-The Swedish Monitoring of Pesticide Residues in Food of Plant Origin: 2001

Report concerning Directives 90/642/EEC, 86/362/EEC and Commission Recommendation 2001/42/EC

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EC and National Report

Summary

In 2001, a total of 2 897 surveillance samples of fruits, vegetables, juices, fruit drinks, cereal grains, cereal products, vegetable oils, and oil seeds were analysed for residues of 224 pesticides (263 analytes). National or EU harmonised Maximum Residue Limits (EC-MRLs) were exceeded by 57 samples (2.0 %). One sample of domestically grown vegetables contained residues above the MRLs.

Detectable residues were found in 21 out of 74 samples of foods for infants and young children.

Apples, strawberries, table grapes, lettuce and tomatoes, in all 555 samples, were analysed in the 2001 EU co-ordinated programme. Three of these samples exceeded any of the EC-MRLs for the pesticides concerned.

In five commodities (eight samples) pesticide residues were found at levels more than 10 times the MRLs. The highest violation rate, 38 times the MRL, was found in a sample of dill containing endosulfan.

The homogeneity factor, calculated as the highest value found in an individual unit divided by the mean of individual units in a single sample, was determined for eleven pesticides. The factor varied between 1.4-5.6.

The short-term intake was estimated for 18 pesticides based on the highest residue found in a surveillance (composite) sample and UK consumption data. The acute reference dose (ARfD) was exceeded for toddlers in two cases, endosulfan in melons and monocrotophos in table grapes and in one case for adults, monocrotophos in table grapes.

A total of 52 enforcement samples of fruits and vegetables were collected and 17 lots (148.5 tons) were prohibited from being sold.

Introduction

Foods of plant origin are checked for pesticide residues by the Swedish National Food Administration (NFA). Annual reports have been published in English since 1986. The present report is our third combined European Commission (EC) and national report. It is aimed for the Commission, the Member States in the European Union (EU) and all other interested parties. The report contains general information about the monitoring programme, sampling procedures and analytical methods as well as detailed information about residues found using a format requested by the European Commission (Table A–G). Certain results are also presented in percent of the MRL according to our general format for reporting residues found (Appendices 4–5). Assessments of the short-term intake, based on the 2001 monitoring data, has also been carried out.

This report is available on NFA's web site (www.slv.se).

Since 2001 quarterly summary reports from the pesticide residues monitoring are available in Swedish on NFA's web site (www.slv.se).

Monitoring programme

The target number of samples to be collected of each food is roughly proportional to the food's consumption rate and takes into account both the amount of domestic production and the amount of imports from EU-countries and third countries. However, the number is also based on the importance of the foodstuff in the diets of infants and young children and if the food is consumed with or without the peel. In some cases, the number of samples of a specific food or a food from a particular country was increased based on residues found in prior samples.

By analysis of 100 samples it can with 95 % confidence be predicted that the actual percentage of exceedances is less than 3 % provided that no exceedances was discerned.

About 110 different foodstuffs were included in the sampling plan for year 2001 (Table 1).

Table 1. Number of samples of important commodities to be collected according to the monitoring programme 2001 and the outcome of the sampling.

COMMODITY	No. of samples		COMMODITY	No. of samples	
	planed	outcome		planed	outcome
Fruits (fresh)	***1 115***	***1 123***			
Apples	200	202	Peppers	75	80
Bananas	150	149	Potatoes	140	144
Mandarins and similar	100	99	Others	470	425
Oranges	140	140			
Peaches and nectarines	60	54	***Cereal grains***	***245***	***237***
Pears	130	131	Rice	50	51
Strawberries	60	68	Wheat	145	143
Table grapes	100	105	Others	50	43
Others	175	175			
			Processed or dried foods	***435***	***456***
Vegetables (fresh or frozen)	***1 110***	***1 081***	Baby foods	50	74
Carrots	100	102	Cereal products	125	109
Cucumbers	100	99	Juice, fruit drinks	95	105
Head cabbage	50	51	Potatoe products	45	47
Lettuce	75	75	Others	120	121
Tomatoes	100	105	***Total:***	**2905**	**2 897**

Sampling procedures

Surveillance monitoring

Samples collected in accordance with the monitoring programme were defined as surveillance samples, i.e. there were no suspicions about excessive amounts of pesticide residues in the lots prior to sampling.

Enforcement sampling

When a surveillance sample contained a pesticide residue above the national or EC maximum residue limit (MRL), the NFA prescribed a condition for the offering for sale or other handling of the food or lot to which the food belonged. As a follow-up, next lots of the commodity from the grower/exporter were detained and enforcement samples were collected. The condition was cancelled either when a certain number of lots contained pesticide residues below the MRLs, or when other information showed that the residue problem did not exist any longer. Surveillance sampling was then once more resumed.

Sample collection

Fresh fruit and vegetables were sampled at wholesalers' warehouses in the first trade channel. Normally, a sample included three sub-samples, each of about 1–3 kg. The sub-samples were collected from at least three different boxes or places throughout the lot (1). The sample was sealed and labelled with a unique sample identity.

Most of the samples of processed or frozen fruit and vegetables, juices, fruit drinks, rice, cereal products, vegetable oils, and oil seeds were collected in retail shops or department stores. As a rule 2–4 consumer packets, weighing about 2 kg in all, were collected. However, if the weight of an individual package was above 1.5 kg, only one package was collected.

Samples of domestic produced cereal grains were collected at the milling plants. The imported cereal grains were sampled at the port where the shipment was discharged. Usually, one bulk sample of about 3–5 kg was collected by stream sampling technique.

Plant inspectors from the National Board of Agriculture collected most of the samples, but inspectors from the Municipal Environmental and Health Protection Committees were to some extent also involved.

Quality assurance measures

Trained inspectors belonging to the National Board of Agriculture collected the samples according to written instructions from the National Food Administration. The bags with the samples were sealed and a photo was taken of the box that had been sampled.

Analytical procedures

Methods and pesticide coverage

In all, by using both multi-residue methods and single residue methods it was possible to determine 224 pesticides corresponding to 263 analytes (Appendices 2–3). This is an increase with 26 pesticides compared with year 2000 (2). The analytical method codes and their sources are listed in Appendix 1.

A total of about 394 000 residues (analyte/commodity combinations) were sought (Table A2-Part I and II).

Fruit and vegetables

Practically all samples of fruit and vegetables were analysed by the multi-residue method (MRM) code 001. By this method, the samples were extracted with ethyl acetate, cleaned up on an S-X3 gel permeation column and determined by capillary gas chromatography. A total of 176 pesticides (205 analytes) were quantitatively covered by using this method.

