

*Presentation to the 4th European Commission Forum
on Fusarium toxins.
Brussels, January 15-16th, 2007*

T-2, HT-2 and deoxynivalenol (DON) in malting barley and malt



Outline of presentation

- What is Euromalt
- Occurrence of T-2 and HT-2 toxins in malting barley
- Changes in incidence
- T-2 and HT-2 toxins in commercial malts
- Effects of malting on T-2 and HT-2 under experimental conditions
- Summary

Euromalt



- Euromalt was established in 1959 and represents the interests of the EU malting industry
- Around 9 million tonnes of malt (half the world total) are produced annually in the EU
- Around one quarter of this is exported
- 94% of total malt production is used for beer brewing
- 4% is used for whisky distilling
- 2% is used in the food industry



- Euromalt has been surveying mycotoxins in European malting barleys and malts since 2002

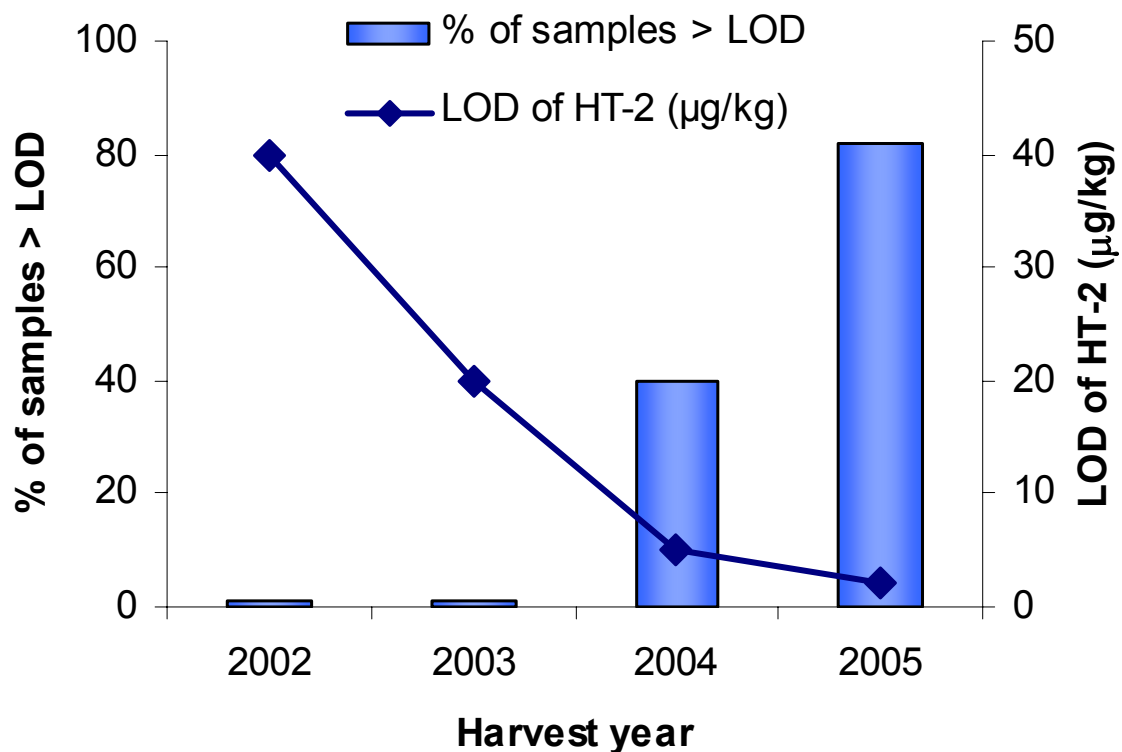
Euromalt mycotoxin survey

- 100 - 200 samples per year
- Includes all EU member states with significant malt production
- Number of samples/country proportional to malt production
- 10kg samples, collected and analysed according to EU protocol (Directive 2002/26/EC)
- Analysed for a wide range of Fusarium toxins by validated GC-MS or LC-MS/MS
- Ongoing improvement in Limits of Detection



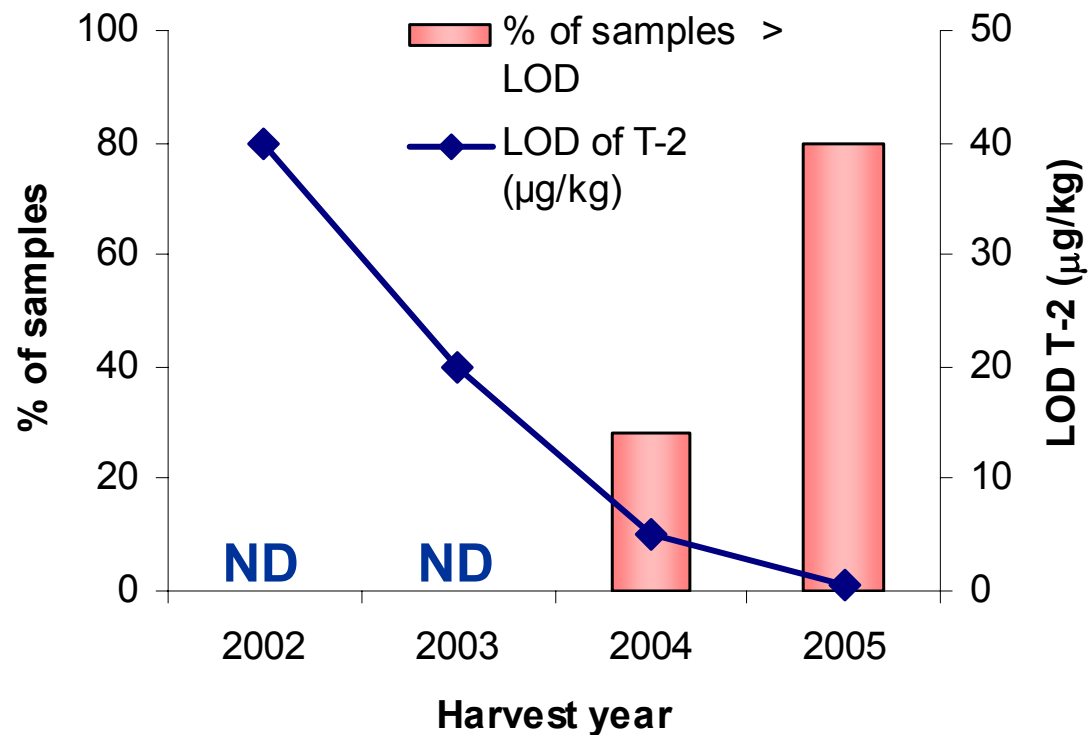
**Incidence of T-2 and HT-2 toxins in
European malting barleys:
Data from Euromalt survey**

