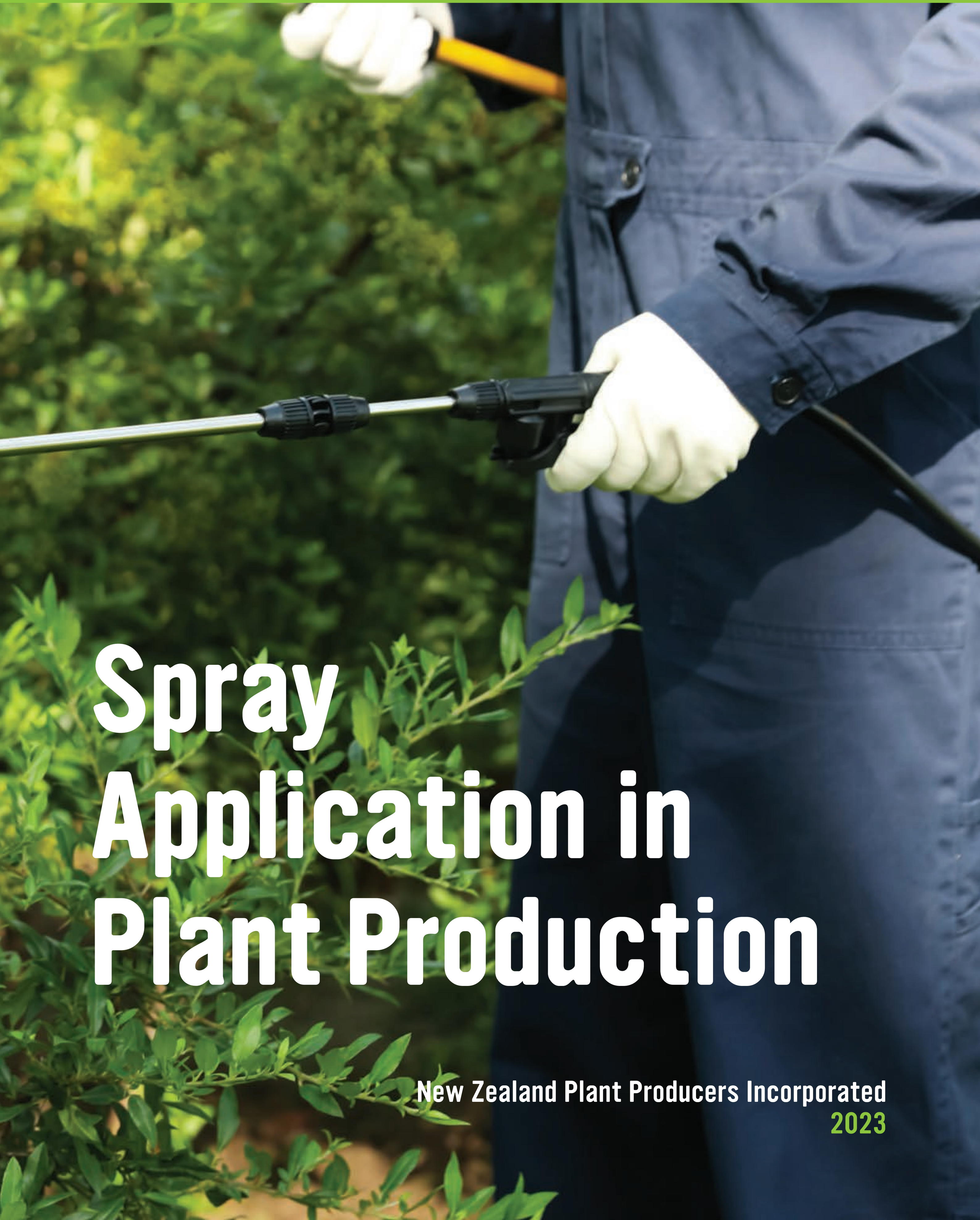
NZPPI Extension Resources



Spray Application in Plant Production

New Zealand Plant Producers Incorporated
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CONTENTS

