New Zealand Institute for Crop & Food Research Limited
A Crown Research Institute

Mana Kai Rangahau

TBG project: Sustainable control of insect pests in Brassicas—for period ending 31 March 2000

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Vegfed

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1 Summary

This is the sixth report on the project "IPM in Brassicas". The project focuses on developing sustainable control measures for diamondback moth (DBM), the key insect pest of vegetable brassicas, and integrates this approach with the control of other pests.

In the January-March 2000 period the major efforts and highlights for each of the six objectives are outlined below.

- The economic threshold trials were completed. The broccoli threshold developed the previous year was confirmed as the optimum action threshold. In the cauliflower trial, this broccoli threshold led to a lower percentage of premium cauliflower heads compared with broccoli.
- Further surveys for overwintering of the new white butterfly parasitoid in Gisborne, Hawke's Bay and Waikato were undertaken. It appears that *C. rubecula* has not established in Gisborne. The parasite has persisted at one overwintering site in Hawke's Bay, but has not dispersed. A single parasite was recovered from one of the two overwintering sites in Waikato. The parasite has dispersed another 10 km south from Pukekohe into the northern Waikato, with 95% parasitism recorded in an organic broccoli crop near Pokeno. At the two Waikato overwintering sites, growers suffered considerable crop loss over summer where crops were left unsprayed.
- Growers have complained that there is no selective alternative to Success for use against large larvae in the late window period of the rotation strategy. The relevant agrichemical companies have been contacted and are working as fast as possible to register one or perhaps two new selective insecticides for next season.
- Training of scouts has continued. One scout trainee in each district withdrew from the programme because they left the region.
- In the IPM demonstration sites it has been notable that due to the reduction in use of broad spectrum insecticides there has been a marked increase in natural enemy predator activity.
- A possible control failure after applying a synthetic pyrethroid insecticide on a crop in Hawke's Bay has been confirmed as resistance by lab assays. Indications are that the resistance is about 100-fold. Despite a number of attempts, DBM collections from Canterbury could not be lab reared, mainly due to high parasitism rates in the field collections. However, lab colonies have been established from collections from the other three regions and resistance assays are beginning.

2 Progress by objectives

2.1 Objective 1: refinement of thresholds

- The results from the refinement of thresholds trial from year 1 have been incorporated in the draft IPM Manual and used in this year's scout training sessions (objective 4). Scouts and growers are learning to use these new, proven action thresholds especially developed for broccoli crops as well as those previously developed for cabbages.
- Past assumptions that the broccoli and cauliflower thresholds should be the same had been queried by some growers and consultants and were, therefore, tested this season. Treatments for the second years trial were as follows:

Broccoli:

1. Control (no insecticide applications)
2. Calendar (insecticide application every 10 days)
3. Refined threshold 1: seedling (30%), 6-8 true leaf to floret initiation (20% - "heart leaves" only), protect the floret (10%)
4. Refined threshold 2: seedling (30%), 6-8 true leaf to floret initiation (no spray), protect the floret (5%)

Cauliflower:

1. Control (no insecticide applications)
2. Calendar (insecticide application every 10 days)
3. Refined threshold 1: seedling (30%), 6-8 true leaf to curd initiation (20% - "heart leaves" only), protect the curd (10%)
4. Refined threshold 2: seedling (30%), 6-8 true leaf to curd initiation (no spray), protect the curd (5%)

- Broccoli and cauliflower were planted in a split plot design to ensure a comparison could be made not only between treatments but between broccoli and cauliflower.
- The trial was harvested and assessed in late February. The data have been collated and are currently being analysed.
- Preliminary results (not statistically analysed) for broccoli indicate treatment 3 (seedling (30%), 6-8 true leaf to floret initiation (20% - "heart leaves" only), protect the curd (10%)) had the highest % of acceptable broccoli heads (95%) and resulted in significant insecticide savings (two sprays compared with five sprays (calendar treatment)).
- This seasons' results are consistent with the previous year's, demonstrating that treatment 3 is likely to be the optimum action threshold for broccoli.

- Preliminary results also indicate that the % of acceptable heads for any treatment were not the same between broccoli and cauliflower. For example, the % of acceptable cauliflower heads from treatment 3 was 81% (27% premium, 54% acceptable) compared with 95% for broccoli (85% premium, 10% acceptable).
- Results will be statistically analysed and any refinements to the action thresholds will be incorporated in the IPM manual.

