

Reduction of T-2 and HT-2 toxin in UK cereal production

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Issues for Cereal Crops in UK

% greater than limits (2002-2008)

	DON	ZON	HT2+T2
Wheat	4.0 (0-13)	6.5 (0.3-29)	0.4 (0-1)
Barley	0.3	2.0	0.1 (0-1)
Oats	0.1	0.9	16 (1-30)

DON: 1250 ppb (1750 ppb for oats)

ZON: 100 ppb

HT2+T2: 100 ppb for wheat, 200 ppb for barley, 1000 ppb for oats HT2+T2

Data is for all cereals sampled, not all intended for human consumption



Monitoring of UK Cereal Crops

WHEAT: Continued monitoring of UK wheat at harvest in England via a stratified survey 2008-2013.

Very low percentage with HT2 and/or T2 greater than 10 ppb.

No samples have exceeded 100 ppb from 2008-2012

No results from 2013 harvest yet

No funding beyond 2013

Barley and Oats: No survey of UK crops at harvest for barley or oats since 2008.

Smaller scale monitoring conducted in store and industry monitoring of oats at mill intake.



Issue for HT2 and T2 in UK oats

Observational studies 2002-2005 and 2006-2008 (n=702).

Conventional oats collected at harvest (food and feed samples)

The percentage above a range of limits is shown below:

	HT2+T2 (%> ppb)		
	> 500	> 1000	> 2000
2002	23	10	3
2003	41	29	8
2004	27	15	6
2005	51	30	10
2006	43	21	9
2007	18	8	5
2008	6	1	0
Overall	30	16	6



Impact of agronomy

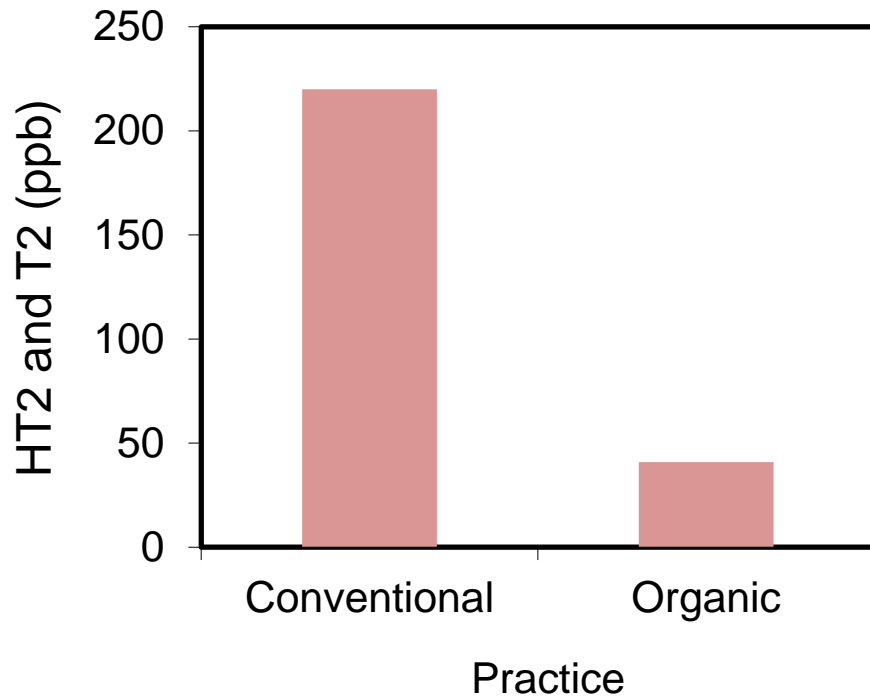
Various UK oat studies since 2002

- Organic and conventional UK oats
- Previous crop and cultivation
- N rates x PGR
- Fungicides
- Variety

