IMPACT OF SOWING DATE ON CROWN ROT LOSSES

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Key words

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GRDC code

DAN00109: Management of Fusarium and other winter cereal diseases in the northern cropping zone
NGA00001: validation and integration of new technology through grower groups in north-west NSW and south-west Queensland grain growing zones

Take home message

- *Sowing date had the largest impact on final crop yield followed by variety choice. Both of these far outweighed the crown rot effect*
- *Percentage yield loss to crown rot in three bread wheat varieties was similar across 3 sowing dates*
- *Addition of crown rot inoculum resulted in similar impacts on yield, grain size, disease incidence and severity across the three varieties*
- *There was little impact from time of sowing on level of incidence HOWEVER severity of crown rot, as measured by basal browning, INCREASED with later sowing*
- *Delayed sowing does NOT appear to be a useful tool for the management of crown rot*
- *Decisions on planting date should be made on earliest adequate soil moisture levels and appropriate variety maturity used to manage frost risk in your region*

Background

Collaborative work between NSW DPI and NGA in 2007 across 11 sites demonstrated that, although the five wheat varieties examined have a wide difference in resistance ratings to crown rot, the actual variation in yield loss due to crown rot between varieties was much narrower (10-15% max). A potential concern with our previous work was that these varieties had different maturities but in each trial all entries were sown on the same date. Questions remained as to 1. Does sowing a longer season variety earlier expose it to greater infection from crown rot or does later sowing reduce exposure to infection? 2. Does grain-fill under cooler conditions resulting from earlier sowing reduce expression of yield loss to crown rot? 3. What is the final impact of crown rot on yield and quality with different sowing times?

How was it done?

Three bread wheat varieties (EGA Gregory, Strzelecki and EGA Wylie) were used in the experiment with the first two being longer season and rated as being more susceptible to crown rot and EGA Wylie a main season variety which has the best resistance rating. Plots of each variety were either uninoculated or inoculated with sterilised durum grain colonised by the crown rot fungus at a rate of 2g/m of row. Plots of each treatment were then sown on three different dates in 2008 being: 1st sowing = 21st May, 2nd sowing = 10th June and 3rd sowing = 27th June. There were four replicates of each treatment which were blocked for sowing time with treatments randomised within each block. Hand samples were removed from each plot at physiological maturity to obtain pathology measures while yield and quality were obtained from samples collected using a small plot harvester.

Effect on yield

Good rainfall occurred at Tamworth late in the season during grain-fill which prevented the formation of whiteheads in all treatments. Overall the addition of crown rot significantly reduced yield but only averaged around 4% (-0.2 t/ha, Figure 1.) However, there was no significant variety x inoculum or variety x sowing time x inoculum effect on yield given the good finish to the season.

