FOOD STANDARDS AGENCY FINAL REPORT
FS241003

Arsenic speciation in fruit and vegetables grown in the UK

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Date of report: 31/05/2012

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i Summary

A field and market basket survey of produce from the SW of Britain (Cornwall and Devon), and a produce market basket survey of the NE of Britain (Aberdeenshire), were conducted to determine the concentration of total and inorganic arsenic in locally grown fruit and vegetables.

For the market basket survey, in general, the concentration of total arsenic in most of the produce categories was low in the SW, and lower still in the NE surveys. The highest total arsenic was present in produce like kale, chard, lettuce, greens, and spinach. To determine if this elevated total arsenic concentration was caused by soil contamination, the aluminium concentration of the open leaf structure produce (i.e kale, chard, lettuce, greens, and spinach) was determined and a significant positive correlation was observed for produce between aluminium and total arsenic concentrations, indicating that the elevated total arsenic concentration may be due to soil contamination.

For the field survey both produce and soil total arsenic concentrations were determined. For potatoes (unpeeled and peeled), root vegetables (unpeeled), cabbages, and when cauliflower and broccoli (including romanesque) were grouped together, there were significant correlations between the produce total arsenic concentration and the soil arsenic concentration. However, for root vegetables (peeled), open leaf structure produce (kale, chard, lettuce, greens, and spinach), and soft fruits there were no significant correlations between produce total arsenic concentration and soil arsenic concentration. The reason why total arsenic in open leaf structure produce correlates with leaf aluminum but not with soil arsenic is due to the fact that the dust deposited on the leaf, which the aluminum serves as a surrogate of, may be windblown from nearby sites, such as unvegetated mine spoil soils that litter this region, as well as derived from the soil it grows on.

When comparing different preparation methods (i.e. peeling *versus* as harvested after washing) for the basket survey it was found that for carrots, potatoes, and swedes there was significantly more total arsenic in the unpeeled produce compared to the peeled produce. However, for apples, beetroots, courgettes, cucumbers, parsnips, and squashes there was no significant difference between the total arsenic concentration in the unpeeled and peeled produce.

The total arsenic concentration in baked potato skins was compared to baked potato flesh and it was found that there was significantly more total arsenic in the skins. On average, the concentration of total arsenic in the potato skins was 462 ng/g compared to 6 ng/g in the flesh.

To determine the depth of total arsenic localization with distance from the surface skin Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry (LA-ICP-

MS) of relevant subsamples of produce that is eaten in both the peeled and unpeeled state was investigated. The results indicated that total arsenic is consistently found elevated in the skin of beetroot and potatoes, typically elevated within 2 mm from the surface. For carrots, apples, and parsnips there was no indication from LA-ICP-MS of arsenic elevation in the skin.

Arsenic speciation of a subset (258 analysis) of the samples indicated that on average 98.5% of the summed arsenic species were present in the inorganic form. A number of the samples (48) had organic arsenic (predominantly dimethyl arsenic [DMA]) present, ranging from the limit of detection value (2.3 ng/g) up to 81.3 ng/g (dry weight); in percentages this was <0.1% up to 48.5% of the total arsenic detected. However, a majority (36/48) of the samples in which DMA was detected had less than 10% DMA. There was no systematic pattern to which produce had elevated DMA, suggesting that local soil factors (i.e. the presence of DMA in the soil) governed produce DMA content.

ii Background

This project was to conduct 3 field campaigns to survey total arsenic and arsenic speciation in fruit and vegetables from the geogenically enriched areas of SW Britain. The study focused on the Mount's Bay and Tamar Valley areas of the county of Cornwall as these are the main vegetable and fruit growing zones, respectively, of this region, while also having the most geogenically arsenic enriched soils. The project sampled: (a) locally produced fruit and vegetables in retail outlets, (b) survey field crops and soil so that the two can be related, and (c) a comparative survey for the NE of Scotland, a region with low arsenic in the soil. The campaigns were in late autumn, early spring, and mid-summer so that seaonality of crop production is taken into account. All samples (vegetable matter and soil) were analysed for total arsenic, while a subset were analysed for arsenic speciation by High Performance Liquid Chromatography – Inductively Coupled Plasma – Mass Spectrometry (HPLC-ICP-MS), with the list of samples to be speciated to be identified in consultation with the FSA.

The objectives were:

1. To basket survey fruit and vegetables as well as conduct a field survey of this produce (and associated soil) in SW Britain during 3 campaigns to reflect seasonality of production
2. To analyse these materials for total arsenic
3. To speciate a subset for arsenic following consultation with the FSA
4. To conduct a comparative basket survey for the NE of Scotland

The reason for undertaking these objectives is because there is a growing need to understand arsenic species concentrations in food (EFSA 2009). Total arsenic is the sum of all arsenic species present, and it is these individual species that constitute the risk posed by arsenic. Terrestrial agronomic produce tends to be dominated by inorganic arsenic, with DMA being the other species routinely found (Williams et al. 2006). Inorganic arsenic is a class one, non-threshold carcinogen whose chronic exposure leads to bladder, lung, and skin cancers (IARC 2004). Previous legislative and regulatory focus on inorganic arsenic has been on drinking water as a human exposure source, with water standards in the European Union being in place (European Commission 1998). There are no food standards for either total or inorganic arsenic for foods for the EU (EFSA 2009). However, it is increasingly recognised that some food sources can be a significant route to inorganic arsenic exposure, leading to a commissioning of a report on this subject area by the European Food Standards Authority (EFSA) (EFSA 2009). The consequences for chronic human exposure to DMA and other organic arsenic species is currently uncertain, but organic arsenic compounds exposure to humans is thought to be of less concern as compared to inorganic arsenic (EFSA 2009).

SW Britain, particularly the counties of Cornwall and west Devon, were selected as the appropriate regions to investigate for arsenic species in horticultural produce because these counties have soils/sediments geogenically enriched in arsenic (Wolfson Atlas, 1978). The Environment Agency has recently compiled soil – vegetable/fruit transfer factors, from literature review, for setting Soil Guideline Values (SGVs) for arsenic in soil (EA 2009). This compilation focused on contaminated soils, including vegetable studies in geogenically impacted soils of SW England (Xu and Thornton, 1985). Xu and Thornton (1985) recorded levels in vegetables exceeding 1 mg/kg dry weight, with lettuce being the highest. Generically, these studies showed that the geometric mean for soil to edible tissue transfer for vegetables and fruits ranged from 0.001 to 0.00043. As garden soils in the study area range from 120-1130 mg/kg, average 320 mg/kg, vegetable and fruit concentrations above 0.1 mg/kg are expected, equating to levels found in rice (Williams et al. 2005, 2006, 2007), which is the crop considered, generally, to be most widely elevated with arsenic. Similarly, a wheat and barley survey of geogenically-enriched areas of SW Britain found elevated arsenic levels in grain, correlated to soil concentrations (Williams et al. 2007). However, such studies on total arsenic have only limited value for conducting risk to humans from consumption, as it is speciation that drives risk of arsenic from food (EFSA, 2009) and, therefore, the relationship between total arsenic and its speciation in horticultural produce needs to be established.

There have been a number of studies that have speciated arsenic in a wide range for fruit and vegetables (Munoz et al. 2002, Schoof et al. 1999, Smith et al. 2009, Williams et al. 2006) and, generally, as for the more widely studied rice (Williams et al. 2005, Meharg et al. 2009), the dominant speciation is inorganic arsenic, the species that causes concern with regards to food risk assessment (EFSA, 2009). Some studies show that monomethylarsonic acid (MMA), dimethylarsinic acid (DMA). and tetramethyl arsonium can be present in vegetation (Meharg and Hartley-Whitaker, 2002), including fruit and vegetables (Slejkovec et al. 2010). Baseline, food-basket surveys from a US study found less than 0.01 mg/kg dry weight inorganic arsenic in a range of fruit and vegetables, with total arsenic less than 0.06 mg/kg; included in this study were beans, carrots, corn, cucumbers, lettuce, onions, peas, potatoes, spinach, tomato, apple, grapes, oranges, peaches, and watermelons (Schoof et al. 1999). Baseline, total arsenic ranges have also been reported for the UK (Al Rmalli et al. 2005). Similar levels are also reported for vegetables and fruits grown in UK allotment soils (Nathanail et al. 2004; Weeks et al. 2007).

Limited work has been conducted on arsenic speciation in vegetables and fruit from the geogenically enriched areas of Britain. Slejkovec et al. (2010) determined that blackberry fruits from mine spoil soil had over 0.25 mg/kg dry weight inorganic arsenic, with traces of MMA. High concentrations of inorganic arsenic have been reported for a range of fruit and vegetables growing on arsenic contaminated soils elsewhere in the world (Munoz et al., 2002; Smith et

al. 2009). For example, crops can contain up to 0.8 mg/kg dry weight inorganic arsenic when grown in the arsenic irrigated soils of Bangladesh (Williams et al. 2006).

The University of Aberdeen has been at the forefront of (a) developing analytical approaches for arsenic speciation in fruit and vegetables (Williams et al. 2006) and (b) in highlighting concerns regarding inorganic arsenic in terrestrial food-chains (Meharg and Raab 2010). The method used for total arsenic speciation is the highly sensitive and elemental specific technique of ICP-MS. Speciation is conducted by anion exchange HPLC-ICP-MS, the gold standard for arsenic speciation, as it efficiently separates the species of interest, and quantifies them, again, with high sensitivity (Williams et al. 2005, 2006).

iii Contents of this report

This first report will only deal with the arsenic related data collected during this project.

1 Survey of total arsenic concentrations in fruit and vegetables (and associated soil) in SW Britain and comparison with NE Britain

In this section objectives 1 and 2 of the project will be covered. Objective 1 of the project was “To survey fruit and vegetables (and associated soil) in SW Britain during 3 campaigns” and objective 2 “To analyze these materials for total arsenic”. The initial proposal was to conduct three field campaigns to survey total arsenic in fruit and vegetables from the geogenically enriched areas of SW Britain. The study focuses on the Mount's Bay and Tamar Valley areas of the counties of Cornwall and Devon as these are the main vegetable and fruit growing zones, respectively, of this region, while also having the most geogenically arsenic enriched soils in Britain. Due to a very mild spring in 2011, a fourth field campaign was also incorporated into the project in late spring/early summer. The four SW sampling campaigns were conducted during November 2010, May 2011, June 2011, and September 2011. Alongside the survey of SW Britain, a basket survey of total arsenic in Aberdeenshire fruit and vegetables was conducted.

1.1 Surveying strategy

The project sampled (a) locally produced fruit and vegetables in retail outlets (Cornwall, Devon, and Aberdeenshire surveys) and (b) field crops and soil so that the two can be related (Cornwall and Devon only). All samples (fruit and vegetable produce and soil) were analysed for total arsenic, with representive subsets of all common produce speciated so that the relationship between total arsenic and its speciation could be established.

1.1.1 Basket survey

Local farm shops, greengrocers, “pick your own”, supermarkets, honesty boxes, and farmers markets were targeted. For each establishment all samples of local fruit and vegetable produce were purchased, confirming with the seller that the produce was locally produced, if it was not clearly labelled as such. Either 100g or 5 individual vegetables or fruits were sampled (depending on size). All samples were washed in a kitchen sink using local tap water, to a thoroughness normally used in food preparation. Once cleaned the samples were finely diced in a food processor (which was cleaned between processing each sample). The samples were then frozen and sent back to the University of Aberdeen for further processing (as described in Section 1.2.1)

For items eaten with and without skin (potatoes, root vegetables, apples, pears, etc.) separate samples were taken for unpeeled and peeled, to reflect different dietary exposures. The data presented in this report, with exception of peeled versus unpeeled comparisons, are based on the preparation most commonly consumed, i.e. unpeeled for apples and courgettes, while peeled for potatoes, swedes, parsnip, carrots, beetroots, and squashes, with the other preparation

method (i.e. peeled apples, unpeeled potatoes etc.) referred to as the “alternative preparation”. The SW basket survey consisted of 630 samples with 207 alternative preparations. The NE basket survey consisted of 190 samples with 69 alternative peeling preparations.

1.1.2 Field Sampling and soil sampling

To establish the link between soil arsenic and the concentration of total arsenic in vegetable and fruit produce, farmers’ fields in the two SW geographic areas were sampled, with the farmer’s permission, for fruit and vegetables in season. GPS locations of the fields were recorded. A transect 20 m long, sampled at 5 m intervals, was taken through the centre of the field and soil (top 20 cm, sampled using a stainless steel corer), and a sample of the fruit or vegetable was taken at each location. These 5 soil and 5 produce samples were bulked to give one soil and one produce sample per field. Produce samples were prepared as in 1.1.1. Soil samples were oven dried and 2 mm sieved before analysis. For the SW campaigns a total of 174 soil samples were analysed along with corresponding crops, as well as 56 alternative preparations for produce eaten either peeled or unpeeled, to reflect all potential consumer exposures.

1.2 Analytical materials and methods

1.2.1 Determination of arsenic in produce samples

Samples were oven dried at 70^{o}C and the moisture content of the produce determined. Approximately 0.2-0.3g of dried produce was accurately weighed out into 50 ml polyethylene centrifuge tubes; 2.5 ml of concentrated nitric acid was added to each sample and then incubated overnight. Trace reagent analysis grade reagents were used throughout. Prior to microwave digestion 2.5 ml of hydrogen peroxide was added to each tube and then the samples were digested using a Microwave Accelerated Reaction System (MARS) from CEM manufacturer. The digestion parameters were a 5-minute ramp to 55^{o}C and then hold at 55^{o}C for 10 minutes, followed by a 5 minute ramp to 75^{o}C and then hold at 75^{o}C for 10 minutes, followed by a 5 minute ramp to 95^{o}C and then hold at 95^{o}C for 30 minutes. Samples were then made up to 50ml and accurately weighed. Each analytical batch was accompanied by a minimum of 1 reagent blank, 1 spike, and 4 different certified reference materials: IC-INCT-MPH-2 mixed Polish herbs (191 ng/g arsenic), NIST-1568a rice flour (290 ng/g arsenic), CTA-OTL-1 Oriental tobacco leaves (539 ng/g arsenic), and NCS ZC73012 cabbage (62 ng/g arsenic). Total arsenic analysis was performed by ICP-MS (Agilent Technologies 7500). Rhodium (10 µg/L) was run on an external line as the internal standard. The arsenic standards ranged from 0.1 – 300 ug/L. The elements measured were arsenic (*m/z* 75) and rhodium (*m/z* 103 – internal standard). Possible argon chloride interference (none was found) on m/z 75 was monitored directly using m/z 77 and m/z 82. In the appendix tables the arsenic concentration data is given on both a fresh weight and dry weight basis. Fresh

and dry weight Limits of Detection (LOD) are both given, however as samples were weighed out on a fresh weight basis a unified LOD can be given for fresh weight analysis, and this LOD is the most appropriate. Dry weight LODS can be generated using fresh:dry weight conversions, and then the individual sample LODs averaged to give a mean dry weight LOD. In the appendix, for a small number of samples the arsenic value is above the LOD in the fresh weight analysis but below the LOD in the dry weight analysis or *vice versa.* This is due to the estimation of the dry weight LOD. For statistical purposes the highest overall LOD generated during all the batches of samples was used to provide uniform wet and dry weight LODS.

1.2.2 Determination of arsenic in soil samples

Sieved soil samples were weighed (0.1g) into glass digest tubes and 2.5 ml of concentrated nitric acid was added to each tube. The samples were incubated overnight with the acid. Hydrogen peroxide (2.5 ml) was added to each tube; the digest tubes were then transferred to a digest-heating block set at 100^{o}C, after 1 hour the temperature was increased to 120^{o}C, then after 1 hour the temperature was increased to 140^{o}C. The samples were then digested for 4 hours. The samples were transferred to 15 ml centrifuge tubes and made up to 10 ml, followed by a 1:10 dilution of the digest. For each soil batch 1 reaction blank, 1 spike, and 1 soil CRM (NCS DC73319) were used. Analysis of arsenic was performed as described in 1.2.1.

1.3 Results

1.3.1 Quality control

A total of 36 independent digests were analyzed for the cabbage, herb, and tobacco CRM and 28 for the rice CRM. The average recovery for the cabbage and the tobacco CRMs was very good, and the recoveries for the herb and rice CRMs was over 80%. This variation in CRM is to be expected as the efficacy of acid digestion is dependent on arsenic speciation in the CRM, and this will vary between CRM. The fact that CRM recovery was optimal for cabbage and tobacco, but sub-optimal for rice and herb illustrates this phenomenon. As the cabbage CRM was closest in character and relevance to the fruit and vegetable produce analysed in this study, the cabbage CRM recovery is the most relevant. No spiked additions of samples were planned or conducted; however, multiple CRMs (which are the gold standard in quality control) were analysed.

Table 1. Certified reference material recoveries for total arsenic analysis.

	Certified value (ng/g)	Determined value (mean ± s.e.m; ng/g)	Recovery (%)
Cabbage CRM[#]	62 ± 14	60.3 ± 0.7	97.3
Herb CRM[#]	191 ±23	165.0 ± 2.5	86.4
Tobacco CRM[#]	539 ± 60	527.3 ± 7.7	97.8
Rice CRM*	290 ± 30	239.1 ± 3.9	82.5

[#] Total number of independent digest = 36; * Total number of independent digest = 28

The LOD was determined for each independent analytical run. The LOD was calculated from the arsenic concentration of the sample blanks (minimum of three per analytical run). The average concentration for the blanks was calculated and three times the standard deviation added to this value; this value was then multiplied by the average dilution factor of the samples to give a value in ng/g.

The highest LOD was 2.0 ng/g (fresh weight). All data was corrected for the highest LOD, therefore all values below 2.0 ng/g were determined to be below the LOD. For the samples below the LOD a value of half LOD was used for statistical analysis. For the appendix tables data is also presented as dry weight; the highest dry weight LOD was 18.3 ng/g, and samples below that value are reported as <LOD (see section 1.2.1)

1.3.2 Basket survey SW Britain

For the SW basket survey a total of 630 samples with 207 alternative preparations were analysed. The total arsenic value for every sample (including alternative preparations) is presented in appendix table A. For the produce, for which at least three independent samples were collected, the mean, median, minimum and maximum total arsenic value for that produce class are presented in Table 2. The distribution of the total arsenic concentrations for the classes are presented in Figure 1. For most classes of produce (27 out of 33) from the basket survey the mean total arsenic concentration did not exceed 25 ng/g arsenic (fresh weight), with only kale, chard, lettuce, greens, spinach, and mixed leaf salad having a mean total arsenic concentration above 25 ng/g arsenic (fresh weight). When looking at the median data the only produce which exceeds 25 ng/g arsenic (fresh weight) is mixed leaf salad. A total of 17 of the produce classes had a maximum total arsenic value that was above 25 ng/g (fresh weight).

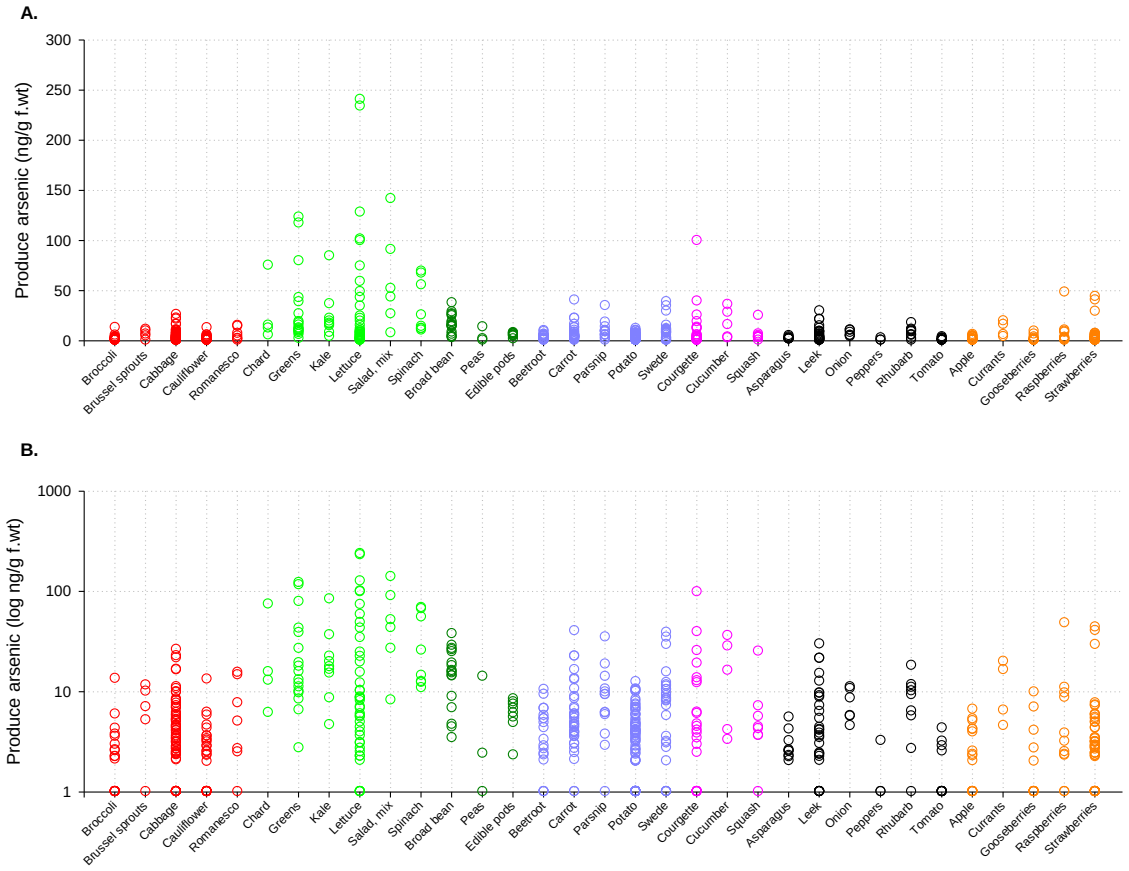

Figure 1. Arsenic concentration of the produce sampled in the SW basket survey. (A) Y-axis scaled on a linear scale, (B) y-axis scaled on a logarithmic scale.

Table 2. Average arsenic concentrations in produce collected for the SW basket survey.

