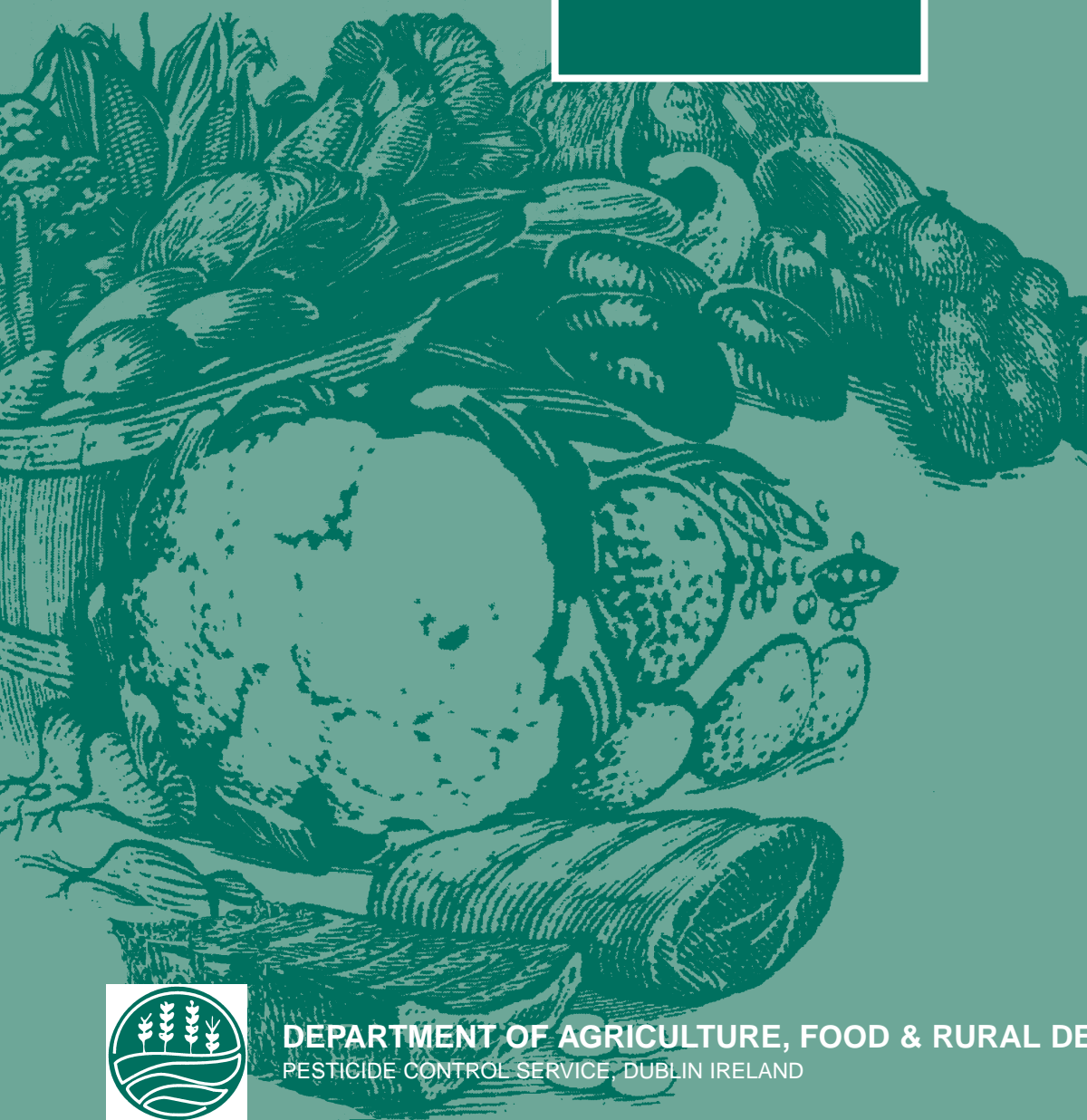


2000

**PESTICIDE  
RESIDUES  
IN  
FOOD**



**DEPARTMENT OF AGRICULTURE, FOOD & RURAL DEVELOPMENT**  
PESTICIDE CONTROL SERVICE, DUBLIN IRELAND

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## PESTICIDE RESIDUES IN FOOD-2000

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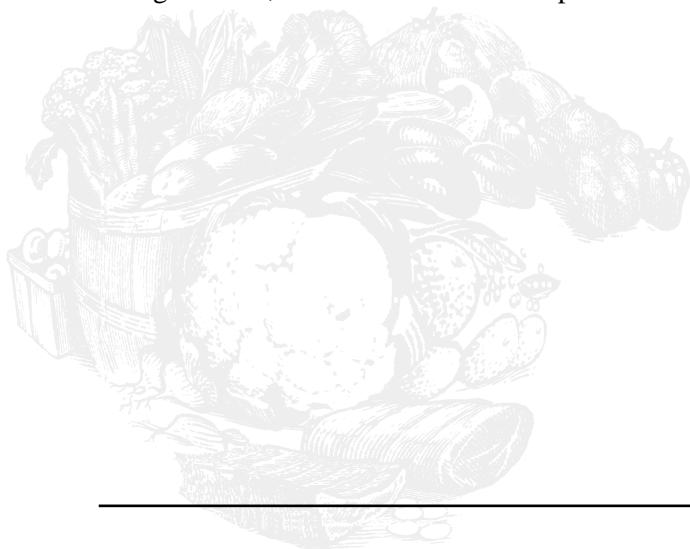
## FOREWORD

I am very pleased to present the results of the national monitoring programme for pesticide residues in food carried out in 2000 by the Department's Pesticide Control Service as a service contract to the Food Safety Authority of Ireland. Food safety is of great importance to all involved in the food chain and, through the residue monitoring programme, consumers can be assured that they are not exposed to unacceptable pesticide residue levels and that only authorized pesticides are applied to food crops. I am also pleased to report that the Pesticide Control Laboratory has achieved accreditation from the National Accreditation Board (NAB) of Ireland to the ISO 17025 standard, during 2000, for the analysis of selected pesticide residues in food of plant origin. The accreditation status of the laboratory will be extended to cover additional pesticides and food commodities. This report provides detailed information on the results of the sampling and analysis programmes for residual traces of pesticides in both imported and domestic food.



Noel Davern TD

Minister of State at the Department  
of Agriculture, Food and Rural Development





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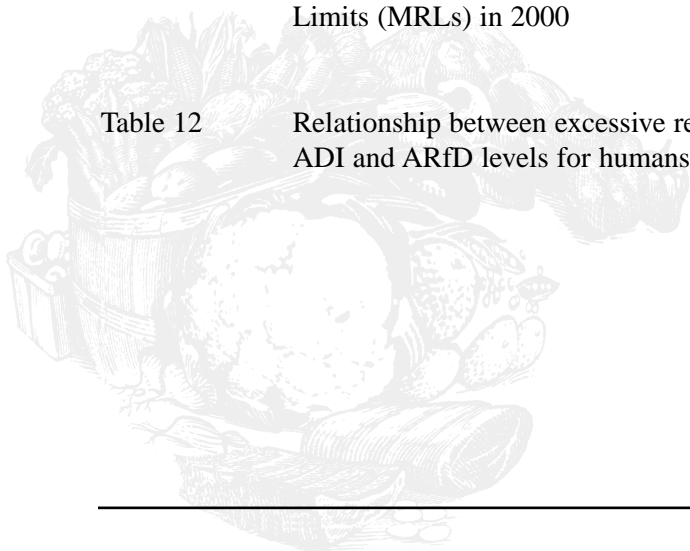
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## INTRODUCTION

The monitoring programme for pesticide residues in food undertaken by the Department of Agriculture, Food and Rural Development through its Pesticide Control Service, at Abbotstown, Dublin 15, is aimed at ensuring that consumers are not exposed to unacceptable pesticide residue levels. In addition, it is aimed at ensuring that authorised pesticides are correctly applied to food crops.

In accordance with the contractual arrangements agreed between the Department and the Food Safety Authority of Ireland (FSAI)<sup>1</sup>, the monitoring programme has since 5 July 1999, been agreed with and has been conducted on behalf of the FSAI.

The monitoring programme in place involves the sampling of produce of imported and of domestic origin. The analytical part of the monitoring programme reflects pesticide usage patterns both in Ireland and abroad. Some 800 active substances are registered for use in plant protection products around the world, of which between 300 and 400 are in common use.

Pesticide residue levels in treated crops are regulated through the establishment of Maximum Residue Levels (MRLs). Currently MRLs have been established in Ireland for some 129 pesticides in fruit and vegetables (including tea), some 79 pesticides in cereals and some 62 pesticides in food of animal origin, reflecting relevant European Union (EU) legislation. Following the adoption of changes in EU procedures for setting MRL's, more rapid progress is being achieved than heretofore in their elaboration<sup>2, 3</sup>.

When MRLs are exceeded, officers of the Pesticide Control Service can remove the produce concerned from the market and destroy it at the owner's expense. Prosecutions may also be taken by the Minister. Where warranted, a Rapid Alert<sup>4</sup> can be issued by the FSAI. A Rapid Alert is issued when the residues detected in food are considered to be harmful to the consumer.

Explanations of the various technical terms used in this report are provided in a glossary at the end of this report (Annex III).

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## MONITORING PROGRAMMES

Monitoring programmes are in place for the three different food groups for which MRLs have been established, food of plant origin (including fruit and vegetables), cereals and food of animal origin (meat, milk, and dairy produce). Officers of the Pesticide Control Service carry out the sampling of food of plant origin, while members of the Dairy Science and Veterinary Inspectorates of the Department of Agriculture, Food and Rural Development carry out the sampling of food of animal origin.

<sup>1</sup> Service Contract between the Food Safety Authority of Ireland and the Department of Agriculture, Food and Rural Development dated 5th day of July 1999.

<sup>2</sup> Council Directive (91/414/EEC) of 15 July 1991, concerning the placing of plant protection products on the market, OJ No. L 230/1 of 19.8.1991.

<sup>3</sup> Council Directive (97/41) of 25 June 1997 amending Directives 76/895/EEC, 86/362/EEC, 86/363/EEC and 90/642/EEC relating to the fixing of maximum levels for pesticide residues in and on, respectively, fruit and vegetables, cereals, foodstuffs of animal origin, and certain products of plant origin, including fruit and vegetables OJ No. L 184 of 12.7.1997.

<sup>4</sup> Council Directive of 29 June 1992 on general product safety (92/59/EEC) OJ No. L 228 of 11.08.1992.

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The monitoring programme for 2000, agreed with the FSAI, was designed on the basis of -

- i the programme recommended by the European Commission<sup>5</sup>,**
- ii dietary intake patterns of Irish consumers<sup>6</sup>, and**
- iii the residues profile of commodities established through the results of the monitoring programme in previous years.**

The total number of samples analysed at 556, reflected the capacity of the laboratory to process samples submitted. The capacity of the laboratory in 2000 reflects the staffing levels within the laboratory and the need to develop systems and procedures necessary to obtain and maintain NAB<sup>7</sup> accreditation, as required in accordance with the provisions of Council Directive 89/397/EEC<sup>8</sup> and Council Directive 93/99/EEC<sup>9</sup>. The laboratory was accredited to the ISO 17025 standard in December 2000 for the analysis of pesticide residues in food of plant origin using gas chromatographic techniques.

The monitoring programme is the prime means of ensuring that pesticides are used in accordance with *Good Agricultural Practice*. The programme is essential to the elimination of abuses in the use of pesticides, such as use of excessive dose rates, failure to respect the minimum periods specified between last application and harvest (*i.e.* pre-harvest intervals) and use for purposes for which they are not authorised (*i.e.* illegal uses). When used in accordance with *Good Agricultural Practice* unacceptable levels of pesticide residues should not occur in treated produce.

In accordance with the European Communities (Prohibition of Certain Active Substances in Plant Protection Products) Regulations, 1981 to 1990, the marketing and use of certain pesticides are prohibited because of the risks to human health or the environment associated with their use. The residue-monitoring programme also serves as an indicator of the level of compliance with those provisions.

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## **A SAMPLING OF FRUIT AND VEGETABLES**

Routine sampling is biased in favour of food commodities that are of greater dietary importance. Within particular commodity groups, samples are taken at random. As part of the violation investigation programme, fruit and vegetables of specific origin are targeted for further special attention, where residues at levels in excess of MRL's have been found following routine sampling. When a crop is encountered which is targeted for statutory sampling, due to historical information or by way of rapid alert, the sampled lot is seized pending analysis. Since monitoring of pesticide residues commenced in 1982, five

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<sup>5</sup> Commission Recommendation of 17 December 1999, concerning a co-ordinated Community monitoring programme for 2000 to ensure compliance with maximum levels of pesticide residues in and on cereals and certain products of plant origin including fruit and vegetables (2000/43/EC) OJ No L 14/36 of 20 January 2000.

<sup>6</sup> Irish National Nutrition Survey, 1990.

<sup>7</sup> National Accreditation Board.

<sup>8</sup> Council Directive of 14 June 1989 on the official control of foodstuffs. (89/397/EEC) OJ No. L 186 of 30.6.1989.

<sup>9</sup> Council Directive of 29 October 1993 on the subject of additional measures concerning the official control of foodstuffs. (93/99/EEC) OJ No. L 290 of 24.11.1993.

<sup>10</sup> 1994, 1995 & 1996 Pesticide Residues in Food, 1998 Pesticide Residues in Food, and 1999 Pesticide Residues in Food, Department of Agriculture, Food and Rural Development, Pesticide Control Service, Dublin, Ireland. Published by the Stationary Office Available from the Government Publications Sale Office, Sun Alliance House, Molesworth Street, Dublin 2.

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repeat violations in targeted crops have been encountered<sup>10</sup> - one of which led to prosecution and conviction. The sampling programme for fruit and vegetables is under the direct control of the Pesticide Control Service. Both domestic and imported produce are sampled, primarily at wholesale level. This approach ensures that samples taken are representative of consumption patterns and allows action to be taken, where necessary, prior to distribution.

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## **B SAMPLING OF CEREALS**

The main concern with respect to cereals relates to residues that arise as a result of post-harvest application of plant protection products. The current sampling programme for cereals is confined, for practical reasons, to the sampling and analysis of grain used in the milling, malting and breakfast cereal industries. Cereals and cereal products of both domestic and imported origin are sampled on a random basis, at point of assembly or storage. Samples analysed were taken at random by authorised officers of the Pesticide Control Service.

