

## Confidential Appendix – Research into alternatives

Below is a summary of some of the formal research activities and programmes that have been undertaken by the Vegetable Sector to identify alternatives to the 3 compounds for which reassessment is being sought. This is not an exhaustive list but it is sufficient to demonstrate that significant efforts have been made by industry – funded via grower levies to try and identify replacements for these critical insecticides.

### Wider vegetable sector

The Vegetable Research and Innovation board was established in 2006 and is funded by Vegetables NZ, Process Vegetables NZ, Tomatoes NZ, Onions NZ and the NZ Buttercup Squash Council. In combination with Potatoes NZ, the VR&I board has actively pursued an agrichemical strategy for the last decade. A key component of this strategy is an annual update of high priority pest, disease and weed issues where new control options are greatly needed. This list, as well as information about the scale of production of each crop in NZ, is then circulated to a number of crop protection companies who are approached to suggest potential candidates for the identified control gaps and vulnerabilities. Where a proposed control option seems promising for a particular product group, it usually offers to co-fund trials and/or registration costs in order to incentivize development on solutions for these control gaps.

We have pasted the list of high priority pest problems where alternatives are needed from a number of different years below. The total investment in these strategies since 2011 - 2020 has been over \$100,000. Please note that these are lists of all insect control gaps, not just those that are currently met using Diazinon, Fenamiphos or Methamidophos.

### 2010

#### List of high priority pest problems where new chemical options are needed

| Pest  | Crops  |
|---|--|
| Leafminer / springtail  | Forage brassica, baby leaf, pak choy, bok choy |
| whitefly/thrips/psyllid/aphid   | Greenhouse sector                              |
| Green vegetable bug   | Sweetcorn, beans                               |
| Beetle/weevil (wireworm, vegetable weevil, white fringed weevil, black beetle, Argentine stem weevil) | Potato, root crops, sweet corn                 |
| Potato tuber moth   | Potato   |
| Onion thrips  | Onion  |
| Lepidoptera   | Squash, lettuce, brassicas, salad leaf         |

2013

**List of high priority pest problems where new chemical options are needed**

| <b>Pest</b>   | <b>Crops</b>                                   |
|---|--|
| Leafminer / flies / springtail  | Forage brassica, baby leaf, pak choy, bok choy |
| whitefly/thrips/psyllid/TPP/aphid   | Greenhouse sector                              |
| Green vegetable bug   | Sweetcorn, beans                               |
| Beetle/weevil (wireworm, vegetable weevil, white fringed weevil, black beetle, Argentine stem weevil) | Kumara   |
| Potato tuber moth   | Potato   |
| Onion thrips  | Onion  |
| Lepidoptera   | Squash, lettuce, brassicas, salad leaf         |
| Mites   | Cucurbits                                      |
| Cutworm   | Squash, sweetcorn, kumara                      |
| Nematode  | Carrot/parsnip & potato                        |

2016

**Summary of high priority pest issues where new insecticide control options are required**

| <b>Pest/s</b>                     | <b>Crop/s</b>  |
|-----------------------------------|--|
| Nematode                          | Carrot/parsnip and potato                                      |
| Mites                             | Cucurbits  |
| Leaf miner / springtail           | Brassica and baby leaf   |
| Tropical armyworm                 | Brassica   |
| Black beetle                      | Brassica, spinach, baby leaf                                   |
| Whitefly/thrips/psyllid/TPP/aphid | Greenhouse crops   |
| Black beetle, weevils, wireworm,  | Kumara   |
| Army caterpillar, field cricket   | Kumara (field cricket currently controlled by Organophosphate) |

|                     |  |
|---------------------|--|
| Lepidoptera         | Squash, lettuce, brassicas, salad leaf |
| Green vegetable bug | Sweet corn, maize and beans            |
| Tomato fruit worm   | Squash                                 |
| Wireworm            | Melons                                 |
| Nysius / wheat bug  | Beet                                   |
| Symphilids          | Onions and brassica                    |

