PESTICIDE USAGE IN SCOTLAND

POTATO STORES 1998

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SUMMARY

This is the eighth survey on the use of pesticides on potatoes stored on both farms and licensed merchant stores in Scotland.

Compared with the last survey in 1996 the overall tonnage of potatoes stored fell by 13% to approximately 1,100,000 tonnes. As in previous surveys the majority of potatoes (85%) were held in farm stores. Seed potatoes rose from 320,000 tonnes to nearly 385,000 tonnes, but in contrast ware potatoes fell by 25% to 715,000 tonnes.

Imazalil was the principal active ingredient used on seed potatoes, and was applied to almost 105,000 tonnes. On ware potatoes, the main active ingredient used was tecnazene, applied to nearly 44,000 tonnes.

INTRODUCTION

This is the eighth survey of the use of pesticides on stored potatoes in Scotland[1-5].

The data collected were obtained by personal interview. Farm stores data were raised to national levels for Scotland using figures provided by the British Potato Council. No raising of data for merchant stores was necessary, this being a one hundred percent sample using a list of licensed dealers provided by the British Potato Council.

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 the latter are 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 percentage of potatoes treated.

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 proportion of potatoes originally planted for seed but later sold as ware. The recorded quantity of stored potatoes following the harvest will include soil, wastage, and those potatoes downgraded to animal feed.

Farm stores include grower-dealers, i.e. those who grow and trade in potatoes, and merchants who own agricultural land and are therefore included in the Agricultural Census.

Merchant stores refers only to those merchants who do not possess agricultural land and are therefore not included in the Agricultural Census but who do store potatoes.

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

METHOD

For this survey, the sample of farm stores was the same as that for the Arable Crops 1998[6] and was drawn from the 1998 Agricultural Census[7]. All the potato merchants known to the British Potato Council were surveyed.

The country was divided into 11 land-use regions[8] (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. The three land-use regions of Caithness & Orkney, Highlands & Islands and Moray Firth were amalgamated, due to low sample populations in these areas. Southern Uplands and Solway were also amalgamated for the same reason, as were East Fife and Lothian.

Information was collected on quantities of potatoes stored, the storage environment, methods of storage and on storage chemicals applied. Fungicidal seed treatments prior to planting in 1999 were not recorded as this usage is covered by the Arable Crop reports.

National estimates of storage chemical usage were produced from the sample data by applying raising factors (Table 12) based on the areas of potatoes grown in 1998[7]. An adjustment was made to the ware fraction to allow for the potatoes grown for seed that were designated as ware (Table 13). A second adjustment (Table 14) was made to the survey estimates of stored potatoes to bring them into line with the actual potato movement figures provided by the British Potato Council.

DISTRIBUTION OF STORES

Information was obtained from 78 farm stores. Their distribution throughout Scotland is shown in Table 1. In addition, information was collected from 13 merchants identified by the British Potato Council.

SEED POTATOES

The quantity of seed potatoes stored on Scottish farms rose from nearly 284,000 tonnes in 1996 to 331,500 tonnes in 1998. Similarly, the tonnage stored by merchants rose from just under 36,500 tonnes to just under 53,400 tonnes.

Storage methods (Tables 2, 3)

Storage methods of seed potatoes on farms were the same as those recorded in the 1996 survey. As in 1996, all seed potatoes were stored in boxes, and 69% were held in ventilated stores, whilst 18% were within refrigerated stores. The remaining 13% were stored in unventilated stores.

As in 1996, all potatoes in merchant stores were boxed. Fifty-four percent were refrigerated, slightly more than the 50% recorded in 1996. The remaining 46% were held in ventilated stores.

Use of pesticides (Tables 4 - 8)

On farms, the proportion of seed potatoes treated in store increased from 28% in 1996 to 38% in the current survey.

The principal pesticide used in farm stores was imazalil, applied both alone and in formulation with thiabendazole to 95,500 tonnes of seed potatoes. The usage of thiabendazole had not been encountered at all in 1996. There was a continued decline in the use of 2-aminobutane, and the proportion of potatoes treated fell from 22% in 1994 to only 8% in 1998.

The proportion of seed potatoes treated in merchant stores decreased from 53% in 1996 to 34% in 1998. The usage of imazalil almost halved from 33% to 18% of the tonnes stored, and there was a slight reduction in the use of 2-aminobutane from 20% to 16%.

As in previous surveys, the potatoes in both farm and merchant stores were treated as a general disease precaution with the control of gangrene, dry rot and skin spot as the main specific reasons given.