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## **C SAMPLING OF FOOD OF ANIMAL ORIGIN**

Random samples of fat of bovine, porcine, ovine, poultry and venison are taken at a range of meat plants around the country. Dairy produce is sampled at production plants or points of assembly. The samples analysed relate only to domestic produce. The meat samples analysed are from individual animals. Each dairy produce sample taken is representative of a particular bulk consignment. Members of the Dairy Science and Veterinary Inspectorates of the Department of Agriculture, Food and Rural Development carry out the sampling of meat and dairy produce.

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## **D SAMPLES OF MISCELLANEOUS PRODUCTS**

Complaint or suspect samples are submitted from time to time for analysis by other Services of the Department of Agriculture, Food and Rural Development, other State Services, Local Authorities, by commercial organisations and by concerned consumers.

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## **E ANALYTICAL PROCEDURES**

The methodologies used in the analysis of the different food samples involve -

- i homogenisation of samples,**
- ii extraction of the samples into a suitable organic solvent,**
- iii clean-up of the solvent extract using chromatographic techniques, and**
- iv analysis of the cleaned up extract with capillary GC and HPLC instrumentation, using specific detectors and GC-mass spectrometry.**

The methods used in most cases are multi-residue in nature, an approach that facilitates the maximisation of laboratory output. The detection and confirmation of the presence of residues in food samples depends on the use of chromatography columns of different polarity. Quantitative determinations are made by -

- (i) comparison with external standards, and

- 
- (ii) in the case of fruit & vegetables, use of a 3-point calibration curve of matrix-matched standards.

Due to the wide variety of fruit and vegetables analysed, it is not practical to use all matrices. In 2000, peppers and peas were selected for the preparation of matrix matched standards used for quantification of all routine samples. In the case of targeted statutory samples, quantitative determinations were made using, where possible, the matrix of the commodity analysed.

Where a pesticide residue approaches or exceeds an MRL (other than MRLs set at the LOD), GC-mass spectrometry is used, where possible, to provide additional confirmation as to its identity.

Specific rather than multi-residue methods of analysis are used for the detection of benzimidazole residues. The method of analysis for the benzimidazole pesticides was not an accredited method of analysis in 2000.

Further details of the methods employed are provided in Annex IV.

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## QUALITY ASSURANCE

Routine quality assurance procedures within the laboratory involve:

- i all bovine and porcine fat samples being spiked with aldrin;
- ii 1 in 30 samples of bovine/porcine fat being spiked with the organochlorine pesticides endosulfan-1 and lindane;
- iii 1 in 20 samples of bovine/porcine/ovine/poultry/venison fat being spiked with an organochlorine pesticide mixture, containing 10 different compounds;
- v 1 in 25 samples of bovine/porcine/ovine/poultry/venison fat being spiked with a PCB mix containing 7 congeners.
- vi 1 in 20 samples of bovine/porcine fat being spiked with an organophosphorous pesticide mixture, containing 3 different compounds;
- vii 1 in 25 samples of ovine fat being spiked with an organophosphorous pesticide mixture containing 12 different compounds;
- viii 1 in 30 samples of bovine/porcine fat being spiked with an organophosphorous pesticide mixture, containing 2 different compounds;
- ix 1 in 25 dairy product samples being spiked with an organochlorine pesticide mixture, containing 10 different compounds;
- x 1 in 25 dairy product samples being spiked with an organophosphorous pesticide mixture, containing 10 different compounds;
- xi 1 in 10 of cereal or cereal product samples being spiked with an organochlorine pesticide mixture containing 14 different compounds
- xii 1 in 10 of cereal or cereal product samples being spiked with an organophosphorous pesticide mixture containing 12 different compounds
- xiv 1 in 15 of fruit and vegetable samples being spiked with one of five organochlorine pesticide mixtures, one containing 14 compounds, the second 13 compounds, the third 8 compounds, the fourth 8 compounds and the fifth 2 compounds (45 different compounds in total.);
- xv 1 in 15 of fruit and vegetable samples being spiked with one of six organophosphorous pesticide mixtures, one containing 12 compounds, the second 9 compounds, the third 6 compounds, the fourth 7 compounds the fifth 4 compounds and the sixth 4 compounds (42 different compounds in all);
- xvi 1 in 10 samples of fruit and vegetables subjected to analysis for benzimidazole residues being spiked with a mixture of 2 different benzimidazole compounds.

---

Recovery studies were carried out using at least one ‘*reference pesticide standard mixture*’ representative of the range of pesticides analysed by the laboratory. These studies were generally carried out at concentrations equivalent to the lowest calibration level (LCL) or at 10 times the LCL for the pesticides concerned. Recovery levels are considered acceptable for routine monitoring samples if they are in the range of 60 - 140%.

In addition to the in-house quality assurance programme, the laboratory successfully participated in four rounds of a proficiency testing scheme organised and run by the Food Analysis Performance Assessment Scheme (FAPAS)<sup>11</sup>. This involved analysis of an apple extract, pepper extract, melon extract and vegetable oil - all of which contained incurred residues. Up to 80 laboratories participated in the scheme and in all cases the results of the Pesticide Laboratory were acceptable.

The methods of analysis employed by the Pesticide Control Service are used to detect some 43% of the pesticides for which MRLs have been established in fruit and vegetables and 47% of the pesticides for which MRLs have been established in cereals. It will be necessary in the future to further expand the number of pesticides being analysed for in these samples either by expanding the capacity of current analytical methods or by the introduction and use of additional analytical methodologies.

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## RESULTS AND DISCUSSION

### A FRUIT AND VEGETABLES

#### i Routine Monitoring Programme

In 2000, some 238 samples of 43 different types of fruit and vegetables were analysed for their pesticide residue content, of which 22.7% were of domestic origin, and 77.3% were of imported produce or of unknown origin. Details are provided in Table 1. Samples were analysed for residues of 89 pesticides and metabolites (Annex V). MRLs have been established for an additional 74 compounds which are not yet included in the monitoring programme. The percentage of samples found to contain pesticide residues was 52.9%, while 3.4% contained residues in excess of the MRLs.

Details of the residues detected are provided in Table 2. In all, residues of 37 different pesticides were detected in 2000. MRLs exist for 31 of these compounds, but have not as yet been set for the remaining 6 pesticides.

Thiabendazole (17.2% of samples), chlorpyrifos (9.2% of samples), carbendazim (8.4% of samples), captan 6.7% of samples), dicofol (5.5% of samples), bromopropylate (5.0% of samples), malathion and methidathion (4.6% of samples), endosulfan and iprodione (3.8% of samples), chlorothalonil (3.4% of samples), dimethoate and tolyfluanid (3.3% of samples), procymidione and vinclozolin (2.5% of samples), cypermethrin (2.1% of samples) folpet, phosalone and tetradifon (1.7% of samples), chlorfenvinphos (1.3% of samples) and omethoate (1.2% of samples) were the residues most commonly detected in the routine monitoring programme. The other pesticides detected in samples analysed were azinphos-methyl, demeton-S-methyl sulfone, methamidophos, phosmet, binapacryl, captafol, cyfluthrin, DDT, deltamethrin, dichlofluanid, parathion methyl, pirmifos-methyl,

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<sup>11</sup> FAPAS is a registered trade mark of the UK Ministry of Agriculture, Fisheries and Food.

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quintozene, tecnazene, tolclofos-methyl and triazophos which were detected in less than 1% of the samples analysed.

Residues of thiabendazole were detected in apples, banana cabbage, citrus, and strawberries; residues of chlorpyrifos were detected in apples, citrus, grapes and cabbage; residues of carbendazim were detected in apples, blueberries, citrus, cucumber, grapes, pears and strawberries; residues of captan were detected in apples, blueberries, grape, pear and strawberries; residues of dicofol were detected in citrus; residues of brompropylate were detected in apple, citrus, strawberry and tomato; residues of malathion were detected in citrus and in peppers; residues of endosulfan were detected in blackcurrant, citrus, melon, pear and strawberry; residues of chlorothalonil were detected in aubergine, blackcurrant, cabbage, celery, peas and tomato while residues of iprodione were detected in apples, grape, lettuce, pear and strawberries.

In all, some 34 samples (14.3%) contained residues of two pesticides, 12 samples (5%) contained residues of three pesticides, 3 samples (1.3%) contained residues of four pesticides, 12 samples (5%) contained residues of five pesticides and 1 sample (0.4%) contained residues of six pesticides.

One of the 8 samples found to contain residues in excess of the MRLs was of Irish origin (a sample of cabbage), the remainder being samples of imported produce. Of the 54 samples of domestic origin analysed one (1.9%) contained residues in excess of the MRLs, while in the case of the 184 samples of imported origin analysed 7 (3.8%) contained residues in excess of the MRLs. Six of the 7 samples of imported produce found to contain pesticide residues levels in excess of the MRL were of commodities that are of limited dietary importance (blueberries, celery, fennel and peppers). In the case of grapefruit, while there are very few consumers of grapefruit at circa 3.8% of the population, an extreme consumer [the 97.5th percentile] can consume a large quantity, at 324g, on a daily basis. This is of importance in the event of exposure to an acutely toxic pesticide where single instances of high pesticide intake can be of concern. This was not relevant, however, in this particular case where a residue of thiabendazole exceeded the MRL in grapefruit as thiabendazole is not considered to be acutely toxic and is applied to the peel of the grapefruit only.

In the case of pesticides not used in the European Union but which may be used in other countries, EU MRLs are generally established at the limit of determination (LOD) for the compounds concerned, reflecting this non use in the EU. The occurrence of residues in excess of such MRLs in imported produce, in most cases, does not present risks for consumers (*i.e.* technical breaches of MRLs). Such anomalies should be resolved in due course by the World Trade Organisation (WTO) and by continuing co-operation between the EU and producer groups in third countries.

There were two instances of technical breaches of MRLs in 2000 involving produce imported from outside the EU, that did not involve risks for consumers: -

- carbendazim in blueberries (Chile)
- thiabendazole in grapefruit (Cyprus)

There were five instances in 2000 of the occurrence of residues, in excess of the MRL, following unauthorised use of pesticides in EU countries. The residues detected may have resulted in some cases from use on crops for which the particular pesticides are not

authorised and in other cases from improper use of the pesticide. Improper uses can involve non-compliance with the pre-harvest intervals specified, use of excessive rates or numbers of applications and/or the use of an inappropriate method of application. Instances of such excessive residues that did not involve risks for consumers, included: -

- methamidofos in peppers (Spain)
- procymidone in celery (Spain)
- procymidone in fennel (France)
- vinclozolin in celery (Spain)
- vinclozolin in fennel (France)

There was one instance of the occurrence of a residue, in excess of the MRL, which related to produce of domestic origin and which involved a potential health risk for consumers

- demeton-S-methyl sulfone in cabbage (Ireland)

**Table 1:- Fruit and vegetable samples analysed for their pesticide residues content in 2000**

Commodity	No. Samples Analysed	No. Domestic Samples	No. Imported or Unknown Origin Samples	Residues		
				> MRL	≤ MRL	ND
Apple	42	2	40		25	17
Aubergine	1		1		1	
Avocado	2		2			2
Banana	4		4		3	1
Blackcurrant	6	6			5	1
Blueberry	1		1	1		
Brussels Sprout	2	2			2	
Cabbage	13	12	1	1	5	7
Cactus Pear	1		1			1
Carrot	10	5	5		5	5
Cauliflower	2	2				2
Chinese Cabbage	1		1			1
Celery	5	1	4	2		3
Clementine	10		10		10	
Cucumber	12	5	7		3	9
Fennel	2		2	2		
Grape	6		6		4	2
Grapefruit	8		8	1	4	3
Kiwi	4		4		2	2
Lemon	3		3		2	1
Lettuce	12	5	7		7	5
Lime	1		1			1
Mangetout	1		1		1	
Mango	2		2		1	1
Melon	1		1		1	
Mineola	1		1		1	

**Table 1:- Continued**

Commodity	No. Samples Analysed	No. Domestic Samples	No. Imported or Unknown Origin Samples	Residues		
				> MRL	≤ MRL	ND
Mushroom	1	1				1
Orange	14		14		13	1
Papaya	1		1			1
Parsnip	2	1	1		1	1
Peach	2		2			2
Pear	10		10		8	2
Peas	12		12			12
Pepper	7		7	1		6
Plum	2		2			2
Potato	11	7	4		1	10
Salad Onion	1		1			1
Satsuma	7		7		7	
Spinach	1	1			1	
Strawberry	8		8		5	3
Swede	1	1				1
Tomato	4	2	2		2	2
Watercress	1	1				1
<b>TOTALS</b>	<b>238</b>	<b>54</b>	<b>184</b>	<b>8</b>	<b>118</b>	<b>112</b>

ND = None detected



Table 2:- Pesticide residues detected in fruit and vegetables in 2000

Sample number	Country of origin	Residue detected	Residue (mg/kg)	MRL (mg/kg)
<b>1. Fruit.</b>	<b>1.1 Citrus Fruit</b>		<b>1.1.2. Clementines</b>	
60630	SPAIN	chlorpyrifos	0.09	2
		phosmet	0.14	No MRL.
		thiabendazole	4.4	6
60634	SPAIN	chlorpyrifos	0.03	2
		malathion	0.06	2
		methidathion	0.05	2
		dicofol	0.2	2
		thiabendazole	2.2	6
60647	SPAIN	thiabendazole	4.3	6
		dicofol	0.05	2
61013	S AFRICA	thiabendazole	0.66	6
61081	CHILE	chlorpyrifos	0.15	2
		thiabendazole	0.9	6
61102	SPAIN	malathion	0.16	2
61127	SPAIN	malathion	0.35	2
		chlorpyrifos	0.09	2
		dicofol	0.31	2
61137	SPAIN	chlorpyrifos	0.08	2
		malathion	0.11	2
		dicofol	0.55	2
		carbendazim	0.12	5
		thiabendazole	1.29	6
61153	SPAIN	malathion	0.08	2
		methidathion	0.05	2
		dimethoate	0.26	1
		chlorpyrifos	0.27	2
		dicofol	0.62	2
61154	SPAIN	chlorpyrifos	0.04	2
		methidathion	0.13	2
		azinphos-me	0.11	2
		dicofol	0.20	2
			<b>1.1.3. Grapefruit.</b>	
60599	TURKEY	methidathion	0.04	2
		thiabendazole	5.0	6
60612	CYPRUS	brompropylate	0.44	5
		methidathion	0.05	2
		thiabendazole	4.5	6
		chlorpyrifos	0.1	0.3
		carbendazim	0.44	5
60641	CYPRUS	brompropylate	0.30	5
		parathion-me	0.07	0.2
		<b>thiabendazole</b>	<b>8.9</b>	<b>6</b>
61055	S AFRICA	tetradifon	0.09	No MRL
		brompropylate	0.32	5

