EVALUATING THE MANAGEMENT OF BOLLWORM IN COTTON

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Abstract

The significance of my research is to determine if the current thresholds for bollworm in cotton are the most economical the various cotton technologies. The objective of this research was to compare and validate bollworm action thresholds on cotton varieties currently published in the Mississippi State University Insect Control Guide. Studies were conducted in Stoneville, MS and Clarksdale, MS, using a RCB design with treatments replicated four times. Factors included cotton variety and threshold. Plots were checked weekly for eggs and once eggs were found, each plot was checked for damage, eggs, and live larvae in ten plants per plot using a modified whole plant search. The bollworm populations were low overall at both locations throughout the year. The damage to non-Bt was greater than that of Bollgard II and Bollgard 3. When comparing the thresholds, the damage thresholds triggered and were sprayed more often than the egg thresholds over all varieties. No differences in cotton yield were observed among the threshold treatments on Bollgard II or Bollgard 3 in Stoneville. At the Clarksdale location, no differences were observed among threshold treatments for any of the cotton varieties. Bollworm numbers were lower than expected during the 2019 growing season, but populations persisted over several weeks. In general, little benefit was observed on from supplemental sprays on Bollgard II and Bollgard 3 in these tests. However, previous research has shown improved yields from one to two diamide applications on Bollgard II cotton under more normal bollworm pressure.

Introduction

Bollgard cotton was introduced in 1996 using the Cry1Ac protein for control of tobacco budworm, bollworm, and pink bollworm. Bollgard cotton provided good control of tobacco budworm and pink bollworm, but was less effective against high populations of bollworm. Bollgard II was introduced in 2003 to provide better control of bollworm. Bollgard II produces the Cry1Ac protein from Bollgard, plus the Cry2Ab protein to increase overall toxin levels. Recently, bollworm populations became increasingly resistant to both of these Bt proteins. Bollgard 3 cotton was introduced during the 2018-2019 growing season. This new technology uses the Cry1Ac and Cry2Ab proteins found in Bollgard II, but adds a third protein, Vip3A which provides a different mode of action to control bollworms.

The current threshold for bollworms in Non-Bt and two gene cotton varieties is 8 or more larvae per 100 plants or 6% fruit injury before bloom and 20 eggs per 100 plants or 6% fruit damage after bloom. In 3 gene cotton varieties the threshold is 8 or more larvae per 100 plants or 6% fruit injury pre bloom and 4 or more larvae at least 1/8-inch long per 100 plants or 6% fruit injury. Currently, no research has been done to validate these thresholds, especially since resistance to multiple Bt proteins has developed.

Materials and Methods

This experiment uses a randomized complete block design with treatments replicated four times over two locations. The experiment was conducted in Stoneville, MS with a duplication in Clarksdale, MS. For each location there were two factors used, variety and threshold. Three varieties were used, Non-Bt, Bollgard II, and Bollgard III and for each variety there was an untreated control, 20% Egg, and 6% damage threshold plot per rep. To collect data, the entire test area was sampled weekly for the presence of bollworm eggs. Once eggs were found, each plot was checked weekly for damage, eggs, and live larvae. 10 plants per plot were examined using a modified whole plant search which involves checking the terminal, at least two squares, and at least two bolls of each plant. The mean number for each treatment among all four reps was used to determine if a spray was needed for the corresponding threshold.

Results and Discussion

Overall, bollworm populations were fairly low throughout the year at both locations, but populations persisted over several weeks. At both locations, bollworm damage was greater on non-Bt cotton compared to Bollgard II and Bollgard 3 cotton. As a result, two sprays were made for the 6% damage threshold on non-Bt cotton at each location (Tables 1 & 2). In contrast, one spray was made for the 6% damage threshold on Bollgard II at each location. One spray was made based on the 6% damage threshold on Bollgard 3 only at the Clarksdale location. The egg threshold was sprayed only on the non-Bt cotton one time at both locations.

Table 1. Number of sprays per threshold for each variety in Stoneville, MS.

	Stoneville	
Variety	**Threshold**	**No. Sprays**
Non-Bt	Egg	1
Non-Bt	Damage	2
BG2	Egg	0
BG2	Damage	1
BG3	Egg	0
BG3	Damage	0

Table 2. Number of sprays per threshold for each variety in Clarksdale, MS.