Depending on commodity/country combination, the GPC cleaned-up extract was also determined by HPLC (method codes 101and 103) and HPLC with post-column reaction (method code 104). For acidic commodities sodium hydroxide was added in the extraction step to enable quantitative determination of 3,5-dichloroaniline, the benomyl group, thiabendazole and imazalil (method code 002 and 102). In all, using ethyl acetate extraction, GPC clean-up and the different detection systems 195 pesticides (237 analytes) were covered.

In addition to the MRM, 18 single residue methods were used and in all 218 pesticides (255 analytes) were sought in fruits and vegetables. Of these pesticides 97 were actually found. It is an increase with 29 pesticides sought and 20 additional found compared with year 2000 (2). Figure 1 shows number of samples analysed and pesticides sought and detected during the last five years.

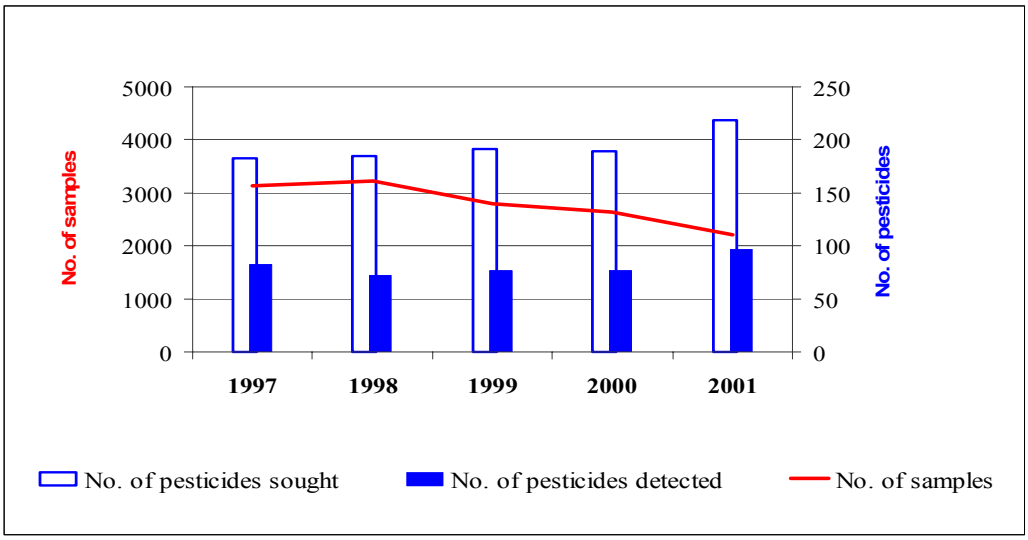

Figure 1. *Number of pesticides (active substances) sought and detected, and number of samples of fruit and vegetables analysed, surveillance sampling 1997–2001.*

Vegetable oils and oil seeds
The samples were extracted using hexane and acetonitrile. After clean-up on an S-X3 gel permeation column the residues were determined by GC equipped with EC, FPD or N/P-detector. A total of 32 pesticides (37 analytes) were covered by the method used (code 018).

Cereal grains and cereal products
All samples of cereal grains and cereal products were analysed using MRM code 901. This method is similar to the multi-residue method (code 001) used for analysis of fruit and vegetables. Single residue methods were used for analyses of carbendazim, chlormequat, mepiquat, inorganic bromide, phosphine, glyfosate and AMPA. In all, 46 pesticides (55 analytes) were included in the control.

Quality control

Among other procedures, the quality control included daily checks of the instruments' sensitivity and possible matrix effects by injection of test solutions. GC-determinations were in most cases carried out using standards in matrix extracts.

The EC guidelines ”Quality Control Procedures for Pesticide Residue Analysis” (3) has been implemented as far as practicable (Table G).

The laboratory has participated in six proficiency tests. These were organised by FAPAS, United Kingdom and Finish Customs laboratory, Finland (Table G).

Laboratory used and accreditation

The analyses were carried out on a contract basis at AnalyCen Nordic AB, Lidköping. This laboratory is accredited by the Swedish accreditation authority SWEDAC for all analytical methods used for the NFA’s official control of pesticide residues in food of plant origin.

Reporting levels

The majority of the pesticide residues were measured and reported from the limit of quantitation (determination), generally in the range of 0.01–0.2 mg/kg. Reporting levels for each of the pesticides are given in Table A2-Part I-II. For certain pesticides, e.g. cypermethrin, imazalil, methamidophos, and thiabendazole the EC-MRLs set at the LODs (Limit of Determination) were not achievable in our routine monitoring.

Maximum Residue Limits

The National Food Administration's Regulations on Pesticide Residues in Food, sets MRLs for about 180 individual substances or group of substances (according to the residue definition in the regulation) in fresh, frozen and dried fruits and vegetables as well as in cereals and some cereal products (1).

The MRLs, including national and EC-MRLs, apply equally to domestic and imported commodities whether or not the pesticide is authorised in Sweden. When regulations concerning a certain pesticide or a certain group of food products are not given in the regulations, the NFA can decide the maximum level to be applied in each individual case.

Results and discussion

Surveillance monitoring

In 2001, a total of 2 897 surveillance samples of fresh, frozen or processed fruit and vegetables, juices, fruit drinks, cereal grains, cereal products, vegetable oils and oil seeds, were analysed for pesticide residues. Table 2 shows the number of surveillance samples analysed by country of origin. About 63 % of the samples originated from imports from 57 countries. Most of the samples with unknown origin came from processed products. In 2000, the number of samples amounted to 3 301 originating from 66 countries (2).

National and EU harmonised Maximum Residue Limits (EC-MRLs) were exceeded by 57 (2.0 %) of the 2 897 samples analysed.

Out of 2 441 samples of fresh or frozen fruits and vegetables and cereal grains 965 samples (39.5%) contained residues at or below national and EC-MRLs and 57 samples (2.3%) exceeded these limits (Tables A1-Part I and D1–2).

In all, 6 389 analyses were carried out using 27 analytical methods. The number of surveillance samples, analysed by the different analytical methods and arranged by food-groups, is shown in Appendix 3. Out of the 224 pesticides (active substances) sought in all foodstuffs 100 were actually detected. The total numbers of findings of each pesticide in fruits, vegetables and cereal grains are shown in Table A2-Part I-II.

Table 2. Total number of surveillance samples by country analysed in 2001.

