Rodent Control Techniques-An Overview

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Abstract: No one strategy or method of control is practical or appropriate in all different pest situations due to variations in geographical and climatic factors, crop production and post-harvest storage systems, carrying capacity of the environment, biology of the pest rodent species, the nature and extent of rodent problems, and perceptions and socioeconomic conditions of the people. Additionally, farmers employ a number of conventional rodent control methods, and during the past two to three decades, a number of more effective methods, particularly rodenticides, have also been accessible. The two fundamental methods of rodent control that are accessible are lethal or reductional and non-lethal or preventative. While non-lethal or preventive measures involving environmental, cultural, and biological approaches, which may produce a more lasting effect, are rarely adopted, the lethal approach, particularly the use of rodenticides and trapping, which provides an immediate solution to the problem, is frequently considered the most practical, economical, and effective method of combating rodents.

Introduction

The simplest solution is to eliminate the pest, which usually entails killing it, if it is causing damage. However, in reality, this direct method might not be the most economical or effective. Instead,then killing the bug, pest management should focus more on minimizing harm. The application of a fatal poison is typically the fastest way to solve an urgent pest problem. fatal control, however, may be followed by quick immigration, making the damage reduction transient. In the same way, excluding a pest could stop damage without resorting to lethal control. As a result, it's crucial to consider the pest's spatial dynamics. In order to increase individual fitness, it is crucial to take into account behavioral responses that have evolved through natural selection in rodents, which are mammals with complex behavior.

Mechanical Rodent Control Methods

The removal of rodents from buildings is not difficult, but it is never as simple as placing a few mouse traps or a container of rat poison. Rodent control must be carried out in a professional manner and viewed as a collaborative effort by site occupants, pest management experts, and site management in order to be effective. Rodent management in buildings must, at the very least, include the following:

- A working understanding of rodent biology. A basic comprehension of the customs andthe ability of various rodent species to reproduce is useful for determining where to look for animal signals and how to pick the most effective control methods.

- A working knowledge of NPS regulations. According to NPS policy, local rodents are protected. This ruleencourages keeping rodents outside in their native environments, or using rodent exclusion tactics.Management approaches will vary internally and externally and are recommended on a case-by-case basis.
- A close examination of a building's outside and interior. The primary goal of anInspection is used to find structural issues that allow rodents to access structures. Inspections can reveal the kind of rats that are present, important shelter locations, animal feeding and drinking areas, and environmental factors that encourage infestations surrounding structures. These conclusions are used to prioritize the repairs required to keep animals out of buildings and to suggest modifications to the environments that promote rodent populations.
- A successful exclusion. Rodents must be trapped if they want to be controlled in constructions. Not allowed to enter a building or a space. preventing rodents by plugging any openingsThe most crucial defense against infestation is to block all points of entry or exit.
- Sanitary methods that prevent rats from finding food, drink, and shelter. exemplary hygienereduces the number of animals that can live in a region by removing the necessities that rodents need, such as food, water, and shelter. Even the best sanitation practices won't stop infestations where exclusion is insufficient. Good sanitation is crucial for controlling rodent populations.
- Systematically eliminating 85 to 95% of the rats that can reproduce that are present. Rodentsgrow swiftly and give birth to a lot of offspring. The amount of creatures here won't change.If the majority of the breeding adults are not removed, the population may not alter much or may even keep growing.
- Routinely keeping an eye out for new rodent behavior. monitoring) of regular documented re-inspectionslocations is crucial for figuring out whether past control efforts were successful, finding any recently openedholes animals could utilize, keeping an eye out for changes in cleanliness and harborage conditions, and figuring out whether the number of animals there is rising, falling, or staying the same. Knowing how quickly rodent populations can grow and how difficult it is to eliminate established infestations, it is evident the significance of ongoing vigilance.
- Charge with responsibility. defining roles for everyone involved in the rodent infestationProject management is crucial to success. There should be obligations with

completion dates.decided upon by the participants and recorded. This makes sure that everyone on the team is informed of what is being done and their roles.

