Occurrence and prevention of T-2 / HT-2 and some other *Fusarium* toxins in Norwegian cereals

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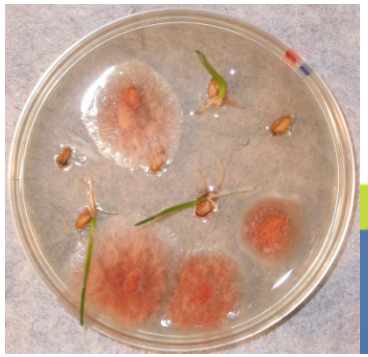
Samples collected 2004-2008

Approximately 600 samples of grain samples from oats and spring wheat harvested in the major cereal growing regions of Norway have been analysed for mycotoxins (18 different compounds)

Data on climatic conditions from a network of local weather stations and information regarding each single sample have been collected (location, species and cultivar, tillage, agronomic cultivation practice, previous crops, soil etc.)

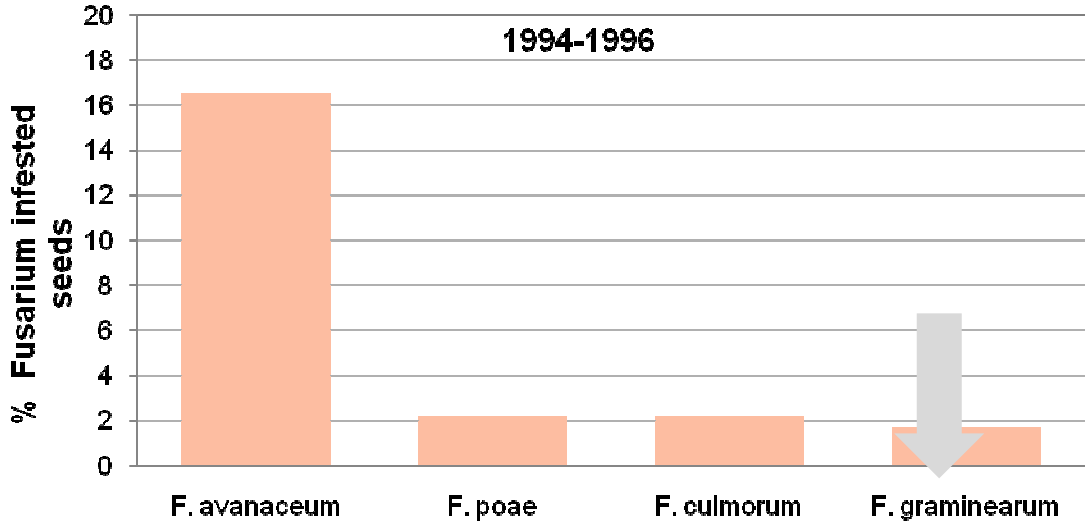


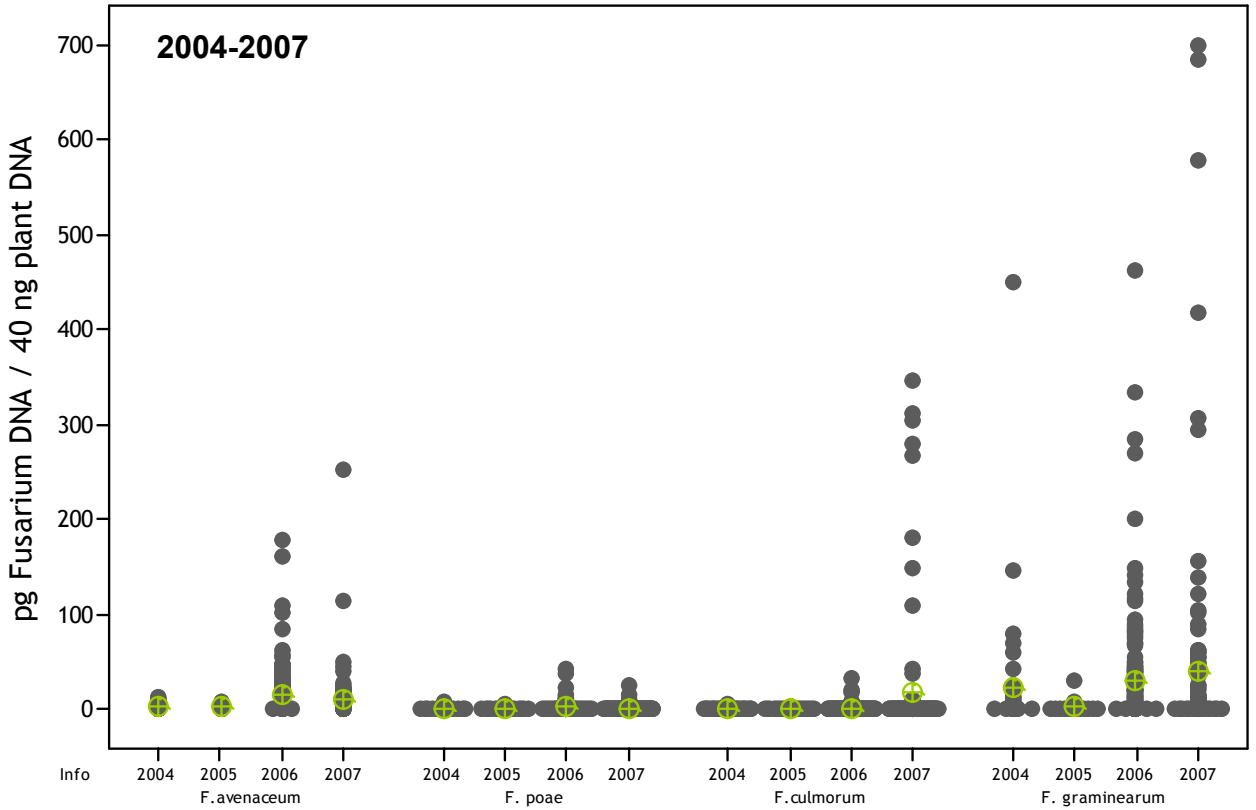
Fusarium avenaceum,
F. poae,
F. culmorum