Country	No. of samples	Country	No. of samples	Country	No. of samples
Argentina	60	Ghana	1	Peru	3
Australia	2	Greece	32	Philippines	2
Austria	9	Guatemala	1	Poland	2
Belgium	33	Honduras	9	Puerto Rico	4
Brazil	55	Hungary	17	Russia	1
Cameroon	1	India	5	Senegal	3
Canada	3	Iran	1	South Africa	60
Chile	35	Israel	75	Spain	322
China	6	Italy	222	Sudan	2
Colombia	59	Ivory Coast	11	Sweden	865
Costa Rica	37	Kazakhstan	1	Thailand	46
Cuba	3	Kenya	2	Turkey	42
Cyprus	49	Madagascar	2	United Kingdom	25
Denmark	15	Malaysia	1	United States	110
Dominican Rep.	5	Mali	1	Unknown country	218
Ecuador	20	Morocco	43	Uruguay	12
Egypt	9	Netherlands	175	Viet nam	1
Finland	1	New Zealand	21	Zambia	1
France	65	Norway	1	Zimbabwe	5
Germany Fed. Rep.	49	Panama	36		
				Total	**2 897**

The most commonly found pesticides in fresh or frozen fruit, vegetables and cereal grains are presented in Table 3. The fungicide imazalil and thiabendazole were among those most often found in fruits, while the insecticide endosulfan was most often found in the vegetable samples. Out of the seven different pesticides detected in cereal grain, inorganic bromide was most often found.

Table 3. Pesticides most commonly found in fruits, vegetables and cereal grains, surveillance sampling in 2001.

Fruits (1 123 samples)		**Vegetables** (1 081 samples)		**Cereal grains** (237 samples)	
Pesticide	*No. of findings*	*Pesticide*	*No. of findings*	*Pesticide*	*No. Of Find-ings*
Imazalil	260	Endosulfan	44	Bromide, inorganic	7
Thiabendazole	232	Iprodione	37	Phosphine	6
Methidathion	79	Chlorothalonil	29	Chlorpyrifos-methyl	4
Chlorpyrifos	71	Procymidone	27	Glyphosate	4
Orthophenylphenol	68	Diquat	16	Deltamethrin	3
Captan	67	Dithiocarbamates	16	Pirimiphos-methyl	3
Azinphos-methyl	57	Pyridaben	15	Dichlorvos	2
Diphenylamine	56	Dimethoate	13		
Tolylfluanid	49	Methamidophos	27		
Iprodione	47	Chlorpropham	10		

Fruits and vegetables - fresh or frozen

A total of 2 204 samples of fresh or frozen fruit and vegetables including potatoes were analysed for residues of 218 pesticides (255 analytes). Residues at or below national or EC-MRLs were found in 42.8% of the samples and 2.5% exceeded these limits (Figure 2).

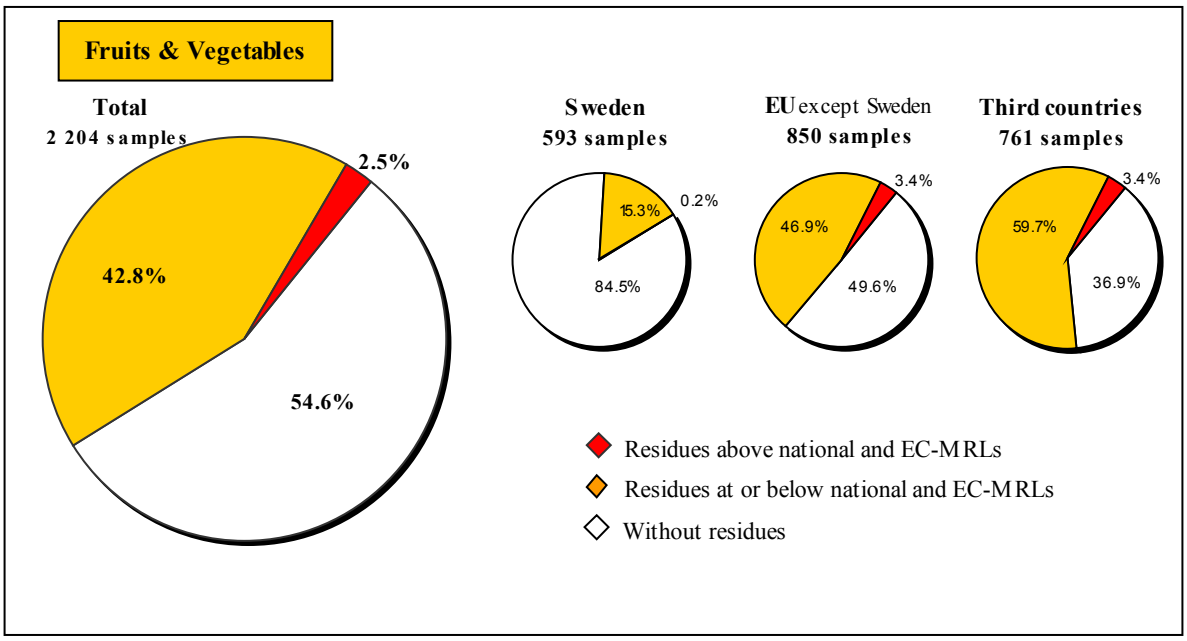

Figure 2. *Summary of results for fruits and vegetables, surveillance sampling in 2001.*

In general, the imported commodities contained considerably more often residues than the domestic, but in most cases the residues were below the MRLs. Most samples (84.5%) of domestically grown fruit and vegetables contained no residues. The corresponding figures for EU-countries (except Sweden) and third countries were 49.6 % and 36.9 %, respectively. 0.2% of the domestic grown fruits and vegetables exceeded national or EC-MRLs compared with 3.4 % of the samples from third countries or EU countries (except Sweden).

Commodities containing pesticide residues greater than 10 times the MRL are shown in Table 4. The ratio between the highest level found in the surveillance sampling and the MRL is given. Residues of endosulfan in a sample of dill amounted to 38 times the MRL. However, the high figures are partly due to cases where the MRLs are set at the limit of determination.

Vegetables from Thailand

Twenty samples were analysed in a special survey of fresh vegetables, mainly beans and products of "spinach or cabbage type", imported from Thailand. The classification of these products is not yet finalised. Residues were found of 13 different pesticides, e.g. dicrotophos, dimehoate, EPN, methamidophos, monocrotophos, omethoate and profenofos.

