

# PRACTICAL GUIDELINE



## Effectively Controlling Rats with Ecological Methods



Rijksdienst voor Ondernemend  
Nederland



**META**  
**META**



Green Rodent Control

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## 01. INTRODUCTION

This brochure describes how to reduce the problems with rats, using a number of activities that have no risk to humans, domestic animals and the environment.

Rats have always created damage and are the cause of unhealthy living conditions. Rats are responsible for the considerable loss of crops in the field and of stored grains. They contaminate food. Many human diseases and illnesses of unknown origin are associated with rats. Rats damage property in the house. The presence of rats appears to have increased in recent years.



Figure 1: Rat damages and contaminates food by excreta in storage



Figure 2: Rat damage, eats and contaminates cooked foods in the house

In Amhara Region of Ethiopia there are different types of rats. Some rats stay around the house, especially around stores. Such rats, because of their close presence to humans, not only damage crops and properties, but also have a serious effect on health as they 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 number, rats do considerable damage to the standing crop. They may sometimes destroy it completely.



Figure 3: damaged crops by rats in the field



Figure 4: Rat damage in grazing land



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



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



Here are some rat facts:



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



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



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



Rats usually move within 30-100 metres from their shelter.

This manual firstly describes the basics of how to control rats in chapter 2. **There are two essential requirements:**

1. We need to do **perfect timing** of rat control, before rats become abundant.
2. We need to **work together**. It is a community effort to control rats.

Further 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 to be done:**

- Chapter 3: Controlling 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.

The cost of all these measures is easily earned back from the crops that are not lost and the diseases that are prevented. The chapters 2-5 describe what can be done, with pictures showing examples. Chapter 6 is a check-list 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 an absolute need to work together as a community.

There are activities that can be done in individual households and activities that require cooperation between different families. What is important is to do joint planning. We need to undertake community campaigns aimed to greatly reduce the rat population. To be effective it is important to understand the behaviour of the rats: when they multiply, how they feed, where they hide, how they move.

In order to ensure everybody to join the campaigns, as a community you can agree on bylaws regarding collective rat control. This ensures all households to join and to do their share, and will greatly help to see the big impact on reducing the amount of rodents. It is advised to do frequent campaigns in the time when the rats are few, the grass is low and the rains are little (pre-season). At this time the work is most effective.

### 2. Control rats when they are not yet abundant.

Many rat controlling measures are most effective when there are few. In Amhara Highlands the period June to August is most suitable. The total number of rats is small in this season, because burrows are flooded and there is much land preparation. Any rat killed in such seasons will prevent many rats from being born. Control measures which are late will yield very little result.

**So control measures need to be timed perfectly, to ensure that rat numbers are reduced before they start breeding.**

In other parts of the country the dry season is when rats are few. Before the rains have come there is not much food in the fields. Therefore rats do not start reproducing yet and they are weaker. In the more arid parts of Ethiopia this dry season before you start planting crops, is the best time to control rats.

In addition one can spread different rat control measures over time. When rats retreat to the homesteads, crop fields or ridges nearby, for example during heavy rainfall, you can focus on taking rat control measures in those specific areas. So when rats move away from grazing lands to the homes, you start with trapping or killing rats at the homes. This means that rats do not have any safe place, but are continuously chased.



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

### 03. CONTROLLING 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 food and contaminate it. Rats create unrest in the house. In and around the compound and storage you should try to keep rats away at all time. Do not give them a reason to come near, do not let them smell food or provide a nice shelter. Here are 5 measures you can take.

**1. Cleanliness:** In managing rats in and around the house the first important requirement is to keep the house clean, and the areas around the house (garden, grain storage areas, fences, hedgerows, etc.). There should be no open left-over food, no open pile of garbage, no open stored product or open storage. These are food sources and provide shelters for rats. They should be frequently

eliminated and avoided whenever possible.



Figure 13: Example of a dirty surrounding

**2. No rat shelter:** It is important to make it difficult for rats to enter the house. We should close all entry holes to the house, cracks in the wall and drainage pipes. It also useful to seal the corner point of a house with concrete, this make it difficult for rats to enter the house. When you notice a rat in the compound, immediately plug (block or fill) a rat entry hole or hiding place with solid material.

