

**ECONOMICS OF A KARATE Z/TRACER
CONVENTIONAL COTTON PROGRAM VS. BT
COTTON: TWO YEAR RESULTS**

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Abstract

Dow AgroSciences and Zeneca Ag Products, Inc. co-sponsored studies in 1998 and 1999 to compare the economics of a Karate™ Z/Tracer™ program on conventional cotton with a Bt cotton program. Approximately 50 sites in 6 states throughout the Cotton Belt were selected for the studies each year. Thirty-one consultants completed the trials each year and provided data for application costs, technology fees, insect numbers, and yields at the end of each season. Input costs were higher in the conventional cotton plots each year, but conventional cotton treated with Karate™ Z and Tracer™ had higher yields than Bt cotton in 1998 and 1999. This additional yield provided an advantage of \$3.12/acre and \$42.08/acre for the Karate™ Z/Tracer™ program in years of heavy (1998) and light (1999) bollworm/budworm larval pest pressure, respectively. The Karate™ Z/Tracer™ program on conventional cotton provided a higher overall net return than Bt cotton in two years of testing.

Introduction

Karate™ Z is a new micro-encapsulated formulation of lambda-cyhalothrin which provides broad-spectrum cotton insect control. The new formulation of Karate with Zeon technology provides control of cotton caterpillar pests as well as secondary arthropod pests. Tracer™, the first product in the Naturalyte™ class of compounds, was recently registered for control of Lepidoptera in cotton. The active ingredient in Tracer is spinosad, a naturally derived fermentation product. Tracer™ has a unique mode of action as an insecticide with little effect on beneficial arthropod populations. The use of these two products in a season-long program compliments the strengths of both products by providing excellent Lepidoptera control (including late season outbreaks), early season beneficial conservation, and secondary insect pest control.

Transgenic Bt cotton is an effective new technology that provides an alternative for Lepidoptera control. Although growers pay a technology fee at planting for protection from caterpillar pests throughout the season, Bt cotton should be scouted regularly for insect pests along with conventional cotton. Concern also has been expressed regarding potential

resistance development to the Bt toxin. As these concerns arise, growers must continue to evaluate the real costs of conventional vs. Bt cotton. Therefore, studies were conducted in 1998 and 1999 to determine if a Karate™ Z/Tracer™ program in conventional cotton would provide an economically viable alternative to Bt cotton.

Materials and Methods

Dow AgroSciences and Zeneca Ag Products, Inc. co-sponsored large scale plots in 1998 and 1999 to demonstrate the efficacy and economics of conventional season-long insect control. Approximately 50 trials were planned at the beginning of each season. Consultants from Alabama, Arkansas, Georgia, Louisiana, Mississippi, and Texas were selected to participate in the program. Consultants worked with growers to choose preferred varieties of conventional cotton and Bt cotton varieties to plant in adjacent fields. Conventional and Bt cotton varieties were selected without regard to parent lines.

Each consultant was presented with a decision criteria chart (Table 1) to determine the correct spray regime for the Karate™ Z/Tracer™ program plots. The spray program focused on chemical rotation to provide better resistance management and to ensure the best use of the different spectrums of Karate™ Z and Tracer™. Consultants chose their own spray regimes for Bt cotton plots as no spray guidelines were presented for Bt cotton plots. All cotton varieties were monitored for insect pests throughout the season. Cotton plots were treated with insecticides when state and local thresholds for pest populations were met or exceeded. All plots received weed control, plant growth regulators, and other non-insect control inputs as needed.

During transition times, consultants were encouraged to follow certain additional criteria. Between early and mid-season, the following guidelines were included:

- If beneficial preservation was a continuing goal in early July, Tracer™ was recommended.
- If a mixed population of Heliethine from eggs to 5 days old was present in the field, two applications of Karate™ Z 4-5 days apart were recommended.

Mid- to late-season transition guidelines were:

- If an application of Karate™ Z failed to bring TBW below the economic threshold during the mid- to late-season transition, Tracer™ was recommended to clean up the situation.
- Based on secondary pests present, tank mixes with Karate™ Z were recommended.

- Karate™ Z tank-mixes were not recommended to attempt the clean-up during this time period.

Following the criteria in Table 1, tank-mixes were used to control late-season mixed complexes of caterpillars plus stink bugs, boll weevils, and/or plant bugs. The guidelines required tank-mixes to include a labeled rate of both Karate™ Z and Tracer™.

Consultants returned completed scouting forms, application details, and insect control costs for both programs. Data were analyzed and summarized each year. A summary of Karate™ Z/Tracer™ program costs included the costs of all foliar insecticides used plus the costs of application. Bt cotton program costs included the technology fee, costs of all foliar insecticides used, and application costs. Costs of \$0.75/lb of cotton and \$0.60/lb of cotton were used in 1998 and 1999, respectively, for calculating costs/acre and net returns for each program.

