Ministry for Primary Industries
Manatū Ahu Matua

Plant & Food Research
Rangahau Ahumāra Kai

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Guide to myrtle rust removal and treatment

Information for plant nurseries, council-controlled areas and private land, including home gardens

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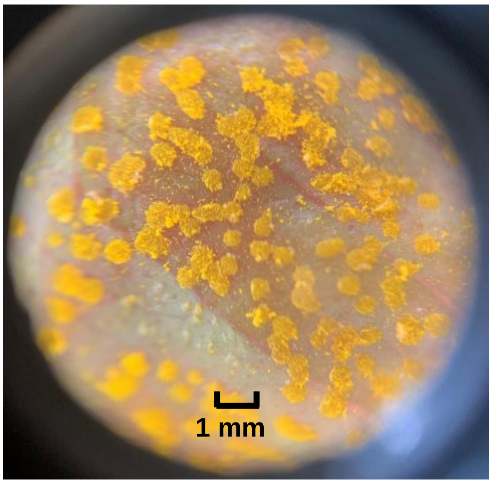
Contents

1 Myrtle rust in Aotearoa/New Zealand

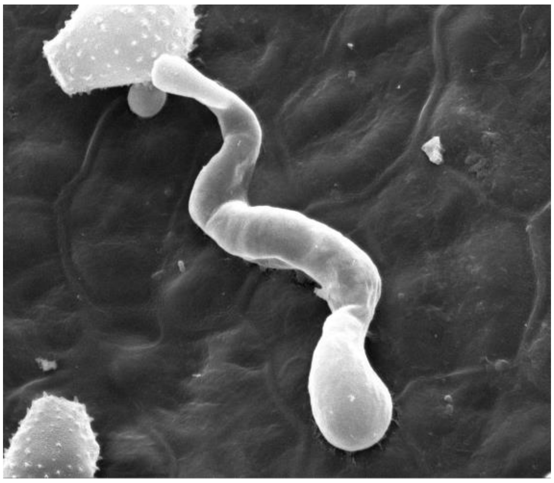
- Myrtle rust is caused by the fungal pathogen *Austropuccinia psidii*. It was first found in Aotearoa/New Zealand in 2017 and is now widespread throughout Te Ika-a-Māui/North Island and the upper part of Waipounamu/South Island. It has also been found as far south as Canterbury and the West Coast.
- It is still spreading and increasing in severity, with more plant species becoming affected.
- Only plants in the myrtle family (Myrtaceae) are affected. For all host species recorded in NZ, see: https://www.myrtlerust.org.nz/about-myrtle-rust/species-infected-with-myrtle-rust-in-new-zealand/
- See Appendix 1 for the most severely affected native and exotic species.
- Only young, actively growing leaves, stems, flowers and fruit can become infected. It is important to understand that a plant that is genetically susceptible to *A. psidii* but is not actively growing cannot become infected unless susceptible new growth develops.
- Myrtle rust risk is greatest in summer when temperatures are warm and new growth is present. The risk is greater in warmer northern areas than cooler southern areas, as shown in Appendix 1.

1.1 Myrtle rust infection

- Yellow spore pustules on infected plants are the most obvious sign of myrtle rust.
- Spores infect healthy plants when there is wetness or high humidity for more than 6 hours and the temperature is above 10–12°C. These conditions occur often at nighttime during summer.
- Infection conditions are often provided by overnight dew, particularly in summer, but light rain or overhead irrigation also provide suitable conditions.
- Myrtle rust spores are short lived; they either infect during wetness, or they die. They survive at most a few days on non-host plant surfaces, including in the soil.



Spore pustules on an infected leaf.


Myrtle rust spore infecting a pōhutukawa leaf
Electron micrograph by Ian Hallet.

2 How to identify, remove and dispose of myrtle rust infected material

- If you think you see a plant infected by myrtle rust, first be sure it is in the myrtle family (Myrtaceae) and then make sure you know what myrtle rust symptoms look like. See the following resources:

  Key to the Myrtaceae of New Zealand » Manaaki Whenua (landcareresearch.co.nz)

  How to recognise myrtle rust » Myrtle Rust

  Plant-species-confirmed-to-be-infected-with-myrtle-rust-in-New-Zealand4.pdf (myrtlerust.org.nz)

