

Ground-cover plants could replace herbicides in orchards

Establishing perennial ground-cover species, as a management practice to suppress weeds in a pipfruit orchard's 'weed spray strip'.

Why: To test whether low-growing, perennial plants can be established as a ground cover in pipfruit orchards, as a replacement for a traditional 'weed spray strip'.

Where: On a mature 2D Breeze (Royal Gala strain) orchard in the Brightwater region of Nelson. The block is on M9 rootstock at an intensive planting of 2.5 m x 1.4 m.

Who: Aimee Lister and Craig Hornblow (AgFirst), Rob Holtham (Willisbrook Orchard), Anna Lambourne and Jake Tully (NZ Apples & Pears), and Rebecca Campbell (Plant & Food Research).

What:

- We can establish spring-sown perennial ground-cover species in a 2D apple orchard's weed spray strip. The ability of the species to 'cover ground' depended strongly on how well the species was sown and its individual growth habit.
- Sheep's burnett and plantain were the most successful, with the least weed species present at the end of the trial and good ground cover.
- The biggest hurdle was the ability to source specialised machinery for cultivating and sowing under/next to a canopy.

More:

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Low-growing perennial plants grew well beneath the canopy in a Nelson pipfruit orchard in a trial designed to test whether ground-cover species could help reduce spray use without adversely affecting fruit production or tree health.

Growing ground-cover plants under the canopy in pipfruit orchards as an alternative to spraying with herbicide is a practical option, according to a trial conducted in a Nelson orchard.

Seven low-growing perennial species were established in the weed spray strip to determine their ability to establish and thrive in this area of low light, with poor structured bare soil. Soil testing showed signs of long-term herbicide use: low organic matter, low soil biology, low abundance of favourable soil organisms, and a high abundance of weeds.

"In the pipfruit industry there's a big drive towards spray-free targets. Our small trial is tied in with that, but also it's trying to find a practical management practice that a grower can adopt or trial for themselves," says researcher Aimee Lister of AgFirst. "Rather than just cutting sprays out, we tried an alternative to see what happened."

Bird's foot trefoil, narrow-leaved plantain, common yarrow, chicory, alyssum, sheep's burnett and strawberry clover were sown in spring. All but one of those species (alyssum) established well, covering the ground to various degrees, and competing with or shading out weed species.

"It's all about choosing the species right for the situation, so if you needed to mow something to keep it lower, then you would choose something you know



Spring-sown row on the right, autumn-sown row on the left (pre-sowing). Image taken in April 2023

would bounce back. With chicory, for example, if you cut leaves off, it would probably die back, so you'd choose something else that could come away again," Lister says.

Three aspects to trial

The trial had three aims: to determine the practicality and efficacy of this as a management practice, to understand any effect these plants may have on tree health and crop quality, and to understand what effect these perennial cover species may have on soil health and biology.

The trial was established on a mature 2D Breeze (Royal Gala strain) orchard in the Brightwater region of Nelson. Funding was provided by Our Land and Water's Rural Professionals Fund.

To ensure good seed-to-soil contact at sowing, the soil was first cultivated. The trial aimed to cultivate close to the tree trunks and far enough into the inter-row space that the entire weed spray strip

would be covered without disturbing the permanent grass sward.

The trial included both spring and autumn sowing using a specialist piece of viticulture machinery and a row hucker that was rear-mounted on a tractor. Tilling to a depth of 8 cm during tree flowering, when the soil was warming up, was enough to establish a seed bed without damaging any tree roots that were close to the surface.

With no planting machinery available, each species was sown by hand at a heavier rate than would be standard practice to ensure good coverage (see Table 1).

"In a perfect world, you wouldn't be sowing the seed and covering it back up by hand obviously, it would be horrific. But if sowing ground-cover catches on, and those pieces of machinery are needed, somebody will make them," reckons Lister.

Irrigation in the form of sprinklers was set up for the spring sowing, in case of a dry season, but in this instance was only used twice during germination.

The autumn sowing was undertaken in a similar way to the spring sowing, except the trial plots weren't raked over. This resulted in less seed-to-soil contact, which is possibly why germination was much poorer than in spring.

Which species covered the ground best?

The spring-sown species all established well, although sheep's burnett was rated okay as opposed to good for the other plants. The trial team worked with Plant & Food Research and used a light meter placed on the orchard floor to understand the difference between each species' ability to cover the ground, and potentially reduce the level of light to the soil.

Measurements in February 2023 indicated that plantain was rated best at 70% light interception, sheep's burnett 65%, trefoil 60%, common yarrow 65% and chicory 70%. Alyssum grew well at first, but yellowed off in summer and rated only 20% for light interception.

Measurements were made again at the end of the trial. First equal were sheep's burnett and plantain, which had the least weed species present and covered the ground best, creating a low-growing ground floor 'canopy'. Sheep's burnett was assessed as having a better habit, staying closer to the ground rather than growing straight up as plantain did, potentially flowering in the pipfruit canopy.

Table 1: Spring sowing at the end of October with the soil warming up and rain forecast

Species	Sow rate	Seed weight
Plantain	10g/m ²	4,000 seeds/g
Sheep's burnett	16g/m ²	140 seeds/g
Bird's foot trefoil	14g/m ²	2,000 seeds/g
Common yarrow	14g/m ²	1,700 seeds/g
Chicory	10g/m ²	700 seeds/g
Strawberry clover	10g/m ²	330 seeds/g
Alyssum	14g/m ²	1,000 seeds/g

Chicory came second and covered the ground very well, but may have an issue over time as it will grow taller. Trefoil also covered the ground well, but its small leaves and wiry stems meant more light could get through its canopy. The researchers believe that this species may come away next spring and cover the ground better than.

Yarrow (with its very light seeds) was difficult to sow, but did cover the ground very well where the seed germinated well, its prostrate habit meaning it excluded most weeds. Where the seed was not so well spread, weeds persisted and grew through the trial species.

Clover suffered from rabbit damage with some being chewed off. The species did persist though, and where it formed a dense mat can suppress some weeds.

Alyssum germinated quickly and established well, but as the days became warmer and drier, the seedlings

yellowed and by the end of the trial few plants had survived.

“I was happily surprised by the results,” says Lister. “It was really pleasing having things work better than I expected. Depending on the species you choose, you could have a permanent crop under the trees, it’s just choosing the right species and monitoring them over time.”

A preliminary establishment guide is now being prepared for orchardists. “Hopefully that will be a really handy tool for growers,” says Lister. She hopes the orchardist who participated in the trial will keep the plots in place and that trials can also be undertaken at different sites and different pipfruit situations.

Tony Benny for the Our Land and Water National Science Challenge



Sheep's burnett



Plantain