Table 2:- Continued

Sample number.	Country of origin.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
61080	S AFRICA	tetradifon brompropylate	0.09 0.47	No MRL 5
<b>1.1.4. Lemons</b>				
60578	CYPRUS	methidathion	0.27	2
		thiabendazole	1.4	6
60649	SPAIN	dicofol	0.22	2
		folpet	0.05	0.1
		tetradifon	0.05	No MRL
<b>1.1.6. Mineola</b>				
61062	PERU	carbendazim	0.07	5
		thiabendazole	0.11	6
<b>1.1.7. Orange</b>				
60592	CUBA	carbendazim	0.1	5
		thiabendazole	4.1	6
60593	SPAIN	chlorpyrifos	0.05	0.3
		malathion	0.04	2
		pirimifos-methyl	0.07	1
		carbendazim	0.05	5
		thiabendazole	0.73	6
60610	ISRAEL	methidathion	0.07	2
		thiabendazole	1.7	6
		brompropylate	0.41	5
60629	SPAIN	dimethoate	0.03	1
		endosulfate	0.02	1
		thiabendazole	1.2	6
		malathion	0.11	2
		carbendazim	0.14	5
60642	ISRAEL	brompropylate	0.46	5
		chlorpyrifos	0.08	0.3
		methidathion	0.15	2
		thiabendazole	2.6	6
60651	MOROCCO	thiabendazole	3.2	6
61035	S AFRICA	thiabendazole	2.3	6
61042	S AFRICA	tolyfluanid	0.56	No MRL
61056	S AFRICA	brompropylat	0.71	5
		carbendazim	0.10	5
61071	BRAZIL	dicofol	0.11	2
		captafol	0.003	0.02
		thiabendazole	1.4	6
61078	S AFRICA	methidathion	1.0	2
61136	S AFRICA	chlorpyrifos	0.15	0.3
		dicofol	0.16	2
		thiabendazole	3.7	6

Table 2:- Continued

Sample number.	Country of origin.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
69056	UNKNOWN	chlorpyrifos	0.05	0.3
		methidathion	0.03	2
		thiabendazole	4.7	6
<b>1.1.8. Satsuma</b>				
60611	SPAIN	dicofol	0.26	2
		methidathion	0.43	2
		thiabendazole	0.51	6
61008	S AFRICA	tetradifon	0.04	No MRL
61098	SPAIN	chlorpyrifos	0.17	0.3
		carbendazim	0.01	5
		dicofol	0.03	2
		thiabendazole	2.5	6
		malathion	0.12	2
61101	S AFRICA	chlorpyrifos	0.13	0.3
		malathion	0.17	2
		thiabendazole	2.0	6
		carbendazim	0.02	5
		dicofol	0.23	2
61132	SPAIN	dicofol	0.86	2
		malathion	0.11	2
		chlorpyrifos	0.05	0.3
		carbendazim	0.07	5
		thiabendazole	2.3	6
61138	TURKEY	brompropylate	0.34	5
61139	TURKEY	chlorpyrifos	0.08	0.3
		brompropylate	0.31	5
<b>1.3. Pome Fruit.</b>				
<b>1.3.1. Apple</b>				
60576	FRANCE	carbendazim	0.07	2
		thiabendazole	0.45	5
60582	HOLLAND	captan	0.25	3
60594	FRANCE	dimethoate	0.03	1
		chlorpyrifos	0.04	0.5
		captan	0.04	3
		tolyfluanid	0.05	No MRL
		thiabendazole	0.35	5
60608	CUBA	thiabendazole	0.8	5
60609	HOLLAND	captan	0.17	3
		carbendazim	0.2	2
60622	FRANCE	thiabendazole	0.6	5
60637	FRANCE	thiabendazole	0.22	5
60638	FRANCE	thiabendazole	0.05	5
60639	FRANCE	thiabendazole	0.22	5
60648	FRANCE	carbendazim	0.05	2
		phosalone	0.12	2

Table 2:- Continued

Sample number.	Country of origin.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
61006	FRANCE	brompropylate	0.04	5
61011	FRANCE	carbendazim	0.05	2
		thiabendazole	0.18	5
61014	UNITED STATES	thiabendazole	1.1	5
61015	NEW ZEALAND	chlorpyrifos	0.06	0.5
61039	FRANCE	tolyfluanid	0.1	No MRL
61057	FRANCE	cyfluthrin	0.03	0.2
61061	UNITED KINGDOM	captan	0.07	3
61064	IRELAND	captan	0.04	3
61072	HOLLAND	captan	0.07	3
		folpet	0.02	3
61075	FRANCE	captan	0.42	3
61076	FRANCE	thiabendazole	0.3	5
61079	S AFRICA	iprodione	0.33	10
61082	FRANCE	omethoate	0.06	0.5
		chlorpyrifos	0.08	0.5
		captan	0.04	3
		dimethoate	0.05	1
		phosalone	0.11	2
61083	FRANCE	dimethoate	0.15	1
		azinphos-me	0.12	1
		omethoate	0.04	0.5
		chlorpyrifos	0.21	0.5
		thiabendazole	0.08	5
61134	ITALY	captan	0.01	3
<b>1.3.2. Pear.</b>				
60595	HOLLAND	tolyfluanid	0.72	No MRL
		carbendazim	0.16	2
61038	FRANCE	phosalone	0.11	2
61049	FRANCE	phosalone	0.13	2
61053	PORTUGAL	folpet	0.04	3
		captan	0.08	3
61058	BELGIUM	tolyfluanid	0.10	No MRL
61065	PORTUGAL	phosmet	0.2	No MRL
		captan	0.29	3
61073	HOLLAND	endosulfan-1	0.24	1
		captan	0.04	3
61135	UNITED KINGDOM	iprodione	1.3	10
		carbendazim	0.318	2
<b>1.5. Berries &amp; Small Fruit.</b>			<b>1.5.1.1. Grape</b>	
60577	NAMIBIA	iprodione	1.2	10
60623	S AFRICA	procymidone	0.1	5
60652	INDIA	captan	0.03	3
		carbendazim	0.09	2

Table 2:- Continued

Sample number.	Country of origin.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
61099	SPAIN	iprodione chlorpyrifos	0.48 0.11	10 0.5
<b>1.5.2.1. Strawberry</b>				
60618	SPAIN	dimethoate captan endosulfan-2 endosulfan-1 endosulfate procymidone carbendazim thiabendazole	0.65 0.08 0.04 0.02 0.01 0.16 0.68 0.19	1 3 No MRL No MRL No MRL 5 No MRL 5
61044	BELGIUM	tolyfluanid	0.06	No MRL
61140	HOLLAND	iprodione	0.19	10
61158	AUSTRALIA	endosulfate iprodione captan carbendazim	0.06 0.25 0.79 0.12	1 10 3 2
61163	BELGIUM	brompropylate iprodione	0.31 0.39	5 10
<b>1.5.4.1. Blackcurrant</b>				
61094	IRELAND	chlorothalonil endosulfate	0.01 0.02	10 No MRL
61095	IRELAND	endosulfan-2 endosulfate	0.02 0.01	No MRL No MRL
61096	IRELAND	endosulfan-2 chlorothalonil endosulfate	0.05 2.3 0.07	No MRL 10 No MRL
61112	IRELAND	chlorothalonil cypermethrin	0.2 0.05	10 0.05
61113	IRELAND	endosulfan-1 endosulfan-2 endosulfate chlorothalonil tolyluanid	0.03 0.15 0.08 4.1 0.02	99999 No MRL No MRL 10 No MRL
<b>1.5.4.2. Blueberry</b>				
60619	CHILE	captan <u>carbendazim</u>	0.36 <u>0.15</u>	3 <u>0.1</u>
<b>1.6. Miscellaneous Fruit.</b>				
<b>1.6.2. Banana</b>				
61133	COLOMBIA	thiabendazole	1.3	3
61152	UNITED STATES	thiabendazole	0.91	3
61162	COLOMBIA	thiabendazole	0.07	3

Table 2:- Continued

Sample number.	Country of origin.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
<b>1.6.5. Kiwi</b>				
60574	ITALY	vinclozolin	1.3	10
60640	ITALY	vinclozolin	2.0	10
<b>1.6.6. Mango</b>				
61009	AFRICA	pp-DDT	0.02	0.05
		pp-DDD	0.02	0.05
<b>2. Vegetables.</b>				
<b>2.1. Root &amp; Tuber Vegetables</b>				
<b>2.1.1. Carrots.</b>				
60583	IRELAND	triazophos	0.18	1
61024	FRANCE	binapacryl	0.05	0.05
61089	IRELAND	chlorfenvinphos	0.12	0.5
61097	IRELAND	chlorfenvinphos	0.04	0.5
61106	IRELAND	triazophos	0.04	1
<b>2.1.3. Parsnip</b>				
60617	IRELAND	chlorfenvinphos	0.08	0.5
<b>2.3. Fruiting Vegetables.</b>				
<b>2.3.1. Solanacea</b>				
<b>2.3.1.1. Aubergine</b>				
60588	SPAIN	chlorothalonil	0.05	2
<b>2.3.1.2. Pepper</b>				
60581	SPAIN	vinclozolin	0.04	3
		malathion	0.11	3
		<b>methamidophos</b>	<b>0.35</b>	<b>0.01</b>
<b>2.3.1.3. Tomato</b>				
60579	SPAIN	chlorothalonil	0.06	2
60597	SPAIN	brompropylate	0.08	1
<b>2.3.2. Cucurbits (edible peel)</b>				
<b>2.3.2.1. Cucumber</b>				
60606	SPAIN	carbendazim	0.05	0.5
		methamidophos	0.10	1
61090	HOLLAND	tolyfluanid	0.03	No MRL
61103	HOLLAND	procymidone	0.07	1
<b>2.3.3. Cucurbits (inedible peel)</b>				
<b>2.3.3.1. Melon</b>				
60632	BRAZIL	endosulfate	0.07	1
<b>2.4. Brassica Vegetables.</b>				
<b>2.4.2. Head Brassicas</b>				
<b>2.4.2.2. Head Cabbage.</b>				
61001	SPAIN	chlorothalonil	0.16	3
61019	IRELAND	demeton-S-methyl-sulfone	0.06	0.5
		cypermethrin	0.08	0.5
<b>61029</b>	<b>IRELAND</b>	<b>demeton-S-methyl-sulfone</b>	<b>0.72</b>	<b>0.5</b>

Table 2:- Continued

Sample number.	Country of origin.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
61091	IRELAND	cypermethrin	0.45	0.5
		chlorpyrifos	0.07	1
61104	IRELAND	cypermethrin	0.13	0.5
61128	IRELAND	thiabendazole	0.05	No MRL
		thiabendazole	0.05	No MRL
<b>2.5. Leafy Vegetables. 2.5.1. Lettuce &amp; Similar. 2.5.1.1. Lettuce.</b>				
60575	FRANCE	procymidone	3.9	5
60584	UK	iprodione	3.4	10
60591	SPAIN	dichlofluanid	0.15	10
		procymidone	0.52	5
61004	IRELAND	tolclofos-methyl	2.4	No MRL
		deltamethrin	0.11	0.5
61023	IRELAND	dimethoate	0.06	1
61045	IRELAND	quintozene	0.06	No MRL
		folpet	0.02	2
61131	IRELAND	iprodione	0.09	10
<b>2.5.2. Spinach &amp; Similar. 2.5.2.1. Spinach.</b>				
61130	IRELAND	cypermethrin	0.04	0.5
		omethoate	0.16	0.5
		dimethoate	0.05	1
<b>2.6. Legume Vegetables. 2.6.2. Peas 2.6.2.1. Mangetout.</b>				
60605	GUATEMALA	chlorothalonil	0.17	2
<b>2.7. Stem Vegetables 2.7.2. Celery</b>				
<u>60570</u>	<u>SPAIN</u>	<u>procymidone</u>	<u>0.42</u>	<u>0.02</u>
<u>60590</u>	<u>SPAIN</u>	<u>vinclozolin</u>	<u>0.06</u>	<u>0.05</u>
		chlorothalonil	0.09	10
<b>2.7.3. Fennel</b>				
<u>60572</u>	<u>FRANCE</u>	<u>vinclozolin</u>	<u>0.18</u>	<u>0.05</u>
<u>60627</u>	<u>FRANCE</u>	<u>vinclozolin</u>	<u>0.24</u>	<u>0.05</u>
<b>2.11. Potatoes</b>				
60645	IRELAND	tecnazene	0.03	No MRL.

## ii Targeted Sampling Programme

Targeted sampling of domestically produced cabbage, which through the routine monitoring programme was found to contain residues above a prescribed MRL, was carried out as part of the violation investigation programme (Table 3). The sample analysed was from the next production cycle of the producer involved and no residues were detected in the sample analysed. In the case of fennel, from France, a follow up sample, when

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analysed, was found to contain residues of vinclozolin in excess of the MRL. The consignment of fennel was destroyed.

Three further consignments of imported produce (2 pepper and one celery), which previously had been found to be in breach of established MRLs, did not, on analysis, contain any pesticide residues in excess of current MRL's during 2000.

As part of the continuing programme for the investigation of violations, future consignments of food commodities which were found to contain pesticide residues in excess of the MRLs in 1999 and 2000 will be targeted for sampling and analysis. When statutory samples are taken the produce will be seized pending analysis to allow the produce to be removed from the market if the MRL is exceeded. Future consignments of Irish cabbage from the grower of the produce found to contain excessive residues during 2000 will be subjected to particular scrutiny in 2001.

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**Table 3:- Pesticide residues detected in targeted samples of fruit and vegetables, 2000**

Commodity	Sample number	Follow up to sample number	Country of origin	Residue detected	Residue (mg/kg)	MRL (mg/kg)
Cabbage	61114	61029	Ireland	none	0	0
Celery	60628	60570	Spain	none	0	0
Fennel	60627	60572	France	<b>vinclozolin</b>	<b>0.24</b>	<b>0.05</b>
Pepper	60601	60581	Spain	none	0	0
Pepper	60602	60581	Spain	none	0	0

### **iii Sampling of vegetable crops produced by growers participating in the *An Bord Glas Quality Programme***

The *An Bord Glas Quality Programme* is targeted at both growers and pre-packers of fresh produce. It encompasses all the main sectors of production, including field vegetables, mushrooms, soft and top fruit, protected crops and potatoes. Participation involves implementation of quality systems designed to ensure that horticultural produce is produced and handled in accordance with best practices and procedures and complies with current regulatory requirements. The standards established are outlined in a series of Quality Manuals tailored to the specific needs of the individual sectors of the horticultural industry.

Participants in the *An Bord Glas Quality Programme* are independently audited to assess compliance with the standards specified in the relevant Quality Manual(s).

