SUBMISSION ON

Preliminary Consultation for the reassessment of selected Synthetic Pyrethroids (APP203936)

30 April 2024

To: Environmental Protection Authority
Name of Submitter: Horticulture New Zealand

Contact for Service:

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Horticulture™ New Zealand
Ahumāra Kai Aotearoa

OVERVIEW

Submission structure

Our submission

Horticulture New Zealand (HortNZ) thanks the Environmental Protection Authority (EPA) for the opportunity to submit on the Preliminary Consultation for the reassessment of selected Synthetic Pyrethroids (APP203936).

HortNZ is submitting on behalf of the following grower representative organisations:

- NZ Avocado Industry Ltd
- NZ Persimmon Industry Council
- Onions New Zealand Inc
- Potatoes NZ Inc
- Process Vegetables NZ
- Vegetables NZ Inc
- Zespri International Limited

Submitted Information
The information supplied is current as at 30 April 2024. This submission represents considerable input from individual growers to present to the EPA details around application methods of synthetic pyrethroids and how spray drift and risk to aquatic environments are mitigated.

We acknowledge and thank the EPA for extending the deadline for submissions until the 30 April 2024.

Confidentiality
We have read and understood the process for confidential, commercially sensitive, and private information, and **DO request** that the information contained in this submission be kept confidential and not be published on the EPA website.

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HortNZ's Role

Background to HortNZ

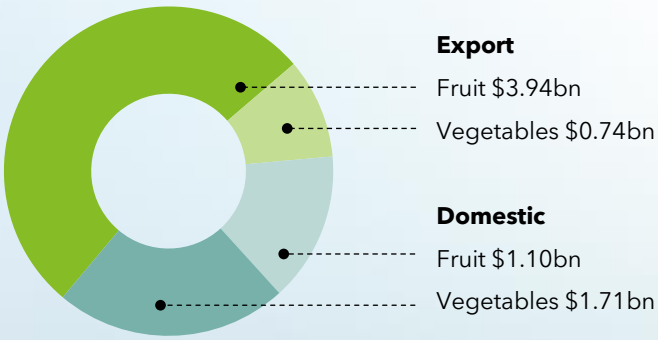
HortNZ represents the interests of approximately 4,200 commercial fruit and vegetable growers in New Zealand who grow around 100 different fruits and vegetables. The horticultural sector provides over 40,000 jobs.

There are approximately 80,000 hectares of land in New Zealand producing fruit and vegetables for domestic consumers and supplying our global trading partners with high quality food.

It is not just the direct economic benefits associated with horticultural production that are important. Horticulture production provides a platform for long term prosperity for communities, supports the growth of knowledge-intensive agri-tech and suppliers along the supply chain; and plays a key role in helping to achieve New Zealand's climate change objectives.

The horticulture sector plays an important role in food security for New Zealanders. Over 80% of vegetables grown are for the domestic market and many varieties of fruits are grown to serve the domestic market.

HortNZ's purpose is to create an enduring environment where growers prosper. This is achieved through enabling, promoting and advocating for growers in New Zealand.



Industry value $7.48bn

Total exports $4.67bn

Total domestic $2.81bn

Source: Stats NZ and MPI

Executive Summary

This submission has been prepared on behalf of seven horticultural Product Groups in response to the EPA reassessment of selected synthetic pyrethroids (SP).

This submission expands on the information submitted by horticulture industry groups in 2019 in response to the EPA 31 October 2018 Call for Information on the use of 11 SPs. We refer the EPA to this previous submission[1] for details on the use pattern information of SPs used in commercial fruit and vegetable production, and details of the benefits of SP containing insecticides, and the negative consequences that banning these insecticides would result in.

This current submission is intended to provide the EPA with updated information from the 2019 submission, with new information on:

- crop specific information on the critical uses of SPs for the crops listed;
- the growth stages of the crop when SPs are used;
- information on application methods, including boom heights, droplet sizes and any other technologies or management approaches that are used by growers to mitigate spray drift and exposure to aquatic environments.

This submission also reviews the EPA aquatic risk modelling[2] and the derived hazard classifications, noting where the modelling approaches and assumptions appear deficient.

[1] Submission from selected Horticulture Industries on the EPA Call for Information on Synthetic Pyrethroids (February 2019) 44p. Rebecca Fisher, Market Access Solutionz on behalf of horticulture industry groups.

[2] APP203936 – Synthetic Pyrethroids (SP) and SP-containing formulations – Agricultural Crop Protection Risk Assessment. Ecotoxicology. Aquatic Risk Assessment. 197p (https://www.epa.govt.nz/assets/Uploads/Documents/Hazardous-Substances/Synthetic-Pyrethroids-consultation/APP203936-Draft-Agricultural-uses-aquatic-risk-assessment-science-memo.pdf?vid=2)

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Submission

Part 1. Critical Use Pattern Information

Of the eight SP insecticides that the EPA are seeking information on, six are considered critical use for fruit and vegetable growers represented in this submission.

Summary of SPs and crops in this submission

This table summarises the SPs that are currently used on each crop.

SP active	Crops
Alpha-Cypermethrin	Carrot and parsnip, kumara, sweetcorn
Bifenthrin	Kiwifruit, kumara, potatoes, processed vegetables, squash and pumpkin
Cypermethrin	Kumara
Deltamethrin	Kumara, onion, processed vegetables, sweetcorn
Lambda-cyhalothrin / Cyhalothrin	Brassica, carrot and parsnip, kumara, lettuce, onion, processed vegetables, salad leaf and baby spinach, squash and pumpkin, sweetcorn, potatoes
Permethrin	Avocado, kumara, persimmon,

Product changes

This table summarises the product trade name changes from the 2018 submission and the current products used on each crop.

Crop	SP products used – 2018 submission	SP products used – 2024 submission
Avocado	Attack	Ambush, Attack
Brassica	Attack, Deltaphar, Karate Zeon	Karate Zeon
Carrots and Parsnip	Bestseller, Karate Zeon	Bestseller, Karate Zeon (no changes)
Kiwifruit	Talstar, Venom	Assail, Venom
Kumara	Bestseller, Deltaphar, Karate Zeon, Permigas, Ripcord, Talstar, Venom	Bestseller, Deltamax, Karate Zeon, Permigas, Ripcord, Tal-ken, Talstar, Venom,
Lettuce	Karate Zeon	Karate Zeon (no changes)
Onions	Kaiso, Karate Zeon, Proteus	Kaiso, Karate Zeon, Proteus (no changes)
Persimmon	Attack	Attack (no changes)

Crop	SP products used – 2018 submission	SP products used – 2024 submission
Potatoes	Ballistic, Cobalt Advanced, Karate Zeon, Proteus, Venom	Karate Zeon, Venom
Processed Vegetables	Cyhella, Deltaphar, Kaiso, Karate Zeon, Talstar	Ballistic, Cyhella, Deltamax, Kaiso, Karate Zeon, Talstar
Salad Leaf and Baby Spinach	-	Karate Zeon
Squash, pumpkin and other outdoor Cucurbit	Attack, Kaiso, Karate Zeon, Venom	Cyhella, Halex, Karate Zeon, Lavron, Venom
Sweetcorn	Alpha-Scud, Dominex, Karate Zeon, Ripcord, Sheriff	Ballistic, Bestseller, Cutter Safe, Cyhella, Cypher, Deltamax, Halex CS, Kaiso 50 WG, Karate Zeon, Ken-Tac 100, Lavron, Taekwando 250 CS

The EPA has requested new information in response to the questions noted below.

EPA questions	Response
Do you have any further information on the application methods for SP-containing products?	Yes
Do you have any further information on the spray droplet sizes used for applying SP-containing products?	Yes
Do you have any further information on the crop types and seasons SP-containing products are used on?	Yes
Do you have any further information on the growth stages that SP-containing products will be applied?	Yes
Do you have any further information on what boom heights are used to apply SP-containing products?	Yes

The following crop tables summarise the above information requested by the EPA.

