

Time trend analysis of pesticide residues in pears.

1. Introduction

- 1.1 In previously published annual reports on pesticide surveillance, by the Working Party on Pesticide Residues (WPPR), a section on time trends of pesticides in fruit and vegetables was produced. When the Pesticide Residues Committee (PRC) took over the publication of the surveillance reports, the FSA as part of its watchdog role began to contribute by producing time trend papers. It was decided after discussion with the PRC that a paper on pesticide residues in pears should be produced for the 2002 annual report.
- 1.2 Pears were listed as the fifth most regularly bought fresh fruit in the UK in the 1999-2000 Mintel report. UK retail sales for 1999-2000 were worth £155 million. Statistics show that 22% of pears consumed in the UK are grown in the UK (Defra Basic Horticultural Statistics for the UK 1991-2002).
- 1.3 This paper presents a time trend analysis of pesticide residues in pears based on surveillance carried out by the then Working Party on Pesticide Residues (WPPR) and the Pesticide Residues Committee (PRC). From this analysis three main areas of interest have been considered:
 - the effects of the enforcement actions dealing with the most common residue found, chlormequat;
 - trends in the next two most common residues, carbendazim and dithiocarbamates; and
 - occurrence of multiple residues.

The results reported between 1995-2002 for residues in pears were considered at the time that they were published and were considered to be of no concern to the health of consumers.

2. Residue surveillance

- 2.1 The WPPR (1989-99) and the PRC (from 2000) surveillance is targeted towards foods which are widely consumed and in which pesticide residues are most likely to be present. The results therefore tend to exaggerate the extent to which residues are present in the food supply as a whole. The data from these surveys were analysed by Central Science Laboratory, York (CSL) for the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) as part of the Report on Risk Assessment of Mixtures of Pesticides and Similar Substances (WIGRAMP) that was published in October 2002. Chlormequat was the most commonly reported pesticide found in pears between 1997 and 2001 (63% of samples) followed by dithiocarbamates (60%) and carbendazim (50%).

2.2 Pears (UK and imported) have been part of a rolling retail surveillance programme for approved and non-approved pesticides since 1988. The years in which surveillance of pears was carried out were 1989/1990, 1992, 1995, 1997 - 2000 and 2002. Analyses carried out by the Department of Health in 2001 and 2002 for the school fruit initiative have been included to increase the data set.

2.3 As a result of changes in the design of the retail surveys the dataset reflects year-on-year variation in the number of pear samples analysed (19-155) and the number of pesticides for which the samples were analysed (1-120) (see Table 1 for full details). It was necessary to exclude from the analysis data from:

- 1989/90-1992 due to the changing analytical detection limits (different limits of detection were applied in 1989-1992 compared to 2002)
- those, relatively few (21), samples of unknown origin.

The results presented here relate to the analytical detection limits and the maximum residue limits (MRLs) in place when the surveys were carried out. There is no standardisation to take account of any changes in these limits.

Table 1: Number of pesticides tested for and number of pears tested

Year	1989/1990	1992	1995	1997	1998	1999	2000	2001*	2002\$
No. of pesticides tested for #	16	30	100	108	104	1~	60	59	120
Total No. of pears samples analysed (UK+ Imported.)	45	49	45	67	41	90	133	19	155

Not every sample was tested for all pesticides

* Data from the school fruit initiative only. Due to the small number of samples, this data has not been used in Figures 1-4

\$ Data from the PRC surveillance and the school fruit initiative combined.

~ Only chlormequat was tested for in 1999.

2.4 A time trend analysis for data for pears reported by the WPPR/PRC between 1995-2002 is presented below. For any given year this sets out:

- The percentages of all samples (imported & UK produced) analysed, found to contain pesticide residues (Figure 1) and the proportion exceeding the MRL; (e.g. in 1998 100% of UK samples had residues, 20% of these exceeded the MRL).
- The percentages of all samples (imported & UK produced) analysed, found to contain multiple pesticide residues (Figure 2);