Peppers
Out of the 80 samples of peppers analysed only two samples (2.5%) contained residues above the limits. This is an improvement compared with year 2000, when 17% of the pepper samples exceeded the limits mainly due to residues of methamidophos. None of the samples contained any residues of methamidophos in 2001.

Table grapes
A total of 105 samples of table grapes from 11 countries have been analysed. Eleven samples (10.5%) contained residues above the EC- or national MRLs. Residues of monocrotophos were found in four out of 14 samples that originated from Cyprus. The highest residue found was 0.37 mg monocrotophos/kg in one of these samples.

Potatoes
Residues were found in 27 (19%) out of 144 samples analysed. One sample contained tecnazene above the MRL. The other pesticides found were diquat, chlorpropham and maleic hydrazide.

Number of samples of each fruit and vegetable and the pesticide residues found (in per cent of the MRL) are presented in Appendix 4.

Table 4. Commodities containing pesticide residues greater than 10 times the MRL, surveillance sampling in 2001.

Commodity	Pesticide	Country of origin	No. of samples with residues >10 times MRL	Max. residue found mg/kg	MRL mg/kg	Ratio max. residue/ MRL
Dill	Endosulfan	Italy	1	1.9	0.05	38
Dill	Methamidophos	Italy	1	0.28	0.01	28
Papayas	Thiabendazole	Brazil	1	1.34	0.05	27
Table grapes	Acephate	Spain	1	0.55	0.02	27
Courgettes	Methamidophos	Turkey	1	0.26	0.01	26
Parsley	Endosulfan	Italy	2	0.98	0.05	20
Papayas	Chlorothalonil	Brazil	1	0.18	0.01	18
Parsley	Ethion	Italy	1	1.26	0.1	13

The EU co-ordinated programme

The EU co-ordinated programme for 2001 consisted of five commodities, which should be analysed for 32 pesticides (4). All Member States (MS) have to analyse these pesticide/crop combinations. The minimum number of samples to be analysed by each of the member states varied between 12 to 93 depending on the population size in the MS. In Sweden the EU co-ordinated programme is included in the national monitoring programme. In all 555 samples of apples, strawberries, table grapes, lettuce and tomatoes were analysed (Table B). Residues above the EC-MRLs for the pesticides mentioned in Table B were found in one out of 202 samples of apples and in two out of 105 samples of table grapes (Figure 3).

The EU co-ordinated programme included also analysis of individual units for the combination phorate in potatoes and/or methidathion in apples. The homogeneity factor has to be calculated based on the residues in the individual units. No investigations were possible to carry out as no residues were found of methidathion in apples. Furthermore, phorate is not yet included in the programme. However, the homogeneity factor has been determined for 11 other pesticides. The results are shown in Table 8.

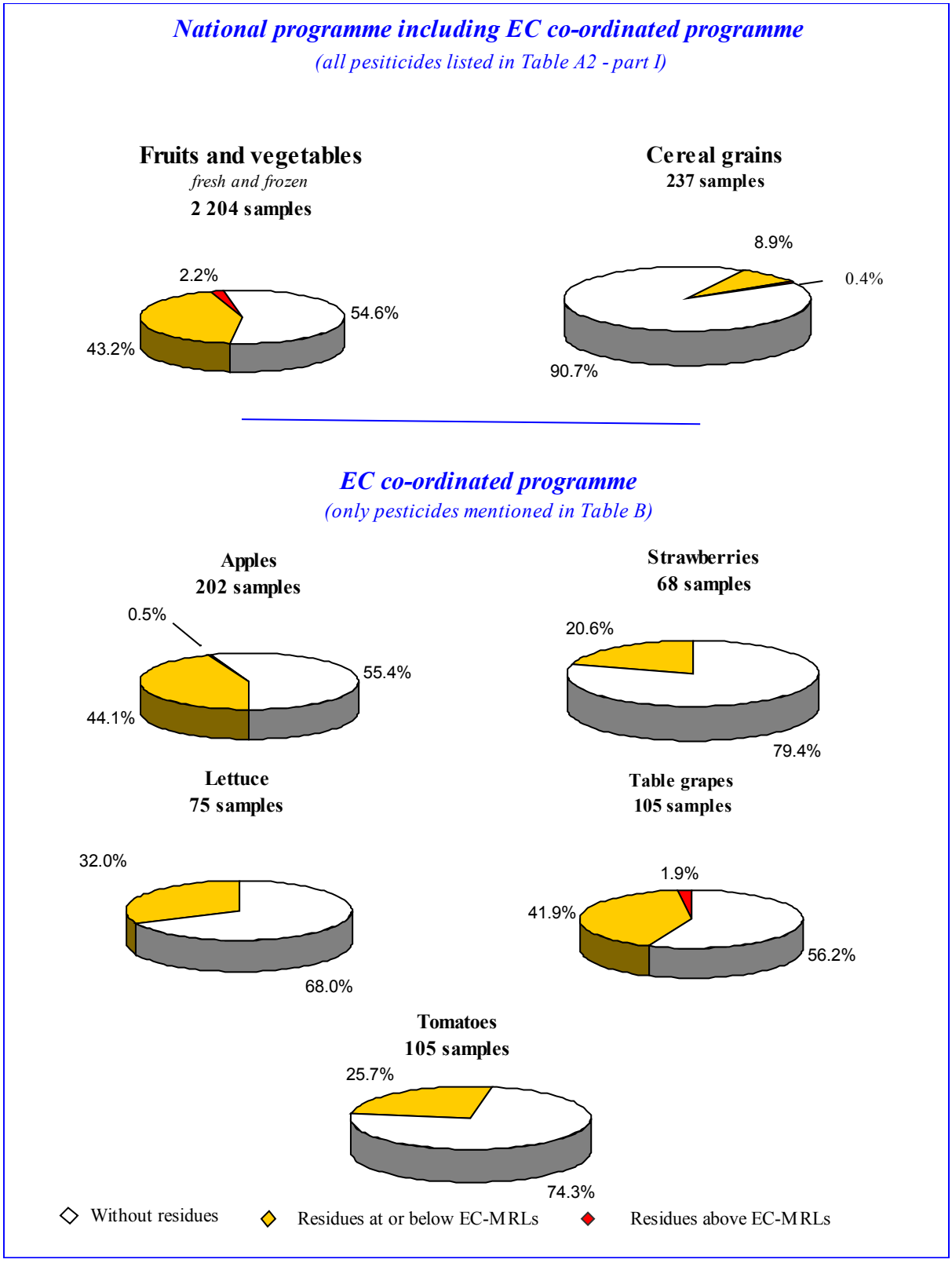

Figure 3. *Summary of results for the national programme and the EU co-ordinated programme, only EC-MRLs, surveillance sampling in 2001.*

Exceedances of EC-MRLs

Table D1 gives detailed information about pesticide residues found and action taken for those 48 samples that exceeded EU harmonised MRLs. In three of the samples, two pesticides in each sample exceeded the EC-MRLs. These combinations were carbendazim/chlorothalonil in papaya, acephate/methamidophos in table grapes and carbendazim/chlorpyrifos in table grapes.

