

Cereal pathology update - learnings from 2020, planning for 2021

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Take home messages

- Ensure you are using the latest variety disease ratings for wheat stripe rust which incorporate changes that have occurred in 2020
- Inoculum of many cereal pathogens will be higher in 2021 hence plans need to account for higher disease risks
- Reduce the risk of rust epidemics in 2021 by controlling cereal volunteers during February
- Use break crops to improve root health and reduce soil-borne disease risks.

Introduction

The favourable 2020 season across southern NSW resulted in high yields for many growers but also favoured development of many cereal diseases. Some diseases such as stripe rust were managed effectively through application of fungicides, while others such as take-all, which cannot be controlled in-crop, caused significant losses in individual paddocks. In this paper we discuss preliminary results from the southern NSW 2020 survey of 32 barley and 54 wheat paddocks which are part of the northern region Grains Agronomy & Pathology Partnership (GAPP) disease investment. This is the second year of the survey and we can start to see trends emerging from the data which can help inform agronomists and growers to improve their rotation decisions to reduce disease risk.

What we did

In 2020, NSW DPI undertook an extensive random survey of winter cereal crops in the northern region to determine disease levels as part of GAPP. In collaboration with locally based agronomists, in southern NSW, 86 winter cereal crops were surveyed between the start and end of grain filling (Zadok stages 71 and 91). The GPS location and background information for each paddock were recorded, but to maintain confidentiality, data is presented here based on broad boundaries and distribution maps (Figure 1). Central NSW sites were situated between Dubbo and West Wyalong, and southern NSW sites were south of West Wyalong. East and west locations were defined by the Newell Highway.

Within each crop, a diagonal transect (~500 m) was created starting at least 50 m in from a road or fence line and avoiding obvious barriers such as trees or dams. Five consecutive whole plants (roots with adhering soil, stems and heads) were collected along the planting row from ten separate sampling points across the diagonal transect (i.e. total of 50 plants/crop). Samples were transported to Wagga Wagga and stored at 4°C before processing. 100 random tillers (i.e. two/plant) were

assessed for incidence of basal browning (crown rot), leaf diseases (e.g. yellow spot or net blotch) and head infections (e.g. bunt, smut or Fusarium head blight (FHB)).

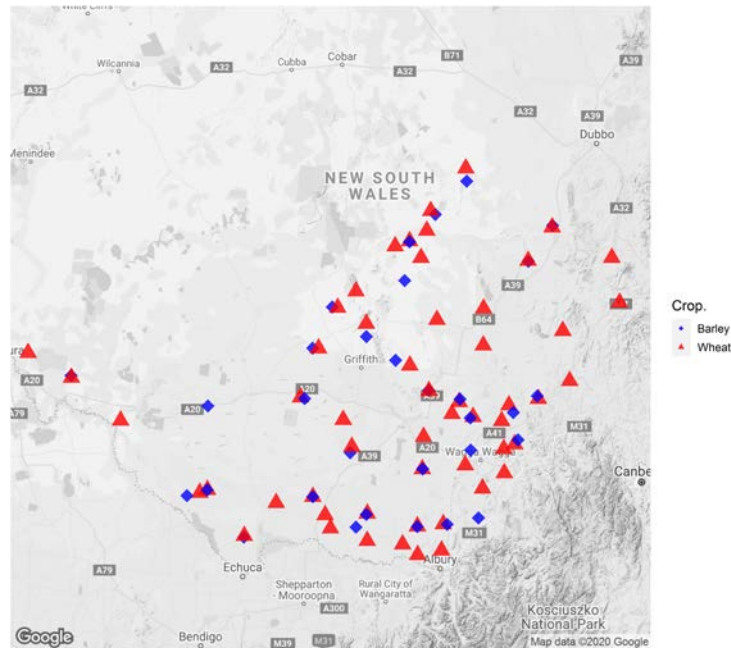


Figure 1. Location of barley (blue diamonds) and wheat (red triangles) paddocks sampled across southern NSW in 2020.