have been the most prevalent *Fusarium* species in Norwegian grain

F. graminearum is now more prevalent

F. langsethiae is also widespread (especially in oats)

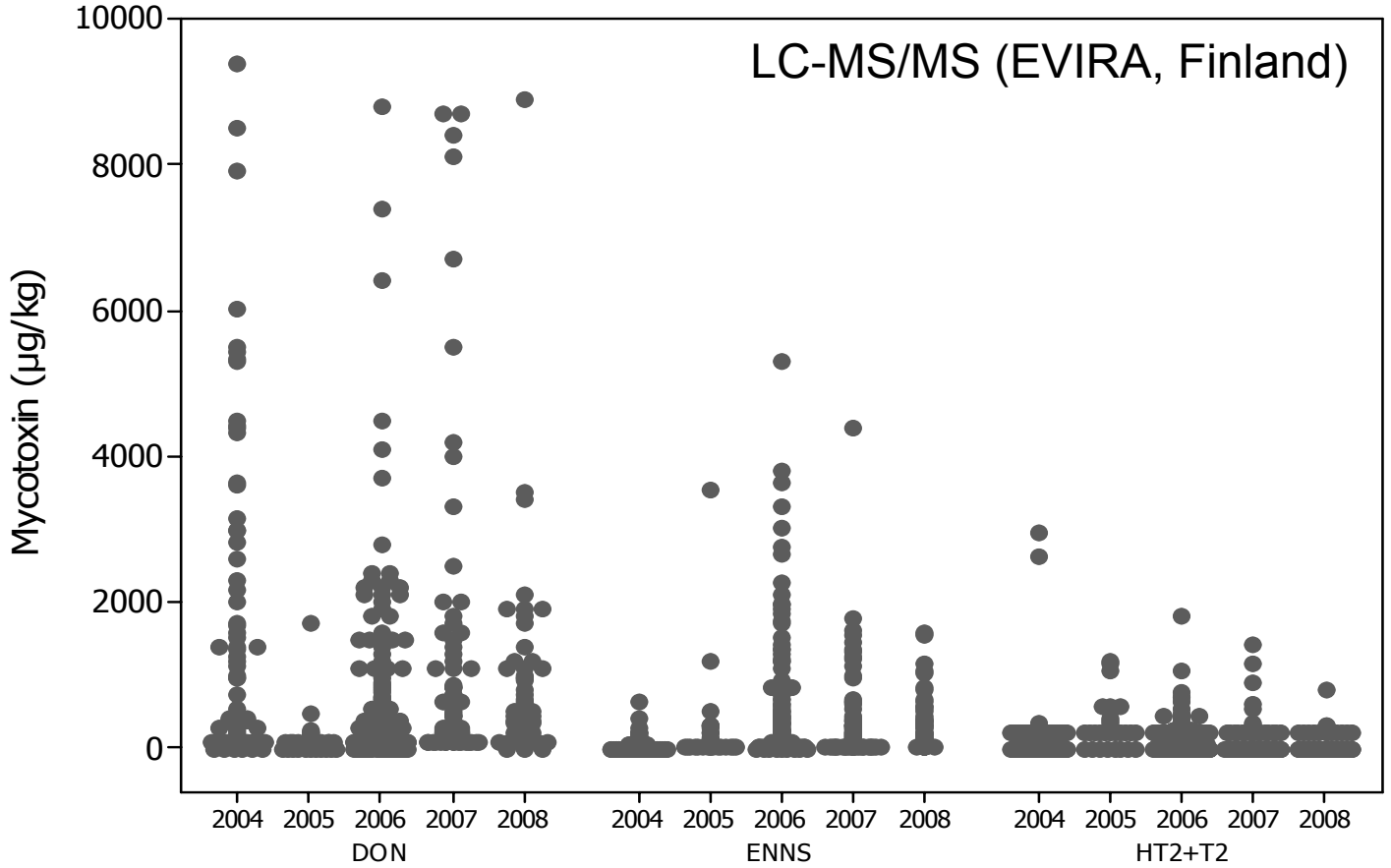


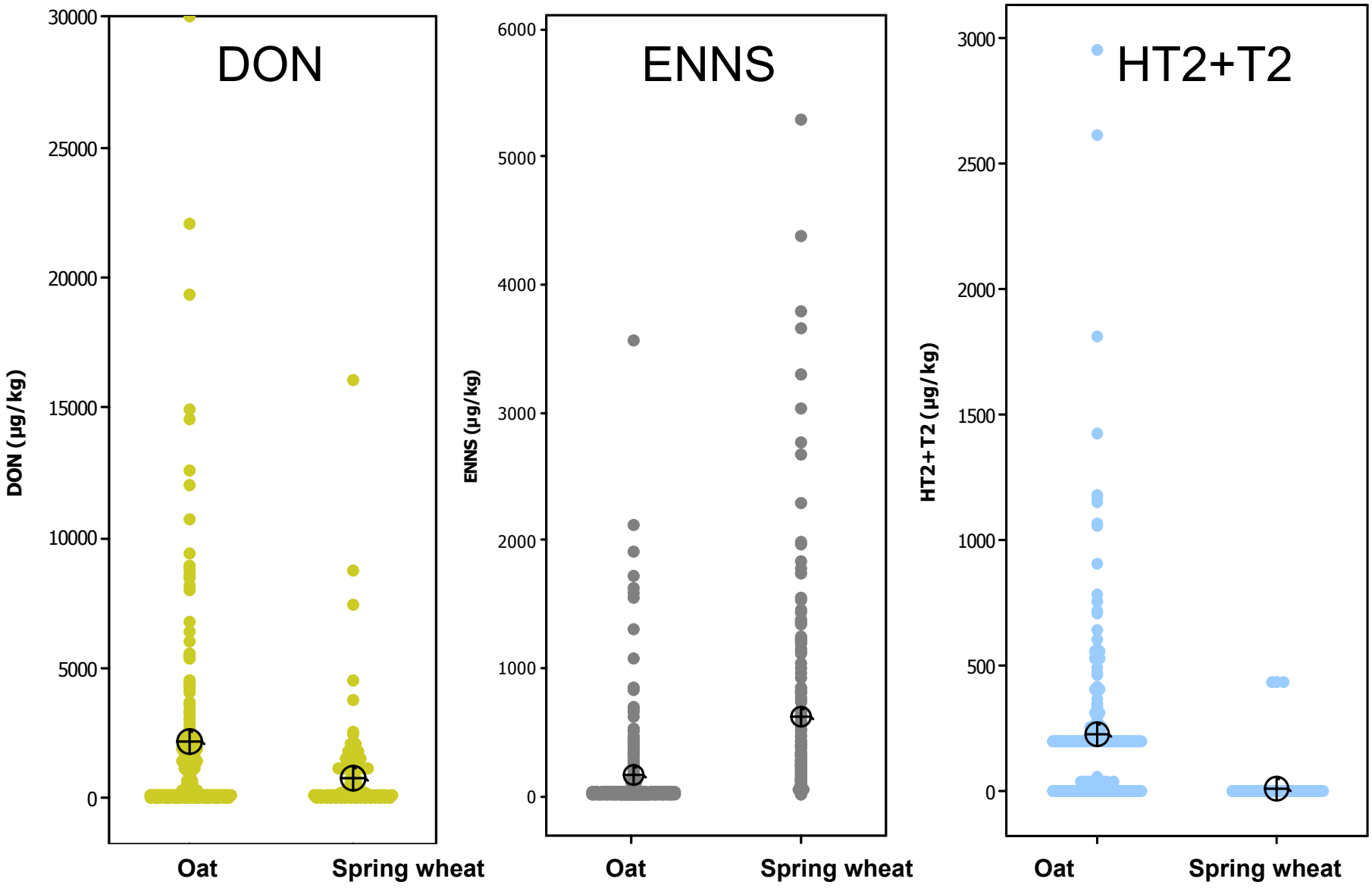


DON **Enniatins** **HT-2/T-2**

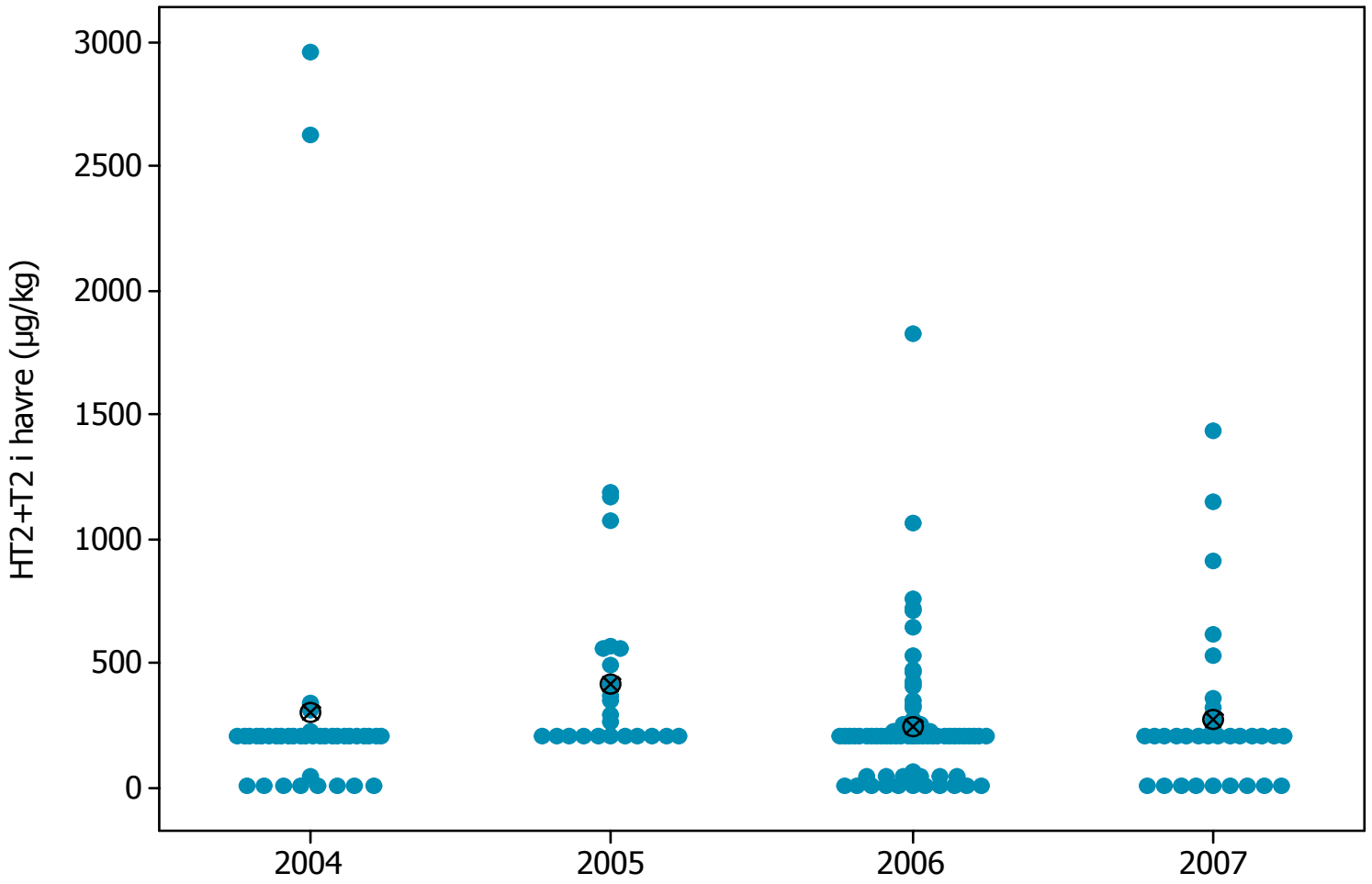
Fusarium avenaceum
Fusarium culmorum
Fusarium graminearum