- If it is likely to be myrtle rust, report your find on iNaturalist: https://www.inaturalist.org/taxa/549208-Austropuccinia-psidii. When recording an observation in iNaturalist, have clear photos ready to load for identification. It is helpful to use the 'Notes' to record the name of the host plant (if known), the type of surroundings and the severity of infection, e.g., the percentage of the plant or plants that are affected.
- If possible, remove myrtle rust infected plants or plant material to prevent the spores spreading. This can be done by members of the public on private land with landowner permission but cannot be done on council controlled and Department of Conservation land.
- If you suspect myrtle rust is on a new Myrtaceae host or in a new region, it should be reported to the appropriate authority and to the **MPI Biosecurity Hotline (0800 80 99 66).**
- **When removing infected material with yellow spore pustules, don't delay** – new spores are produced every day that the yellow pustules are present.
- **Remove as much infection as possible and minimise disturbance** – to avoid sending a spore cloud into the air, spray infected material with water before removal. If infection is too extensive or impractical to remove then consider removing entire infected plants. Larger trees may need the assistance of an arborist.
- **Dispose of infected plant material by burying, bagging and composting, or bagging and disposing at a landfill as general waste**. Leave infected plant material sealed in bags for 2–3 weeks until the plants and the myrtle rust have died. The plant material can then be composted.
- For further information see:

  https://www.doc.govt.nz/nature/pests-and-threats/diseases/myrtle-rust/#:~:text=Myrtle%20rust%20attacks%20young%2C%20soft,if%20the%20infection%20is%20severe.

  https://www.myrtlerust.org.nz/what-to-do-if-you-find-myrtle-rust/#remove for more details.

  How-to-remove-infected-myrtle-plants-and-safely-dispose-of-the-waste.pdf (myrtlerust.org.nz). Note that some of the information at this particular website is out of date.

3 Sources of infection

- Myrtle rust spores are mainly carried by wind, but can also be spread via infected planting stock and by spores on clothing, animals, etc. Although wind can carry the spores long distances, the most important source of new infection for healthy plants is generally the closest infected plant producing airborne spores. Removal of nearby infected or highly susceptible plants is an important way to reduce risk of infection on plants that need protection from myrtle rust.
- Some myrtle species are more susceptible to myrtle rust infection than others (Appendix 1). The most susceptible native species are swamp maire (maire tawake; *Syzygium maire)*, ramarama (*Lophomyrtus bullata)*, rōhutu (*L. obcordata)* and pōhutukawa (*Metrosideros excelsa*).
- Hedges of Australian lilly pilly (*Syzygium australe*) are a major problem in the upper North Island because they spread myrtle rust spores that infect nearby pōhutukawa and other native species. Several species are called lilly pilly but only *Syzygium australe* appears susceptible to myrtle rust (see https://www.landcareresearch.co.nz/discover-our-research/biodiversity-biosecurity/ecosystem-resilience/beyond-myrtle-rust/news/whats-in-a-name-demystifying-lilly-pilly-hedges/).

4 Use of fungicide sprays

- If you need to control myrtle rust, spray infected plants/branches, and, where possible, spray other vulnerable myrtles in the vicinity. The spraying target is the new flush growth, including any flower buds, flowers and fruit that may be present.
- To start with, use one of the synthetic fungicides with high or very high efficacy listed in Table 1 below. After that, vary the fungicide used according to the fungicide resistance prevention guidelines in Section 5 below. Although some synthetic fungicides can be absorbed into the plant and have systemic or curative activity, which supresses infection that has already occurred, it is generally preferable to apply fungicides preventatively before myrtle rust infection has become established.
- For plant nurseries, a year-round preventative spray programme is required on highly vulnerable species. New Zealand Plant Producers Inc. (NZPPI) has a list of fungicides available in New Zealand that are suitable for controlling myrtle rust. (Download.aspx (nzppi.co.nz))
- Appendix 2 shows examples of annual spray programmes for the most vulnerable species in high- and low-risk climatic areas of New Zealand (Northland and Canterbury, respectively). This is further explained in a report by The New Zealand Institute for Plant and Food Research Limited (Plant & Food Research) for the Ministry for Primary Industries (MPI), which is available through this link:
  Risk-based fungicide management for myrtle rust in nurseries (mpi.govt.nz)
- A weather-risk tool to help with timing fungicide sprays according to seasonal weather risk is available, thanks to NZPPI, at NZPPI Plant Disease Management Platform (metwatch.nz). Click on the ‘WEATHER & DISEASE’ tab to get to the login/create an account page. At the time of writing this service has free public access.
- See the Glossary of terms relating to fungicides (Section 7).

Table 1. Mode-of-action groups, example products and relative efficacy for selected fungicide active ingredients effective against myrtle rust[1].

Compiled from NZPPI fungicide information, field trial data published internationally (Chng et al. 2019) and from New Zealand field trials (Beresford & Wright 2022). Application rates for fungicides used to control of myrtle rust should be chosen from product labels based on an appropriate equivalent disease.