Rotation impacts

In south/central NSW during 2020, 74% of barley crops were sown into the stubble of a previous barley, oat or wheat cereal crop (Table 1). This position in the cropping sequence potentially exposes barley to high root disease pressure. In 2020, barley paddocks suffered higher levels of root disease than in 2019. This was most likely due to build-up of pathogen populations in the 2019 wheat crops (Table 2). Barley is seen as the preferred cereal option to follow wheat when there is a risk of crown rot because of its disease tolerance/late season stress escape with earlier maturity. In addition to this barley is also sown targeting lower protein and higher yield potential. While considered to be lower risk, there can still be yield losses from root diseases in barley crops. If growers wish to maximise yield potential and profitability, then selecting paddocks with lower disease burden would result in higher returns from barley.

Compared to barley, only 36% of wheat crops in 2020 were following another cereal, which was mainly wheat in 30% of the surveyed paddocks. In these wheat-on-wheat paddocks, 62% (10) had moderate to high root disease scores. Whereas wheat following canola in 2020, 60% (9) of paddocks had nil to low root disease scores (data not shown). This highlights the benefits of having non-host disease breaks in the rotation for the control of cereal root diseases. In general, the 2020 season had improved root health in the south-east and south-west regions, while the central regions (based on data collated to date) appear to have experienced similar levels of root disease to 2019.

Table 1. Percent frequency of previous crop in rotation sequence with barley and wheat crops sown in 2020 for southern and central NSW. Numbers in brackets are actual number of paddocks surveyed.

Previous crop (2019)	2020 crop	
	Barley	Wheat
Barley	6 (2)	4 (2)
Canola	6 (2)	28 (15)
Chickpeas	0 (0)	6 (3)
Cotton	6 (2)	0 (0)
Failed wheat	3 (1)	2 (1)
Fallow	3 (1)	7 (4)
Lentils	0 (0)	2 (1)
Lupins	0 (0)	6 (3)
Oats	12 (4)	2 (1)
Pasture	3 (1)	4 (2)
Peas	0 (0)	4 (2)
Vetch	0 (0)	2 (1)
Wheat	53 (17)	30 (16)
Unknown [#]	6 (2)	6 (3)
Total	100 (32)	100 (54)

[#]At the time of writing there were 12 paddocks with an unknown previous crop. These are being followed up to complete the dataset.

Table 2. Percent incidence of root diseases in randomly surveyed barley and wheat crops in southern and central NSW in 2019 and 2020. Root disease incidence records the visual presence of crown rot, take-all, Rhizoctonia, common root rot and Pythium. Root disease scores range from 0 (no visual incidence of disease) to 10 (100% of tillers inspected have a root disease). 100 tillers in total from 10 locations within each paddock were assessed. Numbers in brackets are actual number of paddocks surveyed.

Barley	CE NSW		CW NSW		SE NSW		SW NSW	
	2019	2020	2019	2020	2019	2020	2019	2020
Root disease score								
Nil (0)	12 (1)	0 (0)	36 (8)	0 (0)	0 (0)	0 (0)	25 (1)	0 (0)
Low (0.1-3)	75 (6)	0 (0)	59 (13)	33 (2)	7 (1)	17 (2)	25 (1)	17 (2)
Moderate (4-6)	12 (1)	0 (0)	5 (1)	17 (1)	0 (0)	25 (3)	0 (0)	8 (1)
High (7-10)	0 (0)	100 (2)	0 (0)	50 (3)	93 (13)	58 (7)	50 (2)	75 (9)
Total	100 (8)	100 (2)	100 (22)	100 (6)	100 (14)	100 (12)	100 (4)	100 (12)
Wheat	CE NSW		CW NSW		SE NSW		SW NSW	
	2019	2020	2019	2020	2019	2020	2019	2020
Root disease score								
Nil (0)	53 (9)	60 (3)	19 (10)	40 (4)	0 (0)	5 (1)	0 (0)	12 (2)
Low (0.1-3)	35 (6)	20 (1)	65 (34)	30 (3)	0 (0)	36 (8)	33 (2)	24 (4)
Moderate (4-6)	12 (2)	0 (0)	13 (7)	10 (1)	8 (2)	14 (3)	0 (0)	18 (3)
High (7-10)	0 (0)	20 (1)	2 (1)	20 (2)	92 (24)	45 (10)	67 (4)	47 (8)
Total	100 (17)	100 (5)	100 (52)	100 (10)	100 (26)	100 (22)	100 (6)	100 (17)

