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Managing onion thrips in cabbage and lettuce — progress report no. 1

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1 Executive summary

During the last two to three seasons large populations of onion thrips have developed in some onion crops from which they have been able to invade other crops such as vegetable brassicas and lettuce. Onion thrips have become increasingly prevalent in cabbage and lettuce and, in some cases, have caused major crop losses.

Over a two-year period, this study aims to develop action thresholds for controlling onion thrips in cabbage and lettuce. In the first year of this study three cabbage plantings and one lettuce planting were made over nine weeks to determine the effect of insecticide applications and an application of *Bacillus thuringiensis* on onion thrips populations at different plant stages and different times of the season in these crops.

Numbers of onion thrips on 50-100 plants per treatment per crop were recorded weekly from cabbage/lettuce transplanting to harvest. At maturity, 50 cabbages per treatment were harvested and assessed (200 per planting) for onion thrips presence and damage. Fifty lettuces were also harvested to assess onion thrips presence and damage. In the first cabbage planting, due to the lack of high numbers of onion thrips and onion thrips damage, an action threshold was not established (in consultation with Richard Wood, Vegcon Services Ltd). Onion thrips numbers remained low in cabbage plantings 2 and 3. Therefore, alternative action thresholds were tested. In cabbage planting 2, the lepidopteran action threshold used in the Crop & Food Research IPM programme (15% infested plants) was chosen to determine the effect of any insecticide applications (made as a result of exceeding the action threshold) on onion thrips numbers and damage. This threshold was compared with calender insecticide applications, a control (no insecticides) and *Bacillus thuringiensis* (Bt) only applications. In cabbage planting 3, the lepidopteran action threshold was compared with a plant growth stage threshold, calender insecticide applications and a control (no insecticides).

Results from the weekly scouting and harvest assessment of the three cabbage plantings and the lettuce will be collated and analysed in the next two months. However, initial results from the cabbage and lettuce scouting data show that the numbers of thrips and the extent of thrips damage was higher in cabbages than in lettuces. In contrast, harvest assessment data show more thrips and thrips damage in lettuces than cabbages.

Alternative monitoring techniques are required to reduce the time spent monitoring crops and, therefore, to increase the probability that growers will use them. Onion thrips monitoring is already a feature of the Crop & Food Research IPM programme for brassicas. High infestations on seedlings or at cupping or headfill would be recorded as "severe" and a recommendation made to control thrips.

In lettuce medium to high rates of thrips infestations may lead to bacterial soft rots and major crop losses. In addition, there is no proven IPM monitoring programme for lettuce in New Zealand. Therefore, we recommend that in the second year of this study effort is concentrated on developing an efficient monitoring system and action thresholds for onion thrips in lettuce.

2 Introduction

Onion thrips (*Thrips tabaci*) is a sporadic, but serious pest of cabbages in many brassica growing countries. Onion thrips feeding damage causes small, silvery areas with black specks (faecal matter) on the frame leaves, and bronze, rough areas on and in the head. Excessive damage on cabbage head leaves may render the cabbage unacceptable for fresh market. Heavy infestations can also kill significant numbers of cabbage seedlings in a crop.

In 1998 onion thrips resistance to the synthetic pyrethroid (SP) group of insecticides was confirmed in the Pukekohe district. In vegetable brassicas, another serious pest, the diamondback moth, has also developed high levels of resistance to synthetic pyrethroids. In response to this a resistance management strategy was developed for the Insecticide Resistance Task Group of the New Zealand Committee on Pesticide Resistance (Cameron 1996). Included in that resistance management strategy was a recommendation to alternate different groups of insecticides (Cameron 1996). In the past two years the Vegfed/TBG "IPM in Brassicas" programme has been developed and is being used in the Pukekohe region. Implementation of the IPM programme in brassicas is reducing insecticide use in vegetable brassicas. It is, therefore, important that management strategies for the control of insecticide resistant insect pests are co-ordinated over the range of crops where onion thrips are a major pest so that sustainable vegetable production can be maintained in the Pukekohe region.

