Summary

Fusarium ear blight (*Fusarium* spp.) is seen as an increasing problem in many parts of Europe. The disease is of major concern due to the production of mycotoxins by the fungi involved. It is a disease which is highly linked to crop rotation and tillage methods. The risk is particularly high in regions where maize is a widely grown crop in the rotation and reduced or minimum tillage is practiced.

Genetic resistance is available with effective levels of control available in some cultivars. Application of good agricultural practices can help significantly to keep the disease and mycotoxin levels low. In seasons with high rainfall levels during flowering combined with high risk situations (normally maize and minimal tillage) specific fungicide programmes need to be applied during flowering.

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About ENDURE

ENDURE is the European Network for the Durable Exploitation of Crop Protection Strategies. ENDURE is a Network of Excellence (NoE) with two key objectives: restructuring European research and development on the use of plant protection products, and establishing ENDURE as a world leader in the development and implementation of sustainable pest control strategies through:

> Building a lasting crop protection research community

> Providing end-users with a broader range of short-term solutions

> Developing a holistic approach to sustainable pest management

> Taking stock of and informing plant protection policy changes.

Eighteen organisations in 10 European countries are committed to ENDURE for four years (2007-2010), with financial support from the European Commission's Sixth Framework Programme, priority 5: Food Quality and Security.

Website and ENDURE Information Centre

www.endure-network.eu

This publication was funded by EU grant (Project number: 031499), and is catalogued by the ENDURE Executive Committee as ENDURE Wheat Case Study - Guide Number 2, published in February, 2009

From Science to Field
Wheat Case Study – Guide Number 2

Strategies to Control *Fusarium* Ear Blight and Mycotoxin Production in Wheat

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endure
diversifying crop protection

Food Quality and Safety
SIXTH FRAMEWORK PROGRAMME

Strategies to Control *Fusarium* Ear Blight and Mycotoxin Production in Wheat

Fusarium ear blight is an increasing problem in many parts of Europe, and understanding the factors which influence the severity of the attack is key

Fusarium ear blight (*Fusarium* spp.) is seen as an increasing problem in many parts of Europe, including Germany, France, Denmark, Italy and Hungary. The disease is of major concern due to the production of several mycotoxins by the fungi involved which pose a threat to the health of both humans and animals.

There are several species of *Fusarium* that affect wheat, the main species being *F. avenaceum, F.culmorum, F. graminearum, F. poae* and *F. langsethiae*. *Microdochium nivale* and *M.majus* also affect wheat and may cause ear blight. However, *Microdochium* species do not produce mycotoxins; they are the main cause of seedling blight. Often several species can infect the same ear and the severity of attack depends mainly on weather conditions during flowering and a combination of agricultural factors.

Manipulating the agricultural factors can contribute strongly to reducing this risk, without the need for fungicides. Fungicides applied to the ear during flowering can reduce the incidence and severity of *Fusarium* ear blight but in high-risk seasons high levels of control are unlikely.

Typical symptoms of infection by *F. graminearum* and *F. culmorum*
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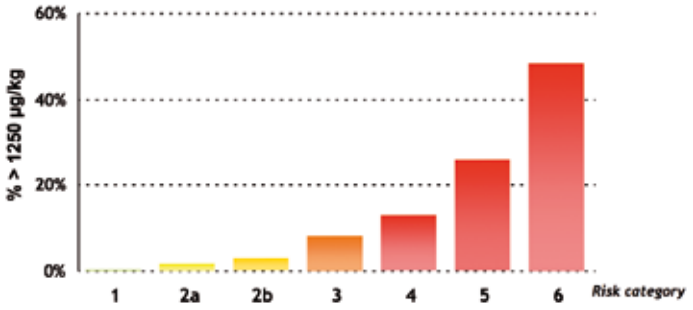

Figure 5: Risk percentage of exceeding the DON legal limit for each risk category (1902 fields surveyed from 2001 to 2008).
(Source: Arvalis, France)

Complete feedstuffs for		
- Pigs	900	250 (100*)
- Calves, Lambs and Kids	2000	500

* Feed intended for piglets or gilts

Reducing the risk of *Fusarium* by management

The risk from *Fusarium* is strongly linked to crop rotation and tillage methods. The risk is particularly high in regions where maize is a widely grown crop in the rotation. Direct drilling and reduced tillage leaving debris on the surface as a source of inoculum at field level also increase the risk of fusarium ear blight.

