

# Cereal root disease: what can your crop tell you?

Hart Twilight Walk | October 18, 2022

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As part of the SAGIT funded project “Managing crown rot on Upper Eyre Peninsula – a joint learning experience” managed by AIR EP (Agricultural Innovation and Research, Eyre Peninsula), I’ve been running field-based activities to show small groups of participants how to look at cereal root systems in-crop.



Photo: Dr Marg Evans at the 2022 Hart Spring Twilight Walk

I’d planned a modified version of this activity for the Hart Twilight Walk – but this plan required further modification and a move into the shed when extreme winds began blowing samples away.

This summary of the information provided at the Twilight Walk includes some photographs taken at other times to explain points that were made to participants using fresh plants dug up from the Hart commercial crop area.

## CONTENTS AND KEY POINTS

### Why check plant roots?

- Inform nutrient application decisions.
- ID ‘hidden’ problems with root health, particularly diseases.
- Detect sowing depth and compaction layer issues.
- Understand what healthy roots look like on your property.

### How to check plant roots:

- Timing - around early stem elongation to head emergence is a good time.
- Method - dig, don’t pull! Wash and compare roots from healthy and poor plants.
- Root architecture - primary roots, secondary (crown) roots, sub-crown internode.
- How poor roots limit grain yield & quality - moisture stress, poor nutrition.
- What do healthy roots look like? – white, smooth, good laterals, root hairs on crown roots.
- What are the symptoms of disease? – multiple! Not always easy to ID, consult an expert.
- Getting advice from the experts - get in touch before you take (or send) samples! Provide all the background information, samples and photographs they will need. (You’ll find contact details for SARDI experts Blake Gontar and Katherine Linsell at the end of this document).

## Why check plant roots?

We're all time poor these days, so it's quick and easy to drive past (or even stop at the gate!) to check whether a crop has a problem. Usually, it's only when there's an obvious problem that we get out and take a closer look – often just at the leaves, sometimes at the stem bases and rarely at the roots. Examining plant roots can provide valuable information for decision making as well as giving you an understanding of what a healthy root system should look like on your property.

Digging up plants, checking stem bases and washing dirt off the roots and examining the root system can help identify:

- Root disease issues.
- Health of primary and secondary root systems before making nutrient application decisions.
- Sowing depth issues (too shallow or too deep).
- Compaction layers that are restricting root growth.
- Whether root diseases are contributing to unevenness or poor growth in crops where the problem has always been thought to be due to soil type differences, herbicide damage etc.
- Stem base diseases such as crown rot, take-all and eyespot. These diseases can still cause yield losses even where white head and lodging symptoms are not present.
- Inoculum of root and stem base diseases likely to be present next year.

## Timing:

Around early stem elongation to head emergence is a good time to examine root health. Symptoms of most root diseases (and crown rot symptoms on the stem base) should be visible at this time and the health of primary and secondary roots can also be assessed to help inform nutrient application decisions. Samples can be taken at other times for specific purposes (e.g. to see whether rhizoctonia is the cause of patching early in the season).

