

A robust foundation to instil confidence

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AHDB

CEREALS & OILSEEDS

*from theory
to field*

While growers strive to achieve quality and other criteria in cereal grain, it's important these efforts don't result in undesirables creeping in. CPM reports on the research that monitors contaminants.

By Tom Allen-Stevens

Cereals are inherently safe. We know that, but have you ever wondered how we know? A large part of what underpins that knowledge is the monitoring of cereals for contaminants that takes place, funded by AHDB Cereals and Oilseeds.

But it's not just about keeping cereals safe. Most UK growers will probably have viewed the recent shenanigans over the re-registration of glyphosate with some incredulity. But a consumer, unfamiliar with farming practices and bombarded with messages from single-issue pressure groups designed to throw the science into question, needs a level of reassurance that's pretty universally accepted as robust.

That's just what the monitoring

programme provides, according to Dr Dhan Bhandari of AHDB Cereals and Oilseeds. "For many years, glyphosate has been included in the programme of independent monitoring that's been running since the 1980s," he notes

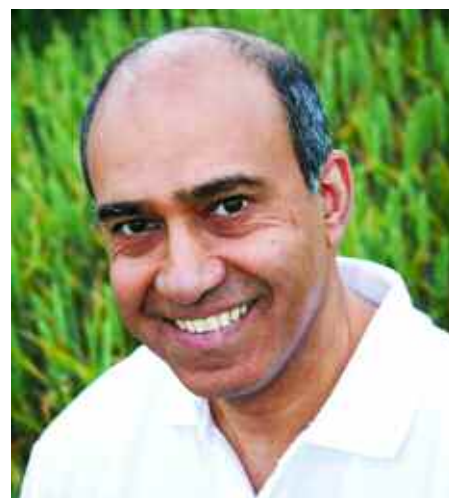
Independent testing

"It's a service that's highly valued by the industry and today takes in a range of contaminants, including mycotoxins. Samples of the main UK cereals — wheat, barley and oats — and co-products — wheatfeed and oatfeed — are tested in an independent manner to provide reliable and consistent data that reflects the safety and quality of UK grain."

Maintaining the integrity of UK cereals is an important element of the AHDB strategy, and feedback from levy-payers, as well as the wider industry, suggests the monitoring work is seen as an important part of delivering this, he says.

"It's also vital for maintaining consumer confidence in cereals. If the industry is to optimise the marketing opportunities for UK grain, it has to be underpinned with a robust assurance of crop safety."

But the monitoring programme goes beyond addressing the current concerns over the integrity of UK cereals, continues Dhan Bhandari. "A key role the partners in



The monitoring work is vital for maintaining consumer confidence in cereals, says Dhan Bhandari.

the programme perform is to anticipate any future issues that may arise, so it helps ensure UK grain is prepared for any future legislation and meets the growing demands on the grain supply chain."

In practical terms, that means testing for contaminants on which there may currently be no legal limit, or based on parameters which EU authorities are consulting member states. "It puts the UK in a strong position if we already have data that

reflects the level of contaminants we currently experience. That's both in terms of influencing whatever limit can practically be achieved and proactively addressing how we stay below that limit."

Glyphosate is a good example here, he points out. "It's one of the contaminants included in the monitoring work and we now have quite a few years of data on the levels found on a number of cereal crops at harvest. Typical levels detected are around 10µg per kg, or parts per billion, although this may peak between 1000-2000 ppb (see table on p17). But these levels are well below the legal limit of 20,000 ppb for barley and oats, and 10,000 ppb for wheat. That limit is set way below the level at which there could be any risk of toxicity to humans, even if such a risk existed.

"The fact we have detailed, reliable data helps put into context the risk pre-harvest use of glyphosate may actually present, which builds a very robust case for how it's currently used. But should legislation change as a result of current concerns, we also have year-on-year data of peak levels found in samples, so can move swiftly towards practical on-farm guidelines to ensure growers stay within any new limits that may be set," he adds.

There's precedent for this, he continues. "When EC limits for the fusarium mycotoxins deoxynivalenol (DON) and zearalenone (ZON) were introduced, this followed a period of consultation to determine at what level the limits should be set. We know that in most years, UK grain stays comfortably within those limits, but in some years the risk of triggering an exceedance can be raised — rainfall during flowering and at harvest are high risk factors."

