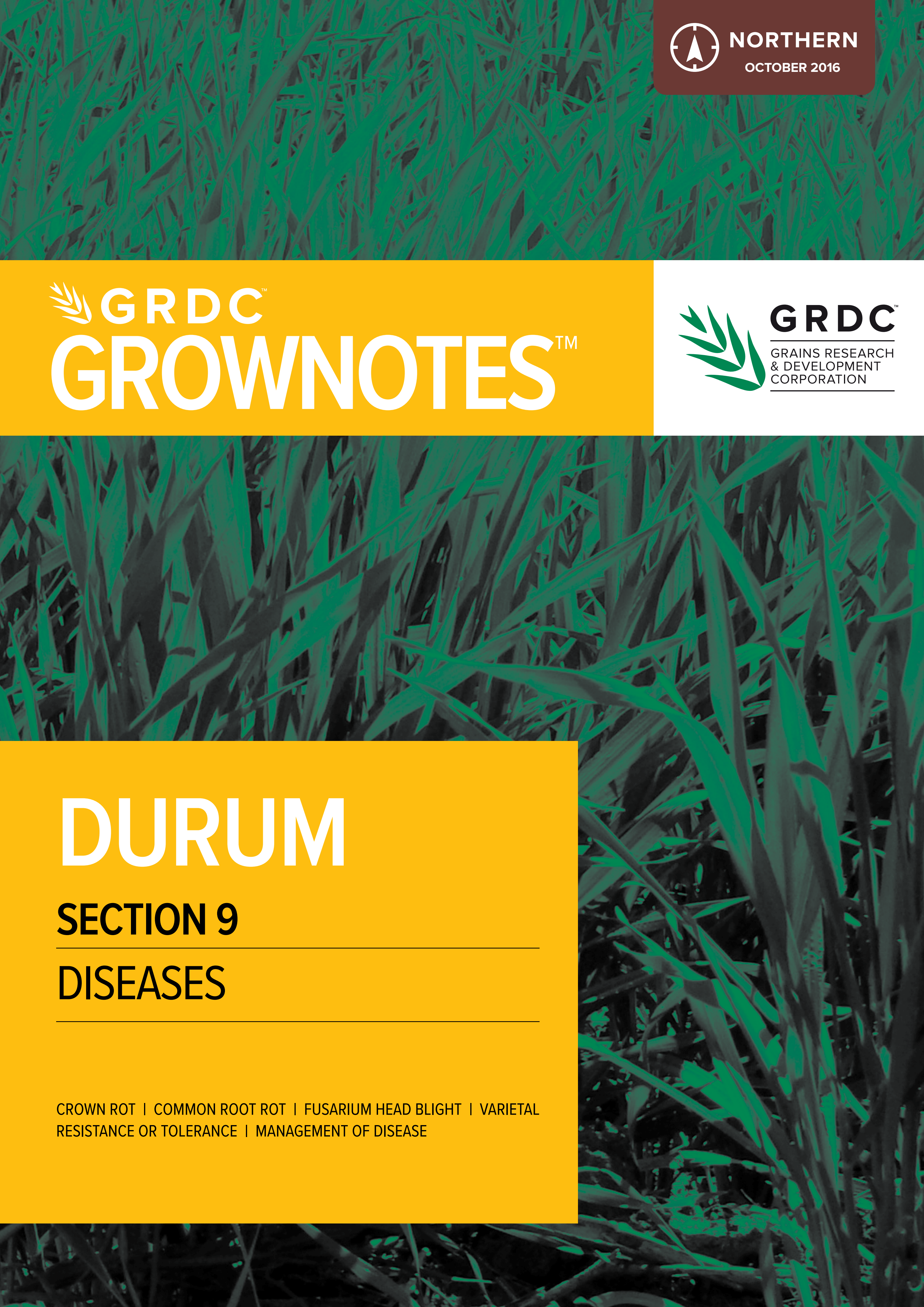

NORTHERN
OCTOBER 2016

GRDC GROWNOTES™

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

DURUM

SECTION 9

DISEASES

CROWN ROT | COMMON ROOT ROT | FUSARIUM HEAD BLIGHT | VARIETAL RESISTANCE OR TOLERANCE | MANAGEMENT OF DISEASE

SECTION 9

Diseases

For more information, see the *GRDC GrowNotes WHEAT (Northern region),* Section 9: Diseases.