Figure 1: Percentage of pear samples containing residues

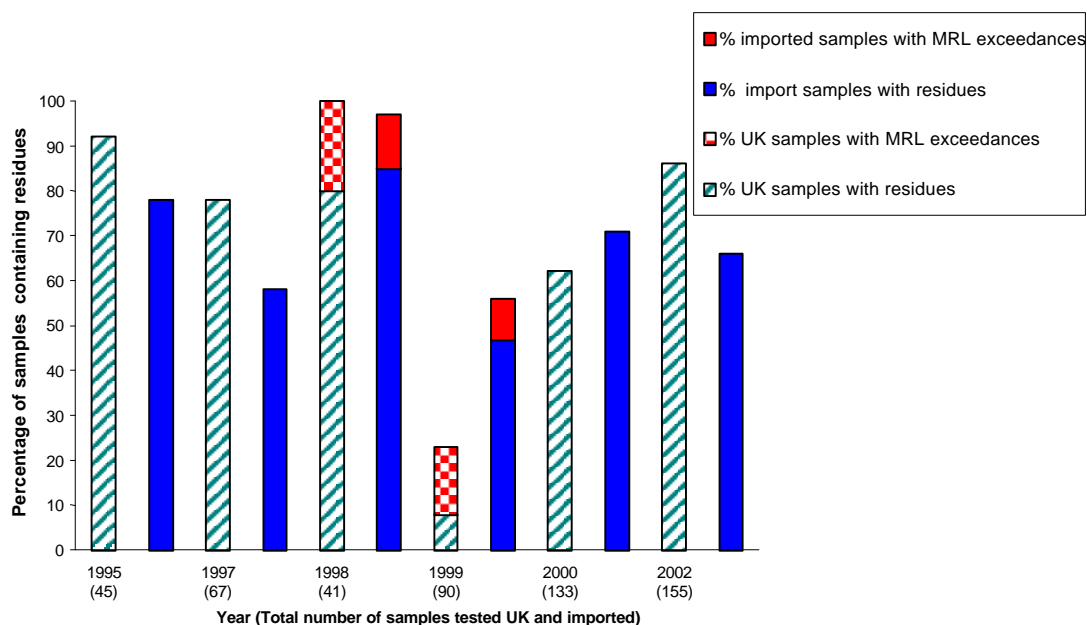
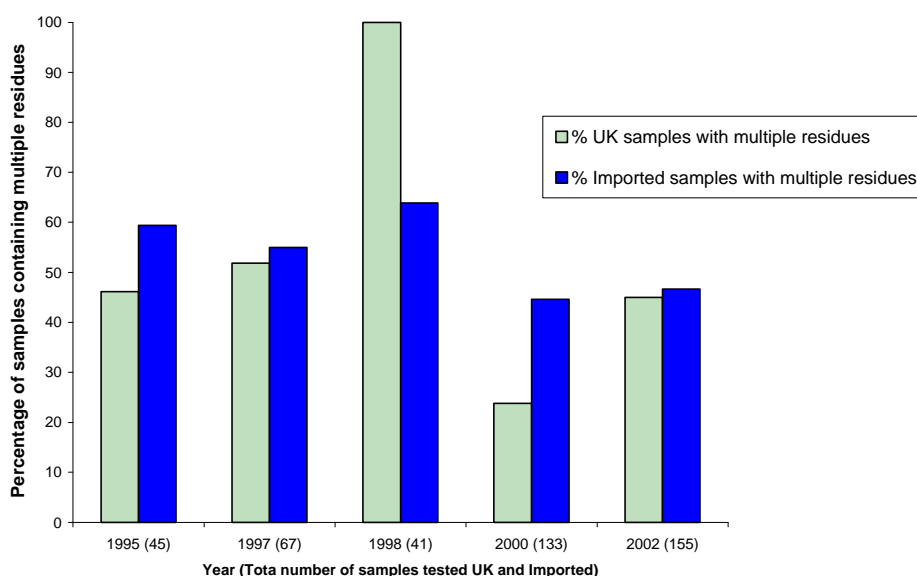


Figure 2: Percentage of pear samples containing multiple residues



2.5 In general there is no obvious change in the percentage of samples containing multiple residues in pears, although the 1998 UK result appears anomalous (see Figure 2). It should be noted that as the number of pesticides sought and samples tested increased (see Table 1) so an increase in residues would be expected.

3. Trends in exceedance of MRLs

3.1 Figure 1 above includes data on MRL exceedances in imported and UK grown pears. However it is not possible to identify a trend, as exceedances were infrequent.

3.2 MRLs are not safety limits. They represent technically acceptable residue levels in foods providing that Good Agricultural Practices are followed. The MRL exceedances reported here (which are relatively few) were assessed at the time the results were published and were not considered to be at levels expected to have effects on health.