During 2000, some 142 samples of fruit and vegetables were taken by An Bord Glas personnel from crops grown by or pre-packed by participants in the *An Bord Glas Quality Programme*. The samples were taken following harvest at point of packaging or assembly and were dispatched using a courier service to an accredited laboratory for analysis. The samples were analysed for up to 97 pesticides and metabolites (Annex X). The results obtained (Annex XI) demonstrate that vegetables produced by growers participating in the *An Bord Glas Quality Programme* have a low pesticide residue content. Only 22.5% of samples submitted for analysis were found to contain pesticide residues and only one sample, a sample of cabbage, was found to contain a residue of the pesticide omethoate in excess of the MRL.

## B CEREALS

### i Routine Monitoring Programme

In 2000, 13 samples (12 of rice) of imported, blended or of unknown origin were analysed for residues of 89 pesticides and metabolites (Annex V). None of the samples analysed contained detectable pesticide residues (Table 4). MRLs have been established for 42 compounds not yet included in the monitoring programme.

**Table 4:- Cereal samples analysed for their pesticide residues content in 2000**

Commodity	No. Samples Analysed	No. Domestic Samples	No. Imported* Samples	Residues		
				> MRL	≤ MRL	ND
Wheat wholemeal	1	0	1	0	0	1
Rice grain	12	0	12	0	0	12
<b>Totals</b>	<b>13</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>13</b>

\* includes samples from consignments of unknown origin

ND = No residue detected

### ii Targeted Sampling Programme

As there were no violations of MRLs in 1997, 1998 or in 1999, targeted sampling of cereals and cereal products was not undertaken in 2000.

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## C FOOD OF ANIMAL ORIGIN

The monitoring programme in place is restricted to the sampling and analysis of fresh meat, milk and dairy products of Irish origin. Bovine meat (57 fat samples), ovine meat (49 fat samples) and porcine meat (85 fat samples) were analysed for residues of 56 pesticides, metabolites and polychlorinated biphenyl (PCB) congeners [ no's 28, 52, 101, 118, 138, 153 and 180.] (Annex VI). Venison (24 fat samples) and poultry meat (33 fat samples) were analysed for residues of 31 organochlorine pesticides, metabolites and PCB congeners. (Annex VII). 56 samples of dairy produce were analysed for 50 pesticides and metabolites (Annex VIII).

MRL's have been established for 27 of the compounds included in the monitoring programme. 43 compounds for which MRLs have been established are not yet included in the monitoring programme. Samples are also analysed, as indicated above, for residues of the environmental contaminants polychlorinated biphenyls (PCB's). PCB's are persistent organochlorine compounds and are included in the residue monitoring programme due to concerns associated with their presence in food and due to their links with polychlorinated dibenzodioxins.

### 1 Bovine Meat

#### i Routine Monitoring Programme

Details of the analytical results obtained are presented in Table 5. Some 5.3% of samples analysed contained detectable residues of DDT (as metabolite ppDDE), and 1.8% of samples contained trace residues of PCB (PCB congeners 138 and 180). The residue levels detected are of no relevance from a consumer safety viewpoint. The DDT residues reflect background levels in soil as a consequence of the former use of this pesticide or intake through feed of residual traces present in feeding stuffs. Generally, the quantities detected and reported reflect the sensitivity of the analytical methodologies currently used. During 2000 the analytical method used to determine PCB residues was modified by changing the reference standard from a commercial PCB mixture ( Alachlor 1248 ) to a mixture containing 7 PCB congeners [PCB 28, 52, 101, 118, 138, 153 and 180]. This modification targets the analysis of samples for the specific congeners indicated and enables the detection and quantification of these congeners at a level far lower than previously possible. The detection of residues of the 138 and 180 PCB congeners in 2000 reflects the sensitivity of the modified analytical procedure.

**Table 5:- Pesticide residues detected in bovine kidney fat in 2000**

Sample number	Country of origin	Residue detected	Residue (mg/kg fat)	MRL (mg/kg fat)
65284	Ireland	pcb138	0.01	No MRL.
65284	Ireland	pcb180	0.01	No MRL.
65289	Ireland	ppDDT	0.006	1
65291	Ireland	ppDDT	0.007	1
65372	Ireland	ppDDT	0.005	1

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## ii Targeted Sampling Programme

As there were no violations of MRLs in the past number of years, targeted sampling of samples of bovine meat was not undertaken in 2000

## 2 Ovine Meat

### i Routine Monitoring Programme

Details of the analytical results obtained are presented in Table 6. Some 33% of samples contained detectable residues. Residues of 5 different pesticides were detected. MRLs have been established for 4 of those compounds. One sample contained residues of 3 pesticides, two samples contained residues of 2 pesticides and 12 samples contained a residue of a single pesticide. The residue levels detected were lower than the relevant MRLs and are of no relevance from a consumer safety viewpoint. The quantities detected and reported reflect the sensitivity of the analytical methodologies currently used.

The residues detected were DDT (12% of samples), HCB (12% of samples), dicofol (4% of samples), diazinon (6% of samples) and lindane (6% of samples). In most cases, the levels found reflect background levels present in soil as a consequence of the former use of the compounds concerned or intake through feed of residual traces present in imported constituents of these feeding stuffs. The presence of diazinon is consistent with the use of an eco-parasiticide for the control of blow-fly, keds, lice, sheep scab and ticks.

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**Table 6:- Pesticide residues detected in ovine kidney fat in 2000**

Sample number	Country of origin	Residue detected	Residue (mg/kg fat)	MRL (mg/kg fat)
65432	Ireland	HCB	0.006	0.2
65438	Ireland	HCB	0.006	0.2
65439	Ireland	HCB	0.006	0.2
	Ireland	lindane	0.001	2
	Ireland	ppDDE	0.008	1
65440	Ireland	ppDDE	0.007	1
65441	Ireland	ppDDE	0.01	1
65442	Ireland	ppDDE	0.005	1
65445	Ireland	HCB	0.005	0.2
65446	Ireland	HCB	0.005	0.2
65447	Ireland	ppDDE	0.01	1
	Ireland	dicofol	0.006	0.5
65448	Ireland	HCB	0.005	0.2
65451	Ireland	ppDDE	0.01	1
65454	Ireland	lindane	0.006	2
65455	Ireland	dicofol	0.01	0.5
	Ireland	lindane	0.005	2.0
65464	Ireland	diazinon	0.31	No MRL.
65516	Ireland	diazinon	0.11	No MRL
69061	Ireland	diazinon	0.05	No MRL.

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**ii Targeted Sampling Programme**

As there were no violations of MRLs in the past number of years, targeted sampling of samples of ovine meat was not undertaken in 2000.

**3 Porcine Meat****i Routine Monitoring Programme**

Details of the analytical results obtained are presented in Table 7. Twelve samples (14%) contained detectable residues, none of which contained residues in excess of the MRLs. Residues of 2 different pesticides, lindane and dicofol, were detected. MRLs have been established for both of the compounds detected.

Residues of dicofol (twelve samples) and of lindane (one sample) were detected in the samples analysed. The levels found are thought to reflect the intake of residual traces of these pesticides through the consumption of feeding stuffs containing imported ingredients. Care is required to ensure that residues of dicofol in the individual food ingredients used to formulate the feeding stuff are not present at a level which will result in the MRL for dicofol in porcine meat being exceeded.

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**Table 7:- Pesticide residues detected in porcine kidney fat in 2000**

Sample number	Country of origin	Residue detected	Residue (mg/kg fat)	MRL (mg/kg fat)
65309	Ireland	dicofol	0.02	0.05
65310	Ireland	dicofol	0.006	0.05
65311	Ireland	dicofol	0.005	0.05
65328	Ireland	dicofol	0.005	0.05
65329	Ireland	dicofol	0.005	0.05
65330	Ireland	dicofol	0.006	0.05
65331	Ireland	dicofol	0.006	0.05
65332	Ireland	dicofol	0.008	0.05
65333	Ireland	dicofol	0.008	0.05
65334	Ireland	dicofol	0.006	0.05
65335	Ireland	dicofol	0.007	0.05
65511	Ireland	dicofol	0.007	0.05
	Ireland	lindane	0.04	1

**ii Targeted Sampling Programme**

There were no violations of MRLs in either 1997 or in 1999. The likely source of the dicofol residues detected in 1998 which were in excess of the MRL was considered to be from the incorporation of citrus pulp into pig feedingstuffs. It is considered that this is also the source of the dicofol residues detected in 2000. These residues are not problematic from a consumer health point of view but may result in trade difficulties since the MRL for

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dicofol in pig meat is set at 0.05 mg/kg. The presence of elevated residue levels in citrus pulp, which is incorporated into pig meal, may result in the MRL for dicofol being exceeded again in porcine meat.

#### **4 Dairy Products**

##### **i Routine Monitoring Programme**

56 samples of milk were analysed. None of the samples analysed contained any detectable pesticide residues from the current screen.

##### **ii Targeted Sampling Programme**

As there were no violations of MRLs for a number of years, targeted sampling of samples of dairy produce was not undertaken in 2000.

#### **5. Venison**

Details of the analytical results obtained are presented in Table 8. Twenty four samples of venison were analysed for pesticide residues. Four samples (16.7%) contained detectable residues of HCB but none exceeded the MRL for HCB.

**Table 8:- Pesticide residues detected in venison fat in 2000**

<b>Sample number</b>	<b>Country of origin</b>	<b>Residue detected</b>	<b>Residue (mg/kg fat)</b>	<b>MRL (mg/kg fat)</b>
65549	Ireland	HCB	0.006	0.2
65551	Ireland	HCB	0.006	0.2
65555	Ireland	HCB	0.006	0.2
65557	Ireland	HCB	0.006	0.2

#### **6. Poultry**

Details of the analytical results obtained are presented in Table 9. Thirty three samples of poultry fat were analysed for pesticide residues . One sample (3.0%) contained a detectable residue which did not exceed an MRL.

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**Table 9:- Pesticide residues detected in poultry fat in 2000**

Sample number	Country of origin	Residue detected	Residue (mg/kg fat)	MRL (mg/kg fat)
65534	Ireland	dieldrin	0.006	0.2

#### D MISCELLANEOUS SAMPLES

One miscellaneous sample was submitted for analysis (Table 10). The sample concerned, a sample of humus of United Kingdom origin, did not contain any detectable pesticide residues.

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**Table 10:- Results of analyses of miscellaneous samples submitted in 2000**

Sample number	Country of origin	Residue detected	Residue (mg/kg)	MRL (mg/kg)
69057	UK (Humus)	None		

## CONCLUSIONS

### A INTRODUCTION

When assessing the impact for consumers of exposure through diet to pesticide residues, it is appropriate to consider the effects of both chronic exposure and acute exposure. For the purposes of assessing the effects of chronic exposure, the level of exposure over a lifetime and the likely effects on health of such exposure must be considered. The techniques necessary for such assessments are well developed and involve consideration of the highest levels of exposure likely (97.5 percentile intake levels) in relation to the acceptable daily intake (ADI) values established for individual pesticides. ADI values, which are a measure of the maximum level of intake over a lifetime adjudged to result in no adverse toxicological effects, include a safety factor to ensure that the elderly, infants and children, and those whose systems are under stress because of illness are protected.

For the purposes of assessing the effects of acute exposure, the level of exposure likely over a single day or a single meal and the effects on health of such exposure must be considered. The techniques necessary for such assessments are less well developed than those relating to chronic exposure. For commodities consisting of large sized units (*e.g.* melons) or medium sized units (*e.g.* citrus and pome fruit), it is necessary that the variability of residues in individual commodity units be taken into account. For that purpose a variability factor “v” must be applied to the maximum residue levels detected in composite samples analysed<sup>12</sup>. In assessing the effects of acute exposure, the level of exposure must be

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<sup>12</sup> Food consumption and exposure assessment of chemicals. Report of a FAO/WHO consultation, Geneva, Switzerland, 10-14 February 1997, WHO/FSF/FOS/97.5.

considered in relation to the acute reference dose (ARfD) value established for individual pesticides. ARfD values, which are a measure of the maximum level of intake at one meal, or over a day, judged to result in no adverse toxicological effects, include a safety factor to ensure that the elderly, infants and children and those whose systems are under stress because of illness are protected. To date ARfD values have been established for only a few pesticides. Procedures are still under development particularly at the FAO/WHO Joint Meeting for Pesticide Residues (JMPR) and at EU level with a view to improving the procedures for the establishment of ARfD's.

## B ROUTINE MONITORING PROGRAMME

Inspection of the routine monitoring results for the year, which involved the analysis of some 551 samples (5 targeted samples were also taken), shows that some 29.7% of samples analysed contained quantifiable pesticide residues and 1.3% contained residues in excess of the statutory MRLs (Table 11). The levels present in most samples found to contain residues were extremely low. The presence of residues in such low levels reflects the sensitivity of current analytical techniques. These results, like those obtained in previous years, show that a significant proportion of the samples analysed contain pesticide residues but that the levels present are generally very low.

An assessment of the relationship between ADIs and the level of residues in samples exceeding established MRLs (Table 12) demonstrates the extent of the risks associated with dietary intake of such residues. The intake figures used for individual commodities are the 97.5 percentile intake figures of consumers of the relevant commodities, where available. Through use of such intake figures, all but the most extreme intake figures likely to arise, have been taken into account.

**Table 11:- Samples(routine) containing pesticide residues exceeding Maximum Residue Limits (MRLs) in 2000**

Commodity	Sample number	Country of origin	Residue detected	Residue (mg/kg)	MRL (mg/kg)
Blueberry	60619	Chile	carbendazim	0.72	0.5
Cabbage	61029	Ireland	demeton-S-methyl-sulfone	0.2	0.01
Celery	60590	Spain	vinclozolin	0.06	0.05
Celery	60570	Spain	procymidone	0.42	0.02
Fennel	60572	France	vinclozolin	0.18	0.05
Grapefruit	60641	Cyprus	thiabendazole	8.9	6.0
Pepper	60581	Spain	methamidofos	0.35	0.01

In the case of consumers represented by the 97.5 percentile level of intake, their health would only have been at risk if that level of residue intake was repeated every day for an extended period of time. Nevertheless, the fact that abuses can occur and that excessive residue levels are detected, points to the need for the continuation and strengthening of the monitoring and violation investigation programmes.

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The occurrence of one instance in which both the ADI and the ARfD for demeton-S-methyl sulfone was exceeded in a sample of cabbage is indicative of an incorrect use of a plant protection product containing oxydemeton-methyl which can be metabolised to demeton-S-methyl sulfone and is a matter of concern. This is further complicated by the fact that the MRL for demeton-S-methyl sulfone is old and is in urgent need of review. The exceedance of the ADI for demeton-S-methyl-sulfone is not considered to be serious in that the risk of chronic effects would only arise if exposure at such levels was continued for an extended period of time. This is not considered to be likely.

