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CROP(S)	DISEASE(S)	
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Introduction

The CropLife Australia Expert Committee on Fungicide Resistance (ECFR) has drafted disease resistance management strategies in conjunction with growers, researchers and agronomists to minimise the development of resistance to fungicides. These strategies provide growers with guidelines for fungicide use (and other methods) for sustainable disease control.

What is fungicide resistance?

Resistance by fungal pathogens to fungicides usually evolves following the intensive use of fungicides for disease control. In any fungal population there are likely to be individuals that have some degree of natural resistance and which are less susceptible to fungicides, even before the chemicals are used. Resistance arises mainly through the incorrect use of fungicides, which selects for the resistant individuals. Continued use of a fungicide or fungicide chemical group can result in a significant build-up of resistant individuals in the fungal population – to the point where that particular product, or other products from the same chemical group, is no longer effective. In some cases, removal of the selection pressure can result in the fungal population regaining its sensitivity to the fungicide group, but this is not always the case. The risk of fungicide resistance developing varies between different chemical groups and different fungal pathogens, such that specific strategies are recommended for those situations considered to carry the highest risk.

What can be done to prevent or delay resistance?

The most common approach to managing fungicide resistance is through responsible use of fungicides, of which the resistance management strategies presented in this document are good examples. In their most basic form, these strategies advocate rotation of fungicide products with a different chemical activity group to prevent over-use of any one product or activity group. More complex strategies safeguard against the development of cross-resistance or resistance to multiple chemical groups. In Australia, all fungicide products are labelled to identify which activity group they belong to. The activity group is indicated by a number (or letter/number combination) code on the product label.

Selecting the most effective way to apply fungicides will make them work better and assist in delaying the development of resistance. A good understanding of the pathogen's life cycle and epidemiology will also help in the selection of the most effective application method. As a general rule, targeted applications to control a certain development stage or population level are most effective, whereas shotgun approaches like application of fungicides through irrigation systems could accelerate the development of resistance by exposing a large portion of the fungal population to sub-lethal rates. Particular attention should be given to label recommendations, rates and coverage. Adherence to suggested disease threshold levels is also good resistance management practice.

The use of cultural practices or growing varieties of crops with a high degree of natural resistance to diseases – requiring fewer or less frequent fungicide applications.

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Working with industry bodies such as the CropLife Australia Expert Committee on Fungicide Resistance to establish resistance management strategies for minor crops and/or those crops for which no strategies exist. Of particular concern are permitted uses of fungicides, often in minor crops, where repeated use of a limited number of fungicide alternatives occurs. Although not explicitly stated on agricultural use permits, such permitted uses should also incorporate measures to prevent resistance.

In the event of tank mixing products and/or co-formulations, always follow the recommendation from the most recent Fungicide Resistance Management Strategies and apply the most stringent strategy applicable to the pathogen most at risk of developing resistance.

Certain environments are conducive to continuous infection and consistently high disease pressure. Examples of such environments are nurseries, tunnels, greenhouses and other structures of protected cultivation. Because protected cultivation usually requires multiple applications of fungicides at short intervals to control high disease incidence, there is a much higher risk of development of resistance to fungicides. Users of fungicides under these conditions should be particularly mindful of the enhanced resistance risk. Do not use a fungicide product to which resistance has been confirmed and stop using a product if resistance is suspected. When the fungicide in question no longer gives adequate control, stop using it temporarily and consult the supplier on its current resistance status.

In the absence of an established resistance management strategy for a particular crop/disease situation, it is recommended that the use of fungicides from any given activity group (excluding Group M and BM) be limited to a maximum of one-third of the total number of fungicide applications. The use of consecutive applications of fungicides from the same activity group should also be limited by alternating between products from different activity groups.

Low risk fungicide mode of action groups

The use of **Group M** and **BM** fungicides is not limited, as these fungicides carry an inherently low risk of fungicide resistance developing. No specific resistance management strategy has been developed for these low-risk fungicides. These products should be included in a management strategy as per label recommendations.

Activity group labelling in Australia

In order to help fungicide users to manage fungicide resistance, all fungicide products sold in Australia are classified according to the chemical activity group of their active constituent. The activity group must be indicated by a letter code on the product label. Australia was the first country to introduce compulsory activity group labelling on products. Since the introduction of activity group labelling in Australia, other countries have adopted activity group classification systems, however caution should be shown if cross-referencing activity groups between Australia and other countries, as there are some differences in classification.

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Changes to activity group

In 2008, CropLife Australia completely revised Australia's fungicide activity grouping system to bring it into line with the international Fungicide Resistance Action Committee (FRAC) activity group classification system. This was the first major revision of the Australian classification system since its introduction several years ago. Activity group codes have now been changed from letters to numbers (or letter/number combinations). For a complete list of all fungicide active constituents registered in Australia and their old and new activity groups, see the Fungicide Activity Group Table on the CropLife Australia website at www.croplife.org.au.

Fungicide application in Australian orchards and vineyards

Fungicide performance against the various diseases in orchards and vineyards is governed by application of the correct dose of the fungicide.

Growers must ensure if dilute spraying or concentrate spraying is used, adequate coverage of the target is achieved. To the point of runoff is related to target wetness on the entire canopy. It is important to ensure that both the inner leaves have the same level of leaf wetness as the outer leaves. Poor coverage often looks like outer leaves dripping and the inner leaves being dry, which can lead to underdosing and increase the risk of resistance. Calibration, nozzle selection/direction, pressure and droplet size all contribute to ensure even coverage of the top, middle and bottom of the target canopy is achieved.

Growers have the choice of either using the true dilute spray volume which matches the size of their crop canopy or using a lower spray volume to allow more crop to be sprayed with the same spray vat. The spray machinery must have capacity to achieve adequate coverage at low volumes.

When growers choose to apply concentrate spraying, spray coverage is critically important, and must guarantee the correct dose. If a concentrate spray volume of 2X (i.e. half of the dilute spray volume for the canopy in question) obtains good spray coverage, but if the label rate is not adjusted upwards by a factor of 2 then the application will be under-dosed. Under-dosing can lead to inadequate disease control and increase the development of disease resistance. For example:

1. Dilute spray volume as determined above: for example 1000 L/ha
2. Your chosen concentrate spray volume: for example 500 L/ha
3. The concentration factor in this example is: 2X (i.e., 1000 L ÷ 500 L = 2)
4. Product use rate of 50 mL / 100 L is selected, Product is used in 500 L/ha water with a concentration factor of 2.
5. Vat requirement would be 2 x 50 mL per 100 L or 100 mL / 100 L of concentrate spray.

The same amount of product per hectare or per 100m of row regardless of the water volume chosen.

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CropLife Australia recommends that all spray equipment is checked and calibrated by trained/experienced persons before each season in order to ensure that fungicides are applied throughout the growing season according to the product label instructions.

Resistance risk

Table 1: Plant pathogens accepted as showing a medium risk of development of resistance to fungicides.

FRAC Pathogen	Crop	Disease
Bremia lactucae	Lettuce	Downy mildew
*Gibberella fujikuroi**	Rice	Bakanae
Leptosphaera nodorum (Stagonospora nodorum)	Wheat	Leaf spot
Monilinia spp.	Stone and pome fruit	Monilinia rots
Zymoseptoria tritici (Mycosphaerella graminicola,Septoria tritici,)	Wheat	Septoria leaf blotch
Mycosphaerella musicola	Banana	Yellow Sigatoka (Leaf Spot)
Peronospora spp.	Various	Downy mildew
Podosphaera leucotricha	Apple	Powdery mildew
Puccinia spp.	Wheat/barley	Rusts
Pyrenophora teres	Barley	Net Blotch
Pyrenophora tritici-repentis	Wheat	Tan spot (yellow spot)
Tapesia spp.	Wheat/barley	Eyespot
*Erysiphe necator**	Grapevine	Powdery mildew

** The EPPO Guideline lists these pathogens as high risk and baselines are normally requested.*

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Table 2: Plant pathogens accepted as showing a high risk of development of resistance to fungicides (adapted from APPO, 2022).

FRAC Pathogen	Crop	Disease
Botrytis cinerea	Various, especially grapevine	Grey mould
Erysiphe graminis	Wheat/barley	Powdery mildew
Mycosphaerella fijiensis	Banana	Black sigatoka
Phytophthora infestans	Potato	Late blight
Plasmopara viticola	Grapevine	Downy mildew
Pseudoperonospora cubensis and related	Cucurbits	Downy mildew
Pyricularia oryzae	Rice	Rice blast
Sphaerotheca fuliginea and related	Cucurbits	Powdery mildew
Venturia spp.	Apple, pear	Scab

Table 3. Plant pathogens for which resistance or reduced sensitivity has been confirmed or suspected in Australian field conditions. Users are advised to adhere to effective resistance management strategies at all times.

Pathogen	Disease/Crop	Compound affected	FRAC group	Ref.	Comments
Broadacre					
Blumeria graminis f. sp. hordei	Barley powdery mildew	tebuconazole, propiconazole, flutriafol	3	1, 2, 3, 4,	Field failure reported in WA to low label rates. Resistance detected in laboratory testing of samples from in WA, Qld, NSW, Vic, Tas.
Blumeria graminis f. sp. tritici	Wheat powdery mildew	strobilurins	11	1, 2, 5	Resistance detected in laboratory testing of samples from Vic, Tas.
Botrytis fabae	Chocolate spot	carbendazim	1	1, 2	Field resistance in SA
Leptosphaeria maculans	Canola black leg	fluquinconazole	3	1, 2, 6	Reported in WA, NSW, Vic, SA, however field implication is not clear
		SDHIs: pydiflumetofen, fluopyram, fluxapyroxad and bixafen	7	31	No field failure has been reported at this stage.
Pyrenophora teres f. sp. maculata	Spot form of net blotch on barley (SFNB)	tebuconazole, epoxiconazole, propiconazole, prothioconazole	3	1, 7	Reduced field efficacy reported in WA. Resistance detected in laboratory testing.

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Pathogen	Disease/Crop	Compound affected	FRAC group	Ref.	Comments
Pyrenophora teres f. sp. teres	Net form net blotch on barley (NFNB)	SDHI	7	1, 8	Reduced field efficacy reported in WA. Resistance detected in laboratory testing.
		propiconazole, prothioconazole tebuconazole	3	1, 9	Reduced sensitivity reported in WA. Resistance detected in laboratory testing. No confirmation of field failure.
		SDHI	7	1, 10	Reduced field efficacy reported in SA to SDHI and DMI. Resistance detected in laboratory testing.
Zymoseptoria tritici	Wheat septoria leaf blotch	tebuconazole, flutriafol, propiconazole	3	1	Reduced sensitivity reported in NSW, Vic, SA, Tas but does not cause complete field failure.
Ornamentals					
Botrytis cinerea	Grey mould, multiple hosts	iprodione	2	11	Resistance detected in laboratory testing – field relevance not assessed
Strawberries					
Botrytis cinerea	Grey mould	iprodione	2	12	Failure of fungicides in experimental plots on 2 commercial strawberry farms. Resistance detected in laboratory testing.
		pyrimethanil	9	13	Resistance detected in laboratory testing, field relevance not assessed
		fenhexamid	17		
Tree fruit					
Venturia inaequalis	Black spot on apples	myclobutanil	3	14	Reduced field efficacy reported in NSW. Resistance detected in laboratory testing.
Monilinia fructicola	Brown rot stone fruit	dicarboximides	2	15	Reduced field efficacy reported to vinclozolin. Resistance detected in laboratory testing. Cross resistance confirmed to iprodione and procymidione.
Tropical fruit					
Alternaria alternata	Alternata rot in passionfruit	dicarboximides	2	16	Cross resistance proven *in vitro* to iprodione and procymidone
Mycosphaerella musicola	Yellow sigatoka of bananas	strobilurins	11	17	Lack of control in field trial. Resistance detected in laboratory testing.

