



ANR-1032

ALABAMA A & M AND AUBURN UNIVERSITIES

Insect Scouting In Bt-Transgenic Cotton

Bt cotton is a technology that provides varying degrees of control for caterpillar pests.

Control among species ranges from very good for tobacco budworm, to near zero for cutworms. Most of the other caterpillar species fall somewhere between and include the corn earworm, the armyworm complex, and the loopers. In addition, control of a particular species can vary over different portions of the plant and during different times of the season.

The wide adoption of this technology in the short term may virtually eliminate the tobacco budworm as a threat to cotton production. When a pest as dominant as the tobacco budworm is removed, several events can be expected to happen.

Through selection pressure, the tobacco budworm will be altered toward survival on Bt cotton. While the tobacco budworm population is low, other pests—such as plant bugs and stink bugs—will likely take advantage of this lack of competition and exploit cotton. Exactly what will occur in Bt cotton over the next few years is largely unpredictable, but significant change is highly probable.

Experiences with Bt cotton in 1996 indicate that traditional scouting techniques need to be adjusted. Some suggestions for modifying scouting techniques follow.

Identifying Escaped Caterpillars

The inherent mode of action associated with the Bt technology requires changes in scouting procedures. Bt cotton does not prevent egg deposition by moths nor does it repel this activity. Susceptible caterpillars hatch, feed for a short time, and eventually die. As a result, numbers of eggs and newly hatched larvae do not pose a problem. They do continue to indicate the degree of pressure. There is no particular point at which a caterpillar can be identified as an escape, but most authorities agree that if an individual larva becomes $\frac{1}{4}$ inch long and appears healthy then the odds for survival are good.

Scouting And Thresholds For Caterpillar Pests

A modified whole plant search is suggested to detect tobacco budworm, corn earworm, and fall armyworm escapes on Bt cotton. There are already indications that the latter two species are capable of exploiting this technology. The tobacco budworm is not expected to present a problem in the near future, but this technique also will detect tolerant budworm larvae.

In the past, scouting for budworms and bollworms consisted of estimating the numbers of eggs and small larvae in or near the terminal of the cotton plant as well as looking at damaged

squares. On Bt cotton, these techniques provide little useful information other than relative pressure.

Escaped ($\frac{1}{4}$ inch or longer) bollworm or budworm larvae are the important stages in scouting Bt cotton. Experience with Bt cotton has shown that few escaped larvae are found in the terminal of the plant or feeding on squares. Most of the surviving corn earworms have been found inside dried blooms, inside red blooms, feeding on young bolls, or in open white blooms.

Locating and quantifying these larvae before they reach 7 to 8 days of age is a difficult and tedious task. Whole plant searches seem the best means of quantifying this sort of infestation, but the amount of time required for this sample makes it impractical.

The proposed solution to this dilemma is a modified whole plant search. This technique involves concentrating on a zone of the plant at and just beneath the white blooms. With this technique, examine all red and dried blooms as well as the bolls associated with them. In addition, examine all white blooms. Also, search the bolls beneath this zone outwardly for bract etching by fall armyworm larvae. If etching is present, make a more thorough examination. This technique will not locate all larvae, but should provide a workable compromise.

The modified whole plant search is designed for blooming

cotton. For prebloom cotton (June), use a whole plant search.

Tally fall armyworm larvae separately from bollworms and tobacco budworms. Still use egg counts in the top quarter to third of the plant to indicate pressure. Searching for eggs in the upper portion of the plant and locating larvae through a modified whole plant search are not techniques which can be done simultaneously. Sampling eggs will have to be a separate task.

Proposed Thresholds For Caterpillar Pests

One problem in changing sampling techniques is interpreting the resulting counts and adapting them to existing thresholds. A modified whole plant search may reveal more bollworm larvae than did terminal inspections. This might indicate a need for increasing thresholds. Another possible reason for increasing thresholds is the benefit provided to Bt cotton technology by natural enemies. On the other hand, most of the larvae uncovered during this sample will already be feeding on harvestable fruiting forms which might imply that lower thresholds be adopted.

Realizing that adjustments will be necessary as we gain experience, our proposed thresholds to go with the modified whole plant sample are as follows: (1) 5 bollworm or tobacco

budworm larvae (greater than 1/4 inch) per 100 plants if natural enemies are not common, or (2) 10 larvae per 100 plants if natural enemies are plentiful.

Threshold guides for the fall armyworm are 10 larvae per 100 plants. Since the fall armyworm is difficult to control, consider only larvae less than 6 days old.

Scouting And Thresholds For Plant Bugs And Stink Bugs

The low-spray environment associated with boll weevil eradication and Bt cotton production increases the odds for more plant bug and stink bug problems during July and August. Experience with high plant bug populations last July revealed that traditional methods of measuring plant bugs are of little value. We have been able to confirm plant bug infestations in June through visual examinations or by drop cloth or sweep net samples. The damage from these infestations was further evaluated through pinhead square retention samples and control decisions were then made. This method continues to be effective for prebloom cotton.

Plant bug damage on blooming cotton (July and August) is more complex. This is true for both Bt and non-Bt cotton. For one thing, damage becomes more varied. In addition to the

damage to pinhead squares, damage to young bolls and larger squares becomes common. The large square damage is revealed several days later when the square blooms. These so-called "dirty" blooms exhibit browned anthers which upset pollination and result in deformed bolls. Plant-bug-damaged bolls can be identified by small black spots on the outside. This damage should be confirmed by slicing the bolls and looking for discolored tissue. Stink bug damage generally is confined to bolls and is virtually identical to plant bug damage.

Suggested thresholds for July and August plant bug infestations are 15% dirty blooms or 10% damaged bolls. This includes the tarnished plant bug, the cotton fleahopper, the clouded plant bug, or combinations thereof. Control of plant bugs during or after peak bloom is difficult and may require more than one insecticide application.

The stink bug threshold is one per 6 feet of row or 10% damage to immature bolls. Stink bug infestations are sometimes quite localized which could provide the opportunity for spot treatments.

Summary

Since many factors are involved, thresholds should be flexible. Interpret the above suggestions as starting points which may be adjusted up or down with experience.



ANR-1032

This publication was prepared by Barry L. Freeman, *Extension Entomologist*, Associate Professor, and Ronald H. Smith, *Extension Entomologist*, Professor, both in Entomology at Auburn University.

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

Issued in furtherance of Cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, and other related acts, in cooperation with the U.S. Department of Agriculture. The Alabama Cooperative Extension System (Alabama A&M University and Auburn University) offers educational programs, materials, and equal opportunity employment to all people without regard to race, color, national origin, religion, sex, age, veteran status, or disability.

UPS, 5M04, New 4:97, ANR-1032