CEREAL PATHOGEN SURVEY OF CENTRAL AND NORTHERN NSW - 2011

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KEY WORDS
PreDicta B, root lesion nematodes, common root rot, *Pythium,* crown rot, Fusarium head blight

GRDC CODES
DAN00143: Northern NSW integrated disease management
DAS00115 : Molecular Diagnostics Centre for delivery of training and diagnostics for soilborne disease management

Take home message

1. The root lesion nematode *Pratylenchus thornei* is widespread, detected in 70% of paddocks and at populations representing a risk of yield loss in intolerant varieties in 33% of the 248 paddocks surveyed.
2. The root lesion nematode *Pratylenchus neglectus* has a more restricted distribution, detected in 38% of paddocks and at populations representing a risk of yield loss in intolerant varieties in only 5% of the random paddocks surveyed.
3. The fungal pathogen *Bipolaris sorokiniana* was present in 69% of paddocks and at levels which presented a medium to high risk of common root rot in 2011 in 16% of the surveyed paddocks.
4. The fungal root pathogen *Pythium* was detected in 67% of paddocks but was at low levels which presented a risk of yield loss in <2% of paddocks.
5. The crown rot pathogen *Fusarium pseudograminearum* was detected in 63% of paddocks and was at high enough levels to present a medium to high disease risk in 23% of paddocks.
6. The Fusarium head blight pathogen *Fusarium graminearum* was detected in 28% of paddocks and was at high enough levels to present a medium to high disease risk in 8% of paddocks.
7. PreDicta B, a soil based DNA test, appears to be a valuable tool for detecting and determining at the individual paddock level the relative risk posed by the major soil-borne wheat diseases in central and northern NSW.

BACKGROUND

PreDicta B is a DNA based soil test developed by the South Australian Research and Development Institute (SARDI) to detect and quantify a range of important cereal pathogens. Each cereal pathogen has a unique DNA code so the PreDicta B test is very selective and sensitive for the individual pathogens detected. Risk categories have been developed for DNA levels of a range of cereal pathogens in South Australian and Victorian cropping systems but these categories have not been validated or calibrated for central and northern NSW.

Project aim:

To help calibrate risk categories for the DNA based soil testing service, PreDicta B in central and northern NSW. In collaboration with NSW DPI District Agronomists around 120 focus paddocks will be assessed each year for 3 years (2010-2012) in twelve agronomy districts ranging from Dubbo in the south up to the Qld border in the north and west to Warren, Walgett and Mungindi.

Pathogens detected by PreDicta B:

1. *Pratylenchus thornei* and *Pratylenchus neglectus* which are the two important species of root-lesion nematodes (RLN). Nematodes are microscopic worms that feed and reproduce inside plant roots which can lead to yield loss in intolerant cereal and pulse crops. There is limited information on the distribution and importance of RLN in central and northern NSW farming systems.

2. *Bipolaris sorokiniana* is a soil and stubble-borne fungal pathogen which causes common root rot in winter cereals. *Bipolaris* has a dark thick wall spore which can survive up to two years in soil. Common root rot infects the sub-crown internode (joins seed to crown) and generally causes ill-thrift in infected plants.

3. *Pythium* spp. This test detects a wide range of *Pythium* species which can cause damping-off (death) of winter cereal seedlings. *Pythium* spp. can also infect older plants and generally reduces the production of lateral roots which can lead to minor yield reductions which are often difficult to attribute to a cause.

4. *Fusarium pseudograminearum* (*Fp*) is the stubble-borne fungus which causes crown rot in winter cereals.

5. *Fusarium culmorum/F. graminearum.* This DNA test detects both *Fusarium culmorum* which can cause crown rot but is generally considered to be uncommon in northern NSW from previous studies and *F. graminearum* which is the main pathogen causing Fusarium head blight in winter cereals. However, this test can not differentiate between these two fungal species.

