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SURVEY OF RETAIL RICE FOR A RANGE OF MYCOTOXINS

Key Facts

- Mycotoxins are naturally occurring chemicals produced by moulds growing on foodstuffs, including rice. A number of mycotoxins are genotoxic carcinogens, i.e. they can cause cancer by damaging genetic material. Expert committees have recommended that exposure to genotoxic mycotoxins should be reduced to levels as low as technologically achievable.
- In this survey a total of 100 samples of rice and rice products were obtained from a variety of retail outlets in three areas of England, including long grain, basmati, brown and ground rice.
- Samples were analysed for a range of mycotoxins; aflatoxins (B₁, B₂, G₁, G₂), fumonisins (B₁, B₂, B₃), ochratoxin A, sterigmatocystin, trichothecenes (deoxynivalenol, 15-acetyl deoxynivalenol, diacetoxyscirpenol, fusarenon X, nivalenol, neosolaniol, T-2 toxin, HT-2 toxin and T-2 triol), and zearalenone.
- No samples had levels of mycotoxins present above current or proposed EC limits.
- There is therefore no need for anyone to alter their dietary habit as a result of the findings in this survey.
- The Agency will continue to periodically monitor the incidence and levels of mycotoxins in rice to ensure these remain as low as achievable.

Summary

A survey to determine the levels of a range of mycotoxins present in rice available at retail outlets in the UK has been completed. One hundred samples were collected from retail outlets in three areas of England. The number of samples of each type of rice was calculated on a market share basis. The samples were analysed by RHM Technology Ltd (RHM) using validated methods of analyses. The survey was undertaken to assess the current situation regarding mycotoxin contamination of rice. Previous surveys^{1,2}, which included a relatively small number of rice samples, indicated low levels of contamination by aflatoxins, fumonisins, trichothecenes and zearalenone but not sterigmatocystin.

A range of long grain rice, easy cook rice, basmati rice, speciality rice, brown rice, short grain rice, flaked and ground rice were analysed for aflatoxins (B₁, B₂, G₁ and G₂), the fumonisins (B₁, B₂ and B₃), ochratoxin A, sterigmatocystin, and the trichothecenes (deoxynivalenol, 3-acetyl deoxynivalenol, 15-acetyl deoxynivalenol, diacetoxyscirpenol, fusarenon X, nivalenol, neosolaniol, T-2 toxin, HT-2 toxin and T-2 triol), and zearalenone. Ochratoxin A, sterigmatocystin, fumonisin B₁, B₂, B₃ and zearalenone were not detected in any of the samples. Aflatoxins were quantified in 17 of the rice samples analysed at levels ranging from 0.2 to 1.8 micrograms/kg total aflatoxins. The highest levels of aflatoxin were found in basmati and brown rice. All levels found were below the EC legislative limits of 2 micrograms/kg aflatoxin B₁ and 4 micrograms/kg total aflatoxin in cereal products for direct human consumption. A low level of deoxynivalenol (12 micrograms/kg) was detected in one sample of rice, however, no other trichothecenes were detected in any of the samples. This is well below the proposed EC action limit of 500 micrograms/kg. There is therefore no need for anyone to alter their dietary habit as a result of the findings in this survey. No specific Agency action was required in this instance, however the Agency undertakes a rolling programme of food surveys to assess mycotoxin contamination of retail products and will continue to monitor the situation.

Background

The aflatoxins, the fumonisins, ochratoxin A, sterigmatocystin, the trichothecenes, and zearalenone are naturally occurring chemicals produced by moulds. The moulds species which produce aflatoxins are generally found in tropical and sub-tropical climates. Ochratoxin A, the fumonisins, sterigmatocystin, the trichothecenes and zearalenone are produced by different moulds, which generally favour climates with lower temperatures

and humidity. Growth of the moulds and the production of mycotoxins is dependent upon a number of environmental factors such as temperature and humidity during growth, harvesting, drying and subsequent storage of crops. Table 1 summarises the major fungal species responsible for the contamination of foods by each of these mycotoxins, the foods that are susceptible and includes the latest expert committee opinion on possible health effects.

Rice is one of the major cereals crops consumed by the UK population, with increasing consumption both in the home and from catering outlets.³ Unlike other cereals, reports on the actual incidence of mycotoxins in rice are limited, especially in rice retailed in the UK. In a survey of ethnic foods carried out in 1994,¹ in which samples of rice were included, low levels of aflatoxin, zearalenone, fumonisins and trichothecenes were found. However, the number of rice samples analysed was small. No sterigmatocystin was detected in 21 samples of rice analysed in a more recent survey in 1998.² No other detailed surveys of rice have been reported.

Rice has been reported to contain a diverse range of fungi, including strains from *Aspergillus*, *Penicillium*, *Alternaria* and *Fusarium* species which are known toxin producers, for example *Aspergillus* strains isolated from Egyptian paddy rice included *A. flavus* and *A. ochraceus*.⁴ Rice is a commodity that is frequently used as a substrate for laboratory production of mycotoxins,⁵⁻⁷ and reports indicate that rice is highly susceptible to fungal infection⁸ and thus a likely substrate for aflatoxin formation.

Mycotoxin contamination of rice has been reported from most areas of the world although, as indicated above, less frequently than for other cereals. Aflatoxins have been reported in rice and rice products in South East Asia,⁹⁻¹³ South America,¹⁴ North America,¹⁵ the Middle East,¹⁶ Africa¹⁷ and Europe.^{18,19} Reports of contamination of rice by other mycotoxins include trichothecenes,^{20,23} fumonisins,^{24,25} ochratoxin,^{26,27} zearalenone^{28,29} and sterigmatocystin.^{30,31}

There are very few reports^{32,33} of human mycotoxicosis related to the ingestion of rice contaminated by the mycotoxins covered in this survey.

Previous studies have demonstrated that aflatoxins and other mycotoxins are seldom uniformly distributed throughout most food and feed commodities, their occurrence being

uneven and spasmodic.³⁴⁻³⁶ For this reason, sampling procedures have been established in order to obtain the most accurate estimation of mycotoxin contamination in foods at different points in the supply chain. Procedures for appropriate sampling of products on retail sale will be different from those appropriate for sampling of bulk consignments. There is an EC approved sampling plan for cereals, including rice, at the point of import that involves taking a sample of approximately 30kg. The Food Standards Agency Guidance Note, which is intended to provide guidance to food authorities, industry and other interested parties on the Aflatoxins Regulations and practical advice on implementing the sampling plan, recommends alternative sampling plans to be used by enforcement authorities when it is inappropriate to follow the proscribed official plan.

For mycotoxin surveys carried out by the Agency a representative retail sample, in this case of approximately 1kg in weight, is taken. Where the product was retailed in packs of less than 1kg, a number of retail packs were purchased ensuring that all came from the same batch, and these were ground and mixed thoroughly before analysis.

EC Regulations

An EC Regulation setting limits for aflatoxins in certain foods came into force on 1 January 1999.³⁷ This Regulation was implemented in the UK in June 1999.³⁸ It set limits of 2 micrograms/kg aflatoxin B₁ and 4 micrograms/kg total aflatoxins in cereals, including rice, and cereal products intended for direct human consumption or use as an ingredient in foodstuffs.

An EC Regulation setting limits for ochratoxin A in cereals, cereal products and dried vine fruits has been published³⁹ and came into force on 5 April 2002. It sets a limit of 3 micrograms/kg for ochratoxin A in cereal grains and cereal products intended for direct human consumption.

