



Food and Agriculture Organization
of the United Nations

INTEGRATED RAT MANAGEMENT



**IPM National Programme
Vietnam**

**Plant Protection Department
Food and Agriculture Organization**

*supported by the government of Australia
2010 (rev.)*

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Introduction

In the last two years, rats have been an increasing problem for farmers in Vietnam. This is visible when travelling around in Vietnam. In many fields plastic rat fences are raised, which was not seen a couple of years ago. In discussion with farmers, rats are mentioned as a problem, which was not the case a while ago. In planning meetings held with IPM farmer groups in over 30 villages in the different regions in Vietnam, groups expressed intention and made plans to address the rat problem in their village. Several research institutes have been working on rat management more intensively in the last few years. The reasons they give for an increase of rat populations is the intensification of agriculture (more crops per year) combined with destruction of natural habitats for rats.

The National IPM programme was asked by the MARD to assist in developing integrated rat management training for farmers. To do this, the programme organized a workshop on rat management to design studies and exercises that farmer groups can carry out in order to understand rats better, and develop methods on how farmer groups can organize their communities to manage rats. The workshop was participated in by several researchers from the National Institute of Plant Protection (NIPP), Vietnam Institute of Agriculture and Science (VASI), Southern Institute of Agriculture and Science (SIAS), Hanoi National University and Ministry of Health. IPM trainers and farmers from several provinces also participated. (List of workshop participants are annexed.)

This Field Guide Exercises on Rats is one of the outputs of the workshop. Field Guide Exercises from Indonesia have been adapted and incorporated in this document. During the same workshop, the researchers worked on putting together an Ecological Field Guide which provides basic technical information for trainers who will work with farmer groups in carrying out rat management activities.

The intention of carrying out field exercises with farmers' groups is for them to initiate the development and implementation of a community action plan on rat management. Using the exercises solely for training purposes might not lead to a successful rat management program for the village. Rat management is a social/community problem which must have the participation of everyone in the village. Community action is the key to rat management.

Field Study

Integrated Rat Management

Introduction:

Rats are not a new problem in agriculture. In recent years, however, there has been a population explosion of rats in Vietnam for various reasons. Many programmes have been used to attempt to control rats such as rat drives, rat trapping, rat tail campaigns and burrow destruction. However, long-term rat control requires sustained interests and an understanding of the ways rats live. The focus of rat control must be on reducing yield losses.

Rat control is a social/community concern which should be implemented continuously throughout the rice season and must have the participation of everyone in the farmer group. Integrated rat management includes prevention methods (reducing habitat and cover), mechanical methods (direct killing in rat drives or traps), biological control (enhancing predators) and chemical baiting methods. All these methods should be used together. When poisons should be used, they should be used with care, and the community should be aware of the effect of these poisons on animals and children. Care in handling poisons is necessary to avoid self-poisoning. The important point is that community action is the key to rat control.

Objectives:

- Monitor activity level and rat population dynamics in different times of the season in different ecological zones
- Use the information to work out suitable management methods for rats
- Calculate costs for integrated rat management

Materials:

Area for study: Five fields in different ecological zones (rice field at edge of village; early transplanted rice; late transplanted rice; large edge of ditch; secondary crop like potato or sweet potato)

Other materials: Tracking tiles, small plates and paddy mounds, live traps and baiting materials such as sweet potato, materials for digging burrows like spade and hoe, pens and paper to record observations/results

Methods:

- * Select five fields of different ecological zones and assign one each per group to take observations from:
 - ⇒ rice field at edge of village
 - ⇒ early transplanted rice
 - ⇒ late transplanted rice
 - ⇒ large edge of ditch
 - ⇒ secondary crop field
- * Follow procedures for setting up observation tools below. The observation tool/s to be used in each ecological area shall be determined by each group. If needed, set up observation tools in a bigger area where the integrated rat monitoring field is located.
- * Weekly, do agroecosystem analysis with special attention to rats using results of observations and rat damage assessment as basis for decision making . Details provided below.

Results:

At the end of the season:

1. Plot number of tillers/hills damaged by rats
2. Plot rat population in each of the ecological areas
3. Take crop cuts and plot yield for each ecological area
4. Calculate costs for integrated rat management for each ecological area

Questions:

1. How were the yields in each of the fields?
2. Which of the areas had more rats? Why? Describe the conditions and surroundings of the areas.
3. In which area and at what month did rats cause the most serious damage? What was the damage caused by rats? What could be the reason for this?
4. Based on the activity index and the crop development stage, what management methods are suitable to the conditions of each area and can be applied by farmers?
5. What can farmers do together about rats?

How to set up tracking tiles

Materials: Steel pieces (wood and carton can also be used) 20 X 20 cm; apply a thin layer of cow fat on its surface to keep rats' footprints.

Procedure: Set up 30 - 100 pieces of tracking tiles for 3 nights in succession on rice bunds surrounding the IRM plot and the FP plot. Do this twice a month. Set up one piece between distances of 10 meters each. In the mornings, count the number of footprints and calculate activity index as follows:

$$\text{Rat activity index (\% tiles with footprints)} = \frac{\text{\# of tiles with footprints}}{\text{Total \# of tiles}} \times 100$$

- < 20% = rat activity is low
- 20 - 40% = rat activity is moderate
- > 40% = rat activity is high

Note: Applying mud on bunds can also be done using the same dimension of 20 X 20 cm. Cover the areas on the bund with mud to observe but avoid rain and apply fresh mud often to prevent from drying.

How to set up rice mound baits

Material: paddy rice (about 10 gms per mound)

Procedure: Set up 30 - 100 paddy mounds for 3 nights in succession on rice bunds surrounding the IRM plot and FP plot. Do this twice a month. Set up one paddy mound between distances of 10 meters each. In the mornings, count the number of mounds eaten from and calculate activity index as follows:

$$\text{Rat activity index (\% of eaten mounds)} = \frac{\text{\# mounds eaten from}}{\text{Total mounds}} \times 100$$

- < 20% = rat activity is low
- 20 - 40 % = rat activity is moderate
- > 40% = rat activity is high

How to count burrows

Procedure: While visit fields or taking care of rice fields everyday keep a look out for, count and check rat burrows/nest to estimate relative rat populations.

How to recognise burrows with rats: Newly dug burrows have new soil. There are rat footprints at the entrance, there is mud and rat droppings. You can use straw to block the entrance at late afternoon. Next morning, if the straw has been pulled out (not in the same place) this indicates that the burrow has rats.

To calculate the burrow index, divide the number of rat burrows counted by the total number of meters observed of field bunds or canal edges. If the burrow index/meter is high, rat population is high and vice versa.

How to set up live traps and snap traps

Material: Any kind of trap which can catch live rats (live traps); any kind of snap trap (traps which kill rats immediately); baits like sweet potato, broiled crab, dried fish, etc.

Procedure: Set up 30 live traps/snap traps for 3 nights in succession on rice bunds surrounding the IRM plot and FP plot. Do this twice a month. Set up one trap between distances of 10 meters each. In the mornings, evaluate effectivity of live traps (live traps with rats inside and without rats but that have traces of blood or some hairs on it are considered traps with rats). Calculate abundance index of rats as follows:

$$\text{Abundance index of rats} = \frac{\text{\# of traps with rats}}{\text{Total of traps}} \times 100$$

Using Dr. Dao Van Tien's classification, classify rats in the fields and calculate abundance index of each rat species as follows:

$$\text{Abundance index of rat species} = \frac{\text{\# of traps with rats of that species}}{\text{Total of traps}} \times 100$$

The rat population dynamics in general and for each species can be inferred from the abundance index. A high abundance index means a high rat population and vice versa.

