Crown Rot: A Validation of the Commercial Benefits of Inter-row Sowing

Background

Crown rot remains the number one winter cereal disease in the northern grain region. Yield losses in wheat of 50 per cent or more are not uncommon where high disease levels are combined with moisture stress late in the season. The disease crown rot is caused by a stubble-borne pathogen *Fusarium pseudograminearum* (Fp) that survives in cereal or grass weed residues. In a no-till farming system the pathogen is concentrated in the previous cereal rows.

Cryon Trial NGA0608 5/10/2006
Whiteheads are a function of disease level and moisture stress.
Few whiteheads in outside row due to extra moisture

Why look at inter-row sowing?

Research conducted by the UNE showed infection will only occur when the new wheat plant comes in contact with stubble residue that contains the crown rot fungus. Inter-row sowing (sowing between the old cereal rows) can provide a physical separation between the new plant and the infected stubble.

Evaluation by the NSW DPI in 2004 and 2005 showed that inter-row sowing can reduce both the severity of crown rot and incidence of Fp by an average of 45-60%.

Cryon Trial NGA0607 20/7/2006
LHS Between-row sowing NB majority of stubble intact
RHS On-row sowing NB increased disturbance and spread of stubble

Contents

In a nutshell

Crown rot severity: Inter-row sowing reduced disease severity by an average of 53%.

Grain yield and quality: Inter-row sowing resulted in an average 5% (101 kg/ha) yield advantage. There was negligible impact on grain quality.

Economic benefit: $20/ha net gain over the series of 7 trials at $200/t grain prices.

Overall: *Effective crown rot management must be based on crop rotation. Inter-row sowing is a useful, but secondary disease management tool. It will provide best benefit when used under low inoculum levels as part of an integrated disease management program. In this situation it will limit the amount of infection and slow the rate of pathogen build-up.*

*Inter-row sowing is **NOT***

- *a crown rot 'circuit breaker' to use when disease levels are out of control.*
- *a strategy that will enable 'back to back' wheat production under increased crown rot risk.*

This work validated the level of disease impact recorded by the NSW DPI in 2004 and 2005. It is important to note that although large average reductions in disease impact were seen, the yield increases recorded were much more modest.

Aims

1. Validate the level of disease suppression seen by NSW DPI
2. Evaluate the impact on grain yield and quality
3. Generate regional commercial data to indicate the benefits available to growers

Trial design

In 2006, 8 trials were established in the Walgett, Cryon, Burren Junction and Edgeroi districts. All trials were established on a large plot basis – planted, managed and harvested with commercial equipment. In each trial, sowing on top of the old row (on-row) and sowing between the previous cereal rows (between-row) were compared. There were 4 replicates of each treatment at 6 sites and 3 replicates at the remaining 2 sites. One trial was discontinued because of poor uniformity evident after early establishment. All trial sites had been sown to wheat in 2005.

Edgeroi Trial NGA0613 17/6/2006
Between-row sowing showing minimal stubble disturbance