[2]FRAC group code and Example product names	Active ingredient name	[3]Myrtle rust efficacy	Mode-of-action and type of activity
Synthetic petrochemical based – *Single-site inhibitors (site-specific fungicides)*			
Group 3 DMIs (demethylation inhibitors)			
Jupiter®, Vandia®, Citadel®	Triadimenol	**++++**	*Systemic with good curative and variable protectant activity*
Validus®, Yates® Fungus Fighter	Myclobutanil	**+++**	
Tilt®, Spotless, etc.	Propiconazole	**+++**	
Opus®, Stellar, etc.	Epoxiconazole	**+++**	
Radial®	Epoxiconazole+trifloxystrobin	++++	
Several other DMI fungicides			
Group 11 QoIs (Quinone outside inhibitors)			
Amistar®	Azoxystrobin	**+++**	*Protectant and curative activity*
Comet®	Pyraclostrobin	**+++**	
Flint®, Protiva®	Trifloxystrobin	**+++**	
Radial®	Trifloxystrobin +epoxiconazole	++++	
Several other QoI fungicides			
Group 7 SDHIs (Succinate dehydrogenase inhibitors)			
Sercadis®	Fluxapyroxad	**++**	*Mainly protectant activity*
Elatus® Plus	Benzovindiflupyr	**+++**	
Seguris® Flexi	Isopyrazam	**+++**	
Luna® Privilege	Fluopyram	**+++**	
Several other SDHI fungicides			
Synthetic petrochemical based – *Multi-site inhibitors (broad spectrum fungicides)*			
Group M3 (dithiocarbamates) & Group M5 (chloronitriles)			
Dithane®, Mancozeb, etc.	Mancozeb	**+**	*Protectant activity only*
Bravo® , etc.	Chlorothalonil	+	
Inorganic compounds – *Multi-site inhibitors*			
***Groups M1* (copper-based) *& M2* (sulphur-based)**			
Kocide® Opti™	Copper hydroxide	**+**	*Protectant activity only*
Yates® copper oxychloride	Copper oxychloride	**+**	
Nordox	Copper oxide	**+**	
Sulphur	Sulphur	**+**	

[1]Also see fungicide information from New Zealand Plant Producers Inc. Download.aspx (nzppi.co.nz)).
[2]Fungicide Resistance Action Committee, Europe (frac-code-list-2024.pdf). Use the Ministry for Primary Industries - ACVM Register (nzfsa.govt.nz) to discover all New Zealand registered products containing the above active ingredients. Note that some products may be seed treatments or pruning wound treatments.
[3]Relative efficacy from field trial data in NZ or overseas: **+ = low; ++ = Moderate; +++ = High; ++++ = Very high.**
Relative efficacy inferred from other members of the same MOA group: + = low; ++ = Moderate; +++ = High; ++++ = Very high.

4.1 Regulations on fungicide use

- Government registration of plant protection products by the Agricultural Compounds and Veterinary Medicines Group of MPI (ACVM) checks products used in food crops for efficacy, plant damage (phytotoxicity), residues, chemistry, manufacturing and product quality to make sure the product does what it says it will do on the label.
- No fungicides are registered specifically for myrtle rust in New Zealand, but many ACVM-registered products can be used for controlling myrtle rust under 'off-label use' conditions (Guidelines (nzgap.co.nz)); however, the user is responsible for managing any risks, including residues, health and environmental considerations. Users should also check the Hazardous Substances and New Organisms Act 1996, administered by the Environmental Protection Authority (EPA), for any additional controls on any fungicides being used.
- For non-food crops, which includes most Myrtaceae in New Zealand, any non-registered materials can be used, with the user responsible for managing risks. For myrtle rust on feijoa (a food crop), only registered products can be used under off-label use conditions. (Myrtle rust control is not generally needed for feijoa.) For mānuka that could be used for honey production, advice should be sought from ACVM before using any fungicides, including on seedlings in nurseries.
- The application rate for fungicide products used under off-label use conditions should be chosen from the label rate for an appropriate equivalent disease. Refer to the Ministry for Primary Industries - ACVM Register (nzfsa.govt.nz).
- A **Growsafe Approved Handler Certificate** is generally required when purchasing and applying fungicides. Growsafe information: Home (growsafe.co.nz).

  However, anyone can buy fungicides from garden supply shops without an Approved Handler Certificate, but **Growsafe Basic** training is still recommended.
- The garden supply shop products shown here contain active ingredients that are effective against myrtle rust.
- Most fungicides potentially affect human health and the environment. For the hazard classification system for fungicides see Risks of Agrichemicals (growsafe.co.nz).
- To find out about the hazards for individual products, search online for the safety data sheet (SDS) under the fungicide product name.