- < 3% = rat population is low
- 3 - 5% = rat population is moderate
- > 5% = rat population is high

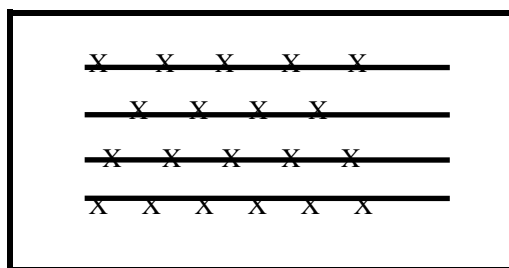
Note: For snap traps, use the same procedure. Compute for abundance index of rats and abundance index per specie using the same formula. Also use the above interpretation for rat population dynamics.

Rat Damage Assessment

Rats reduce yields of plants by direct feeding on the tillers and on the young rice grains. In newly planted fields rats can remove new transplants resulting in missing hills. In older fields, the rats cut or bend the tillers to feed on the top foliate or panicle. During the booting stage, rats will feed through the sheath on the young panicle. Near maturity, the rats cut and bend tillers to feed on the grains. A cut tiller is usually cut at a 45° angle with a small part of tiller still sticking up from the cut tiller. From the edge of the field, the damage may not be readily seen until a large number of tillers are already cut. Newly cut and dying tillers may even look like a deadhart or diseased tiller from the bund. It is very important for monitoring to enter the field and examine the field looking for cut tillers.

Rat damage in the rice fields is not uniform. Rat damage is often more serious in fields that are near the village edge, hills, or on edges of big canals.

Evaluate rat damage in the rice fields using the method developed by IRRI. Select a typical site representative of the area damaged by rat. Observe 10 rows distributed throughout the field. For each row, observe 10 hills at random.



On each hill count the total number of uncut tillers and the number of tillers which have been cut. A cut tiller is usually with a tuft of plant material. To determine the percent cut tillers use the following formula:

$$\begin{aligned} \text{Total number of tiller} &= \text{total uncut tillers} + \text{total cut tillers} \\ \% \text{ cut tillers} &= \text{total number of cut tillers} / \text{total number of tillers} \times 100 \end{aligned}$$

To determine rat damage use the following scale.

Development stage	Rat damage (%)		
	Slight	Moderate	Serious
Tillering stage	5 - 10%	> 10 - 20%	> 20%
Booting stage	2 - 5%	> 5 - 10%	> 10%

Ecosystem Analysis

Introduction:

Decision making in IPM requires an analysis of the ecosystem. We will use our background on sampling, thresholds and interaction between components of the ecosystem to facilitate discussion and decision making. This Ecosystem Analysis will be a special one because it will give emphasis on Rats. It will be a special one because to collect as much information on rats and to get the community involved, weekly observation will be done in five different ecological areas in the village. This information will be used to discuss whether or not there is a need to control rats. If there is a need we will identify the most suitable methods for IRM and discuss how to get other farmers involved to implement the decision.

The Rat Ecosystem Analysis will be done weekly, following monitoring activities. The results of field observations will be drawn on a large piece of paper using specific rules given below. The drawing will then be used for discussion. There are questions designed for discussion during each stage of the crop. After discussion it is important that the results are presented to other groups. Everyone should be involved in the observations, drawing, discussion and presentation. Changing the person who gives the presentation each week is important to keep everyone involved.

Objective:

The goal of the activity is to analyze the field situation by observation, drawing, and discussion. At the end of the activity, the group should have made a decision about any actions required in the field and the area in which the field is located.

Time required:

120 minutes

Materials (per group):

One piece notebook paper, one poster paper/newspaper, pencil and drawing crayons

Methods:

1. If there are twenty-five farmers, divide them into groups of five and assign an integrated rat management area each for observation. The fields should be in different ecological areas such as:

- rice field at edge of village
- early transplanted rice
- late transplanted rice
- large edge of ditch
- secondary crop field

Each group should use the same area each week to make observations.

1. Each week, a total of one hundred (100) plants for each plot should be observed. This means, each group should choose ten rows at random in the area assigned to them for IRM. Observe ten (10) plants at random per row and record the following:

- * Plants: Determine density by counting total plants/hills per meter square.

- * Rat damage: Count the total number of uncut tillers and the number of tillers which have been cut. A cut is usually with a tuft of plant material. To determine the percent cut tillers use the formula in the box below. To determine rat damage use the scale in the box below.

Total number of tiller = total uncut tillers + total cut tillers			
% cut tillers = total number of cut tillers/total number of tillers X 100			
Development stage	Rat damage (%)		
	Slight	Moderate	Serious
Tillering stage	5 - 10%	> 10 - 20%	>20%
Booting stage	2 - 5%	> 5 - 10%	>10%

- * Rat population: Refer to observation methods in boxes in earlier section, i.e, tracking tiles, paddy mounds, live traps and snap traps, number of burrow/meter.
 - * Other observations on crop development, insect pests, natural enemies, disease, weeds. Also observations on the weather, water situation, fertilizer requirements, etc.
3. Find a shady place to sit as a group. Each group should sit together in a circle, with pencils, crayons, data from the IRM field, and the drawing of the ecosystem of the previous week.

Now make a drawing on the large piece of paper. Everyone should be involved in the drawing. Make a drawing for each plot observed. There are several rules for drawing as follows:

- * Make a map of the field observed and its surrounding areas, e.g. including bunds, bushes, hillocks, etc.
- * Using drawings, indicate where in the IRM field the different observation tools were set up. Use a different symbol for each tool, e.g., tracking tiles, paddy mounds, live/snap traps. Color tools which indicate rat presence/populations, e.g., tiles with footprints, paddy mounds eaten from, live/snap traps with rats or rat hairs.
- * Draw also the location of burrows and indicate by color whether they are live, dead or new.
- * Indicate on the map what rat management activities were held in the last week.
- * Indicate rat damage by the % cut tillers and whether this is slight, moderate or serious.

- * If the ecosystem analysis is done after taking observations on rat populations also indicate:
 - ⇒ rat activity index (% tiles with footprints)
 - ⇒ rat activity index (% of mounds eaten from)
 - ⇒ abundance index of rats and rat species
 - ⇒ number of rat burrows/meter.

 - * Draw observations on other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds.
4. Keep your drawings for comparison with weeks later in the season.
 5. Now discuss the questions listed below for each stage of the plant observed. Using the information from the field, what would be the group's decision for rats in their ecological field? What would the decision be for the larger area where their IRM field is located?
 6. Each group should make a presentation of their field observations, drawing, discussions and summary. A different person should make the presentation each week.

Ecosystem Analysis Questions

Seedling stage

(3-30 days after seeding)

1. Were any rats or signs of rats seen? Were they males? Females? Young? Old? Pregnant? What should be done about them? Were plants damaged by rats? How many? What was the level of damage? What should be done about damaged plants? Can plants recover at this stage?
2. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
3. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? How would you involve other farmers?
4. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
5. What is the management plan for the next week?

Early Vegetative Stage

(4-10 days after transplanting)

1. Were any rats or signs of rats seen? Were they males? Females? Young? Old? Pregnant? What should be done about them? Were plants damaged by rats? How many? What was the level of damage? What should be done about damaged plants? Can plants recover at this stage?
2. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
3. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? How would you involve other farmers?
4. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
5. Were weeds present? What is the average density of weeds? How does the presence of weeds influence rat populations?
6. How does the condition of the field compare with the previous week?
7. What is the management plan for the next week?

Mid-vegetative Stage

(2-4 weeks after transplanting)

1. Were any rats or signs of rats seen? Were they males? Females? Young? Old? Pregnant? What should be done about them?
2. Were plants damaged by rats? How many? What was the level of damage? What should be done about damaged plants? Can plants recover at this stage?
3. What about damage caused by rats? Is it in patches in the field? Or only some plants per hill?
4. Should a rat drive be organized in the village? Should baiting start? What kind of baits and how many bait stations should be used per hectare?
5. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
6. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? How would you involve other farmers?
7. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
8. What is the condition of other fields in the area? Do the other fields influence your fields?
9. How does the condition of the field compare with the previous week?
10. What is the management plan for next week?