The crop tables present further information requested by the EPA on the use of SP-containing products including application method, triggers for application, growth stage when the SP is applied, boom height, and droplet size.

New information is in red text.

Crop: Avocado

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate (L/ha)	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Permethrin + Pirimiphos Methyl										
Attack, Ambush (Permethrin 25g/L + Pirimiphos Methyl 475g/L)	Leafroller, mealybug, greedy scale, (Also affects thrips)	Generally high volume application. Low volume application* used for high density plantings and where orchards have access challenges	Fruit bearing trees during pest pressure – generally September to May	Determined by pest pressure and market access requirements for residues against use of the product.	At pre-blossom, post-blossom then at 4 - 6 week intervals, as determined by pest pressure	100ml/100L water	Not applicable due to canopy variability	n/a	High volume application – fine to coarse droplet size.	28

* aerial or ground based use.

Product changes between 2018 and 2024

Added: Ambush (permethrin + Pirimiphos methyl)

Product Group comments

NZ Avocado does not allow off label use without notification and dispensation. Both products have a label claim for avocado.

Crop: Brassica

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate (L/ha)	Boom height	Spray droplet size (microns)	PHI / WHP (days
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Diamondback moth, green looper, soybean looper, tomato fruitworm, tropical armyworm on broccoli and cabbage.	Ground-based boom sprayer: some air-assisted boom. Air induction nozzles.	As required, generally in the last 2 weeks before crop harvest	0 - 1 applications per crop. Used as a resistance management tool in a final spray at high pest pressure when all other available modes of action have already been used.	n/a	40 ml/ha	310	0.5 -0.75 metres, depending on crop height	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	3
Karate Zeon (Lambda-cyhalothrin 250g/L)	Greasy cutworm	Applied to nursery seedlings using nursery boom sprayer.	As required, during early post-emergence phase of 4-7 week nursery production.	0 - 1 applications per crop. Sporadic pest issue in nursery greenhouse – only occasionally required.	n/a	40 ml/ 1000 litres	0.25 litres per square metre	0.5 metres	Mainly using XR8008VK spray tips at 2 bar operating pressure, drift not a significant issue in glasshouse. Medium droplet size of 200-300 microns.	3

Product changes between 2018 and 2024

Deleted: Deltaphar (deltamethrin) no longer registered or available, Attack (permethrin + Pirimiphos methyl) no longer used.

Crop: Carrot and Parsnip

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Alpha-cypermethrin										
Bestseller, (Alpha-cypermethrin 100g/L)	Carrot rust fly on parsnip	Tractor with boom sprayer, 4000L tank, 400L/ha.	Feb to April, mid growth	2 – 3 As determined by pest pressure	10 - 14	200ml/ha	400L/ha	50 cm	Droplet size 200-400 µm	14
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Carrot rust fly/ Aphids on parsnip & carrot	Tractor with boom sprayer, 4000L tank, 400L/ha.	Feb to April, mid growth	2 – 3 As determined by pest pressure	10 - 14	40ml/ha	400L/ha	50 cm	Droplet size 200-400 µm	14

Product changes between 2018 and 2024

No product changes

Crop: Kiwifruit

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Bifenthrin										
Assail (Bifenthrin 100g/L)	Scale – sucking insect, attaches itself to the plant by its mouth. Passion Vine Hopper / Cicada affecting plant through sooty mould growing on honey dew it excretes	Foliar, varied equipment depending on orchard size can range from hand application to larger motorised sprayers.	Dormancy, pre-flower	Max 2	n/a applied at different growth stages	Dormancy: concentrate sprays: 600 ml/ha dilute sprays: 40ml/100L water (min. 600 ml/ha) Pre-flower: concentrate sprays: 500 ml/ha dilute sprays: 20ml/100 L (min. 500 ml/ha)	Dependant on canopy coverage - typically 700-1,000L/ha	n/a	*	n/a applied pre-flower
Venom (Bifenthrin 100g/L)	Scale, Passion Vine Hopper, Cicada	Foliar, varied equipment depending on orchard size can range from hand application to larger motorised sprayers.	Pre-flower	Max 2	Up to approx. 90 days depending on timing of orchard flowering. From late dormancy to pre flower, growers have no benefit / need to apply closer together	20 – 40ml/100L water (min 500-600mL/ha) Airblast: 1L in 600 - 1,000L water /ha	Dependant on canopy coverage - typically 700-1,000L/ha	n/a	*	n/a applied pre-flower

* refer to Part 3. Spray deployment, Drift mitigation and Field Descriptions.

Product changes between 2018 and 2024

Deleted: Talstar (bifenthrin), no longer used.

Added: Assail (bifenthrin)

Crop: Kumara

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Alpha-cypermethrin										
Bestseller, (Alpha-cypermethrin 100g/L)	Caterpillars	Boom foliar high volume 02 turbo drop nozzles. Fine / medium droplet size. 760mm spray height, 380mm air induction nozzle spacing over crop height of 15cm	Mid-season 60 days after planting to harvest	2 – 3 As determined by pest pressure, which is generally greater in lighter soils	14	250ml/ha	250L	760mm spray height. Crop height is 15 cm	Fine/ medium droplet size. 200 - 300 microns	14
Bifenthrin										
Talstar, Tal-ken, or Venom (Bifenthrin 100g/L)	Symphilid. All soil dwelling grubs overwintering in soil	Per plant incorporation in soil. Watered in using 2700L water cart on newly planted cuttings. Also boom foliar high volume 02 turbo drop nozzles. Fine / medium droplet size. 760mm spray height, 380mm air induction nozzle spacing over crop height of 15cm	Plant establishment in spring	1 As determined by pest pressure, which is generally greater in lighter soils	n/a	0.5 – 2 L/ha	500mL/ha	760mm spray height. Crop height is 15 cm	Fine/ medium droplet size. 200 - 300 microns	3
Cypermethrin										
Ripcord (Cypermethrin 200g/L)	Storage shed disinfestation between seasons – storage pests	knapsack sprayer	n/a	1	n/a	100ml	10L	n/a	n/a	n/a not applied to crop

Crop: Kumara (continued)

Deltamethrin										
Deltamax (Deltamethrin 25g/L)	Caterpillars, crickets, black beetle that attacks plants and/or tubers	Boom foliar high volume 02 turbo drop nozzles. Fine / medium droplet size. 760mm spray height, 380mm air induction nozzle spacing over crop height of 15cm	Established plants, at least a month prior to harvest, in Summer	1 – 3 As determined by pest pressure, which is generally greater in lighter soils	14	500ml/ha	200 - 250L/ha	760mm spray height. Crop height is 15 cm	Fine/ medium droplet size. 200 - 300 microns	14
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Cutworm and caterpillars	Boom foliar high volume 02 turbo drop nozzles. Fine / medium droplet size. 760mm spray height, 380mm air induction nozzle spacing over crop height of 15cm	1 - 4 weeks after planting if cut worm damage is sighted during crop scouting	1 As determined by pest pressure, which is generally greater in lighter soils	n/a	40ml/ha	300-400L/ha	760mm spray height. Crop height is 15 cm	Fine/ medium droplet size. 200 - 300 microns	14 - 21
Permethrin + Pyrethrins										
Permigas (Permethrin 4g/kg + Pyrethrins 1g/kg)	Tropical army caterpillar, Opogona worm, Fruit midge	Special applicator into shed into back of circulation fan which disperses gas throughout the storage shed or fumigation via handheld gun. Used by some growers	n/a – used Post harvest in long term storage sheds.	1 – 4 As determined by pest presence	7 – 80	2g/m3	n/a	n/a	n/a	7

Product changes between 2018 and 2024

Deleted: Deltaphar (deltamethrin) no longer available or registered
Added: Deltamax (deltamethrin)

Crop: Lettuce

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate (L/ha)	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Green looper, soybean looper, tomato fruitworm	Ground-based boom sprayer: some air-assisted boom. Air induction nozzles.	As required, generally in the last 2 weeks before crop harvest	0 - 1 applications per crop. Used as a resistance management tool in a final spray at high pest pressure when all other available modes of action have already been used.	n/a	40 ml/ha	310	0.5 -0.6 metres, depending on crop stage.	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	3

Product changes between 2018 and 2024

No product changes.

