CROWN ROT IN CEREALS FACT SHEET

GRDC Grains Research & Development Corporation

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SOUTHERN AND WESTERN REGION

Understanding the disease underpins effective management

Assess crown rot risk in paddocks by checking crops for browning of the stem base or by taking soil and stubble samples for analysis. Don't rely on whiteheads as an indicator.

Key messages for crown rot in cereals

- Keeping crown rot inoculum at low levels is by far the most effective way to reduce yield loss from this disease.
  A grass-free break from cereals is the best way to lower crown rot inoculum levels.
- It is essential to assess paddocks for crown rot risk. Sow cereals, particularly durum, into paddocks where the risk is lowest.

About the crown rot disease:

- This fungal disease is hosted by all winter cereals and many grassy weeds;
- Crown rot survives for many years in infected plant residues and infection can occur when plants come in close contact with those residues;
- High cereal intensity and inclusion of durum wheat in cropping programs are factors which increase crown rot levels;
- Major yield losses occur when disease levels are high and there is moisture stress during grain fill. In these circumstances yield loss can be up to 90 per cent in durum and 50 per cent in bread wheat; and
- Grain quality is not greatly affected in barley but screenings may increase in bread wheat and durum.

If a cereal must be sown but there is a risk of yield loss from crown rot:

- Select a cereal type which will have the lowest yield loss. Barley is the first choice, followed by bread wheat and triticale. Avoid durum;
- Match nitrogen application to stored soil moisture and potential yield;
- Limit nitrogen application prior to and at sowing to avoid excessive early crop growth;
- Ensure zinc nutrition is adequate; and
- Sow on the inter-row if this option is available.

Don't rely on whiteheads as an indicator.

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THE DISEASE

Survival

All winter cereals and many grass weeds host the crown rot fungi, which survive over summer on infected plant residues. As infected residues decompose, inoculum levels reduce. This means that where decomposition rates are low, crown rot inoculum can survive for several years.

Infection

When infected plant residues are close to growing plants, crown rot infection can occur. Even minute pieces of residue can cause infection and a paddock with little visible stubble may still have a crown rot risk. Infection is favoured by moderate soil moisture at any time during the season. Infection occurs in the sub-crown internode, crown and/or outer leaf sheaths at the tiller bases. The fungus spreads up the stem during the season, with most inoculum being found near the base of the plant (see Figure 2).

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Infection occurs when plants are close to infected plant residues.

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Whiteheads are more prevalent with moisture stress.

Stem browning

A brown stem base is the most reliable indicator of crown rot and this symptom becomes more pronounced from mid to late grain fill through to harvest.

To see the honey/dark brown colour more easily the leaf sheaths should be pulled back. This symptom may not appear on all stems of an infected plant and is difficult to see in oats.

Whiteheads

Whiteheads caused by crown rot are usually scattered through the crop and do not appear in distinct patches as seen with the root disease take-all. The expression of whiteheads is favoured by moisture stress during grain fill and there is a direct relationship with yield loss. Whiteheads may first appear in wheel tracks and old weed patches where crop-available soil moisture is more limited. However, whiteheads may not appear on all stems of an infected plant.

Barley generally does not produce whiteheads because it matures earlier than wheat, which helps it escape late season moisture-stress. Oats rarely exhibit this symptom.

REDUCING YIELD LOSS

If crown rot is present, there are a number of ways to minimise the risk of cereal yield loss in the coming season. However, actual yield loss from this disease will be determined by seasonal conditions. For example, a paddock may have a high disease risk but the cereal crop may only have small yield losses if there is good spring rainfall with mild temperatures.

Paddock selection

- Durum wheat – select paddocks with a low risk of crown rot.
- Other cereals – avoid paddocks with a high crown rot risk.
- Determine paddock risk by visually assessing crown rot levels in a prior cereal crop – see Stem browning or have soil samples analysed at a testing laboratory.

Paddock history can also provide clues. Histories likely to result in high crown rot risk include:

- durum wheat in the past one to three years;
- winter cereal or a high grass burden from last season – crown rot fungus survives in winter cereal residues, dense stubble cover or where dry conditions have made residue decomposition slow;
- break crops can influence crown rot in cereals by manipulating the amount of nitrogen and moisture left in the soil profile; and
- paddocks that have high nitrogen at sowing and/or low stored soil moisture at depth.

