

Revised orchard fungicide programme for anthracnose in avocado

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Given the recent granting by APVMA of an Emergency Use Permit (PER94009) for Score® and Switch® fungicides, and resistance in *Colletotrichum* to strobilurin fungicides (e.g. azoxystrobin), it is time to revise the orchard fungicide program.

Fungicides available for managing fruit diseases (field sprays)

All fungicides claiming efficacy for disease control are registered through the APVMA, and assigned a group number by the Fungicide Resistance Action Committee (FRAC), based on chemistry, mode of action and risk of resistance (for further information on fungicide activity groups, see <https://www.croplife.org.au/resources/programs/resistance-management/fungicide-activity-group-table/>). Effective spray programs are designed with background knowledge of the disease cycle of the pathogen, with targeted applications and timing of fungicides from different groups used in sensible rotations.

Protectant fungicides must be present on the fruit surface to inhibit spore germination and/or infection. As avocado fruit are susceptible to infection from early fruit set right through to harvest, frequent sprays are required to maintain this protective film. They are typically effective against a broad range of fungi, and have multi-site activity, that is, target multiple fungal metabolic pathways and thus are at lower risk for fungi to develop resistance. In avocado, protectant fungicides include the various formulations of copper-based chemicals (Group M1), as well as registered “biofungicides” based on *Bacillus amyloliquefaciens* strain QST 713, Serenade® Opti, and Serenade® Prime, both Group BM02. Thiram (Group M3) is also registered but doesn’t seem to be used much in avocado.

Systemic fungicides enter host tissues and may be transported short distances, or throughout the plant. These fungicides may have preventative as well as post-infection activity, and are useful in avocado where *Colletotrichum* sp., the fungus causing anthracnose, has infected and is present in peel in an invisible dormant phase until ripening. These fungicides target very specific fungal metabolic pathways, and are therefore at higher risk for fungi to develop resistance. Azoxystrobin (Group 11) has been used in avocado for more than 20 years, and we have recently detected isolates of *Colletotrichum* which are resistant to this group ([previous azoxystrobin article](#)). This means the fungus can grow in the presence of even very high concentrations, and thus the Group 11 strobilurin fungicides are no longer effective against such populations of the pathogen. There are high frequencies of resistance from Queensland farms, associated with high disease pressure and prolonged strobilurin use. For more information on fungicide resistance, visit the CropLife webpage <https://www.croplife.org.au/resources/programs/resistance-management/fact-sheet-fungicide-resistance/>). Luna® Sensation is a combination of two chemical actives,

trifloxystrobin (Group 11) and fluopyram (Group 7) and has been available for many years.

Field trials undertaken within project AV16007 “Improving avocado orchard productivity through disease management”, identified fungicide candidates which could be useful in managing panicle dieback and anthracnose. Hort Innovation submitted an application to APVMA, with data from AV16007 and Syngenta Australia, and two fungicides, difenoconazole (Score®, Group 3) and cyprodinil + fludioxonil (Switch®, Group 9 + Group 12), have now been granted an Emergency Use Permit ([PER94009](#)) until 30 November 2025. These represent three new mode of action groups for field application in avocado (fludioxonil is also a component of Graduate® A+, registered for postharvest application).

When to use the new fungicides

Score® and/or Switch® will be useful under the following scenarios:

- If strobilurins have been used extensively in your orchard for a number of years and you suspect you may have resistance (see below on how to check if strobilurin fungicides are no longer effective).
- Apply Switch® 80g/100L at flowering if your orchard has a history of panicle dieback ([refer to this article](#)). (None of the fungicides tested in AV16007 caused phytotoxicity to flowers when applied as single products, i.e. not tank mixed. Difenoconazole was not effective in our trials against panicle dieback).
- Apply Switch® 80g/100L and/or Score® 50mL/100L as preharvest sprays, noting the maximum residue levels (MRLs) and withholding periods (WHPs) for Australia and export destinations in Tables 1 and 2, below.
- Apply Switch® or Score® at above rates during fruit development after periods of extended rainy weather if coverage with protectant fungicides has been difficult to maintain.
- Maintain thorough protectant (copper) coverage between applications of Switch® or Score®. Although 4 applications of each are allowable under the Permit, that many sprays is likely to be unnecessary and not cost effective. One to two of each, used in a sensible rotation of fungicides from different groups, should suffice.
- Follow the permit and label directions and adhere to good spray practices. Test mixtures of crop protectants for compatibility and crop safety prior to commercial scale application.