Crop: Onions

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Deltamethrin										
Proteus (Deltamethrin 20g/L + thiacloprid 150g/L)	Onion thrips	Ground-based boom sprayer. Air induction nozzles.	At bulbing stage for onion thrips	0 – 2 As determined by pest pressure	When thresholds exceed acceptable numbers	500ml/ha	400L/ha	50 cm	Droplet size 200-400 µm	14
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Cutworm, Onion thrips	Ground-based boom sprayer. Air induction nozzles	At immediate damage from cutworm, generally at true leaf stage. At bulbing stage for onion thrips	0 – 3 As determined by pest pressure	When thresholds exceed acceptable numbers	40ml/ha	500L/ha	50 cm	Droplet size 200-400 µm	14
Kaiso (Lambda-cyhalothrin 50g/kg)	Cutworm, Onion thrips	Ground-based boom sprayer. Air induction nozzles	At immediate damage from cutworm, generally at true leaf stage. At bulbing stage for onion thrips.	0-2 As determined by pest pressure	When thresholds exceed acceptable numbers	200g/ha	300L/ha	50 cm	Droplet size 200-400 µm	14

Product changes between 2018 and 2024

No product changes

Crop: Persimmon

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Permethrin + Pirimiphos Methyl										
Attack (Permethrin 25g/L + Pirimiphos Methyl 475g/L)	Leafroller, mealybug, caterpillars, scale, mites, thrips, green vegetable bug	Air blast spray – fine foliar, high volume. Sprayer generally used at 250 psi. Low fan speed	Summer and autumn / fruit bearing in later stages of fruit maturity	2 – 3 As determined by pest pressure	14 – 42 depending upon season	2L/ha	1,000 - 2,000L/ha	n/a	*	NZ – 7 Export – 52 - 56

* refer to Part 3. Spray deployment, Drift mitigation and Field Descriptions.

Product changes between 2018 and 2024

No product changes

Crop: Potatoes

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Bifenthrin										
Venom (Bifenthrin 100g/L)	Potato tuber moth (PTM) (Franklin region only)	High volume boom spray ground rig	Full canopy and Senescence Based on trapping results or programme approach	1 – 2 Dependent on pest pressure	7 - 10	500ml – 1L /ha	200 - 300L/ha	50cm	Droplet size 200-400 µm	14
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Seed and table potatoes – biting / sucking insects such as Tomato Potato Psyllid, PTM and aphids	Foliar boom spray, tractor mounted, standard nozzles 003, 2-bar pressure, ground rig	14 days after plant emergence, and Full canopy to senescence for table potatoes. Mid – end of crop. Spring / summer	1 – 10 including desiccation	7 - 10	Max label rate 100mls/ ha	200 - 500Lha	50cm	Droplet size 200-400 µm	14

Product changes between 2018 and 2024

Deleted: Cobalt Advanced (Lambda-cyahalothrin) no longer used and no longer registered, Proteus (deltamethrin) no longer used, Ballistic (deltamethrin) not used on potatoes.

Crop: Processed Vegetables (Tomatoes, Beans (new crop))

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Bifenthrin										
Talstar (Bifenthrin 100g/L)	Process Tomato Alternative to Kaiso/Karate if required for aphids	Low volume Boom spray	Throughout the growing season	2 As determined by pest pressure	7 – 14	250 – 500ml/ha	250 – 500L	50 cm	Droplet size 200-400 µm	3
Deltamethrin										
Deltamax (Deltamethrin 25 g/L)	Beans – looper caterpillar (on-label)	Ground based boom sprayer. Usually applied in combination with fungicide	At first signs of damage and throughout growing season	Minimum of 3 applications, as determined by pest pressure.	As determined by pest presence	400 ml/ha	500-600 L (400ml/100L)	50 cm	Droplet size 200-400 µm	3
Ballistic (Deltamethrin 27.5 g/L)	Beans – looper caterpillar (on-label)	Ground based boom sprayer. Usually applied in combination with fungicide	At first signs of damage and throughout growing season	Minimum of 3 applications, as determined by pest pressure. Usually applied in combination with fungicide	As determined by pest presence	360 ml/ha	500-600 L (36 ml/100L)	50 cm	Droplet size 200-400 µm	3

Crop: Processed Vegetables (Tomatoes, Beans (new crop)) (continued)

Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Beans – Cutworm, looper caterpillar	Low volume Boom spray Usually applied in combination with fungicide	At emerging seedling stage and throughout growing season	Minimum of 3 applications, as determined by pest pressure.	As determined by pest presence	40ml/ha	250 – 500L	50 cm	Droplet size 200-400 µm	Seedlings only
Karate Zeon or Cyhella (Lambda-cyhalothrin 250g/L) Kaiso 50WG (Lambda-cyhalothrin 50g/L)	Process Tomato Tomato Potato Psyllid	Low volume Boom spray	Throughout the growing season	2 – 5 As determined by pest pressure	7 – 14	25g active / ha	250 – 500L	50 cm	Droplet size 200-400 µm	3

Product changes between 2018 and 2024 – processed beans are a new crop
Deleted: Deltaphar (deltamethrin) no longer available or registered
Added: Deltamax (deltamethrin)

Crop: Salad leaf and Baby spinach (new crop)

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Lambda-cyhalothrin										
Karate Zeon (Lambda-cyhalothrin 250g/L)	Leaf miner	Ground-based boom sprayer: some air-assisted boom. Air induction nozzles.	As required, generally in the last 2 weeks before crop harvest	0 - 1 applications per crop. Used as a resistance management tool in a final spray at high pest pressure when all other available modes of action have already been used.	n/a	40 ml/ha	300	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	7

Crop: Squash, Pumpkin and other outdoor cucurbits

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Bifenthrin										
Venom (Bifenthrin 100g/L)	Pumpkin – spring tails, aphid and thrips	Ground based boom sprayer	1-2 true leaves. Around 14 days after direct sowing	1 As determined by pest pressure	n/a	200 – 400ml/ha	250 – 400L/ha	0.5 metres	Coarse droplet size 300-400 microns	Not applied after flowering
Lambda-cyhalothrin										
Karate Zeon, Cyhella, Halex CS, Lavron (lambda-cyhalothrin 250g/L)	Squash and Pumpkin (and other outdoor cucurbits, watermelons, courgettes) - cutworm	Ground-based boom sprayer*: some air-assisted boom. Air induction nozzles.	Applied at or soon after crop emergence in response to pest presence or damage seen in early stages of crop.	0 – 1. Only applied to those crops at high risk or with actual damage. One application is usually sufficient.	n/a	40 ml/ha	300L/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	Cotyledon stage / seedling use only

* Label claim for aerial application but this is seldom used. Would only be necessary where the ground is too wet to get machinery onto and aerial application is the only option.