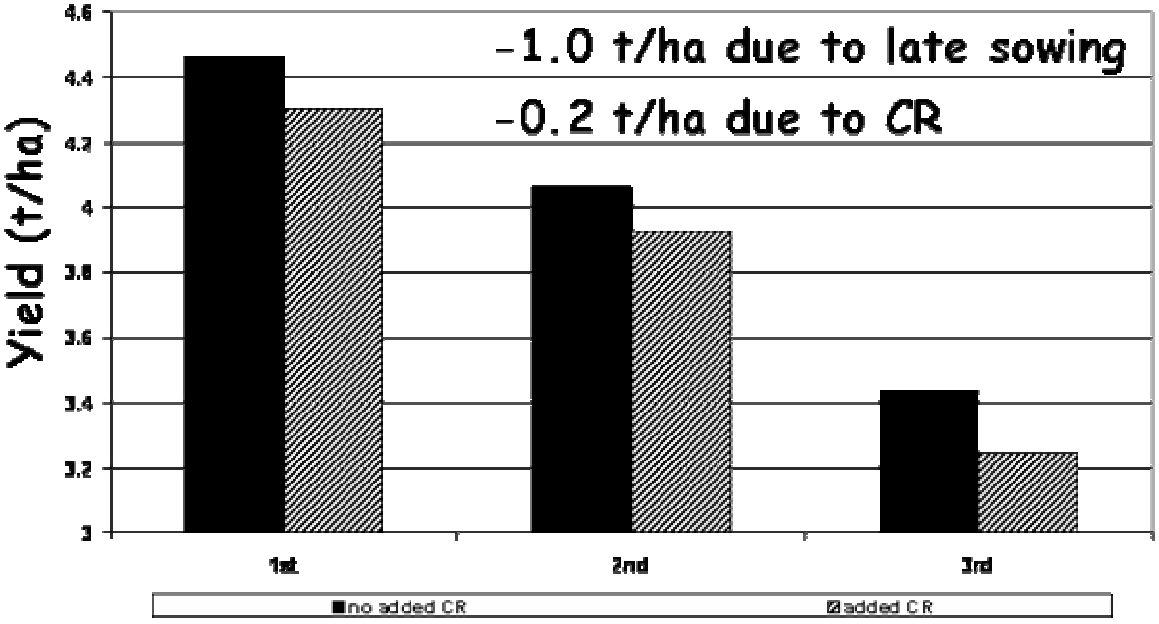

Figure 1. Effect of sowing time and crown rot on yield

Sowing time as expected had a significant impact on final grain yield in all three varieties especially EGA Gregory and Strzelecki which are longer season. The percentage yield reduction between the 1st and 3rd sowing times was 30% in EGA Gregory, 24% in Strzelecki and 14% in EGA Wylie (Table 1). Despite the higher yield drop off for EGA Gregory and Strzelecki they still produced significantly higher yield than EGA Wylie at the late sowing time. Late timing of fungicide application across the trial allowed moderate levels of stripe rust to develop in the first two sowing times of EGA Wylie which may have limited yield in this variety at the earlier sowings.

Table 1. Effect of sowing time on yield (t/ha)

Numbers followed by the same letter are not significantly different at 95% confidence level

Sowing time	EGA Gregory	Strzelecki	EGA Wylie
1st	4.90 a	4.58 b	3.67 e
2nd	4.32 c	3.99 d	3.68 e
3rd	3.44 f	3.47 ef	3.15 g

Quality effects

Percentage screenings were significantly affected by sowing time (1st av. 4.0%, 2nd av. 5.4% and 3rd av. 8.0%, Figure 2). Variety also significantly affected screening levels with EGA Gregory (4.6%) resulting in lower screenings that the other two varieties (6.4% Strzelecki and 6.5% EGA Wylie). Screenings varied from a minimum of 2.7% in uninoculated EGA Gregory at the 1st sowing time up to 10.1% with inoculated Strzelecki at the 3rd sowing date. However, more importantly the level of crown rot also appeared to have a greater impact on increasing screenings as the sowing date was delayed (Figure 2).