Cereal type

All winter cereals host crown rot with yield loss due to infection varying depending on cereal type:

- Durum wheat – highest yield loss;
- Triticale – average yield loss;
- Bread wheat – average yield loss; and
- Barley – average yield loss – barley finishes earlier than other cereals and can sometimes avoid the disease as grain fill has occurred before moisture stress.

Variety resistance

Varietal resistance and tolerance to crown rot is limited.

Resistance: the plant's ability to limit the development of crown rot.

Tolerance: the plant's ability to maintain yield whilst crown rot is present.

Durum wheat – very susceptible.

Other winter cereals – varying levels of susceptibility.

- Resistance is only possible in healthy, growing plants. Once a plant is stressed or starts to dry off at the end of grain fill, the crown rot fungus will take hold regardless of its resistance rating.
- Crown rot ratings are mostly based on the evaluation of resistance in the variety – go to Variety disease guides or the National Variety Trials website, www.nvtonline.com.au for more information.

Stubble management

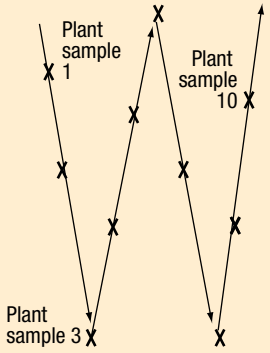
- Stubble management practices such as spreading and slashing through cultivation can increase the rate of stubble decomposition but can also spread the infected residues across the paddock due to loss of soil moisture (see Figure 2).
- Where there is no stubble moisture or adequate time to accelerate stubble breakdown, then these practices can increase infection rates in the next winter cereal crop.
- Grazing stubble can also spread inoculum.

ASSESSING THE DISEASE RISK

Stem browning assessment

- Check your cereal crops for crown rot between grain fill to harvest. Collect plant samples from deep within the paddock by walking in a large 'W' pattern, collecting 5 plants at 10 different locations (see Figure 3). Examine each plant for basal browning, record what percentage shows the symptom and then put in place appropriate measures for next year.
- As a general rule, the risk for a cereal in the next season will be:
  - LOW – less than 10 per cent of plants infected;
  - MEDIUM – 10 to 25 per cent of plants infected; and
  - HIGH – more than 25 per cent of plants are infected.

FIGURE 3 PATTERN FOR PLANT SAMPLES



COX INIALL

Healthy tillers (left) and severe basal or stem browning (right).

Soil sampling for future risk

- The DNA-based soil test (PreDicta B™) provides a risk level for crown rot and other soil-borne diseases including take-all.
- Soil samples that include plant residues should be tested early in late summer to allow results to be returned before seeding.
- This test is particularly useful when sowing durum and for assessing risk between cereal stubble rows or after a non-cereal crop (See Useful resources).

Inter-row seeding

- Infection rates can be reduced by sowing between rows of standing stubble.
- In the southern region inter-row sowing using accurate ± 2cm differential GPS autosteer has shown a decrease in the number of infected plants by 50 per cent – resulting in a 5 to 10 per cent yield increase.

Crop nutrition

- Bulky crops are more likely to experience moisture stress during grain fill which makes them more vulnerable to yield losses from crown rot.
- Match nitrogen rates and timing to stored soil moisture and targeted potential yield – this will avoid excessive early crop growth.
- Pay attention to zinc nutrition – the expression of whiteheads in crown rot infected tillers can be more severe in zinc-deficient crops. Applying zinc above recommended rates will not provide further protection from crown rot.

CHANGING CROWN ROT LEVELS

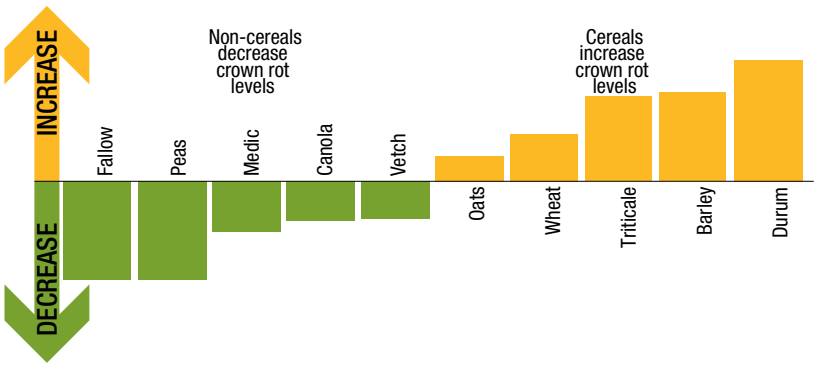
Reducing inoculum is central to controlling crown rot.

