HELIOTHINE MANAGEMENT SYSTEMS IN UNR COTTON

A. L. Catchot and J. T. Reed
Mississippi State University
Mississippi State, MS

Abstract

An experiment was conducted in Leland, MS in 1998, 1999, and 2000 to evaluate various heliothine management systems in ultra-narrow row (UNR) cotton. The study was conducted as a split-split block design. Whole plots were 7.5" and 38" rows (wide-row). Sub-plots were B.t and non-B.t. cotton. Sub-sub-plots were treatment thresholds including: 2%, 4%, 8%, and 12% infested plants. Data collected in 1998 were used to establish thresholds for the for the 1999 and 2000 study. Plots were monitored bi-weekly and sprayed for *Heliothis virescens*, Tobacco budworm and *Helicoverpa zea*, Cotton bollworm according to established thresholds. Ultra-narrow row and 38" row B.t. plots did not reach established thresholds in 1999. Wide-row non-B.t. 2% plots were sprayed for budworm/bollworm four times and UNR plots were sprayed two times in 1999. In 2000, 2% B.t. wide row plots received two budworm/bollworm sprays, 4% B.t. wide-row plots were sprayed once. B.t. UNR plots did not trigger a budworm/bollworm spray in 2000. In 2000, wide-row 2% non-B.t. plots received seven applications for budworm/bollworm, wide row 4% non-B.t. plots were sprayed six times, wide row 8% non-B.t. plots were sprayed four times, wide-row 12% non-B.t. plot were sprayed three times, UNR 2% plots were sprayed three times, UNR 4% non-B.t plots were sprayed one time and UNR 8% and 12% plots did trigger an application.

Data for 1999 and 2000 were pooled. B.t. and non-B.t. UNR plots had significantly fewer budworm/bollworm than wide-row B.t. and non-B.t. plots respectively. No significant differences were observed in budworm/bollworm numbers at any treatment threshold in the B.t. plots. In the non-B.t wide row plots the 2% plots had significantly fewer budworm/bollworm larvae than the 8% and 12% plots. Significantly more eggs were found in the wide row planting compared to the UNR plantings (~3X). There were no significant differences in yield in 1999 or 2000 among any treatments. Numerically, UNR plots tended to yield slightly higher in both years of the study although not significantly. Ultra-narrow row plots set one to three bolls per plant and cutout 7-10 days earlier than the 38" row plantings. The data suggests that UNR is possibly not as attractive to heliothines for oviposition as wide row plantings.

Introduction

Ultra- narrow row cotton (UNR) has been slowly regaining popularity over the last several years. The opportunity to decrease costs and increase yields have helped contribute to the rebound in UNR cotton. Ultra-narrow row also affords the grower the opportunity to plant cotton on marginal soils with the possibility of higher returns than soybeans or wheat/soybeans double crop systems traditionally grown on these type soils (Bullen and Brown 2000). While UNR cotton systems seems to have many advantages, there are also several factors that may limit the success of UNR cotton and need to be addressed empirically. Planting equipment is generally restricted to grain drills that are not as accurate as modern planters designed for wide row spacing. Achieving a highly populated uniform stand is an essential part of the UNR system. This limits the amount of lateral branching and increases harvesting efficiency.

The ability to manage weeds in an UNR cotton system is also different from wide row plantings. The ability to post direct herbicides is eliminated requiring the grower to rely on broadcast over-the-top applications that are often expensive. Also, broadleaf over-the-top herbicides in cotton are limited. Ultra-narrow row cotton is typically short with only a few fruiting structures per plant. Cotton planted in narrow rows has a faster canopy closure then wide row cotton (Jost and Cothern 2000). These factors may influence the density and relative occurrence of pests populations in the UNR system compared to wide row systems. The need for alternative thresholds or pest management systems for pests in the UNR system needs to be evaluated to determine if different management systems need to be implemented in the UNR system compared to wide row plantings. This study addresses several management scenarios in the UNR system for heliothine pests as compared to wide row management systems.

