New Zealand
Food Residue Surveillance Programme

Consolidated results report for 2005/06 for plant-based foods

A report for the New Zealand Food Safety Authority
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by

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EXECUTIVE SUMMARY

The 2005/06 New Zealand Food Residue Surveillance Programme (NZFRSP) is part of an on-going agricultural compound food residue surveillance programme initiated in 2003/04 by the New Zealand Food Safety Authority (NZFSA) to verify the effectiveness of regulatory measures on the use of agricultural compounds and resulting residues.

Primary plant, animal, seafood and related products were selected on the basis of likely residues, lack of NZFSA information about actual residues, food consumption and other intelligence. In this third year of the programme, eight foods were sampled (number of samples per food type in brackets):

- cabbages (48),
- carrots (48),
- celery (48),
- cucumbers (48),
- onions (48),
- plums (48),
- pumpkins (48), and
- wheat (50)

The seven fruit and vegetable commodities were sampled from wholesale and retail outlets at each of four locations (Auckland, Palmerston North, Christchurch and Dunedin). Wheat samples from the 2006 harvest were obtained from grain mills and consolidators in Christchurch (2), Tauranga and Ashburton.

The 386 plant-based food samples were analysed, as received, by a multi-residue agricultural compound screen covering 215 compounds, including organochlorine and organophosphorus pesticides, fungicides, herbicides and plant growth regulators. Six of the plant-based food samples (totalling 288 samples, but not cabbages or wheat), were also analysed for dithiocarbamates (DTCs).

Out of a total of 83,326 agricultural chemical/food results, 276 (0.3%) had detectable residues. Of these, the samples of cabbages analysed had a total of 9 detectable agricultural chemical residues found, carrots only one residue, celery (106), cucumber (52), onions (11), plums (57), pumpkins (4), and wheat (36).

Five agricultural chemical residues (chlorothalonil [55], iprodione [45], pirimiphos methyl [34], dithiocarbamates [31], and difenoconazole [17]) accounted for 182 (66%) of the 276 different residue/food results detected. The other residues detected most were methamidiphos (11), indoxacarb (11), and metalaxyl (9). A total of 33 different agricultural chemical residues were detected out of 216 screened for (215 by multi-residue, and DTCs screened as a group separately).

Of the 386 plant-based food samples analysed, the 32 imported foods (four samples of wheat and 28 of plums) had 30 samples (93.8%) with detectable residues, while the 354 domestic foods (all cabbages, carrots, celery, onions, pumpkins, most of the wheat and about half of the plums) had 145 samples (41%) with detectable residues.

The one hundred and seventy-five (175) different plant-based food samples with detectable agricultural chemicals out of the 386 analysed in total is equivalent to 45%.

Of the 175 different plant-based food samples with detectable residues, cabbages had a total of nine residues detected, carrots (1), celery (106), cucumbers (52), onions (11), plums (57), pumpkins (0), and wheat (36).

The individual samples with the most different residues were celery (one sample with nine different residues, two with five, two with four, seven with three and 23 with two), cucumber (two with five, two with four, one with three, and eight with two) and plums (one with three and 11 with two).

Twenty-two individual food samples (5.7%) exceeded the maximum residue limit (MRL) out of the 386 plant-based foods in the 2005/06 NZFRSP. Of these 22 samples, three exceeded the MRL where one was specifically defined (pendamethalin in NZ carrots 0.06 mg/kg, where the NZ MRL for carrots is 0.05 mg/kg; and methamidiphos in NZ cucumbers 0.33 mg/kg and 0.26 mg/kg; with the NZ MRL for fruiting vegetables being 0.2 mg/kg).

The other twenty results were all in excess of the default NZ MRL of 0.1 mg/kg, and so could be considered 'technical non-compliances'. The technical non-compliances in NZ celery were acephate (0.44 mg/kg); chlorpropham (0.11 mg/kg), difenoconazole (eight from 0.10 – 0.42 mg/kg); methamidiphos (0.21 and 0.27 mg/kg); methiocarb (0.18 and 0.26 mg/kg); pirimiphos methyl (0.63 mg/kg); and trifloxystrobin (0.12, 0.12, 0.24 mg/kg); The other 'technical non-compliance' was iprodione (0.11mg/kg) in a sample of NZ cucumbers.

GLOSSARY OF TERMS, ABBREVIATIONS AND ACRONYMS

ACVM	Agricultural Compounds and Veterinary Medicines
agricultural compound	is a generic term for any substance intended for preventing, destroying, attracting, repelling, or controlling any pest (including unwanted species of plants or animals) during the production, storage, transportation, distribution, and processing of food, agricultural commodity, or animal feed. The term includes fungicides, herbicides, and veterinary medicines. It includes substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transportation.
agricultural compound residue	is any specified substance in food, agricultural commodity, or animal feed resulting from the use of an agricultural compound (from known, unknown or unavoidable sources). The term includes any derivatives of an agricultural compound, such as conversion products, metabolites, reaction products, and impurities considered to be of toxicological significance.
analyte	a substance detected by chemical analysis.
Codex	Codex Alimentarius. A publication of the joint FAO/WHO Codex Alimentarius Commission (CAC) which sets international food standards, including acceptable levels of chemical components in food.
composite	a sample produced by combining portions of each of a number of constituent samples. In this report, composite refers to the product resulting from mixing equal portions of constituent samples.
default MRL	a legal limit of 0.1 ppm (that is 1 part of agricultural compound in ten million parts of food) in New Zealand of agricultural compound residues where an MRL has not been specified elsewhere. This limit is specified in 6(2) of the New Zealand (Maximum Residue Limits of Agricultural Compounds) Food Standards 2006.
ESR	Institute of Environmental Science and Research Limited.
EU	European Union
FAO	Food and Agriculture Organization.
FSANZ	Food Standards Australia New Zealand
FSC	Food Standards Code, set by FSANZ
g	gram(s).

GAP	Good Agricultural Practice is the nationally authorised safe use of agricultural compounds under actual conditions necessary for effective and reliable pest control. GAP encompasses a range of agricultural compound applications up to the highest authorised use, applied in a manner which leaves a residue which is the smallest practicable.
GEMS	Global Environmental Monitoring System (a WHO programme).
HPOs	Health Protection Officers.
JMPR	the Joint FAO/WHO Meeting on Pesticide Residues.
kg	kilogram(s).
LOR	Limit of Reporting is the minimum concentration of an agricultural compound residue in a commodity that can be determined quantitatively with acceptable accuracy and consistency. The limit of reporting is also referred to as the 'limit of quantitation' (LOQ) in the international literature. In monitoring programmes LORs are generally at 10-50% of the MRL; except where the MRLs are set at or about the practical limits of reporting. When a residue is quoted as 'not detected', this means that they were not present at levels above the relevant LOR.
MAF	Ministry of Agriculture and Forestry (New Zealand).
MAFF	Ministry of Agriculture, Fisheries and Food (United Kingdom).
mg/kg	milligrams per kilogram; equivalent to parts per million (ppm).
µg/kg	micrograms per kilogram; equivalent to parts per billion (ppb).
MRL	Maximum Residue Limit is the maximum concentration of a agricultural compound residue legally permitted (or recognised as acceptable) in or on a food, agricultural commodity or animal feed. These limits are recommended by New Zealand Food Safety Authority ACVM group or the Codex Alimentarius Commission (Codex 1996, 2004) as being the maximum likely to result from the use of the agricultural compound according to GAP, and which is toxicologically acceptable. MRL units are expressed in ppm or mg/kg of the commodity. MRLs are currently set out in the New Zealand MRL Food Standards 2006.
non-complying	when a residue detected in an imported or domestically produced food exceeds the specific MRL listed in the New Zealand Food Standards, or the Codex MRL if the food is imported, or Standard 1.4.2 of the Australian Food Standards Code if imported from Australia.
NZFRSP	New Zealand Food Residue Surveillance Programme (2004/05 -)
NZFSA	New Zealand Food Safety Authority

NZMRS	New Zealand Multi-Residue Survey (2003/04)
NZTDS	New Zealand Total Diet Survey.
PHI	Post harvest interval is the minimum suggested time interval that should elapse between the last administration or application of an agricultural chemical product to a crop, vegetation, or food commodity of plant origin and: • Harvesting or sale/supply of that crop, vegetation or food commodity of plant origin, and/or • Further testing for residue levels in that crop, vegetation or food commodity of plant origin
surveillance	The process of collecting data, using random sampling, with regards to ascertaining a general overview (of agricultural compound residue levels on foods)
technical non-compliance	When an agricultural compound residue detected in a food exceeds the 'default NZ MRL' of 0.1 mg/kg.
TTMRA	Trans Tasman Mutual Recognition Agreement between Australia and New Zealand, designed to facilitate trade by removing potential regulatory barriers.
USDA	United States Department of Agriculture
US FDA	United States Food and Drug Administration.
WHO	World Health Organization.
WHP	Withholding period is the minimum period which should elapse between the last administration or application of an agricultural or veterinary chemical product, including treated feed, and the slaughter, collection or harvesting for human consumption or the use of animal commodity. It is worth noting that the WHP is not a legal requirement, whereas the MRL is.

