

Crown rot resistance and yield loss

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Key Findings:

- Some new durum lines show promise of improved resistance to crown rot.
- Yield loss in Hindmarsh in this trial is a reminder that barley can also exhibit yield loss from crown rot.
- Percentage yield loss from crown rot may only be small in a good season, but this can equate to significant production loss.
- Knowing the risk of yield loss from crown rot in paddocks prior to sowing is an important management strategy.

Why do the trial?

To evaluate resistance to crown rot and yield losses from crown rot in commercial cultivars of bread wheat, durum wheat and barley.

How was it done?

The trial was direct drilled in plots of 6 rows x 7 m. Sterilised durum wheat grain colonised by *Fusarium pseudograminearum* (application rate of 2 g / m row) was mixed with seed prior to sowing to screen for resistance. To assess yield loss, a second, uninoculated plot was included for selected entries. Four replicates were used in a randomised block design. Durum breeding lines developed by Hugh Wallwork and Dr Jason Able, University of Adelaide (UAD and WID lines), were assessed for resistance only. For many of these lines, limited seed was available and only three replicates were sown.

Plant samples were collected from 4 x 0.25 m rows per plot on October 21st at early grainfill. White heads and total heads were counted to give % white heads and main stems were assessed for severity of crown rot symptoms. Crown rot severity on main stems was scored visually on the following scale:

0 = 0%	No yield loss
1 = 1-10%	Possibility of minor yield loss
2 = 10-25%	Possibility of some yield loss
3 = 25-50%	Possibility of significant yield loss
4 = 50-75%	Significant yield loss likely
5 > 75%	High yield loss likely

Results

Plant establishment was good in all plots and weeds and other diseases were not an issue.

Rainfall for June-August was well above average and resulted in good plant growth and excellent yields in the trial. Bread wheat yields ranged from 3.8 to 5.5 t/ha, durum wheat yields ranged from 3.3 to 4.0 t/ha and barley yields ranged from 5.1 to 6.4 t/ha.

Rainfall for September-October was 40% lower than the long term average and it is likely that plants would have experienced low-level moisture stress during flowering and early grain fill.

The basal stem browning and white head expression associated with crown rot were both low. Basal stem browning scores averaged 1.06 (range 0.11-2.13) in inoculated plots, which is below the severity score (2.0 – 2.5) normally associated with yield loss from crown rot. Basal stem browning was also present in uninoculated plots, where scores averaged 0.82 (range 0.08-1.8). Whiteheads were present at an average of 0.8% (range 0-4%) in inoculated plots and 0.5% (range 0-2%) in uninoculated plots.

Cereals with MR, MS and MS-S disease ratings did not exhibit yield losses (Table 1). Bread wheat entries with an S rating and durum entries (VS) generally exhibited similar levels of yield loss, with the durum cultivar Tjilkuri having the highest (15%) yield loss. Tamaroi unexpectedly had no yield loss. Yield losses in other cultivars ranged from 2% to 6%, with actual yield losses between 0.10 t/ha and 0.32 t/ha (Table 1). The mid-season barley cultivars Commander and Schooner did not exhibit yield loss in the crown rot inoculated plots, but Hindmarsh (early season) exhibited a 5% yield loss.

In general, the rankings of commercial cultivars were consistent with their currently accepted disease ratings as given in the Cereal Variety Disease Guide (Table 2). A number of the durum lines, notably, 1333-56, 1349-29 and WID902 had lower basal stem browning scores than did the commercial durum cultivars (Table 2).

Table 1. Yield reductions in cereal plots inoculated with crown rot at Hart in 2013.