WARE POTATOES

There was a decrease in the tonnage of ware potatoes stored on farms, from nearly 860,000 in 1996 to 607,600 tonnes in 1998. Tonnages in merchant stores increased, from 88,000 tonnes in the previous survey to over 107,000 tonnes in 1998.

Storage methods (Tables 2, 3)

The proportion of potatoes stored in boxes on farms was 96%, a similar level to that in 1996 (92%). Ventilated stores accounted for 54% of all potatoes stored on farms followed by refrigerated (32%) and unventilated stores (14%).

All potatoes in merchant stores were boxed. The store types were similar to that recorded in 1996, with 47% refrigerated, 41% ventilated and the remaining 12% unventilated.

Use of pesticides (Tables 4 - 8)

The proportion of ware potatoes treated in farm stores, 12%, was similar to that recorded in 1996. Tecnazene and imazalil were each applied to almost 30,000 tonnes, 5% of the stored tonnage. Usage of tecnazene declined compared with 1996 when 11% had been treated, whilst that of imazalil had increased (only 1% in 1996). Chlorpropham was used on almost 20,000 tonnes of ware potatoes, (2%). No chlorpropham had been recorded on farms in 1996.

Fourteen percent of the tonnage stored by merchants was treated, compared with only 5% in 1996. The most commonly used active ingredient was tecnazene, applied to 13% of the stored tonnage, more than double that recorded in 1996 (5%). Chlorpropham was also widely used, and was applied to 6,000 tonnes, (6%).

As in previous surveys the potatoes in both farm and merchant stores were treated mostly for sprout suppression and general disease precaution, with gangrene and dry rot as the main diseases specified.

COMPARISONS WITH PREVIOUS SURVEYS

Comparisons in the usage of pesticides between the present and two recent surveys are presented in Tables 9-11 and Figures 6 & 7.

Compared with 1996 the tonnage of all stored seed potatoes rose by 20% from 320,000 to 385,000 in 1998, whilst the quantity of ware potatoes fell by 25% from 947,500 to around 715,000 tonnes.

The average dosage rate of active ingredients (g/tonne) applied to seed potatoes has fallen from 136 in 1994 to only 64 g/tonne in 1998, due mainly to the decline in use of 2-aminobutane which is applied at a relatively high rate. The comparative rate applied to ware potatoes has fallen less sharply from 69 in 1994 to 51 g/tonne in 1998 (Table 10).

The proportion of potatoes treated with pesticides has remained at a roughly similar level for each of the three surveys (Table 11).

Although the combined overall tonnage of seed and ware potatoes in 1998 dropped by 13%, compared with 1996, the tonnage treated with pesticides rose by 16%. There were large increases in the use of chlorpropham on ware potatoes and of imazalil which was applied both on its own and in formulation with thiabendazole to both seed and ware potatoes. Thiabendazole had not been encountered in the 1996 survey. The use of tecnazene on ware potatoes in merchant stores rose by 8% although its overall use dropped by 4%.

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Figure 1 Land-Use Regions of Scotland

