

Title: Using a Spot-Treatment Method to Control Townsend's Ground Squirrels (*Spermophilus townsendii mollis*) in Irrigated Crop Ground

Project Personnel: Mark Nelson (Project Leader). Nicki Frey (Project Co-leader)

Cooperators: Tammy Pearson, Beaver County Commissioner; Mark Whitney, Beaver County Commissioner; Arlan Mayer, Soil Conservation District Chairman; Keith James, grower; Scott Wiseman, grower.

Justification:

Townsend's ground squirrels, subspecies Piute ground squirrel, (*Spermophilus townsendii mollis*) populations on agricultural lands in Beaver County, Utah are increasing. Hundreds of acres of alfalfa ground in western Beaver County are currently infested with the ground squirrel. High populations of ground squirrels can compete with livestock for forage; destroy food crops, golf courses, and lawns; and can be reservoirs for diseases such as plague. Their burrowing activities alter irrigation systems. Burrow mounds not only cover and kill vegetation, but can damage haying machinery.

Since 2009, we've implemented a population control program that consisted of prebaiting and then baiting with Zinc Phosphide (Nelsen et al. 2012). For the first several years this baiting program helped reduce the number of squirrels; however, in the past 3 years the squirrel numbers have significantly increased. In 2015, we tested poisoning at different times of the spring, different bait stations, and trapping to control ground squirrels. None of these methods were effective at decreasing ground squirrel numbers.

Ground squirrels hibernate during the coldest part of the winter. Males usually become active above ground 1 to 2 weeks before the females in the spring, sometimes as early as late February or early March. Breeding occurs immediately after hibernation and the young are born after a 4-to 5-week gestation period. Generally, only one litter of 2 to 10 young is produced each year. Usually, densities of Townsend's ground squirrel populations can range from 2 to 20 or more per acre, although Piute ground squirrels have been previously documented at rates 115-130 per acre. At this density it is difficult for a farmer to obtain a profit from the harvest, due to the amount of damage incurred to the property and crop.

Our current control programs targets the ground squirrels from when they first come out of hibernation, before they start breeding, usually starting in the middle of February and lasts till the alfalfa greens up around the middle of March. This is only a 30-day - or less - window of control. Sometimes, due to snow or cold temperatures, this window of application might only last 2-3 weeks. Unfortunately, it appears our current method is not flexible in order to coincide with the biological activity of ground squirrels each spring.

We would like to study a method of spot-treating, which is directly treating only active burrows. This method has been studied in California on California ground squirrels using

Ditrac Ground Squirrel bait, and resulted in high efficacy of the method. Additionally, we would like to test this method using Rozol Vole Bait, a bait currently labeled to control voles in Utah. Additionally, California, Nevada and Oregon uses cabbage laced with liquid zinc phosphide to control Townsend's ground squirrels. We would also proposed to test this method in Utah as well.

Currently, the commercial label for this bait, Ditrac, is only permitted for controlling California ground squirrels in Utah; this species does not occur in Utah. Rozol Vole Bait is only labeled for use on voles, and zinc phosphide is not labeled for application to cabbage for squirrel control in Utah. If successful on Townsend's ground squirrels, we would also pursue the changing of the administration label for any of these applications to allow for this type of control by farmers with the appropriate license in Utah.

In addition to the proposed study, we will continue to train farmers to effectively use a successful combination of methods such that the community of farmers collaborates to control ground squirrel populations across the landscape. We will increase their knowledge of ground squirrel biology in order to assist them in targeting the correct time of year with the correct control method. A collaborative, systematic control strategy would be more effective at decreasing the population of ground squirrels in the landscape and decrease the overall individual effort needed from each farmer from year to year. Trainings will include fact sheets of effective methods to control ground squirrels, presentation of data at local meetings, and an annual Crop School to share information with local farmers.

Objectives

1. To train Beaver County farmers impacted by ground squirrels about integrated pest management approaches to Townsend Ground Squirrels in irrigated crop ground.
2. To determine the effectiveness of spot treatment of Ditrac Ground Squirrel Bait, Rozol Vole Bait, and liquid Zinc phosphide to control ground squirrels.
3. To determine the effectiveness of using bait stations in May, when juveniles come above ground, to control ground squirrel densities.
4. To pursue the adjustment of the bait label to include Townsend's ground squirrels on the permitted application for Utah.