## Method:

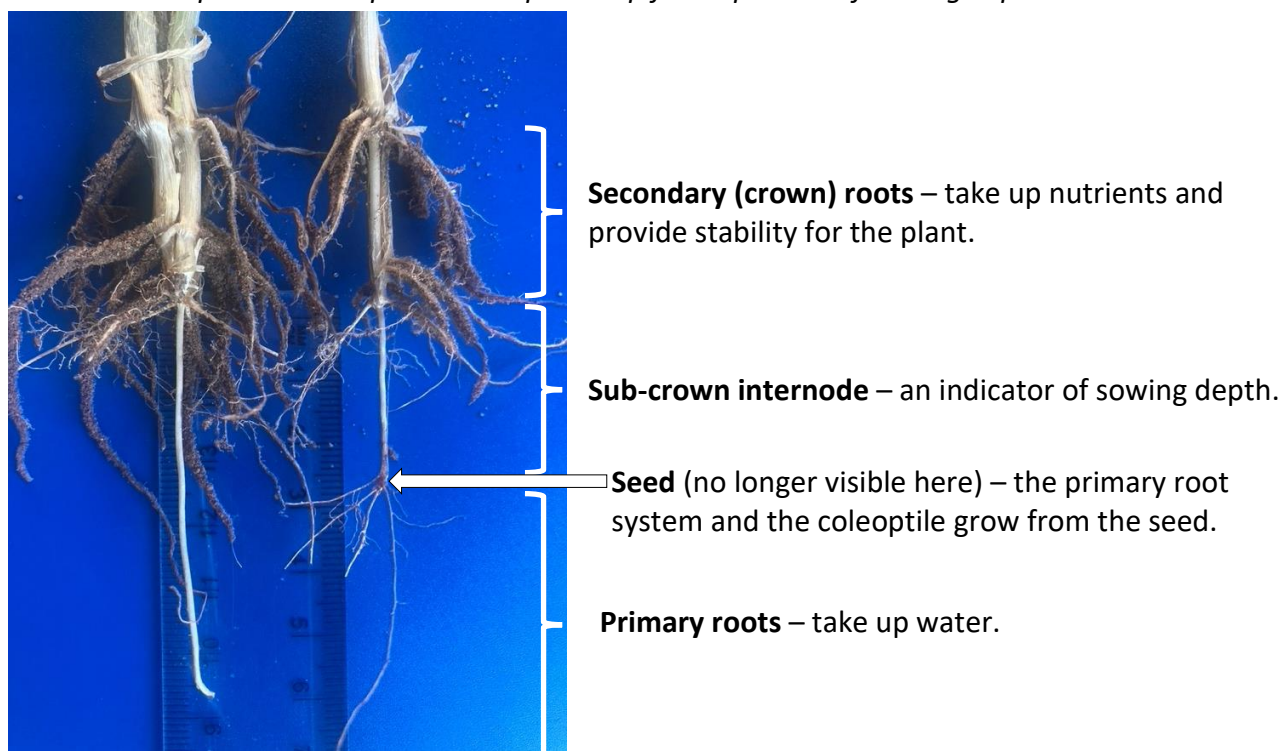
- Do NOT pull plants up, as much of the root system will be lost.
- Take a spade and a bucket and walk out into the crop, away from fence lines and headlands.
- Select an area of good plant growth. Dig up a section of row – push the spade into the soil (ideally to more than 20 cm) on each side of the section before lifting it out. Hold the spade close to the ground and drop the sample onto the ground (see photos below) – you can gently step on the sample to loosen the soil. Support the roots, shaking gently to remove more soil and lift the sample up and place in the bucket. These roots will show you what a healthy root system should look like in this paddock.
- At an area showing poor plant growth, repeat the above step.
- Back at the shed (or in the paddock if you have water and time), soak the samples in a bucket full of water (see photo below) to make washing the roots easier. In heavy soils, soaking for about 30 minutes to an hour prior to washing out is good.



- Jiggle the samples up and down in the water until most of the soil is gone (keep the root ball under water to support the roots so they don't break off).
- Place the good and poor growth samples into separate, clean buckets (support the roots if there's still a lot of mud on them).
- Pour clean water into each bucket and, keeping the roots under the water, gently tease apart 2-3 plants with good root growth and 2-3 plants with poor root growth. Separating out a couple of plants of each type makes the washing process faster and easier.
- Place the good and poor plants in separate, clean buckets to ensure you know which is which.
- Continue to wash the roots until they are clean enough to look at easily. If available, use a hose (a spray nozzle is good, too) to gently wash the roots. Otherwise, change the water in the buckets until the roots are clean.
- Gently remove any leaves or leaf sheaths that are mixed in with the root systems.
- Place the clean roots in a shallow layer of water in a dish with a white (or light coloured) base. Tease the root systems out until you can see them easily.
- Good lighting on the roots will make it easier to see what is going on (sun is ok, but sometimes the light from a mobile phone or torch can help).