Product changes between 2018 and 2024

Deleted: Kaiso (lambda cyahalothrin), Attack (Permthrin/Pirimiphos-methyl)
Added: Cyhella, Halex CS, Layron (lambda-cyhalothrin)

Crop: Sweetcorn

Trade name of product and active ingredient (g/L)	Pests controlled	Application method	Growth stage & season	Number of applications	Interval between applications (days)	Product rate	Water rate	Boom height	Spray droplet size (microns)	PHI / WHP (days)
Alpha-cypermethrin										
Bestseller 100 EC, Cypher, Ken-Tac 100 (alpha-cypermethrin 100g/L)	Greasy cutworm	Ground-based boom sprayer *: some air-assisted boom. Air induction nozzles.	Applied either with pre-emergence herbicides (known high pest risk) or at VE to V3 growth stages (in response to pest presence).	0 – 1. Only applied to those crops at high risk or with actual damage. One application is usually sufficient.	n/a	150-200ml/ha	300 L/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	7, seedling use only
Cutter Safe (acetochlor 840 g/L + alpha-cypermethrin 6 g/L)	Greasy cutworm	Ground-based boom sprayer: some air-assisted boom. Air induction nozzles.	Pre-emergence in known high pest risk situations	0 – 1. Only applied to those crops with known high risk.	n/a	2.5-3.0 L/ha	300 litres/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	Crop pre-emergence use only
Lambda-cyhalothrin										
Karate Zeon, Cyhella, Halex CS, Lavron, Taekwando 250 CS (lambda-cyhalothrin 250g/L)	Greasy cutworm	Ground-based boom sprayer*: some air-assisted boom. Air induction nozzles.	Applied either with pre-emergence herbicides (known high pest risk) or at VE to V3 growth stages (in response to pest presence).	0 – 1. Only applied to those crops at high risk or with actual damage. One application is usually sufficient.	n/a	40 ml/ha	300L/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	Seedling use only

Crop: Sweetcorn (continued)

Kaiso 50 WG (lambda-cyhalothrin 50g/L)	Greasy cutworm	Ground-based boom sprayer:* some air-assisted boom. Air induction nozzles.	Applied either with pre-emergence herbicides (known high pest risk) or at VE to V3 growth stages (in response to pest presence).	0 – 1. Only applied to those crops at high risk or with actual damage. One application is usually sufficient.	n/a	200 g/ha	300 L/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	seedling use only
Deltamethrin										
Ballistic (deltamethrin 27.5 g/L)	Greasy cutworm	Ground-based boom sprayer: some air-assisted boom. Air induction nozzles.	Applied either with pre-emergence herbicides (known high pest risk) or at VE to V3 growth stages (in response to pest presence).	0 – 1. Only applied to those crops at high risk or with actual damage. One application is usually sufficient.	n/a	450 ml/ha	300 L/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	7, seedling use only
Deltamax (deltamethrin 25 g/L)	Greasy cutworm	Ground-based boom sprayer: some air-assisted boom. Air induction nozzles.	Applied either with pre-emergence herbicides (known high pest risk) or at VE to V3 growth stages (in response to pest presence).	0 – 1. Only applied to those crops at high risk or with actual damage. One application is usually sufficient.	n/a	500 ml/ha	300 L/ha	0.5 metres	Mainly using AIC 11004 spray tips at 3 bar operating pressure, producing a coarse droplet size of 300-400 microns	7, seedling use only

* Kaiso 50WG has a label claim for aerial application but this is seldom used. Aerial use would only be necessary where the ground is too wet to get machinery onto and becomes the only option.

Product changes between 2018 and 2024

Deleted: AlphaScud, Dominex, Sheriff (alpha- cypermethrin) all no longer available or registered, Ripcord (cypermethrin)
Added: Bestseller 100 EC, Cypher, Ken-Tac 100, Cutter Safe (alpha-cypermethrin); Cyhella, Halex CS, Lavron, Taekwando 250 CS, Kaiso (lambda-cyhalothrin); Ballistic, Deltamax (deltamethrin).

Karate Zeon is the only product still in use from 2018.

Part 2. Commentary on Critical Uses

There has been a reduction in overall use of SPs since the EPA Call for Information in 2018. Generally, one application of SP is used per planting, and this one application is based on when the pest pressure is high. This is the most important application and is a critical use for knockdown of the most important and damaging pests.

SPs are mainly used on many crops for the control of greasy cutworm. SPs have good efficacy for cutworm. SPs are used for specific control of leafroller, mealybug, and scale (avocado, persimmon); diamondback moth (brassica); carrot rust fly (carrots and parsnips); scale, passion vine hopper and cicada (kiwifruit); crickets, black beetle and storage pests (kumara); mites (persimmon); leaf miner (salad leaf and baby spinach); potato tuber moth (potatoes); tomato potato psyllid (potatoes, tomatoes); and onion thrips (onions). SPs also control for thrips, aphids, and caterpillars.

For some crops, SPs are used at seedling stage only (e.g., brassica, processed vegetables, squash and pumpkin, sweetcorn), mainly to control cutworm which if not treated can result in the loss of an entire planting. For other crops (e.g., brassica, lettuce, salad leaf and baby spinach), SPs are applied near harvest to reduce the risk of resistance to other modes of action.

Bifenthrin has critical uses in a biosecurity response. Bifenthrin is used for knockdown of BMSB, and is specified in the Fruit fly standard for organism management in a fruit fly response.

The following table describes the critical uses of SPs for each crop in this submission.

Crop	Details of critical use
Avocado	SPs used on fruit bearing trees to control leafrollers, mealybug, and greedy scale when pest pressure is high, generally during September to May.
Brassica	Diamondback moth is the main trigger for insecticide use. It has a short generation time and overseas has rapidly developed resistance to multiple modes of action. In the field at peak pest pressure (Jan-Feb harvest), lambda-cyhalothrin is used as a final application before harvest to reduce the risk of resistance for other modes of action. SPs are used only once per crop planting on a few plantings each year. With the removal of organophosphates, SPs have now moved into the "break group" role formerly occupied by organophosphates in the NZ industry diamondback moth resistance strategy.[3]

[3] Walker, G.P., Davis, S.I., MacDonald, F.H., Herman, T.J.B. (2012). Update on diamondback moth (*Plutella xylostella*) insecticide resistance and the vegetable brassica insecticide management strategy. New Zealand Plant Protection 65: 114-119. https://www.nzpps.org/_journal/index.php/nzpp/article/download/5397/5225&hl=en&sa=X&ei=PtEhZuHtEJSr6rQP2cCl-Ao&scisig=AFWwaeZ9_PCihvzRSVrScHMS7TBU&oi=scholarr

Crop	Details of critical use
	In the seedling nursery, SP use is only occasional. A single application of lambda-cyhalothrin is the best control measure for greasy cutworm which is a sporadic pest of brassica seedlings. This is an occasional, not wide-dispersive use. In some years, there are no SP applications in a year-round nursery operation, use is very dependent on pest pressure. The loss of SPs would risk increased resistance and lower efficacy.
Carrot and Parsnip	There are no other alternatives to SPs for the control of carrot rust fly. Flight occurs every 4-5 years and there is a very narrow window for control. SP use is determined by pest pressure. Traps are put in place to monitor for carrot rust fly. Organophosphates were previously used but these are being removed. There are also no other alternatives for the control of greasy cutworm which attacks young crops, emerging seedlings and transplants, which can occur when there is only a light covering of soil. If young crops are not treated, the whole crop can be lost to cutworm. Treatment occurs at the 1-2 leaf stage (after direct drill) and used when required during key periods. SP usage depends on region and other hosts that may be present.
Kiwifruit	No new information from the 2019 submission. Recent Plant and Food Research work reiterates the benefit of bifenthrin on passion vine hopper eggs, though critical uses remain the same at pre-flowering for control of scale, passion vine hopper and cicada.
Kumara	Alpha-cypermethrin, bifenthrin, deltamethrin and lambda-cyhalothrin are all required for kumara growing depending on the pest problem in the crop during a season. The SP used is determined by the pest problem at the time and the most suitable SP is usually chosen. Deltamethrin is used for the control of crickets, alpha-cypermethrin or bifenthrin for caterpillars, and lambda-cyhalothrin for cutworm. The selection and use of any one SP will also control for the other pests. A grower is unlikely to use all four SPs in one season.
Lettuce	In the field, crop is grown year-round with multiple plantings per month. SP product is used once per crop planting on a few plantings each year at the time of peak pest pressure (Apr-May). Other modes of action are available and are used in a rotation to control for caterpillar species. However, populations can build over successive generations through the warm months. In warmer years, at the time of peak pest pressure (Apr-May harvest), all other mode of action options have been used on a single planting with lambda-cyhalothrin used as a final application before harvest to reduce the risk of resistance for other modes of action. In particular, tomato fruitworm is a direct pest of lettuce and can rapidly cause a high level of damage due to high autumn populations and their habit of tunnelling directly through multiple layers of leaves into the heart of the lettuce head. A timely application of SP can knock down these populations close to

