

Fusarium mycotoxins

Regulations have been introduced setting legal limits for certain mycotoxins in cereals and cereal products intended for human consumption. In recent years very few grain samples from UK crops have exceeded these limits.

These guidelines aim to help the industry identify the risk factors and the appropriate agronomy which can minimise risk of mycotoxins from field infections. They also aim to identify when testing is appropriate without incurring needless costs.

These guidelines should be read in conjunction with the UK Codes of Practice produced by the Food Standards Agency, see: www.food.gov.uk/foodindustry/farmingfood/fusariumadvice

Occurrence and significance

Mycotoxins are toxic chemicals produced by specific fungi which infect crops. Different fungal species produce mycotoxins of widely varying toxicity to humans and animals; hence there are different permitted levels in foodstuffs and feed.

In cereals, mycotoxins can result from fungi that either develop in stored crops or from field-borne infections. This publication focuses on the fusarium mycotoxins, which can arise from field-borne infection. While fusarium mycotoxins remain stable during storage in the UK, levels do not normally increase.

Mycotoxins from storage fungi

Once in storage, grain may be infected by fungi, such as *Penicillium verrucosum*, which can produce the mycotoxin ochratoxin A when grain is stored damp, even for short periods. Grain above 18% moisture content is at risk.

Legal limits for ochratoxin A are 5ppb (parts per billion) for grain intended for human consumption and 3ppb in finished cereal products.

(see **The grain storage guide**).

Mycotoxins from field fungi

Five *Fusarium* species: *F. avenaceum*, *F. culmorum*, *F. graminearum*, *F. poae* and *F. langsethiae*; and *Microdochium nivale* and *M. majus* infect cereals and may cause 'head' (ear) blight. However, *Microdochium* species do not produce mycotoxins.

Some *Fusarium* and *Microdochium* species also cause seedling blight and brown foot rot (see **The Wheat Disease Encyclopaedia**).



Infection of ears by *Fusarium* species can result in mycotoxin development when the weather is warm and wet at flowering. Mycotoxin occurrence may be greater when wet weather delays harvest.

Crops infected at flowering may have individual bleached spikelets, or partially bleached ears, resulting at harvest in pink or chalky-white shrivelled grains. However, there is little correlation between fusarium-damaged grains and mycotoxin occurrence.

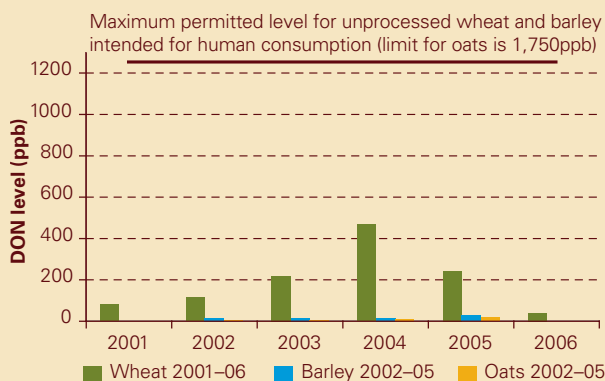


Figure 1. Average DON concentration in ex-combine cereal samples harvested (2,800 samples)

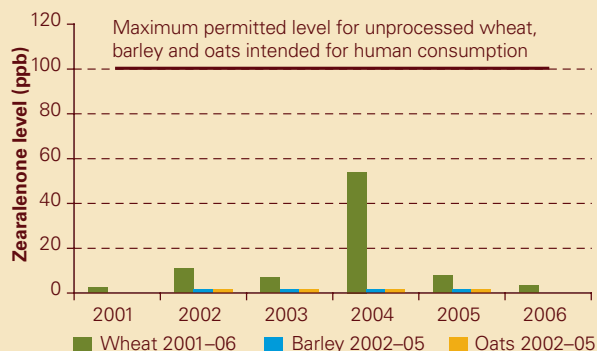


Figure 2. Average zearalenone concentration in ex-combine cereal samples harvested (2,500 samples)

Occurrence of mycotoxins in UK cereals

Levels of mycotoxins in cereals were assessed in HGCA and FSA-funded work across the UK.

The most common fusarium mycotoxins of concern are deoxynivalenol (DON) and zearalenone. There are legal limits for these mycotoxins in grain intended for human consumption. HT-2 and T-2 are also found in cereals and legal limits are under consideration.

Average results in wheat, barley and oats for DON and zearalenone are shown in Figures 1 and 2.

Wheat

DON and zearalenone are frequently detected in wheat, but average concentrations are well below the legal limits. Less than 3% of all samples taken between 2001 and 2006 exceeded the legal limits for DON and zearalenone.

Barley

In general barley had very low levels of DON and zearalenone compared to wheat and legal limits were not exceeded.

Oats

In general mycotoxin levels were low compared with wheat. The predominant *Fusarium* species that infect oats produce the mycotoxins HT-2 and T-2, for which there are currently no legal limits. However, ongoing research is investigating the risk factors associated with mycotoxins in oats.