A draft EC Recommendation on the reduction of the presence of deoxynivalenol in cereals and cereal products has been agreed. This Recommendation includes an action limit, to be used as guidance, of 500 micrograms/kg for deoxynivalenol for cereals as consumed and other cereal products at the retail stage.

The survey

The purpose of the Agency's Food Surveys is varied. In this instance there was no core baseline data on mycotoxin contamination of retail rice. The survey was therefore carried out to:

- assess the incidence and contamination of retail rice with aflatoxin, ochratoxin A and deoxynivalenol and compare these levels with the current Regulations on aflatoxins, the proposed Regulations on ochratoxin A and the proposed action limits for deoxynivalenol.
- determine the incidence and contamination levels of other mycotoxins (sterigmatocystin, fumonisins, zearalenone and the remaining trichothecenes) in retail rice in order to assess consumer exposure to these toxins.

Sampling

Samples of long grain rice (25), easy cook rice (23), basmati rice (18), speciality rice (16), brown rice (6), short grain rice (6), flaked (3) and ground rice (3) were purchased from retail outlets in 3 areas of England; Crawley, Bristol and County Durham between April and May 2000. The sampling was carried out by Mintel International Group Ltd, who maintain full traceability records. The number of samples of each type of rice collected was calculated on a market share basis. Details of the samples purchased are given in Table 2. The absence of a particular brand means only that the brand was not included in the survey. No further meaning should be read into its absence from the report.

Methodology

All the samples were delivered to the RHM Technology Ltd at ambient temperature and were stored at -16°C until initial sample preparation after which they were stored at -16°C until required for analysis. Samples were allowed to defrost to ambient temperature prior to analysis and returned to -16°C immediately after analysis.

Rice samples were ground to pass through a 1mm screen and mixed to ensure homogeneity prior to analysis. Where the samples were received as several packets, all

the material was homogenised as above. After homogenisation the sample was split equally among three containers, 'A', 'B' and 'C', and stored in a freezer at -16°C. Sample 'A' was used for the analyses and samples 'B' and 'C' were stored frozen; one for analysis by the manufacturer/retailer at their request and the other for referee purposes.

Analyses were carried out using validated, published^{40,41} and UKAS accredited methods of analysis. Details of the analytical procedures used and the limits of quantification (LOQ) are summarised in Table 3.

Quality control

All analyses were subject to quality control procedures. To ensure method validity, each analytical batch contained at least one reagent blank and one spiked sample fortified at a specific level for each of the toxins analysed. Spiked samples were used to assess recovery, and recoveries between 70 and 110 per cent were classed as valid. Spiked samples were also used for quantification and all results were corrected for recovery (see Annex 1). The limits of quantification (LOQ) were calculated for each batch of samples and are detailed in Table 3. Analytical quality assurance data are described in Annex 2. The repeatability (short-term differences between a single operator on the same day) and the reproducibility (longer term variability between different operators on different days, possibly using different instruments), were continually assessed on methods performed for mycotoxin determination.

Measurement of uncertainty

The analytical results have a variability known as the measurement of uncertainty. For any analytical method each result is reported as the best estimate for the sample, it is always qualified by a measurement uncertainty, e.g. x microgram/kg \pm y microgram/kg. The assessment of measurement uncertainty was targeted at samples containing mycotoxins at a range of levels. The measurement uncertainty determined for the analyses are detailed in Annex 3.

Results

A summary of the results is given in Tables 4, 5 and 6. All results are given as the best estimate value, corrected for recovery, but do not take into account the measurement of uncertainty. Surveys on contaminants are usually reported in this manner since the best

estimate values are used to calculate intake data for the various contaminants. Where surveys are conducted for other purposes, the data are interpreted differently. In their own surveys, for statutory enforcement purposes, public analysts and enforcement authorities always take the uncertainty associated with an analytical measurement into account when considering whether a product breaches regulatory limits. As a result of this they only take action when they are sure that levels of contaminants are above the regulatory limits.

Ochratoxin A (OA), sterigmatocystin (SMC), fumonisins B₁, B₂, and B₃ (FB₁, FB₂ and FB₃) and zearalenone (ZEA) were not detected in any of the samples analysed. A low level of the trichothecene mycotoxin, deoxynivalenol (DON), was detected in 1 sample of Italian easy cook rice at a concentration of 12 micrograms/kg. This is well below the proposed action limit of 500 micrograms /kg for DON in cereal food products at the retail level. None of the other trichothecenes, nivalenol (NIV), diacetoxyscirpenol (DAS), 3-acetyldeoxynivalenol (3AcDON), 15-acetyldeoxynivalenol (15AcDON), neosolaniol (NEO), fusarenone X (Fus X), T-2 toxin (T-2), HT-2 toxin (HT-2) and T-2 triol (T₂3), were detected in any of the samples analysed.

Aflatoxin B₁ (AFB₁) was quantified in 17 (17 per cent) of the 100 samples analysed ranging from 0.2 to 1.7 micrograms/kg. Aflatoxin B₂ (AFB₂) was also quantified in 2 of these samples at a level of 0.2 micrograms/kg. Aflatoxins G₁ (AFG₁) and G₂ (AFG₂) were not detected in any of the samples. The levels for AFB₁ and total aflatoxins were below the EC legislative limits of 2 micrograms/kg and 4 micrograms/kg respectively, for cereals for direct human consumption or for use as an ingredient in foodstuffs. A summary of the results is shown in Tables 7 and 8. Aflatoxins were quantified in 2 of the 25 samples of long grain rice, in 2 of the 23 samples of easy cook rice, in 9 of the 18 samples of basmati rice, in 3 of the 6 samples of brown rice, and in 1 of the 3 samples of ground rice. Aflatoxins were not quantifiable in speciality, short grain or flaked rice.

The sampling plan did not specifically include a set percentage of organic samples, however, in making a fair representation of market share and range some organic samples were purchased. The total number of organic samples is not sufficient to allow a statistical interpretation to be made in comparison with those products produced by conventional means.

Conclusions

All the rice samples analysed contained no or low levels of mycotoxins. The levels detected were below the EC legislative limits and proposed EC action limits. The results of this survey suggest that rice is not a major dietary source of aflatoxins (B₁, B₂, G₁, G₂), ochratoxin A, zearalenone, trichothecenes, fumonisins and sterigmatocystin in the UK. However, the fact that 17 per cent of the samples contained aflatoxins, albeit at low levels, indicates the need for continuing vigilance. The Agency will continue to monitor rice at regular intervals as part of its rolling programme of food surveys to assess mycotoxin contamination of retail products. These and previous results indicate that, despite the potential for mycotoxin contamination, efforts by producers, importers and retailers ensure that rice on retail sale in the UK meets the current or proposed limits for mycotoxins. Consumers can be reassured and there is no need for them to change their diets.

Summary of units

Milligram: 1 thousandth of a gram

Microgram: 1 millionth of a gram

Kilogram (kg): 1 thousand grams

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The full report of this survey is held in the Library at Aviation House, 125 Kingsway, London, WC2B 6NH; Tel: +44 (0) 20 7276 8181. If you would like to consult a copy, please contact the Library giving at least 24 hours notice or, alternatively, copies can be obtained from the Library; a charge will be made to cover photocopying and postage.

