Upper North Farming Systems

Stubble Management Guidelines

White grain disorder

Grain severely affect by white grain disease is light grey to white and sometimes pinched when compared with normal grain. Photo: Dr Margaret Evans, SARDI

Key facts

- Current grain receival standards allow a maximum of 1% by count of white grain — export markets will not accept levels higher than this.
- The pathogen for white grain disorder (WGD) was present in soil samples taken across the Upper North during 2014 and was found at high levels in some paddocks.
- Check heads for signs of white grain before harvest if there has been moisture during flowering and grain fill.
- Grain with white grain symptoms will not germinate and other grain not showing symptoms in an affected sample also could have a lower germination rate.

White grain disorder (WGD) affects bread wheat, durum wheat, barley and triticale, although mainly commercial bread wheat crops have shown symptoms in South Australia to date.

At least three species of fungi in the genus *Eutiarosporella* are associated with WGD but the main fungal species in SA is *E. tritici-australis* (= WGD Clade 1).

Symptoms and biology

Signs of WGD are difficult to detect before grain development, as leaf symptoms have not been seen in the field. Even at crop maturity, symptoms are difficult to detect unless grain is rubbed out and inspected.

Following grain development, green heads may show bleaching or grey discolouration where infection has occurred. The whole head may not be affected. Mature plants infected with WGD may have darkened stems below the head.

Severely affected grain is light grey to white and sometimes pinched when compared with normal grain and the germ of this grain is often a shrivelled shell.

Less severe symptoms of WGD can be difficult to detect, as infected grains can look similar in size and colour to normal grain. White grains will not germinate and germination may also be reduced in affected grains not showing severe symptoms.

Project information

This white grain disorder management guideline has been developed for the Upper North Farming Systems Group (UNFS) as part of the Maintaining Profitable Farming Systems with Retained Stubble Initiative, funded by the Grains Research and Development Corporation (GRDC).

The Stubble Initiative involves farming systems groups in Victoria, South Australia and southern and central New South Wales, collaborating with research organisations and agribusiness, to address challenges associated with stubble retention.

The GRDC, on behalf of growers and the Australian Government, is investing $17.5 million in the initiative that has been instigated by the GRDC Southern Regional Panel and the four Regional Cropping Solutions Networks that support the panel.

GRDC Grains Research & Development Corporation
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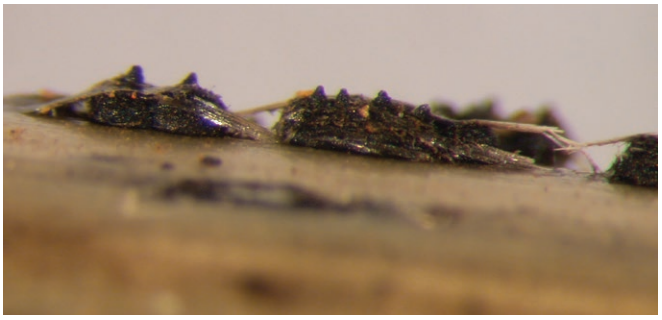
The spikelets of heads affected by WGD can show grey discolouration. Photo: Dr Margaret Evans, SARDI

WGD-affected plants can show brownish discolouration below the head (left). Healthy stem (right). Photo: Dr Margaret Evans, SARDI

The stems of infected crop stubble can have black, slightly-raised structures on the nodes (see inset for closer detail).
Photo: Dr Margaret Evans, SARDI



WGD spores on cereal stubble. Infected stubble can produces spores of the WGD pathogen for at least two subsequent seasons. Photo: Mark Butt, SARDI

Stubble from an infected cereal crop can produce spores of the WGD pathogens for at least the next two growing seasons. Air-borne spores infect the grain and are most commonly released during mid to late season. This type of spore may spread the WGD pathogens to uninfected paddocks.

Spores dispersed by rain-splash onto plants are also produced and can be released during rainfall events over most of the season. Plants infected by rain-splash are unlikely to show WGD symptoms but they will allow the WGD pathogens to survive in commercial paddocks under dry spring conditions.

Assessing the white grain disorder risk

Crop inspection

- If there has been moisture during flowering and grain fill, check grain before harvest. At least 24 hours of high humidity is optimal for infection.
- Affected heads occur patchily within paddocks, so it is important to check a number of areas — particularly low-lying parts of the paddock and other locations where humidity in the crop is likely to be high.

Soil sampling

- The PreDicta™ B analytical service has developed tests for WGD pathogen levels in soil samples. However, this analysis is only available for research purposes, such as the UNFS paddock survey.
- The commercial applicability of these tests and the relationship between soil levels of the WGD pathogens and the risk of grain being affected are still being investigated.

Market implications of WGD

White grains are also a symptom of infection by fusarium head blight/head scab (northern NSW and Queensland), where toxins are present in the affected grain, but there is no evidence to suggest white grain in SA is associated with these toxins. However, grain buyers may believe white grain occurring in SA crops is associated with toxins. This is a particular issue for export markets and current receival standards for wheat in SA only allow a maximum limit of 1% WGD affected grains per 300 grain sample.

Managing the impact of WGD

Check grain before harvest: Management options for WGD are limited and symptoms are difficult to detect, so it is important to check grain before harvest if there has been moisture during flowering and grain fill. This will allow informed decisions to be made about how to manage grain from affected crops.