Category	Produce	n	mean arsenic (ng/g f.wt.)	min arsenic (ng/g f.wt.)	median arsenic (ng/g f.wt.)	max arsenic (ng/g f.wt.)
Compact florets and leaves	Broccoli	20	2.8	1.0	2.2	13.7
	Brussel sprouts	5	7.1	1.0	7.2	11.8
	Cabbage	66	5.3	1.0	3.6	26.7
	Cauliflower	28	2.9	1.0	2.5	13.5
	Romanesque	7	7.1	1.0	5.1	15.8
Open leaf structure	Chard	4	27.8	6.3	14.6	75.8
	Greens	17	33.0	2.8	16.0	123.7
	Kale	9	25.5	4.7	17.9	85.2
	Lettuce	42	30.8	1.0	7.7	241.2
	Salad, mix	6	61.0	8.4	48.3	142.2
	Spinach	8	33.9	11.1	20.5	69.9
Legumes	Broad beans	17	17.1	3.5	15.9	38.4
	Peas	3	6.0	1.0	2.5	14.4
	Edible pods	8	6.3	2.4	6.6	8.6
Roots and tubers	Beetroot	18	4.4	1.0	3.9	10.6
	Carrot	36	7.6	1.0	4.8	41.1
	Parsnip	13	10.4	1.0	9.4	35.5
	Potato	82	3.5	1.0	3.0	12.7
	Swede	27	9.8	1.0	8.3	39.5
Squashes	Courgette	23	11.8	1.0	4.2	100.4
	Cucumber	5	17.9	3.4	16.5	36.7
	Squash	8	7.0	1.0	4.4	25.7
Various	Asparagus	9	3.1	2.1	2.6	5.6
	Leek	31	6.6	1.0	3.9	30.3
	Onion	6	7.9	4.6	7.3	11.3
	Peppers	3	1.8	1.0	1.0	3.3
	Rhubarb	9	8.6	1.0	9.4	18.5
	Tomato	12	1.8	1.0	1.0	4.4
Fruit	Apples	17	2.7	1.0	2.3	6.7
	Currants	4	12.1	4.7	11.7	20.3
	Gooseberries	12	2.8	1.0	1.0	10.0
	Raspberries	11	8.7	1.0	3.2	49.1
	Strawberries	47	5.4	1.0	2.9	44.7

1.3.3 Comparison of different preparation methods

For nine different classes of fruit and vegetables a comparison was conducted between fruit and vegetable with unpeeled and peeled (Figure 2). Statistical analysis was performed using a paired t-test for each produce category. For apples (n=17), beetroots (n=14), courgettes (n=22), cucumbers (n=3), parsnips (n=9), and squashes (n=7) there was no significant difference between the preparation styles. For carrots (n=32), potatoes (n=79), and swedes (n=23) there was significantly more arsenic in the vegetables that had not been peeled.

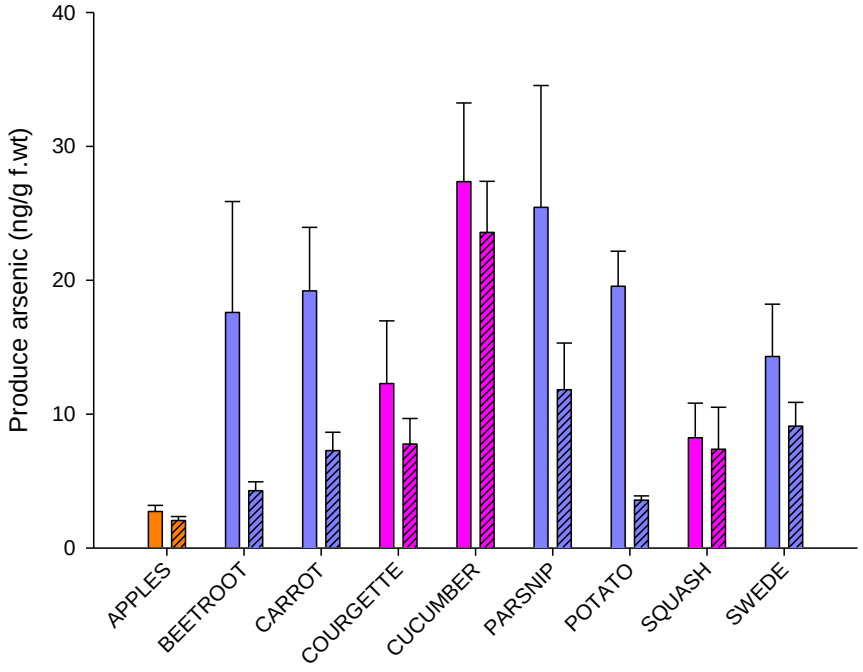

Figure 2. Total arsenic detected in the unpeeled produce (non-shaded bars) compared to the peeled produce (shaded bars). Bar is the mean arsenic concentration for each produce class and the error bar is the standard error of the mean.

1.3.4 Basket survey NE Britain

For the NE basket survey a total of 190 samples with 69 alternative preparations were analysed. The total arsenic value for every sample (including alternative preparations) is presented in appendix Table B. For the produce for which at least three independent samples were collected the mean, median, minimum and maximum total arsenic value for that produce class are presented in Table 3. The total arsenic concentration distribution for the classes is presented in Figure 3. For all the classes of produce from the basket survey the mean (and median) total arsenic concentration did not exceed 25 ng/g arsenic (fresh weight). Only 1

class of produce (kale) had a maximum total arsenic concentration greater than 25 ng/g (fresh weight).

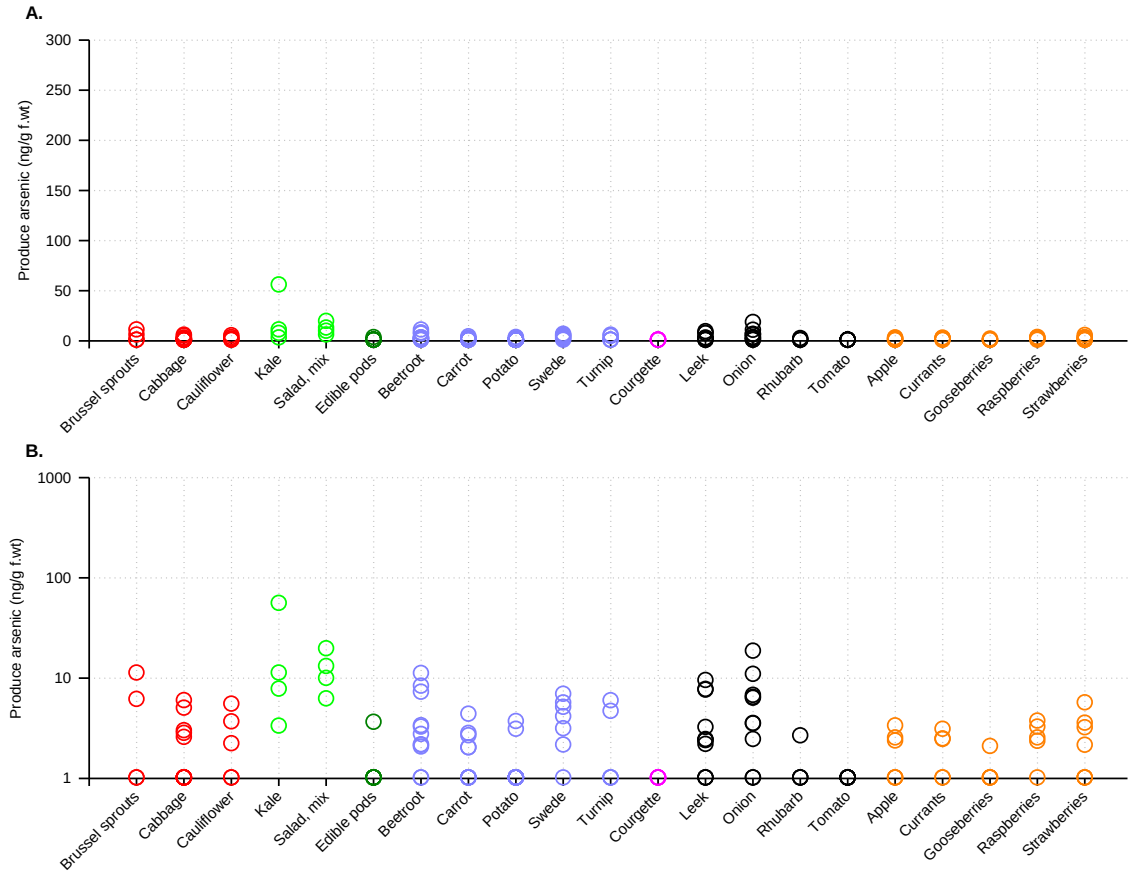

Figure 3. Arsenic concentration of the produce sampled in the NE basket survey. (A) Y-axis scaled on a linear scale, (B) y-axis scaled on a logarithmic scale.

Table 3. Average arsenic concentrations in produce collected for the NE basket survey.

Category	Produce	n	mean arsenic (ng/g f.wt)	min arsenic (ng/g f.wt)	median arsenic (ng/g f.wt)	max arsenic (ng/g f.wt)
Compact florets and leaves	Brussel sprouts	4	4.9	1.0	3.6	11.3
	Cabbage	14	2.1	1.0	1.0	6.0
	Cauliflower	5	2.7	1.0	2.2	5.6
Open leaf structure	Kale	4	19.7	3.4	9.6	56.1
	Salad, mix	4	12.3	6.3	11.6	19.8
Legumes	Edible pods	9	1.31	1.0	1.0	3.7
Roots and tubers	Beetroot	11	4.1	1.0	2.8	11.2
	Carrot	12	1.8	1.0	1.0	4.4
	Potato	28	1.2	1.0	1.0	3.7
	Swede	7	4.1	1.0	4.2	7.0
	Turnip	5	2.8	1.0	1.0	6.0
Squashes	Courgette	5	1.0	1.0	1.0	1.0
Various	Leek	11	3.7	1.0	2.4	9.6
	Onion	10	6.1	1.0	5.0	18.7
	Rhubarb	4	1.4	1.0	1.0	2.7
	Tomato	7	1.0	1.0	1.0	1.0
Fruit	Apple	6	1.9	1.0	1.7	3.4
	Currants	5	2.0	1.0	2.5	3.1
	Gooseberries	5	1.2	1.0	1.0	2.1
	Raspberries	5	2.6	1.0	2.6	3.8
	Strawberries	7	2.5	1.0	2.2	5.7

1.3.5 Relationship between soil arsenic and total arsenic concentrations in fruit and vegetables

A total of 174 produce samples (as well as 56 alternative preparations) were analysed along with corresponding soil samples. The total arsenic concentration determined for the soil CRM (NCS ZC73007) was 14.17 mg/kg (s.e.m was 0.12 mg/kg; n = 12) which gave a recovery of 78.7 % (certified value is 18 ± 2 mg/kg). The determined arsenic value of the soil CRM is slightly below that of the certified value, which is probably due to the extraction methodology. This was to be expected, as without hydrofluoric (HF) acid digestion, which is considerably more expensive to conduct, complete recovery of arsenic from soil mineral phases is not possible. Furthermore, HF digestion has little relation to bioavailability to crops, with the nitric acid procedure used being more appropriate. As such, the nitric acid extraction must be viewed as “operationally” defined.

The LOD for the soil samples was 43 µg/kg. The LOD was calculated from the arsenic concentration of 8 sample blanks. The average concentration for the blanks was calculated and three times the standard deviation added to this value; this value was then multiplied by the average dilution factor of the samples to give a value in µg/kg.

Soil arsenic concentrations ranged from 11.4 – 438.6 mg/kg, with an average concentration of 110.3 mg/kg. All the soil arsenic values and associated produce total arsenic concentrations are presented in appendix table C.

Good correlations between produce total arsenic (as normally eaten) and soil arsenic were identified for a number of produce (Figure 4A-H). There was a significant positive correlation ($P<0.001$, $r= 0.756$, $n= 26$) between soil arsenic concentration and the concentration of total arsenic in peeled potatoes (there was also a significant positive correlation between unpeeled potatoes and soil arsenic [$P<0.001$, $r= 0.756$, $n=24$]), Figure 4A and B. For root vegetables (beetroot, carrots, parsnips, swedes) there was not a significant correlation for peeled produce ($P=0.063$, $r=0.423$, $n=20$), however for the same unpeeled produce there was a significant correlation ($P = 0.036$, $r = 0.482$, $n=19$), Figure 4C and D. For cabbages there was also a significant correlation between total arsenic in the produce and soil arsenic ($P=0.007$, $r= 0.516$, $n=25$), Figure 4E. When cauliflower and broccoli (including romanesque) are grouped into a single class there was a significant correlation ($P=0.013$, $r=0.531$, $n=21$), however this correlation was driven by two high total arsenic data points, Figure 4F. For the open leaf structure produce (chard, kale, and greens) there was no significant correlation ($P=0.063$, $r=0.434$, $n=19$), Figure 4G. For the soft fruit (berries and currants) there was no correlation ($P=0.264$, $r=0.32$, $n=14$) between the produce arsenic and the soil arsenic, Figure 4H.

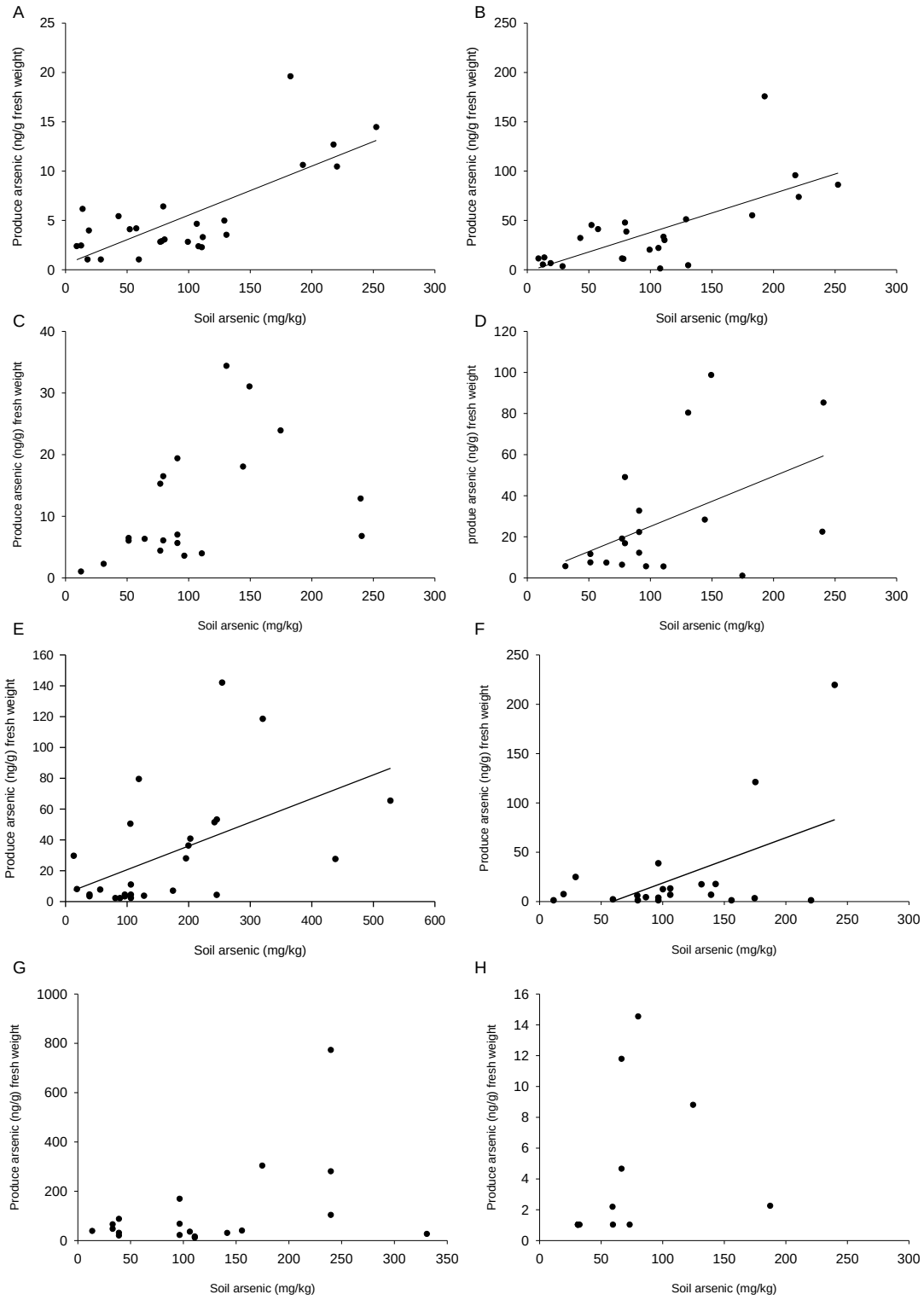

Figure 4. Relationship between produce arsenic concentration and soil arsenic. (A) peeled potatoes, (B) unpeeled potatoes, (C) peeled root vegetables, (D) unpeeled root vegetables, (E) cabbage, (F) cauliflower and broccoli, (G) open structure produce, (H) soft fruit.

1.4 Conclusions and discussion of findings from survey

In general the produce from the SW basket survey had higher concentrations of total arsenic compared to the produce from the NE basket survey. Of particular note is the observation that the produce with the highest concentrations of total arsenic are loosely classed into open leaf structure vegetables, i.e. those produce which have a large surface area in relation to mass. Whether this is due to the accumulation of the arsenic in internal plant tissues, or contamination of the shoot surface with soil particles, is discussed later in Section 5. For potatoes, swedes, and carrots there were significantly lower concentrations of total arsenic in the peeled produce compared to the unpeeled produce, however this was not the case for all root vegetables. Parsnips and beetroots had no significant difference in total arsenic concentration for peeled or unpeeled produce. It may be that for the parsnips and beetroots there were not enough samples (these are the lowest numerically represented root vegetables) to identify a significant difference between preparation methods. For all the above ground produce peeling did not have a significant effect on the total arsenic concentration of the produce. The relationship between soil arsenic and produce total arsenic was most evident in the potatoes with there being a good positive relationship; however for other classes of produce this relationship was not as strong, and for some classes not present. For the root vegetables the relationship between soil arsenic and produce total arsenic was only significant in the unpeeled produce, not the peeled produce, however the peeled produce is only just not significant. For the open leaf structure vegetables and soft fruits there was no significant correlation between soil arsenic and produce total arsenic, whereas for the broccoli and cauliflower there is a significant correlation. The correlations suggest that for below ground produce the soil arsenic concentration is a determining factor in produce total arsenic concentration, whereas for above ground produce the concentration in the soil that the produce is grown in is not always a determining factor in the produce arsenic concentration.

2 Determination of arsenic species in fruit and vegetables

2.1 Sample selection

Samples were selected from all the SW surveys (both basket and field). The samples selected cover the range of different produce sampled as well as the different preparation methods (i.e. peeled and unpeeled). A total of 247 samples were speciated. A full list of the samples speciated is presented in appendix table D.

2.2 Analytical materials and methods

Samples were oven dried at 70^{o}C and the moisture content of the produce determined. Dried samples were then powderized and approximately 0.2 g of dried produce was accurately weighed out into 50-ml polyethylene centrifuge tubes; 10 ml of 1% nitric acid was added to each sample and then left overnight. Trace reagent analysis grade reagents were used throughout. Microwave extraction was performed using a MARS, CEM microwave digestor with the following parameters; 5 minute ramp to 55^{o}C and then hold at 55^{o}C for 10 minutes, followed by a 5 minute ramp to 75^{o}C and then hold at 75^{o}C for 10 minutes, followed by a 5 minute ramp to 95^{o}C and then hold at 95^{o}C for 30 minutes. Samples were then accurately weighed. Each analytical batch was accompanied by a minimum of 1 reagent blank, and 2 certified reference materials (1x Rice flour NIST-1568a and 1 x cabbage NCS ZC73012). After extraction samples were centrifuged at 10,000xg for 10 minutes at 4^{o}C and 900 µl of supernatant was removed. To the supernatant 100 µl of hydrogen peroxide was added and the samples then were stored at 4^{o}C overnight. Arsenic speciation was determined using high performance liquid chromatography linked to an HPLC-ICP-MS (Agilent Technologies 7500). The samples were run using a mobile phase of ammonia phosphate buffer (6.6 mM ammonium dihydro-phosphate, 6.6 mM ammonium nitrate, pH 6.2); 100 µl of the sample was injected into a PRP -X100 anion exchange column, and after separation the sample flowed into the ICP-MS where the samples were quantified. Rhodium (10 µg/L) was run on an external line as the internal standard. The elements measured were arsenic (*m/z* 75) and rhodium (*m/z* 103 – internal standard). Possible argon chloride interference on m/z 75 was monitored directly on m/z 77 and m/z 82. Standards used to determine arsenic were DMA standards ranging from 0.5 µg/L – 75 µg/L; a standard mix of arsenate, arsenite, DMA, and MMA was used to determine the position of the arsenic peaks. To determine the stability of arsenic species during the extraction step rice flour CRM (NIST-1568a) was extracted in triplicate with each batch of samples. The rice flour CRM is not commercially certified for arsenic species but it has been speciated in numerous studies (using different extraction procedures) and the information is summarised in Raab et al. (2009). A comparison of the rice flour CRM to the literature data was conducted to determine the validity of the extraction process. As the extraction procedure was performed on dried material, the composition of

the inorganic arsenic species arsenite and arsenate cannot be discriminated, therefore it is expressed as inorganic arsenic concentration. For the speciation analysis the sample values are presented as per dry weight; this is because for the speciation analysis a dry weight was used, and as wet to dry weight conversions differ for each product type, while a uniform and single LOD for each arsenic species can be calculated readily on a dry weight basis, converting this LOD to fresh weight will result in a different LOD for each produce type. This is different than the method used for total arsenic analysis where a predetermined fresh weight was used, which was determined would give a known dry weight that would be suitable for the total analysis.

2.3 Results

For the rice flour CRM the average inorganic arsenic concentration was 89.9 ± 6.4 ng/g, DMA concentration 167.9 ± 9.1, and MMA concentration 10.3 ± 1.0, with an average recovery for the sum of species of 269.7 ± 5.3 ng/g (93% of the total arsenic concentration of the CRM). These arsenic species concentrations are comparable with other studies (Raab et al., 2009). The cabbage CRM had average values of 51.9 ± 3.5 ng/g inorganic arsenic, a DMA concentration of 1.5 ± 0.6, and an MMA concentration of 0.9 ± 0.3, with an average recovery for the sum of species of 54.8 ± 3.9 ng/g (88.4% of the arsenic concentration of the CRM). As no other studies have performed speciation of this CRM it was just used as an in-house control.

There was a good correlation between the speciated arsenic (i.e. sum of species) and the total arsenic from the digestions ($P > 0.001$, $r = 0.903$). This correlation could be further improved if only the samples with a total arsenic value of below 125 ng/g were used ($P < 0.001$, $r = 0.928$). The average extraction and column recovery for the samples was 96.1% (± standard error of the mean of 5.5%) compared to the total digestions (Table D).

The average percentage of inorganic arsenic (arsenite and arsenate) was 98.5% of the summed arsenic species for all the samples. Only 48 (out of 247 analysed) samples had detectable concentrations of DMA ranging from the LOD value of 2.3 ng/g up to 81.3 ng/g (dry weight); in percentages this was <0.1% up to 48.5% of the total summed arsenic species detected. However, a majority (36/48) of the samples for which DMA was detected in them had less than 10% DMA. Inorganic arsenic ranged from 0 ng/g up to 2455 ng/g (dry weight); in percentages this was 0% up to 100% of the total summed arsenic species detected. Also of interest is the detection of an unknown arsenic species in 19 of the samples; this species was normally below or just above the LOD. The very short elution time for this species would indicate that it is most likely a cationic arsenic species.

