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# FIELD EVALUATION OF CANDIDATE RODENTICIDE

Milo E. Richmond
*New York Cooperative Wildlife Research Unit, Cornell University, Ithaca, NY*

Pamela N. Miller
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Milo E. Richmond
Pamela N. Miller
New York Cooperative Wildlife Research Unit
Cornell University
Ithaca, N.Y. 14853

During autumn of 1978 and 1979 the New York Cooperative Wildlife Research Unit continued its program of research and management aimed at the pine vole (Pitymys pinetorum) and meadow vole (Microtus pennsylvanicus). Two herbicides, Ammate-X (E.I. Dupont de Nemours) and Kerb (Rhom & Haas Corp.) along with 4 candidate rodenticides, Bromadiolone and Chlorophacinone (Chempar Inc.), Volak (I.C.I. Chemicals Inc.) and zinc phosphide (Bell Laboratories Inc.) were tested in both orchard and laboratory situations. This work is being conducted in conjunction with a separate research unit project aimed at evaluating the potential of using populations of the larger meadow vole to limit the invasion and success of the smaller but more troublesome pine vole. This biological control aspect will be treated in a separate manuscript.

## METHODS

Because prepared baits and chemicals may deteriorate with time and handling we examined all of our test materials in laboratory trials to establish their lethality. Likewise we examined the candidate herbicides for any direct toxic effects on voles. This work was conducted with a laboratory colony of prairie voles (M. ochrogaster), a species closely related to the orchard voles that are pests in New York. Adult animals were housed two per cage and provided with rabbit chow and water ad libitum. Wood shavings served as bedding; all animals were subjected to a lighting regime of 14 L 10 D.

The herbicides Kerb and Ammate-X were prepared as per label instructions and each applied to 16 animals and their food pellets with a hand sprayer. The animals were observed for mortality or aberrant behavior for two weeks post treatment. Bromadiolone, Chlorophacinone, Volak and zinc phosphide each were offered to 8 caged pairs as treated baits in the absence of other food. These pairs were also observed for two weeks or until all had died. Results of this work are summarized in Table 1.

Field testing of the 2 herbicides and 4 rodenticides was conducted in Ulster Co., New York between 2 September and 15 December of 1978 and 1979. Thirteen separate orchard plantings of 45 trees each (5 rows x 9 trees) were selected in the towns of New Paltz, Highland, Clintondale and Brewster, N.Y. All 13 of the orchards had pine vole populations and 5 had both pine and meadow voles present as confirmed by live trapping. Tree variety, age and management differed across plots and there was no attempt to control these variables. A pre-treatment vole activity index (Eadie 1954) was determined by placing an apple slice under a tarpaper cover and reexamining the apple slice after 24 hours. Post-treatment activity levels were monitored in the same way usually at one, two, four and six weeks.

Table 1. Results of preliminary laboratory screening for toxicity of candidate rodent control materials.

| Candidate material | No. voles M. ochrogaster | No. surviving after 4 da | 8 da | 16 da | 14 da | Percent mortality |
|---|---|---|---|---|---|---|
| Herbicide | | | | | | |
| Kerb (4 lbs/a) | 16 | 16 | 16 | 14 | 14 | 12% |
| Ammate (120 lbs/a) | 16 | 16 | 16 | 15 | 15 | 6% |
| Rodenticide | | | | | | |
| Bromadiolone (pellets) | 16 | 5 | 1 | 0 | 0 | 100% |
| Volak (pellets) | 16 | 0 | 0 | 0 | 0 | 100% |
| Zinc phosphide (pellets) | 16 | 2 | 1 | 1 | 1 | 94% |
| Chlorophacinone (lacquered wheat) | 16 | 6 | 2 | 1 | 0 | 100% |

There are two basic choices to be made in the field evaluation of candidate rodenticides. One must make either an intensive effort to study a few materials with different application rates and times and with replication of each test or an extensive effort with a variety of candidate materials but with fewer treatment variables and replications. Because there exist a variety of candidate materials and methods that have some potential in orchard pest management and because we were attempting to provide a preliminary screening of several materials we opted for the extensive approach with a limited number of replications. Table 2 provides a summary of the materials tested, their formulation, and rates of application. Results are given as the percent activity remaining in the treated plot. Post-treatment indices are derived only from those trees that were determined active at the time of pre-treatment indexing.

