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9. ABSTRACT

**A brief discussion of rodent damage to food crops in Southeast Asia, the Pacific Islands, South Asia, Latin America, Africa, and the Near East. To boost the production of needed food, the world now is looking to technology-intensive agriculture. Ironically, though, these progressive agricultural practices are accompanied by an increase in the complexity and intensity of pest problems. To solve these problems and to reap the full benefits of modern agriculture, pest management systems thus must be refined even further.**

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## Rodents Affecting Food Supplies in Developing Countries: Problems and Needs<sup>1</sup>

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Throughout much of the developing world, rodents are major pests contributing to low agricultural production. While it is extremely difficult to obtain adequate quantitative data, serious rodent damage to major crops in most of the developing countries has been reported. Estimates from various sources are available giving national loss figures, but they are largely "guesstimates", i.e. unsound, generalized projections from localized data. It is certain, however, that rodents exert a serious limitation on the world food supply as well as causing chronic losses to the export crops upon which these countries depend for foreign exchange.

Because of a general lack of reliable data this presentation aims to provide an overview of the ways rodents are problems contributing to low agricultural productivity in the developing world. Characteristically, many of the most severely affected areas are within the tropic zone. Favorable environmental conditions may have much to do with the dense rodent populations and severe damage problems occurring

in the tropics, although serious losses to rodents occur in the temperate countries as well.

In the rice growing regions of the world, particularly in tropical Asia, several species of rodents cause chronic losses from sowing until harvest and, subsequently, in storage from farm to warehouse (1, 2, 4, 8, 13, 14, 17). Other major crops subject to rodent depredations are maize, wheat, coconut, sugar cane, oil palm, cocoa, and root crops (1, 2, 3, 4, 9, 12, 14, 15, 16). Severe food shortages have occurred in the past in large localized areas in several Asian countries due to serious rat population eruptions. In most of the region, farmers are virtually helpless to control rodent depredations — not because of indifference, but because of lack of technology, knowledge, and capital. While farmers do employ various methods of rodent control, they are largely ineffective and indicate a poor understanding of particular pest situations on the part of all concerned.

### Pest species

Species of the genus *Rattus* are among the principal crop pests of widespread importance in the tropical and subtropical areas of the world. Several subspecies of *Rattus rattus*, *R. norvegicus*, *R. argentiventer*, *R. exulans* and several similar species of *Bandicota* are often identified as important pest species in these areas (3, 4, 8). *R. rattus* and *R. norvegicus* are worldwide in distribution. *R. argentiventer*'s distribution extends from Thailand through the Indo-China region, Malaysia, Indonesia and the Philippines. *R. exulans*' range includes Burma, Thailand, Malaysia, Indonesia, the Philippines

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ceeding discussion, an overview of rodents as pests in agriculture by region is given.

### Damage to crops

#### SOUTHEAST ASIA

Rodents cause serious chronic losses in the region's agriculture, while serious rat outbreaks have occurred sporadically over wide areas of the Philippines (13), Indonesia, Malaysia and Thailand. The Philippines, in the early 1950s, experienced the disastrous rat outbreaks on the island of Mindanao which triggered food shortages in the area. Repeated outbreaks have occurred before and since then, emphasizing the continuing importance of rodents in the well-being of the country's agriculture. Rice is the most important crop affected in the Philippines but maize, coconut, sugar cane, and root crops are also seriously damaged.

Rodents cause considerable damage to Malaysia's major economic crops, the most seriously affected being rice, oil palm, and cocoa. Four rat species are important in rice fields in peninsular Malaysia (3, 17) and three rodent species are serious pests in oil palm and cocoa plantations.

Indonesian agriculture, like that in much of the southeast Asian region, is beset with serious rodent problems (4, 10). Rat outbreaks have been recorded on Java during the years of 1915, 1938, 1953-54, 1963-64, and 1972-73. Serious rat damage has, likewise, occurred in Celebes and Sumatra at various times. The major crops that are affected by rodent depredations in Indonesia are rice, oil palm and sugar cane. Some damage also occurs on maize and coconut.

In Thailand rodents are also important agricultural pest problems (8). More than ten species are associated with rice alone under field conditions. In addition to rice, rodents damage maize, sugar cane, soybean, peanut and coconut.

Rodent damage to rice in the Republic of South Viet-Nam is widespread and includes even the floating rice varieties. Four species

are responsible for damage to rice but *R. argentiventer* apparently predominates.

Although no estimates of damage are available, rodents are marked as particularly serious pests of rice and sugar cane in Burma.

#### PACIFIC ISLANDS

Among the Pacific Ocean Islands coconuts constitute a major crop and one that is heavily damaged by rats (11, 16). Losses from these pests in Tahiti and the Fiji Islands (15) are at times quite heavy, sometimes approaching 50 percent. Similarly heavy losses to coconuts have been reported in New Hebrides, the Tokelaus (18), Gilbert and Ellice Islands (9). Some studies suggest that coconut trees in some areas compensate for a portion of the damage by additional nut production (15).

