FUNGICIDE RESISTANCE IN PULSES

FACT SHEET

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Fungicide resistance in pulses: causes, management and mitigation strategies

KEY POINTS

- Fungicide resistance is the loss of fungicide effectiveness against a specific pathogen.
- Pulse production is at high risk of yield losses if fungicide resistance develops, due to the susceptibility of crops and the reliance on fungicides to protect them.
- Crop rotations, planting resistant varieties and managing stubble loads will help minimise disease pressure.
- Rotate and mix fungicide actives to avoid consecutive applications of the same Mode of Action Groups across and within season, regardless of the disease(s) being controlled.

Photo: GRDC.

Pulse production in Australia is heavily reliant on fungicides to ensure crops achieve their yield potential. This reliance on fungicides poses significant risk that fungicide resistance may develop. Of particular concern is the use of single Mode of Action (MoA) fungicides, such as carbendazim and procymidone, which are used to control Botrytis grey mould and chocolate spot in lentil, faba bean, vetch and chickpea crops.

Other fungal diseases of pulses, such as ascochyta blight and sclerotinia stem rot could also develop resistance to any single site fungicide that is used repeatedly. Adopting good integrated disease management and fungicide usage practices now will help preserve the effectiveness of these useful chemicals.

Numerous cases of reduced sensitivity and resistance to fungicides have been identified in Australia's grain growing regions. More cases are expected to arise as survey and detection methods improve, and if current fungicide use patterns continue.

Fungicide resistance occurs when a previously effective fungicide fails to control a disease.

Increased use of single site fungicides will also increase the risk of fungicide resistance development in Australian pulses.

Pulse production is at a high risk due to most crops being susceptible to at least one disease. Although breeding has resulted in some resistance or partial resistance to diseases, there are many susceptible varieties still grown. The pulse industry has historically been

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reliant on fungicides to ensure these susceptible crops are profitable.

Fungicide resistance is a preventable issue, caused by repeatedly exposing a pathogen to a single fungicide active or to the chemical actives of a single Mode of Action (MoA) group. It can become a major constraint to good disease control, especially where no alternative fungicide or host-plant resistance is available.

Fungicide resistance result	Impact on fungicide use
Sensitive	Still works
Reduced sensitivity	Might still work okay • May need to use higher label rates • Higher risk of developing resistance
Resistant	Doesn't work – avoid use
Lab detection	None – but indicates a potential risk to field effectiveness.

Fungicide resistance can be a regional problem. Spores released by resistant fungi can spread over a large area in a short time. Stubble borne diseases, such as ascochyta blight, can also be spread over large distances if infected stubble is moved. Misuse of fungicides and poor disease management practices on a single farm can affect everybody in the district.

Known detections of fungicide resistance - pulses

The following information is correct at the time of publication and is subject to change. For the latest data on fungicide resistance in pulses, please consult an agronomist or refer to the AFREN website.

Ascochyta blight of lentils

(Pathogen: *Ascochyta lentis*)

Ascochyta blight of lentils is favoured by prolonged cool and wet conditions (5 to 15°C) early in the growing season, or heavy rainfall later in the season leading to pod and seed infections.

The disease can be difficult to detect in its early stages but can lead to yield losses of 50% or more and, in severe cases, may cause the crop to drop all its leaves.

Photo: GRDC.

Ascochyta blight of lentils.

It is spread via stubble, volunteer plants and seed.

- **Lab detection** of resistance to Group 1 fungicides carbendazim and thiabendazole in South Australia.
- **Resistance** to Group 11 fungicides has been documented overseas.

Resistance to the Group 1 fungicide carbendazim has been detected in the lab in several fungal isolates obtained from samples collected in South Australia during 2010 and 2011.

Resistance to the Group 1 fungicide thiabendazole was detected in the lab in fungal isolates collected in South Australia during 2020. All carbendazim resistant isolates collected in 2010 and 2011 were also resistant to thiabendazole.

Thiabendazole is used in mixture with the multi-site fungicide thiram and is registered as a seed treatment under the brand name P-Pickel T®.

These lab detections indicate that although no recent field resistance to group 1 fungicides has been detected in ascochyta blight, there is a propensity

for resistance to occur without a good integrated disease management strategy.

Resistance to Group 11 fungicides overseas is an indication that ascochyta blight could also develop resistance to these fungicides in Australian pulse crops. This Mode of Action group includes azoxystrobin, which is an active component of several registered fungicides in pulses.

Botrytis grey mould of chickpeas

(Pathogen: *Botrytis cinerea*)

Botrytis grey mould has a wide host range including grapes and multiple pulse species. This and its capacity to survive on dead plant matter means inoculum is almost always present and infections can proceed quickly under favourable conditions.

Botrytis grey mould is typically favoured by crops with closed canopies that create temperature and humidity conditions (20-25°C, relative humidity > 90%) conducive to infection.

Disease spread by airborne spores, infected alternative hosts and contaminated seed, soil and stubble mean resistant strains could quickly become established.

- **Lab detection** of resistance to Group 1 fungicide carbendazim in South Australia.

In 2003, a botrytis grey mould isolate with resistance to the Group 1 fungicide carbendazim was detected in the lab in chickpea samples collected from South Australia. There have been no reports of reduced sensitivity or field failure to date.

The chickpea field was adjacent to a vineyard, so the resistance may have originated in the grape crop. However, Group 1 fungicides have been commonly used against botrytis species infecting pulses in South Australia, including seed dressings containing the Group 1 fungicide thiabendazole in mixture with the multi-site fungicide thiram.

