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Fusarium head blight of cereals and stalk rot of maize, millet and sorghum and their identification

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Key messages

- Fusarium head blight reduces yield and greatly reduces marketability of grain. Wheat, barley, oats, triticale and rye are susceptible to Fusarium head blight.
- Maize, millet, sorghum and related grasses are susceptible to stalk rot caused by the same fungus, *Fusarium graminearum*.
- The fungus can spread through infected seed or from infested crop residues.
- Highest risks from this disease are when cropping summer cereals with stubble retention in sequence with winter cereals.
- Look for dead bleached spikelets during grain filling.
- Distribution in Western Australia is limited. Take care to avoid spread of this fungus.

Fusarium head blight is a very damaging and persistent threat to wheat and barley in many production areas of the world. It causes yield reductions and quality defects in grain, and most notably, it produces fungal toxins which affect grain marketability.

The main fungus causing Fusarium head blight is *Fusarium graminearum* (sexual stage *Gibberella zeae*). Head blight is sometimes also a complex with other *Fusarium* species, including *F. culmorum*, *F. pseudograminearum* and *F. avenaceum*.

The fungi causing Fusarium head blight produce several toxins, most commonly DON (deoxynivalenol = vomitoxin). The milling, malting and brewing industries set very strict tolerances for Fusarium toxins in wheat and barley.

In addition to wheat and barley, *Fusarium graminearum* also affects maize, millet and sorghum. The survival of the fungus on stubble and its capacity to spread through wind-blown spores or on seed, represent significant risks in the cropping of winter cereals in sequence with summer cereals with stubble retention.

The fungus *F. graminearum* was recorded as a stalk rot of sorghum in Western Australia in 1959, but has been considered rare. It was detected in grain of wheat in Western Australia in 2004 on a quality assurance sample from the 2003/04 harvest and subsequently on residues of summer cereal crops.

Symptoms

Winter cereals – head blight

- dead bleached spikelets appear several weeks after flowering; spikelet death spreads along the head and heads ripen prematurely
- pink or orange spores form at the edge of glumes (with wet conditions)
- white or pink discoloured and shrivelled grain ('Fusarium damaged kernels')
- small blue/black fruiting bodies (perithecia) grow on affected heads and crop residues
- seedlings can be blighted in young crops sown with infected seed

Figures 1a and b. Symptoms of a) wheat and b) barley with partially blighted heads

During grain fill, look for scattered, bleached heads that indicate the disease (Figures 1 and 2). At harvest, look for white or pink discoloured and shrivelled grains known as Fusarium-damaged kernels (FDK) (Figure 3), among normal grain in a sample. On crop residues, look for small blue/black 'poppy seed' clusters of fruiting bodies (perithecia) (Figure 4a).

Figure 2. Orange spores form at the edge of glumes, with wet conditions

Figure 3. Fusarium-damaged kernels may be evident as shrivelled and discoloured white (top) or pink (centre) grain among normal grain (bottom)

Figures 4a and b. Perithecia of the fungus, clustered like poppy seeds on a) wheat and b) millet

Summer cereals – stalk and cob rot

The fungus causes root and stalk rot of summer cereal crops such as maize, millet and sorghum (Figure 5). Infected stalks become straw-coloured or otherwise discoloured and plants may wilt. Red discolouration develops inside stalks and perithecia may develop at internodes or around stem bases. Maize also develops cob rot (Figure 6). Summer crop residues are large and break down slowly. This infected crop debris is a source of infection (Figure 4b) for several years.

Figure 5. Stalk rot of summer crops can result in lodging (at arrows)

Figure 6. Cob rot of maize caused by Fusarium graminearum*. Affected kernels are brown and may show purple or white fungal growth*

