

**PESTICIDE SELECTION FOR RESISTANCE
MANAGEMENT BASED ON PEST POPULATION
AND PREVIOUS PESTICIDE USE**

D. M. Hunt
Bayer Corp.
Opelika, AL
J. A. Hopkins
Bayer Corp
Greenbrier, AR
F. S. Donaldson
Bayer Corp
Pineville, LA
W. D. Rogers
Bayer Corp.
Tifton, GA

Abstract

In 1997, BAYER CORPORATION began developing a computer program, for use in the southeast and mid-south, that can make cotton insecticide selections based on pest population and previous pesticide use. In addition, the program takes into account the possible need to delay, alternate or mix chemistries for resistance management. It is named The Bayer Cotton Insecticide Guide and will be available as a downloadable application on the BAYER web site <http://uscrop.bayer.com> under the What's New section.

Mr. Alan Hopkins, who initiated the idea and led in the development of the computer program, will present, at this conference, data from studies designed to test the recommendations used in this program.

Introduction

Resistance to pesticides is a crucial concern of all pesticide manufacturers. The present cost to bring one pesticide to market is at least \$45 million spent during ten years of development and it is likely that cost and regulatory requirements to register and maintain registration of a pesticide will increase. To compound the problem, registration of new chemistries are slow in coming making it imperative to sustain the potency of each pesticide by managing for resistance.

In 1998, BAYER CORPORATION will market seven different insecticides representing three chemistry groups, several which are offered in more than one formulation or product name. Of these, BAYTHROID is a synthetic pyrethroid. PROVADO and ADMIRE, both imidacloprid products, are chloronicotinyls. GUTHION, MONITOR, DI-SYSTON, and NEMACUR are organophosphates. Given the pest spectrum covered by all these insecticides,

it is possible to protect a cotton crop from planting to harvest using only BAYER products especially on Bt cotton. In addition, alternation and mixing of different chemistries for resistance management can be practiced using only BAYER products for most pests found in cotton.

**Characteristics of the BAYER
Cotton Insecticide Guide**

Since the Bayer cotton insecticide line offers a variety of chemistries with different modes of action capable of controlling most cotton pests throughout the season, it was logical to develop a computer program that would provide recommendations and guidelines for product use. In order to simplify this procedure, the cotton season is divided into four growth stages in the program: at planting, emergence to 5-leaf stage, squaring, and bloom to harvest.

The pests for each growth stage are listed with check-off boxes so that one or more pests can be selected. Appropriate insecticide recommendations are listed, many with additional comments that clarify how the product should be used in a resistance management program.

In addition, there is a utility for calibration and rate calculation that is linked to the insecticide recommendation selected. This feature will automatically calculate rates and can be configured according to the user's preferences. The program provides product information and instructions for use. In addition, the recommendations, rate, and product information can be printed and identified by field and date to help with record keeping.

Criteria for Insecticide Recommendations

In practice, cotton insecticide resistance is managed using one or more of the following strategies:

1. Avoidance of particular chemistries during certain periods of cotton development. An example of this would be delaying the use of pyrethroids until July.
2. Tank-mixing different chemistries.
3. Alternating different chemistries.

The computer program provides insecticide recommendations based on the following criteria which compliment the three resistant management strategies previously listed:

1. The pest species present and, for some pests, the level of infestation.
2. The desire to delay or avoid the use of a particular chemistry.

3. Prior use of a particular chemistry and the level of concern of resistance developing for that chemistry.
4. The need to mix different chemistries to increase the pest spectrum controlled and as a resistant management strategy.
5. The need to preserve beneficial arthropods.

The program is designed to be flexible and does not subscribe to a particular resistant management strategy. Its successful use as a recommendation tool in a resistance management program relies on the ability of the user to make the appropriate choice to fit the situation at hand.

Application of the Bayer Cotton Insecticide Guide in a Resistance Management Program

The following examples demonstrate how the program incorporates resistant management strategies with the recommendation. Avoidance of pyrethroids under certain circumstances and tank-mixing different chemistries are common strategies utilized.

1. Pest Control During Emergence to 5-leaf Stage

If a foliar application for thrips control is necessary, the program will provide 2 alternatives: MONITOR at 1 gallon/40 acres, when it is desired to delay pyrethroid use, and BAYTHROID at 1 gallon/130 acres, when there is a low concern for pyrethroid resistance. PROVADO at 1 gallon/64 acres is recommended as a tank-mix partner with MONITOR or BAYTHROID when aphids, fleahoppers and thrips are present.

2. Pest Control During the Squaring Stage

If bollworm is the pest species present during squaring, the program will offer one recommendation: BAYTHROID at 1 gallon/71 acres with the comment that BAYTHROID can also be used to control boll weevil, plant bug and non-resistant tobacco budworm. It is up to the user to decide on the appropriateness of choosing BAYTHROID, based on the timing of the application, and how its use will fit into a resistant management strategy. However, BAYTHROID should only be used in the pyrethroid use window starting in July.

When tobacco budworm and bollworm are present, the options provided are based on whether or not there has been prior use of pyrethroids and whether or not there has been resistance documented in the area. Tank-mixing BAYTHROID with a non-pyrethroid is the recommendation made when resistance is of concern.

The addition of plant bug to the bollworm-budworm complex triggers other options by the program which considers resistance management for the bollworm-budworm complex or plant bug. In both cases, a tank-mix strategy is recommended. The recommendation when resistant tobacco budworm is present is BAYTHROID

tank-mixed with a non-pyrethroid, which also controls plant bug. When plant bug resistance to pyrethroids is the concern, BAYTHROID + PROVADO is the recommendation.

3. Plant Bug Control During Squaring and Bloom to Harvest

The program makes three recommendations for plant bug control during squaring: PROVADO, MONITOR, and BAYTHROID which represent three different chemistries that can be rotated if sequential applications are needed. The program comments that MONITOR is a desirable choice when pyrethroid use should be delayed or prior use of a pyrethroid has been made, and it suggests that PROVADO is a good choice if aphids are present. After first bloom, two additional options are recommended: BAYTHROID + PROVADO and MONITOR + PROVADO. Also, the recommended BAYTHROID rate is increased to address potential plant bug resistance to pyrethroids after first bloom. The tank-mix recommendations are appropriate options during squaring and have been added to that segment of the program.

Summary

In 1997, BAYER CORPORATION developed The Bayer Cotton Insecticide Guide, a computer program designed to make cotton insecticide recommendations of Bayer products. Because the program's recommendations are based on criteria that are complimentary with current resistant management strategies, its use for making recommendations would assist in maintaining the effectiveness of Bayer cotton insecticides.

The Bayer Cotton Insecticide Guide will be available as a downloadable application on the Bayer web site <http://uscrop.bayer.com>.

References

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