During the last two to three seasons large populations of onion thrips have developed in some onion crops from which they may invade other crops such as brassicas and lettuce. Onion thrips and signs of onion thrips damage in cabbage and lettuce have, therefore, become increasingly prevalent. It is claimed that the large numbers of onion thrips in cabbage and lettuce crops are related to the drying off of nearby onion crops, causing major crop losses (R Wood and H Young, pers. comm.).

3 Aims

This study aims to develop action thresholds for controlling onion thrips in cabbage and lettuce crops. Monitoring techniques will be developed to assess thrips populations and damage. A number of action thresholds will be tested using a sequence of plantings to determine the effect of onion thrips at different plant stages and different times of the season. In the first year of this

study one lettuce and three cabbage crops were used. The second year of this study aims to "range-find" action thresholds in lettuce.

This study is linked with a project being carried out by HortResearch in which the movement of onion thrips from onion fields into cabbage and lettuce crops is being investigated.

4 Methods

4.1 Site

Replicated plot trials were conducted at Crop & Food Research's Pukekohe Station in 1999/00.

Three blocks of onions (4 rows x 60 m in length) were planted in July 1999 to provide a source of onion thrips. Numbers of onion thrips were recorded from 100 onion plants in November, December and January to confirm the presence and abundance of onion thrips in the trial area. Onion plants were lifted in early February to encourage an "en masse" onion thrip movement into the three adjacent cabbage plantings.

Three cabbage crops (cv. Matador) and one lettuce crop (cv. Casino) were transplanted in a sequence of plantings over nine weeks (see Table 1 for planting dates). Each cabbage crop consisted of 16 rows, approximately 55 m in length. Rows were spaced 0.75 m apart, with plant spacings within row of 0.45 m, as in standard commercial practice. The lettuce crop consisted of six beds, three rows of lettuce/bed, approximately 55 m in length at standard spacings.

The cabbage crops were marked out in a randomised block design with four treatments replicated five times. Each plot consisted of 104 plants (8 rows of 13 plants). Monitoring techniques and action thresholds for onion thrips in cabbage have not been previously investigated in Pukekohe. Therefore, decisions on action thresholds (treatments) were made as the trial progressed (see below).

4.2 Insect monitoring

Numbers of onion thrips were recorded weekly from cabbage transplanting to harvest. Scouting comprised of counting the total number of thrips on plant seedlings, whereas on older plants, thrips numbers were recorded on the growing tip and the outer four leaves of plants.

Lepidopteran monitoring was based on the methods of Beck et al. (1992), and the percentage of plants infested was calculated for each insect group. Prior to heading, all leaves were examined and plants were scored as infested if any caterpillar was seen. After heading, the head and four inner wrapper leaves were examined. A plant was scored as infested if any larval instar of diamondback moth was observed, or any large (third instar or larger) white butterfly larvae or noctuid (heliothis or loopers) larvae were observed.

4.2.1 *Cabbage planting 1 (25-11-99)*

Numbers of onion thrips on 50-100 randomly selected plants were recorded weekly from cabbage transplanting to harvest (5-10 plants /plot). Treatments were planned to consist of:

1. an untreated control,
2. a calender scheduled insecticide application every 7 days (see Table 2), regardless of pest numbers,
3. action threshold 1, x number of onion thrips per plant,
4. action threshold 2, y number of onion thrips per plant.

The number of plants assessed was reduced to 50 when the sampling of the second cabbage planting began. All cabbage plots, except calender scheduled application plots, were scouted together. This was planned until onion thrip numbers per cabbage plant had reached an action threshold level.

4.2.2 *Cabbage planting 2 (23-12-99)*

Because onion thrips numbers per cabbage plant remained low, the trial was modified to investigate the effect of the current lepidoptera action threshold (Crop & Food Research IPM programme) and any subsequent insecticide applications on thrip numbers. The cabbage crop was marked out in a randomised block design with four treatments replicated five times.

Treatments were:

1. an untreated control,
2. a calender scheduled insecticide application every 7 days, regardless of pest numbers,
3. lepidopteran action threshold (15% infested plants),
4. Bacillus thuringiensis applications only.