Late Vegetative and Maximum Tillering

(5-7 weeks after transplanting)

1. How many tillers are on the plant? If there was earlier damage of rats, was there a difference in the number of healthy tillers between damaged and non-damaged hills? What will happen if one plant in the hill is less vigorous? Do the other plants in the hill compensate for the one plant?
2. If there was earlier damage caused by rats, is the rice recovering from it? What was the level of damage? Did you have to replant in spots? How is the plant development in these spots compared to the rest of the field? Is there any new damage to the rice crop?
3. Were any rats or signs of rats seen? Were they males? Females? Young? Old? Pregnant? What should be done about them? What will happen next season if nothing is done now?
4. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
5. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? Does your community have a good action plan for rats? How would you involve other farmers?
6. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
7. What is your summary for this week? What is the management plan for next week?

Primordia

1. Were any rats or signs of rats seen? Were they males? Females? Young? Old? Pregnant? What should be done about them?
2. Were plants damaged by rats? How many? What was the level of damage? What will happen next season if nothing is done about rats now?
3. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
4. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? Does your community have a good action plan for rats? What can be done in the community to control rats? How would you involve other farmers?
5. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
6. What do you expect to happen in the next week? What is your summary of important actions to be taken?

Booting stage (panicle development)

1. Were any rats or signs of rats seen? Were they males? Females? Young? Old? Pregnant? What does it mean if there are more male rats in the field? Where are the females? What should be done about them?
2. Were plants damaged by rats? How many? What was the level of damage? What will happen next season if nothing is done about rats now?
3. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
4. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? Does your community have a good action plan for rats? What can be done in the community to control rats? How would you involve other farmers?
5. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
6. How does the condition of the field compare with the previous week?
7. What do you expect will happen in the next week? What is the management plan for next week?

Flowering and Milky Stage (35 to 30 days before harvest)

1. How are rats? Were the rats seen males? Females? Young? Old? Pregnant? What does it mean if there are more male rats in the field? Where are the females? What should be done about them?
2. Were plants damaged by rats? How many? What was the level of damage? What will happen next season if nothing is done about rats now?
3. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
4. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? Does your community have a good action plan for rats? What can be done in the community to control rats? How would you involve other farmers?
5. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?
6. What will happen in the next week? What is your summary for the week?
7. Try to think as a farmer. Are you happy with the results in your field so far? What would you do differently next season for activities up to this point? What would you have expected from your IPM trainer in your area so far? What could the IPM trainer have done for you?

Dough stage

1. Did you apply any rat management methods in the previous week? What is the effect on damage in the field? What are your observations on rat populations based on the different observation methods, e.g., tracking tiles, paddy mounds, live/snap traps, etc.
2. Based on your observations, is there a need to control rats in one or all of the areas observed? What should be done? How should this be done? Would the method be effective if applied only to your field? Does your community have a good action plan for rats? What can be done in the community to control rats? How would you involve other farmers?
3. Are there areas in the field with heavy rat damage? Where else is rat damage heavy in the village? What is the reason for the high damage? If there is high damage, why isn't there a good community action program? How can a program be developed or improved for the next season if rats are heavy this season? Rats should be controlled continuously.
4. Are there other ecosystem components which would require special attention, i.e., crop development, insect pests, natural enemies, water situation, nutrient requirements and weeds? What should be done?

Maturity and Harvest

1. What will be done about rats in the next season? Is there a good community action program planned and ready to start after harvest?
2. What could you do differently to improve yields for the next season? What could you do differently to improve profits for the next season?
3. From your ecosystem analysis, can you calculate costs for integrated rat management?
4. How can you assist other farmers in the next season?

Exercises on Rat Management

Some basic physiological characteristics of rats: identification of species and sex

Introduction

Rats are one among the most important pests of rice and secondary crops. In recent years, the rat problem in Vietnam increased for various reasons such as reclining waste lands and intensified production. Disturbance of habitats and increase in food have created favorable conditions for rat populations to increase. Almost everyone knows a rat when they see one. However, what is more important for making management decisions is understanding the rat populations and changes in the populations. As with all pests, small numbers are not a problem, big numbers can be. To understand the rat populations we have to know the characteristics of the species, and the sex.

Objectives:

- Describe basic physiological characteristics of different rat species
- Distinguish between and among male, female, young, adult, and productive rats

Materials:

Rats: male, female, young, adult and productive; of the species occurring in the village

Tools for dissection - knife, scissors, forceps, gloves and tray

Cage to keep rats

Paper and pens to record observations

Procedure:

1. Ask farmers to bring rats (dead or alive) to the session. Ask them to take note of the surroundings where the rats were caught for later discussions.
2. In the session, let farmers work in five small groups. Let them distinguish between and among rats by observing their external appearance. Ask them to separate into different species (if indeed more than one). Separate male and female rats, young and old. Draw and take notes.
3. Dissect rats for further observation following the procedure in the box below. Dissect young and old males, young and old females. Compare reproductive organs of males and females. Observe the female organs and try to find out whether the rat is pregnant; whether she has had previous pregnancies; how many litter per pregnancy.
4. Record observations for discussions.
5. Each group will discuss questions and present results.

Discussion:

1. How many different species of rats did you observe? How can you tell the difference between species? Where does each species live? What is the main food source for each species?
2. Where were the different species caught? Describe the surroundings where these were caught. What does this mean for management?
3. How do you know a male from female rat based on external appearance?

4. Describe observations on rat with previous pregnancies and without previous pregnancies?
5. How can you tell the number of pregnancies of rats? How can you tell the number of offsprings per litter per rat? How long is the duration of rat pregnancy? How can you find out about this?
6. Do rats just continue to deliver without break? How many pregnancies did the female rats you observed had? Can you see in the female the #offsprings/litter? Can you see the chronological order?
7. Where do the male rats mostly stay? In the field? In the burrows? What about females? Young rats? Old rats? Is it always the same during the season? How can your group find out about this?
8. Does your village regularly observe rat populations? Do you count the number caught? Do you look at the number of males, females, young, old, pregnant? How can this information help you to improve decisions on rat management?
9. Is the number of offsprings per litter always the same? Why or why not? What factors influence the number of offsprings per litter?
(Note: Competition factor: More rats = less food/rat = fewer offspring; Fewer rats = more food/rat = more offspring)
10. When do you think it is necessary to carry out management methods on rats? (physical methods, chemical methods, community action, etc.) Why?

Procedure for dissecting rats

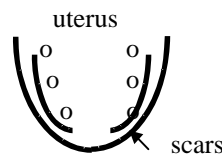
Materials: Tray, scissors, knife, alcohol, cotton, blade, forceps, piece of glass

Procedure:

1. Make sure that the rat you are going to dissect is dead.
2. Put the rat on its back with its head towards the person who is dissecting.
3. Hold the forceps with the left hand, the knife or scissors with the right hand. If using scissors, cut from inside; if using a knife, cut from outside. Use forceps to turn the rat over while cutting. Cut from the head to the anus.
4. Remove all internal organs except the reproductive organs. If two testicles are seen, the rat is male. If it is not a male rat, cut out the uterus. Stick it on to a piece of glass which can then be raised and seen against the sunlight.



testicles



6. The number of offsprings in one litter is equal to the number of scars that can be seen on the inner edges of the uterus. The scars can easily be seen with bare eyes.
7. The number of scars is the number of litters. By observing the rat uterus, it is possible to determine whether the rat has had previous pregnancies; the number of litter; the number of offsprings in each litter.
8. Wash your hands thoroughly. Rats may carry diseases! When cutting open the rats, place plastic bags over your hands for gloves. Do not handle the rats with your bare hands if possible. If you have open wounds on your hands do not touch the rats yourself. Ask somebody else in your group to do the cutting.
9. Bury the rats after you are finished.