Rotation remains the most important component in the integrated management of crown rot.

Rotations

- All winter cereals increase crown rot inoculum – durum wheat and barley increase the levels most (Figure 1).
- Generally bulkier cereal crops result in more crown rot inoculum present.
- Breaks from winter cereals decrease crown rot inoculum (Figure 1). This is most effective if free of grass weeds and volunteer cereals.
- Good rainfall increases the effectiveness of the break, because microbial decomposition of the cereal residues harbouring the pathogen is greater in moist conditions.
- For break crops, early canopy closure and warm, damp conditions under the canopy will result in the fastest decomposition of crown-rot-infected residues.
- Where disease levels are high and there is low rainfall, it may take two to four years for infected plant residues to decompose enough for durum wheat to be sown without a yield risk. →

FIGURE 1 ROTATION EFFECTS ON CROWN ROT LEVELS IN THE SOIL IN THE FOLLOWING YEAR (SUMMARY FROM FIVE TRIALS IN SA AND VIC)



Cultivation

Incorporating infected plant residues into the soil by cultivation can increase the rate of decay.

However, decay may take several years as it is also influenced by biological activity, soil moisture and nutrient availability.

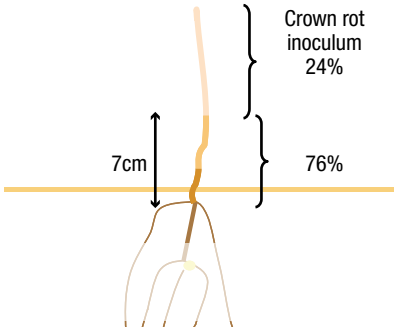
Cultivation spreads infected residues, which may increase plant infection rates – counteracting any benefits from increased residue breakdown.

Baling and burning

Baling and removing straw or hay are not instant solutions for crown rot. This is because the crown rot inoculum is mostly below ground and in the bottom seven centimetres of the stem (Figure 2).

Stubble burning is not a quick-fix for high crown rot levels because burning does not remove inoculum from below ground.

FIGURE 2 CROWN ROT DISTRIBUTION ON INFECTED CEREAL STUBBLE



Frequently asked questions:

Q. Can I spray to control crown rot?

A. No. There are no fungicide options for the control of the crown rot. The crown rot fungus is protected inside plant material.

Q. Do any soils suppress crown rot?

A. There is little current paddock evidence for this.

Q. My durum crop is in head and has crown rot, should I cut it for hay?

A. Not necessarily. Check the level of crown rot first. Pull up 5 to 10 plants at each of three to four sites within the same paddock and check stem bases for browning. As a broad rule if less than 10 to 15 per cent of plants are infected do not cut for hay and if 30 to 40 per cent or more of plants are infected do cut for hay. Durum wheat prices, potential yields and the possibility of baling and selling straw will all influence the final decision.

Q. I want to grow durum wheat, but what about crown rot?

A. Despite losses to crown rot, some growers report durum wheat on average gives better gross margins than bread wheat. Their approaches to minimising crown rot include:

- choosing paddocks with low crown rot inoculum (soil test using PreDicta B™ if unsure);
- not sowing durum after a certain date;
- choosing soil types with better soil moisture storage; and
- limiting early nitrogen application.

Useful resources:

- **Grant Hollaway, DPI Victoria** (03) 5362 2111 Email Grant.Hollaway@dpi.vic.gov.au
- **Margaret Evans, SARDI** (08) 8303 9379 Email margaret.evans@saugov.sa.gov.au
- **Bill MacLeod, DAFWA** (08) 9368 2958 Email william.macleod@agric.wa.gov.au
- **Steven Simpfendorfer, NSW DPI** (02) 6763 1261 Email steven.simpfendorfer@dpi.nsw.gov.au
- **Annette Tredrea, Crown Analytical Services NSW** (02) 6792 6510 Email crownanalytical@bigpond.com
- **PreDicta B™ – a soil analysis service delivered by accredited agronomists. Contact your local agronomist or to locate your nearest supplier, e-mail your contact details and location to predictab@saugov.sa.gov.au**
- **National Variety Trials – www.nvtonline.com.au**
- **Cereal Variety Disease Guides produced by each state**
- ***Cereal Root and Crown Diseases* (2000), Hugh Wallwork, GRDC and SARDI.**

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