Results and Discussion

Consultant participation in the program and response to data requests at the end of each season were remarkably similar in 1998 and 1999. Of approximately 50 consultants surveyed in 1998 and in 1999, 40 consultants provided performance data and yield information each year. Nine consultants provided only performance data in 1998. Similarly, nine consultants did not provide yield data or sufficient application information in 1999. Without yield data a full economic evaluation could not be completed and, therefore, data from 31 consultants each year is presented.

Growers experienced unusually high insect pressure in 1998. In addition, resistant tobacco budworm and beet armyworm populations were present in many cotton growing regions of the U.S. This resulted in a greater number of insecticide applications in both conventional and Bt cotton. Figure 1 provides a summary of numbers of eggs, bollworm/budworm larvae, and damaged squares before and after insecticide applications in 1998. Few differences in numbers of eggs and damaged squares were detected among cotton plots. Greater differences in larval pre-counts were detected, but this difference decreased after application. Although total insect control costs (product + application costs/acre) were higher with the Karate™ Z/Tracer™ program (Figure 2), yields were higher in conventional cotton plots than in Bt cotton plots (Figure 3) in 1998. Furthermore, the Karate™ Z/Tracer™ program provided a higher average net return than the Bt cotton program in 1998 (Figure 4). The following demonstrates that conventionally managed cotton was produced economically in areas where growers experienced the worst larval pest pressure since 1995:

Year	Yield	Cost/Acre	Advantage Karate Z/Tracer
1998	+\$27.75*	-\$24.63**	\$3.12 /acre

*(37 pounds of cotton) (\$0.75/lb) = \$27.75

**\$110.43 (Karate™ Z/Tracer™ program cost/acre) minus \$85.80 (Bt cotton program cost/acre) = \$24.63

Cotton growers experienced lower overall numbers of insect pests in 1999. Fewer numbers of insecticide applications were made for caterpillar pests, in particular, in 1999. Numbers of eggs, bollworm/budworm larvae, and damaged squares before and after insecticide applications are presented in Figure 5. Trends in 1999 were similar to those observed in 1998 with few differences in numbers of eggs and damaged squares before and after application. Pre-count larval numbers were higher in conventional cotton plots, but these numbers decreased after Karate™ Z/Tracer™ applications. Again, insect control costs per acre were higher in conventional cotton plots (Figure 6), but conventional cotton plots treated with Karate™ Z and Tracer™ had higher yields than Bt cotton plots (Figure 7) in 1999. As in 1998, average net returns were higher in Karate™ Z/Tracer™ program plots than in Bt cotton plots in 1999 (Figure 8). Therefore, the advantage of Karate™ Z/Tracer™ applications on conventional cotton in 1999 is as follows:

Year	Yield	Cost/Acre	Advantage Karate Z/Tracer
1999	+\$49.20	-\$7.12	\$42.08 /acre

*(82 pounds of cotton) (\$0.60/lb) = \$49.20

**\$76.07 (Karate™ Z/Tracer™ program cost/acre) minus \$68.95 (Bt cotton program cost/acre) = \$7.12

The Karate™ Z/Tracer™ program for conventional cotton outperformed a Bt cotton program in terms of net return in two years of testing. The increase in yield and therefore higher overall net return of the Karate™ Z/Tracer™ program each year may be explained by several factors. Insecticide applications for control of the bollworm/budworm complex in conventional cotton provided control of secondary pests in the system. These pests cannot be controlled in Bt cotton without supplemental insecticide applications. Second, although Bt cotton is extremely effective in controlling tobacco budworm, bollworm is more tolerant of the Bt toxin. Karate™ Z and Tracer™ provide excellent bollworm control. Finally, growers and consultants were able to choose preferred high-yielding varieties for planting in conventional cotton plots of the Karate™ Z/Tracer™ program.

A Karate™ Z/Tracer™ program in conventional cotton does provide an economically viable alternative to Bt cotton even under a broad range of pest conditions. Studies in 1998 and 1999 indicated that growers have an alternative to Bt cotton that will allow them to:

- better manage risk.

- plant responsible acreages of Bt cotton.
- plant favorite, high yielding, conventional varieties.
- avoid investing in a technology fee for caterpillar pest control at the beginning of the season.

Acknowledgments

Dow AgroSciences and Zeneca Ag Products, Inc. would like to thank the consultants who participated in this study. The study could not have been completed without the help of the sales forces within both companies to coordinate the trials.

Table 1. Karate™ Z/Tracer™ decision criteria for conventional cotton.