Data from the monitoring programme, and subsequent AHDB-funded research, have helped AHDB draw up the risk assessment



Rainfall at harvest is a high risk factor for mycotoxins associated with fusarium.

used by wheat growers (Information Sheet 40). That's now part of the accepted due diligence the industry relies on to assure consumers UK grain stays below the legal limit, says Dhan Bhandari.

Having such monitoring in place appears to provide the industry with the reassurance it needs. Ochratoxin A is a mycotoxin commonly associated with poorly stored grain — such conditions encourage the growth of the fungus *Penicillium verrucosum*, believed to be responsible for the mycotoxin that can cause kidney damage and affects foetal development and the immune system.

"The industry reported that levels in some commodities for grain stored in 2015 were a little higher than in previous years, although no one is entirely sure why. However, the



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climatic conditions have been different for the harvest 2015 crop, and initial reports suggest it's not a concern this year."

The AHDB-funded programme is not the only monitoring of contaminants for cereals. All food companies have their own due diligence programme that ensures ►

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► compliance with the Food Safety Act, and CRD has a surveillance programme for monitoring pesticide residues in food.

“But the AHDB-funded monitoring is carried out annually and the data is publicly available,” points out Dhan Bhandari. “The results are also shared and discussed by the project partners, which helps all sides of the cereals industry understand the issues and put them into perspective.”

Feedback from the project partners suggest the robustness of the data delivers a level of crop assurance overseas buyers like to see, he adds. “It’s a similar picture when the EC is setting legal limits and EFSA looks for evidence. You do get differences across Europe, and member states will lobby their own case hard with EFSA. You need to be sure of your position and have robust data to lobby effectively.”

One set of contaminants currently being evaluated at EC level are those associated with



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ergot. The disease is caused by a fungus that infects the wheat ear and sclerotia grow in place of the grain. While these can be removed from the harvested crop, the legal limit is 0.05% and the industry has set a standard of 0.001% for feed and zero tolerance for other grains.

“The concern is the alkaloids produced by ergot — there are 12 of which four or five are the main ones. Even where ergot sclerotia have been removed from grain, the alkaloids remain

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Acrylamide angst and CIPC concerns

AHDB-funded trials have shown that a sulphur deficiency in cereal grains is linked to acrylamide levels found in certain cooked foods.

“If wheat is grown without an adequate application of sulphur, it raises the level within the grain of the amino acid asparagine,” reports Dhan Bhandari.

“It’s an entirely safe and natural amino acid, but if it exists at high levels in a low moisture dough that’s baked at high temperature, these conditions encourage the formation of acrylamide.”

The food industry must follow guidelines set down by the EC to reduce the risk of acrylamide. But growers should also keep sulphur levels in cereals at the appropriate level. “Research shows there’s a yield benefit from S applications, and bread-making quality can be reduced if there isn’t adequate



Chlorpropham (CIPC) permeates into the fabric of a store and can persist for decades.

sulphur,” he adds.

Meanwhile potato growers, and especially those moving out of the crop, are reminded that stores treated with the potato sprout-suppressant chlorpropham (CIPC) should never be used to store grain.

“The chemical permeates into the fabric of the building and can persist for decades. This is then transferred to grain and trace amounts can be detected,” notes Dhan Bhandari.