Multiple residues in a single sample

Out of 2 493 samples of fruit, vegetables and cereal grains (surveillance and compliance) 461 contained residues of two or more pesticides in a single sample. The highest number of pesticides found was seven in one sample of mandarins from Cyprus. Six pesticides were found in one sample of dill from Italy, two samples of mandarins from Spain and one sample of oranges from Israel. Detailed information is given in Table E for all samples with two or more pesticide residues in a single sample.

Violation rates of pesticide residues

The frequency of samples of fruit and vegetables with pesticide residues above national or EC-MRLs the last ten years is shown in Figure 4. In 1995, the percentage of exceedances in imported fruit and vegetables reached 5.8%, the highest figure since beginning of the 1980s. However, the violation rate has then decreased and amounted to 3.4 % in 2001. Two samples (0.2%) of domestic origin exceeded the limits in 2001.

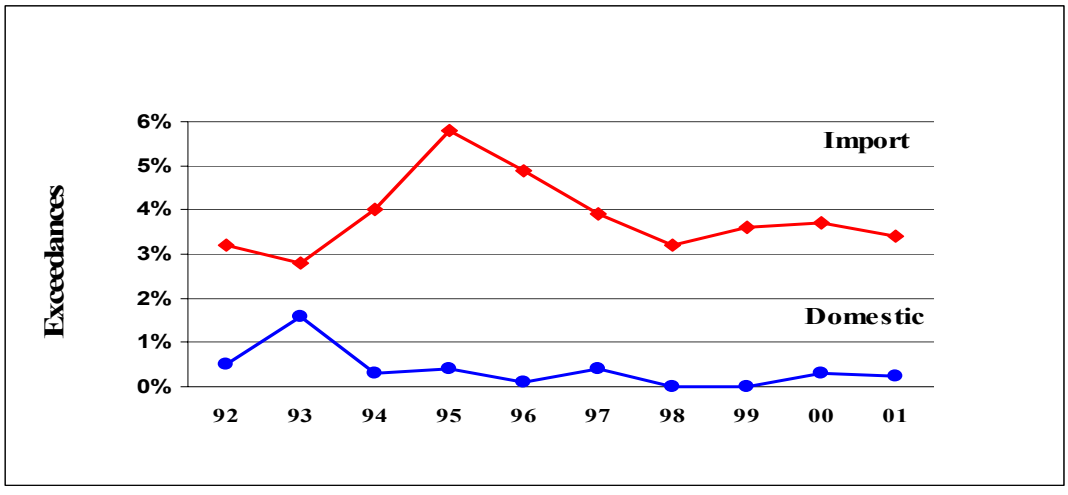

Figure 4. *Violation rate of pesticide residues in samples of fresh or frozen fruits and vegetables, national or EC-MRLs, surveillance sampling during 1992–2001.*

Foods intended for infants and young children

An increased sampling of baby foods was carried out in 2001 since chlormequat was found in products based on pears in the beginning of the year. In total, 74 samples of baby foods e.g. juices, fruit drinks, canned fruits and vegetables were analysed. Residues of chlormequat were found in 21 samples of canned pear products. The highest residue found was 0.96 mg/kg in a pear purée. From the 1st of July 2001 the MRL for chlormequat in pears was reduced to 0.5 mg/kg. Two lots with pear purée were prohibited from being sold due to residues above this limit.

No other pesticide residues were detected in baby foods.

Juices and fruit drinks

A total of 109 samples of juices and fruit drinks, among them orange juice, apple juice, grape juice, black currant juice, grapefruit juice, carrot juice and tomato juice were analysed. No residues were found in any of the samples (Table C).

Fruits and vegetables – processed or dried

42 samples of canned fruits and canned vegetables were analysed (Table C). Methamidophos (0.30 mg/kg) was found in one out of 10 samples of canned beans. Two out of six samples of canned mushrooms contained low levels of carbendazim and endosulfan.

Two out of 20 samples of pommes frites and 13 out of 27 samples of other potato products contained residues of the sprout inhibitor chlorpropham. The highest residue found was 0.73 mg/kg (in one sample of the pommes frittes), which is below the national MRL of 1 mg/kg.

Four out of 10 samples of dried grapes contained levels of propargite, iprodione and inorganic bromide. No residues were found in the 20 samples of dry beans, lentils and peas. Detailed information is shown in Table C.

Vegetable oils and oil seeds

Olive oil and rape seed oil, 25 samples in all, were analysed for residues of 32 pesticides (method code 018). Endosulfan was detected in five samples of olive oils. The highest residue found was 0.08 mg/kg.

Furthermore, 20 samples of peanuts were analysed for residues of 33 pesticides including phosphine. No detectable residues were found (Table C).

Cereal grains

A total of 237 samples of cereal grains, mainly wheat, rice and rye, were analysed. Only one of the samples (rice from India) exceeded the EC-MRLs for deltamethrin. However, residues of pirimiphos-methyl, diclorvos, chlorpyrifos-methyl, phosphine, deltamethrin, inorganic bromide and glyphosate were found in 21 of the samples. The vast majority of the samples (90,7%) were free from residues (Figure 5 and Table C).

Cereal products

A total of 109 samples of cereal products, mainly wheat flour, corn flakes and pasta, were analysed. Two of the samples contained low residues of pirimiphos-methyl and chlorpyrifos-methyl, 0.09 and 0.12 mg/kg, respectively (Table C).

