BOLLWORM MANAGEMENT IN VIRGINIA COTTON: HISTORY, STRATEGIES AND SUCCESSES

D. Ames Herbert, Jr.
Tidewater Agricultural Research and Extension Center
Virginia Polytechnic and State University

Abstract

Cotton has become a dominant crop in southeastern Virginia since reestablishment in the mid-1980's. Acreage is averaging about 100,000 per year, with 110,000 acres planted in 1999. The bollworm/budworm complex (*Helicoverpa zea*/H. *virescens*) is a primary insect pest problem with larvae attacking squares and bolls causing significant yield losses if left uncontrolled. In response, Virginia Cooperative Extension entomologists imported bollworm management recommendations from the North Carolina Cooperative Extension Service and began field research to validate and refine those recommendations for the Virginia crop/pest environment. Several bollworm control tactics consisting of different pyrethroid insecticides, applied at different rates, and using different spray application schedules, were compared over several years for bollworm efficacy, boll damage and cotton lint yields. Overall, results indicated that two control tactics provided the highest and most consistent yield increases over untreated controls. Each of these began with a broadcast spray application of pyrethroid at a standard rate (0.018 to 0.028 lb ai/acre) at the bollworm egg threshold. With tactic one, a second pyrethroid spray was applied at a high rate (0.03 to 0.04 lb ai/acre) 5 days after the egg threshold spray. With tactic two, two additional standard rate sprays were applied, 5 and again 10 days after the egg threshold spray. With tactic one, lint yields were increased by 87 to 323 lb/acre, depending on the year, over untreated controls; with tactic two, lint yields were increased by 97 to 341 lb/acre.

Introduction

In recent years, cotton has gained prominence as a rapidly expanding crop that is well suited for production in eastern Virginia. Acreage expanded from almost none in the early 1980's to an average of almost 100,000 acres each year from 1995 to1999. Farm gate value exceeded $64,000,000 in each of the past three years, and this income is welcome to many producers compromised by recent downward trends in grain, soybean and peanut prices. Minimizing production costs will be critical to maintaining cotton as a competitive crop alternative. Insect control is a major cost in many cotton producing areas. It has been a priority to determine which insect pests pose an actual threat to cotton yield in Virginia, and to evaluate and develop economic control strategies. The bollworm/budworm complex (*Helicoverpa zea*/H. *virescens*) is a primary insect pest problem with larvae attacking squares and bolls causing significant yield losses if left uncontrolled. Field tests in 1994 showed as much as 358 lb lint/acre reductions, almost 20% of yields in protected plots, in the absence of insecticidal controls (Herbert et al. 1994). Field tests in subsequent years showed variable but significant lint yield losses due to bollworm damage (Herbert 1996, 1997). In response, Virginia Cooperative Extension entomologists imported bollworm management recommendations from the North Carolina Cooperative Extension Service (NCCES, NCSU 1999) and began field research to validate and refine those recommendations for the Virginia crop/pest environment. Emphasis was on control, cost, and lint yields protected. The findings summarized here indicate that several control tactics were successful in minimizing losses and maximizing yields. Two tactics consistently provided the highest lint yields. All tactics that were tested are presented with the best two highlighted in the discussion.

Materials and Methods

All field research tests were conducted at the Virginia Tech Tidewater Agricultural Research and Extension Center, Suffolk, VA, in the 1994 through 1999 growing seasons. 'DPL 51' cotton was planted in 36 inch-wide rows, using conventional full tillage (minimum strip tillage in 1998 and 1999) and managed according to recommended practices for Virginia (Maitland, 1998). Several bollworm control tactics consisting of different pyrethroid insecticides, applied at different rates, and using different spray application schedules (insecticide + rate + spray schedule = a spray tactic), were compared for bollworm efficacy, boll damage and cotton lint yields. Tactics were assigned to plots based on a RCB experimental design using four replicates. Plots were four rows by 40 feet long. Only the center two rows were treated and sampled for boll damage and bollworms. Insecticides included lambda-cyhalothrin, cyfluthrin, or deltamethrin applied at either suggested industry standard rates (0.025, 0.028, and 0.018 lb ai/acre, respectively), or at suggested high rates (0.04, 0.04, or 0.03 lb ai/acre, respectively). Insecticides were broadcast with water using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 39 psi through one TX 10 hollow cone nozzle over the top of each row. Spray application schedules varied somewhat over the years, but mostly consisted of first sprays applied when fields reached the egg threshold (10 or more eggs per 100 terminals, or 2 eggs per 100 fruiting forms) using either a standard or high insecticide rate. These were followed by second and/or third sprays at 5 and/or 10 days after the egg threshold spray, using either a standard or high rate. Percentage of bolls damaged by bollworms (data not presented) was estimated by randomly sampling 25 bolls per plot, weekly, beginning one week after application of the egg

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1101-1104 (2000)
National Cotton Council, Memphis TN

threshold sprays. Yields were determined by harvesting the center two rows of each plot (80 row feet) using a John Deere 2-row cotton combine. Data were analyzed using analysis of variance procedures and appropriate means separation tests.