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Copies of the statements from the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment can be obtained from:

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Table 1: Summary of mycotoxins covered by this survey

Mycotoxin	Predominant Fungal Species	Foodstuffs susceptible	Assessment of the effects on health by expert committees*
Aflatoxins are a group of closely related compounds, aflatoxins B ₁ , B ₂ , G ₁ and G ₂	<i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i>	Cereals, nuts, spices, dried figs.	All aflatoxins are acutely and chronically toxic in animal studies. They are recognised animal and human genotoxic carcinogens, with aflatoxin B ₁ being the most potent (COT). Recommendation to reduce levels to lowest technologically achievable (FAC).
Ochratoxin A	<i>Aspergillus ochraceus</i> and <i>Penicillium verrucosum</i>	Cereals, beer, cocoa, coffee, dried fruit, pulses, grape juice, wine.	Ochratoxin A has been linked with kidney damage in pigs and in humans has been associated with Balkan endemic nephropathy. Appears to be an animal carcinogen and is regarded as a genotoxic carcinogen (COT). Recommendation to reduce levels to lowest technologically achievable (FAC).
Fumonisin are a group of closely related compounds, fumonisins B ₁ , B ₂ and B ₃	<i>Fusarium moniliforme</i>	Primarily maize, rice.	Causes leukoencephalomalacia which affects the central nervous system of horses, carcinogenic in rats and mice. The potential carcinogenic effects of fumonisins were considered (COC). No firm conclusions were made on the evidence available in 1993.
Zearalenone	Various <i>Fusarium</i> Species	Cereals primarily maize, wheat, barley and sorghum.	Tests have shown that zearalenone is a weak genotoxin and has oestrogenic properties, but no evidence to indicate that it is mutagenic or teratogenic (COM).
Sterigmatocystin	Various <i>Aspergillus</i> species	Cereals, particularly maize, cheese and coffee.	The COC and COM have advised that sterigmatocystin is an <i>in vivo</i> mutagen, a multispecies animal carcinogen and a potential human carcinogen. The COT recommended continued vigilance to ensure that sterigmatocystin does not contaminate the food supply. The FAC recommended that further surveys be carried out.
Trichothecenes	Various <i>Fusarium</i> species	Cereals.	Ingestion of trichothecene contaminated feed by animals causes a variety of toxic effects, such as vomiting, diarrhoea, feed refusal, weight loss and suppression of immunity. In humans, ingestion of contaminated food has been associated with an often fatal disease, alimentary toxic aleukia. The COT has not considered the trichothecenes as a group nor individual trichothecenes.

* In the UK, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT), the Committee on Mutagenicity of Chemicals in Food, Consumer Products and the Environment (COM) and the Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment (COC) assess the significance of mycotoxins for human health. These Committees made recommendations to the FAC (Food Advisory Committee) who endorsed these recommendations as appropriate.

Table 2. Sample details

Sample Number	Quantity	Sample	Brand	Store Name	Place of Purchase*	Country of Origin	Best before end	Product code
T21147	1kg	Long Grain Rice	Uncle Bens	Tesco	1	Packed in Belgium	14/09/2002 C	unknown
T21148	1kg	Long Grain Rice	Iceland	Iceland	2	USA	24-Sep-01	LT0084 1:23 C
T21149	2x500g	Camargue Long Grain Rice	Sainsbury's	Sainsbury's	3	France	Jan-02	0018A
T21150	1kg	American Long Grain Rice	Tesco	Tesco	1	USA	Aug-01	0053
T21151	1kg	American Long Grain Rice	Asda	Asda	4	USA	Sep-01	0089 05:16
T21152	1kg	American Long Grain Rice	Sainsbury's	Sainsbury's	3	USA	Mar-02	0084A
T21153	1kg	Economy Long Grain Rice	Sainsbury's	Sainsbury's	3	Netherlands	Feb-02	0033E
T21154	1kg	Farm Stores Long Grain Rice	Farm Stores	Asda	4	UK	Sep-01	0090
T21155	1kg	Value Long Grain Rice	Tesco	Tesco	1	unknown	Sep-01	0091
T21156	1kg	American Easy Cook Rice	Asda	Asda	4	USA	Sep-01	0087 03:36
T21157	1kg	Italian Easy Cook Rice	Sainsbury's	Sainsbury's	3	Italy	Feb-02	0061A
T21158	1kg	American Easy Cook Rice	Sainsbury's	Sainsbury's	3	USA	Mar-02	0104A
T21159	1kg	Easy Cook Rice	Best-in	Best-In Patmans	5	Several Countries	Feb-02	unknown
T21160	1kg	American Easy Cook Rice	Tesco	Tesco	1	USA	Oct-01	0094
T21161	1kg	Italian Easy Cook Rice	Tesco	Tesco	1	Italy	Oct-01	0098
T21162	1kg	American Easy Cook Rice	Safeway	Safeway	6	USA	Dec-01	9336F
T21163	2kg	American Easy Cook Rice	Tilda	Sainsbury's	3	USA	Jan-02	0013
T21164	1kg	Basmati Rice	Uncle Bens	Tesco	1	India/Pakistan	02.09.02C	unknown
T21165	1kg	Basmati Rice	Sainsbury's	Sainsbury's	3	India	Feb-02	WF0055C 14:38
T21166	1kg	Basmati Rice	Tilda	Safeway	6	India	Mar-02	unknown
T21167	1kg	Basmati Rice	Asda	Asda	4	Pakistan	Oct-01	0107 10:16
T21168	1kg	Basmati Rice	Veetee	Tesco	1	India	Mar-02	VT0062
T21169	1kg	Value Basmati Rice	Tesco	Tesco	1	More than one country	Sep-01	0070
T21170	1kg	Thai Jasmine Rice	Tilda	Safeway	6	Thailand	Jun-01	9180 09:05 L3
T21171	1kg	Thai Fragrant Rice	Safeway	Safeway	6	Thailand	27.04.2002	06255763
T21172	2x500g	Carnaroli Risotto Rice	Riso Gallo	Asda	4	Italy	04.11.01	09/01/1974
T21173	2x500g	Paella Valencia Rice	Asda	Asda	4	Spain	Sep-01	MCR0085