Crop	Details of critical use
	harvest before the larvae begin tunnelling. Loss of SPs would risk increased resistance and lower efficacy.
Onions	Cutworm has emerged as a major pest of onions. There are no other alternatives for its control as it attacks young crops and emerging seedlings, which can occur when there is only a light covering of soil. If young crops are not treated, the whole crop can be lost to cutworm. Treatment occurs at the 1-2 leaf stage (after direct drill) and used when required. SP usage depends on region and other hosts that may be present. SPs are also used to control onion thrips in some onion-growing regions.
Persimmon	SP is the only product that can be used for mealybug during the mid-Jan to late Feb period, when it is most difficult to control. Other products are not needed during this period as SPs also controls for thrips and leafroller. The use of an SP follows on from two December applications of spirotetramat (for thrips), which is only marginally effective against mealybug on persimmons.
Potatoes	SPs are being used less and less in the potato industry for insect control as better more targeted (and beneficial friendly) products are available and there is increasing resistance developing, particularly in potato tuber moth. Karate (lambda-cyhalothrin) is no longer recommended for potato tuber moth control (due to resistance) or tomato potato psyllid control (due to subsequent pest flair ups) and its impacts on beneficial insects. However, SPs still form part of the control programme for some growers. On the occasions where SPs are being used, they are frequently the final spray application before crop termination/maturity. SPs are not critical for use in the potato industry.
Processed Vegetables (Beans, Tomatoes)	Cutworm and looper caterpillar are an issue for processed beans. Cutworm attacks emerging seedlings and once the pods have formed, these are attacked by looper caterpillars. Lambda-cyhalothrin (e.g., Karate) is used to control for cutworm and a range of lambda-cyhalothrin and deltamethrin products are used to control for looper caterpillar. Overseas market requirements for processed products are stringent and specify minimal damage. To achieve this, SPs are applied as soon as there are any signs of looper caterpillar activity. The control of cutworm is determined by pest pressure. Bifenthrin and lambda-cyhalothrin are needed to control tomato potato psyllid throughout the growing season, although its use is determined by pest pressure.
Salad Leaf and Baby Spinach	Alternative modes of action are used (all off-label) for management of leaf miner in these crops but loss of this use of SPs would be at the risk of increased resistance and lower efficacy. There are other modes of action (IRAC groups 4C, 5 and UN) available that are used in a rotation to control for leaf miner. However, at the time of peak pest pressure (typically Dec-Jan), all of these other options may have already been used and lambda-cyhalothrin is used as a final application before

Crop	Details of critical use
	harvest to reduce resistance risk for other modes of action. SP is used to manage resistance and provide knockdown prior to harvest at times of high pest pressure. In the field, crop is grown year-round with multiple plantings per month. SP product is used once per crop planting on a few plantings each year at the time of peak pest pressure (Dec-Jan).
Squash, Pumpkin and other Cucurbits	SPs are the only on-label products available for use against greasy cutworm on squash and pumpkin. As they are used in a single application at early crop establishment, the absence of alternatives is not a concern from a resistance management perspective. The only other active ingredient with known activity against greasy cutworm and with label claims for greasy cutworm on these crops is from a less desirable mode of action: organophosphate (chlorpyrifos). Chlorpyrifos is not permitted to be used on squash exported to several key export markets (Japan, Korea, EU, and China) as outlined by the NZ Buttercup Squash Council export spray programme. Greasy cutworm can usually be managed in squash and pumpkins by a stale seedbed fallow before sowing. However, where weather delays pre-plant cultivation, it is not always feasible to meet seasonal planting programmes and SPs are the only on-label products available. A single application of an SP product is used as required during the early stages of the crop based on pest activity (cutworm), and on only a portion of total plantings. SPs do not cause leaf distortion when used at expanded cotyledon stage and the first leaf is appearing. In addition, SPs also control for thrips, aphids and cutworm when present on the same crop, with use dependent on pest pressure.
Sweetcorn	The three SP-only alternatives (alpha-cypermethrin, lambda-cyhalothrin, deltamethrin) need to be retained to provide some price competition. Likewise, the acetochlor + alpha-cypermethrin alternative for high-risk situations is often cheaper than purchasing them as individual components. SPs are preferred over alternative sprays which have less desirable modes of action: organophosphates (maldison, chlorpyrifos) and carbamates (methomyl). The other alternative is neonicotinoid (clothianidin) seed treatment which is logistically compromised (i.e. it requires prior knowledge of the problem area to be planted or all seed is treated regardless). SP-only products (alpha-cypermethrin, lambda-cyhalothrin, deltamethrin) are applied in response to pest presence/damage during susceptible crop growth stages (VE to V3). Acetochlor + alpha-cypermethrin product is applied at crop pre-emergence only in high-risk situations (e.g., following a short ex-pasture fallow where weather has delayed pre-plant cultivation) obviating the need for one machinery pass. SP is used once per crop on only a portion of total plantings, and only used on some plantings each season.

Crop	Details of critical use
Other – Silverbeet, Beetroot	No new information from the 2019 submission. The same critical uses remain. For silverbeet SPs are used for the control of tomato fruitworm, green looper, soyabean looper pre-harvest. Beetroot relies on SPs to control chewing insects when plants have germinated.

Part 3. Spray Deployment, Drift Mitigation and Field Descriptions

Different application methods are used to apply insecticide sprays to tree crops, and to ground crops. Air-blast sprayers are generally used for tree crops because of the height and canopy volume whereas for ground crops (vegetables), ground-based boom sprayers are used with air induction nozzles. The air induction creates larger droplet sizes and reduces drift potential.

The EPA requested information on the boom heights and spray droplet sizes that were used to apply SP-containing products. The information in following table is used to describe and categorise the droplet sizes.

Description of droplet size

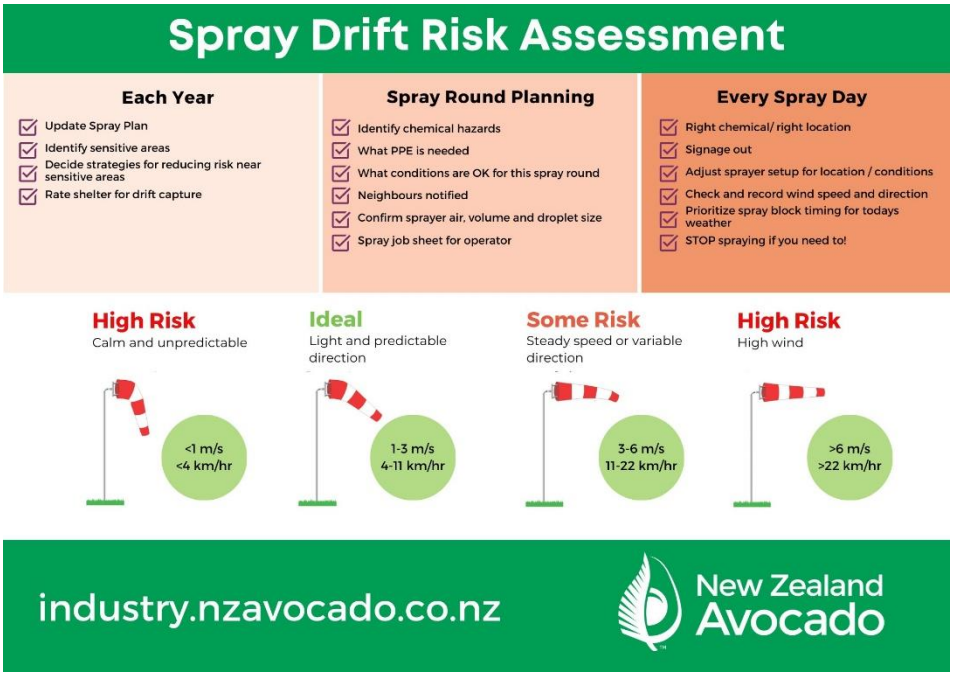
Droplet size category	Droplet size (microns)
Very fine	< 145 microns
Fine	145 – 225 microns
Medium	226 – 325 microns
Coarse	326 – 400 microns
Very coarse	401 – 500 microns

Source: https://pesticidestewardship.org/pesticide-drift/understanding-droplet-size/

The EPA has also requested information on how sprays are deployed in-field or on-orchard and the approaches taken to mitigate spray drift risk to aquatic environments.

