Impact of common root rot and crown rot on wheat yield – Tamworth 2016

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Key findings

- A medium level of common root rot infection reduced the yield of LRPB Gauntlet(ф) by 5% with a high level of infection resulting in 13% yield loss.
- The expression of crown rot was reduced in 2016 due to the wet seasonal conditions. The medium level of infection did not significantly reduce the yield of LRPB Gauntlet(ф), but a high level of infection caused 9% yield loss.
- Combined infection with both pathogens – common root rot and crown rot – further exacerbated yield loss, which equated to 23% with a high level of inoculum of both pathogens.
- The effect from a mild, wet season on reducing the extent of yield loss caused by either of these two pathogens appears to be more pronounced with crown rot than common root rot.

Introduction

Crown rot, caused by the stubble-borne fungus *Fusarium pseudograminearum* (*Fp*), is a significant disease of winter cereals across the northern grains region. Considerable research has established its impact on the yield of commonly grown wheat, barley and durum varieties across environments and seasons.

Common root rot, caused by the fungus *Bipolaris sorokiniaina* (*Bs*), is a widespread pathogen of winter cereal crops throughout Australia and is often found in association with crown rot. *Bs* survives not only as mycelium inside winter cereal and grass weed residues, but also has a thick-walled spore structure (conidium) that allows it to survive in the soil for around two years. *Bs* infects the sub-crown internode where it causes complete or partial dark brown to black tissue discolouration.

Symptoms of common root rot are fairly indistinct in the paddock, with severely infected plants having reduced thrift and decreased tiller numbers. Common root rot is generally considered a less significant pathogen of winter cereals across the northern grains region than crown rot or root lesion nematodes. A 15% yield loss from common root rot under severe levels of infection is often quoted, but there is limited published data to support this value.

The prevalence of common root rot has increased across the region in recent seasons, usually associated with deeper sowing where growers are forced to moisture seek at planting as a result of diminishing soil moisture at the surface. This practice unfortunately lengthens the sub-crown internode, which appears to be exacerbating common root rot infection.

A similar trial conducted at Tamworth in 2015 found that common root rot reduced the yield of LRPB Gauntlet(ф) by 11% and 20% with a medium or high level of infection, respectively. However, crown rot infection resulted in around double the extent of yield loss, 23% and 41% with a medium or high level of infection, respectively. Combined infection with both pathogens further exacerbated yield loss in 2015, which equated to 31% and 52% with a medium or high level of inoculum of both pathogens, respectively.

This study aimed to compare the relative impact of common root rot and crown rot on wheat yield and determine if mixed infection exacerbates losses in a second season.

Site details

Location	Tamworth Agricultural Institute
Sowing date	16 June 2016
Plant population	Target 100 plants/m^2
Fertiliser	100 kg/ha Urea and 50 kg/ha Granulock® 12Z at sowing
Rainfall	The growing season rainfall was 431 mm

Harvest date	12 December 2016

Treatments

Varieties

One variety, LRPB Gauntlet(ф), which is rated moderately susceptible-susceptible (MS–S) to both common root rot and crown rot.

Pathogen treatments

Added common root rot inoculum at sowing using sterilised durum grain colonised by at least three different isolates of *Bs* at three rates to create nil (0 g/m row), medium (1.0 g/m row) or high (2.0 g/m row) infection levels.

Added crown rot inoculum at sowing using sterilised durum grain colonised by at least five different isolates of *Fp* at three rates to create nil (0 g/m row), medium (1.0 g/m row) or high (2.0 g/m row) infection levels.

Different inoculum rates of the two pathogens added alone or in combination at sowing with viable LRPB Gauntlet(ф) seed with four replicates of each treatment.

A control (uninoculated) nil treatment consisted of nil (0 g/m row) of both pathogens.

Results

A medium level of common root rot (Bipolaris) inoculum reduced the yield of LRPB Gauntlet(ф) by 0.22 t/ha (5%), with a high level of inoculum reducing yield by 0.59 t/ha (13%) compared with plants not inoculated with either fungal pathogen (Figure 1).

A medium level of crown rot (*Fusarium*) inoculum did not significantly reduced the yield of LRPB Gauntlet(ф), but a high level of inoculum reduced yield by 0.41 t/ha (9%) compared with plants not inoculated with either fungal pathogen (Figure 1).