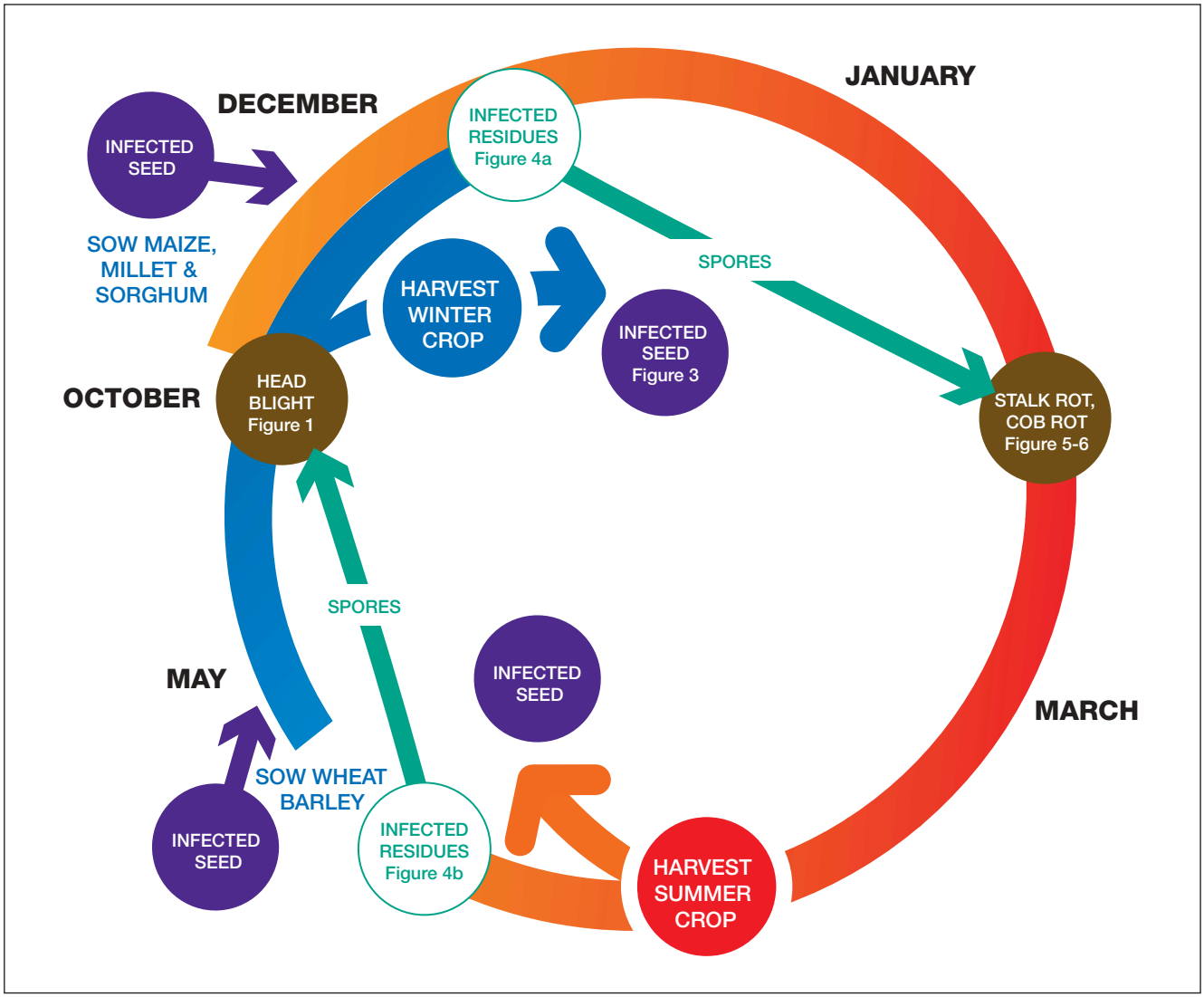

Figure 7. The life cycles of the fungus on winter cereals (blue) and summer cereals (orange) in Western Australia

Seedling blight

The use of Fusarium-affected seed for sowing can result in seedling blight, reducing plant establishment and vigour. Seed from an affected crop should not be sown as this is an important means of spread of the disease into new areas. Seed suspected of infection with Fusarium may appear normal and should be tested before sowing.

Infection cycle

The fungus is seed borne. It also spreads locally through airborne spores produced on infested crop residues of either summer or winter cereals (Figure 7). Spores are blown onto heads of wheat and barley (or other winter cereals) and infect through flower parts. Initially, infected florets become bleached and die (Figures 1 and 2). Severe infection follows multiple infection periods, then spread of the fungus through the head along the stalk. Affected heads ripen prematurely, forming white or pink discoloured and shrivelled grains (Figure 3). The fungus produces perithecia, small purple/black fruiting bodies (like poppy seeds), on residues of infected winter or summer cereals (Figure 4). They release spores of the fungus that are dispersed through air and infect subsequent cereal crops.

Disease risk

Cropping practices

- Summer cereal crops host the fungus. Maize, millet or sorghum cropping has been strongly linked to FHB in winter cereals.
- Stubble retention can favour this disease because the fungus survives on crop residues. Do not follow summer crops with winter cereals until all summer crop residue is broken down, that is, 24 to 36 months after harvest of the summer crop.
- Separate winter cereal crops (for example wheat, barley) from summer crop residues by 500m.
- Avoid multiple winter cereal crops which can promote the disease once established.

Climate

- Fusarium head blight is a destructive disease in humid and semi-humid wheat and barley growing areas.
- The fungus develops active spore production at temperatures of 9^{o} to 30^{o}C when humidity in crop canopies is high (around 90 per cent) and stubble residues are moist with dew or rain.
- Head infection is favoured by moisture or high humidity around flowering time.

Potential losses

Reduced grain number and smaller grain size can affect yield by up to 30-50 per cent with severe quality impacts. In situations overseas where Fusarium head blight has become endemic, significant discounts have applied to affected grain.

FHB is one of the most devastating and serious diseases of barley. Fusarium-contaminated barley results in brewing problems (excess foaming causing gushing of beer) and consumers do not want beer that may contain traces of Fusarium toxins. Malting barley markets are very sensitive to Fusarium head blight.

Acknowledgements

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Further reading

Farmnote 79/2004 ‘Fusarium head blight - risk avoidance and integrated management in cereals’. Department of Agriculture, Western Australia.

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