

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 1).



Infection occurs when plants are close to infected plant residues.



SARDI

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 has caused yield loss, or is suspected, there are a number of ways in which the risk can be minimised in the coming season. However, actual yield loss 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/stubble 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;

- low rainfall during the last break from cereals; and
- paddocks with low stored soil moisture at grain fill will help to minimise yield loss.

Cereal type

While all winter cereals host crown rot, yield loss due to infection varies with cereal type.

- Durum wheat – highest yield loss (average 58%).
- Bread wheat – average yield loss of 25%.
- Triticale – average yield loss of 23%.
- Barley – average yield loss of 20%. Less visual as it tends to not produce whiteheads, but, still occurs through the loss of tillers and infection plants.

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.

Bread wheats – some cultivars are rated as moderately resistant.

Under high disease pressure and moisture stress during grain fill plants can suffer a 50 per cent yield loss.

Note: Variety disease guides and the National Variety Trials website, www.nvtonline.com.au provide crown rot ratings which are largely based on the evaluation of resistance. The differences in actual yield loss to crown rot between varieties appears much narrower than their wide disease ratings would indicate.

Time of sowing

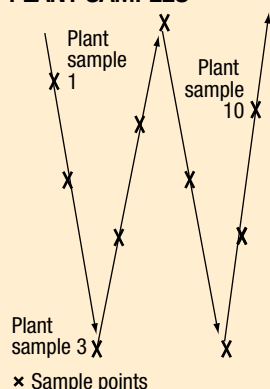
- A sowing cut-off date – for sensitive crops such as durum can help avoid major yield losses.
- Research has found little impact from the time of sowing on the level of crown rot incidence, however the severity as measured by basal browning, increases with later sowing.
- Planting date should be determined by the presence of adequate soil moisture and the type of variety sown to also manage frost risk.
- Sowing a variety early in its sowing window will help to buffer the detrimental effects of any crown rot infection.

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 2). 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 2 PATTERN FOR PLANT SAMPLES



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

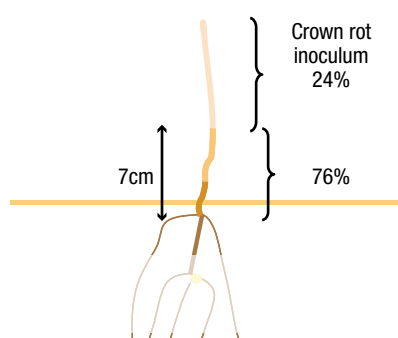
Soil sampling for future risk

- PreDicta B™ provides a soil test for crown rot and other diseases, but has proven less reliable in the north for predicting disease risk (See Useful resources). Soil samples that include plant residues should be tested in late summer to allow results to be returned before seeding.

Stubble assessment

- A commercial stubble assessment service is available from Crown Analytical Services (Narrabri) for crown rot and other common root rot pathogens (See Useful resources).

FIGURE 1 CROWN ROT DISTRIBUTION ON INFECTED CEREAL STUBBLE



Stubble management

- By harvest the crown rot fungus may have colonised from the crown to around the second to third node in the stem.
- The presence of inoculum will be more concentrated below ground and in the bottom seven centimetres of the stem (Figure 1).
- Stubble management practices such as cultivation, spreading and slashing can increase the rate of stubble decomposition but can also spread the infected residues across a paddock.
- Where there is no stubble moisture or adequate time to accelerate stubble breakdown, then these

practices can increase the infection rates in the next winter cereal crop.

- Grazing stubble can also spread inoculum.

Inter-row seeding

- Infection rates can be reduced by sowing between rows of standing stubble.
- In the north inter-row sowing using accurate $\pm 2\text{cm}$ 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, making 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 levels is central to controlling crown rot. Rotation remains the most important management option.

Rotations

- All winter cereals increase crown rot inoculum, with durum wheat and barley increasing the levels most. Planting of winter pulses and oilseeds should be considered.
- Breaks from winter cereals decrease inoculum and will be most effective if free of grass weeds and volunteer cereals.
- Inoculum declines most after break crops such as canola, mustard or faba bean. Chickpeas are less effective at decomposing cereal stubble due to their canopy growth but are still better than a fallow.
- 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 plant residues and reduction of inoculum levels.

- Where disease levels are high and there is low rainfall, it may take several years for infected plant residues to decompose to reduce disease risk to a low enough level for durum wheat.

Cultivation

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

Unfortunately, cultivation also spreads infected residues. This may increase the proportion of plants infected in a paddock, counteracting any benefits from increased rates of residue breakdown.

Cultivation also results in a loss of soil moisture, which may also increase the expression of crown rot.

Residue decay is also influenced by biological activity, soil moisture and nutrient availability.

Stubble burning

Stubble burning is not a quick-fix for high crown rot levels.

Burning does not remove inoculum from below ground.

Depending on the timing of the burn, significant levels of soil moisture storage can be lost through the lack of stubble cover during the fallow period. This can have a big effect on the expression of crown rot late in the season.

Frequently asked questions:

Q. How do I know if there's crown rot in my paddocks?

A. Pull up cereal plants around grain fill through to harvest. Avoid oats, which do not show crown rot symptoms. Infected stem bases will have a golden to dark brown discolouration – pull back the leaf sheaths to look carefully. Stubble samples can be submitted to Crown Analytical Services for a definitive assessment.

Q. Can I spray to control crown rot?

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

Q. Do any soils suppress crown rot?

A. There is little current paddock evidence for this.

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 (test if unsure);
- not sowing durum after a certain date;
- choosing soil types with better soil moisture storage; and
- limiting early nitrogen application.

Useful resources:

- 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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Any research with unregistered pesticides or of unregistered products reported in this document does not constitute a recommendation for that particular use by the authors or the authors' organisations.

All pesticide applications must accord with the currently registered label for that particular pesticide, crop, pest and region.

CROWN ROT IN CEREALS **FACT SHEET**

NORTHERN 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 winter 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 winter cereals is the best way to lower crown rot inoculum levels.

- It is essential to assess paddocks for crown rot risk. Sow winter 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.