2.4 Conclusions and discussion of findings of arsenic speciation

A majority of the arsenic detected in the produce was inorganic arsenic. The identification of inorganic arsenic as being the dominant form of arsenic is important for determining any risk assessment, as inorganic arsenic is a known class one human carcinogen (EFSA, 2009). There was no systematic pattern for the organic arsenic content (as DMA), where present, in the produce, i.e. certain crops did have organic arsenic while other did not. This suggests that the organic arsenic may be present in the environment and taken up by the plants; recent work in rice, red clover, and tomato has shown that arsenic is unlikely to be methylated in plants (Lomax et al., 2011).

3 Baked potato skins and total arsenic

3.1 Sample selection and analytical materials and methods

From the third SW surveys (both field and basket) 20 potato samples were selected for the determination of total arsenic in the skin and flesh of baked potatoes. If possible the potatoes were classified as floury or waxy based on the information from the seller or farmer. For each sample three potatoes were washed as described in section 1, and then baked at 180^{o}C for 90 minutes. After the potatoes had cooled down the flesh was scooped out of the skins. The samples were then processed as described in section 1. Analysis of total arsenic was conducted using ICP-MS as described in section 1. Statistical analysis was performed using either paired t-tests to test for significance between skin and flesh total arsenic, one-way ANOVA to determine differences between floury and waxy potatoes, and correlation analysis to identify relationships between total arsenic in the skin and flesh of potatoes.

3.2 Results

There was significantly ($P < 0.001$) more total arsenic in the skins of the baked potatoes compared to the flesh (Figure 5A). On average the concentration of total arsenic in the potato skins was 462 ng/g compared to 6 ng/g in the flesh. When comparing the concentration of total arsenic between the paired samples there is a significant positive correlation ($P = 0.008$, $r = 0.577$, $n = 20$) between the concentration of total arsenic in the skin and the matched flesh (Figure 5B). For the potatoes that could be categorized into waxy ($n = 6$) and floury ($n = 8$); there was no significant difference in the total arsenic concentration in the flesh, however, floury potatoes had significantly more total arsenic ($P = 0.021$) in their skin compared to the waxy potatoes. The average total arsenic concentration in the skin of the floury potatoes was 510 ng/g while for the waxy potatoes it was 133 ng/g.

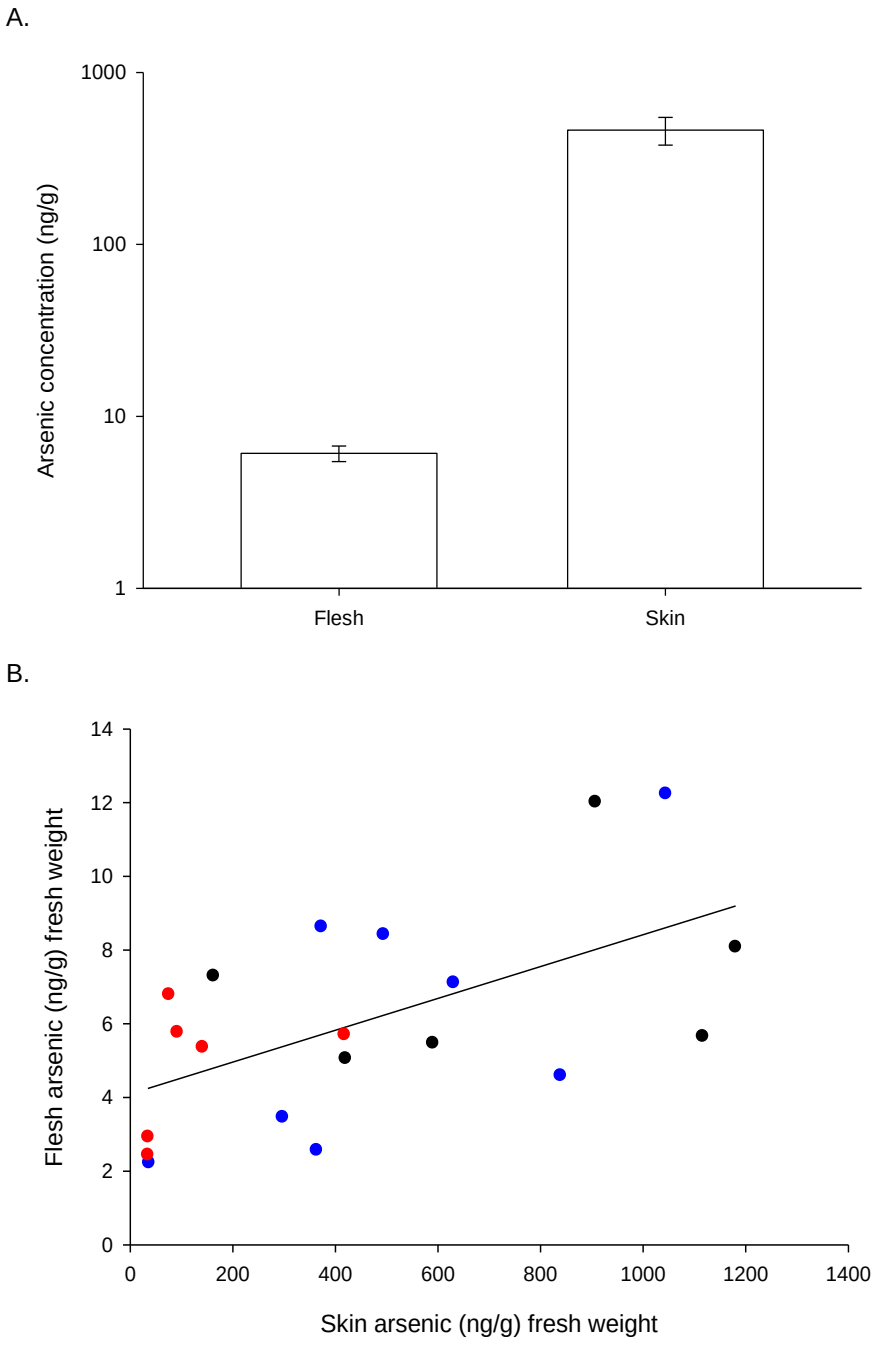

Figure 5. Total arsenic concentration in the flesh and skin of baked potatoes (A). Relationship between total arsenic in the flesh and skin of baked potatoes; blue symbols are floury potatoes, red symbols are waxy potatoes, and black symbols are unknown type potatoes (B).

3.3 Conclusions and discussion of findings of total arsenic in baked potato skins

The analysis clearly demonstrates that for baked potatoes the concentration of total arsenic in the skin is on average approximately 75 times greater than that of the flesh. Also for the comparison of waxy and floury type of potatoes, the floury potatoes have on average 4 times higher concentration of total arsenic in their skins compared to waxy type potatoes. However, the comparison between floury and waxy type potatoes has two limitations. Firstly, this is only on a small number of samples, and secondly, as demonstrated in the previous section, the soil environment that the potato is grown in has a significant effect on the total arsenic concentration of the potatoes. Therefore, it is recommended that to confirm this finding of differences between floury and waxy potatoes future experiments are conducted using different varieties of potatoes grown in the same soil environment.

4 Localization of arsenic in root vegetables/tubers using laser ablation-ICP-MS

The aim of this study was to map total arsenic along skin to centre transects in a subset of the fruits and vegetables from the basket and produce survey using Laser Ablation - Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS).

4.1 Material and methods

4.1.1 Sampling

The vegetables and fruits used for this study were collected from SW England during the fourth sampling campaign for the basket and product survey, as well as Aberdeen produce sampled during the month of September 2011. The produce chosen were apples, beetroots, carrots, parsnips, and potatoes, and each sample contained at least 3 items. See Table 5 for produce details including cultivar and total arsenic concentration. After sampling all produce was stored fresh at 5^{o}C for up to 1 week.

4.1.2 Sample preparation

The produce samples were thoroughly washed with tap water, as per typical food preparation. Samples were then diced (~1 cm^{3}) and 3 skin-containing dice samples were randomly chosen per item. The cubes were then flash frozen using liquid nitrogen (-192^{o}C) and stored frozen at -20^{o}C until sectioning.

Sections were prepared from each batch at -15^{o}C using a cryostat (Model OTF including microtome 5030, Bright). A random cube from each batch was chosen for sectioning; the cube was mounted on a sample holder and fixed on it using Tissue-Tek O.C.T. paste (Sakura Finetek Europe). The microtome used prepared thin-sections of up to 35µm depth. The slices were thaw-mounted onto microscope slides and allowed to air-dry at room temperature, and subsequently stored frozen at -20^{o}C until the day of analysis.

4.1.3 Laser Ablation - Inductively Coupled Plasma analysis (LA-ICP-MS)

The LA system used in this study was a New Wave model UP-213. Each sample analysed by LA-ICP-MS required different laser settings. Optimal parameters for analysis of vegetables and fruits are reported in Table 4. Also, 3 ablation lines were performed for each section and the data averaged for linear plots. The ablation always started at least 200 µm outside the sample, on the skin side. A typical ablated slide is pictured in Figure 6.

Table 4: LA system parameters

Parameters	Settings
Power	30%
Frequency	10Hz
Speed	20µm/sec
Beam diameter	100µm
Length of ablation / number	4mm / 4
Space between ablation lines	300µm

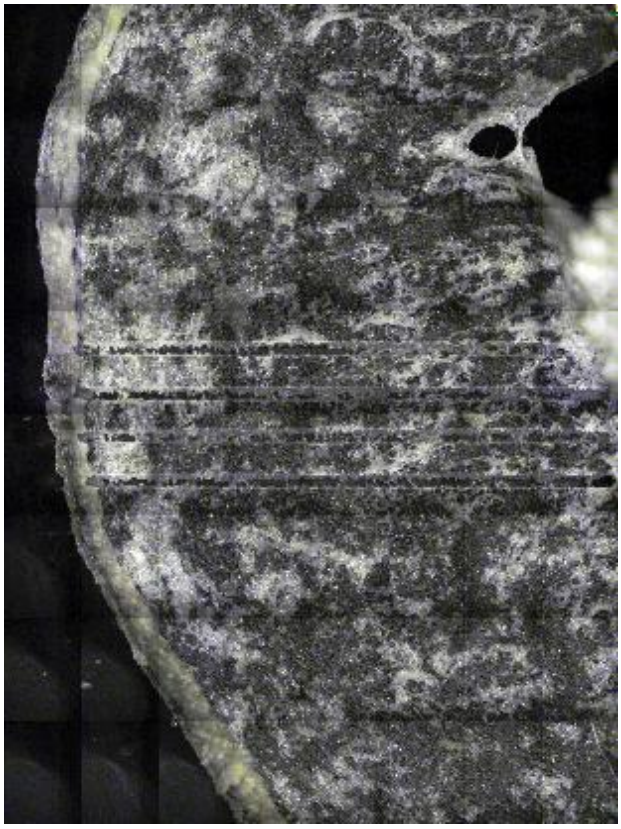

Figure 6: Typical ablated produce. Sample 24, carrot. Each line = 4mm transect. The “light” area is the carrot tissue while the “dark” area is the slide the tissue was mounted on.

4.1.4 ICP-MS

The ICP-MS (Agilent Technologies, model 7500c) monitored masses (m/z) carbon (13), sulphur (34), silicon (29), arsenic (75), and selenium (77). Silicon was monitored in order to make sure that only the sample, and not the microscope slide, was ablated by the laser. Carbon and sulphur were used to verify that the thickness of the ablation was relatively constant.

4.1.5 Total arsenic analysis by ICP-MS

Because the structure of each sample will determine (density and porosity) how much of it is ablated, LA-ICP-MS cannot be used for quantitative analysis. For quantitative comparison, subsampled cubes, i.e. those also used to prepare the slides, were oven-dried and digested by microwave according to the method used throughout the survey. Dry and fresh weights were determined. A subset of the samples was also digested with and without skin. All the results in the report are in fresh weight and are reported in Table 5.

Table 5. Samples selected for LA. Total arsenic concentrations as determined by sampling whole produce.

	Laser Code	Produce	Sample	Type Shop	Unpeeled As (ng/g)	Peeled As (ng/g)
Potatoes	**1**	Maris Peer	P3-21	FS	47.6	n/a
	3	Maris Peer	B3-17	GG	16.5	<LOD
	10	Salad/ mild	B3-61	GG	9.7	5.0
	11	Salad/ mild	B3-70	GG	13.7	5.9
	12	Salad/ mild	B3-111	GG	11.5	3.7
	16	Maris Peer	B3-28	FM	135.0	10.8
Beetroots	**7**	Beetroots	P3-19	FS	16.7	n/a
	8	Beetroots	B3-13	FS	118.7	5.9
	18	Beetroots	B3-94	FM	15.1	2.7
	27	Beetroots	L27		13.9	n/a
Parsnips	**13**	Parsnips	B3-82	GG	10.0	9.4
	14	Parsnips	B3-107	GG	11.6	10.8
	15	Parsnips	B3-129	FS	22.4	14.4
	22	Parsnips	L22		<LOD	n/a
	23	Parsnips	L23		<LOD	n/a
Apples	**152**	Kate	B3-153	FS	<LOD	<LOD
	154	Sunset	B3-155	FS	6.7	<LOD
	156	Bramley	B3-157	FS	4.3	<LOD
	26	Apples	L26	FS	<LOD	n/a
Carrots	**4**	Carrots	P3-17	FS	49.0	n/a
	5	Carrots	B3-11	FS	15.2	3.9
	17	Carrots	B3-30	FS	12.6	4.0
	20	Carrots	L20		<LOD	n/a
	21	Carrots	L21		<LOD	n/a
	24	White Carrots	L24		4.3	n/a

4.2 Arsenic analysis

4.2.1 Apple

There is little sulphur in the skin compared to the flesh and the arsenic trace seems to follow the sulphur pattern (Figure 7). LA-ICP-MS detected that total arsenic is mainly present in the bulk flesh although total data do not confirm this (Table 5). All samples digested without skin are below LOD while only 2 out of 4 samples (samples 154 and 156 at 6.7 and 4.3 ng/g respectively) are above LOD when digested unpeeled. Moreover, sample 154 presents a peak in arsenic situated halfway in the skin. Finally, samples collected in SW Britain (samples 152, 154, and 156) do not greatly differ from those from NE Britain (sample 26).

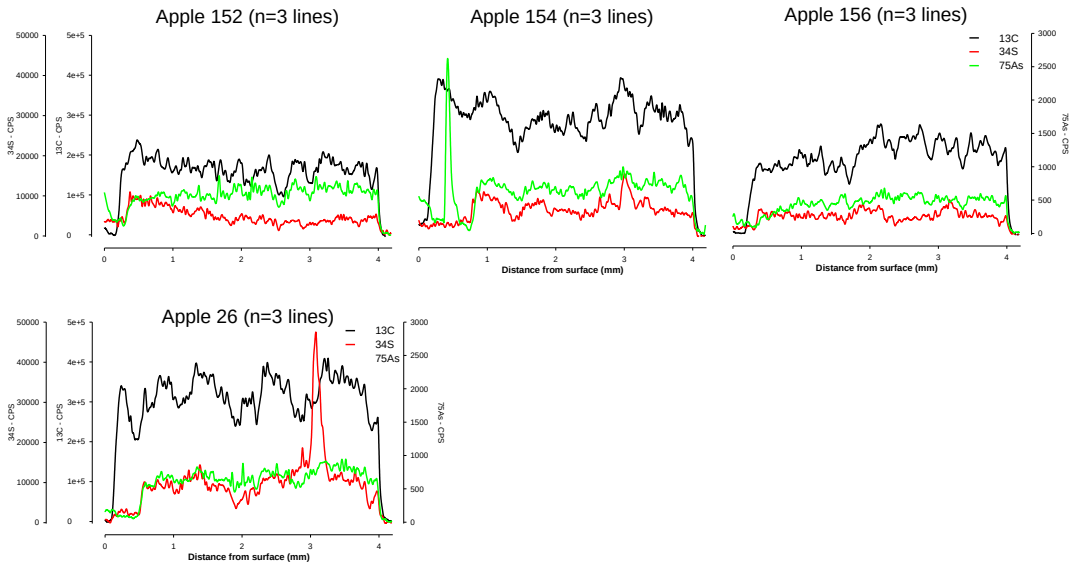

Figure 7. LA-ICP-MS traces for apple.

4.2.2 Beetroot

LA-ICP-MS detected that arsenic in beetroot is consistently elevated in the skin in the outer 300-600µm (Figure 8). Although samples 7, 18, and 27 have a similar total arsenic concentration (13.9 to 16.7 ng/g) this is not reflected by the LA-ICP-MS analysis as the 3 traces display very different ablated arsenic peak areas, probably due to elevated peak observed in LA-ICP-MS being sufficiently diluted in the bulk sample to result in no significant differences between the bulk samples with and without skin.

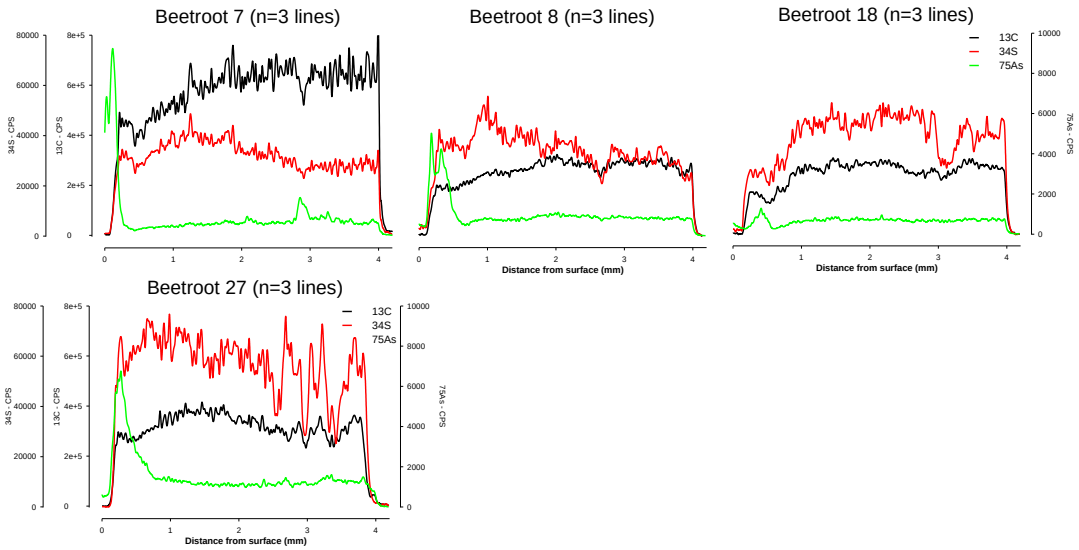

Figure 8. LA traces for beetroot.

4.2.3 Carrot

Carrots do not present any obvious trend regarding LA-ICP-MS detected arsenic within the samples. There appears to be slightly more arsenic in the flesh compared to the skin in most of the samples, as well as a gap at the interface between skin and flesh (Figure 9). Finally, samples collected in SW England (4, 5, and 17) differ little from those from Scotland (20, 21, and 24), even though the Scottish samples are lower in terms of total arsenic.

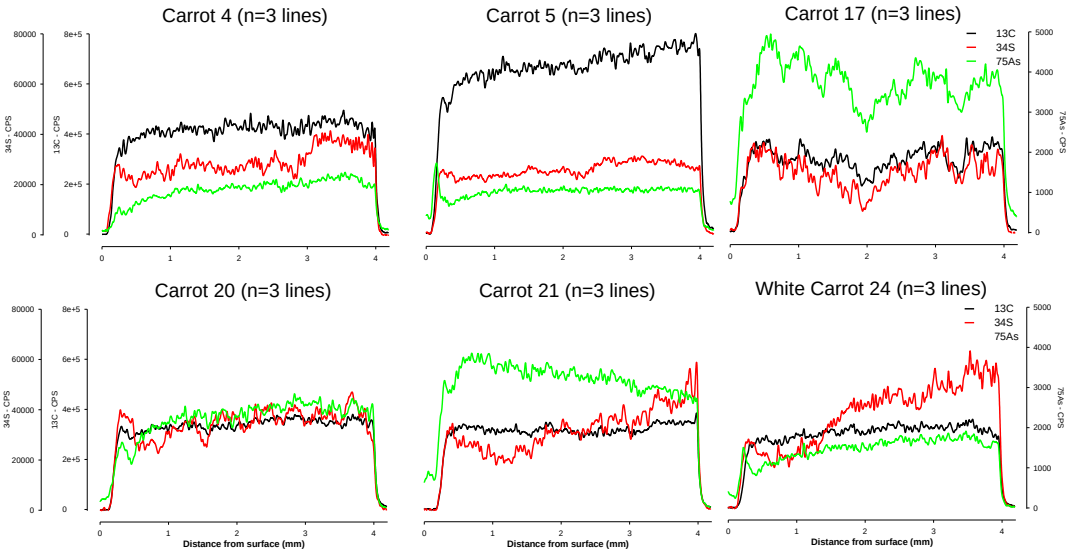

Figure 9. LA-ICP-MS traces for carrot.

4.2.4 Parsnip

Parsnips do not show any trends in arsenic deposition (Figure 10). The total arsenic analysis on bulk samples revealed that peeled and unpeeled samples had similar concentrations, confirming the LA-ICP-MS findings.

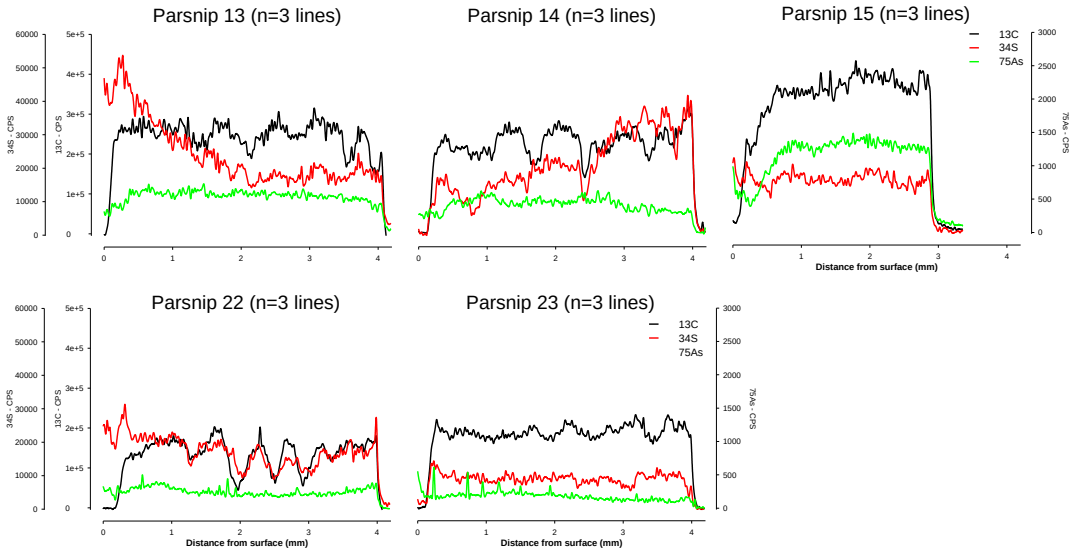

Figure 10. LA-ICP-MS traces for parsnip.

