FIVE YEARS OF VIAL TESTING ON A COUNTY-WIDE BASIS FOR BOLLWORM AND BUDWORM RESISTANCE TO TRACER, PYRETHROIDS, AND CURACRON IN AHLEY COUNTY, ARKANSAS

Kenneth R. Williams
Cooperative Extension Service, University of Arkansas
Hamburg, AR

Abstract

Vial testing for insecticide resistance was begun in 1994 to monitor the development of insecticide resistance to the pyrethroids (cypermethrin) and Curacron (profenofos) and beginning in 1997 testing for Tracer (spinosad) by the tobacco budworm *(Heliothis virescens)*, and the cotton bollworm (*Heliothis zea)*. Pyrethroid resistance by the tobacco budworm has progressed to the point of basically no control from 1994-1998. Curacron resistance in 1994 was very low. By 1998, Curacron was reaching critical levels of resistance by the budworms. Tracer is showing good control and low resistance levels. Bollworms are beginning to show some signs of resistance to pyrethroids.

Introduction

Ashley County is located in southeast Arkansas with the cotton producing area of the county located in the eastern 1/3. From 40,000-55,000 acres of cotton are grown annually in the Mississippi river alluvial part of the county.

The tobacco budworm (*Heliothis virescens)* and the cotton bollworm (*Heliothis zea)* are long time pests of cotton in the county. Resistance has developed over the years to the various classes of pesticides as they have been developed. In the late 1980's and early 1990's small pockets of control problems began to occur with the pyrethroid insecticides.

As problems continued to increase, in 1994 the cotton producers in the county became increasingly concerned. As a result the Ashley County Extension Cotton Committee, recommended that an effort be made to establish a vial testing program to monitor the developing resistance problems. Funding for the project was to be provided 75% by the producers in the county by an assessment on the cotton scouting fee and 25% by the University of Arkansas primarily for the preparation of the testing vials. Laboratory space was established in a classroom of the defunct Parkdale school system, which had been purchased by Ernest O'Neal of Parkdale, for office space, storage, etc.

Methods

Geographically the county was divided into 10 areas in the cotton growing region. These areas followed natural boundaries of the cotton growing area, and/or denoted areas that had experienced control problems in the past. Seventy-seven tobacco budworm moth traps were placed in the area, insuring that no cotton field in the county was farther than one mile from at least 1 trap and at least 5 traps were placed in each area. In addition, five cotton bollworm moth traps were scattered around the cotton growing area of the county. Two routes of 150 miles each were established to collect moths from the traps on Monday, Wednesday and Friday beginning around June 1 and continuing until September. The trap routes were run early in the morning with all moths collected by 12:00 noon and in the laboratory, which was maintained around 75°F.

The moths collected were kept separate by the ten areas from which they were collected.

Budworms were tested with vials treated with a pyrethroid (cypermethrin) at 10 ug per vial and Curacron (profenofos) at 20 ug per vial. Beginning in 1997 Tracer (spinosad) was added to the test with vials treated at 15 ug per vial. Each vial had one moth per vial.

Bollworms were tested with vials treated with pyrethroid at 2.5 ug per vial also with one moth per vial.

An untreated check consisting of up to ten moths per area for budworms for a maximum of 100, and 10 moths per trap for bollworms for a maximum of 50 moths was provided on each test.

All vials had a piece of sugar- water coated cotton in the vial. All vials were color coded for identification.

A maximum of 10 budworm moths per area were tested per treatment for a maximum of 100 moths per test per day. A maximum of 10 bollworm moths were tested for each of the five traps for a maximum of 50 moths per test. Tests were run three days a week, Monday, Wednesday, and Friday.

The moths were placed in the vials and exposed for 24 hours. Reading of the test results was done on Tuesday, Thursday, and Saturday.

Moths were tossed into the air to determine mortality . Moths able to fly after two or three tosses (some tended to play possum for the 1st time or two) were considered alive. A dead moth had to be completely dead and motionless. Anything in between was considered down but not dead.

