

PESTICIDE RESIDUES IN FOOD - THE UK MONITORING PROGRAMME

STEWART REYNOLDS

THE WORKING PARTY ON PESTICIDE RESIDUES

The Working Party on Pesticide Residues (WPPR) was established in 1977 to centrally coordinate the monitoring of pesticide residues in the UK food supply. The WPPR is a Government appointed committee comprising independent and Government scientists, a consumer representative and members from the agricultural and retail sectors. By considering historical trends, and the results of monitoring by industry and authorities in other countries, the WPPR targets its resources at commodities where residues are most likely to be found.

THE STRUCTURE OF THE UK ANNUAL MONITORING PROGRAMME

The monitoring programme has two main aims;

1) To check compliance with UK legislation

Are UK growers using approved products? Are they obeying the instructions with regard to application rates and harvest intervals? Are residues in imported food below Maximum Residue Levels (MRLs), or where MRLs have yet to be set are the levels safe?

2) To refine risk assessments

What are the levels of residues in retail commodities? What is the total intake of pesticides from the diet?

To fulfil these aims a surveillance strategy was put together in 1988, the basis of which is still followed to this day;

- i) continuous monitoring of dietary staples - bread, milk and potatoes;
- ii) rolling programmes - covering fruit and vegetables, cereals, animal products and fish (between a 1 and 6 year cycle dependent on the dietary importance of the particular commodity);

- iii) surveys to estimate human dietary exposure - total diet study, human fat and human milk surveys (once every 5 year);
- iv) miscellaneous surveys and trials as deemed necessary;

The WPPR has increased its spending on monitoring from £0.5m in 1986 to £2m in 1996. Between 3-4,000 samples are analysed annually for 60-80,000 different analytes with >100 pesticides now being sought in some samples.

SAMPLING

Samples are purchased from a range of retail outlets in 12 centres in the UK. Each centre is sampled on alternate months during a 12 month period of January to December. Two centres are located in each of the following six regions;

- 1) London area (within the boundary of the M25 motorway)
- 2) The Midlands
- 3) Scotland & Northern Ireland
- 4) The South & East Anglia
- 5) The North
- 6) Wales & South West

THE INFLUENCE OF THE EUROPEAN COMMUNITY ON THE UK MONITORING PROGRAMME

1) Regulations Relating to Maximum Residue Levels (MRLs)

The European Commission (EC) has in recent years had a major influence on the UK monitoring programme. In 1988 there were 1,000 UK MRLs. However, by 1996 the number of MRLs has risen to 9,000 and the vast majority of these MRLs have been set under the EC harmonisation programme. This process will continue until there are MRLs set for all pesticides used within the European Union (EU).

Within the UK pesticide residues are controlled by "The Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuff) Regulation 1994". This made up of two Statutory Instruments (SIs) which implement the provisions of Council Directives;

1994 SI No.1985: 90/642/EEC, 93/57/EEC and 93/58/EEC setting MRLs for fruit and vegetables, cereals and animal products. They also introduce some national MRLs pending the adoption of Community provisions;

1995 SI No.1483 (Amendment): 94/29/EC and 94/30/EC setting further MRLs for fruit and vegetables, cereals and animal products.

II) Submission of Monitoring Data

There is a requirement for all member states to submit their monitoring results and forward programmes to the European Commission (EC) on an annual basis. The WPPR publishes and submits the results of their previous years surveillance to the EC the following Autumn - the 1995 WPPR Annual Report was published and released on 12 September 1996.

III) European Harmonised Monitoring Programme

As from 1997 a voluntary EC core monitoring programme is under discussion. At the present time this would involve the analysis of a small number of samples for an agreed list of pesticides. For example, for bananas the list of pesticides to be sought is;

acephate	carbendazim	chlorothalonil
chlorpyrifos	DDT	diazinon
endosulfan	imazalil	iprodione
metalaxyl	methamidophos	methidathion
thiabendazole	triazophos	

The proposed 1997 UK monitoring programme includes all the commodities (marked with an * in Table 1) which might make up the new harmonised EU core monitoring programme.