Table 2. Sample details

Sample Number	Quantity	Sample	Brand	Store Name	Place of Purchase*	Country of Origin	Best before end	Product code
T21174	2x500g	Carnaroli Risotto Rice	Asda	Asda	4	Italy	May-01	MCR9310
T21175	1kg	American Brown Rice	Asda	Asda	4	USA	Sep-01	0090 20:02
T21176	1kg	American Wholegrain Brown Rice	Sainsbury's	Sainsbury's	3	USA	Feb-02	0060A
T21177	2x500g	Short Grain Pudding Rice	Asda	Asda	4	EU	Oct-01	MCR0103
T21178	1kg	Pudding Rice	Sainsbury's	Sainsbury's	3	Italy	Feb-02	0074A
T21179	4x250g	Flaked Pudding Rice	Tesco	Tesco	1	Belgium	MAR 2001B	M0074 9:45
T21180	2x500g	Ground Rice	Whitworths	Asda	4	unknown	Mar-01	L0066A160
T21181	2x500g	American Long Grain Rice	Somerfield	Somerfield	7	USA	Aug-01	WF0053 C 20:26
T21182	2kg	Long Grain Rice	Somerfield	Somerfield	7	Packed in Holland	Apr-02	00 95
T21183	1kg	American Long Grain Rice	Golden Sun	Lidl	8	USA	61201	unknown
T21184	1kg	Long Grain Rice	Betterbuy Morrisons	Morrisons	9	unknown	Mar-02	FS0060
T21185	1kg	American Long Grain Rice	Morrisons	Morrisons	9	unknown	Feb-02	FS0053 09:54
T21186	1kg	Long Grain American Rice	CO-OP	CO-OP	10	USA	May-01	9351H7
T21187	1kg	Value long Grain Rice	Everyday	CO-OP	10	EC	Sep-01	0094H7
T21188	1kg	Long Grain Rice	Nisa	Price Watch	11	Guyana	Feb-02	VT0052 09:03
T21189	1kg	Loose Long Grain Rice	Hider	Chittocks	12	unknown	unknown	unknown
T21190	2kg	Basics Easy Cook Rice	Somerfield	Somerfield	7	Holland	Mar-02	00 66
T21191	2x500g	American Easy Cook Long Grain & Wild Rice	Veetee	Somerfield	7	USA	Oct-00	VT8282
T21192	1kg	American Easy Cook Long Grain Rice	Somerfield	Somerfield	7	USA	Sep-01	WF0103 16:06
T21193	1kg	USA Easy Cook Parboiled Patna Rice	Golden Sun	Lidl	8	USA	270302	unknown
T21194	1kg	Easy Cook Rice	Nirvana	Aldi	13	unknown	290901	unknown
T21195	1kg	American Easy Cook Rice	Morrisons	Morrisons	9	unknown	Jan-02	FS0018 13:56

Table 2. Sample details

Sample Number	Quantity	Sample	Brand	Store Name	Place of Purchase*	Country of Origin	Best before end	Product code
T21196	1kg	American Long Grain Easy Cook Brown Rice	Morrisons	Morrisons	9	unknown	Feb-02	FS0033 13:40
T21197	1kg	Easy Cook American Rice	CO-OP	CO-OP	10	USA	Jun-01	0014H7
T21198	1kg	Basmati Rice	GURU	Sainsbury's	14	India	Dec-01	WF0013C 20:47
T21199	1kg	Basmati Rice	Somerfield	Somerfield	7	India	Mar-01	WFC0094 10:30
T21200	2x500g	Basmati Rice	Golden Sun	Lidl	8	unknown	50402	unknown
T21201	1kg	Basmati Rice	Bilash	Aldi	15	Himalayas	101001	unknown
T21202	1kg	Basmati Rice	Morrisons	Morrisons	9	Himalayas	Mar-02	FS0067 18:51
T21203	1kg	Basmati Rice	CO-OP	CO-OP	10	Packed in UK	Aug-01	0065H7
T21204	2x500g	Triple Blend Long Grain Gourmet Rice	Country Harvest	Sainsbury's	14	unknown	Apr-01	00 98
T21205	1kg	Thai Fragrant Rice	Veetee	Somerfield	7	Thailand	Dec-01	VT9340
T21206	2x500g	Arborio Risotto Rice	Tilda	Morrisons	9	Italy	Feb-02	19:46 L3
T21207	6x175g	Pilau Rice	Uncle Bens	Morrisons	9	Belgium	300801	unknown
T21208	2x500g	Loose Arborio Rice	Hider	Chittocks	12	unknown	unknown	unknown
T21209	1kg	American Brown Long Grain Rice	Somerfield	Somerfield	7	USA	Jan-01	WF0027 0 13:40
T21210	1kg	Brown Rice	CO-OP	CO-OP	10	Packed in UK	Sep-00	0024H7
T21211	1kg	Shortgrain Rice	CO-OP	CO-OP	10	unknown	Jul-01	0053H7
T21212	1kg	Shortgrain Pudding Rice	Morrisons	Morrisons	9	unknown	Apr-01	0/10H10
T21213	4x250g	Flaked Rice	Sainsbury's	Sainsbury's	14	UK	Mar-01	WF0077 9:05B
T21214	2x500g	Ground Rice	Sainsbury's	Sainsbury's	14	France	Jan-02	0043 A
T21215	2x500g	Ground Rice	Great Scot	Somerfield	16	Packed in UK	31-Mar-01	00691H8
T21216	1kg	Long Grain Rice	Somerfield	Somerfield	16	USA	Oct-01	WF0110 6:08
T21217	3x375g	Long Grain Rice	Uncle Bens	Somerfield	16	Packed in Belgium	25-Jul-02	B
T21218	2x500g	Long Grain Rice	Today's	NewsStore	17		Jul-01	0011 H1
T21219	1kg	Long Grain Rice	Happy Shopper	Dave's	18	USA	Oct-00	WF9 307 13:12
T21220	2x500g	Long Grain and Wild Rice	St Michael	Marks and Spencer	19	USA	13-Mar-02	unknown
T21221	1kg	Long Grain Rice	Farm Stores	Asda	20	Packed in UK	Nov-01	0 121
T21222	1kg	American Long Grain Rice	Sainsbury's	Sainsbury's	21	USA	Mar-02	0100A
T21223	4x250g	Flaked Rice	Sainsbury's	Sainsbury's	21	Produced in UK	Mar-01	WF0077 7:25B
T21224	1kg	Italian Easy Cook Brown Rice	Somerfield	Somerfield	16	Italy	Feb-01	WF0056 C 0:51
T21225	2x500g	American Easy Cook Rice	Veetee	Felix van der Berghe	22	USA	Oct-01	VT9294
T21226	2x500g	Easy Cook Rice	Today's	NewsStore	17	unknown	May-01	9309H1
T21227	1kg	Easy Cook Rice	Happy Shopper	Dave's	18	USA	Feb-01	WF0070A 13:29

Table 2. Sample details

Sample Number	Quantity	Sample	Brand	Store Name	Place of Purchase*	Country of Origin	Best before end	Product code
T21228	1kg	Easy Cook Long Grain American Rice	Asda	Asda	20	USA	Oct-01	0106 05:15
T21229	1kg	American Easy Cook Rice	Sainsbury's	Sainsbury's	21	USA	Mar-02	0104A
T21230	2x500g	Easy Cook White Long Grain Organic Rice	Country Harvest	Sainsbury's	21	Italy	Feb-01	0 122
T21231	1kg	Basmati Rice	Asda	Asda	20	Pakistan	Oct-01	011109:43
T21232	2x500g	Basmati Rice	Uncle Bens	Somerfield	16	Belgium	12-Jul-02	C
T21233	1kg	Basmati Rice	St Michael	Marks and Spencer	19	India	04-Apr-02	unknown
T21234	1kg	Basmati Rice	Sainsbury's	Sainsbury's	21	India	Apr-02	WF0109 14:27
T21235	2x500g	Basmati Long Grain Organic Rice	Country Harvest	Sainsbury's	21	Packed in UK	Jan-01	00 92
T21236	1kg	Basmati Easy Cook Rice	Sainsbury's	Sainsbury's	21	India	Mar-02	0103A
T21237	2x500g	Thai Jasmin Rice	Veetee	Aldi	23	Thailand	July-01	VT9197
T21238	2x500g	Thai Rice	St Michael	Marks and Spencer	19	Thailand	18-Aug-01	unknown
T21239	2x500g	Italian Risotto Rice	St Michael	Marks and Spencer	19	Italy	31-Jan-01	unknown
T21240	2x500g	Aborio Risotto Rice	Asda	Asda	20	Italy	Aug-01	MCR0053
T21241	2x500g	Thai Fragrant Rice	Asda	Asda	20	Thailand	Aug-01	MCR0045
T21242	2x500g	Aromatic Long Grain Red Rice	Country Harvest	Asda	20	Packed in UK	Feb-01	OO38
T21243	1kg	American Brown Long Grain Rice	Somerfield	Somerfield	16	USA	Feb-01	WF0075 21:37
T21244	1kg	American Wholegrain Brown Rice	Sainsbury's	Sainsbury's	21	USA	Apr-02	0110A
T21245	2x500g	Italian Pudding Rice	Somerfield	Somerfield	16	Italy	Sep-01	WFO 105 6:27
T21246	2x500g	Short Grain Rice	Happy Shopper	Dave's	18	Italy	Dec-00	11:54 WF0015A
* Place of purchase								
	1	Tesco	Hazelwick, Crawley					
	2	Iceland	35 High Street, Crawley					
	3	Sainsbury's	West Green, Crawley					
	4	Asda	Hollingbury, Brighton					
	5	Best-In Patmans	Ewhurst Road, West Green, Crawley					
	6	Safeway	East Grinstead, RH19 4YZ					
	7	Somerfield	Arnison Centre, Pity Me, Durham					
	8	Lidl	Pity Me, Durham					
	9	Morrisons	Bob Hardistry Drive, Bishop Auckland, Durham					
	10	CO-OP	Church Street, Shildon, Durham					
	11	Price Watch	Church Street, Shildon, Durham					

