

# EFFICACY OF DIPEL<sup>®</sup> DF BIOLOGICAL INSECTICIDE FOR CONTROL OF DIAMONDBACK MOTH LARVAE ON COLLARDS

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## Introduction

DiPel<sup>®</sup> DF is an OMRI (Organic Materials Review Institute) listed biological insecticide approved for use in production of organic crops. DiPel<sup>®</sup> is based on the naturally occurring bacterium strain *Bacillus thuringiensis* subsp. *kurstaki*. Under certain fermentation conditions, this bacterium produces insecticidal protein toxins that are very specific for Lepidoptera larvae. Once pest larvae consume the toxin crystals and bacterial spores contained in DiPel<sup>®</sup>, the insects stop feeding rapidly and die a short time later. The toxins act by binding to specific receptors in the insect gut. Once bound to these receptors, the toxins disrupt the cells of the gut quickly causing the insect to stop feeding thus protecting the crop.

The organic foods segment is one of the fastest growing areas of the agricultural industry. An increasing number of consumers are looking for produce that is grown in a sustainable manner with limited conventional chemical inputs. Organic produce is grown, harvested, and stored under strict guidelines outlined by the U.S. National Organic Standards. Farm inputs for growing organic produce need to be approved by accredited independent state or private organizations such as OMRI. Most of the organically listed insecticide inputs come from natural sources and this limits the number of insecticides available to organic farmers.

Because of the limited insecticides available to organic growers, Bt products such as DiPel<sup>®</sup> DF are important materials for insect control. Since they have limited options for insect control the organic grower also wants to be sure that the insecticide they use will be efficacious against prominent pests of their crops. DiPel<sup>®</sup> is known for its ability to control a wide range of Lepidoptera pests and it has been used extensively by both organic and conventional farmers. In this study we tested a season-long program that relied solely on weekly applications of DiPel<sup>®</sup> DF to control diamondback moth (*Plutella xylostella*). DiPel<sup>®</sup> DF at both the 1 and 0.5 lb/acre rates significantly reduced diamondback moth worm populations to under threshold levels compared to the untreated check for all but one evaluation period during the course of the season. Leaf damage by these pests was also significantly reduced compared to the untreated check. These studies show that DiPel<sup>®</sup> DF can be a highly efficacious insecticide for control of diamondback moth larvae.

## Materials and Methods

Crop: To determine the efficacy of a DiPel<sup>®</sup> 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.

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.

Location: Reno, GA

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 2.5024 liters. All applications were made with a backpack sprayer. Speed during the applications was 3 mph. All DiPel<sup>®</sup> treatments were made with Dynamic at 0.5% v/v.

The crop was set on 10/8/09 when the collards were at the 2-3 leaf stage. While the collard transplants were in the greenhouse diamondback moth larvae were present at threshold levels. Insecticide applications began on 10/9/09 as a pre-count (1 day after transplanting) due to rapid build-up of the worm population. DiPel<sup>®</sup> DF applications were made on an approximately one week schedule after the initial application. Larval ratings were also made on a weekly basis.

#### Treatments:

1. DiPel DF at 0.5 lb/acre
2. DiPel DF at 1.0 lb/acre
3. Untreated check (UTC)

#### Application dates:

10/9, 10/16, 10/23, 10/30, 11/5, 11/12, with larval counts immediately before applications.

## Results and Discussion

Collard was chosen as the crop in this study because of its attractiveness to Lepidoptera insect pests and fast growth characteristics. The crop had the desired effect because pest populations established rapidly and grew quickly. The population for diamondback moth (*Plutella xylostella*) in the untreated check increased from approximately 5 insects per 10 plants at one week after the first application to a peak of over 30 insects per 10 plants by 34 days after the initial application (Figure 1). DiPel<sup>®</sup> DF at both the 0.5 and 1.0 lb/acre rates showed statistically significant control (ANOVA, P=0.05) of the diamondback moth

larvae at all evaluation dates after October 16. Populations were held below the economic threshold of 3 insects per 10 plants for all dates except the last evaluation period (Figure 1).

Figure 1. Diamondback moth larval counts for collard plants that were left untreated (UTC), and treated with DiPel® DF at two rates.

