TECHNICAL

THE LATEST INNOVATIONS AND IMPROVEMENTS

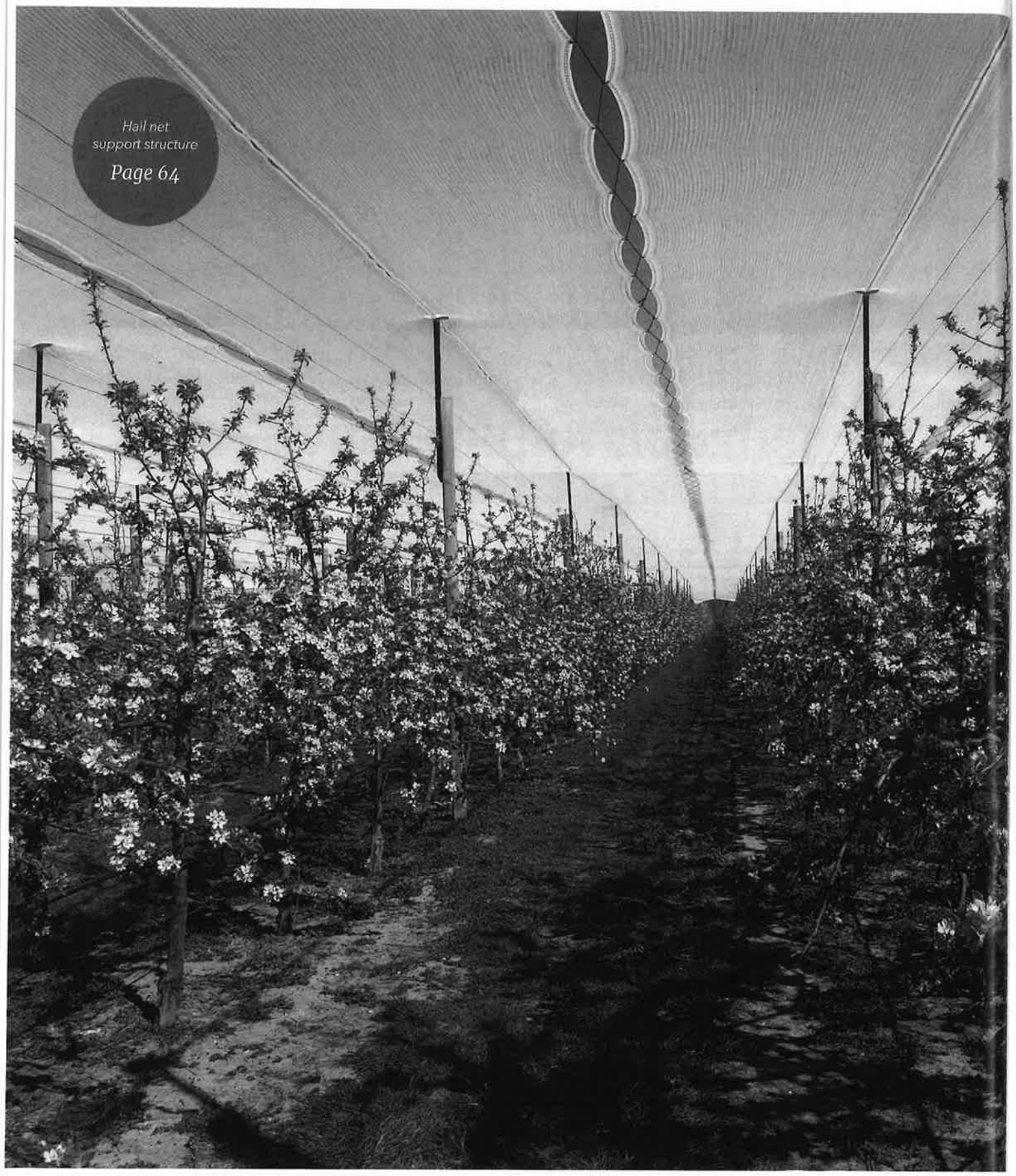


Figure 1: (above) Light hail in the early season can become very ugly by harvest. With warming climate it is likely that hail incidence will increase because higher temperatures mean more energy in the weather systems that drive storms. Hail nets will minimise this injury.

Climate Change Is Upon Us – Time to Future Proof Your Orchard

Over the last few years I have noticed a distinct shift in our climate towards a longer growing season, with warmer and drier summers.

By John Wilton : Deciduous Fruit Specialist, AgFirst

A few years back we usually experienced a significant frost event in the more sheltered parts of the Heretaunga Plains sometime in the first half of April. These days such frosts do not tend to turn up until into May.

Spring frosts, however, are not so kind to us in that damaging frosts continue to occur after bud break, so good frost protection is still necessary.