Fusarium langsethiae
Fus. sporotrichioides
Fusarium poae
Fusarium tricinctum

Mycotoxins (µg/kg) in Norwegian oats and spring wheat 2004-2008:

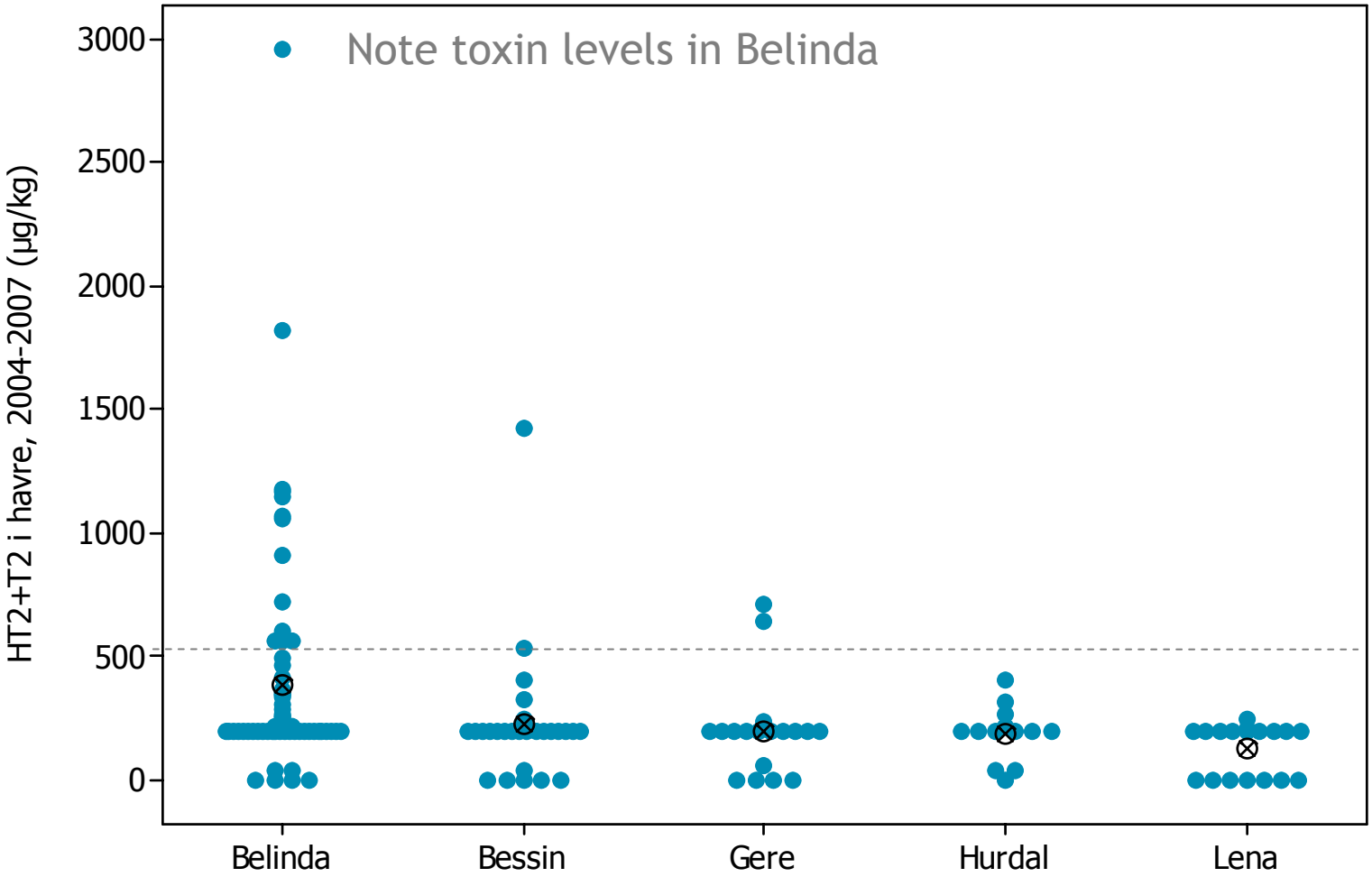



DON
DON (µg/kg)
30000
25000
20000
15000
10000
5000
0
Oat
Spring wheat
ENNS
ENNS (µg/kg)
6000
5000
4000
3000
2000
1000
0
Oat
Spring wheat
HT2+T2
HT2+T2 (µg/kg)
3000
2500
2000
1500
1000
500
0
Oat
Spring wheat