SURVEY DETAILS

In collaboration with NSW DPI District Agronomists, 248 focus paddocks were assessed around sowing in 2011 in twelve agronomy districts (19-24 paddocks/district) ranging from Dubbo in the south up to the Qld border in the north and west to Warren, Walgett and Mungindi. A one hectare area was established in each focus paddock. Two separate paddocks were surveyed on each farm in 2011. Paddock A is the same location as sampled in 2010 and a second paddock B which was planned to be sown to a winter cereal in 2011 was also established. Twenty small cores were collected in a grid across the trial area targeting the previous crop rows to a depth of 0-30 cm prior to sowing. Soil samples were sent to SARDI for PreDicta B analysis.

NEMATODE DISTRIBUTION AND IMPORTANCE

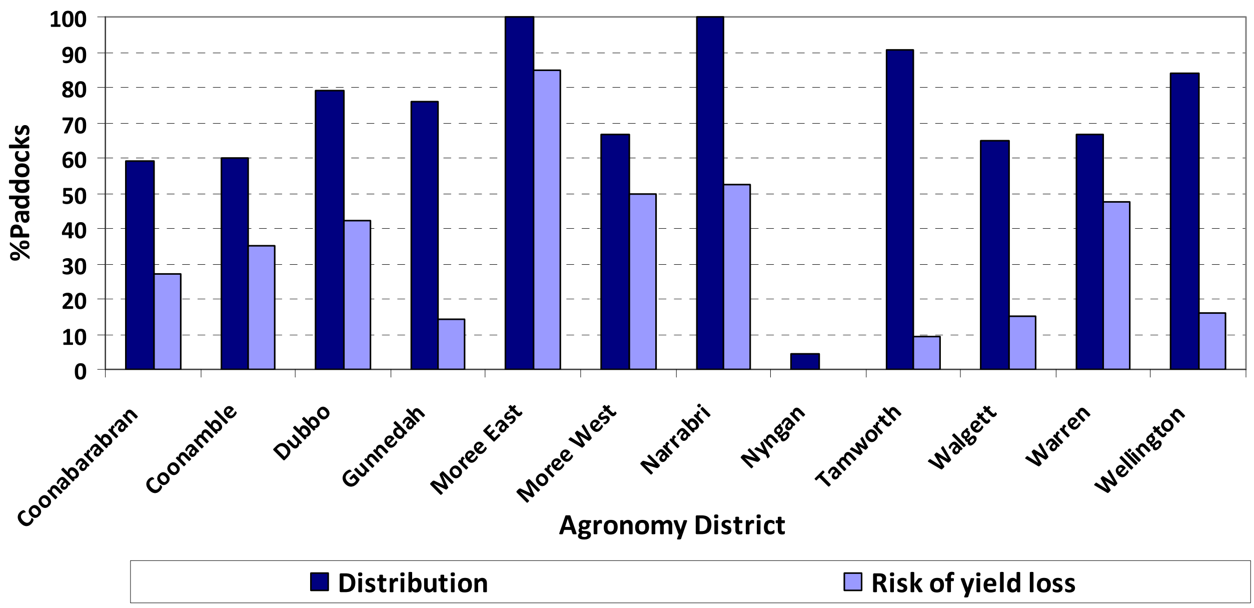

Figure 1: Distribution and potential importance of Pratylenchus thornei in central and northern NSW

- *Pratylenchus thornei* (*Pt*) was widespread, being detected in all 12 agronomy districts, and distributed in 59 to 100% of random paddocks within a district. Nyngan was an exception with *Pt* detected in only 5% of random paddocks in this district. Averaged across districts, *Pt* was detected in 70% of random paddocks in central and northern NSW.
- The Qld based threshold for yield loss in intolerant wheat varieties is 2,000 *Pt*/kg soil.
- A lower percentage of random paddocks in 11 of the 12 agronomy districts (all except Nyngan), had *Pt* populations >2,000/kg soil indicating a risk of yield loss if intolerant varieties were sown in 2011. Averaged across districts, 33% of random paddocks had a risk of yield loss in 2011.

