

**HGCA Project 2804:  
Food Safety Review for malt and malting barley**

**2003 harvest; barleys and resultant malts  
Final report, January, 2005.**

**Summary of Key Points**

1. Overall, the results of this survey confirm that UK malts are wholesome and comply with legal or proposed limits for contaminants.
2. The results show that levels of **mycotoxins** (including ochratoxin A, deoxynivalenol, nivalenol, T2 and HT2, and zearalenone) in malting barleys from the 2003 harvest, and in malts produced from them, were well below any existing or proposed legal limits (see Table 1).

**Table 1. Mycotoxins in stored 2003 harvested barleys and the malts made from them** (*Figures in parentheses =2002 harvest*)

Toxin		LOD µg/kg	% of samples > LOD	Mean* µg/kg	Max µg/kg	Legal or proposed limits µg/kg
<b>DON</b>	<b>Barley</b>	5	53	5.8	13	1250
	<b>Malt</b>		28 (42)	6.1 (8)	27 (56)	
<b>NIV</b>	<b>Barley</b>	5	3	3.4	11	none
	<b>Malt</b>		0 (0)	2.5 (2.5)	<5 (<5)	
<b>3-Ac DON</b>	<b>Barley</b>	5	0	2.5	<5	none
	<b>Malt</b>		0 (0)	2.5 (3.4)	<5 (19)	
<b>15-Ac DON</b>	<b>Barley</b>	5	0	2.5	<5	none
	<b>Malt</b>		0 (4)	2.5 (2.6)	<5 (6)	
<b>HT-2</b>	<b>Barley</b>	5	0	2.5	<5	Not yet set
	<b>Malt</b>		0 (0)	2.5 (2.5)	<5 (<5)	
<b>T-2</b>	<b>Barley</b>	5	0	2.5	<5	Not yet set
	<b>Malt</b>		0 (0)	2.5 (2.5)	<5 (<5)	
<b>ZEA</b>	<b>Barley</b>	2	10	1.9	12	100
	<b>Malt</b>		16 (0)	1.4 (1)	4 (<2)	
<b>Ochratoxin A</b>	<b>Barley</b>	0.1	21	0.28	1.0	5
	<b>Malt</b>		33 (38)	0.23 (0.30)	1.4 (1.18)	3

**DON:** as in previous years levels of DON were low. Incidence in malts (that is samples above the detection limit of 5 µg/kg) was 28% (significantly lower than for the 2002 harvest, which was 42%). The mean value (assuming that samples below the LOD contained half that limit, i.e. 2.5 µg/kg) was 6.1 µg/kg, slightly lower than in 2002. The highest concentration of DON found was 27 µg/kg in one malt, while the legal limit proposed for unprocessed cereals in the EU is 1,250 µg/kg.

**Other Trichothecenes;** 3-acetyl-DON, 15-acetyl-DON, T-2 and HT-2 were not detected in any barley or malt samples. Three barleys contained traces of nivalenol (all less than 10 µg/kg). No NIV was detected in the corresponding malts.

**Zearalenone:** Three malts and two barleys contained traces of zearalenone (maximum value 12 µg/kg). In only one case was the mycotoxin detected in both barley and its corresponding malt. Thus there was no evidence of significant formation of zearalenone during the malting of any of these barleys.

**Ochratoxin A:** Ten samples (6 malts and 4 barleys) contained detectable ochratoxin A. All were well below 3 µg/kg (the legal limit for OA in malt). The maximum level detected was 1.4 µg/kg in one malt.

3. There was little consistency between formation or disappearance of OA or of any individual trichothecenes or zearalenone during malting. This supports previous experience in both UK and Euromalt surveys, and indicates that in a commercial situation, sampling and analytical errors at these low concentrations are responsible for much of the variation observed.

4. Each of the malt samples were also analysed for **pesticide** residues. The chemicals most likely to leave residues in the grain were identified using a risk assessment protocol, which took into account the extent of use, timing of applications and the chemical nature of the pesticide. Chemicals identified as likely to leave residues included storage pesticides, ear fungicides, and growth regulators. A GCMS method was used for the insecticides and fungicides and an LC-MS.MS method, based on that used at the UK Government's Central Science Laboratory (CSL), was used for the growth regulators mepiquat and chlormequat.

Residues on the malts were all very low.

**Growth regulators:** All samples contained detectable chlormequat but concentrations were low - on average less than 10% of the EU MRL (which is 2 mg/kg). The maximum concentration detected was 0.33 mg/kg. A majority of barley samples (75%) also contained mepiquat, but mean levels were lower than for chlormequat (0.04 mg/kg, with a maximum of 0.4 mg/kg). This ratio of chlormequat to mepiquat corresponds closely with that found in formulations containing both active ingredients.

**Insecticides:** The storage insecticide pirimiphos-methyl was detected in 7 malts, but again levels were well below legal limits. The concentrations were very low, with the highest level found being 0.22 mg/kg, compared with the EU MRL of 5 mg/kg.

**Fungicides:** Only one sample contained detectable fungicide residues (cyprodanil), at a concentration which was just above the limit of detection. No MRL for cyprodanil has yet been set for cereals. None of the strobiluron ear fungicides were detected.

Results, including a full list of all the residues sought, are given in Table 2.

**Table 2. Residues of plant protection chemicals sought in BRi multi-residue screen**

*(limit of detection was 0.01 mg/kg for all chemicals)*

Chemical	Barley			Malt		
	No.> LOD	Mean mg/kg	Max. mg/kg	No.> LOD	Mean mg/kg	Max. mg/kg
<b>Growth Regulators</b>						
Chloromequat	19 (100%)	0.12	0.33	18 (100%)	0.09	0.25
Mepiquat	14 (74%)	0.04	0.05	10 (55%)	0.03	0.15
<b>Fungicides</b>						
cyprodanil				1(6%)	0.02	0.02
azoxystrobin				0 (100%)		
kresoxim-methyl				0 (100%)		
trifloxystrobin				0 (100%)		
<b>Insecticides</b>						
chlorpyrifos				0 (100%)		
chlorpyrifos-methyl				0 (100%)		
diazinon				0 (100%)		
dichlorvos				0 (100%)		
etrimfos				0 (100%)		
fenitrothion				0 (100%)		
malathion				0 (100%)		
methacrifos				0 (100%)		
pirimiphos-methyl				7 (39%)	0.10	0.22
lindane				0 (100%)		
cypermethrin				0 (100%)		
fenvalerate				0 (100%)		
permethrin				0 (100%)		
deltamethrin				0 (100%)		

