Some International Approaches to Rat Control

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Some International Approaches to Rat Control
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ABSTRACT: There are many basic requirements concerning the political structure, financial support needed, proper organization, staff training, public education, laws and regulations, and the keeping of good records, which must be adequately considered before a rat control program can become successful. Likewise, there are also a number of basic principles concerning rodent control that must be understood and adhered to. Some villages in Korea and the country of Kuwait will be used as examples of new rat control approaches.

INTRODUCTION

Most of my comments are applicable throughout the world. The principal difference in controlling rodents in temperate climates and the tropics is the long growing season in the tropics where agricultural crops are such that essentially a year-round smorgasbord of varying food is available in fields and small gardens.

All vertebrate pest control operations, including rodent control, must be based on practical needs, an intelligent appraisal of the related biopolitical factors, the establishment of good lines of communication between all affected government and nongovernment parties, thorough planning, adequate inspection and enforcement of regulations, and sound ecology. To control rats and other rodent pests is not all that complicated biologically. Effective tools are available, and it usually is not difficult to determine which method is the least expensive, safest, simplest to apply, and most effective, if proper steps are followed. The difficulty lies in the political-economic problems. These are usually the reason an effective rodent control program has not been developed. As with mosquitoes, it is not possible for individual farmers or homeowners to independently control rats and other rodent pests, for these animals do not recognize property boundaries. Also, as with mosquitoes, most rodent populations cannot be controlled effectively if poisoned only once a year in an annual campaign; their reproductive potential is too great. In addition, it is important to recognize that rodent problems have much in common whether they are associated with agricultural crops, food storage, villages, cities, ports, or public health, and to be successful control programs must give attention to all these situations.

Before a rodent control program can be considered effective, certain basic requirements must be met. The program must be simple to operate, inexpensive, safe to humans and nontarget species, effective under adverse weather conditions, adaptable to a variety of environmental situations, be designed so that inspectors can readily check to see that the recommendations are being followed, if some persons do not wish to carry out their duties, and the methods employed must not require too frequent attention by either the homeowner, farmer, or inspector.

The obstacles to effective rodent control are mainly in various human relationships; it is not because biological information is inadequate. The
difficulty usually lies in not having the government structure organized properly for consideration of all the economic, social, and political aspects of rodent control. Only with a proper government organization and interest can an effective program be implemented that will keep a country or city nearly rodent-free, and do so in a manner that is inexpensive, safe, and simple to apply. Unfortunately, many citizens often lose interest in control programs once rodents are reduced to a low level and crop or other damage is largely stopped; and, of course, this is the time when additional control is most effective and the least amount of toxic bait is required.

One of the major problems commonly confronted in controlling rodents in agriculture and cities is who is responsible for controlling these pests along rivers, railways, roads, low-value unused land, or other private or government-owned parcels where they may not be any direct economic or health concern.

It is very seldom that urban rodent problems can be independently resolved by homeowners and other property owners. Government assistance and direction is usually essential to achieve permanent reduction of rodent pests. Many of the more favorable habitats such as sewers, city drains, and refuse disposal sites are not privately owned, hence require government action. The potential health problems from rodents are usually greater in the urban environment than with the agricultural community because of the concentration of people. Rodent control is largely a people problem, and to be effective it first requires the resolution of many economic, political and social problems, which often are more complicated in cities than in agricultural areas.

Rodent control has suffered badly in the United States because of its incorrect political structure. At the federal level in the United States, animal damage control is administered by an assistant secretary in the Department of Interior, who is also in charge of National Parks, whereas all other forms of crop protection are in the Department of Agriculture. Also, too many city, county and state health departments are not active concerning rodent control in their cities, as their responsibilities are not adequately spelled out.

SOME PRINCIPLES OF RODENT CONTROL

Prevent Damage Rather Than Try to Stop It

One of the most important rodent control principles to recognize is that it is much more effective, also safer and cheaper, to prevent an urban or agricultural rodent problem from ever occurring than trying to stop damage after it has started. Control methods do not recover damage losses, and once rodents have started feeding on a crop, bait acceptance is usually very poor.

Rodents Require Both Food and Cover

Another significant rodent control principle too often not adequately considered is that no matter how much food is available, rodents cannot survive unless they have adequate cover and, with most rat species, also water. At garbage transfer sites and in feed mills, etc., high rodent populations will be found only if there are numerous cracks in the floors or foundations, or other favorable shelter and if breeding places are close by.
Coordinate All Adjacent Control Programs

When rodent control is needed in sugar cane, rice, or other crops, the control program should include all the surrounding area as well. These buffer strips should be at least 0.6 mile (1 km) wide, or not less than 0.3 mile (0.5 km). This requires careful organization of the control program, because inevitably such a plan will involve many properties, houses, even villages, and numerous nonagricultural situations such as roads, rivers, rock outcrops, clumps of trees, etc.