Hailstorms are also a continuing hazard to developing fruit crops, and most years there are damaging hailstorms somewhere across our fruitgrowing districts.

Warming climate means more energy driving the weather, so it is likely that adverse weather events may become more ferocious in the future.

In my younger days I recollect eastern areas of the North Island to be pretty windy, particularly over the spring and early summer period.

In the last few years there has been a lot less wind, particularly over the winter and summer. For instance, the prevailing south-westerlies that used to blow for many weeks on end in late winter and spring are no longer getting as far north as the Heretaunga Plains.

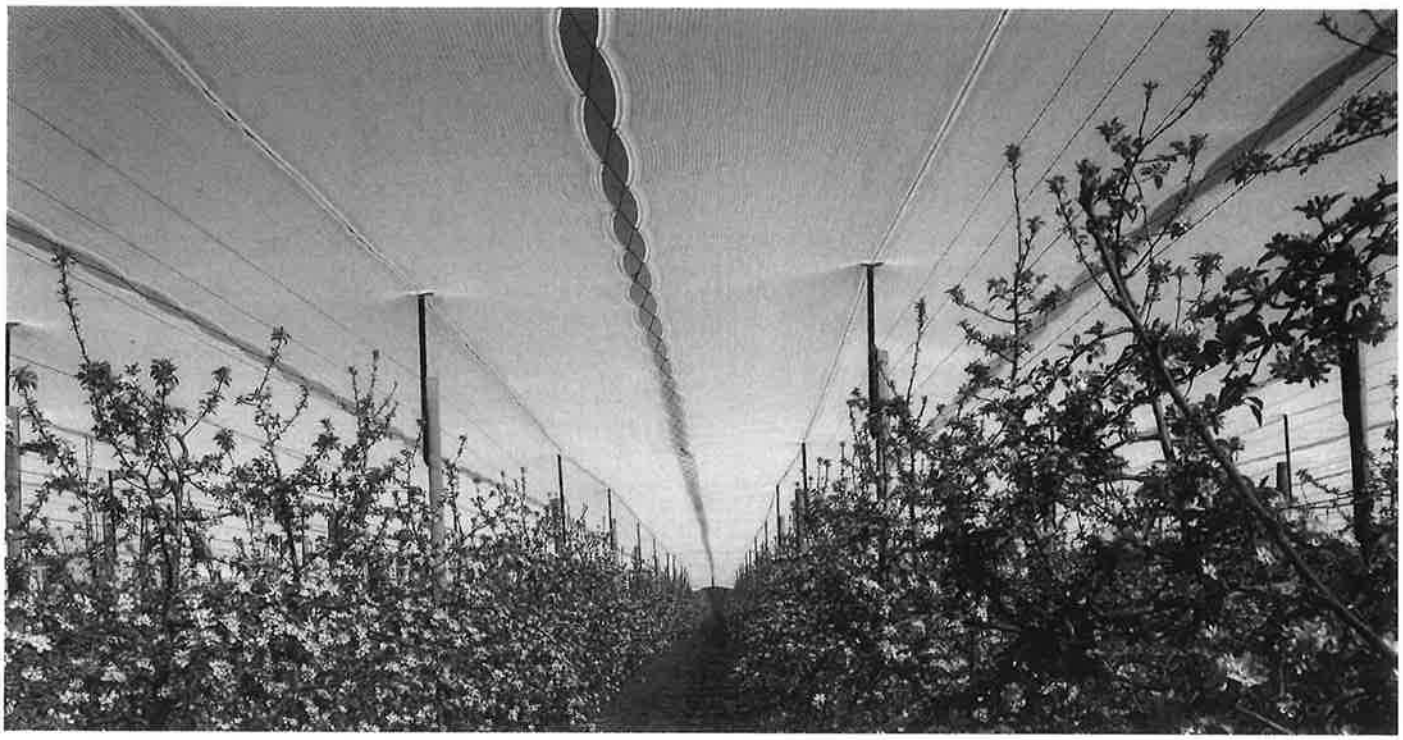


Figure 2: An example of a hail net support structure designed into the tree support structure. Additional costs of the hail net in this situation are estimated to be around $15,000/ha, and the whole tree support structure with its 4.2m posts plus hail net around $55,000/ha.

The lower eastern side of the North Island receives most of its rainfall out of the east and south-east. In the past a good easterly weather system would give three or four days of rain and such events could deliver 100mm of rain or more.

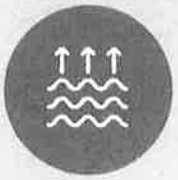
These days we still have the odd easterly weather system, but often we only get a few showers out of them rather than a consistent rain event.

