

PRACTICAL GUIDELINE



Effectively Controlling Rats with Ecological Methods

Ethiopia edition 2020



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01. INTRODUCTION

This manual describes how to reduce the problems with pest rats and mice in agricultural settings using several methods that pose no risk to humans, domestic animals, or the environment. Ecologically based rodent management (EBRM) is part of regenerative agriculture since it strives for increased yields, through improving watersheds, enhancing ecosystem services and in this way preventing pre- and post-harvest losses. Reducing losses and waste of resources for inputs, are key aspects which get profound attention under EBRM.



Figure 1: Rats damage and contaminate food by excreta in storage

Rats and mice (rats hereafter) have always caused damage to human properties and carry many diseases affecting human health. Rats are also responsible for considerable damage and contamination of crops in fields and storage areas. The presence of rats remains a major problem for many farmers all over the world. Specific attention is required to manage and control the population numbers. This manual gives a range of ecological methods to apply around the house and in agricultural fields to effectively control rats.



Figure 2: Rats damage, eat and contaminate cooked foods in the house

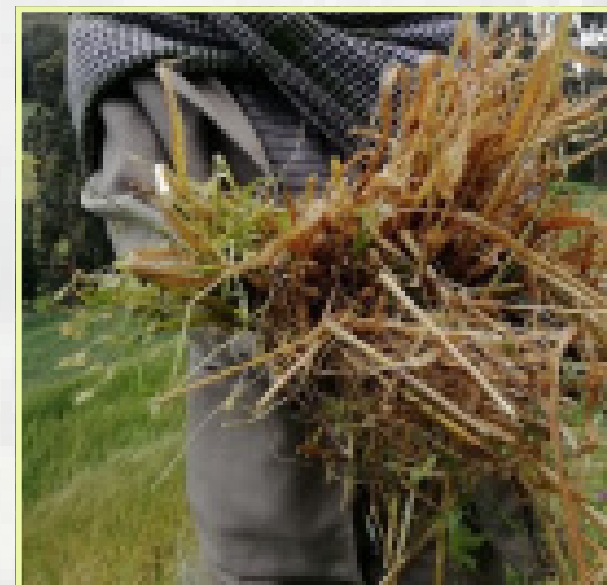


Figure 3: Damaged crops by rats in the field





Figure 5: Rat damages fruits and vegetables in garden and house/store



Figure 4: Rat damage in grazing land



Figure 6: Rat bite fever, *Spirillum minus* & *Streptobacillus moniliformis*



In Ethiopia, there are different types of pest rats. Some rats stay around the house, especially around food stores. Rats that stay near humans have a serious effect on human health and transmit multiple diseases. Other rats live in the field, with some species active during the day and others active at night. Because of their larger numbers, rats can eat large portions of standing crops and cause severe damage. They can sometimes destroy crops completely.



Here are some rat facts:



Rats multiply quickly. From one pair of rats, 1250 rats can be born in one year.



Rats greatly depend on the availability of good quality food and shelter to breed.



Rats affect 9-46% of the annual production of all crops in Ethiopia.



Rats usually move within 30-100 metres of their shelter each day depending on food/mate availability.



Rats play a role in the transmission of more than 60 types of diseases.



Rats are very clever animals and can learn to avoid measures taken against them.

Chapter 2 of this manual describes the basics of how to control rats. **There are two essential requirements:**

1. **Perfect timing:** We must control rats when they are few and weak, before they start to reproduce.
2. **Cooperation:** Rats easily move from one field or house to another; therefore, an entire area needs to cooperate to get good results; it is a community effort.

Furthermore, this manual describes what can be done to ensure that: a) rats cannot access food, b) rats do not have a place to hide, and c) rats are reduced in numbers. In controlling rats, there are **three important activities:**

- Chapter 3: Ensuring the **cleanliness** of grain storage areas and household compounds
- Chapter 4: Controlling the **environment** in the agricultural fields
- Chapter 5: Take **special actions** to control and kill rats

All measures proposed are low-cost and can be very well integrated in houses, storage structures, and fields. The goal is to grow and store food crops safely and ensure nothing is lost to rats. Additionally, we must create a safe and healthy environment for people to thrive, preventing rodent vectored diseases.

Chapters 2-5 describe the different measures in detail with examples provided in pictures. Chapter 6 is a checklist for community rat control.

