Proceedings of the Ninth International Conference on Urban Pests
Matthew P. Davies, Carolin Pfeiffer, and William H Robinson (editors) 2017
Printed by Pureprint Group, Crowson House, Uckfield, East Sussex TN22 1PH UK

FIELD EVALUATION OF TWO SINGLE FEEDING ANTICOAGULANT RODENTICIDES AGAINST *MUS MUSCULUS* IN A CONFINED SWINE FACILITY

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Abstract Three commercial rodenticide bait blocks were tested at a confined swine facility in Lafayette, Indiana to compare efficacy for control of the house mouse (*Mus Musculus*). The three products were Talon® Ultrablok rodenticide (brodifacoum 0.005%), Final® All-Weather Blox™ (brodifacoum 0.005%), and Contrac® All-Weather Blox (bromadialone 0.005%). Pretreatment monitoring with non-toxic bait blocks and tracking pads determined that mouse populations were equivalent in the three buildings used as treatment sites. Each building was treated with toxic bait for 15 days. Bait consumption and tracking pad activity were monitored. After a three-day rest period the sites were monitored again with non-toxic bait and tracking pads for eight days. Following the monitoring, multi-catch mouse traps were placed in each building to trap mice remaining in the building. Consumption of Contrac bait (7136 grams) was significantly greater than for Talon (2454 grams) and Final (1094 grams). Consumption of Talon brodifacoum was significantly greater than Final. Following the 15 day toxic baiting period, bait consumption and tracking pad activity were significantly lower for the Talon treatment, (1% bait consumption and tracking pad activity), than for the Final (38 % bait consumption, 27% tracking pad activity) and Contrac (91% bait consumption and 78% tracking pad activity). Trap catches following baiting were 6 mice for Talon, 44 mice for Final, and 57 mice for Contrac. Results indicate that there was probably bait aversion to the Final bait and rodenticide resistance to bromadialon, the active ingredient in Contrac. DNA analysis showed that 67% of the trapped mice were homozygous for Y139C mutation for anti-coagulant resistance, and 33% were heterozygous for the same mutation. In addition 33% of the mice were homozygous for L128S mutation for anti-coagulant resistance. The test confirms the presence of single feeding anticoagulant resistance in a house mouse population in the United States.

Key words Brodifacoum, bromadialone, resistance, DNA, Y139C, L128S.

INTRODUCTION

The house mouse, a commensal rodent pest, is common in animal production facilities. Control of these pests is difficult in these situations because of the abundance of harborage and food, and a controlled temperature environment. Growers typically rely on the use of chemical rodenticides, principally the single feeding anticoagulant rodenticides, for control of these rodent pests. Two factors can influence the success of mouse baiting programs, the acceptability of the bait and physiological resistance to the active ingredient. Physiological resistance to single feeding anticoagulant rodenticides has been identified in several locations around the world (Buckle, 2012). This study was initiated to compare three rodent bait formulations for acceptance and control of a house mouse infestation in a confined swine facility.

MATERIALS AND METHODS

Three rodenticide bait blocks were compared for consumption, speed of control, and effectiveness of reduction of a house mouse infestation in a confined swine facility. The test was conducted at the Swine Unit of the Animal Sciences Research and Education Center (ASREC), a commercial swine farm operated by the Department of Animal Sciences at Purdue University in West Lafayette, Indiana. Three separate buildings were used. Each building received one of three treatments.

The three treatments were Talon® Ultrablok (0.005% brodifacoum), Contrac® All Weather Blox™ (0.005% bromadialone), and Final® All Weather Blox™ (0.005% brodifacoum). Baits were placed in the buildings in the areas of highest mouse activity as determined by visual inspection. Baits were placed in tamper resistant mouse bait stations (Bell Protecta® Mouse Station). Tracking pads were placed at both entrances of the bait stations. Tracking pads were 6 inch by 6 inch PVC tiles coated with blue construction chalk.