	Clarksdale	
Variety	**Threshold**	**No. Sprays**
Non-Bt	Egg	1
Non-Bt	Damage	2
BG2	Egg	0
BG2	Damage	1
BG3	Egg	0
BG3	Damage	1

For cotton yields, significant differences were observed on the non-Bt cotton at the Stoneville location (Fig. 1). Non-Bt cotton that was sprayed two times based on the 6% damage threshold yielded greater than the non-Bt cotton sprayed one time based on the egg threshold and the non-treated control. Non-Bt cotton sprayed one time based on the egg threshold yield greater than the non-treated non-Bt cotton. No differences in cotton yield were observed among the threshold treatments on Bollgard II or Bollgard 3 in Stoneville. At the Clarksdale location, no differences were observed among threshold treatments for any of the cotton varieties (Fig. 2) When looking at combined yield data from both locations, (Fig. 3) the non-Bt variety shows significant variation between the thresholds while both Bollgard 2 and Bollgard 3 show no significant variation in yields.

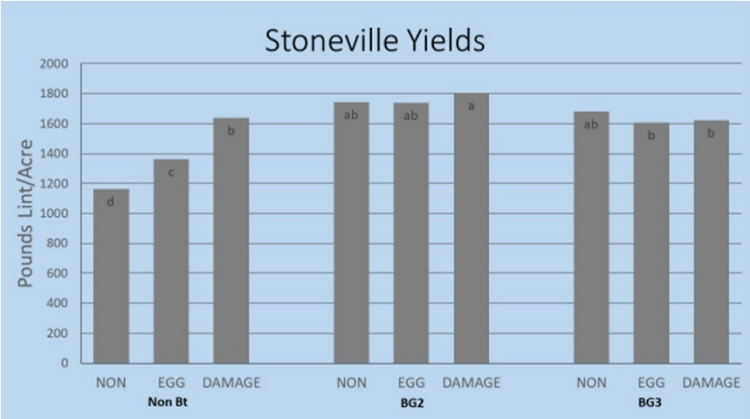

Figure 1. Stoneville cotton yields in lint/acre

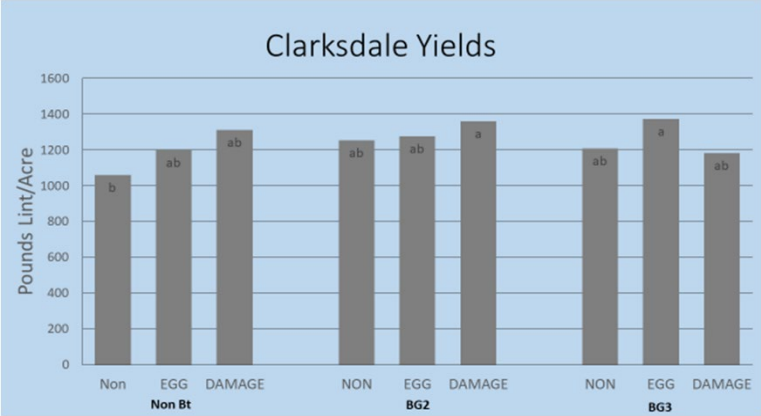

Figure 2. Stoneville cotton yields in lint/acre

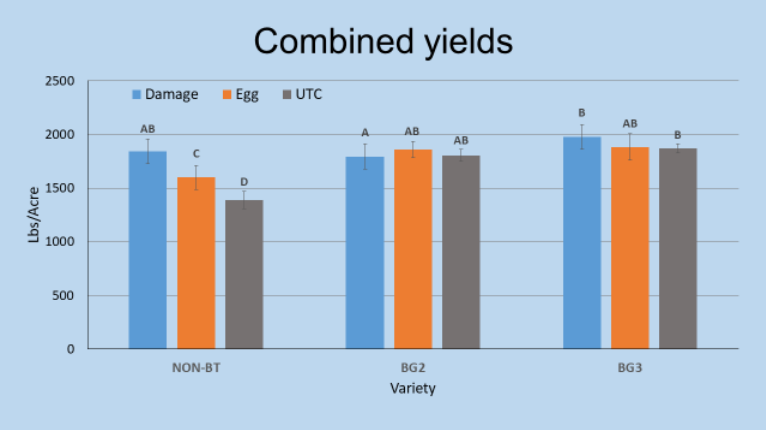

Figure 3. Combined cotton yields in lint/acre between Stoneville and Clarksdale locations

Summary

Bollworm numbers were lower than expected during the 2019 growing season, but populations persisted over several weeks. Wet weather during the spring delayed planting of some corn fields which likely contributed to the population dynamics experienced in 2019. As a result, the damage threshold plots triggered sooner and more often than the egg threshold plots both in Stoneville and Clarksdale. In general, little benefit was observed on from supplemental sprays on Bollgard II and Bollgard 3 in these tests. However, previous research has shown improved yields from one to two diamide applications on Bollgard II cotton under more normal bollworm pressure. This study will be continued in

2020 to improve our understanding of action thresholds for bollworm control in cotton.

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References

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