2.2 *Objective 2: Spread of the white butterfly parasitoid*

- Summer surveys have continued in all three regions (Gisborne, Hawke's Bay and Waikato) to ascertain where the new parasitoid, *Cotesia rubecula,* has overwintered successfully and also to determine its spread.
- In Gisborne, no overwintering recoveries were made from three separate collections made by Leaderbrand staff adjacent to the overwintering sites in the region.
- In Hawke's Bay, *C. rubecula* has persisted at the Lawn Rd Crop & Food Research site. This is the first establishment record for this parasitoid on the east coast of the North Island. Surveys in neighbouring brassica crops suggest that it has not spread very far through the district.
- The parasitoid was not recovered from four separate large collections from Kai Whenua Gardens, the other main overwintering site in Hawke's Bay.
- In the Waikato, a single specimen of *C. rubecula* was recovered from collections made in late January at one of the overwintering sites in south Hamilton. No parasitoids were recovered from the other overwintering site.
- The new parasitoid has been recovered from another site in the North Waikato region. At this organic site near Pokeno, 95% of larvae (21 out of 22) collected off broccoli plants were parasitised by the new parasite. This record shows that the parasite has dispersed another 10 km from its most southerly position in Bombay. Earlier surveys have suggested that it disperses at about 10 km per year from its original establishment site.
- Overwintering and dispersal surveys are continuing in all three regions.

2.3 *Objective 3: Development of rotation strategy*

- A popular article published in the December issue of the Commercial Grower, entitled "DBM resistance update", publicised the updated insecticide rotation strategy. Since then, two more articles in local papers have emphasised the importance of "scouting", and only spraying when action thresholds are exceeded, and then only using the "softer, safer sprays". These articles were: Hawke's Bay Today, "Softer way to control bugs", 23 March 2000; and Marlborough Express, "New approach to cabbage pest control".

- The rotation strategy recommends that growers switch from Btk products used in the early window (before the end of January) to Bta products in the late window. Then, in the early window the IPM programme recommends using Success (spinosad) as a selective insecticide for control of large larvae on large plants. However, in the late window period there are no IPM-compatible replacements for Success. Approaches have been made to specific agrichemical companies to gain registration for other, new "environmentally-sound, selective" chemical groups as soon as possible. One of these new products will fit into the late window period, hopefully in time for use in the rotation strategy next summer. This will mean growers will gain maximum benefit from natural enemies all year, conserving them over the winter period for maximum use in the following season. Without the addition of a new selective insecticide, resistance pressure may be placed on the new chemical, Success (spinosad).

2.4 *Objective 4: training crop managers in insect identification and crop scouting*

- Training of scouts and growers (crop manager trainees) has continued in Pukekohe and Hawke's Bay. Seminars were presented by Dr Cheah, Crop & Food Research, Palmerston North, in each district on IPM of diseases in vegetable brassicas. Other training has predominantly been undertaken in commercial fields (the IPM demonstration sites) where trainees practise scouting, recording and becoming familiar with the complex of insects in these crops.
- At Pukekohe, Alanna Grace-Dare stopped training because she left the district. Colin Young discontinued scouting his crops in March because he was too busy, but agreed to allow his crop to be used as a demonstration site.
- In Hawke's Bay, Claire Mills has not been able to continue training with C&FR staff because she is stationed outside the district.
- Trainees report that their knowledge of pests, beneficials, crop monitoring and the crop has improved significantly.
- It is noteworthy that many more beneficial insects are being recognised in localised, brassica-growing areas using the IPM programme. Also, the scouting method may need to be adjusted to account for the increasing absence of pests where fresh damage is observed. At these sites, it is clear that predators such as spiders are taking many more larvae than in conventionally grown crops. Plants recorded as being infested (because of the presence of fresh chewing), in fact are often not infested. Further research is required.

2.5 *Objective 5: demonstration sites*

- Demonstration sites are being used for scout training sessions to provide practice in crop scouting, pest identification, recording and formulating recommendations for growers.