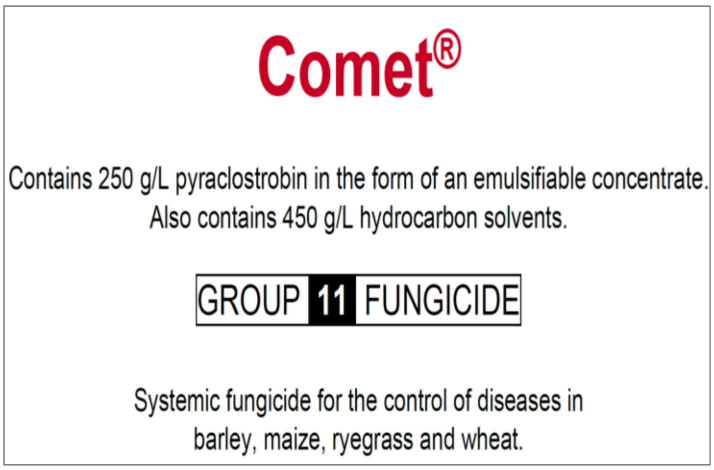
5 Avoiding fungicide resistance

5.1 What is fungicide resistance?

- Nurseries in high-risk northern areas (Appendix 2) could require as many as 20–30 fungicide sprays per year to control myrtle rust on vulnerable hosts. Such high use poses a risk from fungicide resistance developing in *A. psidii,* especially if certain fungicides are used repeatedly. This fungicide resistance risk needs to be managed.
- Fungicide resistance develops when repeated use of a particular fungicide selects a part of the pathogen population that has a natural genetic mutation allowing increased survival in the presence of the fungicide. Continued exposure to the fungicide may cause the resistant part of the population to be selected until it dominates and the fungicide may eventually no longer control the disease.
- Fungicide active ingredients at risk from resistance are modern synthetic ones where the mode-of- action (MOA) inhibits a specific biochemical pathway vital to the pathogen's metabolism (single-site inhibitors). Older fungicides, which have a more general poisoning effect, are known as multi-site inhibitors or broad-spectrum fungicides and are generally considered to be at low risk from resistance (see Table 1 for single-site inhibitor examples and the Glossary, Section 7, for fungicide related terms).

5.2 How can fungicide resistance be avoided?

- Resistance development to an at-risk active fungicide ingredient can be delayed by avoiding its repeated use. A commercially available fungicide product contains one or more active ingredient(s), and several different products often contain the same active ingredient.
- Different active ingredients fall into groups according to their MOA, and group MOA code numbers appear on the product label. To help avoid repeated use, do not apply consecutive sprays of products containing active ingredients with the same code number.
- Example MOA Group Codes on a Group 3 product and a Group 11 product (see Table 1 for examples of myrtle rust fungicides).



5.3 Myrtle rust fungicide resistance management guidelines

See https://resistance.nzpps.org/index.php?p=crops/myrtle_rust for the official myrtle rust Resistance Management Strategy. Here is a summary:

Fungicides in mode of action groups 3 (DMI), 7 (SDHI) and 11 (QoI) (Table 1) are effective for myrtle rust but are at risk from resistance. These should be used as follows:

- Apply fungicide sprays preventatively at full label rate to new growth when disease risk is high but before disease appears or is still at low severity. If disease is present, preferably spray after infection has been removed. Where possible, spray other vulnerable myrtles in the vicinity.
- A weather risk tool is available through NZPPI (https://nzppi.co.nz/DISEASE-MANAGEMENT/19881/) to help identify seasonal conditions favourable for myrtle rust infection and assist decision making on when sprays should be applied.
- Make no more than **five applications** of each **at-risk fungicide group** per year (1 July – 30 June).
- Make each application of an at-risk fungicide either as a **mixture with an effective dose of a multi-site inhibitor** (FRAC MOA groups M1 [copper], M3 [mancozeb], M5 [chlorothalonil], or sulphur) or in **strict alternation with either a single-site inhibitor in a different MOA group or a multi-site inhibitor**.
- When choosing fungicides, make use of the group codes displayed on product labels to avoid mixed or consecutive applications of the same at-risk MOA group.
- The application rate of a fungicide used for myrtle rust control should be at the recommended label rate for that fungicide against an appropriate other disease (Ministry for Primary Industries - ACVM Register (nzfsa.govt.nz)).
- An application of a product containing a **mixture of single-site inhibitor fungicides in different MOA groups counts towards the maximum number for each group**. An application of a product containing a mixture of single-site inhibitor fungicides in the same MOA group counts as one application for that group.
- The EPA may specify a maximum number of applications per year for particular fungicide products. This takes priority over maximum numbers indicated in this resistance management guideline for any product. (Controls for hazardous substances | EPA).

5.4 Fungicide mixtures

- Mixtures of fungicide active ingredients can be either pre-mixed by manufacturers or tank mixed by the user.
- When fungicide mixtures are used for resistance prevention, each component must have efficacy against myrtle rust on its own and must be applied at an effective dose. When using a fungicide mixture, it is important to understand the efficacy of each component.
- A mixture of an efficacious fungicide with a compound or agent having little or no efficacy is undesirable because it is not possible to tell which component is providing disease control.
- Mixtures of two fungicides, each at their respective effective dose, would be expected to have an additive effect. However, claims are sometimes made that particular mixtures have a synergistic effect (greater than the combined individual effects). Always test any new mixture at appropriate application rates on a few plants to check for chemical compatibility, myrtle rust efficacy and any plant damage (phytotoxicity).