Anecdotal evidence indicates the climate is sure changing.

Future Hazards

As far as I can see we face two main problems going into the future:

More droughts with higher summer temperatures



Rising sea levels

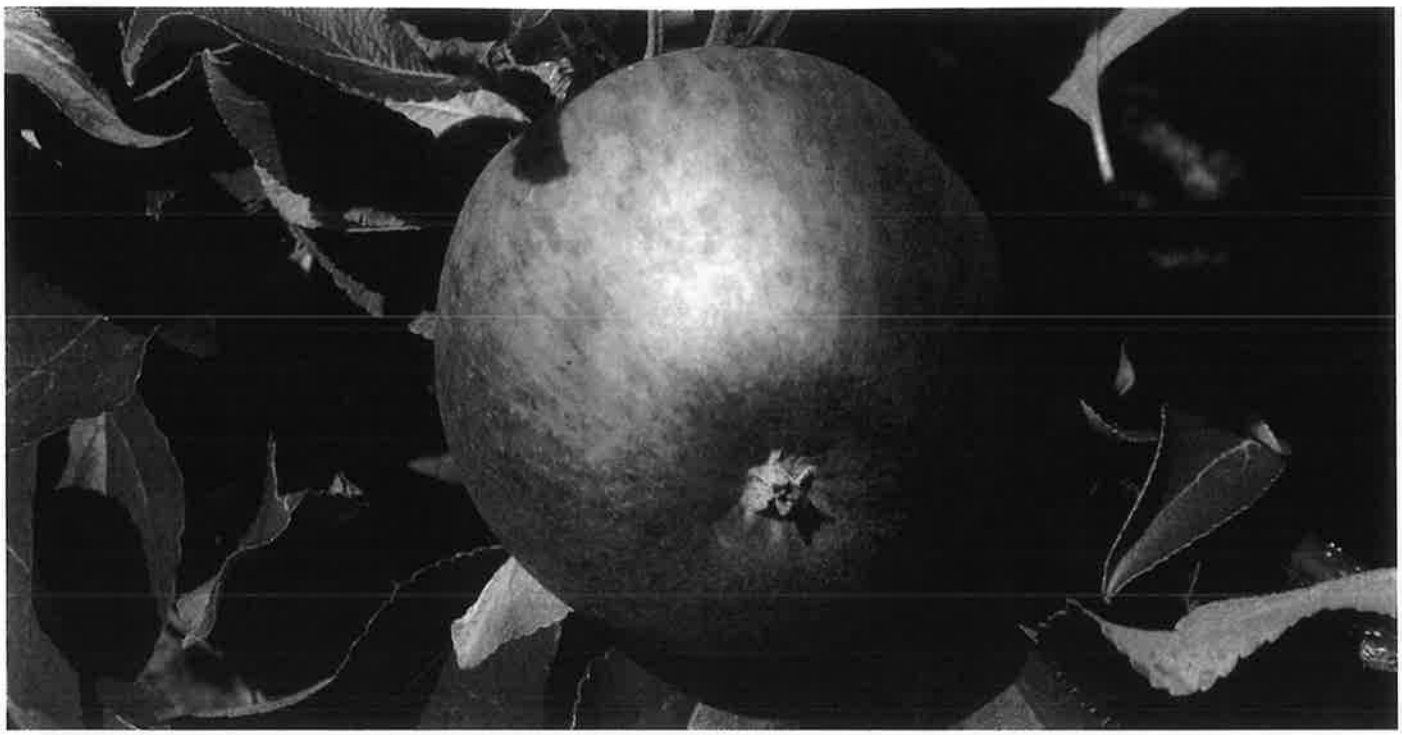


Figure 3: Beginnings of sunburn injury to Scilate apple without net protection. Note paling of the upper sky facing apple skin.

While these are the main problems, there will be numerous side effects resulting from them.

Other effects we can expect to see include:

- Marginal winter chilling to satisfy dormancy breaking requirements.
- Increasing levels of sunburn and heat injury to sensitive fruit crops.
- Reduced photosynthesis as a result of higher summer temperatures and water stress shutting the stomatas, preventing gas exchange. This will lead to smaller fruit size at given crop loads.
- Microclimate effects will alter and there will be a general shift in production to higher altitudes and further south for temperate crops.
- New higher value sub-tropical 'niche' crops are likely to extend southwards onto the more sheltered, milder parts of the Heretaunga Plains. E.g. Avocados and kiwifruit.

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Tackling the drought problems

Water storage

Winter water storage for summer release into our main river systems is the key to managing summer water supply problems.

This water storage needs to be located in the terrace and hill country between the Heretaunga Plains and the mountains where most of our rainfall occurs.