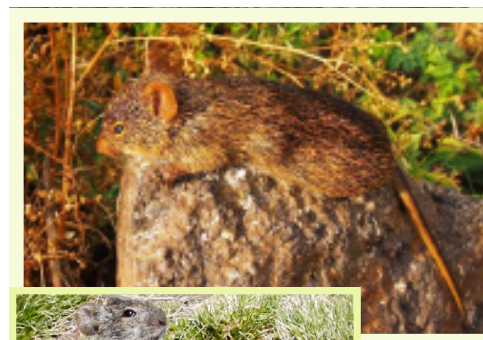


Figure 7:
Arvicanthis



Figure 8: Stenocephalemys



Figure 9: Mastomys



Figure 10: Rattus rattus



Figure 11: Mus musculus

02. ESSENTIALS: TIMING AND COLLABORATION TO CONTROL RATS

1. To control rats, it is absolutely necessary to work together as a community. There are activities that can be done at the individual field/household level and activities that require cooperation among farmers/households (e.g., among neighbours and neighbouring crop fields, also called clustered fields in Ethiopia).

For instance, if a household separately undertakes a rat control intervention in its house/storage area, rats will avoid that household temporarily and move to (infest) the neighbouring houses/storage areas where rat control measures are not initiated. Likewise, if a farmer deploys a rat control measure separately on a crop field, rats will avoid that crop field temporarily and move to (infest) the neighbouring crop fields. Some rats may even return to the original household or crop field when the rat control measures have ended. Rats are very clever animals. Therefore, rat control interventions at individual household or crop field level often yield fewer results, only providing short-term relief.

Joint planning with neighbours and neighbouring farm owners is important. As a group, people can plan what methods to implement and when. This can be divided into methods undertaken as a group and methods undertaken individually. Before measures are decided upon, it is important to obtain

information on the behaviour of the rats from agricultural extension staff: when they multiply (reproduce), how they feed, where they hide, and how they move.

In order to ensure that everybody joins the rat control campaign, a community can agree on bylaws regarding collective rat control. This ensures that all households join and do their share, which will greatly help in reducing the number of rodents. The next paragraph explains when to engage in rat control.

2. Control rats when they are not yet abundant.

It is advised to initiate frequent campaigns and individual rat control measures at the time when the rats are few, the vegetation (grass) cover is low, and the rains are little (pre-season). Campaigns conducted at this time will be most effective.

In crop fields that are under rain-fed conditions, the rat population numbers are lowest in the peak of the dry season, a few weeks before the start of the rainy season (cropping season). Before the rains come, there is not much



Figure 12: working together as a community in planning and implementation of EBRM



food or crop/grass cover in the fields. Therefore, rats will not start reproducing and they are weaker. In the more arid parts of Ethiopia, the dry season before the start of planting crops is the best time to execute rat control measures.

In other parts of the country, for example, in Amhara and Tigray Highlands, the period from May to July is very suitable for rat control measures. Burrows are flooded as the main rainy season starts in June, and there is intense land preparation for the start of the cropping season. Any rat control measure executed in this period of the cropping season will prevent many rats from being born, as it mainly reduces the adult (breeding) members of the rat population. It is important to initiate control measures in the first 30 days after planting (before rats breed). Control measures executed late in the season will yield truly little result.

As a rule of thumb, rat control measures should be done at the end of the dry season and at the beginning of the rainy season. In the dry season, you target the weak animals, reduce their numbers, and prevent them from reproducing. At the beginning of the rainy season, you target the rats that have survived, applying different measures as part of land preparation and destroying rat habitats. These measures are described in chapters 4 and 5.

3. Control measures need to be timed perfectly to ensure that rat numbers are reduced before they start breeding.

In addition, one can spread different rat control measures over time. When rats retreat to the homesteads, crop fields, or ridges nearby, for instance during heavy rainfalls, farmers can focus on rat control measures in those specific areas. For example: When rats move from grazing lands to homesteads, you should start trapping or killing rats at the homesteads. When they move to the grazing lands to hide and eat, you should trap or kill rats in the grazing lands. This means rats have no safe place and are continuously being chased out. This restrains them from establishing an abundant population.