At the season when a field is inhospitable to rodents due to soil cultivation, it is important to locate the adjacent sites where potential invading rodents may still be able to survive. Such places serve as the reservoir where the new invaders will come from once the new crop matures enough to provide both food and cover. To carry out an effective area-wide control program, therefore, it is essential to develop close cooperation amongst all the landowners involved, acid to establish permanent bait stations supervised by government officials.

If socioeconomic-political factors make area-wide control impossible, it is still possible to design a workable program, but it may require a greater variety of control methods to intercept invading rodents, hence be more expensive.

Requirements of an Effect Effective Control Program

There is no one best way to control rodents. Some important considerations a, - .,.

1. Proper political support: have the necessary regulations, adequate funding, and availability of equipment and supplies.

2. Adequate publicity and thorough training of personnel.


4. Do preliminary field tests, then conduct public demonstrations.

5. Coordinate an integrated pest management program over a wide area and strive for permanent., relatively rodent-free situations.

6. Establish effective inspection and enforcement methods so no rodent population is allowed to flourish.

7. Continuously monitor the program and investigate thoroughly any problems that develop.

8. Do back-up research and constantly strive to improve efficacy of program.

SOME INTERNATIONAL EXAMPLES

South Lore-8-n Villages

An effective rodent control model was developed for controlling rodents in South Korean villages, but not in the larger cities (Howard, W. E., J. S. Park, W.
The key to the Korean model involves several points. The authority existed, fortunately, to require all residents to participate by keeping at least 1 bait station (box) active at all times. "Active" means it contained 0.2 ounce (5 g) of clean rice to indicate that no rodents were present, or had fresh toxic bait.

To inaugurate the control program, it was very important to have the residents of each house follow specific instructions. They were issued a bait station and several numbered packages of bait.

Step 1 consisted of putting 0.2 ounce (5 g) of clean rice from package 1 in the bait station. Not until it was eaten by a rodent were they to add package 2. This meant that before a toxic bait was used, the rats were prebaited. But, more importantly, it meant no toxic bait was used until the bait station was properly located so it was known to be visited by rodents and not disturbed by pets or children. Homeowners should always be instructed to first put nontoxic bait in all bait stations.

Another value of using nontoxic bait first is to insure that the homeowners do not get discouraged and lose confidence in the bait. This would happen if the toxic bait was used at the beginning, and if the bait station was set in the wrong place so as not to be visited by rodents. The bait would then be incorrectly blamed as not being any good.

We also found that it was much better to use only 0.9 ounce (25 g) packages of anticoagulant baits, as long as additional bait was readily available from the village leader. If large amounts of bait were used, the residents would not be aware of rodents feeding on the bait until after a large amount was consumed, hence they could become discouraged. Whereas, with only 0.9 ounce (25 g), any feeding was easy to detect, and this encouraged the homeowners.

Kuwait

Kuwait has been outstandingly successful in practically eliminating a high infestation of Norway rats (*Rattus norvegicus*), although some problems with house mice still exist. Much credit is due Khalid Salem Al-Sanei, the Assistant Undersecretary for Financial Affairs and Head of the Supreme Committee of Rodent Control for his strong determination and leadership. However, his great success would not have been possible without the strong support provided by both the Minister and Under Secretary of Public Health. Their control program was initiated in 1979, following an outbreak of plague. The success of the rat control program was due to the excellent organization and strong political support, although they used conventional control procedures.

Since the current control program against Norway rats has been so successful, and the same is expected to occur with house mice, homeowners and others may not wish to be bothered by members of the Rodent Control Unit if the emphasis is only on control of rodents instead of eradication. Therefore, I strongly recommended that plans be made for changing the objective from control to one of rodent eradication in the not too distant future.
Better rodent detection might be accomplished by developing nontoxic and long-lasting baits, such as pure paraffin blocks (or with some grain, sugar, or vegetable oil added). The durable paraffin-based baits can be placed either in bait boxes, separately, or hung by wires into sewers and storm drains. Hopefully, they will remain acceptable to rodents for 1 year or longer.