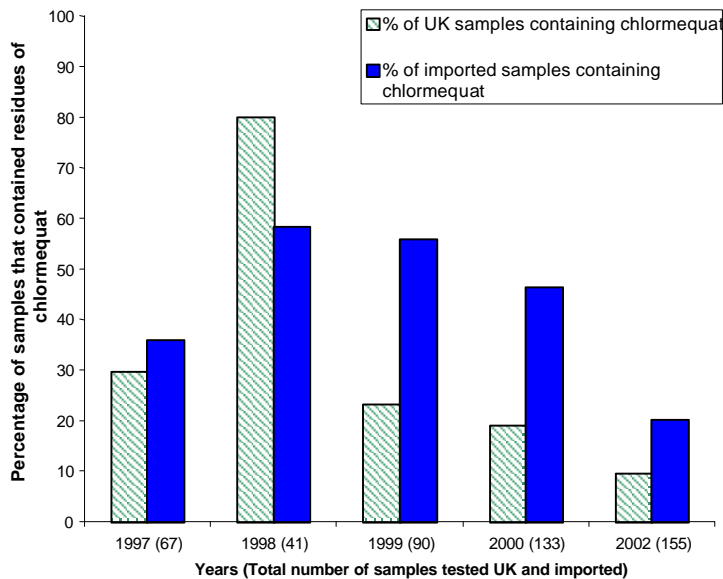
4. Trends in chlormequat residues

4.1 Chlormequat is a gibberellin biosynthesis inhibitor, acting as a plant growth regulator by restricting cell elongation. By restricting the resources plants expend on stem extension, chlormequat may also increase flowering, fruit and seed yields (Pesticide Manual, 2000). It

may also improve the shape of some types of pears such as 'Conference', and improve the quality of the fruit.

- 4.2 Chlormequat has not been approved for use on fruiting pears in the UK but was approved for use on pears in some EU member states (EU MRL 3 mg/kg). In July 2001, a temporary EU MRL (0.5 mg/kg) came into force that only allowed for carry-over of chlormequat from previous usage, with the intention of subsequently introducing a LOD (limit of detection) MRL of 0.05 mg/kg. This effectively banned the further use of chlormequat on pear trees and approval for the use on pears was withdrawn in all EU countries in which it had previously been authorised. (Stewart L Reynolds, Alan R C Hill & Miles R Thomas, Food Additives and Contaminants, (in press)).
- 4.3 A survey of pears was carried out in 1995 following intelligence that chlormequat was being used by some UK growers and residues were found. This led to annual surveillance to monitor for the presence of chlormequat from 1997. Early in 2000, the food industry, led by the major supermarket companies, introduced a positive release scheme in which pears were checked for compliance with MRLs before they were traded. This forced most growers to abandon the use of chlormequat in that year and proved to be very effective in removing most, if not all, of the lots containing unacceptable residues from the UK food supply. Residues of chlormequat have been detected in pears at low levels in subsequent surveys. This may reflect the persistence in fruit trees
- 4.4 The following time trend analysis was carried out to see whether the enforcement actions were effective. The percentage of all the pear samples (imported & UK produced) analysed, found to contain residues of chlormequat is shown in Figure 3.

Figure 3: Percentage of pear samples containing chlormequat residues



4.5 This Figure indicates that the percentage of pear samples containing chlormequat has fallen following enforcement action taken in 1999.

5. Trends in carbendazim and dithiocarbamate residues

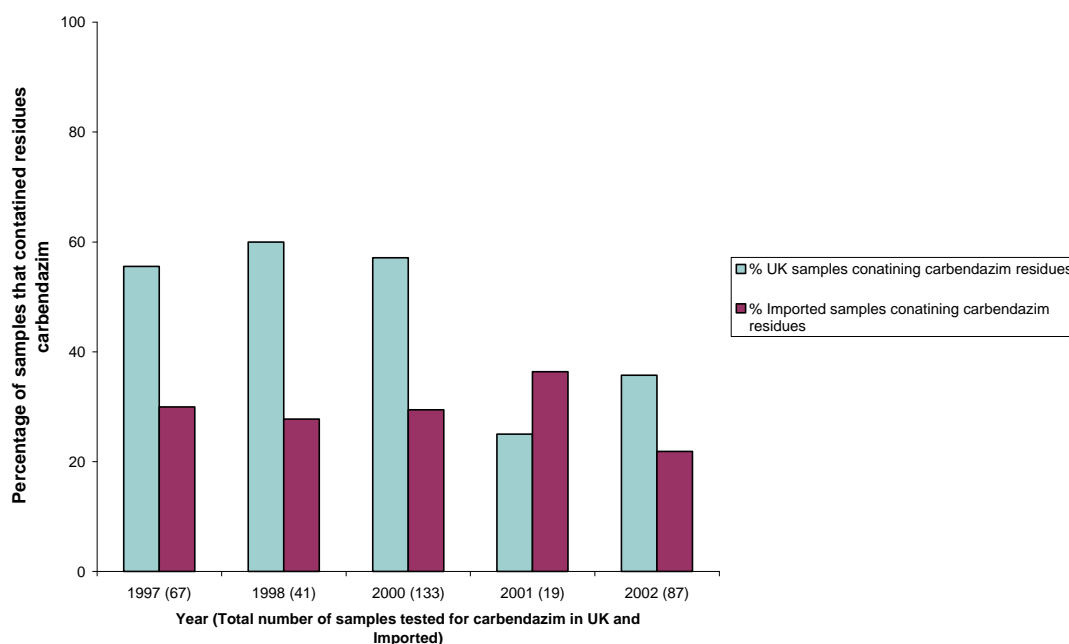
5.1 After chlormequat, the next two most commonly detected pesticide residues in pears were dithiocarbamates and carbendazim. Time trend analyses were carried out for these residues using data from PRC surveillance between 1997-2002 (excluding 1999 when only chlormequat was tested) and the school fruit survey in 2001 and 2002. For both of these residues we have included the data from 2001 even though there were few samples tested (see Table 1).