Table 1
Proposed UK monitoring programme for 1997

Commodity	Type	Number of samples
Potatoes*	maincrop	96
Apples	dessert	72
Pears*	including ornamental	62
Bananas*		50
Soft citrus*	mandarins	50
Pineapples		24
Raspberries		24
Cherries		24
Radishes		24
Strawberries		48
Brussels sprouts		24
Green beans*	Runner, French and Stick	50
Cabbage	White and Red	24
Coconut		12
Baby vegetables		48
Celery		48
Infant foods	Fruit based	48
Salad crops	Spanish and Dutch	48

IV) Laboratory Proficiency Testing

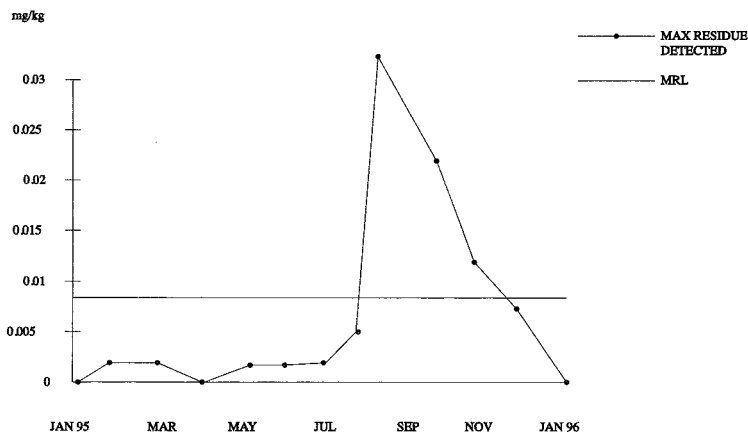
Further co-operation is planned during 1997 with member states being requested to take part in a "proficiency study" or "ring test" to ensure that all participating laboratories are operating to equivalent standards.

THE MAIN FINDINGS AMONGST THE 1995 RESIDUE RESULTS

I) Milk

In previous years very low levels of gamma-HCH have frequently been detected in retail milk samples well below the MRL. A similar pattern was observed between January and June 1995. However, between July and December an unexpected elevation, which peaked in October, occurred with 9 of the 108 samples analysed during that 6 month period exceeding the MRL of 0.008 mg/kg. The residues of gamma-HCH continued to decline in the early part of 1996 and had fallen back to the very low levels experienced in previous years. The maximum levels detected during 1995 have been plotted on a monthly basis in Fig. 1;

Fig 1
Lindane in milk



A risk assessment demonstrated that the acceptable daily intake (ADI) would not be exceeded by the highest residue detected (0.03 mg/kg), even by extreme consumers of milk and other milk derived dairy products. The source of the gamma-HCH was thought to be contaminated compounded animal feed, perhaps containing lindane treated cottonseed waste, although to date no hard evidence to back this explanation has been forthcoming.

II) Dessert Apples

A survey of 73 samples of dessert apples (both UK produced and imported) showed that 54 (73%) contained at least one pesticide residue, with 27 (37%) containing more than one residue. This was in line with 1994 when 85% were found to contain residues and 1993 when 71% contained residues. No residues were detected which exceeded MRLs.

Table 2
Residues found in dessert apples (UK produced) 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
bupirimate	no MRL	0.2	1
captan	3	0.05 - 0.9	4
carbaryl	5	0.1, 0.1, 0.1	3
carbendazim	no MRL	0.5 - 1.1	7
chlorpyrifos	0.5	0.07, 0.5	2
dithiocarbamates	3*	0.1	1
metalaxyl	1	0.1 - 0.5	6

* CODEX MRL

26 Samples analysed. There were 6 samples which contained multiple residues (2 - 3 compounds)

Table 3
Residues found in dessert apples (Imported) 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
azinphos-methyl	1	0.1	1
bromopropylate	2*	0.1	1
captan	3	0.05 - 0.7	8
carbaryl	5	0.1 - 0.7	4
dimethoate	1	0.2	1
diphenylamine	10**	0.1 - 5.0	14
dithiocarbamates	3*	0.1 - 0.3	5
ethoxyquin	3**	0.07, 0.1, 0.3	3
omethoate	0.2	0.05	1
phosalone	2	0.1 - 0.3	8
phosmet+	10*	0.06, 0.7	2
propargite	5*	0.1 - 1.0	9
thiabendazole	10*	0.2 - 1.4	11
tolylfluanid	5*	0.2	1

* CODEX MRL

** PERMITTED LEVEL

+ Parent compound only

47 Samples analysed. 21 samples contained multiple residues (2 - 5 compounds)

III) Oranges

Residues were found in all 72 samples of a survey of oranges, including 67 (93%) with 2 or more residues (9 different residues were found on one sample). The most frequently encountered residue was imazalil which was found on all but 3 of the samples. One sample from Cyprus, contained parathion-methyl at 0.8 mg/kg which exceeded the MRL of 0.2 mg/kg. The relevant authorities in Cyprus have been notified of this finding.

