Field Guide:

Farmers' Field Schools for Rice Plant Genetic Resources Conservation, Development and Use

BUCAP

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By the Biodiversity Use and Conservation in Asia Programme

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PREFACE

The use of Farmers' Field School (FFS) approach for rice Plant Genetic Resources Conservation, Development and Use (PGR CDU) was initiated by SEARICE in its projects in North Cotabato and Bohol, Philippines as early as 1995. During this time, rice PGR CDU was just one special topic under the Ecological Pest Management FFS. The learning field is usually set-up for varietal comparison or for organic agriculture comparison only. After the FFS, farmers are given seeds of varieties they want to evaluate under their own field conditions. Some farmers eventually try to make crosses, select from their crosses or select off-types from the stable materials or varieties given to them aside from selecting and planting the varieties they want to maintain.

In 1998 to 1999, SEARICE along with the Development Fund of Norway explored the possibility of having a regional rice PGR CDU program called the Biodiversity Use and Conservation in Asia Program (BUCAP). The program linked with the National Integrated Pest Management (IPM) Program in partnership with non-government organisations and research stations in Bhutan, Lao PDR and Vietnam. It was the partnership that led to the development of FFS specific for rice PGR CDU. It is different from earlier efforts (in both the IPM program and SEARICE experiences) because the FFS focus on rice PGR CDU from the field layout, special topics, field exercises and field diary.

In the first quarter of 2000, SEARICE gave a training of trainers along the FFS approach to core provincial IPM trainers in Laos and Vietnam. There were some exercises initially developed by SEARICE but at the end of the training, special topics, field layout and plan for the season were discussed by the trainers.

There were difficulties in the first season of implementation in June - October 2000 as most of the topics discussed lacked focus and were leaned towards IPM rather than IPM in relation to rice PGR CDU. IPM trainers got confused and tend to get weekly data more for IPM than for rice PGR CDU.

These difficulties proved to be a driving force in defining more clearly the steps, the topics, the field layout and the requirements in setting up an FFS for rice PGR CDU. It was the provincial IPM trainers and the farmers in Vietnam and Laos who started defining the FFS curriculum for rice PGR CDU.

In November 2000, the IPM trainers from the pilot site in Quang Nam, Vietnam , Vietnam National IPM trainers, Food and Agriculture Organization (FAO-IPM) staff in Vietnam and SEARICE organised a curriculum development workshop. The IPM trainers outlined their experiences, while FAO-IPM and SEARICE worked on the translation and subsequent formatting of the experiences to come up with an instructional material intended for other trainers. FAO-IPM and SEARICE reviewed the process and technical content with the IPM trainers. By December 2000, the draft Field Guide Exercises for rice PGR CDU was produced and translated back to Vietnamese with technical backstopping from the Mekong Delta Farming Systems Research Institute and the National Institute of Plant Protection.

In the first quarter of 2001, Lao PDR adapted the Vietnamese curriculum development process and output to produce their version of the Field Guide. The draft was a collective work of the National IPM Program, National Agriculture Research Centre, Oxfam-Solidarity Belgium in Laos, International Cooperation for Development and Solidarity-Laos and SEARICE. Critical support was also provided by the FAO-IPM team in Lao PDR especially in drafting the field diary. In May 2001, the Field Guide for Lao PDR was produced.

The curricula were used by all provincial trainers in Lao PDR and Vietnam for the past seasons. At the same time, both curricula are being used by Bhutanese extension agents and researchers in some of the pilot sites in Bhutan. SEARICE has also been using the curricula in Bohol, North Cotabato and Sultan Kudarat provinces in the Philippines and with it's partners in South Vietnam and Northeast Thailand.

Trainers, extension agents, researchers, and development workers have started adapting the field guide with great success which proved its strength and potential as a publication worthy to be shared to a wider audience.

The field guide is an evolving document to be enriched with diverse experiences and adapted according to specific needs and conditions. The key elements, steps for conducting an FFS (i.e., preparatory planning, meeting, baseline establishment and setting up the field studies), and special topics and field exercises for rice PGR CDU are presented.

BUCAP Partners

- National Biodiversity Centre, Ministry of Agriculture, Royal Government of Bhutan (RGOB)
- Renewable Natural Resources Research Centre – Yusiphang, MoA, RGOB
- Renewable Natural Resources Research Centre – Bajo, MoA, RGOB
- Renewable Natural Resources Research Centre – Khangma, MoA, RGOB
- Dzongkhag Agriculture Offices in Paro, Thimpu, Wangdue, Mongar and Trashigang
- Plant Protection Centre, Department of Agriculture, Ministry of Agriculture and Forestry, Lao PDR
- National Agriculture Research Centre, National Agriculture Forestry Research Institute, Ministry of Agriculture and Forestry, Lao PDR
- CIDSE-Laos, Lao PDR
- Oxfam-Solidarity Belgium in Lao PDR
- Plant Protection Department, Ministry of Agriculture and Rural Development, Vietnam
- Oxfam-Solidarity Belgium in Vietnam
- SEARICE
- The Development Fund of Norway

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- Friends in FAO-IPM who have supported the development of this module through their comments and encouragement, specifically to Ms. Patricia Matteson and Mr. Jan Willem Ketelaar
- Mr. Rene Salazar for the concept of using FFS for PGR CDU and for assisting in developing the initial exercises which became the seed from which the field guide was developed

This document is evolving and dynamic as farmers and trainers are continually developing new exercises and methodologies as we speak. We encourage comments and feedbacks as we further enrich the methodologies for rice PGR CDU.

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CONTENTS

INTRODUCTION

Development and Scope of the Field Guide

In the FFS approach of the IPM Programme, community-based study groups are formed composed of 20-30 farmers. Extension workers or trainers provide technical inputs and facilitation. A group field is set-up as a common learning area from which hands-on exercises on ecological aspects of rice production are studied. The 'learning field' provides the main learning material, and the field exercises and special topics are rooted in the fields, i.e., before starting any discussion or activity, the study group must first observe the field. FFS is more of an education tool than a high-level research. The important aspect is the process of learning, where farmers discover the results on their own, through a simple field experiment.

This educational process was adapted in rice PGR CDU. The concept was further extended by engaging farmers in research whose outcome is not pre-determined. In the process, generating new information which are not known by facilitators nor by research institutions, at the same time, developing the capacity of farmers to conduct crop improvement researches for improved production.

If the farmer group considers varietal evaluation, line selection, seed rehabilitation, and plant breeding as some of their most important study fields, this field guide will provide information on what can be done to understand more about these topics. The field guide is intended for a first season of studies in which the group will meet once a week. For the succeeding seasons, the group makes a sustainability plan.

In addition to the main studies, small experiments and special topics will be facilitated to help farmers learn more about community rice PGR CDU. Although farmers will be working in small groups managing one field study each, all participants of the field school will learn about the other studies through discussions and field visits. Therefore, it is important that all field studies are set up in one area so that during weekly meetings, farmers are able to observe all studies. The community rice PGR CDU activities will require farmers to work together for several seasons. For this matter, it is important that farmers understand and appreciate the significance of local genetic resources and the limited choice of high-yielding varieties. For example, although farmers still have good access to local varieties, these are increasingly replaced. This has set in motion a process of genetic erosion and loss of biodiversity. Genetic erosion has brought with it increasing problems of insect pests and diseases leading to increased pesticide use. The situation is made more complicated by the inadequacy of the existing, if any, formal seed supply system to meet the requirements of farmers. Experiences gained from the activities are expected to bring farmers, trainers and researchers working together to address issues and concerns on rice PGR CDU. The experience should encourage and equip farmers to take the lead by improving varieties through participatory varietal selection and plant breeding.

Style and Structure of the Field Guide

This Field Guide was developed as a simple, clear and systematic approach to rice PGR CDU. Extension agents, plant protection specialists, and development workers can use this Field Guide for planning, implementation and monitoring of rice PGR CDU.

This Field Guide is intended for use and adaptation to suit local settings, and not as a blueprint on rice PGR CDU. This is only a general guide that can help users realise the need, use, and practice rice PGR conservation and development.

The field guide is divided into eight sections. The first section serves as the Introduction to the development and scope, and style and structure of the field guide. The second section describes Preparatory Activities to the FFS that establishes the setting and the selects the target farmer participants. The third section introduces the various approaches and tools to Baseline Establishment necessary as benchmark data, while the fourth section gives the steps to the Planning Meeting sessions. The fifth section on Field Studies serves as the core of the field guide that includes the Varietal Evaluation Study, Seed Rehabilitation Study, Plant Breeding Study, and Line Selection Study. The sixth section is on Group Dynamics that provides additional activities to futher set the tone of the FFS. The section on Special Topics and Field Exercises contains the bulk of the sessions spanning from conceptual exercises to field practices. Lastly, the section on Winding Up Activities formally closes the FFS with its exhibits and evaluation.

The structure of this Field Guide follows an orderly manner of presentation with standard divisions (i.e., objective, materials, and procedure) per exercise. The content of these divisions are as follows:

Objective

A statement of objective is given at the start of every exercise or study. It spells out the target/s to be achieved by the participants and trainer/s at the end of the exercise.

Materials

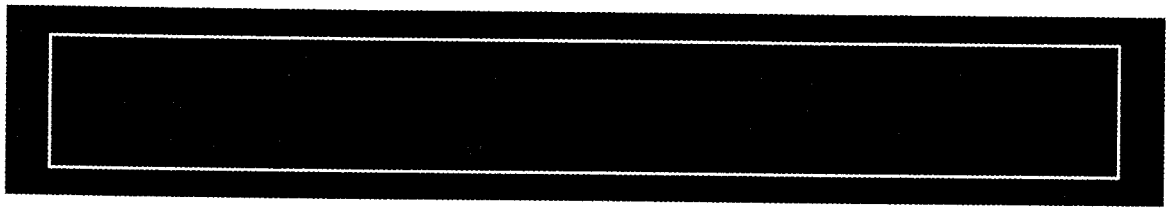
These are the basic requirements that are locally available to be used in the exercise. Some materials need to be prepared ahead of time, especially the need for seeds. Trainers and farmers are also encouraged to use available materials (i.e., leaves and stones) and be resourceful and creative on the use of these materials in the conduct of the procedure. Minimum requirements are pens, coloured markers, field notebook, and newsprint for documenting the process and results of the activities.

Duration

The duration of the procedure is estimated for some exercises. However, for other exercises, such as those under Special Topics and Field Exercises, no duration is indicated due to the flexibility and need for timing of the exercise or seasonality of the activities. Field exercises depend on biophysical conditions and need constant monitoring.

Procedure

These are series of steps to ensure a systematic and organised method to achieve the objective of the exercise. Each step is described in detail, with guide questions for trainers to help farmers in small groups process their experience.



Observation

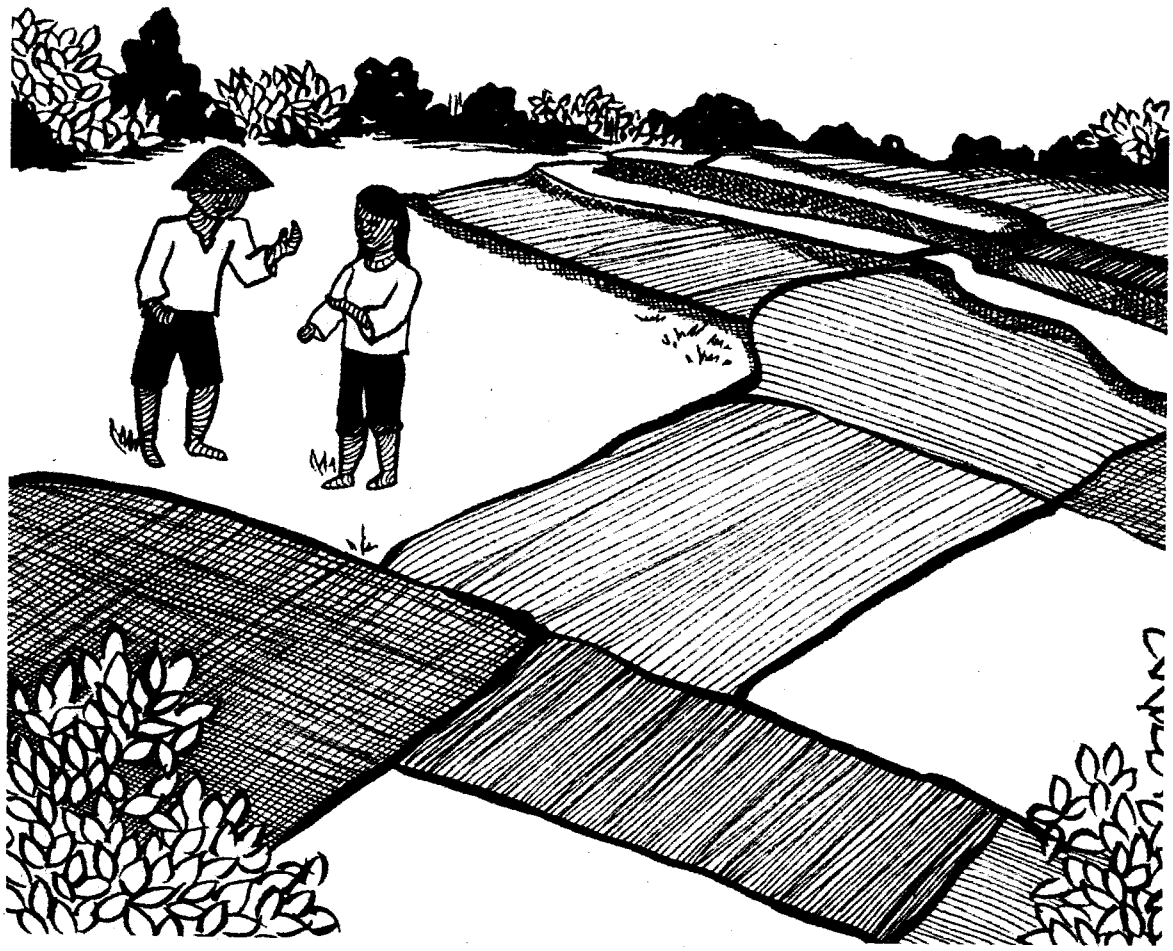
This is specifically indicated for Special Topics and Field Exercises where experiments are conducted and field conditions monitored.

Discussion

Guide questions for discussion are listed to allow in-depth and comprehensive understanding of the exercise after field observation. The discussion is intended for the big group to share results from the small groups and to process their experience, as well as come up with consensus about the exercise.

Preparatory Activities

Before starting an FFS for rice, the target community, participants and field site should be selected. The selection process and criteria presented are based on the experiences in running an FFS for rice PGR CDU project in Lao PDR and Vietnam, where an FFS is undertaken through the government's plant protection units with support from non-government organisations and research centres.



Community Protocols and Courtesy Calls

1. Perform a courtesy call to the head of the Provincial Agricultural Service to explain the objectives and basic operations of the project. This meeting aims to seek permission in carrying out an FFS and to ask recommendation for a district to work on.

2. Introduce the project objectives and basic operations to the head of the district. Also, seek recommendation and endorsement (through a letter) for a village to work on following the **Criteria for Village Selection** (see below).

3. Discuss the objectives, activities and target partners with the village head. It is preferred that a district personnel accompany the trainer to the field. Seek the assistance of the village head in selecting farmer participants.

4. Meet with all the farmers in the village for an orientation about the project. The idea is to inform all the farmers of the activities and get them interested and involved.