Procedures

Study Area

Field trials will be conducted in cooperation with local alfalfa producers in Beaver County. Beaver County is considered high desert, part of the Great Basin. Native vegetation communities consist of sagebrush-steppe in the valleys, transitioning into pinyon-juniper along the hillsides. Most farmers conduct irrigated agriculture, for alfalfa and corn, in the valleys of the county. At our Ground Squirrel Control Workshop held the end of January 2016, I will inform the farmers of the research we are planning on

conducting on the ground squirrels and find farmers who would like to take part in the study.

Survey Methods

Field trials will consist of the following treatment types: spot treating ground squirrel burrows with either Ditrac or Rozol; treating cabbage with liquid zinc phosphide and baiting in fallow corners of irrigated agriculture; and traditional bait stations. We will use fields of farmers that are willing to cooperate with our study.

Efficacy of New Applications:

For each compound, we will use a 1 acre field. For zinc phosphide application, we made need several adjacent fields such that the total study area is equal to 1 acre. Additionally, we will have one 1-acre field for control, which will have no pesticides applied; for a total of 4 acres in the study. Each plot will be selected such that there is a minimum of 20 ground squirrels visibly present in the survey area. The perimeter of the plots will be mark with colored flagging. Around each acre will be a 200 ft. buffer, also marked with flagging (of an opposing color). The buffer zone will be included in the pesticide application, but not the surveys for squirrel activity. Each study area (and buffer) will be separated from the next study area by 300 feet. We will survey for squirrel activity using both visual counts and burrow surveys.

Ground Squirrel Surveys: Visual counts will be conducted on days with <50% cloud cover and sustained winds <20 mph, to reduce the influence of weather on monitoring ground squirrel activity. Pre-treatment visual surveys will be conducted on each study plot for a total of 4 days, 4- 8 days prior to the beginning of the baiting. We will attempt to make them 4 consecutive days, and will randomly assign the order in which study plots are surveyed. Post-baiting surveys will begin 15 days after the initial application of bait.

Visual counts will be taken from within a truck, roughly 300 feet from the study plots. Upon arrival to a study plot, the observer will wait 10 minutes before starting the survey, to minimize the effects of human disturbance on squirrel activity. Using binoculars, the observer will begin to count squirrels on one side of the field, excluding the buffer, and slowly panning across the field for approximately 2 minutes. The observer will record the number of ground squirrels counted. The observer will then wait 5 minutes and repeat the process, wait 5 more minutes, and continue to repeat the process for a total of 5 surveys. The average number of squirrels counted per 2-minute scan will be recorded as the official count.

Active burrow indices will be taken pre-and post-treatment. Three days before the beginning of the trials, all burrows will be covered, in each treatment plot and the control plot. Active burrows, indicated by fresh excavated soil, will be flagged. After 48 hours, we will resurvey the plots, checking each flagged burrow. If any have been opened, we considered these active burrows. After the post-treatment visual count surveys have been

completed, we will repeat this process to determine the number of active burrows after the areas have been treated.

Bait Application: Commercial bait: Before the testing period begins, we will calibrate a measuring device (i.e ¼ cup measure) to determine the average application weight of each cup. Thus we will then be able to calculate the weight (amount) of bait applied over each study area by multiplying the number of “cups” used by the average weight of the bait inside the measuring device.

Both pesticides will be applied on the same day or within 24 hours. The control field will be visited in a similar manner to the treated fields, but without any application of poison or placebo bait. We will treat all burrow openings that appeared to be active in the pre-treatment survey conducted the day before, applying the bait to the study area as well as the buffer zones. We will spread bait 40-50 square foot area around the entrance to each burrow. Four days after the initial application, we will repeat the process, to ensure that ground squirrels had access to bait over multiple days within a 6 day period.

Two days before the trials begin, we will pre-bait the zinc phosphide fields. We will follow the process of preparing cabbage for zinc phosphide bait, but will not add the zinc phosphide. Following the label instructions we will pre-bait the study areas that are part of the zinc phosphide test (fallow fields of irrigated agriculture). Within 24 hours of completing the baiting with Ditrac and Rozol, we will bait the fields that are part of the zinc phosphide test. We will apply liquid zinc phosphide according to label instructions to cabbage, and distribute the cabbage in the same manner as during the pre-test period.