Water storage needs to be focussed on relatively non-productive land. The economics of building dams for water storage is very dependent on the topography of sites chosen. The most economic are narrow dam sites with a huge area for potential water storage behind them. We have many summer dry gullies in the terrace and hill country behind our high quality cropping and orchard land which are around 30m wide, perhaps 15 to 20m deep, and in the terrace country often stretch back a kilometre or more without gaining much in the way of elevation. Great sites for water storage.

Building water storage on valuable land in comparison to this approach is very expensive and will take up more productive land, in comparison to the area that would become productive with the benefit of summer irrigation supply on land that is left to use. Furthermore, storing water on high value sites is likely to bring with it other problems such as altering water tables and Occupational Safety and Health (OSH) issues.

Figure 4: This Scilate apple is in a similar position to the unprotected apple in figure 3, but is in the netted part of the block. Note the absence of any evidence of sunburn injury. Net trials have been shown.

Drainage

Experiences and lessons learned in the 2020 summer drought showed that on the better soils where trees were well established with deep root systems, many orchard blocks came through the dry well with little need for irrigation.

Our soil moisture monitoring indicated that while the top 50cm to 70cm of soil profile was dry, and had moisture levels below irrigation trigger points, there was still ample deep water for the roots to tap into, consequently these blocks showed little indication of stress.

There are also benefits for fruit quality in forcing trees to tap deep water. Nitrogen levels down there are low, so summer nitrogen uptake is less, leading to much better fruit colour development.

To maximise the ability of the soil to supply moisture during the summer, drainage systems need to be as deep as practicable, preferably 1.2m or more. Often drainage depth is limited by outflow. As sea levels rise this will become a greater problem. The answer to this problem will be to install sump pumps rather than drain directly into an open drain or stream outlet.

In recent years low voltage pumps that do not need an expensive 230-volt power supply have become available so there is no need for expensive mains supply.

Irrigation Management

Newly planted trees with confined root systems need relatively frequent watering because of their limited rooting zone, but once established, beginning in the second growing season irrigation frequency needs to be pulled back and length of run increased to encourage deeper water penetration and therefore deeper rooting. On good soils, even in the second growing season it may not be necessary to commence irrigation until well into summer.

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Even dwarfing rootstocks such as M9, which individually is quite drought tolerant, can be encouraged to develop deep and resilient root systems.

Light shallow soils, or sandy soils with restricted drainage tend to give the most water stress and drainage problems. Unless there is a good long-term guaranteed irrigation water supply, these soils are best avoided for fruit crops because they do not have the ability to supply adequate soil moisture to prevent water stress during prolonged dry periods.

Heat Stress and Sunburn

Incidence of these problems will increase as climate change progresses.

Areas near the coast in the sea breeze zone will be less affected than inland locations.

Hail net is the most effective tool for managing heat stress and sunburn as well as giving hailstorm cover.

Provided hail net has been considered prior to planting the orchard, the additional cost for hail net is not that great if the tree support structure has been designed to support the net as well.

Hail net will alter the orchard environment, so crop husbandry practices need to take into account the net effect on tree growth behaviour.

Netting has been found to change tree behaviour in the following ways:

- Tree vigour increases.
- Pollination can be more difficult.
- Harvest maturity is delayed a few days.
- Irrigation water requirement is about 30% lower.
- Chemical thinning sprays are more effective.
- Slower drying may lift disease pressure.

Husbandry practices need to be adjusted to counter these effects on tree behaviour, otherwise the impact of the net may be negative rather than positive.

Because tree vigour is increased, wider tree spacing may become necessary to accommodate this. Incidentally, this would be a good way of paying for the net without increasing the total cost of the orchard development.

Increased tree vigour can increase pit and blotch incidence.

'In row' pollinators are necessary to ensure uniform fruit set.

Netting is a useful way of spreading harvest.

Irrigation requirement is lowered so there is less pressure on limited summer water supplies.

Wind run under nets is 30 to 50% lower than an open orchard. This means less wind blemish to fruit, and enables more spraying time for netted orchards.

A well-managed orchard under net should show a positive return on the additional capital outlay without hail, due to the impact of the net on sunburn, other blemish and fruit quality issues.

For those growers operating in 'niche' market areas, continuity of supply to their customers is an important consideration, so a severe hailstorm can cause serious injury to their supply base.

Rising Sea Levels

This problem appears inevitable and unless well managed mitigation measures are developed and implemented, will likely rob us of our best soils.

There are solutions to the problem, as the Netherlands and other coastal European nations have shown us.

Fifty years ago I was in orchards six to seven metres below sea level in the new Polders in the Northern Netherlands. It can be done but will need very good long-term planning, lots of capital and the defeat of a few sacred cows in conservation land. ●