

PESTICIDE USAGE IN SCOTLAND

SURVEY REPORT 73

**POTATOES IN STORE
1986-87**

J P SNOWDEN & H M BOWEN

**Agricultural Scientific Services
Department of Agriculture and Fisheries for Scotland
East Craigs, Edinburgh**

J M DICKSON

**Scottish Agricultural Statistics Service
The King's Buildings
Mayfield Road
Edinburgh**

CONTENTS

Summary	1
Introduction	1
Method	2
Results and discussion	3
Acknowledgements	6
References	7
Figure 1 showing agricultural regions	8
Merchants' stores	23

SUMMARY

A survey of chemical usage on potatoes by growers and licensed merchants in store from the 1986 crop was conducted during the winter of 1987/88.

A sample of 308 growers, responsible for 173,000 tonnes of potatoes (16% of the crop), showed that 32% were treated in store following the 1986 harvest. This proportion was similar to that found in the previous survey, although there had been a 66% increase in production since 1976.

Of the 500,000 tonnes of potatoes intended for seed, about 80,000 tonnes (16%) and 69,000 tonnes (14%) received treatment with 2-aminobutane and thiabendazole respectively.

Of the 600,000 tonnes of ware potatoes, some 33% were treated including 146,000 tonnes (24%) with tecnazene and 58,000 tonnes (9%) with other chemicals.

Only one case of potatoes being treated twice at different periods of their storage was recorded. Insecticides were used on only 3 farms.

Forty-one out of 43 licensed potato merchants provided information by telephone and the data are reported separately. Only small quantities of potatoes were treated: 1,200 tonnes with 2-aminobutane, 5,500 tonnes with thiabendazole, 6,500 tonnes with tecnazene, and 2,000 tonnes with chlorpropham.

INTRODUCTION

This is the fourth survey of the use of pesticides on stored potatoes. The previous three covered crops harvested in 1973, 1975 and 1976 (see references 1, 2 and 3).

The potato storage industry in Scotland is very complex and for the purposes of this survey was divided into 3 distinct groups. Firstly, farmers who grew potatoes on their own land only and secondly, farmers who used their own land and also grew potatoes on leased land. Those in the latter category are referred to as grower-dealers, a group which

included those growers who rented land on only one holding to those whose main interest was in potatoes and who may have been responsible for 200 ha or more. The third category consisted of merchants who did not own land and did not therefore appear in the Agricultural Census. These were surveyed separately using information provided by the Potato Marketing Board (PMB). The pesticide usage information from this last category is reported separately.

METHOD

Using the Agricultural Census returns for 1986 (reference 4), three mutually exclusive samples were drawn: (i) holdings where plantings were classified as 'mainly for seed', (ii) holdings which grew 'early ware' (as defined in the Agricultural Census), and (iii) holdings which grew 'ware' only or ware with either or both of the other two categories. This procedure was to ensure proper representation of seed, early ware and maincrop potatoes from the whole of Scotland. The country was divided into the eleven land-use regions shown in Figure 1. A one in four sample, stratified by region and farm size was obtained except in the large group of holdings growing less than 0.5 ha of ware potatoes where one in forty was chosen. Table 1 shows the areas sampled in each region and census category.

The PMB staff indicated those holdings in the sample which were farmed or controlled by grower-dealers, ie those which grew potatoes on other land as well as their own. As many as possible were visited, as it was expected that they were more likely to be specialist growers who would store larger quantities of potatoes and be more likely to use pesticides; in the event, 60 grower-dealers (80% of the total) responsible for 2,300 ha (82,000 tonnes) of crop were visited. Of the individual growers, 863 were written to and asked to complete a questionnaire, but none were visited; 248 questionnaires were returned covering a further 2,400 ha (91,000 tonnes) of crop. Information was obtained on the quantities of seed and ware potatoes harvested and on treatments with fungicides and sprout suppressants, together with space treatments in stores against aphids and flies. Treatments with fungicides at planting were omitted from this survey as these were included in a survey of pesticides used on the growing crop in 1987 (in prep).

The survey covered the storage period following the 1986 harvest, which could have been up to 12 months. The questionnaires were sent out in the autumn of 1987, and the grower-dealers were interviewed during the winter 1987-88.