Incidence of HT-2 in malting barleys: Euromalt survey



LOD = Limit of detection

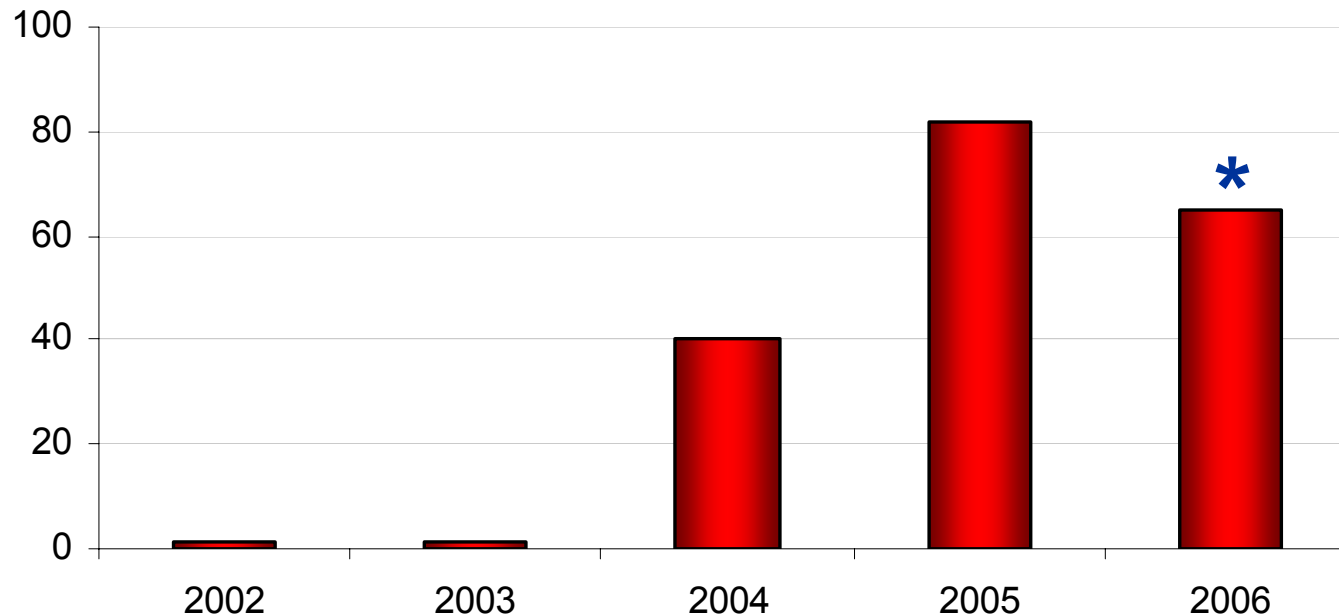
Incidence of T-2 in malting barleys: Euromalt survey



LOD = Limit of detection
ND = not detected

Combined incidence of HT-2 + T-2

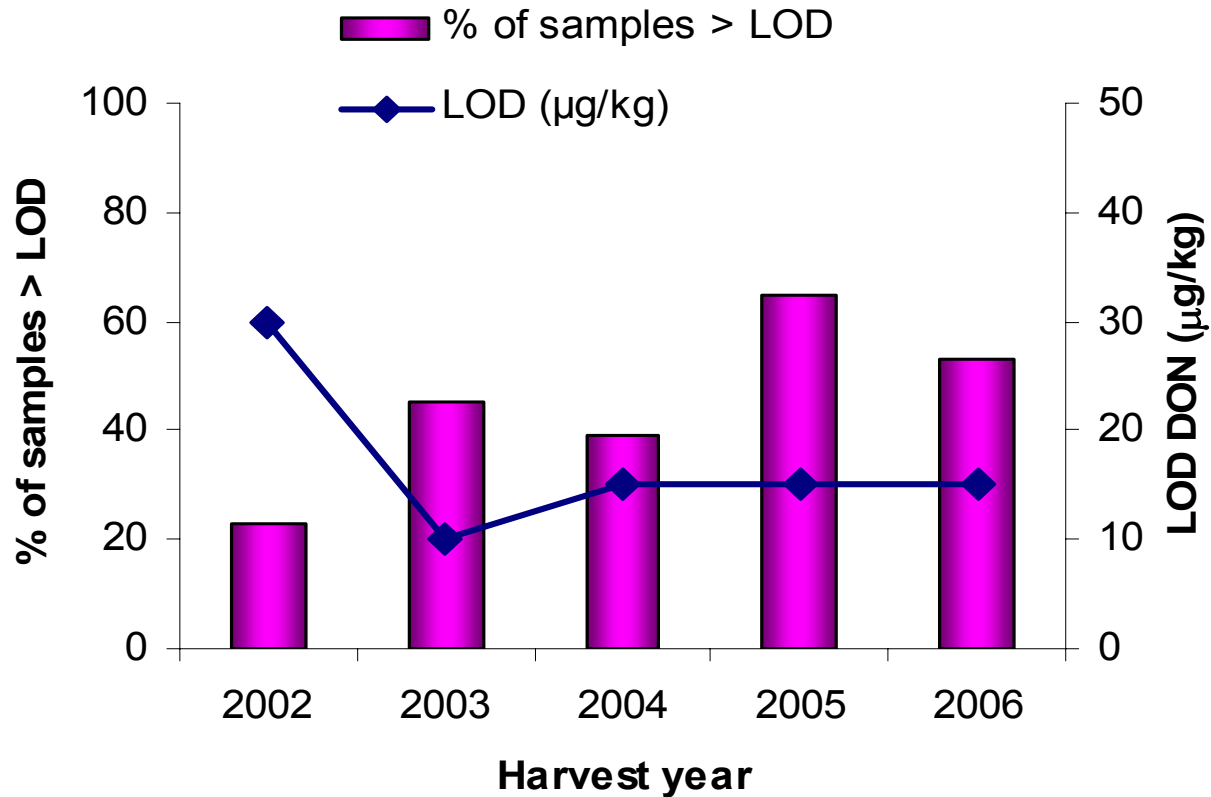
% of samples
with
detectable T-2
or HT-2



