

PESTICIDE USAGE IN SCOTLAND

POTATO STORES 2002

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This is the tenth survey on the use of pesticides on stored potatoes in Scotland, covering the crop harvested in 2002.

Compared with the previous survey in 2000, the quantity of both seed and ware potatoes stored rose by around 7% to a total of over 1,234,000 tonnes. There was a significant increase in refrigerated storage resulting in 75% of seed potatoes and 71% of ware potatoes being stored by these means.

The total quantity of all potatoes treated, 235,538 tonnes, rose roughly in line with the increase in tonnage stored, although pesticide usage on seed potatoes increased, whilst that on ware potatoes fell, compared with the previous survey.

Overall, imazalil remained the principal active ingredient, being applied to a total of 218,231 tonnes, predominantly to seed potatoes. Use of 2-aminobutane, applied to seed only, increased, whilst use of chlorpropham, applied to ware only, declined.

● ***INTRODUCTION***

This is the tenth survey of the use of pesticides on stored potatoes in Scotland, a list of previous surveys can be found in the references¹⁻⁷.

Both the methodology employed in this survey and the presentation of data in the report are similar to those of the previous survey covering the potato crop harvested in 2000.

● ***DEFINITIONS AND NOTES***

Pesticide information recorded in this survey relates to post-harvest applications, including those carried out in the field prior to entry to the store, but excluding pre-planting fungicidal seed treatments applied towards the end of the storage period, even if they were applied in store. Usage of pesticides in the latter situation is recorded in the Arable Crop reports.

Basic tonnage is the quantity of potatoes treated with a pesticide, irrespective of the number of times they were treated or the number of pesticides used. This figure is used to calculate the percentage of potatoes treated with a chemical or groups of chemicals.

Tonnes treated is the basic tonnage multiplied by the number of treatments those potatoes received.

Seed potatoes are those designated as seed, after dressing and removal of the ware fraction.

Ware potatoes include those grown for the ware market plus the portion of potatoes originally planted for seed but later sold as ware. The quantity of stored potatoes following the harvest recorded in this report will include soil, wastage, and those potatoes downgraded to animal feed.

Farm store data include information obtained from grower-dealers, i.e. those farmers who grow and trade in potatoes.

For the purpose of this survey, potato merchants do not own agricultural land and are therefore not in the Agricultural Census. As in the previous report, merchants have been subdivided into those that grow potatoes on rented land and store potatoes, and those who only store.

Due to rounding, there may be slight differences in totals both within and between tables.

For this survey, the sample of farms was the same as that for the Arable Crops 2002⁸ and was drawn from the 2002 Agricultural Census⁹. In addition, a number of grower-dealers and potato merchants who grew potatoes were identified during the survey fieldwork. All the known merchants in Scotland who did not grow potatoes were surveyed.

The country was divided into 11 land-use regions¹⁰ (Fig.1), and the farm store sample was drawn from Census returns of holdings growing any of the combine crops. The sample was stratified by land-use region and size of holding. Sampling fractions within region and size group related to area of crops grown rather than number of farms, so that smaller size groups did not dominate the sample. A number of regions were amalgamated, due to the low number of stores sampled. These regions were Highlands & Islands with Moray Firth and Aberdeen, Lothian with Tweed Valley, and Southern Uplands with Solway.

The data collected were obtained by personal interview and details included the areas grown, quantities of potatoes stored, the storage environment, methods of storage and storage chemicals applied. Fungicidal seed treatments applied prior to planting are included in the Arable Crop reports and are therefore not recorded in this report.

The data from merchants that grew on rented land were merged with the farm sample. National estimates of storage chemical usage were produced from the sample data by applying raising factors based on the areas of potatoes grown in 2002⁹. An adjustment was made to the ware fraction to allow for the potatoes grown for seed that were designated as ware (Table 11). A second adjustment (Table 12) was made to the survey estimates of stored potatoes to bring them into line with the figures provided by the British Potato Council.