1 INTRODUCTION

1.1 Project Background and Rationale

Agricultural compounds are used widely in agriculture (Manktelow *et al*, 2005). Their application has improved crop yields and has increased the quantity of fresh fruits and vegetables available to the consumer (Pimentel, 1992). Agricultural compounds also have the potential to cause harm. Some may damage the environment and accumulate in ecosystems. If the dose is sufficiently high, some agricultural compounds can cause a range of adverse effects on human health, including acute and chronic injury to the nervous system, lung damage, reproductive dysfunction, possibly cancer and dysfunction of the endocrine and immune systems (NRC, 1993). However, foods produced in accordance with good agricultural practice (GAP) should not contain levels of agricultural compounds residues from which adverse effects are likely to result.

Residues of agricultural compounds are of significant concern to consumers and other stakeholders (Worsley and Scott, 1997; White, 1998; Groth *et al*, 1999).

For the aforementioned reasons, overseas surveillance programmes monitor the presence of agricultural compounds in food commodities, including plant-based foods (EU, 2006; USDA 2006; USFDA 2005).

The New Zealand Food Safety Authority (NZFSA) has for some time identified a need for data to verify the effectiveness of regulatory measures on the use of agricultural compounds and resulting residues.

1.2 Objectives and benefits of the NZFRSP

The key objectives of the New Zealand Food Residue Surveillance Programme (NZFRSP) were :-

a) To assist in regulatory risk management by providing factual data about the actual level of residues of agricultural compounds on selected primary produce available in NZ. Possible regulatory outputs may include :- amendment of MRLs, with-holding periods (WHPs), post harvest intervals (PHIs) or label claims, advice to industry, investigation, or introduction of compliance monitoring.

b) To contribute to the development and implementation of the broader on-going New Zealand Food Residues Surveillance Programme (NZFRSP) of the NZFSA.

c) To generate data suitable for inclusion in the World Health Organization Global Environmental Monitoring System (WHO GEMS) / Food Programme.

d) To communicate findings to stakeholders and contribute to the NZFSA's chemical risk communication strategy.

The NZFRSP is primarily a surveillance tool, not a monitoring or compliance exercise. Sampling is, therefore, not intended to support possible prosecutions, but nonetheless, results are compared to MRLs to provide information about any possible non-compliances. One of the outcomes of the NZFRSP may be that it identifies priority areas for subsequent

monitoring or compliance. The NZFRSP will also complement the dietary exposure assessments undertaken by the New Zealand Total Diet Survey (NZTDS). The NZFRSP surveys foods 'as produced', whereas the NZTDS assesses foods 'as consumed'.

1.3 Operation of the 2005/06 NZFRSP

Funding of the 2005/06 NZFRSP was provided by the New Zealand Food Safety Authority (NZFSA). Management of the NZFRSP was carried out by the Institute of Environmental Science and Research Limited (ESR), in consultation with the NZFSA. The NZFRSP follows on from surveys in 2003/04 (Vannoort, 2005) and 2004/05 (Vannoort and Thomson, 2006; Vannoort *et al*, 2006) and is intended to be an on-going programme. Future resampling of certain food commodities in subsequent years is possible.

The 2005/06 NZFRSP involved eight food commodities, sampled in multiple locations, and generating 83,326 analytical results. Details of the methodology of the NZFRSP are detailed in the appendices. They cover :-

- Food selection, including ranking and prioritisation criteria, and foods chosen (Appendix 1),
- Sampling, including dates and locations, sample types and numbers, outlets and sampling procedures (Appendix 2),
- Analyses, including analytes covered in multi-residue screen, limits of reporting and quality control procedures (Appendix 3).

The NZFRSP was conducted in accordance with the recommendations of the FAO/WHO Joint Meeting on Pesticide Residues (JMPR), Codex Committee on Pesticide Residues (CCPR) (Codex 1993 a,b; 1996, 1999) and in agreement with the objectives of the Joint FAO/WHO Global Environmental Monitoring Systems (GEMS) (FAO/UNEP/WHO, 1979; WHO, 1987).

2 RESULTS OF THE 2005/06 NEW ZEALAND FOOD RESIDUE SURVEILLANCE PROGRAMME

2.1 Introduction

Agricultural compounds residues are usually present in foods as the result of intentional application to crops or stored food products for a defined purpose at a particular time. While levels of nutrients in foods are relatively well established in food composition databases (Athar et al, 1999), the agricultural compound content of foods can vary significantly over time and from place to place. The sampling and analyses included in this NZFRSP and subsequent surveys should allow temporal and geographical differences to be examined.

2.2 Comparison to other New Zealand agricultural compound residue data in food

A previous survey of agricultural compound residues in NZ food produce was performed in 1990/91 (DoH/MAF, 1992). It focused on domestically consumed fruit, vegetables and cereal products. The survey included 33 samples of cabbages, carrots (25), celery (60), cucumber (70), onions (30) and wheat (27). They were similarly analysed by a multi-residue method, although it was capable of detecting only 82 different agricultural compounds, and only down to limits of reporting of 0.05 mg/kg at that time. The survey covered different geographical regions, types of food outlets and seasons, so it should provide useful comparative data.

The results of the 2005/06 NZFRSP have also been compared to the food commodities in the 2003/04 New Zealand Multi-Residue Survey (NZMRS) and the 2004/05 NZFRSP, if those same foods were included.

It may also prove useful to make comparisons of the 2005/06 NZFRSP data to other agricultural compound residue data from dietary exposure studies, such as the 2003/04 New Zealand Total Diet Survey (NZTDS) (Vannoort 2003, 2004; Vannoort and Thomson, 2005).

It should be borne in mind, however, that caution needs to be made in making comparisons between surveys. Differences in percentage of samples with residues detected, actual concentrations and MRL exceedances between the 2005/06 NZFRSP, the 1990/91 NZ and the 2003/04 NZTDS are likely to reflect some or all of the following :-

- the relative sizes of the different surveys,
- differences in design and purpose (surveillance, monitoring, or dietary exposure)
- differences in sampling (random or targeted, mix of domestic vs imported produce)
- differences in regulatory limits (MRLs) over time
- differences in agricultural compound usage reflecting different climates, pests and good agricultural practice
- differences in analytical methods, including range of agricultural compounds screened for, their associated limits of reporting, and quality control

2.3 Summary overview of 2005/06 NZFRSP

The results for both seasons of the 2005/06 New Zealand Food Residue Surveillance Programme (NZFRSP) have been provided to the New Zealand Food Safety Authority (NZFSA) independently of this report. The results presented in this section are consolidated data, and include a summary overview, and then a more detailed discussion on a food by food basis.

Table 1 summarises the results of the 2005/06 NZFRSP. For each food (listed alphabetically), information is provided about the number of samples analysed, how many samples had no residues detected, how many samples contained residues below the maximum residue limit (MRL), and how many samples exceeded the MRL.

Table 1 Summary overview of the 2005/06 NZFRSP results for plant-based foods.