03. ENSURING THE CLEANLINESS OF GRAIN STORAGE AREAS AND HOUSEHOLD COMPOUNDS

Rats are a major problem in many houses. Rats damage clothes, furniture, electric wires, and paper. Rats eat from the household's food stores and contaminate them. Rats create unrest in the house. Occasionally they bite children and the elderly during the night. Therefore, they should always be kept away from the house, homestead, compound, and storage areas. They should not be given any reason to come near; therefore, it is key to ensure that they cannot smell food and cannot get access to a shelter. Here are five rat control measures you can take:

1. Cleanliness: In managing rats in and around houses, the first important requirement is to keep the house and the areas around the house (garden, grain storage areas, fences, hedgerows, etc.) clean. There should be no

open left-over food, no open piles of garbage, no open stored product or open storage. These are food sources that attract rats and provide shelter. One should keep food locked away and air-tight so rats cannot smell it. All items that attract rats should be eliminated or stored in closed-off containers/boxes/jars/other.



Figure 13: Example of unclean neighbourhood proving a potential food and shelter for establishment of rats.

2. How to prevent rats from entering houses: It is important to make it very difficult for rats

to enter houses and stores. We should close all entry holes and cracks in walls and drainage pipes. It is also useful to seal the corner points of houses and stores with concrete to restrain rats from entering. When you notice rat activity (including fresh droppings and runways/pathways) in the household compound, immediately plug (block or fill) all potential rat entry holes with solid material and eliminate all potential hiding places.

In general, it is good to interrupt the movement of rats around houses and storage structures. For instance, put prickly plants in a hedge/fence formation. This creates a barrier for rats and confines their movement, making it difficult for rats to reach the house or store. It is advised to combine these prevention measures.



Figure 14: Examples of clean household compounds and houses with concrete floor suitable to prevent rat entry



Figure 15: Example of compound fenced with cactus

3. Good storage structures: The third requirement is to have a rat-proof storage area and storage material for grains and other harvested items. Rats should not be able to get access to stored items.

Placement of outside storage: The storage should not be placed under trees, because then rats can jump in from the top. Also, there should not be bushes, garbage, or watering places around the storage system, because these will attract rats.

Raise storage structure on poles: it is important to make it impossible for rats to get into the storage structure. The best way to do this is to raise the storage structure on poles, for example 0,5m from the ground, and to put iron or metal pins or disks, or barbed wire on the poles on which the storage structure stands. This prevents rats from climbing up, either because the surface is too slippery and rats will slide off, or because the barbed wire is too prickly.



Figure 16: Good storage structure raised on poles with metal plates wrapped around the poles against rats

Good materials for your storage structure include wood/bamboo, dung, grass roof, and wood poles to raise the structure.

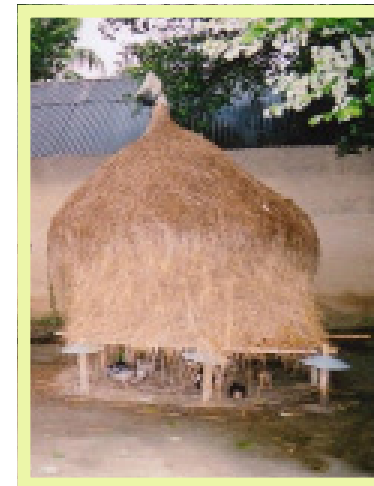


Figure 17: Example of rotational disk at the poles to prevent rats to climb up



Figure 18: A farmer standing next to an outside grain store made from wood walls painted with dung and covered with grassed roof. The floor of the store is about half a meter hanging above the ground (borrowed from Meheretu et al. 2019).

Metallic silos: A recommended practice is to make special safe containers from corrugated iron sheets on poles. Such metallic silos have a special opening to take out the grain when needed. The corrugated iron prevents rats from gnawing through, and the slippery surface prevents them from climbing up to enter the silo. You can also use metal barrels as storage. Make sure to have a tight lid that fits well to close the wide mouth of the barrel.



Figure 19: Barns in the house; on the left made from wood and metal, on the right made from wood and bamboo, painted with cow dung. See again the round disks on the poles, these prevent rats from climbing up.

Hermetic bags: For storage of grains in bags, using hermetic bags is recommended. Hermetic bags are poly-ethylene storage bags with an additional plastic liner inside. When these are tightly closed (air-tight), rats cannot smell the food inside. This keeps them from gnawing through the bag and eating the grains. The hermetic bags also prove to be remarkably effective against weevils and mould aflatoxins. Hermetic bags should be used both in storage and in the house whenever possible.



