Institution: Harper Adams University
Unit of Assessment: 6 – Agriculture, Veterinary and Food Science
Title of case study: Reducing food chain waste from fusarium mycotoxin contamination of wheat grain

1. Summary of the impact (indicative maximum 100 words)

This research (total cost £320,738) discovered which agronomic practices influence fusarium mycotoxins contaminating wheat grain, and led directly to a Food Standards Agency (FSA) Code of Practice aimed at reducing the mycotoxin concentrations in wheat grain for food processing. The impact has been to improve management practices leading to less waste. The implementation of the code led to fewer loads of wheat, sent by farmers for flour milling being rejected due to mycotoxin contamination above the EU permitted limits, and less food grade wheat grain wasted. These benefits have been independently estimated as worth £26 million in 2010.

2. Underpinning research (indicative maximum 500 words)

- The key insight from the underpinning research was the identification of the agronomic practices promoting fusarium mycotoxin contamination of UK wheat grain. The extent of the influence was quantified to enable clear priorities to be established for measures to reduce contamination.

- The underpinning research involved the collection of three hundred samples of wheat per year from fields of known agronomy over a number of seasons. These were analysed for ten trichothecene mycotoxins, including deoxynivalenol (DON), and zearalenone. The mycotoxin concentration was statistically modelled against the agronomic practices (e.g. variety, cultivation and previous crop) applied to each field, to quantify the extent of influence of each agronomic factor found to be important.

- The research was a five-year project started in 2001.

- The research was supervised by Dr (now Professor) Simon Edwards, who was Reader in Plant Pathology at the time.

- The context for the project was that the introduction was anticipated of European Commission (EC) legislative limits for the fusarium mycotoxins, DON and zearalenone in cereals and cereal products. This was the driver for the Food Standards Agency (FSA) and the Home-Grown Cereals Authority (HGCA) to fund the work in order to be able to give guidance to wheat growers on how to reduce the risk of mycotoxin contamination. Legislative limits were introduced in 2006.

3. References to the research (indicative maximum of six references)

a. Edwards SG (2006) Investigation of Fusarium mycotoxins in UK wheat production. Project Report No. 413 FSA Project No: CO4022 HGCA Project No: 2452. Agriculture and Horticulture Development Board: Stoneleigh, Warks UK. Available from: http://www.hgca.com/publications/documents/abouthgca/PR413_Final_Project_Report.pdf

b. Edwards SG (2009) Fusarium mycotoxin content of UK organic and conventional wheat. *Food Additives and Contaminants* 26(4): 496-506. **DOI:** 10.1080/02652030802530679

Indicators of quality of the research

i. Grant awarded to Professor Simon Edwards, Harper Adams University College.
Grant Title: Investigation of Fusarium mycotoxins in UK wheat production
Sponsor: FSA and HGCA
Period of Grant: April 2001 for 60 months
Value of Grant: FSA: £215,217; HGCA: £56,771; Industry: £48,750 (Total Grant: £320,738)

ii. As part of a review of mycotoxin and nitrate research funded by FSA, the scientific quality and value for money of the outputs from each project were assessed by a panel of scientific experts. The panel reported on the HAU project that "the research performed was of a very high quality and of a standard expected of a first rate research laboratory" and "the work fully addressed the project aims and the objectives of the ROAME and made a significant contribution to the outputs of the programme as a whole."
The report is available at:
http://www.food.gov.uk/multimedia/pdfs/c03andc04progreviewmyco

iii. The paper Edwards (2009) has had 59 citations on Google Scholar in the four years since publication (at 20 November 2013). The HGCA Report, Edwards (2006), has had 10 citations on Google Scholar since publication (at 20 November 2013).

4. Details of the impact (indicative maximum 750 words)

A. Informed UK cereal industry on Good Agricultural Practice to reduce fusarium mycotoxins
Results of the research were used in the production of the Food Standards Agency's *The UK Code of Good Agricultural Practice to Reduce Fusarium Mycotoxins in Cereals* and the leaflet *Code of Good Agricultural Practice for the reduction of mycotoxins in UK cereals* which was distributed to all cereal growers in the UK. The results were also used to develop the HGCA-Agriculture and Horticulture Development Board *Guidelines to minimise risk of Fusarium mycotoxins in cereals*.

B. *Provided a due diligence tool to assess risk in UK wheat crops*
The *HGCA Risk Assessment for Fusarium Mycotoxins* was developed based on the output from the HAU research. The Risk Assessment became a requirement for UK cereal assurance schemes with results reported on grain passports. The majority of UK wheat for human consumption is covered by assurance schemes and must have a grain passport with a risk assessment score reported for each consignment of wheat delivered to mills.

Implementation of the advice and risk assessment by UK farmers has led to the impact that fewer loads of wheat sent by farmers for processing for human consumption have been rejected due to mycotoxin contamination above the EU permitted limits. This has led to less food-grade wheat grain wasted. The main beneficiaries have been farmers, because wheat grain downgraded from food use receives a lower price. Thus the impact is also on the income of farmers. There is also a cost in additional sampling, testing and haulage for the whole cereal chain.

The HGCA commissioned an independent audit of the financial benefit of this research (DTZ, 2010). These benefits have been independently estimated as worth £26 million to the UK farming and food industry for 2010. The HGCA Chairman wrote a letter of endorsement for Professor Edwards in 2011 stating that 'The industry owes a lot of its current good practice to his research work…'.

C. Informed European legislation
All mycotoxin results were reported to the European Food Safety Authority (EFSA) where they are used, in combination with all other submitted data from Member States, to assess

the European population exposure to fusarium mycotoxins. This data is used to formulate opinions by EFSA to questions raised by the European Commission Working Group on Agricultural Contaminants (WGAC). Based on these opinions the WGAC determine the need for, and set maximum legislative limits if needed.

5. Sources to corroborate the impact (indicative maximum of 10 references)

a. DTZ (2010) *Evaluating the Impact of HGCA-Funded Research*. Final Report to HGCA. (Confidential report, available for audit)

b. Tipples (2011) Letter of endorsement of Professor Edwards from HGCA Chairman (Confidential letter, available for audit)

c. FSA (2007) The UK Code of Good Agricultural Practice to Reduce Fusarium Mycotoxins in Cereals. York: Chemical Safety Division. http://www.food.gov.uk/mulitmedia/pdfs/fusariumcop.pdf

d. FSA (2007) Code of Good Agricultural Practice for the reduction of mycotoxins in UK cereals Leaflet No. FSA/1170/0507. http://www.food.gov.uk/multimedia/pdfs/mycotoxincop2007.pdf

e. HGCA (2010) Guidelines to minimise risk of Fusarium mycotoxins in cereals (2nd Edition) Warwickshire: HGCA. www.hgca.com/document.aspx?fn=load&media_id=6174&publicationId=3848

f. HGCA (2013) HGCA risk assessment for fusarium mycotoxins in wheat. Topic Sheet 121. http://www.hgca.com/document.aspx?fn=load&media_id=8828&publicationId=9293