Food	Total samples analysed	Samples with No detectable Residues	%	Samples with Residues < MRL	%	Samples with Residues > MRL	%
Cabbages	48	41	85.4	7	14.6	0	0
Carrots	48	47	97.9	0	0	1	2.1
Celery	48	1	2.1	29	60.4	18	37.5
Cucumbers	48	20	41.7	25	52	3	6.3
Onions	48	37	77.1	11	22.9	0	0
Plums	48	4	8.3	44	91.7	0	0
Pumpkins	48	45	93.8	3	6.2	0	0
Wheat	50	16	32	34	68	0	0
Total	**386**	**211**	**54.7**	**153**	**39.6**	**22**	**5.7**

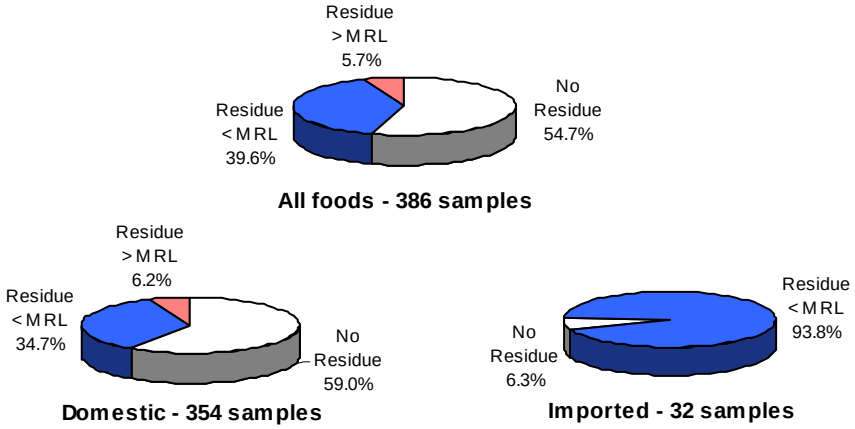
Figure 1 shows that a total of 386 samples were analysed in the 2005/06 NZFRSP, of which 211 samples (54.7%) had no detectable residues, 153 (39.6%) had residues below the MRL and 22 (5.7%) of samples exceeded the MRL. It should be noted that for the 22 exceedances, only three exceeded the MRL where one was specifically defined in the NZ MRL Food Standards 2006, or Codex MRLs for imported produce, or Codex or FSC MRLs, if from Australia. The other 19 exceeded the default MRL of 0.1 mg/kg because no specific MRL existed for that food/agricultural compound combination, and they were thus 'technical non-compliances'.

Figure 1 also demonstrates that imported samples in the 2005/06 NZFRSP had a higher proportion of samples with residues detected (93.8%), compared to 40.9% in domestic samples. This presumably reflects different agricultural practices for the different food types in each category, and is also associated with the differing pest vectors and climatic conditions.

Of the 386 foods sampled, 354 were domestically produced and these were all cabbages, carrots, celery, cucumber, onions, pumpkins, wheat (46 samples) and plums (20). The 32 imported food samples were four wheat and 28 plum samples.

Figure 1 also shows that domestic foods had a higher proportion of samples with residues that exceeded the MRL (6.2%), as opposed to 0% > MRL for those imported.

Figure 1 Summary of 2005/06 NZFRSP results - all plant-based foods, domestic and imported



Of the 386 plant-based food samples analysed in the 2005/06 NZFRSP, 65 (17%) had more than one agricultural compound residue in each sample. Those foods with the most multiple residues per sample were celery (one sample with nine different residues, two with five, two with four, seven with three, and 23 with two), cucumbers (two with five, two with four, one with three, and eight with two) and plums (one sample with three different residues, and 11 with two) (Table 2).

Table 2 Summary of plant-based foods in 2005/06 NZFRSP with multiple residues per sample

Food	Total samples	Number of residues detected per sample						
		0	1	2	3	4	5	>= 6
Cabbages	48	41	5	2				
Carrots	48	47	1					
Celery	48	1	12	23	7	2	2	1
Cucumbers	48	20	15	8	1	2	2	
Onions	48	37	11					
Plums	48	4	32	11	1			
Pumpkins	48	45	2	1				
Wheat	50	16	32	2				
Total samples	**386**	**211**	**110**	**47**	**9**	**4**	**4**	**1**
Total residues	**276**	**0**	**110**	**94**	**27**	**16**	**20**	**9**

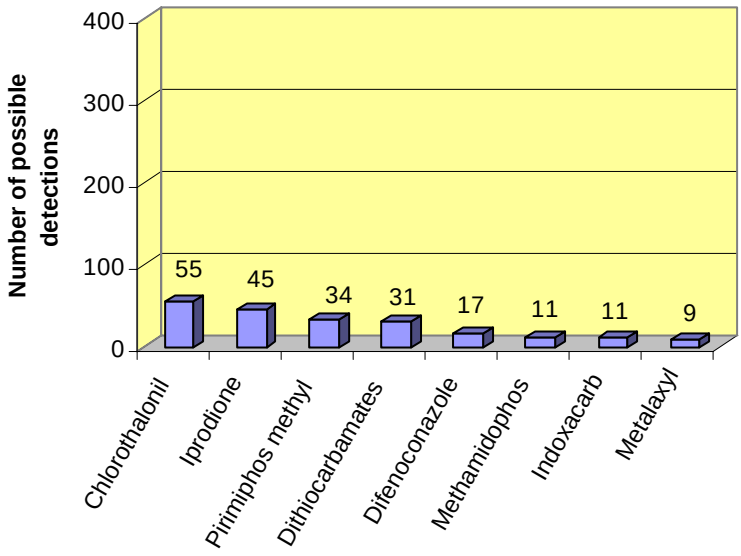
The 386 plant-based food samples of the 2005/06 NZFRSP were each analysed for 215 agricultural compound residues (Table 18, Appendix 3), and 288 samples also analysed for dithiocarbamates (Table 19, Appendix 3). Of the 83,326 results generated, a total of 276 (0.3%) food/residue results were detected (Table 2). The NZFSA website provides

information about which of the 216 agricultural compound residues are registered for use in New Zealand in respective food commodities (NZFSA, 2007).

A total of 33 different agricultural chemicals were detected out of the 216 screened. Details of the agricultural compounds and their concentrations detected are listed in Tables 3, 5, 7, 9, 11, 13, 14 and 15.

Five agricultural chemical residues accounted for 182 (66%) of the 276 different residue/food results detected. Those detected most were chlorothalonil (55), iprodione (45), pirimphos methyl (34), dithiocarbamates (31), difenoconazole (17), methamidiphos and indoxacarb (both 11) and metalaxyl (9) (Figure 2).

Figure 2 Agricultural compound residues detected most in the 2005/06 NZFRSP



2.4 Results discussion by plant-based food type

The results for the 2005/06 NZFRSP are discussed for each separate plant-based food type, ordered on an alphabetical basis. The format for each discussion has been standardised to enable comparisons between food types, if so desired.

The number of agricultural compounds detected in each food type is identified, and a summary of the results for these agricultural compounds given in an associated table, either as the number of residues detected which are less than the detection limit, or the number within a defined range. For the highest residues detected and when there were five or less, the actual residues have been given. Results non-complying or technically non-complying are in bold.

If the produce is imported, this is also noted.

The percentage of samples with no detectable residues, and those with residues less than and those exceeding the MRL are discussed, as well as being represented graphically.

Comparative data to previous New Zealand agricultural compound residue data is tabulated, if available, and then discussed.

2.4.1 Cabbages

Four agricultural compound residues were detected in cabbages in the 2005/06 NZFRSP (Table 3). The other 211 agricultural compound residues screened for were not detected in cabbages, while DTCs were not screened for in cabbages.

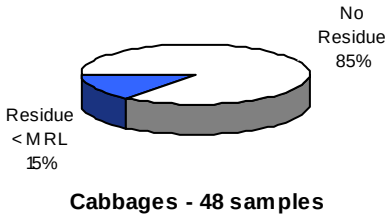
Table 3 Summary of agricultural compound residues found in cabbages in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Chlorothalonil	< 0.01 (not detected)	45	
		0.03, 0.15. 0.19	3	5 [a]
48	Difenoconazole	< 0.01 (not detected)	47	
		0.01	1	0.2 [a]
48	Indoxacarb	< 0.01 (not detected)	44	
		0.02, 0.02, 0.02, 0.06	4	0.5 [a]
48	Procymidone	< 0.01 (not detected)	47	
		0.03	1	0.1 [d]

All cabbages were domestically produced.

For the 48 samples of cabbages in the 2005/06 NZFRSP, 7 (15%) had detectable residues and 41 (85%) had no residues detected (Figure 3).

Figure 3 Summary of 2005/06 NZFRSP results - cabbages



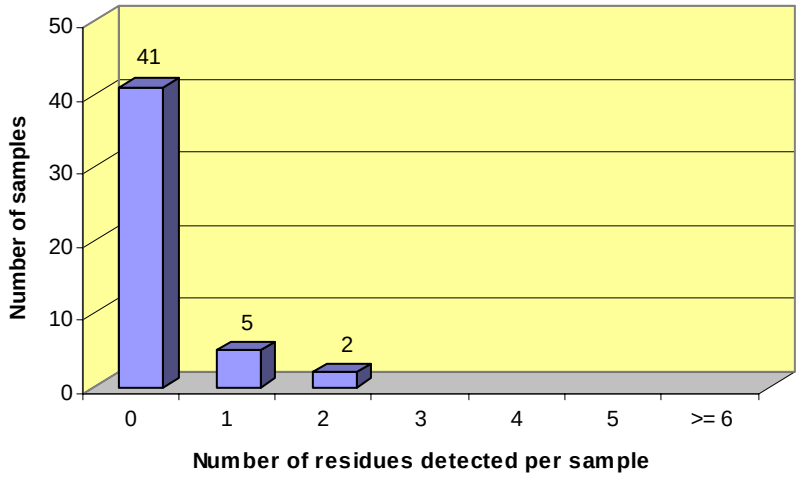
The percentages of cabbage samples in the 2005/06 NZFRSP with no detectable agricultural compound residues are very similar to those of the 1990/91 NZ survey. The residues detected in this survey are all < MRL, whereas in 1990/91 they all exceeded the MRL (Table 4).

