EFFICACY OF XENTARI® DF BIOLOGICAL INSECTICIDE IN LATE SEASON APPLICATION AS PART OF A ROTATIONAL PROGRAM TO CONTROL LEPIDOPTERA PESTS IN COLLARD

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Introduction

Residues from application of agricultural chemicals are an increasing concern globally. Consumers worried about the potential negative health effects of chemical products are demanding that the produce they consume contain little to no residue at the time of purchase. Some grocery store chains have even used low residues as a marketing tool to appeal to this expanding customer base. In response to public pressure and scientific studies, regulatory agencies are placing increasingly strict standards for the maximal chemical residue levels (MRL) of pesticides that can be found on crops. A number of insecticides, especially those that have been on the market for many years, have very long pre-harvest intervals (PHI) associated with them to reduce the potential of residues that are above the established MRLs. Long PHIs wih these chemistries can reduce application flexibility for the grower at a time when the potential economic impact of pest damage is at its highest.

Insecticides based on the bacteria *Bacillus thuringiensis* (Bt) have no government mandated MRLs associated with their use. XenTari® DF is one of those Bt insecticides, and is the only natural Bt based on the *aizawai* strain. With no associated residue limits, XenTari® DF can be used right up to the time of harvest. Increasingly growers recognize this unique feature of XenTari® and have started to incorporate it into their season-long pest control programs, especially utilizing XenTari® as the last application or applications before harvest. With XenTari® as the last application (s) they get good Lepidoptera pest control before harvest. This strategic use of XenTari® in a Bt/chemical rotational program also provides a longer time in the field for the earlier chemical application residues to decay to below MRL-specified levels.

In this study we looked at pest control programs that included the new insecticide Coragen® in rotation with XenTari® where XenTari® was the last application. This application schedule was compared to a Coragen® only program for control of cabbage looper and imported cabbage worm in collard. The ability of collard to grow rapidly and to attract and maintain good insect pest pressure made it an ideal crop for these comparative treatment studies. This study shows that rotation of XenTari® with Coragen®, ending the program with XenTari®, provided excellent control of heavy populations of Lepidoptera pests.

Materials and Methods

Crop: To determine the efficacy of a XenTari® only control program, collard (*Brassica oleracea acephala*) was chosen as a crop for its fast growth characteristics, attractiveness to Lepidoptera pests, and susceptibility to feeding damage.

Location: Reno, GA, USA

Trial Dimensions: The crop was set on a 36 inch row spacing with plants set every 12 inches. Plots dimensions were 4 rows X 30 feet with the first two rows of each plot being the sprayed rows.

Experimental Design: The experimental design of the trial was a randomized complete block design with 4 replications per treatment.

Statistical Analysis: Mean separations were performed using ANOVA with P set at 5%.

Spray Description for Applications
The boom used in the trial was 6 feet wide with 3 nozzles per row. Spray tips used were Tee-jet TX-6. Pressure used was 55 psi. Carrier used was water. The total volume used to spray 2 rows X 30 X 4 was 3.128 liters. All applications were made with a backpack sprayer. Speed during the applications was 3 mph. All treatments were used with X-77 as a surfactant at a rate of 0.25% v/v.

The crop was set on 3/12/09 when the collards were at the 2-3 leaf stage. Insecticide applications began on 3/18/09 (7 days after transplanting) due to rapid build-up of the worm population. Applications where XenTari® DF was in rotation with Coragen® were made based on pest thresholds of 3 insects per 10 plants or 1 hole per plant. The Coragen® program consisted of application of Coragen® by drip 3x during the season.

Rates:
XenTari® was applied at a rate of 1 lb/acre.
Coragen® was applied at a rate of 5 oz/acre.