The study consisted of 3 phases. Phase I was pre-baiting with non-toxic bait blocks (Detex® Block, Bell Labs) and monitoring with tracking pads. Each building was continuously baited for 8 days and bait was replaced every 48 hours as needed. Bait consumption and tracking activity were measured in each building. During phase II each building was baited with one of the three treatments and tracking was monitored with tracking pads. Phase II began 3 days after the completion of phase I. Each building was baited continuously for 15 days and bait was replenished every 48 hours as needed. Bait consumption and tracking activity were measured. Phase III began 3 days after the end of phase II. Phase III was baiting with non-toxic bait blocks and monitoring with tracking pads. Each building was continuously baited for 8 days and bait was replaced every 48 hours as needed. Bait consumption and tracking activity were measured in each building. At the end of the 8 days of baiting live catch traps (JT Eaton 420CL Repeater™ Multiple Catch Mouse Trap) were placed throughout each building to determine if any mice remained active in the buildings.

To check for the presence of anti-coagulant rodenticide resistance a one inch section of the tail of mice that were captured at the end of the study was collected from 12 mice and submitted to the Rodent Research Lab at Reading University (Reading, UK) and a genetic analysis was conducted to look for the presence of the two anti-coagulant resistant mutations, Y139C and L128S.

Data Analysis. Differences between tracking activity, bait consumption, and mouse trapping were analyzed by one way Analysis of Variance using SPSS Software. Differences were significant at the $p < 0.001$ level.

RESULTS AND DISCUSSION

Consumption of non-toxic bait for all three buildings during phase I averaged 96.3% of bait applied +/- 1.5%. Mean percent tracking during phase I for all three buildings was 87% +/- 1.7% (Figure 1). There was no significant difference in mouse activity between the three buildings.

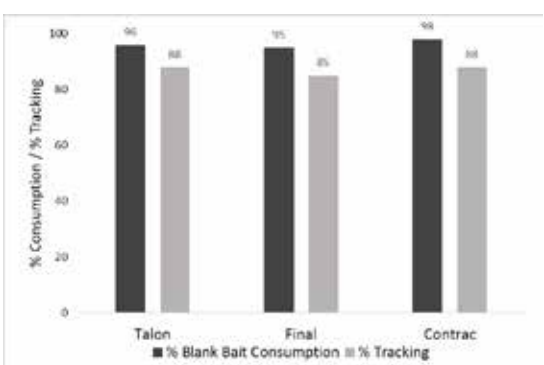

Figure 1. Phase I, Percent Consumption of non-toxic bait and Percent Tracking by Treatment.

Bait consumption during phase II was; Talon 2454 grams, Final 1094 grams, and Contrac 7136 grams (Figure 2). Consumption of Contrac bait was significantly greater than consumption of Talon and Final baits. Consumption of Talon was significantly greater than consumption of Final. No Final was consumed after the 2nd day of baiting. Tracking during phase II was significantly lower for Talon than for Contrac and Final Figure (3).

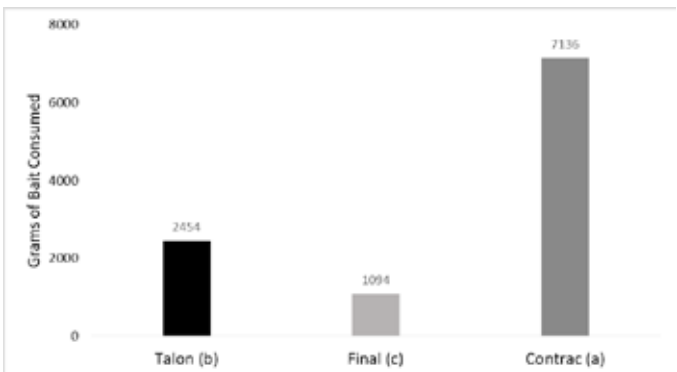

Figure 2. Phase II, Total grams of bait consumed for each treatment during 15 days of continuous baiting. No Final All Weather Blox were consumed after the second day of baiting.

