March 1983

RESULTS OF 1982 RODENTICIDE FIELD TESTS

M. H. Merson
Virginia Polytechnic Institute and State University

R. E. Byers
Virginia Polytechnic Institute and State University

RESULTS OF 1982 RODENTICIDE FIELD TESTS

M. H. Merson and R. E. Byers
Winchester Fruit Research Laboratory
Virginia Polytechnic Institute and State University
Winchester, VA 22601

Abstract: A 2.0% zinc phosphide pellet and a 0.001% brodifacoum bait gave the lowest percentage post-treatment activity in a field test in which broadcast applications were followed shortly by rain. There was not a clear difference in performance between the single-feeding toxicants and the multiple-feeding anticoagulants in this experiment. A 0.075% cholecalciferol bait gave control comparable to some registered materials and shows promise for future development. A bait containing 0.0216% diphacinone gave significantly better control than one containing 0.005% diphacinone.

Introduction

In the fall of 1982 eight rodenticide compounds were tested for efficacy in orchards against pine voles (Microtus pinetorum) and meadow voles (M. pennsylvanicus). Three of the compounds (diphacinone, chlorophacinone, and zinc phosphide) are currently registered for use against field rodents. Pival, brodifacoum, and bromadiolone are currently registered only for use against commensal rodents. In addition, two relatively new materials for rodent control in the U.S., reserpine and cholecalciferol, were tested.

Two tests were performed. The first was designed to examine the effect of precipitation immediately after bait application on the efficacy of mechanically broadcast bait treatments. Included in this experiment were handplaced treatments of reserpine and cholecalciferol. The second experiment compared the relative effectiveness of diphacinone baits of two different concentrations applied at two different rates.

Methods

Field tests were conducted using a randomized complete block design. Each treatment (material and rate combination) was replicated three times in randomly selected plots within blocks. Plots were blocked according to high, medium, and low activity from data collected in the first activity reading.

Bait efficacy was determined on the basis of pre- and post-treatment apple index activity readings and a final post-treatment trap-out of all plots. A more detailed description of the methods used has been published previously (Byers, 1981).

In the first test, broadcast applications of a 0.005% pival bait (Contrax-P), a 0.005% diphacinone bait (Ramik brown), a 0.005% bromadiolone bait (MAKI), a 0.005% chlorophacinone bait (Rozol), a 0.001% brodifacoum bait (VOLID), and two 2.0% zinc phosphide baits (ZP Rodent Bait AG and ZP Rodent Bait-Special) were made using a tractor-mounted mechanical spreader on 12 November 1982. Precipitation was expected that

evening. Hand placements of 0.01% reserpine and 0.075% cholecalciferol baits were made under roofing shingle covers on 16 November 1982.

In the second test, diphacinone baits (Ramik brown) containing 0.005% and 0.0216% active ingredient were mechanically broadcast at two different rates. Included in the test for comparative purposes was another anticoagulant bait containing 0.005% chlorophacinone (Rozol).

Results and Discussion

In the first test, 7.62 mm (0.30 in) precipitation fell in the 48 hours beginning at 1830 hours on 12 November 1982. All the materials broadcast significantly reduced post-treatment activity levels below those in untreated control plots (Table 1). The greatest differences between materials occurred in the percentage of sites active post-treatment. The trends in voles trapped per plot post-treatment and voles per site tended to follow the trends seen in percent active sites, but there were few significant differences between materials for these variables.

ZP Rodent Bait AG and brodifacoum bait (VOLID) plots averaged significantly ($P < .10$) fewer percent active sites than all other materials tested. The original hypothesis was that the single-feeding materials (zinc phosphide, brodifacoum, bromadialone) would outperform the multiple-feeding baits (chlorophacinone, diphacinone, pival) in situations where precipitation might make the baits unavailable or unacceptable soon after treatment. In such cases, ample time would not be available for the voles to feed sufficiently on the multiple-feeding baits to obtain a lethal dose.

The results obtained with VOLID and ZP Rodent Bait AG are consistent with this hypothesis, but exceptions occurred in the case of Rozol, which performed as well as ZP Rodent Bait-Special, and MAKI which left the highest post-treatment activity of any material. This inconsistency cannot be explained on the basis of the ability of the pellets to withstand weather and consequent availability. Pellets of all materials could be found 5 days post-treatment. Rozol appeared to be most adversely affected by the rain, but performed about average in the test. In contrast, MAKI pellets were affected very little by the rain and could be found readily in the treated plots, but MAKI gave relatively poor reductions in activity. This suggests that factors other than weatherability such as bait acceptability were also operative.

The handplaced treatment of cholecalciferol gave control comparable to that of some of the registered rodenticides (Table 1). Modifications in the formulation could possibly improve the performance of cholecalciferol to the point where it would be commercially competitive. Reserpine gave relatively poor control. This could be due to the vole species composition found in the test orchard which was almost exclusively pine voles. Poorer results have been obtained in laboratory tests with reserpine against pine voles than against meadow voles (Merson and Byers, unpublished).