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Pathogen	Disease/Crop	Compound affected	FRAC group	Ref.	Comments
Vegetables					
Botrytis cinerea	Grey mould, various hosts	benzimidazoles	1	18	Resistance detected in laboratory testing, limited reports of field failure. Field relevance not assessed
		dicarboximides	2		
		boscalid	7		
Botrytis cinerea	Grey mould, tomato	dicarboximides	2	19	Reduced field efficacy reported to iprodione. Resistance detected in laboratory testing. Cross resistance confirmed to vinclozolin and procymidione.
Bremia lactucae	Lettuce downy mildew	metalaxyl	4	18, 20	Reduction in field sensitivity. Resistance detected in laboratory testing.
Podosphaera xanthii	Powdery mildew cucurbits	buprimate	8	21, 22, 23	Reduced field efficacy reported in Qld, NSW & SA. Resistance detected in laboratory testing.
		triadimefon triadimenol	3		
		QoI	11	23	Reduced field efficacy reported in Qld. Resistance detected in laboratory testing.
Peronospora destructor	Onion downy mildew	phenylamides	4	24	Reduction in field sensitivity. Resistance detected in laboratory testing.
Pseudoperonospora cubensis	Cucurbit downy mildew	metalaxyl	4	25	Found in areas with high usage patterns.
Sclerotinia spp.	various hosts	benzimidazoles	1	18	Resistance detected in laboratory testing, limited reports of field failure. Field relevance not assessed
		dicarboximides	2		
Grapes					
Erysiphe necator	Powdery mildew	pyraclostrobin azoxystrobin trifloxystrobin	11	26, 27, 28	Confirmed in most growing areas. Reports of field failure for trifloxystrobin and pyraclostrobin, confirmed by phenotypic and genotypic testing.
		triadimenol, fenarimol, myclobutanil	3	26, 27, 29	Current reports of field failure to myclobutanil, confirmed by phenotypic and genotypic testing.
Botrytis cinerea	Grey mould, Botrytis bunch rot	anilinopyrimidines	9	26, 27, 30	Regularly found in commercial testing. Limited reports of field failure.
		dicarboximides	2	26, 27	
		boscalid	7	26, 27	

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Pathogen	Disease/Crop	Compound affected	FRAC group	Ref.	Comments
		fenhexamid	17		Resistance detected in field samples but no evidence of field failure.
		metalaxyl	4	26, 27, 28	Loss of field efficacy reported in areas with high usage patterns. Resistance detected in laboratory testing.
Plasmopara viticola	Downy mildew	pyraclostrobin	11	26	

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Pathogens with high resistance risk

In some cases, fungicides from additional fungicide activity groups may be available under permit for use in the above crop/pest situations. Details of such permits can be obtained from the Australian regulator's (APVMA) website (www.apvma.gov.au). In the absence of a resistance management strategy for activity groups of products available under permit, or in the absence of restrictions contained within the permit, it is strongly advised that those products (excluding **Group M** and **BM** fungicides) be used in alternation with registered products from other fungicide activity groups, which should be used in accordance with the following resistance management strategies.

Pathogens with medium or unlisted resistance risk

In some cases, fungicides from additional fungicide activity groups may be available under permit for use in the above crop/pest situation. Details of such permits can be obtained from the Australian regulator's (APVMA) website: (www.apvma.gov.au). In the absence of a resistance management strategy for activity groups of products available under permit, it is advised that spray programs incorporating those products (excluding Group M fungicides) also incorporate registered products from other fungicide

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activity groups. Programs should be used in accordance with the following resistance management strategies.

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Crop(s) **Almond**
Disease(s) **Blossom blight and brown rot**

Resistance management strategy for:

Group 2	Dicarboximides;
Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11	Quinone outside inhibitors (QoI);
Group 11+3	QoI + DMI; and
Group 11+7	QoI + SDHI.

		Maximum recommended number of sprays which can contain Group:			
		2	**3**	**7** (inc. 7+3 & 7+11)	**11** (inc. 11+3 & 7+11)
Total number of blossom blight/brown rot targeting sprays	**1**	1	1	1	1
	2	2	2	1	1
	3	2	2	1	2
	4	2	2	1	2
	5	2	2	1	2
	6	3	3	2	2
	7	3	3	2	2
	8	3	3	2	2
	9+	3	3	3	3

Guidelines

1. **Do not** apply consecutive sprays of products containing **Group 7** or **11**. Consecutive sprays include mixtures containing **Group 7** or **11.**
2. **Do not** apply more than three **Group 2** sprays in one season. Apply no more than two consecutive sprays before changing to another group.
3. Consecutive application includes from the end of one season to the start of the following season.
4. The spray program should be considered and the strategy applied on a whole-orchard basis.

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Crop(s)	**Almond**
Disease(s)	**Rust**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11	Quinone outside inhibitors (QoI);
Group 11 + 3	QoI + DMI; and
Group 11 + 7	QoI + SDHI.

		Maximum recommended number of sprays which can contain Group		
		3	**7** (inc. 7+3 & 7+11)	**11** (inc. 11+3 & 7+11)
Total number of rust targeting sprays	**1**	1	1	1
	2	2	1	1
	3	2	1	2
	4	2	1	2
	5	2	1	2
	6	3	2	2
	7	3	2	2
	8	3	2	2
	9+	3	3	3

Guidelines

5. **Do not** apply consecutive sprays of products containing **Group 7** or **11** if applied solo. Consecutive sprays include mixtures containing **Group 7** or **11.**
6. If applying **Group 7** or **Group 11** fungicides in mixtures e.g. **Group 11+7**, consecutive application is allowed. **Do not** apply more than two consecutive sprays before changing to another group.
7. If two consecutive sprays of **Group 3** or **Group 11+3** fungicides are used, then use the same number of sprays of an alternative group(s) before using another **Group 3**, including sprays in the following seasons.
8. Rotate with products from **Group M**.
9. The spray program should be considered and the strategy applied on a whole-orchard basis.

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Crop(s)	**Apple, pear**
Disease(s)	**Apple and pear scab**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 11	SDHI + QoI;
Group 9	Anilinopyrimidines (AP);
Group 11	Quinone outside inhibitors (QoI);
Group 52	DHODHI-fungicide (dihydroorotate dehydrogenase inhibitor); and
Group U12	Guanidines.

Guidelines

10. Not all listed products are registered for both diseases. Ensure the product is registered for the disease being targeted.
11. **Do not** apply more than four sprays per season of **Group 3** fungicides as solo products; **if** more sprays containing **Group 3** are required apply as a tank mixture with a non-cross resistant fungicide.
12. **Do not** apply more than four sprays per season of products containing **Group 9**. In locations where resistance has been reported use a **Group 9** only in mixture with a registered, alternative mode of action for which resistance is not known.
13. **Do not** apply more than three sprays per season of **Group 7**, **Group 11** or **Group 52** fungicides.
14. If two consecutive applications of **Group 7, 9**, **11** or **Group 52** fungicides are used, then they must be followed by at least the same number of applications of fungicide(s) from a different mode of action group(s) before the same group is used again, either in the current or following season.
15. When mixtures are used for resistance management, applied as tank mix or as a co-formulated mixture, the mixture partner should provide effective disease control when used alone on the target disease and must have a different mode of action.
16. **Do not** apply more than three consecutive sprays of **Group U12**, and no more than a total of six **Group U12** sprays per season.
17. If more sprays are required, tank mix **Group U12** with a protectant product at the registered rate.

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18. Pomefruit spray guidelines for SDHI fungicides:

Total number of spray applications per crop	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Max. recommended alone SDHI fungicide sprays	1	1	1	1	2	2	2	2	2	3	3	3
Max. recommended SDHI fungicide sprays in mixture or co-formulated	1	1	2	2	2	3	3	3	3	3	3	4

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Crop(s)	**Avocado and mango**
Disease(s)	**Anthracnose (Colletotrichum spp.)**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7 + 11	Succinate dehydrogenase inhibitors (SDHI) + Quinone outside inhibitor (QoI); and
Group 11*	Quinone outside inhibitor (QoI).

Guidelines

19. If applying **Group 11** (including **7+11**) fungicides, **do not** apply more than two consecutive sprays before changing to another group.
20. **Do not** apply more than three **Group 11** sprays per season within the field. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 11***.
21. **Do not** apply more than four **Group 3** sprays in a season. Apply no more than two consecutive sprays of a **Group 3** fungicide alone.

* *Registered for use in mangoes only.*

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Crop(s)	**Banana**
Disease(s)	**Yellow Sigatoka**

Resistance management strategy for:

Group 3	Demethylation Inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 9	Anilinopyrimidine (AP); and
Group 11	Quinone outside Inhibitor (QoI).
Group 21	Quinone inside Inhibitor (QiI)

Guidelines

Far North Queensland

22. De-leafing must be conducted in accordance with industry guidelines.
23. Apply a regular schedule of protectant sprays.
24. When disease potential is high, apply a maximum of two consecutive **Group 3** sprays before changing to a fungicide of a different activity group.
25. **Do not** apply more than six **Group 3** sprays in any 12-month period. **Do not** apply any **Group 3** sprays in the months of June to September.
26. **Do not** apply more than two **Group 11** sprays in any 12-month period. **Do not** apply **Group 11** sprays in the months of May to September.
27. **Do not** apply more than four **Group 7** sprays in any 12-month period. **Do not** apply **Group 7** sprays in the months of June to September.
28. **Do not** apply more than three **Group 21** sprays in any 12-month period. Exposure **to Group 21** fungicides should not exceed 33 per cent of the total protection for the crop. After one **Group 21** application, change to a fungicide of a different activity group. The next fungicide should preferably have curative activity and a different mode of action.
29. **Group 7** or **11** fungicides should be applied in mixture with another fungicide from a different activity Group registered for the control of Yellow Sigatoka at the full registered rate.

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30. **Do not** apply consecutive sprays of **Group 7**, **11** or **21** fungicides.
31. Apply a minimum of two sprays from a different activity group between sprays of a **Group 7** or **11** fungicide.
32. **Do not** apply more than six **Group 9** sprays in any 12-month period.
33. **Do not** apply more than two consecutive sprays of a **Group 9** fungicide before changing to a fungicide of a different activity group. When using consecutive applications of **Group 9** fungicides, follow with at least as many different activity group fungicides before resuming with a **Group 9** fungicide.

