Managing rust and yellow leaf spot in 2022

Lislé Snyman, Dept. Agriculture and Fisheries Queensland

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GRDC code

National Variety Disease Screening (NVT)

UOA2003-008: Program 2: Minimising the impact of major barley foliar pathogens on yield and profit – surveillance and monitoring of pathogen populations.

DAQ2106-007: Disease surveillance and related diagnostics for the Australian grains industry within the northern region

Take home messages

- Management strategies for foliar diseases include resistant varieties, crop rotation, seed treatment and timely fungicide application
- Monitor crops for early disease detection
- Crop rotation and reducing surface stubble decrease inoculum levels of stubble-borne diseases
- Limit fungicide application by spraying only when necessary, rotate fungicides with different modes of action and use recommended rates
- Economic response to fungicide application is a factor of varietal susceptibility, severity of the epidemic, product choice and application timing.

Background – 2022 season

La Nina has impacted farming operations in many Queensland cereal growing regions with above average monthly rainfall since November 2021. In many areas planting is/has been delayed and many early sown crops are waterlogged. The Hermitage Research station has received 650mm of rain since January 2022, surpassing the long term annual mean rainfall (Fig. 1).

Wet and humid conditions are favourable for disease development; hence diseases are expected to have a major impact on production in 2022. Disease management will be crucial to limit yield and quality loss.

An increase in rust observations were made in wheat and barley crops in Qld. in 2021. This could be attributed to a return of environmental conditions favourable for disease development. Ninety-two rust samples collected in Qld. were submitted to the Plant Breeding Institute (PBI), Sydney University for pathotyping. These include leaf rust samples collected from both wheat (6) and barley (9) and 58 wheat stripe rust samples. A significant stripe rust epidemic was reported in NSW in 2021 (Simpfendorfer et al 2022). Despite an increase in rust observations in Qld. in 2021, dry conditions during August and September limited disease spread and impact.

Wet conditions over summer provided an opportunity for rusts to survive and be present at higher levels than what we were used to in recent years, early in the growing season. These pathogens have the ability to develop into epidemics very quickly if conditions are suitable. Current environmental conditions will likely result in rust epidemics in 2022.

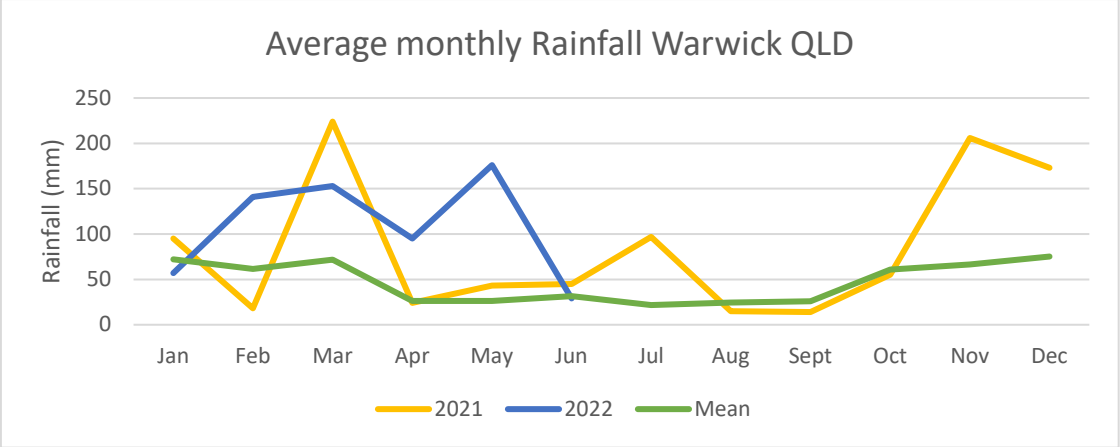

Figure 1. Monthly rainfall for the Hermitage Research Station, Warwick.
(Note June 2022 rainfall as of 20 June)

Barley leaf rust

Leaf rust of barley is widely distributed and occurs regularly in the northern region. It is considered one of the five major barley diseases in Australia and can significantly reduce yield and quality. Barley leaf rust was widespread in Queensland in 2016, but due to the drought conditions, was only present at very low levels until 2021. Samples submitted from Qld crops during 2021 to PBI, were collected from varieties Compass(Þ), Laperouse(Þ) and Leabrook(Þ). These varieties are rated as susceptible to very susceptible (SVS) in Qld. We can expect these varieties to be planted across Qld growing regions in 2022, with increased acreage expected to be planted to the new varieties Yeti(Þ) (SVS) and Beast(Þ) (S).

The disease is caused by the obligate parasite, *Puccinia hordei.* It spreads by means of airborne spores, able to travel long distances. The pathogen spreads rapidly when conditions are favourable and large areas are planted to susceptible varieties, resulting in the development of epidemics. In the presence of a green bridge, the pathogen can survive over summer and be present at high levels early in the growing season. High inoculum levels put pressure on major resistance genes and can lead to the development of new, more virulent pathotypes.

Large areas sown to S to VS varieties across a range of environments almost ensures that leaf rust will be a problem in some areas, contributing to high inoculum levels causing epidemics whilst adding selection pressure on the pathogen to mutate and acquire new virulences.

Wheat rusts – stripe rust

The stripe rust situation in Eastern Australia has changed dramatically since 2020. Of main concern are two recent exotic incursions, the 239 E237 A- 17+ 33+ and the 198 E16 A+ J+ T+ 17+ pathotypes (pts).