6 Alternatives to synthetic fungicides for myrtle rust control

- Alternatives to synthetic petrochemical-based fungicides are preferred by some people because of perceptions about human health and environmental safety. A range of alternative products was tested in New Zealand in field trials between 2022 and 2025 and compared with several synthetic fungicides (Reglinski et al. 2025).
- Two things are of particular interest in assessing the performance of alternative products:
  i. Efficacy in controlling myrtle rust
  ii. Plant damage caused by the product (phytotoxicity)
- Table 2 summarises the performance of the alternative products tested in the field trials and selected synthetics using rating scales from 1 to 10 for efficacy and phytotoxicity.

Table 2. Relative efficacy and phytotoxicity ratings for synthetic fungicides and non-synthetic alternatives tested on Lophomyrtus sp. at Plant & Food Research, Pukekohe, from 2022 to 2025. Application rates are from field trial data or ACVM-registered product labels.

Alternatives to synthetic fungicides

Product type	[1]FRAC MOA Code	Active ingredient	Product name	[2]ACVM registered	Relative performance: Myrtle rust efficacy	Relative performance: Plant damage	Product application rate (g or ml /litre)
Synthetic single-site inhibitors	3	Triadimenol	Vandia®	✓	10	1	1
	11	Trifloxystrobin	Flint®	✓	10	1	0.12
	7	Fluxapyroxad	Imtrex®	✓	9	1	3.2
	7	Isopyrazam	Seguris® Flexi	✓	10	1	1.6
	7	Benzovindiflupyr	Elatus® Plus	✓	10	1	0.5
	7	Fluopyram	Luna® Privilege	✓	10	1	0.3
	1	Carbendazim	Protek®	✓	8	3	0.5
Synthetic multi-site inhibitors	M3	Mancozeb	Dithane® Rainshield®	✓	8	1	2
Copper fungicides	M1	Copper oxide	Nordox™	✓	9	2	1.7
	M1	Copper oxychloride	Yates® Copper oxychloride	✓	9	1	2.5
	M1	Copper hydroxide	Kocide® Opti™	✓	8	1	3.12
Sulphur fungicides	M2	Sulphur	Kiwicare® Organic Super Sulphur	✓	8	2	3
	–	Lime sulphur	Yates® Lime Sulfur	✓	6	4	5
Chitosans	–	PB 23-2	–	–	6	4	10
	–	PB 23-4	–	–	6	4	10
Plant oils	BM1	Rosemary oil	The essential Oils of New Zealand Ltd	–	5	5	10
	BM1	Aniseed oil	The essential Oils of New Zealand Ltd	–	5	5	10
Biologicals	BM2	*Bacillus subtilis*	Bactstar™	✓	5	5	2
	BM2	*Bacillus subtilis*	Serenade®	✓	4	4	2.5
Bicarbonates	–	Sodium bicarbonate	Baking soda (food grade)	✓	3	7	10
	–	Potassium bicarbonate	OCP Eco-fungicide™	✓	2	8	5
Others	–	Potassium soap	NSA (potassium soap)	✓	2	5	10
	–	Potassium silicate	HML Silco™	✓	2	8	5
	–	Sea salt	Maldon Sea salt flakes (food grade)	–	1	10	10

[1]FRAC = Fungicide resistance Action Committee (Europe) ; MOA = mode of action.
[2]✓ = Registered by Agricultural and Veterinary Medicines Group (ACVM) of the Ministry for Primary Industries.

	Performance categories									
	A. High efficacy; low phytotoxicity			**B.** Slight efficacy; slight phytotoxicity			**C.** Low efficacy; moderate phytotoxicity		**D.** Neglibile efficacy; high phytotoxicity	
Myrtle rust efficacy	10	9	8	7	6	5	4	3	2	1
Phtyotoxicity risk	1	2	3	4	5	6	7	8	9	10

The alternatives and synthetics are aligned with the four performance categories as follows:

Category A. **Synthetic fungicides:** Single-site inhibitors were better than multi-site inhibitors. Triadimenol (Group 3), trifloxystrobin (Group 11) and the four Group 7 fungicides were all highly effective. **Alternatives to synthetics:** Copper fungicides and sulphur are excellent protectants, although coppers have strongly negative environmental effects. Sulphur is more benign than copper.

Category B. **Alternatives to synthetics:** Chitosan, plant oils and biologicals have slight efficacy (Bacstar is a little better than Serenade Optimum). Lime sulphur has similar performance to the chitosans.

Category C. **Alternatives to synthetics:** Sodium bicarbonate (baking soda) has weak efficacy, gives variable results and is prone to causing plant damage at fungicidal application rates. Potassium bicarbonate is similar to sodium bicarbonate for efficacy and phytotoxicity.

Category D. **Alternatives to synthetics:** Potassium soap, Potassium silicate and sea salt appear to have negligible efficacy against myrtle rust and are therefore of no use for myrtle rust control.