Durum varieties generally have useful levels of resistance to all pathotypes (including the new virulent strains) of the three rusts – stem, leaf and stripe rust - but are very susceptible to crown rot. They are also susceptible to Fusarium head blight, which is common in very wet seasons and in areas where durum is grown in close proximity to maize stubble. [1]

The major diseases of durum wheat are controlled by genetic traits that have been crossed into current varieties. These include tolerance to the major diseases such as stem, leaf and stripe rust. The changing pattern of behaviour of leaf and stem diseases of all cereal crops requires careful monitoring. It is most important to report any irregularities in the behaviour of these diseases to an adviser/agronomist or plant breeder. Yellow leaf spot, another significant disease of winter crops, is largely avoided by not planting cereal crops into previous cereal crop residues; hence, crop rotation is important. Most durum varieties carry useful resistance. [2]

More information

R Graham, N Graham, S Simpfendorfer (2015), Yield impact of crown rot and sowing time on winter cereal crop and variety selection Tulloona 2015.

S Simpfendorfer, R Graham, G Brooke (2015), Yield impact of crown rot on winter cereal crop and variety selection (Nyngan 2015).

A Verrell (2016), Integrated management of crown rot in a chickpea – wheat sequence.

S Simpfendorfer (2016), Crown rot – does cereal crop or variety choice matter?

S Simpfendorfer (2016), Do seed treatments have a place with crown rot.

E Readford, D Tan, R Tokachichu, R Trethowan (2015), The effect of crop rotations on the incidence of crown rot in wheat.

R Graham, S Simpfendorfer, G McMullen, N Graham (2015), p104.

9.1 Crown rot

Crown rot, caused predominantly by the fungus *Fusarium pseudograminearum*, is considered the most important disease of durum wheat in the northern grains region, and is also a major constraint to both bread wheat and barley production. Yield losses attributed to crown rot can exceed 60% in susceptible crops such as durum wheat particularly if moisture stress occurs during grain filling. Crown rot infection is characterised by a honey-brown discolouration at the base of infected tillers. [3] Infection of winter cereals can occur through the crown, sub-crown internode, basal internode and/or lower leaf sheaths. This can occur at any growth stage from seedling emergence through to maturity. Crown rot infection is characterised by a light honey-brown to dark brown discoloration of the base of infected tillers. The fungus survives in cereal and grass weed residues, while yield loss from the production of whiteheads is related to moisture stress post-flowering (Figure 1). [4]

Rotation to non-host pulses (chickpea, faba bean), oilseeds (canola, mustard) or summer crops (sorghum, sunflower, mungbean, cotton) essentially reduces crown rot inoculum levels by starving the fungus of a suitable host and allowing natural decline of cereal residues that harbour the pathogen. The length of rotation needed for effective management of crown rot depends on the rate of decomposition of the infested residues. In particular, canola and mustard provide an effective break crop for crown rot

1 P Matthews, D McCaffery, L Jenkins (2016), Winter crop variety sowing guide 2016. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2016.pdf

2 Primary Industries Science and Research. Tamworth Agricultural Institute—Research projects. Australian durum wheat improvement Program (ADWIP). NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/research/centres/tamworth/research-projects

3 R Graham, S Simpfendorfer, G McMullen, N Graham (2015), Fusarium crown rot of wheat - impact on plant available soil water usage. http://www.agronomy2015.com.au/papers/agronomy2015final00210.pdf

4 S Simpfendorfer,J Kirkegaard, J Holland, A Verrell, R Bambach, K Moore (2004) Managing soil-borne and stubble-borne cereal pathogens in the northern grains belt. In: Proceedings Soil Biology in Agriculture Workshop. pp. 112–119. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/166919/soil-biology-agriculture.pdf

in northern NSW. Furthermore, brassicas would provide an excellent alternative rotation crop to chickpea in areas where adapted varieties are available, as they appear to have an improved capacity to reduce the severity of crown rot in subsequent wheat crops. [5]

Resistance to crown rot must continue to be a major breeding objective if the industry is to expand. There appears very little genetic tolerance to crown rot within the tetraploid (durum) population. This means that durable resistance will most likely have to be bred into durum from the hexaploid (bread wheat) population as a matter of high priority. [6] In 2012, crosses of bread and durum wheat lines were produced showing partial resistance equal to, or better than, the bread wheat parent. [7] Work is under way to boost crown rot resistance in durum wheat.

