Date: 9 December 2024

Subject: Information for Hearing 9 Panel

From: Sarah Cameron, Senior Policy Advisor, Horticulture NZ

Following on from HorticultureNZ attendance at Hearing 9 on Wednesday 4 December, the following information has been requested to assist council and the panel in regard to decision making for Hearing 9:

- Artificial and natural shelter shading and production
- Impact of coloured cloth on artificial crop protection structures and production
- Assessment of financial impact on setbacks of lost production
- Shelter and spray drift

While artificial shelter is used on many crops, the information provided relies on research undertaken by Zespri and by Horticulture NZ for kiwifruit orchards.

Artificial shelter was introduced into the kiwifruit industry as a mitigation to environmental factors, particularly wind as kiwifruit vines do not tolerate wind well as it leads to increased physical damage and blowouts of shoots which means young plants and spring canopies are slower to establish.

In an established orchard, reduction in wind speed will raise orchard productivity through improved growth and reduced fruit loss from defects such as wind rub[1]. Gold and red varieties are more sensitive to this than green. Blow outs and physical damage on canes can also be entry points for Psa infection.

As well as reducing wind speeds, good shelter will increase the temperature in the orchard. Cooler temperatures can cause decreased growth and smaller leaves in young plants. Warmer temperatures in the orchard during flowering can also encourage bee activity and

[1] Wind rub on kiwifruit is a type of damage that occurs when the fruit rubs against other fruit, stems, or foliage due to high winds

promote normal flower and fruit development. During summer when vines typically require more water, reducing wind speeds reduces evapotranspiration, decreasing how much water the vines require in windier seasons.

Natural shelter from tree shelterbelts is used extensively in New Zealand. Shelterbelts are relatively low cost but take considerable time to establish and can shade orchards. Internal shelter tends to be deciduous which increases risk of wind damage. Natural shelter comes with regular maintenance costs, including trimming, mulching and spraying for pests. It also takes up productive land area.

Artificial shelter (when used with white cloth on vertical and horizontal surfaces) doesn't shade orchards and maximises productive land area. Artificial overhead shelter covers kiwifruit vines with hail netting on horizontal and wind break cloth on the vertical surfaces.

Artificial and natural shelter shading and production

A 2008 Zespri report[2] found that natural shelter takes up valuable orchard space and the shading they cause reduces the productivity of adjacent rows of fruiting vines (McAneney et al. 1990).

In addition, Zespri provided the following information:

> Vertical shelter belts in kiwifruit cultivation have both benefits and drawbacks. One of the benefits is that they provide a three-dimensional division of the orchard space and overlay the edges of blocks and property boundaries. This can help protect the vines from wind damage, which is a common problem in kiwifruit orchards.
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> The use of standing shelters along the orchard perimeters is a common practice among growers, however, there are also drawbacks to implementing vertical shelter belts. One drawback is that they can reduce the amount of light reaching the vines by up to 50%, resulting in poor yields on shelter-row vines. The reduction in light penetration can vary depending on the width and length of the block, with a block 3 shelter-heights wide and 6 shelter-heights long having about 70% light penetration. Additionally, there is heavy shading along the northern sides of blocks on clear days, and narrower blocks experience even smaller light penetration to the kiwifruit vines.

Artificial shelter with while cloth on vertical surfaces typically transmits 70-90% of sunlight depending on the net's density and material. White netting is preferable, as it ensures even light distribution, minimises extreme shading and offers greater control over light exposure.

[2] Protected Cropping to ReduceZESPRI™GOLD Blemish

Impact of coloured cloth on ACPS and Production

A preliminary observational and non-replicated study[3] was undertaken to monitor late season fruit growth and development on 'Hort16A' (gold) vines grown under four different coloured netting materials at two orchards in the Latina region of Italy. White overhead netting is used by all 'Hort16A' growers in this region to protect their vines and fruit from hail damage.

Picture one: Coloured overhead hail netting at the New Gold (left) and Contarino 'Hort16A' orchards in Latina, Italy.

The study found that the use of blue nets appeared to delay commercial fruit harvests by up to 15 days and reduced average fruit dry matter by 1.9%. Yellow nets appeared to have no effect on fruit development over and above the use of white nets.

A study was also undertaken in New Zealand to test the shade factor from different coloured netting materials. The study showed that black netting significantly increased shading.

Table one: Shade factors of four netting materials at different times of the afternoon on two sunny days in comparison with overcast conditions, Riwaka.

[3] Protected Cropping to ReduceZESPRI™GOLD Blemish

Date	Time	% shade factor			
		bird	white	black	Red quad
31 Jan. 2008	13.57	9.3	11.2	19.2	19.2
	15.09	7.0	11.3	20.1	22.1
	16.09	7.8	11.3	21.3	21.7
5 Feb. 2008	13.49	7.5	12.7	21.2	19.6
	14.57	7.1	10.7	20.2	20.2
	15.51	7.7	10.9	23.8	21.8
	17.16	9.9	13.4	21.9	31.2
Overcast		10	14	26	24

Assessment of financial impact on setbacks of lost production

In the Waikato District Council proposed version of the district plan, artificial crop protection structures were included in the definition of building[4]. The plan proposed the following setbacks:

a. A non-habitable building located on a Record of Title less than 1.6ha must be set back a minimum of:
   I. 7.5m from the road boundary
   II. 17.5m from the centre line of an indicative road
   III. 12m from every boundary other than a road boundary
b. A non-habitable building located on a Record of Title 1.6ha or more must be set back a minimum of:
   I. 12m from the road boundary
   II. 22m from the centre line of an indicative road
   III. 12m from every boundary other than a road boundary.