Typical life cycle of *Fusarium* species in wheat.

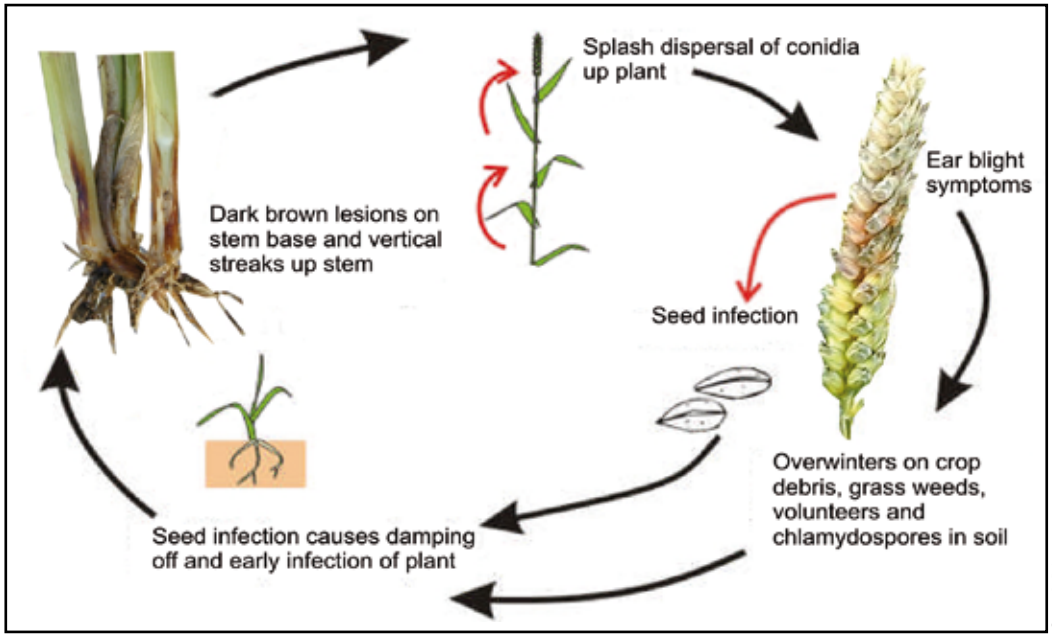

Table 1: Legal limits for mycotoxins (ppb) in grain intended for human consumption.

	DON	Zearalenone
Unprocessed soft wheat and barley	1250	100
Unprocessed durum wheat and oats	1750	100
Flour	750	75
Finished products	500	50
Infant food	200	20

Table 2: European Union guidance on mycotoxin levels (ppb) in grain intended for animal feed.

