

# Management of fruit rot diseases & fungicide resistance: 2024 update

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Fruit diseases, such as grey mould and powdery mildew, are an unfortunate part of strawberry production, in all areas and across all production systems. Use of fungicides is a vital aspect of managing strawberry diseases. In the last couple of years, several new fungicides have been registered for use in strawberry fruit production. It is important to be aware of these new products and their use in disease management. It is equally important is to ensure they are used correctly to avoid fungicide resistance developing. The effectiveness of any chemical programs is only good for as long as it takes for resistance to develop.

An updated list of registered fungicide products for strawberry production is listed on Table 1 and includes relevant information on product FRAC Code/Group, active ingredient, disease controlled. Fungicides with letters 'M' and 'BM' in their FRAC Code/Group indicates those products have a multi-site activity against the pathogen and are generally less likely to develop resistance. Fungicides with a FRAC Code/Group number only, including 'U6', are classified as single-site fungicides, meaning that they target the pathogen at one specific site. This makes them more prone to developing resistance and why there are maximum limits to how many applications are allowed.



**(Top) Grey mould (botrytis) and (Bottom) powdery mildew**  
Photo credits: (Top) Queensland Department of Agriculture & Fisheries  
(Bottom) Tasmanian Institute of Agriculture

## Managing grey mould and powdery mildew

A general strategy to manage grey mould is to rotate multi-site products to provide protection when plants have established after planting and flowers start to appear. Apply single-site fungicides when conditions that favour disease development (e.g. rainy periods) are imminent and rotate with other fungicide groups when disease symptoms persist. Removal of diseased fruits will help reduce the amount of inoculum and further spreading the disease. The severity of grey mould disease is generally dependent on wet periods. Rotation of multi-site products may be enough if disease pressure is low and combined with on-farm practices to minimise disease. In protected cropping systems,

the incidence of grey mould is generally lower than in plants grown outdoors.

Management of powdery mildew differs to that of grey mould. Different production systems (open-field, substrate/tabletops, tunnels, cloches) and the length of the season in different production areas must be considered. Crop consultants may be able to provide a specific and strategic approach for management of powdery mildew relevant to different production areas and systems. As with grey mould management, rotation of powdery mildew fungicides is recommended to manage the disease and minimise the risk of fungicide resistance.

## What fungicides are currently available for strawberry fruit production?

Table 1. Fungicides for strawberry fruit production

FRAC Code	Active constituent	Product name	Registered for	Conditions to note
<b>M2</b>	sulphur	Various e.g. Thiovit	Powdery mildew	NSW and WA only
<b>M2</b>	potassium bicarbonate	Various e.g. Ecocarb®	Powdery mildew	
<b>M2</b>	potassium bicarbonate + potassium silicate	Ecocarb® PLUS	Powdery mildew	
<b>M3</b>	thiram	Various e.g. Thiram	Grey mould, black spot	2-day WHP
<b>M4</b>	captan	Various e.g. Captan	Grey mould, black spot, scorch, leaf blight, leather rot	1-day WHP
<b>BM02</b>	<i>Bacillus amyloliquefaciens</i> strain MBI600	Serifel® Biofungicide	Grey mould	
<b>BM02</b>	<i>Bacillus amyloliquefaciens</i> strain QST 713	Serenade® Opti	Grey mould	
<b>NC</b>	<i>Aureobasidium pollulans</i>	Botector®	Grey mould, anthracnose fruit rot, Phomopsis fruit rot, Rhizopus fruit rot	

