Samenvatting. **Strategieën voor de bestrijding van aarinfectie door *Fusarium* en mycotoxineproductie in tarwe**

Aarinfectie door *Fusarium* (*Fusarium* spp.) wordt beschouwd als een toenemend probleem in veel delen van Europa. De ziekte is vooral van belang door mycotoxinen die door deze schimmels worden geproduceerd. Het is een ziekte die nauw samenhangt met vruchtwisseling en grondbewerkingsmethoden. Het risico is vooral hoog in gebieden waar maïs een belangrijk deel uitmaakt van de vruchtwisseling en waar beperkte of minimale grondbewerking wordt toegepast.

Er bestaat genetische resistentie waarbij enkele rassen effectieve bestrijdingsniveaus bieden. Toepassing van goede landbouwpraktijk kan aanzienlijk bijdragen tot beperking van de ziekte- en mycotoxineniveaus. In seizoenen met hoge regenval tijdens de bloei in combinatie met situaties met hoge risico's (gewoonlijk maïs en minimale grondbewerking) moeten specifieke fungicidebehandelingen worden uitgevoerd tijdens de bloei.

Voor nadere informatie kunt u contact opnemen met:

Huub Schepers, PPO, Wageningen UR,
Postbus 430, 8200AK, Lelystad
Telefoon: (+31) 320 291 636
E-mail: huub.schepers@wur.nl

Over ENDURE

ENDURE is het Europees Netwerk voor de Duurzame Toepassing van Gewasbeschermingsstrategieën. ENDURE is een 'Network of Excellence' (NoE) met twee hoofddoelstellingen: herstructurering van Europees onderzoek en ontwikkeling op het gebied van gewasbeschermingsmiddelen en het ontwikkelen van ENDURE tot wereldleider in de ontwikkeling en toepassing van duurzame bestrijdingsstrategieën door middel van:

> Opbouw van een blijvende onderzoeksgemeenschap op het gebied van gewasbescherming

> Eindgebruikers voorzien van een bredere reeks korte-termijn oplossingen

> Ontwikkeling van een holistische benadering van duurzame gewasbescherming

> Volgen van en informeren over veranderingen in het gewasbeschermingsbeleid.

Achttien organisaties in 10 Europese landen hebben zich voor vier jaar verbonden aan ENDURE (2007-2010), met financiële steun van het Zesde Kaderprogramma, prioriteit 5: Voedselkwaliteit en Veiligheid, van de Europese Commissie.

Website and ENDURE Information Centre

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From Science to Field
Wheat Case Study – Guide Number 2

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

Bill Clark, Rothamsted Research, UK
Lise Nistrup Jørgensen, Aarhus University, Denmark
Daniele Antichi, SSSUP, Italy
Tomasz Góral, IHAR, Poland
David Gouache, Arvalis, France
Laszlo Hornok, SZIE, Hungary
Marga Jahn, JKI, Germany
Philippe Lucas and **Bernard Rolland**, INRA, France;
Huub Schepers, Wageningen UR, The Netherlands

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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*
© B. Clark, Rothamsted Research, UK

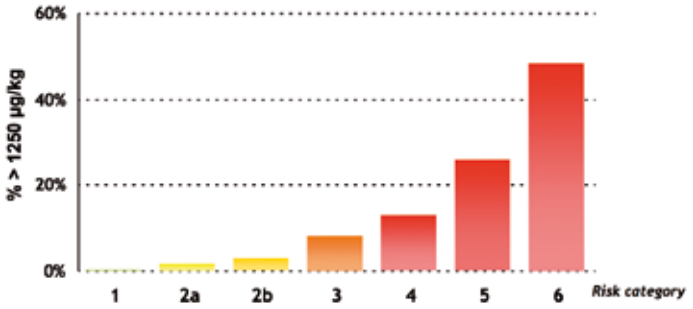


Figure 5: Risk percentage of exceeding the DON legal limit for each risk category (1902 fields surveyed from 2001 to 2008). (Source: Arvalis, France)