The exceedance of the ARfD is of greater concern from a consumer point of view but is still not considered to present a major risk to the consumer. This conclusion is based on the calculations which use a variability factor of 5 and the 97.5% percentile consumption intake of cabbage. The use of the variability factor of 5 is based on the assumption that a consumer may be exposed to x5 greater concentration of the pesticide than that detected in the cabbage sample analysed. This is based on the proposition that pesticide residues may not be equally distributed across the 5 heads of cabbage taken for analysis and that all of the residue may be concentrated in the one head of cabbage consumed. There is no internationally accepted ARfD for demeton-S-methyl sulfone so an estimated ARfD of (0.0006 mg/kg bw/day) was used in the assessment of the acute intake.

The need to urgently review the demeton group of pesticides has been recognised at both EU and CODEX levels. Oxydemeton-methyl is soon to be reviewed in the EU in accordance with the requirements of directive 91/414/EEC.



**Table 12:- Relationship between excessive residue levels found and the ADI and ARfD levels for humans**

Commodity-Pesticide	MRL mg/kg	Residue mg/kg	ADI mg/kg bw/day	ARfD mg/kg bw/day	Commodity Intake * g/person/day	Pesticide Intake † mg/kg	Portion of ADI Accounted For %	Variability Factor	Portion ARfD accounted For %
Cabbage- demeton-S- methyl sulfone	0.5	0.72	0.0003	0.0006	57 (36 for raw cabbage)	0.0007	222	5	360
Pepper- methamidophos	0.01	0.35	0.004	0.004	18	0.0001	2.5	7	17.5
Celery-procymidone	0.02	0.42	0.01		33	0.0002	<1		
Celery -vinclozolin	0.02	0.06	0.01		33	0.00003	< 1		
Fennel - vinclozolin	0.02	0.18	0.01		3 #	0.000008	< 1		
Fennel - vinclozolin	0.02	0.24	0.01		3 #	0.000012	< 1		
Blueberry - carbendazim	0.1	0.15	0.03		3 #	0.000008	< 1		
Grapefruit – thiabendazole	6.0	8.9	0.1		324	0.05	50		

\* 97.5 percentile level of intake, derived through analysis of the results of the Irish National Nutrition Survey, 1990

† assuming body weight to be 60 kg and that all the residue survives preparation for consumption and/or is in the edible portion

# in the absence of data, an estimated intake level of 3 g per person per day was used

‡ in the absence of data, the 97.5 percentile intake was estimated by multiplying average intake by 3

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The results of the monitoring programme indicate a need to:

- i increase the number of pesticides being analysed;**
- ii broaden the range of commodities sampled and analysed;**
- iii increase the number of samples analysed; and**
- iv extend the range of pesticides for which MRLs are established.**
- v reduce the time period between sample receipt in the laboratory and the results of the analysis.**

The expansion of the routine monitoring programme through increasing the number of pesticides determined, through extending the range of commodities sampled (*e.g.* meat samples taken at abattoirs, poultry and eggs, animal feedingstuffs) and through increasing the number of samples analysed requires a major investment in personnel and equipment. Planning is currently at an advanced stage to expand the capacity of the laboratory and it is expected that additional staff will be recruited before the end of 2001. Following their training in laboratory procedures, it is believed that these new recruits will begin to have a significant effect on laboratory output in 2002.

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## **C VIOLATION INVESTIGATION PROGRAMME**

Targeted sampling of produce found to be in breach of established MRLs is the prime means of determining whether violations that occur result from the systematic misuse of pesticides or are isolated incidents. The repeated occurrence of excessive residue levels in particular food commodities, which would result in consumer safety being prejudiced, is clearly unacceptable. The violation investigation programme is geared to eliminate any such abuses. The programme is also designed to ensure that isolated incidents of excessive residues are not repeated.

In 2000 five statutory samples were taken as part of the targeted sampling of suspect fruit and vegetables. Statutory samples of celery, fennel, peppers (x2) and cabbage were taken for analysis. In one instance (fennel) a residue of vinclozolin in excess of the MRL was detected (Table 3). The consignment was destroyed, at the owners expense, to prevent it being supplied to consumers.

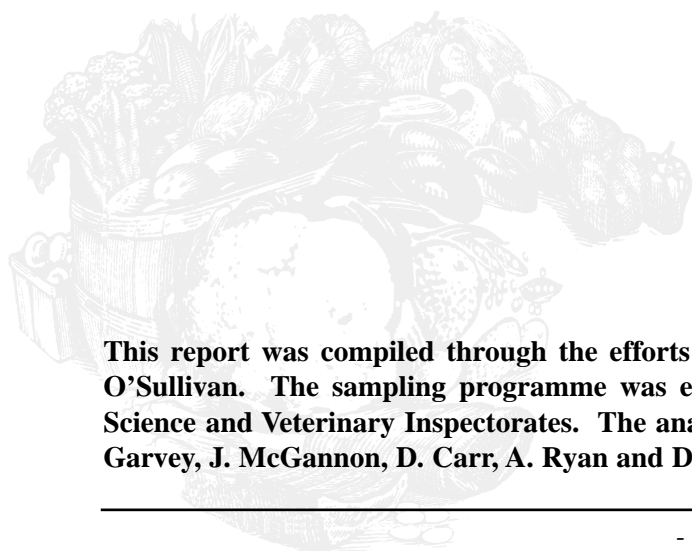
With the exception of the instance described above, detailed examination of the results of the monitoring programmes for 2000, together with a detailed examination of the results of the analyses of targeted samples (Table 3) and of the results obtained in previous years, confirms that the majority of the breaches of MRLs detected do not involve risks for consumers.

The occurrence of isolated instances of excessive residue levels is a matter of concern. The findings reported are indicative of a need to further develop follow-up procedures for the investigation of violations of established MRLs. It is also necessary that educational and training programmes relating to the safe and responsible use of pesticides be continued and strengthened. In 2000 some 12 seminars were given for growers, Teagasc advisers and other extension workers.

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## D CONCLUDING REMARKS

The Department of Agriculture, Food and Rural Development and the Food Safety Authority of Ireland continue to be committed to the strengthening of the pesticide residue monitoring programmes, thereby, insofar as pesticide residues are concerned, ensuring the safety of food for consumers and ensuring the quality of produce offered for sale.



**This report was compiled through the efforts of M. Lynch, D Sheridan, M. B. Dolan and D. O'Sullivan. The sampling programme was effected by P. Carey and members of the Dairy Science and Veterinary Inspectorates. The analytical results were generated by B. McHugh, J. Garvey, J. McGannon, D. Carr, A. Ryan and D. Harris.**

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**ANNEX I REGULATIONS FIXING MAXIMUM LEVELS FOR PESTICIDE RESIDUES IN AGRICULTURAL PRODUCE**

- 1 European Communities (Pesticide Residues) (Fruit and Vegetables) Regulations 1989, S.I. No. 105 of 1989
- 2 European Communities (Pesticide Residues) (Fruit and Vegetables) (Amendment) Regulations 1997, S.I. No. 218 of 1997
- 3 European Communities (Pesticide Residues) (Fruit and Vegetables) (Amendment) Regulations 1998, S.I. No. 563 of 1998
- 4 European Communities (Pesticide Residues) (Feedingstuffs) Regulations 1992, S.I. No. 40 of 1992
- 5 European Communities (Pesticide Residues) (Products of Plant Origin, including Fruit and Vegetables) Regulations 1999, S.I. No. 179 of 1999
- 6 European Communities (Pesticide Residues) (Products of Plant Origin, including Fruit and Vegetables) (Amendment) Regulations 1999, S.I. No. 458 of 1999
- 7 European Communities (Pesticide Residues) (Foodstuffs of Animal Origin) Regulations 1999, S.I. No. 180 of 1999
- 8 European Communities (Pesticide Residues) (Foodstuffs of Animal Origin) (Amendment) Regulations 1999, S.I. No. 460 of 1999
- 9 European Communities (Pesticide Residues) (Cereals) Regulations 1999, S.I. No. 181 of 1999
- 10 European Communities (Pesticide Residues) (Cereals) (Amendment) Regulations 1999, S.I. No. 459 of 1999



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## ANNEX II EC DIRECTIVES FIXING MAXIMUM LEVELS FOR PESTICIDE RESIDUES IN AGRICULTURAL PRODUCE

- 1 Council Directive of 23 November 1976 relating to the fixing of maximum levels for pesticide residues in and on fruit and vegetables. (76/895/EEC) OJ No. L340 of 9.12.1976,

and amending Directives -

79/700/EEC of 24 July 1979	OJ No. L207 of 15.8.1979
80/428/EEC of 28 March 1980	OJ No. L102 of 19.4.1980
81/36/EEC of 9 February 1981	OJ No. L46 of 19.2.1981
82/528/EEC of 19 July 1982	OJ No. L234 of 9.8.1982
88/298/EEC of 16 May 1988	OJ No. L126 of 20.5.1988
89/186/EEC of 6 March 1989	OJ No. L66 of 10.3.1989
93/58/EEC of 29 June 1993	OJ No. L211 of 23.8.1993
Corrigendum to 93/58/EEC	OJ No. L219 of 24.8.1994
96/32/EC of 21 May 1996	OJ No. L144 of 18.6.1996
97/41/EC of 25 June 1997	OJ No. L184 of 12.7.1997

- 2 Council Directive of 24 July 1986 on the fixing of maximum levels for pesticide residues in and on cereals. (86/362/EEC) OJ No. 221 of 7.8.1986

and amending Directives -

88/298/EEC of 16 May 1988	OJ No. L126 of 20.5.1988
93/57/EEC of 29 June 1993	OJ No. L211 of 23.8.1993
94/29/EC of 23 June 1994	OJ No. L189 of 23.7.1994
95/39/EC of 17 July 1995	OJ No. L197 of 22.8.1995
Corrigendum to 95/39/EC	OJ No. L164 of 3.7.1996
96/33/EC of 21 May 1996	OJ No. L144 of 18.6.1996
97/41/EC of 25 June 1997	OJ No. L184 of 12.7.1997
97/71/EC of 15 December 1997	OJ No. L347 of 18.12.1997
98/82/EC of 27 October 1998	OJ No. L290 of 29.10.1998
1999/65/EC of 24 June 1999	OJ No. L172 of 8.7.1999
1999/71/EC of 14 July 1999	OJ No. L194 of 27.7.1999

- 3 Council Directive of 24 July 1986 on the fixing of maximum levels for pesticide residues in and on foodstuffs of animal origin. (86/363/EEC) OJ No. L221 of 7.8.1986

and amending Directives -

93/57/EEC of 29 June 1993	OJ No. L211 of 23.8.1993
94/29/EC of 23 June 1994	OJ No. L189 of 23.7.1994
95/39/EC of 17 July 1995	OJ No. L197 of 22.8.1995
Corrigendum of 95/39/EC	OJ No. L164 of 3.7.1996
96/33/EC of 21 May 1996	OJ No. L144 of 18.6.1996
97/41/EC of 25 June 1997	OJ No. L184 of 12.7.1997
97/71/EC of 15 December 1997	OJ No. L347 of 18.12.1997
98/82/EC of 27 October 1998	OJ No. L290 of 29.10.1998
1999/71/EC of 14 July 1999	OJ No. L194 of 27.7.1999

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## ANNEX II Continued

- 4 Council Directive of 27 November 1990 on the fixing of maximum levels for pesticide residues in an on certain products of plant origin, including fruit and vegetables. (90/642/EEC) OJ No. L350 of 14.12.1990

and amending Directives -

93/58/EEC of 29 June 1993	OJ No. L211 of 23.8.1993
Corrigendum to 93/58 EEC	OJ No. L219 of 24.8.1994
94/30/EC of 23 June 1994	OJ No. L189 of 23.7.1994
95/38/EC of 17 July 1995	OJ No. L197 of 22.8.1995
Corrigendum to 95/38/EEC	OJ No. L155 of 28.6.1996
95/61/EC of 29 November 1995	OJ No. L292 of 7.12.1995
96/32/EC of 21 May 1996	OJ No. L144 of 18.6.1996
97/41/EC of 25 June 1997	OJ No. L184 of 12.7.1997
97/71/EC of 15 December 1997	OJ No. L347 of 18.12.1997
98/82/EC of 27 October 1998	OJ No. L290 of 29.10.1998
1999/65/EC of 24 June 1999	OJ No. L172 of 8.7.1999
1999/71/EC of 14 July 1999	OJ No. L194 of 27.7.1999

- 5 Council Directive of 4 March 1991, amending Directive 74/63/EEC on undesirable substances and products in animal nutrition. (91/132/EEC) OJ No. L66 of 13.3.1991



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## ANNEX III GLOSSARY OF TERMS

**Acceptable Daily Intake (ADI)** An ADI is an estimate of the amount of a residue in food or drinking water, expressed on a body weight basis, that can be ingested daily over a lifetime without appreciable health risk.

The particular vulnerability of infants, children, the elderly and those whose systems are under stress because of ill-health, are taken into account, through application of a safety factor, when ADI values are established.

ADI values are based on the no-adverse-effect level in the most sensitive animal species used in the toxicological experiments, or if appropriate data are available, in humans. Invariably, a safety factor to account for inter-species and intra-species variations, is applied. Studies used as a basis for the identification of the relevant no-adverse-effect levels and hence for deriving ADI values, are conducted using active substance as manufactured. Accordingly the toxicological effects of impurities present in active substances are included in the assessment. Account is also taken of metabolites that may influence the toxicological significance of the residue reaching the consumer.

**Acute Reference Dose (ARfD)** An ARfD is similar in nature to an ADI but it relates to intake of residues at one meal or on one day.

The particular vulnerability of infants, children, the elderly and those whose systems are under stress because of ill-health, are taken into account, through application of a safety factor, when ARfD values are established.

ARfD values are based on the no-adverse effect level in the most sensitive animal species used in the toxicological experimentation, or if appropriate data are available, in humans. ARfD values are derived from the results of those toxicological studies that are most relevant to short term exposure.

**Good Agricultural Practice (GAP)** GAP in the use of a plant protection product (pesticide) includes authorized use under practical conditions necessary for effective control of harmful organisms. It encompasses a range of levels of application up to the highest level authorized, applied in a manner that leaves a residue that is the smallest amount practicable.

**Lowest Calibrated Level (LCL)** The lowest concentration of a pesticide residue with which the detection system is calibrated for the purposes of determining the presence or absence of measurable residues. It normally also serves to define the reporting limit for individual pesticide residues.