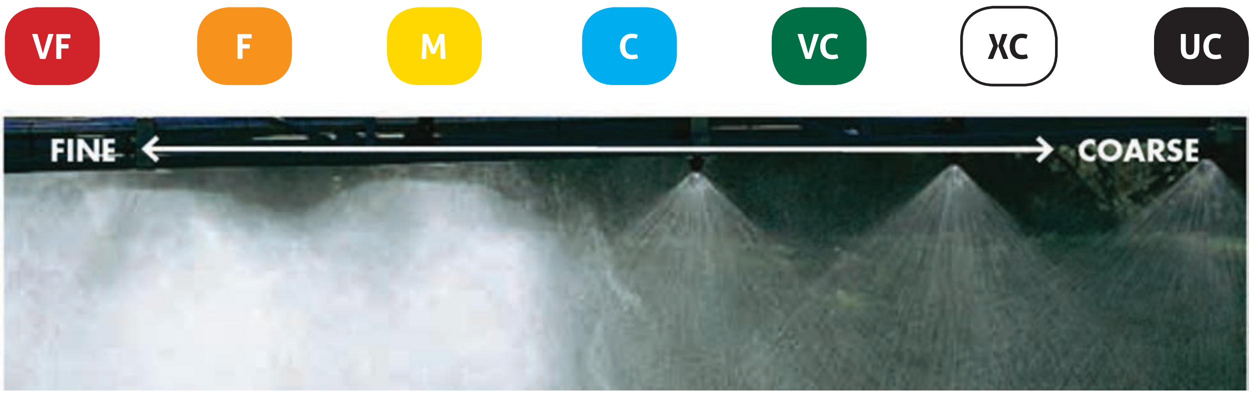
Background

Fungicides are used for disease control in NZ nurseries. The appearance of myrtle rust has lifted the focus in this space. Application technique is critical to successful disease control as thorough coverage of foliage, both upper and lower leaf surfaces, is required. This information sheet reports on some coverage testing from a NZ nursery, spray application options, the dose rate achieved and recommendations in relation to plants as spray targets.

Coverage testing

The pest and disease control programme in the trial nursery involved monthly spraying once daytime temperatures reached over 15C in about October through to about late April. A fungicide/insecticide mix was applied with a hand lance attached to a 50L tank and 12V 107psi pump. The nozzle used was a TeeJet adjustable spray tip. This provided adjustable spray from a solid stream to a hollow cone pattern. This was set manually to maximise spread and minimise small droplets. A solid stream was selected on occasion to reach distant plants.

Modifications were made to the end of the lance to accommodate a range of hydraulic nozzles operated between 2 and 5 bar. The range of conventional hydraulic nozzles used provided better control of droplet size. Hydraulic nozzles produce a range of droplet sizes which are described as "Spray Quality" in nozzle catalogues. As pressure increases, the proportion of fine droplets also increases so one nozzle can produce up to three different spray qualities. Spray quality ranges from Very Fine to Ultra Coarse.



(from Nufarm Spraywise Horticulture Application Handbook)


WATER SENSITIVE PAPERS

Smaller droplets improve coverage but are more prone to drift. Larger droplets have more momentum, reduced evaporative losses but require more volume for similar coverage.

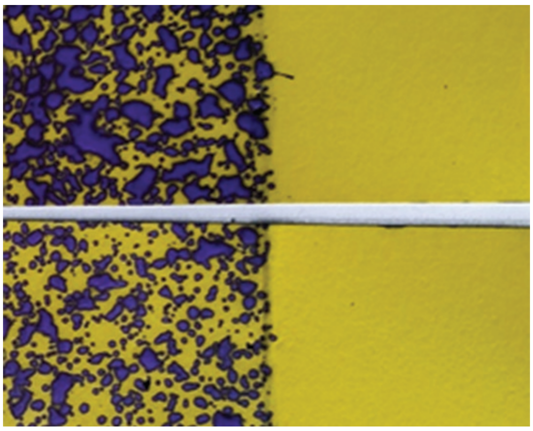
Coverage was assessed using water sensitive paper (WSP). The application of liquid to WSP turns the yellow paper to blue. Targets were set up among pohutukawa (*Metrosideros excelsa*) plants as shown below to check coverage on vertical (facing and away) and horizontal (top and bottom) surfaces, and at two heights (75mm and 125mm above soil surface).

Nozzles tested included Flat Fan, TwinJet, Hollow Cone and Full Cone at between 2 and 5 bar pressure.

Results

Typically, the top surface of the WSP was well covered. However, none of the nozzles or range of spray qualities tested achieved coverage on the bottom surface of the WSP targets. A typical result is shown below.