Figures 20: Example of metal silo for storage, made from corrugated iron. It has a lid on top and poles at the bottom. Made from material where rats cannot gnaw through.



Figure 21: Example of a plastic barrel with a tightly closed lid

Caution should be taken to place grains in hermetic bags that are fully dried (10-11% moisture content).



Figure 22: Bad example of storage bags that can easily be attacked by rats and are not stored away safely

4. Keep predator animals: Keep domestic cats and dogs at home for rat control. Cats hunt and eat rats. Moreover, the smell of these animals – especially the smell of female cats

(or their urine) - scares rats and prevent them from establishing a shelter nearby.



Figure 23: Good examples of hermetic storage bags, preventing rats to smell the food

Furthermore, the presence of predator animals—cats (domestic and wild), dogs, mongoose, genet, and owls—around household

compounds and villages scare rats away. Rats perceive a predation risk; hence, they will limit their movement to seek food and mates. It is advisable not to chase away rat predators, but rather to attract them around the compounds and villages. Chapter 5 advises in detail how to attract predator animals.



Figure 24: Keeping cats around the house is a good method against rats



Figure 25: Dogs can scare away rats through their scent

5. Place traps: The final method to control rats around the house is to place traps, particularly in places where rats are suspected of moving and hiding. There are different kinds of traps, locally made or purchased from local markets, that can be deployed in fields and storage areas: stone traps, spring traps, cage traps, and bucket traps (half-filled with water). One can also devise a home-made trap; an example of how to make a bucket trap is provided below.



Figure 26: Cage trap to use around the house



Figure 27: Spring trap

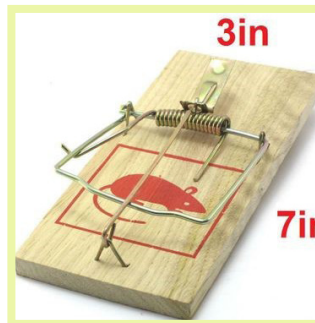


Figure 28: Spring trap

EXAMPLE: Home-Made Bucket Trap

You need:

- 20 liter bucket or larger
- Water bottle, soda can, or pvc pipe
- Steel wire
- Stick to use as a ramp
- Water
- Bait – for example peanut butter or linseed

How to do it:



Figure 29:
Step 1

Step 1: Drive a steel wire through the opposite ends of the water bottle (or any round object which can easily roll and is slippery/smooth).

Step 2: Drill holes in two sides of the bucket near the top where you can push the steel wire through, with the bottle in the middle of the bucket opening.



Figure 30:
Step 2



Figure 31: Step 3

Step 3: Set your ramp up to the bucket opening.

Step 4: Place bait on the ramp and the rolling mechanism.



Figure 32: Step 4

Step 5: Fill the bucket with water.



Figure 33: Step 5

Step 6: You'll have rats climbing up to get to the delicious bait only to be dropped to the bottom of the bucket!



Figure 34: Step 6

04. CONTROLLING THE ENVIRONMENT IN THE AGRICULTURAL FIELDS

Rats are a major threat to crops and fodder. In different areas, the number of rats in crop fields and grazing areas is increasing.

We summarize three reasons for this development:

1) Rats have more to eat with more choice. More crops are grown in multiple cropping seasons per year, and new crop fields are being created in previous natural habitats. Furthermore, new crop varieties, such as malt barley, are introduced to the system. As a result, there is more food available for rats. Also, perennial plants introduced in agroforestry systems are adding biomass (e.g., seeds and foliage) favourable to rats.

2) Rats have more places to hide and shelter. The introduction of watershed conservation measures (stone bunds, terracing, mulching) has greatly increased the number of shelter places for rats. Stone bunds are often great places for rats to hide and shelter in close proximity to food crops. Furthermore, perennial plants provide shelter for rats.

3) Rats have few natural enemies. In some areas, the natural enemies of

rats (snakes, owls, raptor birds, mongoose, and genet) have disappeared due to killings or the destruction of their habitats. A good example is the absence of trees and shrubs on which raptor birds perch in order to make a kill. In the absence of natural enemies, rats can move freely without being preyed upon.

All in all, these agroecosystems create a suitable habitat for pest species, such as the multimammate mouse, the *Mastomys* species, to thrive.