* *Preliminary data based on 161 samples from 4 countries*



Incidence of DON in malting barleys



* Preliminary data based on 161 samples from 4 countries

Incidence of T-2 and HT-2 toxins

Conclusions from survey

- Rate of detection of T-2 and HT-2 toxins is increasing in barley
- More change with T-2 and HT-2 than with DON
- WHY?
 - Lower limits of detection
 - Climate change?
 - Agronomic practices such as minimum tillage?
- More research needed to confirm causes and identify feasible growing practices to reduce contamination

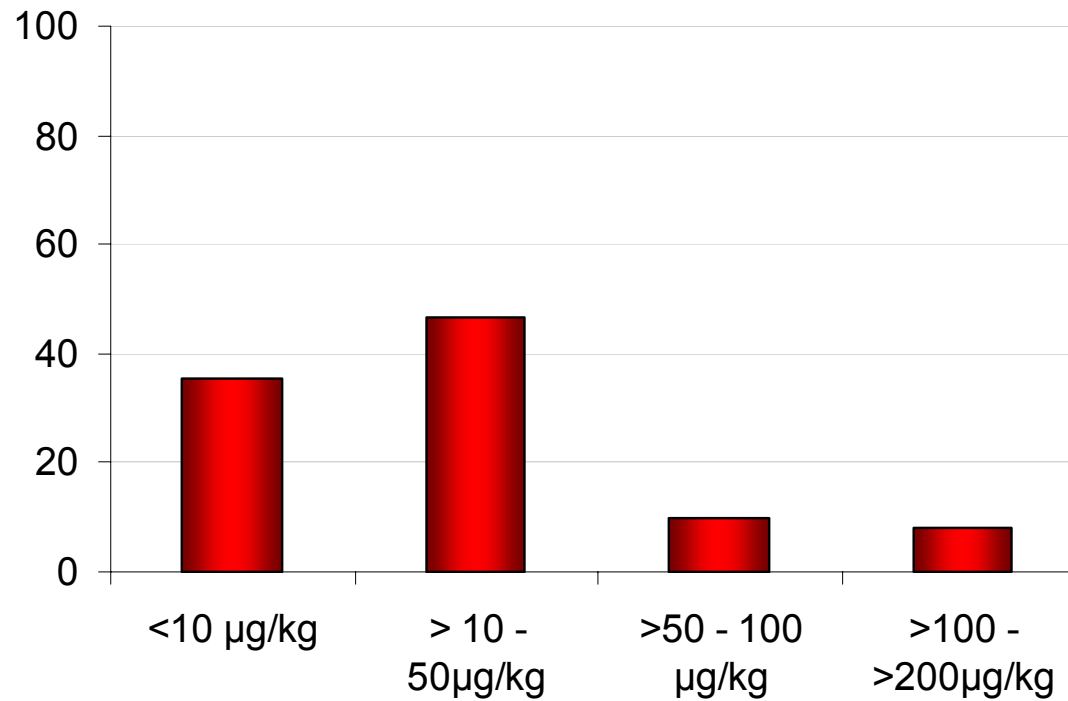
Concentrations of T-2 and HT-2 toxins in malting barley

T-2 and HT-2 in malting barleys

Toxin		Mean µg/kg	Median µg/kg	Maximum µg/kg
HT-2	2004	7	2.5	45
	2005	14	7.4	113
T-2	2004	4.9	2.5	45
	2005	3.7	1.9	21
HT-2 + T-2	2004	12	5.0	90
	2005	18	9.5	131
DON	2004	36	15	231
	2005	39	15	237

