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RODENTICIDE USE IN APPLE ORCHARDS

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Introduction

The preliminary data presented in this paper were obtained from the 1978 Survey of Pesticide Use on Deciduous Fruits (Figure 1). The survey was conducted by the Economics, Statistics and Cooperatives Service, USDA.

The purpose of this paper is to present information on: (1) rodenticides used in controlling meadow and pine voles, (2) method and timing of applications and type of coverage, (3) tree losses due to vole injury by region, and (4) growers perceived efficacy of chemicals versus cultural and mechanical controls. These data are based on the aggregated responses of the surveyed apple producers.

Rodenticide Application

On an acre treated basis, zinc phosphide, diphacinone, endrin and chlorphacinone are the four major chemicals used for controlling voles in apple orchards (Table 1). Strychnine and warfarin are used to a minor extent. The acreage treated by these six rodenticides accounted for 28 percent of 0.5 million acres of bearing and nonbearing apple orchard acreage indicated in the 1974 Census of Agriculture. In terms of quantity applied, endrin is the most used rodenticide. Nearly 42,000 pounds (a.i.) of endrin were applied in 1978. The number of applications per season ranged from 1.0 to about 1.3 for the six rodenticides.

Rodenticides are generally applied by the growers (Table 2). An exception is zinc phosphide where custom applicators treated 16 percent of the acreage. Zinc phosphide is applied only as a bait. In the State of Washington, which accounts for about 20 percent of the U.S. apple acreage, zinc phosphide is often applied immediately after harvest for meadow vole control by custom applicators using a trail building machine.

Most of the U.S. acreage is treated after harvest. Seventy-two percent of the endrin and chlorphacinone and 100 percent of the warfarin and strychnine is applied in the fall after harvest. The remaining endrin and chlorphacinone are applied prior to the pre-bloom stage of growth.

APPLE PRODUCTION REGIONS

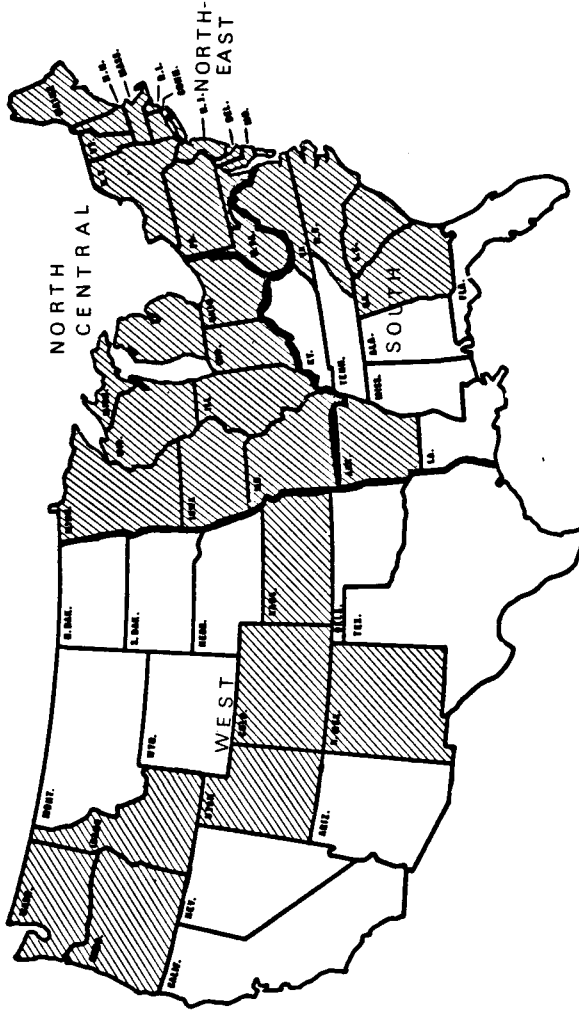


Figure 1
Shaded areas reflect surveyed states
in 1978 Survey of Pesticide Use on
Deciduous Fruits (California, for example,
is not included).

Generally, the area around the base of each tree in the orchard is treated when endrin, diphacinone, strychnine and zinc phosphide are used. Spot treatments also are used to treat only those areas of an orchard where evidence of infestation is found. Some 60 percent of the chlorophacinone-treated acreage is on a spot basis. Spot treatment reduces costs and environmental exposure.

Tree Losses

Of the nearly 9,000 apple producers in the U.S. (excluding California), about 3,500 or 39 percent report trees lost in 1978 to vole injury (Table 3).

Meadow voles girdle the bark at the base of the tree while pine voles feed on the roots. Trees may sustain damage over several years before they die. Growers reported that a total of 123,000 trees died in 1978 as a result of vole injury. Growers were not asked to report the number of trees damaged by voles or the loss in apple production from vole injury. About 60 percent of the trees killed were of non-bearing age. Young trees are particularly susceptible to voles because they are not strong enough to compensate for the damage. Orchards in the Northeast are affected most by vole injury with about 74,000 trees reported lost in 1978. Some 30,000 of these trees were of bearing age.