Group	Max. number of applications per year	Max. number of consecutive sprays	Restricted (no spray) periods
3	6 (& no more than 2 of 3 sprays)	2	June to September inclusive
7	4 (& no more than 1 of 3 sprays)	Not allowed	June to September inclusive
9	6 (& no more than 2 of 4 sprays)	2	No restriction
11	2 (& no more than 1 of 3 sprays)	Not allowed	May to September inclusive
21	3 (& no more than 1 of 3 sprays)	Not allowed	No restriction

Everywhere except far North Queensland

34. When using **Group 3** fungicides, apply a maximum of two consecutive **Group 3** sprays before changing to a fungicide of a different activity group.
35. **Do not** apply more than six **Group 3** sprays in any 12-month period.
36. **Do not** apply more than four **Group 7** or **11** sprays in any 12-month period.
37. **Do not** apply consecutive sprays of **Group 7**, **11** or **21** fungicides.
38. Apply a minimum of two sprays from a different activity group between sprays of a **Group 7** or **11** fungicide.
39. **Do not** apply more than six **Group 9** sprays in any 12-month period.

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40. **Do not** apply more than two consecutive sprays of **Group 9** fungicides before changing to a fungicide of a different activity group. When using consecutive applications of **Group 9** fungicides, follow with at least as many different activity group fungicides before resuming with a **Group 9** fungicide.
41. **Do not** apply more than three **Group 21** sprays in any 12-month period. Exposure **to Group 21** fungicides should not exceed 33 per cent of the total protection for the crop. After one **Group 21** application, change to a fungicide of a different activity group. The next fungicide should preferably have curative activity.

Group	Max. number of applications per year	Max. number of consecutive sprays	Restricted (no spray) periods
3	6 (& no more than 2 of 3 sprays)	2	No restriction
7	4 (& no more than 1 of 3 sprays)	Not allowed	No restriction
9	6 (& no more than 2 of 4 sprays)	2	No restriction
11	4 (& no more than 1 of 3 sprays)	Not allowed	No restriction
21	3 (& no more than 1 of 3 sprays)	Not allowed	No restriction

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Crop(s)	**Barley**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation Inhibitors (DMI);
Group 5	Morpholines;
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11 + 3	Quinone outside Inhibitor (QoI) + DMI;
Group 11 + 4	QoI + Phenylamide;
Group 13	Aza-naphthalene; and
Group 11 + 7 + 3	QoI +SDHI + DMI.

Guidelines

42. Fungicides should be used preventatively (as protectants), or at the very first sign of disease. If disease is established within the canopy, fungicides may not produce optimal results and there is a high chance of selection for fungicide resistance. In high disease pressure situations, integrated management approaches should be considered to reduce fungicide resistance including:
    a. Removal of stubble;
    b. Crop rotation (**avoid** barley on barley);
    c. Control of green bridge volunteers;
    d. Use of tolerant or resistant varieties; and
    e. Strategic use (timing, application technique and rate) of fungicides.
43. **Do not** apply more than two applications per growing season of products containing any of the above listed Groups containing products. This includes in-furrow or seed treatments that have activity on powdery mildew. Combinations of in-furrow and seed treatment are counted as one application.
44. **Do not** apply consecutive applications of **Group 11** containing products. This includes in-furrow i.e. If a **Group 11+4** fungicide has been used in-furrow at planting, and the **Group 11** has foliar activity (as determined by label claims), the first foliar fungicide spray must not contain a **Group 11** fungicide.
45. If a **Group 7** seed treatment has been used with foliar activity (as determined by label claims), the first foliar fungicide applied must not contain a **Group 7** fungicide.
46. **Group 7** and **Group 13** foliar fungicides must always be in a co-formulation or in mixture with a registered mixing partner with a different mode of action, with no known resistance.
47. Minimise use of fungicides which are known to have compromised efficacy due to resistance.

Crop(s)	**Barley**

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Disease(s) Scald and net blotch

Resistance management strategy for:

Group 3	Demethylation Inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11 + 3	Quinone outside Inhibitor (QoI) + DMI;
Group 11 + 4	QoI + Phenylamide; and
Group 11 + 7 + 3	QoI + SDHI + DMI.

Guidelines

48. Not all listed products are registered for both diseases. Ensure the product is registered for the disease being targeted.
49. Fungicides should be used as protectant treatments – where there is no more than 5% leaf area infection evident anywhere in the canopy. In high risk disease environments, integrated management approaches should be used to reduce fungicide resistance risk, which may include:
    a. Removal of stubble;
    b. Crop rotation (**avoid** barley on barley);
    c. Control of green bridge volunteers; and
    d. Use of tolerant or resistant varieties.
50. **Do not** apply more than one application of a **Group 7** seed treatment with foliar activity in any two consecutive growing seasons.
51. **Do not** apply more than two applications per growing season of **Group 11** or **7** containing products. This includes foliar sprays as well as in-furrow or seed treatments that have activity on foliar diseases. Combinations of in-furrow and seed treatment are counted as one application.
52. **Do not** apply consecutive applications of **Group 11** containing products. This includes in-furrow i.e. if a **Group 11+4** or **11+3+7** fungicide has been used in-furrow at planting, the first foliar fungicide spray must not contain a **Group 11** fungicide.
53. If a **Group 7** seed treatment has been used with foliar activity (as determined by label claims), the first foliar fungicide applied should not contain a **Group 7** fungicide. An alternative mode of action fungicide should be applied at typical foliar fungicide timing.
54. If a **Group 7 or Group 11** fungicide is being applied as a foliar spray, it must be in a co-formulation or in mixture with a registered mixing partner with a different mode of action, with no known resistance.
55. **Do not** apply more than three applications containing **Group 3** fungicides per growing season. This total of three applications includes DMIs applied as **Group 11+3** or **Group 11+7+3** co-formulations

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and in-furrow or seed treatments that have activity on foliar diseases. Combinations of in-furrow and seed treatments are counted as one application.

56. Minimise use of **Group 3** and **Group 7** fungicides which are known to have comprised resistance status.

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Crop(s) **Berry (generic, other than strawberry)**
Disease(s) **Grey mould (*Botrytis*)**

Resistance management strategy for:

Group 2	Dicarboximide;
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 11	SDHI + Quinone outside inhibitors (QoI);
Group 7 + 12	SDHI + phenylpyrroles (PP);
Group 9	Anilinopyrimidine (AP);
Group 9 + 12	AP + PP;
Group 17	Hydroxyanilide;
Group 19	Chitin synthase inhibitor;

Guidelines

57. Apply a program of protectant fungicides during flowering.
58. **Do not** apply more than two consecutive sprays of **Group 2**, **9**, , **17**, **19** or fungicides. Continue alternation of Mode of Action between successive crops.
59. Do not apply **17** (solo) as consecutive applications, or more than 3 times per season.
60. If using **Group 17** with an effective mixing partner, or a different **Group**, **do not** apply the **Group 17** containing mixtures for more than 50% of all applications.
61. If applying **Group 7** (including**, 7+11** or **7+12**) fungicides, **do not** apply more than two consecutive sprays before changing to another group. **Do not** apply more than three **Group 7** sprays per season. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 7**, including sprays in consecutive seasons.
62. If three or fewer sprays are applied per crop, use only one spray containing a **Group 9** or **12** containing fungicide. Use a maximum of three sprays containing **Group 9, or 12** containing fungicides, or 33% of sprays (whichever is lower).
63. **Do not** apply **Group 19** fungicides more than 6 times per season, or more than 50% of the total number of sprays.

Please note:

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	Group						
	2	**7** **7+11** **7+12**	**9** **9+12**	**12** **12+7** **12+9**	**17** (solo)	**17** (in mixture)	**19**
Maximum number of consecutive applications	2	2	2	2	1	1	2
Maximum number of sprays per crop/season	2-3	3 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower	1 in 2 (50%)	6 Or 1 in 2 (50%) whichever is lower

*Where there are several crop cycles per year, up to a maximum of five (5) applications containing **Group 21** can be applied.*

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Crop(s)	**Broccoli and cauliflower**
Disease(s)	**Downy mildew**

Resistance management strategy for:

Group 4	Phenylamide;
Group 11	Quinone outside Inhibitor (QoI);
Group 21	Quinone inside Inhibitor;
Group 28 + 43	Carbamate + benzamide; and
Group 49	Oxysterol binding protein inhibitor (OSBP).

Guidelines

64. Applications made within the nursery count towards the total number of applications allowed per crop. It is recommended that disease control is started early and maintain a regular program using a fungicide from groups other than **Group 4**, **11**, **21, 28+43** or **49**.
65. When conditions favour disease development, **do not** wait for disease to appear, but apply two consecutive sprays of a **Group 4**, **11**, **21, 28+43** or **49** product at the interval recommended on the label. Then resume the program of sprays using products from a different group to the products just applied.
66. **Do not** apply more than three sprays of a **Group 4**, **11**, **21, 28+43** or **49** product or 33% of the total number of fungicide sprays per season, whichever is more restrictive.
67. Apply **Group 4** and **49** fungicides preventatively and only in mixtures with effective protectant fungicides from a different group.
68. **Do not** use a **Group 49** product if it will be the last fungicide applied to the crop.
69. Continue alternation of fungicides between successive crops. **Do not** make more than (6) six total applications of a **Group 49** product per year on the same area targeting the same disease.

	Group				
	4	**11**	**21**	**28 + 43**	**2**
Maximum number of consecutive applications	2		2	2	2
Maximum number of solo sprays	None		None	N/R	None
Maximum number of sprays per crop/season	3 (or 1 in 3)	3 (or 1 in 3)	3 (or 1 in 3)	3^ (or 1 in 3)	3^ (or 1 in 3)

* Maximum application number on product label may differ. Ensure you follow the label recommendations.

^ Not allowed in nursery production.

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Crop(s)	**Broccoli and cauliflower**
Disease(s)	**White blister**

Resistance management strategy for:

Group 4	Phenylamide;
Group 11	Quinone outside inhibitor (QoI);
Group 21	Quinone inside inhibitor; and
Group 28 + 43	Carbamate + benzamide.

Guidelines

70. Apply fungicides from **Group 4**, **11**, **21** or **28+43** in a preventative strategy when conditions favour disease development. Applications made within the nursery count towards the total number of applications allowed per crop.
71. Always apply **Group 4** in mixtures for foliar applications. Apply no more than two consecutive sprays of products containing **Group 4** actives.
72. Apply no more than two consecutive sprays of fungicides containing **Group 11** or **21**. Consecutive sprays should only be adopted if these groups are applied in mixture with an alternative mode of action fungicide. **Group 11** or **21** fungicides should be applied in strict alternation with other fungicide groups if being applied without mix partners.
73. **Do not** apply more than two applications of **Group 4** and **Group 11** fungicides per crop.
74. **Do not** apply more than three applications of a **Group 21** or **28+43** fungicide per crop.