Table 4
Residues found in oranges 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
aldicarb	0.2*	0.1	1
biphenyl	70**	0.1 - 1.0	5
chlorpyrifos	0.3	0.05 - 0.3	5
dichloran	no MRL	0.1	1
dimethoate	2	0.06	1
dicofol	5	0.07 - 0.3	7
endosulfan	2	0.1	1
ethion	2	0.08, 0.2	2
fentrothion	2	0.05 - 0.2	4
fenthion	2*	0.08, 0.1	2
imazalil	5	0.06 - 4.9	3
malathion	2	0.07, 0.08, 0.2	3
mercabam	2*	0.1	1
metalaxyl	5	0.08 - 3.4	8
methidathion	2*	0.06 - 0.9	17
parathion	no MRL	0.05	1
parathion-methyl	0.2	0.1, 0.5, 0.8	3
2-phenylphenol	12**	0.1 - 1.6	38
phosmet	5*	0.08, 0.1	2
pirimiphos-methyl	0.5	0.07	1
tetradifon	no MRL	0.06, 0.06, 0.08	3
thiabendazole	10**	0.05 - 6.6	46
triazophos	no MRL	0.1, 0.1	2
2,4-D	2*	0.02 - 1.2	41

* CODEX MRL

** PERMITTED LEVEL

72 samples analysed

IV) Tea

A survey of 59 retail brands of tea revealed residues in only 10 (17%). Dicofol and ethion were the only residues detected of the 61 pesticides sought and neither case was an MRL exceeded. Neither of the pesticides detected are readily transmitted from the dry tea leaf into the aqueous brew. It was estimated that between 10 - 30% could be transferred into the brew. Residues of both dicofol and ethion were found in 3 samples.

Table 5
Residues found in tea 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
dicofol	5	0.06 - 0.6	8
ethion	5	0.1 - 1.9	5

59 samples analysed

V) Fresh Herbs

For the first time, a small survey of fresh herbs was undertaken. The sample of mint was found to contain 1.9 mg/kg of deltamethrin well above the MRL of 0.05 mg/kg. In the same sample a residue of heptenophos was found at a level of 14 mg/kg which suggested misuse of this pesticide. If herbs containing this level of heptenophos were eaten throughout ones' life, the ADI would be exceeded. However, this scenario is highly improbable.

Table 6
Residues found in fresh herbs (UK produced) 1995

Residue	MRL (mg/kg)	Concentration Range Range (mg/kg)	Number of Residues
PARSLEY	9 samples analysed		
chlorpyrifos	no MRL	0.1, 0.3	2
dithiocarbamates	no MRL	8.9	1
pirimicarb+	no MRL	0.1, 0.4	2
MINT	1 sample analysed		
deltamethrin	0.05	1.9	1
heptenophos	no MRL	14	1
CHIVES	2 samples analysed	No residues found	
CORIANDER	3 samples analysed	No residues found	
DILL	1 samples analysed	No residues found	
THYME	1 samples analysed	No residues found	

+ Parent compound only

17 samples analysed

VI) Carrots

Carrots grown in the UK are particularly susceptible to attack by carrot fly. Organophosphorus (OP) or carbamate pesticides are therefore commonly used to control this pest. In 1994 high residues of a number of OPs had been found which exceeded MRLs and in a few cases left little or no safety margin with respect to ADIs.

Before the 1995 growing season, restrictions on the use of the number applications of OPs were introduced in an attempt to remove this problem. The 1995 monitoring results, the first generated since these restrictions has been introduced, indicated a reduced level and incidence of residues. Although this looks encouraging, it is by no means certain that the reduced levels were solely due to these restrictions, as the unusually hot and humid weather conditions experienced during the 1995 summer may also have helped to increase residue degradation.

Table 7
Residues found in carrots (UK produced) 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
chlorfenvinphos	0.5	0.01 - 0.1	6
iprodione	no MRL	0.01 - 0.07	15
pendimethalin	1	0.01 - 0.03	4
phorate	0.2	0.01 - 0.1	14
pirimiphos-methyl	1	0.01	1
quinalphos	no MRL	0.01 - 0.1	10
triadimefon	no MRL	0.01	1
triazophos	1	0.01 - 0.2	32
trifluralin	no MRL	0.01 - 0.03	5

63 samples analysed

VII) Celery

All but one of the 49 samples of celery analysed contained residues, including 26 (53%) containing more than one residue. 15 (41%) samples contained residues which exceeded MRLs. 3 samples from Israel contained methamidophos in excess of the MRL of 0.01 mg/kg.