Table 2. Candidate materials selected for field-testing in 1978 and 1979.

| | | | |
|---|---|---|---|
| Bromadiolone (pellets) | Handbaiting | @ | 10-12 lbs/A |
| | Handbaiting | @ | 10-12 lbs/A |
| | Broadcast | @ | 20 lbs/A |
| Chlorophacinone (lacquered wheat) | Handbaiting | @ | 10-12 lbs/A |
| | Handbaiting | @ | 10-12 lbs/A |
| | Handbaiting | @ | 10-12 lbs/A |
| Zinc phosphide (pellets) | Handbaiting | @ | 4 lbs/A |
| | Handbaiting | @ | 4 lbs/A |
| | Broadcast | @ | 10 lbs/A |
| Volak (pellets) | Broadcast | @ | 10 lbs/A |
| Kerb (wettable powder) | Backpack sprayer | @ | 1 lbs/A |
| | Backpack sprayer | @ | 4 lbs/A |
| Ammate (liquid) | Backpack sprayer | @ | 120 lbs/A |

## RESULTS AND DISCUSSION

Laboratory evaluation of Kerb and Ammate for a direct effect on voles proved negative (Table 1). The voles in both herbicide treatment groups ate less than did a control group given untreated rabbit chow; however, there was no mortality or unusual behavior within the first eight days and the deaths that did occur later may have been caused by an aggressive cage mate. Later, when applied as intended for vegetation control both materials were very effective. All four rodenticides were effective when offered without choice to caged voles (Table 1). The Chlorophacinone lacquered wheat was not eaten as readily as the other baits but was consumed as rapidly as untreated wheat offered to a control group. Overall, the baits were quite toxic when offered without choice over several days.

Field evaluations of three herbicide treatments are shown in Figures 1 and 2. Kerb applied at one and at four pounds per acre of ground cover had a slight effect in reduction of pine vole activity. Kerb was very effective in killing the ground cover in both of the plots but well-established vole tunnels continued to harbor animals in spite of a dead sod layer on the surface. Heavy snow cover prevented later evaluation of these plots and by spring, pine voles had declined to an extremely low level throughout the control and experimental plots.

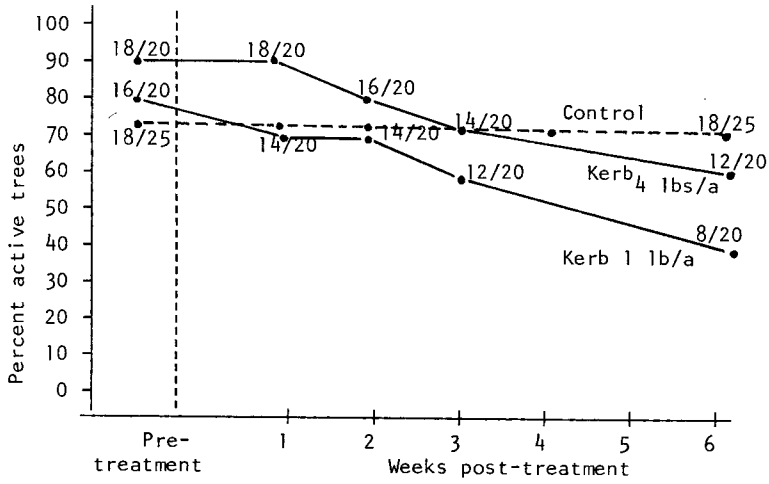


Figure 1. Effects of ground-sprayed Kerb on pine vole activity indices, Ulster, Co., New York.