### Root architecture - what you should see once the roots are clean:

*\*Note that the plants in this photo were pulled up for inspection of sowing depth treatments.*



### Poor root development can limit yield potential and grain quality in the following ways:

- Compromised primary root system - water uptake will be limited leading to moisture stress prior to and/or during grain filling. If the primary root system is badly compromised, applying nutrients might not be cost-effective.
- Compromised secondary root system – poor nutrient uptake from the soil; plants can become destabilised and are more likely to lodge in windy conditions. If the secondary root system is compromised but the primary root system is not, then foliar fertilizer application might be most cost-effective.

### **Healthy root systems should:**

- Have soil adhering to the bases of the secondary roots (as in the photo above) even after washing, showing that there are plenty of root hairs present to take up nutrients.
- Be a nice clean and bright white. Some soil types will cause a little discolouration of the whole root system but this is not an issue.
- Be an even thickness along their length, with a smooth surface.
- Have a white cross-section to the roots if you break or cut the thicker ones.
- Have plenty of lateral roots of good length coming off the main roots.

### **Diseased root systems may exhibit any one of or a combination of the following symptoms:**

- Spear tips at the end of roots (typical of rhizoctonia root rot).
- Black or dark brown discolouration.
- A black centre to the cross-section of roots (typical of take-all).
- Few lateral roots.
- Thickened and stumpy roots (particularly the lateral roots).
- Knotting of the root system (typical of cereal cyst nematode).
- Lumpy or uneven appearance to the surface of the roots.
- Rotten appearance to sections of the surface of the roots.

### **Getting an ID from an expert:**

Identifying root diseases can be difficult, even for the experts, using just visual symptoms. Sometimes experts can use photographs alone to identify a disease problem, but often they will need actual samples. They will then do microscopic examinations and/or put affected tissue on agar (to grow fungal colonies with spores that allow identification) or will put soil and roots under a misting system (to collect and identify nematodes).

- Call the experts before taking samples so they can discuss with you what they want and when/how to get the samples to them (contact details below).
- Basic information you need to provide includes:
  - Your contact details and the location of the crop.
  - A description of the issue and the area of crop affected (e.g. approx. %).
  - Crop type and variety.
  - Paddock history at least for last year and for 2-3 years if possible.
  - General comments about the season, the paddock, toxicities/deficiencies, the herbicides applied etc.
- Good quality photographs can be helpful:
  - General photos of the paddock showing expression on a large scale.
  - Photos of the root system of a plant that is growing well and one that has the problem will assist.
  - To have a better chance of successful ID using photos alone, you will need good close-ups of the specific symptoms (e.g. spear tips) of concern.
- Hand-delivering or posting samples to an expert:
  - Four – five (4-5) plants from an unaffected area should be provided as well as 4-5 plants from the symptomatic areas. Keep the plants separate and labelled as 'good' and 'bad'.

- Keep samples in the fridge until they are posted/delivered.
- If sending samples ensure they are sent early in the week so that they do not sit in the post over the weekend.
- If plants are being sent without washing the roots (probably preferable) then the tops of very large plants can be cut off leaving at least 10-15 cm of the stem base on the roots. Gently remove the bulk of the soil from the roots and enclose them in paper or a paper bag with a rubber band or other tie around the top of the roots to prevent dirt covering the whole sample. Keep the 'good' and 'bad' plants in separate paper/paper bags labelled as 'good' and 'bad'.
- If washing the roots, wrap the wet roots in paper towelling and put them in a plastic bag but don't seal the bag. It is important to keep these samples in the fridge until they are posted. If washing the roots, it's probably best to hand-deliver the samples.
- Notify the expert when the samples are on the way to ensure samples are dealt with as soon as they arrive (even if the expert is not there).

Contact SARDI root disease experts at the Plant Research Centre

Blake Gontar | 0430 597 811

Katherine Linsell | 0417 889 253

Postal address for samples

(Attention Blake or Katherine)

SARDI Plant Research Centre

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