Table 2. Sample details

*Place of purchase							
12	Chittocks	Newgate Street, Bishop Auckland, Durham					
13	Aldi	Spennymoor, Durham					
14	Sainsbury's	Arnison Centre, Pity Me, Durham					
15	Aldi	Bishop Auckland, Durham					
16	Somerfield	Canford Lane, Westbury-on-Trym, Bristol					
17	NewsStore	High Street, Westbury-on-Trym, Bristol					
18	Daves'	Grey Stoke Avenue, Southmead, Bristol					
19	Marks & Spencer	The Mall, Cribbs Causeway, Bristol					
20	Asda	Highwood Lane Patchway, Bristol					
21	Sainsbury	Fox Den Road, Filton, Bristol					
22	F Van Den Berghe	High Street, Westbury-on-Trym, Bristol					
23	Aldi	Arnside Complex, Southmead, Bristol					

Table 3: Summary of analytical methodology

Mycotoxin	Clean-up	Quantitation	LOQ (mg/kg)
Aflatoxins	Immunoaffinity column	HPLC with fluorescence detection and post column derivatisation with bromine	0.2
Ochratoxin A	Silica Sep-Pak™ column	HPLC with fluorescence detection	0.2
Sterigmatocystin	Florisil Sep-Pak™ column	HPLC with fluorescence detection and post column derivatisation with aluminium chloride hexahydrate	6
Zearalenone	Immunoaffinity column	HPLC with fluorescence detection	6
Fumonisin	SAX anion exchange column	HPLC with pre-column derivatisation with ortho-phthalaldehyde and fluorescence detection	20
Trichothecenes	Charcoal/alumina column	GC/MS	10

Table 4. Summary of results for zearalenone and fumonisins

Sample Number	Sample	Brand	Mycotoxin (µg/kg)			
			ZEA	FB1	FB2	FB3
T21147	Long Grain Rice	Uncle Bens	< 6	< 20	< 20	< 20
T21148	Long Grain Rice	Iceland	< 6	< 20	< 20	< 20
T21149	Camargue Long Grain Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21150	American Long Grain Rice	Tesco	< 6	< 20	< 20	< 20
T21151	American Long Grain Rice	Asda	< 6	< 20	< 20	< 20
T21152	American Long Grain Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21153	Economy Long Grain Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21154	Farm Stores Long Grain Rice	Farm Stores	< 6	< 20	< 20	< 20
T21155	Value Long Grain Rice	Tesco	< 6	< 20	< 20	< 20
T21156	American Easy Cook Rice	Asda	< 6	< 20	< 20	< 20
T21157	Italian Easy Cook Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21158	American Easy Cook Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21159	Easy Cook Rice	Best-in	< 6	< 20	< 20	< 20
T21160	American Easy Cook Rice	Tesco	< 6	< 20	< 20	< 20
T21161	Italian Easy Cook Rice	Tesco	< 6	< 20	< 20	< 20
T21162	American Easy Cook Rice	Safeway	< 6	< 20	< 20	< 20
T21163	American Easy Cook Rice	Tilda	< 6	< 20	< 20	< 20
T21164	Basmati Rice	Uncle Bens	< 6	< 20	< 20	< 20
T21165	Basmati Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21166	Basmati Rice	Tilda	< 6	< 20	< 20	< 20
T21167	Basmati Rice	Asda	< 6	< 20	< 20	< 20
T21168	Basmati Rice	Veetee	< 6	< 20	< 20	< 20
T21169	Value Basmati Rice	Tesco	< 6	< 20	< 20	< 20
T21170	Thai Jasmine Rice	Tilda	< 6	< 20	< 20	< 20
T21171	Thai Fragrant Rice	Safeway	< 6	< 20	< 20	< 20
T21172	Carnaroli Risotto Rice	Riso Gallo	< 6	< 20	< 20	< 20
T21173	Paella Valencia Rice	Asda	< 6	< 20	< 20	< 20
T21174	Carnaroli Risotto Rice	Asda	< 6	< 20	< 20	< 20
T21175	American Brown Rice	Asda	< 6	< 20	< 20	< 20
T21176	American Wholegrain Brown Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21177	Short Grain Pudding Rice	Asda	< 6	< 20	< 20	< 20
T21178	Pudding Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21179	Flaked Pudding Rice	Tesco	< 6	< 20	< 20	< 20

Table 4. Summary of results for zearalenone and fumonisins

Sample Number	Sample	Brand	Mycotoxin (µg/kg)			
			ZEA	FB1	FB2	FB3
T21180	Ground Rice	Whitworths	< 6	< 20	< 20	< 20
T21181	American Long Grain Rice	Somerfield	< 6	< 20	< 20	< 20
T21182	Long Grain Rice	Somerfield	< 6	< 20	< 20	< 20
T21183	American Long Grain Rice	Golden Sun	< 6	< 20	< 20	< 20
T21184	Long Grain Rice	Betterbuy Morrisons	< 6	< 20	< 20	< 20
T21185	American Long Grain Rice	Morrisons	< 6	< 20	< 20	< 20
T21186	Long Grain American Rice	CO-OP	< 6	< 20	< 20	< 20
T21187	Value long Grain Rice	Everyday	< 6	< 20	< 20	< 20
T21188	Long Grain Rice	Nisa	< 6	< 20	< 20	< 20
T21189	Loose Long Grain Rice	Hider	< 6	< 20	< 20	< 20
T21190	Basics Easy Cook Rice	Somerfield	< 6	< 20	< 20	< 20
T21191	American Easy Cook Long Grain & Wild Rice	Veetee	< 6	< 20	< 20	< 20
T21192	American Easy Cook Long Grain Rice	Somerfield	< 6	< 20	< 20	< 20
T21193	USA Easy Cook Rice Parboiled Patna Rice	Golden Sun	< 6	< 20	< 20	< 20
T21194	Easy Cook Rice	Nirvana	< 6	< 20	< 20	< 20
T21195	American Easy Cook Rice	Morrisons	< 6	< 20	< 20	< 20
T21196	American Long Grain Easy Cook Brown Rice	Morrisons	< 6	< 20	< 20	< 20
T21197	Easy Cook American Rice	CO-OP	< 6	< 20	< 20	< 20
T21198	Basmati Rice	GURU	< 6	< 20	< 20	< 20
T21199	Basmati Rice	Somerfield	< 6	< 20	< 20	< 20
T21200	Basmati Rice	Golden Sun	< 6	< 20	< 20	< 20
T21201	Basmati Rice	Bilash	< 6	< 20	< 20	< 20
T21202	Basmati Rice	Morrisons	< 6	< 20	< 20	< 20
T21203	Basmati Rice	CO-OP	< 6	< 20	< 20	< 20
T21204	Triple Blend Long Grain Gourmet Rice	Country Harvest	< 6	< 20	< 20	< 20
T21205	Thai Fragrant Rice	Veetee	< 6	< 20	< 20	< 20
T21206	Arborio Risotto Rice	Tilda	< 6	< 20	< 20	< 20
T21207	Pilau Rice	Uncle Bens	< 6	< 20	< 20	< 20
T21208	Loose Arborio Rice	Hider	< 6	< 20	< 20	< 20
T21209	American Brown Long Grain Rice	Somerfield	< 6	< 20	< 20	< 20