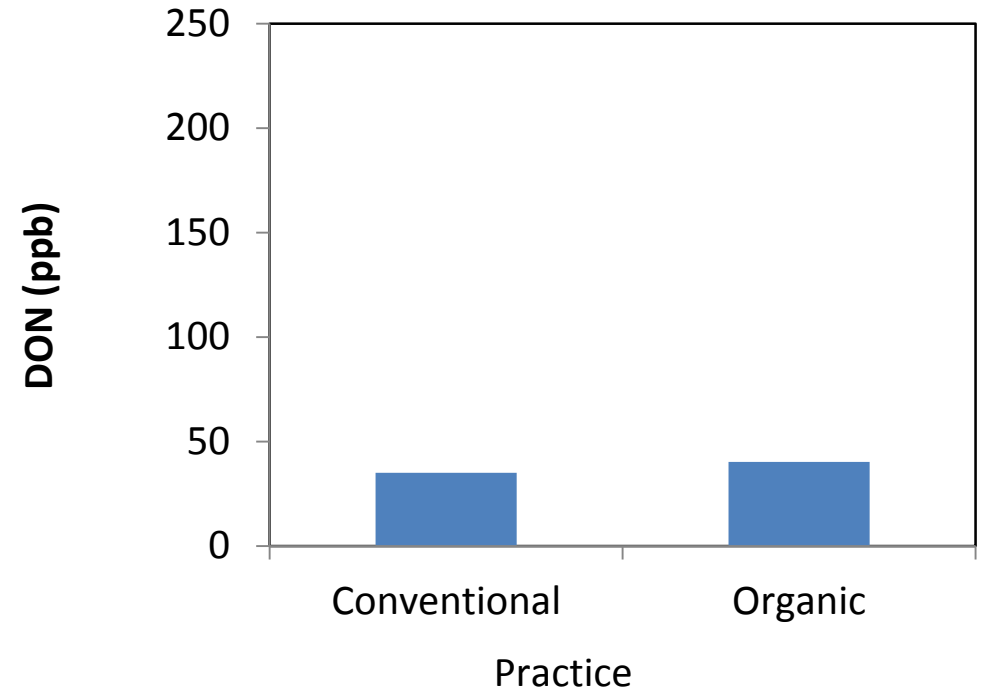


Conventional and organic oats

HT2 and T2 in oats



DON in Wheat





2. Oat agronomy study: Previous crop and cultivation

Winter and spring oats x 2 sites x 2 years

2 x 2 factorial strip trial

Strips of wheat and oil seed rape
(96 x 12 m)

Perpendicular strips of ploughed
and minimum tillage (96 x 12 m)

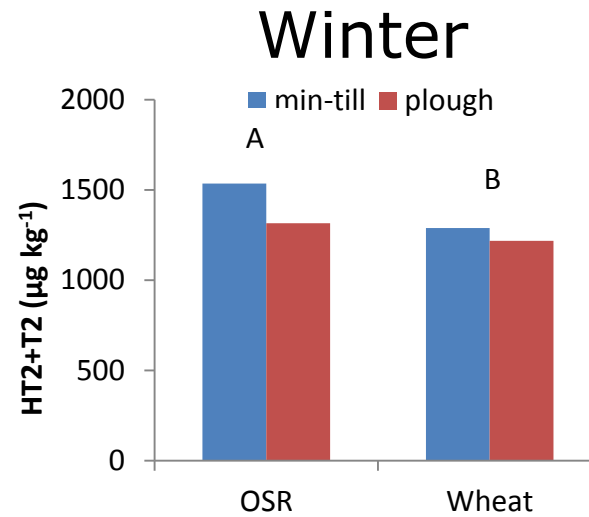
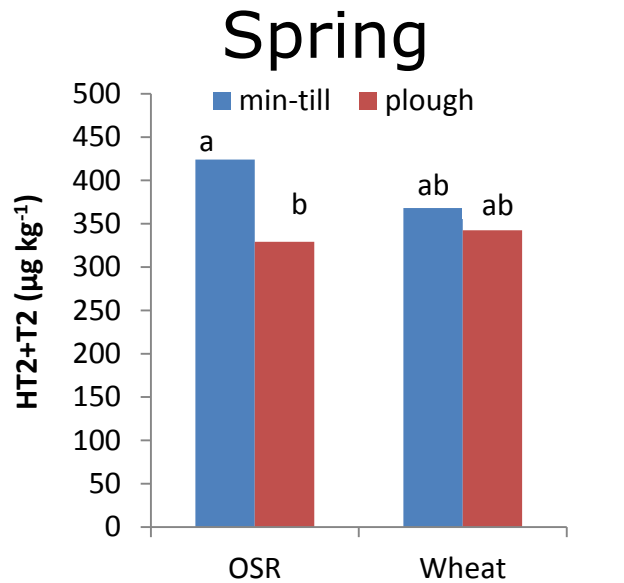
Drilled with winter and spring
oats (12 x 12 m) plots