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Crop(s)	**Canola**
Disease(s)	**Black leg and sclerotinia**

Resistance management strategy for:

Group 2	Dicarboximides;
Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 7 + 12	SDHI + phenylpyrroles (PP); and
Group 11 + 3	Quinone outside inhibitors + DMI

Guidelines

75. Not all listed products are registered for both diseases. Ensure the product is registered for the disease being targeted.
76. Fungicides should be used primarily as a preventative or at first sign of disease. If disease is established within the canopy, fungicides may not produce optimal results and there is very strong potential to select for fungicide resistance. Sclerotinia targeted applications should be applied during flowering of the crop, prior to an infection period. Application of fungicides for Sclerotinia may put selection pressure on the blackleg population.
77. In high risk disease environments, integrated management approaches should be used to reduce fungicide resistance risk. This includes growing canola at least 500 m from previous season's canola stubble, the use of resistant varieties, using alternative fungicide modes of action and stubble management such as knocking down and/or strategic burning.
78. The risk of developing resistance to fungicides can be reduced by incorporating different modes of action into blackleg management programs as either mixtures, co-formulations or rotations.
79. If a **Group 7** seed treatment has been used with foliar activity on blackleg (as determined by label claims), the seedling fungicide application at 4-6 leaf stage targeting blackleg should not contain a **Group 7** fungicide.
80. **Do not** apply more than two applications containing **Group 7** fungicides per growing season. Combinations of in furrow and seed treatment are counted as one application.
81. **Do not** apply more than two consecutive applications of a **Group 3** fungicide.
82. **Do not** apply more than one application containing a **Group 11** fungicide.
83. Minimise use of fungicides which are known to have compromised resistance status.
84. If seasonal conditions require a second fungicide application at 50% flowering after a 20% flowering timing, the second application should be from a different **Group**.

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Application stage (Disease being controlled)		Rotation options for different fungicide active groups											
Seed dressing & in-furrow (Blackleg)		None	None	None	None	None	None	3	3	3	3	3	3
Seedling foliar (Blackleg)		None	3	7	7+3	7+12	11+3	None	3	7	7+3	7+12	11+3
20% flower (Sclerotinia, first spray) Choose only one option from this section (a-f)	a	None	None	None	None	None	None	None	None	None	None	None	None
	b	2	2	2	2	2	2	2	2	2	2	2	2
	c	3	3	3	3	3	3		3		3	3	
	d	7+3	7+3	7+3	7+3	7+3			7+3		7+3	7+3	
	e	7+12	7+12	7+12	7+12		7+12	7+12	7+12	7+12			7+12
	f	11+3	11+3	11+3	11+3	11+3			11+3		11+3	11+3	

(continued) Application stage (Disease being controlled)		Rotation options for different fungicide active groups					
Seed dressing & in-furrow (Blackleg)		7	7	7	7 + 3	7 + 3	7 + 3
Seedling foliar (Blackleg)		None	3	11+3	None	3	11+3
20% flower (Sclerotinia, first spray) Choose only one option from this section (a-f)	a	None	None	None	None	None	None
	b	2	2	2	2	2	2
	c	3	3	3	3		
	d	7+3	7+3	7+3	7+3		
	e	7+12	7+12	7+12	7+12	7+12	7+12
	f	11+3	11+3		11+3		

If a second application at 50% flower required:

Application at 20% flowering	Rotation options for different fungicide active groups				
	2	3	7+3	7+12	11+3
Rotation options for 50% flowering second application		2	2	2	2
	3			3	
	7+3				
	11+3			11+3	

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Crop(s)	**Cucurbit**
Disease(s)	**Downy mildew**

Resistance management strategy for:

Group 4	Phenylamides (PA);
Group 11	Quinone outside inhibitors (QoI);
Group 28 + 43	Carbamates + benzamides;
Group 40	Carboxylic acid amide (CAA);
Group 45 + 40	Quinone outside inhibitors, stigmatellin binding type (QoSI) + CAA;
Group 49	Oxysterol binding protein inhibitors (OSBPI); and
Group 49 + 11	OSBPI + QoI.

Guidelines

85. Applications made within the nursery count towards the total number of applications allowed per crop. It is recommended that disease control is started early and maintain a regular program using a fungicide from groups other than **Groups 4**, **11**, **28+43**, **40**, **45+40, 49** or **49+11**.
86. When conditions favour disease development, **do not** wait for disease to appear, but apply two consecutive sprays of a **Group 4**, **11**, **28+43**, **45+40, 49** or **49+11** fungicide, at the interval recommended on the label, then resume the program of sprays using products from a different group to the fungicide just applied.
87. **Do not** apply more than four sprays of a **Group 4** or **Group 40** containing product per season.
88. **Do not** apply more than three sprays of a **Group 49** containing product. **Group 49** containing sprays should not consist of more than one in every three sprays of the total number of fungicide sprays per crop. **Group 49+11** sprays count as both a **Group 49** and a **Group 11** spray.
89. **Do not** apply more than two sprays of **Group 28+43, 45+40** or **11** containing fungicides (including **49+11**) per crop.
90. Apply **Group 4**, **11, 45+40** and **49** (including **49+11**) fungicides preventatively.
91. Apply **Group 4** and **49** fungicides only in mixtures or co-formulations with a registered fungicide from a different mode of action group with no known resistance.
92. Continue alternation of fungicides between successive crops. **Do not** make more than (6) six total applications of a **Group 49** product per year on the same area targeting the same disease.

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	Group				
	4	**11**	**28 + 43**	**40, 45 + 40**	**49, 49 + 11**
Maximum number of consecutive applications	2	1	2	2	2
Maximum number of solo sprays	None				None of **49**
Maximum number of sprays per crop or season inc. Nursery*	4	2	2^	2 or 4	3^ (or 1 in 3) 6 per year

* Maximum application number on product label may differ. Ensure you follow the label recommendations.

^ Not allowed in nursery production.

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Crop(s)	**Cucurbit**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 8	Hydroxy-(2-amino-) pyrimidines;
Group 11	Quinone outside inhibitors (QoI);
Group 11 + 7	QoI + SDHI;
Group 13	Aza-naphthalenes;
Group 21	Quinone inside inhibitors (QiI);
Group U6	Phenyl-acetamide; and
Group 50 (U8)	Actin disruptors (aryl-phenyl-ketones).

Guidelines

93. Start disease control early. **Do not** wait for powdery mildew to appear before spraying but start as soon as possible after crop emergence.
94. Use protectant sprays in early crop growth. Apply protectant sprays up to the fruit set stage of the crop if the disease normally occurs during this period. If this schedule is interrupted (e.g. by rain) use a tank mix of protectant plus systemic before recommencing the protectant program.
95. After fruit set, use systemic fungicides in one or more of the following ways:
    a. Tank mix systemic fungicides with a protectant fungicide **and** use fungicides from at least two different mode of action groups per crop.
    b. Alternate systemic fungicides with a protectant fungicide **and** use fungicides from at least two different mode of action groups per crop.
    c. Alternate systemic fungicides from at least three different activity groups per crop.
96. Apply **Group 7, 11** and **21** fungicides preventatively (as protectants).
97. Use a maximum of one **Group 11** or **Group 21** containing spray out of every three fungicide applications.
98. **Do not** use consecutive applications of **Group 11** or **Group U6** fungicides.
99. **Do not** apply more than two **Group 11** (including **11+7**) or **Group U6** products per crop.
100. **Do not** apply more than three **Group 21** containing products per crop, with up to two consecutive applications. **Do not** apply more than five **Group 21** products per calendar year in case of multiple cropping cycles. Continue alternation of fungicides between successive crops.

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101. SDHI guideline – use SDHI fungicides as per label instructions and as protectants only.

Total number of spray applications per crop	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**>12**
Max. recommended alone SDHI fungicide sprays (**apply in strict alternation**)	1	1	1	1	2	2	2	3	3	3	3	4	*
Max. recommended SDHI fungicide sprays in mixture (**apply a max. of 2 consecutive applications**)	1	1	1	2	2	3	3	3	3	3	4	4	*

** When more than 12 fungicide applications are made, observe the following guidelines:*

i. When using an SDHI fungicide alone, the number of applications should be no more than 1/3 (one in every three sprays) of the total number of fungicide applications per season

ii. If used alone, apply SDHI fungicides in strict alternation with fungicides from a different cross-resistance group.

iii. For programs in which tank mixes or pre-mixes of SDHI fungicides are utilized, the number of SDHI-containing applications should be no more than 1/2 (50%) of the total number of fungicide application per season.

iv. If used in mixture, apply SDHI fungicides in a maximum of 2 consecutive applications.

v. In programs where SDHIs are made with both alone and in mixtures, the number of SDHI containing applications should be no more than ½ (50%) of the total no. of fungicides applied per season.

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Crop(s)	**Fruit (post-harvest treatment)**
Disease(s)	**Post-harvest diseases**

Resistance management strategy for:

Group 2	Dicarboximides;
Group 3	Demethylation inhibitors (DMI);
Group 3 + 12	DMI + Phenylpyrroles;
Group 9	Anilinopyrimidine (AP);
Group 11 + 12	Quinone outside Inhibitors (QoI) + Phenylpyrroles; and
Group 12	Phenylpyrroles.

Guidelines

102. For the last pre-harvest spray, use a fungicide with a different activity group to the fungicide planned for use as a post-harvest treatment.
103. Where alternatives are available, rotate to use as many different activity groups as possible.
104. **Do not** dispose of unused dip solutions as a spray to crops or orchards.
105. **Do not** dispose of unused dip solutions within or near the crop or orchard area.

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Crop(s)	**Grape**
Disease(s)	**Downy mildew**

Resistance management strategy for:

Group 4	Phenylamides (PA);
Group 11	Quinone outside inhibitors (QoI);
Group 11 + 3	QoI + Demethylation inhibitors (DMI);
Group 21	Quinone inside inhibitors (QiI);
Group 40	Carboxylic acid amides (CAA);
Group 40+49	CAA + Oxysterol binding protein homologue inhibitors (OSBPI);
Group 45+40	Quinone outside inhibitor, stigmatellin binding type) (QoSI) + CAA; and
Group 49	Oxysterol binding protein homologue inhibitors (OSBPI).

Guidelines

106. Start preventative disease control sprays using **non-Group 4** protectant fungicides, typically when shoots are 10-20cm long. Continue spraying at intervals of 7-21 days depending on disease pressure, label directions and rate of vine growth.

107. **Group 4** fungicides should be applied as soon as possible after an infection period, and before the first sign of oilspots. Limit the use of **Group 4** fungicides to periods when conditions favour disease development. Always apply **Group 4** fungicides in mixtures.

108. **Group 49** fungicides should be applied prior to infection and only in mixtures with effective fungicides applied at an effective rate from a different cross resistance group. The mixing partner should give effective control of downy mildew at the rate and interval selected. A maximum of two **Group 49** applications may be made per season. Only apply **Group 49** for a maximum of one in every three sprays of the total number of downy mildew sprays. A **Group 49** application must be followed by at least two applications of a different group(s) before being reapplied.

Group 49 fungicides should be applied prior to infection and only in mixtures with effective fungicides applied at an effective rate from a different cross resistance group. The mixing partner should give effective control of downy mildew at the rate and interval selected. Only apply a spray containing **Group 40**, or **40+49** as a maximum of 33% of the total number of downy mildew sprays. A **Group 49**, or **40+49** application must be followed by at least two applications of a different group(s) before being reapplied.

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109. Fungicide mixtures are defined as co-formulations, or tank mixes at label rate of an alternative mode of action.