To make this system work, the Kuwait Rodent Control Unit will need to provide the public and custodians in many buildings with inexpensive rodent detection baits and/or nontoxic tracking powder and tunnels. When a report is received that a rodent has been detected, the complaint team is to respond and verify by the size of tracks and/or tooth marks whether it is a mouse-sized or rat-sized rodent. Then the needed control measures are to be carried out.

An important function of the paraffin bait detectors and tracking-patch tunnels is that they will also serve as prebait. After rodents have passed through a tunnel, or fed on a bait, the chance is then increased that the animals will return, thus making the later substitution of toxic bait or tracking powder (with DDT, if it is mice) more effective.

At this stage of planning, it seems desirable for the Kuwait Government to have the Rodent Control Unit install bait detectors inside and/or outside all buildings that have a history of a rodent infestation. They should then insist that the property occupant or their custodian periodically check the rodent detectors. It seems likely that homeowners and others will at least cooperate and check the detectors whenever they become suspicious that a mouse or rat is present. The Rodent Control Unit can make periodic annual random inspections of buildings to make sure that detectors are being used and/or to provide fresh nontoxic bait and nontoxic tracking powder as needed, but at the same time putting out toxic bait if the situation makes this possible.

There are marked psychological, political, and economic advantages of changing to a rodent eradication program. When the objective is just "control," interest and support for the program will naturally diminish once there is no longer a rodent program. However, before "eradication" can be achieved, it is clearly obvious that the cooperation of everyone is required to insure that no new infestations occur in Kuwait.
Economic Model of Pocket Gopher Control

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ABSTRACT: A computer model calculates the dollar loss due to the presence of plains pocket gophers (Geomys buCarius majuscillus) in alfalfa fields. Five alternative control methods are then evaluated. Total cost, cost per acre, hours of labor, and economic feasibility are printed for each control method. The model serves not only as an immediate decision aid but also serves to simulate conditions that likely might occur in the future which in turn could influence current decisions on control of pocket gophers.

The purpose of this report is to describe the use of a computer model as an aid in deciding whether to control pocket gophers and what control method to employ. The computer analysis can be run with minimal knowledge of pocket gopher damage or control measures. Basically the analysis compares the dollar loss of alfalfa production, due to the presence of pocket gophers, to the cost of reducing the gopher population. We feel this analysis is important for informing the producer of the magnitude of the economic impact of pocket gophers in addition to establishing an economic threshold for various control strategies.

The intent of this paper is not to report a detailed documentation of the model but to demonstrate its application. Nonetheless there are several caveats and assumptions germane to the model and its use which are as follows:

- no assessment was made of cultural methods such as crop rotation or use of alternative varieties of alfalfa.
- alfalfa loss due to the presence of pocket gophers was estimated for dryland alfalfa and the plains pocket gopher. Losses in other forages or irrigated alfalfa or due to other species or subspecies of pocket gophers may be different.
- we assumed forage yields were restored during the season of control. This is certainly not true, but they may be restored by 60% if control occurs during the spring.
- we assumed control measures would need to be repeated every 3 years.
- costs of mechanical equipment malfunction or failure or slowing of harvesting machinery caused by gopher mounds are not assessed. PROGRAM OPTIONS

The options and format of the model are summarized in a flow chart (Fig. 1). The user must input the number of acres infested by pocket gophers, the value of the alfalfa to the producer (dollars/ton), and the expected yield with pocket gophers.
Fig. 1. Economic model of the impact of plains pocket gophers on yield of alfalfa and pocket gopher population reduction measures.
gophers present (tons/acre for all cuttings). Following this, there are 2 major options: the first requires specific input on methods used in controlling pocket gophers while the second option specifies values for those methods. The latter choice is expected to be chosen by those not familiar with the model or with gopher damage and its control. For the latter choice, the specified values are:

1. **tractor drawn burrow builder**
   - tractor horsepower = 45
   - fuel type = diesel
   - cost of fuel = $1.40/gallon
   - cost of tractor rental = $0.13/horsepower-hour with a minimum of 8 hours use
   - burrow builder rental = $25.00/day

2. **hand methods**
   - spade = $15.00
   - trowel = $5.00
   - hand probe = $10.00
   - automatic gopher probe = $40.00
   - 45 traps at $3.00/trap
   - bait = $0.75/pound
   - labor - $5.00/hour

A table is printed which includes the total cost, cost per acre, hours of labor, and economic feasibility for each method. Recognizing that poison control methods may not result in an 80-90% population reduction and assuming 50% population reduction on the first effort, retreatment is assumed necessary and an additional table is printed. The same categories as above are depicted but now the information is inclusive of both treatments. Since trapping is assumed to require checking and resetting traps, no additional costs are included for retreatment.