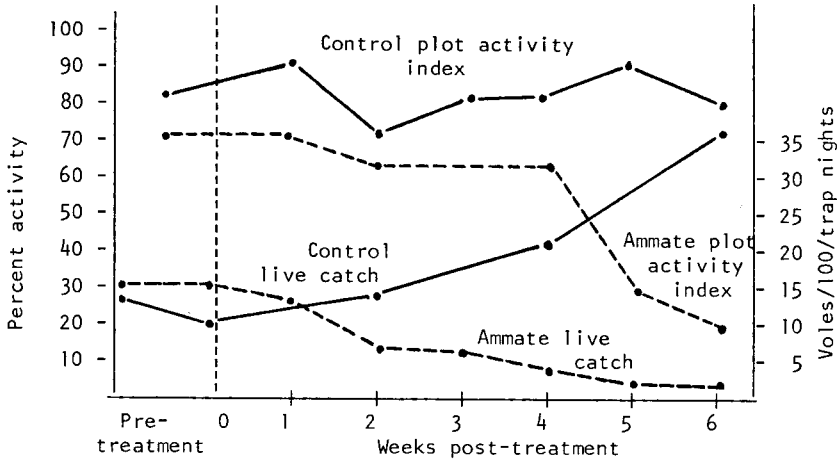


Figure 2. Effects of the herbicide Ammate-X on pine vole and meadow vole activity indices and live catch.

Ammate-X, a broad spectrum herbicide, was applied at the recommended rate of 120 lbs/acre to an orchard that we had previously live-trapped and also indexed using the apple slice technique. A drift fence, 8 inches high, placed on all sides of the orchard allowed us to measure ingress and egress of voles by livetrapping before and following herbicide treatment. The results shown in Figure 2 indicate that destroying the ground cover in early fall will cause a substantial movement of voles from the treated area. Both the activity index and the live catch dropped markedly after treatment. It should be noted that the treatment area contained a large proportion of meadow voles and only a few pine voles. In the previous experiment with Kerb (Figure 1) the population was known to be largely pine voles. The difference in response to the two herbicides is likely due to behavioral differences in the two species. Pine voles appear to be slower than meadow voles in responding to a habitat change that affects the orchard ground cover. In both experiments however the number of animals showed a decline lending promise to the continued testing of herbicides for vegetative manipulation and ultimately vole management.

Results from the application of Volak to a single plot at the rate of 10 lbs. per acre are shown in Figure 3. Drawing conclusions from a single application is inappropriate; however, the material does appear promising due in part to the fact that it gave reasonably good results when applied via broadcast in an orchard heavily infested with pine voles. A repeated broadcast application or handbaiting would likely yield even better results.

Bromadiolone (Maki), a new anticoagulant from the family of hydroxycoumarins, has shown considerable promise as a rodenticide and was investigated on three plots. The results of this work are shown in

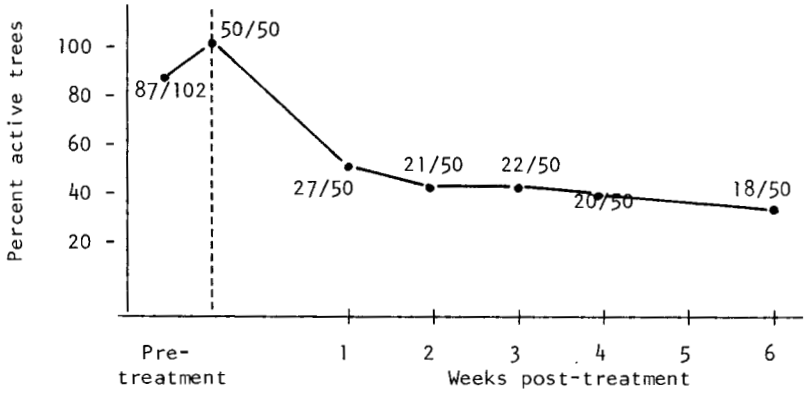


Figure 3. Effects of broadcast baiting with Volak on orchard vole activity indices.

figures 4, 5 and 6. The two handbaiting trials proved more effective than the broadcast method as has been our experience from previous work with rodenticides and pine voles. Bromadiolone was readily accepted by prairie voles in the laboratory and by both pine and meadow voles in the field.