Table 4 Comparison of 2005/06 NZFRSP data for cabbages with previous New Zealand data

Data source	Samples analysed	No Residues	%	Residues < MRL	%	Residues > MRL	%	Reference
NZFRSP 05/06	48	41	85	7	15	0	0	This survey
NZ 90/91	33	29	88	0	0	4	12	DoH/MAF, 1992

Figure 4 shows that two (4%) of the 48 samples of cabbage in the 2005/06 NZFRSP had multiple residues per sample, with both samples having two residues each.

Figure 4 Cabbages in 2005/06 NZFRSP – numbers of residues per sample



2.4.2 Carrots

One agricultural compound residue was detected in carrots in the 2005/06 NZFRSP (Table 5). The other 215 agricultural compound residues screened for were not detected in carrots.

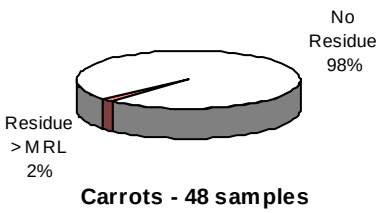
Table 5 Summary of agricultural compound residues found in carrots in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Pendamethalin	< 0.01 (not detected)	47	
		0.06	**1 (non-compliant)**	0.05 [a]

All carrots were domestically produced.

For the 48 samples of carrots in the 2005/06 NZFRSP, one sample (2%) just exceeded the MRL for pendamethalin (NZ MRL = 0.05 mg/kg), and 47 (98%) had no residues detected (Figure 5).

Figure 5 Summary of 2005/06 NZFRSP results – carrots



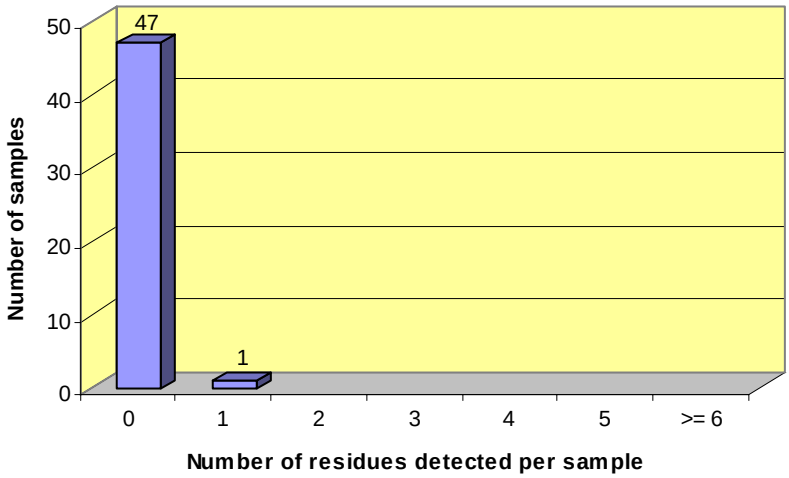
The agricultural compound residue results from the 2005/06 NZFRSP appear to be better than those obtained in 1990/91 (Table 6). In addition, significantly more agricultural compounds are being screened for in 2005/06 (216 cf 82 in 1990/91) and to much lower limits of reporting (0.01 cf 0.05 mg/kg).

Table 6 Comparison of 2005/06 NZFRSP data for carrots with previous New Zealand data

Data source	Total samples analysed	No Residues	%	Residues < MRL	%	Residues > MRL	%	Reference
NZFRSP 05/06	48	47	98	0	0	1	2	This survey
NZ 90/91	25	19	76	4	16	2	8	DoH/MAF, 1992

Figure 6 shows that almost all the carrot samples in the 2005/06 NZFRSP had no detectable residues, with only one sample with one residue.

Figure 6 Carrots in 2005/06 NZFRSP – numbers of residues per sample



2.4.3 Celery

Eighteen agricultural compound residues were detected in celery in the 2005/06 NZFRSP (Table 7). The other 198 agricultural compound residues screened for were not detected.

Table 7 Summary of agricultural compound residues found in celery in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Acephate	< 0.02 (not detected)	47	
		0.44	**1 (technically non-compliant)**	0.1 [d]

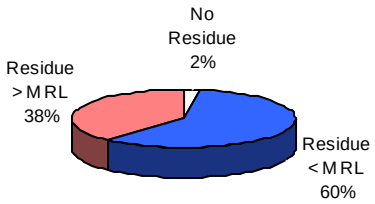
Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Chlorothalonil	< 0.01 (not detected)	6	
		0.02 < x ≤ 1	19	
		1 < x < 8	23	15 [a]
48	Chlorpropham	< 0.01 (not detected)	47	
		0.11	**1 (technically non-compliant)**	0.1 [d]
48	Chlorpyrifos	< 0.003 (not detected)	47	
		0.06	1	0.1 [d]
48	Cypermethrin	< 0.01 (not detected)	47	
		0.03	1	0.1 [d]
48	Diazinon	< 0.01 (not detected)	47	
		0.03	1	0.5 [a]
48	Difenoconazole	< 0.01 (not detected)	32	
		0.01 < x ≤ 0.1	8	
		0.1 < x ≤ 0.42	**8 (technically non-compliant)**	0.1 [d]
48	Dithio-carbamates	< 0.02* (not detected)	30	
		0.02* < x ≤ 2.6*	18	10 [a *]
48	Endosulfan 1	< 0.005 (not detected)	47	
		0.016	1	2 [a]
48	Endosulfan 2	< 0.005 (not detected)	47	
		0.006	1	2 [a]
48	Endosulfan sulphate	< 0.005 (not detected)	47	
		0.016	1	2 [a]
48	Indoxacarb	< 0.01 (not detected)	41	
		0.01 < x ≤ 0.04	7	0.1 [d]
48	Methamidophos	< 0.02 (not detected)	44	
		0.06, 0.08, **0.21, 0.27**	4 **(2 technically non-compliant)**	0.1 [d]
48	Methiocarb	< 0.02 (not detected)	46	
		0.18. 0.26	**2 (technically non-compliant)**	0.1 [d]
48	Permethrin	< 0.01 (not detected)	47	
		0.05	1	0.1 [d]

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Pirimiphos methyl	< 0.01 (not detected)	47	
		0.63	**1 (technically non-compliant)**	0.1 [d]
48	Procymidone	< 0.01 (not detected)	47	
		0.09	1	0.1 [d]
48	Trifloxystrobin	< 0.02 (not detected)	43	
		0.04, 0.05	2	
		0.10, 0.12, 0.24	**3 (technically non-compliant)**	0.1 [d]

* Dithiocarbamates are reported as mg/kg carbon disulphide (CS_2), as per international convention.

All 48 samples of celery in the 2005/06 NZFRSP were domestic. Of these 48 samples, one (2%) had no detectable residues and 47 (98%) had residues detected. Of those with detectable residues, 29 (60%) were below the MRL, and 18 (38%) exceeded the default NZ MRL of 0.1 mg/kg (Figure 7, Table 7). All exceedances were therefore 'technically non-compliant'.

