Maintaining profitability in retained stubble systems on upper Eyre Peninsula

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Guideline 5: Stubble management and cereal disease impacts

Conservation farming systems with stubble retention and reduced tillage are currently implemented by most growers on upper Eyre Peninsula. This has improved soil moisture conservation, increased timeliness of sowing and reduced soil erosion due to lower levels of soil disturbance and increased levels of soil surface cover, especially as livestock are still a major component of the farming system[1]. At Minnipa, research has shown stubble management and seeding position have not impacted highly on crop production, weeds, disease and pests over three years with relatively high stubble loads[2].

Stubble borne diseases such as Take all, Crown rot, Yellow Leaf Spot, Eyespot and White Grain in wheat, and Barley scald, Barley net and spot form of blotch, will all have increased inoculum levels in an infected paddock with the retention of stubble. If the disease level was an issue, a break from cereals in an infected paddock or stubble removal will reduce numbers of air-borne spores present in that paddock in the subsequent year. Rhizoctonia disease risks will also change depending on stubble management.

KEY MESSAGES

- Every disease is different and requires a different management strategy.
- Growing non-host crops will help to keep disease inoculum levels low.
- Grass weed control may be important for reducing disease inoculum levels.
- Testing for disease risks using PreDictaB may be useful if unsure of the disease and inoculum levels.
- Stubble management or seeding position may help with disease management.
- Fungicides as seed treatments, foliar applications or in-furrow may give economic control for some diseases, but not others.

CEREAL DISEASES

Take-all *(Gaeumannomyces graminis var. tritici (Ggt))*

Take-all, also called hay-die, is a fungus which affects all cereals except oats *(which is affected by the closely related Gg var. avenae)* and cereal rye. Severe early infection can cause patches of poor crop growth of pale stunted plants with few tillers. The most common sign of take-all is patches of whole plants haying off or dying prematurely in spring with whiteheads containing no grains[4]. The roots will show symptoms at 6-8 weeks with characteristic blackening in the center of the root (stele). Severely infected plants may show blackening of the crown and lower stem. Good seasons and especially wet springs will increase inoculum levels[3]. Yield losses of up to 25% can occur with no above ground symptoms[3].

Management

- Avoid cereal on cereal rotations - intensive cropping and stubble retention will increase inoculum levels.
- Delayed sowing and sowing inter-row with adequate nutrition will reduce risk of crop infection.
- Remove grass from pastures, pulses, canola or oats (where Ggt oats strain is not present).
- An effective one year break will lower inoculum levels, unless in drought conditions.
- Registered seed dressings and in furrow fungicides are available.
- Summer rainfall events (>25mm) and microbial activity can reduce inoculum levels by 30%[3].

Crown Rot *(Fusarium pseudograminearum)*

Crown rot is a fungal disease of cereals which affects wheat, barley, oats, triticale and rye. Durum wheat is the most susceptible, with barley rarely producing white heads and oats being symptomless. Crown rot can cause losses up to 90% in durum, but 5-30% losses are more common.

The most common symptom is scattered single tillers of whiteheads after flowering with no or small grain, especially under water stress. Where severe, whole plants may be affected and tiller bases often have a honey brown color. Pink hyphal growths or pink discoloration around or in the crown or under leaf sheaths (at nodes) may be seen, especially in moist conditions. Moisture stress and warm conditions at crop maturity will increase the growth of the fungus and exacerbate symptoms.

Management

- Break from cereal on cereal rotations - grass free pastures, pulses, canola or fallow.
- Large amounts of infected stubble and reduced/minimum tillage will increase crown rot inoculum.
- Stubble removal by baling will lower inoculum by 20-30%, and autumn burning by 40-50%, but inoculum will still be present in stubble residues e.g. crowns.
- Inter row sowing, moving the new plant away from potential infection, and adequate nutrition will help the following crop.
- If inoculum levels are high a 2-3 year break from cereal and grass weeds may be required to lower the disease risk.