Three technicians were hired to run the program. Two ran moth trap routes and worked in the lab, and an additional technician helped with trap running as necessary and worked with the two trap runners in the lab.

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Results were determined as percent survival. For budworms, results were tabulated for each of the 10 geographical areas and also county-wide. For bollworms, results were tabulated county-wide only.

Results were reported three days per week: (1) utilizing posters throughout the county , (2) Contacts with consultants and producers, (3) Included in a weekly cotton insect letter.

Producers and consultants utilized the results by watching percent survival for each material, corresponding moth flight patterns and adjusted the materials being used accordingly.

With the high percent survival with pyrethroids by the budworms, the pyrethroid test was dropped from the program during the summer of 1998 and Tracer was added.

The program has been run in this manner for five years. Season long survival charts have been constructed and compared in order to observe the pattern of resistance that developed.

Results

Tobacco Budworm - Pyrethroids

With the beginning of the program in 1994, test results showed an extremely variable pattern of survival with ups and downs and large swings. This pattern continued until 1997 at which time the percent survival started high - around 75% - and pretty much stayed there or increased throughout the summer. The 1998 testing showed the same problem and pyrethroid testing for budworms was discontinued mid-season.

Tobacco Budworm - Curacron

When testing began in 1994 Curacron had extremely low, nearly zero survival all season long except for a slight increase beginning mid-August. Tests for 1995 and 1996 showed similar results but with slight increases being noted. Beginning in 1997, a marked increase in survival occurred beginning with the mid-July moth flight and an even higher increase to 50% occurred with the next moth flight beginning mid-August. 1998 began with a survival rate of 60% the first of June followed by a drop to 20% in mid-June. Beginning July 1, survival rates rose to 50% and began fluctuating between 20 and 80% survival with 50% being a common number for the remainder of the season.

Tobacco Budworm - Tracer

With the beginning of regular testing in mid-July of 1998, budworms showed a low survival rate of 0-20%.

Cotton Bollworm - Pyrethroid

Testing from 1994-98 to the extremely low rate of cypermethrin showed extremely low survival rates of near zero in 1994. Beginning in 1995 an increase in survival was noted in the last two weeks of July, 20-40% , but dropped back to near zero. The following four years continued to show slight increases in survival until 1998. During the first two weeks in July 1998, survival went as high as 60% and never did drop all the way to zero and experienced a smaller peek in survival of 30% in mid-August.

Conclusion

Over the five year period of 1994-1998 survival of tobacco budworm to the pyrethroids progressed from a spotty nature to consistently high, season long survival. This resulted in the pyrethroids not being an option for control of budworms in 1998. During this same period of time, Curacron survival has steadily increased and has now reached critical levels with some flights of budworms.

The 1998 pattern of resistance by the budworms to Curacron has now reached a similar point that the pyrethroids were in 1994 with large up and down swings of resistance. Producers are being forced to look at a third class of insecticides represented by Tracer for budworm control. Tracer at this point is showing low levels of resistance.

Experience in the field demonstrated the results of the tests with those unfortunate producers who tried to use the pyrethroids for budworm control at any time in 1998, or Curacron after mid-August. Both experienced very poor control. Tracer gave good control in the field when applied for budworm control.

Bollworm control in the field has continued to be very good with the pyrethroids. However, it is at least of some concern, that bollworms are beginning to show some signs of resistance development in the vial tests at low rates.