Figure 7 Summary of 2005/06 NZFRSP results - celery



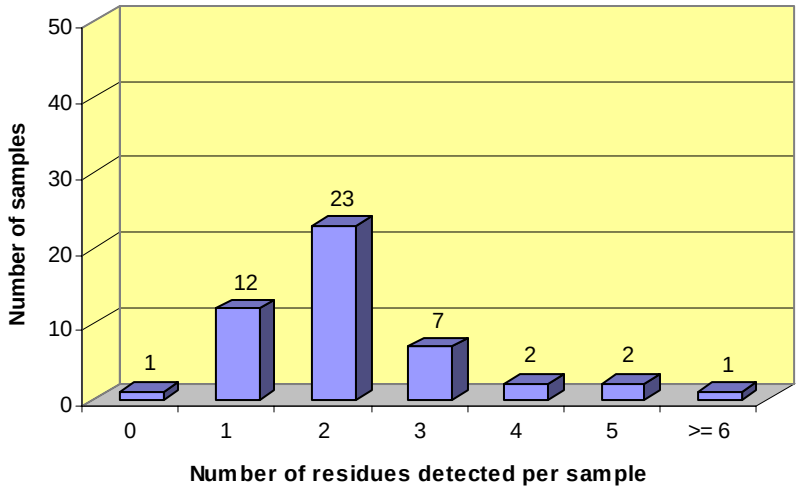
The percentages of agricultural compound residue results which were not detected, detected but below or above the MRL from the 2005/06 NZFRSP survey are very similar to those obtained in 1990/91 (Table 8). However, significantly more agricultural compounds are being screened for in 2005/06 (216 cf 82 in 1990/91) and to much lower limits of reporting (0.01 cf 0.05 mg/kg).

Table 8 Comparison of 2005/06 NZFRSP data for celery with previous New Zealand data

Data source	Total samples analysed	No Residues	%	Residues < MRL	%	Residues > MRL	%	Reference
NZFRSP 05/06	48	1	2	29	60	18	38	This survey
NZ 90/91	60	5	8	34	57	21	35	DoH/MAF, 1992

Figure 8 shows that most of the celery in the 2005/06 NZFRSP had multiple residues, with 23 samples with two different residues, seven with three, two with four residues, two with five and one sample with nine different residues detected.

Figure 8 Celery in 2005/06 NZFRSP – numbers of residues per sample



2.4.4 Cucumbers

Twelve agricultural compound residues were detected in cucumbers in the 2005/06 NZFRSP (Table 9). The other 204 agricultural compound residues screened for were not detected in cucumbers.

Table 9 Summary of agricultural compound residues found in cucumbers in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Chlorothalonil	< 0.01 (not detected)	38	
		0.01 < x ≤ 0.97	10	5 [a]
48	Dithio-carbamates	< 0.02* (not detected)	47	
		0.03*	1	7 [a *]
48	Endosulfan 1	< 0.005 (not detected)	45	
		0.006, 0.007, 0.011	3	2 [a]
48	Endosulfan 2	< 0.005 (not detected)	47	
		0.005	1	2 [a]
48	Endosulfan sulphate	< 0.005 (not detected)	44	
		0.01 < x ≤ 0.015	4	2 [a]

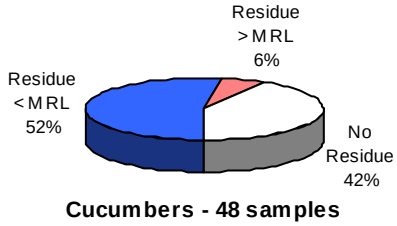
Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Iprodione	< 0.01 (not detected)	39	
		0.01 <x ≤ 0.10	8	
		0.11	**1 (technically non-compliant)**	0.1 [d]
48	Metalaxyl	< 0.02 (not detected)	40	
		0.02 < x ≤ 0.14	8	0.2 [a]
48	Methamidophos	< 0.02 (not detected)	41	
		0.02 < x < 0.2	5	
		0.26, 0.33	**2 (non-compliant)**	0.2 [a]
48	Pirimiphos methyl	< 0.01 (not detected)	47	
		0.12	1	1 [a]
48	Procymidone	< 0.01 (not detected)	47	
		0.03	1	1 [a]
48	Tolylfluanid	< 0.01 (not detected)	46	
		0.06, 0.07	2	0.1 [d]
48	Triadimefon	< 0.01 (not detected)	43	
		0.01 < x ≤ 0.03	5	0.1 [d]

* Dithiocarbamates are reported as mg/kg CS2, as per international convention.

All samples of cucumbers were domestically produced.

For the 48 samples of cucumbers in the 2005/06 NZFRSP, 28 samples (58%) had detectable residues and 20 (42%) had no residues detected. Of those with detectable residues, three (6%) exceeded the MRL (Figure 9, Table 9). Although Codex permit methamidophos on cucumbers at 1 mg/kg and FSANZ at 0.5 mg/kg, the cucumbers in question were not imported but domestically produced, and thus the 0.26 and 0.34 mg/kg exceeded the NZ MRL of 0.2 mg/kg for fruiting vegetables and were 'non-compliant'. The iprodione residue of 0.11 mg/kg just exceeded the default NZ MRL of 0.1 mg/kg and was therefore 'technically non-compliant'.

Figure 9 Summary of 2005/06 NZFRSP results – cucumbers



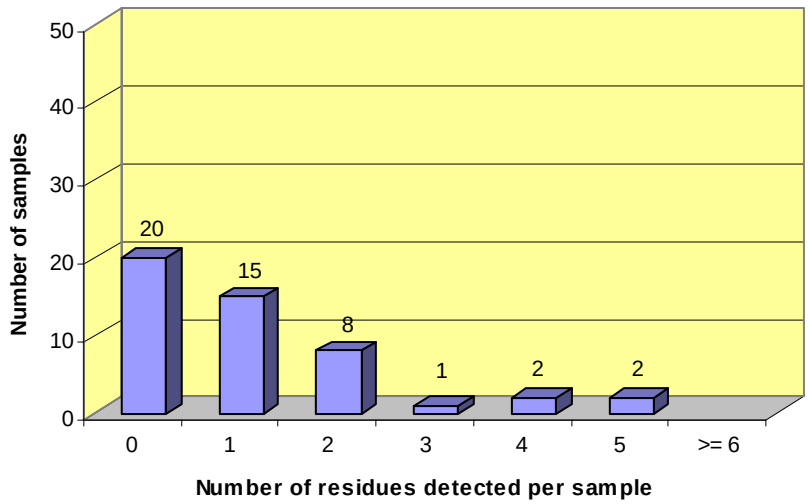
The agricultural compound residue results from the 2005/06 NZFRSP have a higher percentage of samples with detectable residues than those obtained in 1990/91 (Table 10). However, it should be noted that significantly more agricultural compounds are being screened for in 2005/06 (216 cf 82 in 1990/91) and to much lower limits of reporting (0.01 cf 0.05 mg/kg).

Table 10 Comparison of 2005/06 NZFRSP data for cucumber with previous New Zealand data

Data source	Total samples analysed	No Residues	%	Residues < MRL	%	Residues > MRL	%	Reference
NZFRSP 05/06	48	20	42	25	52	3	6	This survey
NZ 90/91	70	49	70	16	23	5	7	DoH/MAF, 1992

Figure 10 shows that for the 28 samples of cucumbers in the 2005/06 NZFRSP with detectable residues, 13 had multiple residues; with eight samples with two residues per sample, one with three residues, and two samples each with four and five residues.

Figure 10 Cucumbers in 2005/06 NZFRSP – numbers of residues per sample



2.4.5 Onions

One agricultural compound residue was detected in onions in the 2005/06 NZFRSP (Table 11). The other 215 agricultural compound residues screened for were not detected in onions.

Table 11 Summary of agricultural compound residues found in onions in 2005/06 NZFRSP

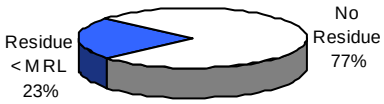
Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Dithio-carbamates	< 0.02 * (not detected)	37	
		0.02* < x ≤ 0.08*	11	7 [a *]

* Dithiocarbamates are reported as mg/kg CS_2, as per international convention.

All onions were domestically produced.

For the 48 samples of onions in the NZFRSP, 11 (23%) samples had detectable residues and 37 (94%) had no residues detected (Figure 11). Of those with detectable residues, all were well below the MRL (Table 11).