	DON	Zearalenone
Feed grains	8000	2000

DON risk assessment grid on wheat ARVALIS-Institut du végétal 2008

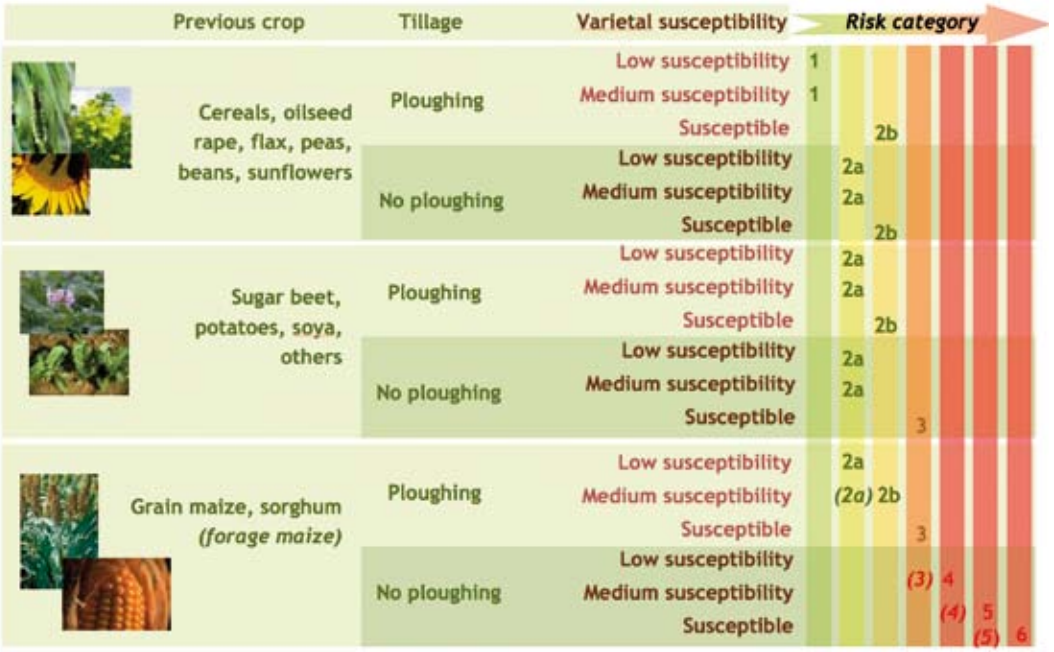

Figure 4: Decision key for DON risk (Source: Arvalis, France)

Fusarium mycotoxins

Fusarium mycotoxins are toxic chemicals produced by some species of *Fusarium* which attack the ears of wheat and other cereal crops. *Fusarium* mycotoxins are produced in the field as part of the fungal colonisation of the ear and rarely increase after harvest.

Infection of ears by *Fusarium* species occurs when the weather conditions during flowering are warm and wet. Wheat crops infected at flowering often have individual bleached spikelets or partially bleached ears, resulting in pink or chalky-white shrivelled grains at harvest.

Levels of ear blight seen in the field do not always correlate with mycotoxin occurrence. Legal limits exist for *Fusarium* mycotoxins (deoxynivalenol (DON) and zearalenone) in wheat intended for human consumption (see table 1) and there are guidance limits for grain for feed (see table 2).

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Figure 1 (overleaf) illustrates that maize as the preceding crop strongly increases the risk of DON-contamination in the following wheat crop. Minimal or reduced tillage increases this risk still further. Conversely, ploughing can significantly reduce the risk, even when maize is the previous crop. In some countries wheat after wheat in combination with minimal tillage has also been found to increase the risk of *Fusarium* ear blight.

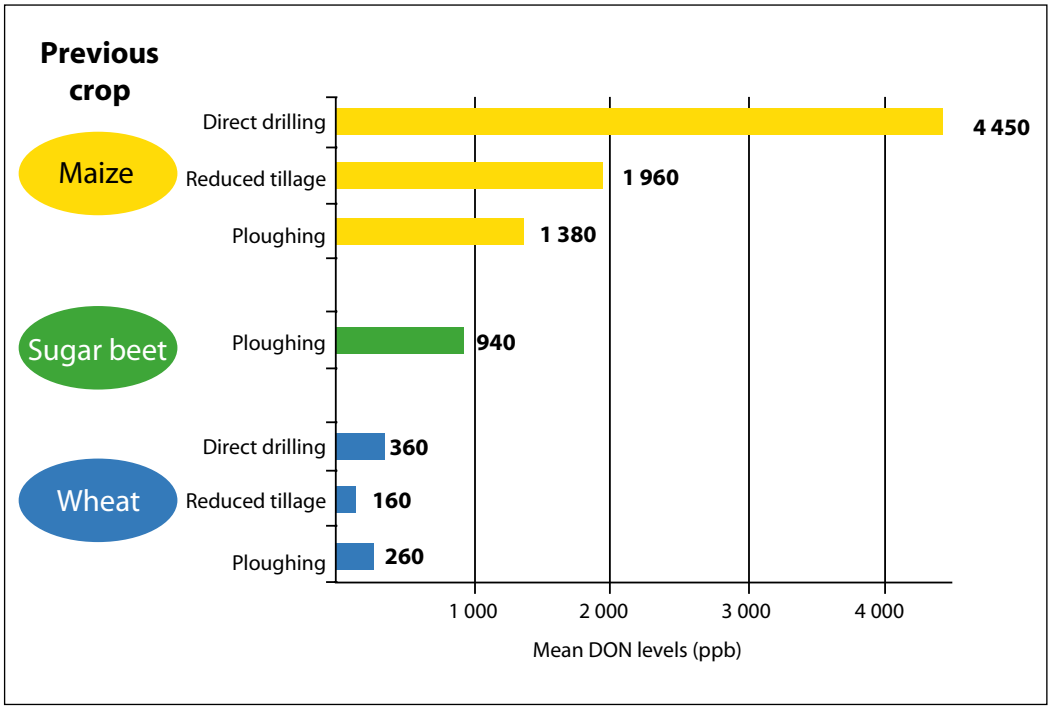

Figure 1: Mean DON levels for different preceding crops and tillage practices in Boigneville, France, from 1999-2004. (Source: Arvalis, France)