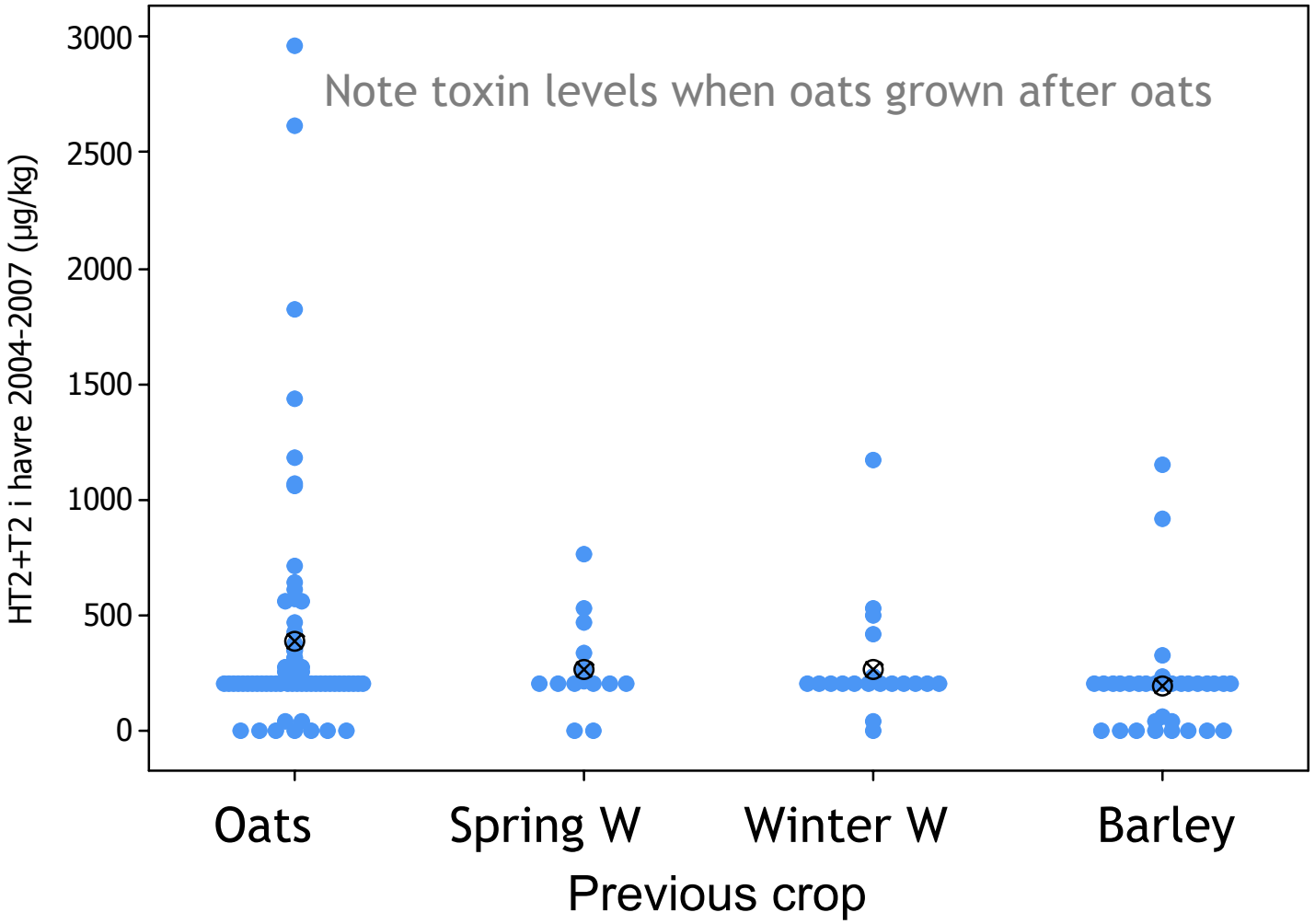
HT2+T2 (µg/kg) in oats



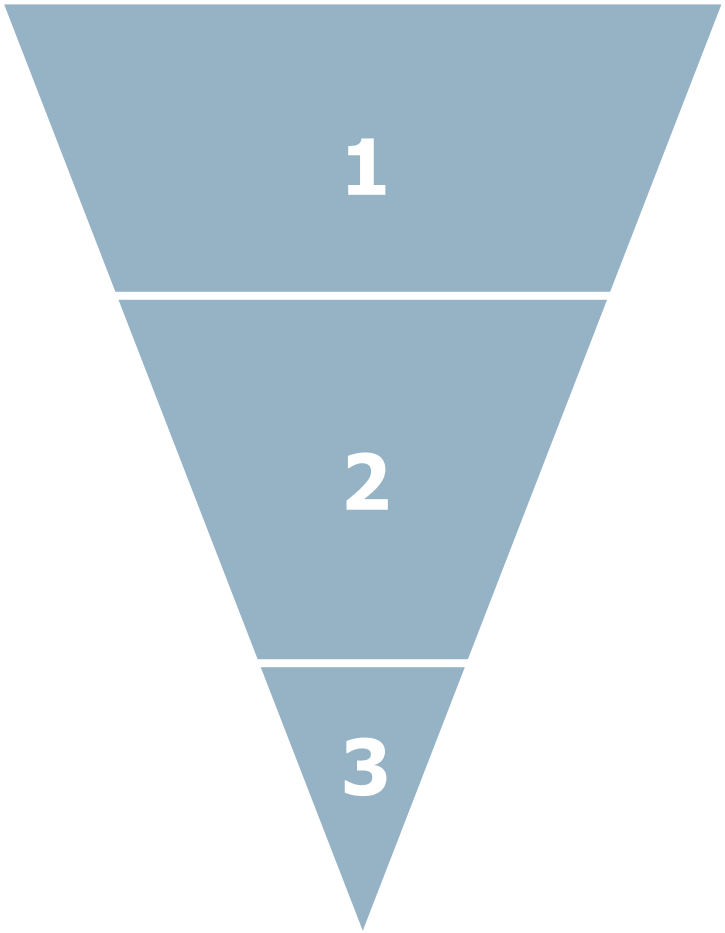
HT2+T2 (µg/kg) in different cultivars of oats



Effect of previous crop on HT2+T2 (µg/kg) in oats



Surveillance system: Three-step screening to identify highly contaminated grain lots



1: **Prediction models** estimate the risk of *Fusarium*/mycotoxin development in cereal fields

2: **Rapid screening methods** for *Fusarium* or mycotoxins in grain lots from 'high-risk' fields (step 1)

3: **Chemical mycotoxin analyses** of grain lots if needed (step 1 or 2)

1: Prediction models

600 samples of Norwegian **oats and spring wheat** collected from farmers fields in 2004-2008

Data on **environmental factors** (cultivation practice and weather data) collected

