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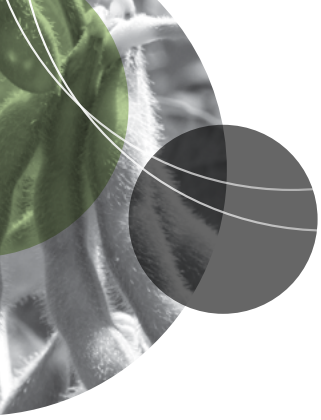

Crop protection

Crown rot resistance rating does not necessarily reflect yield performance when disease is present – six sites in 2017

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Key findings

- Average yield loss from crown rot across the six field sites in 2017 ranged from 16% (0.46 t/ha) in the bread wheat variety Sunguard(ф) to up to 50% (1.32 t/ha) in the durum variety DBA Bindaroi(ф).
- A variety's resistance rating was not a good reflection of its yield performance when infected with crown rot as tolerance level also dictates the rate of yield loss from this disease.
- Variety choice resulted in an 8–34% yield benefit over growing the standard bread wheat variety EGA Gregory(ф) when infected with crown rot.
- Variety choice is not the sole solution to crown rot.
- Variety choice can maximise profit in the current season, but does not reduce inoculum levels for subsequent cereal crops as all are susceptible to crown rot infection.

Introduction

Crown rot (CR), caused predominantly by the fungus *Fusarium pseudograminearum*, remains a major constraint to winter cereal production in the northern grains region. Cereal varieties differ in their resistance to CR, which can significantly affect their relative yield in the presence of this disease by limiting the severity of infection that develops within a season. However, recent research has demonstrated that varieties also differ in their tolerance to CR. Tolerant varieties have a lower level of yield loss when infected, which appears to be independent of their resistance rating.

Six replicated field experiments were conducted in 2017 across central/northern NSW extending into southern Qld, to examine CR effects on the yield of four barley, four durum and 12 bread wheat varieties. Sites varied in their sowing date (SD), plant available soil water (PAW) at sowing and in-crop rainfall (Table 1), which interacted with CR expression.

Site details

Details of the six experiment sites are in Table 1

Table 1 Crown rot experiment site details – 2017.

Site	Location	Sowing date	PAW at sowing (0–120 cm)	In-crop rainfall (mm)
Wongarbon	Central west NSW	23 May	145 mm	122
Gilgandra	Central west NSW	11 May	120 mm	63
Edgeroi	North eastern NSW	31 May	295 mm	164
Rowena	North western NSW	7 June	185 mm	103
Westmar	Southern Qld	22 May	170 mm	157*
Meandarra	Southern Qld	18 May	195 mm	204*

* Majority fell in October

Treatments

Varieties (20)

Four barley varieties:

- susceptible–very susceptible (S–VS) = La Trobe$^{\Phi}$
- susceptible (S) = Commander$^{\Phi}$, Compass$^{\Phi}$, and Spartacus CL$^{\Phi}$.

Four durum varieties:

- VS = Jandaroi$^{\Phi}$
- S–VS = DBA Lillaroi$^{\Phi}$, DBA Bindaroi$^{\Phi}$ and the numbered line AGD043 which is not currently rated.

Twelve bread wheat varieties:

- S = EGA Gregory$^{\Phi}$
- moderately susceptible–susceptible (MS–S) = Suntop$^{\Phi}$, LongReach Mustang$^{\Phi}$, LongReach Lancer$^{\Phi}$, LongReach Gauntlet$^{\Phi}$, LongReach Flanker$^{\Phi}$, Coolah$^{\Phi}$ and Sunmate$^{\Phi}$
- moderately susceptible (MS) = Sunguard$^{\Phi}$, Mitch$^{\Phi}$, LongReach Reliant$^{\Phi}$ and LongReach Spitfire$^{\Phi}$.

Pathogen treatment

Added or no added CR at sowing using sterilised durum grain colonised by at least five different isolates of *F. pseudograminearum* at a rate of 2.0 g/m of row at sowing.

