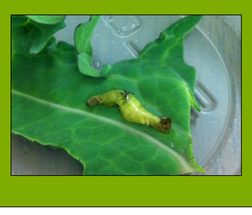

Mixes and Rotations: Incorporating the new baculovirus product Loopex into an IPM Strategy for Lepidoptera Brassica pests

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INTRODUCTION

- Baculoviruses are highly infectious to many lepidopteran pests but safe for non-target organisms, making them attractive for integration into pest management strategies.
- BC growers of brassica crops (i.e. cabbage, kale, broccoli) use *Bacillus thuringiensis* (Bt) almost exclusively to control the 3 major lepidopteran pests: *Plutella xylostella* (diamondback moth), *Trichoplusia ni* (cabbage looper), *Pieris rapae* (imported cabbageworm), but resistance has been reported.
- A new product, Loopex FC (*Autographica californica* multiple nucleopolyhedrovirus, AcMNPV) effective against *T. ni* may impede resistance.
- The challenge for a biologically-based IPM program is controlling all species. These studies investigated the potential of integrating a new biological product with Bt, and investigating the use of two spray technologies with the new biological product, Loopex.

OBJECTIVES

1. To examine the efficacy of Loopex FC alone and in combination with Bt (DiPel®) for the control of lepidopteran species in organic brassica field crops.
2. To compare low and high volume spray applications of Loopex FC for the control of *Trichoplusia ni* in broccoli.

METHODS

Field Trial:

- The trial was performed at the Tsawwassen Farm School (20 acre organic farm) in Delta, BC.
- A row of 200 plants of each broccoli and cabbage was grown. Each row was divided into 24 plots with 8 plants (4 plots/treatment).
- Lepidopteran larvae naturally infested plants. Spray treatments and monitoring were performed weekly.

Treatments:
(1) Bt (Dipel, 1 lb/acre)
(2) Loopex FC (10^{11} occlusion bodies/ha)
(3) Loopex Bt tank mix, both at 50% rate
(4) Alternate Loopex and Bt weekly
(5) Untreated (water, negative control)
(6) Row cover (Reemay, positive control)

- The number of eggs, larvae and pupae of the 3 lepidopteran species were counted on 3 leaves/plant and % damage on 2 leaves/plant.
- Crops were harvested and weighed for marketable yield.

Spray Trial: high vs low volume applications

- 16 broccoli transplants were planted in each of four raised beds (2 beds/treatment) with row covers.
- *T. ni* eggs were obtained from Benzon Research and reared in the laboratory.
- Six, 2nd instar larvae were transferred to each plant.

Treatments:
(1) High volume (Green Gorilla, total spray volume = 800 L/ha)
(2) Low volume (Ulva+, total spray volume = 10 L/ha)

- 2 applications were performed one week apart (Loopex FC, 10^{11} OBs/ha)
- 2 days after each application 1 row of plants (8 plants) was harvested.
- Larvae were collected and monitored daily for death in individual cups.
- Baculovirus death was confirmed with light microscopy.

Fig. 1 *T. ni* larvae dead from baculovirus infection. Larvae liquefy after death releasing virus particles (occlusion bodies).

RESULTS AND DISCUSSION

Field Trial:

- The lowest number of larvae were found on broccoli and cabbage plants under the row cover, followed by those treated weekly with Bt or the Bt Loopex tank mix.
- Loopex treated plants had significantly fewer *T. ni* larvae than the untreated plants in the broccoli (Fig. 1A) and showed a similar level of suppression of *T. ni* larvae as all other spray treatments in cabbage (Fig. 1C).
- Loopex alone did not reduce the number of *P. rapae* larvae in either crop (Fig. 1B, D). The *P. xylostella* population was too low to assess statistically.
- These results indicate the high degree of host specificity of Loopex.
- Plant damage was <10% for all treatments except the untreated control and Loopex alone. Reflecting this, 30% of the Loopex alone treated broccoli was unmarketable.
- High temperatures under the row cover likely had a negative impact on broccoli head development, since the number of unmarketable broccoli heads was over 50% in the row covered plots.