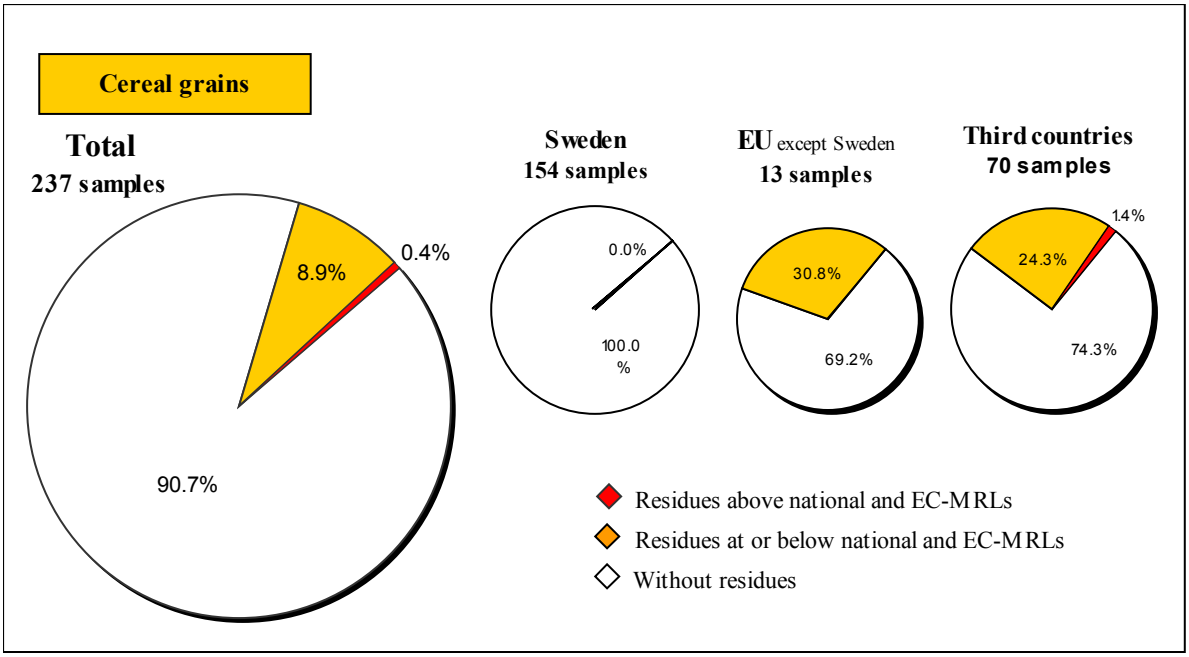

Figure 5. *Summary of results for cereal grains, national or EC-MRLs, surveillance sampling in 2001.*

Enforcement

Enforcement samples were collected as a follow-up, when excessive amounts of pesticide residues were found in surveillance samples. Eleven out of 52 enforcement samples exceeded EC-MRLs (Tables A1-Part II, C and D3).

A total of 17 lots (148,5 tons) of foods were prohibited for sale in 2001 (Table 5) compared with 13 lots (18,4 tons) in 2000 (2). These lots had either to be destroyed or returned to the supplier. If a re-export will be accepted the competent authority in the receiving country has to give its approval.

The number of samples analysed, grouped by food commodity, country of origin and residues found, expressed in per cent of the MRL, are shown in Appendix 5.

Table 5. Lots prohibited for sale in 2001.

Food	Country	No. of lots	Weight, ton
Pear purée, (baby food)	Sweden	2	4.3
Celery	Italy	1	0.6
Mandarins	Cyprus	1	63.4
Mangoes	Puerto Rico	1	1.3
Papayas	Brazil	4	1.5
Parsley	Italy	2	0.5
Pears	Argentina	1	12
Table grapes	Cyprus	5	64.9
Total		**17**	**148.5**

Rapid Alert System

The Rapid Alert System for Foodstuffs (RASFF) was established by Council Directive 92/59/ECC on General Product Safety. Products entailing a serious health risk to the consumer are classified as Alert notifications. The notifying Member State (MS) informs the Commission, which then notifies the other Member States.

One sample of table grapes from Cyprus contained 0.34 mg/kg (composite sample) of the insecticide monocrotophos. Our assessment showed that the acute reference dose (ARfD) was exceeded. The Commission was notified about the finding and an alert notification was distributed to MS.

Dietary Exposure Assessment

Short-term Intake

The acute dietary intake or short-term exposure has to be considered for those pesticides that are classified as acutely toxic. This is a relatively new topic and approaches how to estimate the acute intake has been put forward by WHO (5-7) and UK (8). The aim of the WHO is to evaluate all pesticides and establish an acute reference dose (ARfD) for each pesticide that possibly impose an acute health risk (9). The acute reference dose of a chemical is an estimate of the amount a consumer can ingest during one meal or during one day without any health risk.

In this study the national estimated short-term intake (NESTI) of pesticides has been calculated for a each pesticide found in the control programme where there is an established acute reference dose. Pesticides that impose a possible risk of being acutely toxic but not yet has an established reference dose has been evaluated (9). In the latter case the intake has been compared with the ADI-value (Acceptable Daily Intake – a value used for long term risk evaluation).

The type of foodstuffs of most concern when estimating the acute exposure are those where the entire fruit (including peel) is consumed at one occasion, i.e. tomatoes, apples or grapes. In the present study calculations are performed on each foodstuff where a relevant pesticide is detected.

Calculation of the national estimated short-term intake

The national estimated short-term intake was calculated using the formulae shown in Figure 6 (5). These formulae are used when the meal-sized portion, as a single fruit or piece of vegetable (unit weight of the whole portion is >25g) might have a higher concentration of residue than the composite due to variability of residues in individual units. When the residue data reflect residue levels in the food as consumed no variability factor is concerned (i.e. cereals, juice).

The consumption figures (LP) used when calculating the national estimated short-term intake (NESTI) are based on the 97.5^{th} percentile consumption of eaters only, which reflects the largest portion consumed during one meal or during one day. In this study United Kingdom consumption figures have been used. In the calculation of NESTI the median unit size (U) of the commodity is also included (Table 7).

Case 1: **The composite residue data reflect residue levels in the food as consumed**

$$NESTI = \frac{LP * OR_{comp.}}{bw}$$

Case 2a: **The unit weight of the whole commodity (U) is smaller than the large portion (LP)**

$$NESTI = \frac{U * OR_{comp} * V + (LP - U) * OR_{comp}}{bw}$$

Case 2b: **The unit weight of the whole commodity (U) is larger than the large portion (LP)**

$$NESTI = \frac{LP * OR_{comp.} * V}{bw}$$

NESTI = **National estimated short-term intake**

U = **Median unit wight, of the edible portion (kg)**

ORcomp. = **Highest observed residue in composite sample of edible portion incorporation processing factors if availabel (mg/kg)**

V = **Variability factor; 1 to 10 depending on unit weight and commodity**

LP = **Highest large portion provided (97.5th percentile of eaters) in kg of food per day**

bw = **Body weight (kg)**

Figure 6*. The formulae used calculating the national estimated short-term intake (NESTI).*

The observed residue (OR_{comp}) is the highest residue derived from the composite sample. In order to refine the intake estimate, correction factors (when available) were applied to foodstuffs that normally are peeled or prepared, e.g. boiled or fried (Table 6). Since monitoring data reflect residue levels found in the products on the market, these correction factors are important in cases where most of the residues are to be found in the non-edible part of the foodstuff, e.g. in the peel of citrus fruits (9-13).