There were very few returns for 'early ware' potatoes, and these were amalgamated with the main ware crop. Results from both seed and ware samples were then raised to national level using the raising factors shown in Table 2, calculated from the Agricultural Census returns for 1987 (reference 5).

RESULTS AND DISCUSSION

The results were based on returns from the 60 grower-dealers and 248 individual growers who were responsible for 173,000 tonnes (16% of the total potato production), Tables 3 and 4.

The importance of the seed potato industry in Scotland, where 59% of the total area devoted to potatoes is intended for seed production, 17,726 ha out of a total 30,090 ha, affects the choice of storage chemicals. In particular the use of chlorpropham, a volatile sprout suppressant, is unacceptable on holdings where seed might be stored. This precludes any use on potatoes on a large number of farms. In comparison, out of a total area of 135,323 ha in England and Wales, only 1,633 ha (1%) were planted as 'classified for seed' (reference 6) and the use of chlorpropham is little affected; for this reason, information provided in this survey pertains to Scotland only, and no attempts should be made to estimate usage in England and Wales from these data. In Northern Ireland where the total area of potato plantings was much smaller at 11,813 ha, the area planted for seed is again proportionally higher - 4,707 ha (40%), (pers. comm.).

It should be noted that much of the data recorded from postal returns, concerning reasons for use of chemicals (Tables 6 and 8) were often very general, eg 'storage diseases', rather than suggesting specific disease problems which were likely to have occurred in the absence of chemical treatment.

The 3 major chemicals used to treat potatoes in Scotland were 2-aminobutane, tecnazene and thiabendazole. Usage of each chemical varied both between regions and between the seed and ware crops.

Gangrene (Phoma foveata) is more prevalent in the northern parts of Scotland (regions 3 and 4, Moray Firth and Aberdeen, Figure 1), while skinspot (Polyscytalum pustulans) is only slightly affected by geographical area (reference 7). On the other hand, dry rot (Fusarium solani var. coeruleum) is more common in southern regions which are milder and where there are longer storage periods associated with greater production of ware potatoes (pers. comm. - Carnegie, S F).

Treatment of seed potatoes

Of the 1,115,000 tonnes of potatoes harvested, over 500,000 tonnes were intended as seed (Table 3) and were treated accordingly (Table 4), but not all potatoes intended for seed were necessarily sold as such, an estimated 150,000 tonnes were, for various reasons, diverted to the ware market, animal feed, or to waste. It is not known how much of this tonnage had received treatment, but it is thought that a higher proportion of treated potatoes would remain as seed (pers. comm. - Ruthven, A D). Of the 500,000 tonnes of seed crop, 154,500 tonnes (31%) were treated (Table 8a).

Of the 80,000 tonnes (16%) which had been treated with 2-aminobutane, mostly against gangrene, 73,000 were in regions 3, 4 and 5 (Moray Firth, Aberdeen and largely Angus, Table 5a). It is probable that most of the 34,000 tonnes recorded as treated against 'storage diseases' or for 'insurance' were in fact treated against gangrene. A small quantity (845 tonnes) was treated as late as February and March (Table 7), when, because of the maturity of the crop, the efficacy of the 2-aminobutane application would have been reduced.

Almost 69,000 tonnes were treated with thiabendazole, of which nearly half was in region 5, largely Angus, and a further 26% in region 9, Tweed Valley (Table 5a). Due to uncertainties in some of the postal replies it was not possible to separate those formulations which contained thiabendazole alone from those which also contained iodophor, but it is thought that approximately 3,500 of the 69,000 tonnes received the mixed

formulation. Growers were even less forthcoming in providing specific reasons for their use of thiabendazole. Only 23,000 tonnes (33%) were treated primarily against gangrene; skinspot and, to a lesser extent, silver scurf were recorded as other potential problems (Table 8a). The reasons for treating the remaining 46,000 tonnes were described only as storage diseases, insurance, or buyers' request.

Over 5,000 tonnes (1%) were treated with tecnazene, and of these about 2,000 tonnes received a tecnazene/iodophor formulation. Most tecnazene treatments were applied in regions 5 and 7, largely Angus and Lothian, Table 5a. It is thought that the tecnazene treated seed was intended for long term storage, especially of those varieties which were lifted early.