Early Season				
TBW only	Mixed Heliathine TBW/CBW	CBW only	Heliathine plus Plant bug/boll weevil	
↓	↓	↓	↓	
Tracer	Tracer	Tracer	Tracer plus Provado/ Lorsban4E/ Orthene/ Bidrin/ MethylParathion/ Endosulfan	
Mid Season				
TBW only	Mixed Heliathine TBW/CBW	Heliathine plus armyworm ¹	CBW only	Heliathine plus plant bug/ boll weevil/stinkbug
↓	↓	↓	↓	↓
Tracer ³ or Karate Z Tank-mix (Curacron or Larvin)	Karate ² Z or Karate Z Tank-mix or Tracer ³	Karate ² Z or Karate Z Tank-mix or Tracer ³	Karate Z	Karate ² Z or Karate Z Tank-mix (plus Tracer ³ Curacron or Larvin)
Late Season				
TBW only	Mixed Heliathine TBW/CBW	Heliathine plus armyworm ⁴	CBW only	Heliathine plus plant bug/ boll weevil/stinkbug
↓	↓	↓	↓	↓
Tracer	Tracer	Tracer	Karate Z	Karate Z plus Tracer tank-mix

¹ Use Tracer™, not Karate™ Z, for control of beet armyworm.

² Dependent on resistance level and TBW population.

³ Only recommend Tracer™ during mid season if still within labeled resistance management parameters.

⁴ Use Tracer™, not Karate™ Z, for control of soybean loopers.

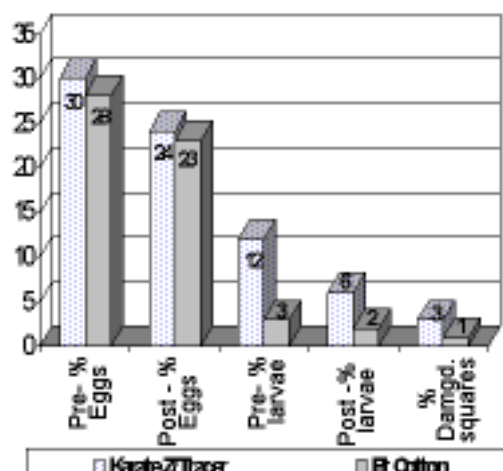


Figure 1. Karate™ Z/Tracer™ vs. Bt Cotton - Performance, 1998 (123 ratings).

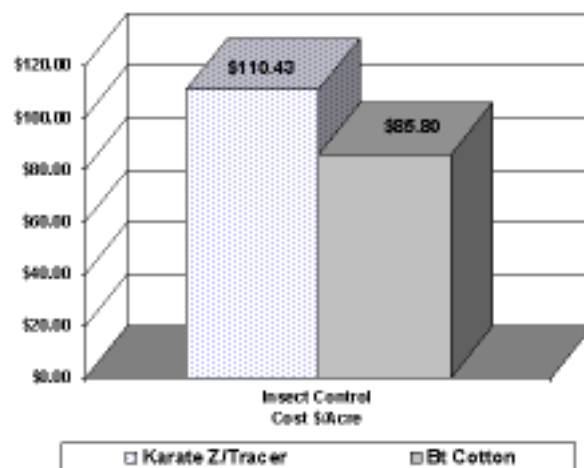


Figure 2. Karate™ Z/Tracer™ vs. Bt Cotton - Cost, 1998 (Average of 31 Consultant trials).

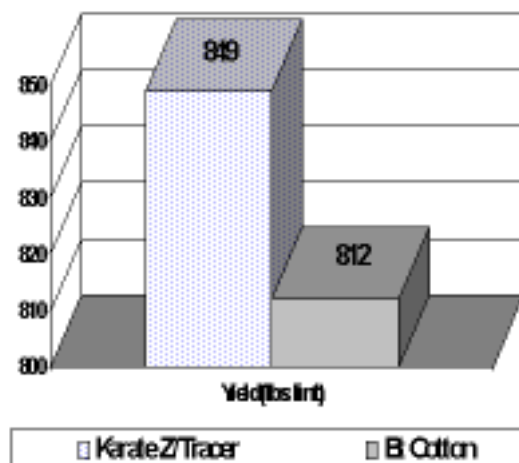


Figure 3. Karate™ Z/Tracer™ vs. Bt Cotton - Yield, 1998 (Average of 31 Consultant trials).