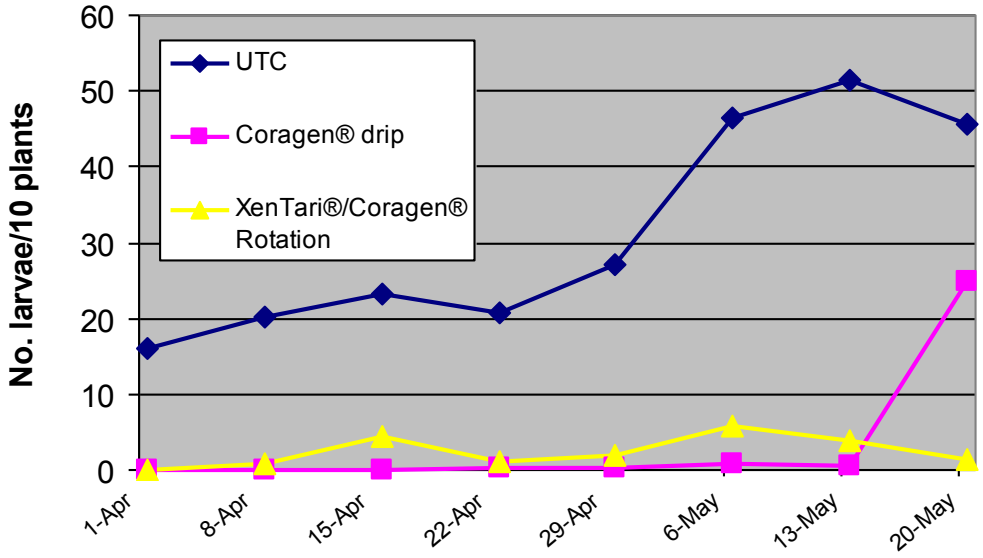
Application dates:
XenTari®/Coragen® Rotation: XenTari® 3/18, Coragen® drip 3/25, XenTari® 4/8, Coragen® drip 4/15, XenTari® 4/29, Coragen® foliar 5/6, XenTari® 5/20.
Coragen® only program: Coragen® drip 3/18, Coragen® drip 4/1, Coragen® drip 4/23

Results and discussion:
A XenTari®/Coragen® "low residue" program was evaluated on collards by rotating applications of XenTari® and Coragen® during the growing season and finishing with a last treatment of XenTari® to reduce the potential of residues at the end of the season. The efficacy of this program was compared to a Coragen® only program where Coragen® was applied systemically by drip irrigation. Coragen® has been shown to have long residual activity when applied through irrigation.

Both imported cabbage worm (*Pieris rapae*) and cabbage looper (*Trichoplusia ni*) populations were very heavy in this study. In the untreated check, cabbage worm populations grew from 16 insects per 10 plants to more than 50 insects per 10 plants within 5 weeks (Figure 1).

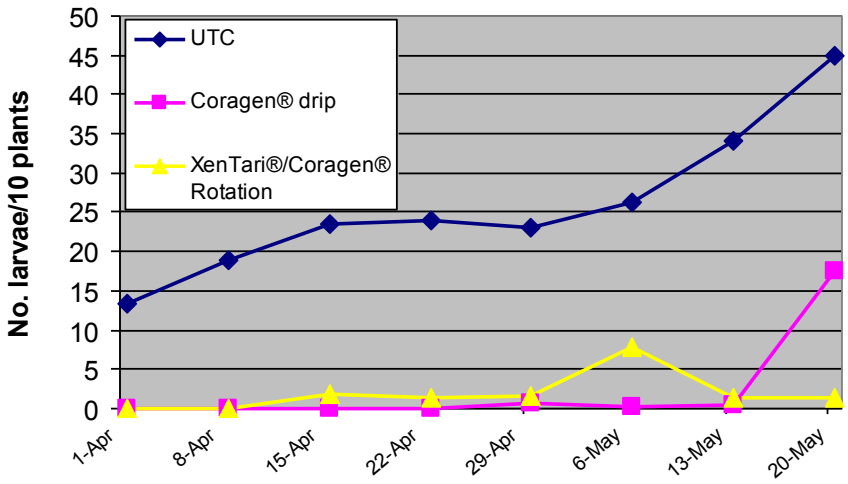
A XenTari®/Coragen® rotation program based on applications when pest populations reached threshold levels of 3 insects per 10 plants provided excellent control of cabbage worm during the course of the season (Figure 1). At no evaluation time did the populations rise above 6 imported cabbage worms per 10 plants. In most cases the insects were maintained below 3 insects per 10 plants. This includes the final evaluation period of May 20. The XenTari®/Coragen® program with a final treatment of XenTari® provided similar control to that of the systemic Coragen® treatment program up until the last evaluation time. At this point the population in the Coragen® only program increased significantly compared to that of the rotation program. This could be because the residual activity from the last Coragen® treatment on 4/23 had decayed to where it was no longer effective.