The following table provides information for each crop on these aspects.

Crop	Details of spray deployment, drift mitigation and typical field description
Avocado	**Spray height**: Avocado trees are of variable heights and spacings. The tree size of the industry is being reduced with a greater focus on smaller trees to facilitate better tree heath, productivity and pest and disease management. **Droplet size**: Typically spray units are fitted with Masotti gun nozzles and traditional disc and core nozzles and used for relatively high-volume spray applications. Spray quality data for these nozzles is not available from the manufacturers but the nozzles produce a range of fine to course droplets. The proportion of output spray volume from typical avocado spray nozzles in the very fine, fine or smaller droplet size fractions, that are likely to drift, is typically expected to be less than 5-10% of the total applied volume. The potentially driftable portion of a typical avocado spray plume is relatively low compared with nozzles used in other fruit crops. (Information provided by Dr David Manktelow). **Spray deployment**: All spray activity has to meet the requirements of the Regional Air Plans and the risk hazard assessment undertaken as per the spray plan in terms of drift and managing sensitive areas including waterways,

Crop	Details of spray deployment, drift mitigation and typical field description
	paying attention to wind conditions including speed and direction, and managed accordingly. **Typical field description**: Two outstanding features of avocados are: • The use of both natural and artificial shelter that provide significant improvement to conditions for spraying and off target losses. • All avocado growers are required to develop documented Spray Plans to identify sensitive areas including waterways and include a continuous risk assessment leading up to and during any spray activity. **Other comments**: NZAvocado is exploring the use of low drift high target activity to tree tops using drone spraying technology as part of developments to achieve greater on target deposit of agrichemicals to further improve efficacy and reduce drift. NZAvocado provides growers with resources to assist with Spray Drift Risk Assessment (see figure). 
Brassica	**Spray height**: In the field, ground-based boom sprayers are used, some are air-assisted booms. Air induction nozzles are used. The height of the boom is set at 0.5 – 0.75 metres depending on crop height. In the nursery, a nursery boom sprayer is used for applications to seedlings. **Droplet size**: AIC 11004 spray tips at 3 bar operating pressure are mainly used, producing a coarse droplet size of 300-400 microns in the field, and 200-300 microns in the nursery. **Spray deployment**: Air induction spray tips are used to give effective coverage at larger droplet size and lower pressures. Some field sprayer units are air-assisted. Spraying is programmed for low wind conditions whenever

Crop	Details of spray deployment, drift mitigation and typical field description
	possible. Handheld anemometers and on-farm meteorological stations are used to ensure no spraying occurs at windspeeds above 20 km/hr. **Typical field description**: The minimum distance of the crop from a permanent waterway is typically 5 metres, often up to 10 metres allowing for headland and vegetated buffers. Typically, an adjacent waterway will be a drain which will typically have intermittent flow. Non-cropped areas are usually 5-10 metres from drains, and there is generally a greater distance to natural waterways. Non-cropped areas typically have riparian planting and/or a grass strip for natural waterways. For drains on flatter land, there is a vegetated grass strip of 1-5 metres plus a headland of 5+ metres. On sloping land, there is often no vegetated strip, but an uncropped headland of 5-10 metres to a drain or sediment trap. Crop rows generally run towards a waterway, i.e. are perpendicular to the waterway. The topography and paddock shape, typically determines the orientation of the rows. Row orientation is not typically alternated (controlled traffic farming to reduce compaction) in the short term.
Carrot and Parsnip	**Spray height**: Application is by boom sprayer set at a typical height of 50 cm, using air induction nozzles. Air induction nozzles create aerated droplets to reduce drift and provide better coverage on a leaf, compared to a solid droplet. **Droplet size**: Droplet size ranges 200-400 µm. **Spray deployment**: Air induction nozzles are used to mitigate drift. Adjuvants such as oils and surfactants, are added to spray mixtures and improve spray performance, e.g., DriftStop. Growers use handheld anemometers, and other weather tools to determine optimal conditions for spraying. **Typical field description**: Fields typically have drains for run-off. There is typically a 5-10 metre buffer area. Crop planting would occur away from any flowing waterways, and not close to waterways. If water flow of the waterway is constant, then the waterway would be fenced off. Field topography generally determines row orientation. Rows are typically perpendicular to the drain/waterway.
Kiwifruit	**Spray details:** Zespri provides guidance to growers regarding sprayer set-up and spray application and evaluation of new spray technologies. The details of this advice are described in several documents: Gaskin et al. (2016) Novel technologies to deliver protectant sprays to strung canopies. https://kvh.org.nz/assets/projects/103507_2021-10-26-224947_outl.pdf 37p. KVH (2011) Sprayer nozzling guide. https://kvh.org.nz/vdb/document/896 9p. **Other comments:** All Zespri growers must adhere to the Zespri Crop Protection Standard (CPS) when considering an application of any agrichemical or input on their orchard (This standard is available on request from Zespri). Kiwifruit Vine Health (KVH) provides its growers with a guide on nozzle options for a range of sprayer and canopy configurations, and

Crop	Details of spray deployment, drift mitigation and typical field description
	application volumes. https://kvh.org.nz/vdb/document/896 Zespri also provides growers with resources related to spray plans and good practice.
Kumara	**Spray height**: A variety of boom sprayers are used by growers. Air induction nozzles are used to create large, aerated droplets, and dramatically reduces drift. Typically spray height is 760 mm with nozzle spacing at 380mm. Kumara crop height is approximately 15 cm. **Droplet size**: Droplet size is fine/medium, 200-300 microns. **Spray deployment**: Air induction nozzles are used to mitigate drift. DuWett surfactant is added to the spray mixture to improve the spreading of the spray on the crop. The speed of application varies but is approx. 8 to14km/hr, in minimal wind. **Typical field description**: There is generally a drain on one side of the field, sometimes 2 depending on the layout. In summer, the drains are dry, with negligible water flow. Field sizes are variable. Distances to the drain/waterway can be one metre which is uncropped, with rows parallel to the drain. There can be a 6 metre headland at the row ends. Rows can be in the same direction in a block, in other blocks the rows are in a mixture of directions.
Lettuce	**Spray height**: In the field, ground-based boom sprayers are used, some air-assisted booms. Air induction nozzles are used. The boom is set at 0.5 – 0.6 metres depending on crop height. **Droplet size**: AIC 11004 spray tips at 3 bar operating pressure are mainly used, producing a coarse droplet size of 300-400 microns. **Spray deployment**: Air induction spray tips are used, chosen to give effective coverage at larger droplet size and lower pressures. Some field sprayer units are air-assisted. Spraying is programmed for low wind conditions whenever possible. Handheld anemometers and on-farm meteorological stations used to ensure no spraying in windspeeds above 20 km/hr. **Typical field description**: The minimum distance from a permanent waterway is typically 5 metres, often up to 10 metres allowing for headland and vegetated buffers. Typically, an adjacent waterway will be a drain which will typically have intermittent flow. Non-cropped areas are typically 5-10 metres from drains, and there is generally a greater distance to natural waterways. Non-cropped areas typically have riparian planting and/or a grass strip for natural waterways. For drains on flatter land, there is a vegetated grass strip 1-5 metres plus a headland of 5+ metres. On sloping land, there is often no vegetated strip, but an uncropped headland of 5-10 metres to a drain or sediment trap. Crop rows generally run towards a waterway, i.e. perpendicular to the waterway. The topography and paddock shape, typically determines the orientation of the rows. Row orientation typically not alternated (controlled traffic farming to reduce compaction) in the short term.
Onions	**Spray height**: Application is by boom sprayer set at a typical height of 50cm, using air induction nozzles. Air induction nozzles create aerated droplets to