REML analysis of yield, quality
and HT2+T2 at harvest

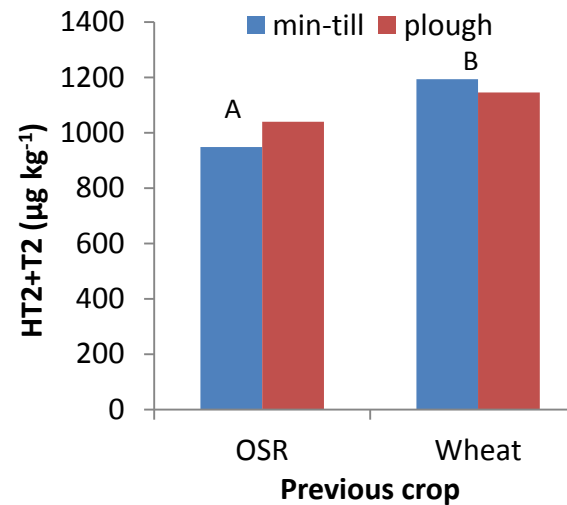
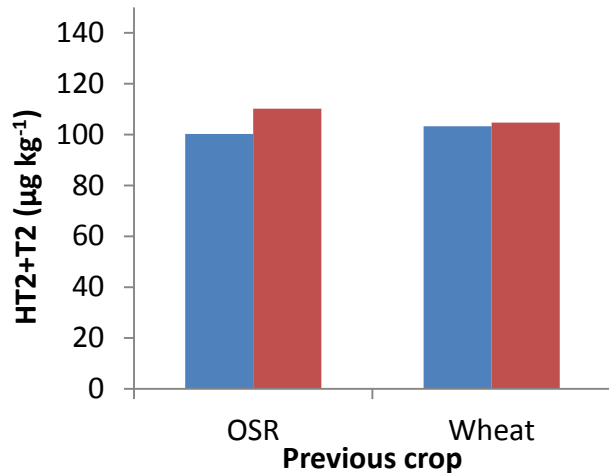