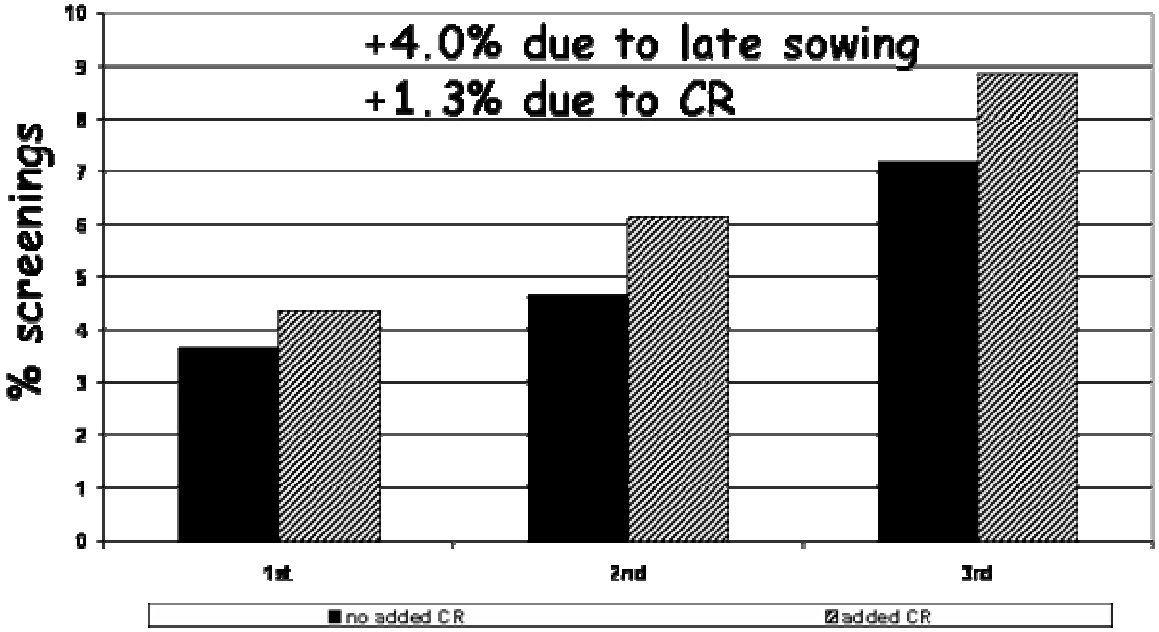

Figure 2. Effect of sowing time and crown rot on screenings

Later sowing significantly reduced grain size in all three varieties with smaller but significant effects from variety and crown rot addition (Figure 3).

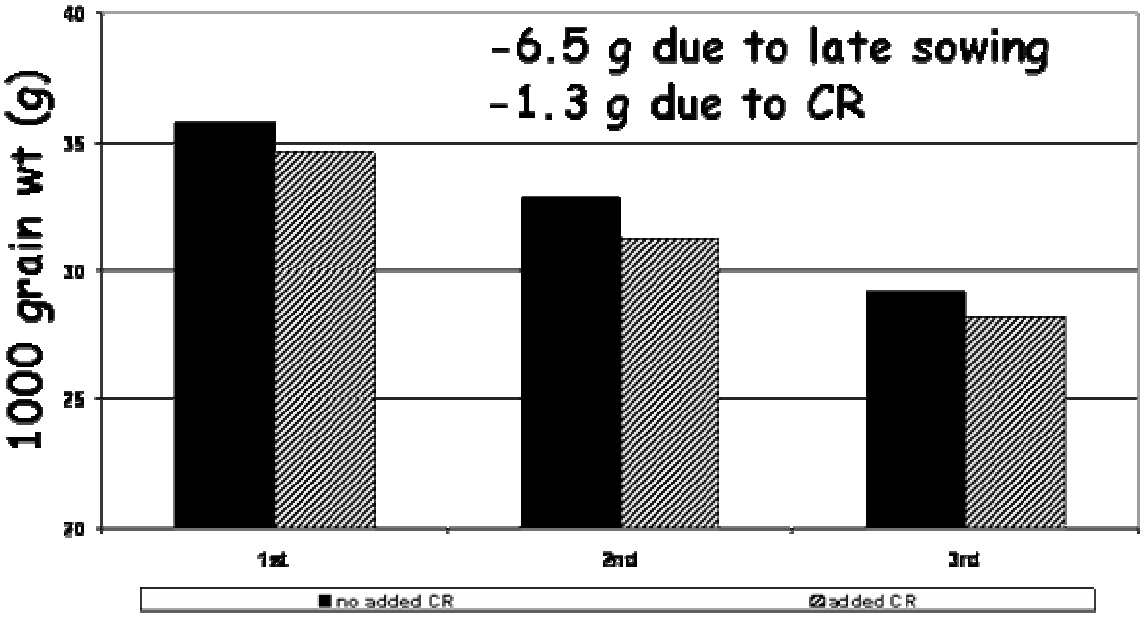

Figure 3. Effect of sowing time and crown rot on grain size

What about disease?