Data Source: APVMA, CropLife Australia

FRAC Code	Active constituent	Product name	Registered for	Conditions to note
<b>2</b>	iprodione	Various e.g. Rovral®	Grey mould	1-day WHP
<b>3</b>	myclobutanil	Various e.g. Systhane®	Powdery mildew	4 max. sprays of Group 3 per season
<b>3 + 7</b>	tebuconazole + fluopyram	Luna® Experience	Grey mould	1-day WHP; 2 max. sprays per season of product; also follow the sprays limits for Groups 3 and 7
<b>7</b>	penthiopyrad	Fontelis®	Grey mould, powdery mildew	3 max. sprays of Group 7 per season
<b>7</b>	isofetamid	Kenja®	Grey mould	3 max. sprays of Group 7 per season
<b>7 + 11</b>	fluopyram + trifloxystrobin	Luna® Sensation	Grey mould, powdery mildew	1-day WHP; 2 max. sprays per season of product; also follow the sprays limits for Groups 3 and 7
<b>7 + 12</b>	pydiflumetofen + fludioxonil	Miravis® Prime	Grey mould, powdery mildew	3 max. sprays of Group 7 and 12 per season
<b>9</b>	pyrimethanil	Various, e.g. Scala®	Grey mould	1-day WHP; 3 max. sprays of Group 9 per season
<b>9 + 12</b>	cyprodinil + fludioxonil	Switch®	Grey mould, Colletotrichum crown rot	3-day WHP, 3 max. sprays of Group 9 and 12 per season
<b>11</b>	trifloxystrobin	Various, e.g. Flint®	Powdery mildew	1-day WHP; 3 max. sprays of Group 11 per season
<b>17</b>	fenhexamid	Various, e.g. Teldor®	Grey mould	1-day WHP
<b>19</b>	Polyoxin D zinc salt	Intervene®	Grey mould, powdery mildew	6 max. sprays per season
<b>21</b>	florylpicoxamid	Verpixo® Adavel® Active	Grey mould, powdery mildew	3 max. sprays per season
<b>52</b>	ipflufenquin	Migiwa® Kinoprol® Active	Grey mould	1-day WHP, 3 max. sprays per season
<b>U6</b>	cyflufenamid	Flute®	Powdery mildew	2 max. sprays per season

FRAC - Fungicide Resistance Action Committee; WHP - withholding period. Shaded area indicates fungicides with a multi-site activity.

## Why is fungicide resistance a concern?

- Reliance or repeated use of a fungicide or products from the same fungicide group, particularly single-site fungicides, increases the risk of pathogen populations becoming resistant
- There is genetic variability in pathogen populations and this variability gives protection and may allow populations with resistance to survive and multiply if the same fungicides are frequently used
- As a result, over-time, the effectiveness of a fungicide product or products within the same group will be reduced, or worse, will no longer be effective at all
- For strawberry production, fungicide resistance should be avoided as it will put significant pressure on other fungicide groups, potentially leading to significant yield losses

## What can we do to avoid fungicide resistance from developing?

- ✓ Only **use products registered** for strawberry and always follow the product label
- ✓ **Rotate fungicides** with different FRAC Code/Group throughout the crop growing season
- ✓ **Manage the use of different fungicide products** that are in the same group
- ✓ **Manage the use of co-formulated products** - these are products that have two active ingredients; hence two fungicide groups are applied
- ✓ **Spray coverage** is critical to control/manage both powdery mildew and grey mould, where infection occurs mainly on the lower side of the leaves and on fruit that may be within/under the plant canopy
- ✓ **Reduce the amount of disease inoculum through cultural and hygiene practices**, such as regular disease monitoring, removal of diseased fruit or plant debris within the production area, and adequate plant spacings to reduce moisture and humidity around the plants
- ✓ **Early detection** in pathogen populations for fungicide resistance is important to consider changes in fungicide practices and prevent yield losses
- ✓ **Coordination of fungicide groups** between the nursery and fruit production sectors is vital. Fungicides specifically registered/permitted for non-fruiting strawberry (only) helps to reduce the risk of fungicide resistance developing for the whole-of-industry and extends the effectiveness of registered products used in fruit production



CropLife Australia promotes the responsible use of pesticides to ensure sustainable outcomes and is a good resource for more information on fungicide resistance management [www.croplife.org.au](http://www.croplife.org.au)

**Disclaimer:** While care has been taken to ensure the accuracy of the information provided in this document the APVMA registered label and/or where relevant the APVMA approved permit must always be followed. The strategy discussed in this article is only a guide. The Queensland Department of Agriculture & Fisheries do not specifically endorse any of the products mentioned and is not liable for any loss or damage suffered.



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