110. Apply a maximum of two consecutive applications of **Group 4**, **21**, **40**, or **45+40** containing fungicides.

111. **Do not** apply **Group 11** (including mixture formulations) consecutively.

112. Apply a maximum of two sprays per season of **Group 11** (including mixtures) **Group 45+40, Group 40 +49** and **Group 49**.

113. **Do not** apply a spray containing **Group 40** as the last spray of the season. Only apply a spray containing **Group 40** a maximum of 50% of the total number of downy mildew sprays.

114. Apply a maximum of three **Group 21** containing sprays per season, and a maximum of two consecutive sprays.

	Group						
	4	**11** (inc. 11 + 3)	**21**	**40***	**45 + 40**	**40 + 49**	**49**
Max. number of consecutive applications	2	None	2	2	2	None	None
Max. number of solo sprays	None	2	3	2 (50%)	None	2	None
Max. number of sprays per season	4-mix	2	3	4-mix (50%)	2	2 (33%)**	2-mix
Areas of higher agronomic risk	Mix	Mix	N/A	Mix	N/A	N/A	Mix

** Refer to point 8.*

*** Refer to point 3*

N.B. Consecutive sprays include mixture formulations.

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Crop(s)	**Grape**
Disease(s)	**Grey mould (*Botrytis* bunch rot)**

Resistance management strategy for:

Group 2	Dicarboximides;
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + Demethylation inhibitors (DMI);
Group 7 + 12	SDHI + phenylpyrroles (PP);
Group 9	Anilinopyrimidines (AP);
Group 9 + 12	AP + PP;
Group 11	Quinone outside inhibitors (QoI);
Group 11 + 3	QoI + DMI;
Group 17	Keto reductase inhibitors (KRI); and
Group 19	Chitin synthase inhibitor;
Group 21	Quinone inside inhibitors (QiI); and
Group 52	DHODHI-fungicide (dihydroorotate dehydrogenase inhibitor);

Guidelines

115. Always use an integrated disease management approach to grey mould management in vines. Manipulate the bunch zone microclimate to reduce humidity and enable rapid drying of wet bunches. Always aim to reduce spore load, flower and fruit infection and limit regrowth of latent infections and disease spread by timely fungicide application in an IDM approach. Use fungicides registered to control *Botrytis* at label rates from as many different mode of action groups as possible when needed.
116. Apply all these fungicides as protectants before the first sign of disease.
117. Consecutive applications include from the end of one season to the start of the next, for products applied either stand alone or in mixtures.

Continued on next page.

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118. Varying the number of fungicides applied targeting *Botrytis* changes the relative resistance risk to any one fungicide group. When three or fewer sprays are applied, it is recommended that three different groups of fungicides are used (see table below). When four sprays are applied, try to use 3 or 4 different groups of fungicide.

		Maximum recommended number of sprays which can contain Group									
		2	**7** (inc. 7+3 & 7+12)	**7 + 12**	**9**	**11** (inc. 11 + 3)	**12** (inc. 9 + 12)	**17**	**19**	**21**	**52**
Total number of *Botrytis* targeting	**1**	1	1	1	1	1	1	1	1	1	1
	2	1	1	1	1	1	2	1	1	1	1
	3	1	1	1	1	1	2	1	1	1	1
	4	2	1	1	2	2	2	2	2	1	2
	5	2	1	1	2	2	2	2	3	1	2
	6+	2	2	1	2	2	2	2	3	2-3	2

119. If a **Group 11** or **7** fungicide is used solo, it should only be used in strict alternation with fungicides from a different mode of action group.

120. **Do not** apply more than two consecutive sprays from the same fungicide group, for any **Group 2**, **7**, **9** (including combinations with **Group 12**), **11+3, 17, 19** or **21** or fungicide, including from the end of one season to the start of the following season.

121. If two consecutive applications of **Group 11+3** fungicides are used, then they must be followed by at least the same number of applications of fungicide(s) from a different group(s) before a **Group 11** (including combinations with **Group 3**) fungicide is used again, either in the current or following season.

122. **Do not** apply more than three **Group 21** containing products per crop, or a maximum of 33% of total applications (whichever is lower). Continue alternation of fungicides between successive seasons.

123. **Do not** apply **Group 52** as consecutive applications, or more than 2 times per season.

124. If resistance to a fungicide group has been detected within a region, only use that fungicide group in mixtures or in strict alternation with fungicides from a different cross resistance group. A fungicide group that has been applied as the final application of the season should not be the first fungicide in the following season.

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Crop(s)	**Grape**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 5	Amines (morpholines);
Group 5 + 3	Amines + DMI;
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 7 + 12	SDHI + phenylpyrroles (PP);
Group 11	Quinone outside inhibitors (QoI);
Group 11 + 3	QoI + DMI;
Group 13	Aza-naphthalenes;
Group 19	Chitin synthase inhibitor;
Group 21	Quinone inside inhibitors (QiI);
Group 50 (U8)	Actin disruptors (aryl-phenyl-ketones); and
Group U6	Phenyl-acetamide.

Guidelines

125. Apply all these fungicides preventatively.

126. Consecutive applications include from the end of one season to the start of the next. Medium to high risk fungicides (**Group 7** and **11**) if used consecutively should be applied in a mixture or co-formulation with a registered, alternative mode of action for which resistance is not known – where these fungicides have been routinely used for many seasons, field research indicates there is an increased risk of powdery mildew resistance. To ensure effective powdery mildew control in these circumstances, either use alternative modes of action or apply in mixtures.
127. **Do not** apply more than one application of **Group 5+3**.
128. **Do not** apply more than two consecutive sprays of **Group 3**, **5**, **13**, **19**, **21**, **50 (U8)** and **U6** (including mixture formulations, apart from **Group 5+3** which should be a maximum of one application).
129. **Do not** apply more than three **Group 21** containing products per crop, or a maximum of 33% of total applications (whichever is lower). Continue alternation of fungicides between successive seasons.

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		Group									
		3	**5**	**5 + 3, 7 + 12**	**7** (inc. 7 + 3)	**11** (inc. 11 + 3)	**13**	**19**	**21**	**50** (U8)	**U6**
Total number of powdery mildew targeting sprays	**1**	1	1	1	1	1	1	1	1	1	1
	2	2	1	1	1	1	2	2	1	1	1
	3	2	2	1	1	2	2	2	1	1	1
	4	2	2	1	1	2	2	2	1	2	2
	5	2	2	1	1	2	2	2	1	2	2
	6	3	3	1	2	2	3	3	2	2	2
	7	3	3	1	2	2	3	3	2	2	2
	8	3	3	1	2	2	3	3	2	2	2
	9+	3	3	1	2	2	3	3	3	2	2

N.B. Consecutive sprays include mixture formulations.

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Crop(s)	**Lettuce**
Disease(s)	***Botrytis* and *Sclerotinia***

Resistance management strategy for:

Group 2	Dicarboximides;
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 11	SDHI + Quinone outside inhibitors (QoI);
Group 7 + 12	SDHI + phenylpyrroles (PP);
Group 9	Anilinopyrimidines (AP);
Group 11	QoI;
Group 9 + 12	AP + PP, and
Group 21	Quinone inside inhibitors (QiI).

Guidelines

130. Not all listed products are registered for both diseases. Ensure the product is registered for the disease being targeted.
131. Maintain a cover with protectant fungicide sprays at seven to ten day intervals from planting.
132. **Do not** apply **Group 2** fungicides more than four times per season, irrespective of the target disease.
133. **Do not** apply more than two fungicides containing **Group 9** per crop (including **Group 9+12**).
134. **Do not** apply more than three **Group 7**, **Group 11,** or **Group 21** containing fungicides per crop and no more than two consecutive sprays per crop. If a **Group 7** or **11** fungicide has been used solo it should be in strict alternation with other modes of action. If used in a mixture, no more than two consecutive sprays per crop. This includes the treatment at the end of one crop and the start of the next as consecutive.
135. **Group 7** and **Group 21** containing sprays should not make up more than one in every three of the spray program.
136. **Do not** apply more than two consecutive applications of a **Group 12** containing fungicide.
137. Apply **Group 21** as a protectant spray only. Continue alternation of fungicides between successive crops. Do not apply more than five (5) applications of **Group 21** per year on the same area.

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		2	**7** (inc. 7 + 11)	**9** (inc. 9 + 12)	**11** (inc. 7 + 11)	12 (inc. 7 + 12)	**21**
Total number of targeting sprays	**1**	1	1	1	1	1	1
	2	1	1	1	1	2	1
	3	1	1	1	1	2	1
	4	2	1	2	2	2	1
	5	2	1	2	2	2	1
	6	2	2	2	2	2	2

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Crop(s)	**Lettuce**
Disease(s)	**Downy mildew**

Resistance management strategy for:

Group 4	Phenylamides (PA);
Group 28 + 43	Carbamates + benzamides;
Group 40	Carboxylic acid amides (CAA);
Group 45 + 40	Quinone outside inhibitors, stigmatellin binding type (QoSI) + CAA;
Group 49	Oxysterol binding protein inhibitors (OSBPI); and
Group 49 + 11	OSBPI + quinone outside inhibitors (QoI).

Guidelines

138. Applications made within the nursery count towards the total number of applications allowed per crop. It is recommended that disease control is started early and maintain a regular program using a fungicide from groups other than **Group 4**, **40**, **45+40**, **49** (or **49+11**) or **28+43**.
139. When conditions favour disease development, **do not** wait for disease to appear, but apply two consecutive sprays of a **Group 4**, **40**, **49**, **49+11** or **28+43** product at the interval recommended on the label. Then resume the program of sprays using an alternative fungicide group to what was just applied.
140. **Do not** apply more than four sprays of a **Group 4** or **40** product per season.
141. **Do not** apply more than four sprays of a **Group 45+40** product per crop.
142. Apply **Group 45+40** fungicides preventatively.
143. **Group 49** including **Group 49+11** fungicides should only consist of a maximum of one in every three of the total fungicide sprays per crop targeting downy mildew. **Do not** apply more than three sprays of a **Group 49** containing product including **Group 49+11** sprays per crop. **Group 49+11** sprays count as both a **Group 49** and a **Group 11** spray. If there are multiple crops per year, **do not** make more than (6) six total applications of a Group 49 product on the same area.
144. **Do not** apply more than three sprays of a **Group 28+43** product per crop.
145. Apply **Group 4** and **49** (or **49+11**) fungicides preventatively and only in mixtures or co-formulations with a registered fungicide from a different mode of action group, with no known resistance.
146. Continue alternation of fungicide modes of action between successive crops.

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	Group			
	4	**28 + 43**	**40, 45 + 40**	**49, 49 + 11**
Maximum number of consecutive applications	2	2	2	2
Maximum number of solo sprays	None			None of **49**
Maximum number of sprays per crop or season inc. Nursery*	4	3^ (or 1 in 3)	2 or 4	3^ (or 1 in 3) 6 per year

* Maximum application number on product label may differ. Ensure you follow the label recommendations.

^ Not allowed in nursery production.