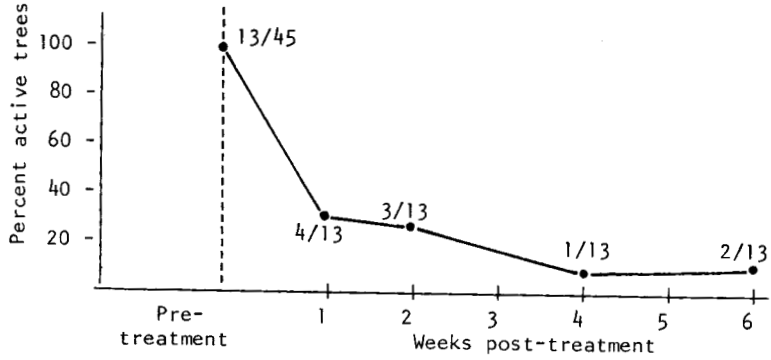


Figure 4. Effects of handbaiting with Bromodiolone pellets (Maki) on orchard vole activity indices.

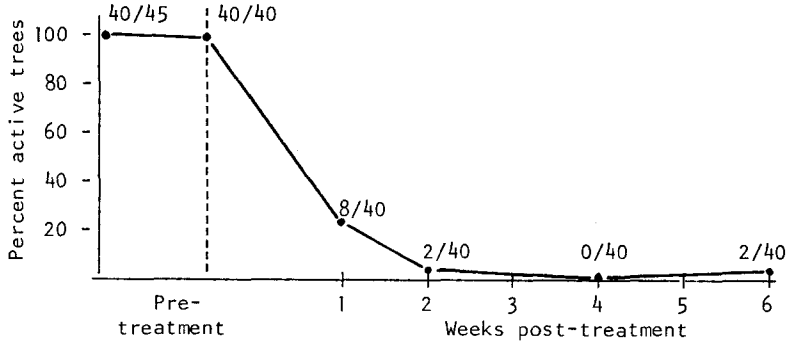


Figure 5. Effects of handbaiting with Bromodiolone pellets (Maki) on orchard vole activity indices.

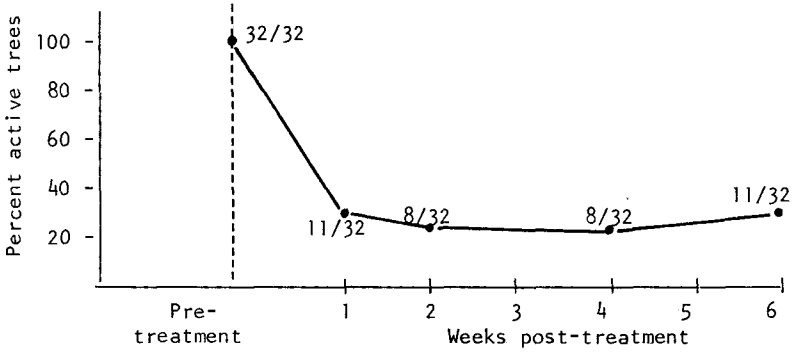


Figure 6. Effects of broadcasting with Bromodiolone pellets (Maki) on orchard vole activity indices.

Another anticoagulant, Chlorophacinone (Rozol), was tested as a lacquered wheat preparation and applied by handbaiting under tarpaper bait covers. Results of this work are presented in Figures 7, 8 and 9. Chlorophacinone/wheat gave reasonable control in the two low density plots but was much less effective in the high density situation (Figure 7). These results suggest that a second baiting is necessary in orchards where vole density is high.