3 samples from Spain exceeded MRLs; 2 contained chlorpyrifos-methyl above the MRL of 0.05 mg/kg and 1 contained chlorpyrifos above the MRL also of 0.05 mg/kg. 9 Spanish samples also exceeded the MRL for procymidone of 0.02 mg/kg. These MRLs have been set at the limit of determination to reflect the fact that there should be no approvals for the use of

Table 8
Residues found in celery (Imported) 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
carbendazim	2	0.6	1
chlorothalonil	15*	0.05 - 0.7	11
chlorpyrifos	0.05*	0.1	1
chlorpyrifos-methyl	0.05	0.2, 0.2	2
diazinon	0.5	0.1	1
dichlofluanid	no MRL	0.2, 0.4	2
dithiocarbamates	5*	0.1 - 1.0	9
inorganic bromide	300	5 - 26	29
iprodione	no MRL	0.5, 2.0	2
methamidophos	0.01	0.08, 0.09, 0.2	3
parathion-methyl	5*	0.05, 0.08	2
permethrin	2	0.2	2
procymidone	0.02	0.07 - 0.4	9
thiabendazole	no MRL	0.2, 1.0, 1.4	3
triazophos	no MRL	0.05	1
vinclozolin +	5	0.08, 0.1	2

* CODEX MRL

+ Parent compound only

these pesticides within the EU. The number of Spanish samples in excess of the MRL suggests that either there are extant uses of these pesticides or that they are being misused.

Although these residues in imported celery pose no risk to consumers, both the Israeli and Spanish authorities have been notified of these findings.

VIII) Winter Lettuce

Intense production of UK winter lettuce under glass, in relatively low light and temperature conditions, requires excellent pest control regimes during the production period as the plants only grow very slowly. In consequence, this crop has become associated with significant residues. For a number of years, WPPR surveillance has indicated misuse of pesticides, particularly fungicides, on winter lettuce.

Whilst the residues found are not a health concern, they do indicate that some growers are not respecting approval conditions. The four residues of vinclozolin, the one residue of chlorothalonil and the one residue of carbaryl detected, all indicate misuse as none of these chemicals are approved for use on lettuce within the UK. For vinclozolin, there are unacceptable risks to operators associated with the application of this pesticide in enclosed environments, such as glasshouses.

Three residues of iprodione, exceeded the MRL (10 mg/kg), whilst 7 residues of propamocarb also exceeded the CODEX MRL (10 mg/kg) and 3 residues of dithiocarbamates were also above the CAC MRL (5 mg/kg). These residues could have arisen for a number of individual reasons, but more likely as result of a combination of events; i) disregard of the instructions on the label, e.g. over application of the pesticide (too concentrated, or more than the recommended maximum number of applications) or not allowing the minimum period of time to elapse between pesticide application and crop harvest, ii) particularly slow/poor plant

Table 9
Residues found in winter lettuce (UK produced) 1995

Residue	MRL (mg/kg)	Concentration Range (mg/kg)	Number of Residues
carbaryl	no MRL	1.2	1
chlorothalonil	no MRL	0.02	1
dithiocarbamates	5*	0.1 - 4.8 6.6, 7.7, 9.8	31 3
iprodione	10	0.08 - 8.9 13, 16, 19	27 3
propamocarb	10*	0.1 - 8.0 11 - 17 21, 26, 27	17 6 3
propyzamide	no MRL	0.01 - 7.6	15
toloclofos-methyl	no MRL	0.01 - 3.4	40
vinclozolin	5	0.03 - 1.9	4

* CODEX MRL
70 samples analysed

growth resulting in less "dilution" of the residue in the "adult" plant, iii) a lack of sufficient light and temperature to produce the expected level of pesticide degradation.

There is no MRL for tolclofos-methyl, but 3 residues exceeded 1 mg/kg, which suggests that the pesticide may have been applied post-planting (a non-approved use). There is currently no MRL for propyzamide in lettuce, but 3 samples exceeded the proposed EC MRL of 0.1 mg/kg.

These results will be discussed with representatives from the lettuce growers and the retailers association in a further attempt to improve the situation. Further enforcement action is also planned for the 1996/7 season.

SUMMARY OF RESULTS FROM 1995 SURVEILLANCE

In view of the targeted nature of many of the surveys undertaken during 1995, the overall picture is reassuring, following the general pattern seen in previous years. In total 3230 samples were analysed of which 2205 (68%) were found to contain no residues. 993 (32%) did contain residues, and only 32 (<1%) were above the MRL.

REFERENCE

HMSO, 1996; Annual Report of the Working Party on Pesticide Residues 1995, Supplement to The Pesticide Register 1996 (London: HMSO) ISBN 0-11-243020-1.