Ways Using the Environment and Culture

Several methods are applied either directly against the rodents or as part of regular agricultural and post-harvest storage processes. These either directly or indirectly lessen rodent immigration into a habitat and/or lessen the habitat's carrying capacity.

Reduction of Harborage

The presence of rats is deterred by a tidy atmosphere. The wastelands and untamed vegetation on crop field edges, which would otherwise serve as rat harborages, have been decreased by agricultural mechanization. Bandicoot rats typically dig large burrows in earthen water channel embankments, bunds, and dikes. For digging, they prefer thick bunds with more height, and they get discouraged if the thickness and height of the bunds are reduced (Rana et al. 1994; Kumar et al. 1995a). In homes for animals and people, as well as in shops and godowns, rodents can find shelter among trash, rubbish, and other hiding and nesting materials. Rodents are deterred from living in these areas by routine trash clearance and proper hygiene (Christopher et al. 1984; Save Grain Manual 1990; Parshad et al. 1991: Malhi and Parshad 1995a).

Reduces the Source of Food

Rodents selectively invade and inflict more damage on weedy than on weeded crops, as seen in experimental plots of rice in the Philippines (Drost and Moody 1982) and of rice and wheat in India (unpublished observation). Weeds are an important part of rodents' diets (Fulk et al. 1981; Malhi and Parshad 1994a). Rodent pest issues in agriculture fields have decreased as a result of the practice of weed control using pesticides and other ways, which has improved during the last two to three decades in India. Similar to this, it's crucial to get rid of extra food sources for rats in buildings and residences. After moving the food hoppers and chicks, controlling rats in poultry houses using these approaches is simpler.

Decline in Immigration

Rodent removal from a space or structure is based on the biology and physical characteristics of the pest species. B. as an example. bengalensis excavate huge tunnels, R. Rattus scales trees and structures, and M. Musculus can fit through a small opening with a diameter of roughly 1 cm. These three species may disseminate swiftly due to their morphological attributes, which allow

them to mate all year long and maintain enormous populations (Parshad et al., 1989). Rodents can't access food in agricultural fields or during post-harvest storage because of several methods, including barriers, electric fences, repellents, and rat proofing.

Barriers

Ratsare prevented by banding the trunk of coconut plants with metallic sheet. Rattus accessing coconuts by ascending to the crown. In an area where the tree trunks were banded, 7.5% of coconut trees were reported to have rat infestations, as opposed to 25% of trees in an unbanded region (Guruprasad and Srihari 1978). Lethal and sub-lethal electric barriers or fences around the fields have not been used much in India to protect crops from rats (Sreenivalu et al. 1971). This technique is crucial for defending expensive goods or buildings.

Repellents

Farmers use a few traditional techniques to scare away rodents, including placing screw-pine leaves along the edges of paddy fields (Subiah 1978), flagging palm leaves or pieces of polythene on a 3–4-foot-long rod in rice fields (Neelanarayanan et al. 1995a), and using plant material that rattles (Sharma 1994). It is unknown whether these techniques are effective. Ultrasonic repellers were introduced to the market for use in buildings in both India and other nations, although there is inadequate proof of their efficacy (Lund 1988). Similar to this, a variety of compounds have been studied for their ability to repel (Rana et al. 1994), but no single chemical is being used in repellent applications today.

Rodent-Proofing

The first line of defense against rodents is to apply the proper procedures to prevent their entry into buildings such as godowns, stores, shops, and homes for animals (Save Grain Manual 1990, Meyer 1994, Malhi and Parshad 1995a). Most slum homes in rural and urban areas are constructed of mud and wattle and have thatched roofs. There is no way to make such buildings rodent-proof. Despite being constructed of brick and concrete, the homes of middle-class families, as well as shops and stores, frequently lack rat proofing. However, newly built homes in towns and cities, as well as public godowns and warehouses, are typically made rodent proof, however occasionally the established proofing is lost due to maintenance issues.