TOP BOTTOM

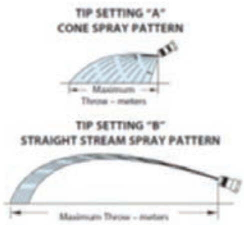
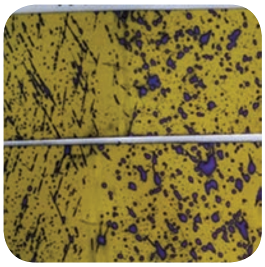
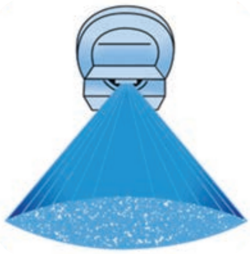
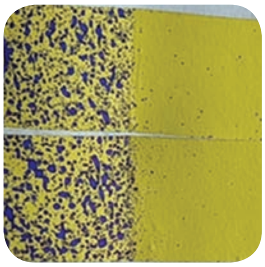
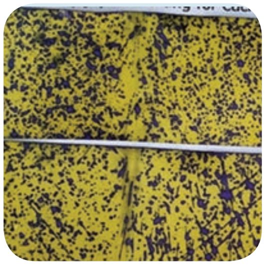


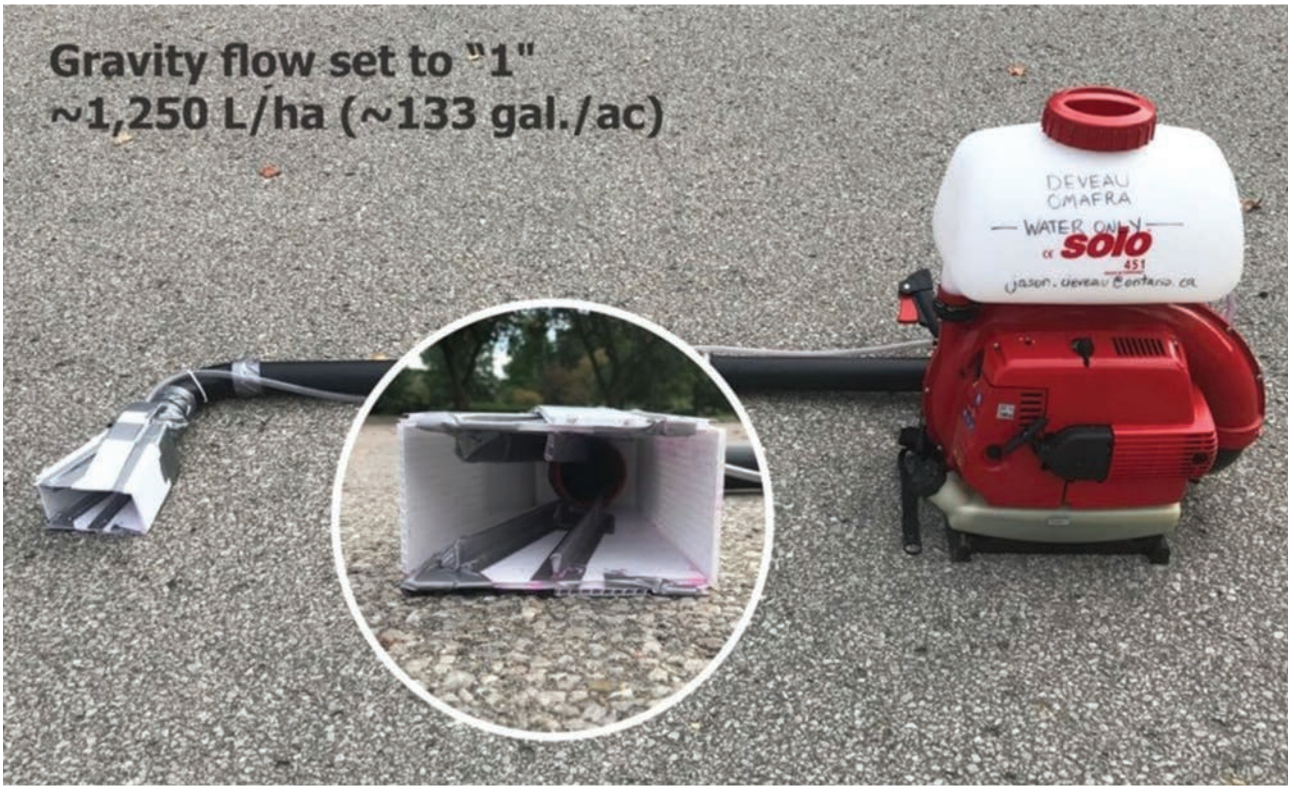
Effect of nozzle types and spray quality