Crop	Details of spray deployment, drift mitigation and typical field description
	reduce drift and provide better coverage on a leaf, compared to a solid droplet. **Droplet size**: Droplet size ranges 200-400 µm. **Spray deployment**: Air induction nozzles are used to mitigate drift. Adjuvants such as oils and surfactants, are added to spray mixtures and improve spray performance, e.g., DriftStop. Growers use handheld anemometers, and other weather tools to determine optimal conditions for spraying. **Typical field description**: Fields typically have drains for run-off. There is typically a 5-10 metre buffer area. Crop planting would occur away from any flowing waterways, and not close to waterways. If water flow of the waterway is constant, then the waterway would be fenced off. Field topography generally determines row orientation. Rows are typically perpendicular to the drain/waterway.
Persimmon	**Spray height**: Air-blast sprayers are typically used for persimmons. Low fan speed is typically used. The sprayer is used at 250 psi with a water rate ranging from 1,000 to 1,800 litres per hectare. **Spray deployment**: Spraying is normally carried out at wind speeds less than 10 kph. **Typical field description**: Orchards are typically surrounded by tall shelter trees which keep the spray contained to the orchard. There are typically very few waterways in a persimmon orchard.
Potatoes	**Spray height**: A tractor-mounted high volume boom sprayer ground rig set at 50cm is used for spraying on potatoes. Standard nozzles 003 are used at 2-bar pressure. **Droplet size**: Droplet size ranges 200-400 µm. **Spray deployment**: Air induction nozzles are used to mitigate drift. **Typical field description**: Fields typically have drains for run-off. There is typically a 5-10 metre buffer area. Crop planting would occur away from any flowing waterways, and not close to waterways. If water flow of the waterway is constant, then the waterway would be fenced off. Field topography generally determines row orientation. Rows are typically perpendicular to the drain/waterway.
Processed Vegetables (Beans, Tomato)	**Spray height**: Application is by boom sprayer set at a typical height of 50cm, using air induction nozzles. Air induction nozzles create aerated droplets to reduce drift and provide better coverage on a leaf, compared to a solid droplet. **Droplet size**: Droplet size ranges 200-400 microns **Spray deployment**: Air induction nozzles are used to mitigate drift. Adjuvants such as oils and surfactants, are added to spray mixtures and improve spray performance, e.g., DriftStop. Growers use handheld anemometers, and other weather tools to determine optimal conditions for spraying.

Crop	Details of spray deployment, drift mitigation and typical field description
	Typical field description: Fields typically have drains for run-off. There is typically a 5-10 metre buffer area. Crop planting would occur away from any flowing waterways, and not close to waterways. If water flow of the waterway is constant, then the waterway would be fenced off. Field topography generally determines row orientation. Rows are typically perpendicular to the drain/waterway.
Salad Leaf and Baby Spinach	**Spray height**: In the field, ground-based boom sprayers are used, some are air-assisted booms. Air induction nozzles are used. Boom height is set at 0.5 metres depending on crop height. **Droplet size**: AIC 11004 spray tips at 3 bar operating pressure are mainly used, producing a coarse droplet size of 300-400 microns. **Spray deployment**: Air induction spray tips are used, chosen to give effective coverage at larger droplet size and lower pressures. Some field sprayer units are air-assisted. Spraying is programmed for low wind conditions whenever possible. Handheld anemometers and on-farm meteorological stations are used to ensure no spraying in windspeeds above 20 km/hr. **Typical field description**: The minimum distance from a permanent waterway is typically 5 metres, often up to 10 metres allowing for headland and vegetated buffers. An adjacent waterway will be a drain which typically has an intermittent flow. Non-cropped areas are 5-10 metres from drains, generally the distance is greater for natural waterways. Non-cropped areas have riparian planting and/or a grass strip for natural waterways. For drains on flatter land, there is a vegetated grass strip of 1-5 metres plus a headland of 5+ metres. On sloping land, there is often no vegetated strip, but an uncropped headland of 5-10 metres to a drain or sediment trap. Crop rows generally run towards a waterway. The topography and paddock shape, typically determines the orientation of the rows. Row orientation typically not alternated (controlled traffic farming to reduce compaction) in the short term.
Squash, Pumpkin and other Cucurbits	**Spray height**: In the field, ground-based boom sprayers are used, some are air-assisted booms. Air induction nozzles are used. The height of the boom is set at 0.5 metres depending on crop height. **Droplet size**: AIC 11004 spray tips at 3 bar operating pressure are mainly used, producing a coarse droplet size of 300-400 microns. **Spray deployment**: Air induction spray tips are used to give effective coverage at larger droplet size and lower pressures. Some field sprayer units are air-assisted. Spraying is programmed for low wind conditions whenever possible. Handheld anemometers and on-farm meteorological stations are used to ensure no spraying at windspeeds above 20 km/hr. Some growers add Driftex (canola oil and surfactants) adjuvant into the spray mixture. **Typical field description**: The minimum distance of the crop from a permanent waterway is typically 5 metres, often up to 10 metres allowing for headland and vegetated buffers. Typically, an adjacent waterway will be a drain which will have intermittent flow. Non-cropped areas are 5-10 metres from drains, and there is generally a greater distance to natural waterways.

Crop	Details of spray deployment, drift mitigation and typical field description
	Non-cropped areas typically have riparian planting and/or a grass strip to the natural waterways. For drains on flatter land, there is a vegetated grass strip of 1-5 metres plus a headland of 5+ metres. On sloping land, there is often no vegetated strip, but an uncropped headland of 5-10 metres to a drain or sediment trap. Crop rows generally run towards a waterway, i.e. perpendicular to the waterway. The topography and paddock shape, typically determines the orientation of the rows. Row orientation is not typically alternated (controlled traffic farming to reduce compaction) in the short term.
Sweetcorn	**Spray height**: In the field, ground-based boom sprayers are used, some are air-assisted booms. Air induction nozzles are used. The height of the boom is set at 0.5 metres depending on crop height. **Droplet size**: AIC 11004 spray tips at 3 bar operating pressure are mainly used, producing a coarse droplet size of 300-400 microns. **Spray deployment**: Air induction spray tips are used to give effective coverage at larger droplet size and lower pressures. Some field sprayer units are air-assisted. Spraying is programmed for low wind conditions whenever possible. Handheld anemometers and on-farm meteorological stations are used to ensure no spraying at windspeeds above 20 km/hr. **Typical field description**: The minimum distance of the crop from a permanent waterway is typically 5 metres, often up to 10 metres allowing for headland and vegetated buffers. Pest damage to crops is generally higher at crop margins due to slower crop development (due to soil compaction) and higher pest presence (due to proximity to alternative hosts, and refugia). An adjacent waterway will be a drain which will typically have intermittent flow. Non-cropped areas are 5-10 metres from drains, and there is generally a greater distance for natural waterways. Non-cropped areas have riparian planting and/or a grass strip for natural waterways. For drains on flatter land, there is a vegetated grass strip of 1-5 metres plus a headland 5+ metres. On sloping land, there is often no vegetated strip, but an uncropped headland of 5-10 metres to a drain or sediment trap. Crop rows generally run towards a waterway, i.e., perpendicular to the waterway. The topography and paddock shape, typically determines the orientation of the rows. Row orientation is typically not alternated (controlled traffic farming to reduce compaction) in the short term.