Information from merchants that did not grow potatoes were recorded separately, as this data was not raised. The two data sets were then merged in the final tables to provide total national usage figures.

DISTRIBUTION OF STORES

Information was obtained from a total of 56 stores. The distribution of these stores throughout Scotland is shown in Table 1.

SEED POTATOES

The quantity of seed potatoes stored in 2002 was 385,934 tonnes, a 6% increase compared with the previous survey, but roughly similar to that recorded in 1998.

● **Storage methods (Tables 2, 3)**

There has been a dramatic increase in refrigerated storage, and in 2002 it was estimated that 75% of all seed potatoes were stored in this way, compared with only 37% in 2000. There was a corresponding drop in basic ventilated storage, from 63% in the previous survey to only 20% in 2002. Unventilated storage (5%) remained low.

Nearly all (99%) seed was boxed, compared with 88% in 2000.

● **Use of pesticides (Tables 3, 4)**

Almost half (47%) of all seed potatoes were treated in 2002, a higher proportion than in any of the previous surveys.

Only two pesticides were recorded on seed potatoes, imazalil and 2-aminobutane. The former remained the most widely used, and almost 170,000 tonnes were treated compared with only 75,000 tonnes in the previous survey. Usage of 2-aminobutane also increased, from under 5,000 tonnes in 2000 to 12,372 tonnes in the present survey.

As in previous surveys, potatoes were treated with pesticides as a general disease precaution. No specific reasons were given by growers.

There was a 7% increase in the tonnage of ware potatoes from around 790,000 in 2000 to almost 850,000 in 2002.

● ***Storage methods (Tables 2, 3)***

Storage methods for 2002 harvested ware potatoes were similar to those recorded for seed potatoes. It was estimated that 71% of all ware potatoes were refrigerated and 23% ventilated, compared with 33% and 62% respectively in 2000. Unventilated storage remained low (6%).

Similar to data presented in the previous two surveys, nearly all ware potatoes were stored in boxes.

● ***Use of pesticides (Tables 3, 4)***

The increase in use of refrigerated storage and the recent withdrawal of tecnazene may be the reasons for the reduction in pesticide usage, from 9% of the tonnage treated in 2000 to only 6% in 2002, the lowest in recent surveys. Usage of imazalil, applied to 48,423 tonnes, increased compared with the previous survey from 26,522 tonnes, whilst usage of chlorpropham, applied to under 5,000 tonnes, declined.

As in previous surveys, ware potatoes were treated mostly for general disease precaution and sprout suppression.

COMPARISONS WITH PREVIOUS SURVEYS

Comparisons in the usage of pesticide with previous surveys are presented in Tables 6-10 and Figures 6 and 7.

Compared with 2000, the total tonnage of all stored potatoes increased by 7% from a little over 1,155,000 to 1,234,191, with both seed and ware increasing in roughly similar proportions.

The total tonnage and proportion of all potatoes treated, together with the weight of pesticides applied, were roughly similar to those recorded in the previous two surveys, although there were significant increases in the treatment of seed potatoes, and a corresponding decrease in those designated as ware.

When the tonnage of all potatoes treated is taken into account, imazalil remained the most widely used pesticide. When measured by weight of active ingredient applied, 2-aminobutane, applied to seed only, replaced chlorpropham, applied to ware only, as the main pesticide.