T-2 + HT-2: 2006 harvest

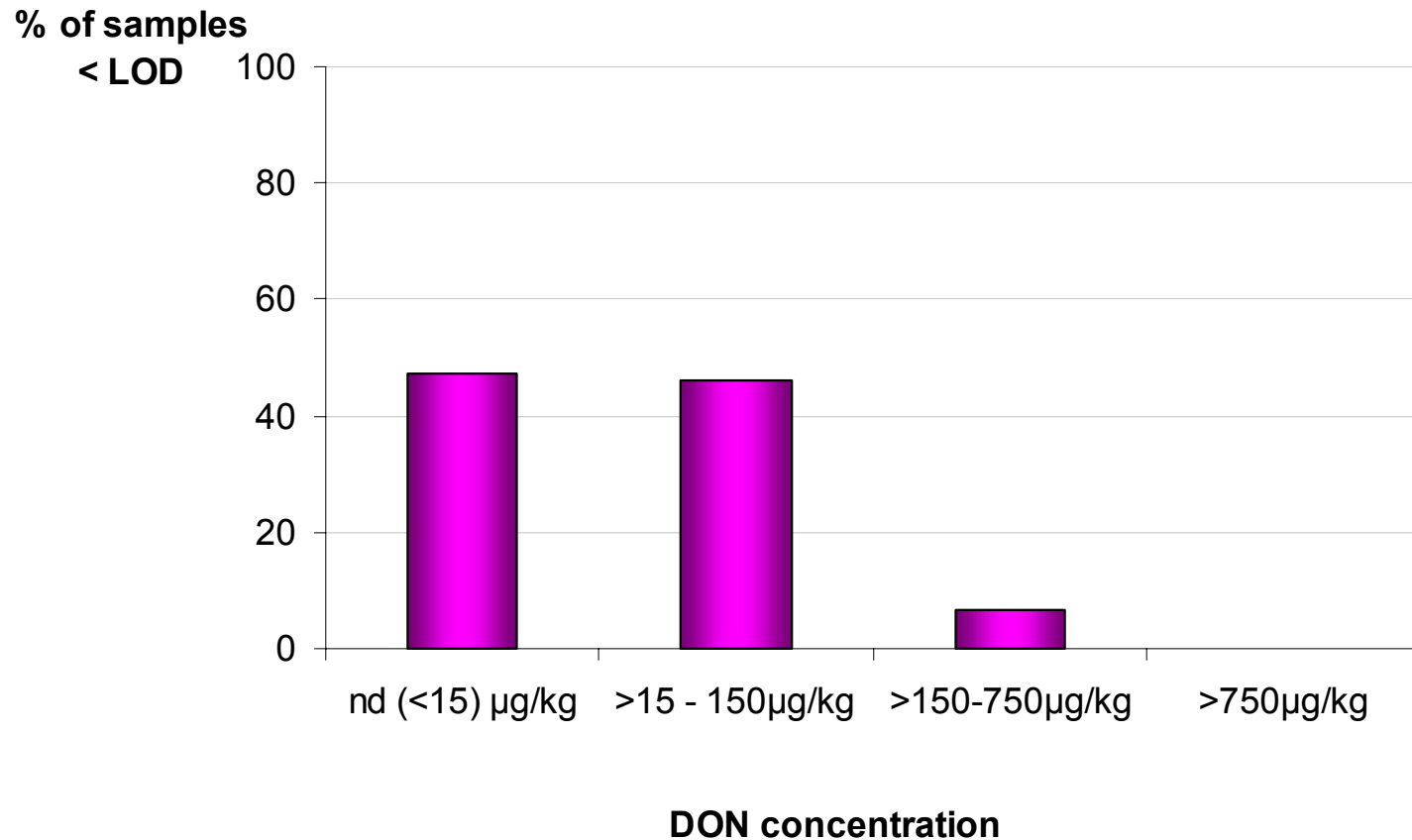
% of
samples
> LOD



Preliminary data based on 161 analyses from 4 countries



DON: 2006 harvest



Preliminary data based on 161 analyses from 4 countries



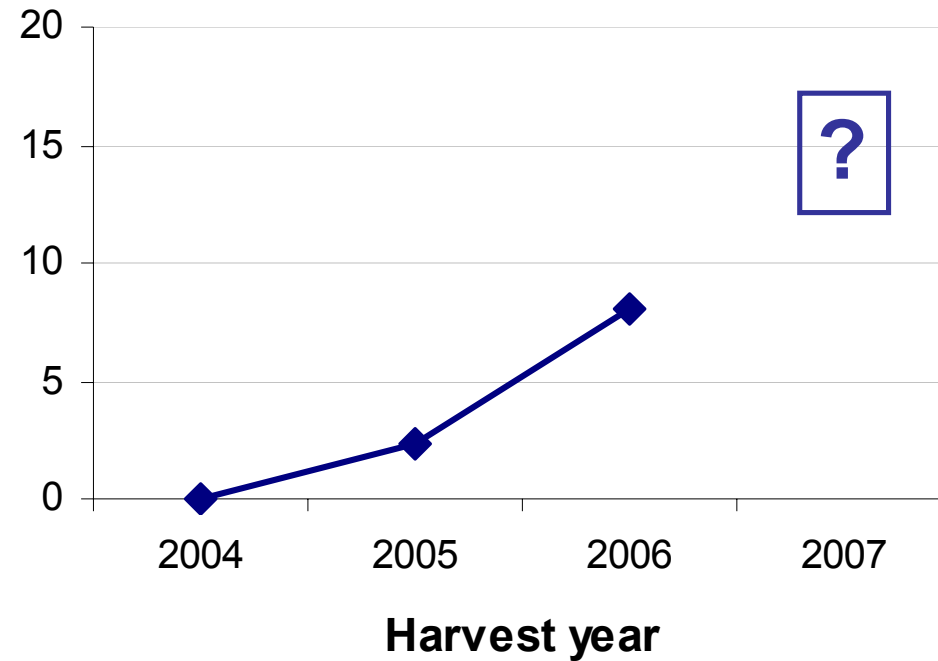
Concentrations of T-2 and HT-2 toxins in malting barley