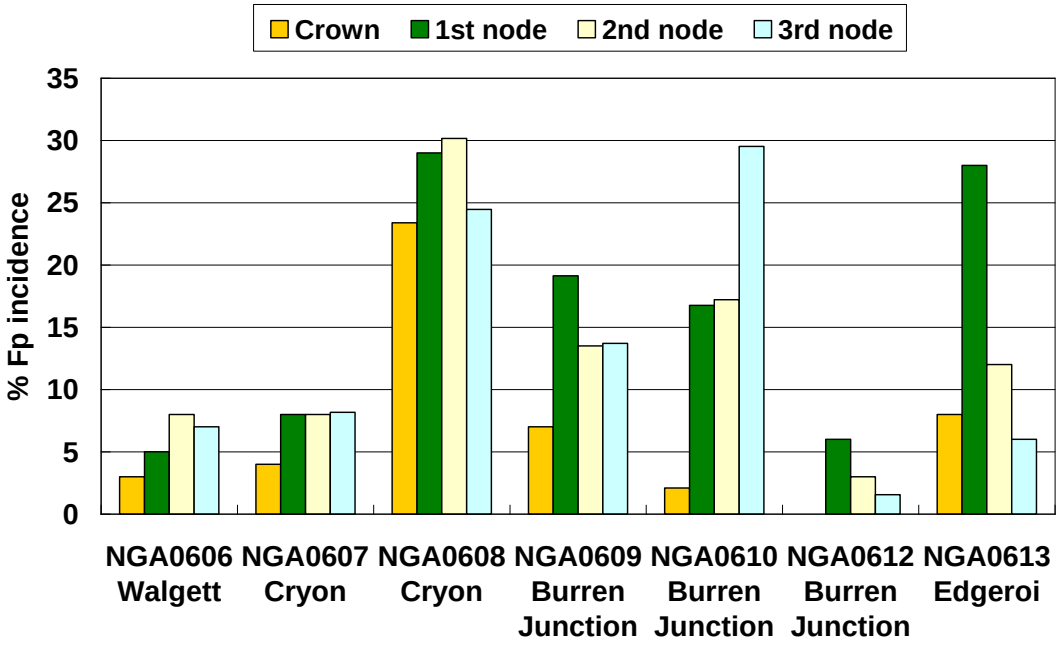
Assessments

1. **Baseline pathogen level in stubble at planting:** 25 random plants taken from each replicate. Samples 'plated' from the main tiller by NSW DPI to indicate level of *Fusarium pseudograminearum* (Fp) incidence.
2. **Plant establishment:** Counts of established plants in 10 x 1m rows per replicate at 11/7/2006.
3. **Grain yield:** Yield comparisons by weigh-bin in all trials except NGA0613. GPS yield mapping used for NGA0613.
4. **Grain quality:** Samples of grain from each replicate analysed for screening %, test weight and protein level.
5. **Pathogen incidence and disease severity at harvest:** Samples taken immediately prior to harvest and assessed for severity of crown rot and Fp incidence.

Edgeroi Trial NGA0613 16/10/2006
LHS Normal plant, RHS Brown discolouration of lower nodes

Multi-trial summary

Baseline pathogen level in stubble at planting

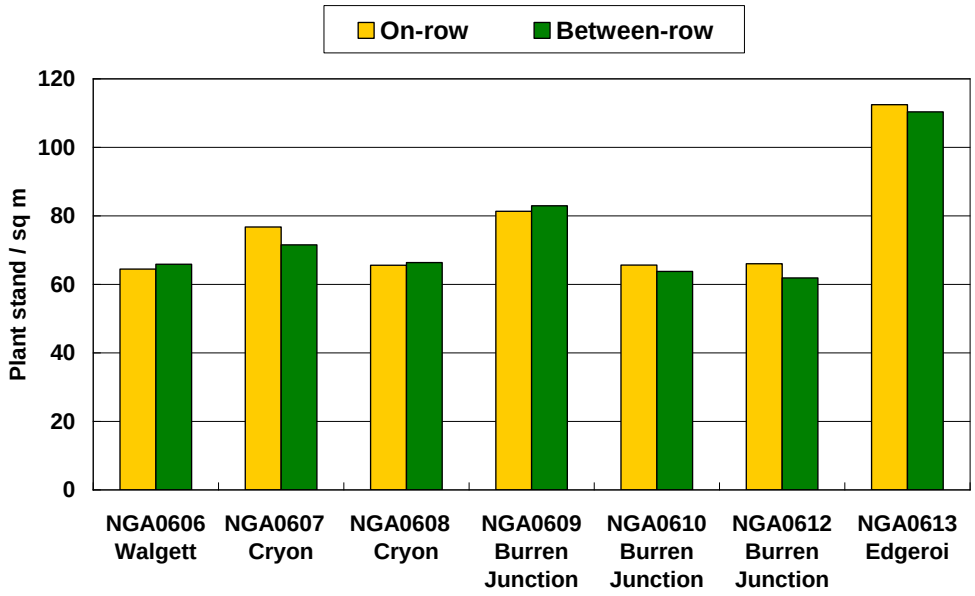


The figure above shows the incidence of Fp detected by the NSW DPI in the old (2005) wheat stubble. eg in trial NGA0608, Fp was recovered from the crown in 23% of main tillers and found at the 1st node in 29% of tillers. On average the highest recovery was at the 1st node, followed by similar levels at the 2nd and 3rd nodes and the lowest level at the crown. The low levels at the crown are likely to reflect 'displacement' of Fp by other fungi during the fallow period.