- The Moree East district appears to be particularly challenged by *Pt* being detected in 100% of random paddocks and at populations representing a risk of yield loss in 85% of paddocks in this district. One paddock in the Moree East district had the highest *Pt* population (50,152 *Pt*/kg soil) of all the 248 paddocks surveyed in 2011. In fact, 30% of the paddocks in the Moree East district had *Pt* populations >15,000 *Pt*/kg soil (>7.5 times the threshold for yield loss).

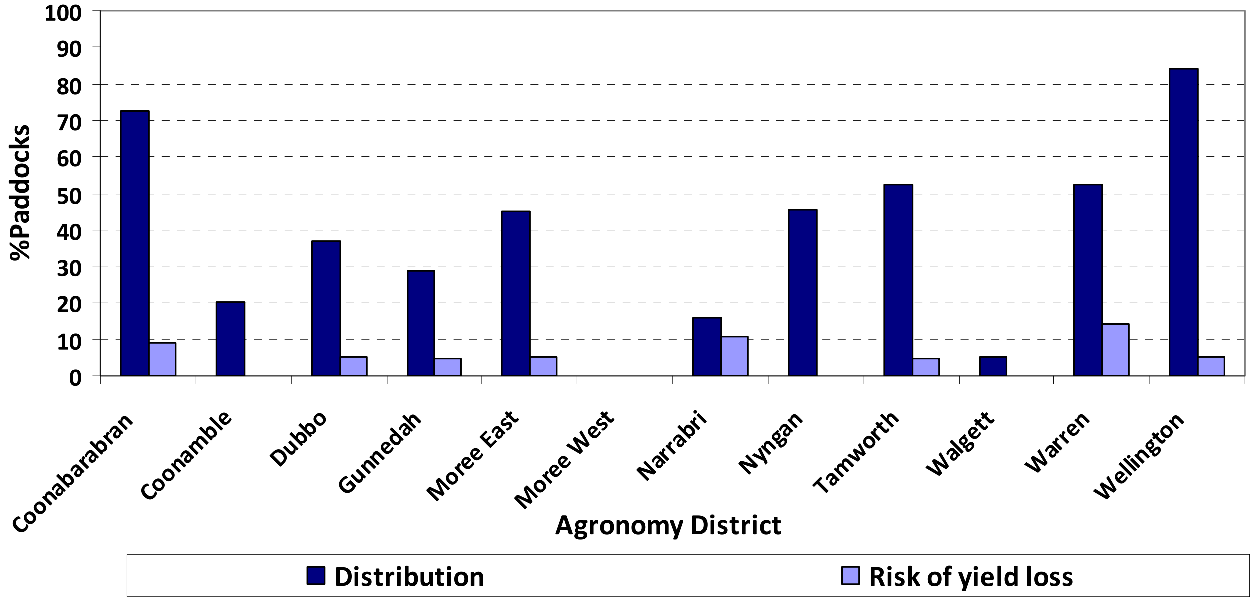

Figure 2: Distribution and potential importance of Pratylenchus neglectus in central and northern NSW

- *Pratylenchus neglectus* (*Pn*) was widespread being detected in 11 of the 12 agronomy districts (all except Moree West) but generally had a lower distribution within districts than *Pt* of between 5 to 84% of paddocks. Averaged across districts, *Pn* was detected in 38% of random paddocks in central and northern NSW.
- Only 5% of paddocks had high *Pn* populations (>2,000 *Pn*/kg soil) indicating a risk of yield loss in 2011 if intolerant varieties were sown.