Figure 1. Larval counts per 10 plants for imported cabbage worm on collard treated with XenTari®/Coragen® rotation or Coragen® only programs.



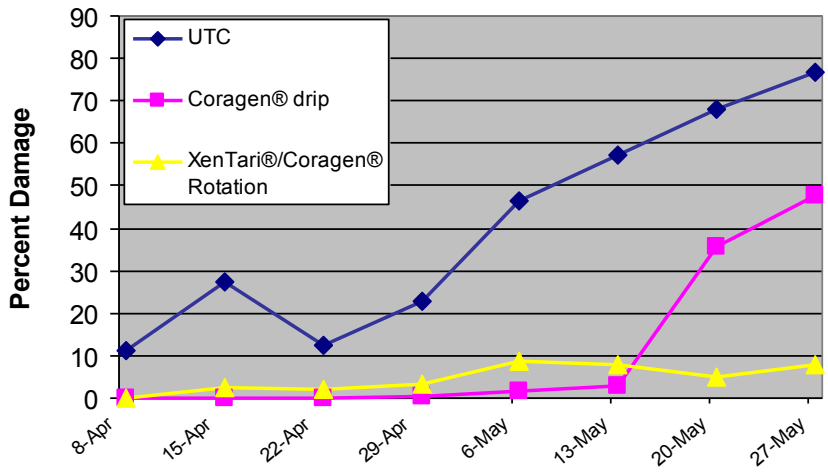
Cabbage looper populations were also very heavy in this study with numbers going as high as 50 insects/10 plants in the untreated check near the end of the trial (Figure 2). Both the XenTari®/Coragen® rotation and the Coragen® drip treatments provided good control of this pest. As with the cabbage worm populations, the Coragen® drip program did extremely well through the early part of the season but had less control at the end, with a slight increase in pest populations. The rotation program also kept the insects in check through the season, providing statistically similar control to the Coragen® program at all evaluation periods.

Figure 2. Cabbage looper larval counts per 10 plants on collard treated with XenTari/Coragen rotation or Coragen only programs.



As expected, the feeding damage followed a similar trend to that of the insect populations for both treatment programs (Figure 3). Both programs significantly reduced feeding damage for most of the trial period. For the XenTari®/Coragen® rotations, damage was maintained below 10% for all evaluation periods including the end when XenTari® was the last application. The Coragen® drip applications did an excellent job of keeping feeding damage in check early in the trial. However, as the residual activity of the Coragen® declined, the insect populations started to build, and in the last few evaluation periods, damage increased significantly above that of the rotation program.

Figure 3. Insect damage ratings for collard treated with XenTari®/Coragen® rotation or Coragen® only programs



Conclusions:

This study demonstrates that a rotational control program that includes XenTari® along with a traditional chemistry, and ends with XenTari® for residue management, can be highly effective in controlling even heavy populations of Lepidoptera pests. Use of a Bt product such as XenTari® right before harvest can enhance the pest efficacy of a program compared to one in which the chemical insecticide application is ended early in order to reduce potential residue levels on the crop. XenTari® can be an excellent fit for the grower where chemical residue issues are a concern.