In general, it is good to interrupt the movement of rats – for instance by having prickly plants or using rotational disks on ropes. This confines the areas where rats can move.



Figure 14: example of clean houses with concrete at the bottom part to prevent rats to enter



Figure 15: hermetic storage bags

**3. Good storage structures:** The third requirement is to have proper storage for the grains and other harvested items. Rats should not be able to get access to food in the storage. We can make it impossible for rats to get into stores by having the store on poles and have pins on the poles to avoid that rats will climb up. We can also put disks on the poles or use barbed wire.

For storage it is recommended to use hermetic bags. Hermetic bags are poly ethylene storage bags with an additional liner in side. When these are tightly closed, the probability that rats gnaw through the bags is lower than that of the normal polyethylene grain storage bags currently in use in Ethiopia. Rats can also not smell what is inside the bag as the bag is airtight. The hermetic bags prove to be very effective against storage pests such as weevils and also mould aflatoxins. Use the hermetic bags both in storage and in the house.



Figure 17: Good storage structure raised on poles

In case of larger storage, it is recommended to make special safe containers from corrugated iron sheets on poles. Such storage containers have a special opening to take out the grain when needed. The corrugated iron prevents rats from gnawing through. 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. You can also use metal barrels as storage.

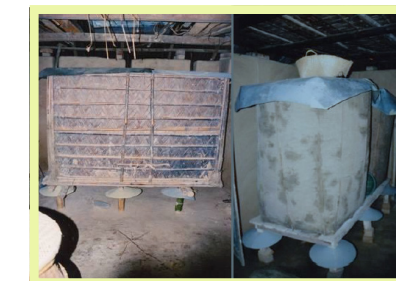


Figure 16: A barn in the house painted with cow dung which made from bamboo and wood and has round barriers on the legs/posts to control rat from climbing



Figure 18: example of rotational disk at the poles to prevent rats to climb up

**4. Keep predator animals:** Also, it is useful to cats and dogs. Cats eat rats. Moreover, the smell of these animals – especially of female cats - scares rats and makes them run away. The presence of cats, dogs, mongoose, genet, owls around a household compound can make the rats scared. And will therefore keep the rats away from the compound.

Figure 19: 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).

**5. Place traps:** The final method to control rats is to place traps, in particular at places where rats are known to move, traps can be placed. There are different kinds of traps: spring traps, sticky traps, cage traps or having rats fall in buckets of water. You can use locally made traps or purchase traps at the local market.



Figure 20: keeping cats around the house is a good method against rats



Figure 21: owls are a very good predator bird to rats



Figure 22: cage trap to use around the house



Figure 23 spring trap

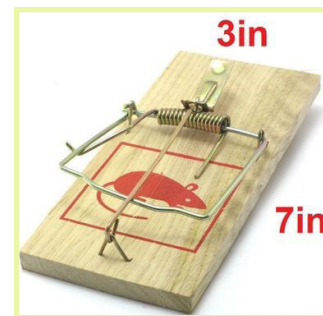


Figure 24 spring trap



Figure 25: sticky trap

**EXAMPLE:**

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

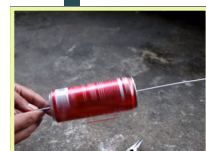
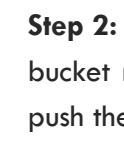


Figure 26: step 1

**How to do it:**

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



**Step 2:** Drill holes in two sides of the bucket near the top where you can push the steel wire through.



**Step 3:** Set up your ramp.

**Step 4:** Place baits on the ramp and the rolling mechanism.



Figure 27: step 1

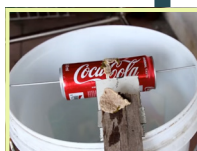


Figure 29: step 4

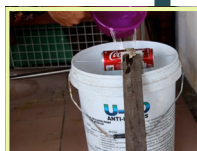


Figure 30: step 5



Figure 31: step 5

**Step 5:** Fill the bucket with water.

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

## 04. CONTROLLING THE ENVIRONMENT IN THE AGRICULTURAL FIELDS

Rats are a major threat to good crops and fodder. It appears that the number of rats in the fields is increasing. The reasons are that there are more crops on the land for a longer period of time. New crop varieties such as malt barley are introduced to the system. As a result, there is more food to eat for the rats now than in the past. Perennial plants introduced as part of agroforestry practices are also adding biomass (e.g. seeds and foliage for rodent feed) and shelter to the system. This creates a nice habitat for rats such as the *Mastomys* species, who like these types of habitats.