Test germination: Carry out a germination test on any WGD-affected seed retained on farm as grain showing visual WGD symptoms will not germinate and seed not showing visual symptoms may also have lower germination rates. Sowing rates may need to be increased where seed infection is severe. Grain infected with WGD will not contribute significantly to inoculum levels unless the seed is transported to previously uninfected regions.

Varietal resistance: Resistance to WGD is still being investigated. Undertaking field screening is impractical as natural infection of grain by the WGD pathogens is unreliable. Preliminary data from variety screening using artificial inoculation at the Plant Research Centre (Urrbrae, SA) during 2014 suggest there are slight differences in WGD expression in current commercial bread wheat cultivars. Variety screening will continue during 2015 and resistance ratings for selected cultivars should be available in 2016.

Inter-row sowing: Inter-row sowing is unlikely to reduce the presence of WGD. Although WGD pathogen levels detected between rows are lower than those detected on-row, infection with WGD occurs due to wind-borne spores, which can move long distances.

Crop rotation: Rotation to a non-cereal will help to reduce WGD pathogen levels, but this may take two or more years. Re-infection from wind-borne spores can occur at any time.

Cultivation: Burying infected plant residues to prevent spore release should contribute to lowering WGD expression, but should be undertaken with consideration to the implications of reduced soil moisture retention, risk of erosion and other benefits of stubble retention lost through cultivation.

Baling: Baling infested straw or burning stubble also will reduce spore release and inoculum levels, but again this should be undertaken with consideration of the impacts of stubble removal.

WGD in the Upper North

WGD was first observed in bread wheat in SA during the 2010 harvest, when a number of grain deliveries were rejected and downgraded. During 2011 174,370 tonnes of affected wheat were delivered to SA silos, with infection rates between 1% and 7% being most common and average infection rates of 5%.

In the Upper North during the 2011 harvest, a total of 38,102 tonnes of grain affected by WGD were delivered to 10 Viterra receival points (see Table 1). This is likely to be an under-estimate of the total tonnage affected by WGD in the Upper North as some grain was kept on-farm or delivered to other markets.

During 2011 six samples of grain from affected deliveries in the Upper North were assessed for levels of infection by WGD. Infection rates ranged from 1%–7%, with an average of 4%, which was consistent with averages across the state that year.

Only two deliveries (on Eyre Peninsula) to SA-based Viterra receival points during 2012 were confirmed as being affected by WGD. Reports indicate there were affected crops in the Upper North during 2012, but this grain may either not have been delivered to silos or may have been delivered to non-Viterra receival points.

During 2013 and 2014 there were no reports of WGD expression in grain in the Upper North or elsewhere in SA.

TABLE 1. Grain receivals affected by WGD in the Mid and Upper North

Receival point 2011 harvest	Tonnes delivered
Gladstone	26,561
Melrose	3,205
Snowtown	2,703
Booleroo Centre	2,238
Port Pirie	1,537
Crystal Brook	978
Brinkworth	402
Jamestown	359
Orroroo	102
Farrell Flat	17
Total	**38,102**

Data courtesy of Viterra

Rotating with non-cereals can help reduce reduce WGD pathogen levels over a number of years.

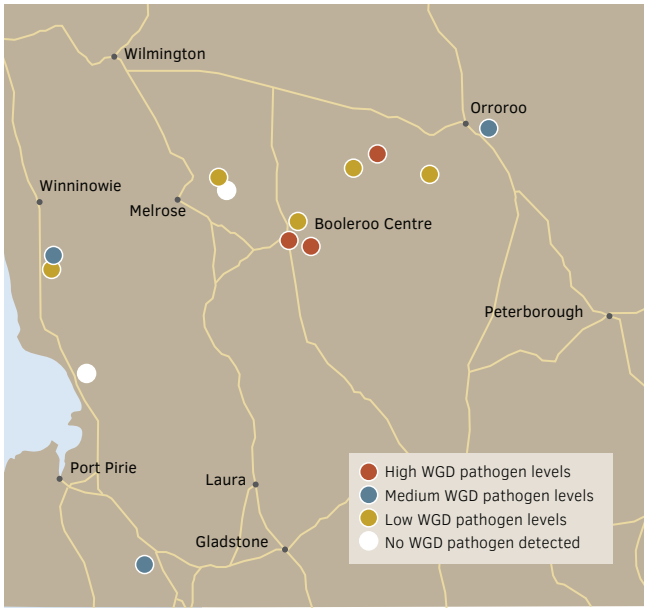
Paddock survey in the Upper North

Thirteen paddocks were sampled for soil-borne diseases during late April 2014. The soil samples collected were submitted to the DNA-based PreDicta™ B service for analysis.

Eleven paddocks, 85% of those sampled, had the Clade 1 WGD pathogen present. None of the paddocks sampled had the Clade 2 WGD pathogen present.

Levels of WGD pathogen (PreDicta™ B assessment in soil pre-sowing) in one of the Upper North paddocks sampled during 2014.
Photo: Dr Margaret Evans, SARDI

Figure 1. Paddock survey for WGD in the Upper North



Further information

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References

» Evans, M (2015) *White grain disorder of wheat in South Australia* Information sheet available from Margaret Evans
» Evans, M (2014) *Soil-borne disease risk in Upper North paddocks, 2014*, UNFS Annual Trial Results Compendium, 2014

Acknowledgements

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DAS00154 *White grain disorder in wheat*
DAS00137 *National improved molecular diagnostics for disease management*.

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