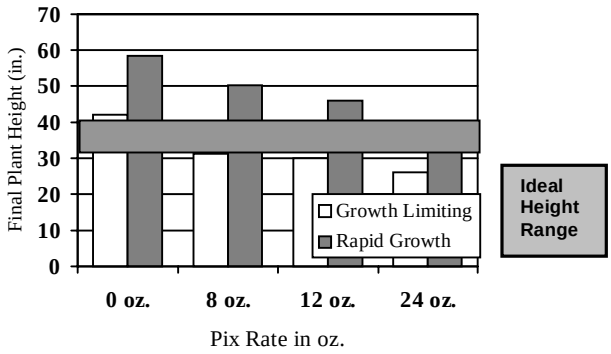

Figure 1. Differences in final plant heights for Pix treatments by soil type.

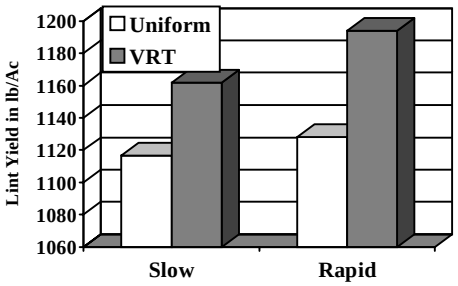

Figure 2 Yield data averaged over two locations for variable rate (VRT) vs. uniform Pix rates by soil type. Lint yield differences between VRT and uniform are shown by the numbers above the bars.

Table 1. Economic Comparison of variable rate vs. uniform Pix treatment for a 45 acre field in Bertie County, North Carolina.

	Uniform	Variable Rate	
		Rapid	Slow
Area (acres)	45.12	36.16	8.96
Pix Rate Total (oz.)	12	24	4
Gallons Pix Reqd.	4.23	6.78	0.28
Pix Costs ($96/gal)	$406.08	$677	
Yield Advantage	0	$1,810.41	
Overall Gain	0	$1,539.42	