6.1 Spraying strategies for alternative products

- While some synthetic fungicides have curative (systemic) activity because they are absorbed into the plant (Table 1), alternative products generally have only protectant activity. Therefore, treatment applications of alternatives must be initiated before visible rust infection becomes established.
- In Category A, copper and sulphur are highly effective when applied preventatively at label rates. In Category B the relatively low efficacy of chitosan, plant oils and biologicals requires more frequent spraying than synthetics, e.g., 1–2 weekly rather than 2–4 weekly during summer on a susceptible species. For Category C alternatives (bicarbonates), more frequent spraying is also required and in high disease risk situations they may fail to control myrtle rust even with weekly applications.

6.2 Regulations and risks around alternative products

- ACVM-registered alternative products can be used under off-label use conditions to control myrtle rust, but users are responsible for managing any risks, including residues, health and environmental considerations.
- Non-ACVM-registered alternative products (e.g., chitosans, plant oils and sea salt) are exempt from registration if used on Myrtaceae plants that are not for human or animal food production, but the user is responsible for managing any risks (Exemptions and Prohibited Substances Regulations 2011). Most Myrtaceae plants growing in New Zealand are not food plants; however, for feijoa and any other myrtaceous plant used for food production, products that are not ACVM-registered cannot be used.
- It is possible rust control efficacy could be improved by mixing products together; however, alternative products may not be chemically compatible with each other and some conventional fungicides and incompatibility could reduce efficacy and risk plant damage.
- Always test any new alternative product at an appropriate application rate on a few plants to observe myrtle rust efficacy and whether any plant damage occurs.
- Alternative products are not considered at risk from fungicide resistance in the same way that single-site inhibitor fungicides are, although the possibility of resistance development cannot be completely ruled out.
- It is important to understand that alternative products do not necessarily have lower risk for human, animal and environmental health compared with appropriately used synthetic fungicides and such risks must be researched and managed appropriately for each alternative product that is used (see Section 4.1 above, ‘Regulations on fungicide use’).

7 Glossary of fungicide-related terms

Active ingredient (active constituent). The component(s) in a formulated fungicide product that specifically inhibit the target pathogen. Products also contain other chemicals to achieve effective delivery of the active ingredient to the plant. The active ingredient name is the common name of the fungicide (e.g., triadimenol).

Control. Demonstrable prevention or inhibition of myrtle rust development.

Curative (systemic). A fungicide active ingredient that is absorbed into the plant and inhibits the pathogen within the plant tissues after infection has occurred. Such fungicides generally have a limited time after infection to ‘cure’ the infection (e.g., 1–3 days). This is often referred to as the ‘reach-back’ or ‘kick-back’ interval or period. ‘Systemic’ means within the plant tissue and is often used synonymously with ‘curative’. Curatives may also be effective protectants.

Effectiveness. The myrtle rust control outcome from using fungicide(s) in the real world where factors in addition to efficacy affect control (e.g., weather conditions; limitations of spray application equipment).

Effective dose. The amount of a fungicide with efficacy against myrtle rust that must be applied to plants to achieve myrtle rust control.

Efficacy. The intrinsic ability of a fungicide to prevent infection or inhibit *A. psidii,* and thereby control myrtle rust, determined under controlled conditions (including application rate, frequency and timing).

Eradicant. A fungicide that kills existing fungal lesions on the plant. Eradicant is sometimes used synonymously with curative, but eradicants are not necessarily absorbed into the plant. Eradicants are often older multi-site inhibitor fungicides.

Mode-of-action (MOA). The biochemical pathway(s) within fungal cells inhibited by a particular fungicide. The Fungicide Resistance Action Committee (FRAC) assigns a code number to each MOA Group (frac-code-list-2024.pdf). The product label displays all the active ingredient groups in the product and the group code numbers. When fungicide resistance develops in a pathogen to a particular fungicide, then all the active ingredients within the same MOA group are expected to be affected by that resistance. However, in practice, different active ingredients within a group are often affected by resistance slightly differently.

Mode-of-action Group 3 (demethylation inhibitor; DMI). Single-site inhibitors with a mode of action that blocks the demethylation step in sterol biosynthesis necessary for chitin cell wall formation in fungi. These are also referred to as azole or triazole fungicides, based on their chemistry.

Mode-of-action Group 7 (succinate dehydrogenase inhibitor; SDHI) Single-site inhibitors with a mode of action that blocks mitochondrial respiration in fungal cells by inhibiting the succinate dehydrogenase enzyme that catalyses the oxidation of succinate into fumarate in the Krebs cycle.

Mode-of-action Group 11 (quinone outside inhibitor QoI; strobilurin). Single-site inhibitors with a mode of action that blocks mitochondrial respiration in fungal cells at the quinone outside binding site of the cytochrome bc_1 complex.

Multi-site inhibitors (Groups M1, M3 and M4). Usually older fungicides that inhibit many metabolic pathways in a target pathogen (also known as broad-spectrum fungicides). These are generally not at risk from resistance development in the pathogen, although instances of copper resistance sometimes occur.

Protectant. A fungicide that is only active against the pathogen on the plant surface where it prevents spore germination and infection.