In the second field test, there was a marked difference in performance between the 0.005% and 0.0216% diphacinone baits (Table 2). The 0.005% diphacinone bait left significantly ($P < .10$) more activity post-treatment than the 0.0216% diphacinone or the 0.005% chlorophacinone baits. The improved performance of diphacinone relative to chlorophacinone, which was achieved by increasing the concentration of diphacinone 4-fold, is consistent with what is known about the toxicity of these materials and illustrates the need to match bait concentrations with the toxicity to the target organisms. The observation that essentially the same level of control was obtained with the 13.1 kg/ha rate of application of the 0.0216% diphacinone bait as with the 23.1 kg/ha rate could indicate that some downward adjustment in the 23.1 kg/ha rate could be made without compromising efficacy.

Literature Cited

Byers, R. E. 1978. Performance of rodenticides for the control of pine voles in orchards. J. Amer. Soc. Hort. Sci. 103(1):65-69.

Byers, R. E. 1982. Field method for evaluation of rodenticides for control of Microtus pinetorum in apple orchards. Pages 77-85 in E. W. Schafer, Jr. and C. R. Walker, eds. Vertebrate Pest Control and Management Materials, Third Conf. ASTM STP 752. American Society for Testing Materials.

Table 1. Results of a field test of rodenticide baits broadcast or handplaced to control meadow and pine voles in a Virginia orchard, November 1982.

Material	Rate (kg/ha)	No. plots	Highly active sites[w] (%) 3 Nov	Highly active sites[w] (%) 30 Nov	Active sites[w] (%) 3 Nov	Active sites[w] (%) 30 Nov	Voles per plot[x] 2-7 Dec	Voles per site[x] 2-7 Dec	% Control
Broadcast[y]									
Control		3	81 a[v]	73 a	91 a	94 a	35.0 a	1.17 a	0
Pival 0.005% (Contrax-P)	21.6	3	80 a	11 bc	90 a	33 bc	5.3 bc	0.18 bc	85
Bromadiolone 0.005% (Maki)	12.7	3	76 a	26 b	86 a	48 b	10.0 bc	0.33 bc	71
Diphacinone 0.005% (Ramik brown)	24.2	3	78 a	23 b	93 a	39 bc	13.3 b	0.45 b	62
Chlorophacinone 0.005% (Rozol)	19.6	3	78 a	7 c	92 a	26 cd	4.7 c	0.16 bc	86
Brodifacoum 0.001% (Volid)	14.1	3	73 a	2 c	89 a	16 de	3.3 c	0.11 c	91
Zinc phosphide 2.0% (ZP Rodent Bait-Special)	11.3	3	69 a	3 c	89 a	27 cd	6.0 bc	0.20 bc	82
Zinc phosphide 2.0% (ZP Rodent Bait AG)	10.4	3	71 a	3 c	87 a	9 e	2.7 c	0.09 c	92

Table 1. Results of a field test of rodenticide baits broadcast or handplaced to control meadow and pine voles in a Virginia orchard, November 1982, continued

Material	Rate (kg/ha)	No. plots	Highly active sites[w] (%) 3 Nov	Highly active sites[w] (%) 30 Nov	Active sites[w] (%) 3 Nov	Active sites[w] (%) 30 Nov	Voles per plot[x] 2-7 Dec	Voles per site[x] 2-7 Dec	% Control
Handplaced[z]									
Control		3	81 a	73 a	91 a	94 a	35.0 a	1.17 a	0
Cholecalciferol 0.075%	11.2	3	73 a	22 bc	94 a	34 bc	8.7 b	0.31 b	75
Reserpine 0.01%	11.2	3	83 a	31 b	92 a	52 b	17.7 ab	0.61 ab	50
Zinc phosphide 2.0% (ZP Rodent Bait AG)	2.2-3.4	3	80 a	7 c	88 a	10 c	3.3 b	0.11 b	91

[w] Values transformed to arcsine $\sqrt{X}$ for analysis

[x] Values transformed to $\sqrt{X+0.5}$ for analysis.

[y] Treatment on 12 November 1982, 7.62 mm precipitation in the 48 hours after treatment.

[z] Handplacement on 16 November 1982.

[v] Mean separation by Duncan's multiple range test, 10% level.

Table 2. Results of a field test of diphacinone (DPN) and chlorophacinone (CPN) baits broadcast for the control of meadow and pine voles in a Virginia orchard 6 Dec 1982.

Material	Rate (kg/ha)	No. plots	Highly active sites[x] (%) 30 Nov	Highly active sites[x] (%) 23 Dec	Active sites[x] (%) 30 Nov	Active sites[x] (%) 23 Dec	Voles per plot[y] 27-31 Dec	Voles per site[x] 27-31 Dec	% Control
Control		3	83 a[z]	80 a	100 a	92 a	39.3 a	1.31 a	0
DPN 0.005%[v]	11.4	3	84 a	37 b	99 a	50 b	13.0 bc	0.43 bc	67
DPN 0.005%[v]	19.3	3	85 a	46 b	100 a	69 b	20.0 ab	0.65 b	49
DPN 0.0216%[v]	13.1	3	81 a	9 c	99 a	19 c	5.3 cd	0.18 c	87
DPN 0.0216%[v]	23.1	3	84 a	5 c	100 a	18 c	4.0 cd	0.13 c	90
CPN 0.005%[w]	24.6	3	86 a	5 c	100 a	9 c	1.7 d	0.06 c	96

[x] Values transformed to arcsine $\sqrt{X}$ for analysis.

[y] Values transformed to $\sqrt{X+0.5}$ for analysis.

[z] Mean separation by Duncan's multiple range test, 10% level.

[v] Ramik brown formulation.

[w] Rozol pellet.