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Methodology

A preliminary study was conducted in Leland, MS in 1998 to establish baseline thresholds for the 1999 and 2000 studies. Four Heliothine thresholds were chosen for the remainder of the study. The study design was a split-split-block design. Whole plots were 7.5 and 38 inch row spacing. Sub-plots were B.t. and non-B.t. cotton. Sub-sub-plots were treatment thresholds of 2%, 4%, 8%, and 12% infested plants. In 1999 varieties planted were PM1220BG/RR and PM1220RR. Varieties planted in 2000 were DP458BG/RR and DP5415RR. UNR plots were planted with a JD750 grain drill and 38 inch row plots were planted with a JD1700 MaxEmerge vacuum planter. Seventy lbs. of Nitrogen was applied in 1999 to the total test area prior to planting. An additional 30 lbs. of Nitrogen was applied in late June by air to the UNR plots due to symptoms of Nitrogen deficiency. One hundred lbs. of Nitrogen were applied prior to planting in 2000. Total test area was ~20 acres and individual plots were 0.25 acres. Plots were scouted twice per week throughout the growing season. Twenty-five terminals, squares, flowers, and bolls were examined. Twenty-five sweeps were also taken in each plot twice per week with a standard sweepnet to monitor *Lygus lineolaris*, and beneficial insects. *Lygus* were managed aggressively with pesticides with little or no lepidopteran activity. Larvae were periodically collected and mandibles were removed to determine species present (Tobacco budworm or Cotton bollworm) and to dictate what pesticides were to be applied. In 1999, Heliothine pressure was light and species present was primarily the Cotton bollworm. In 2000, pressure was moderate to high and Tobacco budworm was the predominant species present. Immediately after scouting, heliothine numbers were tallied and plots that had reached or exceeded predetermined thresholds were treated. Fruit counts were taken once per week in five consecutive row feet in each plot. Cotton was picked on wide row plots with a JD9930 picker and UNR plots with a JD7455 cotton stripper with a Taylor finger stripper head.

Results

Heliothine pressure was relatively light in 1999. No B.t. plots were sprayed for budworm/bollworm regardless of treatment threshold or row spacing, however, the 2% wide row non-B.t. plots were sprayed four times for budworm/bollworm, and the 4% wide row non-B.t. plots were sprayed two times for budworm/bollworm. No other treatment thresholds were reached during the season. In 2000, heliothine pressure was moderate to high and mainly consisted of tobacco budworm, although both tobacco budworm and cotton bollworm were both present in the field late in the season. In 2000, the 2% wide row B.t plots received two heliothine applications and the 4% wide row B.t. plots were sprayed once. No other B.t. plots reached treatment thresholds regardless of row spacing. In 2000 the 2% wide row non-B.t. plots received seven applications for budworm/bollworm, 4% wide row non-B.t. plots received six applications, 8% wide row non-B.t. plots received four applications, and the 12 % wide row non-B.t. plots received three applications for budworm/bollworm. The UNR 2% non-B.t. plots received three applications, UNR 4% non-B.t. plots received one application and no other UNR plots triggered an application for budworm/bollworm (Table 1). There were no year by treatment interactions so data for 1999 and 2000 were pooled. The main effects of row spacing for B.t. and non-B.t were both significant. Ultra-narrow row B.t. plots had significantly fewer heliothines than the wide row plots, and the UNR non-B.t. plots had significantly fewer Heliothines than the wide row plots (Fig. 1). There were no significant differences in the main effect of treatment threshold for the B.t. plots, although, the 2% non-B.t. plots had significantly less heliothines than the 8% and 12% plots (Fig. 2). There were also significantly fewer eggs found in the UNR when compared to the wide row spacing. There were no significant differences in yield in any of the treatments in 1999 or 2000. Although in both years there was a trend toward slightly higher yield in the aggressively (2%) treated plots, but when treatment costs were subtracted from income, these aggressive treatments were not cost effective as compared with plots that were not treated or treated less frequently.