4.2.5 Potato

All potatoes sampled exhibit higher arsenic levels in the skin than in the flesh (Figure 11), consistent with the total arsenic analysis findings (Table 5). LA-ICP-MS showed that arsenic is deposited between 200-1000 µm from the outer surface of the potato, demonstrating that most of the arsenic is present within the skin and not on its outer surface. LA-ICP-MS and total arsenic analysis both showed that arsenic was more elevated in skin.

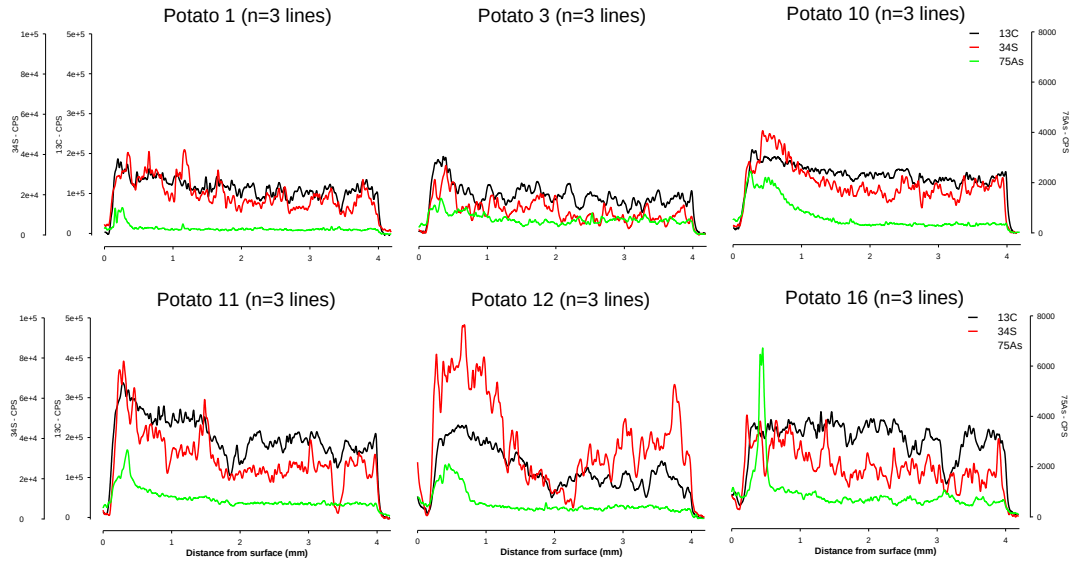

Figure 11. LA-ICP-MS traces for potato.

4.3 General conclusions

LA-ICP-MS showed that arsenic is consistently found elevated in the skin of beetroot and potato. For carrot, apple, and parsnip there was no indication from LA-ICP-MS of arsenic elevation in the skin.

5 Analysis of aluminum in leafy vegetables to study if elevated arsenic concentrations found in this food group is due to soil contamination

From the analysis of total arsenic in produce it was apparent that vegetables categorized as “open leaf structure” had the highest total arsenic concentration. A hypothesis as to why this is the case is that “open leaf structure” results in the more efficient accumulation of soil particles on leaves. To test this hypothesis the concentration of aluminum in “open leaf structure” vegetables was determined, and correlation analysis between the aluminium and total arsenic concentration conducted. Previously, titanium has been measured as a determinant of soil dust contamination; however, titanium was not measured in all the samples, as the nitric acid digestion method used to generate the samples for multi-element analysis using ICP-MS is not sufficient to extract all the titanium from plant material. A much more complex and expensive digestion is needed, for example using HF which is capable of dissolving stable metal oxides.

5.1 Sample selection

Samples were selected from the three main basket surveys and the last field survey. A total of 82 samples were selected consisting of vegetables categorized as “open leaf structure” (see Table E).

5.2 Analytical materials and methods

Approximately 0.2 g of sample was weighed accurately into glass digestion tubes. The digest reagent was prepared by dissolving 4.6 g lithium sulphate in 300 ml of concentrated sulphuric acid (H_2SO_4). A total of 2.4 ml of this reagent was added to the digest tube along with 2.1 ml of 100 volumes hydrogen peroxide (H_2O_2). Trace reagent analysis grade reagents were used throughout. A marble was placed on top of the digest tube to assist reflux and the block digester was heated up to 365^{o}C and held there for 2 hours. After digestion some of the samples still had a deep brown colour indicating incomplete digestion, so a further 1 ml of H_2O_2 was added and the block heated to 365^{o}C again for a further hour. All digests were completely colourless after this. Once cooled the digest was poured into 50 ml centrifuge tubes and the glass digestion tubes rinsed with deionised water 3 times into the centrifuge tubes, then made up to 50ml by volume with deionised water. Three replicates each of blanks and certified reference materials, IC-INCT-MPH-2 mixed Polish herbs, CTA-OTL-1 Oriental tobacco leaves and NCS ZC73012 cabbage, were used as quality controls. All the samples, blanks, and CRMs were randomised prior to analysis.

For analysis samples, blanks and CRMs were diluted 1:1 with 10000 mg L^{-1} lanthanum chloride ($LaCl_3$). Standards in the range 0.2-5 mg L^{-1} were made from 1000 mg L^{-1} Aluminium stock solution in a matrix of 1:1 H_2SO_4 4.8%: 10000 mg L^{-1} $LaCl_3$ to be matrix matched with the final diluted sample. Analysis was

performed on a Perkin Elmer AAnalyst100 Atomic Absorption Spectrophotometer (AAS) with a nitrous oxide/acetelyene flame using a 5 cm burner head. The source lamp was a Perkin Elmer Intesitron^{TM} lamp with the current set at 25 mA. The analysis was performed at wavelength 309.3 nm in absorbance mode and these results were calibrated to give a final concentration in mg/ kg.

5.3 Results

For the CRMs the average recovery for aluminium was very variable for the different CRMs. For the cabbage CRM the recovery was 114.4% ± 6.4%, for the herb CRM the recovery was 61.8% ± 8.6%, and for the tobacco CRM the recovery was 28.5% ± 8.9%. This indicates that the CRM speciation of aluminium differed greatly, and that the results must be considered with this in mind. The LOD for aluminium was 182.3 mg/kg. All samples were run as a single batch. Out of the 82 samples analysed 36 samples were below the LOD. For statistical analysis these 36 samples were allocated a half LOD concentration. The concentration of aluminium in the samples analyzed is presented in appendix Table E.

There was a significant correlation (Figure 12) between the concentration of total arsenic in the samples and the concentration of aluminium ($P<0.001$, $r=0.416$, $n = 82$), and if the data is plotted on a log-log plot a straight-line correlation is observed ($r=0.625$). As this experiment was an exploratory experiment to see if any link existed between total arsenic and aluminum only a single measurement of the samples was performed.

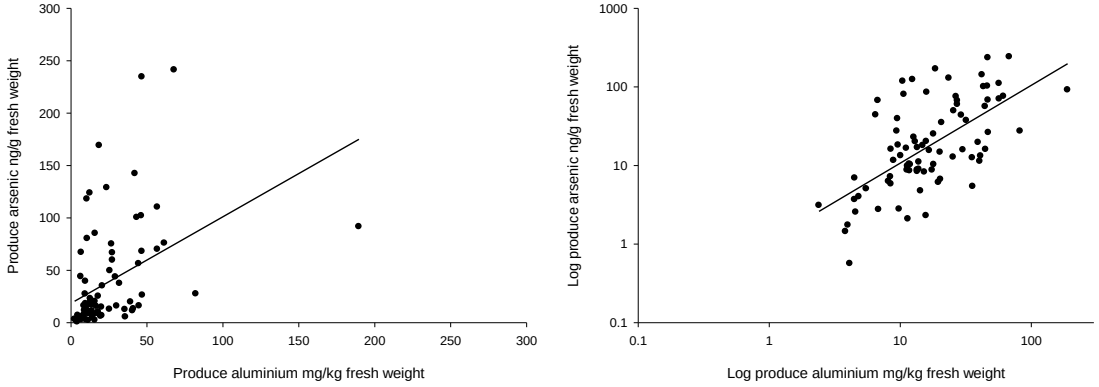

Figure 12. Relationship between aluminium and total arsenic concentration in produce. (A) x- and y- axis plotted using a linear scale. (B) x- and y- axis plotted using a log scale.

5.4 Conclusions and discussion of findings of aluminum in leafy vegetables

For the samples measured for both aluminium and total arsenic there is a significant positive relationship between the two elements. As aluminium is not readily taken up by plants the concentrations observed here are likely to be due to contamination of soil on the produce. Therefore, the relationship indicates that the higher concentrations of total arsenic observed in the leafy vegetables is probably due to higher levels of soil contamination on the surface of the leaves.

6 Overall conclusions and recommendations for future research

Conclusions:

- Arsenic speciation in all samples was dominated by inorganic arsenic, with DMA being the only other species present, and often being absent or present only as a minor contributor
- Fruit and vegetable produce from the SW of England were more elevated in total arsenic than for the NE of Scotland
- “Leafy” vegetables had higher fresh weight arsenic concentrations compared to all other produce classes
- Correlation between aluminium and arsenic in leafy vegetables suggested that they were elevated due to surface dust contamination
- Comparison of peeled and unpeeled produce found higher levels in unpeeled produce
- Laser-ablation confirmed localization of arsenic in skin
- Baked potato skins were found to have highly elevated arsenic contents

Future research suggestions:

- The reason for elevated arsenic in “leafy” vegetables needs to be investigated through reciprocal transplant experiments and controlled glasshouse study
- Arsenic speciation and availability in soils will help increase prediction as to whether that soil will give rise to elevated arsenic in produce
- Eating habits of those in arsenic elevated soils regions need to be assessed to predict risk of exposure from inorganic arsenic

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8 Appendix

Table A. Total arsenic concentration in all samples survey in the SW basket survey. Arsenic concentrations are given as ng/g fresh weight. Shop types HB = honesty box; FS = farm shop; GC = garden centre; GG = green grocer; FM = farmers market; MS = market stall. Note that when no preparation method is given (-) that the food item concerned does not usually have an alternative preparation.

Survey code	Survey sample	Produce	Type shop	Preparation method	As ng/g dry wt	As ng/g fresh wt	Alternative preparation	As ng/g dry wt	As ng/g fresh wt
B1	12	APPLES	HB	Unpeeled	23.2	2.3	Peeled	24.6	2.4
B1	13	APPLES	FS	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B1	20	APPLES	FS	Unpeeled	25.5	4.2	Peeled	<LOD	2.4
B1	22	APPLES	FS	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B1	14	APPLES	FS	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B1	21	APPLES	GG	Unpeeled	<LOD	<LOD	Peeled	18.5	3.4
B1	15	APPLES	CS	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B1	18	APPLES	FS	Unpeeled	29.6	4.0	Peeled	<LOD	<LOD
B1	19	APPLES	FS	Unpeeled	<LOD	2.4	Peeled	<LOD	<LOD
B1	16	APPLES	FS	Unpeeled	<LOD	2.1	Peeled	<LOD	2.2
B1	17	APPLES	GG	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B1	24	AUBERGINE	FS	Unpeeled	93.2	10.1	Peeled	81.3	10.3
B1	25	BEETROOT	GC	Peeled	20.1	2.4			
B1	26	BEETROOT	FS	Peeled	52.6	6.9	Unpeeled	53.1	6.3
B1	27	BEETROOT	FS	Peeled	31.5	5.4	Unpeeled	50.5	8.7
B1	28	BEETROOT	GG	Peeled	<LOD	<LOD			
B1	31	BEETROOT	FM	Peeled	23.6	3.4	Unpeeled	31.2	4.5
B1	29	BEETROOT	GG	Peeled	<LOD	<LOD	Unpeeled	18.5	2.7
B1	30	BEETROOT	HB	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.7
B1	37	BRUSSEL SPROUTS	GG	-	39.5	7.2			
B1	38	BRUSSEL SPROUTS	GC	-	<LOD	<LOD			
B1	39	BRUSSEL SPROUTS	HB	-	35.1	5.3			
B1	40	BRUSSEL SPROUTS	FS	-	62.5	10.2			
B1	41	BRUSSEL SPROUTS	HB	-	72.3	11.8			
B1	42	SQUASH, BUTTERNUT	GG	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD

B1	43	SQUASH, BUTTERNUT	FM	Peeled	248.6	25.6	Unpeeled	217.4	21.7
B1	46	CABBAGE	HB	-	<LOD	<LOD			
B1	47	CABBAGE	CS	-	83.0	8.6			
B1	48	CABBAGE	GC	-	60.4	5.8			
B1	49	CABBAGE	FS	-	22.6	2.1			
B1	50	CABBAGE	FS	-	<LOD	<LOD			
B1	51	CABBAGE	FS	-	45.0	3.1			
B1	52	CABBAGE	HB	-	<LOD	<LOD			
B1	53	CABBAGE	FS	-	46.1	4.2			
B1	54	CABBAGE	HB	-	70.3	7.0			
B1	59	CABBAGE	FS	-	<LOD	<LOD			
B1	55	CABBAGE	GG	-	19.2	<LOD			
B1	58	CABBAGE	FS	-	46.3	5.1			
B1	56	CABBAGE	GG	-	32.6	3.2			
B1	57	CABBAGE	GG	-	34.3	5.3			
B1	60	BROCCOLI / CALABRESE	GG	-	18.9	2.1			
B1	61	BROCCOLI / CALABRESE	GC	-	120.1	13.7			
B1	67	BROCCOLI / CALABRESE	GG	-	<LOD	<LOD			
B1	62	BROCCOLI / CALABRESE	GG	-	<LOD	<LOD			
B1	63	BROCCOLI / CALABRESE	GG	-	<LOD	<LOD			
B1	64	BROCCOLI / CALABRESE	FM	-	43.8	6.0			
B1	65	BROCCOLI / CALABRESE	FM	-	20.2	2.3			
B1	66	BROCCOLI / CALABRESE	GG	-	28.5	3.0			
B1	69	CARROT	HB	Peeled	<LOD	<LOD	Unpeeled	30.0	2.7
B1	68	CARROT	CS	Peeled	35.5	4.4			
B1	70	CARROT	GG	Peeled	28.3	3.0	Unpeeled	28.7	3.0
B1	71	CARROT	FS	Peeled	60.5	7.1	Unpeeled	401.5	45.8
B1	72	CARROT	FS	Peeled	41.3	4.8	Unpeeled	289.7	29.2
B1	73	CARROT	FS	Peeled	47.0	5.8	Unpeeled	68.0	7.7
B1	74	CARROT	GG	Peeled	47.8	6.1			
B1	75	CARROT	FS	Peeled	32.6	3.8	Unpeeled	54.7	6.0
B1	76	CARROT	FM	Peeled	121.2	13.3	Unpeeled	426.0	43.6
B1	77	CARROT	GG	Peeled	181.1	22.9	Unpeeled	692.6	72.2
B1	78	CARROT	FS	Peeled	38.0	3.6	Unpeeled	79.7	8.8
B1	79	CARROT	HB	Peeled	41.9	5.5	Unpeeled	40.4	4.9

B1	90	CAULIFLOWER	HB	-	<LOD	<LOD			
B1	91	CAULIFLOWER	FS	-	32.8	2.6			
B1	92	CAULIFLOWER	FS	-	166.6	13.5			
B1	93	CAULIFLOWER	FS	-	25.0	2.3			
B1	94	CAULIFLOWER	HB	-	56.4	4.7			
B1	95	CAULIFLOWER	GG	-	20.4	<LOD			
B1	96	CAULIFLOWER	HB	-	37.4	3.2			
B1	97	CAULIFLOWER	GG	-	68.7	5.9			
B1	98	CAULIFLOWER	FM	-	40.4	3.3			
B1	99	CAULIFLOWER	GG	-	76.8	6.3			
B1	100	CAULIFLOWER	FS	-	35.5	2.5			
B1	101	CAULIFLOWER	FM	-	37.0	2.9			
B1	102	CAULIFLOWER	FS	-	26.8	2.0			
B1	103	CAULIFLOWER	CS	-	26.6	<LOD			
B1	104	CAULIFLOWER	FS	-	53.0	4.4			
B1	105	CAULIFLOWER	GG	-	<LOD	<LOD			
B1	106	CAULIFLOWER	GG	-	42.7	2.9			
B1	107	CAULIFLOWER	GG	-	<LOD	<LOD			
B1	108	CAULIFLOWER	HB	-	18.8	<LOD			
B1	109	CELERIAC	GC	Peeled	244.1	25.2			
B1	110	CELERIAC	FS	Peeled	168.5	16.3			
B1	111	CELERIAC					Unpeeled	135.9	15.5
B1	113	APPLES, COOKING	CS	Unpeeled	38.2	5.2	Peeled	31.3	4.0
B1	114	COURGETTE					Peeled	31.2	2.1
B1	115	COURGETTE					Peeled	42.0	<LOD
B1	116	COURGETTE	GG	Unpeeled	37.2	<LOD			
B1	118	COURGETTE	FS	Unpeeled	44.5	<LOD	Peeled	38.1	<LOD
B1	119	CUCUMBERS					Peeled	19.7	<LOD
B1	123	CUCUMBER	FS	Unpeeled	336.2	16.5	Peeled	358.0	16.6
B1	122	CUCUMBER	FS	Unpeeled	630.0	36.7	Peeled	528.4	29.8
B1	124	KALE, CURLY	FS	-	486.6	85.2			
B1	125	KALE, CURLY	FS	-	116.1	20.2			
B1	126	KALE, CURLY	FM	-	109.9	17.9			
B1	127	FENNEL	FS	-	145.6	11.4			
B1	128	PEPPERS, green	FS	Unpeeled	38.6	3.3			

B1	129	TOMATO, green	FS	Unpeeled	<LOD	<LOD			
B1	130	JERUSALEM ARTICHOKES	FS	Peeled	33.4	9.5	Unpeeled	105.8	15.8
B1	132	KALE	GG	-	59.2	8.8			
B1	133	KALE	FM	-	84.5	15.5			
B1	134	KALE	GG	-	30.2	4.7			
B1	135	SALAD, LEAFY MIX	GG	-	522.2	52.7			
B1	136	LEEK	HB	-	<LOD	2.3			
B1	137	LEEK	GG	-	23.0	3.1			
B1	138	LEEK	CS	-	161.5	12.8			
B1	139	LEEK	FS	-	29.2	3.7			
B1	140	LEEK	FS	-	97.5	9.7			
B1	141	LEEK	FS	-	278.9	21.8			
B1	142	LEEK	HB	-	48.3	5.5			
B1	143	LEEK	FS	-	22.6	<LOD			
B1	144	LEEK	GG	-	<LOD	<LOD			
B1	145	LEEK	CS	-	20.8	2.4			
B1	146	LEEK	GG	-	20.6	2.1			
B1	147	LEEK	FM	-	31.9	3.9			
B1	148	LEEK	FM	-	166.2	15.4			
B1	149	LEEK	GG	-	26.5	4.4			
B1	151	LEEK	HB	-	26.5	2.4			
B1	152	LEEK	FM	-	68.3	8.9			
B1	153	LEEK	GG	-	32.7	4.2			
B1	154	LEEK	GG	-	36.0	6.4			
B1	155	LEEK	FM	-	221.6	21.7			
B1	156	LEEK	GG	-	<LOD	<LOD			
B1	157	LETTUCE	GG	-	41.6	<LOD			
B1	158	LETTUCE	FS	-	34.4	<LOD			
B1	159	LETTUCE	FS	-	685.2	43.6			
B1	160	LETTUCE	GG	-	49.6	2.1			
B1	161	LETTUCE	FS	-	109.4	4.5			
B1	162	LETTUCE	FM	-	1802.7	100.3			
B1	163	LETTUCE	GC	-	74.7	3.7			
B1	164	LETTUCE	FS	-	75.6	4.0			
B1	165	LETTUCE	GG	-	45.2	2.3			

B1	166	LETTUCE	GG	-	158.7	6.1			
B1	167	MARROW	HB	Peeled	130.2	5.2			
B1	168	MARROW	GG	Peeled	35.1	<LOD	Unpeeled	51.2	2.7
B1	171	MOOLI RADISH	FS	Unpeeled	553.6	31.1	Peeled	308.0	16.3
B1	172	ONION	HB	Peeled	63.3	5.8			
B1	173	ONION	FS	Peeled	43.9	4.6			
B1	174	PAK CHOI	FM	-	101.7	4.9			
B1	175	PARSLEY	HB	-	427.7	61.0			
B1	176	PARSNIP	HB	Peeled	28.1	6.2	Unpeeled	28.7	6.5
B1	177	PARSNIP	FS	Peeled	32.1	6.3	Unpeeled	90.6	22.1
B1	178	PARSNIP	FS	Peeled	49.8	9.4	Unpeeled	53.0	13.0
B1	179	PARSNIP	GG	Peeled	<LOD	2.9			
B1	184	PEARS					Peeled	<LOD	<LOD
B1	185	PEARS	FS	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B1	186	PEPPERS	FS	Unpeeled	<LOD	<LOD			
B1	187	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	30.7	6.1
B1	214	POTATOE					Unpeeled	<LOD	<LOD
B1	189	POTATO	CS	Peeled	<LOD	<LOD			
B1	210	POTATO	GC	Peeled	<LOD	<LOD	Unpeeled	28.1	7.2
B1	190	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	207	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	191	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	192	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	3.8
B1	205	POTATO	HB	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.6
B1	193	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.1
B1	194	POTATO	GG	Peeled	<LOD	<LOD			
B1	195	POTATO	HB	Peeled	<LOD	2.1	Unpeeled	<LOD	3.0
B1	196	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.8
B1	204	POTATO	GG	Peeled	<LOD	2.5	Unpeeled	<LOD	2.9
B1	206	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	208	POTATO	FS	Peeled	<LOD	2.7	Unpeeled	58.6	10.9
B1	211	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.3
B1	212	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.0
B1	197	POTATO	FM	Peeled	20.0	3.3	Unpeeled	20.4	3.0
B1	198	POTATO	CS	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.2