Zinc phosphide, available in a new formulation (pelleted bait) was broadcast at 10 lbs/acre on one plot and handbaited at the rate of 4 lbs/acre on two other plots. Figures 10, 11 and 12 indicate that the broadcast application was as effective as the two handbaiting trials, although none of the treatments reduced vole activity indices below 20 percent. By the end of the 6th week activity indices ranged from 28 to 50 percent of the original activity level. Zinc phosphide has

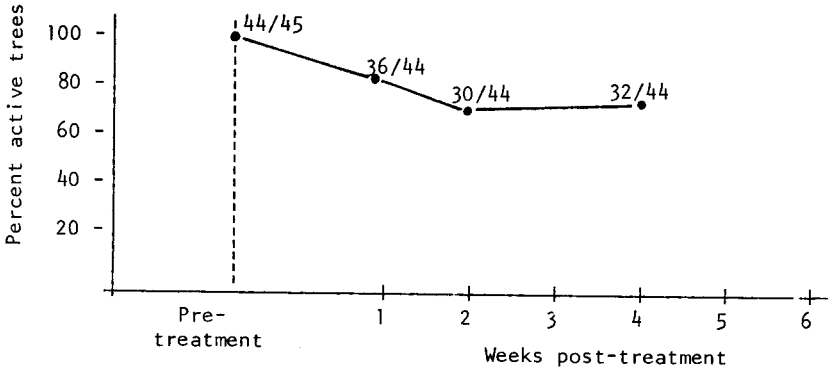


Figure 7. Effects of handbaiting with Chlorophacinone lacquered wheat on orchard vole activity

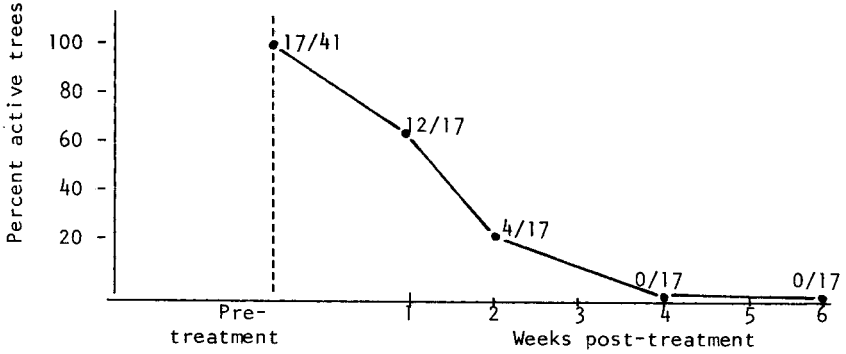


Figure 8. Effects of handbaiting with Chlorophacinone lacquered wheat on orchard vole activity.

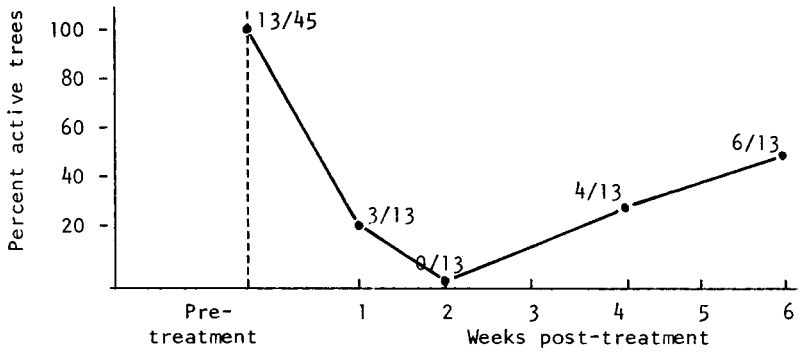


Figure 9. Effects of handbaiting with Chlorophacinone lacquered wheat on orchard vole activity.

traditionally been a suitable rodenticide when applied to apple cubes or cracked corn and we feel that additional trials of the new pelleted formulation are warranted in spite of the somewhat discouraging results noted here.