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

The 2020 season was ideal for the development of take-all to levels not seen for many years. The results of the 2019 GAPP survey showed that the incidence of take-all was common across southern NSW but only at low levels. The conducive conditions of above average rainfall for the months of August - October allowed the pathogen to multiply rapidly and cause yield loss. The reported areas affected, and yield loss varied from small patches, less than 1-3% of paddock area, with 100% loss, to entire paddocks suffering up to an estimated 40-50% yield loss. Compounding the suitable environment for the development of take-all in 2020 was a reduction in the use of flutriafol applied to fertiliser (information provided by agronomists) allowing early infection to occur. This culminated in some paddocks not performing to expected yield potential.

The build-up of take-all inoculum in cereal crops in 2020 will need to be considered when planning 2021 crop choices. This random crop survey highlights that a high proportion of paddocks are sown with a double cereal rotation of wheat and barley. To reduce risk of further losses in those paddocks that showed take-all this year, growers are advised to sow a non-host species such as canola or one of the pulses in 2021. Where a non-host cannot be chosen, growers should consider the use of a fungicide known to provide suppression of early season infections such as flutriafol or fluquinconazole. If the predicted above average summer rainfall occurs, this will also help to reduce take-all inoculum levels over summer as long as grass weeds and cereal volunteers are controlled during this fallow period.

Fusarium crown rot (*Fusarium pseudograminearum*)

The incidence of Fusarium crown rot (FCR) was high in survey paddocks across central and southern NSW in 2019 and again in 2020. This is not surprising given the high frequency of cereal-on-cereal rotations (Table 1) across the region and the prevalence of conservation cropping practices. FCR was often found in association with take-all in 2020 cereal crops.

There are widespread reports of wheat grain yields being lower and grain screening levels higher than expected across many areas of southern and central NSW in 2020, which has often been simply dismissed as frost damage. Frost damage did occur in some more frost prone areas of paddocks or regions in 2020 but underlying levels of FCR and/or take-all appear to have also been potentially involved. Correct diagnosis is important when planning rotations and management for 2021.

Given the extensive area of cereals grown in 2020, to restore ground cover after a run of drier seasons, there is likely to be significant areas of cereal-on-cereal again in 2021. Knowing risk levels prior to sowing is the first step in successfully managing FCR and take-all in 2021. PREDICTA® B testing remains the 'gold standard' for quantification of inoculum and hence risk levels. NSW DPI, Tamworth are also offering a free cereal stubble testing service prior to sowing in 2021. From the 19-cereal stubble samples processed from southern and central NSW so far, Fusarium levels range from 0 to 82% (average 39%). This preliminary testing highlights that FCR risk is very high in the majority of paddocks tested thus far. This is more alarming as FCR inoculum load is a function of infection levels in previous cereal crop and actual amount of stubble present, which is elevated given the seasonal conditions in 2020. However, disease risk can vary dramatically between paddocks with 3 of the 19 tested so far having low to no FCR infection in 2020.

If interested in having paddocks tested using PREDICTA B then refer to [the PREDICTA B sampling protocol](https://pir.sa.gov.au/data/assets/pdf_file/0007/291247/Sampling_protocol_PreDicta_B_Northern_regions.pdf) (https://pir.sa.gov.au/data/assets/pdf_file/0007/291247/Sampling_protocol_PreDicta_B_Northern_regions.pdf) or with a free NSW DPI cereal stubble test then text Steven Simpfendorfer (0439 581 672) for details.