Rat population growth

Introduction

Rat populations increase very rapidly because rats have many offsprings very often. Rats can live for one year or longer. Females may reproduce up to four times a year and have an average of six offsprings in a litter.

This exercise is designed to visualize simple population growth for one year.

Objectives:

- Show rat population growth over several months using seeds or other items
- Ask leading questions about rat populations to bring out two management points; (1) It doesn't matter how many rats were killed, it only matters how many rats remain in the field, and (2) continuous rat control is important to keep populations low.

Materials: for each sub group

2050 seeds, glue and paper

Pencil and pen

Procedure:

1. On the piece of paper, draw several lines as shown below;
2. In the first section place 2 seeds. One seed represents one female rat, and the other represents a male rat.
3. Move to the first month. Add 6 seeds for 6 offsprings from the original pair of rats. Three rats are females and 3 rats are males.
4. Move to the fourth month. Add 6 seeds for 6 offsprings from the original female, then add 18 seeds for the 3 females in the first month (3 females times 6 offsprings each). Half of the seeds are female rats.
5. Move to the seventh month. Add 6 seeds for 6 offsprings from the original female, then add 18 seeds for the 3 females in the first month (3 females times 6 offsprings each). Add 72 (12 females with 6 offsprings each) for offsprings from females in the fourth month. Half of the seeds are female rats.
6. Continue this process for the 10th and 13th months.
7. Write down the total number of rats for each of the months, and the cumulative total from month to month.

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Discussions:

1. How many rats are produced in one year? (One section is three months.)
2. If half of the rats are killed in the seventh month, how many rats will be produced by the end of twelve months?
3. If there are 10 female rats in the first month, how many rats will be produced in the 13th month? If you organize a rat drive and kill this many rats, will you be very excited and call your rat drive a success? How many rats are remaining in the field? Do you think the rat drive was still a success? How many rats will be in the field the next month considering reproduction? (Note that reproduction is even greater after many rats are killed because of less competition for food and space!)
4. What is the meaning of the saying “It doesn’t matter how many rats were killed, it only matters how many are left in the field to reproduce”.
5. Can you explain why fields are destroyed after one rat drive? (Remember reproduction, and that reproduction is faster when the population is lower). Why is it important to begin killing rats early in the season? Why is it important to keep killing rats all season long? What would be the population of rats after 6 months if only one female from each group of six offsprings survived?

Totals by month:

1st month = 6

4th month = 24

7th month = 96

10th month = 382

13th month = 1536

Total = 2046

Note: Trainer provides more information of the development of rats according to seasons

Factors that affect rat populations

Introduction

In recent years, the rat problem in Vietnam has increased because of favorable conditions such as food availability brought about by intensified production. The number of natural enemies have decreased because they have been hunted and used or sold for food inside or outside the country. On the other hand, rat presence have also been affected by factors like flood. Rats do not reproduce when it is flooding. Rats move because they are driven by unfavorable conditions such as absence of crops in the field after harvest. This exercise will give farmers an opportunity to exchange ideas about factors that affect rat presence and how these factors can be played with to manage rats better.

Objectives:

- Discuss factors which may contribute to the increase or reduction of rats in the field
- Use the information to identify suitable management methods

Materials:

Newsprints, markers, rulers, pencils

Procedure:

Farmers work in five small groups to discuss basic needs of rats like food, water, shelter. Also factors that affect rat presence and behavior in the field and how these contribute to the increase or reduction of rat populations. Farmers also discuss external factors which might influence rat populations like natural enemies. On the basis of the discussions, recommendations may be given for appropriate rat management methods. Discussions are written up on big paper for presentation to the big group. For example:

Factor	Effect on rat presence, behavior and populations		How to use for management
	Unfavorable	Favorable	
Floods	May disturb rats from their shelter and cause them to move to higher places		Physical methods and trapping may be employed to catch rats
Drought			
Temperature			
Terrain			
Cultivation practice, e.g., multiple cropping		Food becomes available all the time and rat populations may increase	
Field sanitation			
Natural enemies		Absence of natural enemies brings an increase in rat populations	Rearing of natural enemies such as cats
Man			

Discussions:

1. Why is it necessary to understand how different factors can affect the rat populations?
2. Where do rats live and what do they eat after harvest has been completed?
3. What animals eat rats?
4. How does early or late planting affect presence of rats?
5. How does flood affect rats?
6. What happens if men (communities) do not work together to manage rats?

Rat movement and habitat

Introduction

Rats are perhaps the most important pest of rice. Besides weeds, rats are the only other pest that are sure to cause some loss every season in practically every field. Rats have very good sense of touch, smell and taste but they have poor eyesight. Rats are not so smart and it is known that rats have a short memory. It is only possible to manage these pest of rice by understanding their characteristics and behavior. Some of these are movement and habitat. Rats live in groups and move far to look for food often following a certain route. They often make burrows on the border of fields, in hilly areas, and bushes. This exercise will help farmers make decisions for rat management which comes as a result of better understanding of rat movement and habitat.

Objectives:

- Observe basic activities of rats such as movement (trails, places where they move)
- Dig and draw rat burrows
- Discuss how understanding of rat movement and burrows can be used for better rat management

Materials:

Paper and pencil, newsprints

Tools for digging burrows like spade and hoe

Tracking material, e.g., tracking tiles (See box on how to set up.)

Procedure:

1. Divide the group into five smaller groups. Assign each group to one of the areas mentioned below.
2. In the field, identify five areas of at least 20 meters long each with live burrows. (Live burrows can be identified by fresh mud along its opening which is usually rubbed off from the rat's hairs as it enters the burrow.)
 - Thick rice bund (at least 60 cm wide; 60 cm high), weeded
 - Thick rice bund (at least 60 cm wide; 60 cm high), unweeded
 - Narrow rice bund (at most 30 cm wide; 30 cm high), weeded
 - Narrow rice bund (at most 30 cm wide; 30 cm high), unweeded
 - Areas with bushes/tree clumps or mounds of earth (hillocks)
3. Set up tracking materials at the entrance of the burrows following the procedure in the box below. The following morning, check and record observations.
4. Draw and record the number and location of rat burrows in the assigned area. Make a diagram of the rats' routes from observations of tracking tiles. Also draw the conditions and surroundings of the assigned area.
5. Each group should dig up at least two or three burrows and observe. Draw the configuration and layout of the burrow. Catch the rats, if possible.
6. In the meeting room, discuss, draw and present results of observations.

Discussions:

1. How can one distinguish between a 'live' (with rats) and 'dead' (without rats) burrow? What is your experience about this?
2. Based on the field work, in which of the areas/sites were more rat burrows observed?
3. What can you say about the configuration and layout of rat burrows?
4. Based on the field work, what did you observe about the movement/route of rats? Why do rats often follow a certain route?
5. Did you see rats in the field? Where are the rats during day time?
6. How can the results of this exercise be used to design management methods for rats?

How to set up tracking tiles

Materials: Steel pieces (wood and carton can also be used) 20 X 20 cm; apply a thin layer of cow fat on its surface to keep rats' footprints.

