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Authors

Baldwin, Roger A.
Meinerz, Ryan
Becchetti, Theresa A.
et al.

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Does Diphacinone Application Strategy Affect Secondary Exposure Risk Associated with Management of California Ground Squirrels?

Roger A. Baldwin and **Ryan Meinerz**
Department of Wildlife, Fish, and Conservation Biology, University of California-Davis, Davis, California
Theresa A. Becchetti
University of California Cooperative Extension, Modesto, California
Niamh Quinn
University of California Cooperative Extension, South Coast Research & Extension Center, Irvine, California

ABSTRACT: California ground squirrels (*Otospermophilus* spp.) are one of the most damaging vertebrate species in California agricultural systems, including rangelands. One of the primary tools used to mitigate damage caused by ground squirrels is rodenticide application. First-generation anticoagulants, such as diphacinone, are the most commonly used rodenticide for California ground squirrels and are applied in one of three methods: 1) spot treatments, 2) broadcast applications, and 3) bait stations. Spot treatments involve spreading bait very thinly by hand around a burrow entrance. Spot treatments tend to be time consuming, so they are generally only used to treat a small number of burrow systems. Broadcast applications require the use of a calibrated seed spreader. This allows easier application of bait to much larger areas. Bait stations house bait within a centralized location. They are used to exclude non-target access to bait by animals larger than the entrance of the bait station. Bait stations are generally believed to have the lowest risk of primary non-target exposure (i.e., potential of rodenticide exposure from direct feeding on toxicant) given this exclusionary advantage, but they have been postulated to lead to higher secondary exposure risk (i.e., potential of exposure to predators or scavengers from feeding on intoxicated animals) if repeated feedings at bait stations result in higher residual concentrations in dead and dying ground squirrels. Other factors can influence secondary exposure risk as well, including the amount of bait applied, the time from bait application until death, and the proportion of carcasses that are exposed aboveground. Anticoagulant rodenticides have come under intense scrutiny over the last several decades, given the potential for secondary exposure concerns associated with their use. Therefore, we established a study in rangelands in central California using radiotransmittered individuals to address how bait application strategy (i.e., spot treatment, broadcast application, and bait station) influences diphacinone (0.005% concentration for spot treatments and bait stations, primarily 0.01% for broadcast applications, although 0.005% was used in one application period; see Baldwin et al. 2020 for additional details) secondary exposure risk in California ground squirrels. Specifically, we addressed: 1) differences in amount of bait applied across application strategies, 2) differences in residual concentrations of diphacinone across application strategies, 3) potential variability in time from application until death across application strategies, and 4) proportion of ground squirrels that died belowground.

Bait stations resulted in the greatest amount of bait applied ($\bar{x}$ = 18.6 kg ha^{-1}), followed by spot treatments ($\bar{x}$ = 3.2 kg ha^{-1}), and broadcast applications ($\bar{x}$ = 1.0 kg ha^{-1}). We believe much of the bait that was removed from bait stations was cached, but this was not documented, nor was the potential impact of this caching behavior on non-target species known. This could be an area of additional research in the future. Average time from bait application until death did not vary across application strategies ($\bar{x}$ = 9.1 days), suggesting that application strategy has little effect on this potential exposure risk. The vast majority of ground squirrels died belowground (82-91%), substantially reducing scavenging concerns. Likewise, most carcasses were severely decayed within three days post-mortality, further reducing scavenging risk. We detected no difference in residual concentrations of diphacinone across the three application strategies ($\bar{x}$ = 1,399 ppb), although our results from broadcast applications may have been confounded by our primary use of a higher-concentration diphacinone bait. Our use of this higher-concentration bait was in accordance with the label at the time of this study, but it is possible that the use of a lower concentration bait could yield similar efficacy as compared to the higher concentration product while yielding lower residual diphacinone concentrations. This is another area of potential exploration. We did observe substantially lower residual concentrations of diphacinone in ground squirrels that survived the bait application period ($\bar{x}$ = 112 ppb), suggesting that the greatest risk of secondary exposure lies with scavengers and predators that consume squirrels that would have died from lethal exposure. Collectively, this study helps fill in knowledge gaps into the effect of application strategy on secondary exposure risks. Following proper application protocols, combined with daily carcass searches, should substantially reduce secondary exposure concerns associated with first-generation anticoagulants.

KEY WORDS: anticoagulant rodenticide, baiting strategy, California ground squirrel, diphacinone, *Otospermophilus* spp., rangeland, residual concentration, rodent control, time-to-death

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LITERATURE CITED

Baldwin, R. A., R. Meinerz, T. A. Becchetti, and N. Quinn. 2020. An assessment of secondary toxicity risk for 0.005% diphacinone treated grain via three application strategies for California ground squirrels. University of California, Davis. Final Report to California Dept. of Food & Agriculture.