Grower Summary

FV 389

Combining biopesticides and other treatments to increase pest control

Final 2013

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Title:	Combining biopesticides and other treatments to increase pest control
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Headline

Several biopesticide products were effective against important vegetable pests (cabbage root fly, aphids and diamond-back moth) when applied alone and there was evidence of additive and synergistic effects between biopesticides.

Background

There is much interest in identifying effective treatments for pests whilst reducing reliance on synthetic pesticides. One way to achieve this may be to combine treatments to improve efficacy. Whilst this is done routinely with pesticide mixtures (e.g. Dovetail) and with pesticide/adjuvant combinations, other improvements might be achieved through, for example, combining insecticides or biopesticides with a 'potentiator' treatment that modifies pest activity (and thereby pesticide uptake) or pest susceptibility. Such treatments could be applied at the same time or sequentially.

Summary of the project and main conclusions

The aim of this project was to undertake a series of small-scale laboratory tests with pest insects that can be obtained easily from cultures (cabbage root fly [*Delia radicum*], cabbage aphid [*Brevicoryne brassicae*], peach-potato aphid [*Myzus persicae*], currant-lettuce aphid [*Nasonovia ribisnigri*] and diamond-back moth [*Plutella xylostella*]) to evaluate the potential of a range of treatments by comparing their activity separately and in combination. The term 'biopesticide' used here includes biocontrol agents, botanicals or semio-chemicals.

A literature review was first undertaken to summarise the combinations of biopesticides, conventional pesticides and 'potentiators' that have been evaluated in previous studies and to understand the mechanisms involved in achieving improvements in pest insect control. These improvements can occur for a number of reasons, associated with changes in the susceptibility or behaviour of the target insects.

The approaches to combining treatments vary considerably and may, for example, involve combining two microbial biopesticides (e.g. a fungal pathogen with *Bacillus thuringiensis*), a microbial biopesticide with a reduced dose of a chemical insecticide, or a biopesticide based on a plant extract with a microbial biopesticide. Simplistically, the two main mechanisms by which control is improved are where application of one treatment increases an insect's susceptibility to another, or where the application of one treatment increases the uptake of the second treatment and therefore the effective dose.

Biopesticides were identified that can be tested in combination against a number of vegetable pests. Because most of these materials are being used in the SCEPTRE (Sustainable Crop and Environment Protection – Targeted Research for Edibles) project, the individual products were coded in this project.

The biopesticides were tested in a laboratory situation using potted plants and by infesting them with insects from cultures. For the cabbage root fly, two types of test were undertaken. Firstly, adult flies were exposed to plants whose foliage had been treated with foliar sprays of the test biopesticides. This was either in a 'choice' (flies confined with several treatments) or 'no-choice' (flies confined with one treatment) situation, to investigate effects on fly survival and egg-laying by female flies. Secondly, biopesticides were applied to the compost surrounding the potted plants and the plants were then inoculated with cabbage root fly eggs. In this case, some of the biopesticides were applied with a reduced dose of Tracer (spinosad) (5% or 10% of recommended rate) to investigate whether reduced doses of insecticide and biopesticides might act additively or even synergistically. For aphids, foliar sprays of the biopesticides were applied to infested plants and for diamond-back moth, adult moths were confined with plants whose foliage had been treated with foliar sprays of the test biopesticides.

Cabbage root fly

Most of the biopesticides applied as foliar sprays did not increase cabbage fly mortality. However, HDCI020, or treatments including HDCI020, did increase fly mortality on several occasions in no-choice tests, particularly during the first few days when residues were fresh. Numbers of cabbage root fly larvae/pupae were reduced by several treatments applied to the module compost (Figure A). Of the treatments applied alone, HDCI019 and HDCI021 were most effective and Tracer was also surprisingly effective at a reduced dose. HDCI049 was effective in combination with a reduced dose of Tracer. Treatments that reduced the number of cabbage root fly larvae/pupae also reduced root damage (scored on a 0–5 scale), and some of them increased root weight, compared with the untreated control. There was some evidence – requiring confirmation – that HDCI049 and a reduced dose of Tracer worked synergistically.