Procedure: Set up 30 - 100 pieces for 3 nights in succession in surrounding rice bunds or other places that need to be observed. Set up one piece between distances of 10 meters each. In the mornings, count the number of footprints and calculate activity index as follows:

$$\text{Rat activity index (\% tiles with footprints)} = \frac{\text{\# of tiles with footprints}}{\text{Total \# of tiles}} \times 100$$

- < 20% = rat activity is low
- 20 - 40% = rat activity is moderate
- > 40% = rat activity is high

Note: Applying mud on bunds can also be done using the same dimension of 20 X 20 cm. Cover the areas on the bund with mud to observe but avoid rain and apply fresh mud often to prevent from drying.

Factors that affect rat bait preferences

Introduction

The vision of a rat is not very good, and rats may not be even be able to distinguish colors. But the senses of hearing, touch, smell and taste are very good. Rats can even taste food without putting the food in their mouth because their teeth stick out so far. Rats “learn” that good food is readily available at a particular place and will visit for several days eating the bait. (This is the principle behind “pre-baiting” if poisons are used. By the time poisoned bait is placed, the rats already are happy to eat a lot.)

Rat bait preferences and response to baits may be determined by different factors and might not be constant. (This is the principle behind bait shyness.) For example, the type of container may affect a rat’s response to a particular bait. It will also be affected by the timing of placement of baits, i.e., the stage of crop.

This exercise is intended to find out about factors that affect rat bait preferences to observe rat populations.

Objectives:

- Identify factors that affect rat bait preferences
- Observe rat populations through the use of baits
- Use the information for setting up traps as part of integrated rat management

Materials:

Bait material such as sweet potato, rice, etc
Paper and pen for recording observations

Procedure:

1. Select three fields of six (6) sao each. The fields should have similarities in sizes of bunds; with both thick and narrow bunds.
2. Use the results from an earlier exercise, i.e., identifying trails by tracking footprints.
3. Use 2 cm X 2 cm pieces of sweet potato for baits. Set up the baits at three rice stages:
 - newly transplanted rice
 - tillering stage
 - booting stage
4. At each stage, observe for three nights in succession. Set up baits at night and check in the morning. Count the number of baits eaten and replace baits. Place 10 pieces of baits/field. (Total # of baits = 10/sao/night X 6 sao X 3 fields = 180)

Note: The same kind of container should be used for all baits. Using different kinds of containers may have an effect on the preference for the baits.

5. In the mornings, check and record observations. Calculate as follows:

$$\% \text{ of bait/type eaten/night} = \frac{\# \text{ of eaten baits}}{\# \text{ of total baits}}$$

6. Observe and record damage incidence of rice crop at each stage. Determine rat bait preference at each stage.
7. At the end of the season, summarize data and observations.

Discussions:

1. What was the damage incidence of the rice crop at each stage? At what stage was there a higher percentage of baits eaten? What is the correlation between damage incidence and percentage of rat bait eaten? Should action be taken? When?
2. How can the results of this exercise be used to design management methods for rats?

Factors that affect effectivity of rat traps

Introduction

Rats often travel the same route to the same feeding place each night. In some areas it is possible to distinguish rat trails where the rats pass very often. Rats usually live in burrows in the ground, especially in the rice bunds. Knowing about this behavior of rats helps in preparing a management plan which includes the use of traps. This exercise is intended to find out factors, e.g., placement and timing, that may affect the effectivity of rat traps for use in integrated rat management.

Objectives:

- Discuss factors, e.g., placement and timing, that affect effectivity of traps
- Observe rat populations through the use of traps
- Use the information for setting up traps as part of integrated rat management

Materials:

At least five of one kind of rat traps, e.g., snap (“chem”) trap, trap door (“sap” trap), “rat hotels” (bamboo poles), etc.

Paper and pen for recording observations

Procedure:

1. Select three fields of six (6) sao each. The fields should have similarities in sizes of bunds; with both thick and narrow bunds.
2. Use the results from an earlier exercise, i.e., identifying trails by tracking footprints. Once a month throughout the season, set up the traps each time for three nights in succession. Use 2 cm X 2 cm pieces of sweet potato for baits.
3. Each night set up 5 traps in each of the three fields. (Total = 15 traps)
4. In the mornings, check and record observations. Calculate as follows:

$$\% \text{ traps with rats} = \frac{\# \text{ of traps with rats}}{\# \text{ of total traps}} \times 100$$

$$\text{Ave \#rats/trap} = \frac{\text{total rats caught}}{\text{total \# traps}}$$

Also take the average # of males, females, old and young rats.

5. Observe and record damaged area, tiller incidence every month before and after setting up traps. Compare rat damage incidence in other fields without traps.
6. At the end of the season, summarize data and observations.

Discussions:

1. At different times in the season, what was the percentage of traps with rats (per kind) in each of the different fields? What is the average # of rats per trap? What about the number of males, females, old and young rats?
2. Why were there differences between the fields? When did you find more males, more females, more old, more young rats?
3. What factors can contribute to how a trap can be used effectively? (Recall discussions on characteristics of rats.) Where should traps be installed? How should they be installed? When is the best time in the season to use traps?
4. How can the results of this exercise be used for integrated rat management?

Rat habitats

Introduction

Like other pests, favorable environmental conditions like habitat contribute to the growth of rat population. Rats usually live in burrows in the ground, especially in the rice bunds. They need rice plants and weeds for hiding and prefer undisturbed surroundings. Knowing about these behavior of rats helps in preparing a management plan for rats which includes reducing habitat and cover.

Objectives:

- Observe where rats prefer to stay
- Use the information for integrated rat management

Materials:

Live traps and bait material, preferably sweet potato

Tracking material, e.g., steel pieces (or wood and carton) with thin layer of cow fat

Paper and pen for recording observations

Procedure:

1. Identify four areas of at least 20 meters long each with live burrows. (Live burrows can be identified by fresh mud along its opening that is usually rubbed off from the rat's hairs as it enters the burrow.)

- Thick rice bund (at least 60 cm wide; 60 cm high), weeded
- Thick rice bund (at least 60 cm wide; 60 cm high), unweeded
- Narrow rice bund (at most 30 cm wide; 30 cm high), weeded
- Narrow rice bund (at most 30 cm wide; 30 cm high), unweeded

Once a month each time for three nights in succession, set up tracking materials as described in earlier exercise. In the mornings, check and record observations. Calculate as follows:

$$\text{Rat activity index} = \frac{\text{\# of tiles with footprint}}{\text{Total traps}} \times 100$$

Check for trails to determine where to set up traps.

2. Use results from step 1, i.e., identified trails. Throughout the season, once a month each time for three nights in succession, set up live traps using 2 cm X 2 cm pieces of sweet potato for baits. In the mornings, check and record observations. Calculate as follows:

$$\text{Abundance index of rat} = \frac{\text{\# of traps with rats}}{\text{Total traps}} \times 100$$

$$\text{Ave \#rats/trap} = \frac{\text{total rats caught}}{\text{total \# traps}}$$

Also take the average # of males, females, old and young rats.

3. Each time, note down the total number of rats caught; the number of male and female rats; and the number of pregnant rats. (It will be necessary to dissect those suspected to be pregnant to check for the number of litter.)
4. Every month, observe damaged area and tiller incidence by rat.
5. At the end of the season, summarize data and plot rat populations in each area.

Discussions:

1. Where do rats prefer to stay? What could be the reason for this occurrence?
2. What was the total number of rats caught each time? How many were male? How many were female? How many of the females were pregnant? How many offsprings were there per litter?
3. If there were more males in the field, what does this mean about the females?
4. Where and when was the most damage observed?
5. How can the results of this exercise be used to design management methods for rats?

Methods to observe rat population dynamics: Exercise 1

Introduction

There are many methods to observe rat population dynamics which can be used to learn more about rats on the basis of which suitable management methods may be determined. Farmers have been using these observation methods and researchers have also been using some. The more options the farmers know, the better it is for them. This will allow for them to be able to select what will be most useful for their locality.