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Crop(s) **Macadamia**
Disease(s) **Husk spot**

Resistance management strategy for:

Group 1	Methyl benzimidazole carbamates (MBC);
Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitor (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11	Quinone outside inhibitors (QoI);
Group 7 + 11	SDHI + QoI; and
Group 11 + 3	QoI + DMI.

Guidelines

		Max. recommended number of sprays which can contain Group:						
		1	**3**	**7**	**11**	**7+3**	**7+11**	**11+3**
Total number of husk spot targeting sprays	**1**	1	1	1	1	1	1	1
	2	2	2	1	1	2	2	2
	3	2	2	1	1	2	2	2
	4+	2	2	1	1	2	2	2

147. If application of a single group product is used, **do not** apply consecutive sprays of the same group.
148. If applying a pre-mixture or tank mixture product containing two different groups, **do not** apply more than two consecutive sprays before changing to another Mode of Action group. This includes from one season to the next, and applications made to manage other diseases.
149. The spray program should be considered, and the strategy applied on a whole-orchard basis.

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Crop(s)	**Onion**
Disease(s)	**Downy mildew**

Resistance management strategy for:

Group 4	Phenylamides (PA);
Group 28 + 43	Carbamates + benzamides;
Group 40	Carboxylic acid amides (CAA);
Group 45 + 40	Quinone outside inhibitors, stigmatellin binding type (QoSI) + CAA;
Group 49	Oxysterol binding protein inhibitors (OSBPI); and
Group 49 + 11	OSBPI + quinone outside inhibitors (QoI).

Guidelines

150. Start disease control early and maintain a regular program using a fungicide from groups other than **Group 4**, **40**, **45+40** or **49** (or **49+11**).
151. When conditions favour disease development, **do not** wait for disease to appear, but apply two consecutive sprays of a **Group 4**, **28+43**, **40**, **49** (or **49+11**) product at the interval recommended on the label. Then resume the program of sprays using products from a different mode of action group to the **Group 4**, **28+43**, **40**, **49** or **49+11** products just applied.
152. **Do not** apply more than four sprays of a **Group 4** or **40** product per season.
153. **Do not** apply more than three sprays of a **Group 28+43** or **49** (or **49+11**) product per crop. **Group 49** (or **49+11**) containing sprays should not consist of more than one in every three of the total number of fungicide sprays per crop. If there are multiple crops per year**, do not** make more than (6) six total applications of a **Group 49** (or **49+11**) product per year on the same area.
154. **Do not** apply more than two sprays of a **Group 45+40** product per crop.
155. Apply **Group 4**, **40**, **45+40** and **49** (including **49+11**) fungicides preventatively.
156. Apply **Group 4** and **49** (or **49+11**) fungicides only in mixtures with a registered fungicide from a different mode of action group, with no known resistance.
157. Continue alternation of fungicides between successive crops.

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	Group			
	4	**28 + 43**	**40, 45 + 40**	**49, 49 + 11**
Maximum number of consecutive applications	2	2	2	2
Maximum number of solo sprays	None			None of **49**
Maximum number of sprays per crop season *	4	3^ (or 1 in 3)	2 or 4	3^ (or 1 in 3) 6 per year

* Maximum application number on product label may differ. Ensure you follow the label recommendations.

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Crop(s)	**Ornamentals**
Disease(s)	**Grey mould (*Botrytis*)**

Resistance management strategy for:

Group 2	Dicarboximide;
Group 9	Anilinopyrimidine (AP);
Group 9 + 12	AP + phenylpyrroles;
Group 11	Quinone outside inhibitor (QoI);
Group 11 + 3	QoI + Demethylation inhibitors (DMI); and
Group 17	Hydroxyanilide.

Guidelines

158. If three or fewer sprays are applied per season, use only one spray containing a **Group 9** fungicide (including **9+12**). If four to six sprays are applied per season, use a maximum of two sprays containing **Group 9** fungicides. If seven or more sprays are applied per season use a maximum of three sprays containing **Group 9** fungicides.
159. **Do not** apply more than two consecutive sprays of a **Group 2, 9, 11, 12 or 17** fungicides.

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Crop(s)	**Ornamentals**
Disease(s)	**Myrtle rust**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate Dehydrogenase inhibitors (SDHI);
Group 3 + 11	DMI + Quinone outside inhibitors (QoI); and
Group 11	QoI.

Guidelines

160. Fungicide groups that are classified as medium to high risk for fungicide resistance development, **Group 3, 7** and **11** should be rotated as a key feature to reduce the development of resistance.

161. **Do not** apply more than two (2) consecutive sprays of fungicides from **Group 3, 7** or **11**, unless mixed with a registered fungicide from a different more of action group with no known resistance or low resistance risk.

162. If consecutive sprays of a **Group 7 or 11**, are applied, they must be followed by at least two applications of fungicide from a different group(s) before the same high-risk fungicide is used again.

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Crop(s)	**Passionfruit**
Disease(s)	**Alternata spot (*Alternaria* spp.)**

Resistance management strategy for:

Group 2	Dicarboximide;
Group 7 + 3	Succinate dehydrogenase inhibitor (SDHI) + DMI; and
Group 11	Quinone outside inhibitors (QoI).

Guidelines

163. Maintain a protective cover with a protectant fungicide such as mancozeb.
164. Limit the use of **Group 2** to strategic periods, i.e. before, during and after extended wet periods.
165. Always tank mix the **Group 2** fungicide with a protectant such as mancozeb.
166. **Do not** apply more than four **Group 2** sprays in a season.
167. The total number of **Group 7+3** and **Group 11** sprays should be no more than one-third of the total number of fungicide sprays per season.
168. **Do not** apply more than two consecutive applications of a **Group 11** spray.
169. If two consecutive applications of a **Group 7+3** or **Group 11** spray are applied, they must be followed by at least the same number of sprays from an alternative chemical group.

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Crop(s)	**Peanut**
Disease(s)	**Leaf spot, rust, net blotch**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7 + 3	Succinate dehydrogenase inhibitor (SDHI) + DMI;
Group 11	Quinone outside Inhibitors (QoI); and
Group 3 + 11	DMI + QoI.

Guidelines

170. Not all listed products are registered for all diseases. Ensure the product is registered for the disease being targeted.
171. **Do not** apply more than three consecutive **Group 3** sprays alone, before changing to a fungicide of a different activity group.
172. Apply a maximum of five **Group 3** sprays per season.
173. **Do not** apply **Group 11** or **Group 7** containing products as more than 50% of the total number of sprays in any one season, up to a maximum of three sprays of **Group 11**.
174. **Do not** apply more than two consecutive applications of a **Group 7+3** or **Group 11** spray.
175. If two consecutive applications of a **Group 7+ 3** or **Group 11** spray are applied, they must be followed by at least the same number of sprays from an alternative chemical group.

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Crop(s)	**Poppy**
Disease(s)	**Downy mildew**

Resistance management strategy for:

Group 4	Phenylamides (PA);
Group 11	Quinone outside inhibitors (QoI);
Group 28 + 43	Carbamates + benzamides;
Group 40	Carboxylic acid amides (CAA);
Group 45 + 40	Quinone outside inhibitors, stigmatellin binding type (QoSI) + CAA;
Group 49	Oxysterol binding protein inhibitors (OSBPI); and
Group 49 + 11	OSBPI + QoI.

Guidelines

176. Start disease control early and maintain a regular protectant program. Fungicide applications need to start before the 6-leaf stage for early season control to be effective.
177. When conditions favour disease development (high humidity, still weather, overcast skies), prior to visible disease symptoms (white downy growth on the underside of lower leaves followed by brown angular lesions) apply a single spray of a **Group 49** containing fungicide, or up to two consecutive sprays of a **Group 4**, **11**, **40** or **28+43** product (including mixtures containing **Group 4**, **11** or **40**), at the interval recommended on the label. Then resume the program of sprays using products from a different group to the products just applied.
178. **Do not** apply more than two sprays per season of a product containing a **Group 4**, **11**, **40** (including **45+40**) or **49+11** fungicide. **Group 49** containing sprays should not exceed one in every three sprays of the total number of fungicide sprays per season.
179. **Do not** apply more than three sprays of a **Group 28+43** product per crop.
180. Apply **Group 11, 45+40** and **Group 49+11** fungicides preventatively.
181. Apply **Group 4** and **49** fungicides preventatively and only in mixtures with an effective protectant fungicide from a different mode of action group.
182. **Do not** use a **Group 49** (or **49+11**) product if it will be the last fungicide applied to the crop.

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Please note:

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	Group				
	4	**11**	**28 + 43**	**40, 45+40**	**49, 49 + 11**
Maximum number of consecutive applications	2	2	2	2	1
Maximum number of solo sprays	None				None of **49**
Maximum number of sprays per crop or season*	2	2	3	2	2 (or 1 in 3)

* Maximum application number on product label may differ. Ensure you follow the label recommendations.

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Crop(s)	**Potato**
Disease(s)	**Late blight (Irish blight)**

Resistance management strategy for:

Group 4	Phenylamide;
Group 11	Quinone outside Inhibitor (QoI);
Group 21	Quinone inside Inhibitor (QiI);
Group 28 + 43	Carbamate plus Benzamide; and
Group 40	Carboxylic acid amide.

Guidelines

183. Start disease control early and maintain a regular program using a fungicide from groups other than **Group 4**, **11** or **40**.

184. When conditions favour disease development, **do not** wait for disease to appear, but apply two consecutive sprays of a **Group 4**, **11**, **40** or **28+43** fungicide at the interval recommended on the label. Then resume the program of sprays using products from a different group to the **Group 4**, **11**, **40** or **28+43** fungicides just applied.

185. **Do not** apply more than four sprays of a **Group 4** or **40** fungicides per season.

186. **Do not** apply more than two sprays of a **Group 28+43** product per crop.

187. Apply **Group 11** fungicides preventively. The total number of **Group 11** fungicide applications per season should not exceed one third of the total number of fungicide applications per crop. No more than two consecutive **Group 11** sprays should be applied. If consecutive applications of **Group 11** fungicides are used, then they must be followed by at least the same number of applications of fungicide(s) from a different group(s) before a **Group 11** fungicide is used again, either in the current or following season.

188. Apply **Group 21** fungicides preventatively. The total number of **Group 21** fungicide applications should not exceed six.

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Crop(s)	**Potato**
Disease(s)	**Target spot (early blight)**

Resistance management strategy for:

Group 2	Dicarboximide;
Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 7 + 12	SDHI + phenylpyrroles;
Group 9	Anilinopyrimidine (AP);
Group 11	Quinone outside Inhibitor (QoI); and
Group 11 + 3	QoI + DMI.

Guidelines

189. Limit the use of **Group 2**, **3**, **7**, **9** or **11** fungicides to periods when conditions favour disease development, apply these fungicides preventatively before disease symptoms are visible.
190. **Do not** apply more than six **Group 2** or **3** sprays in one season. Apply no more than two consecutive sprays of a **Group 2** or **3** fungicides.
191. If used solo, apply **Group 7** fungicides in strict alternation with fungicides from a different cross resistance group. If fungicides containing **Group 7** are used in mixture, apply a maximum of 2 consecutive applications. If a **Group 7** seed treatment or in-furrow treatment has been used, the first foliar fungicide application should not contain a **Group 7**.
192. Apply no more than two consecutive sprays containing a **Group 9** fungicide.
193. **Do not** apply more than two consecutive **Group 11** sprays per crop. If consecutive applications of **Group 11** containing fungicides are used, then they must be followed by at least the same number of applications of fungicide(s) from a different group(s) before a **Group 11** containing fungicide is used again, either in the current or following season. When using a **Group 11** fungicide in-furrow at planting, use a fungicide from a different group as the first foliar spray.

