PN-AAK-184
ISN 14625

MANAGEMENT STRATEGIES FOR RODENT DAMAGE PROBLEMS IN AGRICULTURE

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Key words: Small mammals, management, rodent damage, agriculture

ABSTRACT

Accelerated, worldwide effort should be made to evaluate and adapt existing materials and methodology for controlling problem rodent species which have wide geographic ranges and cause damage to a variety of crops. Simultaneous efforts should be made to define rodent damage problems in economic terms and to assist local investigators and operational personnel in organizing, adapting and evaluating programs to protect crops from rodent damage.

INTRODUCTION

At least 20 species of rodents may be considered important pests of agricultural crops in countries of the tropics and subtropics. Some species, such as *Sigmomys alstoni*, have limited geographic ranges in which they may cause severe crop losses, while others, such as *Rattus rattus*, are widely distributed throughout the world and occupy a variety of habitats—both agricultural and non-agricultural. Some of the important species and areas where they occur as agricultural pests are shown in Figure 1. The taxonomy, biology, and distribution of many of these species and other problem rodents are not well known in many of the areas where the greatest crop losses occur. *Rattus argentiventer* in Southeast Asia, *Bandicota bengalensis* in South Asia, *Arvicanthis niloticus* and *Mastomys natalensis* in Africa, and *Sigmodon hispidus* in Latin America probably represent the species or groups of rodents with the greatest impact on small farms in their respective regions.

	S.E. ASIA				S. ASIA				EAST AFRICA			WEST AFRICA				LATIN AMERICA				
	Philippines	Malaysia	Indonesia	Thailand	Nepal	India	Pakistan	Bangladesh	Kenya	Tanzania	Sudan	Liberia	Nigeria	Senegal	Mali	Honduras	Nicaragua	Colombia	Venezuela	Bolivia
Rattus rattus sp.	X	X																		
Rattus argentiventer	X	X	X	X																
Rattus exulans	X	X	X																	
Rattus losea				X																
Rattus brunneus					X															
Millardia meltada						X	X	X												
Mus sp.				X	X	X	X													
Bandicota indica				X		X														
Bandicota savilei				X																
Bandicota bengalensis				X	X	X	X	X												
Nesokia indica						X														
Taterillus pygargus													X							
Mastomys natalensis									X	X	X	X	X	X	X					
Arvicanthis niloticus									X	X	X	X	X	X	X					
Thryonomys swinderianus												X								
Sigmodon hispidus																X	X	X		
Sigmomys alstoni																		X		
Zygodontomys brevicauda																	X			
Holochilus brasiliensis																		X		
Akodon boliviensis																			X	

Figure 1. Rodent species that damage crops in various regions of the world.

A variety of crops are subject to rodent damage in different parts of the world. Many countries have reported heavy damage or crop destruction by rodents, but most reports are largely anecdotal. There is no sufficient information available to even guess the economic impact of rodent damage to small-farm crops on a worldwide scale. Relatively low-level, chronic damage which passes unnoticed year after year, or which is simply tolerated by farmers, probably plays a more important role in reducing available food than the spectacular losses associated with occasional rodent population irruptions. Some of the important crops in which rodents are reported to cause serious losses in different parts of the world are shown in Figure 2.

No single method of rodent control is applicable to all pest situations, and even under the most ideal conditions, the results of most control methods are expected to be somewhat variable. Most farmers with serious rodent damage problems make some effort to control, and many countries have operational rodent control efforts in progress through

	S. E. Asia	S. Asia	East Africa	West Africa	Latin America
Rice	X	X	X	X	X
Corn	X	X	X		X
Wheat		X	X		
Sorghum					X
Peanuts			X	X	
Vegetables	X			X	X
Coconuts	X				
Sugarcane	X		X	X	X

Figure 2. Crops reported to receive serious damage by rodents in various regions.