B1	199	POTATO	HB	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	200	POTATO	HB	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	201	POTATO	FM	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	202	POTATO	GG	Peeled	39.3	6.6			
B1	209	POTATO	FM	Peeled	<LOD	<LOD	Unpeeled	21.5	4.8
B1	203	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	236	PUMPKINS	HB	Peeled	536.2	22.7			
B1	237	BROCCOLI / CALABRESE PURPLE	GG	-	<LOD	<LOD			
B1	238	RADISH	FS	Unpeeled	531.0	45.7			
B1	239	RASPBERRIES	HB	-	97.7	8.9			
B1	240	RASPBERRIES	FS	-	95.5	11.2			
B1	241	RASPBERRIES	GG	-	<LOD	<LOD			
B1	242	CABBAGE, RED	HB	-	<LOD	<LOD			
B1	243	CABBAGE, RED	FS	-	45.5	4.4			
B1	244	CABBAGE, RED	FS	-	75.5	7.0			
B1	245	CABBAGE, RED	FS	-	38.4	4.1			
B1	246	CABBAGE, RED	FM	-	<LOD	<LOD			
B1	247	CABBAGE, RED	FS	-	<LOD	<LOD			
B1	248	CABBAGE, RED	FM	-	27.7	2.6			
B1	249	CABBAGE, RED	FS	-	28.2	2.9			
B1	250	CABBAGE, RED	FM	-	<LOD	<LOD			
B1	251	CABBAGE, RED	GG	-	25.9	2.4			
B1	252	ONION, RED	GG	Peeled	99.4	10.8			
B1	253	ROMANESCO BROCCOLI	FS	-	132.6	14.9			
B1	254	ROMANESCO BROCCOLI	HB	-	121.2	15.8			
B1	255	ROMANESCO BROCCOLI	GG	-	86.5	7.8			
B1	256	ROMANESCO BROCCOLI	FM	-	21.8	2.7			
B1	257	ROMANESCO BROCCOLI	HB	-	24.0	2.5			
B1	258	ROMANESCO BROCCOLI	GG	-	<LOD	<LOD			
B1	259	RUNNER BEANS	FS	-	74.7	6.2			
B1	260	RUNNER BEANS	FM	-	84.9	7.6			
B1	261	KALE, RUSSIAN	FS	-	163.9	22.8			
B1	263	CABBAGE, SAVOY	FS	-	61.4	7.7			
B1	264	CABBAGE, SAVOY	FS	-	195.6	23.1			
B1	265	CABBAGE, SAVOY	FS	-	122.3	16.7			

B1	266	CABBAGE, SAVOY	HB	-	113.5	16.9			
B1	262	CABBAGE, SAVOY	GG	-	41.5	4.7			
B1	267	CABBAGE, SAVOY	GG	-	78.9	9.9			
B1	268	CABBAGE, SAVOY	FM	-	194.0	26.7			
B1	269	CABBAGE, SAVOY	GG	-	43.4	5.2			
B1	270	CABBAGE, SAVOY	FM	-	42.3	6.0			
B1	271	CABBAGE, SAVOY	FS	-	31.8	3.7			
B1	272	CABBAGE, SAVOY	GG	-	35.9	3.4			
B1	273	CABBAGE, SAVOY	FM	-	<LOD	<LOD			
B1	274	CABBAGE, SAVOY	HB	-	80.3	10.9			
B1	275	SPINACH	FM	-	189.7	14.7			
B1	276	SPINACH	GG	-	588.2	67.9			
B1	279	GREENS, spring	GG	-	264.2	27.3			
B1	280	GREENS, spring	FS	-	683.9	80.2			
B1	281	GREENS, spring	HB	-	78.9	9.8			
B1	282	GREENS, spring	FS	-	907.9	123.7			
B1	278	GREENS, spring	GG	-	120.3	13.3			
B1	283	GREENS, spring	FM	-	1026.7	117.9			
B1	284	GREENS, spring	GG	-	375.8	39.3			
B1	277	SPRING ONIONS	CS	-	148.5				
B1	285	SQUASH	FM	Peeled	119.4	4.3			
B1	286	STRAWBERRIES	HB	-	20.3	2.5			
B1	287	STRAWBERRIES	GG	-	78.7	7.4			
B1	288	STRAWBERRIES	GG	-	<LOD	<LOD			
B1	289	STRAWBERRIES	HB	-	27.7	3.2			
B1	290	STRAWBERRIES	GG	-	23.3	2.8			
B1	291	SWEDE	GG	Peeled	<LOD	<LOD	Unpeeled	20.0	2.0
B1	292	SWEDE	GC	Peeled	20.5	<LOD			
B1	293	SWEDE	GG	Peeled	29.1	3.2	Unpeeled	44.6	5.5
B1	294	SWEDE	FS	Peeled	92.1	8.3	Unpeeled	101.6	8.9
B1	312	SWEDE					Unpeeled	112.3	10.3
B1	296	SWEDE	FS	Peeled	51.5	5.8	Unpeeled	89.5	10.3
B1	297	SWEDE	FS	Peeled	90.7	8.5	Unpeeled	339.1	33.9
B1	298	SWEDE	HB	Peeled	93.9	9.2	Unpeeled	138.7	14.4
B1	299	SWEDE	HB	Peeled	108.4	10.6	Unpeeled	116.4	11.0

B1	300	SWEDE	CS	Peeled	87.7	8.7	Unpeeled	119.2	11.8
B1	301	SWEDE	FM	Peeled	31.7	3.6	Unpeeled	30.3	3.4
B1	302	SWEDE	FM	Peeled	75.4	7.3	Unpeeled	103.3	10.6
B1	303	SWEDE	GG	Peeled	29.4	2.8	Unpeeled	51.9	5.0
B1	304	SWEDE	FM	Peeled	85.4	8.2	Unpeeled	95.3	9.6
B1	305	SWEDE	HB	Peeled	26.2	3.1	Unpeeled	24.4	3.1
B1	306	SWEDE	FS	Peeled	97.2	9.6	Unpeeled	96.8	10.0
B1	307	SWEDE	GG	Peeled	<LOD	<LOD			
B1	308	SWEDE	FM	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B1	325	PEPPERS, red	FS	Unpeeled	<LOD	<LOD			
B1	326	TOMATO	FS	Unpeeled	<LOD	<LOD			
B1	327	TOMATO	CS	Unpeeled	<LOD	<LOD			
B1	328	TURNIPS	GG	Peeled	35.7	7.7	Unpeeled	52.2	8.9
B2	1	STRAWBERRIES	FS	-	31.3	3.4			
B2	2	CARROT	FS	Peeled	40.2	4.5	Unpeeled	50.7	6.1
B2	4	SWEDE	FS	Peeled	<LOD	2.1	Unpeeled	21.0	2.5
B2	6	LEEK	FS	-	<LOD	<LOD			
B2	7	CABBAGE	FS	-	31.3	5.6			
B2	8	STRAWBERRIES	FS	-	311.5	29.9			
B2	9	CARROT	FS	Peeled	166.1	16.8	Unpeeled	262.8	23.8
B2	11	LEEK	FS	-	179.3	30.3			
B2	12	BROAD BEAN	GG	-	39.1	9.1			
B2	13	STRAWBERRIES	GG	-	25.9	2.3			
B2	14	POTATO, new	GG	Peeled	22.4	5.4	Unpeeled	157.6	40.5
B2	16	CABBAGE, SAVOY	GG	-	19.7	2.4			
B2	17	CAULIFLOWER	GG	-	<LOD	<LOD			
B2	18	CARROT	GG	Peeled	30.7	3.1	Unpeeled	29.5	2.8
B2	20	STRAWBERRIES	GG	-	33.7	3.5			
B2	21	LETTUCE, oak leaf	GG	-	578.8	35.0			
B2	22	LETTUCE, lollo Rosso	GG	-	612.5	25.1			
B2	23	LETTUCE, Iceberg	GG	-	<LOD	<LOD			
B2	24	POTATO, new	GG	Peeled	<LOD	2.4	Unpeeled	183.2	32.0
B2	26	SWEDE	GG	Peeled	206.4	15.9	Unpeeled	134.7	13.0
B2	28	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	<LOD	3.1
B2	30	STRAWBERRIES	GG	-	34.6	3.0			

B2	31	SPINACH	GG	-	72.7	11.1			
B2	32	CHARD	GG	-	129.3	16.0			
B2	33	LEEK	GG	-	24.1	<LOD			
B2	34	BROAD BEAN	GG	-	134.8	29.3			
B2	35	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B2	37	POTATO, new	GG	Peeled	<LOD	2.9	Unpeeled	127.1	23.7
B2	39	STRAWBERRIES	GG	-	28.6	2.8			
B2	40	BROAD BEAN	GG	-	79.2	18.4			
B2	41	CABBAGE	GG	-	42.5	3.9			
B2	42	CABBAGE	GG	-	<LOD	<LOD			
B2	43	STRAWBERRIES	GG	-	69.3	6.0			
B2	44	BROAD BEAN	GG	-	119.9	25.4			
B2	45	ASPARAGUS	GG	-	42.8	2.6			
B2	46	STRAWBERRIES	GG	-	<LOD	<LOD			
B2	47	LETTUCE	GG	-	50.6	2.5			
B2	48	LETTUCE, red	GG	-	230.9	10.4			
B2	49	CARROT	GG	Peeled	36.0	4.1	Unpeeled	57.5	6.6
B2	51	BROAD BEAN	FS	-	118.3	26.5			
B2	52	PARSNIP	FS	Peeled	<LOD	<LOD	Unpeeled	27.0	4.5
B2	54	CABBAGE	FS	-	32.9	<LOD			
B2	55	SWEDE	FS	Peeled	129.3	11.8	Unpeeled	149.4	11.7
B2	57	POTATO, new	FS	Peeled	23.0	4.2	Unpeeled	118.0	22.1
B2	59	BEETROOT	GG	Peeled	30.4	2.9	Unpeeled	21.5	2.6
B2	61	POTATO	GG	Peeled	22.7	5.2	Unpeeled	135.1	33.8
B2	63	SWEDE	GG	Peeled	110.1	10.6	Unpeeled	158.6	15.0
B2	65	POTATO, new	GG	Peeled	23.9	4.5	Unpeeled	92.2	19.0
B2	67	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	32.9	7.0
B2	69	LEEK	GG	-	98.2	9.8			
B2	70	LETTUCE	GG	-	54.7	3.1			
B2	71	CABBAGE	GG	-	36.2	3.6			
B2	72	CABBAGE	GG	-	37.7	3.2			
B2	73	LEEK	GG	-	35.5	2.5			
B2	74	POTATO	GG	Peeled	<LOD	2.0	Unpeeled	63.6	13.3
B2	76	STRAWBERRIES	FS	-	21.6	2.5			
B2	77	BROAD BEAN	FS	-	38.6	7.0			

B2	78	POTATO, organic	FS	Peeled	19.6	4.5	Unpeeled	111.2	23.2
B2	80	POTATO	FS	Peeled	19.5	3.4	Unpeeled	130.5	26.0
B2	82	GREENS, spring	FS	-	65.9	8.5			
B2	83	ASPARAGUS	FM	-	29.6	2.3			
B2	84	BROAD BEAN	FM	-	89.4	19.5			
B2	85	STRAWBERRIES	FM	-	27.1	2.5			
B2	86	LETTUCE	FM	-	228.0	8.2			
B2	88	APPLES	FM	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B2	89	GOOSEBERRIES	FM	-	<LOD	<LOD			
B2	90	POTATO, new	FM	Peeled	34.5	7.4	Unpeeled	144.5	34.4
B2	92	POTATO, new	GG	Peeled	27.4	6.7	Unpeeled	204.7	43.3
B2	94	CAULIFLOWER	GG	-	21.6	<LOD			
B2	95	CARROT	FS	Peeled	67.6	6.0	Unpeeled	29.0	2.9
B2	97	POTATO, new	FS	Peeled	19.8	4.8	Unpeeled	109.4	24.9
B2	99	CARROT	FS	Peeled	49.2	3.6	Unpeeled	54.0	4.0
B2	101	POTATO, new	FS	Peeled	42.9	10.3	Unpeeled	283.8	58.7
B2	103	CABBAGE	FS	-	20.0	3.4			
B2	104	LETTUCE	GG	-	139.8	6.9			
B2	105	RHUBARB	GG	-	19.9	<LOD			
B2	106	CARROT	GG	Peeled	23.8	2.1	Unpeeled	39.4	3.1
B2	108	POTATO, new	GG	Peeled	<LOD	<LOD	Unpeeled	152.6	28.8
B2	110	BROAD BEAN	GG	-	74.2	15.5			
B2	111	GOOSEBERRIES	GG	-	<LOD	<LOD			
B2	112	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	28.4	5.8
B2	114	CAULIFLOWER	GG	-	39.4	3.7			
B2	115	ASPARAGUS	GG	-	24.9	2.3			
B2	116	STRAWBERRIES	GG	-	<LOD	<LOD			
B2	117	LETTUCE	GG	-	117.4	3.1			
B2	118	BROAD BEAN	GG	-	<LOD	4.5			
B2	119	CARROT	GG	Peeled	<LOD	<LOD	Unpeeled	22.8	2.9
B2	121	POTATO, new	GG	Peeled	29.7	8.1	Unpeeled	173.5	40.9
B2	123	COURGETTE	GG	Unpeeled	33.6	<LOD	Peeled	32.5	2.1
B2	125	BEETROOT	GG	Peeled	<LOD	2.1	Unpeeled	21.2	3.7
B2	127	POTATO	GG	Peeled	23.4	6.0	Unpeeled	37.5	8.6
B2	129	CARROT	GG	Peeled	20.9	2.5	Unpeeled	<LOD	2.1

B2	131	SWEDE	GG	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
B2	133	POTATO, new	FM	Peeled	19.8	3.5	Unpeeled	56.1	10.0
B2	135	SPINACH	FM	-	125.7	12.5			
B2	136	BROAD BEAN	FM	-	132.1	27.3			
B2	137	SALAD, MIX	FM	-	615.7	44.0			
B2	138	RED CURRANTS	FM	-	33.5	4.6			
B2	139	STRAWBERRIES	GG	-	32.6	3.5			
B2	140	LETTUCE, oak leaf	GG	-	81.2	2.8			
B2	141	SALAD, MIX	GG	-	128.4	8.4			
B2	142	CHARD	GG	-	113.0	13.2			
B2	143	SPINACH	GG	-	102.5	12.8			
B2	144	POTATO, new	GG	Peeled	<LOD	2.1	Unpeeled	<LOD	3.0
B2	146	STRAWBERRIES	FS	-	41.2	4.4			
B2	147	RASPBERRIES	FS	-	25.2	3.2			
B2	148	GREENS, spring	FS	-	25.9	2.8			
B2	149	BROCCOLI / CALABRESE	FS	-	23.9	3.6			
B2	150	COURGETTE	FS	Unpeeled	44.2	2.5	Peeled	66.2	3.0
B2	152	CARROT	FS	Peeled	73.8	9.0	Unpeeled	294.5	34.0
B2	154	POTATO, new	FS	Peeled	<LOD	<LOD	Unpeeled	45.6	9.4
B2	156	BEETROOT	FM	Peeled	29.4	4.4	Unpeeled	47.0	7.4
B2	158	SALAD, MIX	FM	-	1403.0	142.2			
B2	159	STRAWBERRIES	FM	-	32.0	3.2			
B2	160	BROAD BEAN	FM	-	81.4	16.4			
B2	161	POTATO, new	FM	Peeled	<LOD	4.2	Unpeeled	96.8	23.6
B2	163	RASPBERRIES	FS	-	60.0	9.8			
B2	164	STRAWBERRIES	FS	-	26.6	2.8			
B2	165	GOOSEBERRIES	FS	-	78.1	10.0			
B2	166	BROAD BEAN	FS	-	21.0	4.8			
B2	167	CAULIFLOWER	FS	-	23.0	<LOD			
B2	168	CABBAGE	FS	-	44.2	5.3			
B2	169	CABBAGE	FS	-	85.4	7.3			
B2	170	PAK CHOI	FS	-	1123.1	66.6			
B2	171	LETTUCE	FS	-	1266.3	101.9			
B2	172	COURGETTE	FS	Unpeeled	65.8	4.2	Peeled	71.6	4.7
B2	174	CARROT	FS	Peeled	114.8	13.7	Unpeeled	298.7	36.2

B2	176	SWEDE	FS	Peeled	83.0	12.5			
B2	177	SWEDE	FS	Unpeeled	256.3	39.5			
B2	178	POTATO	FS	Peeled	<LOD	3.2	Unpeeled	132.5	30.8
B2	180	STRAWBERRIES	GG	-	56.5	2.3			
B2	181	CABBAGE	GG	-	42.9	4.5			
B2	182	LETTUCE	GG	-	146.1	5.8			
B2	183	LETTUCE, oak leaf	GG	-	1207.9	75.0			
B2	184	CAULIFLOWER	GG	-	30.1	2.4			
B2	185	POTATO, new	GG	Peeled	35.0	8.5	Unpeeled	134.8	38.4
B2	187	POTATO	GG	Peeled	<LOD	3.8	Unpeeled	18.7	4.5
B2	189	STRAWBERRIES	GC	-	<LOD	<LOD			
B2	190	COURGETTE	GC	Unpeeled	505.3	26.0	Peeled	668.1	40.4
B2	192	GOOSEBERRIES	GC	-	<LOD	<LOD			
B2	193	BROCCOLI / CALABRESE	GC	-	<LOD	<LOD			
B2	194	CAULIFLOWER	GC	-	37.2	3.7			
B2	195	POTATO, new	GC	Peeled	24.4	4.2	Unpeeled	109.2	20.1
B2	197	POTATO, new organic	GG	Peeled	27.7	6.0	Unpeeled	178.9	41.7
B2	199	SPINACH	GG	-	298.9	26.2			
B2	200	STRAWBERRIES	GG	-	22.7	3.2			
B2	201	GOOSEBERRIES	GG	-	<LOD	<LOD			
B2	202	CABBAGE	GG	-	24.2	2.5			
B2	203	BROCCOLI / CALABRESE	GG	-	<LOD	<LOD			
B2	204	POTATO, new	GG	Peeled	<LOD	4.8	Unpeeled	63.4	11.9
B2	206	RASPBERRIES	HB	-	408.6	49.1			
B2	207	RHUBARB	HB	-	142.3	9.4			
B2	208	LETTUCE, oak leaf	GG	-	176.8	8.7			
B2	209	LETTUCE	GG	-	212.9	15.8			
B2	210	RASPBERRIES	GG	-	<LOD	2.3			
B2	211	GOOSEBERRIES	GG	-	<LOD	<LOD			
B2	212	BROAD BEAN	GG	-	<LOD	3.5			
B2	213	POTATO, new	GG	Peeled	36.5	10.1	Unpeeled	53.6	14.8
B2	215	STRAWBERRIES	GG	-	<LOD	<LOD			
B2	216	RASPBERRIES	GG	-	<LOD	2.5			
B2	217	GOOSEBERRIES	GG	-	<LOD	<LOD			
B2	218	LETTUCE, lollo Rosso	GG	-	760.7	49.5			

B2	219	LETTUCE	GG	-	893.8	59.7			
B2	220	CABBAGE, SAVOY	GG	-	25.8	2.9			
B2	221	POTATO, new	GG	Peeled	<LOD	<LOD	Unpeeled	44.4	11.0
B2	223	SALAD, MIX Organic	GG	-	1147.9	91.5			
B2	224	SPINACH, organic	GG	-	942.5	69.9			
B2	225	GREENS, spring organic	GG	-	156.6	19.6			
B2	226	POTATO, new organic	GG	Peeled	<LOD	3.6	Unpeeled	184.0	50.4
B2	228	STRAWBERRIES	GG	-	23.3	<LOD			
B2	229	RASPBERRIES	GG	-	36.0	3.9			
B2	230	RHUBARB	GG	-	86.0	10.3			
B2	231	BROCCOLI / CALABRESE	GG	-	<LOD	<LOD			
B2	232	BROAD BEAN	GG	-	64.3	14.6			
B2	233	CABBAGE, SAVOY	GG	-	27.0	2.5			
B2	234	CABBAGE	GG	-	42.2	2.7			
B2	235	LEEK	GG	-	<LOD	<LOD			
B2	236	POTATO, new	GG	Peeled	37.0	10.6	Unpeeled	95.9	22.6
B2	238	STRAWBERRIES	HB	-	<LOD	<LOD			
B2	239	CAULIFLOWER	HB	-	<LOD	<LOD			
B2	240	POTATO, new	HB	Peeled	<LOD	4.0	Unpeeled	154.8	39.2
B2	242	STRAWBERRIES	FS	-	90.2	7.8			
B2	243	GOOSEBERRIES	FS	-	18.4	2.0			
B2	244	GREENS, spring	FS	-	77.0	11.3			
B2	245	STRAWBERRIES	FS	-	22.5	<LOD			
B2	246	CAULIFLOWER	FS	-	19.8	<LOD			
B2	247	CABBAGE	FS	-	52.1	4.6			
B2	248	LEEK	FS	-	35.7	3.5			
B2	249	CARROT	FS	Peeled	22.6	2.7	Unpeeled	22.2	2.4
B2	251	PARSNIP	FS	Peeled	24.8	3.8	Unpeeled	29.8	4.8
B2	253	SWEDE	FS	Peeled	206.6	29.9	Unpeeled	324.4	49.5
B2	255	POTATO, new	FS	Peeled	56.4	12.7	Unpeeled	483.0	102.2
B2	257	POTATO	FS	Peeled	<LOD	2.7	Unpeeled	28.5	7.0
B2	259	BEETROOT	FS	Peeled	42.4	6.9	Unpeeled	<LOD	3.0
B2	261	POTATO	FS	Peeled	35.4	7.6	Unpeeled	189.8	46.6
B2	263	STRAWBERRIES	GG	-	35.1	3.2			
B2	264	LETTUCE	GG	-	39.6	<LOD			

B2	265	GOOSEBERRIES	GG	-	69.6	7.1			
B2	266	BLACKCURRANTS	GG	-	34.8	6.6			
B2	267	LOGANBERRIES	GG	-	53.0	7.4			
B2	268	BLACKCURRANTS	GG	-	114.4	20.3			
B2	269	RED CURRANTS	GG	-	102.4	16.8			
B2	270	SWEDE	GG	Peeled	161.1	11.4	Unpeeled	130.6	11.5
B2	272	COURGETTE	GG	Unpeeled	197.1	13.0	Peeled	291.2	18.2
B2	274	CAULIFLOWER	GG	-	39.5	3.4			
B2	275	BROCCOLI / CALABRESE	GG	-	27.2	4.4			
B2	276	POTATO, new	GG	Peeled	34.5	6.9	Unpeeled	317.8	69.7
B2	278	CABBAGE	GG	-	19.8	<LOD			
B2	279	BROCCOLI / CALABRESE	FS	-	<LOD	2.3			
B2	280	CABBAGE, SAVOY	FS	-	<LOD	2.4			
B2	281	COURGETTE	FS	Unpeeled	31.5	<LOD	Peeled	64.4	4.4
B2	283	PEAS	FS	-	<LOD	<LOD			
B2	284	BROAD BEAN	FS	-	62.1	15.9			
B2	285	CABBAGE, SAVOY	FS	-	234.2	22.0			
B2	286	POTATO, new	FS	Peeled	<LOD	2.0	Unpeeled	32.4	9.2
B2	288	SAMPHIRE	GG	-	116.7	16.9			
B2	289	COURGETTE	GG	Unpeeled	82.3	4.5	Peeled	134.9	7.9
B2	291	POTATO, red	GG	Peeled	<LOD	4.2	Unpeeled	63.1	14.6
B2	293	GOOSEBERRIES	GG	-	<LOD	<LOD			
B2	294	LETTUCE, cos	GG	-	132.0	8.9			
B2	295	STRAWBERRIES	GG	-	23.0	2.3			
B2	296	STRAWBERRIES	MS	-	<LOD	<LOD			
B2	297	GOOSEBERRIES	MS	-	25.2	2.8			
B2	298	STRAWBERRIES	GG	-	<LOD	<LOD			
B2	299	GOOSEBERRIES	GG	-	38.9	4.2			
B2	300	LETTUCE, red	GG	-	4277.6	241.2			
B2	301	LETTUCE	GG	-	176.3	7.2			
B2	302	POTATO, new	GG	Peeled	<LOD	<LOD	Unpeeled	25.6	5.6
B2	304	PEAS	MS	-	<LOD	2.5			
B2	305	BROCCOLI / CALABRESE	MS	-	<LOD	<LOD			
B2	306	POTATO, new	MS	Peeled	<LOD	<LOD	Unpeeled	37.1	9.3
B2	308	CABBAGE, SAVOY	MS	-	31.4	2.2			