The coverage achieved by the range of nozzle types is shown over the page. The adjustable nozzle provided surprisingly good coverage although the adjustable nature of these nozzles means that this is not always repeatable. The Twin Jet nozzle performed well and reduced water use by about 30%. The double Full Cone nozzle set up performed well but was still not able to cover bottom surfaces. Fine droplets are more likely to curl around leaf edges to undersides but this did not occur in this trial.

The nursery owner was happy with the pest and disease control achieved with the hose and lance system. However, if they were to continue growing pohutukawa they would have to improve spray coverage.

Effect of nozzle, spray quality and spray pattern on coverage of vertical spray surfaces

	NOZZLE	PATTERN	COVERAGE ON WSP FACING AWAY	SPRAY QUALITY
Adjustable				C
Flat Fan				M
Twin Jet				C
Hollow Cone				F
Full Cone - Forward and Backward facing Disc (3) and Core (35) nozzle				M



Plants as spray targets

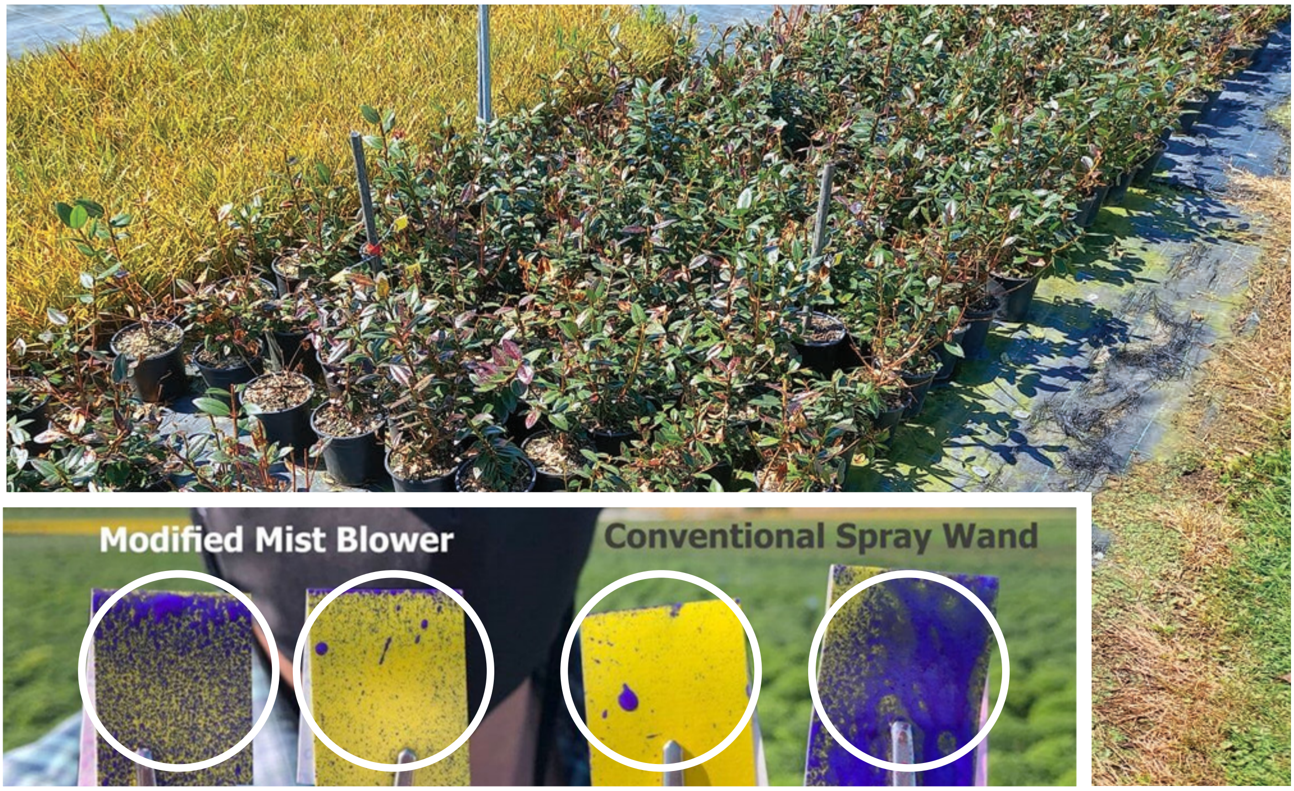
The WSP was set up on a rigid frame similar to the plant structure of pohutukawa or ramarama (*Lophomyrtus bullata*). More even coverage than described here would be expected with this spraying technique on plants with finer, more erect leaves such as manuka. Manuka is a significantly different spraying target to pohutukawa and coverage results would be expected to differ. Nurseries typically have a range of planting architectures and canopy morphologies which present a range of spray targets in terms of size, density and structure. Ideally each style of plant would have a specific sprayer designed to optimise coverage and efficiency. However, this is not realistic, so producers tend to rely on high water volumes and hydraulic pressures to "spray to run-off".