Previous crop and cultivation interaction



2010



2011



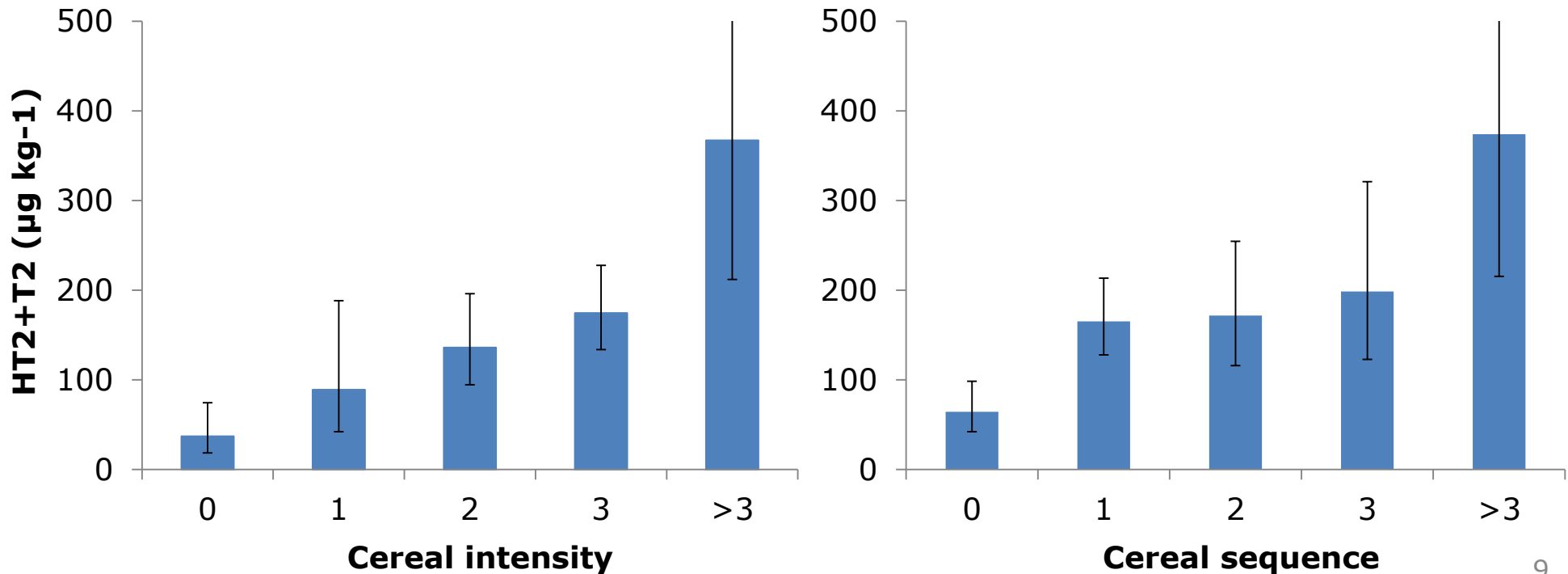
Observational study 2006-2008

Cereal intensity within rotation

Data based on last four years previous crops

Intensity = number of previous cereal crops

Sequence = number of consecutive cereal crops, ie without a break





Industry funded agronomy trials

Conducted over 3 years for winter and spring sown varieties (n=6)

Variety x Nitrogen rate x PGR

- Variety had a significant effect
- Nitrogen rates had no significant effect
- PGR use had no significant effect