The measures to combat rat infestation focus on three aspects: reducing shelter, reducing food availability, and increasing predation pressure. The main measures work in combination to achieve all three aspects.

Here we describe three main measures to scare off rats, keep rats off crop fields, and diminish their numbers.

1. Improve cultivation practices such that there are fewer opportunities for rats to thrive.

The following methods can be used:

- Reduce crop cover: Instead of having a crop that covers the soil completely, it is better to put crops in rows and do proper weeding. This creates open space between the crops, which rats do not like, because it exposes them to their natural enemies. The result is that rats will move less and less far. Harvesting meticulously and ploughing the field also decreases food availability for rats. Clean up cut straw and other debris around fields or spread it thinly, and clean up any grain spills at harvest.
- Synchronized cropping within the community: All farmers with neighbouring crop fields (clustered fields) must synchronize the timing of land preparation, planting, weeding, harvesting, and rodent control measures. Planting and further management must be

within two weeks of each other. Rats will have less chance of survival, because they cannot go to a place nearby where they can roam freely to eat and shelter. This prolongs the lean period for rats when they are already weak, bringing down their numbers.



Figure 35 Examples of planting crops in rows, thereby exposing rats and forcing them to limit their movement

- Leave crop fields fallow for a long period: Rats greatly depend on the availability of good quality food and shelter to breed.

When fields are kept fallow for a large part of the year, it means that rats can only have one breeding season. If farmers were to grow crops two or three times a year, this would mean that the rats could also breed two or three times a year. Fallow fields ensure less breeding, thus low numbers of rats. However, practicing this method is not an easy task where land size per household is small. Besides, when fallowing small plots of land in between cultivated fields, rats will move to the cultivated fields, putting the crops at greater risk of serious damage. Therefore, it is advised to only practice field fallowing when it is organized at a community (cluster) level.

- Consider controlled minimum grazing: In many areas, zero grazing has protected the lands from erosion and other damage, but it has also caused an increase in the number of rats. With zero-grazing, rats are not being

disturbed by livestock and are free to roam and benefit from abundant grass. To reduce the number of rats in grazing lands, controlled grazing can be introduced. In short, controlled grazing entails allowing a limited number of animals to graze on a limited number of days. The best days to let cattle graze are when the grass is shorter, which could be at the start of the rainy season or after mowing the grass. Livestock will destroy rats' shelter by trampling. This is the best way to maintain good grass growth and rat control.

2. Destroy the habitats of rats and ensure they have no place to hide

Destroying rat habitats and shelters denies rats protection from predators, breeding grounds, and temporary safe havens. This results in a decrease in rat survival rates and density, and

ensures that rats can only occupy crop fields later in the cropping season.

- Some rats make their nests from grasses, crop leftovers, and rubbish in the fields, particularly rats that are active during daytime and require surface shelter against potential predators. By having livestock graze on these fields before planting for the new season, the rat nests will be destroyed. For example, one could practice 'stubble grazing,' where cattle are taken to the fields after the harvest to graze on the crop leftovers. After the cattle are finished stubble grazing, the remaining leftovers are collected and burned. This 'field cleaning' exercise is important to do before every new planting season starts. It gives the crops a head-start, because rats have been unable to infest the newly planted field.
- Other rats make burrows and tunnels to shelter underground, especially those

species that are active at night. It is advisable to flood these burrows and tunnels with water first to kill the rats inside just before planting seeds. Another method is to smoke the tunnels.

- Deep ploughing can destroy the rat burrows and tunnels. Rats can dig burrows up to 50cm deep. The ploughing depth preferably would reach this depth to destroy a large part of the rat population; however, ploughing at 20cm depth, for example, would also considerably disturb rat burrows.
- In other cases, search for rat burrows and destroy these by stabbing/poking in the burrows with a pole or hayfork/prong. This can be done during the tilling and ploughing stages. When you find a rat burrow, you can also set kill-traps in front of the burrow on the runway.

- Check regularly for evidence of rodent infestation (burrows, tracks, and runways) to undertake measures.



Figure 36: Flooding and destroying rat burrows in grazing land. First pouring water, then close it off and hit the rat when it tries to escape.



Figure 37: Two farmers discussing the right equipment for destroying rat burrows.

3. Improve the quality of soil and water conservation structures.

These structures are useful to reduce erosion and maintain soil moisture. However, they also serve as shelter for rats.