**Limit of Determination (LOD)** The LOD is the lowest concentration of a pesticide residue or contaminant that can be identified and quantitatively measured in a specified food, agricultural commodity or animal feed, with an acceptable degree of certainty by a method of analysis.

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Matrix Matched Calibration

A system involving use of calibration solutions to ensure that all constituents (other than the analyte) are similar to, or produce the same effect on analytical response as the equivalent solutions generated from the samples to be analyzed.

The objectives of matrix matched calibration are to compensate for analyte response enhancement or suppression effects induced by sample co-extractives and to provide a chromatogram which has underlying interference comparable to that of the sample.

Matrix blanks are prepared using solvents, reagents and clean-up procedures similar to those used for analysis of samples to be analyzed. In practice the pesticide is added to a blank extract of a matrix similar to that to be analyzed. The matrix used may differ from that of the samples if it is shown to achieve the stated objectives.

Maximum Residue Levels (MRLs)

An MRL is the maximum concentration of a pesticide residue, expressed in milligrams per kilogram, legally permitted in or on food commodities and animal feeds. MRLs are based on supervised residues trials data which reflect Good Agricultural Practice (GAP). MRLs established for particular food commodities are such that potential consumer exposure to residues are judged to be toxicologically acceptable.

MRLs are fixed at or about the limit of determination, where there are no approved uses.

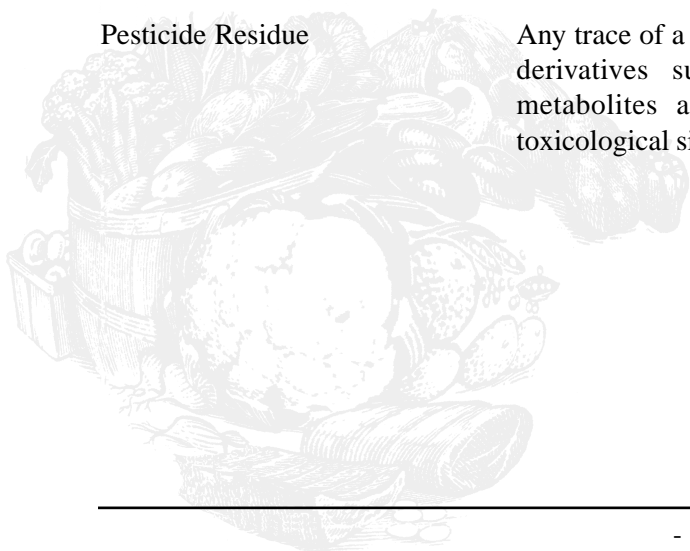
MRLs are established on the basis of sound scientific knowledge. They are only established for those pesticides for which acceptable daily intake (ADI) values exist

No-adverse-effect Level

The no-adverse-effect level is the highest level of continual exposure to a chemical which causes no significant adverse effect on morphology, biochemistry, functional capacity, growth, development or life span of individuals of the target species which may be animal or human.

Pesticide Residue

Any trace of a pesticide found in a sample, including any specified derivatives such as degradation and conversion products, metabolites and impurities, which are considered to be of toxicological significance and are included in the residue definition.



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## ANNEX IV ANALYTICAL METHODS AND PROCEDURES EMPLOYED FOR THE DETERMINATION OF PESTICIDE RESIDUES IN FOODSTUFFS

The methods of analysis currently used in the pesticide residue laboratory include those described hereunder.

- (i) Multi residue method 1, *Analytical Methods for Pesticide Residues in Foodstuffs*, 6th edition, 1996, General Inspectorate for Health Problems, Ministry of Public Health, Welfare and Sport, The Netherlands. The method is used to determine residues of organophosphorous, organochlorine and benzimidazole pesticides in food of plant origin.

Note: A variation of the method is used. The variation involves addition of sodium sulphate at the time of sample extraction to facilitate the extraction of polar organophosphorous pesticides.

- (ii) Multi residue method 1, Sub-method 4, *Dutch Analytical Methods for Pesticide Analysis*, 4th edition, 1985.
- (iii) The Becker method, *A multi residue method for the simultaneous determination of plant protection chemicals in plant material*, Dtsch. Lebensm. Rundsch. 75, 148-152, 1979, using a gel permeation column instead of the silica gel/activated charcoal column specified.
- (iv) The method in use for the determination of organochlorine and organophosphorous residues in samples of fat is based on clean-up method number 5 of the German Manual of Pesticide Residue Analysis (Volume 1 of 1987) and involves extraction with a mixture of acetonitrile and acetone, followed by clean-up using gel permeation chromatography column and alumina/silver nitrate micro columns.

A pulsed flame photometric detector (PFPD), is used for the detection and determination of organophosphorous residues in fruit and vegetables and in cereals. The use of that system results in lower levels of organophosphorous residues being detected than otherwise would be possible.

The method for the analysis of benzimidazole compounds in use is based on that developed by Hiemstra, M., J.A. Joosten and A. de Kok, J. AOAC Int. 78, 1267 -1274, 1995. A fully automated solid-phase extraction cleanup and an on-line liquid chromatographic system, using an UV detector, is used for the determination of the benzimidazole fungicides carbendazim, benomyl and thiophanate-methyl (determined as carbendazim) and thiabendazole, in fruit and vegetables -

LCL for benomyl, carbendazim and thiophanate-methyl 0.1 mg/kg

LCL for thiabendazole 0.05 mg/kg

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**Annex V Pesticides determined in Fruit, Vegetables and Cereals.**

<b>Organochlorine Compounds.</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram – ppm)</b>
aldrin	0.03
bifenthrin	0.07
binapacryl	0.04
brompropylate	0.04
captafol	0.02
captan**	0.03
$\alpha$ -chlordane	0.02
$\gamma$ -chlordane	0.03
chlorothalonil**	0.02
cyfluthrin	0.04
$\lambda$ -cyhalothrin	0.02
cypermethrin	0.07
deltamethrin**	0.05
pp' DDT	0.02
op' DDT	0.02
pp' DDE	0.02
op' DDE	0.03
pp' DDD	0.02
op' DDD	0.03
dichlofluanid	0.03
dicofol	0.04
dieldrin	0.02
$\alpha$ -endosulfan	0.02
$\beta$ -endosulfan	0.03
endosulfate	0.02
endrin	0.02
fenarimol	0.05
fenvalerate	0.06
folpet	0.02
HCB	0.02
$\alpha$ -HCH	0.02
$\beta$ -HCH	0.04
$\delta$ -HCH	0.02
heptachlor	0.02
heptachlor-epoxide	0.02
iprodione	0.07
lindane( $\gamma$ -HCH)	0.02
methoxychlor	0.04
permethrin **	0.2
procymidone	0.1
propryamid	0.1
quintozene	0.02
tecnazene	0.02
tetradifon	0.03
tolyfluanid	0.02
vinclozolin	0.02

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**ANNEX V continued**

<b>Organophosphorous and other Compounds.</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram – ppm)</b>
acephate	0.05
azinphos-methyl	0.1
azinphos-ethyl	0.1
bromophos-ethyl	0.05
bromophos-methyl	0.05
chlorfenvinphos	0.06
chlorpyrifos	0.06
chlorpyrifos-methyl	0.05
demeton-S-methyl sulfone	0.07
diazinon	0.05
dichlorvos	0.04
dimethoate	0.05
ethion	0.05
etrimfos	0.03
fenchlorphos	0.02
fenitrothion	0.05
fonofos	0.05
heptenophos	0.04
iodofenphos	0.04
isofenphos	0.05
malaixon	0.05
malathion	0.05
methacrifos	0.05
methamidophos**	0.04
methidathion	0.04
mevinphos	0.04
monocrotophos	0.06
omethoate**	0.05
paraoxon	0.05
paraoxon-methyl	0.04
parathion	0.05
parathion-methyl	0.04
phosalone	0.1
phosmet	0.1
phosphamidon	0.04
pirimifos-ethyl	0.05
pirimifos-methyl	0.05
propetamphos	0.05
quinalphos	0.04
tolclofos-methyl	0.05
triazophos	0.03
thiabendazole**	0.05
carbendazim**	0.05

\*\*= These pesticides are not included in the scope of the accreditation granted by NAB in 2000.

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**Annex VI Pesticides determined in Meat ( Bovine, Porcine and Ovine).**

**Organochlorine compounds & PCB congeners** **Lowest Calibrated Level (LCL)**  
**(in milligrams per kilogram of fat – ppm)**

aldrin	0.005
$\alpha$ -chlordane	0.005
$\gamma$ -chlordane	0.005
pp' DDT	0.005
op' DDT	0.005
pp' DDE	0.005
op' DDE	0.005
pp' DDD	0.01
op' DDD	0.005
dieldrin	0.005
dicofol	0.005
$\alpha$ -endosulfan	0.005
$\beta$ -endosulfan	0.005
endrin	0.005
HCB	0.005
$\alpha$ -HCH	0.005
$\beta$ -HCH	0.01
$\delta$ -HCH	0.005
heptachlor	0.005
heptachlor-epoxide	0.005
lindane ( $\gamma$ -HCH)	0.005
PCB 28	0.01
PCB 52	0.01
PCB 101	0.01
PCB 118	0.01
PCB 138	0.01
PCB 153	0.01
PCB 180	0.01
permethrin	0.04
quintozene	0.005
tecnazene	0.005

**Organophosphorous Compounds.** **Lowest Calibrated Level (LCL)**  
**(in milligrams per kilogram of fat – ppm)**

azinphos-ethyl	0.2
azinphos-methyl	0.2
bromophos-ethyl	0.1
bromophos-methyl	0.1
chlorfenvinphos	0.05
chlorpyrifos	0.05
chlorpyrifos-methyl	0.05

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**Annex VI continued**

<b>Organophosphorous Compounds.</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram of fat – ppm)</b>
diazinon	0.05
dichlorvos	0.05
dimethoate	0.05
ethion	0.05
fenchlorphos	0.05
fonofos	0.05
iodofenphos	0.1
malathion	0.05
methidathion	0.05
mevinphos	0.05
parathion	0.1
parathion-methyl	0.05
phorate	0.05
phosalone	0.2
pirimifos-ethyl	0.1
pirimifos-methyl	0.1
propetamphos	0.05
triazophos	0.1



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**Annex VII Pesticides determined in Poultry and Venison**

<b>Organochlorine compounds &amp; PCB congeners</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram of fat – ppm)</b>
aldrin	0.005
$\alpha$ -chlordane	0.005
$\gamma$ -chlordane	0.005
pp' DDT	0.005
op' DDT	0.005
pp' DDE	0.005
op' DDE	0.005
pp' DDD	0.01
op' DDD	0.005
dieldrin	0.005
dicofol	0.005
$\alpha$ -endosulfan	0.005
$\beta$ -endosulfan	0.005
endrin	0.005
HCB	0.005
$\alpha$ -HCH	0.005
$\beta$ -HCH	0.01
$\delta$ -HCH	0.005
heptachlor	0.005
heptachlor-epoxide	0.005
lindane ( $\gamma$ -HCH)	0.005
PCB 28	0.01
PCB 52	0.01
PCB 101	0.01
PCB 118	0.01
PCB 138	0.01
PCB 153	0.01
PCB 180	0.01
permethrin	0.04
quintozene	0.005
tecnazene	0.005



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**Annex VIII Pesticides determined in Milk**

<b>Organochlorine Compounds.</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram – ppm)</b>
aldrin	0.005
$\alpha$ -chlordane	0.005
$\gamma$ -chlordane	0.005
dieldrin	0.005
pp' DDT	0.005
op' DDT	0.005
pp' DDE	0.005
op' DDE	0.005
pp' DDD	0.005
op' DDD	0.005
Dicofol	0.01
$\alpha$ -endosulfan	0.005
$\beta$ -endosulfan	0.005
endrin	0.005
HCB	0.005
$\alpha$ -HCH	0.005
$\beta$ -HCH	0.01
$\delta$ -HCH	0.005
heptachlor	0.005
heptachlor-epoxide	0.005
lindane ( $\gamma$ -HCH)	0.005
permethrin	0.4
quintozene	0.005
tecnazene	0.005

<b>Organophosphorous Compounds.</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram – ppm)</b>
azinphos-ethyl	0.2
azinphos-methyl	0.2
bromophos-ethyl	0.1
bromophos-methyl	0.1
chlorfenvinphos	0.1
chlorpyrifos	0.1
chlorpyrifos-methyl	0.1
diazinon	0.1
dichlorvos	0.1
dimethoate	0.1
ethion	0.1
fenchlorphos	0.1
fonofos	0.1
iodofenphos	0.1
isofenphos	0.1
malathion	0.1
methidathion	0.1
mevinphos	0.1

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**Annex VIII continued.**

<b>Organophosphorous Compounds.</b>	<b>Lowest Calibrated Level (LCL) (in milligrams per kilogram – ppm)</b>
parathion	0.1
parathion-methyl	0.1
phorate	0.1
phosalone	0.2
pirimifos-ethyl	0.1
pirimifos-methyl	0.1
propetamphos	0.1
triazophos	0.1



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**ANNEX IX      SUMMARY OF THE RESULTS OF THE QUALITY ASSURANCE  
PROGRAMME FOR ANALYTICAL METHODS**

**1. Fruit and Vegetables**

Organochlorine pesticides

The results of the recovery studies carried out are presented in terms of percentage mean recovery, standard deviation of the mean recovery and coefficient of variation:

17 samples [11 pepper, 2 blackcurrant, 2 peas, 1 lemon, 1 apple] were spiked with an organochlorine pesticide mixture (Mix 1) containing 14 different pesticides.

<b>Mix 1</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
aldrin	0.012-0.016	99.3	10.51	10.59
captan	0.016	93.4	12.62	13.51
chlorothalonil	0.010-0.012	98.8	10.91	11.05
cypermethrin	0.041-0.044	99.9	10.06	10.07
deltamethrin	0.024-0.029	99.9	10.15	10.15
pp'DDD	0.012-0.013	97.9	7.12	7.27
pp'DDE	0.013	98.7	9.42	9.55
pp'DDT	0.011	97.9	9.18	9.37
endosulfan-1	0.011-0.016	96.2	9.07	9.43
endrin	0.011-0.012	97.7	8.03	8.22
HCB	0.011-0.013	96.0	9.92	10.33
lindane	0.011-0.015	97.8	9.84	10.05
methoxychlor	0.023-0.025	99.1	9.49	9.57
permethrin	0.131-0.138	97.5	7.76	7.96

7 samples [all of pepper] were spiked with a second organochlorine pesticide mixture (Mix 2) containing 13 different pesticides.