COMMON ROOT ROT DISTRIBUTION AND IMPORTANCE

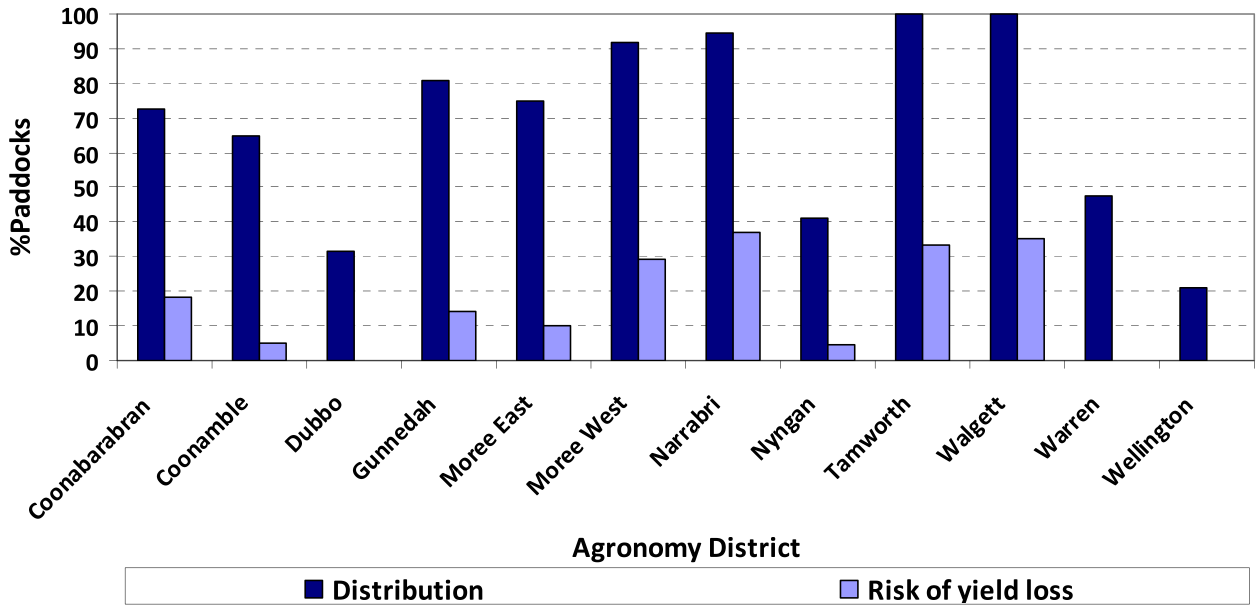

Figure 3: Distribution and potential importance of common root rot in central and northern NSW

- *Bipolaris sorokiniana* (*Bs*), the cause of common root rot (CRR), was very widespread being detected in all 12 agronomy districts and distributed in between 21-100% of random paddocks within each district. Averaged across districts *Bs* was detected in 69% of random paddocks in central and northern NSW.
- *Bs* populations were generally low but reached populations representing a medium to high risk of yield loss from CRR in 2011 in around 30% of paddocks in the Moree West, Narrabri, Tamworth and Walgett districts based on preliminary risk categories.
- A *Bipolaris* level >339 pg *Bs* DNA/g soil represents a high risk of yield loss from CRR based on early preliminary studies with Graham Wildemuth (QDPI retired). Four of the 20 paddocks surveyed in the Walgett district had levels ranging from 1,150 up to 3,940 pg *Bs* DNA/g soil, indicating a high risk of yield loss from CRR in these paddocks in 2011.