Single-site inhibitors. Modern synthetic fungicides that inhibit a specific metabolic pathway in a target pathogen. These are often at risk from development of fungicide resistance in the pathogen.

8 Acknowledgements

The information in this guide has been interpreted and compiled from collaborative work involving the following parties:

9 References

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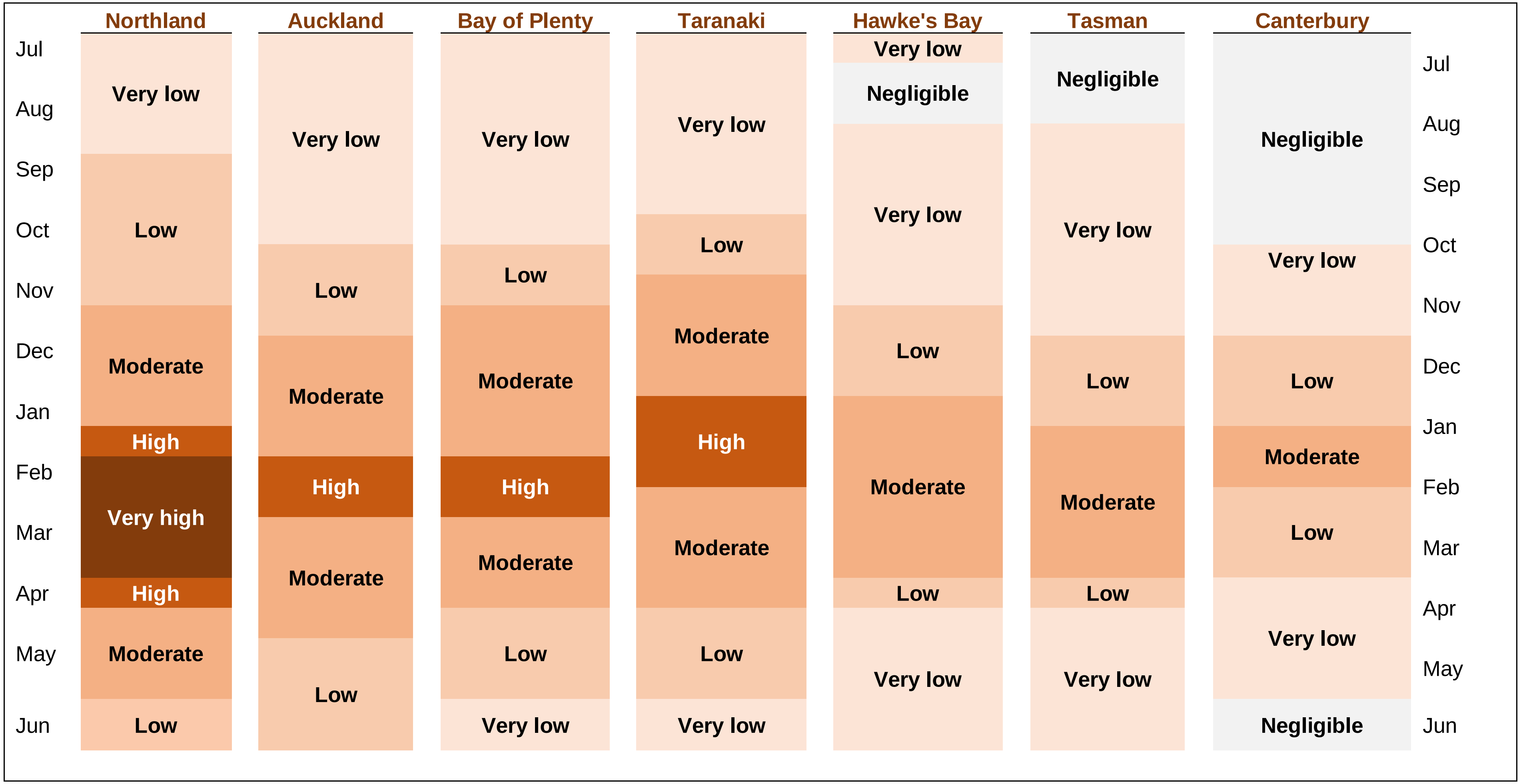
Appendix 1. Vulnerability of myrtle species & myrtle rust climatic risk

Note that our knowledge about the impacts of myrtle rust on different myrtle species is evolving over time.