Figure 11 Summary of 2005/06 NZFRSP results – onions



Onions - 48 samples

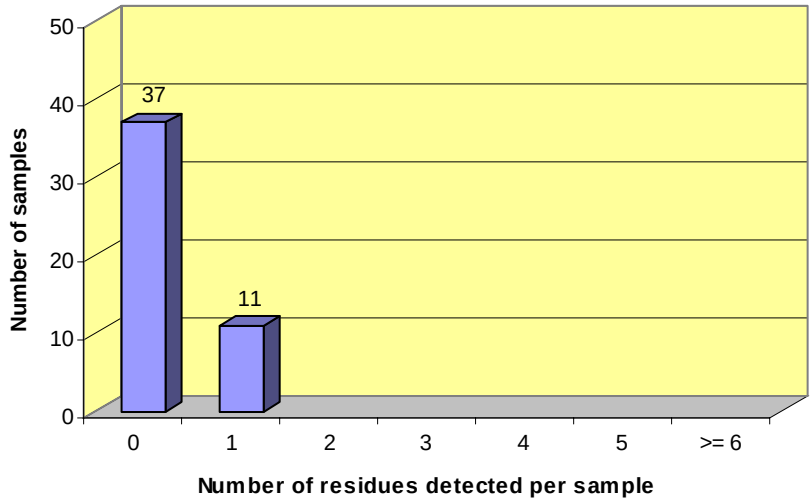
The onions in the 2005/06 NZFRSP have a higher percentage of samples with detectable residues below the MRL to those found in the 1990/91 NZ survey, but all are very low and none exceed the MRL as one did in 1990/91 (Table 12). Dithiocarbamates are measured after digestion of the food in acid and analysis of the CS_2 breakdown product. It is well known that brassicas and onions can naturally produce these CS_2 compounds, so residues detected may be those naturally produced.

Table 12 Comparison of 2005/06 NZFRSP data for onions with previous New Zealand data

Data source	Total samples analysed	No Residues	%	Residues < MRL	%	Residues > MRL	%	Reference
NZFRSP 05/06	48	37	77	11	23	0	0	This survey
NZ 90/91	30	29	97	0	0	1	3	DoH/MAF, 1992

Figure 12 shows that 11 (23%) of the samples of onions in the 2005/06 NZFRSP had one agricultural compound residues per sample, and none had multiple residues.

Figure 12 Onions in 2005/06 NZFRSP – numbers of residues per sample



2.4.6 Plums

Eight agricultural compound residues were detected in plums in the 2005/06 NZFRSP (Table 13). The other 208 agricultural compound residues screened for were not detected in plums.

Table 13 Summary of agricultural compound residues found in plums in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Carbaryl	< 0.02 (not detected)	42	
		0.02 < x ≤ 0.12	6	3 [a]
48	Chlorpyrifos	< 0.003 (not detected)	47	
		0.02	1	1 [a]
48	Dithio – carbamates	< 0.02* (not detected)	47	
		0.21*	1	7 [a]
48	Iprodione	< 0.01 (not detected)	12	
		0.01 < x ≤ 0.1	22	
		0.1 < x ≤ 2.3	14	10 [a]
48	Piperonyl butoxide	< 0.02 (not detected)	46	
		0.02, 0.03	2	8 [a]

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Pirimicarb	< 0.01 (not detected)	46	
		0.02, 0.04	2	1 [a]
48	Propargite	< 0.05 (not detected)	43	
		0.09 < x ≤ 1	5	3 [a]
48	Tebuconazole	< 0.01 (not detected)	44	
		0.05 < x ≤ 0.16	4	1 [a]

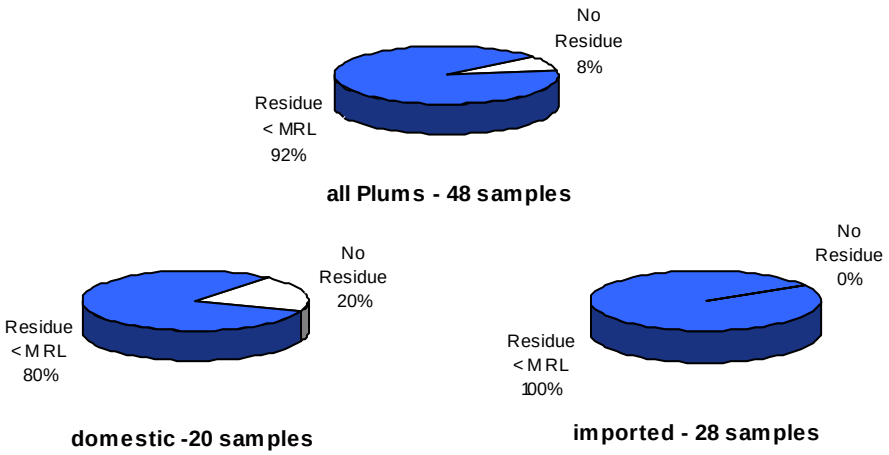
* Dithiocarbamates are reported as mg/kg CS_2, as per international convention.

Of those sampled, 20 lots of plums were domestically produced and 28 imported.

For the 48 samples of plums in the 2005/06 NZFRSP, 44 (92%) had detectable residues and four (8%) had no residues detected (Figure 13).

Of the 20 domestic plums samples, 16 (80%) also had detectable residues, and four (20%) had no detectable residues. For the 28 imported samples, all had detectable residues (Figure 13). All residues detected in both domestic and imported plums were well below the respective MRLs (Table 13).

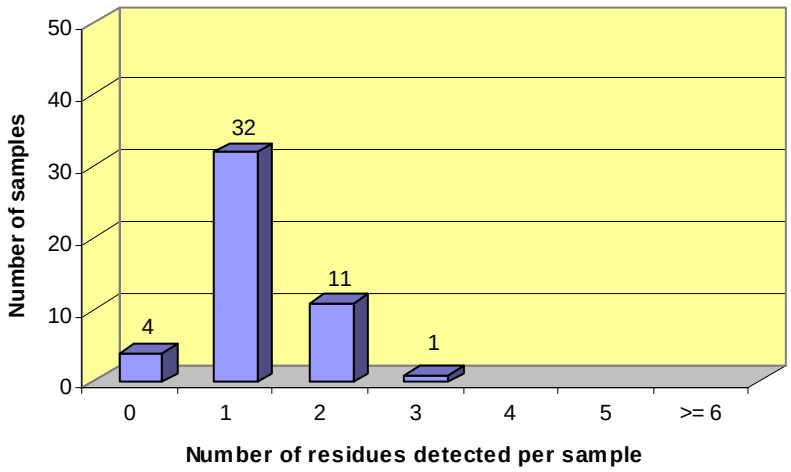
Figure 13 Summary of 2005/06 NZFRSP results –plums



Comparative data for plums was not available from the 1990/91 NZ survey, 2003/04 NZMRS or 2004/05 NZFRSP surveys.

Figure 14 shows that 12 samples (25%) of plums in the 2005/06 NZFRSP had multiple residues. One sample had three different residues, and 11 had two residues per sample.

Figure 14 Plums in 2005/06 NZFRSP – numbers of residues per sample



2.4.7 Pumpkins

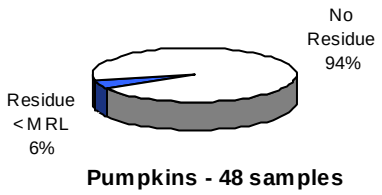
Three agricultural compound residues was detected in pumpkins in the 2005/06 NZFRSP (Table 13). The other 213 agricultural compound residues screened for were not detected in pumpkins.

Table 14 Summary of agricultural compound residues found in pumpkins in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
48	Captan	< 0.01 (not detected)	47	
		0.33	1	10 [a]
48	Carbaryl	< 0.01 (not detected)	47	
		0.08	1	3 [a]
48	Dieldrin	< 0.005 (not detected)	46	
		0.007, 0.016	2	0.1 [a]

All pumpkin samples were domestically produced. For the 48 samples of pumpkins in the NZFRSP, 45 (94%) had no residues detected and only three (6%) had detectable residues, which were all well below the MRL (Figure 15, Table 14).

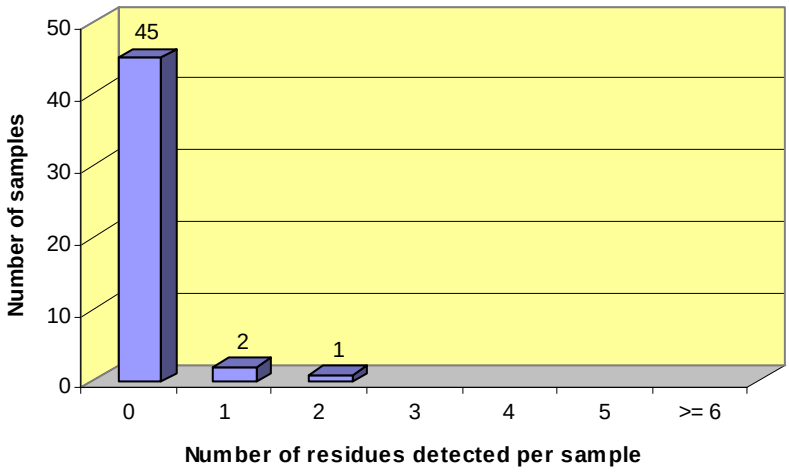
Figure 15 Summary of 2005/06 NZFRSP results – pumpkins



Comparative data for pumpkins was not available from the 1990/91 NZ survey, 2003/04 NZMRS or 2004/05 NZFRSP.