5. Conduct preliminary community baseline exercises to understand the status of the community plant genetic resources. This may be done during the initial meeting. However, if it is not possible to run community baseline exercises during this time, arrange another meeting for the community baseline exercises.

6. Get the basic social and economic data about the village during the meeting or during formal and informal discussions with the village officials and farmers.

Criteria for Village Selection

Prior to the courtesy calls, have a clear set of criteria for selecting the village. In the case of BUCAP, the program targeted the prime irrigated rice areas where genetic erosion is much more pronounced. Some of the criteria used in selecting the villages are:

- A farming community
- A representative village of the district in terms of ecosystem, social characteristics and crop varieties used, especially if it will be the first FFS for rice PGR CDU that will be conducted in the district
- Preferably, but not necessarily a village which has undergone an IPM FFS training before
- With at least two cropping seasons
- With irrigation especially for the dry season
- If possible, a village which is not prone to seasonal flooding
- Preferably a village that is accessible all seasons
- With active and interested farmers

Selection of Farmer Participants

1. In the village meeting with farmers, inform the community of the criteria for selecting the initial farmer partners for the activity. Clarify that selecting initial partners does not mean that other interested farmers are not welcome to join. There will be a Farmers' Field Day (see section on **Winding up Activities**), a venue where the selected participants will report back to the whole community the progress of their study. Also, other farmers are welcome to visit the field anytime to see what the activity is all about.

2. The following are the criteria for selecting initial farmer participants:
   - Farmers who are interested in the activity and are full-time farmers or cultivators and not seasonal workers in the farm or government workers or employees
   - Preferably but not necessarily farmers who have participated in an IPM FFS before
   - Preferably farmers with known experiences in critically selecting plants which they think are better performing than the rest, and plants them in a small plot as a form of experiment)
   - Preferably farmers with experiences in maintaining the quality of the varieties they have
   - Farmers who are committed to attend the duration of the season-long training
   - Farmers in good health, between 18 to 60 years old
   - Male and female participants

3. Be involved with the selection of farmer participants and not just rely on the head of the farmer group or head of the village to decide solely on who shall participate in the FFS.

Site Selection for Field Trial

1. Convene the farmer participants and explain the activities once more (see previous steps on **Community Protocols and Courtesy Calls**). This time highlight the need to identify a common field site for the study. The common field site can be a privately- owned land or communally-owned land where farmers can set-up a field experiment and come together once a week to learn.

2. Decide with the farmers where the field site will be by considering the following criteria:
   - Irrigated land for both the wet and the dry season
   - Levelled land and preferably not subject to flooding
   - Distant from houses or big trees
   - Strategically located in the village where other people can see

3. The common field where they learn can be a counterpart of the farmers. Sometimes, compensation for the use of the trial site may come in various forms, such as: a) payment in cash based on the amount of potential yield loss per season by the farmers; b) payment in kind (e.g., rice grains) by the farmers in lieu of yield loss; and c) payment in cash by the project.

   After selecting the village, the participants and the field site, it is now time to conduct the preliminary exercises with the group. However, before proceeding with the planning meeting of the FFS group, make sure that baseline studies have been undertaken with the community. The next section, details the recommended activities to be undertaken to establish the baseline for subsequent impact monitoring.

Baseline Establishment

Baseline information related to the status of PGR, specifically rice genetic resources in the community should be established prior to the conduct of actual FFS for rice PGR CDU. The baseline information will serve as the benchmark from which the impact of the project will be measured. At the end of two cropping seasons, trainers must run the baseline exercises again as impact monitoring exercises to gauge if the activities already influenced the local seed supply system and the status of rice genetic resources in the community. Trainers must also record basic demographic, social, political and economic data related to rice production in the community. To ensure ownership of the data, the village leaders should keep results of baseline exercises.

Objectives

1. To determine the rice PGR situation
2. To determine farmers' level of knowledge and skills on rice PGR management and breeding
3. To understand and relate farmers' perception on the rice PGR situation
4. To facilitate farmers' data gathering and analysis on rice PGR
5. To motivate farmers to analyse their rice PGR situation and recommend strategies to improve their situation

***Baseline data** are collected at the beginning of a project and is used as benchmark against which change that occurs during the project period can be assessed.*

Content

1. Description of current rice PGR situation - what, how many, where, percentage, when, age of varieties
2. Description of past rice PGR situation (10, 20 years ago) - what, how many, where, when
3. Description of percentage of rice areas planted to traditional rice varieties and modern rice varieties in marginal and in favoured areas
4. Evaluation of strengths and weaknesses of modern rice varieties and traditional rice varieties; specific varieties if possible (evaluation shall be based on few but key morphological and agronomic traits)

Procedure

The recommended steps in baseline establishment were drawn from community organising steps coupled with participatory rural appraisal tools. As a participatory approach, data gathering is an exchange of information between trainers and farmers, while data analyses are done through informal and formal discussions with the community. Three levels of data gathering are recommended to obtain accurate and valid information. Trainers must realise that data gathering is a continual process, hence the baseline exercises may fail to capture all the needed information at once. The important thing is that the baseline establishment is done by both farmers and trainers to guide farmers to understand and improve their situation.

1. One-on-one informal discussions

The trainer, without using a survey form or questionnaire, shall organise the initial data by asking key informants. Informal baseline gathering can be started from the meetings with the head of the Provincial Agriculture Service, the head of the District Agriculture Office, the village head and the farmers group. In the process of complying with the community protocols and in selecting the village and farmers for FFS, the trainers must start asking questions to these key people about the status of rice PGR in the area as well as the basic demographic, political, social and economic data.

Key informants *are persons influential in the community (sometimes they are also called opinion leaders) who are informally interviewed using a semi-structured questionnaire.*

Trainers can take notes during the meeting. At the end of the meeting, the trainers must have fair understanding about rice PGR in the target community, including an assessment of the strengths and weaknesses of the current varieties used, possible breeding objectives and possible parent materials or segregating materials to be used in the community.

2. Small group discussion to affirm the data obtained from one-on-one discussion

The trainer can also run the baseline exercises (see succeeding section) in small groups. The small groups will be invited to present the results of their exercise to the bigger group (the community) for validation.

Small Group Discussion, *sometimes referred to as focus group discussion is a group interview involving 5 - 15 people and focuses on a specific problem or topic.*

Ask the farmers what they liked and did not like about the exercise. Ask them what they would improve if they were to run the exercises themselves. Discuss and record their recommendations. Improve the exercises according to their recommendations.

The small group can be further divided into a female and male sub-groups to see if there are differences in gender perception and if there are, understand the differences and address them in the course of implementation. This will ensure that the activity is gender-sensitive.

3. Form team of farmers to assist with baseline survey as facilitators

From the farmer partners for the FFS, form a team of farmers as facilitators to assist in community baseline gathering. The farmer partners with the rest of the farmers in the village will conduct the same baseline exercises with additional questions and exercises as recommended.

*A **facilitator** is a person who helps members of a group conduct a meeting in an efficient and effective way, but does not dictate what will happen.*

Farmer facilitators participate in the baseline establishment to build their capacity at the onstart to conduct baseline studies and develop their confidence and interest to monitor the development of the project. This is part of the capacity-building process and commitment of the project to the community. It is an initial activity from which trainers can identify potential farmer trainers to be further trained in the future to assist other farmer groups who may be interested to do the same activities.

Trainers are expected to further prepare the team of farmers to handle the exercises. The trainers should run the whole of baseline exercises with the selected facilitators first. A dry run of the exercise with farmer facilitators can be undertaken and the trainers should be present during the village meeting to be facilitated by farmers to provide support.

4. Village meeting

Farmer facilitators should organise and facilitate a village meeting inviting all the farmers in the community. The trainers should only assist the farmer facilitators. However, prior to the community meeting, the trainers should prepare the team of farmer facilitators by orienting them of their tasks and doing role-plays as facilitation exercises for baseline establishment.

*A **village meeting or workshop** is an effective method to assess usefulness of any intervention or forum to obtain feedback on ongoing activities or providing any information in a rural setting.*

In the village meeting, the process becomes a community undertaking and not just an activity of the FFS participants. This strengthens also the FFS participants' accountability and responsibility to the whole community in generating the results. In return, they have to validate the breeding objectives and results of the baseline exercises to the community (see section on **End of Season Evaluation and Farmers' Field Day)** and involve them in decision making processes. Thus, the varieties that will be developed in the FFS will not be products of individual choices but a community product.

5. Document the process and the results in each of the different stages

Outputs

At the end of the exercises the trainers and farmers must have knowledge on the:

1. State of the village rice PGR according to farmers' perception
   - Critical understanding of the problems and weaknesses of farmers' varieties and strategic problem-solving of the rice PGR situation

2. State of the farmers' knowledge and skills according to their own perception
   - Analytical understanding of the problems and weaknesses of farmers' system of rice PGR management and traditional breeding in the context of modernising economy and agriculture
   - Clarification of the training needs, knowledge and skills
   - Identification of the breeding objectives of and by farmers
   - Planned field study (village participatory plant breeding experiment)

Note: *In some FFS, steps 3 and 4 are omitted, and the baseline exercises are directly undertaken by the facilitator or trainer during the community meeting to discuss about the project. Most conduct the baseline exercises at the start of the FFS session with the farmer participants. There are pluses and minuses for these variations, what is important is to establish communal ownership over the research process, and establish the baseline information prior to the start of the FFS.*

Map of Rice Genetic Resources in the Village

Objective

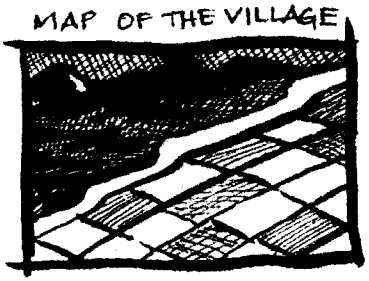
To assess the status of rice PGR in the community through participatory mapping

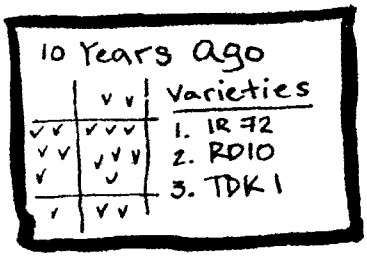
Materials

Pens, newsprint, glue, stones, etc.

Procedure

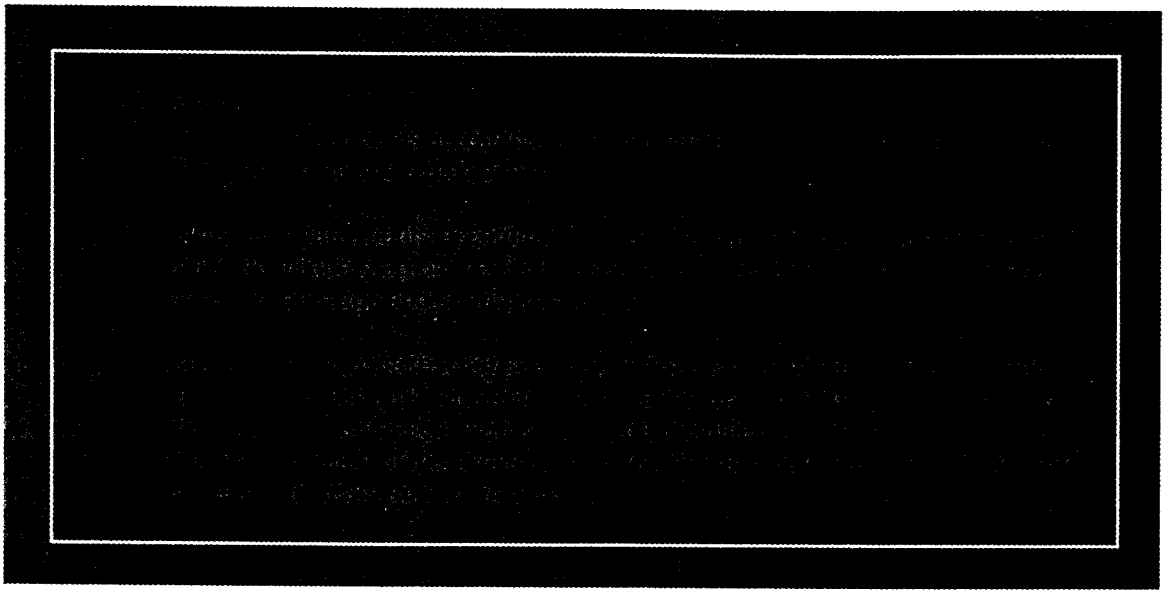
1. Divide farmers into small groups according to sub-villages.
2. Ask farmers to draw an outline of their village, and have them identify the boundaries, major roads and landmarks in the village.
3. Ask farmers to locate in the map the ricefields. To start, ask them 'Where are the ricefields in your village? Can you locate it in your map?' They can use colours, symbols or objects such as leaves (be sure to glue them on the paper) as markers for the ricefields. If possible, have them list beside the ricefield the name of the owner, the size of ricefield and whether it is rainfed or irrigated.
4. Ask farmers if they can identify the rice varieties currently planted this season in the different ricefields. Write the varieties down in the map.
5. Ask farmers to draw a map of resources 10 years ago and 20 years ago and write the varieties planted at that time on the map.





6. Ask groups to present the maps to the bigger group for validation. Guide the discussion and note what were discussed and settled by the participants.
7. Keep the map; redraw it in a smaller piece of paper for filing. This base map will be used as reference for subsequent monitoring of impact of rice PGR FFS.

***Transect** is a length of land usually a straight line that is used as the basis for sampling plants, animals or other indicators of interest using various sampling techniques.*



Discussion

1. Where are the ricefields in your village? Why are the ricefields in that part of the village?
2. What varieties are planted now in each of the ricefield? Briefly describe the different varieties.
3. What were the varieties planted last season? Do you use different varieties for different seasons? What were the varieties planted last year, 5 years ago, 10 years ago, and 20 years ago? Compare the varieties planted now with the varieties planted years ago? Are they the same variety? Why/why not?
4. What happened to the varieties planted before if they are no longer planted now?
5. What were the characteristics of varieties before? What were the characteristics of varieties now?