Part 4. Review of Hazard Classification and Aquatic Risk Modelling

HortNZ contracted Tonkin + Taylor (TT) to review the ecotoxicology modelling used by the EPA for the Synthetic Pyrethroid Reassessment Review of the Hazard Classification and Aquatic Risk Modelling.

This section is a summary of the review and the key issues are highlighted. The review report by Tonkin + Taylor is in Appendix 1.

The EPA used existing and new toxicity and ecotoxicity studies to assess the hazard classification for six SPs. As a result of the assessment, the EPA subsequently updated the hazard classification for these six SPs: alpha-cypermethrin, bifenthrin, cypermethrin, deltamethrin, lambda-cyhalothrin, and permethrin.

Generally, the changes in the hazard classification are minor, with only a few increases, and the proposed exposure thresholds are comparable to those used by other regulators and do not pose significant impact on usage.

The EPA assessment on the impact of these SPs in different applications on ground water concluded that this is considered negligible, and the result of the run-off modelling for the SPs are generally considered acceptable. For the two SPs, alpha-cypermethrin and permethrin, no buffer would be required, while risk from bifenthrin, cypermethrin, deltamethrin and lambda-cyhalothrin could be managed by buffer zones, even when conversative values were used for the modelling.

Two key issues have been identified.

Key issues identified

1) **The EPA applied an overly conservative position and values in their modelling, leading to unrealistic outcomes and unmanageable risk.**
2) **The EPA uses dated and unsuitable risk assessment modelling for toxicity and impact determination where modern assessment tools can provide a more realistic output.**

Key issue 1. The EPA applied an overly conservative starting position and values in their modelling, leading to unrealistic outcomes and unmanageable risk.

The EPA determined the acceptable concentration of the SPs in any waterbodies through aquatic toxicity endpoints and therefore the outcomes of the risk modelling for aquatic risk.

All SPs exhibit high toxicity to aquatic invertebrates, both in acute and chronic exposure scenarios. The EPA applied a standard safety factor to the most severe toxicity outcomes for each aquatic species grouping to derive an acceptable concentration of the SP in

waterways. This represents an overly conservative approach with maximal possible exposure levels and simultaneously disregard of any values and scenarios that would influence those values. In response to the EPA's data request for geomean or species sensitivity distribution approaches, it emerged that the EU's geomean approach – factoring in all relevant toxicity studies for each taxonomic grouping – could reduce conservatism in toxicity endpoints. It was also noted that the EPA's toxicity outcomes for alpha-cypermethrin diverge from recent values published by the Australia New Zealand Guidelines for Fresh & Marine Water Quality (ANZG), a joint government initiative to establish a management framework for the protection of water quality, therefore creating potential conflict and confusion in water quality management.

The EPA's risk assessment methodology follows a tier-based approach (Tier I to Tier III) which should refine risk models from a conservative to a more realistic basis by incorporating additional data (on-farm application details, good agricultural practices, etc.) in later tiers reflecting real-life situations. However, the high conservatism applied by the EPA, starting with the initial screening in Tier I, led to problematic outcomes in this refinement process and resulting in higher levels of conservatism in subsequent Tiers. The applied level of conservatism in the Tier II model for spray drift risk assessment, using the starting assumption of 100% spray drift exposure to receiving waterbodies, and therefore maximum toxicity exposure, presents an unrealistic scenario resulting in assessed SP water concentrations above their stated solubility and unmanageable buffer zones at Tier II to just meet Tier I estimates.

The difficulty in interpreting the EPA's risk assessment outcome is compounded by some errors being reported, the inaccessibility of the modelling approach parameters, and inconsistencies in the SP reassessment models to the EPA's agreed risk assessment methodology.

Key issue 2. The EPA uses dated and unsuitable risk assessment modelling for toxicity and impact determination where modern assessment tools can provide a more realistic output.

A key conclusion of the review is the need for updated and more realistic risk assessment modelling.

Despite acknowledging in a recent briefing to the incoming minister (BIM) that their existing modelling tools are outdated and limited, the EPA continues to use tools like GENEEC2, which are no longer technically supported and are difficult for external parties to validate the outcomes. Also, GENEEC2 does not fully address a number of organisms and environmental scenarios that are specific for Aotearoa with limited realistic data in the New Zealand context.

Alternative tools such as the European Union's (EU) FOCUS model could offer more reliable risk assessments. Tonkin + Taylor proposes that remodelling the impact of SPs using the FOCUS model could result in more realistic evaluations, feasible buffer zones, and more permissible use patterns for many of the reassessed SPs. For example, using a more realistic base assumption of 2.8% edge of field drift for vegetable crops, as used in

the EU, unmanageable risks of previously unacceptable use scenarios could be mitigated with manageable buffer zones.

For the Tier II assessment, the assessment of spray drift, a drift factor is calculated and compared to spray drift deposition curves. The EPA uses the drift model program AgDrift adapted with Australian deposition curves, a method critiqued to become unreliable with distance and potentially the overproduction of deposition values in far fields (>50m). Further, the base assumption of 100% exposure of spray drift to receiving waterbodies represents an unrealistic scenario and does not consider any on-farm practices (including GAP), natural dilution or degradation of substances or vegetation zones that would prevent such an extreme. These calculations predict unobtainable minimum buffer zones and therefore conclude that the predicted risks of all SPs cannot be mitigated with buffer zones or other means. Based on these outcomes, the EPA has not conducted further impact assessments.

Tonkin + Taylor provided a conceptual approach for modernising agricultural chemical spray drift assessment and management for more realistic and feasible outcome in Appendix 2.

The HSNO (Hazardous Substances Assessments) Amendment Act 2022 (Amendment Act) enables the EPA to utilize and rely more on data and assessments from international regulators, while still considering the New Zealand context. Therefore, the EPA could utilize and rely on data and assessments from international regulators, while still considering the New Zealand context.

Addressing the conservatism of the EPA's modelling parameters is likely to provide a large impact on the acceptability of the assessed use patterns. Acceptance of the EU FOCUS model by the EPA would allow many of the uses of the SPs to be managed for aquatic species risk with manageable buffer zones.

The EPA should not rely on outdated and unsuitable modelling software leading to the withdrawal of a whole class of active ingredients, from an ever-shrinking toolbox for crop protection without access and approval to new efficacious alternative chemistry, leading to critical impacts to the food-producing industries. The EPA needs to consider the impact to the crop growing sector, peoples lives and livelihoods, and the socio-cultural impact that the loss of agricultural and horticultural crops would have to all of New Zealand.

This submission as well as previous submissions on this matter provide detailed information on critical use of substances containing SPs as active ingredients for the use agricultural applications and the overall horticulture industry. This submission further details the sustainable and cautious use of those substances in good agricultural practices as widely applied by the horticulture industry. While government and industry collaboratively explore alternative options and practices through specific programmes, such as the Sustainable Food and Fibre Futures (SFFF) project 'A Lighter Touch', our growers rely on those few efficacious crop protection tools to grow crops, contribute to New Zealand's GDP through trade and ultimately provide food for all New Zealanders.

Appendix 1

Tonkin + Taylor Ltd. EPA Synthetic Pyrethroid Reassessment – Review of the Hazard Classification and Aquatic Risk Modelling. For Horticulture New Zealand Incorporated. 29 January 2024. Job No: 1093242.000

Appendix 2

Tonkin + Taylor Ltd. Concept for modernising agricultural chemical spray drift assessment and management. For Horticulture New Zealand Incorporated. 4th March 2024. Job No: 1093505.0000