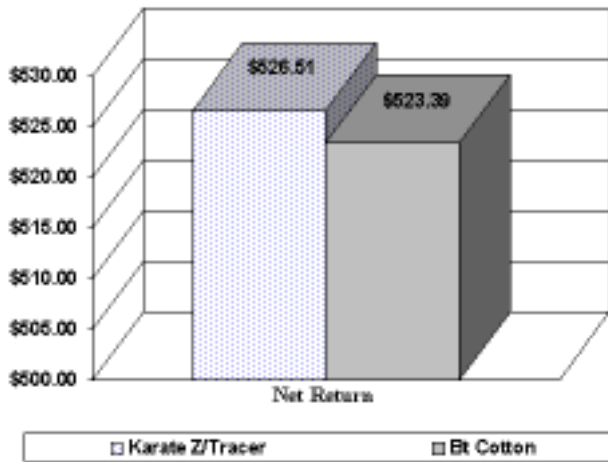


Figure 4. Karate™ Z/Tracer™ vs. Bt Cotton - Net Return, 1998 (Average of 31 Consultant trials).

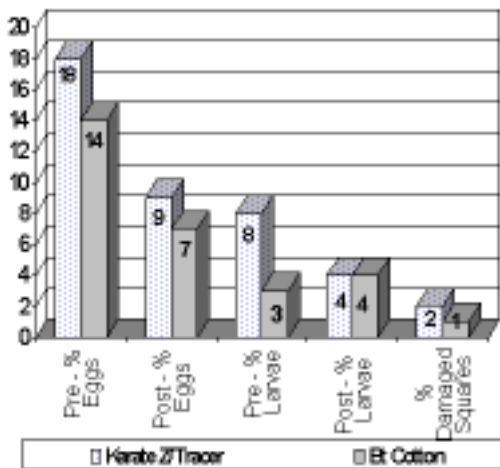


Figure 5. Karate™ Z/Tracer™ vs. Bt Cotton - Performance, 1999 (118 ratings).

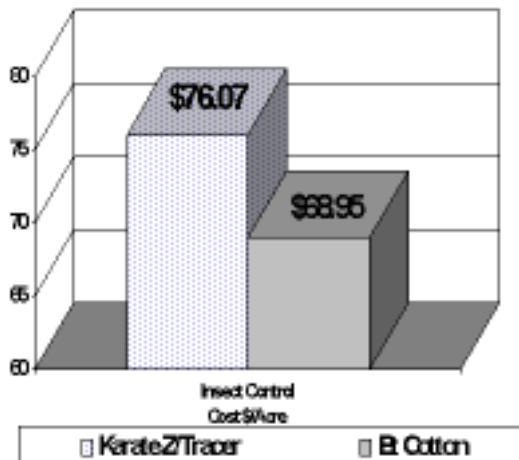


Figure 6. Karate™ Z/Tracer™ vs. Bt Cotton - Cost, 1999 (Average of 31 Consultant trials).

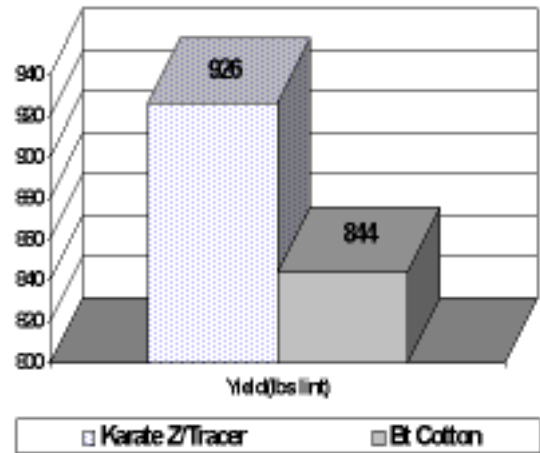


Figure 7. Karate™ Z/Tracer™ vs. Bt Cotton - Yield, 1999 (Average of 31 Consultant trials).

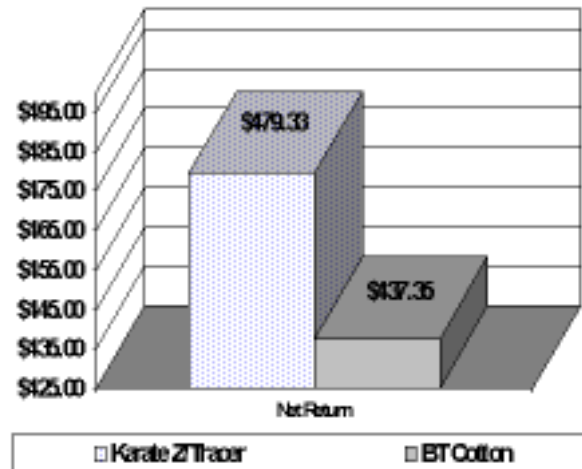


Figure 8. Karate™ Z/Tracer™ vs. Bt Cotton - Net Return, 1999 (Average of 31 Consultant trials).