Cultural Customs

Cultural customsrotation of crops and tillage. The prevalence of rodent pests and the harm they do are influenced by specific cultural behaviors.a crop deep tillage is a practice used by traditional farmers that also destroys rat burrows and chases them away.

Biological Processes

Utilizing predators, parasites, diseases, and reproductive inhibitors is a key component of biological control.rodents. environmental changes brought on by industrialization and overuse of land and forest resources. In certain areas of India, urbanization and agriculture have upset the natural regulation in transportation.

Predators

Cats, geese, jackals, foxes, owls, hawks, kites, monitor lizards, and owls are the main rodent predators.(Prakash and Mathur 1987) Snakes. Due to hunting and environmental factors, these predators' populations have decreased. The barn owl, Tyto alba, mostly consumes rats and mice (Neelanarayanan et al. 1994b).

Illnesses And Parasites

Although they can play a significant regulatory role in their host population dynamics, the potential of microparasites (viruses, bacteria, and protozoa) and macroparasites (helminths and arthropods) as biocontrol agents of rodents has been overlooked (Singleton and Redhead 1990).

Obstructors to Reproduction

Their fast rate of reproduction is a significant factor in rodent populations' abundance and post-control adaptability(Parshad et al. 1989) of reproduction. Due to the possibility of chemically induced reproductive suppression .Several compounds have been assessed against several criteria in integrated rodent control programs.Indian rodent species. These include colchicine, glyzophrol, tetradifon, and clomiphene (seeAlpha-chlorohydrin (Saini and Parshad 1988, 1991, 1993), ethyl methanesulphonate (Kaur and Parshad 1997), Barnett and Prakash (1975), Prakash and Mathur 1987). Alpha-chlorohydrin is harmful to both males and females at greater dosages, and it renders males permanently sterile at low concentrations (Ericsson 1982; Saini and Parshad 1988). Future rodent pest management tactics may benefit from substances that have mutagenetic effects and decrease animal reproduction in both male and female animals.

Mechanical Processes

Mechanical methods, like hunting, killing, and trapping, can have large labor costs and are less efficient.feasible over a wide area. But these can be used with chemical control methods to accomplish in situations where the use of rodenticides may cause health and environmental problems, better control success or other control methods can replace chemical control.the act of killingBandicoot rats can be pursued and killed with sticks while fields are being plowed and burrows are being flooded.

In the time between crops, there may be rain or irrigation water (Anonymous 1995). The bandicoot rats continue to feed on the grain they have stored in their burrows after the crop has been harvested. The rats can be destroyed with sticks or by using rat dogs when their burrows are flooded during irrigation of the land. Rats are retrieved from their tunnels by the tribal people who consume them by digging or by smoking the burrows by igniting rice straw or cow dung cake on one hole to scare the rats away from another opening (Ahmed 1992; Jain et al. 1993b). for managing R. The residents of the Lakshadweep Islands are said to arrange "yelinayatu," or rat hunts, in which the entire community takes part when there are rattus in coconut fields (KidavuKoya 1955; ShahandSubiah 1978).

Trapping

Rodent trapping is a traditional method used in fields and buildings (Fitzwater and Prakash 1989). There are two different kinds of traps in use: the live trap and the snap or kill trap. The wooden snap trap, a locally made trap using timber splinters (Srihari and Chakravarthy 1992), the Urangor arrow trap (Prakash and Mathur 1987), and the break-back spring-loaded snap traps with wooden or jawed iron base (Prakash and Mathur 1987) are among the snap traps that have historically been used by professional trappers in rice fields. Different sorts of traps are employed for the live capture of rats, including the traditional pit fall or potfoldable iron sheet boxes with a spring-loaded shutter known as Sherman traps (Rana 1982), single-rat traps (Pasahan and Sabhlok 1981), and multi-catch wonder traps of various sizes and shapes (Prakash and Mathur 1987, Neelanarayanan et al. 1994c.Sheikher and Jain, Parshad et al. 1987a, 1991, and 1994Kumar et al. 1995b; 1992).