Acknowledgment

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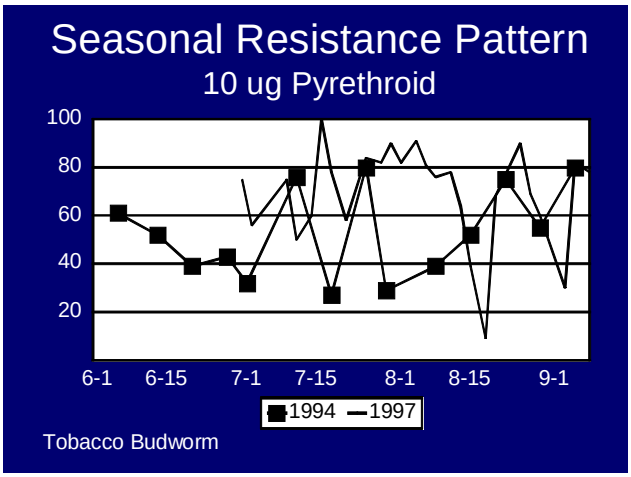
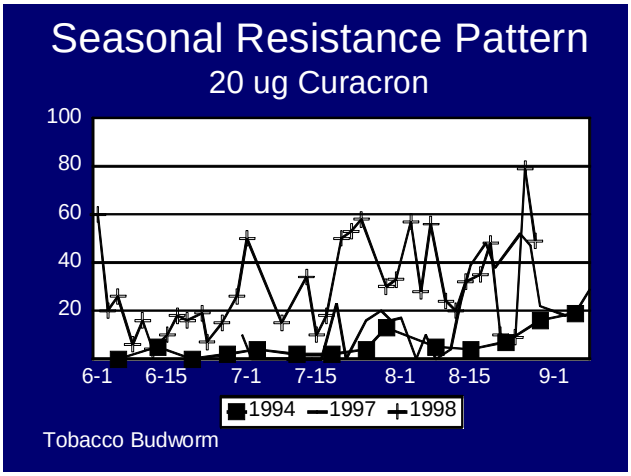
Table 1. Vials

VIALS

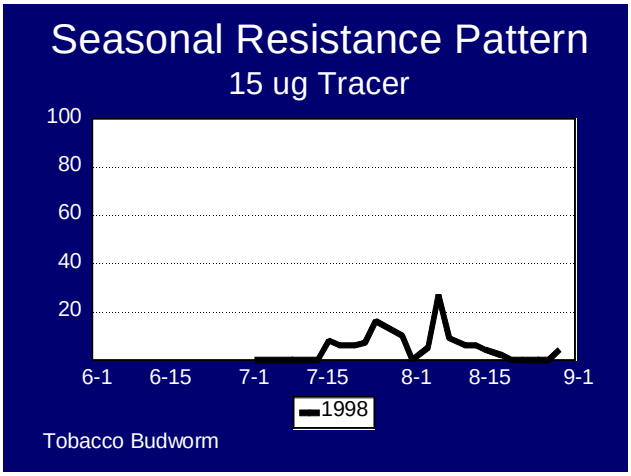
- brown 2.5 ug pyrethroid
- blue 10 ug pyrethroid
- yellow 20 ug Curacron
- teal 15 ug Tracer
- white untreated



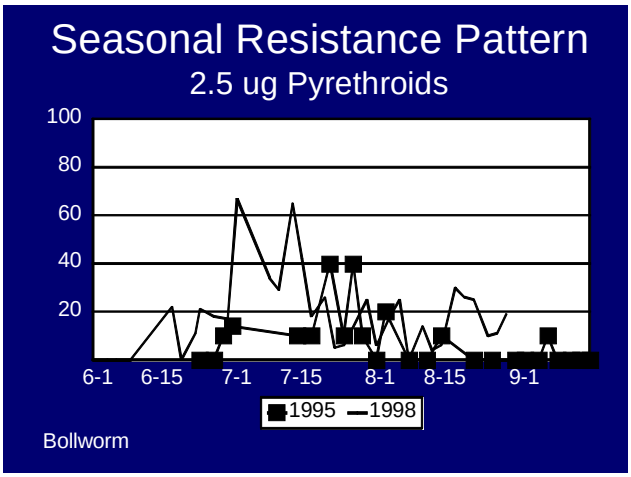
Graph 1. Seasonal Resistance Pattern - 10 ug Pyrethroid



Graph 2. Seasonal Resistance Pattern - 20 ug Curacron



Graph 3. Seasonal Resistance Pattern - 15 ug Tracer



Graph 4. Seasonal Resistance Pattern - 2.5 ug Pyrethroids