Ground Squirrel Control Training and Certification using an Interactive Computer Kiosk System

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ABSTRACT: This study was undertaken to demonstrate and assess the efficacy of a new outreach education tool, an interactive touch-screen computer (kiosk) for ground squirrel control education. The target audience for the concept is the California agricultural industry and urban members of the public who are dealing with ground squirrel problems. Users of the computer kiosk are able to access various learning tools: a learning library, a quiz, video learning, an interactive decision-making tool, and they are able to print information and certificates. The computer kiosks are available at select California County Agricultural Commissioner offices. They are networked (computer linked) so that the education content is capable of being added to or amended from remote locations. In addition, the kiosks seamlessly gather statistical data and also collect voluntary information from users (i.e. email addresses and comments). The success of the computer kiosks demonstrated their potential for use in statewide continuing education and pesticide applicator certification efforts related to vertebrate pest control.

KEY WORDS: anticoagulants, California ground squirrel, computer, education, interactive decision making, rodent control, training

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INTRODUCTION

The California ground squirrel (*Spermophilus beecheyi*) is a serious agricultural and rangeland pest in California, causing damage estimated at $30 to $50 million annually (Marsh 1998, Gilson and Salmon 1990). The species competes with livestock for forage, degrades rangeland, and damages field and row crops. Ground squirrels feed on a variety of orchard crops including almonds, pistachios, walnuts, apples, apricots, peaches, prunes, and oranges (Clark 1994). Vegetable and field crops such as alfalfa, tomatoes, sugar beets, beans, and peas are taken at the seedling stage. Grains and other seed crops are also heavily damaged. Squirrels consume in the field or cache food for later use (Salmon et al. 2006). Their burrow systems can create structural problems and may weaken levees and dams (Grinnell and Dixon 1918, Marsh 1985), contribute toward erosion, and create hazards to livestock (Marsh 1998). Furthermore, the California ground squirrel is a known vector of several human diseases including bubonic plague (Clark 1994, Salmon et al. 2006).

Current vertebrate pest management methods in California use an IPM (Integrated Pest Management) approach to deal with these important and sometimes devastating pests. An essential part of these IPM programs is the use of rodenticide baits such as anticoagulants (chlorophacinone, diphacinone) and zinc phosphide. Each of these rodenticides is registered for agricultural uses in California, and almost 1 million pounds of finished baits are used each year in the state (Clark 1994, Salmon et al. 2000, Timm et. al. 2004).

The U.S. Environmental Protection Agency (EPA) recently issued a proposed risk mitigation decision for rodenticide bait products containing the following 9 active ingredients: brodifacoum, bromadiolone, difethialone, chlorophacinone, diphacinone, warfarin, zinc phosphide, bromethalin, and cholecalciferol (US EPA 2008). This decision was based on EPA's evaluation of the ecological risks associated with the use of rodenticide bait products containing these 9 active ingredients. The EPA decision is proposing labeling changes to mitigate the risks associated with bait products containing any of the 9 rodenticides. The proposed changes would classify diphacinone and chlorophacinone for agricultural uses as Restricted Use Pesticides, limiting the use of these common ground squirrel baits only to those who are Certified Pesticide Applicators. EPA's hope is that certified applicators will have sufficient training to know when and how to use these products in order to limit risks. Unfortunately, the current certification processes do not necessarily ensure the certificate holder has an adequate knowledge about specific anticoagulant uses in agricultural areas.

Proper use of rodenticides is especially important since the active ingredients can pose risks to non-target wildlife, pets, and children when applied as bait products. The risks are from primary exposure (direct consumption of rodenticide bait) for all compounds, and secondary exposure (consumption of poisoned rodents by predators or scavengers) mostly associated with anticoagulants (Salmon 2007).

The aim of this project is to create new outreach education materials using stand-alone multimedia touch-screen computers to help bait applicators better understand the practical use and application of rodenticides, particularly anticoagulants, for California ground squirrel control. If successful, this system could serve as a key tool in the pesticide applicator certification process, especially for anticoagulant rodenticides.