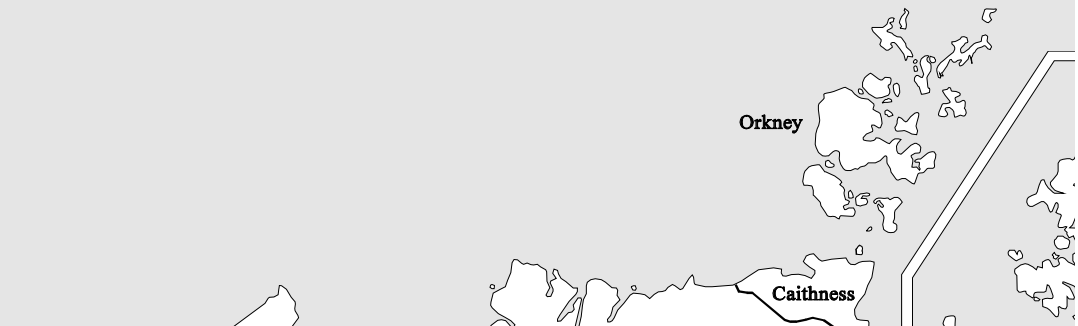

Figure 2 *Storage of seed potatoes 1994*

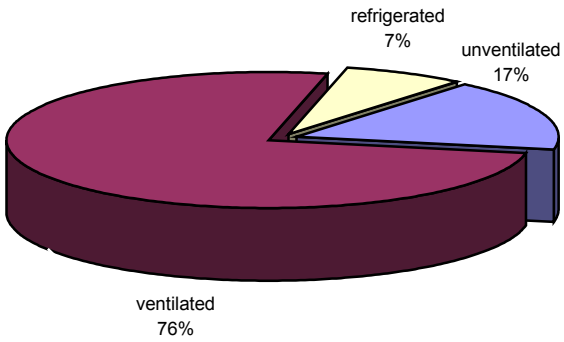

Figure 3 *Storage of seed potatoes 1998*

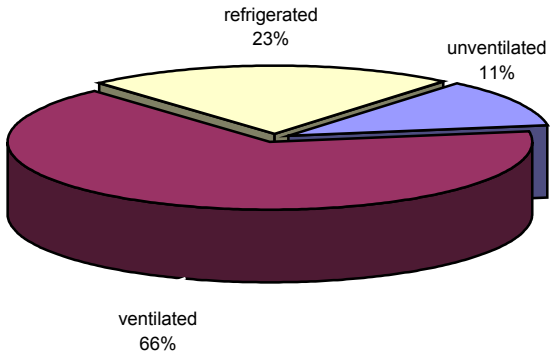

Figure 4 *Storage of ware potatoes 1994*

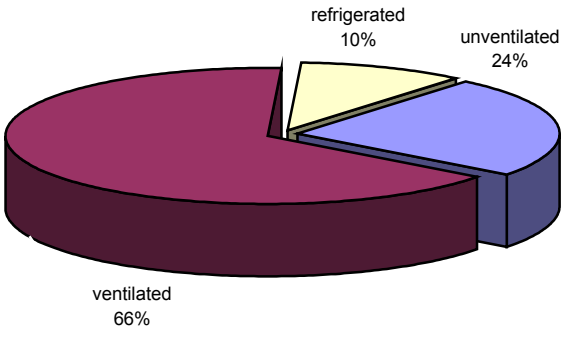

Figure 5 *Storage of ware potatoes 1998*

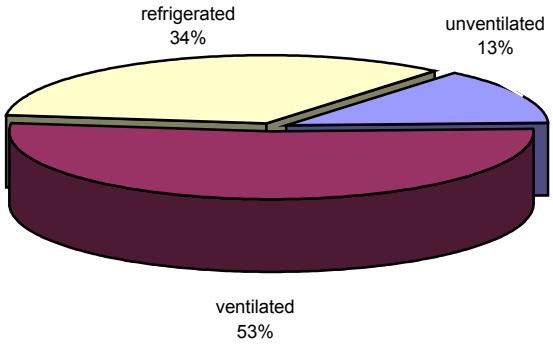

Figure 6 Comparison of pesticide usage 1994 – 1998
Percentage of potatoes treated