***Gender disaggregation** entails the collection and separation of data and statistical information by gender to enable comparative analysis/gender analysis (include sampling of both women and men).*

Matrix of Rice Varieties

Objectives

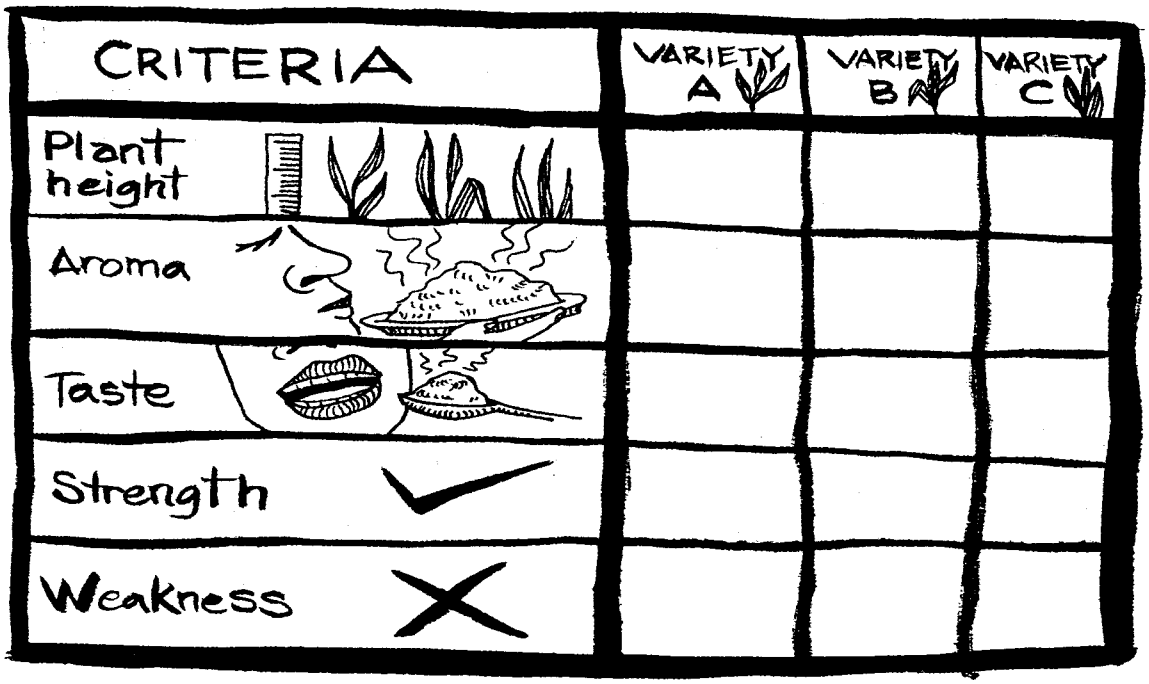
- To determine the characteristics of rice PGR in the community
- To assess the strengths and weaknesses of each rice variety currently planted
- To gauge the need to introduce new rice materials
- To examine the rice plant genetic material at the specific trait level

Materials

Chalk and blackboard, pen and paper

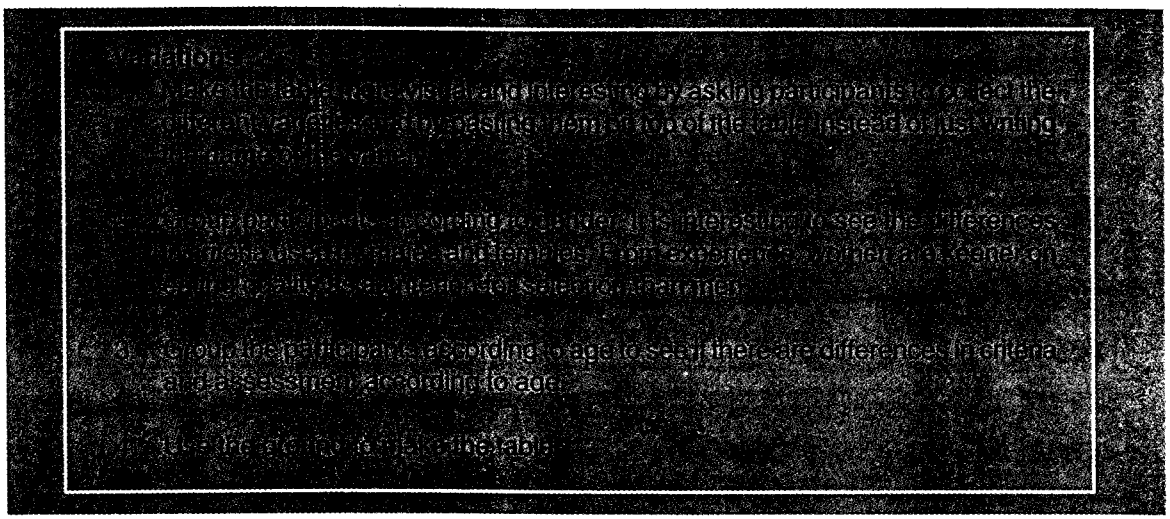
Procedure

1. Using the rice PGR map drawn by the participants, identify the different varieties currently planted in the community.
2. Ask farmers to list down the different varieties in one column.
3. In another column, ask farmers to list down the criteria they use in assessing different varieties. Start by asking, when you select for a good variety what are the things you look for? List or draw the criteria to create a table:



4. Ask farmers to score the different varieties. Using ten stones (or five stones) as the highest, grade each variety according to the criteria. Compare each variety.
5. Ask farmers to explain why they graded the varieties as such. Characterise each of the variety.
6. Add another row to the table on strengths and weaknesses of the variety to summarise the discussion.
7. Ask farmers the age of the variety by asking, when was the variety first used in the village and how long have they been using the same variety? How many years have they been using the materials?
8. Present the matrix to the bigger group. Note the discussion.
9. Keep a record of the matrix and the discussion, as this will be part of the baseline for rice PGR.

Matrix Ranking *involves asking farmers to evaluate each technology or variety of interest with respect to a number of criteria that are specified before ranking begins. For example, three rice varieties might each be evaluated for five criteria: (1) plant height, (2) aroma, (3) taste, (4) strength, and (5) weakness. This tool helps to understand how farmers trade off one trait with another during the decision-making process of rice variety selection.*



Discussion

1. What are the main rice varieties being used in the locality?
2. What are the characteristics of each variety (consider taste, duration, resistance, etc.)?
3. What characteristics should be changed?
4. What is the average age of the varieties used? Why is this so?
5. Is the development and distribution of new varieties fast or slow? How would you want it to be?

Sources of Rice Plant Genetic Resources

Objective

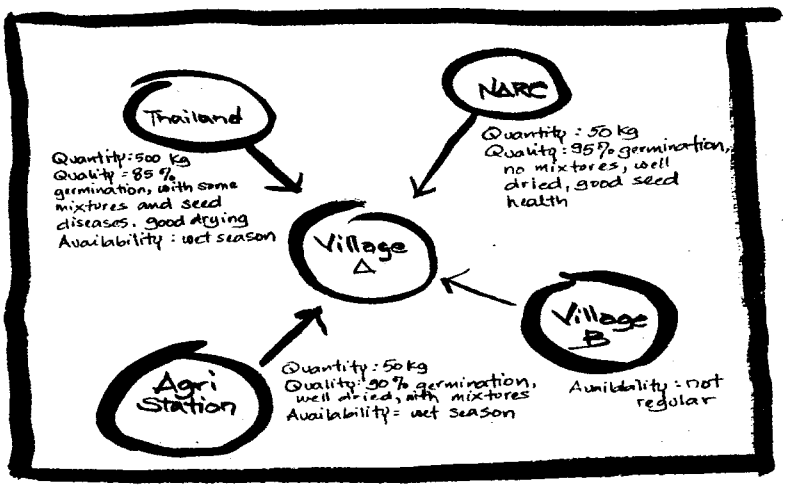
To determine access to rice PGR and understand the local seed supply system

Materials

Pen and paper

Procedure

1. Ask farmers to identify and list the different sources of rice seeds. Ask farmers, if they were to draw the different sources of seeds which one would be easily accessible to their community. Which one would be far? Ask farmers to draw a circle representing their community and to locate the different sources (in terms of accessibility and ease of obtaining seeds), near or far from the community (see sample illustration).



The diagram means that the Agricultural Station is the nearest source of seeds for the village probably because of extension agents who regularly bring seeds to the village. NARC is the farthest source of seeds from the village because it is far from the village. Thailand is the largest source of seeds for the village, i.e., although far it is where farmers get the most number (quantity) of seeds. The Agricultural Station, although near the village, supplies only a small percentage of the total seed requirement of the village.

2. Ask farmers to discuss the quality of seeds provided by the different sources and the quantity. How much does the source supply to the community?
3. Ask farmers about the frequency of distribution. Are the seeds always available all year round or only at a particular month, and is the supply enough?
4. Ask farmers to assess the strengths and weaknesses of each source of seeds. From the previous illustration, what can the farmers conclude about the advantages and disadvantages of the different seed source? Present in a table as shown below:

Sample Table

SOURCES OF SEEDS	ADVANTAGES/ STRENGTHS	DISADVANTAGES/ WEAKNESSES
NARC	Good quality seeds	Far from the village (expensive to go, cannot go regularly), seeds not always available, etc.
Agriculture Station	Near the village Good quality seeds	Cannot supply demand (can only give small quantity of seeds) etc.
Thailand	Good seeds Relatively easy to get Can supply demand	Not available all year round
Village B	Near the village	Quality is not so good

5. Ask farmers to recall the seed sources 10 or 20 years ago and have them assess the quality, quantity, and frequency of distribution, strengths and weaknesses of the different seed sources.
6. Present the result of small group discussion to the bigger group.
7. Keep a record of the discussion and the results of the exercise.

Variations

1. Group the participants according to gender or age to see the differences in opinion between gender and age group.
2. Use leaves or any other materials to represent the different seed sources, so it is easy to move (in terms of nearness to the community) in the course of discussion, rather than immediately draw the source at once.
3. Visit the different sources of seeds with farmers for them to see and discuss the strengths and weaknesses of the different seed sources.

Discussion

1. Is there enough supply of good quality seeds in the village?
2. Are the seeds available all year round?
3. When do you give seeds to other farmers? How do you exchange seeds? How much does a farmer have to pay for the seeds he gets from the different sources?
4. Will you be willing to pay for good quality seeds?
5. How diverse are the varieties from the different sources? Do you get different varieties or just 2-3 varieties per source?
6. How often do the seed sources change the varieties they supply? How many years have they been selling the same variety?
7. Do you think they should provide new variety every year? Why / why not?
8. Was the community (and the farmers) ever a source of seeds before by other villages? Why/why not?

Setting the Breeding Objectives

Objective

To set the breeding objectives for future distribution of materials and development of crosses by farmers

Materials

Pen and paper

Procedure

1. Using the matrix on the different varieties from the earlier exercise (see **Matrix of Rice Varieties**), ask small groups to summarise what they like about traditional varieties and what they don't like about them. Do the same for modern varieties.

	TRADITIONAL VARIETIES	MODERN VARIETIES
What I like		
What I don't like		

2. Present the following scenario: If they were given a chance to change three of the characteristics of the traditional varieties they do not like, what would they change? For modern varieties, what three characteristics will they change? Why?
3. Ask if they are to cross (or marry) a traditional variety with a modern variety what characteristics would they like to have from the traditional and modern variety?

4. Distribute small pieces of paper (ballots) to each farmer and ask them to write down their desired characteristics.
5. Collect answers from farmers and categorise responses.
6. Do a frequency count or tally of farmers who indicated their desire for each category. See following summary table for example. The categories may be considered as the desired breeding objectives. However, FFS participants will still identify their breeding objectives in another workshop when they are ready to conduct the plant breeding field study (see section on **Field Studies**).

CHARACTERISTICS	FREQUENCY
High Yield 	𝍸 - 𝍸 - 𝍸 - 𝍸 = 20
Resistance to pest and diseases 	𝍸 - 𝍸 - 𝍸 = 15
Resistance to floods 	𝍸 - 𝍸 = 10
Short Maturity 	𝍸 - 𝍸 - 𝍸 = 15

6. If farmers can only have two qualities present in a variety what would the two important qualities be? What are the next two important qualities? Rank the categories.
7. What are the possible parents of the cross? What traditional varieties will they use and what modern variety will they use?
8. Ask the small groups to present their discussions to the bigger group for comments.
9. Take note of the important points discussed and keep a record of the exercise results.

Variation
Group the farmers according to gender or age group to see if there are differences in objectives.

Discussion

1. What are the characteristics of traditional and modern varieties?
2. What characteristics of traditional varieties do most like? What characteristics are not well liked?
3. What characteristics of modern varieties do most like? What characteristics are not well liked?
4. What characteristics need to be changed so that the varieties will become suitable?
5. Which characteristics would you like to combine and why?

Assessing Farmers' Skills

Objectives

- To assess farmers' level of knowledge and skills on selection of varieties in order to develop appropriate learning tools that will suit their farming requirements
- To identify sources of knowledge and skills on selection of varieties
- To identify differences in gender perception on selection of varieties

Materials

Pen and paper

Procedure

1. Ask small groups to list (or illustrate) the steps in selecting a variety for planting. Note the characteristics they use in assessing varieties and how they select seeds and maintain them for the next planting season.
2. Ask farmers who selects and who decides for each activity, and who breeds and multiplies the seeds, etc. (see pictogram).
3. Ask farmers, for each step of the process where they got the knowledge and the skills (from husband, wife, parents, grandparents, uncles, aunts, neighbours, IPM trainer, etc.).

Sample Table

Process	Who Decides?	Sources of Knowledge and Skills
Variety to plant -write the steps		• Father or husband • neighbors
Seed selection		• mother or wife
Seed multiplication		• IPM trainer, wife
Seed storage		• Grandmother
Others		

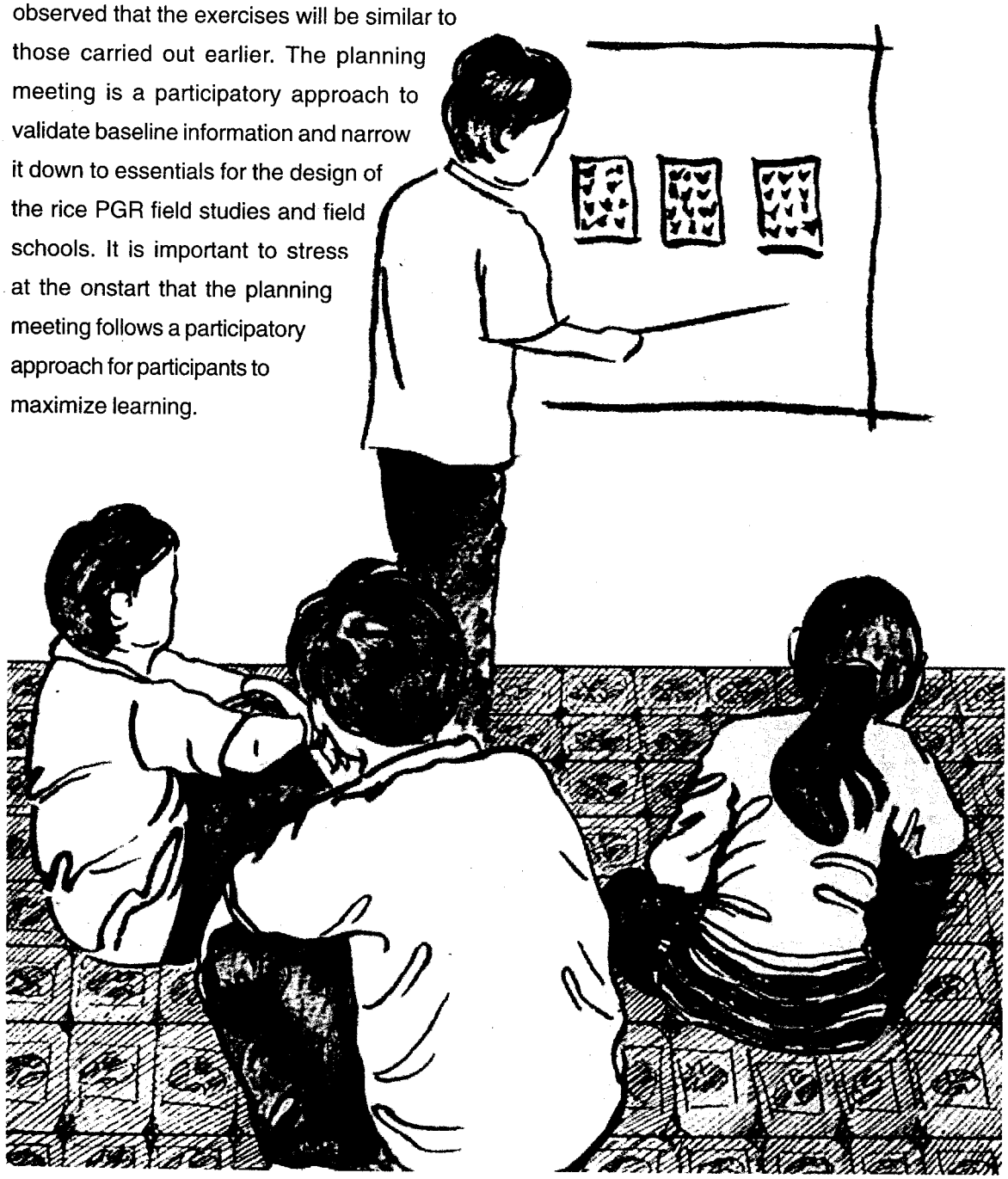
Discussion

1. How do you select which variety to plant this season? Who decides on what variety to plant? How did you learn to select this variety to plant this season? From whom did you learn the selection process?
2. How do you choose the seeds to plant this season? Who selects the seeds? Who introduced you to this technique?
3. From the table, what can you observe? Do the men decide more than the women or the women decide more? What are the things that men decide about? Why? Can women also decide on the same thing as the men? Why / why not?
4. From whom do you ask information on seed selection or variety selection? What information do they give?
5. Can you teach other farmers about your techniques? What do you think are skills and knowledge that you should still learn or are interested to learn? Why?