Our main objective was to test the interactive touch-screen computers at California County Agricultural Commissioner offices that sell rodent bait. The kiosk was designed so that each individual unit serves as a complete interactive education and outreach program, dealing with all aspects of California ground squirrel pest control.

DEVELOPING THE COMPUTER KIOSK SYSTEM

Our overall goal was to develop a comprehensive content management program that would provide users with the ability to self educate and self test using an interactive touch-screen computer. The key feature of this approach would be its innovativeness, flexibility, and ability to respond rapidly to changing rules, regulations, laws, or accepted pest management practices.

Each kiosk unit contained identical content developed from existing squirrel control resources, Vertebrate Pest Control Research Advisory Committee (VPCRAC)-funded research projects, and expertise of ground squirrel control specialists. The kiosk platform (computers and software) and technical support were provided by a San Diego software development company. The computer unit is both innovative and dynamic, because it is interactive and engages people to use the computer through the process of accessing information by 'touching' the computer screen. The kiosk contains 4 main components: a learning library of information relating to the California ground squirrels, a self test, videos, and an interactive portion that provides information on appropriateness of control methods based on information the user provides. Once the screen is touched, the system starts and the main menu is displayed (Figure 1). Each of the component areas is accessed through the main page. A voluntary survey to measure satisfaction with the kiosk and its content was also part of each system.

Figure 1. Main page of the California ground squirrel computer kiosk, September, 2008.

Learning Library Module

The *Learning Library Module* was developed using existing vertebrate pest management information relating to California ground squirrels. Research work and published literature were reviewed to ensure the most current information was available. The information was then compiled in a structured format with particular attention paid to the clarity, conciseness, and information content. Approximately 150 individual 'detail pages' (screens with specific information) were created; these provided information on California ground squirrel identification, behavior, biology, pest management control methods (agricultural and urban), best management practices, and safety concerns including for wildlife, pets, and children. Each detail page contained digital images to accompany the text, and some were linked to appropriate video modules (see Figure 2).

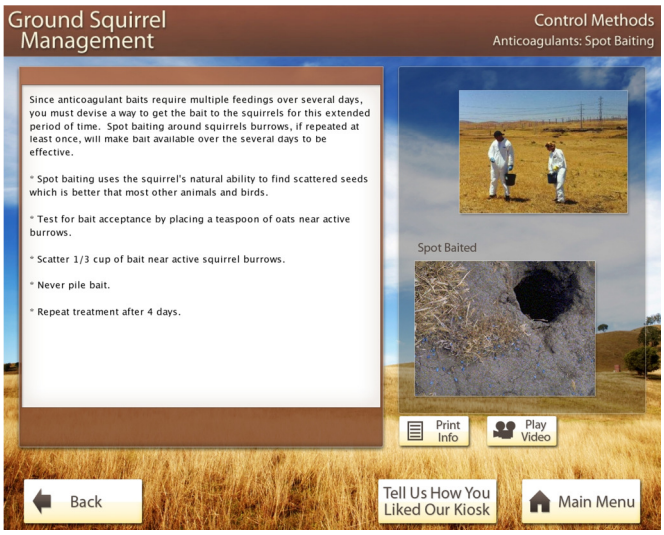


Figure 2. Example of a detail page with video buttons in the California ground squirrel kiosk, September 2008.

Video Module

Short instructional videos were developed to provide information and instruction on a variety of topics including pest control methods, ground squirrel biology, and ground squirrel behavior. We created 20- to 60-second videos in order to maximize user attentiveness. Each *Video Module* can be accessed through the main video button and then by touching the screen where the specific image is located (see Figure 2). The video then automatically starts. Videos are also accessed through the individual detail pages related to the video topic (see Figure 2). Additional video modules can be added to the kiosk as they are developed, and the association of videos to specific detail pages can be moved, altered, or duplicated as desired.