Most Effective Method

Most of the treated acreage is for control of the meadow vole which dwells primarily on the surface and is easier to control than the pine vole, a subsurface dweller. About 58 percent of the surveyed apple producers report chemicals are the most effective method of controlling voles. There is little variation among regions in the proportion of producers judging chemicals as the most effective control. The proportion of producers reporting chemicals to be most effective ranged from 55 to 61 percent for the four regions (Table 4).

From 12 to 18 percent of the producers in each region report cultural methods (mowing, discing, etc.) as the most effective method of vole control.

About 15 and 21 percent, respectively, of the producers in the Northeast and North Central region report mechanical methods (gravel, wire, etc.) as the most effective mice control method. Only 1-2 percent of the producers in the South and West regions report this method as the most effective.

Summary

1. About 28 percent of the apple orchard acreage was treated with rodenticides in 1978.
2. The four major rodenticides used for vole control are zinc phosphide, diphacinone, endrin, and chlorphacinone. Endrin is the most heavily used rodenticide in terms of quantity used.
3. Custom application represents only a minimal proportion of the acreage treated with rodenticides. An exception is zinc phosphide where custom applicators treated 16 percent of the acreage.
4. Most orchards are treated after harvest.
5. Generally, the area around the base of each tree in the orchard is treated when using endrin, diphacinone, strychnine, and zinc phosphide; spot treatment is used for about one-half of the chlorophacinone-treated acreage.
6. Vole injury accounted for approximately 123,000 trees lost during 1978, of which 37 percent were at bearing age.
7. The majority of growers report chemicals as the most effective method of vole control.

Table 1. Apple orchard rodenticides: Acres treated, application rates, and total quantity applied, by region 1978 1/

Rodenticide	: Acres	: Quantity per	: Applications	: Quantity	: Total
	: treated	: acre per	: per	: per acre	: quantity
	: <u>2/</u>	: application	: season	: per	: applied
	:	:	:	: season	:
		<u>Pounds a.i.</u>		<u>---Pounds a.i.---</u>	
Endrin	29,447	[%] 20 1.276	1.111	1.418	41,756
Chlorophacinone	14,833	10 .024 <u>3/</u>	1.297	.031	460
Diphacinone	42,237	29 <u>4/</u>	1.034	<u>4/</u>	218
Warfarin	33	< 1 <u>5/</u>	1.000	<u>5/</u>	<u>5/</u>
Strychnine	162	< 1 <u>4/</u>	1.274	<u>4/</u>	2
Zinc phosphide	57,877	40 .164	1.138	.187	10,823
U.S.	144,589	<u>6/</u>			53,259

1/ Preliminary data from 1978 ESCS Survey of Pesticide Use on Deciduous Fruits. California excluded.

2/ Acres treated one or more times.

3/ The label rate of chlorophacinone is 0.2 lbs./acre applied as a spray or 2 applications of 0.005 lbs. a.i./acre/application applied as a bait. The per acre rate of 0.024 reflects an average of spray and bait applications.

4/ Diphacinone and strychnine are applied as baits only. Growers did not report the rate per acre per treatment. Only the total quantity applied for the season was reported.

5/ Warfarin is applied as a bait only. Growers reported using less than 0.5 lb. of a.i. on the acres treated.

6/ Accounts for 28 percent of the total 507,348 acres in bearing and nonbearing age apple trees indicated in 1974 Census of Agriculture, Volume 1, Part 51, Table 11.

Table 2. Apple orchard rodenticides: Acre treatments, method of application, stage of development and type of coverage, by region, 1978 1/

Rodenticide	Acre treatments	Method of application	When applied		Type of coverage		
			Post-harvest	Prior to bloom	Each tree	Spot treatment	
Endrin	32,709	99	1	72	28	90	10
Chlorophacinone	19,243	97	3	72	28	40	60
Diphacinone	43,681	95	5	96	4	90	10
Warfarin	33	100	-	100	-	50	50
Strychnine	207	100	-	100	-	100	-
Zinc phosphide	65,892	84	16	82	18	80	20

- = zero or less than 0.5.

1/ Preliminary data from 1978 ESCS Survey of Pesticide Use on Deciduous Fruits. California excluded.

2/ Acres that may be treated more than once.

Table 3. Apple producers reporting trees killed by vole injury, by region, 1978.

Region	Producers <u>1/</u>	Total	Reporting trees killed	bearing trees <u>2/</u>	Total	Trees killed by vole injury <u>1/</u>	Non-bearing age
							age
	-----No.-----		-----1,000-----				
Northeast	2,816	1,505	8,587	74	30	44	
South	1,444	624	3,017	23	5	18	
West	1,811	414	10,010	5	<u>3/</u>	5	
North							
Central	2,766	926	5,729	21	11	10	
Total	8,837	3,469	27,343	123	46	77	

1/ Preliminary data from 1978 ESCS Survey of Pesticide Use on Deciduous Fruits. California excluded.

2/ The 27.3 million bearing trees is the total for the States surveyed (Figure 1). This total represents 92 percent of the bearing trees in the U.S. as reported in the 1974 Census of Agriculture, Volume 1, Part 51, Table 11.

3/ Less than 500 trees.