Indigenous Knowledge *develops in a particular area and accumulates over time through being handed down from generation to generation.*

PLANNING MEETING

The planning meeting is intended for the FFS participants and will make use of baseline information established with the community. Hence, it will be observed that the exercises will be similar to those carried out earlier. The planning meeting is a participatory approach to validate baseline information and narrow it down to essentials for the design of the rice PGR field studies and field schools. It is important to stress at the onstart that the planning meeting follows a participatory approach for participants to maximize learning.



Validation of the Local Biodiversity Situation

The change in the country's economic strategies inevitably carries certain potential conflicts for sustainable development, i.e., the exploitation of natural resources in an attempt to increase agricultural productivity. It also brings with it institutional problems and constraints in 'mainstreaming' results of research and development, especially when viewed in the light of biodiversity and plant genetic resource conservation. For example, the use of hybrid varieties is being promoted even though their adaptability and suitability have not been tested extensively in individual localities. Another example is farmers' increasing use of high yielding varieties and reduction in the use of local traditional varieties resulting in the loss of many traditional varieties such as upland rice. This is clearly seen in Thua Thien Hue, Vietnam where the number of traditional rice varieties has declined from around 100 in the past to 30 at present, or a decrease of 70 percent in about 10 years. It is important to raise the awareness of farmers about this issue and carry out discussions about what must be done about it.

*In **Thua Thien Hue, Vietnam**, the number of traditional rice varieties has declined from around 100 in the past to 30 at present, or a decrease of 70 percent in about 10 years.*

Objectives

- To compare varieties 10 years ago and those currently used
- To collect information on other variety-related situation and services, e.g., access to varieties
- To validate information from the baseline survey of the biodiversity situation in the locality

Materials

Markers, tape, and newsprints

Duration

1 hour and 30 minutes

Procedure

1. Divide farmers into small groups according to sub-villages.
2. Summarise results from the baseline exercises collected earlier.
3. Using the format below, ask them to list down on newsprint the varieties which farmers used in their village 10 years ago and what varieties farmers are using at present.

Summary of baseline survey results on variety use

No.	10 YEARS AGO Varieties farmers used	No.	AT PRESENT Varieties farmers use
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	

4. Compare results of baseline studies with the results of group discussions as shown on the table.

Discussion

1. How many varieties were used 10 years ago? What were these?
2. How many varieties are being used currently? What are these?
3. How many of the varieties that were used 10 years ago are still being used at present? Why?
4. Why is there such a difference in the number and kinds of varieties between the two periods?
5. What are the preferred and the non-preferred characteristics of varieties that have disappeared? Why are these varieties not being used now?
6. What are the preferred and the non-preferred characteristics of varieties currently in use? What characteristics would preferably be added to them?
7. How do varieties deteriorate?
8. Do farmers breed seeds? How do they breed seeds?
9. Who supplies varieties to the locality?
10. Why does each area have its own varieties?
11. Are farmers able to keep their preferred varieties?

Characteristics of Local Varieties

There is a gap between the desired characteristics of rice varieties and those that are currently available. This gap refers to the reduction of genetic resources caused by a myriad of factors among which is government policies, e.g., government subsidies for new high-yielding varieties of rice and corn, and lack of government support for biological diversity and rice PGR conservation and development in farming communities. This exercise will raise awareness of farmers about the problem of loss of genetic resources as well as the possibility of conserving genetic resources.

Objectives

- To compare characteristics of varieties currently used locally
- To discuss characteristics of varieties that farmers prefer

Materials

Markers, tape, and newsprints

Procedure

1. In small groups, ask farmers to discuss about the "good" (preferred) and "bad" (non-preferred) characteristics of each variety currently used in the locality. Also, encourage farmers to discuss the reasons why these characteristics are preferred or not and why one variety is "good" or "bad."
2. Each group presents results of their discussions using the following table.

Summary of varietal characteristics currently used in locality

CRITERIA	VARIETY A	VARIETY B	VARIETY C	VARIETY D	VARIETY E
Plant height					
Type of flag leaf					
Yield					
Growth duration					
Others					

3. In the big group, facilitate farmers to discuss and list down their preferred characteristics for varieties. Compare the results with that of the baseline exercises and discuss the differences and similarities. If possible reconcile the differences, if not, note the distinctions.

Discussion

1. What are the main varieties being used in the locality?
2. What are the characteristics of each variety? Consider taste, duration, resistance, etc.
3. What characteristics should be changed?
4. Are the results the same as that obtained from the baseline exercise? What are the reasons for the similarities and differences? What is the consensus of the group on the research subject of this season's study?

Identifying Preferred Varietal Characteristics

The agriculture sector is faced with the loss of indigenous diversity in major crops, particularly in rice. In areas with more favorable conditions (i.e., irrigated and fertile soil), few new and mostly uniform varieties come to the farmers' fields. Less 'well-adapted' cultivars are introduced alongside incentives like subsidised prices for seeds which farmers find tempting to adopt. However, since these cultivars have not been sufficiently tested for suitability and pests, problems become widespread. In marginalised areas major food crops like upland rice and maize suffer genetic erosion. The situation comes about as farmers continue to use farm-saved seeds that have lost their original traits over time. This includes deterioration of preferred traits as resistance to pests and diseases. In either case, i.e., favored or marginalised conditions, when insect pest problems and diseases occur, farmers fall back to using pesticides to deal with the situation. This complicates the declining yield and consequently profit losses that farmers encounter. Furthermore, the lack or inadequacy of formal seed supply system to meet the farmer's requirements worsens the situation. This exercise will articulate the farmer's desired varietal characteristics.

Objective

To formulate breeding objectives

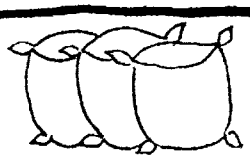
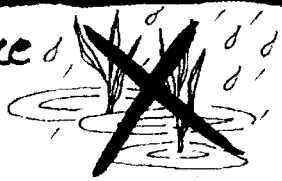
Materials

Markers, tape, small pieces of paper, and newsprints

Procedure

1. Use results from the previous exercise on preferred characteristics of varieties.
2. Distribute small pieces of paper (ballots) to each farmer and ask them to write down their desired characteristics.
3. Collect answers from all farmers and categorise responses.
4. Do a frequency count or tally of farmers who indicated their desire for each category. See following summary table for example.

***Note**: The categories may be considered as the desired breeding objective. However, farmers will still identify their breeding objectives in another workshop when they design their field studies.*

CHARACTERISTICS	FREQUENCY
High Yield 	𝍸 - 𝍸 - 𝍸 - 𝍸 = 20
Resistance to pest and diseases 	𝍸 - 𝍸 - 𝍸 = 15
Resistance to floods 	𝍸 - 𝍸 = 10

5. Compare the group results with the results from the baseline exercises. Discuss the differences and similarities in results and note down the discussion.

Discussion

1. What are the characteristics of available varieties?
2. What characteristics do farmers prefer and should be developed so that the varieties will become suitable (from their group and from the baseline exercises conducted with the community)?
3. What characteristics need to be modified so that the varieties will become suitable?

Plant Breeding Systems

Professional plant breeders and farmers both carry out varietal selection and breeding. They may have the same objective of crop improvement but the processes that they use are very different. Formal institutions usually collect and conserve genetic resources in genebanks. On the other hand, farmers carry out on-farm rice PGR CDU which has a couple of advantages. First, in farmers' fields, genes undergo farmers' selection as well as a natural selection resulting to varieties with better resistant to pests and diseases and improved adaptation to the local environment. Second, the farmers' system develops a heterogeneous genetic pool because of the presence of various local genetic sources. However, farmers are confronted with limited materials and unsystematic selection. Hence, this exercise will allow farmers to discuss ways to improve the two plant breeding systems.

Plant breeding *is the science and art and a branch of agricultural pratice. It is also referred to as the art and science of changing plants genetically.*

Natural selection *is the natural process by which organisms best adapted to their environment survive and those less well-adapted are eliminated.*

Objectives

- To determine strengths, weaknesses, and ways to improve the two plant breeding systems (farmer and government/institution)
- To raise awareness that farmers can produce varieties

Materials

Markers, tape, small pieces of paper, and newsprints

Duration

2 hours

Procedure

1. Ask farmers to work in small groups to discuss strengths, weaknesses, and ways to improve farmer and government/ institution plant breeding systems.
2. Ask groups to use the following table to summarise and present their discussions.

Strengths, weaknesses, and how to improve farmer and government/institution plant breeding systems

NO	CRITERIA	FARMER		GOVERNMENT/ INSTITUTION		HOW TO IMPROVE
		Strength	Weakness	Strength	Weakness	
1	Objective selection					
2	Parent selection					
3	Genetic progress					
4	Techniques of varietal selection					
5	Varietal evaluation					
6	Decision making					
7	Ownership of variety					

Discussion

1. Compare the strengths and weaknesses of the two plant breeding systems in terms of breeding technology, strategy, and participation.
2. What measures should be done to help farmers produce varieties themselves?

Developing Workplans for the First Season

The exercises carried out in the **Planning Meeting** should lead farmers to think about what activities they can implement in the near future. Although rice PGR activities are intended to span several seasons, it is suggested that farmers make plans for the next immediate season. However, farmers must be advised that they should not lose sight of their long-term objectives especially if they are considering plant breeding beginning with rehabilitating preferred varieties.

Objective

To develop a workplan for the rice PGR-related activities (line selection, varietal selection, varietal evaluation, and seed rehabilitation) in the first season

Materials

Markers, tape, and newsprints

Duration

2 hours

Procedure

1. Divide farmers into small groups according to sub-villages to plan activities to carry out for the next two seasons and what the priorities would be for the immediate season.

2. Using the format below, ask them to write on newsprint for presentation.

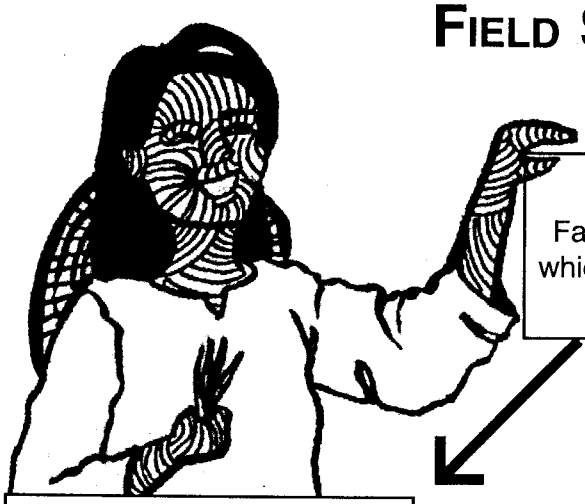
Format for planning rice PGR activities for two seasons

NO.	MAIN ACTIVITY	DESIRED OBJECTIVE	DETAILED ACTIVITIES	NO. OF ACTIVITIES	DURATION	AREA	NO. OF PARTICIPANTS	EQUIPMENT

Discussion

1. What preparations are needed for the implementation of the activities?
2. Who is responsible for each activity?

FIELD STUDIES



VARIETAL EVALUATION STUDY
Farmers identify their preferred varieties which they will then multiply, distribute and plant in their fields.

SEED REHABILITATION STUDY
If the preferred variety from the VARIETAL EVALUATION STUDY has deteriorated (with mixtures and impurities), farmers may opt to rehabilitate them before using them as parent materials.

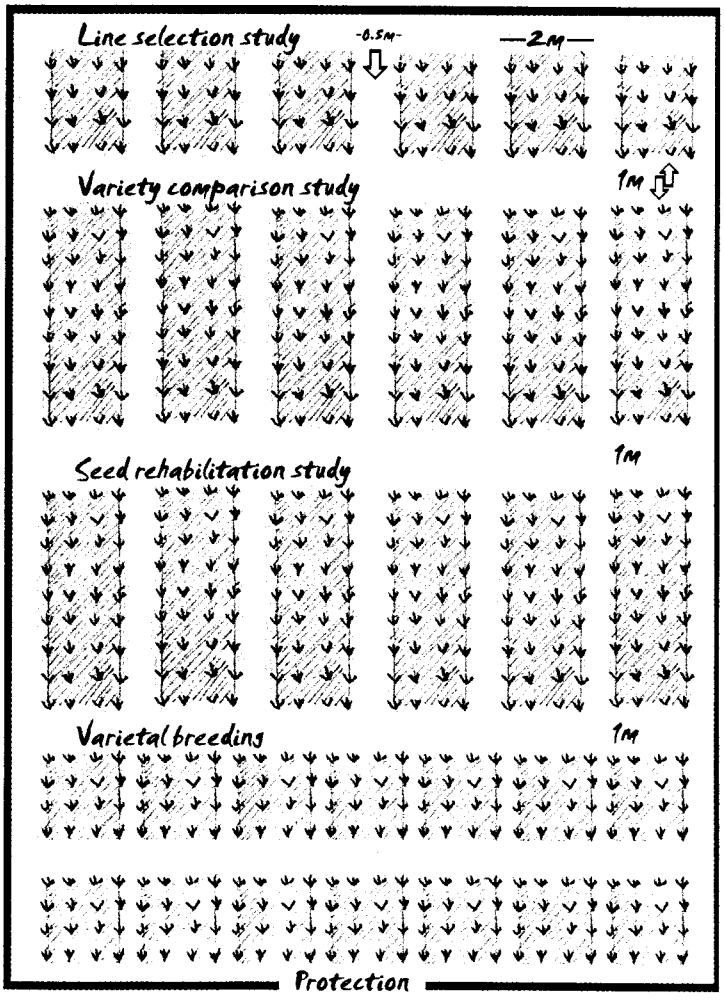
PLANT BREEDING STUDY
Farmers use their preferred varieties from the VARIETAL EVALUATION STUDY as parent materials for crosses.

LINE SELECTION STUDY
After planting F1 seeds from the PLANT BREEDING STUDY for one season, the F2 seeds are evaluated to select lines until a stable material (around F7 of F8) is developed.

The field studies, although they can be undertaken independently, are linked into one process.

It is not necessary to do all the field studies in one season. The decision on the number and kind of field studies to implement will depend on the capability of farmers' groups to manage the activities. A small group of farmers will be assigned to take care of and monitor one field each for an entire season. This will lead to the development of a core group of farmers with specialised skills on each of the topics, e.g., line selection, plant breeding, seed rehabilitation and varietal evaluation. It will be the responsibility of the core groups to help other farmers gain the different skills.