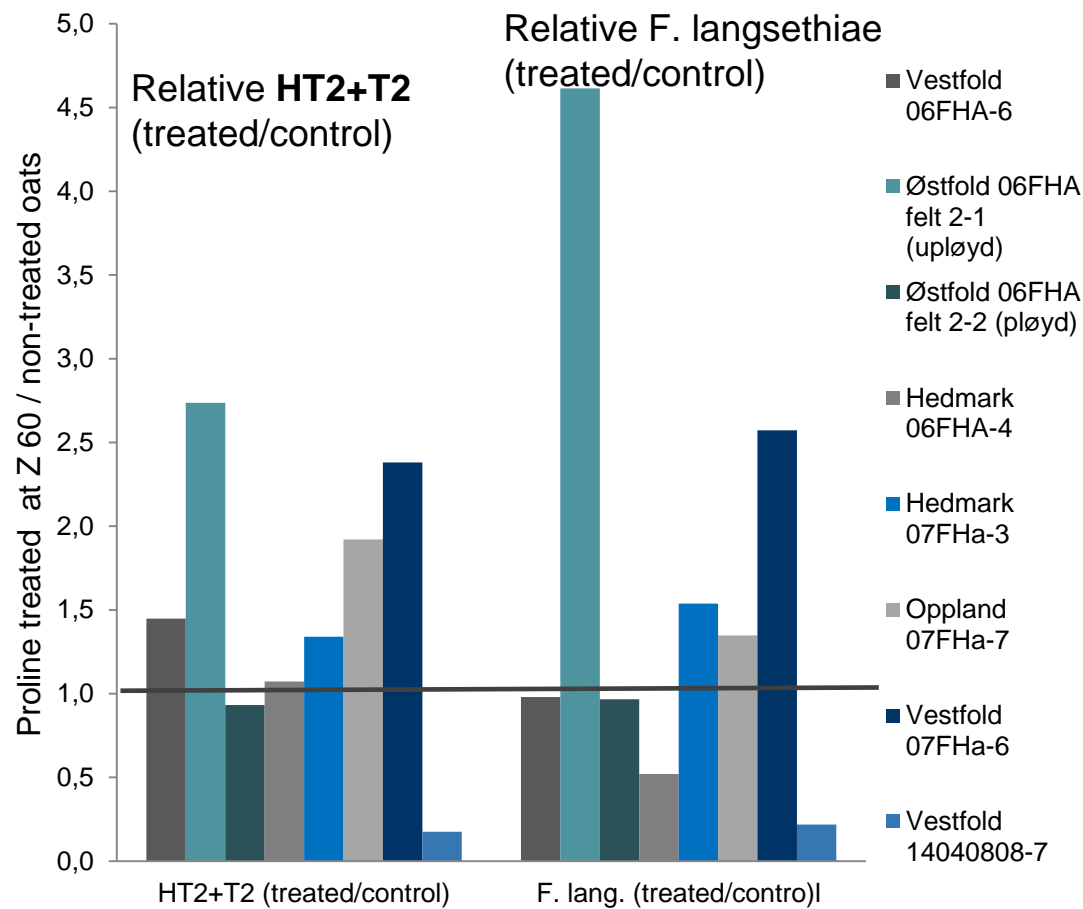
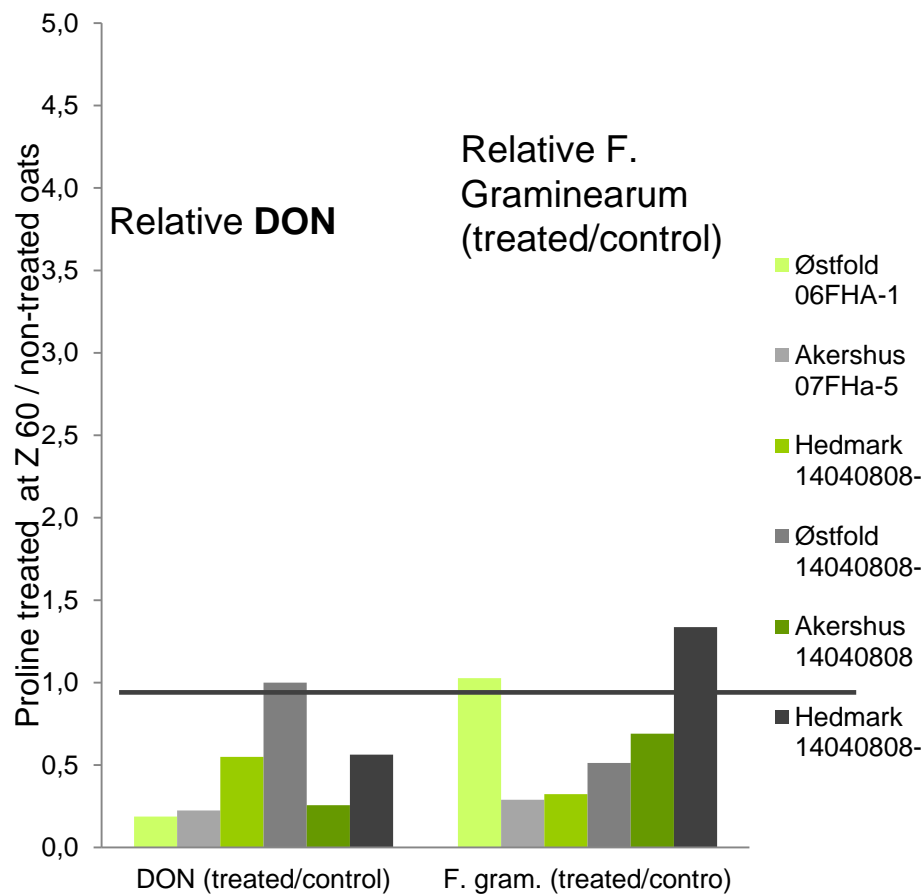
Fungicides