There was no difference between the three varieties in the levels of infection initiated by the crown rot fungus at any sowing date i.e. longer season varieties did not have greater numbers of plants infected irrespective of sowing time. In plots where no additional crown rot inoculum was added (background infections) there was no difference in the percentage of plants infected at harvest between the three sowing times. When crown rot inoculum was added, all sowing times resulted in around 80% of plants or greater being infected at harvest with the 2nd sowing time being significantly higher at 94% than the other two sowing times

(Figure 4). However, with both inoculum levels it was obvious that early sowing did not result in increased numbers of infected plants.

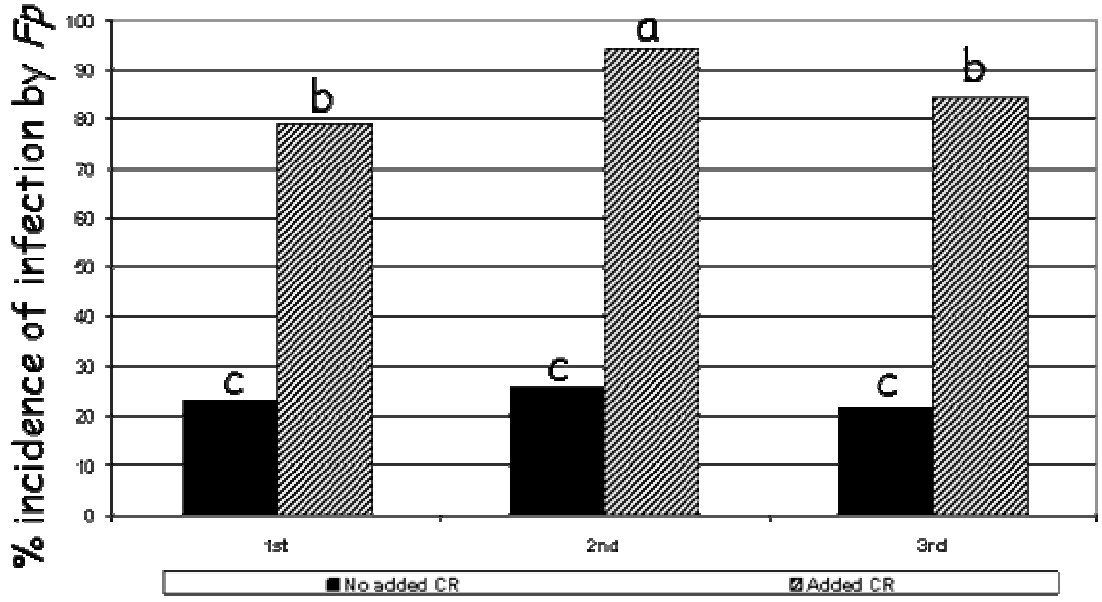

Figure 4. Effect of sowing time on percentage of plants infected with the crown rot fungus *Fusarium pseudograminearum* (*Fp*)

Columns followed by the same letter are not significantly different at 95% confidence level

Although early or delayed sowing time did not impact on the percentage of plants ultimately infected by the crown rot fungus, it did appear to influence disease expression as measured by the extent of basal browning (i.e. crown rot severity). Delaying sowing time significantly increased disease severity across the three sowing dates at both inoculum levels (Figure 5). Increased moisture and temperature stress during grain-fill not only exacerbates the formation of whiteheads but also increases the expression of the disease as basal browning. Later sowing increases the probability that more of the grain-filling period will occur under higher temperatures and evaporative demand that normally occurs later in the season.