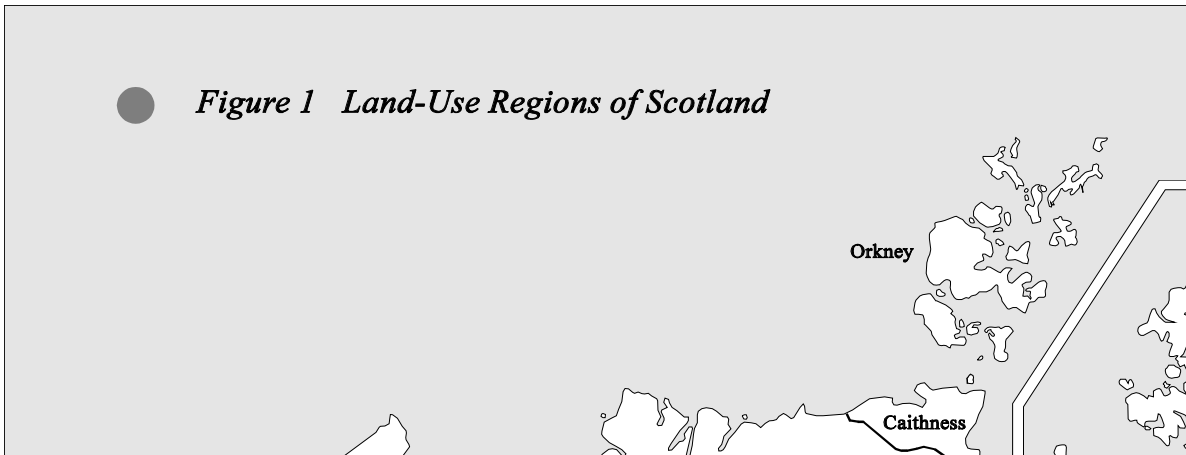
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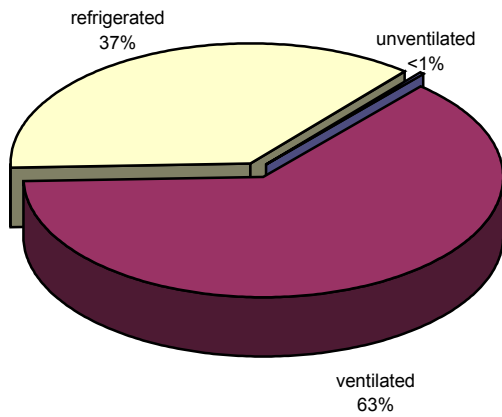
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● *Figure 1 Land-Use Regions of Scotland*

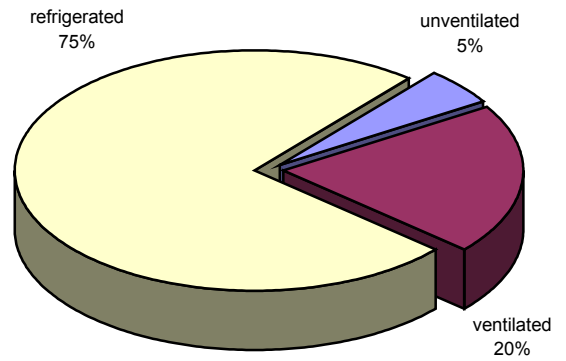




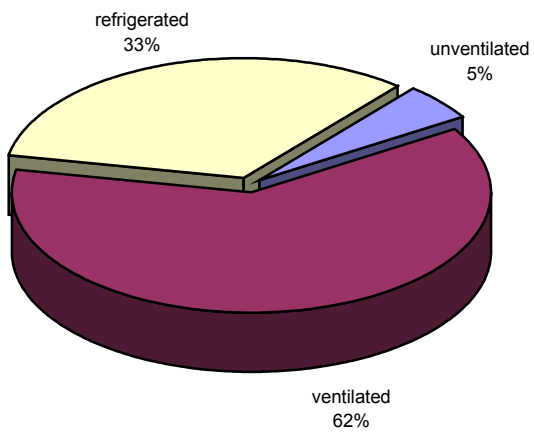
● **Figure 2** Storage of seed potatoes 2000