If the user chooses the more detailed option at the beginning of the program, then specific inputs are required concerning purchase or rental costs, size of equipment, and so on (Fig. 1). Inputs are required for all 5 control methods so the user indeed has a comparison among the available controls.

**RESULTS OF SAMPLE RUNS**

To demonstrate a typical analysis, the following comparisons are made for an alfalfa field with 3 acres inhabited by pocket gophers, alfalfa valued at $50/ton, and an expected yield of 4.5 tons/acre:

<table>
<thead>
<tr>
<th>Run 1</th>
<th>Run 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Currently own 45 horsepower diesel tractor.</strong></td>
<td><strong>Rent a 45 horsepower diesel tractor.</strong></td>
</tr>
<tr>
<td>Tractor list price ($20,000), used 500 hours/year.</td>
<td>Automatically assumes burrow builder rental, $25/day.</td>
</tr>
<tr>
<td><strong>Own a burrow builder. List price $650.</strong></td>
<td></td>
</tr>
<tr>
<td>METHOD</td>
<td>TOTAL COST</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
</tr>
<tr>
<td>HAND PROBE</td>
<td>$12.39</td>
</tr>
<tr>
<td>AUTOMATIC PROBE</td>
<td>$22.39</td>
</tr>
<tr>
<td>HAND POISONING</td>
<td>$22.65</td>
</tr>
<tr>
<td>TRAPPING</td>
<td>$51.84</td>
</tr>
<tr>
<td>BUSSROW BUILDER</td>
<td>$221.45</td>
</tr>
</tbody>
</table>

Estimated total costs (including a second treatment):

<table>
<thead>
<tr>
<th>METHOD</th>
<th>TOTAL COST</th>
<th>COST PER ACRE</th>
<th>HOURS OF LABOR</th>
<th>ECONOMICALLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAND PROBE</td>
<td>$16.09</td>
<td>$5.36</td>
<td>1.3</td>
<td>YES</td>
</tr>
<tr>
<td>AUTOMATIC PROBE</td>
<td>$26.09</td>
<td>$8.70</td>
<td>1.3</td>
<td>YES</td>
</tr>
<tr>
<td>HAND POISONING</td>
<td>$30.97</td>
<td>$10.32</td>
<td>3.6</td>
<td>YES</td>
</tr>
<tr>
<td>TRAPPING</td>
<td>$51.84</td>
<td>$17.28</td>
<td>6.0</td>
<td>YES</td>
</tr>
<tr>
<td>BUSSROW BUILDER</td>
<td>$226.37</td>
<td>$75.46</td>
<td>0.6</td>
<td>YES</td>
</tr>
</tbody>
</table>

The total cost of damage done by pocket gophers = $236.25

Since the only change in Run 2 is rental of tractor and burrow builder, the analysis for the other control strategies is the same as in Run 1 and are not repeated. All methods are economically feasible even when a second treatment is included. For the above specified conditions, renting a tractor and burrow builder is cheaper than owning them, even when a very small proportion of tractor time is allocated for pocket gopher control. Trapping is the most labor intensive control method.

RUN 2

<table>
<thead>
<tr>
<th>METHOD</th>
<th>TOTAL COST</th>
<th>COST PER ACRE</th>
<th>HOURS OF LABOR</th>
<th>ECONOMICALLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>BURROW BUILDER</td>
<td>$59.22</td>
<td>$19.74</td>
<td>0.3</td>
<td>YES</td>
</tr>
</tbody>
</table>

Estimated total costs (including a second treatment):

| BURROW BUILDER    | $118.44    | $39.48        | 0.6            | YES          |

If the value of alfalfa is reduced to $30/ton, then use of the burrow builder (owning your own tractor and burrow builder) is no longer feasible. However, renting a tractor and burrow builder is still economically justified. The dollar loss of alfalfa is reduced to $141.75. All other methods of control remain economically feasible even when a secondary treatment is included.

In conclusion, this rudimentary model has the potential to serve as a valuable aid in making decisions concerning pocket gopher control. The user may vary values, yield, cost of labor, and so on. As such, the model can be used for making a variety of prognostications. The model is still in the early stages of development. As it is further refined, we intend to deal with some of the assumptions listed above.

Acknowledgements - George Proud did the actual programming. Dale Luce's M.S. study determined the impact of pocket gophers on alfalfa yield. Doug Duey helped with many of the calculations concerning the economic analysis of machinery. Jeanne Andelt typed the manuscript. We thank these people for their contributions.