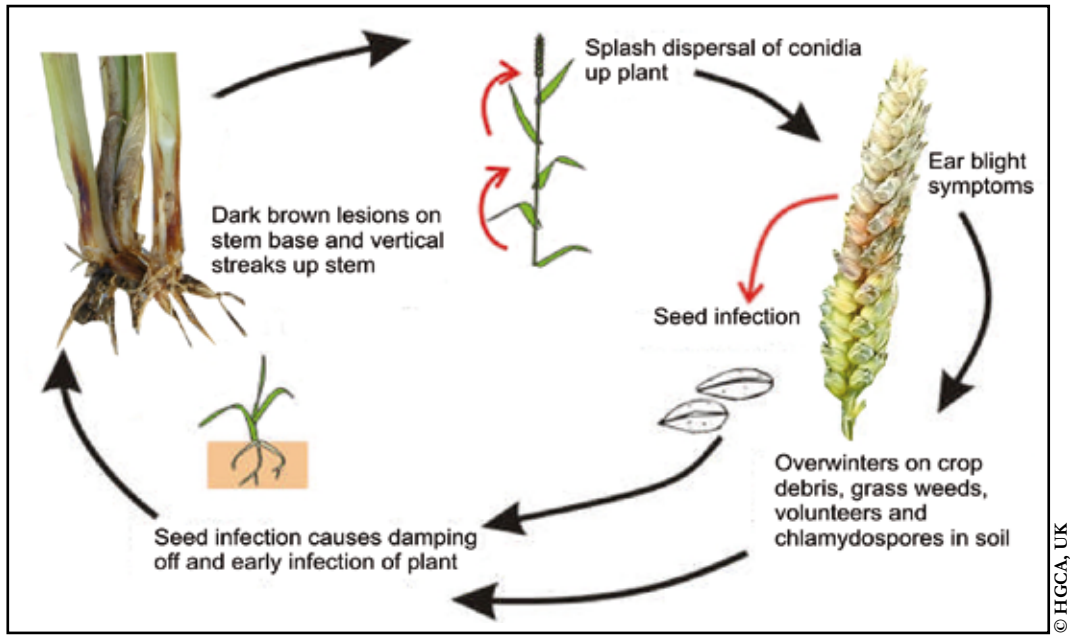
Complete feedstuffs for		
- Pigs	900	250 (100*)
- Calves, Lambs and Kids	2000	500

* 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.



Decision key for *Fusarium* risk assessment

The risk of *Fusarium* ear blight and mycotoxin production can be estimated in a number of ways and several published risk tools exist in different European countries. The common high–risk factors in each of these risk tools are the inclusion of maize in the rotation, particularly as the preceding crop, reduced or minimal tillage and rainfall during flowering.

The risk of *Fusarium* ear blight can normally be reduced by adjusting crop rotation, tillage methods and choice of resistant cultivars. If for various reasons these factors cannot be adjusted there can be a need for fungicide treatment to minimise disease levels. Application of fungicides are most effective during flowering but even at high doses they generally give only 50-60% control.

An example of a decision key in evaluating the risk level for DON in a given field is given in figure 4. In this example we can see that a combination of agricultural practices can drastically reduce the DON risk without the use of fungicides. The quantification of these risk levels is represented in figure 5. In some European countries wheat after wheat in combination with no ploughing also gives rise to an increase risk of *Fusarium* ear blight.

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).

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

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.