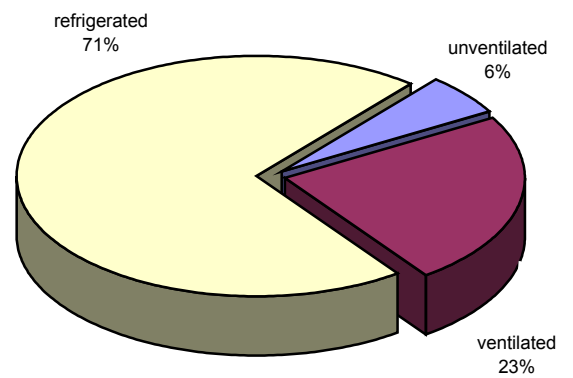
● **Figure 3** Storage of seed potatoes 2002



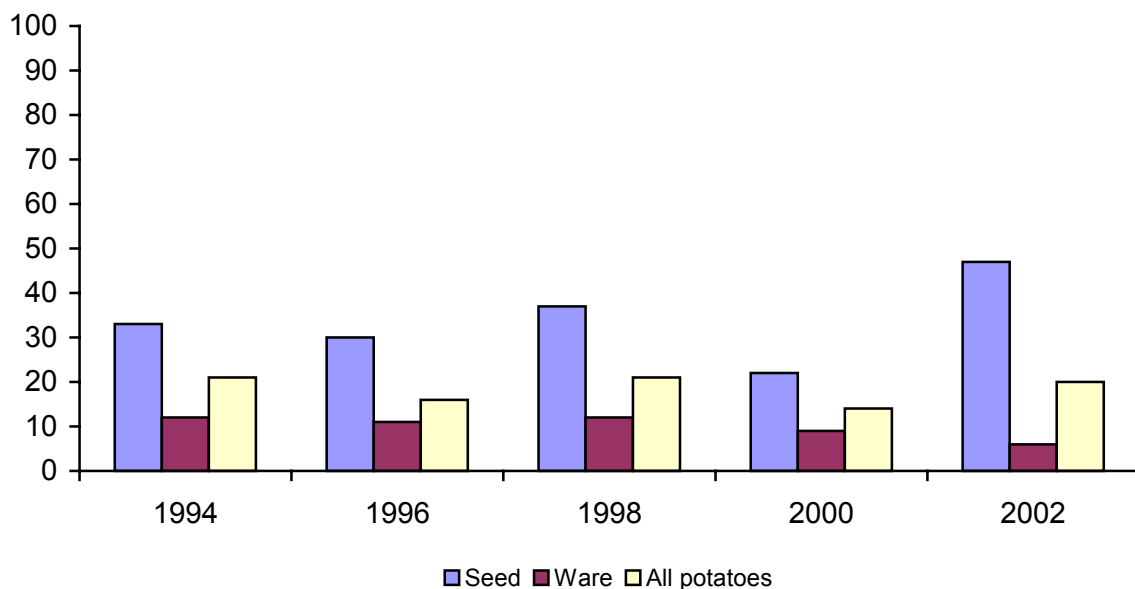
● **Figure 4** Storage of ware potatoes 2000