Testing Module

One important aspect of the kiosk that could prove extremely helpful in dealing with the training requirements for Restricted Use Pesticides is the testing module. Entering this module takes the user to a series of on-screen test questions. The *Testing Module* during our trial consisted of 25 random questions, taken from a bank of 108 questions relating to California ground squirrels and their control. The test questions were taken from information in the learning library detail pages. This means that for each question there is a corresponding detail page. If the user selects the incorrect answer, they will automatically be shown the detail page that provides information to explain the question and appropriate answer. Then the test taker is returned to the question for a second try. The test will only advance if the user selects the correct answer. Thus, we educate through reinforced learning. Flexibility was built into the module to allow us

to alter the test by changing the number of questions asked (1 to 99) and the subject areas stressed. We added a feature to allow a specific emphasis or type of question to be asked, even though the questions themselves are selected randomly. To do this, we subdivided the question bank into 5 sub-areas. Specific questions are put into each sub-area and the test is directed to select a certain number of questions from each sub-area. For example, if we needed to ask 5 questions on safe pesticide storage, we could designate one of the sub-areas as pesticide storage, put all the questions on pesticide storage there, and structure the test to ask 5 questions from that sub-area. The questions on individual tests would be random, but the required subject emphasis would be achieved on each test.

The test module also collects personal information and provides a printed certificate of completion. The certificate demonstrates that the kiosk user has a basic understanding of ground squirrels and their control. Since the test can be altered in length and subject matter, it can easily be tailored to meet specific educational or certification objectives.

Interactive Module

Often, people wanting to deal with ground squirrel problems do not know the control options or which methods and materials are appropriate for them or their specific situation. We wanted to create a tool that would help users make these important decisions. In the *Interactive Module*, the user is asked a series of questions and, based on their answers, is provided a listing of the appropriate ground squirrel control methods including an assessment of the likelihood of their success. This interactive tool asks 9 key questions that help determine appropriate control methods for the specific situation in question. The responses are weighted according to the time of year, location within the state, and the desires/situation of the user. As each user answers the questions, a display of the most appropriate control methods is continuously updated by the computers algorithmic software. The result is a ranked listing of the control methods most appropriate for the user's specific situation and location. The material is presented in written and graphic form and can be printed out for later use.

Survey Module

The kiosk includes a *Survey Module* that asks 7 general questions appropriate for all users. Most of the questions have direct numerical answers but several allow input via a keyboard on the touch screen. Users are invited to provide their email address for follow-up contact, and any other comments they wish to make. In the current kiosk configuration, completing the survey is completely voluntary.

Data Collection

Integrated with the kiosk are data collection processes that allow us to collect all aspects of the kiosk use. These include data on time of use, length of each use, zip code of each use, number of completed self-tests, actual pages accessed, questions answered incorrectly, etc. The data are periodically sent via the internet to a central computer (server) in San Diego Cooperative Extension office, or collected with a standard USB memory device.

KEY FEATURES OF THE KIOSK

Stand-Alone Portable Learning Unit

The interactive computer kiosk is a stand-alone learning unit. Each unit is about the size of a computer screen and can easily be transported to different locations in a protective hard case. The kiosk is very versatile in serving educational needs. In addition to being placed in County Agricultural Commissioner offices, it can be used at presentations, conferences, county fairs, meetings, and other educational events. While direct connection to the internet facilitates updates and data downloads, the unit can operate independently with only 110/120-volt electrical service. The durability of the unit and lack of moving parts make it appropriate for use in unsupervised areas.

Accessible and Changeable

The kiosk can be networked to the internet and accessed at any time through the server in San Diego. This allows for immediate amendments, additions, corrections, and updates to the content portion of the kiosk, library, and test. For example, should the law change relating to rodenticides, the related text within the kiosk can be updated immediately. Another advantage of networking is that all statistical data gathered by the kiosks can be accessed and viewed through the server at any time. Internet connection is extremely important as the number of kiosks increases, since management of individual units can become quite time consuming.

Feedback

The data generated from the kiosk users is the kind of feedback necessary to identify the current understanding of important vertebrate pest issues, how well our educational effort addresses them, and what areas need additional educational and outreach effort.