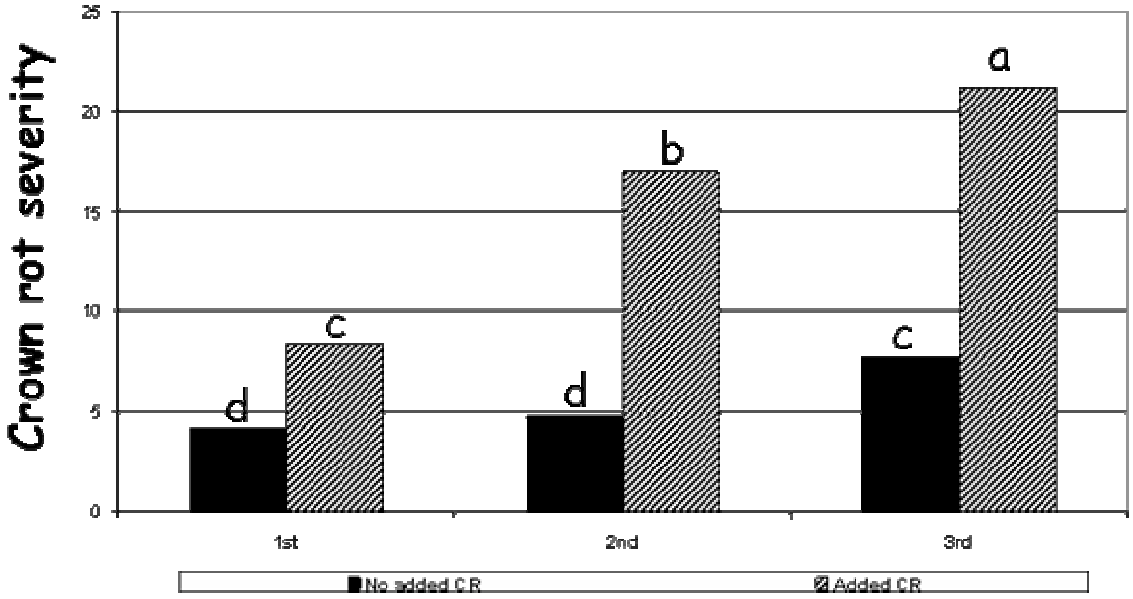

Figure 5. Effect of sowing time on severity of crown rot

Columns followed by the same letter are not significantly different at 95% confidence level

What does it all mean?

Remember this is only one year of data in a favourable season.

However, we can still answer some of our posed research questions with this in mind.

1. Does sowing a longer season variety earlier expose it to greater infection from crown rot or does later sowing reduce exposure to infection? No. Sowing time and hence length of exposure to infection over the season did not result in different levels of plants being infected by the crown rot fungus. The 2008 season was very conducive to infection with good soil moisture for much of the year. Certainly longer season varieties and earlier sowing did not increase the susceptibility to infection.

2. Does grain-fill under cooler conditions resulting from earlier sowing reduce expression of yield loss to crown rot? Results were less conclusive. Earlier sowing certainly increases yield and grain size and reduces screenings irrespective of crown rot. The actual %yield loss to crown rot did not vary greatly between sowing times with each of the varieties. There was an indication that crown rot resulted in increased screenings with later sowings. The 2008 season was not overly conducive to yield and quality loss from crown rot but differences were still measured. It would be interesting to repeat this experiment in a season with a tougher finish. In theory, bringing grain-fill forward even 1-2 weeks may have a considerable impact on disease expression by limiting moisture and evaporative stress.

3. What is the final impact of crown rot on yield and quality with different sowing times? Firstly the major effect on yield and quality comes from the sowing time itself. Later sowing decreases yield potential and grain size and increases screenings. Adding crown rot into the picture on top of this further exacerbates these losses thus increasing the probability of downgrading. The % yield and quality losses attributable to crown rot were pretty consistent across the three sowing dates. If anything they got slightly worse with the later sowings. Hence, sowing earlier in the window, if soil moisture allows, maximises the genetic yield potential, grain size and limits screenings in a variety. This provides buffering from any detrimental effect that crown rot infection may then have.

In this experiment we are not talking about very early sowings in Feb-Mar. The time difference between the 1st and 3rd sowing dates was just over a month (21st May to 27th June). It certainly appears that growers should not be discouraged from sowing earlier because of a perception that this may make crown rot losses worse. Decisions on planting date should be more strongly made on the basis of taking advantage of earliest adequate soil moisture conditions to maximise yield and quality. Variety maturity can then be used to manage frost risk for your region.

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