Results

Yield

Averaged across the 20 cereal entries, yield with no added CR inoculum ranged from 3.82 t/ha at Wongarbon down to 2.15 t/ha at Rowena in 2017 (Figure 1). Crown rot infection (added CR) significantly reduced yield at all sites ranging from a 20% reduction at Gilgandra and Edgeroi, to 26% at Wongarbon and Meandarra, up to 43% at Westmar and 45% at Rowena.

An across-site analysis of the six sites was conducted to examine the yield response of the 20 cereal entries to CR infection in 2017. Average yield in the no added CR treatment ranged from 2.26 t/ha in the durum variety Jandaroi$^{\Phi}$ up to 3.27 t/ha in the barley variety Compass$^{\Phi}$ (Figure 2). The four durum entries were, on average, 0.40–0.53 t/ha lower yielding than the bread wheat or barley entries, respectively.

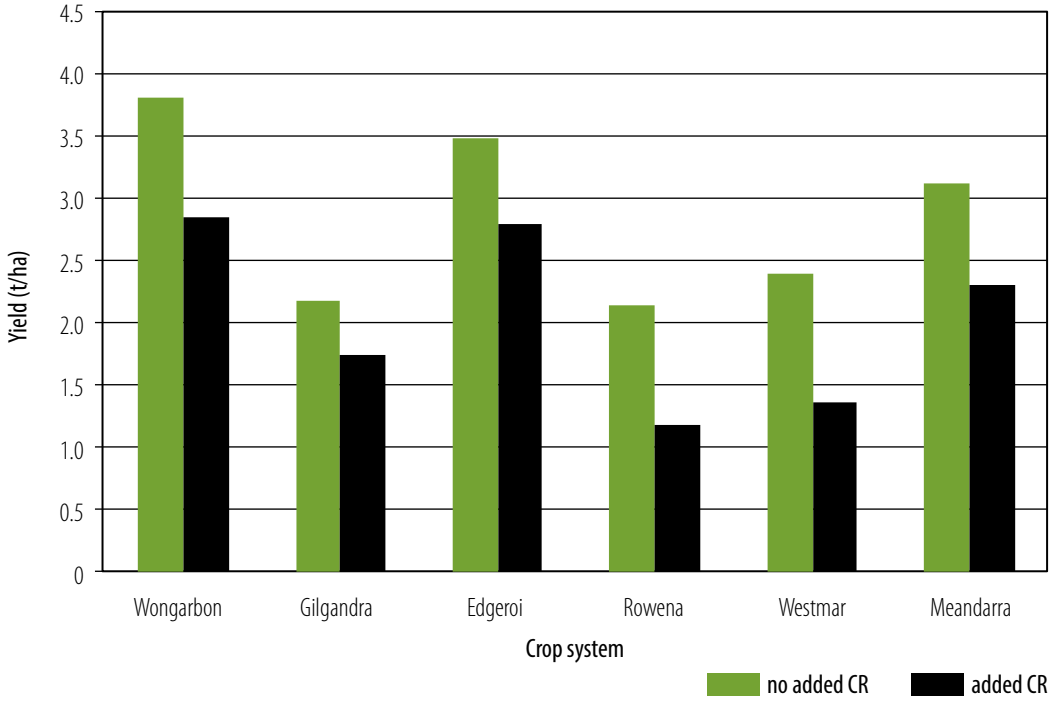

Figure 1 Average yield of cereal entries at six sites in 2017 with no added and added crown rot inoculum (l.s.d. (P<0.01) = 0.115 t/ha).