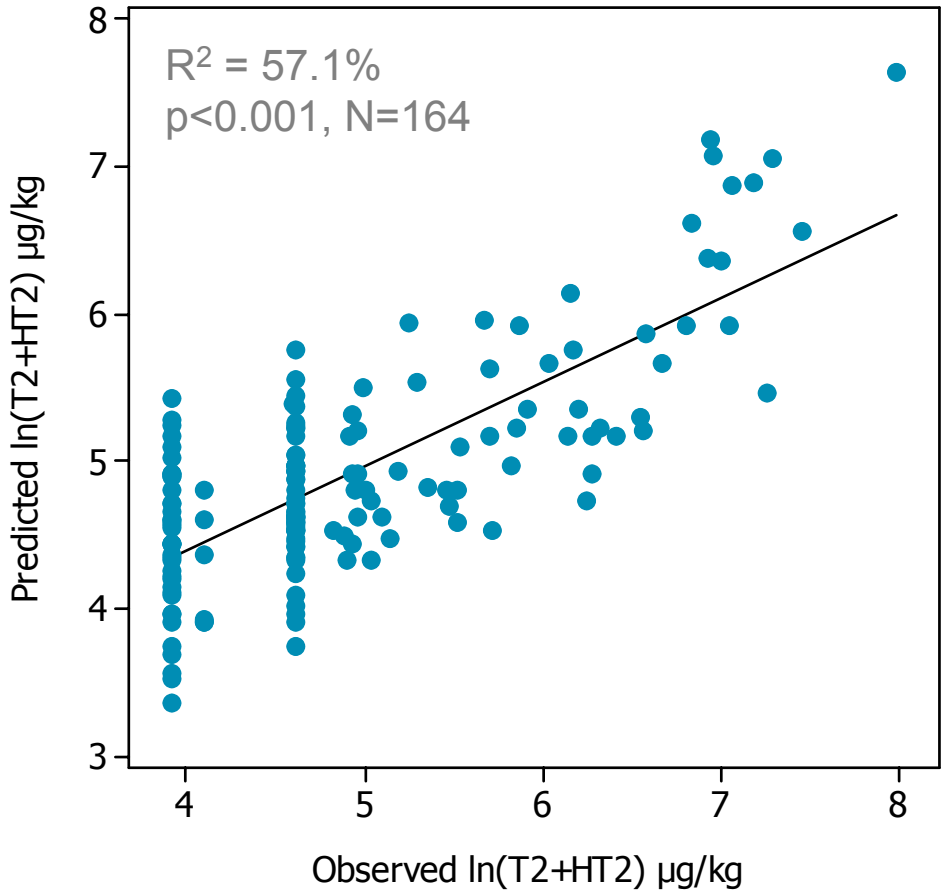
Chemical analysis of **mycotoxins** (DON, HT2, T2, Enniatins, etc.) performed by LC-MS/MS (EVIRA, Finland)

Relationship between **environmental factors** and ***Fusarium* - mycotoxins** studied

- Prediction models for DON in wheat and oats
  and for T2/HT2 in oats are developed
- So far the prediction model does not fit for all growing areas
  - Local models for the different areas are necessary
- 50 – 70 % the variation in DON and T2/HT2 is explained in the models

Prediction models for HT2+T2

Predicted vs. observed (LC-MS/MS)



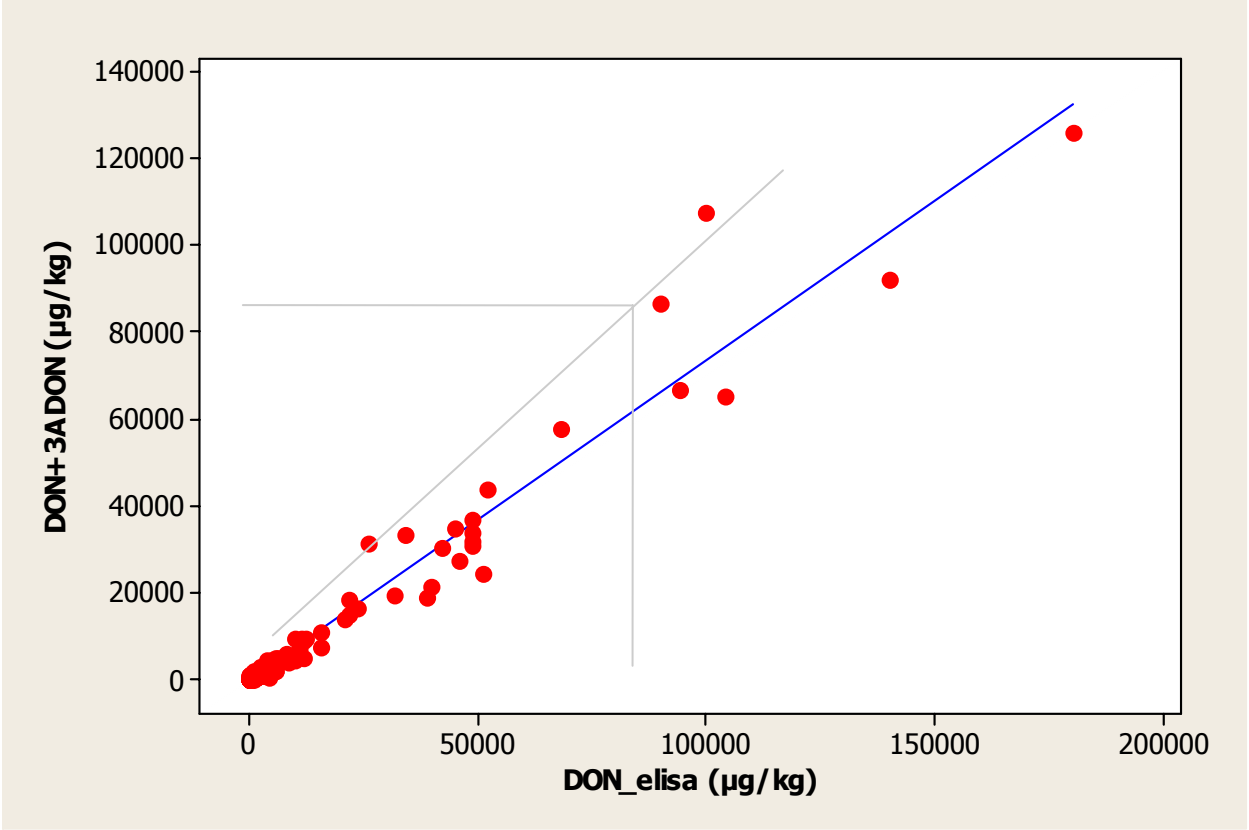
Prediction based on
- previous crop
- soil type
- relative humidity after flowering

2: Rapid screening methods (DON, T2, HT2)

- **FAST ELISA test**
- **Standard ELISA test**
- **Lateral flow test**

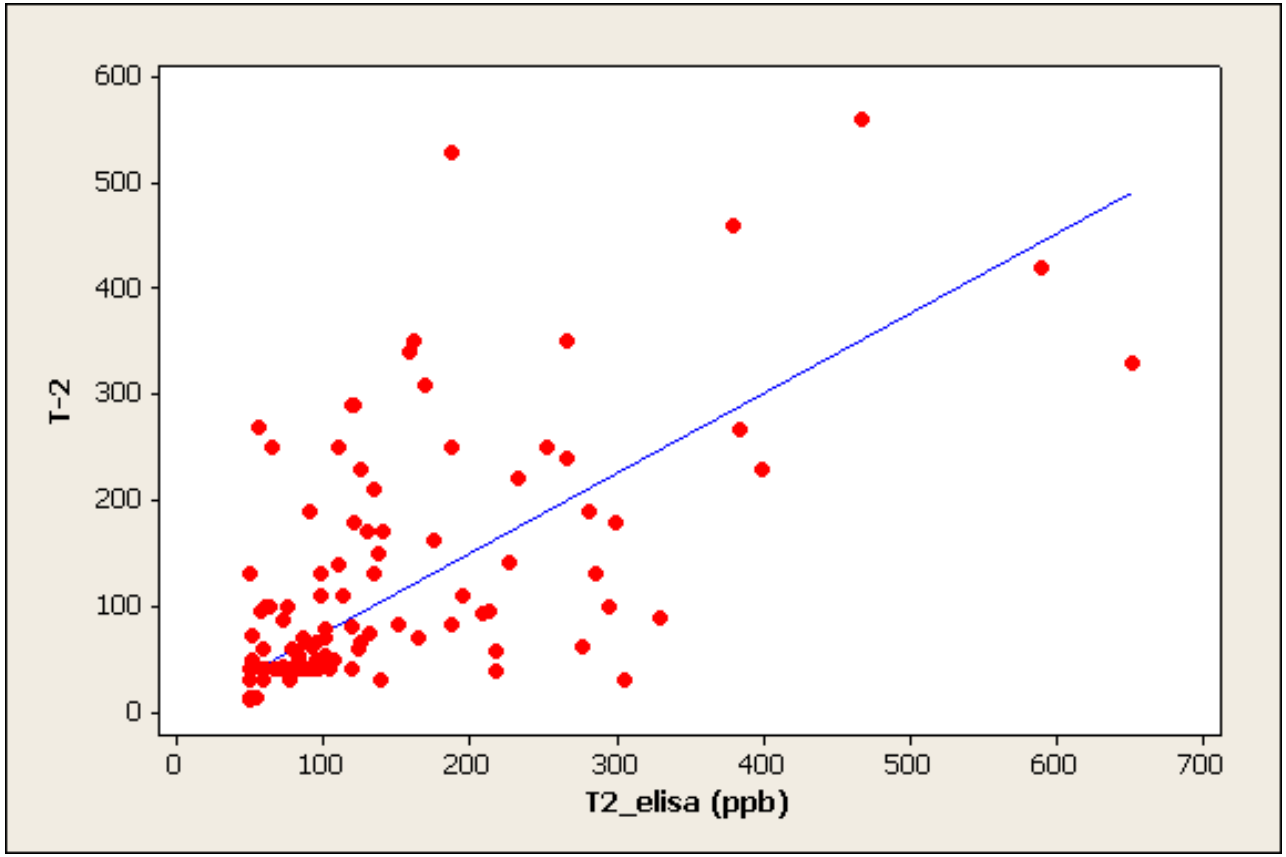
have been compared with **chemical analysis**