Table 4. Summary of results for zearalenone and fumonisins

Sample Number	Sample	Brand	Mycotoxin (µg/kg)			
			ZEA	FB1	FB2	FB3
T21210	Brown Rice	CO-OP	< 6	< 20	< 20	< 20
T21211	Shortgrain Rice	CO-OP	< 6	< 20	< 20	< 20
T21212	Shortgrain Pudding Rice	Morrisons	< 6	< 20	< 20	< 20
T21213	Flaked Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21214	Ground Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21215	Ground Rice	Great Scot	< 6	< 20	< 20	< 20
T21216	Long Grain Rice	Somerfield	< 6	< 20	< 20	< 20
T21217	Long Grain Rice	Uncle Bens	< 6	< 20	< 20	< 20
T21218	Long Grain Rice	Today's	< 6	< 20	< 20	< 20
T21219	Long Grain Rice	Happy Shopper	< 6	< 20	< 20	< 20
T21220	Long Grain and Wild Rice	St Michael	< 6	< 20	< 20	< 20
T21221	Long Grain Rice	Farm Stores	< 6	< 20	< 20	< 20
T21222	American Long Grain Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21223	Flaked Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21224	Italian Easy Cook Brown Rice	Somerfield	< 6	< 20	< 20	< 20
T21225	American Easy Cook Rice	Veetee	< 6	< 20	< 20	< 20
T21226	Easy Cook Rice	Today's	< 6	< 20	< 20	< 20
T21227	Easy Cook Rice	Happy Shopper	< 6	< 20	< 20	< 20
T21228	Easy Cook Long Grain American Rice	Asda	< 6	< 20	< 20	< 20
T21229	American Easy Cook Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21230	Easy Cook White Long Grain Organic Rice	Country Harvest	< 6	< 20	< 20	< 20
T21231	Basmati Rice	Asda	< 6	< 20	< 20	< 20
T21232	Basmati Rice	Uncle Bens	< 6	< 20	< 20	< 20
T21233	Basmati Rice	St Michael	< 6	< 20	< 20	< 20
T21234	Basmati Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21235	Basmati Long Grain Organic Rice	Country Harvest	< 6	< 20	< 20	< 20
T21236	Basmati Easy Cook Rice	Sainsbury's	< 6	< 20	< 20	< 20
T21237	Thai Jasmin Rice	Veetee	< 6	< 20	< 20	< 20
T21238	Thai Rice	St Michael	< 6	< 20	< 20	< 20
T21239	Italian Risotto Rice	St Michael	< 6	< 20	< 20	< 20
T21240	Aborio Risotto Rice	Asda	< 6	< 20	< 20	< 20
T21241	Thai Fragrant Rice	Asda	< 6	< 20	< 20	< 20

Table 4. Summary of results for zearalenone and fumonisins

Sample Number	Sample	Brand	Mycotoxin (µg/kg)			
			ZEA	FB1	FB2	FB3
<i>T21242</i>	Aromatic Long Grain Red Rice	Country Harvest	< 6	< 20	< 20	< 20
<i>T21243</i>	American Brown Long Grain Rice	Somerfield	< 6	< 20	< 20	< 20
<i>T21244</i>	American Wholegrain Brown Rice	Sainsbury's	< 6	< 20	< 20	< 20
<i>T21245</i>	Italian Pudding Rice	Somerfield	< 6	< 20	< 20	< 20
<i>T21246</i>	Short Grain Rice	Happy Shopper	< 6	< 20	< 20	< 20

Table 5. Summary of results for tricothecenes

Sample Number	Sample	Brand	Mycotoxin (µg/kg)									
			DON	DAS	3AcDON	15AcDON	FUSX	NIV	NEO	T23	T2	HT2
T21147	Long Grain Rice	Uncle Bens	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21148	Long Grain Rice	Iceland	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21149	Camargue Long Grain Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21150	American Long Grain Rice	Tesco	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21151	American Long Grain Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21152	American Long Grain Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21153	Economy Long Grain Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21154	Farm Stores Long Grain Rice	Farm Stores	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21155	Value Long Grain Rice	Tesco	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21156	American Easy Cook Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21157	Italian Easy Cook Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21158	American Easy Cook Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21159	Easy Cook Rice	Best-in	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21160	American Easy Cook Rice	Tesco	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21161	Italian Easy Cook Rice	Tesco	12	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21162	American Easy Cook Rice	Safeway	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21163	American Easy Cook Rice	Tilda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21164	Basmati Rice	Uncle Bens	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21165	Basmati Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21166	Basmati Rice	Tilda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5. Summary of results for tricothecenes

Sample Number	Sample	Brand	Mycotoxin (µg/kg)									
			DON	DAS	3AcDON	15AcDON	FUSX	NIV	NEO	T23	T2	HT2
T21167	Basmati Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21168	Basmati Rice	Veetee	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21169	Value Basmati Rice	Tesco	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21170	Thai Jasmine Rice	Tilda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21171	Thai Fragrant Rice	Safeway	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21172	Carnaroli Risotto Rice	Riso Gallo	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21173	Paella Valencia Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21174	Carnaroli Risotto Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21175	American Brown Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21176	American Wholegrain Brown Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21177	Short Grain Pudding Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21178	Pudding Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21179	Flaked Pudding Rice	Tesco	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21180	Ground Rice	Whitworths	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21181	American Long Grain Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21182	Long Grain Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21183	American Long Grain Rice	Golden Sun	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21184	Long Grain Rice	Betterbuy Morrisons	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21185	American Long Grain Rice	Morrisons	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21186	Long Grain American Rice	CO-OP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21187	Value long Grain Rice	Everyday	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21188	Long Grain Rice	Nisa	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21189	Loose Long Grain Rice	Hider	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21190	Basics Easy Cook Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5. Summary of results for tricothecenes