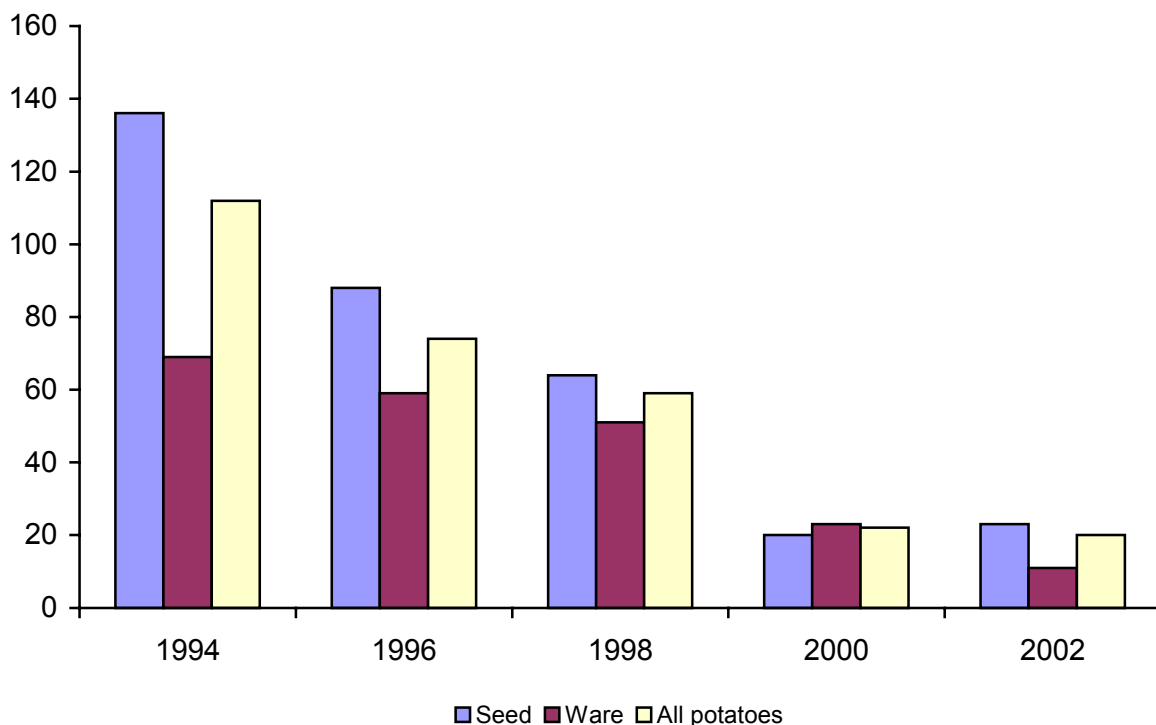
● **Figure 5** Storage of ware potatoes 2002



● **Figure 6 Comparison of pesticide usage 1994 – 2002**
Percentage of potatoes treated



● **Figure 7 Comparison of pesticide usage 1994 - 2002**
Average application of all active ingredients per treated tonne (g/tonne)





● **TABLE 1** *Distribution of stores*

Region	Number of stores
Highlands & Islands, Moray Firth and Aberdeen	7
Angus	21
East Fife	9
Lothian & Tweed Valley	8
Central Lowlands	11
Scotland	56



TABLE 2 Stored potatoes
Storage type and method

<i>Seed</i>	Store type				Storage method		
	<i>Unventilated</i>	<i>Ventilated</i>	<i>Refrigerated</i>	<i>Total</i>	<i>Bulk</i>	<i>Boxed</i>	<i>Total</i>
Tonnes stored	18,990	79,087	287,857	385,934	2,864	383,070	385,934
% type & method	5	20	75	100	1	99	100
Basic tonnage treated		45,085	136,036	181,121	2,864	178,257	181,121
% treated		57	47	47	100	47	47
<i>Ware</i>							
Tonnes stored	47,503	198,659	602,095	848,257	916	847,341	848,257
% type & method	6	23	71	100	+	100	100
Basic tonnage treated		5,735	44,356	50,091		50,091	50,091
% treated		3	7	6		6	6

‘+’= <0.5%

TABLE 3 Stored potatoes*Pesticides used by store type and method (tonnes treated)*

<i>Seed</i>	Store type				Storage method		
	<i>Unventilated</i>	<i>Ventilated</i>	<i>Refrigerated</i>	<i>Total</i>	<i>Bulk</i>	<i>Boxed</i>	<i>Total</i>
2-aminobutane		3,816	8,556	12,372	2,864	9,508	12,372
Imazalil		41,269	128,539	169,808		169,808	169,808
All formulations		45,085	137,095	182,180	2,864	179,316	182,180
Not treated	18,991	34,002	151,819	204,812		204,812	204,812
Ware							
Chlorpropham		3,435	1,500	4,935		4,935	4,935
Imazalil		4,817	43,606	48,423		48,423	48,423
All formulations		8,252	45,106	53,358		53,358	53,358
Not treated	47,504	192,926	557,736	798,166	916	797,250	798,166