Research into Group 1 fungicide resistance in pulse diseases is limited and this resistance may be present in other regions.

Integrated disease management (IDM) in pulses

Good integrated disease management, backed up with strategic use of fungicides only when they are necessary, underpins good fungicide resistance management.

Agronomic strategies

- Plant varieties that are less susceptible to diseases of concern - avoid the most susceptible varieties in disease-prone areas.
- Monitor crops carefully, regardless of varietal resistance, as genetic resistance may be overcome quickly in high intensity systems with low variety diversity.
- Rotate crops and varieties to ensure a more dynamic host environment.
- Use a three-year break between each crop type.
- Sow crops which can be infected by the same diseases at least 250 metres from each other. This includes lentil, faba bean, chickpea or vetch crops or stubble of these crop types.
- Ensure the stubble from the previous pulse crop has broken down before sowing back into the same paddock.
- Sow pulse crops into the standing stubble of a previous cereal crop to limit rain-splash spread of soilborne spores.
- Sow at the optimum time and avoid early sowing except for varieties with complete disease resistance.

Fungicide use and rotation

- Rotate and mix fungicide actives and MoA groups, while minimising the use of fungicides known to

Photo: GRDC.

Botrytis grey mould of chickpeas.

have compromised efficacy due to resistance:

- Avoid using the same fungicide active or MoA consecutively, both within and across seasons.
- Use mixtures containing different MoA groups whenever possible, especially if disease pressure is high.
- Use multi-site (M3, M5) fungicides as rotation and mixing partners to reduce selection pressure on single-site fungicides (i.e. Groups 1, 2, 3, 7 and 11).

- When seed is retained on farm, the fungicide group used for seed treatment and the first foliar application should be different to the group applied in the final foliar spray of the previous season.

- Minimise the application of each fungicide group below, as far as possible. (Note label restrictions on some products specifically limit their use to no more than two applications per season.)

Group 1 (MBC) fungicides

- Group 1 fungicides include the actives carbendazim (e.g. Spin Flo®) and thiabendazole (e.g. P-Pickel T®, in mixture with M3 multisite fungicide thiram).

Group 2 (Dicarboximide) fungicides

- Group 2 fungicides include actives such as procymidone (Procymidone 500, Sumisclex, Nosclex).

Group 3 (DMI) fungicides

- Group 3 fungicides include tebuconazole (e.g. Veritas®, in mixture with G11 fungicide azoxystrobin) and prothioconazole (e.g. Aviator®, in mixture with G7 fungicide bixafen).

Group 11 (QoI) fungicides

- Group 11 (QoI) fungicides include actives such as azoxystrobin (e.g. Veritas®, in mixture with G3 fungicide tebuconazole)

- Regardless of the disease(s) being controlled, growers should plan fungicide use and rotation to avoid repeat applications of actives from the same MoA group within a season.

Any repeated fungicide application can select resistant strains of non-target pathogens that are also present in the crop.

The Fungicide Resistance Five!

1. **Avoid susceptible crop varieties**
2. **Rotate crops – use time & distance to reduce disease carry-over**
3. **Use non-chemical control methods to reduce disease pressure**
4. **Spray only if necessary & apply strategically**
5. **Rotate & mix fungicides / MoA groups**

FREQUENTLY ASKED QUESTIONS

How does fungicide resistance develop?

Fungicide resistance occurs when fungicide resistant strains of a pathogen dominate the whole pathogen population. Fungicide resistant strains are 'selected for' by applications of the fungicide. That is, the non-resistant strains are controlled by the fungicide allowing the resistant strains to proliferate.

For more on the causes and effects of fungicide resistance, read the AFREN Fact Sheet How Fungicide Resistance Develops.

How do I know if I have a fungicide resistant disease in my crop?

If a fungicide application fails to provide adequate control of the disease, or if the lower range of application rates on the label for a fungicide must be steadily increased from application to application, there is cause for concern.

You should keep an accurate record of every fungicide application – including dates, times, weather conditions, application rates, crop growth stage and notes of any evidence of a disease being present.

What should I look for?

It is important to inspect the crop after every fungicide application to confirm whether the expected level of control has been achieved.

If the disease is still present or increasing, review records of the application for reasons why it may have failed. If there is no obvious cause, consult an expert and consider having samples of the infected crop tested for fungicide resistance.

Who do I contact?

Contact your agronomist or adviser and have them review the crop and your fungicide application records. If they suspect fungicide resistance, they will be able to arrange further investigation, sample collection and lab analysis.

Alternatively, you can visit the AFREN website About page for details of fungicide resistance experts in your region.

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USEFUL RESOURCES

Australian Fungicide Resistance Extension Network (AFREN)
Dedicated website for the latest Fungicide Resistance information, reference materials, case studies, grower survey and news.
afren.com.au

AFREN Guide - Fungicide Resistance Management in Australian Grain Crops
Comprehensive guide to fungicide resistance issues, instances and management – including details of fungicide Mode of Action groups, chemical actives and diseases by crop. Prepared by AFREN and published by the GRDC.
afren.com.au/resources#FRManagementGuide

GRDC Fungicides In Australia Fact Sheet

GRDC How Fungicide Resistance Develops Fact Sheet
afren.com.au/resources#factsheets

REFERENCES

The content in this Fact Sheet is based on the content and sources included in the AFREN Guide **Fungicide Resistance Management in Australian Grain Crops.** See 'Useful Resources' above.

MORE INFORMATION

Australian Fungicide Resistance Extension Network
afren.com.au

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