

Development of sustainable aphid control strategies to limit virus infection in potatoes

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Introduction

In New Zealand, aphids in potato crops have the potential to develop insecticide resistance as a result of intensive insecticide use. This would result in loss of aphid control, a corresponding increase in the incidence of viruses (Fig.1) vectored by aphids, and a reduction in potato yield and quality.

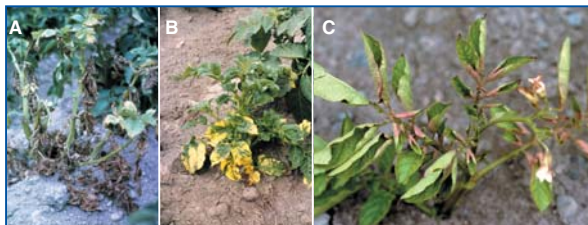


Fig. 1. Potato virus Y (A), alfalfa mosaic virus (B) and potato leafroll virus (C).

The potato industry has initiated a 3-year project through the MAF Sustainable Farming Fund to develop and implement a resistance management programme to control aphids that transmit viruses in potatoes. The aim is to prevent insecticide resistance becoming widespread and thus limiting sustainable uses of insecticides in aphid pest management.

The project team includes a grower group in Canterbury (the main seed-producing region), Vegfed, the agrochemical industry, and other industry partners.

Project tasks and progress

Literature review

Literature on managing aphid resistance to the insecticides used to control aphids in potatoes is being reviewed.

Grower survey

Randomly selected potato growers were surveyed to ascertain their current practices for managing viruses in crops and their current use of insecticides to control aphids.

Results: Fifteen of the 66 registered growers in Canterbury indicated that 94% of potato crops were treated with either imidacloprid or phorate as a seed treatment to control aphids during 2001-02. To control aphids in potato foliage, 16% of crops were sprayed with 3-6 sequential applications of either an organophosphate insecticide, or a carbamate insecticide, a practice known to induce chemical resistance.

Benchmarking aphid resistance

The current level of aphid resistance to insecticides is being assessed. A computer controlled spraying apparatus is being used to ascertain the dose of commonly used pesticides required to kill 50% and 90% (LD50 and LD90) of aphids that colonise potatoes.

Results to date: Assays of Canterbury populations of the important virus vector, green peach aphid (*Myzus persicae*) (Fig. 2) have provided no evidence of resistance to methamidophos (Monitor® and Taron®) and pirimicarb (Pirimor®), but possible resistance to lambda-cyhalothrin (Karate® with Zeon Technology®).



Fig. 2. Green peach aphid.

Insecticide trials

Field trials in the North and South Islands were established in late October 2002 to evaluate the effect of commonly used insecticides on aphids and their predators, and suppression of virus transmission in potatoes. Treatments included an untreated control, and foliar applications of Taron applied fortnightly or Karate applied whenever apterous aphids colonised foliage above 10 aphids per 150 leaves. Both foliar treatments were applied to untreated seed potatoes or to those treated with imidacloprid (Gaucho®).

Results to date: At Pukekohe, four applications of the calendar-applied Taron were not required until mid January due to the absence of aphids. Thereafter, the treatment resulted in higher numbers of wingless aphids (98 aphids/150 leaves) than in the untreated plots (11 aphids/150 leaves), probably because the treatment killed aphid predators (Fig. 3).

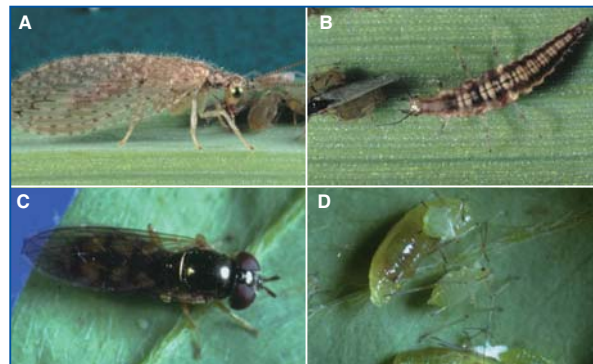


Fig. 3. Aphid predators – lacewing adult (A) and larvae (B), and syrphid adult (C) and larvae (D).

At Lincoln, the Gaucho seed treatment reduced populations of wingless aphids per 150 leaves in mid December from 41 aphids in the untreated controls to 3 aphids in Gaucho-treated plots. Six fortnightly applications of Taron, and one strategic application of Karate kept aphid numbers below the threshold.

Aphid flights

Flights of aphids that colonise potatoes and spread potato viruses were recorded weekly in suction traps (7.5 m in height) in the Hawke's Bay and at Lincoln, Rokeby, Hilton and Courtenay in Canterbury (Fig. 4). The aphids recorded were green peach aphid, potato aphid (*Macrosiphum euphorbiae*), foxglove aphid (*Aulocanthum solani*) and melon aphid (*Aphis gossypii*). The onset of peak flights (Fig. 5) alerted growers to inspect crops for aphids, and to plan insecticide spray programmes.

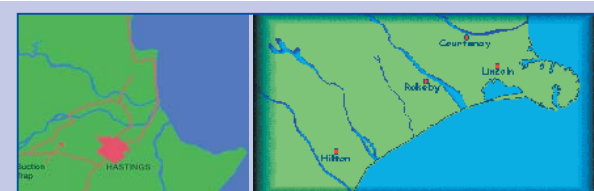


Fig. 4. Suction trap sites

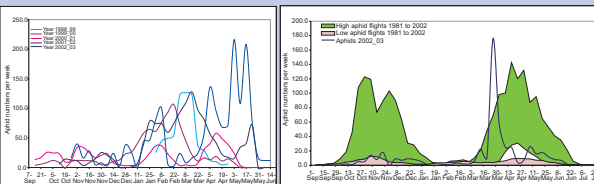


Fig. 5. Flights of aphids that colonise potatoes and vector viruses at Hawke's Bay (Left) and Lincoln (Right)

Scouting

Employees of McCain Foods (NZ) Ltd and Wrightson regularly collect information on aphid infestation and virus infection in potato crops. Grower groups discuss recommendations with staff at Crop & Food Research who collate the information.

Technology transfer

Information on management of potato viruses, and weekly updated graphs on aphid flights at five locations are incorporated into the AphidWatch.com website at www.aphidwatch.com/potato/index.htm. A manual incorporating all available knowledge on sustainable aphid management in potatoes will be produced at the end of the project.

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