Vulnerability of New Zealand myrtles to myrtle rust					**R Beresford, Plant & Food Research – April 2025**	
Common name	**Botanical name**	**Severe infection commonly seen**	**May be severe on young seedlings or basal growth of older trees**	**When growing near more susceptible species**	**Infection seldom seen in the natural environment**	**Infection not confirmed in the natural environment**
Native species						
***Swamp maire**	***Syzygium maire***	✓				
***Ramarama**	***Lophomytus bullata***	✓	(Includes *L. bullata* x *L. obcordata* hybrids)			
***Rōhutu**	***Lophomytus obcordata***	✓				
Pōhutukawa	***Metrosideros excelsa***		✓	(Rust on mature trees is sometimes seen)		
Carmine rātā	***Metrosideros carminea***			✓		
Colenso's rātā	***Metrosideros colensoi***			✓		
White rātā	***Metrosideros perforata***				✓	
White rātā	***Metrosideros diffusa***			✓		
Scarlet rātā	***Metrosideros fulgens***			✓		
Climbing rātā (other)	***Metrosideros* spp.**					✓
Bartlett's rātā	***Metrosideros bartlettii***		✓			
Southern rātā	***Metrosideros umbellata***				✓	
Northern rātā	***Metrosideros robusta***				✓	
Mānuka	***Leptospermum scoparium***	(Young mānuka seedlings may be infected)			✓	
Kānuka	***Kunzea* spp.**					✓
Exotic species						
Lilly pilly, eugenia	***Syzygium australe***	✓				
Chilean guava	***Ugni molinae***	✓				
Guava	***Psidium guajava***				✓	
Feijoa	***Acca sellowiana***				✓	
Brush cherry	***Syzygium paniculatum***					✓
Monkey apple	**Syzygium *smithii***				✓	
Eucalypts	***Eucalyptus* spp.**		✓	(Vulnerability varies between species)		
***These species are the most vulnerable and are severely attacked as both seedlings and mature plants**						

Appendix 1. continued

Climatic risk by season for selected regions (See https://myrtlerust.com/) for current weather risk data)



Appendix 2. Example myrtle rust spray programmes for synthetic fungicides

For highly vulnerable species (e.g., *Lophomyrtus*) in a high risk area (Northland) and a low risk area (Canterbury). Modelling by Beresford & Wright (2022)

Kerikeri, Northland (Infection sources risk = High)

Month	Climatic risk	Spray no.	Fungicide Spray date	Interval to next spray (days)	Fungicide mode-of-action group (see Table 1)
July		1	1-Jul-22	21	M1 copper
	Very low	2	22-Jul-22	21	M1 copper
August		3	12-Aug-22	21	M1 copper
September		4	2-Sep-22	14	M1 copper
		5	16-Sep-22	21	11 QoI
October	**Low**	6	7-Oct-22	14	M3 mancozeb
		7	21-Oct-22	21	3 DMI
November		8	11-Nov-22	14	M3 mancozeb
		9	25-Nov-22	14	7 SDHI
December		10	9-Dec-22	14	3 DMI + M3 mancozeb
	Moderate	11	23-Dec-22	14	11 QoI
January		12	6-Jan-23	10	M3 mancozeb
		13	16-Jan-23	14	3 DMI + 11 QoI
	High	14	30-Jan-23	7	M3 mancozeb
February		15	6-Feb-23	7	7 SDHI
		16	13-Feb-23	7	11 QoI
	Very high	17	20-Feb-23	7	M3 mancozeb
		18	27-Feb-23	14	3 DMI + 11 QoI
March		19	13-Mar-23	14	7 SDHI + mancozeb
		20	27-Mar-23	14	3 DMI + M3 mancozeb
April	**High**	21	10-Apr-23	14	M3 mancozeb
		22	24-Apr-23	7	M3 mancozeb
May	**Moderate**	23	1-May-23	14	7 SDHI +M3 mancozeb
		24	15-May-23	10	M3 mancozeb
		25	25-May-23	14	7 SDHI
June	**Low**	26	8-Jun-23	14	M1 copper
		27	22-Jun-23	14	M1 copper

Lincoln, Canterbury (Infection sources risk = Low)

Month	Climatic risk	Spray no.	Fungicide Spray date	Interval to next spray (days)	Fungicide mode-of-action group (see Table 1)
July					
August	**Negligible**				
September					
October					
	Very low	1	15-Oct-21	28	M1 copper
November		2	12-Nov-21	28	M1 copper
December	**Low**	3	10-Dec-21	28	11 QoI
		4	31-Dec-21	21	7 SDHI
January	**Moderate**	5	21-Jan-22	21	3 DMI
February		6	4-Feb-22	14	M3 mancozeb
March	**Low**	7	4-Mar-22	28	11 QoI
April		8	1-Apr-22	28	3 DMI
	Very low	9	29-Apr-22	28	7 SDHI
May		10	27-May-22	28	M3 mancozeb
June	**Negligible**				

Fungicide spray programme summary

Kerikeri, Northland		**Lincoln, Canterbury**	
Sprayer passes	**27**	**Sprayer passes**	**10**
Product applications	**33**	**Product applications**	**10**
DMIs	**5**	**DMIs**	**2**
QoIs	**5**	**QoIs**	**2**
SDHIs	**5**	**SDHIs**	**2**
Multi-site	**18**	**Multi-site**	**4**

10 About this guide

This guide contains information for public release prepared for the Ministry for Primary Industries (Project # 407135) by Plant & Food Research.

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