ELISA vs. chemical analysis (DON)



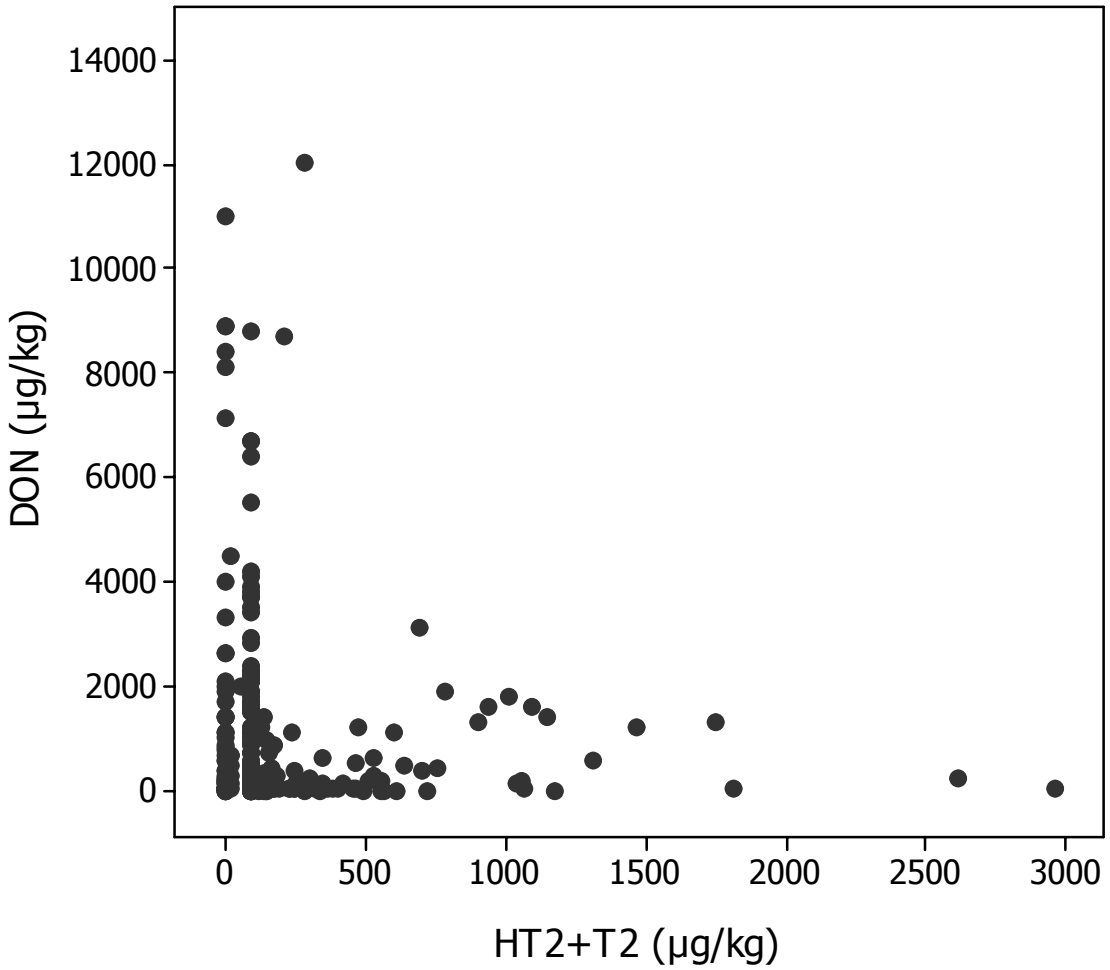
- Number of samples: 291 (156 oats and 135 wheat)
- r^2: 95,7%
- ELISA – results are higher

ELISA vs. chemical analysis (T-2)



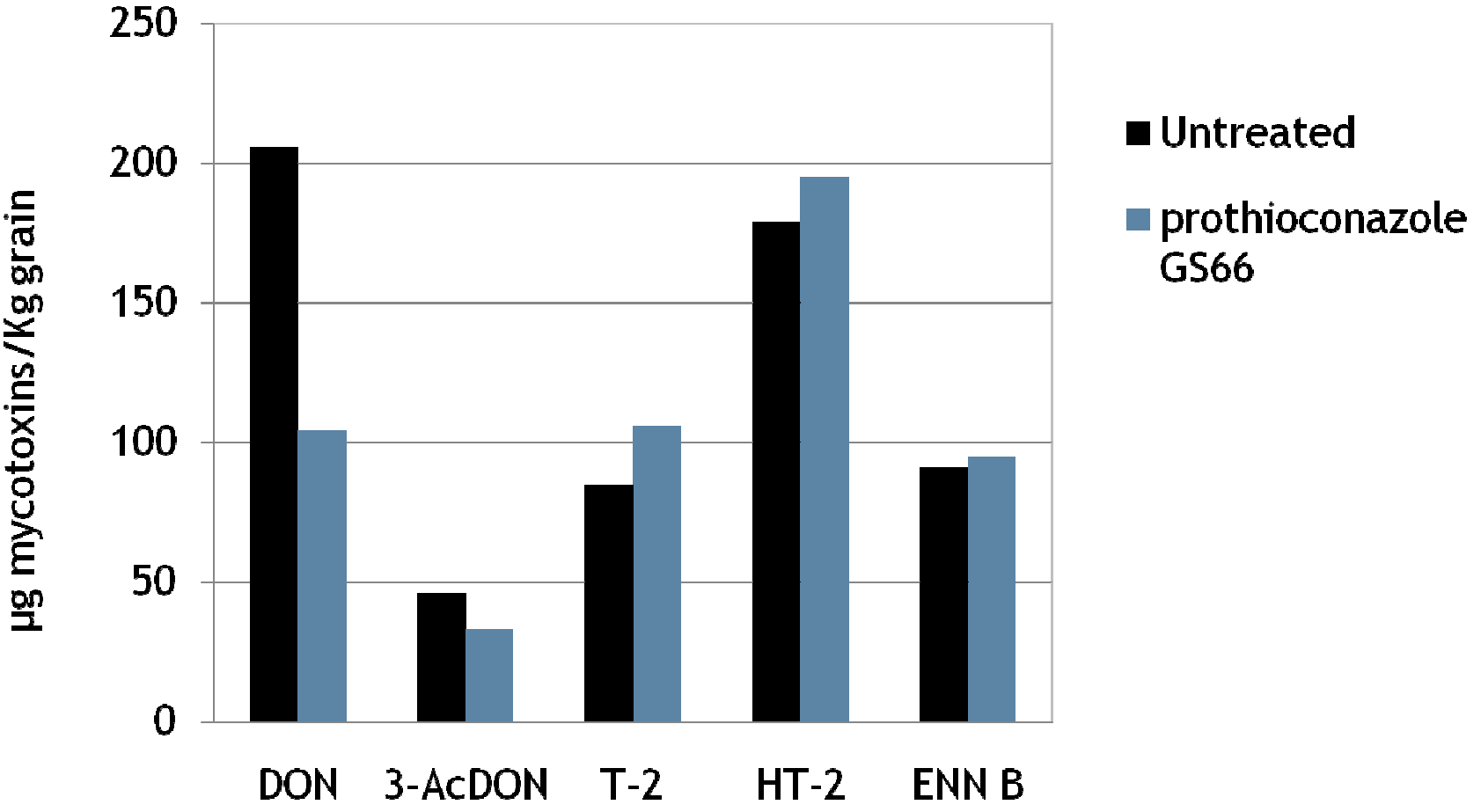
- Number of samples : 190 (145 oats and 45 wheat)
- r^2: 25%