During the season, it is important for each small group in the FFS to share their experiences and understand how their studies are all linked together. For this reason, it is suggested that the studies all be set-up in one field (see proposed diagram) to facilitate observations and learning about each field study.



Evaluation of Varieties

Farmers choose varieties depending on some preferred characteristics. These may be resistance to disease, resistance to lodging, grain quality, or yield potential. In this study, farmers will evaluate the overall performance of a number of rice varieties based on preferred characteristics; and decide their suitability for local production, taking into consideration local biophysical conditions such as soil and weather situations. (The assumption is that before the season, during the planning meeting, the farmers carry out the exercise on **Criteria for Selection of Varieties** in the section on **Special Topics** of this field guide.) The farmers are not only expected to select locally-available varieties and varieties from breeding institutions that they think will be suitable and useful for them, but also try out new plant materials from other countries that may become available for them in the future.

Objectives

- To test local varieties as well as varieties from breeding institutions
- To evaluate preferred characteristics of varieties
- To develop skills on selecting varieties suitable for local production
- To explain relation between variety-insect pests-disease and other environmental factors

Materials

Varieties

The number of varieties will depend on what is available, some of which are already available in the village and some will be new for the village. The new varieties will be provided through the trainers from different rice breeding institutions, genebanks and farmers.

Field size

Each single variety should have about 20 m^2 - 50 m^2 field size. The total area for the study will depend on the number of varieties available. If a maximum of 10 varieties are used, the total area should be about 300 m^2 – 500 m^2. The distance between varieties should be at least 0.5 m. No replications are needed.

Fertiliser level

Fertilizer levels will depend on the farmer practice and local recommendations. The fertilizer levels will be determined for each site, in discussion with the farmer group.

No pesticides will be used in this study, because the resistance against pests and diseases will be evaluated.

Preparing the seedlings

To enhance germination, soak seeds in tap water for about 24 hours. The seed treatment will depend on the weather conditions in the locality. If the weather is warm, it is not necessary to soak the seeds in water until they germinate. However, if the weather is cold, it is necessary to soak the seeds in water until they germinate.

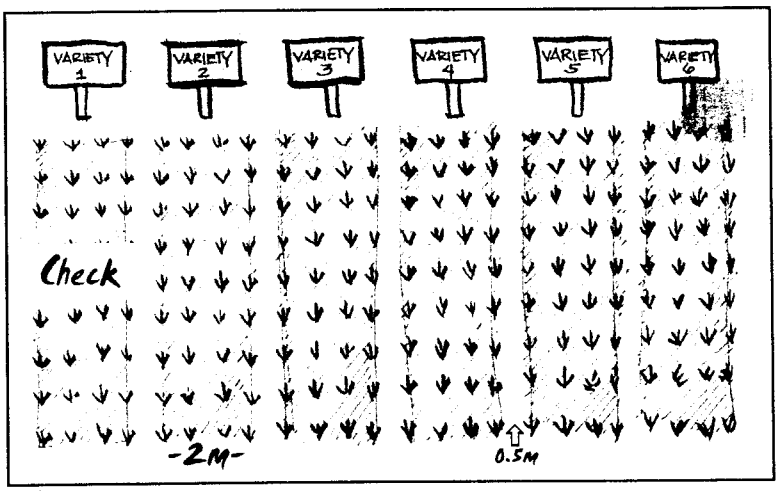
Note: A maximum of 10 varieties is suggested for the first season. This number will be sufficient and manageable for farmers to gain enough learning experience. Make sure that one of the varieties to be used is a check variety.

Density of transplanting

Use the straight transplanting method. Transplant one plant per hill at a distance of 20 cm x 20 cm.

Study Layout

It is very important to label the fields to know the location of the varieties planted. In addition, make a map of the field, and indicate in the map what variety is planted where. The check variety can be planted on the first block, the middle block or even the end block. The study can be set up in the following way:



*A **check variety** can be the variety most commonly planted by farmers in the village. The check variety will serve as the 'standard' for comparison. The assumption is that the check variety, being the one widely used in the village, is the most preferred and therefore possesses the characteristics desired by the farmers in the village. By using the check variety to evaluate the other varieties, farmers are given a more visual and constant reference for comparison.*

Procedure

1. At the beginning of the season, ask farmers to develop the criteria, i.e., define the preferred characteristics, of the variety that they want to use for the season. The exercise on **Criteria for Selection of Varieties** in the section on **Special Topics** of this field guide may be used.

2. As mentioned under the section on preparation of seedlings, soak seeds in tap water for about 24 hours to enhance germination.

3. Using the straight transplanting method, transplant one plant per hill at a distance of 20 cm x 20 cm.

4. Fertiliser management will be based on local farmers' practices. No pesticides will be used for comparison of resistance to insect pests and diseases. Carry out usual field management practices for other aspects, e.g., water management.

Observations

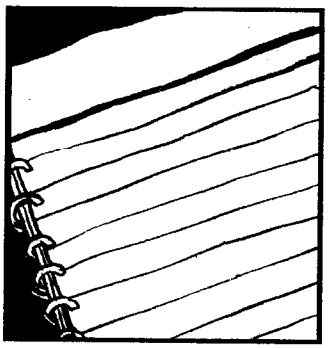
From transplanting period to flowering stage

1. Observe weekly. Ask farmers to randomly choose five hills for each variety to observe and record:
   - ❑ Crop development, i.e., plant height, number of tillers, number of green leaves
   - ❑ General appearance, i.e., uniformity of each variety
   - ❑ Insect pests and disease development
   - ❑ Natural enemies
   - ❑ Water level
   - ❑ Weather conditions are observed

   As usually done in ecosystem observations, present drawings and observations in newsprint. Make field management decisions based on observations.

2. Use a sheet to collect all data as indicated in the following page.

Each group should have ***one notebook for recording all data from observations*** *of each hill.*



Note: *Trainers and farmers are encouraged to add other observation criteria, as needed.*

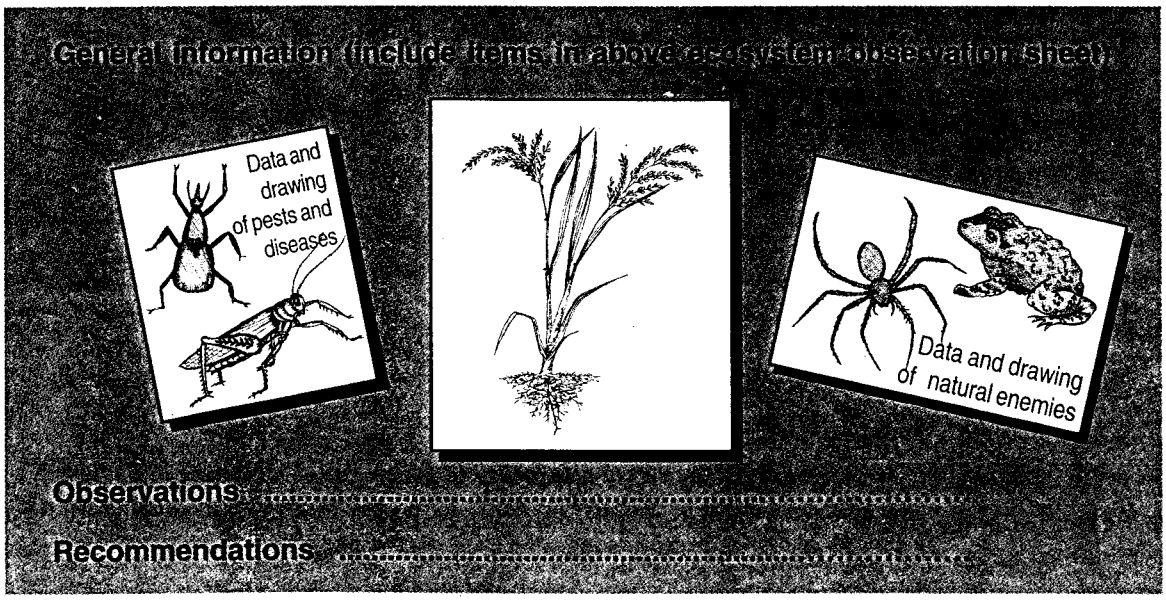
Ecosystem observation sheet (transplanting to flowering)
Date _____
Group _____

Week after transplanting/seedling	.....
Weather condition	.....
Plant development stage	.....
General appearance	.....
Water level	.....

Weekly ecosystem analysis form

Variety / Criteria	1	2	3	4	5	6	7	8	9	10
Plant development										
Pests										
Natural enemies										
Diseases										
Weeds										

Ecosystem analysis presentation
Date: _____
Group: _____



From flowering stage to mature stage

1. Observe every three days. Ask farmers to randomly choose five hills for each variety to observe. For each hill, record the characteristics enumerated by farmers in setting the criteria for selection and their breeding objectives. In addition, trainers may consider the following:
   - ❑ Leaf colour, leaf length, width of the leaf under the flag leaf
   - ❑ Width of flag leaf, angle of flag leaf
   - ❑ Tiller angle, plant type (angle of leaves; stem type; leaf width)
   - ❑ Date flowering started, date flowering was completed
   - ❑ Number of panicle/hill, panicle length, panicle shape (closed or opened), panicle emergence
   - ❑ Level of grain filling, grain color, grain shape, grain awn
   - ❑ Total of grains/panicle, number of full grains/ panicle
   - ❑ Pest and disease infestation level
   - ❑ Duration from flowering to maturation
   - ❑ 1000 grain weight
   - ❑ Plant height
   - ❑ Development stages
2. Prepare tables and graphs on newsprint and keep adding information on the above characteristics for each observation. Present tables and graphs during weekly meetings.
3. Compare observations of each hill in the study with the situation in farmers' fields. Also compare study observations with the variety selection objectives developed by the group. Discuss this during weekly meetings.

At the end of the season

Collect data on yields and carry out a yield component analysis.

1. Crop cuts
   Cut all plants (except the outer row). Measure the area actually harvested (m^2). Measure the total yield of the area harvested and calculate yield in kg/ha.
2. Yield component analysis
   For each variety, a detailed yield component analysis will be done. Collect 10 hills for each variety, and bring them to the meeting room. Select 20 panicles.

***Label** the varieties carefully when taking crop cuts.*

Measure:

- ❑ Length of panicle
- ❑ Number of grains per panicle
- ❑ Number of filled grains per panicle
- ❑ Number of empty grains per panicle
- ❑ 1000 grain weight

Discussion

Weekly

1. Describe the general condition of plant development for each variety. Do the different varieties develop in the same way? How did the weather conditions influence plant development? (Was it sunny or cloudy?)
2. What fertiliser and other management practices were applied during the week? How did these affect crop development for each variety?
3. Compare the pest and disease situation to the previous week? Are there more insect pests and diseased plants? Why? Is the insect pest damage or disease infection more severe? Why? Is the development of insect pests and disease the same on all varieties? Why? Are there some varieties that have few insect pests or little disease infection and that remain like that compared to the weeks before? Why?
4. Compare growth development and performance of varieties. Based on the weekly data gathered, explain the reason for the preferred variety at:
   - ❑ Tillering stage
   - ❑ Booting stage
   - ❑ Early flowering stage
5. Which is second best?

   For items #4 and #5, the trainers can facilitate a preference ranking/scoring or pair-wise ranking exercise as shown in the box below.

Ranking or scoring exercise

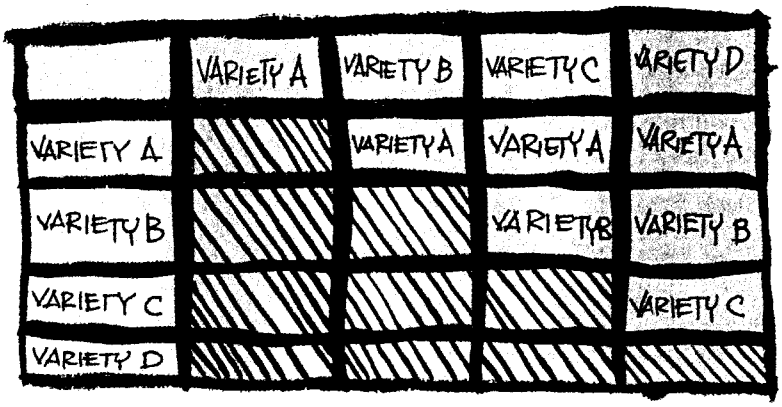
CRITERIA	VARIETY A	VARIETY B	VARIETY C
Criteria A (e.g. short plant height)	6	6	8
Criteria B (e.g. early maturity)	5	8	8
Criteria C			
Criteria D			

Variations:

If farmers want to be more specific, they can also put a weight on each of the criteria. Some of the criteria may be more important than the rest, so farmers can assign a weight or score for that item. For example, if early maturity is the most important criteria, then it is given a weight of 10 points. The score given by farmers for Variety A for that criteria (early maturity) will then be multiplied by 10 to get the actual score for that item.

Using the same format, farmers can rank the varieties according to the criteria. For Criteria A which among Varieties A, B and C is first, second, and third. Tally the ranks to determine the preferred variety.

Pairwise ranking exercise



Pairwise ranking *is a data collection method that is a form of matrix ranking used to determine problems or preferences of individual community members, identify their ranking criteria, and easily compare the priorities of different individuals.*

This is done using the above matrix. Farmers look at the varieties and select which they prefer. For example, between Variety A and Variety B, which do they prefer? And so on.

5. Based on observations of other farmers (farmers aside from the varietal evaluation group), which varieties do they prefer at different growth stages? Are they the same as the field study group results? Why? Are there other important characteristics that were not included in the observations? Why are these characteristics important?

At flowering, ripening and harvesting stage

1. Is there any difference in the time of flowering and ripening between varieties?
2. Do some varieties shatter easily compared to others?
3. What are the panicle characteristics, and grain characteristics?
4. Seven to ten days before harvesting, discuss how to select good plants for the next season based on comparisons of plants in the field study and farmers' fields.

At the end of the season

1. Make a yield analysis.
2. What are preferred traits for rice for this season? What is the reason for each preference? What are the implications of each? (This is taken up in detail as one of the weekly activities.)
3. Discuss the same issue with regard to the other cropping seasons: What traits should be different for the different seasons?
4. Note and discuss specific problems observed for each entry. Were these covered by the traits discussed?
5. Is any one variety obviously the best? Or do different entries have different advantages?
6. How can we improve the study for next season?
7. Carry out a general evaluation of all the varieties. The following table may be used but trainers and farmers are encouraged to add other observation criteria, as needed.