PYTHIUM DISTRIBUTION AND IMPORTANCE

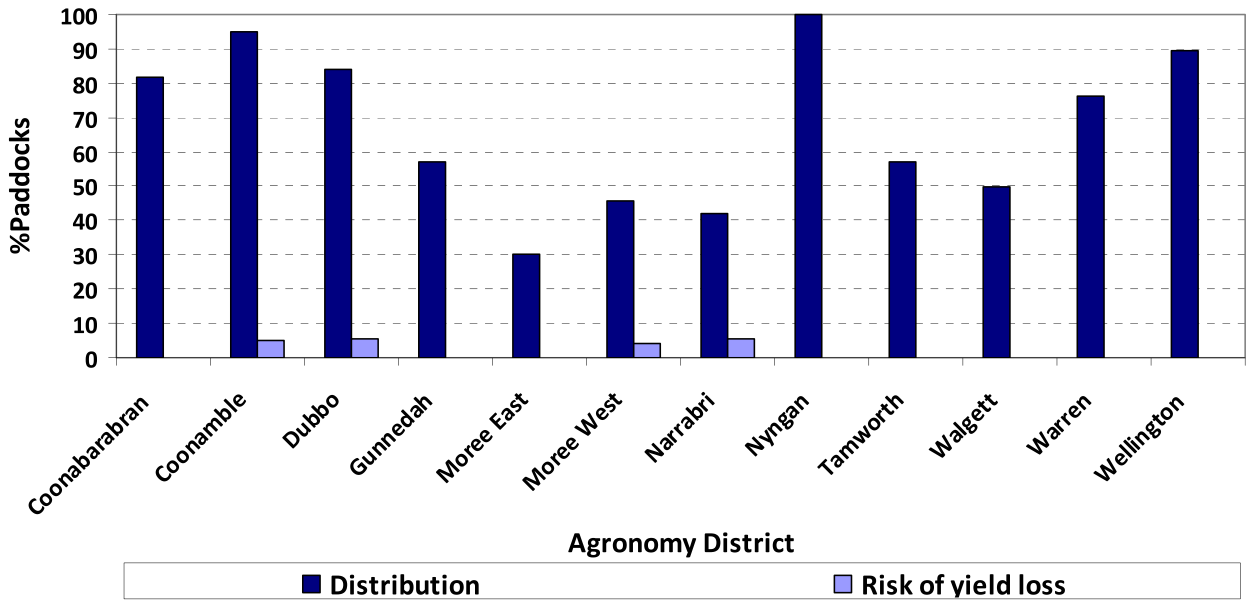

Figure 4: Distribution and potential importance of Pythium in central and northern NSW

- *Pythium* was widespread being detected in all 12 agronomy districts and distributed in between 30-100% of random paddocks within each district. Averaged across districts *Pythium* was detected in 67% of random paddocks in central and northern NSW.
- *Pythium* populations were generally low with populations in only one paddock in the Coonamble, Dubbo, Moree West and Narrabri districts being high enough to represent a medium or high risk of yield loss from *Pythium* infection in 2011 (<2% of random paddocks) based on preliminary risk categories.