- Use fungicides as part of an integrated management program, which also includes canopy management and hygiene, good irrigation and nutrition, and optimal picking and postharvest practices.

Are strobilurin fungicides still effective when applied as a pre-harvest spray?

It is relatively straightforward to determine whether strobilurins are effective at reducing anthracnose when applied before harvest.

- Select and tag several trees or 1-2 rows in each block, which have fruit at commercial maturity
- Spray these selected trees or rows with strobilurin fungicide
- Harvest at least 1-2 trays of fruit from both sprayed *and unsprayed* trees 1-2 weeks later, into separate labelled trays. Select fruit from around the canopy.
- Keep trays of fruit in a warm, humid place to ripen and incubate, e.g. place inside a garbage bag and tie loosely.
- When fruit are ripe, or even a day or so over-ripe, check them for development of anthracnose disease. Fruit may need to be cut and peeled to see disease symptoms in Hass.
- If there is a similar level of disease in strobilurin-sprayed compared with the unsprayed fruit, then it is likely the orchard has fungicide-resistant *Colletotrichum*, and there would be little point continuing with those sprays.
- Minimal or very low disease development in both samples may indicate a very good protectant spray program, early season fruit (which typically has less disease), and/or very low disease pressure (conditions not conducive for fungi to infect and disease to develop)

Table 1. MRLs and WHPs for Score® Foliar Fungicide (50mL/100L), in avocado (prepared by Kath Adams, Syngenta)

Country	MRL difenoconazole (mg/kg)	WHP
Australia	T2	Nil
Hong Kong	0.5	4 weeks
Singapore	0.6	21 days
Malaysia	0.6	21 days
Japan	0.6	21 days
Indonesia	-	7 weeks (1 application only)
Fiji	0.6	21 days
Brunei	0.6	21 days
United Arab Emirates	0.6	21 days
Qatar	0.6	21 days

New Caledonia	0.6	21 days
India	0.01	7 weeks (1 application only)

Note the long withholding period for most export markets, and limit of 1 application only for Indonesia and India. These WHPs are based on modelling of residue data currently available and the MRLs in place in the various importing countries as at 5 Dec 2023

Table 2. MRLs and WHPs for Switch® Foliar Fungicide (80g/100L) in avocado (prepared by Kath Adams, Syngenta)

Country	MRL cyprodinil (mg/kg)	MRL fludioxonil (mg/kg)	WHP
Australia	T2	2	Nil
Hong Kong	1	0.45	Nil
Singapore	1	1.5	Nil
Malaysia	1	1.5	Nil
Japan	1	5	Nil
Indonesia	-	-	Not available
Fiji	1	1.5	Nil
Brunei	1	1.5	Nil
United Arab Emirates	1	1.5	Nil
Qatar	1	0.4	Nil
New Caledonia	1	1.5	Nil
India	0.01	0.01	Not available

Note that for Indonesia and India, there are very low or not set MRLs withholding periods are not available. These WHPs are based on modelling of residue data currently available and the MRLs in place in the various importing countries as at 5 Dec 2023

Acknowledgements

AV16007 was funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government. Hort Innovation is the grower owned, not-for-profit research and development corporation for Australian horticulture. The project was jointly supported by the Department of Agriculture and Fisheries and the University of Queensland. AV16007 has recently been completed.