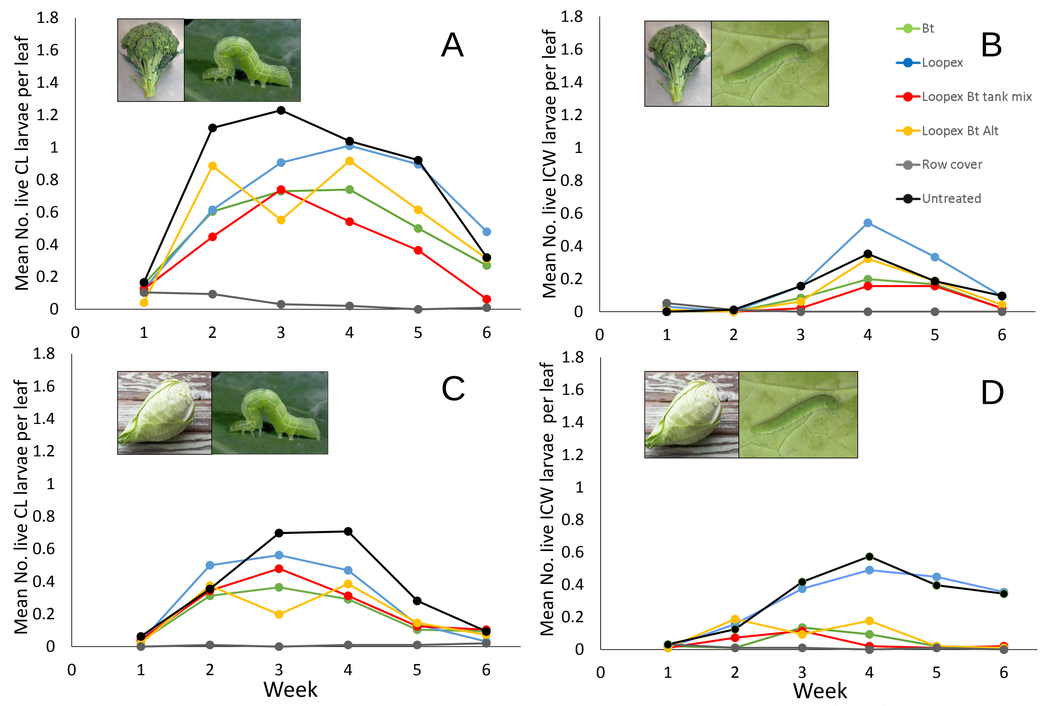

Fig. 2 Mean number of *Trichoplusa ni* (CL) and *Pieris rapae* (ICW) live larvae per leaf on broccoli (A, B) and cabbage (C, D).

Spray Trial: high vs low volume spray applications

- The low volume spray treatment resulted in earlier mortality of larvae: 20% higher on day 3 after the second spray application when compared to the high volume spray treatment (Fig. 3, P <0.0001).
- At the end of the trial, the total larval mortality was significantly higher for broccoli beds sprayed with the low volume sprayer (P =0.0428).
- These results indicate that the Ulva+ low volume sprayer improves the speed of kill and overall *T. ni* larval mortality when compared to conventional high volume spray application equipment.

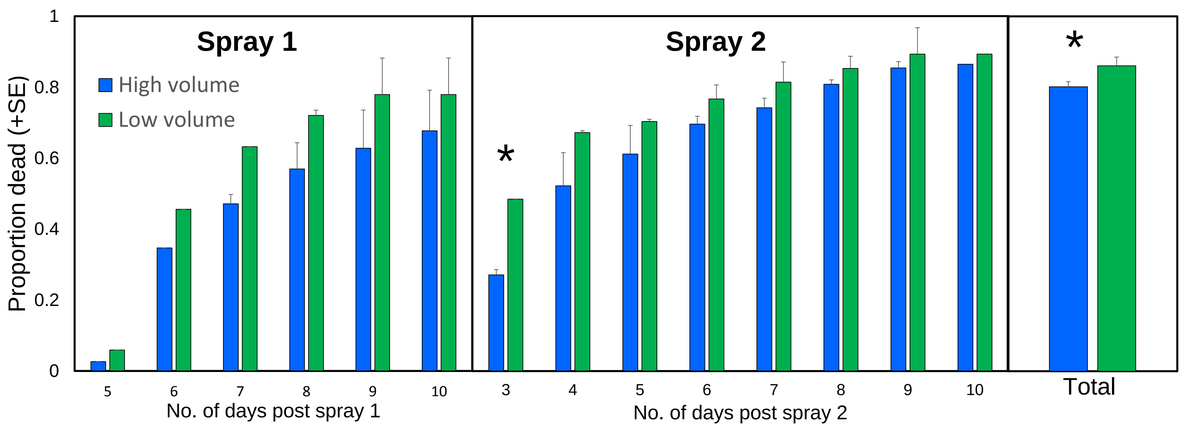

Fig. 3 Comparison of the mean proportion of *T. ni* larvae that died daily and total death from baculovirus infection after two Loopex applications, one week apart with high and low volume sprayers.

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