There was one use of tolclofos-methyl, applied to seed in November (Table 7). This chemical is more commonly applied to potatoes at planting.

Treatment of ware potatoes

Of the 612,000 tonnes of ware crop, nearly 205,000 tonnes (33%) were treated (Table 8b). More than 146,000 tonnes received tecnazene (about 8,000 tonnes was a tecnazene/iodophor formulation), mostly for sprout suppression, of which over 128,000 tonnes was in East Fife, Lothian and Tweed Valley (regions 6, 7 and 9), where there are milder climatic conditions and longer storage periods compared with the other major potato growing areas.

Rather more than 2% of the potatoes offered for sale as ware were treated with 2-aminobutane, but it is thought probable that these were potatoes which were grown 'mainly for seed', and eventually sold as ware due to quality, size, or the market conditions at the time.

Over 58,000 tonnes (9%) received thiabendazole, mostly for the general reason of 'storage diseases or insurance'.

Only 5,500 tonnes of ware potatoes (1%) were treated with chlorpropham, for sprout suppression.

One instance of double treatment was recorded, where a farmer treated all his crop with tecnazene in October, and applied a second treatment in January using chlorpropham to the remaining 550 tonnes.

Use of insecticides

Use of insecticidal space treatments in farm potato stores was reported at only 3 farms. Two farmers used an unknown quantity of smoke generators containing pirimiphos-methyl, one against aphids and flies, the other did not give any reasons. The third farmer used 2 kg a.i. of nicotine shreds, again for unknown reasons.

Comparison with the previous survey

There has been a 66% increase in potato production from 672,500 tonnes in 1976 to 1,115,500 tonnes in 1986. The proportion of the crop treated remained roughly the same, 32% compared with 30%. 2-aminobutane usage had increased from 3% to 8%, and thiabendazole usage from 5% to 12%, while that of tecnazene had decreased from 22% to 14%. More detailed comparison was not possible however as the earlier report contained no information on the proportions of seed and ware potatoes, either harvested or treated.

Neither chlorpropham nor tolclofos-methyl appeared in the previous survey. Tolclofos-methyl was not available then, and chlorpropham may not have been recorded because of the smaller sample employed.