There is good evidence that at least 90% of mycotoxins are removed during de-hulling. In 2003, a FSA survey of fusarium mycotoxins in retail oat products concluded "exposure to these toxins from this group in the UK diet is very low".

Maize

In the UK crop debris from maize grown for silage or grain can be a significant source of fusarium inoculum for following small grain cereal crops.

Control of fusarium in wheat

Rotation and cultivation help to reduce overwintering inoculum by lowering levels of infected crop debris on the soil surface.

Fungicides can provide control at various stages of the disease's life cycle:

1. Seed treatment: the main method of controlling seedling blight (see **Wheat seed health and seed-borne diseases – a guide**).
2. T1 fungicides: control stem-base disease, but not appropriate if only fusarium is present.
3. Effective T3 fungicides (eg dimoxystrobin, metconazole, tebuconazole or prothioconazole): specifically control fusarium head blight and other diseases (see **Wheat disease management guide**).

HGCA-funded R&D has indicated that:

- using azoles at half to full rate significantly reduced DON concentration in harvested grain.
- more reliable fusarium head blight control may be achieved by angling nozzles backwards. Medium spray quality, or air-included sprays, may provide better control than fine sprays.

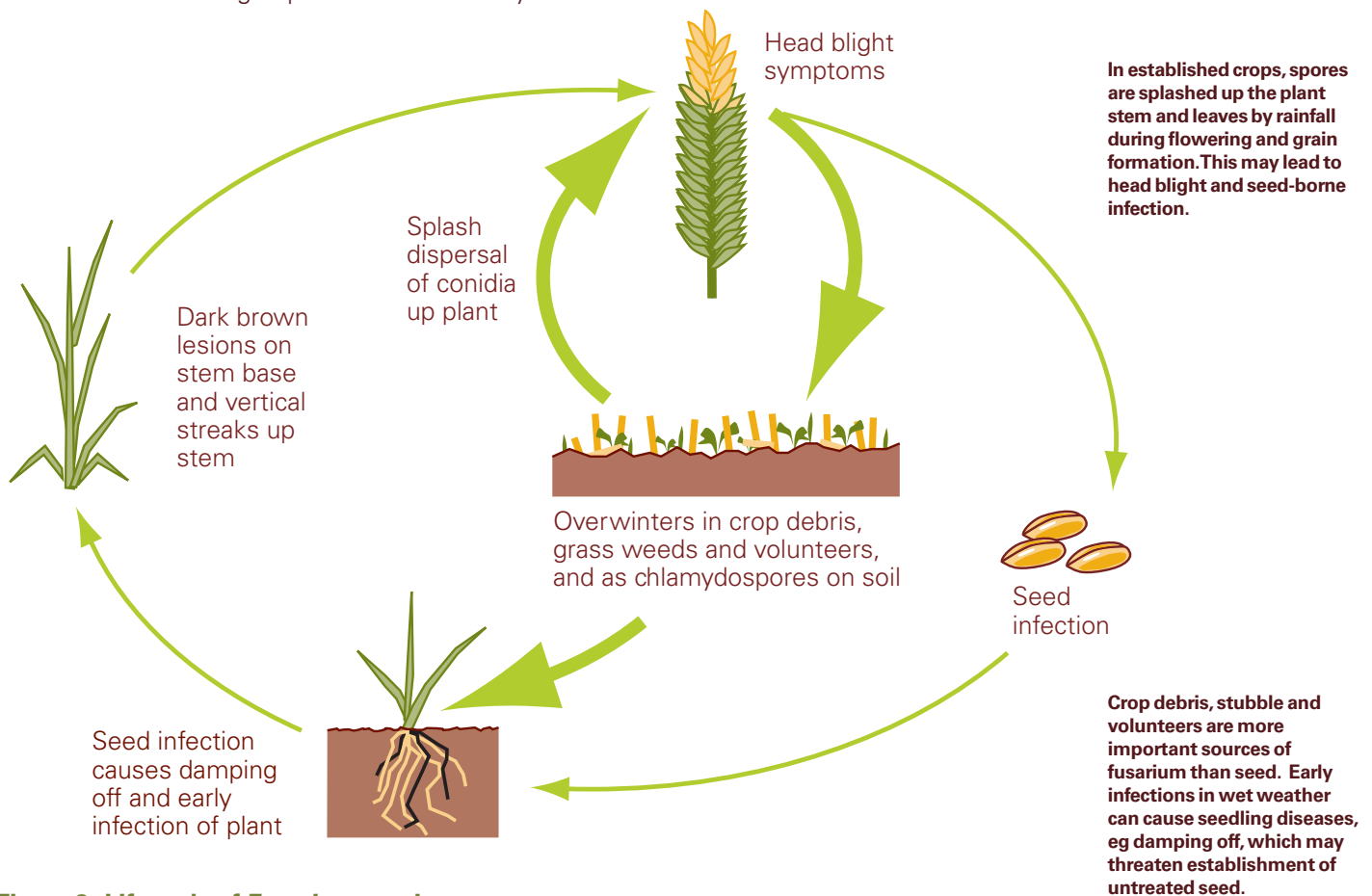


Figure 3. Life cycle of *Fusarium* species