CROWN ROT DISTRIBUTION AND IMPORTANCE

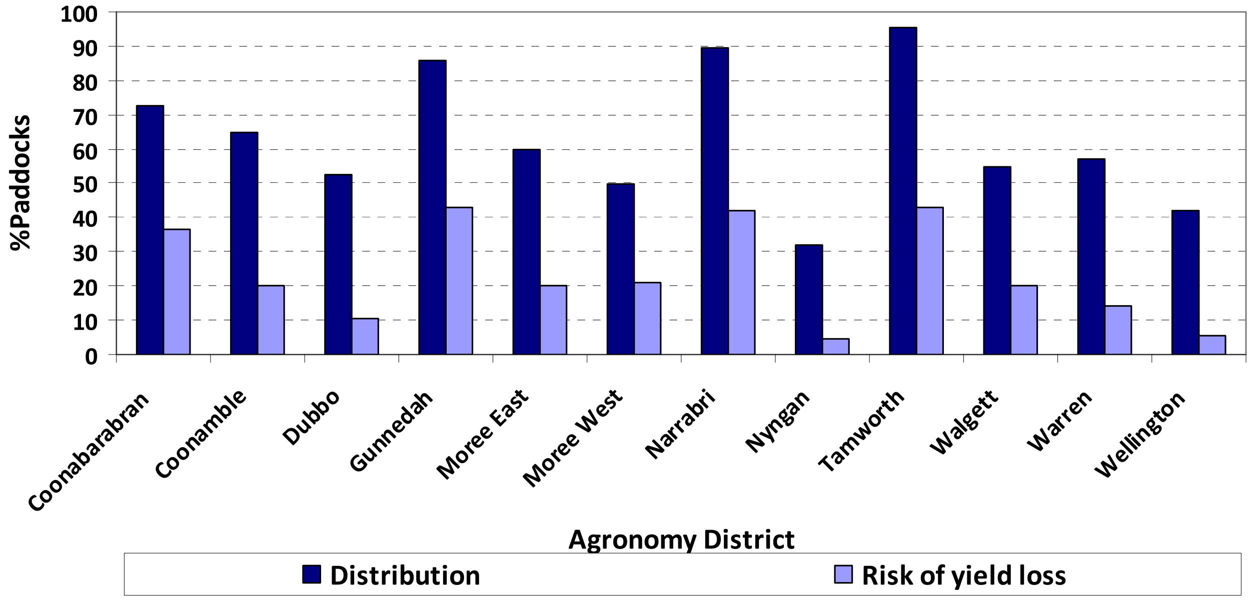

Figure 5: Distribution and potential importance of crown rot in central and northern NSW

- *Fusarium pseudograminearum* (*Fp*), the main cause of crown rot in winter cereal crops, was widespread across the survey area being detected in 32 to 95% of paddocks within each district. Averaged across districts *Fp* was detected in 63% of random paddocks in central and northern NSW.
- *Fp* populations were generally low but reached populations representing a medium to high risk of yield loss from crown rot in 2011 in around 30% or more of paddocks surveyed in the Coonabarabran, Gunnedah, Narrabri and Tamworth districts based on preliminary risk categories.

FUSARIUM HEAD BLIGHT DISTRIBUTION AND IMPORTANCE

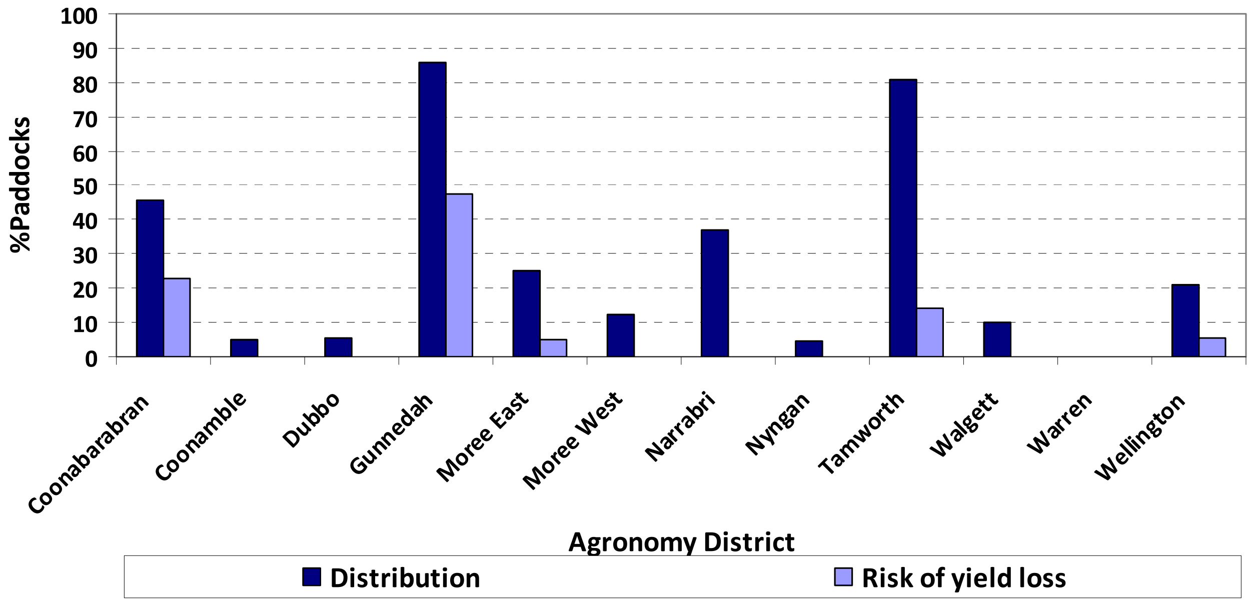

Figure 6: Distribution and potential importance of Fusarium head blight in central and northern NSW

- *Fusarium graminearum* (*Fg*), the main cause of Fusarium head blight (FHB) in winter cereal crops, was detected in all districts except Warren. The number of paddocks within a district in which *Fg* was detected was generally low with the exception of Coonabrabran, Gunnedah, Narrabri and Tamworth districts. Averaged across districts *Fg* was detected in 23% of random paddocks in central and northern NSW.