A medium level of inoculum of both common root rot and crown rot reduced the yield of LRPB Gauntlet(ф) by 0.33 t/ha (7%), with a high level of inoculum of both pathogens reducing yield by 1.05 t/ha (23%). The yield effect from a combination of inoculation with both pathogens was significantly higher than inoculation with either pathogen alone at the high inoculum rates (Figure 1).

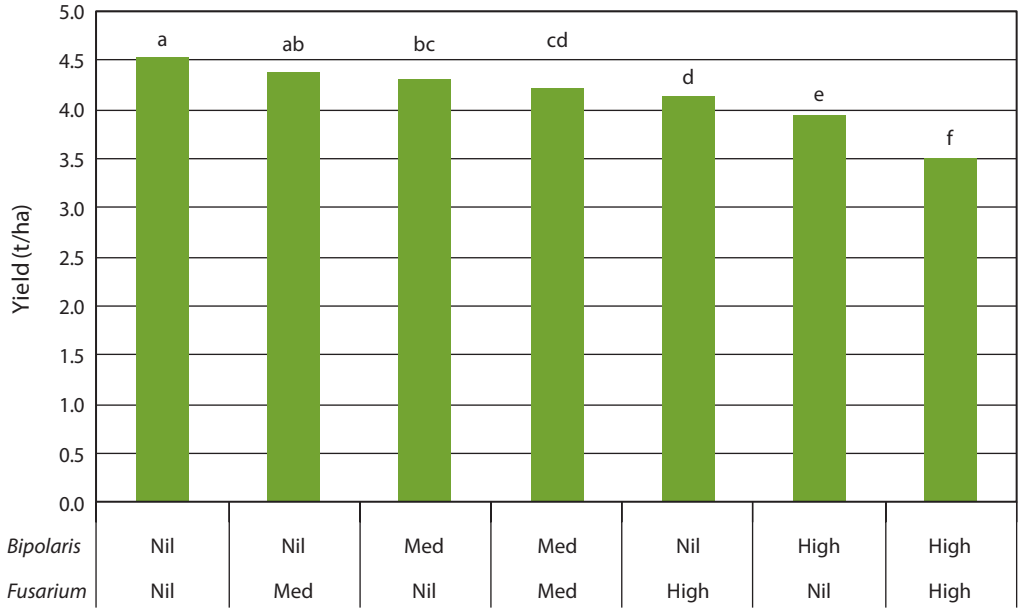

Figure 1. Impact of varying levels of Fusarium (crown rot) and Bipolaris (common root rot) inoculum on the yield of LRPB Gauntlet(ф) – Tamworth 2016. Bars with the same letter are not significantly different ($P = 0.05$).

Conclusions

Crown rot infection was shown to cause less yield loss (not significant to 9%) than common root rot (5–13%) in the MS–S bread wheat variety LRPB Gauntlet(ↀ) in 2016. This was vastly different to the results from the same experiment conducted in 2015, where crown rot (23–41%) caused around double the extent of yield loss compared with common root rot (11–20%). The 2016 season was considerably wetter (431 mm in-crop rainfall) than the 2015 season (286 mm in-crop rainfall), which limited the expression of crown rot. The yield loss associated with common root rot infection was also reduced in 2016 compared with 2015, but not to the same extent as with crown rot.

Visual symptoms associated with common root rot infection are less obvious than those associated with the expression of crown rot in a drier season. Hence, common root rot is generally considered a less important soil-borne pathogen of winter cereal crops than crown rot. However, common root rot is still a significant pathogen of wheat, which appears to being increasing in prevalence in the northern grains region in association with deeper seeding to capture diminishing soil moisture in the surface layer at sowing.

Although common root rot infection generally causes lower levels of yield loss compared with crown rot infection, it still appears to occur in both drier (11–20% in 2015) and wetter (5–13% in 2016) seasons. The potential importance of common root rot in the farming system is further intensified by its interaction with crown rot, especially in drier seasons, with yield losses appearing to be exacerbated by the presence of both pathogens. Common root rot infects the sub-crown internode, which is believed to reduce the efficacy of the primary root system. Yield loss from crown rot is known to be associated with increased moisture/evapotranspiration stress during grain filling, which was limited by wet seasonal conditions in 2016. A reduction in the ability of the primary root system to extract soil moisture at depth, as a result of common root rot infection, appears to increase the expression of crown rot and hence yield loss from these diseases in drier seasons.

Integrated management strategies aimed at reducing effects from crown rot should also consider their effect on common root rot and the interaction between these two pathogens.

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