See Table 1 for insecticides applied and application rate.

Numbers of onion thrips on 50 randomly selected plants were recorded weekly from cabbage transplanting. Two weeks after transplanting, Dipel 2X (*Bacillus thuringiensis* (Bt)) was applied at the rate of 500 g/ha in 1000 litres water/ha to control diamondback moth infestations.

Table 1: Insecticide applications made in cabbage plantings 1, 2 and 3.

Cabbage planting	Treatment	Application date	Insecticide applied (class)	Application rate
1	2	23-12-99 30-12-99 05-01-00 12-01-00 20-01-00 26-01-00 02-02-00	methamidophos (organophosphate)	40 ml/10 litres water
2	whole planting	10-01-00	Dipel 2X (*Bacillus thuringiensis* (Btk))	500 g/ha in 1000 litres water/ha
2	2	20-01-00 26-01-00 02-02-00 08-02-00 17-02-00 01-03-00	methamidophos (organophosphate)	40 ml/10 litres water
2	3	20-01-00	Success (spinosad)	400 ml/ha in 20 litres water/ha
2	3	28-01-00	Xentari (*Bacillus thuringiensis* (Bta))	500 g/ha in 1000 litres water/ha
2	3	17-02-00	Orthene (organophosphate) Pirimor (carbamate)	40 ml/10 litres water 250 g in 500 litres water/ha
2	3	01-03-00	Orthene (organophosphate)	40 ml/10 litres water
2	4	20-01-00	Dipel 2X (*Bacillus thuringiensis* (Btk))	500 g/ha in 1000 litres water/ha
2	4	04-02-00	Xentari (*Bacillus thuringiensis* (Bta))	500 g/ha in 1000 litres water/ha
2	4	17-02-00	Xentari (*Bacillus thuringiensis* (Bta)) Pirimor (carbamate)	500 g/ha in 1000 litres water/ha 250 g in 500 litres water/ha
2	4	01-03-00	Xentari (*Bacillus thuringiensis* (Bta))	500 g/h in 1000 litres water/ha
3	whole planting	10-02-00	Agree (*Bacillus thuringiensis* (Btk+a)) Pirimor (carbamate)	500 g/ha in 1000 litres water/ha 250 g in 500 litres water/ha
3	2	17-02-00 24-02-00 01-03-00 09-03-00 15-03-00	methamidophos (organophosphate)	40 ml/10 litres water
3	3	18-02-00	Orthene (organophosphate)	40 ml/10 litres water
3	3	01-03-00	Orthene (organophosphate)	40 ml/10 litres water
3	3	15-03-00	Orthene (organophosphate)	40 ml/10 litres water
3	4	1-3-00	methamidophos (organophosphate)	40 ml/10 litres water
3	4	15-3-00	Orthene (organophosphate)	40 ml/10 litres water

All cabbage plots, except calender scheduled application treatments, were scouted together until the lepidopteran action threshold of 15% infested plants (treatment 3) was reached. After an insecticide had been applied, that treatment was scouted separately until harvest. A total of 50 plants were sampled per treatment. Numbers of onion thrips, and the percent of plants infested by caterpillars were recorded. When the percent of plants infested by caterpillars exceeded the 15% action threshold in treatment 3, insecticides were applied as recommended in the IPM programme for brassicas. When the percent of plants infested by caterpillars exceeded the 15% action threshold in treatment 4, a *Bacillus thuringiensis* application was made.

4.2.3 *Cabbage planting 3 (28-1-00)*

Because onion thrips numbers per cabbage plant remained low, the trial was modified to compare the effect of the current lepidopteran action threshold and any subsequent insecticide applications on thrips numbers with a plant phenology action threshold.

The cabbage crop was marked out in a randomised block design with four treatments replicated five times.

Treatments were:

1. an untreated control,
2. a calender scheduled insecticide application every 7 days, regardless of pest numbers,
3. lepidopteran action threshold (15% infested plants),
4. plant stage threshold, (thrip control application at cupping and early head formation).

See Table 1 for insecticides applied and application rates.