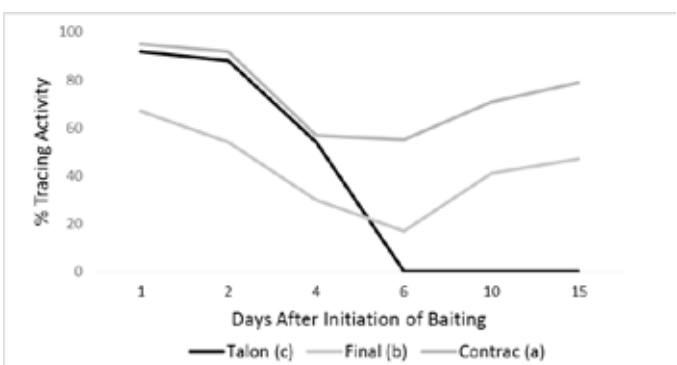

Figure 3. Phase II Percent tracking during the 15 days of baiting

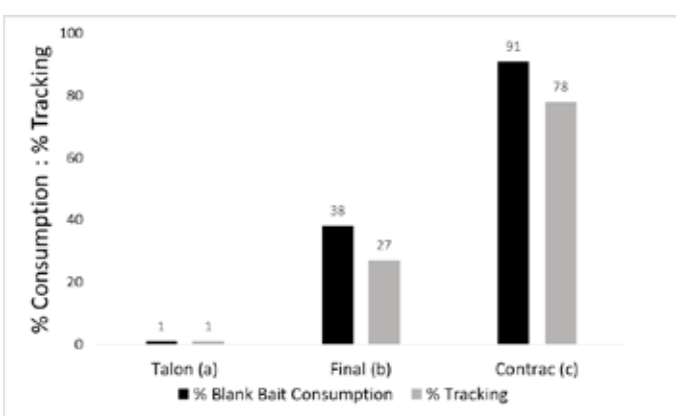

Figure 4. Phase III, Percent Consumption of non-toxic (blank) bait and Percent Tracking by Treatment.

Consumption of non-toxic bait during phase III was 34 grams for the Talon treatment, 1808 grams for the Final treatment, and 2697 grams for the Contrac treatment. Average tracking activity during phase III was 1% for the Talon treatment, 27% for the Final treatment, and 78% for the Contrac treatment (Figure 4). Consumption and tracking for the Talon treatment were significantly less than for the Final and Contrac treatments. Consumption and tracking for Final was significantly less than for Contrac.

At the conclusion of the test 6 mice were trapped in the Talon treatment, 44 mice were trapped in the Final treatment, and 57 mice were trapped in the Contrac treatment. The number of mice trapped in the Talon treatment was significantly lower than trapped in the Final and Cotrac treatments.

DNA analysis showed that 67% of the mice analyzed were homozygous and 33% were heterozygous for the Y139C mutation for anti-coagulant resistance. In addition another 33% of the mice were homozygous for the L128S mutation for anti-coagulant resistance.

CONCLUSIONS

The high rate of consumption of Contrac bait with a low level of control is indicative of physiological resistance to the anti-coagulant active ingredient bromadialone. The results of the DNA analysis confirm the presence of the mutation for anti-coagulant resistance in this mouse population. As this mouse population is fairly isolated is it not indicative that bromadialone resistance is wide spread in the region where the test was conducted.

The low consumption of Final bait with moderate control and no feeding after the second day of baiting indicates bait aversion in the mouse population. As a formulation of bait very similar to Final has been used for years at the facility the selection for aversion is highly probable.

The moderate consumption of Talon bait with a very high level of control indicates that there is as yet no physiological resistance to brodifacoum in this mouse population. The attractiveness of a novel bait formulation resulted in good consumption and a high level of control.

REFERENCES CITED

Buckle, A. 2012. Anticoagulant resistance in the United Kingdom and a new guideline for the management of resistant infestations of Norway rats (*Rattus norvegicus* Berk.). Pest. Manag. Sci. 69:334–341.