Figure 16 shows that two of the 48 samples of pumpkin had one residue, and one had two residues per sample.

Figure 16 Pumpkins in 2005/06 NZFRSP – numbers of residues per sample



2.4.8 Wheat

Five agricultural compound residues were detected in wheat in the 2005/06 NZFRSP (Table 15). The other 210 agricultural compound residues screened for were not detected in wheat, and DTCs were not screened for.

Table 15 Summary of agricultural compound residues found in wheat- in 2005/06 NZFRSP

Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
50	Chlorpyrifos methyl	< 0.003 (not detected)	49	
		0.03	1	10 [b]
50	Fenitrothion	< 0.01 (not detected)	49	
		0.09	1	10 [b]
50	Malathion	< 0.01 (not detected)	49	
		0.05	1	8 [b]
50	Metalaxyl	< 0.02 (not detected)	49	
		0.09	1	0.1 [d]

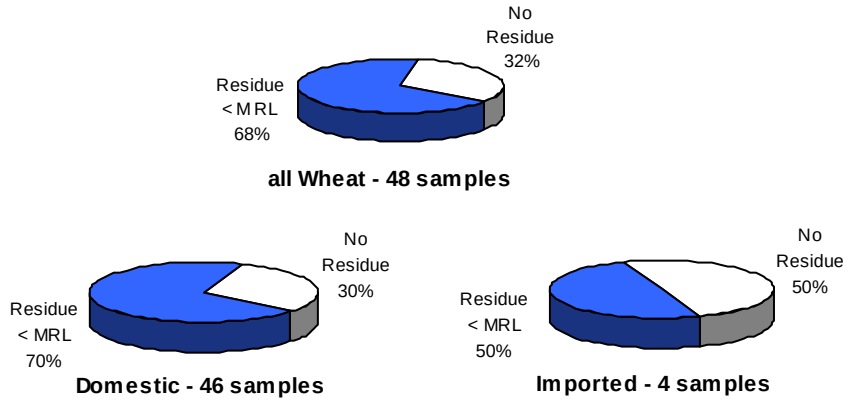
Total samples analysed	Agricultural compound residues found	Range of residues (mg/kg)	Number of samples in specified range	MRL a = NZ ; b = Codex; c = FSC; d = default NZ
50	Pirimiphos methyl	< 0.01 (not detected)	18	
		0.01 < x ≤ 0.1	16	
		0.1 < x ≤ 1	11	
		1 < x ≤ 2.9	5	5 [a]

During sampling, 46 lots of wheat were domestically produced and 4 imported.

For the 50 samples of wheat in the 2005/06 NZFRSP, 34 (68%) had detectable residues and 16 (32%) had no residues detected.

Of the 46 domestic wheat samples, 32 (70%) had detectable residues, and 14 (30%) had no detectable residues. For the four imported samples, two (50%) had detectable residues and two (50%) had no detectable residues (Figure 17). All detectable residues were below the respective MRLs.

Figure 17 Summary of 2005/06 NZFRSP results –wheat



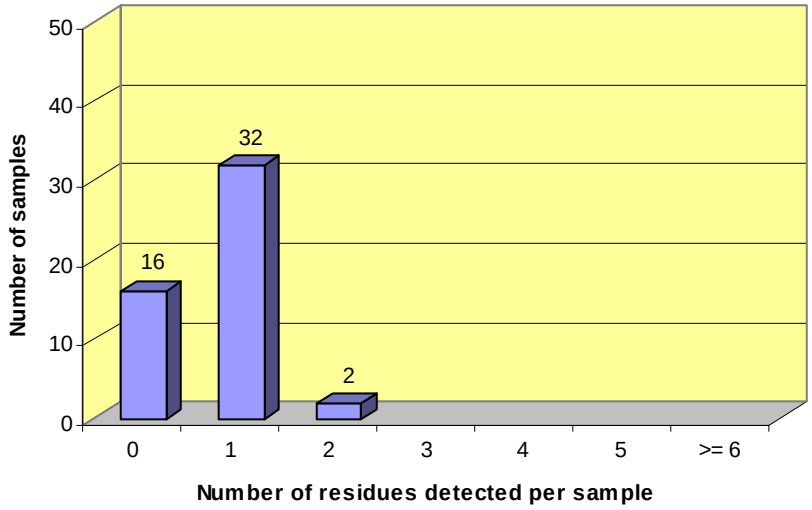
The wheat sampled in the 2005/06 NZFRSP had a lower total percentage of samples with detectable residues compared to those found in the 1990/91 NZ survey, and none exceeded the MRL in 2005/06, whereas 22% did in 1990/91 (Table 16).

Table 16 Comparison of 2005/06 NZFRSP data for wheat with previous New Zealand data

Data source	Total samples analysed	No Residues	%	Residues < MRL	%	Residues > MRL	%	Reference
NZFRSP 05/06	50	16	32	34	68	0	0	This survey
NZ 90/91	27	6	22	15	56	6	22	DoH/MAF, 1992

Figure 18 shows that two samples (4%) of wheat samples in the 2005/06 NZFRSP had multiple residues. They each had two different residues per sample.

Figure 18 Wheat in 2005/06 NZFRSP – numbers of residues per sample



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APPENDIX 1 FOOD SE`LECTION IN THE 2005/06 NEW ZEALAND FOOD RESIDUE SURVEILLANCE PROGRAMME

Food selection

Foods in the 2005/06 NZFRSP are primary produce and related commodity items, primarily of plant origin, for which there is an expectation that foods purchased in one centre have the potential to differ significantly in agricultural compound residues from the same food purchased in other centres. This may be because of different climatic conditions, pests, spray regimes or agricultural practice.

Ranking and prioritization criteria for food/residue combinations

Ranking and prioritisation of food commodities/residue combinations for inclusion in the 2005/06 NZFRSP programme was undertaken by an NZFSA working group. Factors considered were : -

- likely residues,
- lack of NZFSA information about actual residues,
- food consumption data,
- availability of cost effective testing, and
- other intelligence.

NZFRSP food list

NZFRSP foods targeted in 2005/06 were :-

- cabbages,
- carrots,
- celery,
- cucumbers,
- onions,
- plums,
- pumpkins, and
- wheat.

Details of sampling for the eight plant-based foods are provided in Appendix 2.

APPENDIX 2 SAMPLING OF PLANT-BASED FOODS IN THE 2005/06 NEW ZEALAND FOOD RESIDUE SURVEILLANCE PROGRAMME

Sampling locations and dates

Multiple samples of each NZFRSP plant-based food, except wheat, were sampled in each of four locations (Auckland, Palmerston North, Christchurch and Dunedin) on specified and co-ordinated dates (April 2006 and May June 2006). Wheat samples for the 2006 harvest were obtained from grain mills and consolidators in Christchurch (2), Tauranga and Ashburton during April/May 2006.

Sample types and numbers

Sampling of the plant-based food commodities in the 2005/06 NZFRSP included both domestic and imported produce readily available, and thus primarily included those conventionally grown, and occasionally those sold as 'organic' either because they were labelled as such or presumed to be 'organic' because of presentation or context. The total numbers sampled of the 2005/06 year are tabulated below:-

Table 17 Sample numbers and types in 2005/06 NZFRSP

Food	Total sampled	Domestic	Imported
Cabbages	48	48	0
Carrots	48	48	0
Celery	48	48	0
Cucumbers	48	48	0
Onions	48	48	0
Plums	48	26	28
Pumpkins	48	48	0
Wheat	50	46	4
Subtotals		**354**	**32**
Grand Total	**386**		

Sampling outlets

Wherever possible, the purchasing of any particular plant-based food was carried out over a range of outlets. Purchases were made at fruit and vegetable wholesalers, supermarkets, green grocers, road side fruit/vegetable stalls, or occasionally specialty 'organic' stores.

Wheat samples were obtained directly from mills and grain consolidators from different companies and regions.

Range of growers & crop varieties, imported & domestic

For each plant-based food commodity in the 2005/06 NZFRSP, a key priority was in obtaining as wide a range of available growers as possible, including details of their name and location.

Where imported and domestic lines were available for a particular food, the purchasing officer was given specific instructions as to whether he/she should select samples from one, other or both. Country of origin was noted when available. If not possible, foods were identified as either of imported or NZ origin.