Numbers of onion thrips on 50 randomly selected plants were recorded weekly from cabbage transplanting. Ten days after transplanting, Dipel 2X (*Bacillus thuringiensis* (Bt)) was applied (500 g/ha in 1000 litres water/ha) to control diamondback moth infestations in all plants.

As in cabbage planting 2 all cabbage plots, except calender scheduled application treatments, were scouted together until the lepidopteran action threshold of 15% infested plants (treatment 3) was reached. After the above threshold had been reached and insecticide applied in treatment 3, treatments were scouted separately until harvest.

4.2.4 *Lettuce planting (23-12-99)*

Numbers of onion thrips on 50 randomly selected plants were recorded weekly from lettuce transplanting to harvest. Due to time and labour constraints no treatments were made.

4.2.5 *Harvest assessment*

At maturity 50 cabbages per treatment were harvested from each cabbage planting (200 per planting) (Table 2).

Plants in each plot were evaluated for onion thrip damage by scoring on a basis of damage to four inner wrapper leaves (leaves perpendicular to the ground and attached to the head by no more than 50% at their base), and 4 head leaves. Damage to inner wrapper leaves and head leaves were expressed as a % of affected area for each leaf. At maturity 50 lettuces were harvested, plants were evaluated for onion thrip damage in a similar way to above, after the normal grower practice of cutting and trimming the heads for market.

Table 2: Cabbage and lettuce planting and harvest dates.

Planting	Harvest dates
Cabbage 1 (25-11-99)	17-02-00
Cabbage 2 (23-12-99)	7/8-03-00
Cabbage 3 (28-01-00)	19-04-00
Lettuce (23-12-99)	02-03-00

4.2.6 *Insecticide application*

Insecticides were applied with a backpack sprayer and a hand-held boom with three "TeeJet®" flat spray tip (XR 11004VP) nozzles.

5 *Results*

High numbers of onion thrips were found on onions (planted to ensure onion thrips infestation) until mid-January (Table 3), when thrip numbers began to decline. Onion plants did not "dry-off" as expected and, therefore, were lifted in early February to encourage further thrips movement onto the lettuce and three cabbage plantings. However, due to higher than expected thrips numbers on the onions for the previous two months, the eventual lack of photosynthetic material on the onions may have resulted in a slower, more gradual movement of thrips.

Table 3: Abundance of onion thrips on onions.

Date	Number of onions sampled	Mean number of adults per plant	Mean number of nymphs per plant
03-11-99	100	1.3	8.2
19-11-00	100	5.0	17.6
02-12-99	100	8.7	43.2
26-01-00	60	3.6	6.6

Results from the weekly scouting and harvest assessment of the three cabbage plantings and the lettuce will be collated and analysed in the next two months.

Initial observations of the cabbage and lettuce scouting data, indicate that thrips numbers and the extent of thrips damage were greater in cabbages than in lettuces. The maximum numbers of onion thrips found were observed in early January and were:

- on cabbage
  - planting 1 — 16.8 adult thrips/plant, 0.2 larval thrips/plant
  - planting 2 — (32.5 adult thrips/plant), and
- on lettuce
  - 1.72 adult thrips/plant.

However, harvest assessment data show more thrips and thrip damage in lettuces than in cabbages.

6 Recommendations for year 2

The onion thrips monitoring techniques (total thrips counts per plant), although necessary for this trial, are extremely time consuming and are unlikely to be used by growers. Alternative monitoring techniques are, therefore, required to reduce time spent monitoring crops and to increase the probability that growers will use them. Onion thrips monitoring is already incorporated in the Crop & Food Research IPM programme for brassicas. Thrips are recorded on scouting sheets as "low, medium or severe". High infestations on seedlings or at cupping or headfill would be recorded as "severe", and a recommendation to control thrips made.

In lettuce, medium to high thrips infestations may lead to bacterial soft rots and major crop losses. In addition, there is no proven IPM monitoring programme for lettuce in New Zealand. Therefore, we recommend that in the second year of this study an efficient monitoring system and action thresholds for onion thrips in lettuce are developed. These recommendations will be discussed with Richard Wood.

7 Acknowledgements

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8 References

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