FIELD TRIAL, JUNE - SEPTEMBER 2008

Once the kiosks were developed, they were deployed at Agricultural Commissioner offices in San Diego, Salinas, Fresno, and Livermore, California. Each was placed adjacent to the rodent bait sales area of the office. The kiosks required no maintenance throughout the test period other than switching on and off and adding paper to the printer. Individual on-site training was provided on the use and features of the kiosk for the office staff. The kiosks were left *in situ* from June through September 2008. This period is a key time for ground squirrel bait sales.

Midway through the test (July 2008), we instituted a 'bait incentive' program to increase use and completion of the kiosk self test. If completed, the test taker received a small discount on their bait purchase by presenting the certificate of completion to the bait sales staff. At the same time, we also updated the kiosks with additional videos, images, and some editorial changes by mailing staff at each site a USB memory device. Once the update was completed, the staff mailed the USB device containing the usage data back to San Diego. Another update

and data collection was done at the end of our trial (September 12, 2008) using the same method. We also direct linked the San Diego kiosk to the internet to demonstrate that capability. In addition to the data generated at the kiosk, key individuals involved with the kiosk project were interviewed at the conclusion of the test period.

RESULTS

Kiosk Use

The kiosks were used in all offices by staff, growers, pest control advisors, and the general public. Users could spend as much or little time as desired at the kiosk. When evaluating the usage data, we discarded any session length less than 16 seconds, as we considered this insufficient time to provide a meaningful educational experience. Since the kiosks shut down after 2 minutes of idle time, those sessions were also discarded. A total of 231 sessions occurred between June - September 2008 with an average duration of 6.07 minutes (maximum 48.03 minutes) (Table 1). Ninety-one self tests were initiated and 39 were completed during the trial period (Table 2). The San Diego site completed the most self tests (25), which we attribute to enthusiastic staff and the bait discount program.

Table 1. Sessions at the kiosks in 4 Agricultural Commissioner Offices, June through September 2008.

Kiosk Name	Min Duration	Avg Duration	Max Duration	Count
Alameda	0:00:17	0:07:21	0:17:21	46
Fresno	0:00:16	0:05:12	0:48:03	52
Monterey	0:00:24	0:04:17	0:13:19	60
San Diego	0:00:18	0:07:28	0:27:12	73
All Kiosks	***0:00:16***	***0:06:07***	***0:48:03***	***231***

Table 2. Number of kiosk self tests completed between June 12 and September 12, 2008.

Kiosk	Tests Completed	Test Started - Incomplete
Alameda	10	25
Fresno	3	16
Monterey	0	19
San Diego	25	31
Total	***38***	***91***

All answers to the test questions were recorded, so we have data on which ones are answered correctly. Table 3 provides examples of questions and the corresponding number of right and wrong answers. The data allow us to better understand general perceptions and ideas about ground squirrels and their control. From this information, we can add, alter, or amend test questions, detail pages, or other aspects of the kiosk information to clarify, correct, or alter information as appropriate. For example, it is clear from the data that the question "Fumigation works well when ground squirrels are hibernating?" is answered correctly only about 40% of the time. Obviously, either the kiosk information needs clarification, or a new and more focused effort should be included on this topic. This type of information will allow us to tailor a test and/or education program to achieve maximum efficacy, and to target specific information that rodenticide users need to know in order to better control squirrels in an efficient and environmentally appropriate way.

Each time a user accesses a detail page within the kiosk (touches the screen), this information is electronically recorded, giving us information on what interests users (Table 4). The data allow us to focus on areas of ground squirrel education that are either successfully addressed or require further education. For example, it is clear the most popular detail page with users was: "Why it's a Pest". There were very few accesses to "Control gas cartridges: How to use them". If the low-accessed pages are important and in our opinion should be accessed more frequently, we can alter the kiosk to either make them more prominent or even a required page. The information on detail page use and self-test results can be very useful in improving the kiosk to target specific educational objectives. This information can also guide development of other education and outreach programs related to vertebrate pest control.

User Survey

Users of the computer kiosk were asked to complete a survey about their experience with the unit. The survey consisted of 7 questions presented sequentially to the user. Most people who responded to the survey found the

Table 3. Sample self test questions answered correctly and incorrectly, all kiosks combined, June 12 - Sept. 12, 2008.

