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PRELIMINARY RESULTS OF TWO RESEARCH  
PROJECTS IN NEW YORK

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In the fall of 1977, New York fruit growers in the state's Hudson Valley region were given a temporary permit to use endrin in an effort to curb an increasing vole damage problem. The approval of endrin for this use was the first such large scale release of a chemical in this class since the banning in 1971 of most chlorinated hydrocarbons in this state. With approval for limited use came the obligation to monitor the Hudson Valley region for 1) efficacy of the material, 2) non-target effects on aquatic and terrestrial wildlife and 3) persistence in the orchard environment. The New York Cooperative Wildlife Research Unit agreed with the College at Cornell, the State Division of Agriculture and Markets and the State Department of Environmental Conservation to assist in this monitoring effort. In the following report we present a review of our role in the endrin monitoring effort. We also summarize the first year of a habitat manipulation experiment designed to investigate competitive interactions between the two vole species that inhabit these orchards.

The existence and amount of endrin in soil, vegetation, and pine voles, was monitored in 4 orchards treated with endrin at the rate of 1.5 gal/acre on 16-18 November 1977. In each orchard, samples were collected from the central .5 ha of a 1 ha treated block. Samples of humus, vegetation, and soil (1st and 3rd 3 cm sections of a soil core) were collected at 9 systematically located points; voles were trapped throughout the .5 ha test plot.

Residue levels were generally highest in the 5-month postspray samples (Table 1). One year after treatment residue levels were still higher than the pre-treatment levels (except in live vegetation). Residue levels of 12-keto endrin and dieldrin were also determined and will be reported elsewhere.

The impact of endrin on non-target wildlife that come into the treated orchard to forage can be estimated from data on endrin persistence. Species of concern include transient birds that winter in the region or migrate through it, and wide-ranging permanent residents (e.g. foxes) that might obtain a portion of their diet in endrin-sprayed orchards. If individuals of these species are affected deleteriously by endrin application, then the environmental impact extends far beyond the orchard boundaries and the intended target species.

Endrin's impact on such a group of wildlife can be expressed as the amount of endrin consumed daily, divided by the daily concentration that would be lethal to 50% of the group. The amount of endrin consumed can be expressed as the product of 1) the amount of food consumed daily per unit body weight, 2) the fraction of the diet which is contaminated, and 3) the residue level in the contaminated portion. The lethal daily dose depends on the length of time the animal forages in the treated region. For some migrant birds this is only a few days, for other species the period may range from several months to the animal's entire lifetime.

These parameters could be used to estimate the threat posed by endrin to a non-target individual in the following way:

$$\frac{\left( \frac{\text{kg food consumed}}{\text{body weight (kg)}} \right) \times \left( \frac{\text{fraction of diet}}{\text{contaminated}} \right) \times \left( \frac{\text{residue}}{\text{level (mg/kg)}} \right)}{\text{lethal daily concentration (mg/kg)}}$$

To identify the most pressing needs for future research, a literature search to estimate these parameters was carried out, followed by a sensitivity analysis using computer simulations in which the value of each parameter was allowed to vary alone or in combination with others. The results show that there is a critical need for more information on how the lethal daily concentration varies with exposure time. Most of the research on lethal concentration has employed standard exposure times to increase the comparability of results obtained for different species and pesticides. While this approach has clear value for certain objectives, it appears that in future research on the threat of endrin to transient wildlife, more attention should be given to the change in  $LC_{50}$  with exposure time.

The potential use of meadow voles to control pine voles is being evaluated in three orchards. Three plots have been established in each orchard and pre-treatment live-trapping has demonstrated the occurrence of high to moderate density populations of pine voles within each plot. Trapping has also shown that meadow voles are present within or adjacent to each plot.

One plot in each orchard was mowed during August, at approximately the same time that apple growers mow their orchards. The two remaining plots were left unmowed. Meadow voles, which require longer grass than is present on the mowed plots, are expected to increase in abundance on the unmowed plot. The experiment will then consist of monitoring population levels of both species to determine whether the larger and more mobile meadow voles displace the pine voles on the unmowed plots.

An increase in the number of meadow voles is just one of the environmental changes induced by not mowing. If a pine vole reduction occurs, it could be due to meadow vole pressure, but it might also be caused by changes in microclimate, food availability, predator or disease pressure, etc. To determine whether meadow voles, or some other factor associated with unmowed grass, is responsible for any observed changes in pine vole density, meadow voles will be removed from one of the unmowed plots in each orchard. If meadow voles are responsible for the decline in pine vole density, then pine vole populations on these plots should remain essentially unchanged.

Population levels were assessed by live trapping in July, August, and October. Mowing was carried out during August. It appears that population levels are still fluctuating in response to the treatments and that clear trends may not emerge until late next summer. However, preliminary results indicate that, as expected, meadow voles are increasing on the unmowed plots so that the coming field season should provide an opportunity to assess their effects, if any, on the resident pine voles.

Table 1: Endrin residues (ppm) in samples taken from 4 orchards in the Hudson River Valley treated with endrin (1.5 gal/acre) in mid-November 1977.

Sample	N*	Prespray $\bar{x}$ (S.D.)	5-months postspray $\bar{x}$ (S.D.)	1-year postspray $\bar{x}$ (S.D.)
Soil (0-3 cm)	36	7.03 (3.3)	9.06 (4.8)	14.3 (4.9)
Soil (6-9 cm)	36	.74 (.35)	1.77 (.81)	1.05 (.80)
Humus	36	50.99 (39.9)	305.88 (42.0)	211.38 (53.8)
Vegetation	36	1.23 (.70)	65.43 (26.0)	.95 (.09)
Pine voles	29-37	.03 (.015)	.24 (.052)	.09 (.035)

\* Total number of samples per sampling period.