Wheat stripe rust (*Puccinia striiformis*)

There was an early start to the stripe rust epidemic in 2020, which was detected in early sown crops of DS Bennet[Ⓛ] across a very wide area of NSW in late June. A detailed report on the origin of this pathotype and others currently detected across Australia is provided in a 2020 cereal rust report (Volume 17 Issue 4). At the end of the 2020 season there were five pathotypes detected by the Sydney University cereal rust survey in NSW; 198 E16 A+ J+ T+ 17+, 239 E237 A- 17+ 33+, 134E16A+17+, 134E16A+17+ 27+ and 64E0A-, these are likely to be present in 2021. Growers are advised to be alert for the potential of these pathotypes to cause susceptible reactions in some varieties. The NVT stripe rust nurseries at Wagga Wagga and Tamworth provided excellent data to identify varieties with changes in their resistance reactions. These ratings will be published on the NVT online website and in the NSW DPI 2021 sowing guide. Growers should ensure they are using the latest stripe rust ratings when considering variety choice and appropriate management in 2021.

Growers should routinely check their varieties for changes in resistance ratings as pathotypes change over time. Varieties identified for changes in 2021 include; Catapult[Ⓛ], RockStar[Ⓛ], Joey[Ⓛ], Borlaug 100[Ⓛ], Corack[Ⓛ], Devil[Ⓛ], DS Darwin[Ⓛ], Emu Rock[Ⓛ], Hatchet CL Plus[Ⓛ], LRPB Cobra[Ⓛ], LRPB Trojan[Ⓛ], SEA Condamine[Ⓛ], Sheriff CL Plus[Ⓛ], Vixen[Ⓛ], Wallup[Ⓛ], Sting[Ⓛ], Suncentral[Ⓛ] and Denison[Ⓛ].

The NSW DPI sowing guide and NVT online will show a rating that has a '/' such as MRMS/S. The first position indicates the rating for the most common pathotypes received by the Australian cereal rust survey in 2020 which were 198 E16 A+ J+ T+ 17+, 239 E237 A- 17+ 33+, 134E16A+17+, and 134E16A+17+ 27+. The second rating after the '/' indicates that the variety showed a distinct difference in reaction to the less common 64E0A- pathotype. Which pathotype will be dominant in

NSW during 2021 is not possible to predict. The 198 E16 A+ J+ T+ 17+ became dominant in less than 12 months after only being detected in a few crops during 2019. This highlights the dynamic nature of stripe rust and its ability to travel long distances and develop quickly on susceptible varieties.

The control of cereal volunteers to prevent a 'green bridge' for cereal rusts will be important for reducing the chance of early disease development in 2021. Rusts require a living host to survive, so by controlling volunteers over summer or at least for the month of February before the new crop is sown, reduces disease risk across the region. Being wind borne, rusts are social diseases and require an industry wide effort to help everyone to reduce the risk of community transmission (in Covid speak).

Other diseases

Several other diseases occurred during the 2020 season which are worthy of mention to consider in plans for paddock monitoring and control strategies, should they be found in crops during 2021.

Rusts in oats; Stem and leaf rust was observed in oat crops from October to November across central and southern NSW. There is an increased chance for this pathogen to survive on oat volunteers and wild oat populations this summer. Early infections of stem rust can cause high yield losses and be difficult to control with fungicides. Early detection and control are important to prevent losses.

Scald in barley was observed in many crops in southern NSW. Given that most barley was sown following wheat suggests the infections may have been from seed transmission. A spore type which is capable of being wind borne and allows long distance dispersal has not been described for scald, although it may exist. The reduction in use of in-furrow or seed applied fungicides may have also contributed to the increased prevalence of scald during 2020.

Powdery mildew (PM) in both wheat and barley was a feature of 2020. The occurrence of PM in barley is not uncommon in the central region of NSW but the season enabled the spread of the disease into the south-east and south-west barley crops. There are pathotypes of PM that render popular varieties such as La Trobe and Hindmarsh susceptible. For wheat, PM has historically not been a major concern in NSW except in highly susceptible varieties. As with other foliar diseases early detection and action is the best approach. Further information on the fungicide resistance status of NSW wheat PM isolates collected during 2020 will be made available once testing is complete.

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Resources

<https://www.nvtonline.com.au/crop-disease/>

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