- New plantings have provided two more demonstration sites in Pukekohe and three more in Hawke's Bay making a total of four in Pukekohe and six in Hawke's Bay. This has allowed a continuation of scout training and data accumulation at original sites.
- As noted in the previous objective, there have been significant changes to the recording/scouting system used in the demonstration "IPM" crops. Previously, any evidence of caterpillar damage by fresh chewing of leaves resulted in that plant being recorded as infested. However, with the reduction in use of non-selective sprays, many more caterpillars are being "taken" from the plants (activity by spiders and other insect predators). This is a very positive development and illustrates the positive "flow-on" effects of changing to IPM.
- In Hawke's Bay, where two of the three demonstration sites are organic, the threshold for aphids cannot be used because there is no suitable organic product for aphid control. Extremely high infestations of aphids were recorded on new transplants in mid summer in Hawke's Bay, and economic damage concerns were raised. However, within a week this aphid infestation had "disappeared!". It is likely that this is another 'hidden' benefit of not spraying and/or use of selective sprays. We believe these infestations were controlled by predators, particularly spiders. There is a lot of evidence of their presence (spider webbing), but because they are predominantly night-active they are rarely located or recorded when the crop is being scouted.

2.6 *Objective 6: monitoring insecticide resistance in diamondback moth*

- The reference culture of diamondback moth has been maintained and increased in size.
- Establishing laboratory colonies from the field has proved difficult because of high parasitism of DBM larvae and pupae. Where growers are using Bt and Success it has been difficult to collect large enough collections of DBM to start representative colonies.
- Diamondback moth has been collected from the four regions (Canterbury, Gisborne, Hawke's Bay, Pukekohe) in January, February and March. Collections from Canterbury and Gisborne have not yet yielded laboratory colonies due to high parasitism rates.
- In Hawke's Bay, one grower suspected field control failures with an SP product and a Btk product. Collections of DBM were made from this field, a lab colony successfully established and assays undertaken. To date, we have confirmed SP resistance in this population of DBM from Hawke's Bay. Initial results indicate high levels of resistance (about 100-fold). A resistance assay testing Btk needs to be repeated.

3 Budget

Costs are summarised below as R&D expenditure by Crop & Food Research, and in-kind expenditures by growers/scouts and industry staff and grower crop loss.

The budget in this period for in-kind costs was $10 617, whereas the actual in-kind costs were $20 900. This large difference is due to crop losses, particularly in the Waikato region where summer cropping areas were left unsprayed to allow the new white butterfly parasitoid to increase in numbers.

The figures below are the actual hours and costs rounded (GST exclusive).

1) Crop & Food Research R&D costs

Item	Hours charged	Rate	Total
CFR Staff Hours			
Lian-Heng Cheah	12	$85/hr	$1 020.00
G Walker	79	$65/hr	$5 135.00
N Berry	149.5	$65/hr	$9 717.50
T Herman	29.5	$85/hr	$2 507.50
Wages	140		$2 471.00
Operating			$5 507.00
Total (GST Exclusive)	410		$26 358.00

2) In-kind contributions

Grower/scout time	148 hrs@ 50.00 =	$7 400.00
Crop loss (parasite overwintering sites)		$13 500.00
Total (GST exclusive)		**$20 900.00**

Summary of in-kind contributions from

1. Grower crop losses due to unsprayed crops (parasitoid release sites (objective 2):

broccoli and cauliflower, Scott Lawson, Hawke's Bay	$500.00
broccoli, Leaderbrand, Gisborne	3 000.00
brassica crops, Tim Sam, Waikato	7 000.00
brassica crops, Cham Leong, Waikato	3 000.00
Total	**$13 500.00**

2. Grower crop losses due to implementation of IPM (objective 5): **$0.00**

3. Grower phone calls and meetings, scout training and discussions, updating the rotation strategy; organising overwintering surveys for the white butterfly parasite and organising demonstration sites.