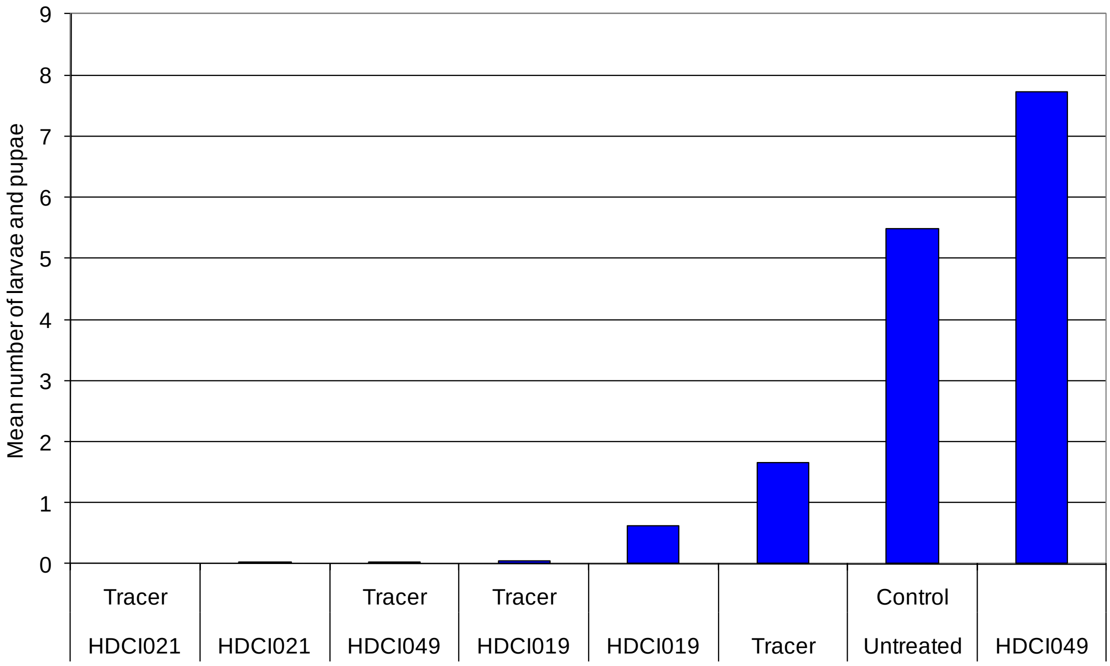

Figure A. Cabbage root fly – biopesticides applied to module compost –mean number of larvae + pupae recovered per plant (back-transformed data). Tracer was applied at 5% of the recommended rate.

Aphids

The levels of control achieved with single products in all the experiments on aphid control (three species) were summarised. Whilst there is a considerable amount of variation, this provides an overview of the performance of the different products when applied alone. The treatments that reduced aphid numbers were HDCI024 (as a spray and a drench), HDCI025 and HDCI026, and of these, foliar sprays of HDCI024 and HDCI025 appeared to be the most effective.

In an experiment on peach-potato aphid there was no evidence that addition of HDCI023, HDCI025 or HDCI026 improved the already good control by HDCI024. In another experiment on peach-potato aphid, addition of either HDCI023 or HDCI026 appeared to improve control by HDCI025, but these were not statistically significant differences. In a third experiment, addition of HDCI023 to HDCI025 did not improve the already good control.

In an experiment on currant-lettuce aphid, all combinations of four products were examined (Figure B). There was an indication that a combination of HDCI026 with another product improved control more than might be expected from an additive effect alone, but this effect requires confirmation.

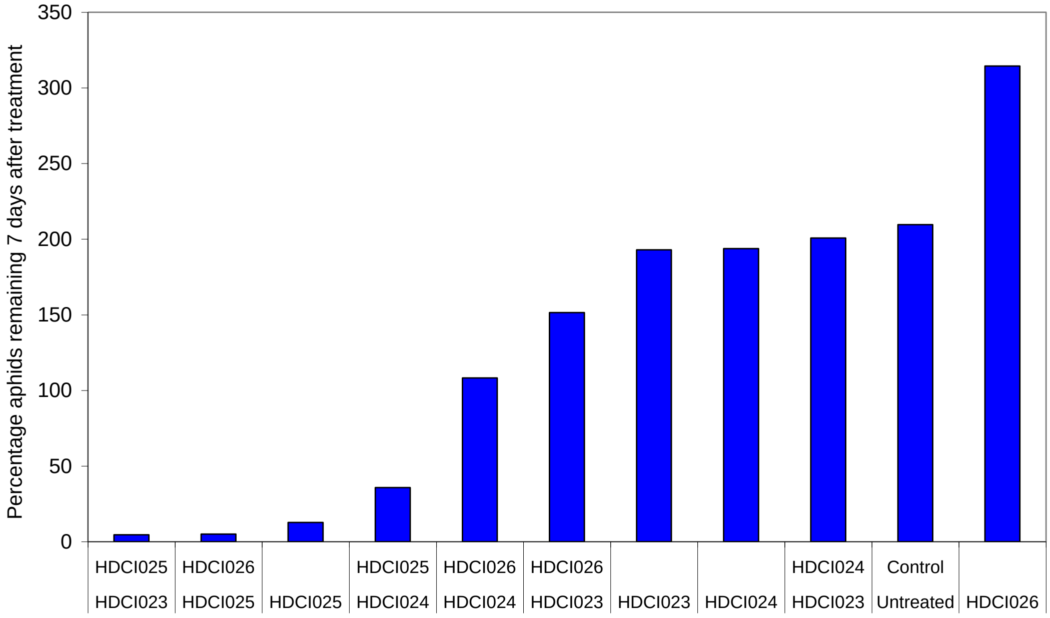

Figure B. Currant-lettuce aphid – mean percentage aphids remaining seven days after treatment. Back-transformed means.