Objectives:

- Discuss advantages and disadvantages of different observation methods for rat population dynamics
- Make decisions on what moments in the cropping season each option is most suitable to bring about good results

Materials:

Poster paper/newsprint
Rulers, markers and pens

Procedure:

Do this exercise first with small groups of five to six people and then summarize in the big group. Each group discusses methods to rat population dynamics that they have applied before. Then they discuss and mark down for each method advantages, disadvantages and the period in the cropping season in which it is most appropriate to apply. Results may be written up on newsprint in the following table:

Methods	Advantages	Disadvantages	Appropriate time to apply

Trainers can add other observation methods they know about and they think might be suitable for the farmers' group as well as discuss advantages and disadvantages.

Discussions:

1. Why is it important to list down all the methods to observe rat population dynamics that we know as well as their advantages and disadvantages?
2. Which of these were you practicing before? At what stage of the crop? Will combination of more measures be more effective? Why? Why not?
3. What happens if only a few farmers observe for rats in their fields?
4. How can we advocate farmers to observe rat populations from the beginning of the season? Is it important to know population structure, i.e., males, females, etc.?
5. How can we use the results from observations rat management decisions?

Methods to observe rat population dynamics: Exercise 2

Introduction

Almost everyone knows what a rat looks like but it is the attributes and characteristics of the rat which is important to know. Rat populations increase very rapidly because rats have many offsprings very often. Rats can live for one year or longer. Females may reproduce up to four times a year and have an average of six offsprings in a litter. It is important to know the distribution and the development of the rat population to work out a successful management method for rats in the field.

Objectives:

- Monitor activity level and rat population dynamics in different times of the season
- Use the information to work out suitable management methods for rats

Materials:

Live traps and baits
Small plates and rice
Dissecting tools like knife, tray and forceps
Tracking tiles
Tools for digging burrows like spade and hoe
Pens and paper to record observation/results

Procedure:

1. Divide the group into five and assign one area each as follows:
 - rice field at edge of village
 - early transplanted rice
 - late transplanted rice
 - large edge of ditch
 - secondary crop field (potato or sweet potato)
2. Following the procedure in the Ecological Guide set up four methods to observe rat populations namely, live traps, tracking tiles, rice mounds and counting burrows. Set up the observation tools monthly throughout the season.
3. Each month, set up the observation tools for three nights in succession. In the morning check, record observations and compute results from live traps, tracking tiles, and rice mounds.
4. To compute the results:
 - Rat activity index = $\frac{\text{number of traps with footprints}}{\text{total \# traps}} \times 100$
 - Rat abundance index = $\frac{\text{number of rice mounds eaten from}}{\text{total \# rice mounds}} \times 100$
 - total of rats caught: male, female, pregnant (If possible, check the number of pregnancies on one female rat and number of offsprings per litter. See Ecological Guide for details.)

5. Every month, observe the damaged area. (Every month, if possible, estimate % of rat delivery based on number of male/female rats and pregnant rats caught.)
6. At the end of the season, summarize data and plot rat populations for each area.

Discussions:

1. Which of the areas had more rats? Why? Describe the conditions and surroundings of the areas.
2. At what stage of the season were rats more active and cause more damage? Why?
3. What was the total number of rats caught each time? How many were male? How many were female? How many of the females were pregnant? (If rats were dissected, how many offsprings were there per litter?)
4. If we can catch a lot of male rats in the field, what could this mean? Where could the females be?
5. In which area and at what month did rats cause the most serious damage? What could be the reason for this?
6. Based on the activity index and the crop development stage, is there a need to implement management methods?
7. What management methods are suitable to the conditions of each area and can be applied by farmers at this stage and the next stages?

How to set up tracking tiles

Materials: Steel pieces (wood and carton can also be used) 20 X 20 cm; apply a thin layer of cow fat on its surface to keep rats' footprints.

Procedure: Set up 30 - 100 pieces for 3 nights in succession in surrounding rice bunds or other places that need to be observed. Set up one piece between distances of 10 meters each. In the mornings, count the number of footprints and calculate activity index as follows:

$$\text{Rat activity index (\% tiles with footprints)} = \frac{\text{\# of tiles with footprints}}{\text{Total \# of tiles}} \times 100$$

- < 20% = rat activity is low
- 20 - 40% = rat activity is moderate
- > 40% = rat activity is high

Note: Applying mud on bunds can also be done using the same dimension of 20 X 20 cm. Cover the areas on the bund with mud to observe but avoid rain and apply fresh mud often to prevent from drying.

How to set up rice mound baits

Material: paddy rice (about 10 gms per mound)

Procedure: Set up 30 - 100 paddy mounds on surrounding bunds or other places that need to be observed for three nights in succession. Set up one mound between distances of 10 meters each. In the mornings, count the number of mounds eaten from and calculate activity index as follows:

$$\text{Rat activity index (\% of eaten mounds)} = \frac{\# \text{ mounds eaten from}}{\text{Total mounds}} \times 100$$

- < 20% = rat activity is low
- 20 - 40 % = rat activity is moderate
- > 40% = rat activity is high

How to count burrows

Procedure: While visit fields or taking care of rice fields everyday keep a look out for, count and check rat burrows/nest to estimate relative rat populations.

How to recognise burrows with rats: Newly dug burrows have new soil. There are rat footprints at the entrance, there is mud and rat droppings. You can use straw to block the entrance at late afternoon. Next morning, if the straw has been pulled out (not in the same place) this indicates that the burrow has rats.

To calculate the burrow index, divide the number of rat burrows counted by the total number of meters observed of field bunds or canal edges. If the burrow index/meter is high, rat population is high and vice versa.

Mapping the Rat Problem

Introduction

Rat management is a social/community problem which must have the participation of everyone in the farmer group. Group activities which emphasize participation and cooperation can be used to begin a program of working together to manage rats. It is important to fully understand the *why* and *where* of the rat problem to get clear ideas on *who* should do *what* and *when* to improve the situation. This field exercise might help to illustrate the complexity of the rat problem and to make recommendations for group action to be followed up by farmer-communities themselves.

I. Individual Mapping

Objectives:

- Illustrate the distribution of the severity of the rat problem in relation to the local topography and ecosystems
- Trace the historical development of the rat problem in the locality

Materials:

Village maps, colored crayons, markers, rulers, pencils

Procedure:

Agree on color codes for:

- Thick bunds (> or = to 50 cm)
- Narrow bunds (< or = to 50 cm)
- Irrigation/drainage canals
- Tree/bush clumps
- Mounds of earth (hillocks)
- Distribution of rat populations
- Areas damaged by rats

Have each farmer identify his/her farm on the map. Ask farmers about the distribution of rat populations and areas damaged by rats. Have them identify thick/narrow bunds and irrigation/drainage canals on their farms. Ask farmers also about tree/bush clumps and hillocks in their areas. Have farmers color in their farms according to all the related information.

Discussions:

1. Do you have problems with rats in your farm? Have rats always been a problem? If not, when did you start to observe the problem? What could have been the reason?
2. How much damage was caused by rats in the last season?
3. Did you observe which part of your field had more damage? Where do you think the rats that damage your field come from? What are the conditions surrounding these parts of the field? How did these conditions contribute to the damage caused? What did you do about it?
4. How do cultivation practices influence damage by rats?

II. Group Mapping

Objectives:

- Illustrate the distribution of severity of the rat problem in relation to local topography and ecosystems
- Trace the historical development of the rat problem in the locality

Materials:

Village maps, colored crayons, markers, rulers, pencils

Procedure:

Use the same color codes for:

- Thick bunds
- Narrow bunds
- Irrigation/drainage canals
- Tree/bush clumps
- Mounds of earth (hillocks)
- Distribution of rat populations
- Areas damaged by rats

which were used in the exercise on individual mapping.