Relationship between DON and HT2+T2 concentration in Norwegian oats (2004-2008)

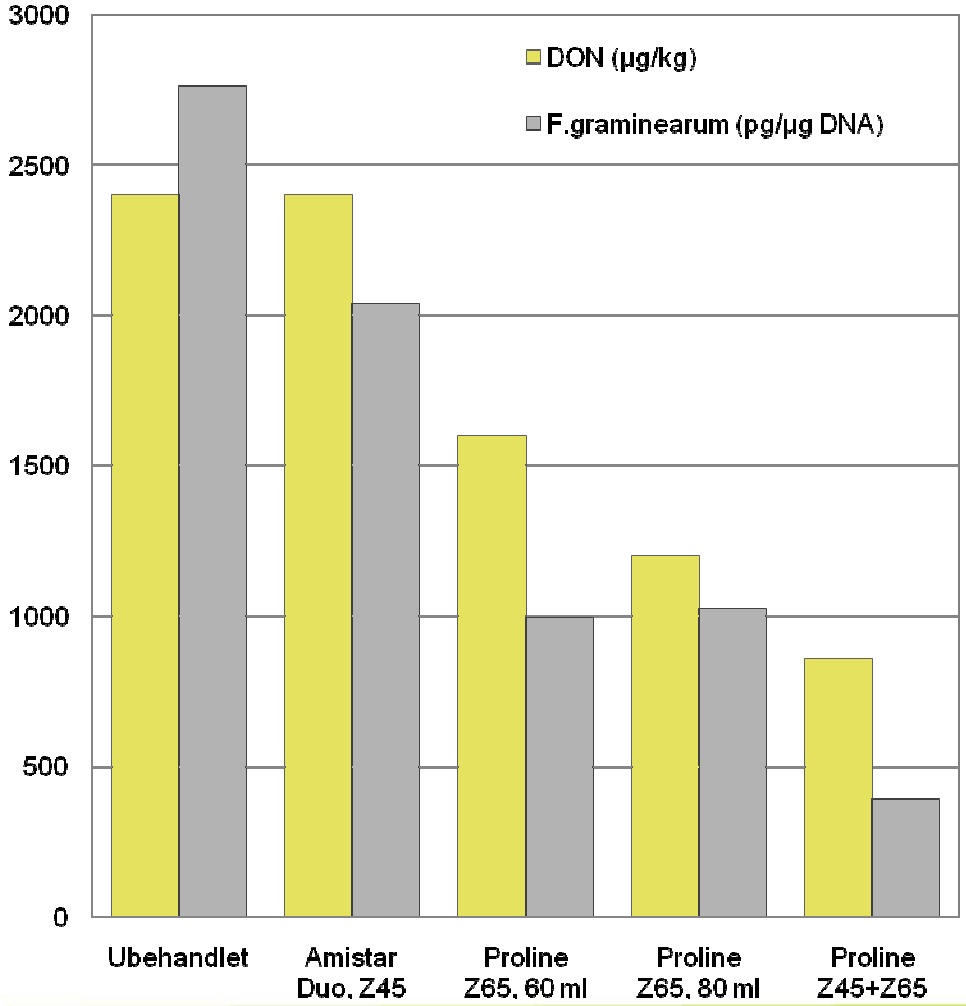


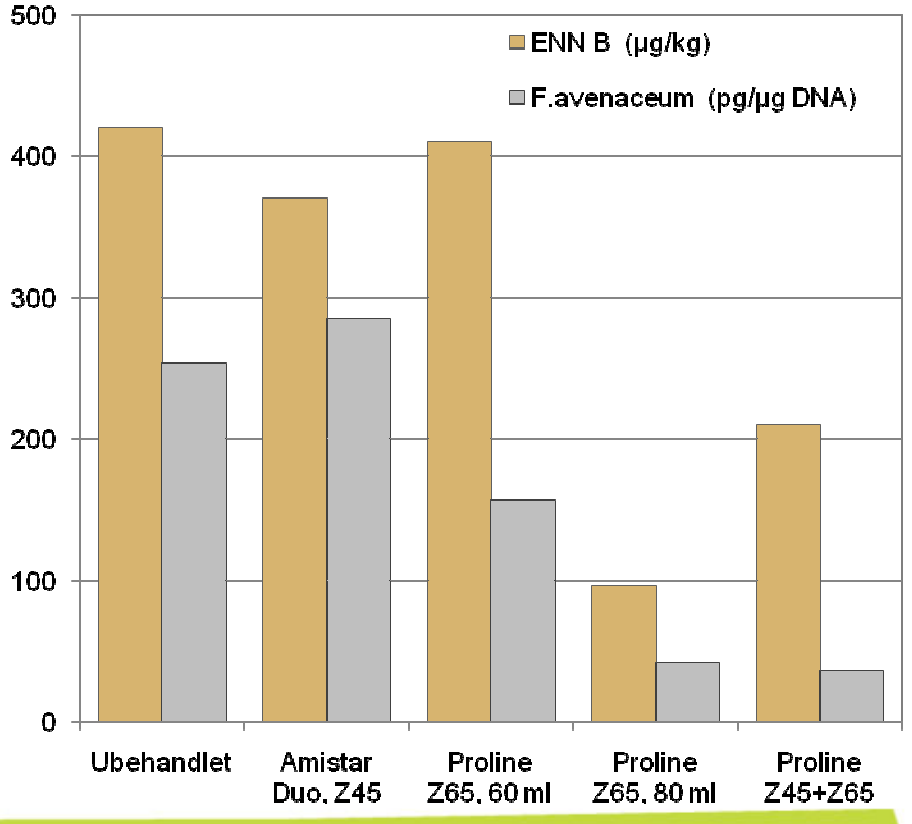
DON concentration cannot be used to predict HT2+T2

No reduction of HT2/T2 or ENNs in oats after prothioconazole (Proline) treatment



Prothioconazole (Proline) can reduce DON and ENNs, and *Fusarium* (real-time PCR analysis) content in spring wheat