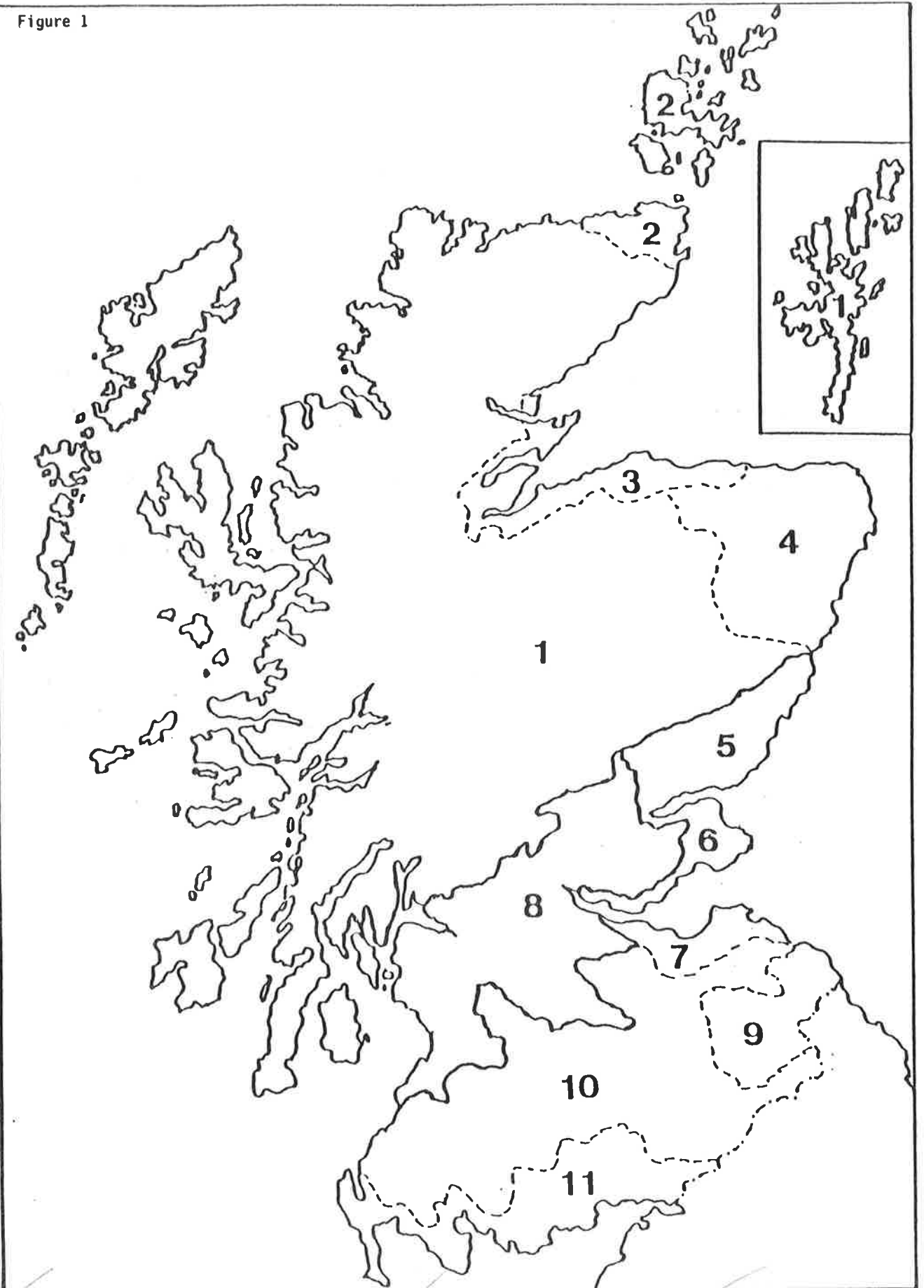
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REFERENCES

1. Chapman, P J, Sly, J M A and Cutler, J R 1977 Pesticide usage survey report 11, Arable Farm Crops 1974, London:MAFF.
2. Tucker, G G 1978 Survey of pesticide usage on potatoes stored from the 1975 crop. The Seed Potato, 18, No 1, pp 17-22.
3. Steed, J M, Sly, J M A, Tucker, G G and Cutler, J R 1979 Pesticide usage survey report 18, Arable Farm Crops 1977, London:MAFF.
4. Agricultural Statistics, Scotland 1986. HMSO, Edinburgh 1987.
5. Agricultural Statistics, Scotland 1987. HMSO, Edinburgh 1988.
6. Potato Statistics Bulletin, Potato Marketing Board 1988.
7. Carnegie, S F, Adam, J W, MacDonald, D M and Cameron, A M 1981 Contamination by Polyscytalum pustulans and Phoma exigua var. foveata of seed stocks derived from stem cuttings in Scotland. Potato Res 24, 389-397.

Figure 1



- ✓ 1. Highlands and Islands
- ✓ 2. Caithness/Orkney
- ✓ 3. Moray Firth
- ✓ 4. Aberdeen

- ✓ 5. Angus
- ✓ 6. E Fife
- ✓ 7. Lothian

- ✓ 8. Central Lowlands
- ✓ 9. Tweed Valley
- ✓ 10. Southern Uplands
- ✓ 11. Solway

TABLE 1 Areas (ha) sampled in each region and census category

	Early ware only	Mainly for seed only	Ware + seed + early ware	All potatoes
Highlands and Islands	.	27.1	4.5	31.6
Caithness and Orkney	1.4	18.6	1.6	21.6
Moray Firth	7.3	130.9	56.1	194.3
Aberdeen	.	475.0	224.1	699.1
Angus	.	1172.4	691.3	1863.7
East Fife	.	52.7	252.6	305.3
Lothian	.	6.6	247.1	253.7
Central Lowlands	1.2	587.2	297.3	885.7
Tweed Valley	.	131.1	170.7	301.8
Southern Uplands	.	2.7	12.1	14.8
Solway	8.2	38.0	83.2	129.4
Scotland	18.1	2642.3	2040.6	4701.0

TABLE 2 Raising factors to convert survey data to represent regional totals

	Individual growers	Grower -dealers
Highlands and Islands	33.20	.
Caithness and Orkney	14.62	.
Moray Firth	10.35	9.00
Aberdeen	10.01	5.09
Angus	5.90	4.67
East Fife	11.28	4.00
Lothian	9.22	4.00
Central Lowlands	7.83	4.00
Tweed Valley	6.42	.
Southern Uplands	15.74	.
Solway	4.27	.