The residue is multiplied with a variability (homogeneity) factor (V) for the pesticide/commodity concerned. For commodities with unit weights between 25-250 g a default factor of 7 is used. A factor of 5 is used for unit weights above 250 g and a factor of 1 is used for unit weights less than 25 g. A factor of 10 is used for leafy vegetables if the unit weight of whole portion is less or equal to 250 g. For refined estimates, available factors based on analyses of individual units in surveillance samples should be used.

Table 6. Correction factors used for refinement of the estimated intake.

Pesticide	**Foodstuff**	**Correction Factor** [1]
All pesticides	Peaches, nectarines	1.19
All pesticides	Plums	1.06
Chlorpropham	Potatoes, baked	0.80
Chlorpropham	Potatoes, raw, peeled	0.20
Dichlorvos	Mandarins	0.02
Dicofol	Citrus	0.03
Dimethoate/ omethoate	Mandarins	0.26
- " -	Oranges	0.26
Ethion	Citrus	0.02
Fenthion	Mandarins	0.01
Methidathion	Citrus	0.03
Parathion-methyl	Citrus	0.05

[1] Fraction of the residue in the edible part

Table 7. Consumption figures and unit sizes for foodstuffs in the short-term intake calculations. All figures originating from United Kingdom.

Foodstuff	Large portion size		Unit size
	Adults (kg)	Toddlers (kg)	(kg)
Apples	0.308	0.199	0.112
Beans (with pods)	0.232	0.059	(<0.025)
Cabbage	0.318	0.086	0.540
Courgette	0.222	0.06	0.114
Cucumber	0.084	0.072	0.084[1)]
Lettuce	0.093	0.025	0.558
Mandarins	0.158	0.176	0.100
Melon	0.513	0.303	0.322
Nectarines	0.172	0.152	0.149
Oranges	0.262	0.181	0.160
Peaches	0.228	0.144	0.110
Potatoes [2)]	0.473	0.241	0.216
Pears	0.274	0.279	0.150
Table grapes	0.190	0.158	0.500
Spinach	0.266	0.031	0.090
Tomatoes	0.157	0.093	0.085
Wheat	0.301	0.128	(<0.025)

[1)] A piece of a cucumber [2)] Baked/roasted

Homogeneity (variability) factor

The homogeneity (variability) factor is defined as the quotient between the maximum and the mean residue of individual units in a sample. In the 1999 residue report the word variability factor was used. However, it was recommended by EU to use the word homogeneity factor for those cases where the factor is derived from monitoring data, hence variability factor is used when the data are based on supervised field trials.

In the EU co-ordinated monitoring programme the homogeneity factor should be determined for phorate in potatoes and/or methidathion in apple. No findings of these combinations where found in the control.

However, the homogeneity factor was determined for the pesticides and commodities shown in Table 8. In the calculations, units containing no residues were assigned half of the reporting level. The homogeneity factor varied from 1.4 to 5.6. Monocrotophos in table grapes was the combination with the highest homogeneity factor. None of the other combinations reach the generally used default value of seven or five depending on the weight of a single unit.

Table 8. Homogeneity factors for certain pesticides/commodities investigated in 2001 surveillance sampling.

Pesticide	Commodity	No. of units	Homo-geneity factor	Max residue mg/kg	Mean residue mg/kg	Sample Reference
Acephate	Table grapes	6	1.7	1.0	0.61	20010822H604
Acephate	Nectarines	12	2.2	0.16	0.073	20010531H102
Acephate	Nectarines	12	2.7	0.22	0.082	20010605S407
Acephate	Nectarines	12	3.2	0.18	0.057	20010611S107
Azoxystrobin	Table grapes	5	1.4	0.90	0.66	20011003M201
Chlorpropham	Potatoes	9	1.9	2.5	1.3	20010727S205
Dichlorvos	Mandarins	10	2.6	1.5	0.58	20010212H502
Dimethoate	Lettuce	6	2.2	0.14	0.064	20010820S506
Dimethoate	Table grapes	5	1.4	0.14	0.10	20011003M201
Methamidophos	Nectarines	12	2.3	0.029	0.012	20010531H102
Methamidophos	Nectarines	12	2.2	0.045	0.020	20010605S407
Methamidophos	Nectarines	12	2.6	0.31	0.12	20010611S107
Methamidophos	Table grapes	6	1.4	0.14	0.098	20010822H604
Monocrotophos	Table grapes	12	4.7	0.18	0.038	20010727H700
Monocrotophos	Table grapes	10	5.6	0.50	0.089	20010801S102
Monocrotophos	Table grapes	10	4.2	1.0	0.24	20010801S102
Monocrotophos	Table grapes	10	5.6	2.1	0.38	20010801H606
Monocrotophos	Table grapes	10	3.9	0.21	0.053	20010807H605
Monocrotophos	Table grapes	10	3.7	0.23	0.064	20010807H606
Omethoate	Lettuce	6	1.5	0.16	0.11	20010820S506
Parathion	Table grapes	5	1.6	0.20	0.12	20011003M201
Phosalone	Table grapes	6	1.5	2.0	1.4	20011004H602
Vinclozolin	Kiwi fruits	10	1.4	17.1	12.5	20010312S406

Results of the assessment of the national estimated short-term intake

Children, with low body weight relative to their high consumption, compose a risk group of approaching the acute reference dose when consuming large amount of fruits or vegetables if these products contain high levels of acutely toxic pesticides. Figure 7 shows that the national estimated short-term intake (NESTI) for a child weighing 14.5 kg exceeded the ARfD for monocrotophos in table grapes and endosulfan in melons.

As last year, monocrotophos in table grapes and chlorpropham in potato products resulted in high intake relative to the ARfD. The calculation for potatoes assumes that the potatoes were consumed with peel. If the potatoes were consumed peeled, the intake was reduced from 91% to 19% of the ARfD (corrected for baking and using a homogeneity factor of 1.9).

The intake of monocrotophos from table grapes reached 10 times the acute reference dose for a child and 2.5 times the ARfD for an adult (Table 9).