- Fungicide input had no significant effect

Proline treatment of oats at early flowering

-reduced DON content and *F. graminearum*

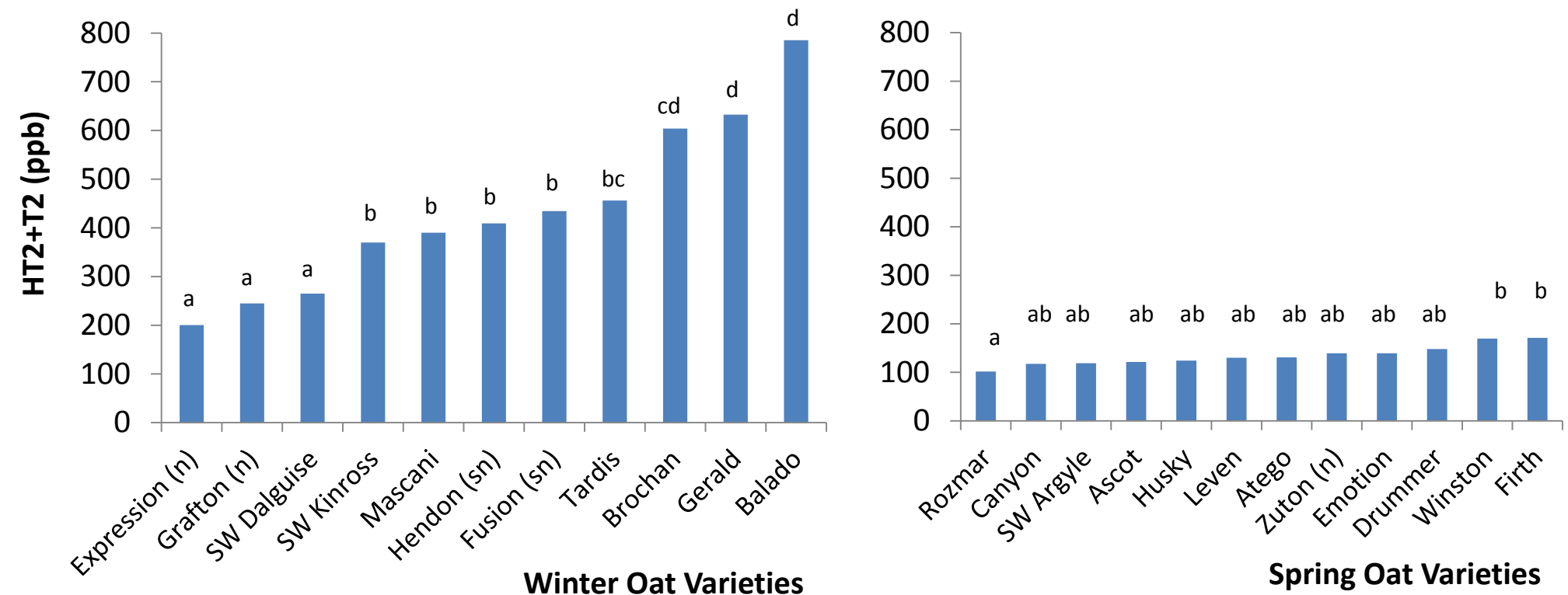
-no consistent effect on HT2/T2 and *F. langsethiae*





Oat varietal resistance

2005-2011 (>20 winter and >14 spring trials)



Varieties with same letter are not significantly different (LSD at P=0.05).
After name (N, naked; S, short-stawed).



FSA funded project (2008-2012):

Investigate the impact of agronomic practices on mycotoxin levels in oats and analysis of the implications of modifying agronomic practices

Objective 3. Propose one or more modifications to oat production which will reduce the HT2 and T2 content of harvested oats

Objective 4. Perform a risk-based analysis of the proposed modifications to oat agronomy, including economic implications



Propose modifications to oat production to reduce the HT2 and T2

1. Switch to less intensive cereal rotations for oat production

Due to the economics of cereal production in the UK, i.e. the high value of wheat, it is unfeasible to grow oats within a rotation with low cereal intensity for most farm enterprises.

(Oats comprise of only 3% of cereal production in the UK)



Perform a risk-based analysis of the proposed modifications, including economic implications

2. Switch from winter to spring oat production

From model:

Difference in predicted mean	2.7 fold (78 cf. 210 ppb)
Difference in predicted %>1000 ppb	4.3 fold (4% cf. 17%)



Switch from winter to spring oat production

- Yield penalty of about 1 tonne /ha
- Impact gross margin forecast at £100 /ha
- Would need to increase cost by £17.50 per tonne
- Would need a 20% increase in the area of land for oat production