Figure 1: 'Whiteheads' (left) associated with crown rot infection in a highly susceptible durum variety, and a breeding line with partial resistance to the disease (right).

9.2 Common root rot

Common root rot, caused by the fungus *Bipolaris sorokiniana*, is often found in association with crown rot. Symptoms are a dark brown to black discoloration of whole or part of the sub-crown internode. Severely affected plants are stunted, have fewer tillers and produce smaller heads. Rotation to non-host break crops is essential to the successful management of both of these diseases.

5 S Simpfendorfer,J Kirkegaard, J Holland, A Verrell, R Bambach, K Moore (2004) Managing soil-borne and stubble-borne cereal pathogens in the northern grains belt. In: Proceedings Soil Biology in Agriculture Workshop. pp. 112–119. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/166919/soil-biology-agriculture.pdf

6 J Kneipp (2008) Durum wheat production. NSW Department of Primary Industries, http://www.nvtonline.com.au/wp-content/uploads/2013/03/Crop-Guide-NSW-Durum-Wheat-Production.pdf

7 R Bowman (2012) Durum to partially resist crown rot. GRDC Ground Cover Issue 96, http://www.grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-96-January-February-2012/Durum-to-partially-resist-crown-rot#sthash.2xvPfsnB.dpuf

9.3 Fusarium head blight

Fusarium head blight (FHB) is a fungal disease that can occur on many grass species, including both crop and weeds. Where it occurs in crops it is most commonly in wheat, durum and barley. Durum is more susceptible to the disease than bread wheat and barley.

Durum crops should be avoided in areas where there is a likelihood of the disease developing. While FHB can be caused by several species of *Fusarium*, the most common species causing the disease is *Fusarium graminearum*. It can cause significant yield losses and quality reductions. Major yield losses occur mainly from floret sterility.

Additional yield and quality losses can occur when damaged and shrivelled lightweight grains are produced as a result of infection. Quality reductions may also occur from seed discoloration, varying from whitish-grey and pink to brown. Fungal infection can sometimes be associated with the production of a toxin (mycotoxins).

If fungal toxins are produced in infected seed, the grain is often unacceptable for certain end uses and downgraded in the marketplace depending on the concentration of toxin present. Toxin levels and fungal infection cannot be accurately estimated from visual appearance.

More information

http://www.daff.qld.gov.au/plants/health-pests-diseases/a-z-significant/fusarium-head-blight

Crop rotation is effective in reducing levels of FHB. Corn is a major alternative host for *F. graminearum* and planting durum in and around corn residues will increase the risk of head blight. The best rotational crops for reducing the inoculum level include any non-grass species (e.g. sunflower, cotton, soybean, chickpea, mungbean, faba bean, canola, field peas). Currently, no seed dressings are registered for control of seedling blight caused by the FHB pathogens. [8]

9.4 Varietal resistance or tolerance

More information

R Long (2015), Crown rot tolerance in new wheat cultivars - is there enough to base varietal decisions on?

New wheat lines are offering hope for providing partial resistance to crown rot disease in durum wheat. The finding is important because durum wheat is particularly susceptible to crown rot. The pathogen causes annual crop losses in Australia estimated at $79 million, or $6.63/ha.

Research funded by the Grains Research and Development Corporation (GRDC) shows that partial crown rot resistance in bread wheat lines could be transferred into durum wheats. Crosses of bread (hexaploid) and durum wheat lines have been produced that show levels of partial resistance equal to, or better than, the bread wheat parent Sunco.

Development of new durum varieties with partial resistance to crown rot could increase yields and quality, and ultimately allow for expansion of Australia's durum industry.