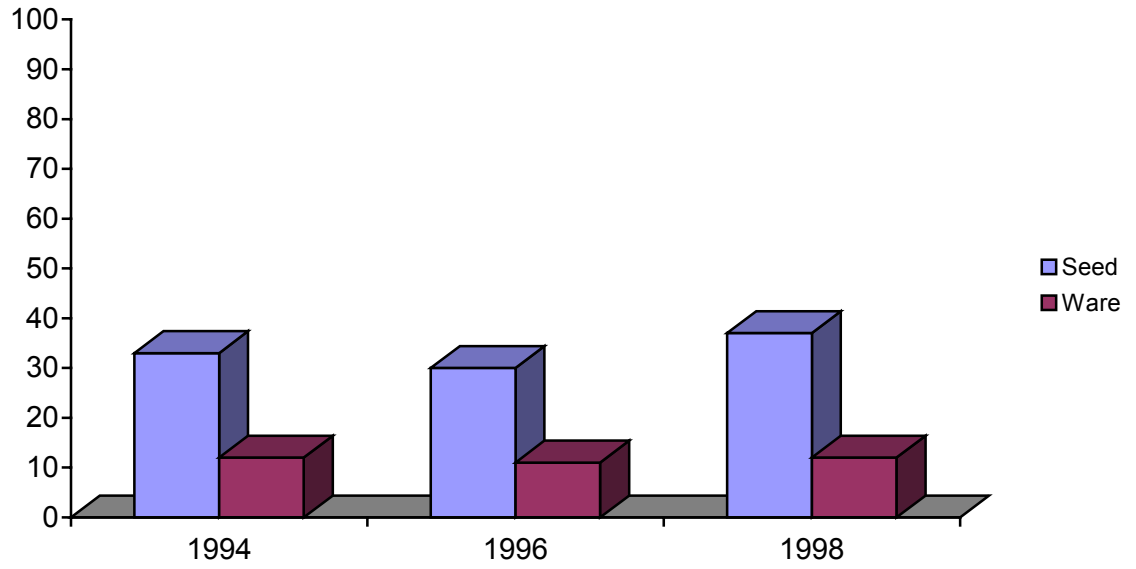

Figure 7 Comparison of pesticide usage 1994 - 1998
Average rate of active ingredient per treated tonne (g/tonne)

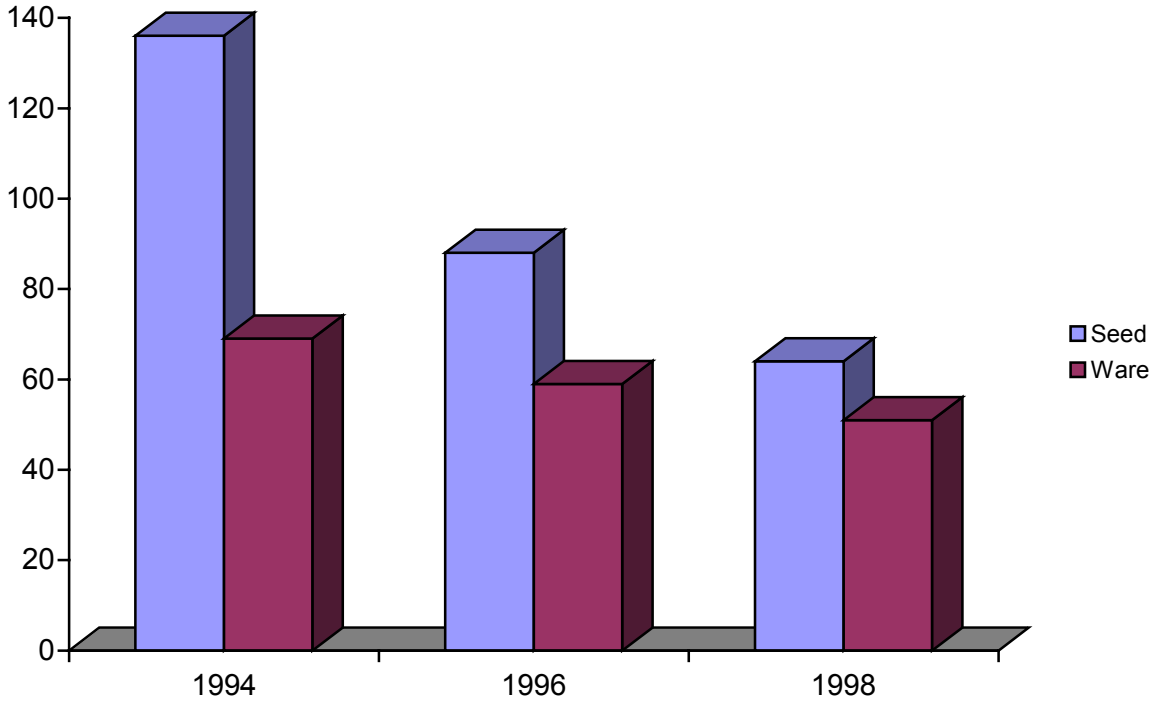

TABLE 1 Distribution of farm store sample

Region	*Number of stores*
Caithness & Orkney, Highlands & Islands, Moray Firth	7
Aberdeen	9
Angus	36
East Fife & Lothian	16
Central Lowlands	2
Tweed Valley	7
Southern Uplands, Solway	1
Scotland	**78**

TABLE 2 Farm stores

Storage type and method

	Store type				Storage method		
Seed	***Unventilated***	***Ventilated***	***Refrigerated***	***Total***	***Bulk***	***Boxed***	***Total***
Tonnes stored	44,188	228,273	59,070	**331,531**		331,531	**331,531**
% type & method	13	69	18	**100**		100	**100**
Basic tonnage treated	17,292	96,475	11,524	**125,291**		125,291	**125,291**
% treated	39	42	19	**38**		38	**38**
Ware							
Tonnes stored	82,364	330,916	194,319	**607,599**	23,694	583,905	**607,599**
% type & method	14	54	32	**100**	4	96	**100**
Basic tonnage treated	9,873	61,219	1,459	**72,551**	18,361	54,190	**72,551**
% treated	12	18	1	**12**	77	9	**12**