Rhizoctonia *(Rhizoctonia solani AG-8)*

Rhizoctonia is a fungal pathogen which causes Rhizoctonia bare patch in cereals and it can also attack pulses and pasture legumes. There are other strains of Rhizoctonia that can cause disease in pulses, canola and pasture legumes. The PreDictaB test is for *Rhizoctonia solani AG8*. Up to 50% yield losses can occur in severely affected paddocks[4].

Barley will show greater symptoms of Rhizoctonia compared to wheat. Rhizoctonia causes bare patches of stunted plants with shorter roots systems and characteristic 'spear tips' which have rotted through. Seminal root attack will show disease symptoms early, about 3-6 weeks after germination, of distinct stunted patches. However later Rhizoctonia attack and disease symptoms on crown roots will result in uneven crop growth. Stems will often show purple coloration on the base. Crown root disease symptoms of 'spear tips' in spring indicate high Rhizoctonia inoculum levels. Cold conditions at establishment will decrease root growth and increase disease symptoms[4].

Management

- Inoculum levels will be lowered for one season by rotation, using grass free pastures, pulses, canola or fallow.
- Cultivation results in disturbance of the fungal network and lowers disease inoculum level at sowing.
- Any factor which limits early root growth like compaction, poor nutrition, cold wet soils or residual herbicides 'pruning' roots, will result in increased Rhizoctonia disease symptoms.
- Summer weed control and green bridge control reduces disease inoculum build up[5].
- In the upper EP environment there is limited disease suppression of Rhizoctonia, as achieving it requires high stubble input and a low N environment, and greater than 60% WUE[4,6].
- Fungicides have limited effectiveness in high inoculum situations on Eyre Peninsula, consider the cost of application and economics[7].

Yellow Leaf Spot *(Pyrenophora tritici-repentis*)

Yellow Leaf Spot (YLS) is a rain dispersed, stubble borne fungal disease found mostly where wheat is grown in short rotation[8]. The disease symptoms are tan-coloured lesions on the leaves which are surrounded by yellow halos. In partially resistant varieties dark rings often form around small tan lesions. Yield losses are generally less than 15% but can be higher in favorable conditions, with moist conditions over longer periods of the growing season and temperatures of 15-28^{o}C[8].

In a stubble management and sowing position trial at Minnipa in 2015 sown with CL Grenade®, a susceptible variety, removing and cutting stubble low decreased the YLS disease incidence compared to high cut stubble[2]. There were no differences in wheat yield in the trial in response to stubble architecture, seeding position and nitrogen treatments[2].

Management

- A one year break from wheat with pulses or canola will generally lower inoculum levels, except in very dry conditions.
- Practices that reduce surface stubble such as grazing, tillage or burning will reduce inoculum levels.
- If wheat on wheat is to be grown, select varieties with better genetic resistance (MS or better). Disease resistance ratings are updated annually, this information is available in the annual Eyre Peninsula Farming Systems Summary.
- Given most YSL infection occurs in winter at early growth stages, fungicides which give 3 weeks protection is generally not economic, however propiconazole foliar application at GS31 and GS39 reduced the incidence of YLS infection in susceptible varieties at Rudall in 2013[8].

Eyespot *(Oculimacula yallundae)*

Eyespot is caused by a stubble-borne fungus and is becoming an increasing problem in medium rainfall areas due to stubble retention, direct drilling and more cereals in rotations[4]. The stubble borne fungus causes eye-like lesions on the stem bases, which can girdle the stem. Yield losses occur as a direct result of the stem lesions and from plants lodging due to a weakened stem which increases harvest losses. Lodging due to eyespot tends to occur in all directions compared to wind or rain damage in which stem damage is generally the same direction. Yield losses in Australia due to eyespot have not been quantified but overseas information suggests 5 to 40%. Overseas, eyespot control is provided by varietal resistance and fungicide application. Registration for chemical control of eyespot in Australia is expected in 2017. Variation in genetic resistance has been identified in Australian varieties and this is available in the 2017 South Australian Cereal Variety Disease Guide[9].