Total: 148 hrs @ $50 = **$7 400.00**

TOTAL in-kind contribution **$20 900.00**

Documentation of in-kind contributions (excluding crop losses)

(time spent with GW, NB, TH)

(Numbers in brackets indicate the objective involved)

In-kind contributions, January 2000

5 January

Phone calls, demonstration crop (5)	20 mins	Colin Young
(NB)		

6 January

Phone calls, 2 fax replies (5)	30 mins	Peter Aarts
(NB)		

10 January

Phone calls, training (4)	10 mins	Alanna Grace-Dare
(NB)	10 mins	Michelle Carter

12 January

Site visit, training (4)	45 mins	Michelle Carter
(NB)		

13 January

Phone call, demonstration crop (4,5)	15 mins	Colin Young
(NB)		

14 January

Phone calls, demonstration crop (4,5)	15 mins	Peter Aarts
(NB)	10 mins	Mike Parker

18 January

Phone calls and visits, overwintering surveys (2)	2 hours	Cham Leong

(GW)	1 hour	Tim Sam
Training meeting (4)	2 hours	Peter Aarts
(NB)		Colin Young
		Jason Dark
		Alanna Grace-Dare

20 January

Phone call, demonstration crop (5)	10 mins	Colin Young
(NB)		
Phone calls, Vegfed funding	10 mins	Ron Gall
		John van Lieshout
		Gavin Stevens
		Howe Young

21 January

Phone call, brassica diseases	15 mins	Cham Leong
(GW)		

25 January

Phone calls and fax reply (4,5)	20 mins	Peter Aarts
(NB)	10 mins	Colin Young

26 January

Phone call, field surveys, meeting scouts in H. Bay, training and demo sites, parasite (2,4,5)

(GW)	20 mins	Robert Joe
	10 mins	Scott Lawson
	30 mins	H Bay scouts

28-29 January

Scout training, IPM demo sites, parasite (2,4,5)	1 hour	Scott Lawson
(GW)	1 hr	Tony Kuklinski
	1 hr	Linda Haughey
	1 hr	David Edwards
	20 mins	Robert Joe

In-kind contributions, February 2000

1 February		
Phone calls, demonstration crop (5)	15 mins	Peter Aarts
(NB)		
4 February		
Phone calls, parasite, DBM collections from Gisborne (2,6)		
(GW)	2 hours	Mike Arnold
18 February		
Phone calls, demonstration crop (4,5)	10 mins	Colin Young
(NB)		
22 February		
Meeting, H. Bay, Disease IPM seminar	3.5 hrs	Tony Kuklinski
(TH, Dr Cheah)		Robert Joe
		David Edwards
		Linda Haughey
25 February		
Phone calls, demonstration crop (4,5)	10 mins	Peter Aarts
(NB)		
28 February		
Phone call, consultants day, field day	15 mins	Anna Ravlich
(NB)		

In-kind contributions, March 2000

7 March		
Meeting, set up demonstration crop (4,5)	2 hours	Peter Aarts
(NB)	1.5 hours	Colin Young
8 March		
Phone call, collecting DBM, parasite survey (2,6)	10 mins	Mike Arnold
(GW)		

9 March		
Phone calls, demonstration crop (5)	10 mins	Peter Aarts
(NB)		
14 March		
Phone calls, demonstration crop (5)	10 mins	Peter Aarts
(NB)	10 mins	Colin Young
15 March		
Phone calls, training, DBM resistance (4,5,6)	15 mins	Robert Joe
(GW)		
17 March		
Phone calls, demonstration crop (5)	10 mins	Peter Aarts
(NB)		
20 March		
Phone calls, demonstration crop (5)	10 mins	Colin Young
DBM collection (6)	10 mins	John van Leishout
(NB)		
20-22 March		
Meetings in Hawke's Bay (2,3,4,5,6)	1 hr	Robert Joe
(GW, TH)	30 mins	Tony Kuklinski
	30 mins	Scott Lawson
	30 mins	Ian Gold, Du Pont
	1 hr	2 S. Ivory reps.
21 March		
Meeting at demonstration crop (4,5)	20 mins	Colin Young
(NB)		
22 March		
Phone calls, demonstration crop (5)	10 mins	Peter Aarts

24 March

Meeting with Leaderbrand, Gisborne (1,2,3,4,5,6)	1 hr	Mike Arnold
(GW, TH)		David Buckley

Total: 44 hrs @ $50 = $2200

Grower/scout trainees scouting time in Pukekohe, 4 scouts x 1hr x 13 occasion; at Hawke' Bay, 4 scouts x 1 hr x 13 occasions

Total: 104 hrs @ $50 = $5200