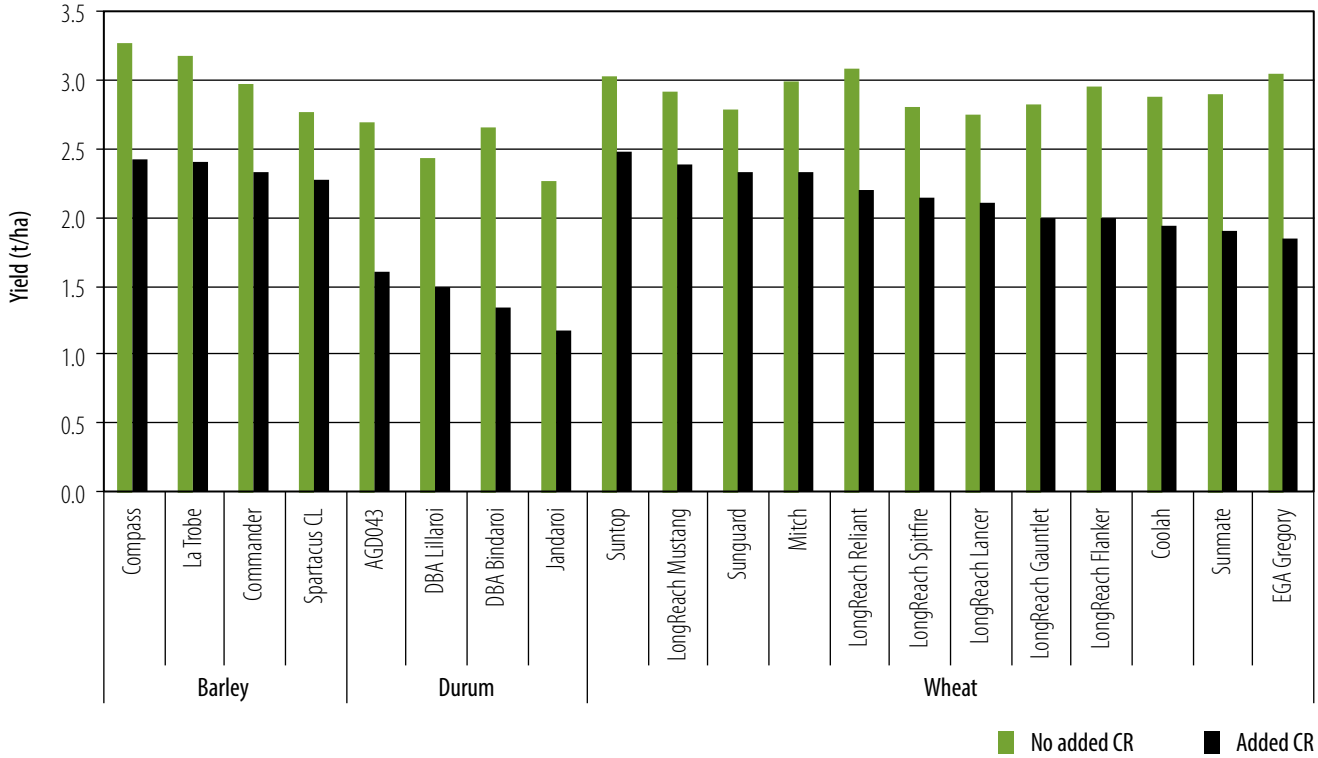

Figure 2 Average yield of four barley, four durum and 12 bread wheat varieties across six sites in 2017 with no added and added crown rot inoculum (l.s.d. (P<0.01) = 0.142 t/ha).

Adding CR inoculum at sowing significantly reduced the yield in all entries, which ranged from an average of 16% (0.46 t/ha) in the bread wheat variety Sunguard$^{\Phi}$ up to 50% (1.32 t/ha) in the durum variety DBA Bindaroi$^{\Phi}$ (Figure 2). Yield loss was highest in the four durum entries (average 44%, range 39% to 50%), followed by the 12 bread wheats (average 27%, range 16% to 39%) and lowest in the four barley entries (average 22%, range 17% to 26%).

Within the bread wheat entries, seven were rated MS–S to CR. However, their average extent of yield loss varied from 18% in Suntop$^{\Phi}$ and LongReach Mustang$^{\Phi}$ up to 24% in LongReach Lancer$^{\Phi}$, 29% in LongReach Gauntlet$^{\Phi}$, 32% in Coolah$^{\Phi}$, 33% in LongReach Flanker$^{\Phi}$ and 35% in Sunmate$^{\Phi}$ (Figure 2).

Suntop$^{\Phi}$, although being MS–S to CR infection has been demonstrated in other studies to have a level of tolerance to CR that reduces the extent of yield loss. It appears that LongReach Mustang$^{\Phi}$ could also have a level of improved tolerance to CR.