Bait Stations in May:

Bait stations will be used to bait squirrels once juveniles have left the burrows, starting in May. We will use 3 different study plots than the ones used in the efficacy trials. The perimeter of each 1-acre plot will be outlined using flagging. Prior to beginning the bait station trial, we will survey ground squirrels using the same methods as described above for the efficacy trials. After 4 days of visual surveys, and surveying active burrows, we will begin the bait trials. Bait stations will be checked every 7 days to ensure that bait is available to ground squirrels. Bait stations will remain active for 15 days. At the end of 15 days, we will conduct post-treatment ground squirrel surveys and burrow surveys, similar to those conducted in the efficacy trials.

Effect of Treatments

For each study, the efficacy trial and the bait station trial, we will use the average number of ground squirrels observed during the visual scans as an index of the population density in each plot for the day counted. We will calculate the average number of squirrels recorded for the pre-treatment and post-treatment count period for each plot. We will also record the number of active burrows per study area in the pre- and post-treatment periods. We will use Kolmogorov-Smirnov nonparametric test to compare the number of ground squirrels recorded in pre- and post-treatment periods. We also will use a one-way

ANOVA and Duncan's multiple range test to compare results from pre- and post-treatment counts. The measure of the success will ultimately be a reduction in the numbers squirrels counted.

Educational Products:

The purpose of the study is to provide information of the best practices to reduce ground squirrel numbers to local farmers. Therefore, our study results will be disseminated directly to local farmers and via open-access forums.

- Peer-reviewed paper presented at professional meetings and published in an open-access peer-reviewed journal.
- A PowerPoint presentation will be put together to use at local and state farmer meetings. This presentation will be posted on the extension.usu.edu/wildlifeconflicts website for future public access.
- Extension Bulletins and Fact Sheets will be written describing the research results.
- The results will be discussed in the county extension newsletters and presented at local and regional farmer meetings including the Pesticide Recertification Classes held in Delta and Richfield.
- USU Extension will video the Ground Squirrel Control Workshop and it will be posted on the web.

Professional Development

- The results of the research will be presented at the National Agricultural Agents Association National meeting.
- The information will also be shared with other USU Extension Agents at the Utah Ag Agent meetings and will be distributed in the proceedings.
- The fact sheet will be peer reviewed and posted to the Extension Website.

Evaluation

We will repeat ground squirrel surveys in the following spring to determine the effectiveness of our methods to reduce ground squirrel numbers on a landscape level.

Project Timeline: All research conducted during the 2016 growing season

January	Beaver County Crop School Discuss the research project with farmers who are having squirrel problems.
February	Identify field sites and create plot borders and buffers. Buy bait stations, bait and prebait.
March	Begin the study of pesticides

April	Complete the study of pesticides
May	Monitor fields for ground squirrels to determine when juveniles become active. Begin bait station trials.
June	Present the results of the pesticide trial at the Utah Extension Agents Summer Meeting; post the presentation on the extension.usu.edu/wildlifeconflicts website
October	Begin pursuing any registration label changes as per the results of our study. Present the results of the pesticide trial at the Western Region Ag. Agents Annual Meeting
November	Present the results of the trial at the Regional Pesticide Recertification workshops
June - December	Create the Bulletins and Fact Sheets Create the peer-reviewed publication and submit

Budget

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Wages	Unit price	Units	Total
Technician Salary	\$120 day	40 days	\$4,800.00
Technician Benefits		@ 8.3%	\$398.40
Travel			
Technician to Field Site	\$48 trip	40 trips	\$1920.00
PI to Field Site	\$40 trip	20 trips	\$800.00
Co-PI to Field Site to Prep Site	\$48/trip	5 trips	\$240.00
Supplies			
Bait and Bait Station	\$35.34	20	\$1591.60

Publication Fees	\$250.00
Total	\$10,000.00

Wages: We are requesting \$5198 in funds to support a technician to collect data. One undergraduate technician will be hired at a rate of \$12/hour. This person will work 10-hour days, including travel. Over the course of the pesticide trial and the bait station trial, the technician will work 40 days. .

Travel: We are requesting \$2960 in travel funds. The technician will be hired via Dr. Nicki Frey, through Southern Utah University. Traveling out of Cedar City, an estimated round-trip cost is \$48 per trip, for 40 trips. Mr. Nelsen will travel within Beaver County to obtain volunteers for the study, attend collaborator meetings and assess field conditions.

Supplies: We are requesting \$1591.60 in funds for supplies to buy the pesticides, pre-bait, bait, and bait stations. Additionally, we are requesting \$250 to support publications fees for publishing in an open access professional journal.