Entry	Cereal type	Disease rating*	No. of rep's	Yield loss		Disease score	White heads (%)
				%	t/ha		
2-49	Wheat	MR	4	0	0	0.11	0
Sunco	Wheat	MS	2	0	0	0.48	0
Kukri	Wheat	MS	3	0	0	0.51	0
Bevy	Rye	-	3	0	0	1.37	1
Emu Rock	Wheat	MSS	4	0	0	0.52	0
Tahara	Triticale	-	4	0	0	1.14	0
Tamaroi	Durum	VS	3	0	0	1.67	3
Commander	Barley	-	4	0	0	1.56	0
Schooner	Barley	-	4	0	0	2.13	0
Mace	Wheat	S	4	2	0.12	0.45	0
UAD0951096	Durum	VS	4	3	0.10	1.35	0
Scout	Wheat	MSS	4	3	0.15	0.88	0
Grenade	Wheat	S	3	4	0.15	1.22	2
Hyperno	Durum	VS	3	5	0.19	1.23	1
WID902	Durum	VS	3	5	0.21	1.06	0
Phantom	Wheat	MS	2	5	0.23	0.52	1
Hindmarsh	Barley	-	2	5	0.32	1.83	0
Shield	Wheat	S	3	6	0.28	0.54	0
WID802	Durum	VS	4	6	0.31	1.66	3
Tjilkuri	Durum	VS	4	15	0.46	1.79	1

* Disease ratings are from the Cereal Variety Disease Guide. MR = moderately resistant; MS = moderately susceptible; MS-S = moderately susceptible to susceptible; S = susceptible; VS = very susceptible.

Discussion

Although crown rot symptoms were limited in 2013, some yield loss from crown rot might have been expected, particularly in durum wheat, given good early growth and low-level moisture stress during grain fill. This is a reminder that crown rot can cause yield losses even in a good year and that in a good season % yield loss may only be small (less than 7% in this trial) but the actual yield loss can be significant (as high as 0.32 t/ha in this trial). Regardless of the season, it is important to know the risk of yield loss from crown rot in paddocks prior to sowing in order to reduce losses from this disease.

Some of the new durum lines show promise of having improved resistance to crown rot when compared with current commercial cultivars. Further field screening is needed to validate these findings, but the progress being made toward improved resistance to crown in durum breeding programs is encouraging.

Barley is not resistant to crown rot, but usually does not show yield loss. This is not a tolerance mechanism and barley is thought to escape significant damage by filling grain at a time when moisture stress is not occurring. If moisture stress does occur when barley is at a susceptible growth stage, then it may also incur yield losses as seen with Hindmarsh in this trial. As barley is usually high yielding, small percentage yield losses can be economically significant.

Table 2. Resistance screening for bread wheat and durum at Hart in 2013.

Entry	Cereal type	Disease rating	No. of rep's	Disease score	White heads (%)
2-49	Wheat	MR	4	0.11	0
Sunco	Wheat	MS	2	0.48	0
Kukri	Wheat	MS	3	0.51	0
Mace	Wheat	S	4	0.45	0
Emu Rock	Wheat	MSS	4	0.52	0
Phantom	Wheat	MS	2	0.52	1
Shield	Wheat	S	3	0.54	0
Janz	Wheat	S	4	0.60	0
Gladius	Wheat	S	3	0.81	3
Scout	Wheat	MSS	4	0.88	0
Grenade	Wheat	S	3	1.22	2
1333-56	Durum	-	2	0.61	0
1349-29	Durum	-	3	1.06	0
WID902	Durum	-	3	1.06	0
1349-27	Durum	-	3	1.07	0
UAD1152020	Durum	-	3	1.21	3
Hyperno	Durum	VS	3	1.23	1
1333-24	Durum	-	3	1.25	1
Yawa	Durum	VS	2	1.28	2
UAD0951096	Durum	-	4	1.35	0
1347-13	Durum	-	3	1.44	4
1349-24	Durum	-	1	1.44	2
1349-49	Durum	-	3	1.45	0
WID802	Durum	VS	4	1.66	3
Tamaroi	Durum	VS	3	1.67	3
Tjilkuri	Durum	VS	4	1.79	1

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