TABLE 3 Estimated quantities (tonnes) and proportions (%) of seed and ware potatoes produced in each region

	SEED tonnes	%	WARE (including earlies) tonnes	%	ALL potatoes tonnes	%
Highlands and Islands	23,275	2	13,580	1	36,855	3
Caithness and Orkney	6,562	1	2,192	+	8,755	1
Moray Firth	35,486	3	28,286	3	63,772	6
Aberdeen	88,639	8	47,142	4	135,781	12
Angus	199,023	18	162,651	15	361,674	32
East Fife	22,098	2	108,575	10	130,673	12
Lothian	3,782	+	93,278	8	97,060	9
Central Lowlands	90,185	8	85,475	8	175,660	16
Tweed Valley	28,972	3	52,685	5	81,657	7
Southern Uplands	.	.	8,391	1	8,391	1
Solway	5,494	+	9,833	1	15,327	1
Scotland	503,516	45	612,088	55	1,115,604	100

+ = less than 0.5%

TABLE 4 Estimated quantities (tonnes) and proportions (%) of seed and ware potatoes treated in each region

	SEED tonnes	%	WARE (including earlies) tonnes	%	ALL Potatoes tonnes	%
Highlands and Islands	.	.	.	.	.	.
Caithness and Orkney	6,153	94	892	41	7,045	80
Moray Firth	22,986	65	10,823	38	33,810	53
Aberdeen	49,555	56	5,618	12	55,173	41
Angus	48,859	25	21,803	13	70,660	20
East Fife	880	4	35,777	33	36,657	28
Lothian	2,214	59	92,337	99	94,551	97
Central Lowlands	5,493	6	5,994	7	11,487	7
Tweed Valley	18,095	62	30,416	58	48,512	60
Southern Uplands	.	.	.	.	.	.
Solway	342	6	981	10	1,322	9
Scotland	154,576	31	204,641	33	359,216	32

TABLE 5a Chemicals used, quantities (tonnes) and proportions (%) of SEED potatoes treated in each region

	Caithness and Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Solway	Scotland
2-aminobutane	6,153 (8)	16,031 (20)	43,270 (54)	13,726 (17)	.	.	640 (+)	.	.	79,820
2-aminobutane + thiabendazole	.	.	.	.	.	.	.	514 (100)	.	514
Tecnazene ± iodophor	.	.	299 (6)	1,770 (34)	654 (13)	2,214 (42)	117 (2)	.	171 (3)	5,225
Thiabendazole ± iodophor	.	6,956 (10)	5,985 (9)	33,270 (48)	226 (+)	.	4,735 (7)	17,581 (26)	171 (+)	68,924
Tolclofos-methyl	.	.	.	93 (100)	.	.	.	.	.	93
All chemicals	6,153 (4)	22,986 (15)	49,555 (32)	48,858 (32)	880 (1)	2,214 (1)	5,493 (4)	18,095 (12)	341 (+)	154,576

(+) = less than 0.5%

Highlands and Islands region and Southern Uplands region have been omitted because no treatments were recorded.