5.2 These pesticides are used on pears for different reasons. Carbendazim is used mainly as a post harvest treatment, as a dip in combination with other pesticides to prevent rot in transport and storage. Dithiocarbamates are fungicides that are sprayed onto pears. The dithiocarbamates are a group of pesticides whose residues are determined by analysing a common metabolite. Hence no data are available for the individual dithiocarbamates that make up the group.

5.3 No trend in the percentage of pear samples containing dithiocarbamate residues is observed. This may be due to the variations in weather conditions between years resulting in variation in usage due to differences in disease pressure.

5.4 The following time trend analysis is presented for the percentage of all the pear samples (imported & UK produced) analysed, found to contain carbendazim residues (Figure 4).

Figure 4: Percentage of pear samples containing carbendazim residues



5.5 From Figure 4 it can be seen that there has been a reduction in the overall percentage of UK samples containing residues of carbendazim. This may be due to changes in pesticide usage or the methods used to store pears in the UK.

6. Multiple residues

6.1 Consumers frequently express concern about multiple residues of pesticides. The COT Report, Risk Assessment of Mixtures of Pesticides and Similar Substances concluded that the probability of any human health hazard from exposure to mixtures of chemicals (combined exposure), each present at a low level, is likely to be small and that effects of mixtures of substances are unlikely to be other than additive. However, the COT also noted that the body of evidence in this area is limited, and it is possible that some interactions of chemicals are not readily predictable.

6.2 A draft action plan to take forward the COT's recommendations has been drawn up in consultation with officials from those agencies and departments with responsibilities both for the approval of agricultural pesticides, biocides and veterinary residues, and the surveillance of their residues in food. The plan has been issued for full public consultation on the FSA website.

7. Pesticide Residue Minimisation

7.1 Consumer preference is for food that does not contain pesticide residues. The Agency is working with a range of stakeholders, acting on consumers' wishes, to develop an action plan to minimise pesticide residues in food. The FSA Board agreed an outline action plan in June 2003. Pears are amongst the five crops identified as priority areas for targeting, as there are already industry initiatives that can be developed.

7.2 The pesticide surveillance data used in this paper from the surveillance programme is targeted at problem areas and the crop/pesticide combinations tested change from year to year. Inherent variability in pesticide usage, due to changes in authorisation imposed by the EU, variations in weather conditions between years resulting in variation in usage due to differences in disease pressure etc, may also have an impact on residues detected. The results reported here for the last 7 years are, however, indicative of a trend in the high frequency of pesticides detected in the pears analysed.

Summary of the results

- The historic pesticide surveillance data is targeted towards problem areas and so pesticide combinations change from year to year.
- Data over the last 7 years indicates that there continues to be a high percentage of the pears tested (81% UK samples and 66% imported 2002) with pesticide residues.
- There is no obvious change in the percentage of pear samples containing multiple residues.
- The enforcement action on chlormequat has been effective in pears although low levels of illegal residues continue to be found in UK pears. This is thought to be due to residues of chlormequat that have remained in the trees for several years.
- There seems to be a reduction in the proportion of samples with carbendazim residues.
- There is no clear trend for dithiocarbamate residues.

8. Conclusions

8.1 Pear samples tested over the last 7 years contain a high percentage of pesticide residues.

8.2 The enforcement action on chlormequat in pears has shown a reduction in chlormequat residues. Changes in legislation for chlormequat has also contributed to the reduction. Approval for use has been withdrawn in all EU countries in which it had previously been authorised.