Sample	Sample	Brand	Mycotoxin (µg/kg)									
			DON	DAS	3AcDON	15AcDON	FUSX	NIV	NEO	T23	T2	HT2
T21191	American Easy Cook Long Grain & Wild Rice	Veetee	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21192	American Easy Cook Long Grain Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21193	USA Easy Cook Rice Parboiled Patna Rice	Golden Sun	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21194	Easy Cook Rice	Nirvana	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21195	American Easy Cook Rice	Morrisons	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21196	American Long Grain Easy Cook Brown Rice	Morrisons	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21197	Easy Cook American Rice	CO-OP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21198	Basmati Rice	GURU	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21199	Basmati Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21200	Basmati Rice	Golden Sun	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21201	Basmati Rice	Bilash	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21202	Basmati Rice	Morrisons	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21203	Basmati Rice	CO-OP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21204	Triple Blend Long Grain Gourmet Rice	Country Harvest	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21205	Thai Fragrant Rice	Veetee	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21206	Arborio Risotto Rice	Tilda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21207	Pilau Rice	Uncle Bens	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21208	Loose Arborio Rice	Hider	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21209	American Brown Long Grain Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21210	Brown Rice	CO-OP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21211	Shortgrain Rice	CO-OP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21212	Shortgrain Pudding Rice	Morrisons	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21213	Flaked Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5. Summary of results for tricothecenes

Sample Number	Sample	Brand	Mycotoxin (µg/kg)									
			DON	DAS	3AcDON	15AcDON	FUSX	NIV	NEO	T23	T2	HT2
T21214	Ground Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21215	Ground Rice	Great Scot	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21216	Long Grain Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21217	Long Grain Rice	Uncle Bens	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21218	Long Grain Rice	Today's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21219	Long Grain Rice	Happy Shopper	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21220	Long Grain and Wild Rice	St Michael	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21221	Long Grain Rice	Farm Stores	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21222	American Long Grain Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21223	Flaked Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21224	Italian Easy Cook Brown Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21225	American Easy Cook Rice	Veetee	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21226	Easy Cook Rice	Today's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21227	Easy Cook Rice	Happy Shopper	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21228	Easy Cook Long Grain American Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21229	American Easy Cook Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21230	Easy Cook White Long Grain Organic Rice	Country Harvest	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21231	Basmati Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21232	Basmati Rice	Uncle Bens	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21233	Basmati Rice	St Michael	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21234	Basmati Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21235	Basmati Long Grain Organic Rice	Country Harvest	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21236	Basmati Easy Cook Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5. Summary of results for tricothecenes

Sample Number	Sample	Brand	Mycotoxin (µg/kg)									
			DON	DAS	3AcDON	15AcDON	FUSX	NIV	NEO	T23	T2	HT2
T21237	Thai Jasmin Rice	Veetee	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21238	Thai Rice	St Michael	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21239	Italian Risotto Rice	St Michael	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21240	Aborio Risotto Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21241	Thai Fragrant Rice	Asda	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21242	Aromatic Long Grain Red Rice	Country Harvest	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21243	American Brown Long Grain Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21244	American Wholegrain Brown Rice	Sainsbury's	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21245	Italian Pudding Rice	Somerfield	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
T21246	Short Grain Rice	Happy Shopper	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 6. Summary of results for aflatoxins, ochratoxin A and sterigmatocystin

Sample Number	Sample	Brand	Mycotoxin (µg/kg)							
			AF B ₁	AF B ₂	AF G ₁	AF G ₂	Total AF	OA	SMC	
T21147	Long Grain Rice	Uncle Bens	0.3	< 0.2	< 0.2	< 0.2	< 0.2	0.3	< 0.2	< 6
T21148	Long Grain Rice	Iceland	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21149	Camargue Long Grain Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21150	American Long Grain Rice	Tesco	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21151	American Long Grain Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21152	American Long Grain Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21153	Economy Long Grain Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21154	Farm Stores Long Grain Rice	Farm Stores	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21155	Value Long Grain Rice	Tesco	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21156	American Easy Cook Rice	Asda	0.3	< 0.2	< 0.2	< 0.2	< 0.2	0.3	< 0.2	< 6
T21157	Italian Easy Cook Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21158	American Easy Cook Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21159	Easy Cook Rice	Best-in	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21160	American Easy Cook Rice	Tesco	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21161	Italian Easy Cook Rice	Tesco	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21162	American Easy Cook Rice	Safeway	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21163	American Easy Cook Rice	Tilda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21164	Basmati Rice	Uncle Bens	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21165	Basmati Rice	Sainsbury's	1.0	< 0.2	< 0.2	< 0.2	< 0.2	1.1	< 0.2	< 6
T21166	Basmati Rice	Tilda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21167	Basmati Rice	Asda	0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21168	Basmati Rice	Veetee	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21169	Value Basmati	Tesco	0.4	< 0.2	< 0.2	< 0.2	< 0.2	0.4	< 0.2	< 6
T21170	Thai Jasmine Rice	Tilda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21171	Thai Fragrant Rice	Safeway	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21172	Carnaroli Risotto Rice	Riso Gallo	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21173	Paella Valencia Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21174	Carnaroli Risotto Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21175	American Brown Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21176	American Wholegrain Brown Rice	Sainsbury's	0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21177	Short Grain Pudding Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21178	Pudding Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21179	Flaked Pudding Rice	Tesco	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6

Table 6. Summary of results for aflatoxins, ochratoxin A and sterigmatocystin

Sample Number	Sample	Brand	Mycotoxin (µg/kg)						
			AF B ₁	AF B ₂	AF G ₁	AF G ₂	Total AF	OA	SMC
T21180	Ground Rice	Whitworths	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21181	American Long Grain Rice	Somerfield	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21182	Long Grain USA Rice	Somerfield	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21183	American Long Grain Rice	Golden Sun	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21184	Long Grain Rice	Betterbuy Morrisons	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21185	American Long Grain Rice	Morrisons	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21186	Long Grain American Rice	CO-OP	0.3	< 0.2	< 0.2	< 0.2	0.3	< 0.2	< 6
T21187	Value long Grain Rice	Everyday	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21188	Long Grain Rice	Nisa	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21189	Loose Long Grain Rice	Hider	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21190	Basics Easy Cook Rice	Somerfield	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21191	American Easy Cook Long Grain & Wild Rice	Veetee	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21192	American Easy Cook Long Grain Rice	Somerfield	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21193	USA Easy Cook Rice Parboiled Patna Rice	Golden Sun	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21194	Easy Cook Rice	Nirvana	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21195	American Easy Cook Rice	Morrisons	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21196	American Long Grain Easy Cook	Morrisons	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21197	Easy Cook American Rice	CO-OP	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21198	Basmati Rice	GURU	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21199	Basmati Rice	Somerfield	0.9	0.2	< 0.2	< 0.2	1.1	< 0.2	< 6
T21200	Basmati Rice	Golden Sun	1.7	< 0.2	< 0.2	< 0.2	1.8	< 0.2	< 6
T21201	Basmati Rice	Bilash	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21202	Basmati Rice	Morrisons	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21203	Basmati Rice	CO-OP	0.3	< 0.2	< 0.2	< 0.2	0.4	< 0.2	< 6
T21204	Triple Blend Long Grain Gourmet Rice	Country Harvest	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21205	Thai Fragrant Rice	Veetee	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21206	Arborio Risotto Rice	Tilda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21207	Pilau Rice	Uncle Bens	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21208	Loose Arborio Rice	Hider	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21209	American Brown Long Grain Rice	Somerfield	1.6	0.2	< 0.2	< 0.2	1.8	< 0.2	< 6
T21210	Brown Rice	CO-OP	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21211	Shortgrain Rice	CO-OP	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6

