

STUDY TITLE:

Field efficacy trial of cholecalciferol + diphacinone baits for California vole control.

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EXECUTIVE SUMMARY

Chronic-exposure anticoagulants (e.g., chlorophacinone and diphacinone) are commonly used to manage rodent populations in agricultural fields in the U.S. Anticoagulants are generally considered one of the safest rodenticides to use, but they pose some secondary-toxicity risk to predators and scavengers, and resistance can evolve in populations repeatedly exposed to these materials. Combination baits containing cholecalciferol plus an anticoagulant are effective against commensal rodents resistant to anticoagulants. They contain lower levels of cholecalciferol which increases palatability and reduces costs of these baits. Additionally, cholecalciferol plus anticoagulant baits can kill after a single feeding and have quicker times to death than anticoagulants. This quicker knock-down time can reduce damage to

crops, while also reducing secondary toxicity risks. Even with all of these positive attributes, these combination baits have not been proven in field applications for agricultural rodent pests. Therefore, we established a study to test the efficacy of cholecalciferol plus diphacinone (C+D) bract and pellet baits to determine their ability to manage California voles (*Microtus californicus*) in globe artichokes, where resistance of anticoagulants is known to occur. Specific details for our sampling methodology and findings included:

1. We erected three 1/16th acre square enclosures made of 1/4 inch hardware cloth to house voles. We randomly designated each plot to a specific treatment type: bract bait, pellet bait, or control.
2. We captured, radiocollared, and released 58 voles into the enclosures across three sampling periods (November, December, and January). The male to female ratio of voles captured did not differ. We placed approximately equivalent sex ratios of voles into each treatment plot for each sampling period.
3. Unfortunately, a large number of voles ($n = 23$) were censored due to escape events, predation/scavenging, inclement weather, and malfunctioning collars. Of the remaining voles, 13, 15, and 7 were located in the bract, pellet, and control plots, respectively. The numbers in each treatment plot varied across the three sampling periods depending on the number of voles we were able to capture for each period and the number of voles that were not censored due to reasons described previously.
4. We observed no mortality from control plots, indicating that efficacy results are an accurate representation of the true impact of the rodenticide on vole survival. Bract baits were highly efficacious (85%), while efficacy of pellet baits (60%) fell below the 70% threshold the U.S. EPA requires to consider a product efficacious. Low observed efficacy of pellet baits may have resulted from poor weather following application during the second sampling period; further testing may yield more positive results.

5. We observed a bimodal distribution in timing of death, with one group of voles dying between 4.3–5.8 days post consumption ($n = 11$), while the other group died between 9.0– 14.5 days post-consumption ($n = 8$). Deaths in the first group were attributed to cholecalciferol, while deaths in the second group were likely due to chronic anticoagulant exposure. Almost double the proportion of voles that died from bract consumption occurred during the early period (8 out of 11) when compared to their pellet-plot counterparts (3 out of 8). This suggests that voles were consuming greater quantities of bract baits over a shorter period of time when compared to the pellet bait.

Collectively, these findings indicate that baiting with C+D-coated bracts appears to be an effective method for controlling vole populations in artichokes. Registration of this product could be pursued to add an additional tool to current IPM programs for managing voles. This addition would likely reduce the impact of chlorophacinone resistance in the local vole population, dramatically increasing the sustainability of vole management in this important crop.

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