After the farmers in the regular/integrated field school have colored in their farms according to all the related information, set schedules with groups to go around the community/village to gather information on other farms in the area. It may be a good idea to divide the village into clusters and ask each farmer group with the trainer to cover one cluster each. Do the same procedure, i.e., color in farms according to information gathered as farmer-groups go around the community. If possible, discuss with/interview farmers who do not attend the regular/integrated field school to get more accurate information on the rat situation. The output should be a rough aerial overview for the purpose of identification of problem areas. The results of the field work may be discussed in the next regular/integrated field school session.

Discussions:

1. Which farms in the village have severe problems with rats based on the map which we have colored? Which areas in the village have severe problems with rats based on the map which we have colored?
2. Why is it important to prepare a map showing rat problems, e.g., distribution and damage?
3. What can we do as a field school/farmers' group to manage rats in the village? What can we ask other farmers in the village to do? What can we do together as a community about these problems? How can village officials and officials at other levels support the farmers' group to get better results in managing rats?

Notes:

- *Before starting the regular/integrated FFS session, make sure that you have good copies of maps (updated, with names and farms) on which farmers' fields can be located. When farms cannot be located on the map, try to reconstruct farm location.*
- *Since individual mapping of farms takes time, it may be a good idea to start the activity by taking aside farmers one by one during spare time, e.g., when farmers enter the FFS early in the morning, so as not to delay group activities.*

Prevention of rats

“Extensive rat damage is a symptom of a community with no leadership”

Introduction

The process of prevention of a field problem usually begins with a problem that is observed in the current season. Prevention management is planned before the beginning of the next season and plans are implemented in the next season. As field workers, we must always be thinking in many time frames; last planting to the present, the present until current harvest, and the present until the harvest of the next season. This takes practice. It takes practice to stand in a field and admit that there is nothing that can be done now to save the harvest, but that plans should be made to protect the next planting. THIS IS THE CASE MOST OFTEN FOUND WITH RATS!

This exercise will explore the prevention of rats. Keep in mind the most important component of the rice ecosystem - MAN as a farmer, as politician, and as extension worker. They are three different biotypes!

Objective:

- Describe ways of preventing rat damage

Materials:

Large paper and markers

Procedure:

1. One person should read the following outloud.

In one village, there is a wide area where about 100 hectares of rice were planted by about 225 farmers. The farmers were generally quite good at planting rice. Each year they met and decided on varieties that they wanted to grow. They had occasional meetings with the district and provincial IPM trainers but most of the time the district trainer did not go to the fields. The trainer did not really know anymore than the farmers.

In 1988, several fields near the railroad tracks began to show some serious rat damage. A couple of the farmers used Zinc phosphate mixed with crabs to kill the rats. In fact they saw dead rats and were happy to see their treatment was working. One farmer even put plastic around the field to protect from rats and had good luck for his field. Other farmers in the area began to show some damage in their field also.

By 1989, about 30 hectares of rice had noticeable damage. The damage was reported by the district and provincial IPM trainers and the head of the DDPS met with the village authorities. The village authorities organized a rat drive. Many of the village and district officials came to the opening of the rat drive. After one day, all the farmers in the area had worked hard to kill and collect almost 1000 rats. The village authorities were very proud and declared their work a success.

By 1990, almost 75 hectares of rice was damaged. Thirty hectares (30 ha) had been completely destroyed while the other 45 hectare was still only moderately damaged. Farmers were losing money and could not afford the expensive poisons and baits. Any work they did on their own fields did not matter because the rats were moving from field to field.

By 1991, most of the area was damaged before flowering. Many farmers were ready to move from the village to earn money in the city.

2. Now divide into groups of three. One person should be the facilitator. This person should ask first “Why did rats become a big problem?” To every response, the facilitator must ask “Why?” until the root of the problem is found. The other two members are allowed to give answers.

Discussions:

1. Each group should present why they thought rats became a big problem.
2. What kind of activities should be done by that group of farmers to prevent the initial problems of rats? What should the district and provincial trainers do in this situation?
3. How did rats become a problem in our village? What has our community been doing about it?

What to do about rats?

This exercise is intended more for trainers than for farmers.

Introduction

The most important and difficult step to do about managing rats is to work together as a community. This exercise will try to explore how to set up an organization for controlling rats based on trainers' knowledge and experience of local government and farmer groups. The activity could be used to help farmers organize themselves, but we will use the activity to think about options in organizing farmers.

Warning: This is an activity in which the trainer must use her farmer experience to understand the problems of group action. It is not easy to lead a farmers' group but the trainer can facilitate the making of plans.

Objective:

- Lead a meeting in which farmers discuss and develop a possible organization structure for managing rats in their area

Materials:

Large paper and markers

Procedure:

1. Divide into groups of about 10 persons.
2. Each person has a role in the group. One person is the Farmer Group Head. One person is the Village Head. One person is the district or provincial IPM trainer. Other persons are Farmers' Group members.
3. A "meeting" is opened with a report by the IPM trainer on the damage in the fields. The field is in milky stage. Rat damage is reported to be very high and there is nothing that can be done this season. The meeting is to discuss what the Farmers' Group is going to do for the next season.
4. Discuss what can be done if anything by the group. Discuss the costs and potential budget sources. Is everyone agrees to work together, make a rat control plan. Each person should play their role as much as possible.
5. Present your discussions to other groups (who are also Farmers' Groups).

Introduction to Integrated Rat Management

Introduction

A variety of cultural and mechanical management measures can be applied throughout the cropping season to avoid rat damage and crop loss and to keep rat populations at a low level. Farmers themselves have been inventing these management measures and farmers are still inventing or adapting measures for more effective rat management. It is important to keep eyes, ears and mind open to be sensitive to farmers' knowledge on managing the rat problem for use in setting up an integrated rat management program for the locality.

Objectives:

- Discuss advantages and disadvantages of different methods for rat management
- Make decisions on what moments in the cropping season each option is most suitable to bring about good results

Materials:

Poster paper/newsprint
Rulers, markers and pens

Procedure:

Do this exercise first with small groups of five to six people and then summarize in the big group. Each group discusses rat management methods which they have applied before. Then they discuss and mark down for each management practice advantages, disadvantages and the period in the cropping season in which it is most appropriate to apply. Results may be written up on newsprint in the following table:

Methods	Advantages	Disadvantages	Appropriate time to apply

Discussions:

1. Why is it important to list down all the management methods that we know as well as their advantages and disadvantages?
2. Which of these were you practicing before? At what stage of the crop? Will combination of more measures be more effective? Why? Why not?
3. What happens if only a few farmers do the measures in their fields?
4. When rat damage and rat populations are high, should the community organize rat campaigns?
5. How can we advocate farmers to manage rats from the beginning of the season?
6. What do we need to know more about rats to be able to manage them better?

Increasing probability of catching rats

Introduction

Certain unfavorable conditions may increase the probability of catching rats. One of these is when they move into areas where there is none or less competition from other species when they look for other sources of food when there is no crop. Another one is when their habitat is disturbed, e.g., during land preparation when bunds are repaired and the fields are flooded. In these cases as in other unfavorable conditions, rats may look for other temporary shelter (hence the term “hotel”).

Objectives:

- Observe increased probability of catching rats due to unfavorable conditions in the environment
- Discuss rat management methods in relation to periods of the season when the environment is less favourable for rats to stay in the field

Materials:

Rat hotels (bamboo poles of about 1.5 meters in length and 10 cm in diameter; one end open and one end closed)

Food (rat baits) for hotels

Empty sack; plastic twine or rope to secure/attach sack to pole

Spades

Dry leaves or rice straw

Procedure:

The exercise should be tried out after harvest. The different activities should be done at least three times in different occasions and different locations to compare results. Each time, establish rat hotels (6 for one sau) at strategic points in the field following results of the tracking activity in the exercise on Rat Habitats. Everyday, check for rats in the bamboo poles. Keep a record of and summarize the number of rats caught during the different activities to compare their results.