Key messages

1. **The crown rot pathogen (Fp) was found in old wheat stubble at all trial sites**
2. **Fp was at a range of levels from low to very high**
3. **Fp was found at a range of heights within the old stubble**

Plant establishment

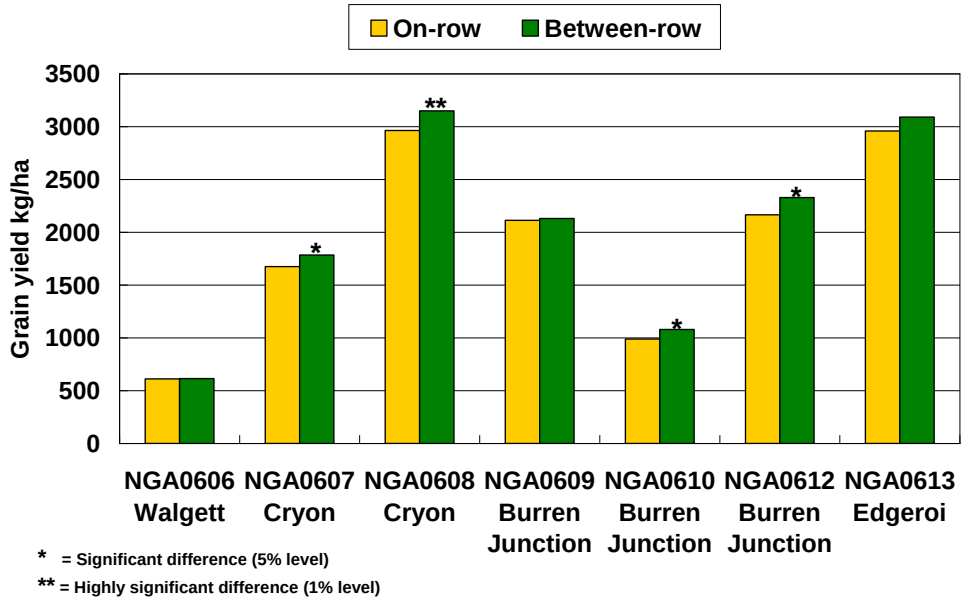


The graph above shows the plant establishment counts taken on the 11/7/2006. There was no significant difference in establishment counts at any single location, or over the entire series of trials.

Key messages

1. **Inter-row sowing had no impact on plant establishment compared to on-row sowing**
2. **Adoption of inter-row sowing is unlikely to have any impact on optimal sowing rates**

Grain yield

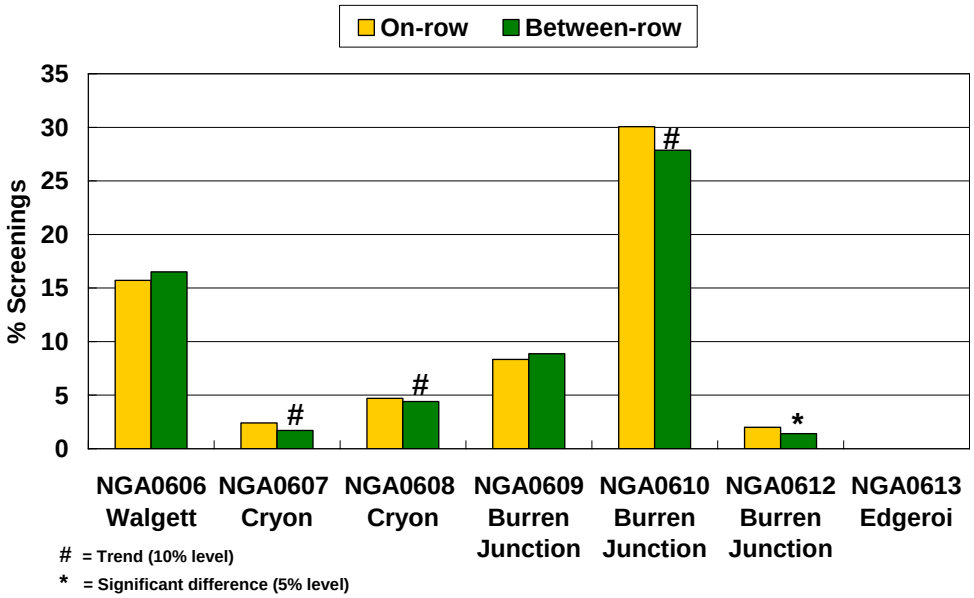


Assessment for grain yield showed inter-row sowing significantly increased wheat yield in 4 of the 7 trials. Higher average grain yields were recorded by inter-row sowing in all trials. Analysis over the entire trial series also showed a significant increase in yield by use of inter-row sowing.