Results and Discussion

Because of the year to year variation in density of bollworm populations and parallel intensity of crop damage, control tactics varied in the amount of lint yield they protected. Yield advantages compared with untreated controls, over all control tactics and years, ranged from 36 to 358 lb lint/acre. In order of magnitude from least to greatest bollworm infestation intensity as indicated by yield impact, years ranked as follows: 1999, 1997, 1996, 1995, 1998, and 1994. Note that within each year and spray tactic, performance, as indicated by lint yields, was not significantly different (P=0.05) among the insecticides used. Therefore, year/tactic yields presented in the figures represent an average of the insecticides used in that year and tactic. All control tactics, in all years, except one case in 1999, resulted in lint increases over untreated controls (Figure 1, a-f). However, not all increases were statistically significant at the P=0.05 level. Overall, results indicated that two control tactics provided the highest and most consistent yield increases over untreated controls. Each of these began with a broadcast spray application of pyrethroid at a standard rate at the bollworm egg threshold. With tactic one, a second pyrethroid spray was applied at a high rate 5 days after the egg threshold spray. With tactic two, two additional standard rate sprays were applied, 5 and again 10 days after the egg threshold spray. With tactic one, lint yields were increased by 87 to 323 lb/acre, depending on the year, over untreated controls (Figure 1, a-f). With tactic two, lint yields were increased by 97 to 341 lb/acre, depending on the year (Figure 1, a-f). These tactics consistently produced higher yields than tactics such as: single high rate sprays at egg threshold; two standard rate sprays, one at egg threshold and another in 5 days; or, beginning with either standard or high rate sprays and following in 10 days with either standard or high rate sprays.

These results, although somewhat variable over years, indicated that a 2-spray system - beginning at egg threshold with a standard rate and following in 5 days with a high rate - resulted in the highest yields for the input cost. Although three standard rate sprays - one at egg threshold, one in 5 days, and another 10 days after the egg threshold spray - did produce higher yields in all years except 1999, the increase ranged from only 1 to 18 lb lint per acre (Figure 2). This increase would not offset the cost of an additional spray (application cost + product cost) at current cotton value. The most cost effective tactic appeared to be the two spray, standard then high rate, system.

References

Herbert, D. A., Jr. 1996. Different application schedules and insecticide rates for control of bollworm in Virginia cotton, 1995. Arthropod Management Tests. 21:252-253.

Herbert, D. A., Jr. 1997. Selected non-pyrethroid insecticides for control of bollworm in Virginia cotton, 1996. Arthropod Management Tests. 22:257.

Herbert, D. A., Jr., M. Arrington, L. Byrd-Masters. 1994. Insect Pest Management in Virginia Peanuts, Soybeans and Cotton, 1994. Virginia Tech, TAREC Info. Ser. No. 358, pp. 97-110.

Maitland, J. C. 1998. 1998 Virginia Cotton Production Guide. Virginia Cooperative Extension, Tidewater Agric. Res. and Ext. Ctr. Info. Ser. No. 403.

North Carolina Cooperative Extension Service, North Carolina State University. 1999 Cotton Information. Raleigh, NC, Publ. AG-417, pp. 132-133.

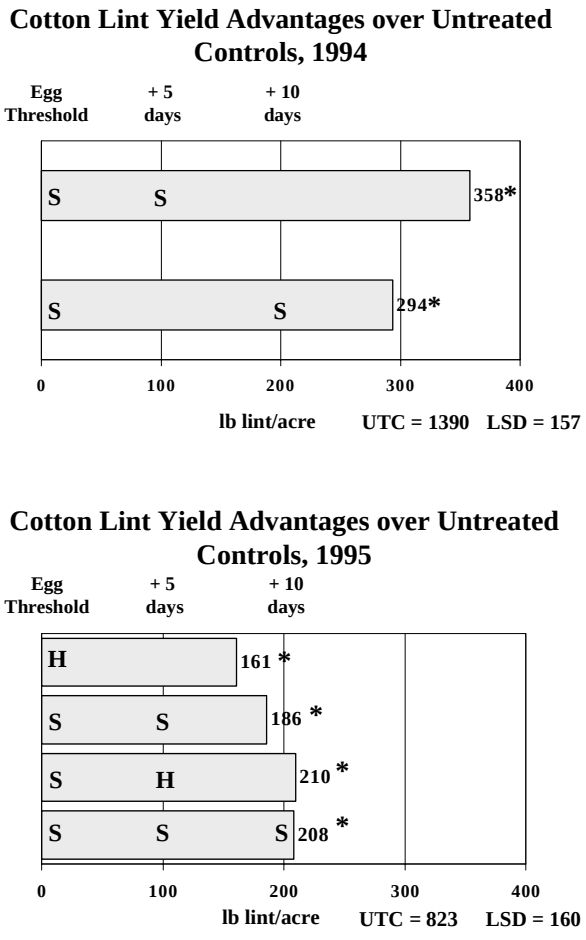
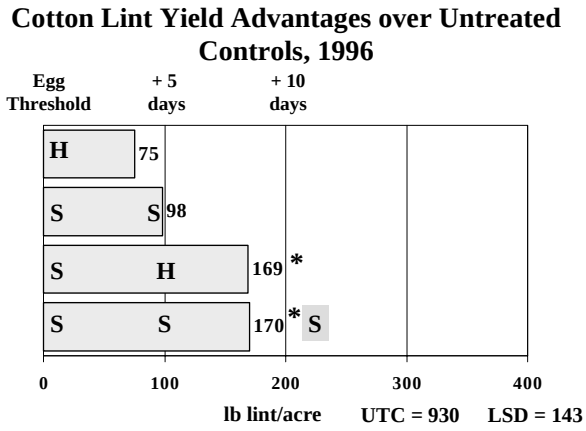
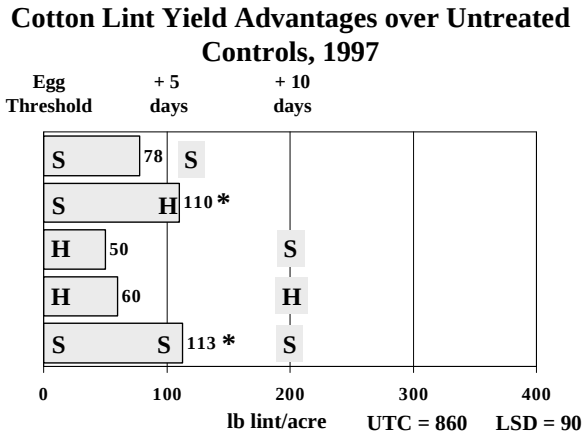