governmental agencies—at least during times of serious rodent population outbreaks. An overwhelming variety of materials, methods, and techniques (Figure 3) have been used or suggested as means of rodent control in particular situations. However, little effort has been made to analyze or evaluate the applicability of most approaches for reducing crop damage in the developing countries. Proposed control methods must be reasonably effective in reducing crop damage in a particular situation, but they must also be evaluated from several viewpoints, including: safety for humans and nontarget animals, cost, practicality, short-term and long-term environmental effects, acceptability to farmers, and availability of materials, to list a few. Unfortunately, even the effectiveness of most

Physical	Chemical	Biological	Others
Barriers	Poison Baits	Sanitation	Bounties
Trapping	Tracking Powder	Parasites	Harvest
Flooding	Poison Sprays	Diseases	Appeasement
Electrocution	Repellents	Predators	Insurance
Drives	Poison Grease	Habitat Modification	Electromagnetic Fields
Hunting	Systemics	Cultural Practices	
Clubbing	Reproductive Inhibitors	Buffer Crops	
Crushing	Fumigation	Ultrasonics	
Frightening Devices	Wetting Agents	Lethal Genes	
	Drugs	Biosonics	
	Glues	Resistant Plants	
	Frightening Agents		

Figure 3. Methods and techniques of rat control that have been used or suggested in various pest situations.

potential control methods is not well established for agricultural situations.

In organizing or planning management programs to reduce rodent damage problems, a number of strategic decisions need to be made. The nature of these decisions has great bearing on the types of control methods and organizational plans that might be useful or appropriate. The ultimate success of a management program to reduce rodent damage may depend to a large degree on our ability to provide biological, economic, and sociological information to the decision makers, if needed, at an early stage of planning. Figure 4 identifies some of the components of potential strategies that could, or should, be considered in each situation where operational rodent control programs are contemplated. It is particularly important to arrive at answers to these questions:

Approaches	Units	Operators
Toleration	Large Areas	Individual Farmers
Reduction	Communities	Groups of Farmers
Eradication	Farms	Community Organizations
Regulation	Fields	Government Organizations
Exclusion	Crops	Private Service Organizations
Management	Individual Plants	Private Industry

Figure 4. Important considerations in determining rodent control strategies.