Using Chemicals (Rodenticides)

In South Asia, using rodenticides to manage rodent populations is a standard practice in urban, rural, and agricultural settings. Their efficacy is influenced by the formulation, application technique, and choice of appropriate chemical. In India, rodenticides like warfarin, racumin, zinc phosphide, and aluminum phosphide are frequently used or advised. Along with these substances, a number of others have undergone testing for rodenticide activity against the main pest species.The following information refers to their evaluation and use in India. Buckle (1994) reviews the mechanisms of action of several substances.

Short-Term Or Acute Rodenticides

Zinc is one of the acute rodenticides whose toxicity and effectiveness have been examined against rodents in India.alphanapthyl thiourea (ANTU), norbormide, scillirocide (red squill), sodium fluroacetate, vacor (RH-787) and a gophacide (Subiah and Mathur 1985, Prakash and Mathur 1992, for reviews). None of these substances are utilized in India, with the exception of zinc phosphide, aluminum phosphide, and barium carbonate, due to toxicity and efficacy issues. In the fields, a phosphorus-based rodenticide known as "Ratol" that contains inorganic phosphorus is occasionally employed. Although it poses a risk to the user, the effectiveness of the bait against house rats was found to be low (Malhi and Parshad 1991). While some rats are killed at low doses, others live at greater amounts. Alu-fumigation of underground tunnels

Generally speaking, phosphide works well in moist soils (Sridhara and Srihari 1979), but its significance is minimal.by the potential toxicity risks, the expense of treatment, and the low efficiency against species like B. bengalensis, maybeblock the tunnels leading to their burrows.

Chronic Rodenticides

Rodenticides with subacute effect, which postpone death for a few days after consumptionBromethalin, flupropadine, calciferol (ergocalciferol, vitamin D2), and cholecalciferol all have deadly doses.(D3 vitamin). There are few reports of its testing on rodents in South Asia. According to reports, bromethalinto work well against B. bengalensis in Bangladesh at a bait dosage of 0.005% or 0.01% (Mian et al. 1993). Feeding calciferol-containing poisonous baits, or calciferol plus 0.025% warfarin (Arora et al.1982) and 0.075% cholecalciferol for a few days (Saini and Parshad 1992) resulted in R's complete demise. rattus. After 3 to 5 days of treatment, the majority of the rats perished. The rats lose their appetite and cease eating after consuming lethal doses of cholecalciferol in 1-2 days of feeding (Saini and Parshad 1992). The benefits of this "stop feed" effect brought on by a deadly dose are that the rats do not take excessive overdoses, which lowers the need for bait and lowers the risk of secondary poisoning (Saini and Parshad 1992).

Preliminary Anticoagulants

Hydroxycoumarins or their related indane-dione chemicals are the only anticoagulant rodenticides.The effects of the first-generation anticoagulant rodenticides are multi-dose and chronic in nature.Warfarin, fumarin, coumatetralyl, diphacinone, and chlorophacinone are a few of the substances.effective against the majority of Indian rodent species (Mathur et al. 1992). One of these isWarfarin and fumarin (Ratafin), which are frequently utilized as ready-to-use wax bound cakes of fumarin (Ratobar) and are typically employed at a concentration of 0.025% in cereal baits. These have been around for a while in India, but they haven't been widely adopted for controlling rodents because they take multiple little doses over a period of days—ranging

from 4 to 28 depending on the species—before they start working (Prakash and Mathur 1987; Mathur et al. 1992).