● **TABLE 4 Stored potatoes**
Pesticides used (tonnes treated) and percentage treated

Seed	Tonnes treated	2002 % treated	2000 % treated
2-aminobutane	12,372	3	1
Imazalil	169,808	44	19
All formulations	182,180	47	22
Tonnes stored		385,934	365,001
Ware			
Chlorpropham	4,935	+	4
Imazalil	48,423	6	3
All formulations	53,358	6	9
Tonnes stored		848,257	790,074

'+' = < 0.5%

TABLE 5 Active ingredients
Tonnes treated and quantities (kg) used

<i>Seed</i>	<i>Tonnes treated</i>	<i>kg</i>
2-aminobutane	12,372	2,493
Imazalil	169,808	1,666
All actives	182,180	4,159
Ware		
Chlorpropham	4,935	104
Imazalil	48,423	482
All actives	53,358	586



TABLE 6 Stored potatoes

Comparison of pesticide usage 1998 – 2002, tonnes stored, tonnes treated and quantities (kg) used

	1998			2000			2002		
	Tonnes stored	Tonnes treated	kg	Tonnes stored	Tonnes treated	kg	Tonnes stored	Tonnes treated	kg
Seed	384,899	143,289	9,116	365,001	81,289	1,582	385,934	182,180	4,159
Ware	715,033	102,672	5,280	790,074	119,536	2,771	848,257	53,358	586
All potatoes	1,099,932	245,961	14,396	1,155,075	200,825	4,353	1,234,191	235,538	4,745

TABLE 7 Stored potatoes

Comparison of active ingredient usage 1998 – 2002, tonnes treated and quantities (kg) used

	1998		2000		2002	
	Tonnes treated	kg	Tonnes treated	kg	Tonnes treated	kg
Seed						
2-aminobutane	36,140	7,286	4,869	727	12,372	2,493
Imazalil	104,974	849	74,862	583	169,808	1,666
Tecnazene	2,175	136	1,560	195		
Thiabendazole	40,096	846	3,823	77		
All actives	183,385	9,117	85,114	1,582	182,180	4,159
Ware						
Chlorpropham	25,955	580	80,930	1,747	4,935	104
Imazalil	32,906	228	26,522	192	48,423	482
Tecnazene	43,811	4,374	12,086	776		
Thiabendazole	3,316	99	2,777	56		
All actives	105,988	5,281	122,315	2,771	53,358	586

TABLE 8 Average application rate

Comparison of pesticide usage 1996 – 2002,
average dosage rate of all actives (g/tonne)

	1996	1998	2000	2002
Seed	88	64	20	23
Ware	59	51	23	11
All potatoes	74	59	22	20

TABLE 9 Percentage treated

Comparison of pesticide usage 1996 – 2002,
percentage treated (%)

	1996	1998	2000	2002
Seed	30	37	22	47
Ware	11	12	12	6
All potatoes	16	21	21	19

Table 10 Active ingredients

Comparison of active ingredient usage 1996 – 2002,
quantities(kg) used on all potatoes

Active ingredient	1996	1998	2000	2002
2-aminobutane	8,666	7,286	727	2,493
Chlorpropham	65	580	1,747	104
Imazalil	687	1,077	775	2,148
Tecnazene	6,202	4,510	971	
Thiabendazole		945	133	
All actives	15,620	14,398	4,353	4,745



● **TABLE 11 Raising factors and first adjustment factors for ware potatoes combined**

<i>Region</i>	<i>Seed</i>	<i>Ware</i>
Highlands & Islands, Moray Firth and Aberdeen	9.56	9.56
Angus	5.66	12.22
East Fife	8.74	7.84
Lothian and Tweed Valley	10.89	6.84
Central Lowlands	2.57	6.10

● **TABLE 12 Second adjustment factors**

Seed potatoes	0.7491
Ware potatoes	1.0759