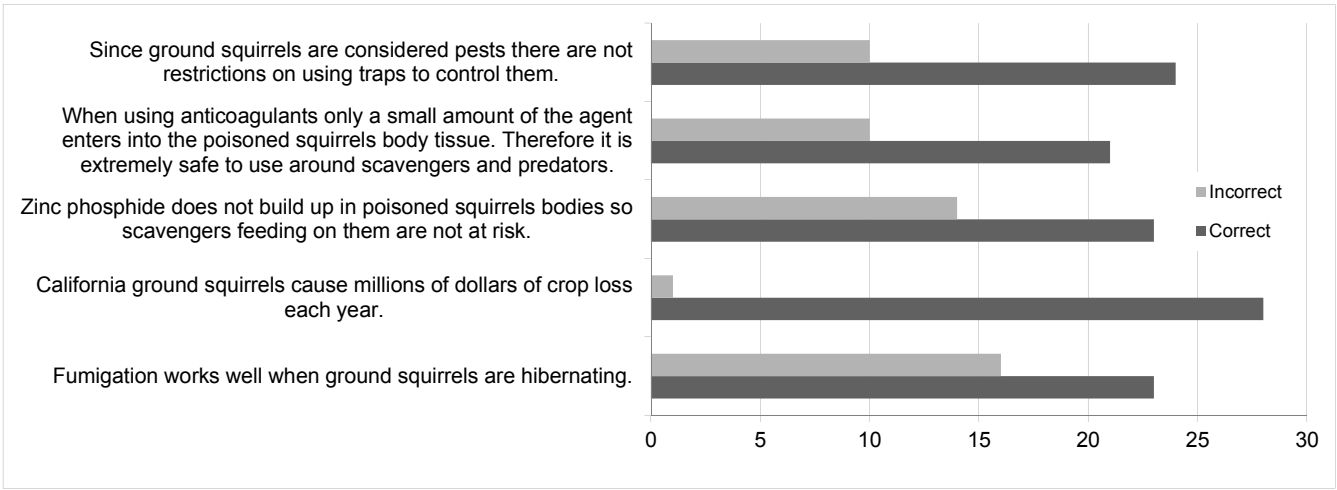
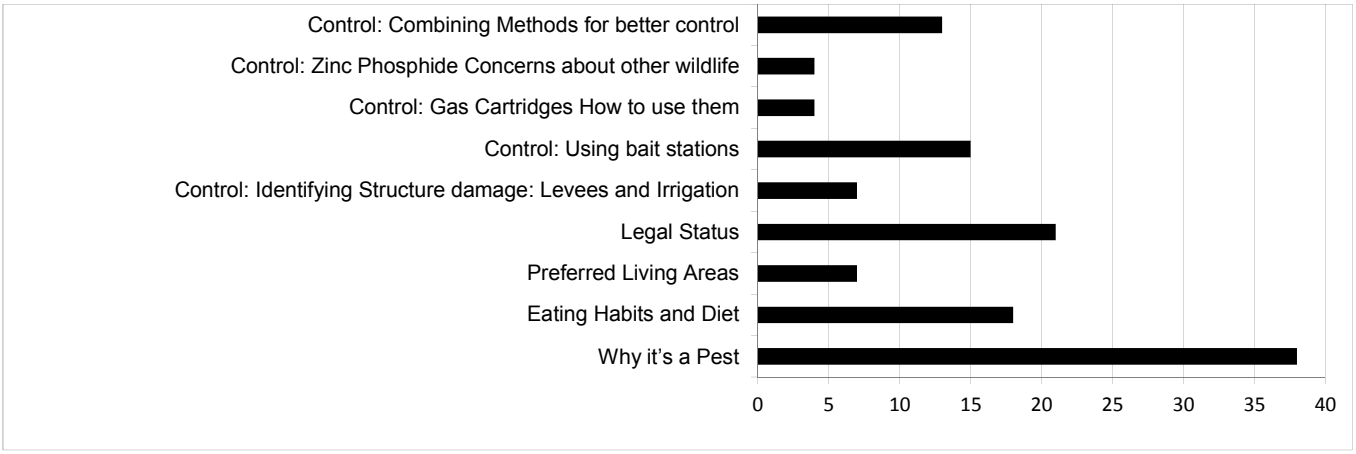