Another reason is that there are more places where rats can take shelter, for instance in stone structures that are not well built. In some areas moreover natural enemies of the rats have disappeared due to killing or destruction of their habitats. A good example is the absence of trees and shrubs up on which birds are perched.

This is all the more reason to control rats by managing the agricultural environment in the best way possible. Here we describe 4 main measures to scare off rats, keep rats off your fields and diminish their numbers.



**1. The first measure is to improve the cultivation practices in a way that gives fewer opportunities for the rats.**

- This can be done by synchronized cropping within the community. If all people with neighbouring fields, plant and harvest at the same time, rats will not be able to move from one field to the other during planting and harvest. In such case the lean period for rats will be longer, therefore rats will not have enough food and their population will diminish. This will also be a very good period to kill rats by special measures.
- Another cultivation method that can help to reduce the occurrence of rats in the field is inter-cropping. By alternating the rows of the crops, rats will find it less attractive to move around the fields as they cannot hide easily. Also planting rows of crops which are not liked by rats could help in keeping rats away from the field.



Figure 32: planting in rows to prevent rats to come in the field



Figure 33: example of inter-cropping from Kenya, rows of maize and beans in between each other



Figure 34: planting a different crop in a line to prevent rats to come in the field

- Another method is to leave your fields fallow for a longer period of time. This

makes that the breeding seasons of rats are reduced. Rats highly depend on available food and the stage of the crop 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 you would grow crops two or three times a year, this would mean the rats can also breed two or three times a year. Keeping your field fallow automatically ensures that rats cannot breed as much, so their numbers stay reduced. However practicing this method is not an easy task where land distribution is very small. Besides unless practiced on clustered farms, fallowing small tracts of land will put rat population pressure on the next land. It is advised to practice fallowing only when it is organized as a community.

- Finally, controlled minimum grazing should be considered. 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. The rats have no longer competition from the livestock and benefit from the more abundant grasses. To reduce the number of rats controlled grazing could be introduced – 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 low at the ground, this can be at the start of the rains or after cutting. This will destroy rats' shelter by trampling. In this way a balance between the watershed protection and rat control can be achieved.

**2. A second measure is to destroy the habitats of rats and ensure they have no place to hide.**

- Some rats have their nest made from grasses, rubbish, and crop leftovers in the fields. This concerns especially those rats that are active during day time. By having livestock graze on these fields

before planting for the new season, the rat nests will be destroyed. For example with 'stubble grazing' where cattle is taken to the field just after the harvest to make use of the remaining crop leftovers. The same thing can be done before the new planting starts, in this case you will destroy the rat shelters as part of the field cleaning.

- The same happens (i.e., rat nests will be destroyed) when we clean the crop fields and burn the rubbish. Such burning rubbish in the fields can best be done just before planting for the new season. This is to ensure that the field is clean and empty of potential rat shelter before the crops are planted.
- Other rats make burrows and tunnels in the ground. This is especially the rat species that is active at night. In irrigated areas we can flood these burrows and tunnels

with water to kill the rats inside. Another method is to put smoke in the tunnels.

- By ploughing these lands deep, the hiding places will be destroyed. In other cases we can also search the hiding places and destroy them. All these measures are most effective during the lean season when rats are at their weakest.

**3. A third measure is to improve the quality of soil and water conservation structures.**

These structures are useful to improve the quality of the land but they also serve as shelter for the rats.

- It is important to make the stone structures very compact and tight, so that there is no open space for rats to hide. The stone structures should be anchored solidly on the ground, to avoid that rats can hide underneath.
- Stone bunds can also be used as 'highways'

for the rats moving between crop fields and even from crop fields to villages, especially when food is scarce. It is important to keep the stone bunds relatively short, not more than 50 meters in length.



Figure 35: bad example: low quality stone bunds invite rats to take shelter



Figure 36: 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 37: make the other stone bunds at sufficient distance from each other

- The movement of rats on top of the stone bunds can also be prevented by placing thorny bushes on the stone bunds or planting

vetiver grass on them. This will make rats very uncomfortable.