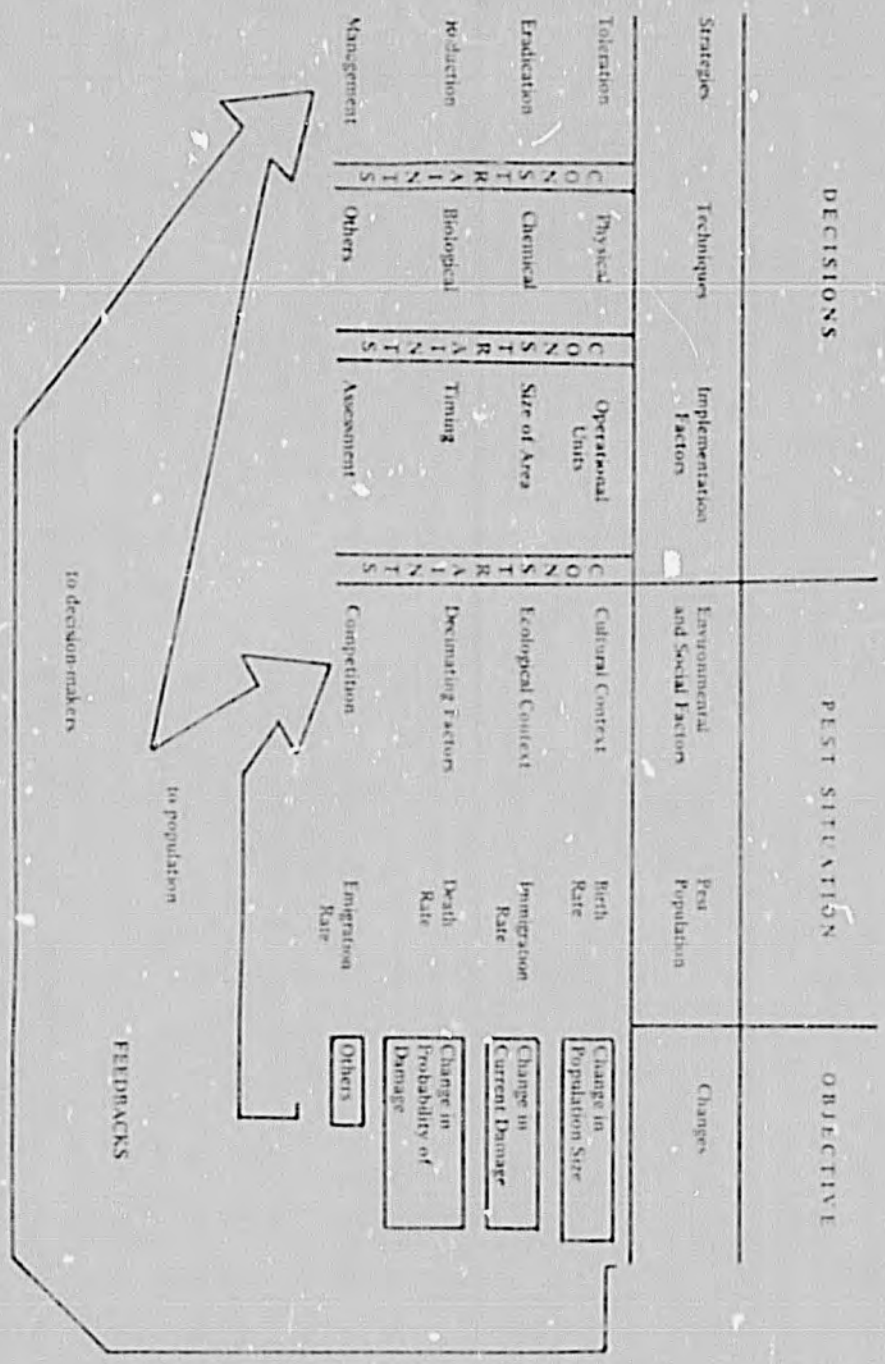

Figure 5. Factors related to the process of devising self-sustaining operational rodent control programs.

1. Who will carry out control?
2. What are the primary areas or units in which control would be carried out?
3. What basic control approach is appropriate?
4. What control methods should be considered?

An attempt to diagram some of the interacting factors affecting decisions in agricultural rodent control is presented in Figure 5. Obviously, we lack even the most rudimentary information about the factors comprising pest situations involving rodent damage to crops—even for the most studied species. In many cases around the world, little consideration has been given to the factors which seem most important in constructing operational programs. Even the objectives of agricultural rodent "control" are often wrongly chosen. Our primary objective in dealing with most rodent damage problem in agriculture is to reduce or eliminate damage or crop losses. Most operational programs are still primarily oriented toward reducing rodent populations, despite the fact that little evidence exists that rodent population size and crop damage are directly related.

If our research efforts are not broadened to obtain more than biological and ecological descriptions of the rodent species which damage crops and efficacy evaluations of candidate chemicals or control methods, our efforts toward using this information in reducing food losses in agriculture will be slow, perhaps fruitless. There is growing recognition among governments and international agencies of the serious crop losses caused by rodents on small farms. Farmers in many areas are becoming more attuned to accepting improved agricultural practices and using simple technology to solve food production problems, with which they have contented for generations. Our challenge during the next few years will be not to learn more about rodent biology and ecology—but to learn what is necessary about the pests, the farmers, and the situations where they interact and to use this information to help establish self-sustaining management programs for protecting crops.

ACKNOWLEDGMENT

This work was supported with funds provided to the U.S. Fish and Wildlife Service by the Agency for International Development under the project, "Control of Vertebrate Pests" PASA ID-DSB-473-01-67.