Table 4. Sample showing data on some of the detail pages accessed in all kiosks between June 12 - Sept. 12, 2008.



kiosk useful, with an average score of 3.4 on a 1-to-5 scale with 5 being the highest. The majority of users were seeking information about ground squirrel problems around homes and private gardens. Users were generally satisfied with the amount of information available from the computer kiosk, with an average score of 3.2 on the 1-to-5 scale. Eleven of 24 survey respondents reported that they planned to use the information they gained to control ground squirrels or for general reference about ground squirrels. Almost as many, however, were seeking the information for general knowledge and were not likely to use it to control squirrels. Users who responded to the survey reported they enjoyed using the kiosk with an average score of 3.7 on the 1-to-5 scale. Sixty percent of the users completing the kiosk survey were homeowners. Unfortunately, the number of computer kiosk users who responded to the voluntary survey was low (n = 44) compared to the total number of kiosk sessions recorded (n = 231).

In addition to the survey questions, computer kiosk users were provided the opportunity to make comments via a touch-screen keyboard. Of the comments received, several indicated they were searching for information on ground squirrel control around the home and for information regarding children and ground squirrel control. The ability to continue to collect statistical data is exciting, and we look forward to future results.

Kiosk Staff Interviews

At the end of the test period, key individuals at each site involved in the computer kiosk deployment were surveyed. All responses about the usefulness of the computer kiosk were very positive. One location stated that another county's officers had seen the computer kiosk and wanted to know where one could be obtained for their own use. In response to how the computer kiosk was received by members of the public (users), responses were excellent. Some commentary, however, suggested a language barrier might exist that could be mitigated by introducing multiple language versions (i.e., Spanish).

Respondents were also asked if they had received specific feedback regarding the computer kiosks. They shared that people liked the kiosk, particularly the videos, as they allowed for real time education and "they can see it". Several locations volunteered that the kiosk would be a great resource for education and outreach for other vertebrate pests such as gophers, meadow voles, deer mice, rats, and moles.

CONCLUSION

We conclude as an outreach education tool, the computer kiosk is very useful and versatile. The interactive element of the computer kiosk means it can be incorporated in structured learning programs, such as lectures by vertebrate pest specialists or others traveling throughout the state.

The computer kiosk provides for different modes of learning: written detail pages, video instruction, testing module, and interactive option selection. We believe the computer kiosks are an efficient use of resources, in comparison to hosting a seminar at a fixed time and place. The computer kiosk allows for someone to use the computer kiosk at any time, and it can be re-located to specific sites as needed.

The computer kiosk engages users through its innovative use of touch-screen computer technology, making users want to use the computer. Questions can be answered in real time and the unit can be a supplemental instructional aid. For example, during the test trial, one of the authors was challenged over the correct use of broadcast baiting for ground squirrel control. By touching several screens on the kiosk, he was able to guide and educate the user to the appropriate 'detail information page' and then to the instructional video presentation on broadcast baiting.

We envisage the computer kiosk has great potential in the licensing arena of pesticide regulation, and for continuing education programs. We anticipate that the computer kiosks might be used as part of a continuing education or certification program in the pesticide licensing arena in California. The certificated testing module of the computer kiosk is key to this. Currently, with minimal content modification the kiosks could in their present format easily be incorporated in a process of certificated testing.

In addition to testing applications, we believe the computer kiosks could be used for many other vertebrate pest mammalian and avian species, as was suggested by

staff at sites where the kiosks were deployed. We envision similar programs for other vertebrate pests such as gophers, rabbits, rat, mice, and voles. Combining a computer kiosk with vertebrate pest education programs on multiple pests is also a possibility. Thus, users could select their pest and receive information, education, and testing on that species.

Our future plans include continued deployment and monitoring at the 4 Agricultural Commissioner offices. Already our host locations have enquired as to whether the computers may be used in alternative education arena (i.e., meetings of specific agriculture grower groups).

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