- In general try to avoid stone bunds and build stone faced soil bunds. So to have a very compact soil bund which is reinforced with stones on one side. This reduces the space for rats to hide.
- Avoid long terraces if conditions allow. It is recommended to make your terrace no longer than 30 meter, at the horizontal interval. Sometimes this may be difficult, especially for graded terraces.
- Add grass strips of for example vetiver grass and other types at the edge of the field or in between rows of crops. This will discourage rats to move in the field. The width of vetiver grass strip could be narrow so that it does not interfere ploughing and requires frequent management.



Figure 38: grass strips in between crop fields

#### 4. A fourth measure is to keep adequate distance between stone bunds

- The distance between stone bunds, based on the vertical interval should be at least ~ 10-15 meters. Rats like stone bunds that are built close to each other, because they can

easily move and hide. Therefore we need to make the rats vulnerable and scared. By forcing the rats into open space predators can hunt rats. Building stone bunds far apart means that rats cannot easily find a hiding place, and that they cannot easily move, because they feel the threat of predators.

- Finally, if there are stone bunds it is always good to keep an empty strip of land between the bunds and the crop. Rats avoid clear spaces. You can keep a strip of two meters clear of vegetation. This can be near stone bunds, hedgerows, enclosures, houses and stores. The clear spaces make that rats are exposed to birds, snakes and other predators. Making rats scared and reducing the chance that rats will cross the open space to a field or compound.



Figure 39: good example of making an open strip between the stone bund and the crop field



## 05. TAKE SPECIAL ACTIONS TO CONTROL AND KILL RATS

In addition, special measures can be taken to reduce the rat population. We describe three main measures to control and kill rats.

**1. The first effective method is to use plant mixtures that will sicken or kill rodents.** The Bureau of Agriculture of the Amhara Region and MetaMeta with farmers, watershed team members and other partners are developing a rodenticide based on plants, so-called bio-rodenticide. They are currently testing it and training local entrepreneurs to prepare and sell a bio-rodenticide in the local market. The advantages are that the bio-rodenticide is friendly to humans and the environment, and that it effectively controls rats. At this moment it is in development, the Bureau of Agriculture will inform farmers immediately when the product is ready for use.



Figure 40: mixing the bio-rodenticide baits in the field



**2. The second additional measure is to promote natural predators.**

Natural enemies of rats function as effective biological control agents. Natural enemies of rats are: domestic cats, wild cats, mongoose, genet, owl, other birds of prey, jackal and snakes.

- As a farmer you should actively promote and attract these predator animals. For example by the use of artificial perches (poles of up to 3 m or more) to attract raptor birds such as owl, buzzards, and falcons. Do this especially in areas without trees and shrubs for such use. Erect the poles in the field to



Figure 41: examples of predator animals to promote around the house and/or in the field

attract the birds to sit on them and hunt down the rat population. In Ethiopian highlands big stone, stone heaps and boulders nearby crop fields have been used as perches by bird predators.

- Mongooses, jackals and snakes are very common predators of small mammals, like rats, in agricultural landscapes. They are adaptable animals and can adapt easily to changing environments. If these animals are kept alive and not scared away from fields, they are useful tools to reduce rat numbers.
- All these types of predator animals are very useful in controlling rat populations. Their effectiveness has been proven in multiple areas. Attracting these predator animals requires a different approach: no killing, no chasing them away, preventing destruction of their habitats in the landscape and actively promote their habitat, so to give birds options to perch for example.

**3. Finally, a special “large traps” can be made.**

- 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.
- They develop TBS technology as the foundation of an integrated and community-based approach to rodent pest management.
- The Community Trap Barrier System method or CTBS which 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 erect. However, for a TBS to work properly, these technical specifications should be met:

**Materials:**

- plastic for barrier fence (stronger material 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 fix plastic to string or wire;
- multiple capture live-traps; and
- kill traps for use within the 'lure' crop.

**Construction:**

- This is done by making so called community-based trap barrier systems (CTBS) in crop fields. This is done by the following steps:
1. Allocating a piece of land of 10 by 10 meter (or more whenever possible, up to 50 by 50 meter). This can be done by organising group of farmers having clustered farms. The owners may make a deal about the trade-off incurred by the individual willing to let part his land for 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 at least half a metre 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 in into the trap crop within the fenced area. Within the CTBS, multiple-capture cage traps are installed inside the plastic fence, 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; and
7. plant the lure crop 2 to 3 weeks before the surrounding crop is planted. Inside this trap for instance malt barley is planted much earlier than in the surrounding fields. This can be done by special watering of this part of land which is allocated for the TBS. So then, the TBS will attract rats who survived the lean season.