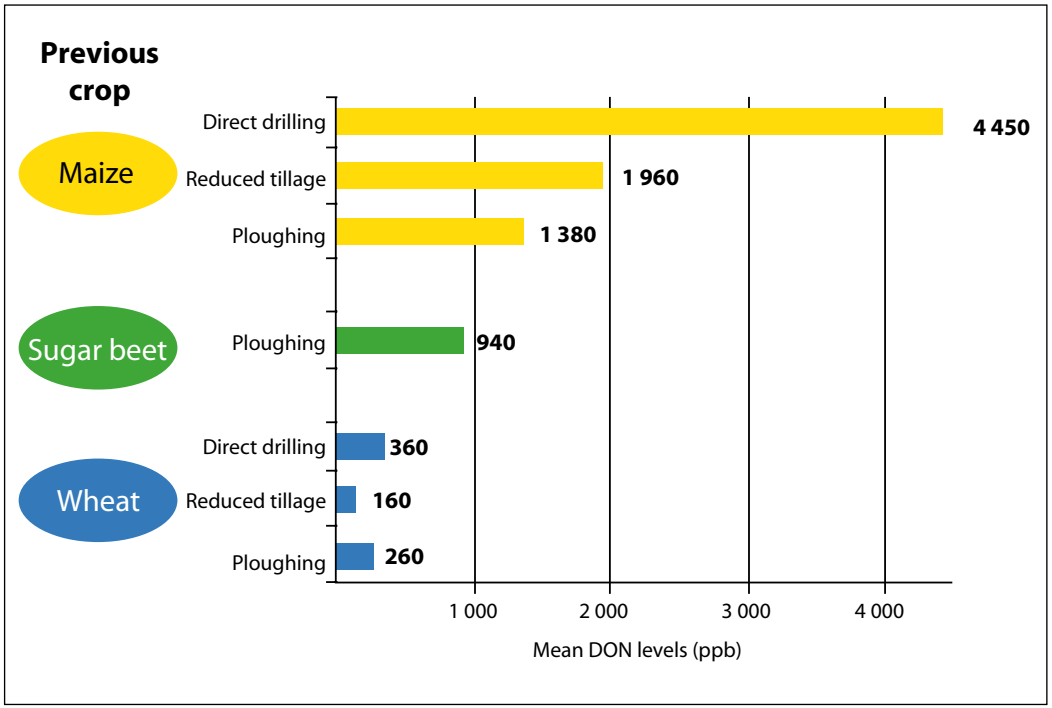


Figure 1: Mean DON levels for different preceding crops and tillage practices in Boigneville, France, from 1999-2004. (Source: Arvalis, France)

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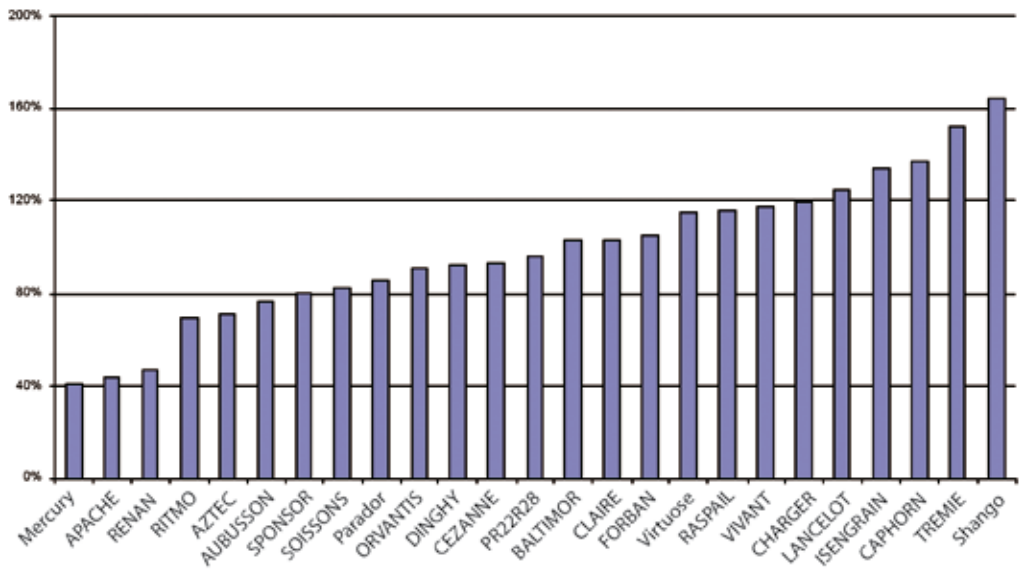

Figure 2: Mean levels (over six trials, 2001-2004) of DON accumulation in cultivars as % of the median value (Source: Arvalis, France).

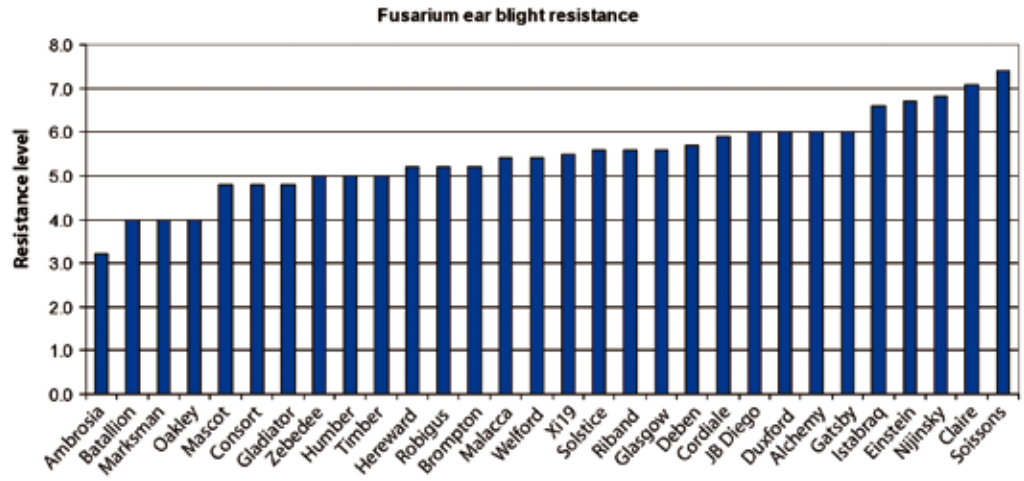

Figure 3: Resistance to *Fusarium* ear blight. A high figure equates to low levels of disease. (Source: HGCA Recommended List 2008, UK).