EVALUATION OF TANK MIX COMBINATIONS OF XENTARI® BIOLOGICAL INSECTICIDE AND BIFENTHRIN SYNTHETIC PYRETHROID INSECTICIDE IN CONTROL OF DIAMONDBACK MOTH ON CABBAGE

Russ Eldridge, Marcus Adair

Valent BioSciences Corporation, 870 Technology Way, Libertyville, IL 60048, USA.

Introduction

There are many advantages to using a microbial insecticide such as XenTari® DF. XenTari® is based on the naturally occurring bacterium *Bacillus thuringiensis* subsp. *aizawai*. It is used commercially for control of a range on Lepidoptera pest larvae, especially diamondback moth, armyworms (*Spodoptera* spp.), and cutworms. In addition to excellent Lepidoptera larvae control, XenTari® has many other benefits including a large safety margin for applicators and field workers, the lowest re-entry interval allowed by law, EPA-granted exemption from residue tolerance, safety for beneficial insect predators, parasites and pollinators.

Synthetic pyrethroids (SP) are broad spectrum insecticides and work against a large range of insect pests including caterpillar pests, bugs, flies, aphids, and others. Unfortunately they also can be toxic against many beneficial insects and some non-target vertebrates such as fish. Due to their long and extensive use for control of insect pests, resistance to pyrethroids is not uncommon and can be highly problematic in many crop areas.

The natural protein toxins in XenTari® work by binding to receptors in the insect midgut and then forming a pore in the insect gut cells that subsequently cause disruption of the gut functions, quickly causing cessation of feeding and eventual death. The synthetic pyrethroids have a completely different mode of action where they work at the insect nervous system, causing rapid paralysis. Because of their different modes of action, use of a Bt insecticides such as XenTari® and a synthetic pyrethroid such as bifenthrin can be the basis of good resistance management since resistance to both active ingredients in one insect population is unlikely.

Another advantage to using both insecticides at lower label rates in a tank mix is reduced chemical residue concerns. Applying mid to lower levels of a pyrethroid means less chance of unacceptably high levels of pyrethroid residue at time of harvest and XenTari® has no residue concerns since there are no tolerances associated with its use.

Using reduced levels of a synthetic pyrethroid can also decrease the chance of adversely affecting non target organisms including beneficial insects. Insect predators and parasites can play a major role in keeping insect pests in check and lower levels of a pyrethroid could help preserve these beneficial populations. Lower levels of a pyrethroid could also reduce the potential of flare-up of mite pest populations which can be associated with use of SPs.

To understand the efficacy of a XenTari®-SP tank mix combination, bifenthrin was mixed with XenTari® DF at a range of rates and the combination was compared to either product alone for control of diamondback moth (*Plutella xylostella*) in cabbage. This study shows good efficacy for the XenTari®/bifenthrin combination, better than either product alone at comparable rates.

Materials and Methods

Efficacy of tank mix combinations of XenTari® DF and bifenthrin were compared to efficacy of each product alone when applied to cabbage for control of diamondback moth. Trial location was Dover, Florida.

The trial consisted of 10 treatments:

1. XenTari® DF at 1 lb/acre + Hook® at 16 fl oz/100 gal
2. XenTari® DF at 0.5 lb/acre + bifenthrin at 5.3 oz/acre + Hook® at 16 fl oz/100 gal
3. XenTari® DF at 0.25 lb/acre + bifenthrin at 5.3 oz/acre + Hook® at 16 fl oz/100 gal
4. XenTari® DF at 0.125 lb/acre + bifentthrin at 5.3 oz/acre + Hook® at 16 fl oz/100 gal
5. Bifenthrin at 5.3 oz/acre + Hook® at 16 fl oz/100 gal
6. Bifenthrin at 10.6 oz/acre + Hook® at 16 fl oz/100 gal
7. XenTari® DF at 0.5 lb/acre + Hook® at 16 fl oz/100 gal
8. XenTari® DF at 0.25 lb/acre + Hook® at 16 fl oz/100 gal
9. XenTari® DF at 0.125 lb/acre + Hook® at 16 fl oz/100 gal
10. Untreated check (UTC)

Application equipment
Spray applied treatments were performed using a CO2 backpack sprayer with a spray boom incorporating 3 Albuz TR 80 cone spray nozzles directed at the plant foliage. Other details of the trial are listed:

Crop:	Cabbage *(Brassica oleracea var. capitata)*	Date/Duration:	4/15/2009-5/19/2010
		Planting Date:	4/15/2010
Objective:	Test efficacy of XenTari DF and Brigade on Diamondback Moth larvae with a cabbage crop.	Planting Method:	Hand transplant
		Harvest Method:	Hand harvest
Pest Species:	Diamondback Moth larvae *(Plutella xylostella)*	Application Method:	Foliar directed
Soil Type:	Sand	Irrigation Method:	Drip
Test Products:	XenTari DF	No. Applications:	1
Cultivar:	Atlantis	Application Date:	5/12/2010
Plot Dimensions:	4' x 24'	Evaluation Dates:	5/11, 5/15 and 5/19/2010
Experiment Size:	0.1 acres	Statistical Design:	RCB
Plant Spacing:	14"	No. Treatments:	10
Row Spacing:	4'	No. Replications:	4

Evaluation
Counts on small medium and large sized larvae were made pre-treatment, and then three and seven days post treatment. Total number of larvae per 5 leaves was counted.