Damage to cocoa by rats is serious in the Solomon Islands, Samoa, and New Hebrides. Rats (principally the Norway rat) are said to limit sugar production in Fiji. Sugar cane is mostly grown along the coastal areas where the rat problem is not acute.

Rats are also serious pests of some of the subsistence crops of the Pacific Islands. Yams, sweet potatoes and cassava may receive substantial damage.

#### SOUTH ASIA

In the vast and densely populated south Asian region (Pakistan, India, Sri Lanka and Bangladesh), rodents are a major cause of food losses (2, 12, 14). Estimates of from 1 to more than 12 million tons' loss have been given for India's yearly food grain production. Indian sugar cane and coconut production are also severely hampered by rodents but estimates for these as well as for other food crops similarly damaged are unavailable.

Pakistan's agriculture is also plagued by rodent pests, but very little information as yet is available. The FAO rodent control project there lists five rodent species as major pests.

Rice in Bangladesh receives heavy damage from two rat species. Other crops are also damaged but losses are poorly documented.

In Sri Lanka rice may also be heavily damaged by a species of *Bandicota*. Damage to coconuts and root crops, at times, are no less serious.

#### LATIN AMERICA

Rodent pests damage the rice crops of Nicaragua, Panama, Colombia, Surinam, and Venezuela (12, 14). Severe infestation of sugar cane fields by rats are problems in most of the Caribbean Islands, Mexico, Panama and Guyana. Maize and sweet potatoes are equally subject to damage as reported from Panama. This limited documentation of rodent depredations serves as an indication of what might be expected from other areas of tropical Latin America where rodents damage major food crops.

Disastrous crop losses are reported repeatedly from northeast Brazil. Argentina's crops are subjected to severe attacks by rodents. Rangeland destruction by rodents is an important problem in Chile. Gophers, *Geomys* sp., are a significant problem in portions of Central America.

#### AFRICA

At least 18 species of rodents have been reported causing damage to various crops in Africa (1). About half of these are established pests of the major agricultural crops of the continent. Serious damage has occurred in wheat, maize, coconut, oil palm, cocoa, cassava and yams. There is no available estimate of rodent damage for Africa, but field losses are often considerable. As in other areas, primitive storage facilities may contribute significantly to problems with substantial post-harvest losses.

Though it is also true in some other areas of the world, the difficulties of rodent control in west Africa are complicated, indeed greatly so, by the fact that some of the pest species, for example, the "grass cutter" of the genus *Thryonomys*, are also important items in the human diet. Safety in control operations assumes a new dimension.

#### NEAR EAST

The problems of north Africa and the Near East include many which also affect nearby parts of Africa and other parts of Asia. But the depredations by species of *Arvicanthis*, *Nesokia*, and *Tatera*, among others, must be noted. Severe damage to grain crops, sugar cane, vegetables and fruits are reported so frequently as to be "routine".

#### Other losses and problems due to rodents

Post-harvest losses of grains, legumes, oil seeds and other agricultural products are prevalent essentially throughout the developing world. These losses do not include only those due to consumption of the product and its loss in weight and volume. The increased losses due to irretrievable spillage and rodent hoarding are significant. Reduction in nutritive value, due sometimes to selective feeding, is great. Rodent feeding results also in increased susceptibility of the stored foods to attack by insects and microorganisms. Losses resulting from gross contamination by faeces and urine do not result in as much less consumption in the developing world as might be thought, but do result frequently in lowered sales prices. And adequate prices are one of the most important incentives to increased production. Mice are important in field crop and postharvest losses. In the latter, however, they are an insidious pest seldom adequately "appreciated" for their true importance. Their ability to live and breed hidden within a stack of bagged grain is responsible for considerable damage.

Rodents are heavily involved in losses in livestock production. Young smallstock are killed and eaten. Rats are notorious for the havoc they wreak in egg production. They are frequently involved in animal disease transmission, notably leptospirosis (12). Their involvement in human disease and its levy on food production is well documented; plague, though reduced in incidence, is still a problem to be settled.

### Other vertebrate problems

Rodents are only one group of vertebrates which cause reductions in world food supplies. Most other mammal and terrestrial vertebrate pests only cause major reductions locally. The depredations of monkeys must not be lightly passed over, however. Even large game animals are destructive when not managed well. Perhaps the greatest losses among these animals are caused by rabbits and hares, with pastures and vegetables suffering most.

The grain eating birds and fruit eating and vampire bats are the greatest sources of agricultural losses among the flying animals. Means have lately been developed to reduce losses due to vampire bats. Among the grain eating birds, the weavers and especially the genus *Quelea* are important pests. FAO is conducting research leading toward control of these bird pests in a regional project in Africa involving 13 nations.