Second-Generation Anticoagulants

The creation of rodenticides of the second generation that are anticoagulant, such as difenacoum, brodifacoum,our ability to control rodents have improved thanks to bromadiolone, flocoumafen, and difethiolone. To reduce agricultural and commensal rodents, bromadiolone has been commercially accessible in India since 1988. This compound, along with other secondgeneration anticoagulants, has been tested extensively against rodents in both laboratory and field studies in India (Mathur and Prakash 1981, Chopra et al. 1983, Parshad et al. 1985, Parshad and Chopra 1986, Balasubramanyam and Purushotham 1987, Parshad 1986, 1988, 1994a,b, Arora et al. 1994) and several other countries (Dubock 1980, Garforth and Johnson 1987, Jackson and Ashton 1992, Gill 1992). Second-generation anticoagulant rodenticides are used at low doses with 0.005% concentration in the bait (or 0.0025% in the case of difethiolone) because they are more toxic and effective than first-generation anticoagulant rodenticides. They are typically effective after a single dose or day's ingestion and therefore require a shorter feeding period and less bait. Most deaths happen between 4- and 10-days following treatment, and the deadly effects of second-generation anticoagulants often start 2-3 days after ingesting the poison bait. In contrast to acute rodenticides, sub-lethally poisoned rats eat enough poison bait for a complete kill since they do not acquire an aversion to it (Parshad and Kochar 1995).

Implementing Integrated Pest Management

Despite major developments in our understanding of the biology and management of rats in rural and agricultural areasand metropolitan areas, the rodent issues continue unabatedly with occasionally disastrous results. The current examination of the information on various control approaches accessible clearly demonstrates that techniquesare now readily available, providing rodent control that is both affordable and efficient in most circumstances. However,Crop production and storage strategies have not yet made rodent control a priority.both in India and other parts of South Asia. The absence of an Integrated Pest Management strategy is a more serious issue.(IPM) strategy, which necessitates the efficient integration of numerous rodent control methodsin a control system with an ecological foundation (Rao 1992; Fiedler and Fall 1994). With adjustments to the agroclimatic. Rodents are displaying changes in the distribution and abundance of various species as a result of environmental factors and cropping patterns (Parshad and Ahmad 1996). In actuality, rodents are very responsive to environmental factors, and their population and behavior change depending on the agro-ecosystem's ecological, phenological, and climatic variables.Long-term planning is necessary for rodent management in agricultural, rural, and urban environments.programs for education and training. Studies in various Punjabi villages in India show that education andby educating farmers and making

rodenticides available, damage can be reduced by 75-85%.compared to rice and wheat (Malhi and Parshad 1988, 1992b). Compared to a yield loss of 1.5–2.0 quintals/hectare ofonly 0.38 to 0.48 quintals/hectare of yield loss occurred in villages where these crops were neglected.Farmers' involvement helped to efficiently complete rodent control efforts. Numerous other studies conducted in other regions of the country also demonstrate the influence of farmers' education and training on their adoption of rodent control (Mathur 1992 for a review).Recognizing the requirement to spread the rodent control technologies, many training programs includingApex level training' for senior government officials, advanced plant protection training for extension specialists, 'subject matter specialist's training courses' for agricultural development and plant protection officers, village level training and field demonstrations, and radio and television programs on rodent control are all being organized, either exclusively on rodents or as part of some other major program.This training's goal is to provide farmers with accurate information regarding rodent control and other agricultural practices. Existence of a well-organized agriculture service has significantly enhanced the nation's agricultural output. The problem was significantly reduced with the help of financial assistance in the form of subsidies for metallic and non-metallic rat proof storage facilities and a free supply of rodenticides (Girish et al.1985, Save Grain Manual 1990), but it still persists in dangerous proportions.

Conclusion

The complex behavior of rodents, their varied adaptation to various pest situations, the potential non-target hazards of rodenticides, the self-protection mechanisms and responses of rodents to control techniques, complex social and religious perceptions, rodents as food sources for some tribes, small land holdings with difficulty organizing village level campaigns, and low economic status are some biological and socioeconomic factors that interact in rodent control. Due to this complexity, it is likely that a specific task force will be needed to plan, organize, and carry out rodent control campaigns in agricultural, rural, and urban settings. Rodent control technologies have substantially improved over the last 20 years, and their effective implementation is due to this improvement.It is necessary to launch specific extension education programs and multi-media campaigns toConcern for rat pest issues and their control among farmers, as well as their motivation.

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