**2017**

**Summary of high priority pest issues where new insecticide control options are required**

| <b>Pest/s</b>  | <b>Crop/s</b>   |
|--|---|
| Nematode   | Carrot/parsnip and potato   |
| Mites  | Cucurbits   |
| Leaf miner / springtail  | Brassica and baby leaf  |
| Tropical armyworm  | Brassica  |
| Black beetle   | Brassica, spinach, baby leaf                                      |
| Whitefly/thrips/psyllid/TPP/aphid                                | Greenhouse crops  |
| Black beetle, weevils, wireworm, army caterpillar, field cricket | Kumara  |
| Lepidoptera  | Squash, lettuce, brassicas, salad leaf                            |
| Green vegetable bug  | Sweet corn, maize and beans                                       |
| Tomato fruit worm  | Squash  |
| Wireworm   | Melons  |
| Nysius / wheat bug   | Beet  |
| Symphilids   | Onions and brassica   |
| Seedcorn maggot  | Beans – emerging pest in the South Island. Seed treatment needed. |

**2018**

**Summary of high priority pest issues where new insecticide control options are required**

| <b>Pest/s</b>                     | <b>Crop/s</b>                |
|-----------------------------------|------------------------------|
| Nematode                          | Carrot / parsnip and potato  |
| Mites                             | Cucurbits                    |
| Leaf miner / springtail           | Brassica and baby leaf       |
| Tropical armyworm                 | Brassica                     |
| Black beetle                      | Brassica, spinach, baby leaf |
| Whitefly/thrips/psyllid/TPP/aphid | Greenhouse crops             |

|  |   |
|--|---|
| Black beetle, weevils, wireworm, army caterpillar, field cricket | Kumara  |
| Lepidoptera  | Squash, lettuce, brassicas, salad leaf                        |
| Green vegetable bug  | Sweet corn, maize and beans                                   |
| Tomato fruit worm  | Squash  |
| Wireworm   | Melons  |
| Nysius / wheat bug   | Beet  |
| Symphilids   | spinach   |
| Seedcorn maggot  | Beans – emerging pest in South Island. Seed treatment needed. |

**2019**

**Summary of high priority pest issues where new insecticide control options are required**

| <b>Pest/s</b>  | <b>Crop/s</b>   |
|--|---|
| Nematode   | Carrot / parsnip and potato                                   |
| Mites  | Cucurbits   |
| Leaf miner / springtail  | Brassica and baby leaf  |
| Tropical armyworm  | Brassica  |
| Black beetle   | Brassica, spinach, baby leaf                                  |
| Whitefly/thrips/psyllid/TPP/aphid                                | Greenhouse crops  |
| Black beetle, weevils, wireworm, army caterpillar, field cricket | Kumara  |
| Lepidoptera  | Squash, lettuce, brassicas, salad leaf                        |
| Green vegetable bug  | Sweet corn, maize and beans                                   |
| Tomato fruit worm  | Squash  |
| Wireworm   | Melons  |
| Nysius / wheat bug   | Beet  |
| Symphilids   | spinach   |
| Seedcorn maggot  | Beans – emerging pest in South Island. Seed treatment needed. |
| Grass grub   | Vegetable seed crops  |
| Thrips   | Onions  |
| Cockroaches  | Lettuce   |

**2020 Summary of high priority pest issues where new insecticide control options are required**

| <b>Pest/s</b>   | <b>Crop/s</b>   |
|---|---|
| Nematode  | Carrot / parsnip and potato   |
| Mites   | Cucurbits   |
| Leaf miner / springtail   | Brassica and baby leaf  |
| Tropical armyworm   | Brassica  |
| Black beetle  | Brassica, spinach, baby leaf  |
| Whitefly/thrips/psyllid/<br>TPP/aphid                                     | Greenhouse crops  |
| Black beetle, weevils,<br>wireworm, army<br>caterpillar, field<br>cricket | Kumara  |
| Lepidoptera   | Squash, lettuce, brassicas,<br>salad leaf                           |
| Green vegetable bug   | Sweet corn, maize and beans   |
| Tomato fruit worm   | Squash  |
| Wireworm  | Melons  |
| Nysius / wheat bug  | Beet  |
| Symphilids  | Onions, brassica and spinach  |
| Seedcorn maggot   | Beans – emerging pest in<br>South Island. Seed treatment<br>needed. |
| Grassgrub   | Vegetable seed crops  |
| Thrips  | Onions  |
| Cockroaches   | Lettuce   |
| Range of insects  | Process Tomatoes  |
| Range of pre harvest<br>insects   | Leafy vegetables  |

Crops that rely on fenamiphos, methamidophos or diazinon for control of certain pests have been seeking alternative solutions since even before the EPA reassessed organophosphates, as demonstrated by the insecticide priorities identified in their approaches to crop protection companies. Unfortunately, there is still a lack of promising candidates on the market for these crops and the continued use of fenamiphos, methamidophos and diazinon is still necessary for some control gaps.