Partial resistance needs to be coupled with an integrated approach to managing the disease, as there is no total resistance to crown rot fungus infection in durum or other cereals. The genes involved provide partial resistance, which appears to slow the rate of it spreading through tissue. [9]

8 DAFF (2012) Fusarium head blight, or head scab. Queensland Department of Agriculture, Fisheries and Forestry, http://www.daff.qld.gov.au/plants/health-pests-diseases/a-z-significant/fusarium-head-blight

9 R Bowman (2012) Durum to partially resist crown rot. GRDC Ground Cover Issue 96, http://www.grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-96-January-February-2012/Durum-to-partially-resist-crown-rot

Stem rust

Caparoi exhibits an excellent foliar disease resistance package. It has also been observed to be genetically diverse from EGA Bellaroi and Jandaroi. This broadening of the genetic base of durum varieties is important for long-term sustainable crop production. Kamilaroi, Yallaroi, Wollaroi and EGA Bellaroi are fully resistant to all existing field strains of stem rust. While stem rust infection is not expected, a new virulent strain may occur.

Leaf rust

Kamilaroi, Yallaroi, Wollaroi and EGA Bellaroi possess slow rusting resistance to all field strains of leaf rust. A small level of infection may be evident as the plant approaches maturity; however, this disease level will not affect yield.

More information

S Simpfendorfer (2015), Wheat rust in 2015 – where are we heading?

Stripe rust

The current durum varieties all express adequate resistance to field strains of this disease at present. The breeding program endeavours to predict virulence changes in all three rust organisms and incorporate appropriate resistance genes into future varietal releases, to remain one or two virulence changes ahead of the rust. The earliest possible detection of new virulent strains, in the unlikely event that they arise, will greatly assist disease-resistance breeding activities. When such a strain is found, steps can be taken to warn growers of a new virulence change and suggest changes to variety recommendations. It is crucial to maintain effective resistance to all field strains of each rust organism in each of the released varieties. Such a comprehensive effective resistance will significantly reduce the build-up of inoculum, leading to less disease both within and between growing seasons. In addition and more importantly, the likelihood that a new virulent strain will arise is greatly reduced. By reducing the chance of the development of a new virulence, the life of the current resistances is greatly prolonged. This amounts to effective conservation of our valuable genetic resources. If breeders are not required to spend considerable breeding resources on developing improved resistant varieties, those resources can be redirected to the improvement of other economically important traits.

Yellow leaf spot

All current northern varieties, EGA Bellaroi, Caparoi and Jandaroi, are rated MR-MS for yellow leaf spot. As yellow leaf spot inoculum is carried over on wheat straw, durum is a better proposition for avoiding yellow leaf spot in stubble-retained situations. [10]

9.5 Management of disease

9.5.1 In-crop fungicides and timing

A NSW DPI study into fungicide use in durum to control FHB shows that timing of fungicide application is critical to efficacy. Although Folicur® still provided measurable suppression of FHB, Prosaro® clearly provided superior levels of control. Prosaro application at GS61 reduced FHB severity by 81%, compared with only 56% control with the application of Folicur at the same timing. This translated into a 130% yield benefit (2.37 t/ha) with Prosaro and 66% (1.20 t/ha) with Folicur compared with the nil fungicide control treatment.

The timing of fungicide application was critical to the efficacy of both fungicides. Spraying 7 days before flowering (flowering, GS61) reduced control levels and the associated yield benefit compared with application at GS61 (+0 days). The anthers (flowers) are the primary infection site for *F. graminearum*, so spraying before flowering provides reduced protection of these plant structures.

Although not examined in that study, overseas research has demonstrated the importance of spray coverage in FHB control, with twin nozzles (forward and backward

10 R Hare (2006) Agronomy of the durum wheats Kamilaroi, Yallaroi, Wollaroi and EGA Bellaroi. Primefacts 140, NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/63646/Agronomy-of-the-durum-wheats---Primefact-140-final.pdf

More information

See the NSW DPI publication 'Northern grains region trial results 2013', pp. 132–136: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/468328/Northern-grains-region-trial-results-autumn-2013.pdf

www.apvma.gov.au

facing) angled to cover both sides of a wheat head and high volumes of water (≥100 L/ha) being critical to efficacy. Aerial application has reduced efficacy for FHB control based on overseas studies.[11]

11 S Simpfendorfer (2013) Control of *Fusarium* head blight in durum wheat using the fungicide Prosaro®. In: Northern grains region trial results, pp. 132–136. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/468328/Northern-grains-region-trial-results-autumn-2013.pdf