Management

- Wheat sown into thick standing stubbles of 10 to 20 cm will have higher risk of infection. Burning stubbles can reduce the inoculum level but does not eliminate the disease.
- Reducing the frequency of growing wheat with break crops will lower inoculum levels, but the fungus can survive in the stubble for two years or more. While barley has not been seen to lodge it can be infected and increase inoculum[10].
- Factors which increase crop density and moisture at the base of the plant such as early nitrogen application, higher seeding rates and early time of sowing can contribute to earlier infection and greater disease[10].
- Properties and paddocks which have had eyespot infection are very likely to have it again[10].
- Differences in eyespot genetic resistance were observed in wheat grown Cummins in 2013 with Trojan and Emu Rock having useful levels of resistance compared to Axe, Mace, Cobra, Scout and Shield which were susceptible[9].

White Grain Disorder *(Tiarosporella spp)*

White grain disorder was first observed on Eyre Peninsula during the 2010 harvest, resulting in rejection and down grading of deliveries[11]. This fungal disease has also been observed in Queensland in 1999, areas of NSW and also Lower Great Southern Region in WA in 2013.The initial fungi involved were identified as *Botryosphaeria* spp., but have more recently been classified as *Tiarosporella* spp. More than one *Tiarosporella* spp. can be associated with the disorder[12].

The fungus survives in cereal stubble residue and is viable for at least two years[11]. Problems are likely to occur in crops grown on infected stubbles and in seasons with wet springs which promote infection. The disorder is caused by the fungal infection of wheat heads during flowering and grain fill. The wheat heads can show bleaching or grey discolouration of infected spikelets. The affected grain can be white to light grey and sometimes pinched compared to normal grain[11]. The grain may be confused with frost damage or fusarium head blight (which contains toxins).

Management

- There are currently no recommended management options for this disease[11].
- There are no associated toxins with white grain therefore the stubbles and grain can be safely grazed and fed to livestock[12].
- The disease survives on infected stubble for more than two seasons so rotation and stubble removal may reduce inoculum levels[12].
- Ongoing spore trapping may help with understanding the disease parameters[12].

BARLEY LEAF DISEASES

Barley Scald *(Rhynchosporium secalis)* – Water soaked areas on the leaves which turn grey-green. Lesions become bleached and develop dark brown margins. All parts of plant can become infected except upper stem. Common in wet conditions when crops sown early[4].

Barley net form of net blotch (NFNB) *(Pyrenophora teres* f. *teres)* – Small circular to elliptical dark brown spots which elongate and produce fine brown streaks along and across the leaf blades, creating a distinctive net like pattern. Severely affected leaves wither rapidly. The disease infects heads and is both stubble and seed borne. Use clean seed[4].

Barley spot form of net blotch (SFNB) *(Pyrenophora teres* f. *maculata)* – small dark brown spots to larger brown blotches up to 10 mm. Blotches are round to oval when small becoming more straight edges as they enlarge. Larger lesions are often surrounded by a yellow margin[4].

Management

- For the stubble borne barley leaf diseases avoid growing barley in successive crops and on infected stubble.
- Remove infected barley straw by grazing or mechanical means.
- Sow more resistant varieties[4].

When should I use stubble management in my system?

Stubble borne diseases will all have increased inoculum levels in an infected paddock with the retention of stubble. If the disease level is an issue, a break from cereal in an infected paddock or stubble removal will reduce numbers of air-borne spores present in that paddock in the subsequent year. Every disease is different and requires a different management strategy, so know the factors which influence the disease inoculum and disease risk.

Testing using PreDictaB may be useful if unsure of the disease and inoculum levels. Growing non-host break crops will help to keep disease inoculum levels low and grass weed control may also be important for reducing cereal disease inoculum levels. Stubble management, removal by grazing, burning or cultivation, and seeding position may help with disease management. Fungicides may give economic control for some diseases, but not others.

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