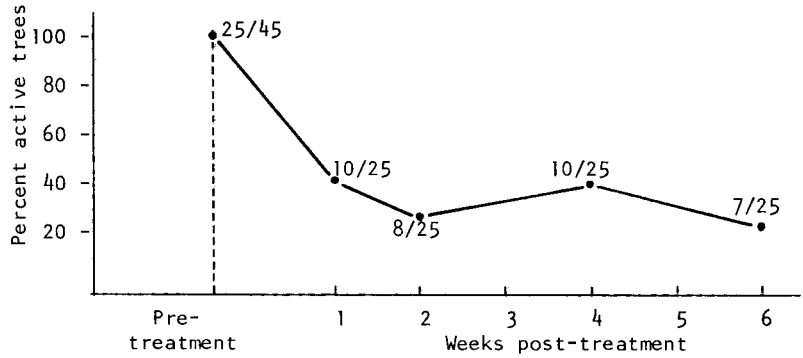


Figure 10. Effects of Zinc Phosphide pellets on orchard vole activity indices (10 lbs/acre broadcast).

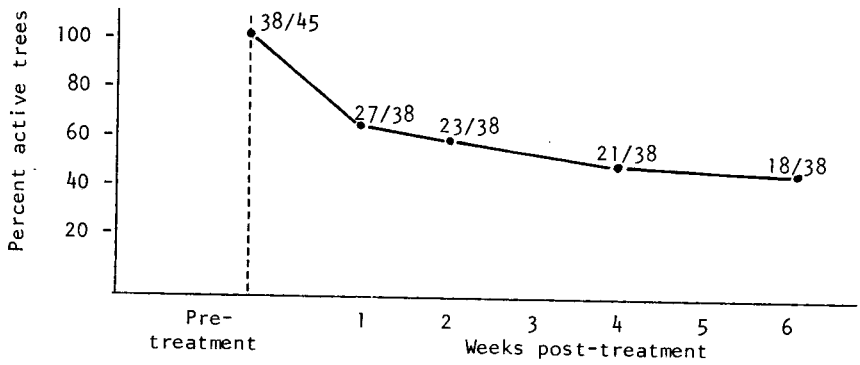


Figure 11. Effects of Zinc Phosphide pellets on orchard vole activity indices (4 lbs/acre handbaited)

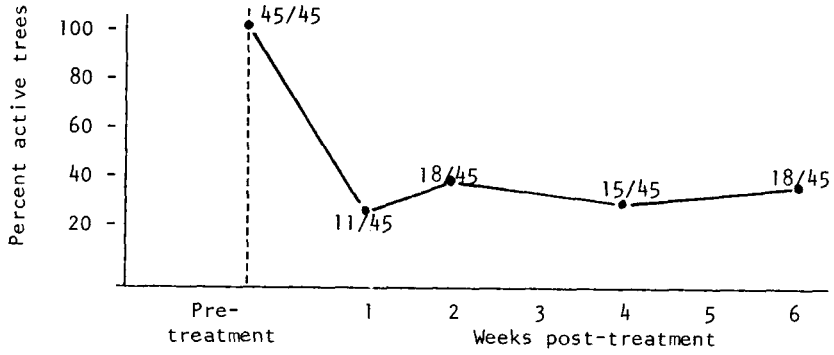


Figure 12. Effects of Zinc Phosphide pellets on orchard vole activity indices (4 lbs/acre handbaited).

The results of this work coupled with findings from previous years (Richmond et al. 1978, Byers and Young 1975, Byers et al. 1976, Byers 1978) suggest that a variety of rodenticides and cultural practices now exist that, in the hands of the careful and well trained pest control manager, will reduce orchard vole populations to a tolerable level. It continues to be argued by growers and others that techniques and products available to us are not cost effective. This may be true; however, the data to refute or accept this claim are not yet available. Regardless of the answer, research and management should expand their efforts to seek optimum, safe control strategies and continue an effort to reduce the cost of pest control for the grower.

We thank the several growers who allowed us access to their property and occasionally provided help by changing their harvest or management plans. John Hochstein, Jon Bart, Bob Mungari and Barbara Hiaasen helped with the livetrapping and some of the indexing of vole populations. Nancy Bowers typed the initial and the final drafts and helped with the figures.

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