Try these activities:

- Burrow digging - After identifying live burrows (See Rat Habitats), dig burrows. Rats may be caught as they run out (SNAKES AS WELL!!!). Those that escape may go into the rat hotels.
- Flooding - Seal off all suspected burrow entrances and exits except for one. Close water outlets and let water in to a level high enough to cover burrows. Rats may be caught as they come out (SNAKES AS WELL!!!). Those that escape may go into the rat hotels.
- Fogging - Seal off all suspected burrow entrances and exits except for one. At the entrance of the burrow which was left open, set off a fire with dried leaves or rice straw. Rats may be caught as they come out (SNAKES AS WELL!!!). Those that escape may go into the rat hotels.

Attached the open end of the pole to the empty sack and secure with twine or rope. Hold the pole upside down so that its contents empty into the sack - just in case a snake instead of a rat is in the pole.

Discussions:

1. What can you say about 'rat hotels'?
2. What can you say about the other practices: burrow digging; flooding; fogging?
3. Are there other practices you have been using which you can suggest?
4. Is there one most effective practice?
5. How could the practices be used for management of rats?

Rat poisons: Zinc Phosphate, *Klerat* and Biocontrol Agent *Biorat*

Introduction

There are many ways of controlling rats without baits. All methods seem to work when they are implemented on a village wide level. In this activity we will look at the differences between three rat poisons. In Vietnam, the government does not recommend using chemical poisons, but we should know about them.

There are several types of rat baits. The first generation poisons (acute poisons) were used for many years and are very toxic to most animals and to people. This group of poisons includes Zinc Phosphate. It is strongly recommended not to use these poisons because they are very poisonous. The poisons may not control rats well because the rats do not eat enough to die. The rats will not continue to eat the bait after eating once and becoming sick. This behavior is called bait shyness. If these acute poisons are going to be used, they should be used correctly. The best way to use them is with several days of pre-baiting in which bait is placed in the field but no poison is added during the first four or five days. On the sixth day, poison is added to the bait. The idea is that the rats learn where food is easily found in the first few days and “trust” the food. When the poison is added, enough bait and poison is eaten to kill the rat. If the poison is put out too soon, the rat will try one time and not feed again.

The second type of newer poisons (chronic) causes the rat to bleed to death because the blood will not clot in the stomach (anticoagulant). The rat will not get sick from eating a little bit of the poison, but must continue to feed on the poisoned bait. It is important to use these poisons from transplanting to two week before harvest. *Klerat* is an example of this type of poison.

The third kind is a biocontrol agent, which is new for Vietnam. It is called *Biorat*. These are microorganisms (*Salmonella*) to cause infectious diseases to kill rats. From studies which have been recently conducted *Biorat* has shown advantages such as being safe for humans, other animals and the environment. It kills rats on a large scale at the same time and considerably reduces rat populations and its damage over long periods of time. However, it is costly; has a short shelf life/storage period and its use in the field is very much affected by weather conditions. Furthermore, because it does not cause immediate death (rats die from 4 - 14 days after eating) farmers do not like to use it.

Objectives:

- Demonstrate bait shyness, proper pre-baiting, and baiting with Zinc Phosphate
- Ask leading questions to get a definition of bait shyness and the action of acute and chronic poisons

Materials:

Rats, chicken wire (1 cm holes), bamboo pieces (15 cm long and 4 cm in diameter) for rats to hide, wire, pliers (tang), bait (rat food), Zinc Phosphate, coconut oil, *Klerat*, *Biorat*, dishes for bait and water

Procedure:

1. Each group should make at least four cages as shown in the diagram. Also prepare bamboo pieces of 15 cm long and at least 4 cm in diameter for rats to hide in cages. Use bamboo nodes for water and bait cups.
2. Label the cages:
 - #1: Zinc Phosphate with no pre-baiting
 - #2: Zinc Phosphate with pre-baiting
 - #3: *Klerat*
 - #4: *Biorat*
 - #5: Control with bait only
3. In cage #1, place bait with Zinc Phosphate for food. Also place a dish for water.
4. In cage #2, place bait with no poison for four days. On the fifth day, add Zinc Phosphate to the bait. Keep water in a dish in the cage.
5. In cages #3 and #4, place baits with *Klerat* and *Biorat*, respectively. Keep water in a dish in each cage.
6. Each group should collect five adult rats and place in the cages. **DO NOT POKE, BURN, OR IN ANYWAY HURT OR SCARE THE RATS!!!** Rats are very sensitive and are under stress in a cage. Keep the cages in a shaded and protected place where children and adults cannot torment the animals.
7. The poisons have a different effect on the rat's stomach. When the rats die, cut open the rat and remove the stomach. Then cut open the stomach and observe the contents and the texture of the stomach. When cutting open the rats, place plastic bags over your hands for gloves. Do not handle the rats with your bare hands if possible. Bury the rats after you are finished.

Discussions:

1. What are the results of each treatment?
2. What is "bait shyness"?
3. Do these studies convince you that Zinc Phosphate is an effective rat poison? What is the difference between rats with anticoagulant and toxins?
4. Can you design another experiment to test *Klerat*?

Note: It is said that a cannibal rat will keep other rats away from a field. To make a cannibal rat follow these steps:

- Place several rats in a large bucket. Place 0.5 cm water in a large bucket for drinking water. Do not give any food. After a couple of days, several of the rats should be missing.
- Wait until there is only one rat left in the bucket. Keep water in the bottom for drinking.
- When only one rat is left, add one more rat and wait until there is only one rat left.
- Release the one remaining cannibal rat. It is claimed that other rats in the area will run away. Try it!!!

Planning and evaluation session

Towards the end of the season it will be helpful to conduct an evaluation and planning session for two reasons. First, this is the first time that field schools have spent a full season on rat management and farmers' inputs on how to improve the exercises are important. Second, the session will allow farmers to develop plans for community action on rat management.

For the session, the following questions may be discussed with the farmers :

I. About the activities in general

1. What were the good and difficult things in the rat management field school? Make a list together and give recommendations for improvement in the future.
2. To improve the exercises, please give comments on:
 - What concepts were new or old?
 - What aspects were valuable? Which were not worthwhile?
 - Are there ideas that could be better introduced or explained in another way?

III. Plans for community action on rat management

1. What are the plans of the group for community action on rat management?
2. How can the farmers' group encourage and advocate for more farmers to be involved in community action on rat management?
3. What are the possible problems in organizing this?

Summarize the plans together. Discuss what kind of support will be needed and how it can be obtained.

Action plan for community rat management

After the evaluation and planning session, the farmers who were involved in the Rat Management Field School should get together with other farmers from the village to discuss about community action on rat management. The results of the discussions may be presented during the Field Day where many other farmers should be invited.

Suggestions for field day

The field day for schools on rat management is primarily the same as that of any regular field school in terms of objectives as well as activities. However, the aim of getting as many farmers to attend the field day is to get them involved in community action on rat management. Field day activities may include the following:

1. **General report** - giving a summary of information about the field school - when the field school started, how participants were selected, the number of participants, activities conducted, etc.
2. **Exhibits/display** to include:
 - **Graphs** showing results of observations on rat population dynamics, rat activity index, rat abundance index, rat damage, etc.
 - **Maps** showing areas damaged by rats, habitats, fields, etc.
 - **Drawings** of life cycle of rats, reproductive system of rats, etc.

Note: Data to be presented is gathered over the season and work on graphs are spread over several days to allow for sufficient time for preparation.

1. **Exchange of ideas** between visitors and farmers particularly on community action on rat management