TABLE 3 Merchant stores

Storage type and method

	Store type				Storage method		
Seed	***Unventilated***	***Ventilated***	***Refrigerated***	***Total***	***Bulk***	***Boxed***	***Total***
Tonnes stored		24,468	28,900	**53,368**		53,368	**53,368**
% type & method		46	54	**100**		100	**100**
Basic tonnage treated		4,614	13,390	**18,004**		18,004	**18,004**
% treated		19	46	**34**		34	**34**
Ware							
Tonnes stored	12,800	44,042	50,592	**107,434**		107,434	**107,434**
% type & method	12	41	47	**100**		100	**100**
Basic tonnage treated	1,200	1,427	1,120	**14,547**		14,547	**14,547**
% treated	9	3	2	**14**		14	**14**

TABLE 4 Farm stores

Pesticides used by store type and method (tonnes treated)

	Store type				Storage method		
Seed	***Unventilated***	***Ventilated***	***Refrigerated***	***Total***	***Bulk***	***Boxed***	***Total***
2-aminobutane	2,681	23,793	1,312	**27,786**		27,786	**27,786**
Imazalil	14,611	35,036	5,782	**55,429**		55,429	**55,429**
Imazalil/thiabendazole		35,668	4,428	**40,096**		40,096	**40,096**
Tecnazene		1,975		**1,975**		1,975	**1,975**
All formulations	**17,292**	**96,472**	**11,522**	**125,286**		**125,286**	**125,286**
Not treated	26,896	131,798	47,548	**206,242**		206,242	**206,242**
Ware							
Chlorpropham		19,954		**19,954**	10,376	9,578	**19,954**
Imazalil	319	28,872		**29,191**	2,394	26,797	**29,191**
Imazalil/thiabendazole		1,857	1,459	**3,316**		3,316	**3,316**
Tecnazene	9,551	20,113		**29,664**	5,587	24,077	**29,664**
All formulations	**9,870**	**70,796**	**1,459**	**82,125**	**18,357**	**63,768**	**82,125**
Not treated	72,498	268,699	192,861	**535,058**	5,337	529,721	**535,058**

TABLE 5 Merchant stores

Pesticides used by store type and method (tonnes treated)

	Store type				Storage method		
Seed	***Unventilated***	***Ventilated***	***Refrigerated***	***Total***	***Bulk***	***Boxed***	***Total***
2-aminobutane		484	7,870	**8,354**		8,354	**8,354**
Imazalil		3,950	5,500	**9,450**		9,450	**9,450**
Tecnazene		180	20	**200**		200	**200**
All formulations		**4,614**	**13,390**	**18,004**		**18,004**	**18,004**
Not treated		19,854	15,510	**35,364**		35,364	**35,364**
Ware							
Chlorpropham	6,000			**6,000**		6,000	**6,000**
Imazalil			400	**400**		400	**400**
Tecnazene	12,000	1,427	720	**14,147**		14,147	**14,147**
All formulations	**18,000**	**1,427**	**1,120**	**20,547**		**20,547**	**20,547**
Not treated	800	42,615	49,472	**92,887**		92,887	**92,887**

TABLE 6 Farm stores

Reasons for use of pesticides (tonnes treated)

Seed	***Gangrene***	***Gangrene & dry rot***	***Gangrene & silver scurf***	***Gangrene & skin spot***	***Skin spot***	***Silver scurf***	***Disease precaution***	***Sprout suppression***	***Total***	***1998 % treated***	***1996 % treated***
2-aminobutane	2,055				1,312		24,419		**27,786**	8	13
Imazalil	5,268	5,461	2,557	2,284	296		39,562		**55,428**	17	18
Imazalil/thiabendazole		22,611		4,415			13,070		**40,096**	12	
Tecnazene							1,975		**1,975**	1	+
All formulations	**7,323**	**28,072**	**2,557**	**6,699**	**1,608**		**79,026**		**125,285**	**38**	**28**
Tonnes stored										331,531	283,809
Ware											
Chlorpropham								19,955	**19,955**	2	
Imazalil		24,902				1,575	2,713		**29,190**	5	1
Imazalil/thiabendazole							3,316		**3,316**	1	
Tecnazene							6,984	22,680	**29,664**	5	11
All formulations		**24,902**				**1,575**	**13,013**	**42,635**	**82,125**	**12**	**11**
Tonnes stored										607,599	859,271