<b>Mix 2</b> Pesticide	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
cyfluthrin	0.026-0.032	99.48	7.57	7.61
op'DDD	0.015-0.016	98.00	5.48	5.59
op'DDE	0.013-0.016	103.14	19.11	18.53
op'DDT	0.013-0.013	98.71	6.63	6.71
dieldrin	0.011-0.012	98.57	7.87	7.99
endosulfate	0.012	98.71	4.42	4.48
fenvalerate	0.034-0.039	98.29	6.55	6.66
alpha-HCH	0.011-0.013	96.57	9.95	10.30
heptachlor	0.011-0.014	99.14	7.97	8.04
heptachlor-epoxide	0.011-0.012	98.57	6.70	6.80
iprodione	0.046-0.051	100.86	5.24	5.20
quintozone	0.01-0.013	98.14	9.04	9.22
tetradifon	0.013-0.016	96.86	4.88	5.04

8 samples [7 pepper,1 peas] were spiked with a third organochlorine pesticide mixture (Mix 3) containing 8 different pesticides.

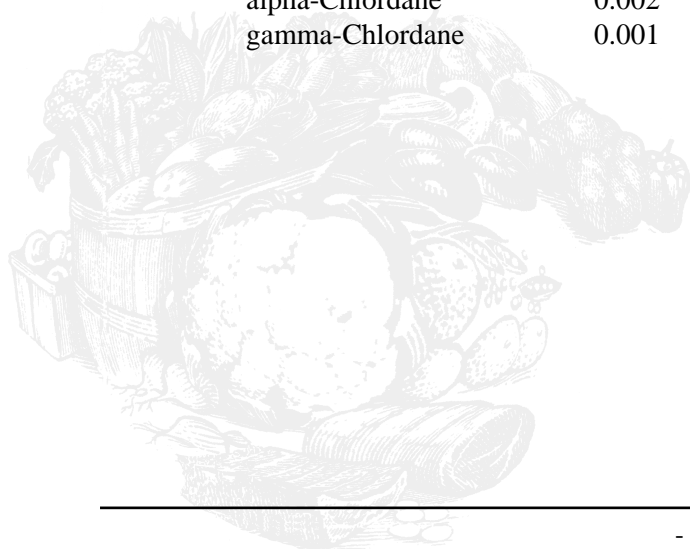
Mix 3 pesticide	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
captafol	0.013-0.017	93.63	7.61	8.13
dicofol	0.022-0.025	98.75	3.92	3.97
endosulfan-2	0.012-0.017	96.38	6.05	6.27
fenairimol	0.022-0.030	110.38	8.60	7.79
beta-HCH	0.027	98.88	6.79	6.87
delta-HCH	0.011	100.00	4.47	4.47
procymidone	0.064-0.072	97.88	5.25	5.36
tecnazene	0.011-0.013	96.88	6.03	6.23

6 samples [5 pepper,1 apple] were spiked with a fourth organochlorine pesticide mixture (Mix 4) containing 8 different pesticides.

Mix 4 Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
bifenthrin	0.042-0.045	94.22	8.28	8.79
binapacryl	0.022-0.024	100.24	5.52	5.51
bromoprylate	0.027-0.025	95.42	5.70	5.97
lambda-cyhalothrin	0.011-0.012	94.74	2.05	2.17
dichlofluanid	0.012-0.019	94.78	6.22	6.57
folpet	0.011-0.013	96.68	7.75	8.01
propyzamide	0.056-0.061	95.75	5.18	5.41
vinclozolin	0.011-0.013	97.22	6.53	6.71

One sample of Blackcurrant was spiked with an additional organochlorine pesticide mixture containing 2 different pesticides:-

Mix 5	Concentration (mg/Kg)	% Recovery
alpha-Chlordane	0.002	89
gamma-Chlordane	0.001	90



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### Organophosphorous pesticides

The results of the recovery studies carried out are presented in terms of percentage mean recovery, standard deviation of the mean recovery and co-efficient of variation: 15 samples [11 pepper, 2 blackcurrant, 1 lemon, 1 apple] were spiked with an organophosphorous pesticide mixture (Mix 20) containing 12 different pesticides.

<b>Mix 20</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
azinphos-methyl	0.549-0.567	95.40	6.13	6.42
chlorpyrifos	0.128-0.275	96.13	6.46	6.72
chlorfenvinphos	0.143-0.289	96.13	6.84	7.12
dimethoate	0.173-0.266	95.20	6.21	6.53
ethion	0.145-0.243	100.80	8.83	8.76
malathion	0.193-0.226	96.40	6.73	6.96
methamidophos	0.172-0.194	69.13	16.74	24.22
methidathion	0.115-0.211	97.42	7.51	7.71
omethoate	0.186-0.212	79.47	14.37	18.09
phosmet	0.225-0.559	98.07	8.56	8.73
tolclofos-methyl	0.116-0.260	96.40	7.28	7.55
triazophos	0.294	96.93	7.38	7.62

9 samples [97pepper, 2 peas] were spiked with an organophosphorous pesticide mixture (Mix 21) containing 9 different pesticides.

<b>Mix 21</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
azinphos-ethyl	0.57-0.498	96.33	4.59	4.77
chlorpyrifos	0.128-0.275	93.44	3.53	3.78
diazinon	0.111-0.269	94.67	4.67	4.93
dichlorvos	0.13-0.188	83.11	8.74	10.51
heptenophos	0.145-0.195	92.22	4.26	4.62
iodofenphos	0.224-0.174	94.56	3.34	3.53
mevinphos	0.122-0.184	92.67	7.99	8.62
quinalphos	0.112-0.180	95.00	5.03	5.30
phosalone	0.569-0.457	95.67	3.80	3.97

6 samples of pepper were spiked with an organophosphorous pesticide mixture (Mix 22) containing 6 different pesticides.

<b>Mix 22</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
acephate	0.146-0.232	90.17	9.37	10.39
bromophos-methyl	0.193-0.231	98.00	5.51	5.63
fenchlorphos	0.122-0.123	97.83	5.81	5.94
isofenphos	0.191-0.243	96.83	3.31	3.4
malaoxon	0.216-0.23	101.67	3.83	3.77
propetamphos	0.106-0.245	100.00	6.63	6.63

7 samples [6 pepper, 1 peas ] were spiked with an organophosphorous pesticide mixture (Mix 23) containing 7 different pesticides.

<b>Mix 23</b> Pesticide	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
bromophos-ethyl	0.206-0.216	96.14	3.44	3.57
chlorpyrifos-methyl	0.189-0.244	90.43	4.69	5.18
etrimfos	0.068-0.162	100.57	5.53	5.50
methacrifos	0.071-0.298	88.29	3.86	4.37
monocrotophos	0.246-0.286	88.50	3.62	4.09
pirimifos-ethyl	0.198-0.241	92.00	3.74	4.07
pirimifos-methyl	0.225-0.234	90.71	2.81	3.10

A single apple was spiked with an organophosphorous pesticide mixture (Mix 24) containing 4 pesticides, while a single blackcurrant sample was spiked with an organophosphorous pesticide mixture (Mix25) containing a further 4 pesticides.

<b>Mix 24</b> Pesticide.	Concentration mg/kg	Mean Recovery
paraoxon	0.247	84
paraoxon-methyl	0.198	79
parathion	0.238	85
phosphamidon	0.173	88

<b>Mix 25</b> Pesticide	Concentration mg/kg	Mean Recovery
demeton-S- methyl sulfone	0.331	94
fenitrothion	0.319	96
fonofos	0.233	84
parathion-methyl	0.204	104

#### Benzimidazole pesticides

28 samples ( 25 pepper, 1 lemon and 2 apple) were spiked with a mixture containing 2 benzimidazole pesticides (HPLC Mix 1)

The results of the recovery studies carried out are presented in terms of percentage mean recovery, standard deviation of the mean recovery and coefficient of variation:

<b>HPLC Mix 1</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
carbendazim	0.168-0.19	109.76	9.03	8.23
thiabendazole	0.168-0.18	107.68	11.08	10.29

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## 2. Cereals.

Recovery results are presented in terms of percentage recovery

One sample of Rice was spiked with an organochlorine pesticide mixture (Mix 1) containing 14 different pesticides and a second sample of Rice was spiked with another organochlorine Mix (Mix 3) containing 8 different pesticides The same rice samples were also spiked with 2 organophosphorous pesticide mixtures ( Mix 20 and Mix 23) containing 14 and 8 different pesticides respectively.

<b>Mix 1</b> <u>Pesticide.</u>	Concentration mg/kg	% Recovery
aldrin	0.012	89.26
captan	0.016	87.65
chlorothalonil	0.012	83.12
cypermethrin	0.036	89.45
deltamethrin	0.029	90.12
pp' DDD	0.012	92.43
pp' DDE	0.013	93.42
pp' DDT	0.012	94.65
endosulfan-1	0.011	97.00
endrin	0.011	91.65
HCB	0.011	84.31
lindane	0.011	85.53
methoxychlor	0.023	89.87
permethrin	0.138	90.43

<b>Mix 3</b> <u>Pesticide:</u>	Concentration mg/kg	Mean Recovery
captafol	0.013	92.45
dicofol	0.022	96.31
endosulfan-2	0.012	92.10
fenairimol	0.03	89.67
beta-HCH	0.027	97.45
delta-HCH	0.011	95.80
procymidone	0.08	96.72
tecnazene	0.013	90.56

<b>Mix 20</b> <u>Pesticide</u>	Concentration mg/kg	% Recovery
methamidophos	0.172	84.36
omethoate	0.212	89.72
dimethoate	0.219	90.16
tolclofos-methyl	0.266	93.42
malathion	0.226	92.56
chlorpyrifos	0.275	89.62
chlorfenvinphos	0.288	95.36
methidathion	0.211	88.67
ethion	0.243	92.54
triazophos	0.294	96.23
phosmet	0.599	87.42
azinphos-methyl	0.567	90.65

Mix 23	Concentration mg/kg	Recovery
bromophos-ethyl	0.216	92.14
chlorpyrifos-methyl	0.244	86.43
etrimfos	0.162	94.78
methacrifos	0.298	85.65
pirimifos-ethyl	0.278	90.56
pirimifos-methyl	0.234	96.42

### 3. Food of Animal Origin.

#### i. Meat Fat

##### Organochlorine pesticides (OC)

Some 57 bovine fat and 86 porcine fat samples were spiked with a single pesticide, Aldrin. In addition

- 13 samples of fat ( 3 bovine, 1 porcine, 2 ovine, 6 poultry and 1 venison) were spiked with a range of OC pesticides (Mix1) containing 10 different pesticides.
- 5 samples (1 ovine, 2 porcine and 2 bovine) were spiked with an OC mix (CK Z) containing 2 different pesticides
- 4 samples of poultry fat were spiked with an OC mix (Mix2) containing 10 different pesticides.
- 12 samples (3 bovine, 3 porcine, 5 poultry and 1 venison) were spiked with a Polychlorinatedbiphenyl (PCB) mix containing 7 PCB congeners.
- PCB recovery studies were also carried out on ovine fat where 6 samples were spiked at 2 different levels.

Results obtained in terms of percentage mean recovery, standard deviation of the mean recovery and coefficient of variation are presented below.:

Aldrin Pesticide	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
aldrin	0.012	95.24	7.87	8.27

Mix 1 Pesticide	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
aldrin	0.012-0.065	90.83	11.26	12.40
pp' DDD	0.013-0.065	95.50	5.54	5.80
pp' DDE	0.013-0.055	94.66	8.29	8.75
pp' DDT	0.011-0.07	95.75	7.12	7.44
endosulfan-1	0.016-0.055	96.16	6.00	6.24
endrin	0.012-0.055	96.92	5.52	5.69
HCB	0.013-0.06	88.83	10.36	11.66
lindane	0.015-0.055	96.16	6.99	7.27
methoxychlor	0.025-0.116	95.91	7.31	7.62
permethrin	0.131-0.655	90.17	12.91	14.32

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<b>CK Z</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
endosulfan-1	0.016	94.0	7.0	7.45
lindane	0.013	93.4	10.78	11.54

<b>Mix 2</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
op'DDD	0.015	90.25	0.96	1.06
op'DDE	0.013	86.5	2.65	3.06
op'DDT	0.013	91.0	1.35	1.48
Dieldrin	0.011	85.75	2.06	2.40
Endosulfate	0.012	88.50	5.07	5.72
α-HCH	0.011	85.75	6.85	7.99
Heptachlor	0.011	61.50	7.33	11.91
Heptachlor-Epoxyde	0.011	94.25	3.30	3.50
Quintozene	0.01	84.75	8.02	9.46
Tetradifon	0.013	89.0	2.45	2.75

<b>PCB Mix</b> Contaminant.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
PCB 28	0.025	94.92	6.99	7.36
PCB 52	0.025	97.75	5.64	5.77
PCB 101	0.025	94.0	4.79	5.10
PCB 118	0.025	91.0	5.03	5.53
PCB 138	0.025	89.90	5.74	6.38
PCB 153	0.025	89.75	5.26	5.86
PCB 180	0.025	86.33	6.60	7.65



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## PCB RECOVERY STUDY.

PCB Mix Contaminant.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
PCB 28	0.025	113.83	8.08	7.10
PCB 52	0.025	118.50	9.93	8.38
PCB 101	0.025	100.00	8.92	8.92
PCB 118	0.025	94.33	6.98	7.40
PCB 138	0.025	95.00	7.87	8.28
PCB 153	0.025	96.42	7.21	7.48
PCB 180	0.025	89.83	6.71	7.47

PCB Mix Contaminant.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
PCB 28	0.005	114.8	15.90	13.85
PCB 52	0.005	115.5	12.48	10.80
PCB 101	0.005	88.8	18.50	20.83
PCB 118	0.005	84.2	14.27	16.95
PCB 138	0.005	87.0	14.00	16.09
PCB 153	0.005	82.8	14.98	18.09
PCB 180	0.005	85.1	14.36	16.87

### Organophosphorous Pesticides. (OP)

The following recovery studies were carried out in 2000,

- 9 samples of kidney fat, (5 bovine, 3 porcine and 1 ovine) were spiked with an OP pesticide mixture (Mix A) containing 3 different pesticides.

- 2 samples of bovine fat and 3 samples of porcine fat were spiked with a second OP mix (Mix X) containing 2 different pesticides.

- 14 samples of ovine fat were spiked with the OP pesticide mixes (20,21,22,23,24&25 – 2 spikes of each mix ) containing a range of different pesticides.