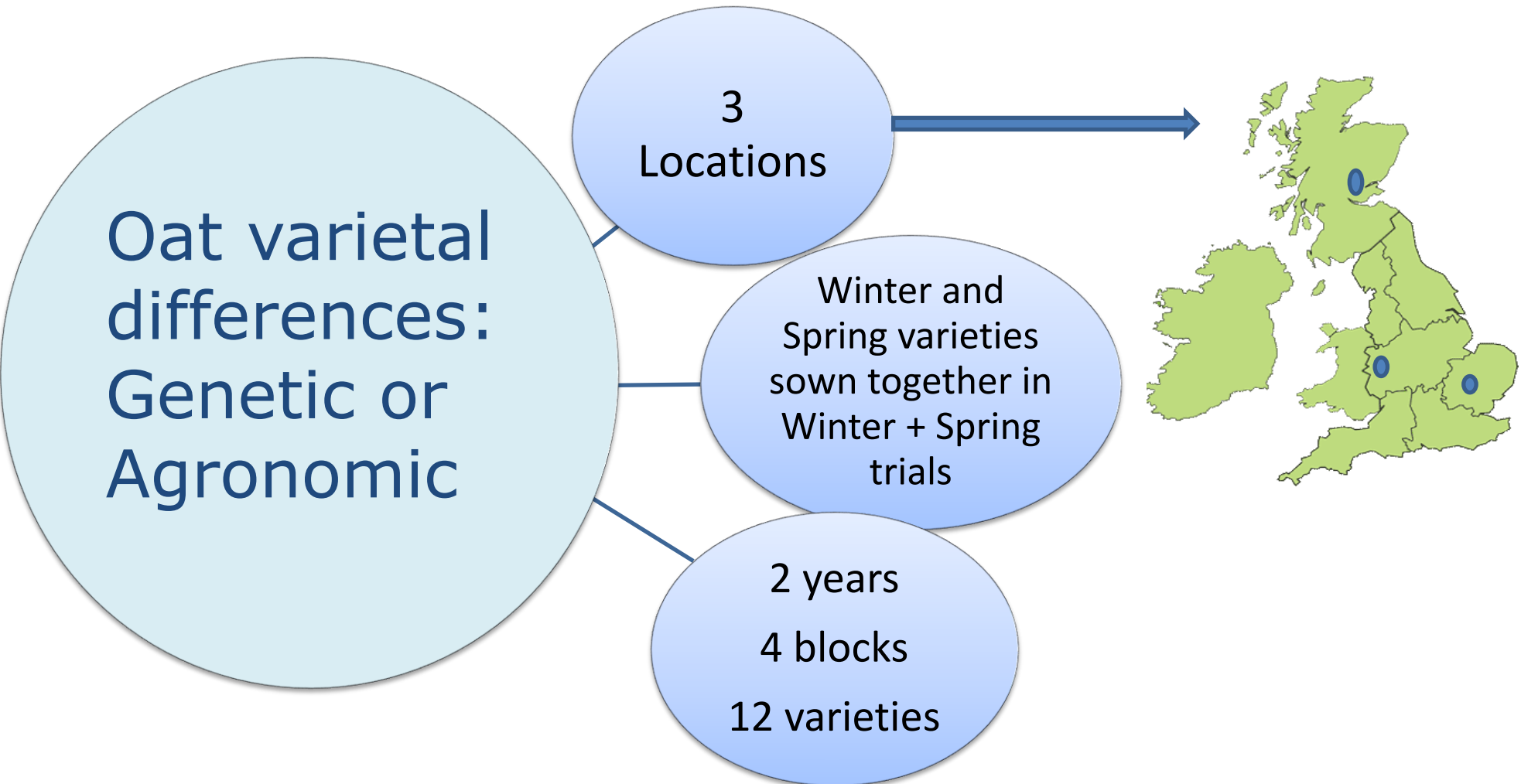


Switch from winter to spring oat production

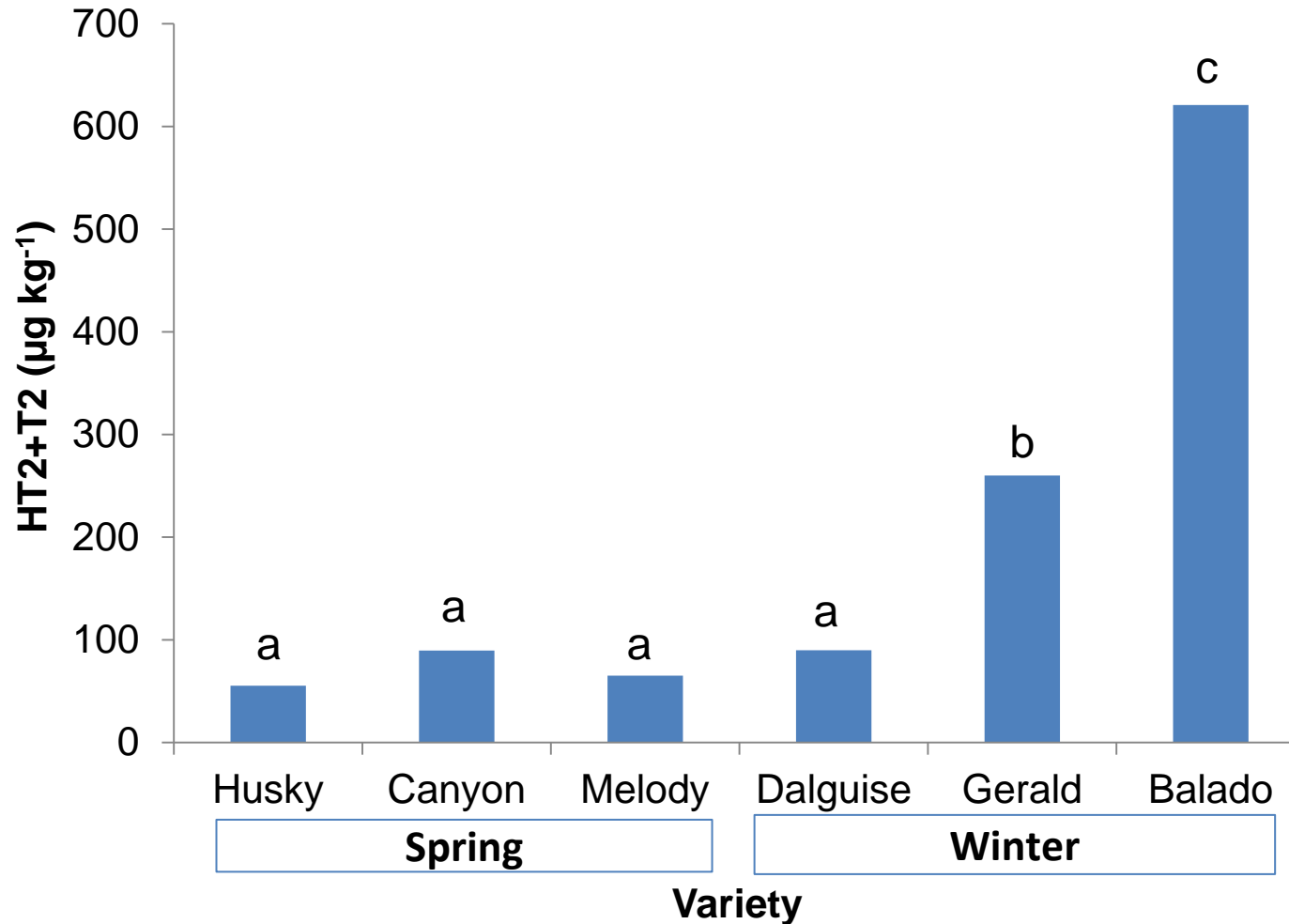
- Increase the costs to the UK oat processing industry by at least £8-9 million/annum, simply to purchase oats.
- This cost could increase as other commodity processors increase the price paid to compete for additional arable land used for oat production.
- Other costs would be incurred due to the need for testing and the additional haulage and marketing costs of oats that do not meet the limit and the seasonal variation in the availability of oats suitable for human consumption.



Oat varietal resistance



Oat varietal resistance – preliminary results from 4 winter sown experiments





Summary

- High levels on UK oats
- Previous crop and cultivation → differences not consistent
- Nitrogen rates have no significant effect
- PGR inputs have no significant effect
- Fungicide applications have no significant effect



Summary cont.

- Lower levels on organic oats
- Lower levels in less intense cereal rotations
- Lower levels on UK spring oat varieties

- Only current feasible method to markedly reduce HT2 and T2 in UK oat production is a switch from Winter to Spring varieties
- Large cost implication to industry due to yield difference
- Need to identify/develop high yielding/high quality winter varieties with resistance to Fusarium / low accumulation of HT2+T2



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