Results and Discussion
Diamondback moth (DBM) larvae for all replicate plots were counted prior to treatment. The pre-treatment populations increased rapidly and were already at 10-18 insects per five leaves at time of first application (data not shown).

At three days after application larval populations were heavy, with counts in the untreated check at approximately 70 larvae per 5 leaves (Figure 1). Larval counts were significantly lower for all treatments compared to the check. XenTari® at 0.5 lb/acre + Bifenthrin at 5.3 oz./acre and XenTari® at 0.25 lb./acre + Bifenthrin at 5.3 oz./acre provided the best numerical control, even compared to the 10.6 oz rate of Bifenthrin although the difference was not significant.

By seven days post treatment the infestation was very heavy with the check showing an average of 95 larvae per 5 leaves (Figure 1). All treatments significantly suppressed the DBM populations compared to the check. The day 7 populations were best controlled by the XenTari® + bifenthrin combinations. Again, the XenTari® + bifenthrin combinations

performed better than the low or high rates of bifenthrin alone, and the tank mix also performed better than all of the XenTari®-only treatments.

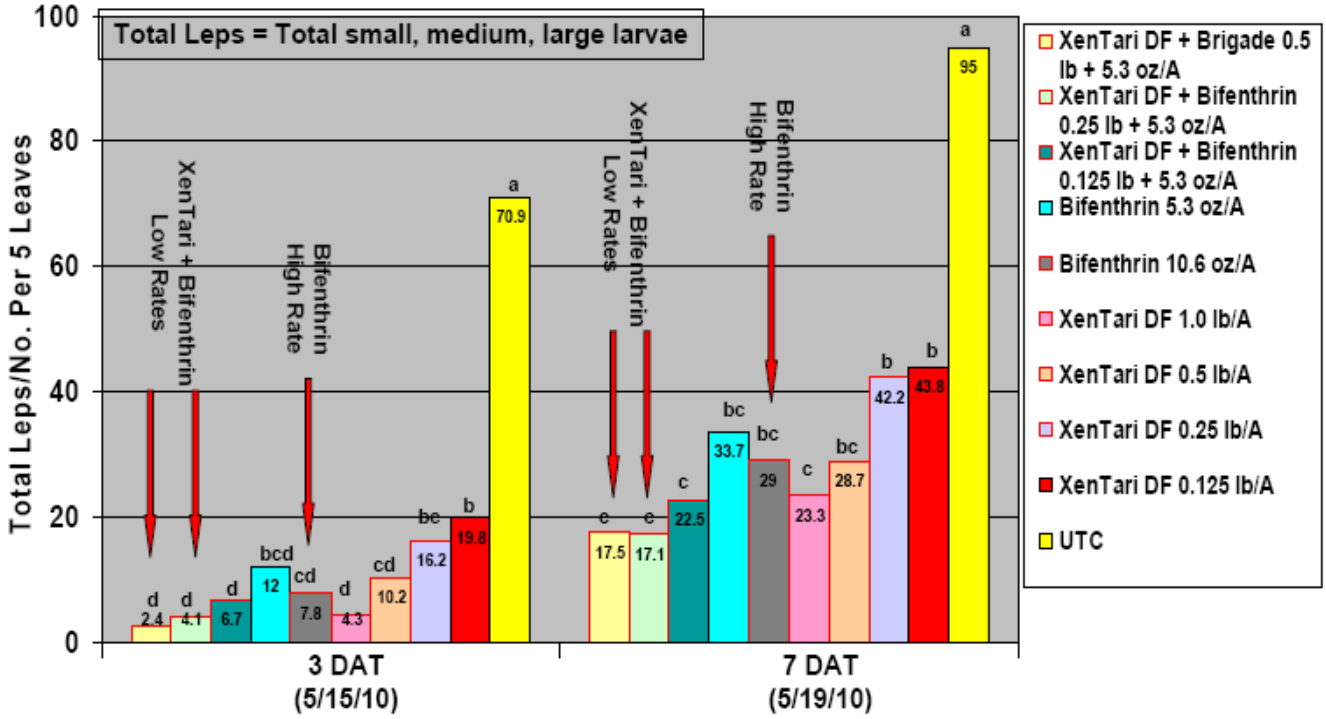

Figure 1. Efficacy of XenTari®/bifenthrin tank mix combinations compared to both products used alone in controlling diamondback moth on cabbage.

Conclusions

For control of diamondback moth on cabbage, XenTari® + bifenthrin combinations were as good as or better than either of the products alone at comparable rates. Using this combination at outlined rates is an effective method for controlling Lepidoptera pests and could provide the grower with additional benefits compared to use of high rates of pyrethroids or Bt alone, including better economics, lower chemical residue, and preservation of beneficial insects.