- It is important to make stone bunds very compact so that there is no open space for rats to hide between the stones. The stone structures should be anchored solidly on the ground to prevent rats from hiding underneath. Additionally, keep bunds as low and narrow as possible (less than 30 cm wide) to make it difficult for rats to burrow.
- Keep the length of stone bunds below 50 meters and keep the distance between parallel stone bunds at least 20 meters. Stone bunds can be used as ‘highways’ for rats moving between crop fields and even from crop fields to villages, especially in times when food is scarce. Rats like stone

bunds that are built long and close to each other, because they can easily move around and hide nearby. In order to make rats vulnerable and scared of predation, we need to build short and widely spaced stone bunds. This exposes rats to predator animals and makes them scared, therefore they will not feel safe to eat and will reduce breeding activity.



Figure 38: Bad example: low quality stone bunds invite rats to take shelter



Figure 39: Make the stone bund unfavourable for the rats to take shelter (in this example you should keep more distance between the bund and the crop)



Figure 40: Make the other stone bunds at sufficient distance from each other

- Finally, it is advisable to keep an empty

strip of land between the stone bunds and the crop whenever possible. The clear spaces expose rats to predators, and rats will therefore avoid moving across the open space. As a result, it reduces the chance of rats crossing the open space to reach a field or compound. This can be done near stone bunds, hedgerows, enclosures, houses, and stores.



Figure 41: Good example of making an open strip between the stone bund and the crop field

- The movement of rats on top of stone bunds can also be prevented by placing

thorny bushes or vetiver grasses (prickly/sharp) on the stone bunds. This will hinder the movement of rats and create an uncomfortable condition for them.

- Thorny bushes and strips of prickly/sharp grasses at the edge of a field or between rows of crops also hinder rat movement. It creates discomfort to rats by cutting into and injuring soft parts of their body. It is best to plant grass strips in a narrow line, discouraging their movement while not interfering with other crops in the field.



Figure 42: Grass strips in between crop fields

05. TAKE SPECIAL ACTIONS TO CONTROL AND KILL RATS

In addition, special measures can be taken to reduce the rat population.

We describe three additional measures to control and kill rats.

1. Use plant mixtures that will sicken or kill rodents. The Bureau of Agriculture of the Amhara Region, Mekelle University, and MetaMeta with farmers, watershed team members, and other partners are developing a rodenticide from plants: a so-called bio-rodenticide. A prototype bio-rodenticide is developed after lab and field testing. Testing and feedback from farmers will be obtained to fine-tune the product. The bio-rodenticide has important advantages: it is environmentally friendly, safe to use, and has long-term effectiveness. Training of local small-scale SMEs is underway to equip them to produce and see the bio-rodenticide in local markets. The Bureau of Agriculture will inform farmers in their region immediately when the product is ready for use.

Figure 43: Mixing the bio-rodenticide baits in the field



2. Promote natural predators.

Natural enemies of rats function as highly effective biological control agents. Natural enemies of rats include domestic cats, wild cats, mongoose, genet, owls, other avian predators, jackals, and snakes. This approach involves no killing, no chasing, protection of habitats, and active promotion of wildlife presence.

- As a farmer, you should actively promote and try to attract these predators to your fields. For example, installing artificial perches (poles of up to 3 m or more) in the fields helps to attract raptor birds such as owls, buzzards, and falcons. Do this

especially in open fields devoid of trees and shrubs. Erect the poles in such fields so that the birds sit on them and hunt down the rat population. In Ethiopian highlands, stone bunds, big stones, stone heaps, and boulders in and nearby crop fields are also used as perches by avian predators.



Figure 44: Owls and other raptor birds are very good at hunting for rats, it is important for these birds to have enough perch sites (poles, shrubs, trees) from where they can hunt for rats



Figure 45a: Example of a perch pole for a raptor bird, like owls, falcons and hawks, 45b: placement of owl nest to attract owls in agricultural fields

- Mongooses, jackals, and snakes are other common predators of rats occurring in agricultural landscapes. They are adaptable animals and can adjust easily to changing environments. Do not kill, scare away, or clear their habitats. Then these animals are capable of significantly reducing rat populations (and rat movements) in agricultural landscapes and villages.