Key messages

1. **Inter-row sowing resulted in a useful, but relatively modest, increase in average yield compared to on-row sowing**
2. **The average level of yield benefit was 5.1%, with a range from 1-9%**
3. **The average level of yield increase was 101 kg/ha, with a range from 4-187 kg/ha**

Grain quality

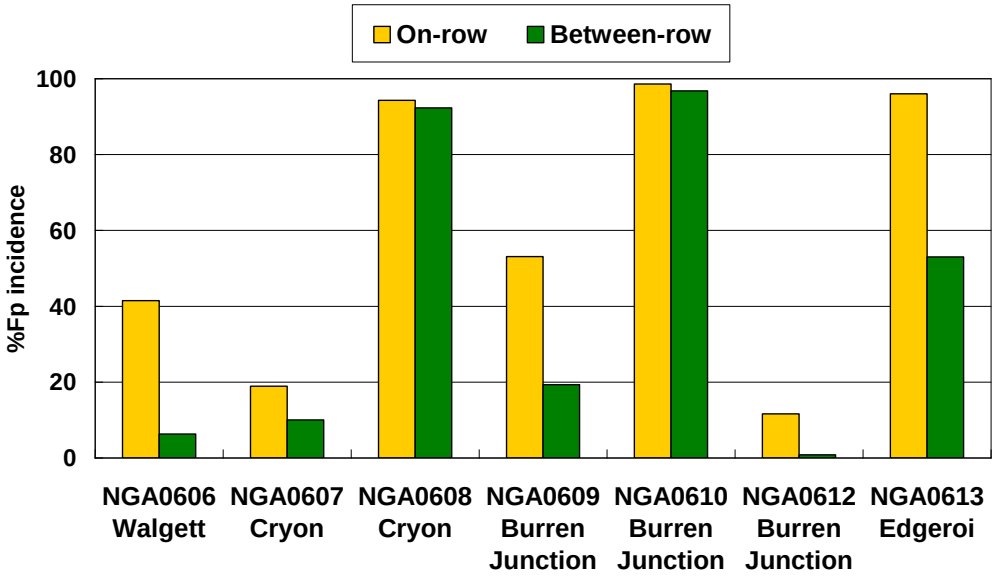


The figure above shows inter-row sowing reduced % screenings in 4 of the 6 sites tested. Higher average screenings were however recorded by inter-row sowing in the other 2 trials. Analysis over the entire trial series showed no significant effect on screenings from use of inter-row sowing. Inter-row sowing trended to reduce test weight at one low disease site and increased test weight at another low disease site. There was no impact from inter-row sowing on test weight at any other site or overall. There was no impact on protein content from inter-row sowing at any site.

Key messages

1. **Inter-row sowing reduced screening levels in 4 of 6 trials**
2. **The level of reduction however is not likely to result in a change of grain classification**
3. **No significant impact from inter-row sowing on test weight or protein content**

Pathogen incidence at harvest



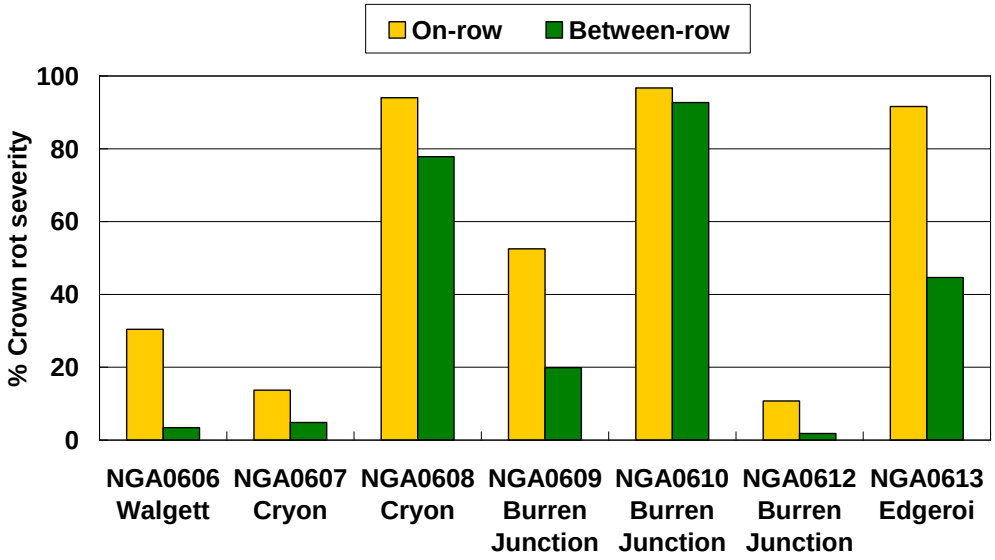
%Fp incidence = (No. of crowns colonised by Fp/total number of crowns)*100 when plated out