Results obtained in terms of percentage mean recovery, standard deviation of the mean recovery and coefficient of variation are presented below.:

Mix A Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
chlorpyrifos	0.128	103.67	8.31	8.01
diazinon	0.111	106.78	10.92	10.22
ethion	0.145	103.78	9.19	8.85
Mix X Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
diazinon	0.111	101.2	15.97	15.78
ethion	0.145	101.8	13.66	13.42

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<b>Mix 20</b> Pesticide.	Concentration mg/kg	Mean Recovery
azinphos-Me	0.567	121.0
chlorpyrifos	0.275	114.5
dimethoate	0.266	123.5
ethion	0.243	114.0
malathion	0.226	120.0
methidathion	0.211	122.0
methamidophos	0.172	119.0
omethoate	0.212	106.0
phosmet	0.559	117.0
tolclofos-Me	0.26	117.0
triazophos	0.147	121.5

<b>Mix 21</b> Pesticide.	Concentration mg/kg	Mean Recovery
azinphos-ethyl	0.57	103.5
chlorpyrifos	0.128	99.5
diazinon	0.111	103.0
dichlorvos	0.13	99.0
heptenophos	0.134	103.5
iodofenphos	0.224	102.5
mevinphos	0.122	108.5
phosalone	0.569	104.0
quinalphos	0.112	104.5

<b>Mix 22</b> Pesticide.	Concentration mg/kg	Mean Recovery
acephate	0.146	134.0
bromophos-methyl	0.193	104.0
fenchlorphos	0.123	110.5
isofenphos	0.191	109.5
malaaxon	0.230	106.0
propetamphos	0.106	108.5

<b>Mix 23</b> Pesticide.	Concentration mg/kg	Mean Recovery
bromophos-ethyl	0.206	98.0
chlorpyrifos-methyl	0.189	98.5
etrimfos	0.246	100.5
methacrifos	0.071	97.0
monocrotophos	0.068	99.0
pirimifos-methyl	0.225	101.0
pirimifos-ethyl	0.198	95.5

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<b>Mix 24</b> Pesticide.	Concentration mg/kg	Mean Recovery
paraoxon-Me	0.233	114.0
paraoxon	0.172	112.0
parathion	0.204	102.0
phosphamidon	0.276	104.5

<b>Mix 25</b> Pesticide.	Concentration mg/kg	Mean Recovery
fenitrothion	0.154	97.5
fonofos	0.138	101.5
parathion-Me	0.114	102.0



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## ii DAIRY PRODUCTS.

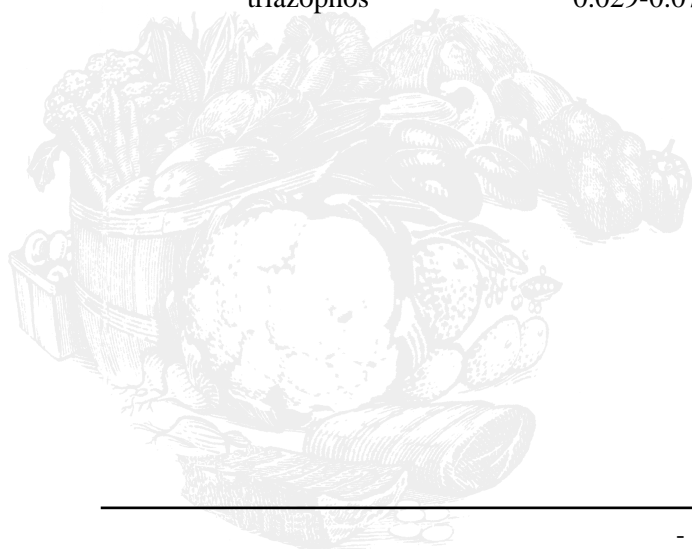
Four samples of whole milk were spiked with

- an organochlorine (OC) pesticide mix (Mix1) containing 10 different pesticides and
- an organophosphorous (OP) pesticide mix (Mix20) also containing 10 different pesticides.

Results obtained in terms of percentage mean recovery, standard deviation of the mean recovery and coefficient of variation follow:

<b>Mix 1</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
aldrin	0.032-0.04	82.75	6.70	8.10
pp' DDD	0.031-0.033	83.00	2.94	3.55
pp' DDE	0.034	80.75	4.86	6.01
pp' DDT	0.025-0.028	78.00	6.19	6.19
endosulfan-1	0.028	83.00	2.83	3.41
endrin	0.028	88.25	9.74	11.04
HCB	0.028-0.029	75.00	8.45	11.26
lindane	0.028-0.029	83.25	7.37	8.85
methoxychlor	0.058-0.059	82.50	4.12	5.00
permethrin	0.327-0.346	82.75	7.93	9.59

<b>Mix 20</b> Pesticide.	Concentration mg/kg	Mean Recovery	Standard Deviation	Co-efficient of Variation
azinphos-ethyl	0.113-0.227	95.00	1.89	2.34
chlorfenvinphos	0.058-0.116	95.00	5.48	5.77
chlorpyrifos	0.055-0.110	92.00	7.62	8.28
dimethoate	0.053-0.110	80.75	1.89	2.34
ethion	0.049-0.122	97.25	7.04	7.24
malathion	0.045-0.113	94.50	4.80	5.07
methidathion	0.042-0.053	101.75	8.02	7.88
phosmet	0.112-0.230	97.25	9.29	9.55
tolclofos-me	0.052-0.109	93.25	7.50	8.04
triazophos	0.029-0.075	94.00	6.38	6.78



**ANNEX X PESTICIDES DETERMINED IN VEGETABLE SAMPLES ANALYZED BY ANALYTICAL CONSULTANTS, ON BEHALF OF BORD GLAS**

<b>Organobromine Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
bromopropylate	yes	> 70	0.05

<b>Organochlorine Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
aldrin	yes	> 70	0.005
cis-chlordane	no	> 70	0.005
trans-chlordane	no	> 70	0.005
oxychlordane	no	> 70	0.005
chlorothalonil	yes	> 70	0.01
dieldrin	yes	> 70	0.005
op'DDE	yes	> 70	0.005
pp'DDE	yes	> 70	0.005
op'DDT	yes	> 70	0.005
pp'DDT	yes	> 70	0.005
op'DDD	yes	> 70	0.005
pp'DDD	yes	> 70	0.005
dicofol	yes	> 70	0.01
endosulfan 1	yes	> 70	0.005
endosulfan 2	yes	> 70	0.005
endosulfate	yes	> 70	0.01
endrin	yes	> 70	0.005
heptachlor	yes	> 70	0.005
heptachlor-epoxide	yes	> 70	0.005
HCB	yes	> 70	0.005
α-HCH	yes	> 70	0.005
β-HCH	yes	> 70	0.01
δ-HCH	yes	> 70	0.005
lindane (γ-HCH)	yes	> 70	0.005
methoxychlor	yes	> 70	0.01
quintozene	yes	> 70	0.005
tecnazene	yes	> 70	0.005

<b>Organonitrogen Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
bupirimate	yes	> 70	0.1

<b>Organophosphorous Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
acephate	yes	> 70	0.02
azinphos-ethyl	yes	> 70	0.05
azinphos-methyl	yes	> 70	0.05
bromophos-ethyl	yes	> 70	0.02
bromophos-methyl	yes	> 70	0.02
chlorfenvinphos	yes	> 70	0.02
chlorpyrifos	yes	> 70	0.02
chlorpyrifos-methyl	yes	> 70	0.02
demeton-S-methyl	yes	> 70	0.02
demeton-S-methylsulfone	yes	> 70	0.05
diazinon	yes	> 70	0.02
dichlorvos	yes	> 70	0.02
dimethoate	yes	> 70	0.02
dioxathion	no	> 70	0.05
disulfoton	yes	> 70	0.02
ethion	yes	> 70	0.02
etrimfos	yes	> 70	0.02
fenamiphos	no	> 70	0.05
fenchlorphos	yes	> 70	0.01
fenitrothion	yes	> 70	0.05
fenthion	yes	> 70	0.02
formothion	yes	> 70	0.02
fonophos	yes	> 70	0.02
heptenophos	yes	> 70	0.02
iodofenphos	yes	> 70	0.02
isofenphos	yes	> 70	0.02
isomalathion	no	> 70	0.1
malaoxon	yes	> 70	0.1
malathion	yes	> 70	0.02
methacrifos	yes	> 70	0.02
methamidophos	yes	> 70	0.01
methidathion	yes	> 70	0.02
monocrotophos	yes	> 70	0.05
mevinphos	yes	> 70	0.02
omethoate	yes	> 70	0.05
paraoxon	yes	> 70	0.02
paraoxon-methyl	yes	> 70	0.05
parathion	yes	> 70	0.05
parathion-methyl	yes	> 70	0.05
phorate	yes	> 70	0.02
phosalone	yes	> 70	0.05
phosmet	yes	> 70	0.02
phosphamidon	yes	> 70	0.02
pirimiphos-methyl	yes	> 70	0.02
propetamphos	yes	> 70	0.02
quinalphos	yes	> 70	0.02
TEPP	no	> 70	0.05
thiometon	yes	> 70	0.02
triazophos	yes	> 70	0.02

<b>Dicarboximide Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
iprodisone	yes	> 70	0.02
procymidone	yes	> 70	0.02
vinclozolin	yes	> 70	0.02

<b>Phthalimide Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
captafol	yes	> 70	0.02
captan	yes	> 70	0.02
folpet	yes	> 70	0.02

<b>Pyrethroid Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
bifenthrin	yes	> 70	0.05
cyfluthrin	yes	> 70	0.02
λ-cyhalothrin	yes	> 70	0.02
cypermethrin	yes	> 70	0.05
deltamethrin	yes	> 70	0.02
fenvalerate	yes	> 70	0.05
permethrin	yes	> 70	0.05

<b>Other Compounds</b>	<b>Included in the PCS Monitoring Programme</b>	<b>Recovery (%)</b>	<b>Limit of Determination (mg/kg)</b>
dichlofluanid	yes	> 70	0.02
fenarimol	yes	> 70	0.02
propyzamide	yes	> 70	0.02
tetradifon	yes	> 70	0.02
binapacryl	yes	> 70	0.02
perthane	no	> 70	0.20



**Annex XI. SUMMARY OF THE RESULTS OF THE ANALYSIS OF IRISH VEGETABLES  
SAMPLED BY AN BORD GLAS.**

**Part 1. Vegetables sampled by An Bord Glas for pesticide residue analysis in 2000.**

<i>Commodity</i>	No. of samples analysed.	Residues detected.		
		> MRL	< MRL.	ND.
Broccoli	2			2
Cabbage	10	1		9
Carrot	7		5	2
Cauliflower	3			3
Celery	5		4	1
Cucumber	2		1	1
Gooseberry	1			1
Greens	2			2
Leeks	3			3
Lettuce	6		5	1
Mushroom	53		8	45
Onion	3			3
Parsnip	4		4	0
Potato	22			22
Raspberry	1		1	0
Rhubarb	1			1
Spinach	1		1	0
Sprouts	3			3
Swede	4			4
Tomato	8		2	6
Turnip	1			1
<b>Total</b>	<b>142</b>	<b>1</b>	<b>31</b>	<b>110</b>

**Part 2:- Pesticide residues detected in vegetables sampled by An Bord Glas in 2000.**

<b>Sample number.</b>	<b>Residue detected.</b>	<b>Residue (mg/kg)</b>	<b>MRL (mg/kg)</b>
<b>1. Fruit.</b>	<b>1.5. Berries &amp; Small Fruit.</b>		<b>1.5.4.2. Raspberry</b>
109	Chlorpyrifos	0.08	0.5
	Bupirimate	0.3	No MRL.
	Iprodione	0.11	5.0
<b>2. Vegetables.</b>	<b>2.1. Root &amp; Tuber Vegetables</b>		<b>2.1.1. Carrots.</b>
117	Chlorfenvinphos	0.12	0.5
1462	Chlorfenvinphos	0.07	0.5
136	Chlorfenvinphos	0.09	0.5
135	Triazophos	0.26	1.0
143	Chlorfenvinphos	0.25	0.5
			<b>2.1.3. Parsnip</b>
139	Chlorfenvinphos	0.14	0.5
148	Chlorfenvinphos	0.17	0.5
125	Chlorfenvinphos	0.1	0.5
120	Chlorfenvinphos	0.07	0.5
<b>2.3. Fruiting Vegetables.</b>		<b>2.3.1. Solanacea</b>	<b>2.3.1.3. Tomato</b>
0264 41	dicofol	0.03	0.5
0265 10	dicofol	0.3	0.5
	Iprodione	0.28	5.0
	Tetradifon	0.09	No MRL.
		<b>2.3.2. Cucurbits (edible peel)</b>	<b>2.3.2.1. Cucumber</b>
0266 24	dicofol	0.03	0.5
<b>2.4. Brassica Vegetables.</b>	<b>2.4.2. Head Brassicas</b>		<b>2.4.2.3. Leaf Cabbage.</b>
145	Omethoate	0.84	0.5
<b>2.5. Leafy Vegetables.</b>	<b>2.5.1. Lettuce &amp; Similar.</b>		<b>2.5.1.1. Lettuce.</b>
1455	Omethoate	0.17	0.5
	Iprodione	2.54	10
	Dimethoate	0.2	1.0
	Propyzamide	0.08	No MRL.
146	Cypermethrin	0.17	2.0
	Propyzamide	0.07	No MRL.
	Iprodione	1.4	10

Sample number.	Residue detected.	Residue (mg/kg)	MRL (mg/kg)
1458	Cypermethrin	0.21	2.0
	Omethoate	0.06	0.5
	Dimethoate	0.1	1.0
	Propyzamide	0.21	No MRL.
	Iprodione	8.82	10
142	Tolcophos-me	0.06	No MRL.
	Cypermethrin	0.22	2
	Iprodione	7.26	10
	Demeton-S-me fon	0.15	0.5
	Propyzamide	0.1	No MRL.
141	Tolcophos-me	0.08	No MRL
	Propyzamide	0.04	No MRL.

### 2.5.2. Spinach & Similar.

### 2.5.2.1. Spinach.

140	Omethoate	0.06	0.5
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### 2.7. Stem Vegetables

### 2.7.2. Celery

1453	Chlorothalonil	1.99	10
1452	Chlorothalonil	0.25	10
126	Chlorothalonil	0.5	10
112	Chlorothalonil	0.06	10

### 2.8. Fungii

### 2.8.1. Mushrooms

0255 C26	Prochloraz	0.1	No MRL.
0282 114	Lindane	0.02	1.0
0277 8	Lindane	0.006	1.0
0275 37	Lindane	0.01	1.0
0274 95	Lindane	0.04	1.0
0273 14	Lindane	0.02	1.0
925 1506	Lindane	0.006	1.0
305 1513	Lindane	0.006	1.0











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