Sample Evaluation Table

NO.	CRITERIA	GROWTH STAGE FOR MEASUREMENT	EVALUATION SCALE
1	Plant height	Weekly	cm
2	Number of green leaves	Weekly	Number of green leaves/female parent plant
3	Number of tillers	Weekly	Number of tiller/plant
4	Pests	Weekly	Number of pest/sampling unit
5	Diseases	Weekly	% of disease infected plant - disease scale (identified as in FFS on Disease Management; see Technical Reference section)
6	Length of flag leaf	Panicle initiation - flowering	cm
7	Width of flag leaf	Panicle initiation - flowering	cm
8	Length of leaf under flag leaf	Panicle initiation - flowering	cm
9	Width of leaf under flag leaf	Panicle initiation - flowering	cm
10	Culm angle	Internode development - panicle initiation	Angle of main stem and tiller (erect < 30^0, moderate = 45^0, slanted > 45^0)
11	Angle of flag leaf	Panicle initiation - flowering	Angle of panicle axis and flag leaf
12	Diameter of rice stem	Ripening	Cut close to the base of the plant
13	Beginning of flowering	Panicle initiation - flowering	First day of flowering
14	End of flowering	Flowering	More than 95% of panicle exerted
15	Duration of flowering stage	Flowering	From first day to end of flowering
16	Harvesting Ripening	Possible to harvest	
17	Duration of rice growth	Ripening	From sowing day to ripening
18	Panicle exertion	Flowering - ripening	Well, moderate, partially exerted, enclosed
19	Length of panicle	Flowering - ripening	cm
20	Type of panicle	Flowering - ripening	Compact, moderate, open (see Technical Reference section)
21	Type of seed	Ripening	Round, oval, long
22	Awn presence	Ripening	Yes or no
23	Number of panicle/m^2	Ripening	Number of panicle/m^2
24	Total of seeds/panicle	Ripening	Count number of seeds of 20 panicles
25	Number of filled seeds/panicle	Ripening	Count number of seeds of 20 panicles
26	Number of empty seeds/panicle	Ripening	Count number of seeds of 20 panicles
27	Weight of 1000 seeds	Ripening	Sample and weigh each variety
28	Theoretical yield	Ripening	Tonne/ha
29	Realistic yield	Harvesting Tonne/ha	
30	Quality of endosperm		Delicious, medium, not delicious

Seed Rehabilitation

There are two main reasons for varietal deterioration. These are accidental incorporation of seeds of other varieties, and mutation or retrogression.

Seed mixtures can come from the field or maybe mixed during harvest. Farm implements, seed storage containers, and tools are also possible sources of seed contaminants. The mechanical mixtures lead to changes in the composition of the population (or variety) as new plants with different characteristics are accidentally added. Therefore, the performance of the original variety is changed.

Mutation occurs at a very low rate. However, the effect can accumulate over time which leads to the deterioration (change from the original state) of both characteristics and performance of a variety. Most mutation that occurs is caused by the environment.

To address the problems of varietal deterioration, some farmers in Vietnam have carried out seed rehabilitation studies. During seed rehabilitation studies, farmers work through three seasons to bring back the preferred characteristic traits of varieties, until they are close to their original state.

Mutation *is a change in the genetic makeup of an organism. It is also referred as the process that leads to heritable structural changes in genes.*

Retrogression *is the return to the unstable state of an organism.*

Objectives

- To explain why varieties deteriorate and the need to rehabilitate seeds
- To carry out seed rehabilitation activities on selected varieties to bring back their preferred original characteristics

Materials

Varieties

The number of varieties will depend on what farmers decide based on their planning meeting. Normally, these varieties are available in the village and have been used for a long time. Farmers' groups are encouraged to use traditional varieties.

Field size

Each variety should be allotted about 500 m^2. The total area for the study will depend on the number of varieties available. No replications are needed but the field should be divided into small separate plots for easier observation. Smaller plots facilitate identification of the good plants so that they can be harvested first.

Fertiliser level

Fertilizer levels will depend on the farmer practice and local recommendations. The fertiliser levels will be determined for each site, in discussion with the farmer group.

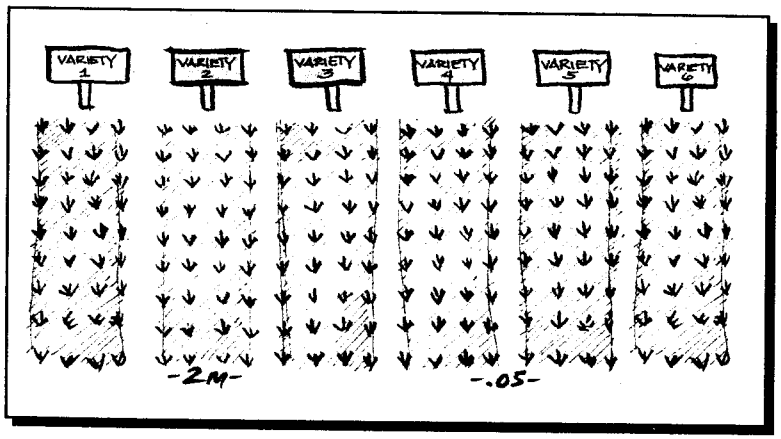
No pesticides will be used in this study, because the resistance against pests and diseases will be evaluated.

Preparing the seedlings

To enhance germination, soak seeds in tap water for about 24 hours. The seed treatment will depend on the weather conditions in the locality. If the weather is warm, it is not necessary to soak the seeds in water until they germinate. However, if the weather is cold, it is necessary to soak the seeds in water until they germinate.

Density of transplanting

Using the straight transplanting method, transplant one plant per hill at a distance of 20 cm x 20 cm.



Procedure

1. At the beginning of the season, ask farmers to identify the criteria of their preferred original characteristics of the variety that they want to rehabilitate. The exercise on **Criteria for Selection of Varieties** in the section on **Special Topics** of this field guide may be used. The criteria that farmers develop at the beginning of the season may be changed as often as farmers identify other important characteristics based on their field observations.

2. Discuss with farmers to agree on the method of seed rehabilitation that they want to use.

3. Based on the decision of the farmers' group, follow procedure for seed rehabilitation.

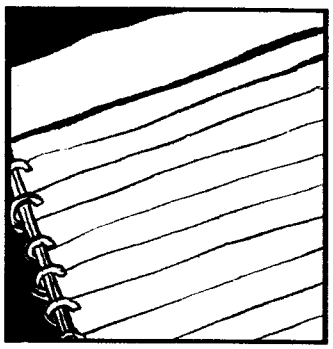
Observations

From transplanting period to flowering stage

1. Observe weekly. Ask farmers to randomly choose 10 hills for each variety to observe and record:
   - ❑ Crop development, like plant height, number of tillers, number of green leaves
   - ❑ General appearance, like uniformity of each variety
   - ❑ Insect pests and disease development
   - ❑ Natural enemies
   - ❑ Water level
   - ❑ Weather conditions are observed

   As usually done in ecosystem observations, present drawings and observations on newsprint. Also make field management decisions.
2. Use a sheet to collect all data as indicated below.

Each group should have ***one notebook for recording all data from observations*** *of each hill.*



Note: *Trainers and farmers are encouraged to add other observation criteria, as needed.*

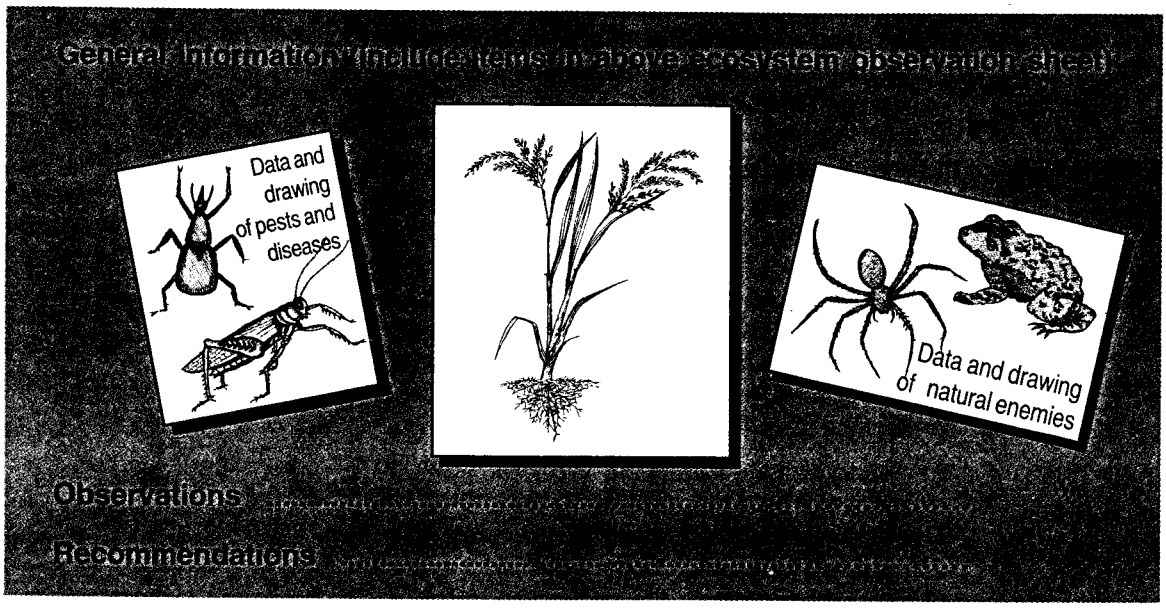
Ecosystem observation sheet (transplanting to flowering)
Date _____
Group _____

Week after transplanting/seedling	.....
Weather condition	.....
Plant development stage	.....
General appearance	.....
Water level	.....

Weekly ecosystem analysis form

Variety / Criteria	1	2	3	4	5	6	7	8	9	10
Plant development										
Pests										
Natural enemies										
Diseases										
Weeds										

Ecosystem analysis presentation
Date: _____
Group: _____



From flowering stage to mature stage

1. Observe every three days. Ask farmers to randomly choose 10 hills for each variety to observe. For each hill record data relating to the preferred characteristics of farmers which may include:
   - ❑ Leaf colour, leaf length, width of the leaf under the flag leaf
   - ❑ Width of flag leaf, angle of flag leaf

- ❑ Tiller angle, plant type (angle of leaves; stem type; leaf width)
- ❑ Date flowering started, date flowering was completed
- ❑ Number of panicle/hill, panicle length, panicle shape (closed or opened), panicle emergence
- ❑ Level of grain filling, grain color, grain shape, grain awn
- ❑ Total of grains/panicle, number of full grains/ panicle
- ❑ Pest and disease infestation level
- ❑ Duration from flowering to maturation
- ❑ 1000 grain weight
- ❑ Plant height
- ❑ Development stages

2. Prepare tables and graphs on newsprint and keep adding information on the above characteristics for each observation. Present tables and graphs during weekly meetings.
3. Compare observations of each hill in the study with the situation in farmers' fields. Also compare study observations with the criteria, i.e., preferred original characteristic traits, developed by the group at the beginning of the season. Discuss this during weekly meetings.

At the end of the season

Collect data on yields and carry out a yield component analysis.

***Label** the varieties carefully when taking crop cuts.*

1. Crop cuts
   Cut all plants (except the outer row). Measure the area actually harvested (m^2). Measure the total yield of the area harvested and calculate yield in kg/ha.
2. Yield component analysis
   For each variety, a detailed yield component analysis will be done. Collect 10 hills for each variety, and bring them to the meeting room. Select 20 panicles. Measure:
   - ❑ Length of panicle
   - ❑ Number of grains per panicle
   - ❑ Number of filled grains per panicle
   - ❑ Number of empty grains per panicle
   - ❑ 1000 grain weight

Discussion

Weekly

1. Describe the general condition of plant development for each variety. Compare the way each variety develops with the criteria that the group has set, i.e., the original characteristic traits? How did the weather conditions influence plant development? (Was it sunny or cloudy?)
2. What fertiliser and other management practices were applied during the week? How did these affect crop development for each variety?
3. Compare the pest and disease situation to the previous week? Are there more insect pests and diseased plants? Why? Is the insect pest damage or disease infection more severe? Why? Is the development of insect pests and disease the same on all varieties? Why? Are there some varieties that have few insect pests or little disease infection and that remain like that compared to the weeks before? Why?

At flowering, ripening and harvesting stage

1. Compare the time of flowering and ripening of each variety with the criteria, i.e., original characteristic traits.
2. Do some varieties shatter easily compared to others?
3. Describe the grain characteristics of each variety.
4. Seven to ten days before harvesting, discuss how to select good plants for the next season based on comparisons of plants in the field study and farmers' fields.

At the end of the season

1. Make a yield analysis.
2. Among all the varieties in the seed rehabilitation study, what variety does the group prefer? Do the traits of these varieties fit the criteria defined early in the season? How different were the characteristic traits listed early in the season from those observed. Is it possible to bring back the original preferred traits of varieties?

3. Note and discuss specific problems observed for each variety.
4. What seed rehabilitation methods did farmers use before? What methods are farmers using now? Should one seed rehabilitation method be used for all varieties?
5. If you were to decide on a seed rehabilitation method, which one would you choose and why?
6. How can we improve the study for next season?
7. Carry out a general evaluation of all the varieties. The following table may be used but trainers and farmers are encouraged to add other observation criteria, as needed.

Sample Evaluation Table

NO.	CRITERIA	GROWTH STAGE FOR MEASUREMENT	EVALUATION SCALE
1	Plant height	Weekly	cm
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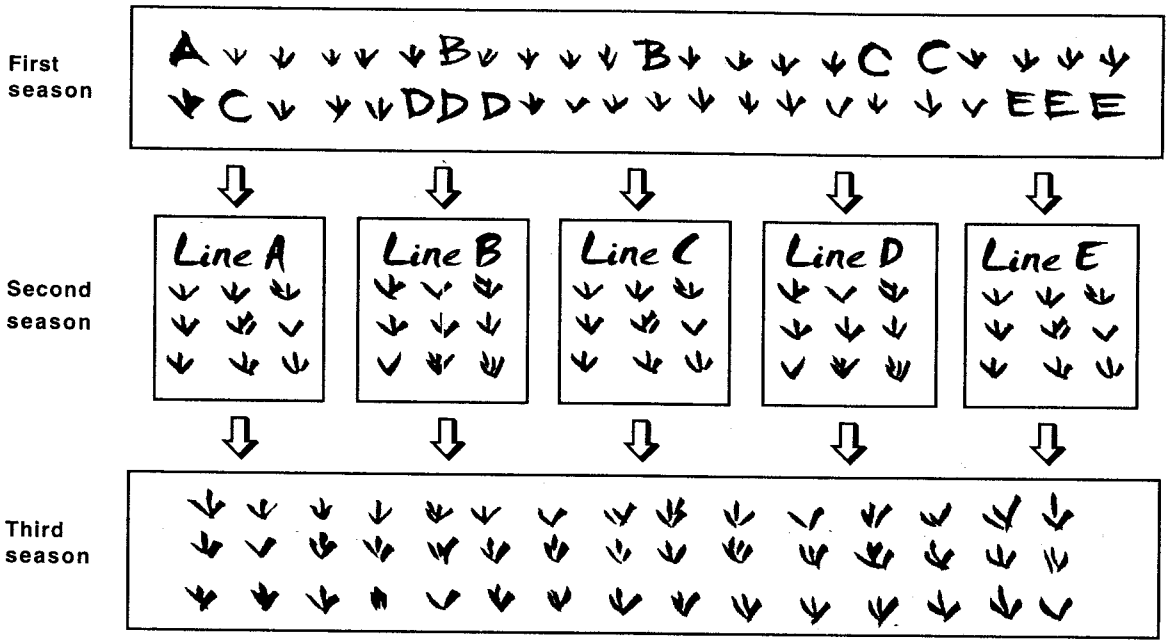
27	Weight of 1000 seeds	Ripening	Sample and weigh each variety
28	Theoretical yield	Ripening	Tonne/ha
29	Realistic yield	Harvesting Tonne/ha	
30	Quality of endosperm		Delicious, medium, not delicious

Methods of seed rehabilitation

1. Mass selection
   Throughout the season, rogue plants with characteristics that do not fit the criteria developed by farmers. At the end of the season, collect seeds from plants remaining in the field. Use these seeds in the following season.