Table 6. Summary of results for aflatoxins, ochratoxin A and sterigmatocystin

Sample Number	Sample	Brand	Mycotoxin (µg/kg)						
			AF B ₁	AF B ₂	AF G ₁	AF G ₂	Total AF	OA	SMC
T21212	Shortgrain Pudding Rice	Morrisons	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21213	Flaked Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21214	Ground Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21215	Ground Rice	Great Scot	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21216	Long Grain Rice	Somerfield	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21217	Long Grain Rice	Uncle Bens	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21218	Long Grain Rice	Today's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21219	Long Grain Rice	Happy Shopper	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21220	Long Grain and Wild Rice	St Michael	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21221	Long Grain Rice	Farm Stores	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21222	American Long Grain Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21223	Flaked Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21224	Italian Easy Cook Brown Rice	Somerfield	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21225	American Easy Cook Rice	Veetee	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21226	Easy Cook Rice	Today's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21227	Easy Cook Rice	Happy Shopper	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21228	Easy Cook Long Grain American Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21229	American Easy Cook Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21230	Easy Cook White Long Grain Organic Rice	Country Harvest	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21231	Basmati Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21232	Basmati Rice	Uncle Bens	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21233	Basmati Rice	St Michael	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21234	Basmati Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21235	Basmati Long Grain Organic Rice	Country Harvest	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21236	Basmati Easy Cook Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21237	Thai Jasmin Rice	Veetee	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21238	Thai Rice	St Michael	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21239	Italian Risotto Rice	St Michael	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21240	Aborio Risotto Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21241	Thai Fragrant Rice	Asda	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21242	Aromatic Long Grain Red Rice	Country Harvest	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21243	American Brown Long Grain Rice	Somerfield	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 6
T21244	American Wholegrain Brown Rice	Sainsbury's	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21245	Italian Pudding Rice	Somerfield	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6
T21246	Short Grain Rice	Happy Shopper	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 6

Table 7: Summary of total aflatoxins in rice

Product	No. of Samples	No. of samples in the range (mg/kg)				Max. (mg/kg)
		< 0.2	0.2 - < 0.5	0.5 - <1.0	1.0 - < 2.0	
Long grain rice	25	23	2	-	-	0.3
Easy cook rice	23	21	2	-	-	0.3
Basmati rice	18	9	6	-	3	1.8
Speciality rice	16	16	-	-	-	-
Brown rice	6	3	2	-	1	1.8
Short grain rice	6	6	-	-	-	-
Flaked rice	3	3	-	-	-	-
Ground rice	3	2	1	-	-	0.2
Total	100	83	13	0	4	

Table 8: Summary of aflatoxin B₁ in rice

Product	No. of Samples	No. of samples in the range (mg/kg)				Max. (mg/kg)
		< 0.2	0.2 - < 0.5	0.5 - <1.0	1.0 - < 2.0	
Long grain rice	25	23	2	-	-	0.3
Easy cook rice	23	21	2	-	-	0.3
Basmati rice	18	9	6	1	2	1.7
Speciality rice	16	16	-	-	-	-
Brown rice	6	3	2	-	1	1.6
Short grain rice	6	6	-	-	-	-
Flaked rice	3	3	-	-	-	-
Ground rice	3	2	1	-	-	0.2
Total	100	83	13	1	3	

ANNEX 1

SUMMARY OF RECOVERY DATA

Mycotoxin	Total Number of Samples	Mean Recovery	RSD (%)
DON	100	93	7.2
DAS	100	94	8.5
3AcDON	100	93	8.3
15AcDON	100	92	8.5
FUSX	100	93	7.7
NIV	100	93	7.7
NEO	100	94	8.0
T23	100	88	9.9
T2	100	83	11.4
HT2	100	88	9.7
Zearalenone	100	86	7.1
Fumonisin B ₁	100	91	5.7
Fumonisin B ₂	100	93	4.9
Fumonisin B ₃	100	90	5.2
Ochratoxin A	100	89	3.0
Sterigmatocystin	100	85	9.0
Aflatoxin B ₁	100	88	3.8
Aflatoxin B ₂	100	95	2.9
Aflatoxin G ₁	100	94	4.1
Aflatoxin G ₂	100	96	3.3

ANNEX 2

Analytical Quality Assurance

The methods utilised during the course of this survey were UKAS accredited and had been validated i.e. evidence had been, and continued to be, generated to demonstrate that the methods do what is intended and are claimed reliable and reproducible.

All analyses were conducted with spiked samples, i.e. to each sample matrix on each day a known amount of toxin was added prior to extraction. These samples were used to assess recovery; recoveries between 70% and 110% were classed as valid. Spiked samples were also used for quantification and all results were corrected for recovery.

Method Validation

HPLC was used for the determination of sterigmatocystin, ochratoxin A, zearalenone, aflatoxin B₁, B₂, G₁ and G₂, fumonisin B₁, B₂ and B₃. The trichothecenes were determined by GC/MS.

Specificity and Selectivity

Immunoaffinity clean-up methods are specific for the chosen toxin. The identification of toxin was based on chromatographic retention time and fluorescence properties of the individual toxin.

Precision and Accuracy

The repeatability (short-term differences between a single operator on the same day) and the reproducibility (longer term variability between different operators on different days, possibly using different instruments), are continually assessed on methods performed for mycotoxin determination.

True accuracy of the methods used is assessed by participation in collaborative trials and the use of reference materials.

Linearity and Range

The linearity of each method was checked and shown to be linear over the range studied in this survey.

Sensitivity

The limit of detection of a method is defined as the minimum detectable level of an analyte under the assay conditions during a particular assay.

The limit of determination is the minimum level of analyte that can reliably be detected. Both the limit of detection and the limit of determination are dependant on the sensitivity of the analyte and the base-line noise at the time of analysis.

Mycotoxin	Detection Limit (µg/kg)	Spike Level (µg/kg)
Trichothecenes	10 for each trichothecene	100
Zearalenone	4	20
Fumonisin	10 B ₁ , B ₂ and B ₃	100
Ochratoxin A	0.1	2
Sterigmatocystin	3	20
Aflatoxin	0.1 B ₁ , B ₂ , G ₁ and G ₂	1.5 B ₁ , G ₁ 0.5 B ₂ , G ₂

Stability

The stability of the analyte in each method is known, and detailed standard operating procedures are available for all the analyses that instruct the operator and give details of any instabilities which need to be considered.

Ruggedness and System Suitability

The performance of a spiked sample with every type and daily batch of samples acts as both a check on the ruggedness of the assay and checks that the whole system is functioning.

ANNEX 3

Measurement Uncertainty

Introduction

All analytical results have a variability known as the measurement uncertainty. The Eurachem/CITAC interpretation of the definition of measurement uncertainty is "the range of values that the analyst believes could be reasonably attributed to the measurand."¹ Thus, the values for 'measurement uncertainty' given in this report represent the range around the best estimate of the concentration of within which the true value for the concentration of is believed to lie.

Method

For this survey the calculation of the measurement uncertainty was carried out using in-house data, performance in International collaborative trials (BCR/SM&T) and FAPAS thus incorporating repeatability and reproducibility data. The measurement of uncertainty was calculated using a standard coverage factor of 2, equivalent to a confidence of approximately 95 per cent. The assessment was targeted at samples containing mycotoxins at a range of levels.

Results

The measurement uncertainty determined for the analyses were:

Aflatoxin B₁, B₂, G₁, G₂

± 0.7µg/kg at a level of 2µg/kg

± 1.1µg/kg at a level of 5µg/kg

Deoxynivalenol

± 5µg/kg at a level of 20µg/kg

± 11µg/kg at a level of 40µg/kg

References

1. *Eurachem/CITAC Guide on Quantifying Uncertainty in Analytical Measurement*, second edition, 2000.