The pathogen incidence ratings above, conducted by NSW DPI, showed inter-row sowing reduced average Fp incidence by 48%. This supports work from 2004 and 2005 where levels of reduction of 52 and 45% were recorded. Previous research had shown that the impact of inter-row sowing was greatest under **low** disease pressure. In these trials where crown rot severity was <50% (NGA0606, 0607 and 0612) inter-row sowing reduced Fp incidence by 75%. However where crown rot severity was >50% (NGA0608, 0609, 0610 and 0613) inter-row sowing only reduced Fp incidence by 28%

Key messages

1. **Inter-row sowing reduced the number of crowns infected with Fp in all trials**
2. **Inter-row sowing provided more benefit in situations of LOW disease pressure**
3. **Results support previous NSW DPI research**

Crown rot severity at harvest



%CR Severity = (No. of tillers with basal browning/total number of tillers)*100

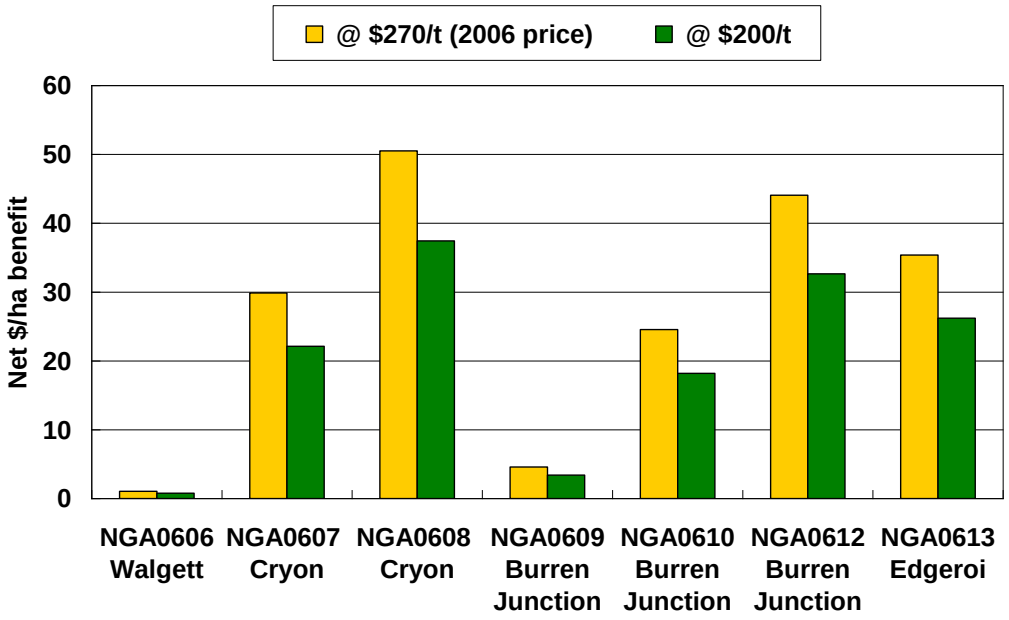
The crown rot severity ratings above, conducted by NSW DPI, showed inter-row sowing reduced average crown rot severity by 53%. This supports work from 2004 and 2005 where levels of reduction of 60 and 51% were recorded.

Previous research had shown that the impact of inter-row sowing was greatest under **low** crown rot severity. In trials where severity was <50% (NGA0606, 0607 and 0612) inter-row sowing reduced severity by 79%. However where severity was high (NGA0608, 0609, 0610 and 0613) inter-row sowing only reduced severity by 34%.

Key messages

1. **Inter-row sowing reduced crown rot severity in all trials by an average of 53%.**
2. **Inter-row sowing provided greater reduction in severity under LOW disease situations**
3. **Results support previous NSW DPI research**

Economic benefit



The graph above details the net economic benefit obtained from inter-row sowing in these trials. Assuming a $200/t grain price, inter-row sowing would have delivered an additional $20/ha. With 2006 grain prices, the return on average was $27/ha. This benefit takes no account of the reduced level of crown rot inoculum carried forward.

Key messages

1. **Inter-row sowing resulted in an average $20/ha net gain at $200/t grain prices**
2. **The benefits of inter-row sowing MUST be considered relative to the scale of crown rot losses. In NGA0610 an $18/ha net benefit was gained compared to on-row sowing. However the estimated loss due to crown rot was 1.5 t/ha of grain production and an overall net cost of $300/ha**