- The actual level of *Fg* required to present a risk of yield loss from FHB is not known so we assumed that a similar level is required as for *Fp* to cause crown rot. Based on this preliminary level, *Fg* populations were generally low but reached populations representing a medium to high risk of yield loss from FHB in 2011 in 5 paddocks in Coonabarabran, 10 paddocks in Gunnedah, 3 paddocks in Tamworth and 1 paddock in both the Moree East and Wellington districts.

CONCLUSIONS

Root lesion nematodes (RLN) are widespread in central and northern NSW with either species being detected in 82% of the 248 paddocks assessed in this random survey. *Pt* generally has a much higher distribution (70% random paddocks) than *Pn* (38% random paddocks). Mixed populations of both RLN species were detected in 26% of paddocks but in only 3 of these paddocks (1.2% of surveyed paddocks) was the population of both *Pt* and *Pn* above the threshold for yield loss. Soil populations of *Pt* were generally higher with 33% of paddocks having *Pt* levels representing a risk of yield loss in 2011 compared to only 5% of random paddocks with *Pn.* RLNs need to become a consideration in rotation sequences within central and northern NSW to maintain, and reduce where needed, populations of both nematode species below damaging levels.

Bs is also widespread in central and northern NSW being detected in around 69% of the 248 random paddocks surveyed in 2011. Fortunately, *Bs* populations around sowing were generally low and only represented a risk for yield loss from common root rot in 16% of paddocks.

Pythium was similarly widespread in the region being detected in 67% of the 248 random paddocks surveyed in 2011. Fortunately, *Pythium* populations around sowing were generally low and only represented a risk for yield loss in <2% of paddocks based on southern thresholds.

Fp, the cause of crown rot, was detected in 63% of the 248 random paddocks surveyed in 2011. Levels were high enough to represent a medium to high risk of yield loss from crown rot in 23% of the paddocks surveyed across central and northern NSW.

Fg, the cause of Fusarium head blight, was detected in 28% of the paddocks surveyed in 2011 which a much higher distribution in 80% or more of paddocks surveyed in both the Gunnedah and Tamworth districts. The Coonabarabran district also had a high distribution of *Fg* (45% of paddocks). The numbers of paddocks in these districts with higher levels of *Fg*, representing a risk of FHB in 2011 was also greater being 48% of paddocks in the Gunnedah, 23% in the Coonabarabran and 14% in the Tamworth districts. These districts encompass or border the Liverpool Plains region which has historically had issues with FHB caused by *Fg,* including the 2010 season. Wet weather during flowering (anthesis) is still required for these high inoculum levels within some paddocks to cause significant FHB infection but it does appear promising that the PreDicta B test can identify particular paddocks at risk.

Note, both Fusarium species (*Fp* and *Fg*) can cause FHB as occurred in the wet 2010 season. However, only *Fg* produces an airborne spore whereas FHB infection from *Fp* results from rainsplash of larger spores from the tiller bases infected with crown rot. This is a much rarer event and usually results in less severe FHB infection compared to that caused by *Fg.* It has also been shown that *Fg* can be associated with causing crown rot but *Fp* is the dominant species isolated from infected tillers in the northern region. However, in practical terms the detection of either *Fp* and/or *Fg* at high levels (>100 pg DNA/g soil) within a paddock should be taken as a medium to high risk situation in terms of both crown rot and FHB if conditions conducive to the expression of either disease eventuates during the season.

ACKNOWLEDGEMENTS

This survey is partially funded by GRDC under projects DAN00143 and DAS00115. Assistance of NSW DPI District Agronomists in co-ordinating survey paddocks and sampling is gratefully acknowledged. We also thank all the growers who allowed access to their paddocks for this survey.

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