Some foods were not available for certain regions/ growers/ domestic/ imported combinations at the time of designated sampling. In these instances, extra samples of available produce were sampled to meet the planned sampling quota. This was so the foods could all be cost-effectively analysed in the same batches, rather than wait further weeks without the surety that the desired region/ grower/ domestic / imported combination could then be purchased.

Sampling procedures

Sampling followed defined procedures consistent with Codex requirements (Codex, 1993a). One 'sample' was not a single fruit or vegetable ie one banana, but was defined by the size of the commodity. For this reason, a single sample of wheat was 0.5kg. Similarly, five cabbages weighing at least 2kg, or ten plums totalling at least 1 kg were purchased.

Sampling of NZFRSP foods was carried out by Health Protection Officers under the direction of a designated contact officer and in co-ordination with ESR.

Sampling officers were provided with a sampling procedures manual and sample shopping ticklists to assist in purchasing. In addition they were provided with preprepared self adhesive labels with a unique NZFRSP code relating to region/season/food type and sample number, as well as a spreadsheet for capturing all the relevant information for each sample purchased.

Purchased food commodities were then dispatched to the analytical laboratory on the same day.

APPENDIX 3 ANALYSES UNDERTAKEN IN 2005/06 NEW ZEALAND FOOD RESIDUE SURVEILLANCE PROGRAMME FOR PLANT-BASED FOODS

The 2005/06 New Zealand Food Residue Surveillance Programme (NZFRSP) analysed eight plant-based foods for a range of agricultural compounds using a multi-residue (MR) screen. The MR screen is a 'package deal' in that it contains a specific set of compounds, each of which can be separately quantified. While the make-up of the MR screen can change over time, the addition of any particular compound to the screen and the related validation of methods and calibration of equipment etc means that short term changes are impractical. Six of the eight plant based foods (excluding cabbages and wheat) were also analysed for dithiocarbamate (DTC) fungicides.

Analyses for agricultural compounds using IANZ (International Accreditation New Zealand) accredited multi-residue and dithiocarbamate methodology capable of analysing 216 compounds was carried out by the RJ Hill Laboratories Limited, Hamilton, resulting in 83,326 analytical results for the 2005/06 NZFRSP.

Analyses were undertaken on composites of each sample submitted, in a manner consistent with Codex (Codex, 1993a). Emphasis was on the raw agricultural product, which was analysed as the unwashed, whole (unpeeled), raw commodity. Information was thus obtained on the basis of key regions to yield from 48 to 50 analytical results for each food commodity (see Table 1 for statistical summary of samples and residues).

The multi-residue compounds that were screened in the 2005/06 NZFRSP are listed in Table 18. The screen contains compounds currently registered for use in New Zealand, some that have previously been registered for use, and some registered for use in other countries and may therefore be present on imported products.

Table 18 Multi-Residue agricultural compound screen in 2005/06 NZFRSP

Compound	Compound	Compound	Compound	Compound	Compound
Acephate	Chlorothalonil	Dimethoate	Fluometuron	Myclobutanil	Propyzamide
Acetochlor	Chlorpropham	Dinocap	Flusilazole	Naled	Prothiofos
Alachlor	Chlorpyrifos	Diphenylamine	Flutriafol	Napropamide	Pyraclofos
Aldrin	Chlorpyrifos methyl	Disulfoton	Fluvalinate	Nitrofen	Pyrazophos
Atrazine	Chlorthal-dimethyl	Diuron	Folpet	Nitrothal-isopropyl	Pyrethrin
Atrazine-desethyl	Chlortoluron	Edifenphos	Furalaxyl	Norflurazon	Pyrifenox
Atrazine-desisopropyl	Chlozolinate	Endosulfan I	Furathiocarb	Omethoate	Pyrimethanil
Azaconazole	Clomazone	Endosulfan II	Haloxyfop-methyl	Oxadiazon	Pyriproxyfen
Azinphos methyl	Coumaphos	Endosulfan sulphate	HCB	Oxadixyl	Quinalphos
Azoxystrobin	Cyanazine	Endrin	Heptachlor	Oxychlordane	Quintozene
Benalaxyl	Cyanophos	Endrin Aldehyde	Heptachlor Epoxide	Oxyfluorfen	Quizalofop-ethyl
Bendiocarb	Cyfluthrin	Endrin Ketone	Hexaconazole	Paclobutrazol	Simazine
Benodanil	Cyhalothrin	EPN	Hexazinone	Parathion ethyl	Simetryn
BHC (alpha)	Cypermethrin	Epoxiconazole	Hexythiazox	Parathion methyl	Sulfentrazone
BHC (beta)	Cyproconazole	EPTC	Imazalil	Penconazol	Sulfotep
BHC (delta)	Cyprodinil	Esfenvalerate	Indoxacarb	Pendamethalin	Tebufenpyrad
Bifenox	DDD (2,4')	Ethion	Iodofenphos	Permethrin	Terbacil
Bifenthrin	DDD (4,4')	Ethoprophos	Iprodione	Phenthoate	Tebuconazole

Compound	Compound	Compound	Compound	Compound	Compound
Bitertanol	DDE (2,4')	Etridiazole	Isazophos	Phorate	Terbufos
Bromacil	DDE (4,4')	Etrimphos	Isofenphos	Phosalone	Terbumeton
Bromophos ethyl	DDT (2,4')	Famphur	Isoprocarb	Phosmet	Terbuthylazine
Bromopropylate	DDT (4,4')	Fenamiphos	Kresoxim methyl	Phosphamidon	Terbuthylazine
Bupirimate	Deltamethrin	Fenarimol	Leptophos	Piperonyl Butoxide	Terbutryn
Buprofezin	Demeton-s-methyl	Fenchlorphos	Lindane (gamma-BHC)	Pirimicarb	Tetrachlorvinphos
Cadusafos	Diazinon	Fenitrothion	Linuron	Pirimiphos methyl	Tetradifon
Captafol	Dichlobenil	Fenobucarb	Malathion	Prochloraz	Thiobencarb
Captan	Dichlofenthion	Fenoxaprop-ethyl	Metalaxyl	Procymidone	Thiometon
Carbaryl	Dichlofluanid	Fenpiclonil	Methacrifos	Profenofos	Tolclofos-methyl
Carbofenothion	Dichloran	Fenpropathrin	Methamidophos	Prometryn	Tolylfluanid
Carbofuran	Dichlorvos	Fenpropimorph	Methidathion	Propachlor	Triadimefon
Carboxin	Dicofol	Fensulfothion	Methiocarb	Propargite	Tri-allate
Chlordane, cis-	Dicrotophos	Fenthion	Methoxychlor	Propazine	Triazophos
Chlordane, trans-	Dieldrin	Fenvalerate	Metolachlor	Propetamphos	Trifloxystrobin
Chlorfenvinphos	Difenoconazole	Fluazifop-butyl	Metribuzin	Propham	Trifluralin
Chlorfluazuron	Diflufenican	Flucythrinate	Mevinphos	Propiconazole	Vinclozolin
Chlorobenzilate	Dimethenamid	Fludioxonil	Monocrotophos	Propoxur	

The dithiocarbamate (DTC) fungicides screen is a separate analysis and involves digesting the foods in acid conditions to form carbon disulphide (CS_2), which is then measured. This is the internationally accepted approach. DTC results are reported as mg/kg CS_2. As the decomposition product (CS_2) is the one measured, it is not possible to identify which of eight DTC in the screen (Table 19) may have been detected, and they are therefore considered as one compound group.

Table 19 Dithiocarbamate fungicide screen in 2005/06 NZFRSP

ferbam	maneb	nabam	thiram	ziram
mancozeb	Metiram	propineb	zineb	

Limits of reporting for agricultural compound screens used in 2005/06 NZFRSP

The limits of reporting (LOR) for the agricultural compounds in the MR screen ranged from some at 0.003 mg/kg to the vast majority at 0.01 mg/kg to a few at 0.05 mg/kg. The LOR for DTC screen is 0.02 mg/kg CS2. The LOR for those agricultural compounds actually detected in the 2005/06 NZFRSP are reported in Tables 3, 5, 7, 9, 11, 13, 14 and 15.

Analytical quality control procedures

Trace analyses of a wide range of complex analytes in a variety of food matrices is an exacting science. For this reason, it is essential to have quality control steps in place to ensure confidence in the methodology and robustness of the results. The following quality control requirements were built into the project – data quality checks, blanks, duplicates, analysis of surrogate spike recoveries, and spike recoveries. Quality control checks in the NZFRSP were generally satisfactory. Any aberrations were followed up on a case by case basis, and actioned accordingly.

APPENDIX 4 ACKNOWLEDGEMENTS

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