There are several possible explanations for significantly fewer heliothines occurring in the UNR system. It is possible that the UNR system is not as attractive for oviposition compared to the wide row system. It has been shown by various researchers that when cotton plants are planted on narrow rows and in high populations, the whole phenology of the crop changes. Plants tend to be short with less fruit per plant, the canopy closes much more quickly, and the growing season is typically reduced 7-10 days. These changes in crop structure may influence the relative attractiveness of the crop. The tight canopy reduces overall contrast of the field which may not be conducive to normal oviposition of the moths. Another possible scenario is oviposition distribution. One hypothesis based on relative densities of eggs found throughout the season in the UNR and wide row plantings is that moths tend to lay more or less uniformly across a geographic area containing a suitable host regardless of number of oviposition sites in a given area. If this hypothesis is correct, using a sampling method as was used in this study there would be approximately three times less eggs found per given sample in the UNR system compared to the wide row system where there were approximately three times more plants per acre in the UNR system than in the wide row system. This is approximately the difference found in this study. In reality, many factors influence the number of eggs deposited in any given field and it is hard to draw definitive conclusions supporting any one parameter based on this particular study. The findings in this study also suggest that aggressive spray regimes may not lead to economic recovery of spray cost. It is worth noting that well timed spray applications based on pests present at certain physiological stages of the crop may be more economical than absolute control throughout the growing season. Based on the preliminary findings in this study our current thresholds may need to be redefined.

Literature Cited

Bullen, S. G., and B. Brown. 2000. Economic Evaluations of Ultra Narrow Row Cotton on a whole Farm Basis. Proceedings Beltwide Cotton Conference. 287-288.

Jost, P. H., and J. T. Cothern. 2000. Evaluations of Cotton Plant Density in Ultra Narrow and Conventional Row Spacings. Proceedings Beltwide Cotton Conference. 659-660.

Table 1. Number of Heliothine spray applications made to B.t. and non-B.t. UNR and wide-row cotton plantings in the 1999 and 2000 growing season.

	1999		2000	
Row spacing and Trt.	**B.t**	**non-B.t**	**B.t.**	**non-B.t**
2%, 38" row	0	4	2	7
4%, 38" row	0	2	1	6
8%, 38" row	0	0	0	4
12%, 38" row	0	0	0	3
2%, UNR	0	0	0	3
4%, UNR	0	0	0	1
8%, UNR	0	0	0	0
12%, UNR	0	0	0	0

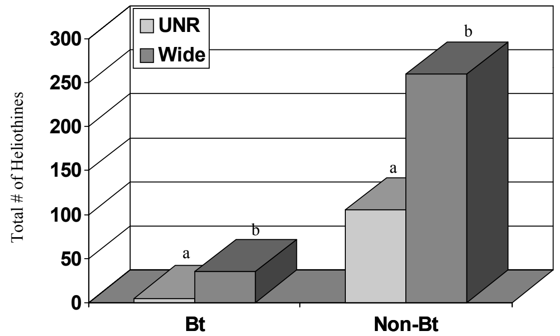

Figure 1. Total number of Heliothines found across all sampling dates during 1999 and 2000 in UNR and 38" row B.t. and non-B.t. plots. (P>0.05)

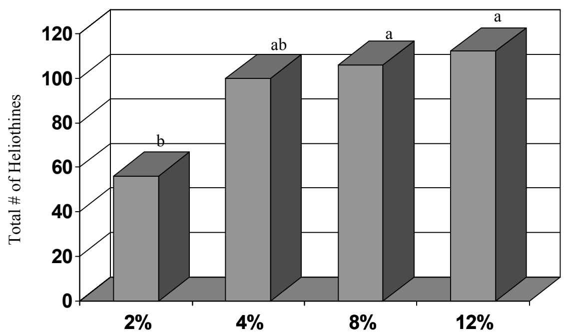

Figure 2. Total number of Heliothines found across all sample dates in 1999 and 2000 in each treatment threshold. (P>0.05)