B2	309	CABBAGE	MS	-	23.7	<LOD			
B2	310	BROCCOLI / CALABRESE	GG	-	<LOD	<LOD			
B2	311	SWEDE	GG	Peeled	317.7	35.3	Unpeeled	660.5	84.4
B2	313	CABBAGE, SAVOY	GG	-	28.8	2.7			
B2	314	CABBAGE	GG	-	<LOD	<LOD			
B2	315	CABBAGE	GG	-	113.3	11.3			
B2	316	POTATO, new	GG	Peeled	<LOD	4.1	Unpeeled	127.4	28.3
B2	318	POTATO	GG	Peeled	<LOD	<LOD	Unpeeled	28.5	6.0
AM	1	GREENS, spring	GG	-	86.9	12.3			
AM	2	LETTUCE	GG	-	407.1	12.3			
AM	3	ASPARAGUS	GG	-	75.0	5.6			
AM	4	LETTUCE, red	GG	-	353.0	22.7			
AM	5	STRAWBERRIES	GG	-	<LOD	<LOD			
AM	6	RHUBARB	GG	-	88.2	5.8			
AM	7	PEAS	FS	-	58.0	14.4			
AM	8	POTATO, new					Unpeeled	281.3	33.3
AM	9	STRAWBERRIES	FS	-	62.6	6.0			
AM	10	BROAD BEAN	FS	-	80.6	14.5			
AM	11	GREENS, spring	FS	-	392.8	43.5			
AM	12	RADISH	FS	-	926.2	53.4			
AM	13	RHUBARB	HB	-	94.0	6.5			
AM	17	ASPARAGUS	GG	-	40.2	3.3			
AM	18	POTATO, new					Unpeeled	151.4	34.0
AM	19	PARSNIP	GG	Peeled	39.7	6.0			
AM	20	CABBAGE	GG	-	111.9	8.2			
AM	21	STRAWBERRIES	GG	-	26.2	2.9			
AM	22	CARROT	GG	Peeled	92.8	6.8			
AM	23	RHUBARB	HB	-	240.4	18.5			
AM	25	STRAWBERRIES	GG	-	53.7	5.9			
AM	26	RASPBERRIES	GG	-	<LOD	<LOD			
AM	27	LETTUCE	GG	-	130.5	5.6			
AM	28	LEEK	GG	-	107.8	9.2			
AM	29	RHUBARB	GG	-	46.8	2.7			
AM	30	STRAWBERRIES	GG	-	<LOD	<LOD			
AM	31	ASPARAGUS	GG	-	30.4	2.7			

AM	32	POTATO, new					Unpeeled	212.8	28.8
AM	42	STRAWBERRIES	FS	-	54.1	5.4			
AM	49	BLUEBERRY	HB	-	88.1	15.2			
AM	50	CHERRY	HB	-	36.9	4.6			
AM	51	STRAWBERRIES	HB	-	62.3	5.1			
AM	52	CARROT	FF	Peeled	280.8	22.9			
AM	53	CABBAGE	FF	-	129.8	8.4			
AM	54	LEEK	FS	-	23.6	4.2			
AM	55	STRAWBERRIES	FS	-	56.0	4.4			
AM	56	POTATO, new					Unpeeled	56.1	8.6
AM	57	ASPARAGUS	FS	-	51.5	4.3			
AM	58	RHUBARB	GG	-	113.0	11.2			
AM	59	STRAWBERRIES	FS	-	392.0	41.2			
AM	60	STRAWBERRIES	FS	-	89.0	7.3			
AM	61	STRAWBERRIES	FS	-	28.8	2.7			
AM	62	ASPARAGUS	FS	-	27.1	2.1			
AM	63	POTATO, new					Unpeeled	<LOD	3.0
AM	64	LETTUCE	FS	-	84.6	2.3			
AM	66	ASPARAGUS	FS	-	32.5	2.6			
AM	67	LETTUCE	FS	-	44.5	<LOD			
AM	68	CARROT	FS	Peeled	100.1	10.8	Unpeeled	232.7	25.2
AM	70	BROAD BEAN	FS	-	176.1	38.4			
AM	71	POTATO, new					Unpeeled	393.2	58.1
AM	72	POTATO, new					Unpeeled	668.4	112.6
AM	73	POTATO	FS	Peeled	22.8	3.9	Unpeeled	203.8	32.6
B3	1	RUNNER BEANS	FS	-	56.4	8.6			
B3	2	TOMATO	FS	-	49.1	3.2			
B3	4	COURGETTE	FS	Unpeeled	180.5	12.4	Peeled	136.8	7.8
B3	5	TOMATO	FS	-	<LOD	<LOD			
B3	6	LETTUCE	FS	-	332.8	20.0			
B3	7	GREENS, spring	FS	-	78.1	10.2			
B3	8	POTATO	FS	Peeled	<LOD	<LOD	Unpeeled	23.1	4.7
B3	10	CARROT	FS	Peeled	29.2	3.9	Unpeeled	110.7	15.2
B3	12	BEETROOT	FS	Peeled	39.9	5.9	Unpeeled	759.7	118.7
B3	14	ONION	FS	-	74.5	8.7			

B3	15	BROCCOLI / CALABRESE	FS	-	25.1	3.8			
B3	16	POTATO	GG	Peeled	<LOD	2.6	Unpeeled	83.7	16.5
B3	18	CARROT	GG	Peeled	33.8	4.0	Unpeeled	103.5	11.6
B3	21	COURGETTE	GG	Unpeeled	344.1	19.4	Peeled	191.6	9.0
B3	22	LETTUCE	GG	-	198.6	8.7			
B3	23	TOMATO	GG	-	<LOD	<LOD			
B3	24	SQUASH	GG	Peeled	22.1	4.5	Unpeeled	36.2	6.7
B3	26	GREENS, spring	GG	-	171.3	18.1			
B3	27	POTATO	GG	Peeled	49.2	10.8	Unpeeled	578.8	135.0
B3	29	CARROT	GG	Peeled	30.2	4.0	Unpeeled	99.1	12.6
B3	32	COURGETTE	GG	Unpeeled	191.8	13.9	Peeled	139.8	8.8
B3	33	LETTUCE	GG	-	205.3	10.3			
B3	34	STRAWBERRIES	GG	-	41.4	5.0			
B3	35	POTATO	GG	Peeled	19.4	4.8	Unpeeled	233.9	48.8
B3	37	CARROT	GG	Peeled	42.2	5.0	Unpeeled	119.5	14.7
B3	39	BEETROOT	GG	Peeled	60.3	9.5	Unpeeled	244.0	41.3
B3	41	ONION	GG	-	86.5	11.3			
B3	42	LETTUCE, cos	GG	-	83.4	5.0			
B3	43	RUNNER BEANS	GG	-	21.0	2.4			
B3	45	COURGETTE	GG	Unpeeled	88.4	6.3	Peeled	110.7	7.0
B3	47	COURGETTE	GG	Unpeeled	96.6	6.1	Peeled	51.2	3.1
B3	48	BROCCOLI / CALABRESE	GG	-	<LOD	2.6			
B3	50	COURGETTE	GG	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B3	52	COURGETTE	GG	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
B3	53	CABBAGE, RED	GG	-	37.8	4.4			
B3	54	KALE, CURLY	GG	-	113.6	16.9			
B3	55	CHARD	GG	-	70.2	6.3			
B3	57	COURGETTE	GG	Unpeeled	48.1	3.0	Peeled	82.0	5.3
B3	59	COURGETTE	GG	Unpeeled	58.2	3.5	Peeled	62.3	2.8
B3	60	POTATO	GG	Peeled	22.1	5.0	Unpeeled	44.8	9.7
B3	62	CUCUMBER	GG	Peeled	114.7	4.2			
B3	63	CUCUMBER	GG	Unpeeled	81.6	3.4			
B3	64	RUNNER BEANS	GG	-	54.5	5.0			
B3	65	ONION	GG	-	43.0	5.8			
B3	66	LEEK	GG	-	76.8	7.3			

B3	67	POTATO	GG	Peeled	35.5	7.1	Unpeeled	303.9	60.5
B3	69	POTATO	GG	Peeled	27.4	5.9	Unpeeled	55.6	13.7
B3	71	SPINACH	GG	-	563.2	56.3			
B3	72	SQUASH	GG	Peeled	22.5	3.7	Unpeeled	34.7	5.9
B3	74	SQUASH	GG	Peeled	23.6	3.7	Unpeeled	18.8	3.0
B3	76	LEEK	GG	-	<LOD	<LOD			
B3	77	POTATO	FS	Peeled	25.0	4.6	Unpeeled	29.1	5.3
B3	79	RUNNER BEANS	FS	-	76.4	6.9			
B3	80	CABBAGE, SAVOY	FS	-	90.2	10.1			
B3	81	PARSNIP	GG	Peeled	43.4	9.4			
B3	82	PARSNIP	GG	Unpeeled	47.4	10.0			
B3	83	STRAWBERRIES	FM	-	<LOD	<LOD			
B3	84	TOMATO	FM	-	<LOD	<LOD			
B3	86	APPLES	FM	Unpeeled	32.4	5.4	Peeled	33.7	5.2
B3	88	CUCUMBER	FM	Unpeeled	665.1	28.9	Peeled	619.2	24.3
B3	90	COURGETTE	FM	Unpeeled	77.3	3.9	Peeled	89.3	4.0
B3	91	CARROT	FM	Peeled	71.7	8.6	Unpeeled	167.8	20.3
B3	93	BEETROOT	FM	Peeled	19.5	2.7	Unpeeled	104.3	15.1
B3	95	STRAWBERRIES	GG	-	563.6	44.7			
B3	96	TOMATO	GG	-	27.6	2.9			
B3	97	LETTUCE, oak leaf	GG	-	4264.8	234.5			
B3	98	RASPBERRIES	GG	-	19.9	2.4			
B3	99	STRAWBERRIES	GG	-	53.3	5.6			
B3	100	CARROT	GG	Peeled	54.3	5.8	Unpeeled	60.9	7.5
B3	102	BROCCOLI / CALABRESE	GG	-	20.0	2.7			
B3	103	RUNNER BEANS	GG	-	53.1	5.6			
B3	104	BEETROOT	GG	Peeled	29.3	5.4	Unpeeled	118.8	22.8
B3	106	PARSNIP	GG	Peeled	40.3	10.8	Unpeeled	44.8	11.6
B3	109	COURGETTE	GG	Unpeeled	617.1	40.1	Peeled	380.1	22.1
B3	110	POTATO	GG	Peeled	<LOD	3.7	Unpeeled	52.8	11.5
B3	112	POTATO	FS	Peeled	<LOD	3.2	Unpeeled	73.8	17.8
B3	114	SQUASH	FS	Peeled	39.3	5.7	Unpeeled	65.7	11.7
B3	116	TOMATO	GG	-	<LOD	<LOD			
B3	117	GREENS, spring	GG	-	68.2	6.7			
B3	118	SALAD, LEAFY MIX	GG	-	275.8	27.3			

B3	119	CARROT	GG	Peeled	53.6	4.7	Unpeeled	112.8	11.4
B3	121	BEETROOT	GG	Peeled	<LOD	2.4	Unpeeled	41.0	7.0
B3	123	LETTUCE, oak leaf	FS	-	1972.9	128.7			
B3	124	TOMATO	FS	-	40.1	2.6			
B3	125	GREENS, spring	FS	-	171.9	16.0			
B3	126	CARROT	FS	Peeled	36.8	4.7	Unpeeled	72.0	9.3
B3	128	PARSNIP	FS	Peeled	48.5	14.4	Unpeeled	77.5	22.4
B3	130	POTATO	GG	Peeled	<LOD	3.9	Unpeeled	<LOD	4.2
B3	133	COURGETTE	GG	Unpeeled	36.6	<LOD	Peeled	99.5	4.5
B3	134	CARROT	GG	Peeled	340.6	41.0	Unpeeled	1063.7	136.2
B3	136	CABBAGE	GG	-	62.6	6.3			
B3	137	TOMATO	FM	-	<LOD	<LOD			
B3	138	CHARD	FM	-	643.2	75.8			
B3	140	COURGETTE	FM	Unpeeled	94.4	4.8	Peeled	100.9	5.2
B3	141	BEETROOT	FM	-	37.9	5.0			
B3	142	BEETROOT	FM	-	78.0	10.6			
B3	143	SQUASH	FM	Peeled	37.9	7.3	Unpeeled	39.6	7.5
B3	145	KALE, CURLY	FS	-	216.8	37.3			
B3	146	RHUBARB	FS	-	131.2	11.9			
B3	147	TOMATO	FS	-	72.8	4.4			
B3	148	RUNNER BEANS	FS	-	65.2	8.0			
B3	149	ROMANESCO BROCCOLI	FS	-	50.5	5.1			
B3	150	PARSNIP	FS	Peeled	69.6	19.0	Unpeeled	276.4	70.2
B3	153	APPLES	FS	Unpeeled	<LOD	2.6	Peeled	<LOD	2.7
B3	155	APPLES	FS	Unpeeled	42.8	6.7	Peeled	<LOD	2.2
B3	157	APPLES	FS	Unpeeled	30.1	4.3	Peeled	<LOD	2.0
B3	158	PARSNIP	FS	Peeled	163.3	35.5	Unpeeled	336.6	74.0
B3	161	COURGETTE	FS	Unpeeled	2303.6	100.4	Peeled	161.4	7.5

Table B. Total arsenic concentration in all samples survey in the NE basket survey. Arsenic concentrations are given as ng/g fresh weight.

Survey number	Produce	Preparation method	As ng/g dry wt	As ng/g fresh wt	Alternative preparation	As ng/g dry wt	As ng/g fresh wt
AB 1	KALE		63.7	11.3			
AB 2	BEETROOT		80.7	11.2			
AB 3	BRUSSEL SPROUTS		58.3	11.3			
AB 4	BEETROOT	Peeled	<LOD	3.4	Unpeeled	<LOD	2.7
AB 6	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	3.1
AB 8	CAULIFLOWER		68.3	<LOD			
AB 9	CARROT	Peeled	41.7	4.4	Unpeeled	34.8	3.4
AB 11	LEEK		55.7				
AB 12	TURNIP		<LOD	<LOD			
AB 13	ONION		71.4	6.8			
AB 14	TURNIP		<LOD	<LOD			
AB 15	BEETROOT	Peeled	<LOD	2.2	Unpeeled	20.4	2.9
AB 17	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	3.1
AB 19	LEEK		25.0	2.5			
AB 20	CARROT	Peeled	<LOD	<LOD	Unpeeled	33.2	3.0
AB 22	CABBAGE, savoy		43.0	5.1			
AB 23	ONION		183.1	18.7			
AB 24	CAULIFLOWER		34.7	2.2			
AB 25	SALAD, mixed leaf		169.4	19.8			
AB 26	RASPBERRIES		<LOD	<LOD			
AB 27	CABBAGE, savoy		<LOD	<LOD			
AB 28	CABBAGE, savoy		<LOD	<LOD			
AB 29	PARSELY		50.7	6.7			
AB 30	KALE		42.8	7.8			
AB 31	LEEK		<LOD	<LOD			
AB 32	BEETROOT	Peeled	<LOD	2.8	Unpeeled	21.1	3.4
AB 34	CARROT	Peeled	<LOD	2.0	Unpeeled	36.5	4.2
AB 36	POTATO	Peeled	<LOD	<LOD	Unpeeled	22.3	3.6
AB 38	BRUSSEL SPROUTS		<LOD	<LOD			
AB 39	GOOSEBERRY		23.5	<LOD			
AB 41	APPLE	Unpeeled	37.1	3.4	Peeled	30.7	3.6
AB 42	BLACKCURRANT		36.3	<LOD			
AB 43	REDCURRANT		<LOD	2.5			
AB 44	POTATO	Peeled	<LOD	<LOD	Unpeeled	21.3	4.3
AB 46	CARROT	Peeled	19.5	2.7	Unpeeled	42.9	6.5
AB 48	CABBAGE, savoy		<LOD	<LOD			
AB 49	GREENS		27.4	4.4			
AB 50	BRUSSEL SPROUTS		<LOD	<LOD			
AB 51	BEETROOT	Peeled	43.5	7.3			
AB 52	JERUSELUM ARTICHOKE	Peeled	<LOD	2.2			
AB 53	POTATO, red	Peeled	<LOD	<LOD	Unpeeled	26.5	4.4
AB 56	APPLE	Unpeeled	-		Peeled	<LOD	<LOD
AB 57	BRUSSEL SPROUTS		39.4	6.2			
AB 58	LEEK		66.6	7.7			
AB 59	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.7
AB 61	CARROT	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
AB 63	POTATO	Peeled	<LOD	<LOD	Unpeeled	35.2	8.0
AB 65	KALE		469.8	56.1			
AB 66	PARSNIP	Peeled	65.7	12.2	Unpeeled	91.1	18.9
AB 68	STRAWBERRIES		<LOD	<LOD			
AB 69	RASPBERRIES		20.8	2.6			
AB 70	REDCURRANT		<LOD	3.1			
AB 71	GOOSEBERRY		<LOD	<LOD			
AB 72	GOOSEBERRY		18.8	<LOD			
AB 73	RUNNERBEANS		24.4	<LOD			
AB 74	KALE, curly		27.9	3.4			
AB 75	RHUBARB		41.5	2.7			
AB 77	LEEK		67.1	7.8			
AB 78	SWEDE	Peeled	41.9	5.71459788	Unpeeled	58.0	8.9
AB 80	LEEK		20.3	2.407951113			

AB 82	APPLE	Unpeeled	19.1	2.383674624	Peeled	<LOD	<LOD
AB 83	SWEDE	Peeled	36.4	4.157616057	Unpeeled	23.9	2.7
AB 85	POTATO	Peeled	<LOD	<LOD	Unpeeled	53.3	9.7
AB 87	LEEK		<LOD	<LOD			
AB 88	CABBAGE		<LOD	<LOD			
AB 89	CARROT	Peeled	26.1	<LOD	Unpeeled	94.1	7.7
AB 91	POTATO	Peeled	<LOD	<LOD	Unpeeled	38.3	8.2
AB 93	BEETROOT	Peeled	<LOD	2.160525298	Unpeeled	48.3	8.1
AB 95	SWEDE	Peeled	19.7	2.169286514	Unpeeled	58.3	6.1
AB 97	SALAD, mixed leaf		108.2	6.262416375			
AB 98	LEEK		<LOD	<LOD			
AB 99	RHUBARB		<LOD	<LOD			
AB 100	BEETROOT	Peeled	18.6	3.275936902	Unpeeled	<LOD	<LOD
AB 102	CARROT	Peeled	<LOD	<LOD	Unpeeled	18.5	<LOD
AB 105	APPLE	Unpeeled	24.7	2.55687673	Peeled	22.1	2.2
AB 106	POTATO	Peeled	19.2	3.725430753	Unpeeled	33.5	5.9
AB 108	POTATO	Peeled	<LOD	<LOD	Unpeeled	27.8	5.3
AB 110	LEEK		21.6	2.412068668			
AB 111	LEEK		34.0	3.253494838			
AB 112	POTATO	Peeled	<LOD	<LOD	Unpeeled	20.9	5.0
AB 114	CABBAGE		39.7	3.014589005			
AB 115	CABBAGE, savoy		28.2	2.586052094			
AB 116	CABBAGE, red		<LOD	<LOD			
AB 117	RHUBARB		<LOD	<LOD			
AB 119	APPLE	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
AB 120	CARROT	Peeled	<LOD	<LOD	Unpeeled	49.6	4.7
AB 122	POTATO	Peeled	<LOD	<LOD	Unpeeled	23.1	4.7
AB 124	SWEDE	Peeled	39.9	5.160618267	Unpeeled	26.3	3.5
AB 126	SWEDE	Peeled	54.4	6.963775984	Unpeeled	27.5	3.5
AB128	STRAWBERRIES		<LOD	<LOD			
AB129	STRAWBERRIES		37.4	3.6			
AB130	STRAWBERRIES		<LOD	<LOD			
AB131	TOMATO		20.4	<LOD			
AB132	TOMATO		<LOD	<LOD			
AB133	TOMATO		<LOD	<LOD			
AB134	SALAD, mixed leaf		203.2	13.2			
AB135	TOMATO		<LOD	<LOD			
AB136	TOMATO		20.2	<LOD			
AB137	ROMANESQUE		33.1	3.4			
AB139	COURGETTE	Unpeeled	41.5	<LOD	Peeled	26.5	<LOD
AB141	COURGETTE	Unpeeled	32.3	<LOD	Peeled	24.4	<LOD
AB143	Cucumber	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
AB144	SWEDE	Peeled	<LOD	<LOD	Unpeeled	36.4	4.3
AB146	POTATO, new	Peeled	<LOD	3.1	Unpeeled	43.7	8.5
AB148	POTATO	Peeled	<LOD	<LOD	Unpeeled	25.5	6.3
AB150	CAULIFLOWER		<LOD	<LOD			
AB151	CABBAGE		20.8	<LOD			
AB152	CARROT	Peeled	20.2	2.0	Unpeeled	70.7	7.1
AB154	SWEDE	Peeled	21.7	3.2	Unpeeled	29.7	4.4
AB156	LEEK		19.5	2.2			
AB157	BROCCALI		<LOD	2.6			
AB158	POTATO	Peeled	<LOD	<LOD	Unpeeled	23.4	5.1
AB160	ONION		103.4	11.0			
AB161	STRAWBERRIES		60.7	5.7			
AB162	STRAWBERRIES		35.4	3.2			
AB163	BLUEBERRY		97.9	12.5			
AB164	RASPBERRIES		32.0	3.8			
AB165	COURGETTE		20.2	<LOD			
AB166	POTATO, new	Peeled	<LOD	<LOD	Unpeeled	30.5	6.2
AB168	POTATO, red	Peeled	<LOD	<LOD	Unpeeled	<LOD	3.9
AB170	SALAD, rocket		138.5	10.0			
AB171	LETTUCE, red		346.2	15.6			
AB172	LETTUCE		166.3	8.5			
AB173	ONION		62.1	6.4			
AB174	ONION, red		<LOD	<LOD			
AB175	SHALLOTS		21.0	3.5			