TABLE 5b Chemicals used, quantities (tonnes) and proportions (%) of WARE potatoes treated in each region

	Caithness and Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Solway	Scotland
2-aminobutane	877 (6)	7,886 (55)	2,403 (17)	3,285 (23)	.	.	.	.	.	14,450
Chlorpropham	.	.	509 (9)	.	.	5,073 (91)	.	.	.	5,582
Tecnazene + iodophor	15 (+)	828 (1)	1,246 (1)	9,204 (7)	35,101 (28)	53,134 (42)	5,876 (5)	20,207 (16)	981 (1)	126,592
Tecnazene + thiabendazole	.	.	.	.	.	17,065 (86)	.	2,697 (14)	.	19,762
Thiabendazole	.	2,110 (6)	1,460 (4)	9,314 (24)	677 (2)	17,065 (45)	118 (+)	7,513 (20)	.	38,256
All chemicals	892 (+)	10,823 (5)	5,618 (3)	21,803 (11)	35,777 (17)	92,337 (45)	5,994 (3)	30,416 (15)	981 (+)	204,642

(+) = less than 0.5%

Highlands and Islands region and Southern Uplands region have been omitted because no treatments were recorded.

TABLE 5c Chemicals used, quantities (tonnes) and proportions (%) of ALL potatoes treated in each region

	Caithness and Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Solway	Scotland
2-aminobutane	7,030 (7)	23,916 (25)	45,673 (48)	17,010 (18)	.	.	640 (1)	.	.	94,270
2-aminobutane + thiabendazole	.	.	.	.	.	.	.	514 (100)	.	514
Chlorpropham	.	.	509 (9)	.	.	5,073 (91)	.	.	.	5,582
Tecnazene + iodophor	15 (+)	828 (1)	1,545 (1)	10,973 (8)	35,755 (27)	55,348 (42)	5,993 (5)	20,207 (15)	1,152 (1)	131,817
Tecnazene + thiabendazole	.	.	.	.	.	17,065 (86)	.	2,697 (14)	.	19,762
Thiabendazole + iodophor	.	9,066 (8)	7,445 (7)	42,584 (40)	902 (1)	17,065 (16)	4,854 (5)	25,094 (23)	171 (+)	107,180
Tolclofos-methyl	.	.	.	93 (100)	.	.	.	.	.	93
All chemicals	7,045 (2)	33,810 (9)	55,172 (15)	70,660 (20)	36,657 (10)	94,551 (26)	11,487 (3)	48,512 (14)	1,323 (+)	359,218

(+) = less than 0.5%

Highlands and Islands region and Southern Uplands region have been omitted because no treatments were recorded

TABLE 6a Reasons for the use of chemicals on SEED potatoes (tonnes treated) in each region

	Gangrene + skinspot + silver scurf	Skinspot	Sprout suppression	Sprout suppression + storage diseases	Storage diseases or insurance	Buyers' or merchants' request	All reasons
Highlands and Islands	.	.	.	.	.	.	.
Caithness and Orkney	6,153	.	.	.	.	.	6,153
Moray Firth	18,414	.	.	.	3,222	1,350	22,986
Aberdeen	16,803	.	146	153	32,198	255	49,555
Angus	8,735	3,447	1,770	.	21,057	13,850	48,859
East Fife	226	.	316	113	226	.	880
Lothian	.	.	369	1,845	.	.	2,214
Central Lowlands	4,078	.	117	.	1,063	235	5,493
Tweed Valley	7,930	.	.	.	10,165	.	18,095
Southern Uplands	.	.	.	.	.	.	.
Solway	.	.	.	171	.	171	342
Scotland	62,339	3,447	2,718	2,281	67,930	15,860	154,576

TABLE 6b Reasons for the use of chemicals on WARE potatoes (tonnes treated) in each region

	Gangrene + skinspot + silver scurf	Skinspot	Sprout suppression	Sprout suppression + storage diseases	Storage diseases or insurance	Buyers' or merchants' request	All reasons
Highlands and Islands	.	.	.	.	.	.	.
Caitness and Orkney	877	.	15	.	.	.	892
Moray Firth	9,230	.	828	.	765	.	10,823
Aberdeen	3,162	.	1,144	611	701	.	5,618
Angus	1,483	2,982	9,204	.	6,512	1,622	21,803
East Fife	2,933	.	29,348	564	2,481	451	35,777
Lothian	.	.	68,074	7,198	17,065	.	92,337
Central Lowlands	78	.	5,876	.	40	.	5,994
Tweed Valley	.	.	20,207	963	9,246	.	30,416
Southern Uplands	.	.	.	.	.	.	.
Solway	.	.	.	.	981	.	981
Scotland	17,763	2,982	134,696	9,337	37,791	2,074	204,641