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		2	3	7 (inc. 7 + 3, 7 + 12)	9	11 (inc. 11+ 3)
Total number of early targeting sprays	1	1	1	1	1	1
	2	2	2	1	1	1
	3	2	2	1	1	2
	4	3	3	2	2	2
	5	4	4	2	2	3
	6	4	4	2	2	3
	7	5	5	2	3	3
	8	6	6	2	3	3
	9	6	6	3	3	3
	10+	6	6	3	3	3

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Crop(s)	**Pulse crops**
Disease(s)	**Grey mould (*Botrytis*) and ascochyta**

Resistance management strategy for:

Group 1	Methyl benzimidazole carbamates;
Group 2	Dicarboximide;
Group 3 + 11	Demethylation inhibitors (DMI) + Quinone outside inhibitor (QoI);
Group 7*	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI; and
Group 7 + 12	SDHI + phenylpyrroles (PP).

* *Currently only available under temporary permit. Always check that permits are valid prior to use.*

Guidelines

194. Not all listed products are registered for both diseases. Ensure the product is registered for the disease being targeted.
195. **Do not** apply more than two **Group 1**, **2**, **3+11**, **7+3** or **7+12** sprays in one season (including seed treatment).
196. **Do not** apply more than two consecutive **Group 1, 2** or **7** sprays, including from season to season and seed treatments. The final foliar spray of the previous season should be considered when planning which fungicide group to use in seed treatments and the first foliar application. **Group 7** containing sprays should not make up more than one in every three of the spray program.
197. If a **Group 7** containing fungicide is used as a seed treatment, the first foliar fungicide used must not contain a **Group 7** fungicide.

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Crop(s)	**Stone fruit**
Disease(s)	**Blossom blight (*Monilinia laxa*), brown rot (*M. fructicola*)**

Resistance management strategy for:

Group 2	Dicarboximides;
Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 11	SDHI + Quinone outside inhibitors (QoI);
Group 9	Anilinopyrimidines (AP); and
Group 11	Quinone outside inhibitors (QoI).

Guidelines

198. If applying **Group 2**, **3**, **7**, **11** or **7+11** fungicides, **do not** apply more than two consecutive sprays of fungicides from the same group before changing to another group, this includes the last application made in-field from one season to the next.
199. **Do not** apply more than three sprays of a **Group 7**, **9**, **11** or **7+11** fungicide per season. Alone, tank mixed or co-formulated all count to total. If group 7 applied alone, apply **Group 7** in strict alternation with fungicides from a different cross-resistance group.
200. When mixtures are used for **Group 7** resistance management, applied as tank mix or as a co-formulated mixture, the mixture partner should provide effective disease control when used alone on the target disease and must have a different mode of action.
201. Always apply **Group 7** fungicides as per label instructions and use preventatively.
202. If consecutive sprays of fungicides from the same chemical group are applied, they must be followed by at least the same number of sprays from an alternative chemical group, before returning to the original group.

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	Group					
	2	**3**	**7**	**9**	**11**	**7 + 11**
Maximum number of consecutive applications	2	2	2	2	2	2
Maximum number of solo sprays	2	2	2	2	2	2
Maximum number of sprays per season	2	3	3	3	3	3

203. A post-harvest foliar treatment should also be counted as an application.

204. The last blossom blight spray and the first pre-harvest brown rot spray should be regarded as consecutive applications.

205. The spray program should be considered and the resistance management strategy applied on a whole-orchard basis.

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Crop(s)	**Strawberry**
Disease(s)	**Grey mould (*Botrytis*)**

Resistance management strategy for:

Group 2	Dicarboximide;
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + Demethylation inhibitors (DMI);
Group 7 + 11	SDHI + Quinone outside inhibitors (QoI);
Group 7 + 12	SDHI + phenylpyrroles (PP);
Group 9	Anilinopyrimidine (AP);
Group 9 + 12	AP + PP;
Group 17	Hydroxyanilide;
Group 19	Chitin synthase inhibitor;
Group 21	Quinoline inside Inhibitor (QiI), and
Group 52 (U)	DHODHI-fungicide (dihydroorotate dehydrogenase inhibitor).

Guidelines

206. Apply a program of protectant fungicides during flowering.
207. **Do not** apply more than two consecutive sprays of **Group 2**, **9**, **12**, **17**, **19** or **21** fungicides. Continue alternation of Mode of Action between successive crops.
208. Do not apply **Groups 52** or **17** (solo) as consecutive applications, or more than 3 times per season.
209. If using **Group 17** with an effective mixing partner, or a different **Group**, **do not** apply the **Group 17** containing mixtures for more than 50% of all applications.
210. If applying **Group 7** (including **7+3, 7+11** or **7+12**) fungicides, **do not** apply more than two consecutive sprays before changing to another group. **Do not** apply more than three **Group 7** sprays per season. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 7**, including sprays in consecutive seasons.
211. If three or fewer sprays are applied per crop, use only one spray containing a **Group 9**, **12** or **21** containing fungicide. Use a maximum of three sprays containing **Group 9, 12 or 21** containing fungicides, or 33% of sprays (whichever is lower). Where there are several cropping cycles per calendar year, a maximum of five (5) sprays containing **Group 21** can be applied.
212. **Do not** apply **Group 19** fungicides more than 6 times per season, or more than 50% of the total number of sprays.

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	2	**7** **7 + 3** **7 + 11** **7 + 12**	**9** **9 + 12**	**12** **12 + 7** **12+ 9**	**17** (solo)	**19**	**21**	**52**
Maximum number of consecutive applications	2	2	2	2	1	1	2	2
Maximum number of sprays per crop/season	2-3	3 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower	6 1 in 2 (50%)	6 Or 1 in 3 (33%) whichever is lower	3 Or 1 in 3 (33%) whichever is lower

Where there are several crop cycles per year, up to a maximum of five (5) applications containing ***Group 21*** *can be applied.*

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Crop(s)	**Strawberry**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 11	SDHI + QoI;
Group 7 + 12	SDHI + phenylpyrroles (PP);
Group 11	Quinone outside inhibitors (QoI);
Group 19	Chitin synthase inhibitor;
Group 21	Quinone inside Inhibitor (QiI), and
Group U6	Phenyl-acetamide.

Guidelines

213. Apply a program of protectant fungicides from early crop establishment and maintain a regular spray program throughout the crop growing cycle.
214. **Do not** use the same fungicide group as the last application on runner production and the first application to in-field fruit production.
215. **Do not** use **Group 3**, **7, 11**, **19, 21** or **U6** fungicides as eradicants (once symptoms are visible).
216. **Do not** apply more than four **Group 3** sprays per season.
217. **Do not** apply more than two consecutive sprays of **Group 3, 7 (**including **7+11 or 7+12)**, **19** or **21** fungicides, including from one season to the next.
218. **Do not** apply more than three **Group 7** containing sprays per season. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 7**, including sprays in consecutive seasons.
219. **Do not** apply consecutive sprays of **Group 11** or **U6** fungicides, including from one season to the next.
220. If three or fewer powdery mildew fungicide sprays are applied per crop, use only one spray containing a **Group 11** fungicide. Use a maximum of three sprays containing a **Group 11** or **21** fungicide, or 33% of total sprays (whichever is lower). **Do not** apply more than three **Group 11** or **21** sprays per season.
221. **Do not** apply **Group 19** fungicides more than 6 times per season, or more than 50% of the total number of fungicide sprays.
222. **Do not** apply more than two **Group U6** sprays per crop.

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Strawberry spray recommendations by mode of action group:

	Group					
	3	**7 7 + 11 7 + 12**	**11**	**19**	**21**	**U6**
Maximum number of consecutive applications	2	2	1	2	2	1
Maximum number of solo sprays	4	3	3	6	3	2
Maximum number of sprays per crop/season	4	3	3 or 33% of spray program, whichever is lower	6 or 50% of spray program	3 or 33% of spray program, whichever is lower	2

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Crop(s)	**Strawberry runner production**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 12	SDHI + phenylpyrroles;
Group 8*	Hydroxy-(2-amino-) pyrimidines;
Group 11	Quinone outside inhibitor (QoI);
Group 13	Aza-naphthalenes; and
Group u6	Phenyl-acetamide.

* *Currently only available under temporary permit. Always check that permits are valid prior to use.*

Guidelines

223. This strategy is for the additional range of compounds available to strawberry runner producers under permit.
224. Apply a program of protectant fungicides from early crop establishment and maintain a regular spray program throughout the crop growing cycle. If weather conditions favour powdery mildew development, use a **Group 3** or **11** fungicide.
225. **Do not** use **Group 3** fungicides as eradicants (once symptoms are visible).
226. **Do not** apply more than four **Group 3** sprays per season.
227. **Do not** apply more than two consecutive sprays of **Group 3** fungicides, including from one season to the next.
228. If applying **Group 7** fungicides (including **7+12**), **do not** apply more than two consecutive sprays before changing to another group.
229. **Do not** apply more than three **Group 7** sprays per season. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 7**, including sprays in consecutive seasons.
230. Apply **Group 11** and **U6** fungicides preventively.
231. **Do not** apply consecutive sprays of **Group 11** and **U6** fungicides, including from one season to the next.
232. If three or fewer powdery mildew fungicide sprays are applied per crop, use only one spray containing a **Group 11** fungicide. If four to six sprays are applied per crop, use no more than two sprays containing a **Group 11** fungicide. If seven or more sprays are applied per crop use a maximum of three sprays containing a **Group 11** fungicide. **Do not** apply more than three **Group 11** sprays per season.

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233. Fungicides from **Group 8*** and **13** are available for use on strawberry runner crops under individual permits from the APVMA.
234. Apply a maximum of two (2) **Group U6** sprays per season.
235. Apply a maximum of four (4) **Group 8** or **13** sprays per season. **Do not** apply more than two consecutive sprays before changing to another group.

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Crop(s)	**Tomato**
Disease(s)	**Grey mould**

Resistance management strategy for:

Group 3	Dicarboximide; and
Group 17	Succinate dehydrogenase inhibitors (SDHI).

Guidelines

236. Tank mix **Group 2** fungicides with a protectant such as chlorothalonil. Avoid applying two **Group 2** fungicides in succession, unless tank mixed with a protectant.
237. **Do not** apply more than four **Group 2** sprays in a season.
238. If applying **Group 7** fungicides, **do not** apply more than two consecutive sprays before changing to another group. **Do not** apply more than three **Group 7** sprays per season. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 7**, including sprays in consecutive seasons.

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Crop(s)	**Tomato**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation inhibitor (DMI);
Group 3 + 11	DMI + Quinone outside Inhibitor (QoI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 7 + 11	SDHI + QoI;
Group 13	Aza-naphthalenes; and
Group 21	Quinone inside Inhibitor (QiI).