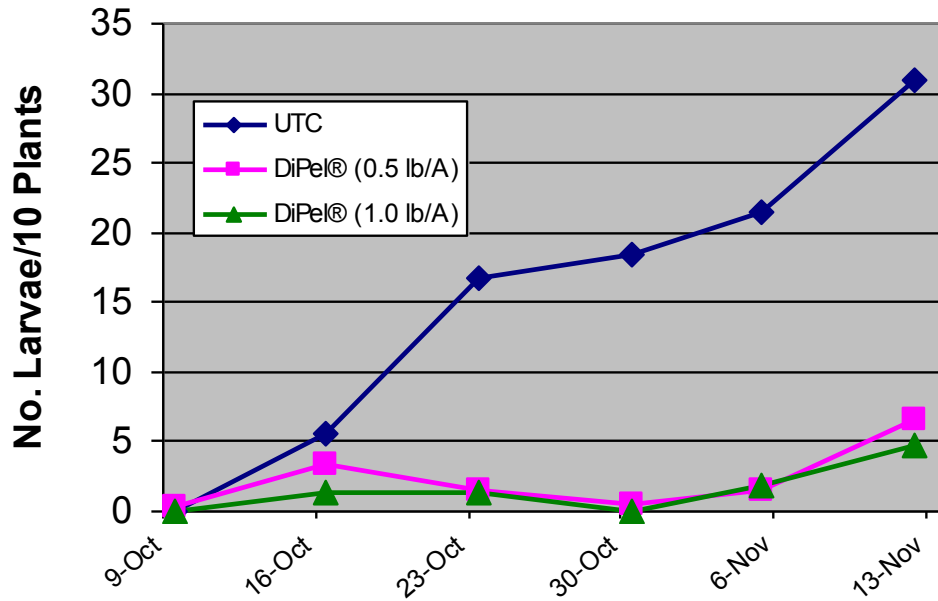
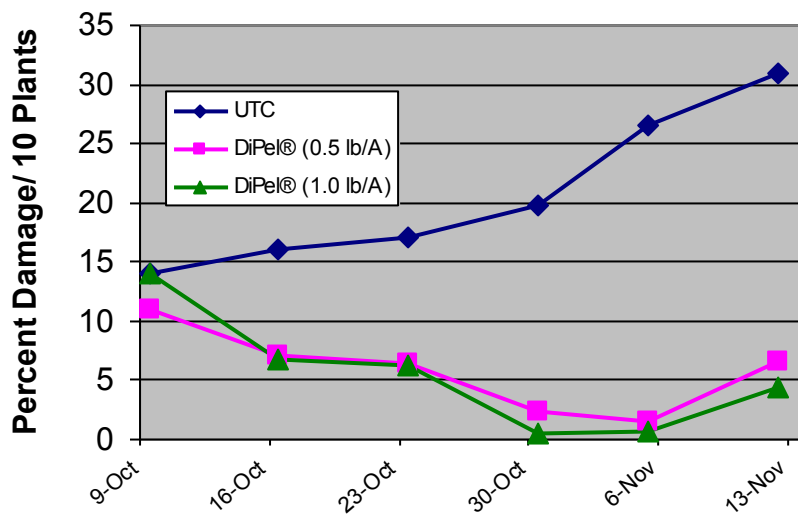


Figure 2. Feeding damage for collard plants that were left untreated (UTC), and treated with DiPel® DF at two rates.



Due to the high efficacy of DiPel<sup>®</sup> DF, the damage to the collard plants from diamondback moth feeding declined over the course of the season (Figure2). Early damage was due to the pre-existing diamondback moth populations in the greenhouse prior to transplant. Once DiPel<sup>®</sup> was applied, the insect populations were brought under control with little further feeding, and the plants grew out of the initial damage observed. Compare this to the untreated check where damage continually increased during the course of the study, peaking at 30% by the last evaluation time. This shows that DiPel<sup>®</sup> can be effective on pre-existing populations of insects and significantly reduce feeding damage.

## **Conclusions**

These studies demonstrate that a season long DiPel<sup>®</sup> program can significantly reduce diamondback moth population and the associated damage in Brassica crops. DiPel can be an effective Lepidoptera pest control product for both organic and conventional growers.