AB177	COURGETTE	Unpeeled	19.3	<LOD	Peeled	35.0	<LOD
AB178	MANGE TOUT		<LOD	<LOD			
AB179	PEAS		<LOD	<LOD			
AB180	FRENCH BEANS		<LOD	<LOD			
AB181	CARROT	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.4
AB183	POTATO	Peeled	<LOD	<LOD	Unpeeled	18.8	2.9
AB185	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD
AB187	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.7
AB189	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	3.1
AB191	CABBAGE		<LOD	<LOD			
AB192	CAULIFLOWER		56.1	3.7			
AB193	RASPBERRIES		20.7	2.4			
AB194	MANGE TOUT		33.6	3.7			
AB195	FRENCH BEANS		21.7	<LOD			
AB196	ONION		<LOD	<LOD			
AB197	TURNIP	Peeled	24.3	<LOD	Unpeeled	25.1	<LOD
AB199	CABBAGE		<LOD	<LOD			
AB200	BEETROOT	Peeled	<LOD	<LOD	Unpeeled	23.6	2.7
AB202	COURGETTE	Unpeeled	<LOD	<LOD			
AB203	SQUASH		63.0	2.7			
AB204	SUGAR SNAP PEAS		<LOD	<LOD			
AB205	MANGE TOUT		<LOD	<LOD			
AB207	Cucumber	Unpeeled	144.1	4.7	Peeled	147.0	5.4
AB208	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.1
AB210	CAULIFLOWER		77.3	5.6			
AB211	CABBAGE, savoy		49.0	6.0			
AB212	CABBAGE		33.7	2.8			
AB213	BEETROOT		<LOD	<LOD			
AB214	BEETROOT		52.0	8.4			
AB215	TOMATO		<LOD	<LOD			
AB216	TOMATO		<LOD	<LOD			
AB217	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.8
AB219	LEEK		112.9	9.6			
AB220	POTATO	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.2
AB222	POTATO, red	Peeled	<LOD	<LOD	Unpeeled	<LOD	4.3
AB224	CABBAGE		22.6	<LOD			
AB225	ONION		<LOD	2.5			
AB226	ONION, red		19.7	3.6			
AB227	SHALLOTS		42.9	6.5			
AB228	ROMANESQUE		22.4	2.6			
AB229	POTATO, red	Peeled	<LOD	<LOD	Unpeeled	<LOD	2.6
AB231	TURNIP	Peeled	45.1	6.0	Unpeeled	65.4	8.9
AB233	TURNIP	Peeled	45.9	4.7	Unpeeled	58.6	6.1
AB235	CARROT	Peeled	19.8	2.8	Unpeeled	19.9	2.8
AB237	REDCURRANT		<LOD	2.5			
AB238	STRAWBERRIES		25.0	2.2			
AB239	RASPBERRIES		21.2	3.3			
AB240	GOOSEBERRY		<LOD	<LOD			
AB241	GOOSEBERRY		<LOD	2.1			
AB242	APPLE	Peeled	<LOD	<LOD			
AB243	APPLE	Unpeeled	<LOD	<LOD	Peeled	<LOD	<LOD
AB244	BLACKCURRANT		<LOD	<LOD			
AB245	SPINACH		137.8	15.7			
AB246	SPINACH		44.5	3.5			
AB247	RHUBARB		30.4	<LOD			
AB248	BROCCALI, purple sprouting		<LOD	<LOD			
AB249	CHARD		55.4	3.9			
AB250	BROADBEAN		<LOD	<LOD			
AB251	PEAS		<LOD	<LOD			
AB252	SUGAR SNAP PEAS		<LOD	<LOD			
AB253	MANGE TOUT		<LOD	<LOD			
AB254	CARROT	Peeled	19.0	<LOD	Unpeeled	28.3	2.1
AB256	BEETROOT	Peeled	<LOD	2.1	Unpeeled	<LOD	<LOD
AB258	POTATO, new	Peeled	<LOD	<LOD	Unpeeled	<LOD	<LOD

Table C. Total arsenic concentration in all samples survey in the SW field survey of fruit, vegetables and associated soils. Arsenic concentrations are given as ng/g fresh weight.

Survey code	Survey sample	Produce	Soil As mg/kg	Preparation method	As ng/g dry wt	As ng/g fresh wt	Alternative preparation	As ng/g dry wt	As ng/g fresh wt
P1	1	BEETROOT	240.6	Peeled	49.0	6.8	Skin on	240.6	582.1
P1	2	BEETROOT	239.8	Peeled	100.2	12.8	Skin on	239.8	198.2
P1	5	BROCCOLI / CALABRESE	19.6	-	64.4	7.3			
P1	6	BROCCOLI / CALABRESE	239.8	-	1751.6	219.5			
P1	7	BRUSSEL SPROUTS	106.3	-	53.0	8.0			
P1	8	BRUSSEL SPROUTS	96.5	-	21.3	3.4			
P1	9	BRUSSEL SPROUTS	39.0	-	59.9	9.4			
P1	10	CABBAGE	106.3	-	51.0	4.4			
P1	11	CABBAGE	88.6	-	20.8	2.1			
P1	12	CABBAGE	245.7	-	42.2	4.2			
P1	13	BROCCOLI / CALABRESE	96.5	-	327.7	38.5			
P1	15	CARROTS	51.3	Peeled	54.8	6.4	Skin on	51.3	101.3
P1	16	CARROTS	77.1	Peeled	44.0	4.4	Skin on	77.1	59.3
P1	17	CARROTS	91.0	Peeled	45.5	5.6	Skin on	91.0	104.7
P1	18	CARROTS	64.4	Peeled	58.0	6.3	Skin on	64.4	81.0
P1	20	CARROTS	31.0	Peeled	24.4	2.2	Skin on	31.0	51.5
P1	25	CAULIFLOWER	96.5	-	45.2	3.6			
P1	26	CAULIFLOWER	11.4	-	<LOD	<LOD			
P1	27	CAULIFLOWER	106.3	-	72.0	6.7			
P1	28	CAULIFLOWER	155.9	-	<LOD	<LOD			
P1	29	CAULIFLOWER	86.5	-	56.5	4.2			
P1	30	CAULIFLOWER	174.8	-	38.1	3.2			
P1	31	CAULIFLOWER	79.8	-	18.7	<LOD			
P1	32	CAULIFLOWER	139.4	-	87.5	6.7			
P1	33	CELERIAC	39.0	-	161.9	16.3			
P1	34	CELERY	239.8	-	279.5	34.5			
P1	35	CELERY	39.0	-	145.1	10.0			
P1	36	CHARD	33.0	-	445.3	46.7			
P1	37	CHARD, MIX	39.0	-	899.0	87.2			
P1	38	KALE, CURLY	106.3	-	236.0	35.4			
P1	39	KALE, CURLY	174.8	-	1984.6	303.4			
P1	41	KALE, CURLY	39.0	-	118.6	19.8			
P1	42	CABBAGE, GREEN	195.9	-	236.1	27.9			
P1	43	KALE	13.7	-	231.1	38.1			
P1	44	KALE	110.9	-	90.0	11.3			
P1	45	KALE, LACINATO	239.8	-	785.5	103.0			
P1	46	LEEKS	240.6	-	404.1	40.6			

P1	47	LEEKS	68.6	-	32.6	5.0			
P1	48	LEEKS	33.0	-	74.6	10.1			
P1	49	LEEKS	174.8	-	90.9	9.1			
P1	50	LEEKS	96.5	-	21.7	<LOD			
P1	51	LEEKS	39.0	-	62.2	5.5			
P1	52	LETTUCES	110.7	-	244.0	10.4			
P1	53	PAK CHOI	39.0	-	269.3	17.2			
P1	54	PARSNIPS	149.5	Peeled	141.0	31.0	Skin on	149.5	389.9
P1	55	PARSNIPS	130.8	Peeled	199.1	34.4	Skin on	130.8	393.5
P1	56	PARSNIPS	77.1	Peeled	61.8	15.2	Skin on	77.1	98.3
P1	57	PARSNIPS	91.0	Peeled	101.2	19.4	Skin on	91.0	165.8
P1	62	PEPPERS MIX	110.7	-	69.6	7.5			
P1	63	POTATO	78.2	Peeled	<LOD	2.9	Skin on	78.2	49.9
P1	64	POTATO	108.1	Peeled	<LOD	2.4	Skin on	108.1	<LOD
P1	65	POTATO	17.9	Peeled	<LOD	<LOD			
P1	66	POTATO	130.8	Peeled	22.4	3.5	Skin on	130.8	22.9
P1	67	POTATO	77.1	Peeled	<LOD	2.8	Skin on	77.1	73.6
P1	70	POTATO	28.7	Peeled	<LOD	<LOD	Skin on	28.7	<LOD
P1	75	KALE, PURPLE	239.8	-	1778.0	280.0			
P1	76	KALE, PURPLE	96.5	-	118.1	21.6			
P1	77	KALE, PURPLE	39.0	-	178.1	30.9			
P1	78	PURPLE SPROUTING	22.4	-	150.7	18.9			
P1	79	PURPLE SPROUTING	39.0	-	99.0	15.6			
P1	80	RASPBERRIES	80.1	-	154.6	14.5			
P1	81	CABBAGE, RED	96.5	-	40.2	3.2			
P1	82	CABBAGE, RED	106.3	-	23.0	2.2			
P1	84	CABBAGE, RED	39.0	-	47.1	4.4			
P1	85	ROMANESCO BROCCOLI	106.3	-	99.7	13.1			
P1	86	CHARD, RUBY	33.0	-	714.1	65.2			
P1	87	CHARD, RUBY	110.9	-	156.9	15.9			
P1	88	CABBAGE, SAVOY	13.6	-	29.5	29.5			
P1	89	CABBAGE, SAVOY	438.6	-	246.7	27.5			
P1	90	CABBAGE, SAVOY	106.3	-	93.0	10.9			
P1	91	CABBAGE, SAVOY	174.8	-	59.2	6.9			
P1	92	CABBAGE, SAVOY	96.5	-	58.2	4.4			
P1	93	CABBAGE, SAVOY	39.0	-	31.6	3.3			
P1	94	CABBAGE, SAVOY	127.8	-	33.7	3.7			
P1	95	SPINACH	33.0	-	138.0	17.3			
P1	97	GREENS, SPRING	239.8	-	6676.4	772.4			
P1	98	GREENS, SPRING	330.8	-	223.5	26.5			
P1	99	GREENS, SPRING	155.6	-	345.0	39.9			
P1	100	GREENS, SPRING	141.6	-	269.7	30.3			
P1	101	SWEDE	144.3	Peeled	176.0	18.0	Skin on	144.3	297.5
P1	102	SWEDE	12.7	Peeled	<LOD	<LOD			

P1	103	SWEDE	174.8	Peeled	231.4	23.9	Skin on	174.8	<LOD
P1	104	SWEDE	51.3	Peeled	63.0	6.0	Skin on	51.3	70.5
P1	105	SWEDE	96.5	Peeled	33.9	3.6	Skin on	96.5	53.2
AM	14	STRAWBERRIES	32.5	-	<LOD	<LOD			
AM	15	RHUBARB	53.3	-	49.5	2.8			
AM	16	STRAWBERRIES	59.4	-	20.3	2.2			
AM	24	SAMPHIRE	118.3	-	318.3	25.8	SAMPHIRE		
AM	33	POTATO, NEW	31.3		<LOD	<LOD	skin on		
AM	34	BROADBEAN	31.3	-	<LOD	<LOD			
AM	35	GOOSEBEERY	31.3	-	<LOD	<LOD			
AM	36	RHUBARB	31.3	-	43.6	2.3			
AM	37	STRAWBERRIES	31.3	-	<LOD	<LOD			
AM	38	REDCURRANTS	31.3	-	<LOD	<LOD			
AM	39	RASPBERRIES	31.3	-	<LOD	<LOD			
AM	40	BLUEBERRY	31.3	-	<LOD	<LOD			
AM	41	BLACKCURRANTS	31.3	-	<LOD	<LOD			
AM	43	CAULIFLOWER	59.6	-	19.6	2.1			
AM	44	STRAWBERRIES	59.6	-	<LOD	<LOD			
AM	45	POTATO	59.6	Peeled	<LOD	<LOD			
AM	46	LEEKS	59.6	-	<LOD	<LOD			
AM	47	GREENS	59.6	-	<LOD	2.8			
AM	48	STRAWBERRIES	187.4	-	24.3	2.2			
AM	65	STRAWBERRIES	73.3	-	<LOD	<LOD			
P2	1	POTATO	80.6	Peeled	18.8	3.0	Skin on	80.6	199.1
P2	3	POTATO	111.6	Peeled	21.9	3.3	Skin on	111.6	174.5
P2	5	POTATO	99.5	Peeled	<LOD	2.8	Skin on	99.5	115.8
P2	7	RASPBERRIES	66.7	-	65.7	11.8			
P2	8	STRAWBERRIES	66.7	-	40.9	4.7			
P2	9	GOOSEBEERY	66.7	-	72.0	9.3			
P2	10	POTATO	9.1	Peeled	<LOD	2.4	Skin on	9.1	49.8
P2	12	POTATO	12.7	Peeled	<LOD	2.4	Skin on	12.7	21.5
P2	14	CABBAGE, SAVOY	18.8	-	43.6	8.0			
P2	15	CABBAGE	56.5	-	67.0	7.7			
P2	16	CABBAGE	81.1	-	19.9	2.1			
P2	17	BROCCOLI / CALABRESE	29.4	-	161.1	24.6			
P2	18	CAULIFLOWER	100.3	-	117.3	12.3			
P2	19	BROCCOLI / CALABRESE	131.5	-	127.4	17.3			
P2	20	CAULIFLOWER	143.1	-	192.8	17.6			
P2	21	BROCCOLI / CALABRESE	175.3	-	802.4	120.9			
P3	1	STRAWBERRIES	124.8	-	85.2	8.8			
P3	2	CELERY	140.3	-	564.6	37.0			
P3	3	SQUASH	132.0	Peeled	<LOD	2.8	Skin on	132.0	28.4
P3	5	SQUASH	132.0	Peeled	176.0	18.4	Skin on	132.0	152.3
P3	7	SQUASH	132.0	Peeled	107.9	5.9	Skin on	132.0	170.5

P3	9	MARROW	132.0	Peeled	101.5	6.1	Skin on	132.0	78.0
P3	12	CUCUMBER	132.0	Skin on	1021.7	39.7	Pealed	132.0	494.8
P3	14	CUCUMBER	132.0	Skin on	1515.2	69.1	Pealed	132.0	1210.4
P3	15	ROMANESCO BROCCOLI	79.5	-	48.1	6.0			
P3	16	CARROTS	79.5	Peeled	133.1	16.5	Skin on	79.5	398.7
P3	18	BEETROOT	79.5	Peeled	32.6	6.1	Skin on	79.5	92.9
P3	20	POTATO	79.5	Peeled	28.1	6.4	Skin on	79.5	259.4
P3	22	RHUBARB	108.5	-	77.8	7.1			
P3	24	APPLE	86.9	Skin on	<LOD	2.4	Pealed	86.9	<LOD
P3	26	APPLE	86.9	Skin on	25.0	3.4	Pealed	86.9	26.5
P3	28	APPLE	86.9	Skin on	22.6	3.9	Pealed	86.9	<LOD
P3	29	PLUMS	86.9	-	23.4	4.6			
P3	30	POTATO	217.7	Peeled	64.2	12.7	Skin on	217.7	439.1
P3	32	POTATO	14.0	Peeled	34.3	6.1	Skin on	14.0	65.4
P3	34	POTATO	182.7	Peeled	104.3	19.6	Skin on	182.7	305.1
P3	36	POTATO	57.5	Peeled	19.5	4.2	Skin on	57.5	180.1
P3	38	POTATO	252.4	Peeled	74.5	14.4	Skin on	252.4	441.4
P3	40	POTATO	192.8	Peeled	50.3	10.6	Skin on	192.8	731.6
P3	42	CABBAGE, SAVOY	320.5	-	891.5	118.5			
P3	43	CABBAGE	105.4	-	483.6	50.4			
P3	44	CABBAGE, SAVOY	527.9	-	528.9	65.3			
P3	45	CABBAGE, SAVOY	254.6	-	1040.6	142.0			
P3	46	CABBAGE, SAVOY	199.9	-	236.8	36.2			
P3	48	COURGETTE	105.7	Skin on	249.2	9.8	Pealed	105.7	223.4
P3	49	CABBAGE, SAVOY	202.9	-	272.4	40.7			
P3	50	GREENS	104.3	-	135.4	16.5			
P3	51	CABBAGE, SAVOY	246.0	-	240.7	53.1			
P3	52	CABBAGE, SAVOY	242.1	-	414.7	51.4			
P3	53	CABBAGE	119.4	-	810.7	79.4			
P3	54	GREENS	106.0	-	980.7	110.2			
P3	55	POTATO	220.6	Peeled	55.1	10.4	Skin on	220.6	356.0
P3	57	CAULIFLOWER	220.6	-	26.0	<LOD			
P3	58	GREENS	220.6	-	118.2	11.6			
P3	59	POTATO	129.1	Peeled	24.8	5.0	Skin on	129.1	220.1
P3	61	POTATO	19.0	Peeled	<LOD	4.0	Skin on	19.0	28.7
P3	63	SQUASH	49.3	Peeled	135.8	41.4	Skin on	49.3	180.8
P3	65	SQUASH	49.3	Peeled	178.4	38.8	Skin on	49.3	148.2
P3	67	POTATO	43.2	Peeled	26.4	5.4	Skin on	43.2	154.8
P3	69	POTATO	106.7	Peeled	23.4	4.6	Skin on	106.7	112.4
P3	71	TOMATO	110.7	-	33.5	2.5			
P3	72	RUNNERBEAN	110.7	-	138.8	11.6			
P3	73	SQUASH	110.7	Peeled	160.8	5.3	Skin on	110.7	248.5
P3	76	APPLE	110.7	Skin on	25.5	3.7	Pealed	110.7	25.5
P3	77	POTATO	110.7	Peeled	<LOD	2.3	Skin on	110.7	118.9

P3	79	CARROTS	110.7	Peeled	45.2	4.0	Skin on	110.7	56.6
P3	81	POTATO	52.3	Peeled	21.9	4.1	Skin on	52.3	194.2
P3	83	CAULIFLOWER	96.5	-	22.9	<LOD			
P3	84	KALE, CURLY	96.5	-	826.9	169.0			
P3	85	KALE, PURPLE	96.5	-	903.9	67.0			

Table D. Arsenic speciation results. Results are given in ng of arsenic per g dry weight.

					Speciation results					
Survey code	survey sample	Produce	Preparation method	Total As	Unknown arsenic species	AsIII	DMA	MMA	AsV	Sum of species
B1	25	BEETROOT	Peeled	20.1	5	2.3	0	0	20.2	27.4
B1	26	BEETROOT	Peeled	52.6	0	0	0	0	98.2	98.2
B1	27	BEETROOT	Peeled	31.5	0	2.3	7.2	0	30.5	39.9
B1	28	BEETROOT	Peeled	11.8	0	0	0	0	11.9	11.9
B1	29	BEETROOT	Peeled	14.2	5.8	6.2	0	0	24.3	36.3*
B1	30	BEETROOT	Peeled	9.8	0	0	0	0	42.4	42.4*
B1	37	BRUSSEL SPROUTS	-	39.5	0	2.3	0	0	30.4	32.6
B1	38	BRUSSEL SPROUTS	-	6.5	2.3	0	0	0	0	2.3
B1	39	BRUSSEL SPROUTS	-	35.1	0	2.3	0	0	9.4	11.6
B1	40	BRUSSEL SPROUTS	-	62.5	0	0	0	0	53.5	53.5
B1	41	BRUSSEL SPROUTS	-	72.3	0	0	0	0	52.2	52.2
B1	68	CARROT	Peeled	35.5	0	2.3	0	0	36.2	38.5
B1	69	CARROT	Peeled	5.9	0	0	0	0	2.3	2.3
B1	70	CARROT	Peeled	28.3	0	2.3	0	0	26.1	28.4
B1	71	CARROT	Peeled	60.5	0	2.3	0	0	63.5	65.8
B1	72	CARROT	Peeled	41.3	0	2.3	0	0	88.4	90.6*
B1	73	CARROT	Peeled	47	0	2.3	0	0	37.7	40
B1	74	CARROT	Peeled	47.8	0	2.3	0	0	49	51.2
B1	75	CARROT	Peeled	32.6	0	2.3	0	0	30.8	33.1
B1	76	CARROT	Peeled	121.2	0	2.3	0	0	134.3	136.6
B1	77	CARROT	Peeled	181.1	0	2.3	0	0	209.3	211.6
B1	78	CARROT	Peeled	38	0	2.3	0	0	30.6	32.9
B1	79	CARROT	Peeled	41.9	0	4.5	0	0	42.7	47.3
B1	80	CARROT	Unpeeled	30	0	2.3	0	0	37.7	39.9
B1	81	CARROT	Unpeeled	28.7	0	2.3	0	0	37.4	39.7
B1	82	CARROT	Unpeeled	401.5	0	2.3	0	0	301.3	303.5
B1	83	CARROT	Unpeeled	289.7	0	4.6	0	0	364.3	368.8
B1	84	CARROT	Unpeeled	68	0	0	0	0	58.1	58.1
B1	85	CARROT	Unpeeled	54.7	0	2.3	0	0	44.6	46.8
B1	86	CARROT	Unpeeled	426	0	2.3	0	0	469.5	471.8
B1	87	CARROT	Unpeeled	692.6	0	2.3	2.3	0	851	855.6
B1	88	CARROT	Unpeeled	79.7	0	2.3	0	0	64.2	66.4
B1	89	CARROT	Unpeeled	40.4	0	2.3	0	0	35.9	38.2
B1	124	KALE, CURLY	-	486.6	0	11.1	0	0	435.3	446.4
B1	125	KALE, CURLY	-	116.1	0	9.8	0	0	69.7	79.4
B1	126	KALE, CURLY	-	109.9	0	0	10.8	0	86.3	97
B1	132	KALE	-	59.2	0	0	0	0	82.8	82.8
B1	133	KALE	-	84.5	0	0	10.5	0	60.4	70.8
B1	134	KALE	-	30.2	0	0	0	0	21.6	21.6
B1	136	LEEK	-	15.4	2.3	7.4	0	0	15.1	24.8
B1	137	LEEK	-	23	0	6.4	0	0	29.7	36.1
B1	138	LEEK	-	161.5	0	0	0	0	182.6	182.6
B1	139	LEEK	-	29.2	0	0	13.3	0	46	59.3*
B1	140	LEEK	-	97.5	2.3	7	4.7	0	85.5	99.3
B1	141	LEEK	-	278.9	5.1	15.8	0	0	319.1	340
B1	142	LEEK	-	48.3	2.3	6.3	5.4	0	39.9	53.9
B1	143	LEEK	-	22.6	0	0	0	0	17.4	17.4
B1	144	LEEK	-	17.1	0	0	0	0	10.7	10.7
B1	145	LEEK	-	20.8	0	0	0	0	30.3	30.3
B1	146	LEEK	-	20.6	0	0	0	0	20.1	20.1
B1	147	LEEK	-	31.9	0	0	0	0	15.4	15.4
B1	148	LEEK	-	166.2	0	0	0	0	164.5	164.5