- Studies in Asia suggest that a 50 x 50 m TBS can protect 10-15 ha field if correctly installed.
- Undertake the TBS early enough! Ensure it is about 4 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 and provide food (e.g. cassava) to keep rats in good condition; and
- if unable to check the CTBS for a few days, place straw in the entrance of the traps.

**Integration opportunities/requirements**

The CTBS method will be most effective when combined with the following rodent control measures and practices:

- keep bunds as low and narrow as possible (less than 30 cm wide) to

- make it difficult for rats to burrow;
- search for rat burrows during the tillering stage and take steps to eradicate pest rodents (digging, fumigation, kill-trapping);
- keep major irrigation channels free of overgrowth and check regularly for evidence of rodent infestation (burrows, tracks and runways);
- keep irrigation banks less than 30 cm wide to make it difficult for rats to build nests;
- conduct community campaigns using local methods to control rats within 30 days of planting the crop (before rat breed); these community actions should focus on village gardens, main irrigation channels, and roadsides;
- clean up cut straw and other debris around fields or spread thinly;
- clean up any grain spills at harvest; and
- synchronise planting of crops – within 2 weeks of each other.



Figure 42: the set-up of a Trap Barrier System

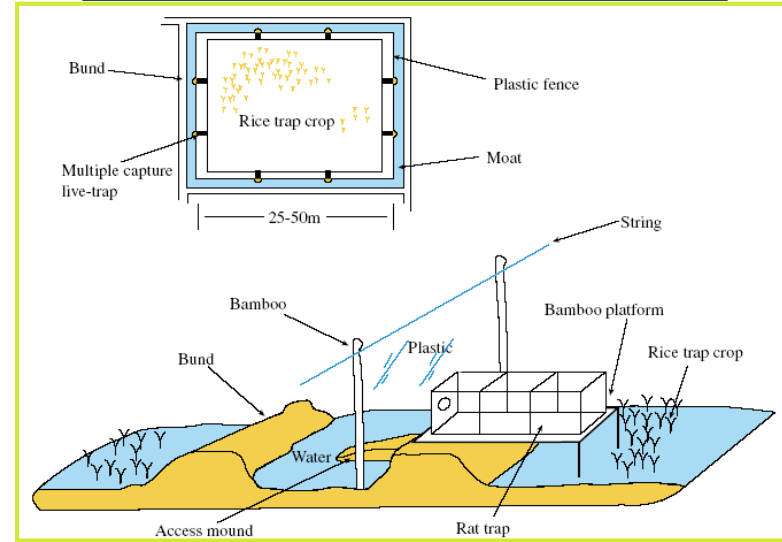


Figure 43: schematic set-up of a Trap Barrier System



Figure 44: 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 45: install multiple-capture cage inside the TBS to catch many rats in once

## 06. CHECKLIST FOR COMMUNITY RAT CONTROL

Measure	Done where	Done by whom
<b>Controlling the cleanliness and storage around the houses</b>		
Keep the house and the areas around the house clean		
Avoid that rats enter into the house and the food storage		
Safe storage for grains and foods in the house		
Prevent rats from moving easily around the house		
Use cats or mongoose to scare away rats		
Place rat traps in selected places		
<b>Controlling the environment in the agricultural fields</b>		
Adjust cropping systems so that rats have less opportunities to feed		
• Synchronized planting		
• Long fallows		
• Intercropping		
• Controlled grazing		

Measure	Done where	Done by whom
Destroy rat habitats by flooding, burning or ploughing the land where they take shelter		
Make stone bunds very compact and anchored in the soil		
Make stone bunds not longer than ~ 50 meters and have a distance of at least ~10-15 meters between rows of stone bunds.		
Keep an open strip of land next to the stone bund		
Have grass strips in and around the field		
<b>Take special actions to control and kill rats</b>		
Use bio-rodenticide		
Promote the population of predator animals		
Use large field traps		

# PRACTICAL GUIDELINE