TABLE 6c Reasons for the use of chemicals on ALL potatoes (tonnes treated) in each region

	Gangrene + skinspot + silver scurf	Skinspot	Sprout suppression	Sprout suppression + storage diseases	Storage diseases or insurance	Buyers' or merchants' request	All reasons
Highlands and Islands	.	.	.	.	.	.	.
Caithness and Orkney	7,030	.	15	.	.	.	7,045
Moray Firth	27,645	.	828	.	3,987	1,350	33,810
Aberdeen	19,965	.	1,291	764	32,899	255	55,173
Angus	10,217	6,429	10,973	.	27,569	15,472	70,660
East Fife	3,158	.	29,664	677	2,707	451	36,657
Lothian	.	.	68,443	9,043	17,065	.	94,551
Central Lowlands	4,157	.	5,993	.	1,103	235	11,487
Tweed Valley	7,930	.	20,207	963	19,411	.	48,512
Southern Uplands	.	.	.	.	.	.	.
Solway	.	.	.	171	981	171	1,322
Scotland	80,101	6,429	137,414	11,618	105,721	17,934	359,216

TABLE 7 Dates of application of chemicals to ALL potatoes (percentage of treated tonnage)

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Tonnes treated
2-aminobutane	51	35	13	(+)	.	1	(+)	.	94,270
2-aminobutane + thiabendazole	.	100	.	.	.	.	.	.	514
Chlorpropham	.	.	.	.	91	.	.	9	5,582
Tecnazene + iodophor	1	90	8	1	(+)	.	(+)	.	131,817
Tecnazene + thiabendazole	.	100	.	.	.	.	.	.	19,761
Thiabendazole + iodophor	29	50	16	3	(+)	2	1	(+)	107,180
Tolclofos-methyl	.	.	100	.	.	.	.	.	93

(+) = less than 0.5%

TABLE 8a Quantities of SEED potatoes treated (tonnes), the reasons for treatment, the proportion of the crop treated (%), and quantities of a.i. (kg) used

No.	Gangrene ± skinspot ± silver scurf	Skinspot	Sprout suppression	Sprout suppression + storage diseases	Storage diseases or insurance	Buyers' or merchants' request	All reasons	% of crop treated	a.i. (kg)
2-aminobutane	39,365	3,237	.	.	33,272	3,947	79,820	16	15,804
2-aminobutane + thiabendazole	.	.	.	.	514	.	514	(+)	62/21
Tecnazene ± iodophor	226	.	2,718	2,281	.	.	5,225	1	390/15
Thiabendazole ± iodophor	22,749	210	.	.	34,052	11,913	68,924	14	2,704/35
Tolclofos-methyl	.	.	.	.	93	.	93	(+)	6
All chemicals	62,340	3,447	2,718	2,281	67,931	15,860	154,576	31	

(+) = less than 0.5% of crop treated

TABLE 8b Quantities of WARE potatoes treated (tonnes), the reasons for treatment, the proportion of the crop treated (%), and quantities of a.i. (kg) used

	Gangrene ± skinspot ± silver scurf	Skinspot	Sprout suppression	Sprout suppression + storage diseases	Storage diseases or insurance	Buyers' or merchants' request	All reasons	% of crop treated	a.i. (kg)
2-aminobutane	12,649	1,802	.	.	.	.	14,450	2	2,861
Chlorpropham	.	.	5,582	.	.	.	5,582	1	140
Tecnazene ± iodophor	2,933	.	112,049	8,373	3,237	.	126,592	21	10,173/92
Tecnazene + thiabendazole	.	.	17,065	963	1,734	.	19,762	3	2,371/790
Thiabendazole	2,182	1,180	.	.	32,821	2,074	38,256	6	877
All chemicals	17,764	2,982	134,696	9,336	37,792	2,074	204,642	33	

TABLE 8c Quantities of ALL potatoes treated (tonnes), the reasons for treatment, the proportion of the crop treated (%), and quantities of a.i. (kg) used