2. Pure line selection
   a. Identify prospective lines
   b. Carry out line multiplication and comparison

Pure Line Selection



3. Pure seed selection
   a. From the start of the season, rogue plants with very obvious characteristics that do not fit the criteria that they identified. Each week, they review the criteria, e.g., plant height, colour of culm, tiller angle, etc. and refine these based on their field observations. Through this process, farmers will be able to continue to improve their standards.

   This method was successfully applied by farmers for selecting pure varieties such as Nang thom cho dao, Tai nguyen, and Tau huong.

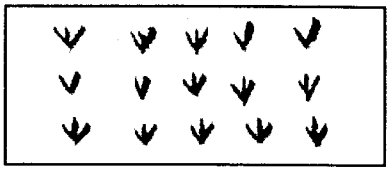
   b. Roguing of plants for seed rehabilitation will begin to be more intense from early ripening because at this time it becomes easier to observe the characteristics that are not preferred.

   c. At ripening stage continue roguing plants that do not come up to the standards. Identify plants that meet the criteria and mark by staking. Make sure to mark the hill on the

map drawn early in the season. (This is to ensure that the plants can be identified even if the stake is removed accidentally.)

- ❑ At maturity (when about 85% of the grains are ripe), collect the best panicle from the best plants, i.e., plants that meet the criteria.
- ❑ Put each panicle separately in a paper bag.
- ❑ The following season, grow seeds from one panicle in one row on 5 m – 10 m. This row is called a seed row.
- ❑ Throughout the following season, remove entire rows with plants that show characteristics different from the criteria.
- ❑ By the end of the season, collect all seeds from the remaining seed rows. The seeds, now classified as a purified variety, can be combined together and used in the next planting season. The seeds should now possess the original characteristic traits. Farmers may choose to multiply the seeds in the following season.

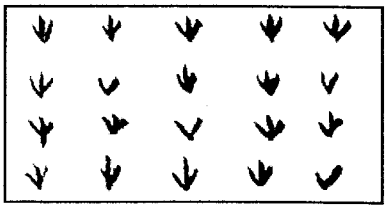
First season



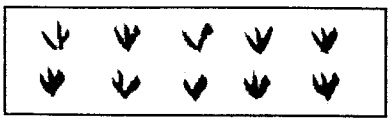
Select 300 - 500 individuals of same variety.
Take one panicle from each individual
(mix the seeds together).

Sow seeds of from one panicle in a seed row.

Second season

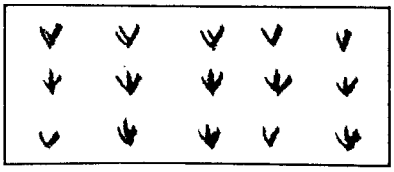


Seedlings from a seed row above are transplanted in rows about 5 m – 10 m long. At flowering and ripening stages, remove whole rows with hills showing unusual characteristic traits. Collect one panicle from each row and keep seeds for the next season.



Sow seeds without treatment,
one panicle/one seed row.

Third season



Remove all rows, which have any unusual hills.
Collect remaining and put seeds together.
This is now a pure variety.

Line Selection

Formal breeding institutions release finished varieties adapted to a wide environment or 'generalised' conditions. The process usually takes years because plant breeders still have to conduct adaptability trials across locations. Often, there are cases where the released variety is not suitable to a village or a province leading to non-adoption by farmers. The participation of farmers in the formal breeding process is also limited. At best, some consultations take place and in some instances farmers are asked to evaluate on-station trials. The farmers who evaluate represent a small fraction of the total farmers who will be potential end-users of the variety.

This study on line selection aims to democratize the plant breeding process by giving farmers a major role in deciding and developing the varieties adapted to their environment and needs. Instead of finished varieties, farmers will be given further unfinished materials or segregating materials of different generations and from different crosses to make a wide choice available to them. Selection will be according to farmers' needs and conditions, thus, the variety that will be developed in the process will most likely be adapted and used by the farmers. The plant breeding cycle is shortened as multi-location trials are done away with and the product is directly utilized by the developers themselves. Aside from material flow, providing early generations to farmers will develop their skills not only in plant breeding but also in decision making in general.

Objectives

- To explain the importance of line selection
- To carry out line selection activities based on a set of criteria farmers themselves identify
- To observe, record, and file data on line selection activities

Materials

Segregating materials

The number of segregating materials (either as established lines where plant breeders have done some selection or as plant populations bulked together) will depend on what is available. If there is a local seed breeder, some segregating materials already available

in the village may be used. Try to get segregating materials from breeding institutions. Involve farmers in securing the materials.

Segregating materials *are products of crosses from F_2 exhibiting unstable (not uniform) characteristics.*

A maximum of 10 segregating materials of different generations and crosses is suggested for the first season. This number will be sufficient and manageable for farmers to gain enough knowledge and skills.

Get at least three sets of segregating materials (F_2 or F_3, F_4 or F_5 and F_6 or F_7), if possible from different crosses using diverse parents. If this is not possible, ensure at least an F_2 or F_3 and an F_6 for use in the field study.

Field size

Each segregating line should be about 10 m. The total area for the study will depend on the number of segregating lines available. If a maximum of 10 lines are used, the total area should be about 150 m^2. The distance between lines should be at least 0.5 m. No replications are needed.

Fertiliser level

In the seed trays, incorporate compost in the soil before seeding based on farmers' practice. Urea should be applied as top dressing. However, extreme care must be taken so that the seedlings are not burned. In the field, fertiliser levels will depend on the farmer practices and local recommendations and should be determined for each site in discussion with the farmers' group.

No pesticides *will be used in this study, because the resistance against pests and diseases will be evaluated.*

Note to the trainer Rationale for getting different generations and lines/segregating materials from different crosses.

The use of different generations for the field study will allow farmers to experience handling the different generations. The F_2 they will be handling will become an F_4 and later an F_6. By getting different generations in the field study, farmers will have a clearer picture of what and how to handle future generations and they will come to a better understanding of the breeding cycle. If the material is only an early generation material like an F_2 or F_3, some farmers may be discouraged to carry out the selection process because F_2 is the most difficult generation to handle. F_2 has the maximum number and degree of genetic variation and it will take several seasons to see a finished product, i.e., until a variety becomes stable it will take around five to six seasons from the F_2 generation. By providing farmers with a later generation material (F_6 or later), the farmers will only have one or two seasons to have a variety, thus building their confidence and enthusiasm.

Different crosses are also recommended to provide diverse materials to farmers and address one of the program's objective, i.e., increased agricultural biodiversity. Preferably, obtain segregating materials from crosses between a modern or improved variety and a local (from the village or at least the province) variety. By combining improved varieties with traditional varieties, the genes of traditional varieties are conserved and utilized and broadens the genetic base from which the farmers can select from.

Preparing and caring for the seedlings

1. To enhance germination, soak seeds in tap water for about 24 hours. The seed treatment will depend on the weather conditions in the locality. If the weather is warm, it is not necessary to soak the seeds in water until they germinate. However, if the weather is cold, soak the seeds in water until they germinate.

2. Germinate parent seeds in trays made of aluminum sheets measuring 40 cm x 60 cm x 12 cm. Holes may or may not be made at the bottom of the trays for drainage. Sow seeds in three furrows, approximately 100 gm per furrow. (This is assuming that the available seeds for each line is about 300 gm.) Put in a layer of soil about 10 cm deep. Sow seeds and cover with a thin layer of soil to provide warmth and to protect from birds. The seeds should grow through the thin soil layer about 2 – 3 days after sowing if the weather is warm; it takes longer if the weather is cold.

3. Keep seeds in the tray for 18 – 20 days. Keep enough moisture – not too wet and not too dry. (The moisture must be such that one can take a handful of the material and it may be squeezed without crumbling but no water should come out.)

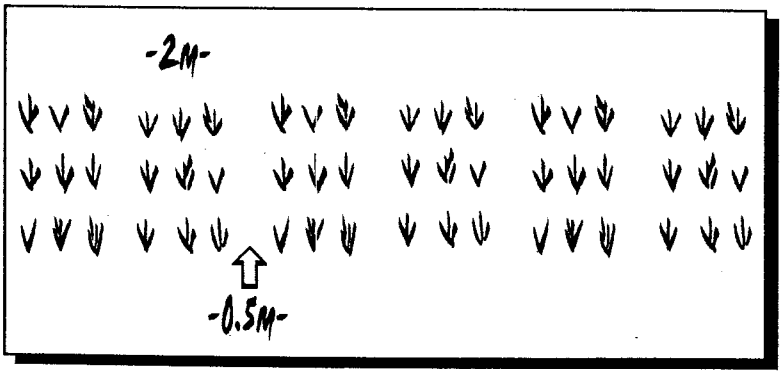
4. Put trays out in open space for sunlight.

Density of transplanting

Using the straight transplanting method, transplant one plant per hill at a distance of 20 cm x 20 cm. The standard density for plant breeding is a minimum of 50 plants per line planted in 2 rows of 5 m each.

Study Layout

Label the fields to know the location of the line; and make a map of the field, indicating also what line is planted where. The study can be set up in the following way:



Procedure

1. At the beginning of the season, farmers should develop the criteria, i.e., define the preferred characteristics of the variety that they want to select. The exercise on **Criteria for Selection of Varieties** in the section on **Special Topics** of this field guide may be used. The criteria that farmers develop at the beginning of the season may be changed as often as farmers identify other important characteristics based on their field observations.
2. Discuss with farmers to agree on the method of line selection method that they want to use.
3. Based on the decision of the farmers' group, follow procedure for line selection at the end of this field study.

Observations

From transplanting period to flowering stage

1. Observe weekly. Ask farmers to randomly choose five hills for each line to observe and record:
   - ❑ Crop development, like plant height, number of tillers, number of green leaves
   - ❑ General appearance, like uniformity of each variety
   - ❑ Insect pests and disease development
   - ❑ Natural enemies
   - ❑ Water level
   - ❑ Weather conditions are observed

   As usually done in ecosystem observations, present drawings and observations on newsprint. Also make field management decisions.
2. Use a sheet to collect all data as indicated below. Trainers and farmers are encouraged to add other observation criteria, as needed.

Ecosystem observation sheet (transplanting to flowering)
Date _____
Group _____

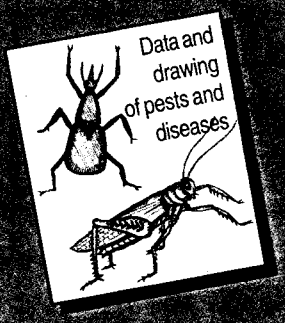
Week after transplanting/seedling	.....
Weather condition	.....
Plant development stage	.....
General appearance	.....
Water level	.....

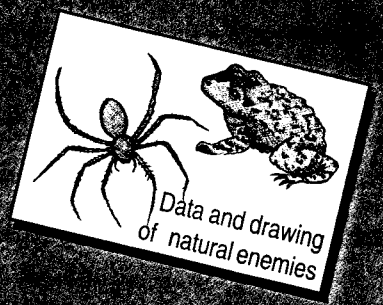
Weekly ecosystem analysis form

Variety / Criteria	1	2	3	4	5	6	7	8	9	10
Plant development										
Pests										
Natural enemies										
Diseases										
Weeds										

Ecosystem analysis presentation
Date: _____
Group: _____

General information (include items in above ecosystem observation sheet)





Observations .....

Recommendations .....

From flowering stage to mature stage

1. Observe every three days. Classify plants in a line into groups. Tag the plants with a color-coded label, i.e., one color for plants in the same group. Get a representative plant of the group and observe using the farmers criteria and some of the following characteristics:
   - ❑ Leaf colour, leaf length, width of the leaf under the flag leaf
   - ❑ Width of flag leaf, angle of flag leaf
   - ❑ Tiller angle, plant type (angle of leaves; stem type; leaf width)
   - ❑ Date flowering started, date flowering was completed
   - ❑ Number of panicle/hill, panicle length, panicle shape (closed or opened), panicle emergence
   - ❑ Level of grain filling, grain colour, grain shape, grain awn
   - ❑ Total of grains/panicle, number of full grains/ panicle
   - ❑ Pest and disease infestation level
   - ❑ Duration from flowering to maturation
   - ❑ 1000 grain weight
   - ❑ Plant height
   - ❑ Development stages
2. The following form may be used to collect data from flowering to ripening:

Line selection data collection form (flowering to ripening)

NO.	CRITERIA	PLANT							
		1st Group				2nd Group			
		Plant				Plant			
1									
2									
3									
4									

3. Prepare tables and graphs on newsprint and keep adding information on the above characteristics for each observation. Present tables and graphs during weekly meetings.

4. Compare observations of each hill in the study with the situation in farmers' fields. Also compare study observations with the criteria, i.e., preferred characteristic traits, developed by the group at the beginning of the season. Discuss this during weekly meetings.

At the end of the season

1. Collect data on yields (if using $F_6 - F_8$ lines) and carry out a yield component analysis (if using $F_2 - F_8$).

   a. Crop cuts
      - ❑ Theoretical method
        Harvest all plants from each group (in each line) to obtain yield for the area. Calculate yield in kg/ha.
      - ❑ Statistical method
        Harvest plants in $1m^2$ area. Calculate yield in kg/ha.

   b. Yield component analysis
      For each group in each line, a detailed yield component analysis will be done. Collect five plants per group for each line, and bring them to the meeting room. Select the best panicle per plant or a total of five panicles. Measure:
      - ❑ Number of panicles/m^2
      - ❑ Length of panicle
      - ❑ Number of grains per panicle
      - ❑ Number of filled grains per panicle
      - ❑ Number of empty grains per panicle
      - ❑ 1000 grain weight

2. Compare information on yield from the breeding institution with data collected from the field.

Discussion

Weekly

1. Describe the general condition of plant development for each line. Do the different lines develop in the same way? How did the weather conditions influence plant development? (Was it sunny or cloudy?)

2. What fertiliser and other management practices were applied during the week? How did these affect crop development for each line?
3. Compare the pest and disease situation to the previous week? Are there more insect pests and diseased plants? Why? Is the insect pest damage or disease infection more severe? Why? Is the development of insect pests and disease the same on all lines? Why? Are there some lines that have few insect pests or little disease infection and that remain like that compared to the weeks before? Why?

At flowering, ripening and harvesting stage

1. Is there any difference in the time of flowering and ripening?
2. Do grains in some groups within lines shatter easily compared to others?
3. What are the grain characteristics of each group in each line?
4. Seven to ten days before harvesting, discuss how to select good plants for the next season based on comparisons of plants in the field study and farmers' fields.

At the end of the season

1. Make a yield analysis.
2. What are your preferred traits for rice for this season? What is the reason for each preference? What are the implications of each? (This is taken up in detail as one of the weekly activities.)
3. Discuss the same issue with regard to the other cropping seasons. What traits should be different for the different seasons?
4. Note and discuss specific problems observed for each entry. Were these covered by the traits discussed early in the season?
5. Did you have to modify your breeding objectives? Why?
6. How can we improve the study for next season?

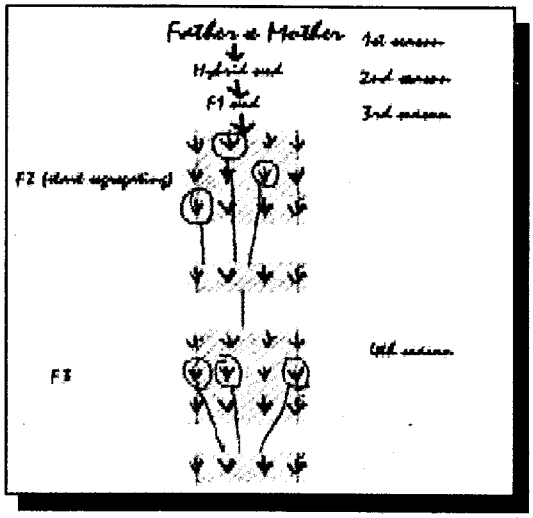
7. Carry out a general evaluation of all the varieties. The following table may be used but trainers and farmers are encouraged to add other observation criteria, as needed.

