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VOLE DAMAGE AND CONTROL METHODS IN ONTARIO ORCHARDS

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In Ontario, herbivorous mammals inflict extensive damage upon fruit tree orchards and hardwood plantations (Radvanyi 1974 a, b; C. Dufault pers. commun., Hikichi pers. commun.). Nevertheless, surprisingly little research has been directed toward reduction or control of this damage and, therefore, growers continue to suffer substantial annual economic losses. Ontario appears to offer no specific guidelines to assist growers in developing effective long-term control programs for mammalian pests in their orchards. Recommended methods of control are limited to brief, general pamphlets most of which have shown little substantive change over the past few decades. There have been virtually no experimental studies of the recommended control methods, and there are almost no data on the identity of the species causing damage nor on the extent and cost of the damage. Finally, there has been no investigation of safer, more economical or more effective alternatives to the traditional means of control (Miller 1976; Hikichi pers. commun.).

In 1977, some Ontario growers expressed concern at the amount of damage caused by mammalian pests and compiled a rough estimate of the extent of this problem in several areas of the province (Table 1). At that time, the Ontario Ministry of the Environment (OME) solicited proposals for research on control of voles in Ontario orchards, but no funds were actually allocated. In 1980, the Ontario Apple Marketing Commission officially recognized a need for vole research in the province and requested that we submit a proposal for research to investigate the source and extent of the damage and a means of reducing destruction of fruit trees by voles. At present, the Ontario Ministry of Agriculture and Food (OMAF) and the Ontario Pesticides Advisory Committee (OPAC) have agreed to assist the Apple Marketing Commission in funding two studies of vole damage in orchards.

In this paper, we present a summary of present knowledge of the extent of vole damage to Ontario orchards and we summarize the methods of control presently recommended and describe some of the problems in vole control specific to Ontario.

Table 1. Wildlife damage survey in Ontario orchards (1977)

Area	Acres	Estimate of trees damaged			With treatment	
		Mice	Rabbit	Deer	# trees damaged	# trees killed
A	1,900	350	30	30		75
B	2,500	2,199	359	235	2,995	356
C	6,000	3,000	1,500	---	6,060	400
D	19,700	1,458	40	20	600	400
E	1,258	653	395	687	199	107
F	2,761	700	10	---	300	80
G	3,250	800	---	---	800	50
H	633	4,061	500	21	3,220	575
Total	38,003	13,221	6,034	983	14,174	2,042

Species Causing Damage to Fruit Trees

While it is evident that deer and "rabbits" often damage Ontario fruit trees, most growers seem to feel that "mice" are the major mammalian source of tree deaths and injury. However, there are few quantitative data that can be used to assess how much damage can be attributed to different pest species. It is probable that meadow voles (*Microtus pennsylvanicus*) cause most damage. Pine voles (*M. pinetorum*) have a very limited distribution in Ontario, being confined to a narrow strip of land along the shore of Lake Erie (Petersen, 1966), and so their importance, if any, is limited to these areas.

Extent of Damage

Apples, pears, peaches and grapes as well as hardwood plantations are injured by rodents. Usually, the main stem and lower branches of young trees are attacked. Root damage is less extensive. Vole damage begins in August and continues through fall and winter, presumably when alternate food sources are scarce or less nutritious. Many areas of Ontario experience deep winter snow cover that offers ideal habitat for the voles. Girdling then occurs below the snow crust, making detection of damage and application of effective control more difficult (OMAF Publ. #64 1981). Occasionally, voles breed under the winter snow (Brooks et al. 1976). In such instances, limiting control to the fall season would be ineffective unless the population was eliminated totally at that time. Therefore, the extended winter season and the possibility of winter breeding produce a major problem in vole control in Ontario.

Another problem in developing a single control program for the province is that orchards occur over a wide area of considerably varied terrain, climate and habitat. This means that it is difficult both to coordinate and plan control measures because of the distance

involved and because the populations that are causing problems may differ in species, numbers and other qualities. For example, attempts to provide province-wide monitoring of levels of vole populations to predict potential damage or to assess levels of control to be applied are impractical because of the diversity of the areas where orchards occur.

Methods and Recommendations for Control

At present, there is very limited and mostly outdated information to direct growers in controlling voles. A recent OMAF factsheet (Ells and Hikichi 1979) provides one page of information for control of voles in orchards. Methods suggested there are traditional and have remained virtually constant over the past 40 years.

Suggestions for control fall into 3 broad categories, mechanical and chemical control and habitat manipulation. It appears that Ontario growers primarily rely on the first two methods, but there has been no systematic evaluation of their relative effectiveness.

Mechanical protection is labor intensive and usually recommended for use in combination with other methods. Most publications indicate that mechanical protection has several limitations (e.g. labor costs, growth of mould, bark damage, failure to protect roots or to protect stem in deep snow, replacement cost etc.) (Agric. Can. Publ. #1153, 1975; OAC Report 1938; Thompson 1943; Ells and Hikichi 1979) and, therefore, are of little value by themselves.

Pitfall traps and snap traps are sometimes recommended for control (MacNay 1965) but it is difficult to imagine anyone using these traps to control voles in large operations because of the labor involved and because of their limited effectiveness. A comprehensive control program in Alberta using tree guards, pitfalls and snap traps was unsuccessful (Radvanyi 1974b).

Habitat manipulation has been less popular as a means of control for voles. Many growers resist clean cultivation or planting of other crops in their orchards (F. Harris pers. commun.) and wish to retain their orchards in sod. Typical recommendations include removal of prunings, rubbish and weeds that provide cover. Brooks et al. (1976) and Radvanyi (1974) reported that mowing did not kill voles or even drive them from an area. However, populations in mowed habitats suffered higher winter mortality than in old fields and leaving straw on harvested fields in fall led to massive increases in vole densities within a few weeks (Brooks et al. 1976).

Removal of sod is often not effective if there is good snow cover. With deep snow, packing is recommended (Thompson 1943). Removal of fallen fruit is recommended to reduce orchard attractiveness to voles and to increase bait acceptance. Ideally, habitat manipulation gives long term and more complete protection, and has no detrimental side effects. However, it is costly and meets with grower skepticism and resistance.

Rodenticides are usually recommended as solutions to vole problems after mechanical and habitat controls have been applied. Zinc phosphide, diphacinone, chlorophacinone, warfarin and pindone are some of the recommended rodenticides (Ells and Hikichi 1979). Many compounds are now banned or severely restricted for use (e.g. endrin, red squill, hydrogen cyanide, methyl bromide, thallium sulphate, toxaphene). The acceptable chemicals have various degrees of restriction depending upon toxicity and concentration. Many chemicals are effective if eaten but have low acceptance by rodents (e.g. zinc phosphide; Buckholtz pers. commun.). There has been little experimentation with this problem. Resistance to specific chemicals is either not reported or occurs sporadically in independent populations of voles. Most recommend applying the pesticides in fall (Sept. - Nov.) (Thompson 1943, Ells and Hikichi 1979). Radvanyi (1974 a, b) reported good and mixed success at reducing populations with anticoagulants (Rozol) in hardwood plantations. However, he also found reinvasion was rapid and felt that winter control was limited. Radvanyi (1974b) has recommended bait stations of his own design, but limited field trials by others suggest that growers find them too time consuming (Hikichi, pers. commun.).

In summary: Ontario has conducted very little research into control of voles in fruit tree orchards. Recommendations for control have changed little in the past 40 years and there appears to have been no proper assessment of the effectiveness of these recommended methods. Recent high levels of damage have led to requests from growers for an assessment of the problem and for development of more effective control measures.

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