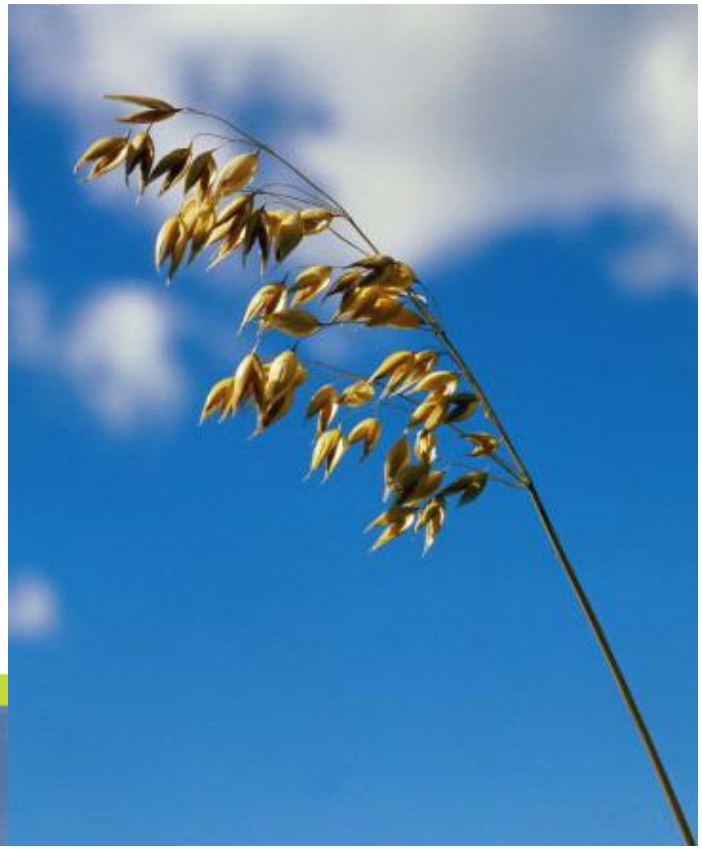
Mycotoxin contamination in oats -

characterization of the infection process by the major T-2 / HT-2 toxin producer *Fusarium langsethiae*

Project leader: Sonja Sletner Klemsdal

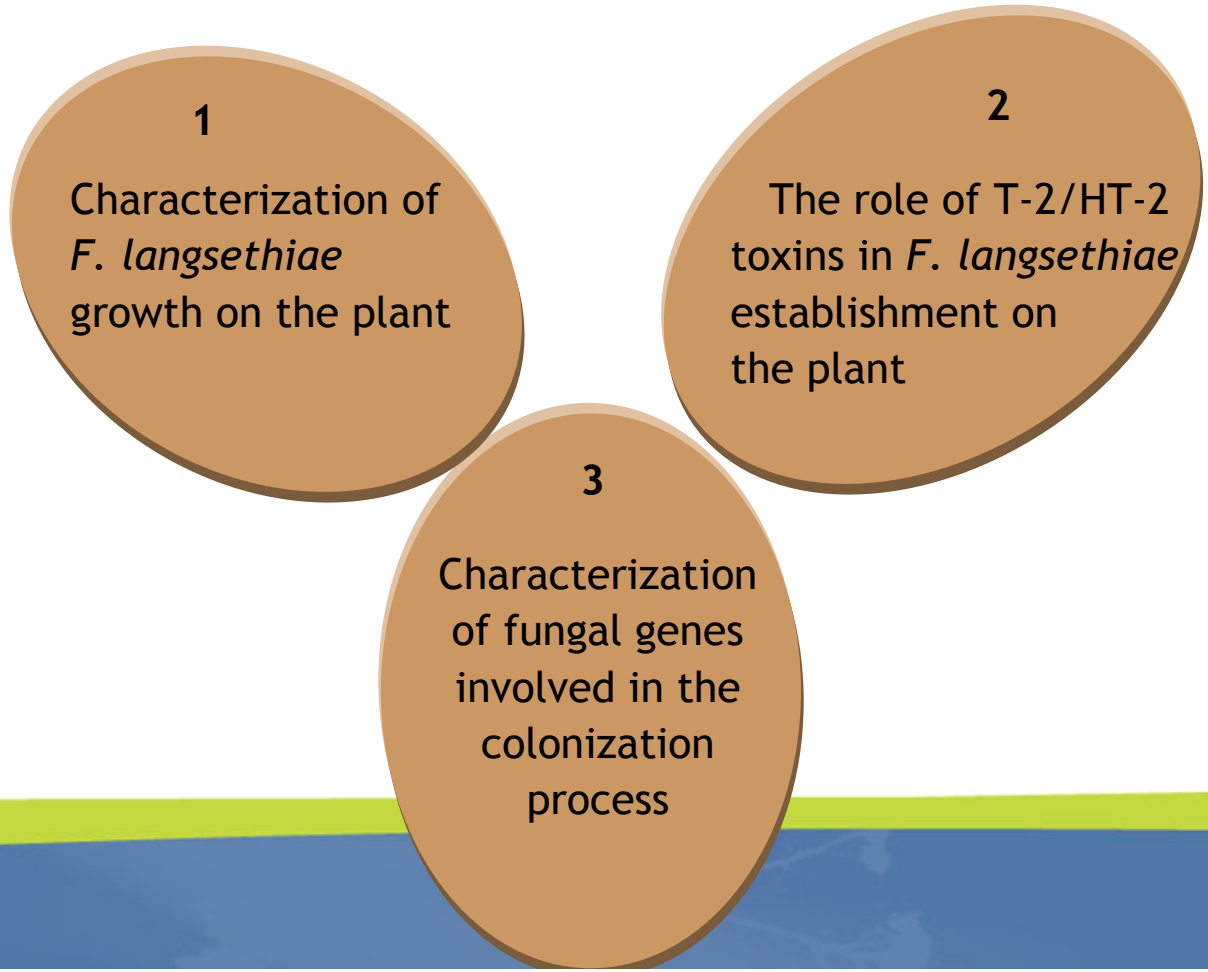
Post doc: Hege Hvattum Divon

Period: 2008 - 2012



Main Objective:

- Enhance the understanding of fundamental processes of *F. langsethiae* colonization of oats
- Reduce the mycotoxin content in oats



Summary

- DON, HT2/T2 and Enniatins was recorded in several samples of oats and spring wheat (2004-2008)
- Some samples of oats (mainly cultivars Bessin and Belinda) had a mycotoxin content well above recommended maximum limits
- Especially high levels of HT2/T2 was recorded when oat was grown after oats
- Samples of spring wheat with DON above maximum limits was recorded, also when potato was grown as the previous crop
- Fungicide treatment did not have an effect on the development of T-2 and HT-2

Reduced risk of *Fusarium* and mycotoxin contamination in Norwegian cereals by the development of a rapid screening system (2006-2009)

Participants: Ingerd Skow Hofgaard, Heidi Udnes Aamot, Guro Brodal, Oleif Elen, and Sonja Sletner Klemsdal. Bioforsk, Norwegian Institute for Agricultural and Environmental Research

Funding: The Norwegian Research Council, farmers organizations and the main cereal grain trade companies in Norway.

Partners/collaborators : FK Agri, Fiskå Mølle, StrandUnikorn, BayerCropScience, Kimen Seed Testing Laboratory, Norwegian Food Safety Authority, The Norwegian Agricultural Extension Service, L. N. Jørgensen, DIAS, Denmark, T. Børjeson, Svenska Lantmännen, Sweden, M. Jestoy, Evira, Finland, N. Magan,Cranfield University, UK, K. O'Donnel, USDA, USA, T. Ward, USDA, USA, L. Niessen, Technische Universität München, Germany, Food Diagnostics Norway.