The 239 pt. was identified in Victoria in 2017 and despite not being detected in 2018 and 2019, was widespread in NSW in 2020. Many varieties are vulnerable to this pathotype.

The 198 pt. was first detected in SNSW in 2018 and spread quickly from there across Eastern Australia. It was the dominant pt. in 2020 and has an impact on many varieties, including some durum and triticale varieties.

These two pts are very different and vary in their impact on varieties. Some varieties are more susceptible to the 239 pt. than the 198 pt. Varieties such as Rockstar(Þ), Vixen(Þ) and Catapult(Þ) did well in 2020, but not so much in 2021 due to the increase in the 239 pathotype and their vulnerability to that particular pt. Varietal responses are determined by the distribution and spread

of these pathotypes; both pathotypes were detected across Qld. growing regions in 2021. Responses of Australian wheat varieties to these pathotypes are available in Cereal Rust Report Vol 17(3) (Park et al, 2020).

Wheat rusts – leaf rust

As with stripe rust, there has been some changes in the leaf rust landscape with a couple of exotic introductions and a new pt. developing locally. They are not expected to be an additional threat to current varieties, but could increase rust on varieties carrying *Lr24.* Growers are advised to monitor crops of varieties carrying *Lr24*. Some of the more widely planted varieties in southern Queensland that rely on the LR24 gene include; Bremer(ϕ) , Chief CL Plus(ϕ) , Cutlass(ϕ) , Elmore CL Plus(ϕ) , Impress CL Plus(ϕ) , LRPB Gazelle(ϕ) , LRPB Lancer(ϕ) , LRPB Oryx(ϕ) , LRPB Parakeet(ϕ) , Sunchaser(ϕ) and Sunguard(ϕ). Varietal responses to leaf rust are also reported in Cereal Rust Report 18(2).

Wheat yellow spot

Yellow spot is a stubble-borne fungal disease caused by the pathogen *Pyrenophora tritici-repentis* and reduces yield and quality. Yield loss depends on varietal resistance and severity of the disease.

Symptoms include tan-coloured oval lesions becoming darker in the centre with a yellow margin, often observed in young seedling leaves from where the disease moves up the plant under suitable conditions. As lesions merge and coalesce, they produce large areas of necrotic tissue, causing leaf death and reducing photosynthetic area.

The fungus survives as small, black fruiting bodies on stubble. From there, fungal spores are released after rain events and spread onto nearby seedlings, resulting in primary infection. Secondary spread occurs when asexual spores are produced on leaves and dispersed by wind, infecting new leaves and neighbouring crops.

At least six hours of leaf wetness with temperatures of 15-28^{o}C are required for the successful infection of leaves from stubble. Secondary infection (leaf to leaf) is favoured by leaf wetness, high humidity and optimum temperatures between 15^{o}C and 25^{o}C.

Disease management

Foliar pathogens are a significant challenge to the grains industry and a major constraint to profitable winter cereal production, affecting both yield and quality. Many of these pathogens are genetically and pathogenically diverse, able to reproduce sexually and can rapidly develop new virulence's and overcome genetic resistance.

Growing a high yielding, well adapted, resistant variety provides the most economic and environmentally friendly means of disease control. Genetic resistances need to be durable to provide long-term protection.

Successful management of yellow spot requires an integrated disease management approach including crop rotation (i.e., avoid wheat on wheat), timely application of fungicides to protect the money leaves (flag and flag-1), removal of stubble and using resistant varieties. A much greater proportion of our wheat cropping area is sown to varieties with useful levels of resistance to yellow spot than a decade ago; therefore, it is worthwhile to consider the economics of fungicide application in relation to varietal resistance and epidemic potential before spraying. Stubble of susceptible varieties harbours more inoculum, hence avoid sowing a susceptible variety into stubble from a previously infected susceptible crop at all cost.

In susceptible varieties where yield potential is high, fungicidal control can be justified. Foliar fungicides should be aimed at protecting the key leaves present during grain filling – namely, the flag leaf sheath, the flag leaf (f), flag-1 (f-1), and f-2.

To ensure that fungicides remain effective, it is important to limit fungicide application by spraying only, when necessary, rotate fungicides with different modes of action and use fungicides at recommended rates. Fungicide applications are more effective if applied before disease becomes established in the crop. This requires regular monitoring to ensure crops can be sprayed at the first sign of disease. When conditions are favourable for disease development, more frequent crop inspections will be needed and repeat fungicide applications may be necessary.

Conclusion and 2022 planning

The absence and/or low incidence of many diseases in 2021 in the northern region does not mean that we can get complacent. With favourable environmental conditions, pathogens will continue to cause yield and quality loss and we have to make the right decisions to ensure that we can stay ahead of disease development and the evolution of the pathogen.

Current and forecast weather conditions indicate that disease epidemics are likely in 2022. Monitoring of crops will play a crucial role in disease management this season.

Continuous monitoring of pathogen populations provides information on the virulence's present and the spread of pathogens. Submit samples of rust to the University of Sydney Australian Cereal Rust Survey and samples of net form net blotch to DAF for pathotyping.

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Contact details

Lislé Snyman
DAF QLD
Hermitage Research Facility, 604 Yangan Rd, Warwick, Qld
Ph: 0428 324 932
Email: lisle.snyman@daf.qld.gov.au