### Critical needs

There are some critical needs, the fulfilment of which should alleviate the rodent and other vertebrate problems affecting food supplies in the developing world. These needs were clearly stated in the report of the 1973 FAO Panel on Vertebrate Pest Management in Asia and the Far East (3). While the recommendations had reference to a particular region they could well be applied to the entire developing world. It may be noted that these recommendations represent no more than a restatement of the ideas espoused for more than 25 years. Another two years have passed since the FAO expert consultation and progress in meeting these needs has been, to say the least, disappointing. The recommendations were:

- (a) Establishment of regional coordination for vertebrate pest management activities.
- (b) Improvement of information exchange through print media and regular meetings of research and extension specialists in vertebrate pest management.
- (c) Encouragement of developed countries and international organizations to provide expert assistance, training opportunities, and appropriate commodity support for vertebrate pest management.
- (d) Development of graduate programmes in vertebrate pest management in the region.
- (e) Establishment of a regional vertebrate pest management programme to undertake research to develop strategies, methods, and materials to protect and ensure the gains made in agricultural production.

At this juncture, it may be opportune to emphasize some considerations that might prove crucial to the success of vertebrate management programmes in developing countries. The variety of situations under which rodents can and do become problems complicate both the development and implementation of control. Our knowledge of the various tropical agroecosystems is woefully inadequate. A thorough understanding of the ecology of pest species, and the varied situations where they are pests, represents an essential need and one which will require expert assistance in most countries.

Often we have no more than a name, of questionable taxonomic validity, by which to identify a pest rodent; the same species may be known by different names in different countries. The identification of the species responsible for crop damage is quite problematic because of the peculiar habits of rodents. In the tropics several species may coexist in the same field area with only one or two being responsible for the damage. Correct identification, nevertheless, is a must for the proper handling of particular rodent pest situations. The general shortage of competent research workers in rodent taxonomy and biology is largely responsible for this sad state of affairs.

Rodent pest problems in neighbouring countries have considerable biological similarities that make the establishment of cooperative regional research programmes aimed at reducing crop losses quite attractive. However, the divergent cultural backgrounds, agricultural practices, and local economics require that each country's programmes be soundly based on

interpretations and evaluations made in a local context.

At the moment sustained baiting with chronic toxicants appears to be a most promising method of control, protecting tropical agriculture from rodent depredations (5, 7). Several variations of this basic programme have been used successfully with several pest species in several crops. The problem of rodenticide resistance, well-known in the temperate countries, should be watched closely in the tropics as the use of chronic rodenticides becomes more intensive and routine. There is a greatly underestimated need for continuing research to develop and test new, safe, and effective chemical control agents.

Because of the tremendous development costs for chemical technology, there has been minimal activity in developing new rodenticides. The market potential for rodenticides in agriculture is quite limited because the quantities of materials typically required, even over large areas, are relatively small compared to insecticides and herbicides. The major markets continue to be urban and industrial applications in developed countries. Chemical companies are understandably reluctant to invest huge sums of money under such a situation. International organizations may be helpful in devising ways to break this stalemate in chemical development.

Though only chronic toxicant baiting may be all that is necessary to manage some rodent problems, most of these and other vertebrate pest situations will require the integration of many techniques based upon multi-disciplinary information. Even the proper timing of chronic toxicant baiting may depend upon information from meteorology, agronomy and sociology as much as that from the vertebrate pest control specialist (6). The use of acute toxicants in baits seems imperative in some control programmes. A recent report on trapping increases the likelihood of this age-old control technique being appropriately used especially where increased employment is also an essential.

Most other management techniques involve modification of the environment in some way. These may include such measures as appropriate crop rotation where multi-cropping is prac-

tised. In mono-cropping, uniform planting dates may be a management technique. The high reduction of losses in storage achievable through exclusion of the animals from the store make consideration of this technique imperative. The techniques to be combined vary from problem to problem. It is easy for those from the more developed world to forget how many of their practices, widely accepted, have been of value in preventing or reducing vertebrate pest problems. Improved construction and garbage-handling techniques are but two examples.

Finally, there are the ultimate problems of implementing programmes and bringing rodent control technology and information to the small farmer. This task is generally delegated to the extension technician who is simultaneously responsible for all other aspects of agricultural production as well. Action to hire and train greatly increased numbers of agricultural technicians and to provide them the means to reach farmers must rest primarily with the developing countries themselves. However, most countries are only beginning to recognize this problem and we can expect that assistance with agricultural training programmes will be an important activity for international and regional organizations for the foreseeable future.

### Summary

Problems with rodent damage to food crops are already worldwide and limit agricultural production in many areas of the developing countries, which are characteristically food deficient. In the years ahead, however, those of us in the developing world could face a surprising paradox. With the goal of increased food production to support expanding human populations, we are pursuing more technology-intensive agriculture. But with our increasingly progressive agricultural practices, we are also experiencing an increase in the complexity and intensity of our pest problems. To meet these problems, and reap the full benefits that modern agriculture can supply, we must increase the sophistication of our pest management systems.

The sheer magnitude of this task requires solid national pest management programmes strengthened, supported and coordinated by equally solid regional and international programmes.

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