Conclusions from survey

- An increasing number of samples exceed 100 µg/kg T-2 and HT-2

Proportion of barley samples which exceed $100\mu\text{g}/\text{kg}$

% of commercial malting barleys where HT-2 + T-2 > $100\mu\text{g}/\text{kg}$



Effects of malting on T-2 and HT-2

Raw barley grain



Steeping



Germination



Kilning

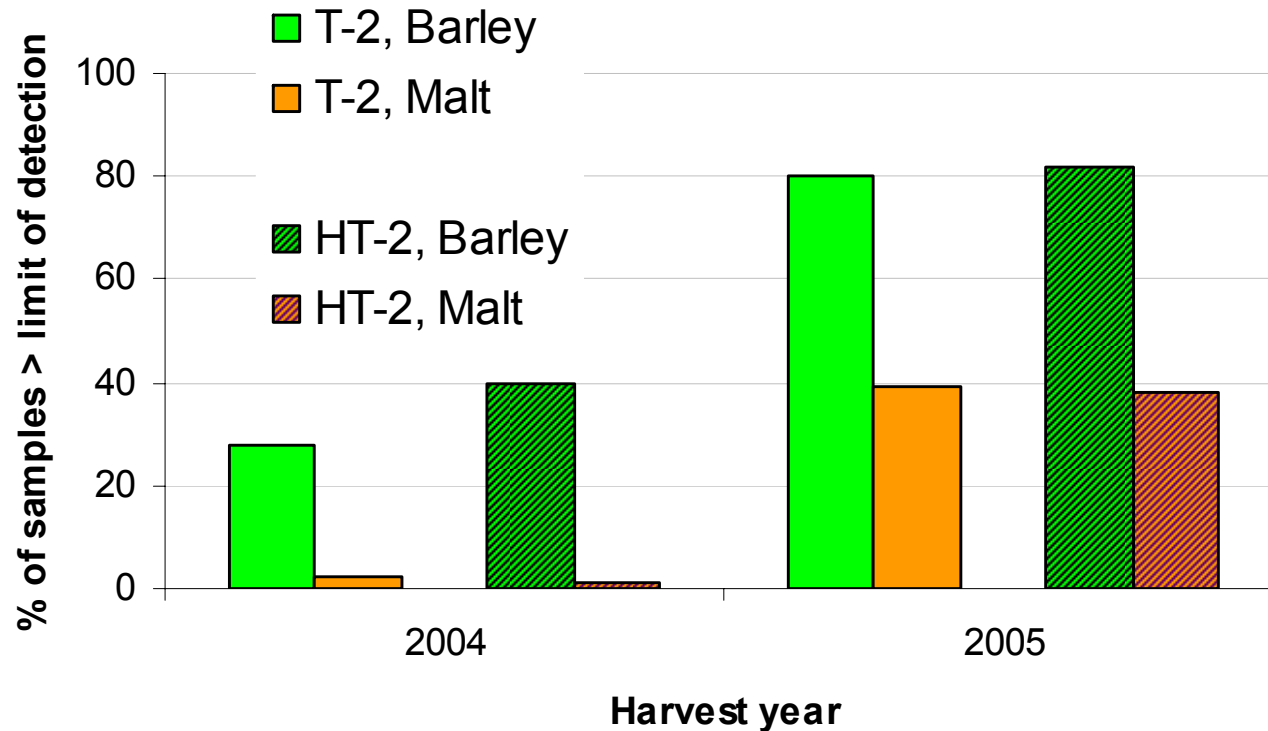


MALT

T-2 and HT-2 in commercial malts

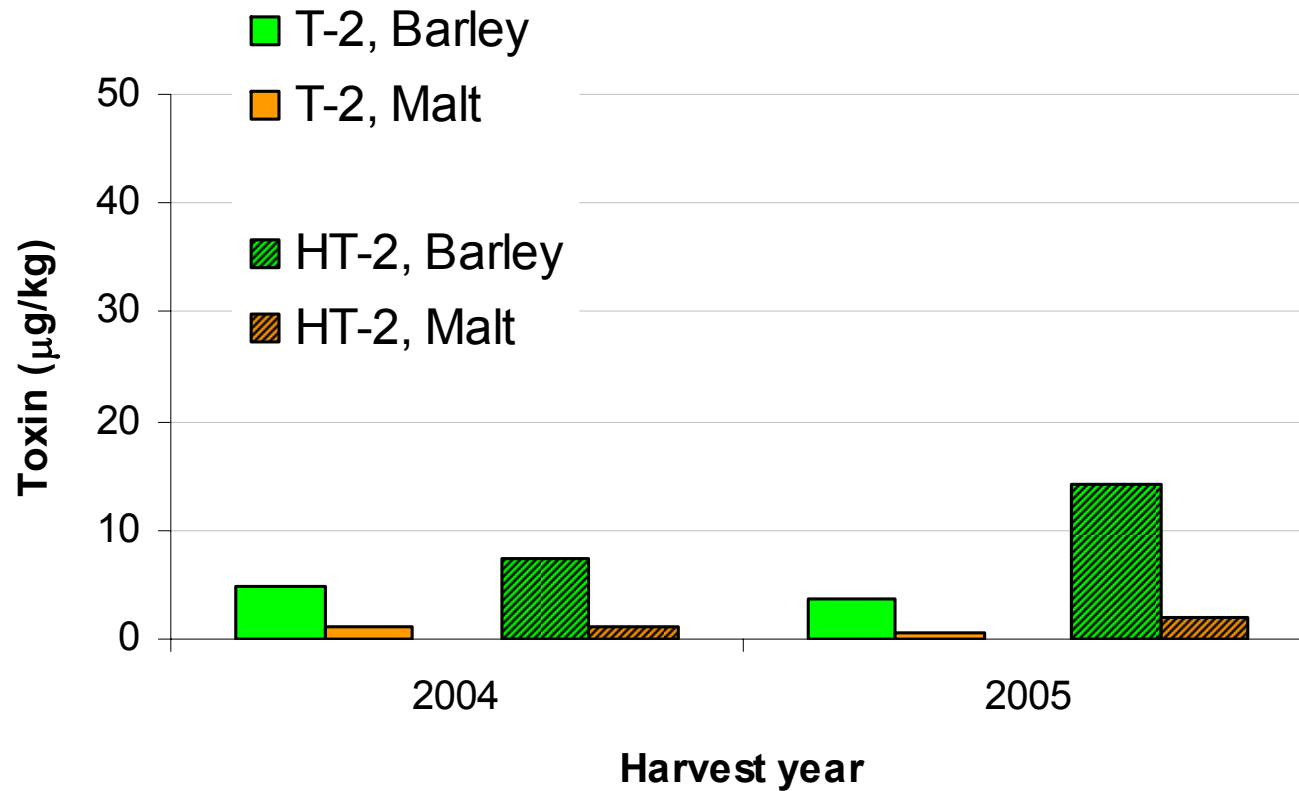
- Euromalt survey also sampled commercial malts prepared from each barley
- 10kg samples, collected and analysed according to EU protocol (Directive 2002/26/EC) as before