Figure 46: Examples of predator animals to promote around the house and/or in the field

3. Install special “large traps” called Trap Barrier Systems

A community-based Trap-Barrier-System (TBS) is basically a system where rodents are trapped in a field that is planted shortly before the surrounding fields are planted. Rodents are drawn to the newly planted field from a wide area, where they are trapped all together. A small field is closed, and eight multiple-cage traps are installed on the fence; when rats enter the

fenced-off field through the hole openings, they are trapped. TBS is a new, environmentally friendly, physical rodent control method. The TBS method will be most effective when combined with the rodent control measures described in this manual.

- These 'barrier systems' sometimes incorporate traps or snares set across gaps or 'doorways' – hence the term Trap Barrier System or TBS.
- The Malaysian Agricultural Research and Development Institute developed the TBS concept.
- TBS technology is part of an integrated and community-based approach to rodent pest management.
- The Community Trap Barrier System method (CTBS) works best, and is most cost effective when adopted by an entire farming community.
- The CTBS is built from readily available materials and is simple to construct. However, for a TBS to work properly, these technical specifications should be met:

Materials:

- Plastic for barrier fence (stronger material is recommended as it will resist damage, withstand high winds and be reusable for several seasons)
- Bamboo or wooden stakes to support the barrier and traps

- String or wire to maintain an erect barrier
- Stapler and staples to affix plastic to string or wire
- Multiple capture live traps (such a trap can trap and capture multiple rats)

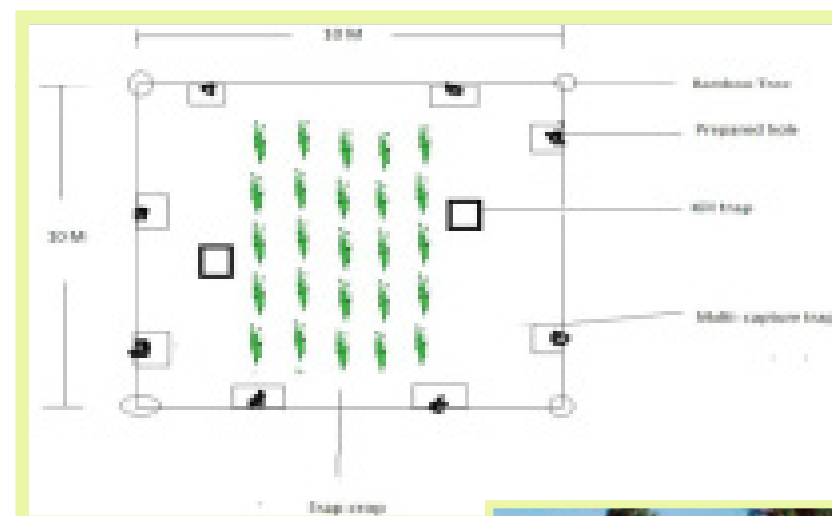


Figure 47: Construction of Trap Barrier System (Courtesy of Mulungu, L.S., Mchukya, B.M. and Mnyone, L.L. (2020). <https://www.intechopen.com/books/pests-control-and-acarology/trap-barrier-system-tbs-as-a-new-tool-for-rodent-pest-management-in-irrigated-rice-in-africa>)

Construction:

1. Allocating a piece of land of 10x10 meter (or more whenever possible,

up to 50 x 50 meters). This can be done by organising a group of farmers with clustered farms. The owners may make a deal about one or more farmers giving up a part of their land to construct the TBS.

2. Fence the allocated piece of land with plastic (tarp) that is dug into the soil. Use stakes and string/wire to erect and secure the fence around the plot, making sure that it is dug at least 10cm into the ground and stands at least 60 cm above the ground.
3. Dig or widen existing channels to construct an encircling moat (trench/ditch) at least half a meter wide.
4. Install at least two multiple capture traps along each side. These must be held tightly against the fence, with no holes or gaps that might allow rats to bypass the traps.
5. Construct earth mounds partway across the moat, leading to traps.
6. Place kill traps along the inside of the fence to catch any rats that have penetrated the barrier. Rats will get into the trap within the fenced area.
7. Within the CTBS, multiple-capture cage traps are installed inside the plastic fence and nearby holes that are purposefully made to allow rats to enter. Once rats have entered the CTBS, they have nowhere else to go than the traps that are set for them.
8. Plant the 'lure' crop 4 weeks before the surrounding crop is planted.

Inside this trap, for instance, malt barley is planted 4 weeks earlier than in the surrounding fields. This can be done by special watering of the part of the land that is allocated for the TBS.