Summary of contaminant results

| | Harvest 2014 | Deoxynivalenol (DON) | | Zearalenone (ZON) | | HT-2 +T 2 | | Ergot alkaloids | | March 2015 | Ochratoxin A | |
|----------------|--------------|----------------------|--------------|-------------------|--------------|-------------|--------------|-----------------|--------------|-------------|--------------|--------------|
| | No. samples | Max (µg/kg) | Mean (µg/kg) | Max (µg/kg) | Mean (µg/kg) | Max (µg/kg) | Mean (µg/kg) | Max (µg/kg) | Mean (µg/kg) | No. samples | Max (µg/kg) | Mean (µg/kg) |
| Milling wheat | 75 | 755 | 110 | 10 | <2 | <10 | <10 | 1738 | 59 | 50 | 9.9 | 0.2 |
| Feed wheat | 10 | 61 | 15 | 18 | 3 | <10 | <10 | 90 | 10 | 35 | 5.5 | 0.3 |
| Wheatfeed | 20 | 650 | 242 | 26 | 7 | <10 | <10 | 811 | 163 | 10 | 1.6 | 0.5 |
| Feed Barley | 11 | 44 | 13 | <2 | <2 | 24 | <5 | 309 | 28 | 24 | 29.5 | 1.4 |
| Malting Barley | 42 | 33 | 6 | 24 | <2 | 43 | <5 | 149 | 13 | 19 | 0.4 | <0.1 |
| Feed Oats | 12 | 309 | 36 | 24 | 2 | 905 | 175 | 601 | 52 | 11 | 139 | 12.8 |
| Oatfeed | 10 | 859 | 155 | 25 | 6 | 4310 | 1197 | 121 | 26 | 8 | 1.9 | 1.1 |

Milling wheat results, harvest 2014

| | No. samples | Max (µg/kg) | Mean (µg/kg) |
|-------------|-------------|-------------|--------------|
| Glyphosate | 20 | 1403 | 165 |
| Chlormequat | 20 | 519 | 197 |
| Mepiquat | 20 | 81 | <10 |
| Lead | 75 | 0.06 | <0.01 |
| Cadmium | 75 | 0.11 | 0.03 |
| Arsenic | 75 | 0.02 | <0.01 |
| Mercury | 75 | 0.03 | <0.01 |
| Nickel | 75 | 0.31 | 0.1 |

at trace level, and the sclerotia bodies easily fragment. Now the European Food Standards Agency (EFSA) is considering what legal limits should be set on these alkaloids, and is looking for data to inform the process. We know the situation with UK grain, so will be passing this information on to the EFSA.”

To provide further evidence, AHDB has recently issued a call for a review of ergot alkaloids. A budget of £15,000 has been set aside for a desk-based study.

But gathering the existing data that underpins this evidence has been no mean feat, points out Nick Byrd of Campden BRI who leads the monitoring programme. “It’s been a particularly important part of the project in recent years to ensure we have a robust practice in place to routinely measure ergot alkaloids.”

While the actual assay used to detect the alkaloids was developed outside the project, its implementation and the monitoring standards built around it have been introduced as part of the ongoing work, he says. ►

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► “Generally we’re finding alkaloids at low levels on most samples. But it’s weather related, so there’s potential for levels to be higher.”

Snapshot representation

Representative samples submitted by the industrial partners with the project provide the basis of the monitoring work. “We process only a few hundred samples each year, so it’s only designed to be a snapshot representation. But we try to ensure there’s a good geographical spread, and we use the latest, class-leading lab technology to make the measurements. This is regularly tested

and accredited to ensure it’s accurate, so there can be no doubts about how robust our data are,” assures Nick Byrd.

The project partners meet regularly to review the programme and anticipate any forthcoming issues. “There’s really good communication within the group. An important part of what we do is the horizon-scanning, and past experience suggests this has been successful in identifying potential concerns before they become an issue,” he points out.

“But as the research partners, we’re very much focused on providing robust, base-level data. That’s then used by the industry to identify trends or peaks and to interpret what action may be needed.”

With the current four-year research programme now coming to an end, AHDB has issued a call for a follow-on five-year project, notes Dhan Bhandari. “One additional aspect of the new project is that it will include oats for human consumption and the British Oat and Barley Millers’ Association (BOBMA) has joined as an industry partner. The project is due to be awarded shortly.” ■

The monitoring programme puts the UK in a strong position when determining legal limits for contaminants at an EU level.



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Research round-up

AHDB project RD-2011-3779, Monitoring of mycotoxins and other contaminants in UK cereals used in malting, milling and animal feed, runs from Aug 2012 to July 2016. Its aim is to survey the incidence and levels of key contaminants in representative samples of UK-grown cereals and co-products to ensure they meet legal compliance guideline limits and are safe for human consumption, and also to monitor legislation and contaminant issues that could impact on the market acceptability of cereal-based foods. Led by Campden Technology, with scientific partner Brewing Research International and industry partners AIC, MAGB and nabim, its total cost is £636,533, funded by AHDB.