Incidence of T-2 and HT-2 Euromalt survey

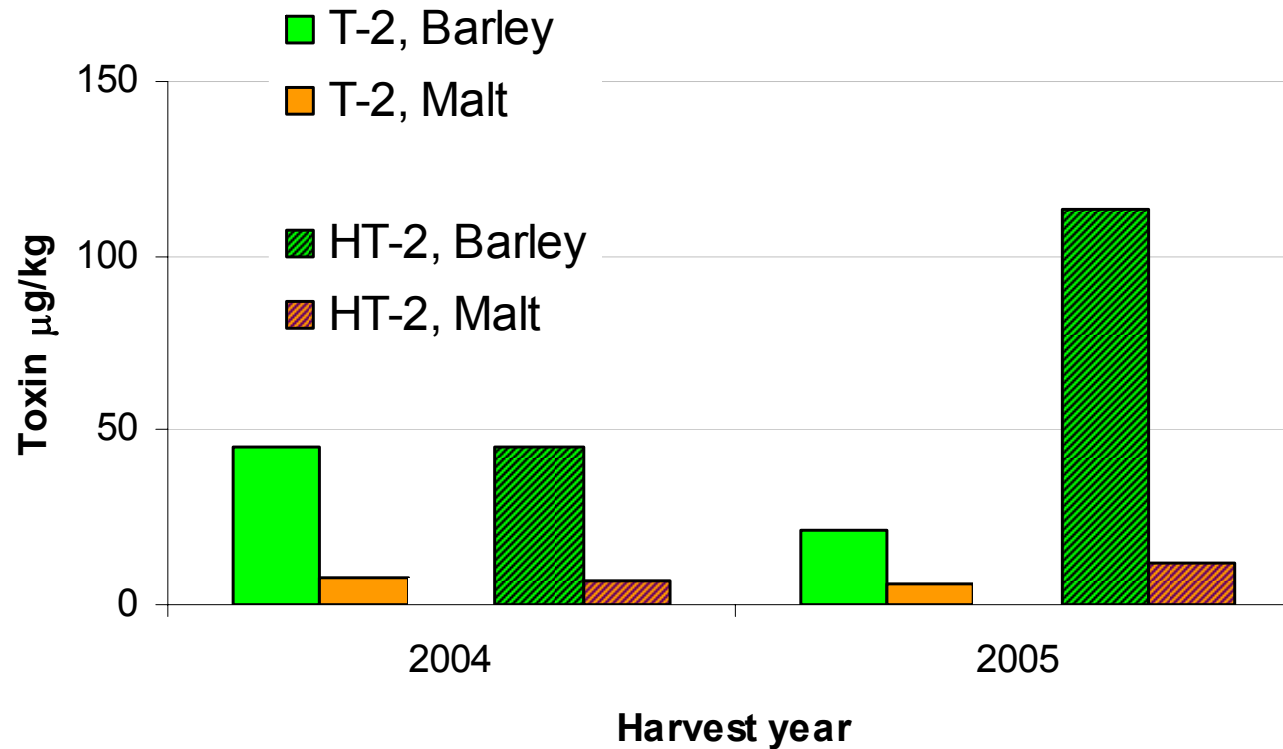


Limits of detection: 2004, 5 µg/kg ;2005, T-2, 0.5 µg/kg; HT-2, 2 µg/kg

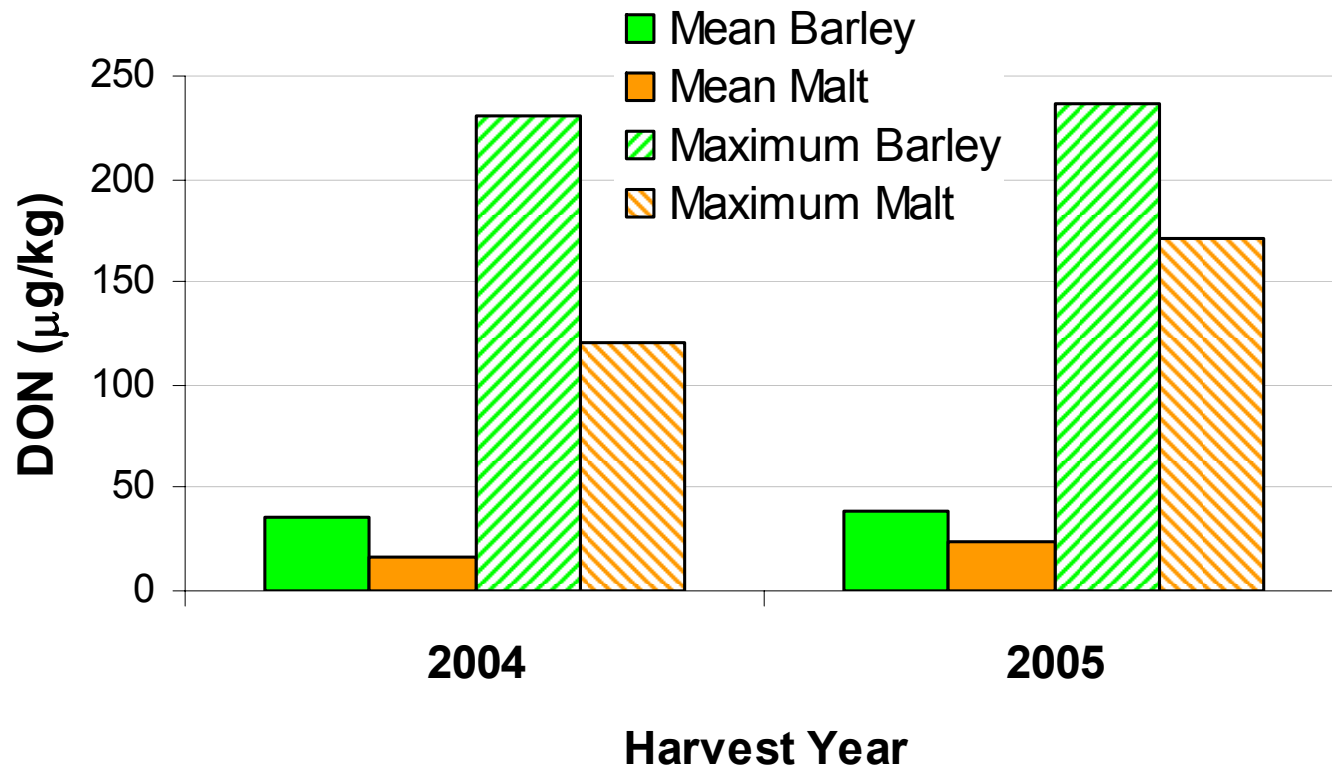
Mean concentrations of T-2 and HT-2



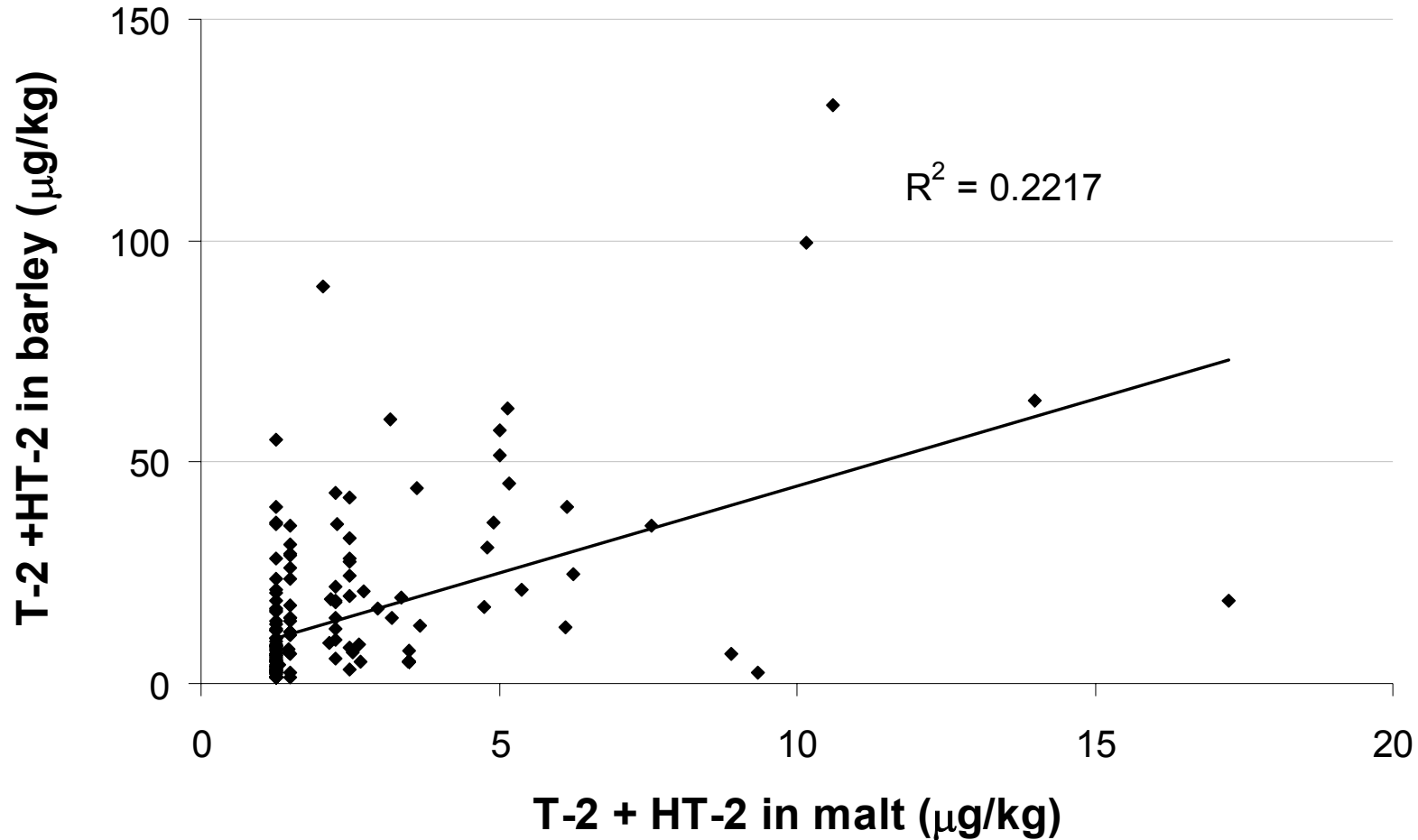
Maximum concentrations of T-2 and HT-2



DON in barley and malt samples



Correlation of toxin levels in barley



Effect of malting on T-2 and HT-2 in malting barley

Conclusions from survey

- Incidence and concentrations of both T-2 and HT-2 are lower in malt than in barley
- There is a similar trend for DON
- Poor correlation between T-2+HT-2 in barley and in resultant malt
- Significant loss of T-2 and HT-2 during malting