B1	149	LEEK	-	26.5	0	0	10.3	0	28.7	39
B1	151	LEEK	-	26.5	0	0	0	0	21.3	21.3
B1	152	LEEK	-	68.3	0	0	11.6	0	95.3	106.8
B1	153	LEEK	-	32.7	0	0	0	0	245.4	245.4*
B1	154	LEEK	-	36	0	0	0	0	21.5	21.5
B1	155	LEEK	-	221.6	5.1	11.3	15.6	0	229.1	261.1
B1	156	LEEK	-	10.5	2.3	5.6	0	0	17.7	25.5*
B1	157	LETTUCE	-	41.6	0	0	0	0	100.8	100.8*
B1	158	LETTUCE	-	34.4	6.3	0	0	0	39.6	46
B1	159	LETTUCE	-	685.2	0	0	0	0	436.8	436.8
B1	160	LETTUCE	-	49.6	7.3	5.8	0	0	101.1	114.2*
B1	161	LETTUCE	-	109.4	0	12.1	0	0	217.5	229.6*
B1	162	LETTUCE	-	1802.7	10	38.6	24.3	5.5	1913.9	1992.2
B1	163	LETTUCE	-	74.7	16.7	0	0	0	83.3	100
B1	164	LETTUCE	-	75.6	0	0	0	0	70.5	70.5
B1	165	LETTUCE	-	45.2	6.7	0	0	0	78.3	85.1
B1	166	LETTUCE	-	158.7	0	0	0	0	140.9	140.9
B1	176	PARSNIP	Peeled	28.1	0	2.3	0	0	16.2	18.4
B1	177	PARSNIP	Peeled	32.1	0	2.3	0	0	29	31.2
B1	178	PARSNIP	Peeled	49.8	0	2.3	0	0	41.2	43.5
B1	179	PARSNIP	Peeled	14.2	0	2.3	0	0	7.3	9.6
B1	180	PARSNIP	Unpeeled	28.7	0	2.3	0	0	15.9	18.2
B1	181	PARSNIP	Unpeeled	90.6	0	2.3	0	0	80	82.2
B1	182	PARSNIP	Unpeeled	53	0	2.3	0	0	63.2	65.4
B1	239	RASPBERRIES	-	97.7	0	0	6.7	0	87.1	93.9
B1	240	RASPBERRIES	-	95.5	0	0	0	0	77.5	77.5
B1	241	RASPBERRIES	-	6.9	0	0	0	0	0	0
B1	261	KALE, RUSSIAN	-	163.9	0	0	6.3	0	124.2	130.5
B1	262	CABBAGE, SAVOY	-	41.5	2.3	0	0	0	38.6	40.8
B1	264	CABBAGE, SAVOY	-	195.6	0	2.3	0	0	224	226.2
B1	265	CABBAGE, SAVOY	-	122.3	0	0	0	0	110.8	110.8
B1	266	CABBAGE, SAVOY	-	113.5	0	2.3	0	0	122.9	125.1
B1	267	CABBAGE, SAVOY	-	78.9	0	0	2.3	0	72	74.2
B1	268	CABBAGE, SAVOY	-	194	0	0	0	0	162.9	162.9
B1	269	CABBAGE, SAVOY	-	43.4	0	0	0	0	34.8	34.8
B1	270	CABBAGE, SAVOY	-	42.3	0	2.3	0	0	36.8	39.1
B1	271	CABBAGE, SAVOY	-	31.8	0	0	0	0	48	48
B1	272	CABBAGE, SAVOY	-	35.9	0	0	0	0	27.5	27.5
B1	273	CABBAGE, SAVOY	-	14.9	0	4.6	0	0	18.8	23.4
B1	274	CABBAGE, SAVOY	-	80.3	0	5	81.3	0	81.3	167.6*
B1	275	SPINACH	-	189.7	6.2	74.8	6.6	0	111.8	199.4
B1	276	SPINACH	-	588.2	0	0	0	0	395.3	395.3
B1	278	GREENS, SPRING	-	120.3	0	0	0	0	93.1	93.1
B1	279	GREENS, SPRING	-	264.2	0	0	0	0	213	213
B1	280	GREENS, SPRING	-	683.9	2.3	11	0	0	532	545.2
B1	281	GREENS, SPRING	-	78.9	4.9	9.4	0	0	69.7	84.1
B1	282	GREENS, SPRING	-	907.9	0	13.1	0	0	640.3	653.4
B1	283	GREENS, SPRING	-	1026.7	2.3	2.3	0	0	827.1	831.6
B1	284	GREENS,	-	375.8	0	0	0	0	340.7	340.7

		SPRING								
B1	286	STRAWBERRIES	-	20.3	0	2.3	0	0	15.2	17.5
B1	287	STRAWBERRIES	-	78.7	0	7.1	8.4	0	77.3	92.8
B1	288	STRAWBERRIES	-	15.5	0	0	0	0	27.7	27.7
B1	289	STRAWBERRIES	-	27.7	0	7.4	0	0	31.8	39.2
B1	290	STRAWBERRIES	-	23.3	0	8.4	0	0	23.6	32
B2	12	BROAD BEAN	-	39.1	0	0	0	0	29.1	29.1
B2	34	BROAD BEAN	-	134.8	0	0	0	0	91.6	91.6
B2	40	BROAD BEAN	-	79.2	0	0	0	0	47.9	47.9
B2	44	BROAD BEAN	-	119.9	0	2.3	0	0	87.5	89.7
B2	45	ASPARAGUS	-	42.8	0	0	0	0	26.9	26.9
B2	51	BROAD BEAN	-	118.3	0	0	2.3	0	95.5	97.7
B2	77	BROAD BEAN	-	38.6	0	0	9.3	0	10.2	19.5
B2	83	ASPARAGUS	-	29.6	0	0	0	0	13.9	13.9
B2	84	BROAD BEAN	-	89.4	0	0	0	0	73.6	73.6
B2	89	GOOSEBERRIES	-	12.8	0	0	0	0	6.6	6.6
B2	110	BROAD BEAN	-	74.2	0	0	0	0	52.7	52.7
B2	111	GOOSEBERRIES	-	10.3	0	0	0	0	2.3	2.3
B2	115	ASPARAGUS	-	24.9	0	0	0	0	8.3	8.3
B2	118	BROAD BEAN	-	17.8	0	0	0	0	9.4	9.4
B2	136	BROAD BEAN	-	132.1	0	9.9	0	0	111.3	121.3
B2	160	BROAD BEAN	-	81.4	0	0	0	0	54.6	54.6
B2	165	GOOSEBERRIES	-	78.1	0	0	2.3	0	39.9	42.1
B2	192	GOOSEBERRIES	-	11.8	0	0	0	0	7	7
B2	243	GOOSEBERRIES	-	18.4	0	0	0	0	34.3	34.3
B2	265	GOOSEBERRIES	-	69.6	0	0	2.3	0	38.3	40.6
B2	288	SAMPHIRE	-	116.7	0	5.8	0	0	54.4	60.2
B2	293	GOOSEBERRIES	-	3.4	0	0	0	0	2.3	2.3
B3	1	RUNNER BEANS	-	56.4	0	0	6.6	0	35.2	41.8
B3	2	TOMATO	-	49.1	0	0	2.3	0	25.3	27.5
B3	3	COURGETTE	Peeled	136.8	0	0	2.3	0	109.3	111.6
B3	4	COURGETTE	Unpeeled	180.5	0	0	2.3	0	133.5	135.8
B3	5	TOMATO	-	14.1	0	0	0	0	12.6	12.6
B3	14	ONION	-	74.5	0	0	0	0	60.4	60.4
B3	20	COURGETTE	Peeled	191.6	0	0	0	0	153.1	153.1
B3	21	COURGETTE	Unpeeled	344.1	0	2.3	0	0	187.2	189.5
B3	23	TOMATO	-	10.3	0	0	0	0	7.1	7.1
B3	24	SQUASH	Peeled	22.1	0	0	0	0	14.6	14.6
B3	41	ONION	-	86.5	0	0	0	0	74.1	74.1
B3	43	RUNNER BEANS	-	21	0	0	0	0	9.3	9.3
B3	44	COURGETTE	Peeled	110.7	0	0	0	0	78.5	78.5
B3	45	COURGETTE	Unpeeled	88.4	0	0	0	0	72.3	72.3
B3	49	COURGETTE	Peeled	7.9	0	0	0	0	7.2	7.2
B3	50	COURGETTE	Unpeeled	7.1	0	0	0	0	11.3	11.3
B3	62	CUCUMBER	Peeled	114.7	0	0	0	0	76.2	76.2
B3	63	CUCUMBER	Unpeeled	81.6	0	0	0	0	79.9	79.9
B3	64	RUNNER BEANS	-	54.5	0	0	0	0	51	51
B3	65	ONION	-	43	0	0	0	0	32.9	32.9
B3	72	SQUASH	Peeled	22.5	0	0	0	0	7.6	7.6
B3	74	SQUASH	Peeled	23.6	0	0	0	0	17.5	17.5
B3	79	RUNNER BEANS	-	76.4	0	0	2.3	0	43	45.3
B3	84	TOMATO	-	10.3	0	0	0	0	2.3	2.3
B3	87	CUCUMBER	Peeled	619.2	0	0	0	0	609.6	609.6
B3	88	CUCUMBER	Unpeeled	665.1	0	0	0	0	680.2	680.2
B3	89	COURGETTE	Peeled	89.3	0	0	2.3	0	62	64.3
B3	90	COURGETTE	Unpeeled	77.3	0	0	0	0	53.2	53.2
B3	96	TOMATO	-	27.6	0	0	2.3	0	8.7	11
B3	103	RUNNER BEANS	-	53.1	0	0	0	0	29.7	29.7
B3	108	COURGETTE	Peeled	380.1	0	0	2.3	0	297.5	299.8
B3	109	COURGETTE	Unpeeled	617.1	0	5.2	0	0	506.5	511.7
B3	114	SQUASH	Peeled	39.3	0	0	0	0	32	32
B3	116	TOMATO	-	5.6	0	0	0	0	2.3	2.3
B3	124	TOMATO	-	40.1	0	2.3	0	0	36.8	39.1
B3	132	COURGETTE	Peeled	99.5	0	0	0	0	36	36
B3	133	COURGETTE	Unpeeled	36.6	0	0	0	0	22.3	22.3
B3	137	TOMATO	-	9.3	0	0	0	0	5.1	5.1

B3	143	SQUASH	Peeled	37.9	0	0	0	0	17.1	17.1
B3	148	RUNNER BEANS	-	65.2	0	6.7	0	0	37.5	44.1
P1	7	BRUSSEL SPROUTS	-	53	0	0	0	0	34.2	34.2
P1	8	BRUSSEL SPROUTS	-	21.3	0	0	0	0	12.9	12.9
P1	9	BRUSSEL SPROUTS	-	59.9	0	2.3	0	0	32.7	35
P1	10	CABBAGE	-	51	0	0	0	0	30	30
P1	11	CABBAGE	-	20.8	0	0	0	0	11.4	11.4
P1	12	CABBAGE	-	42.2	0	0	0	0	24	24
P1	15	CARROTS	Peeled	54.8	0	2.3	0	0	42.7	45
P1	16	CARROTS	Peeled	44	0	2.3	0	0	35.3	37.6
P1	17	CARROTS	Peeled	45.5	0	0	0	0	31.2	31.2
P1	18	CARROTS	Peeled	58	0	2.3	0	0	38.5	40.8
P1	19	CARROTS	Unpeeled	51.5	0	0	0	0	37.7	37.7
P1	20	CARROTS	Unpeeled	24.4	0	0	0	0	24	24
P1	21	CARROTS	Unpeeled	101.3	0	2.3	0	0	64.8	67.1
P1	22	CARROTS	Unpeeled	59.3	0	0	0	0	41.5	41.5
P1	23	CARROTS	Unpeeled	104.7	0	2.3	2.3	0	68.4	72.9
P1	24	CARROTS	Unpeeled	81	0	2.3	0	0	61.7	63.9
P1	25	CAULIFLOWER	-	45.2	0	0	0	0	17.5	17.5
P1	26	CAULIFLOWER	-	17.8	0	0	0	0	8.6	8.6
P1	27	CAULIFLOWER	-	72	0	0	0	0	41.2	41.2
P1	28	CAULIFLOWER	-	16.3	0	0	0	0	10.4	10.4
P1	29	CAULIFLOWER	-	56.5	0	0	0	0	34.3	34.3
P1	30	CAULIFLOWER	-	38.1	0	0	0	0	31.8	31.8
P1	31	CAULIFLOWER	-	18.7	0	0	0	0	13.5	13.5
P1	32	CAULIFLOWER	-	87.5	0	0	0	0	49.7	49.7
P1	38	CURLY KALE	-	236	0	2.3	2.3	0	143.1	147.6
P1	39	CURLY KALE	-	1984.6	0	2.3	2.3	0	725.5	730
P1	41	CURLY KALE	-	118.6	0	2.3	5.4	0	82.4	90.1
P1	46	LEEKS	-	404.1	0	0	2.3	0	245.1	247.3
P1	47	LEEKS	-	32.6	0	2.3	0	0	15.6	17.9
P1	48	LEEKS	-	74.6	0	0	0	0	52.6	52.6
P1	49	LEEKS	-	90.9	0	0	0	0	51	51
P1	50	LEEKS	-	21.7	0	0	0	0	14.8	14.8
P1	51	LEEKS	-	62.2	0	0	0	0	44.9	44.9
P1	54	PARSNIPS	Peeled	141	0	2.3	0	0	59.1	61.4
P1	55	PARSNIPS	Peeled	199.1	0	2.3	0	0	75.3	77.6
P1	56	PARSNIPS	Peeled	61.8	0	2.3	0	0	14.1	16.3
P1	57	PARSNIPS	Peeled	101.2	0	2.3	0	0	37.4	39.6
P1	58	PARSNIPS	Unpeeled	389.9	0	2.3	0	0	200.9	203.1
P1	59	PARSNIPS	Unpeeled	393.5	0	2.3	0	0	129.2	131.5
P1	60	PARSNIPS	Unpeeled	98.3	0	0	2.3	0	39.2	41.4
P1	61	PARSNIPS	Unpeeled	165.8	0	2.3	0	0	68.3	70.5
P1	63	POTATOES	Peeled	13.9	0	0	0	0	6.9	6.9
P1	64	POTATOES	Peeled	12.9	0	0	0	0	7.9	7.9
P1	65	POTATOES	Peeled	3.9	0	0	0	0	10.1	10.1*
P1	66	POTATOES	Peeled	22.4	0	0	0	0	11	11
P1	67	POTATOES	Peeled	16.8	0	0	0	0	96.6	96.6*
P1	68	POTATOES	Unpeeled	49.9	0	0	0	0	31	31
P1	69	POTATOES	Unpeeled	16.5	0	0	0	0	5.1	5.1
P1	70	POTATOES	Unpeeled	5.6	0	0	0	0	5.3	5.3
P1	71	POTATOES	Unpeeled	8	0	0	0	0	2.3	2.3
P1	74	POTATOES	Unpeeled	73.6	0	0	0	0	56.7	56.7
P1	75	PURPLE KALE	-	1778	0	11.3	9.5	0	861.4	882.2
P1	76	PURPLE KALE	-	118.1	0	2.3	2.3	0	99.3	103.8
P1	77	PURPLE KALE	-	178.1	0	2.3	2.3	0	118.6	123.1
P1	86	RUBY CHARD	-	714.1	0	2.3	2.3	0	448.2	452.8
P1	87	RUBY CHARD	-	156.9	0	0	0	0	64.8	64.8
P1	88	SAVOY CABBAGE	-	29.5	0	0	0	0	22.1	22.1
P1	89	SAVOY CABBAGE	-	246.7	0	0	0	0	142.9	142.9
P1	90	SAVOY CABBAGE	-	93	0		2.3	0	73.9	76.1

P1	91	SAVOY CABBAGE	-	59.2	0	2.3	0	0	36.7	38.9
P1	92	SAVOY CABBAGE	-	58.2	0	0	0	0	27.6	27.6
P1	93	SAVOY CABBAGE	-	31.6	0	0	0	0	18.3	18.3
P1	94	SAVOY CABBAGE	-	33.7	0	0	0	0	39.5	39.5
P1	97	SPRING GREENS	-	6676.4	0	4.6	2.3	0	2450.2	2457.1
P1	98	SPRING GREENS	-	223.5	0	0	0	0	100.6	100.6
P1	99	SPRING GREENS	-	345	0	2.3	5.5	0	223.9	231.7
P1	100	SPRING GREENS	-	269.7	0	2.3	2.3	0	169.8	174.3
P3	3	SQUASH	Peeled	17.8	0	0	0	0	9.6	9.6
P3	5	SQUASH	Peeled	176	0	0	0	0	175.1	175.1
P3	7	SQUASH	Peeled	107.9	0	11.9	0	0	69.5	81.3
P3	11	CUCUMBER	Peeled	494.8	0	2.3	0	0	162.7	165
P3	12	CUCUMBER	Unpeeled	1021.7	0	8.8	0	0	860.6	869.4
P3	47	COURGETTE	Peeled	223.4	0	0	5.5	0	156.6	162.1
P3	48	COURGETTE	Unpeeled	249.2	0	11.7	0	0	159.9	171.6
P3	63	SQUASH	Peeled	135.8	0	0	2.3	0	92.5	94.8
P3	65	SQUASH	Peeled	178.4	0	0	2.3	0	119.8	122
P3	72	RUNNERBEAN	-	138.8	0	0	7.3	0	76.6	83.9
P3	73	SQUASH	Peeled	160.8	0	0	15.6	0	86.6	102.2

*For a number of cases the sum of species is greater than the total arsenic concentration. This is most likely due to the two different methods having different dilution factors and samples that are close to the base line are greatly affected when multiplied by the dilution factor.

Table E. Total arsenic and aluminium concentration of open structure vegetables. Data reported as amount of element per g dry weight.

Survey code	survey sample	Produce	Al ug/g	As ng/g
B1	124	KALE, CURLY	16.0	85.2
B1	125	KALE, CURLY	15.8	20.2
B1	126	KALE, CURLY	14.9	17.9
B1	132	KALE	13.5	8.8
B1	133	KALE	16.7	15.5
B1	134	KALE	14.3	4.7
B1	158	LETTUCE	3.8	1.4
B1	159	LETTUCE	29.3	43.6
B1	160	LETTUCE	11.5	2.1
B1	162	LETTUCE	43.3	100.3
B1	163	LETTUCE	4.5	3.7
B1	164	LETTUCE	4.8	4.0
B1	165	LETTUCE	15.8	2.3
B1	166	LETTUCE	19.6	6.1
B1	261	KALE, RUSSIAN	12.7	22.8
B1	275	SPINACH	20.2	14.7
B1	276	SPINACH	46.8	67.9
B1	278	GREENS, SPRING	10.1	13.3
B1	279	GREENS, SPRING	9.4	27.3
B1	280	GREENS, SPRING	10.7	80.2
B1	281	GREENS, SPRING	11.4	9.8
B1	282	GREENS, SPRING	12.4	123.7
B1	283	GREENS, SPRING	10.5	117.9
B1	284	GREENS, SPRING	9.5	39.3
B2	21	LETTUCE, OAK LEAF	20.7	35.0
B2	22	LETTUCE, LOLLO ROSSO	18.0	25.1
B2	23	LETTUCE, ICEBERG	4.1	0.6
B2	31	SPINACH	13.9	11.1
B2	32	CHARD	44.9	16.0
B2	47	LETTUCE	4.6	2.5
B2	48	LETTUCE, RED	11.7	10.4
B2	70	LETTUCE	35.8	5.4
B2	82	GREENS, SPRING	11.8	8.5
B2	86	LETTUCE	15.3	8.2
B2	104	LETTUCE	4.5	6.9
B2	117	LETTUCE	2.4	3.1
B2	135	SPINACH	35.5	12.5
B2	137	SALAD, MIX	6.5	44.0
B2	140	LETTUCE, OAK LEAF	6.8	2.8
B2	141	SALAD, MIX	13.5	8.4
B2	142	CHARD	41.1	13.2
B2	143	SPINACH	25.3	12.8
B2	148	GREENS, spring	9.8	2.8
B2	158	SALAD, MIX	42.1	142.2
B2	170	PAK CHOI	27.3	66.6
B2	171	LETTUCE	46.4	101.9
B2	182	LETTUCE	8.5	5.8
B2	183	LETTUCE, OAK LEAF	26.7	75.0
B2	199	SPINACH	47.0	26.2
B2	208	LETTUCE, OAK LEAF	17.5	8.7
B2	209	LETTUCE	30.1	15.8
B2	218	LETTUCE, LOLLO ROSSOE	25.6	49.5
B2	219	LETTUCE	27.3	59.7
B2	223	SALAD, MIX ORGANIC	189.6	91.5
B2	224	SPINACH, ORGANIC	56.9	69.9
B2	225	GREENS, SPRING ORGANIC	39.3	19.6
B2	244	GREENS, SPRING	40.5	11.3
B2	264	LETTUCE	4.0	1.7
B2	294	LETTUCE, COS	13.9	8.9
B2	300	LETTUCE, RED	68.0	241.2
B2	301	LETTUCE	8.4	7.2
B3	6	LETTUCE	13.0	20.0
B3	7	GREENS, SPRING	11.9	10.2
B3	22	LETTUCE	11.3	8.7
B3	26	GREENS, SPRING	9.6	18.1
B3	33	LETTUCE	18.0	10.3
B3	42	LETTUCE, COS	5.5	5.0
B3	54	KALE, CURLY	13.5	16.9
B3	55	CHARD	8.1	6.3
B3	71	SPINACH	44.6	56.3
B3	97	LETTUCE, OAK LEAF	46.7	234.5
B3	117	GREENS, SPRING	20.3	6.7
B3	118	SALAD, MIXED LEAF	82.3	27.3
B3	123	LETTUCE, OAK LEAF	23.5	128.7
B3	125	GREENS, SPRING	8.5	16.0
B3	138	CHARD	61.5	75.8
B3	145	KALE, CURLY	31.9	37.3
P3	50	GREENS	11.1	16.5
P3	54	GREENS	56.9	110.2
P3	58	GREENS	8.9	11.6

P3	84	KALE, CURLY	18.6	169.0
P3	85	KALE, PURPLE	6.8	67.0