Guidelines

239. Apply fungicides before disease becomes established.

240. **Do not** apply more than four sprays of a **Group 3** containing fungicide per crop.

241. If applying **Group 7**, **11**, **13** or **21** containing fungicides, **do not** apply more than two consecutive sprays before changing to another group. **Do not** apply more than three applications of a **Group 7**, **11**, **13** or **21** containing fungicide per crop. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **fungicide group**, which includes sprays from consecutive crops.

242. **Group 7** and **21** containing product should not exceed thirty-three percent (33%) of the total sprays per crop. A maximum of five applications of **Group 21** may be made per calendar year in case of multiple cropping cycles.

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Crop(s)	**Tomato**
Disease(s)	**Target spot (early blight)**

Resistance management strategy for:

Group 2	Dicarboximide;
Group 3	Demethylation Inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 7 + 11	SDHI + Quinone outside Inhibitor (QoI);
Group 9	Anilinopyrimidine (AP);
Group 11	QoI;
Group 11 + 3	QoI + DMI, and
Group 21	Quinone inside Inhibitor (QiI)

Guidelines

243. Apply a program of protectant fungicides from early crop establishment and maintain a regular spray program throughout the crop growing cycle.
244. **Do not** apply more than four **Group 2** sprays in one crop. Apply no more than two consecutive sprays of a **Group 2** fungicide.
245. **Do not** apply more than six **Group 3** sprays in a crop. Apply no more than two consecutive sprays of a **Group 3** fungicide alone.
246. If applying **Group 7** or **21** containing fungicides, **do not** apply more than two consecutive sprays before changing to another group. If consecutive sprays are used, then use the same number of sprays of an alternative group before using another **Group 7** or **21**, including sprays in consecutive crops.
247. **Group 7** applied solo or **Group 21** should not exceed three applications or thirty-three percent (33%) of the total applications needed per crop (whichever is lower). **Group 7** applied in a mixture should not be more than 50% of applications made in a crop. A maximum of five applications of **Group 21** may be made per calendar year in case of multiple cropping cycles.
248. If three or fewer fungicide sprays for target spot are applied per crop, use only one spray containing a **Group 9** fungicide. If four to six sprays are applied per crop, use a maximum of two sprays containing **Group 9** fungicides. If seven or more sprays are applied per crop, use a maximum of three sprays containing **Group 9** fungicides.
249. Apply no more than two consecutive sprays containing a **Group 9** fungicide.
250. Apply **Group 11** fungicides preventively. **Do not** apply more than six sprays, or one third of the total sprays (whichever is lower) from **Group 11** fungicides. **Do not** apply more than two consecutive sprays of **Group 11** fungicides. If consecutive applications of **Group 11** fungicides are used, then they

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must be followed by at least the same number of applications of fungicide(s) from a different group(s) before a **Group 11** fungicide is used again, either in the current or following season.

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Crop(s)	**Turf**
Disease(s)	**Various**

Resistance management strategy for:

Group 1	Benzimidazoles;
Group 2	Dicarboxamides;
Group 3	Demethylation inhibitors (DMI);
Group 4	Phenylamides (PA);
Group 7 (N3)	Succinate Dehydrogenase inhibitors (SDHI);
Group 7 + 11	SDHI + Quinone outside inhibitors (QoI);
Group 11	QoI;
Group 11 + 2	QoI + dicarboxamides;
Group 11 + 3	QoI + DMI;
Group 12	Phenylpyrroles (PP);
Group 14	Aromatic hydrocarbons (chlorophenyls and nitroanilines);
Group 21	Quinone inside inhibitors (QiI);
Group 28	Carbamates; and
Group 33	Phosphonates.

Guidelines

251. Fungicide groups that are classified as medium to high risk for fungicide resistance development; **Groups 1**, **2**, **4**, **7 (N3)**, **11** and **21** should be rotated as a key feature to reduce the development of resistance.
252. **Do not** apply consecutive sprays of fungicides from the same activity group, unless mixed with a registered fungicide from a different mode of action group with no known resistance.
253. **Group N3** nematicides are also classified as **Group 7** fungicides and consecutive application should be avoided, even if targeting different pests/pathogens.
254. If consecutive sprays are applied of fungicides from a high-risk fungicide group (i.e. **Group 1**, **2**, **4**, **7**, **11** or **21**) they must be followed by at least the same number of applications of fungicide(s) from a different group(s) before the same high-risk fungicide is used again.

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Crop(s)	**Wheat**
Disease(s)	**Powdery mildew**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 5	Amines (“morpholines”);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11 + 3	Quinone outside inhibitors (QoI) + DMI;
Group 11 + 4	QoI + phenylamides (PA);
Group 11 + 7 + 3	QoI + SDHI + DMI;
Group 13*	Azanaphthalene;
Group 50 (U8)	Actin disruption aryl-phenyl-ketones; and
Group U6	Phenyl-acetamide.

* *Currently only available under temporary permit. Always check that permits are valid prior to use.*

Guidelines

255. Fungicides should be used as protectant treatments prior to symptoms of disease when conditions are conducive to disease development.

256. In high-risk disease environments integrated management approaches should be used to reduce fungicide resistance risk, which may include:
    a. Removal or burning of stubble;
    b. Crop rotation (**avoid** wheat on wheat);
    c. Control of green bridge volunteers; and
    d. Use of tolerant and/or resistant varieties.
    e. Strategic use (timing and application technique) of fungicides.
257. **Do not** apply more than two applications per growing season of **Group 5, 7, 11, 13*, 50 (U8)** and **U6** containing products. This includes in-furrow or seed treatments that have activity on powdery mildew. Combinations of in-furrow and seed treatment are counted as one application.
258. **Do not** apply consecutive applications of **Group 11** containing products. This includes in-furrow i.e. if a **Group 11+4** fungicide has been used in-furrow at planting, the first foliar fungicide spray must not contain a **Group 11** fungicide.
259. If a **Group 7** seed treatment has been used that has foliar activity (as determined by label claims), the first foliar fungicide applied should not contain a **Group 7** fungicide.

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260. **Do not** apply more than one application of a **Group 7** seed treatment that has foliar activity in any two consecutive growing seasons.

261. If a **Group 7** or **11** fungicide is being applied as a foliar spray, it must be co-formulated or mixed with a registered product with a different mode of action, with no known resistance in the local area.

262. **Do not** apply more than three applications containing **Group 3** fungicides per growing season. This total of three applications includes DMIs applied as **Group 11+3** or **Group 11+7+3** co-formulations and in-furrow or seed treatments that have activity on foliar disease. Combinations of in-furrow and seed treatment are counted as one application.

263. **Do not** apply **Group 5, 13*, 50 (U8)** and **U6** fungicides onto existing infections of powdery mildew. Always use preventatively. If applying consecutive applications, use an effective mixing partner.

264. Reduced rates, including multiple applications must not be used. Always use label rates.

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Crop(s)	**Wheat**
Disease(s)	**Septoria blotch**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 3 + 7	DMI + SDHI;
Group 11 + 3	Quinone outside inhibitors (QoI) + DMI; and
Group 21	Quinone inside inhibitor (QiI).

Guidelines

265. Fungicides should be used be used as protectant treatments – prior to symptoms of disease when conditions are conducive to disease development.
266. In high-risk disease environments, integrated management approaches should be used to reduce fungicide resistance risk, which may include:
    a. Removal or burning of stubble;
    b. Crop rotation (**avoid** wheat on wheat);
    c. Control of green bridge volunteers; and
    d. Use of tolerant and resistant varieties.
267. **Do not** apply more than one application of a **Group 7** seed treatment with foliar activity in any two consecutive growing seasons.
268. **Do not** apply more than two applications per growing season of **Group 11** or **7** containing products. Foliar sprays and in-furrow or seed treatments, that have activity on foliar diseases, count toward total. Combinations of in-furrow and seed treatment are counted as one application.
269. If a **Group 7** seed treatment has been used with foliar activity (as determined by label claims), the first foliar fungicide applied must not contain a **Group 7** fungicide. An alternative mode of action fungicide should be applied at typical foliar fungicide timing.
270. If a **Group 7** or **11** fungicide is being applied as a foliar spray, it must be in a co-formulation or in mixture with a registered mixing partner with a different mode of action, with no known resistance. The mixture partner should also provide effective disease control when used alone on the target disease.
271. **Do not** apply more than three applications containing **Group 3** fungicides per growing season. This total of three applications includes DMIs applied as **Group 11+3** co-formulations and in-furrow or seed treatments that have activity on foliar diseases. Combinations of in-furrow and seed treatments are counted as one application.

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272. Minimise use of **Group 3** fungicides which are known to have compromised resistance status.

273. Reduced rates, including with multiple applications, must not be used. Always used labelled rates.

274. Apply **Group 21** preventatively, using a maximum of one **Group 21** spray per crop. Do not apply **Group 21** solo, they must be applied in combination with an effective tank mix partner from a different group.

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Crop(s)	**Wheat**
Disease(s)	**Yellow spot**

Resistance management strategy for:

Group 3	Demethylation inhibitors (DMI);
Group 7	Succinate dehydrogenase inhibitors (SDHI);
Group 7 + 3	SDHI + DMI;
Group 11 + 3	Quinone outside inhibitors (QoI) + DMI;
Group 11 + 4	QoI + phenylamides (PA); and
Group 11 + 7 + 3	QoI + SDHI + DMI.

Guidelines

275. Fungicides should be used as protectant treatments prior to symptoms of disease when conditions are conducive to disease development.

276. In high-risk disease environments, integrated management approaches should be used to reduce fungicide resistance risk, which may include:
    a. removal or burning of stubble;
    b. crop rotation (**avoid** wheat on wheat);
    c. control of green bridge volunteers; and
    d. use of tolerant and resistant varieties.

277. **Do not** apply more than two applications per growing season of **Group 11,** or **7** containing products. This includes in-furrow or seed treatments that have activity on foliar diseases. Combinations of in-furrow and seed treatment are counted as one application.

278. **Do not** apply consecutive applications of **Group 11** containing products. This includes in-furrow i.e. If a **Group 11+4** fungicide has been used in-furrow at planting, the first foliar fungicide spray must not contain a **Group 11** fungicide.

279. If a **Group 7** seed treatment has been used with foliar activity (as determined by label claims), the first foliar fungicide applied should not contain a **Group 7** fungicide.

280. **Do not** apply more than one application of a **Group 7** seed treatment with foliar activity in any two consecutive growing seasons.

281. If a **Group 7** or **11** fungicide is being applied as a foliar spray, it must be in a co-formulation or in mixture with a registered mixing partner with a different mode of action, with no known resistance. The mixture partner should also provide effective disease control when used alone on the target disease.

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282. **Do not** apply more than three applications containing **Group 3** fungicides per growing season. This total of three applications includes DMIs applied as **Group 11+3** or **Group 11+7+3** co-formulations and in-furrow or seed treatments that have activity on foliar diseases. Combinations of in furrow and seed treatment are counted as one application.
283. Minimise use of **Group 3** fungicides which are known to have compromised resistance status.
284. Reduced rates, including multiple applications must not be used. Always use label rates.

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