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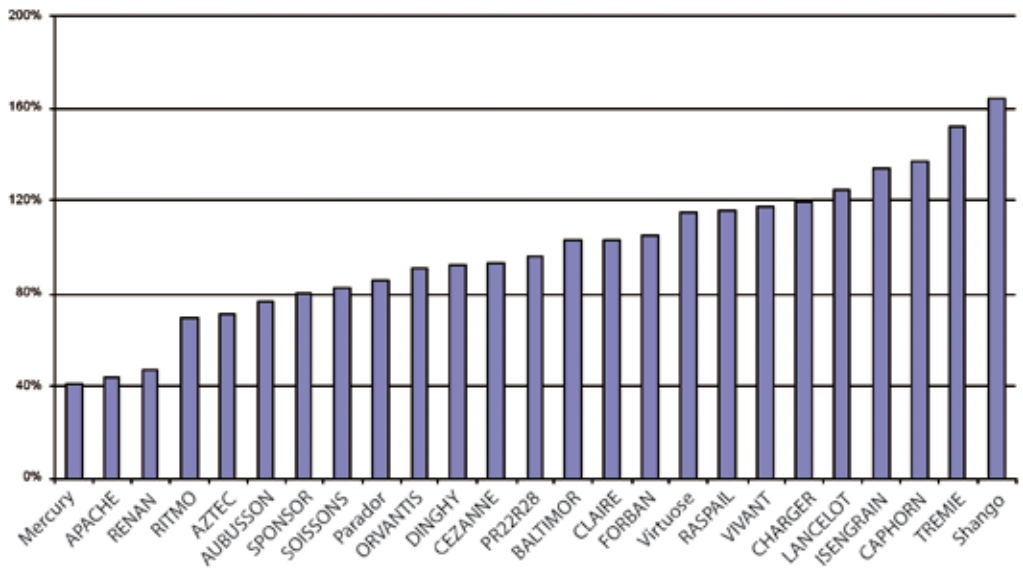

Figure 2: Mean levels (over six trials, 2001-2004) of DON accumulation in cultivars as % of the median value (Source: Arvalis, France).

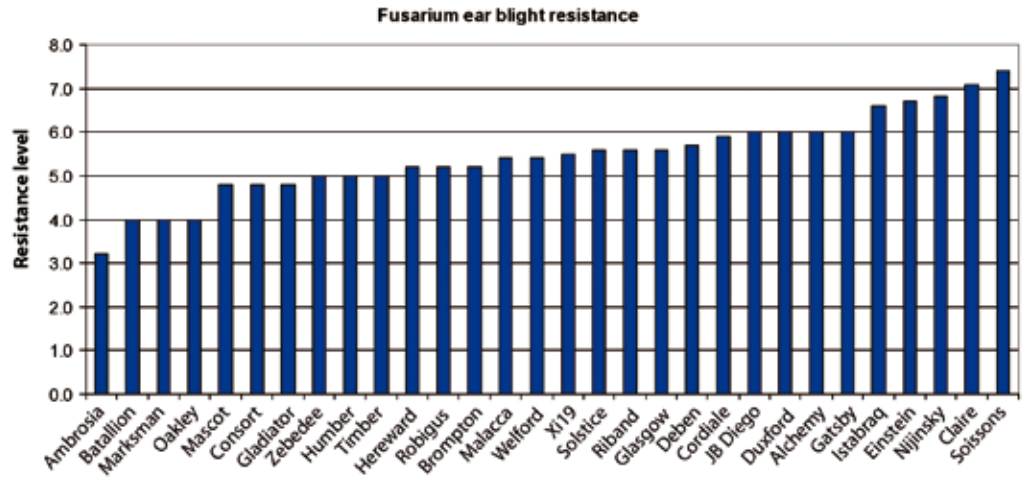

Figure 3: Resistance to *Fusarium* ear blight. A high figure equates to low levels of disease. (Source: HGCA Recommended List 2008, UK).