Application options

Relying on hydraulic pressure and carrier volume may not be achieving the desired spray result especially if coverage of the underside of stationary leaves is required. High water volumes (to point of run-off) may result in wastewater causing other issues in the nursery. For example, in order to get coverage in the middle of a canopy the outside may be drenched. Air-assisted spraying can be a viable alternative (and an improvement) over these approaches. Mobile sprayers already employ air to capitalise on the mechanical advantage offered by smaller and more numerous droplets. Finer droplets have very little mass, so they must be directed and carried by air currents to get them to the target. Sufficient air energy will also displace the air within the target canopy and physically expose otherwise hidden plant surfaces to the spray and has the potential to improve coverage uniformity throughout the target canopy.
An example mist blower is shown above.

Trial work reported that water rate could be halved, and coverage improved by using air assistance as compared with hydraulic nozzles[1] (see below). Note that droplet size is finer for the mist blower than for hydraulic nozzles tested above.

[1] Air-Assisted Spraying in Greenhouse Ornamentals https://sprayers101.com/air-ornamentals/



FACING AWAY FACING AWAY

Product application rate

There will be at least one, if not two, ways of describing the target rate application of fungicides - either per litre or per hectare or both. Standard practice is to use the per litre rate (mls/100 litres) and spray to the point of run-off. The point of run-off (without wetting agents) tends to occur when spray droplets on the outer canopy are beginning to coalesce and drip. At this point the inner canopy should be covered but not wet to point of dripping. This tends to be the technique used for applying protectants such as copper or Mancozeb which rely on good coverage and contact with the target organism. As a result, there are two variables, the concentration in the tank and how much an applicator judges as being enough for coverage to point of run-off, which is why it makes sense to cross check dose rates on an area basis where that is also listed on the label.

There are few label recommendations for ornamentals and no fungicides have New Zealand registered label claims for the control of myrtle rust. The NZPPI publication " Myrtle Rust (*Austropuccinia psidii*) - Prevention with Fungicides" lists appropriate fungicides and suggests using these at label rates.

This can be tricky as label rates vary with target crop. For example, the label rate for Vandia 250EC (250 g/litre triadimenol) ranges from 250 ml/ha for mildew control in peas to 1500 ml/ha for white rot control in onions. However, it does mention rust control at 500 ml/ha in cereals which would likely be similar to infection behaviour to myrtle rust so most appropriate target rate. A ground-based volume application rate of at least 200 L/ha for cereals is also mentioned which provides another reference value.

Volume rates were calculated for the current practice at the nursery where the spray application work reported above was carried out. They ranged from 1180 to 2170 L/ha. Based on that aspect alone there is a risk of over application, waste of product and contamination of the environment suggesting a cross check should be carried out. This will need to consider the area and size of crop to be sprayed which can vary significantly (as shown in the photo on the following page) and the volume applied.

The volume of spray (tank mix) applied to an area can be determined either directly by the volume sprayed from the tank or by measuring the flow rate and using the time taken to spray to calculate the volume applied. The former can be used if the tank has accurate and appropriate volume divisions marked or gauged on the tank. This in my experience is unlikely unless the tank is placed on scales. The latter method is simpler but can only be used where flow is constant. Some handguns have variable rate triggers which make achieving a constant and repeatable flow difficult.