9. The TBS will attract rats that survive the lean season and they will be trapped, diminishing rat numbers before the planting season starts.

Important!

- Studies in Asia suggest that a 50 x 50 m TBS can protect a 10-15 ha field if correctly installed.
- Undertake the TBS early enough! Ensure it is about four weeks prior to the normal planting time.

Maintenance:

- Empty the traps early each morning (dead rats left in the traps will discourage other rats from entering).
- Check the plastic barrier for holes each day and either repair these or install extra traps.
- Keep the moat free of grass (rats can use this to climb over the fence).
- Cover the traps with straw.
- If unable to check the CTBS for a few days, place straw in the entrance of the traps.



Figure 48: Example of TBS in rice fields with multiple capture traps

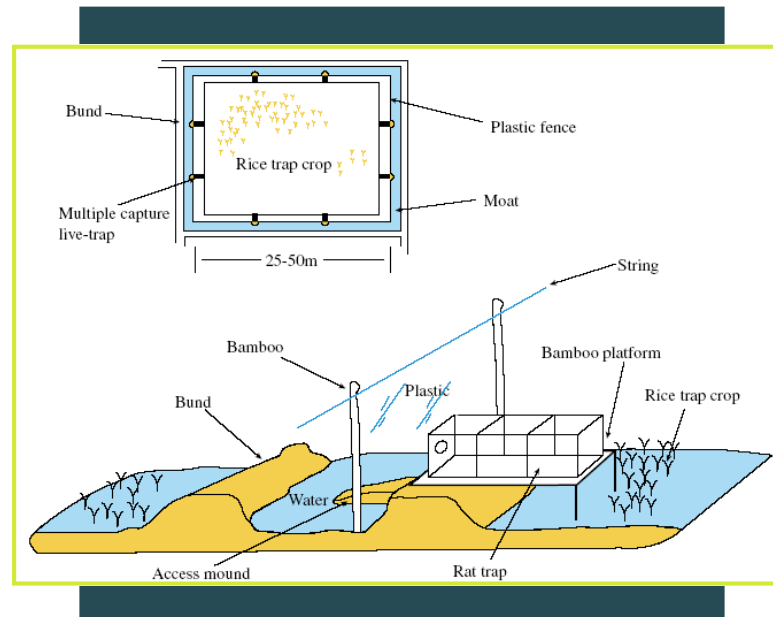


Figure 49: Schematic set-up of a Trap Barrier System in rice field



Figure 50: Installing the plastic fence of a Trap Barrier System with the cage inside at the fence; this TBS now awaits planting of traps crop and construction of moat around the outside perimeter.



Figure 51: Install multiple-capture cage inside the TBS to catch many rats in once

06. CHECKLIST FOR COMMUNITY RAT CONTROL MEASURES

Rat control Measure	Done where	Done by whom
Some control measures and cleanliness of houses and storage areas		
Keep houses and areas around houses clean		
Prevent rats from entering houses and storage areas		
Ensure safe storage of food in the house and grains in storage		
Prevent rats from getting access to household food and stored grain		
Get domestic cats or attract wild predators such as wild cats, mongooses, owls to scare away rats		
Place rat traps in select places		
Controlling the environment in the agricultural fields		
Adjust the cropping calendar of neighbouring (cluster) farm owners so that each activity is undertaken at a community (watershed) level to ensure that rats have fewer opportunities to move between fields and get access to food and shelter		
• Synchronize planting period		
• Synchronize weeding period		
• Synchronize harvesting period		
• Synchronized rat control period		

Measure	Done where	Done by whom
Destroy rat habitats by flooding, burning, or ploughing the land deeply to reach their shelter. Include such measures in the regular farming preparation activities.		
Build stone bunds in such a way that they are very compact and anchored in the soil. Make sure that there are no spaces in between for rats to hide.		
Keep stone bunds as short as possible (e.g., ~ 50 m) and leave considerable distance between matching stone bunds (e.g., > 20 m).		
Leave a strip of open land next to the bunds to expose rats for predators while moving between stone bunds and fields		
Place grass strips in and around the field		
Take special actions to control and kill rats		
Use bio-rodenticide		
Promote the establishment of rat predators around fields and storage areas (avoiding eliminating their habitats)		
Implement the Community Trap Barrier System (CTBS)		

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PRACTICAL GUIDELINE