HortNZ engaged the Agribusiness Group to undertake the economic cost of achieving the proposed setbacks on kiwifruit growers.

The report found that:

- A considerable proportion of the area of horticultural properties would be unable to have crop protection structures erected on them - with the proportion varying between 15% and 46% depending on the size and the shape of the individual property
- The annual net orchard returns that would be foregone ranged from approximately$ 60k to $208k
- The inability to plant kiwifruit in the area required for a setback will lower the value of a SunGold kiwifruit orchard by between $676k and $2.4m

[4] Artificial crop protection structures have been excluded from the definition of building and the only setback applies is 5m adjacent to a residential dwelling

Cost of proposed setbacks to growers

Shelter and Spray Drift

The hearing statement from Vision Kerikeri, Carbon Neutral Trust and Kapiro Conservation Trust provides information on artificial shelter and spray drift. Discharges to air is not a district plan matter and the planning framework for such activities is set out in regional air plans which generally include:

- Drift beyond the boundary is limited and that no adverse events arise
- Applicators have appropriate training and hold a current Growsafe certificate or equivalent
- Application should be undertaken in accordance with NZS8409
- Product must be disposed of correctly through an appropriate means such as Agrecovery and not dumped
- Meet notification requirements to occupiers of nearby properties
- Compliance with signage requirements when spraying
- Some councils require that growers have an annual spray risk management plan and identify sensitive areas.
- Some council air plans require growers to follow label requirements.

HortNZ believes that the consideration of spray drift and artificial shelter falls outside the panel's consideration. However, for the panel's review, the following information has been provided.

Northland Regional Air Plan

Vision Kerikeri, Carbon Neutral Trust and Kapiro Conservation evidence states that the Northland Regional Plan requires larger buffer zones where there is a lack of effective shelter. Effective shelter is defined in the regional plan[5] however a note has been included to the definition which states: **Artificial shelter may also be useful in reducing spray drift (for example overhead hail netting for kiwifruit and apples)**

Artificial shelter and spray drift

[5] https://www.nrc.govt.nz/media/2yojfgax/proposed-regional-plan-february-2024.pdf page 14

Natural and artificial shelter structures reduce spray drift in two ways:

1. By reducing wind speeds which allows spray droplets to fall out of the air closer to their mission point
2. By physically collecting and retaining spray droplets.

The spray droplet collection efficiency of single layers of artificial shelter cloth has been assessed in modelling, wind tunnel and field studies (e.g. Guiseppe *et al.* 2012 and Mercer 2009).

Work conducted for Zespri[6] to assess the effects of artificial shelter on spray drift found consistent and significant reductions could be achieved from artificial shelter cloth.

Table one: Drift reductions achieved by shelter in research trials

Shelter type/quality	**Drift reduction achieved**
Single layer artificial (50% closed)	40-60%
Double layer artificial (50% closed)	80-90%
Single layer artificial (80% closed)	80-90%
Natural shelter	80-90%

In a recent report[7] (Zespri funded work on the potential effects of different types and deployment of artificial shelter wind break as a drift reduction tool that can be integrated into spraying risk assessments and responses) a number of conclusions were noted:

- In some situations, artificial shelter is a more appropriate wind and spray drift management control than natural shelters and, provided artificial shelter structures can achieve high enough levels of drift reduction, they should be recognised as a drift reduction technology that can be incorporated into spraying risk assessments and management responses.
- Artificial shelter can be used during live shelter establishment and to fill gaps in live shelter.
- Likewise, artificial shelter structures may be more appropriate and safer under powerlines and/or on boundaries where live shelter may have adverse effects on neighbours (through shading, competition, or inaccessibility for maintenance of live shelter).

It is important to note that artificial shelter was utilised in the kiwifruit industry to primarily to protect crops from adverse weather and not as a spray drift mitigation. Nearly all kiwifruit

[6] A practical spray drift risk assessment process and risk reduction toolbox for spray applicators November 2022

7 Preliminary findings – Spray drift interception by artificial shelter cloth

orchards in New Zealand have natural shelter and the industry is currently mandating all growers to have either natural or artificial shelter.

Shelter mandate

The shelter requirements have been developed with spray expert Dr David Manktelow and include definitions of sensitive areas along with specifications for effective shelter, including both natural and artificial shelters. Growers have three years to show they are working towards compliance which concludes in 2025.

Growers are required to show in their Good Agricultural Practice[8] audits that they are establishing shelter where required. Orchards that do not have effective shelter will not be permitted to spray vines using a motorised sprayer, within 30 m of the boundary bordering the sensitive area. This has been a recommendation to kiwifruit growers for many years and will be a requirement from 2025 and new orchard developments will be required to have shelter.

8 Fact sheet about GAP certification in