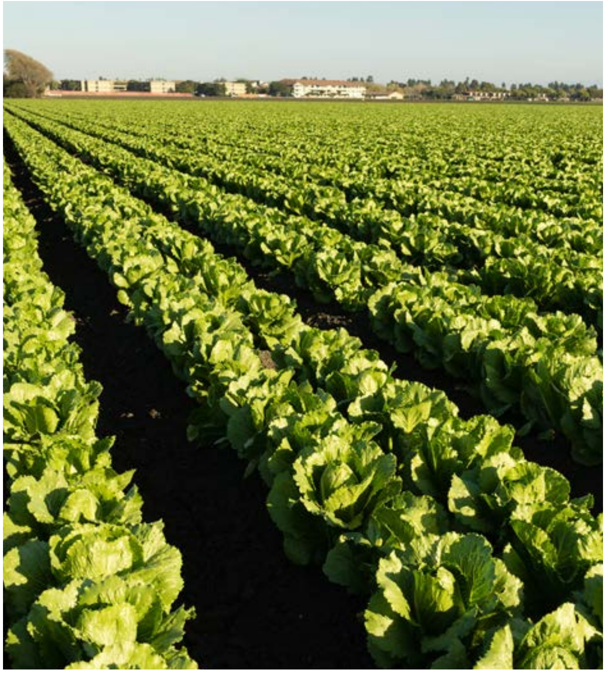
For the work reported here achieving a constant flow was possible. The flow rate was determined by spraying into a container for one minute and measuring the volume collected. In this case 2.9 litres was collected in one minute. This was repeated three times to determine that the flow was 2.9 litres/minute. Then the time taken to spray a series of beds of plants was measured. The areas of these beds were also measured. The results are shown below.

Photo: Range of plant sizes in a nursery

Measuring the volume of spray applied

Crop	Length (m)	Width (m)	Area (m^2)	Crop Height (m)	Flow rate (L/min)	Time (secs)	Volume Application rate (L/ha)
Griselinia*	14.4	1.47	21.2	0.5	2.9	81	1840
Pohutukawa	12.1	1.35	16.3	0.2	2.9	40	1180

* Average of three beds



Product application rate achieved

The table below shows the dose rates achieved in relation to label rates. Unlike the small pohutukawa plants, the height and density of the *Griselinia littoralis* was comparable to a crop of strawberries, barley or brassica (label crops). It would be sensible therefore that the label rate (mls/ha) was applied to that size plant. On that basis, at a volume application rate of 1840 L/ha, the rate of Saprol was about right but the rates of Vandia and Taratek were almost twice label rates. So, tank concentration could be almost halved, or application volume could be reduced. The latter is more difficult as the operator perceived that the volume used was required for adequate coverage.

	Product		
	Saprol	**Vandia**	**Taratek**
Tank concentration	100ml/100 L	50ml/100 L	300ml/100 L
Label rate ml/ha	2000	500	3000
1180 L/ha	1180 ml/ha	590 ml/ha	3540 ml/ha
1840 L/ha	1840 ml/ha	920 ml/ha	5520 ml/ha

rate for strawberries   rate for barley   rate for brassicas

Calculating Your Dose Rate

Date ____ **Sprayer** ____ **Pump** ____ **Nozzles (s)** ____

STEP 1 MEASURE FLOW RATE

[ ] ÷ [ ] x 60 = [ ]

Volume collected (Litres) | Time (sec) | Flow (L/min)

STEP 2 MEASURE THE TIME TAKEN TO SPRAY AN AREA

= [ ]

Seconds

STEP 3 MEASURE AREA SPRAYED

[ ] x [ ] ÷ 10,000 = [ ]

Length (m) | Width (m) | Hectares (ha)

STEP 4 CALCULATE VOLUME APPLICATION RATE

[ ] x [ ] ÷ 60 = [ ] ÷ [ ] = [ ]

Time taken (s) | Flow (L/min) | Litres | Hectares (ha) | L/ha

STEP 5 CALCULATE PRODUCT APPLICATION RATE

[ ] ÷ 100 = [ ] x [ ] = [ ]

L/ha | | Tank Concentration (ml/100 L) | Product Application Rate (mls/ha)

Notes

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