In this study the estimated short-term intake has been calculated for a large number of pesticides but the results are shown only when the intake exceeds 50% of the acute reference dose or when missing, the acceptable daily intake for a child (Table 9).

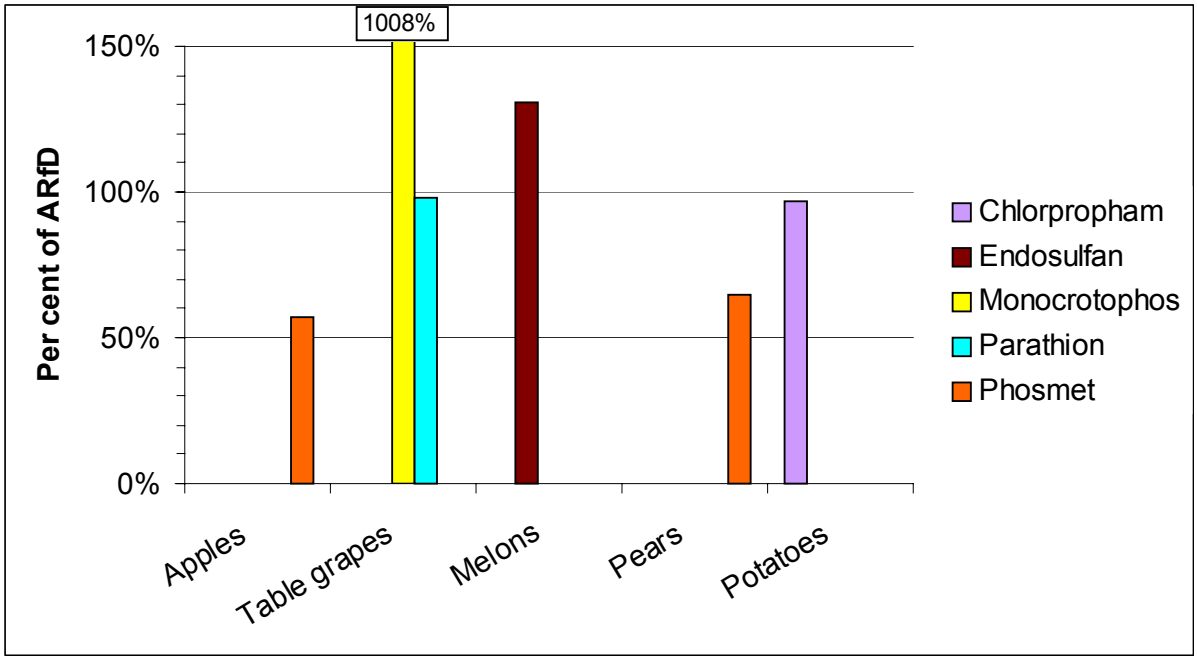

Figure 7. *Estimated short-term intake for a child of certain pesticides with an acute reference dose established.*

Chlormequat in foods intended for young children

An assessment of the intake of chlormequat from baby food based on pears was carried out. No consumption data for such young children are available. However, a child weighing 10 kg has to eat at one meal or during one day more than 500 grams (>2.5 tins) of a product containing the highest level found (0.92 mg/kg) to reach the acute reference dose for chlormequat.

Table 9. The estimated short-term intake of certain pesticides based on the highest residue found in composite samples in 2001. Only intakes exceeding 50% of the ARfD or ADI for a toddler are shown in the table.

Pesticide	ARfD/ ADI mg/kg bw	Commodity	Highest residue in composite sample mg/kg	Intake mg/kg bw/day		% of ARfD		% of ADI	
				toddlers	Adults	Tod-dlers	adults	toddlers	adults
Acephate	0.03*	Table grapes	0.55	0.0300	0.0075			100	25
		Peaches	0.32	0.0211	0.0048			70	16
		Nectarines	0.19	0.0163	0.0034			54	11
Azinphos-methyl	0.005*	Apples	0.37	0.0222	0.0052			445	103
		Pears	0.25	0.0203	0.0042			407	84
Carbofuran	0.002*	Cucumbers	0.032	0.0011	0.0003			56	13
Chlorpropham	0.03	Potatoes w. peel	1.21	0.0291	0.0092	97	31		
		Peeled	1.21	0.0058	0.0018	19	6		
Cyhexatin	0.007*	Apples	0.41	0.0246	0.0057			352	82
		Pears	0.30	0.0244	0.0050			348	72
Cypermethrin	0.05*	Table grapes	0.58	0.0316	0.0079			63	16
Demeton-S-methyl	0.0003*	Spinach	0.06	0.0002	0.0001			76	43
Dichlorvos	0.004*	Wheat	1.41	0.0124	0.0061			311	151
Dicofol	0.002*	Cucumbers	0.16	0.0056	0.0013			278	67
		Mandarins	1.46	0.0023	0.0005			117	24
		Pears	0.15	0.0122	0.0025			610	126
Dimethoate/omethoate	0.002*	Apples	0.1	0.0060	0.0014			300	70
		Cabbage	0.16	0.0047	0.0036			237	181
		Table grapes	0.11	0.0060	0.0015			300	75
		Lettuce (others)	0.26	0.0022	0.0017			112	86
		Oranges	0.066	0.0014	0.0003			68	15
		Pears	0.026	0.0021	0.0004			106	22
Endosulfan	0.02	Melons	0.25	0.0261	0.0064	131	32		
Fenvalerate	0.02*	Apples	0.18	0.0108	0.0025			54	13
		Pears	0.16	0.0130	0.0027			65	13
Methamidophos	0.004*	Beans (w. pods)	0.49	0.0020	0.0016			50	41
		Courgettes	0.26	0.0075	0.0034			188	84
		Cucumbers	0.4	0.0139	0.0034			348	84
		Table grapes	0.087	0.0047	0.0012			119	29
		Melons	0.022	0.0006	0.0023			57	14
		Nectarines	0.18	0.0155	0.0033			386	81
		Peaches	0.087	0.0057	0.0013			144	33
		Tomatoes	0.26	0.0108	0.0025			270	62
Monocrotophos	0.002	Table grapes	0.37	0.0202	0.0050	1008	251		
Oxamyl	0.03*	Cucumbers	0.59	0.0205	0.0049			68	16
Parathion	0.01	Table grapes	0.18	0.0098	0.0024	98	24		
Phosmet	0.02	Apples	0.19	0.0114	0.0027	57	13		
		Pears	0.16	0.0130	0.0027	65	13		

* ADI-values

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