Diamond-back moth

The results of the early experiments on diamond-back moth were hard to explain; this pest requires further experimental work to look at single treatments and interactions. In the later experiments, two of the biopesticides gave statistically significant control of diamond-back moth. The observed control from a combination of these two products was better than predicted from their use alone but this effect requires confirmation (Figure C).

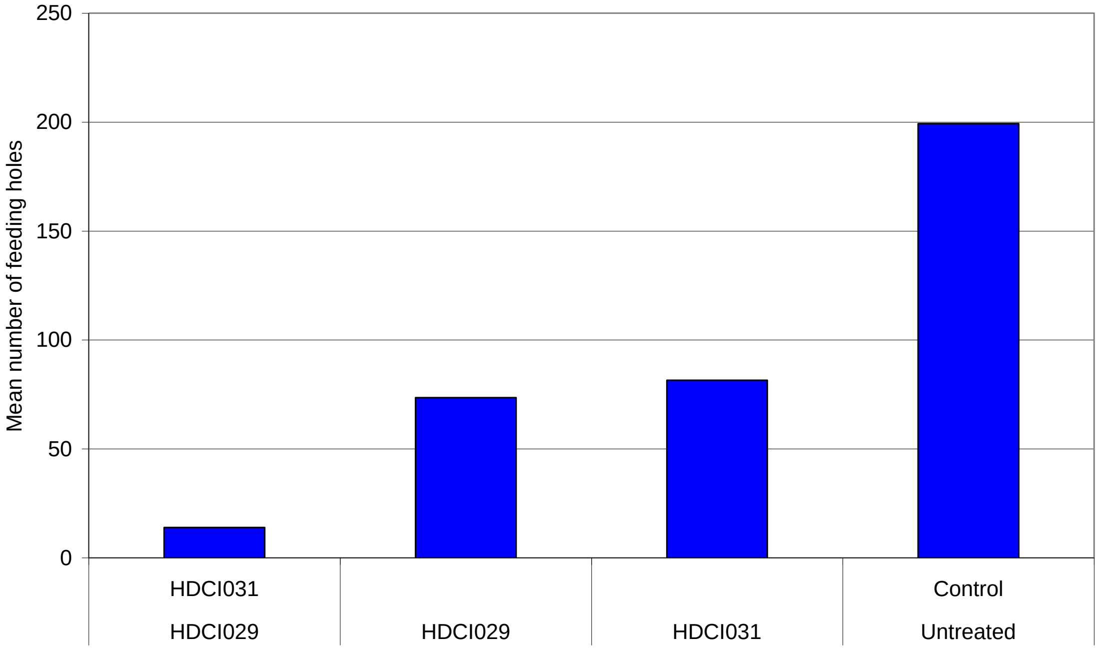

Figure C. Diamond-back moth – mean number of feeding holes per plant. Back transformed data.

General conclusions

The consistency of results was varied, being greatest in the experiments on the use of treatments applied to the compost to control cabbage root fly, and least in experiments with diamond-back moth. With the exception of the former experiments, further repeats would be desirable to increase confidence in the findings.

Time had to be spent evaluating individual treatments in preliminary experiments, which whilst not directly related to biopesticide combinations, has increased understanding of the products and provided information that is complementary to the data collected in the SCEPTRE project.

The study has shown that improved control was achieved with some simultaneous applications of two biopesticides and that this effect may be additive or, in some cases, synergistic. Experiments with reduced doses of Tracer in compost treatments were undertaken to determine whether there were possible synergistic or additive effects of insecticides and biopesticides, and this appears to be the case for this pest and method of application. Further work is needed to explore other pest x biopesticide combinations and to determine how these might be used effectively in the field, particularly in terms of methods and timings of application and the persistence of such biopesticide treatments.

Financial benefits

This project, which is complementary to the HortLINK SCEPTRE project, is relevant to pests that infest a wide range of field vegetable, protected and ornamental crops. The results have indicated which treatments and combinations of treatments may be worth exploring in more detail in future trials.

Action points for growers

- No change of practice is recommended at this stage, since further work is required before most of the coded products will be available for growers to use. However, several of the products are being evaluated in the SCEPTRE project, which may facilitate their availability.