Effects of malting on T-2 and HT-2: Experimental results

Malting with artificially infected barley

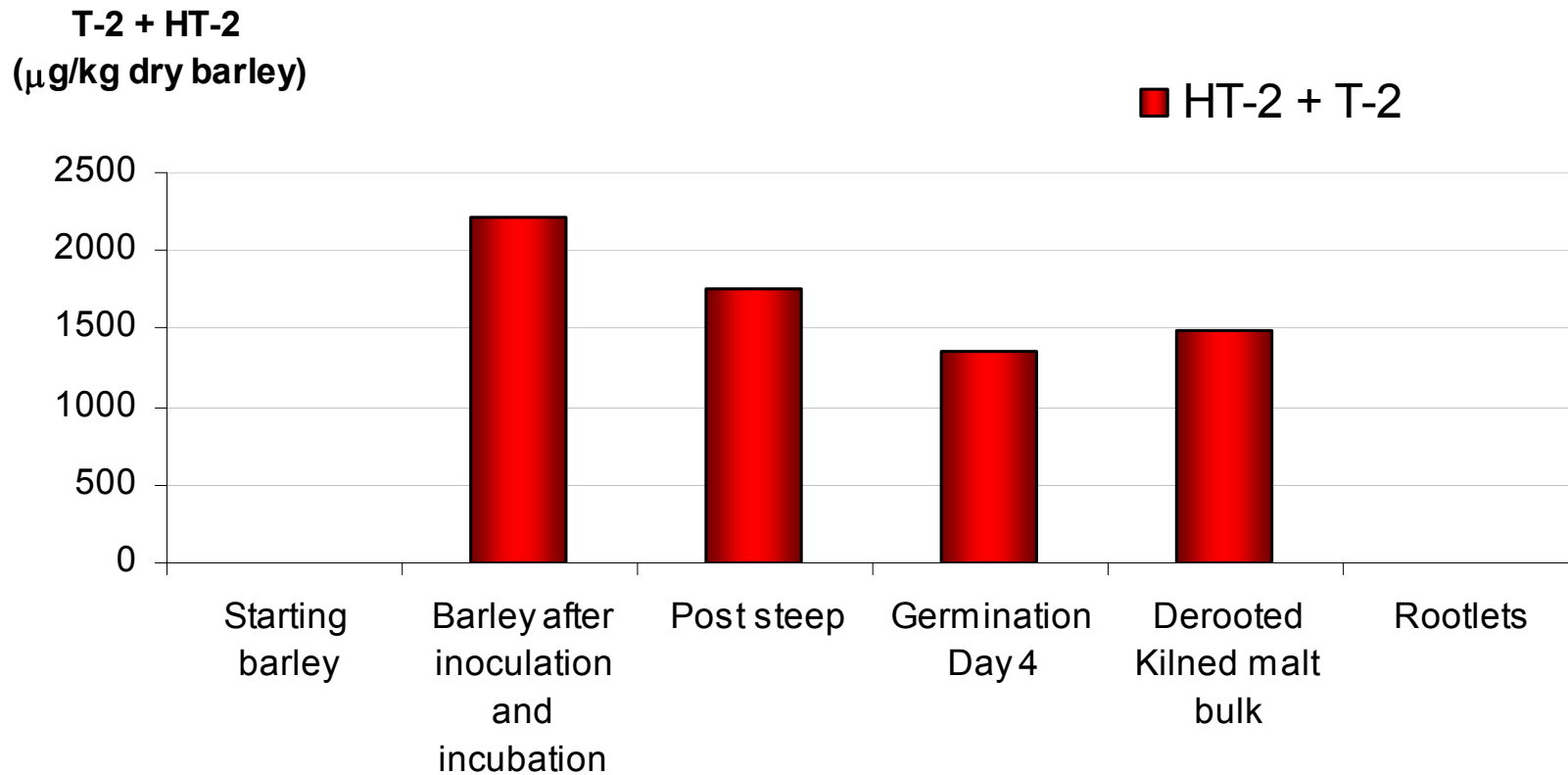
- Project to investigate the behaviour of mycotoxins during malting commissioned by UK's Home-Grown Cereals Authority, 2004-2006
- Barley artificially infected with Fusarium culture and held at high temperature and moisture to simulate conditions during growth in field
- Conditions intended to encourage mould growth leading to high mycotoxin concentrations



Inoculation conditions

- 50 kg barley treated with 10 litres *F.sporotrichioides* inoculum and held for one month at 16 - 20°C
- Moisture level was 24%
- grain was then malted using a standard protocol
- samples taken throughout malting and tested for mycotoxins

Behaviour of T-2 and HT-2 during malting with artificially infected barley



Effect of malting on T-2 and HT-2 in malting barley

Conclusions from experimental study

- Significant fall in concentration of T-2 and HT-2 during malting, even although grain is heavily infected with viable mould
- Most losses during steeping
- Malt contains substantially less T-2 and HT-2 than barley

Overall conclusions

- Occurrence of T-2 and HT-2 toxins appears to be increasing across Europe
- Need to know reason for increase and how it can be combated before legal limits imposed
- If inappropriate limits are set a sizeable proportion of grain could be unmarketable
- Levels of T-2 and HT-2 in malt are always lower than in barley although correlation is poor

Future work at Euromalt

- Survey of the 2006 harvest is in progress
- The survey will be repeated following the 2007 harvest
- Close contacts will be maintained with the Brewers of Europe



Thank you for your attention