Figure 1a and 1b. Cotton lint yield advantages over untreated controls with bollworm control tactics. S = standard rate and H = high rate pyrethroid sprays. Virginia Tech Tidewater AREC, Suffolk, Virginia 1994 – 1995.





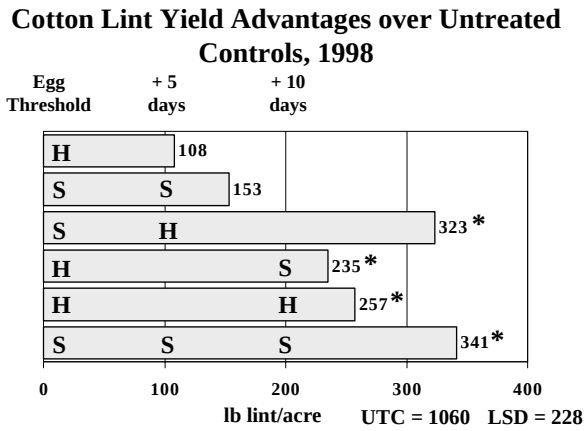


Figure 1c, 1d and 1e. Cotton lint yields advantages over untreated controls with bollworm control tactics. S = standard rate and H = high rate pyrethroid sprays. Virginia Tech Tidewater AREC, Suffolk, Virginia, 1996 – 1998.

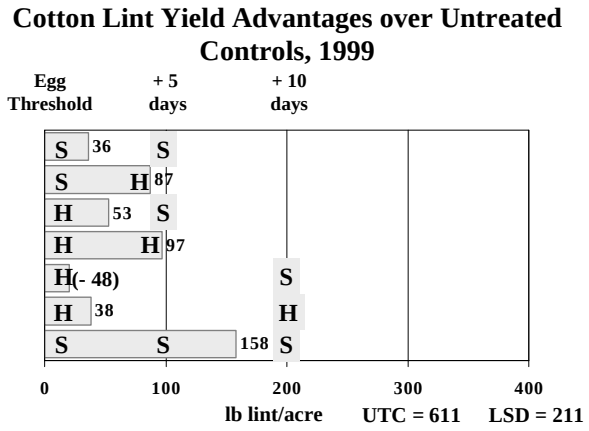


Figure 1f. Cotton lint yield advantages over untreated controls with bollworm control tactics. S = standard rate and H = high rate pyrethroid sprays. Virginia Tech Tidewater AREC, Suffolk, Virginia, 1999.

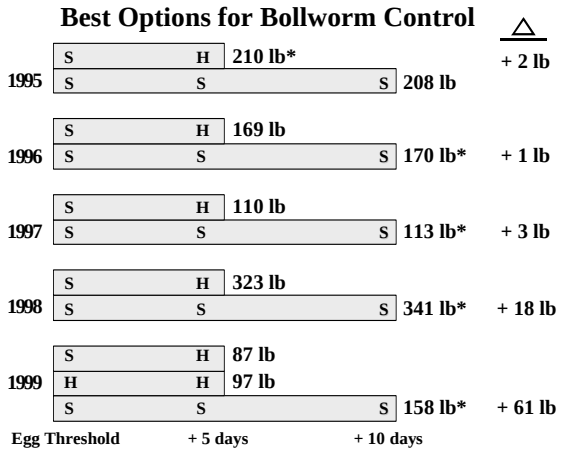


Figure 2. Best spray tactics for bollworm control in Virginia cotton. S = standard rate and H = high rate pyrethroid sprays. Virginia Tech Tidewater AREC, Suffolk, Virginia, 1994-1999.