In the four MS bread wheat varieties, average yield loss ranged from 16% in Sunguard$^{\Phi}$ up to 28% in LongReach Reliant$^{\Phi}$, which overlapped with that measured in the MS–S entries.

The resistance ratings also do not appear to be a good reflection of yield loss when comparing across some of the cereal types, especially with barley. Three of the barley varieties are rated S while La Trobe$^{\Phi}$ is rated S–VS. However, their average yield loss ranged from 17% in Spartacus CL$^{\Phi}$ up to 26% in Compass$^{\Phi}$ (Figure 2). This was around half the extent of yield loss experienced in the S–VS and VS durum varieties of 39–50%. Barley tends to mature earlier than bread wheat or durum, which can provide an escape from later season moisture/temperature stress that exacerbates the expression of the disease. As seen in these six field experiments, this escape from stress reduces the yield loss from CR even though barley is still quite susceptible to infection.

Conclusions

Cereal crop species and variety choice affected yield in the absence and presence of CR infection, which differed by 1.01 t/ha and 1.30 t/ha, respectively between the best and worst entries when averaged across the six sites in 2017. Yield loss associated with increased CR infection in the added CR treatment ranged from 16% in the bread wheat variety Sunguard$^{\Phi}$ up to 50% in the durum variety Jandaroi$^{\Phi}$.

Comparing varieties in terms of percentage yield loss can be potentially misleading for growers and advisers as it masks the actual yields obtained in the presence of CR. An alternate method is to compare yield performance with a standard variety such as EGA Gregory$^{\Phi}$.

In the no added CR treatment, the bread wheat varieties Coolah$^{\Phi}$, LongReach Gauntlet$^{\Phi}$, LongReach Spitfire$^{\Phi}$, Sunguard$^{\Phi}$ and LongReach Lancer$^{\Phi}$ were 0.17 t/ha to 0.29 t/ha lower yielding than EGA Gregory$^{\Phi}$. The other six bread wheat entries had an equivalent yield to EGA Gregory$^{\Phi}$ in the no added CR treatment averaged across the six sites in 2017. All four durum entries were between 0.35 t/ha to 0.78 t/ha lower yielding than EGA Gregory$^{\Phi}$ in the no added CR treatment. With the four barley varieties, only Compass$^{\Phi}$ was higher yielding (0.23 t/ha) than EGA Gregory$^{\Phi}$, La Trobe$^{\Phi}$ and Commander$^{\Phi}$ had equivalent yield and Spartacus CL$^{\Phi}$ was 0.28 t/ha lower yielding.

The comparison between varieties was markedly different in the presence of added CR. With the 12 bread wheat varieties, only LongReach Flanker$^{\Phi}$, Coolah$^{\Phi}$ and Sunmate$^{\Phi}$ had an equivalent yield to EGA Gregory$^{\Phi}$. The remaining eight bread wheat varieties were between 0.15 t/ha (LongReach Gauntlet$^{\Phi}$) and 0.63 t/ha (Suntop$^{\Phi}$) higher yielding than EGA Gregory$^{\Phi}$ in the presence of CR. This represents an 8–34% yield benefit. All four durum varieties were between 0.24 t/ha to 0.68 t/ha lower yielding than EGA Gregory$^{\Phi}$ where CR was added, representing a 13–37% yield penalty. In contrast, all four barley varieties were 0.43–0.57 t/ha higher yielding than EGA Gregory$^{\Phi}$, a 23–31% yield benefit.

These crop or variety choices could have maximised profit in this growing season but will not reduce inoculum levels for subsequent crops, because all winter cereal varieties are susceptible to CR infection. Winter cereal crop and variety choice is therefore not the sole solution to CR, but rather just one element of an integrated management strategy to limit losses from this disease.

Crown rot resistance ratings are based on the extent of basal browning which develops during the season in infected plants and should **not** be confused by growers as necessarily reflecting the yield performance of a variety in the presence of this disease. Growers should consult relative yield

performance data, as presented here, to provide a better indication of how different varieties are likely perform in their paddocks that have a medium–high risk of crown rot infection.

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