	Gangrene + skinspot + silver scurf	Skinspot	Sprout suppression	Sprout suppression + storage diseases	Storage diseases or insurance	Buyers' or merchants' request	All reasons	% of crop treated	a.i. (kg)
2-aminobutane	52,013	5,039	.	.	33,272	3,947	94,270	8	18,665
2-aminobutane + thiabendazole	.	.	.	.	514	.	514	(+)	62/21
Chlorpropham	.	.	5,582	.	.	.	5,582	1	140
Tecnazene + iodophor	3,159	.	114,167	8,227	3,237	.	131,817	12	10,563/107
Tecnazene + thiabendazole	.	.	17,065	963	1,734	.	19,762	2	2,371/790
Thiabendazole + iodophor	24,931	1,390	.	.	66,872	13,987	107,180	10	3581/35
Tolclofos-methyl	.	.	.	.	93	.	93	(+)	6
All chemicals	80,103	6,429	137,414	11,617	105,722	17,934	359,218	32	

(+) = less than 0.5% of crop treated

MERCHANTS' STORES

Information on the use of chemicals on potatoes in stores belonging to licensed merchants who did not appear in the Agricultural Census, was also collected, and is reported here.

A list of 41 such merchants was compiled with help from the PMB. These merchants had varying involvements with potato storage, from those who grew potatoes on leased land, to vegetable wholesalers who dealt mainly with bagged potatoes for resale. Information was obtained by telephone from all but 2 of these merchants. No attempt has been made to estimate usage for those merchants not providing data.

The quantities of potatoes treated, including both seed and ware crops, are shown in Table 1. Because of the nature of the industry, it was not known whether the total throughput of potatoes recorded for these merchants contained some imports into Scotland.

Usage of the 3 main potato storage chemicals, 2-aminobutane, tecnazene, and thiabendazole, was proportionally lower in these stores than usage on farm stores. Chlorpropham usage on ware potatoes was similar to that in the farm survey, and was almost certainly due to specific export requirements. One instance of multiple treatment was recorded where 1,000 tonnes of ware potatoes were treated with fog formulations of tecnazene/iodophor in October and thiabendazole/iodophor in December. Both these formulations contain relatively low quantities of active ingredients. Merchants who treated potatoes which had been brought in from farms or from other merchants' stores stated that none had been treated previously.

More insecticidal space treatments were carried out in the merchants' stores than were recorded on farm stores. In all, 6 out of the 39 stores were treated against flies or unspecified insects; no merchant reported aphids as a pest. Gamma-HCH smoke generators were used in 3 stores resulting in a total use of 3.5 kg a.i. Information from the other stores was less detailed: one used an unknown quantity of nicotine shreds and 2 used an unknown number of generators of unknown active ingredient.

Note Data from this survey, together with the main farm survey, provide an overall picture of potato storage in Scotland. It should be stressed that the 2 sets of data should not be added together to obtain total national usage as there may be some overlap between the surveys: it was not always clear where some of the merchants' treatments had been carried out; those carried out 'on farm' would already have been included in the farm survey.

TABLE 1: Quantities of seed and ware potatoes treated in merchants' stores and quantities of pesticides (kg a.i.) used. Numbers of users shown in parentheses

	SEED			WARE			ALL POTATOES		
	Tonnes treated	% of through-put treated	Kg a.i.	Tonnes treated	% treated	Kg a.i.	Tonnes treated	% treated	Kg a.i.
2- aminobutane	1,175 (5)	2.2	235.0	.	.	.	1,175 (5)	0.6	235.0
Chlorpropham	.	.	.	2,010 (2)	1.3	50.3	2,010 (2)	1.0	50.3
Tecnazene	.	.	.	5,671 (6)	3.6	503.8	5,671 (6)	2.7	503.8
Tecnazene + iodophor	.	.	.	1,000 (1)*	0.6	100/15	1,000 (1)	0.5	100/15
Thiabendazole	1,140 (6)	2.1	60.7	.	.	.	1,140 (6)	0.5	60.7
Thiabendazole + iodophor	3,341 (2)	6.3	25.1/25.1	1,000 (1)*	0.6	7.5/7.5	4,341 (3)	2.1	32.6/32.6
All chemicals	5,636	10.6		8,681	5.5		14,337	6.8	
Tonnes throughput		53,350				157,617			210,967

* This parcel was treated with both formulations