'+' = < 0.5%

TABLE 7 Merchant stores

Reasons for use of pesticides (tonnes treated)

Seed	***Dry rot***	***Gangrene & skin spot***	***Skin spot***	***Silver scurf***	***Disease precaution***	***Sprout suppression***	***No specified reason***	***Total***	***1998 % treated***	***1996 % treated***
2-aminobutane		1,000	1,354		6,000			**8,354**	16	20
Imazalil				450	9,000			**9,450**	18	33
Tecnazene	200							**200**	+	
All formulations	**200**	**1,000**	**1,354**	**450**	**15,000**			**18,004**	**34**	**53**
Tonnes stored									53,368	36,420
Ware										
Chlorpropham						6,000		**6,000**	6	1
Imazalil							400	**400**	+	
Tecnazene					8,147		6,000	**14,147**	13	5
All formulations					**8,147**	**6,000**	**6,400**	**20,547**	**14**	**5**
Tonnes stored									107,434	88,229

'+' = < 0.5%

TABLE 8 Active ingredients

Tonnes treated and quantities (kg) used

	Farm		Merchant		Total	
Seed	***Tonnes treated***	***Kg***	***Tonnes treated***	***Kg***	***Tonnes treated***	***Kg***
2-aminobutane	27,786	5,602	8,354	1,684	36,140	7,286
Imazalil	95,524	754	9,450	95	104,974	849
Tecnazene	1,975	123	200	13	2,175	136
Thiabendazole	40,096	846			40,096	846
All actives	**165,381**	**7,324**	**18,004**	**1,792**	**183,385**	**9,116**
Ware						
Chlorpropham	19,955	430	6,000	150	25,955	580
Imazalil	32,506	224	400	4	32,906	228
Tecnazene	29,664	2,651	14,147	1,723	43,811	4,374
Thiabendazole	3,316	99			3,316	99
All actives	**85,441**	**3,404**	**20,547**	**1,877**	**105,988**	**5,281**

TABLE 9 All potatoes

Comparison of pesticide usage 1994 – 1998, tonnes stored, tonnes treated and quantities (kg) used

	1994			1996			1998		
	Tonnes stored	*Tonnes treated*	*Kg*	*Tonnes stored*	*Tonnes treated*	*Kg*	*Tonnes stored*	*Tonnes treated*	*Kg*
Farm stores									
Seed	341,747	107,895	15,187	283,809	87,199	7,783	331,531	125,285	7,324
Ware	459,302	67,548	4,760	859,271	98,084	5,758	607,599	82,125	3,403
All potatoes	**801,049**	**175,443**	**19,947**	**1,143,080**	**185,283**	**13,541**	**939,130**	**207,410**	**10,727**
Merchant stores									
Seed	51,842	21,677	2,406	36,420	19,200	1,572	53,368	18,004	1,792
Ware	30,788	3,870	165	88,229	7,359	507	107,434	20,547	1,877
All potatoes	**82,630**	**25,547**	**2,571**	**124,649**	**26,559**	**2,079**	**160,802**	**38,551**	**3,669**
All stored potatoes	**883,679**	**200,990**	**22,518**	**1,267,729**	**211,842**	**15,620**	**1,099,932**	**245,961**	**14,396**

TABLE 10 Average application rate

Comparison of pesticide usage 1994 – 1998, average rate (g/tonne)

	1994	*1996*	*1998*
Seed	136	88	64
Ware	69	59	51

TABLE 11 Percentage treated

Comparison of pesticide usage 1994 – 1998, percentage treated (%)

	1994	*1996*	*1998*
Seed	33	30	37
Ware	12	11	12

TABLE 12 Raising factors

Region	Seed	Ware
Caithness & Orkney, Highlands & Islands, Moray Firth	4.01	30.08
Aberdeen	13.27	34.50
Angus	9.00	8.23
East Fife & Lothian	19.27	9.14
Central Lowlands	20.25	40.30
Tweed Valley	19.20	32.37
Southern Uplands, Solway		38.55

TABLE 13 First adjustment factors for ware potatoes

Region	Ware
Caithness & Orkney, Highlands & Islands, Moray Firth	0.56
Aberdeen	0.89
Angus	1.02
East Fife & Lothian	1.02
Central Lowlands	1.00
Tweed Valley	0.96
Southern Uplands, Solway	1.00

TABLE 14 Second adjustment factors

Seed potatoes	0.73
Ware potatoes	0.85