Sample Evaluation Table

NO.	CRITERIA	GROWTH STAGE FOR MEASUREMENT	EVALUATION SCALE
1	Plant height	Weekly	cm
2	Number of green leaves	Weekly	Number of green leaves/female parent plant
3	Number of tillers	Weekly	Number of tiller/plant
4	Pests	Weekly	Number of pest/sampling unit
5	Diseases	Weekly	% of disease infected plant - disease scale (identified as in FFS on Disease Management; see Technical Reference section)
6	Length of flag leaf	Panicle initiation - flowering	cm
7	Width of flag leaf	Panicle initiation - flowering	cm
8	Length of leaf under flag leaf	Panicle initiation - flowering	cm
9	Width of leaf under flag leaf	Panicle initiation - flowering	cm
10	Culm angle	Internode development - panicle initiation	Angle of main stem and tiller (erect < 30°, moderate = 45°, slanted > 45°)
11	Angle of flag leaf	Panicle initiation - flowering	Angle of panicle axis and flag leaf
12	Diameter of rice stem	Ripening	Cut close to the base of the plant
13	Beginning of flowering	Panicle initiation - flowering	First day of flowering
14	End of flowering	Flowering	More than 95% of panicle exerted
15	Duration of flowering stage	Flowering	From first day to end of flowering
16	Harvesting Ripening	Possible to harvest	
17	Duration of rice growth	Ripening	From sowing day to ripening
18	Panicle exertion	Flowering - ripening	Well, moderate, partially exerted, enclosed
19	Length of panicle	Flowering - ripening	cm
20	Type of panicle	Flowering - ripening	Compact, moderate, open (see Technical Reference section)
21	Type of seed	Ripening	Round, oval, long
22	Awn presence	Ripening	Yes or no
23	Number of panicle/m^2	Ripening	Number of panicle/m^2
24	Total of seeds/panicle	Ripening	Count number of seeds of 20 panicles
25	Number of filled seeds/panicle	Ripening	Count number of seeds of 20 panicles
26	Number of empty seeds/panicle	Ripening	Count number of seeds of 20 panicles
27	Weight of 1000 seeds	Ripening	Sample and weigh each variety
28	Theoretical yield	Ripening	Tonne/ha
29	Realistic yield	Harvesting Tonne/ha	
30	Quality of endosperm		Delicious, medium, not delicious

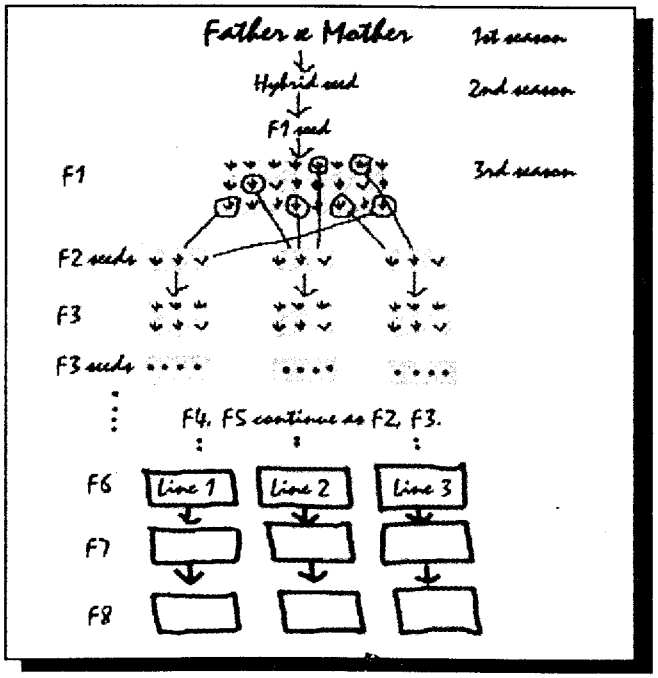
Methods of Line Selection

1. Bulk selection (traditional) method



- Grow F_2, then select and gather good individuals.
- Grow F_3. Continue the selection process through many generations (usually 5 - 8 generations) until the hybrid mass is quite uniform in phenotype or when plants have similar characteristics or beginning at about F_6.
- Test the new variety (with or without replications).
- F_8 may already be multiplied.

2. Modified bulk (modern) method



- Select good plants exhibiting the same characteristics from the second generation (F_2) and gathering them in a group/line. If there are plants exhibiting other preferred but different characteristics, gather them in another group/line. Continue selecting the good plants from the different lines until the fifth generation (F_5).
- Grow these lines separately. Continue the selection process (remove individuals with different characteristics that appear in a population) until the population of the lines become uniform in phenotype, i.e., when plants have similar characteristics or beginning at about F_6.
- Test to compare lines (with and without replication). Pay attention to monitoring for yield, tolerance to pests and diseases, and other standards according to the breeding objectives set by farmers and select the best line.
- From F_6, remove only plants with strange characteristics according to farmers' criteria.

Advantages and disadvantages of bulk and modified selection methods

Advantages

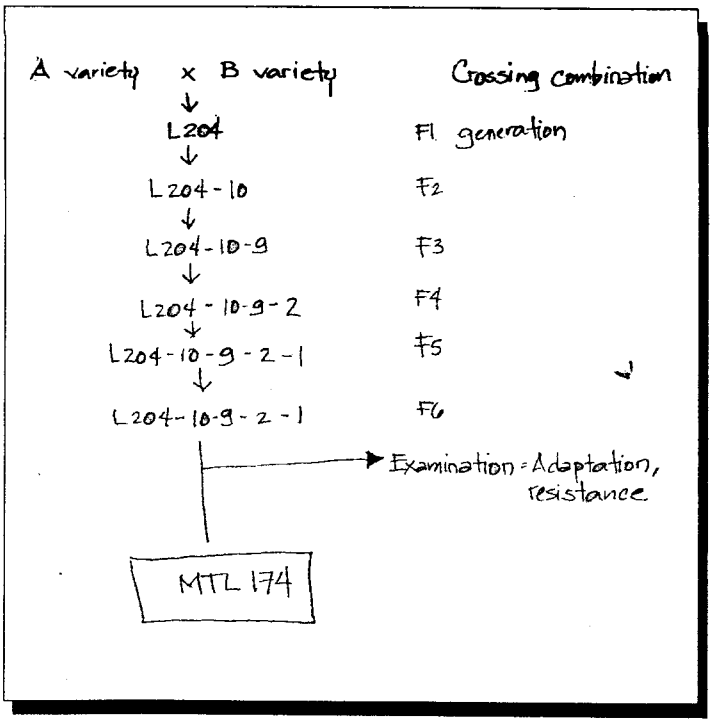
- ❑ This method is simple and easy to do. It does not require much labor and farmers can carry out the method in their own fields.
- ❑ Gene sources are diverse in populations or mass.
- ❑ The process of breeding can be shortened.

Disadvantages

- ❑ Selected variety has much genetic variation. Hence, bulk selection should be continued even during the production process.
- ❑ The duration to create a new variety or a pure line requires a long time (through 8 - 10 generations).
- ❑ There is competition within the population because of differences in individual characteristics.
- ❑ Some valuable individuals may be rejected (classical method). The improved method possibly overcomes this weakness.

Example: The process of selecting rice variety L204 - 10 - 9 - 2 - 1 (MTL 174)

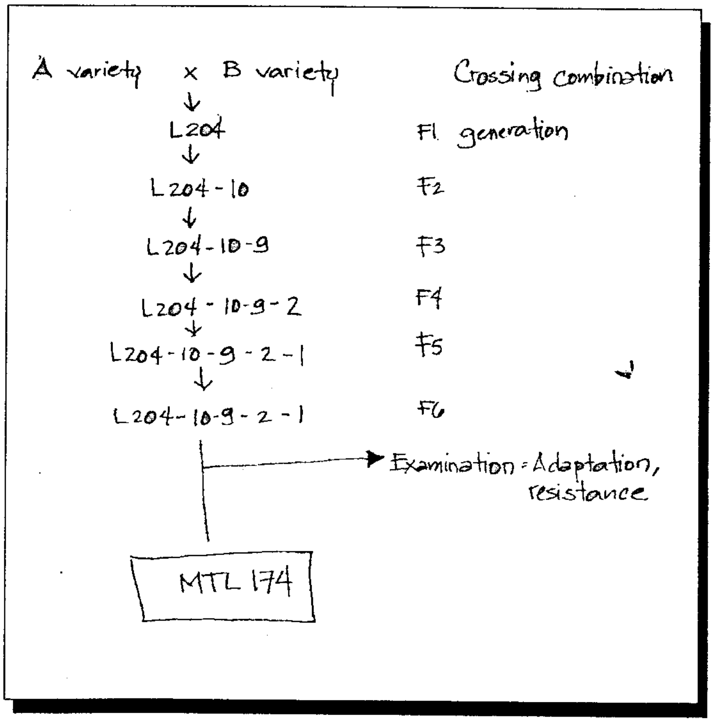
Diagram of selection of MTL 174-rice variety



Example: The process of selecting rice variety L204 - 10 - 9 - 2 - 1 (MTL 174)

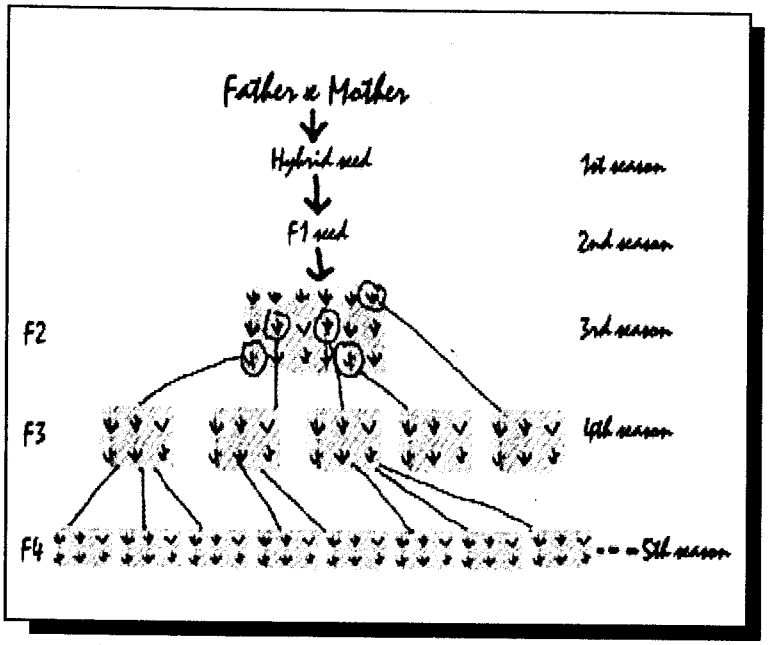
1. The Institute for Study and Development of Farming System created the 204 crossing combination, which was labeled L204.
2. F2 generation: 204 rice plants were grown in the second generation. They were numbered from L 204-1 [illegible]. Plant #10 was selected because of its good quality. Panicles of this plant were separately harvested and grown in the next season.
3. F3 generation: The panicles of plant #10 were grown in rows (one panicle/row). [illegible] each row was numbered and labeled. The best [illegible] of the 9th row was selected and recorded as L204 - 10 - 9.
4. Similar work was continued for F4, F5, and F6 generations. After each generation, the line label was changed. For each generation a hyphen and a row number were added, the number indicating the row from where the good plants were selected. After six generations, the variety (now purified) was tested for yield, tolerance to pests and diseases, and other standards according to the breeding objectives.

Diagram of selection of MTL 174-rice variety



3. Pedigree method

The most critical point in applying this method is that trainers and farmers should know very well the characteristics of parent plants and identify the objectives and criteria for selecting new varieties from hybrid plants.



- F_1 generation: There is no segregation, thus no selection is done. Gather all F_1 plants and grow in the next season.
- F_2 generation: Segregation starts: Select good plants with desired characteristics based on breeding objectives. Selected plants are numbered from one onwards (even up to several hundreds) depending on the number of selected plants. Label plants before harvesting (include names of crossing combinations, name of parent plants, and the number of each plant).
- Continue to select from F_3 to F_7 or F_8 until plants are uniform in phenotype, i.e., when plants have similar characteristics or beginning at about F_6. Test it to compare with other lines then select a suitable variety and name it.

Plant Breeding

Farmers, like institutional plant breeders, carry out crop improvement through varietal selection and breeding. The difference between the two is that scientists develop varieties that can be grown in 'generalised' conditions while farmers develop varieties adopted to their local environment and their social as well as economic needs. For this reason, we have seen how in the past, field problems developed due to the use of hybrid varieties that had not been tested extensively for adaptability and suitability in individual localities. This is ironic considering that the best results can be achieved with farmers and breeding institutions working together to improve plant genetic resources.

Given the opportunity to systematically select and breed their selection in the fields, the resulting crops will be naturally selected by being exposed to pests, diseases, and other local environmental factors. This method is useful to farmers. At the same time, if new genetic materials are introduced, the process will improve the local genetic resource and variability of the ecosystem. Farmers will no longer have to be dependent solely on institutions whose services are often times difficult for farmers to access.

Objectives

- To carry out plant breeding activities based on a set of criteria farmers themselves develop
- To produce F_1 seeds (for the first season)
- To observe, record, and file data on plant breeding activities

Materials

Parent varieties

The number of parent varieties will depend on the breeding objectives determined by the farmers and the available materials. If there is a local seed breeder, some varieties already available in the village may be used. The farmers' group should also try get new varieties from breeding institutions.

It is suggested that farmers use a modern variety and a local (from the province) variety as parents in plant breeding to increase production and conserve genetic resources from traditional varieties.

***A maximum of 10 varieties** or a maximum of 5 crosses is suggested for the first season. This number will be sufficient and manageable for farmers to gain knowledge and skills.*

Equipment and tools

1. For emasculation
   Pots of plants (plants intended as female parent) in flowering stage, scissors, forceps, nylon bag, paper, pen, bamboo stick, etc.
2. For crossing
   Pots of emasculated rice plants (female parent), drinking glasses, panicles of intended male parent, big size paper, knife, magnifier, scissors, materials to protect against the wind, color, pencils, pen, etc.

***In cold weather conditions,** sun light and ambient temperature may not be sufficient to trigger pollen dehiscence, thus trainers should prepare warm water or put on an electric bulb to allow the flowers to open easily and shed pollen.*

Field size

For each parent variety about 4 m^2 per transplanting time or a total of 12 m^2 for 3 transplantings. The total area for the study will depend on the breeding objectives determined by the farmers and the available materials. If a maximum of 10 parent varieties are used, the total area should be about 150 m^2. The distance between parent varieties should be at least 0.5 m. No replications are needed.

Fertiliser level

Fertiliser levels will depend on the farmer practices and local recommendations and should be determined for each site in discussion with the farmers' group.

***No pesticides** will be used in this study, because the resistance against pests and diseases will be evaluated.*

Preparing the seedlings

To enhance germination, soak seeds in tap water for about 24 hours. The seed treatment will depend on the weather conditions in the locality. If the weather is warm, it is not necessary to soak the seeds in water until they germinate. However, if the weather is cold (like in the northern region), it is necessary to soak the seeds in water until they germinate.

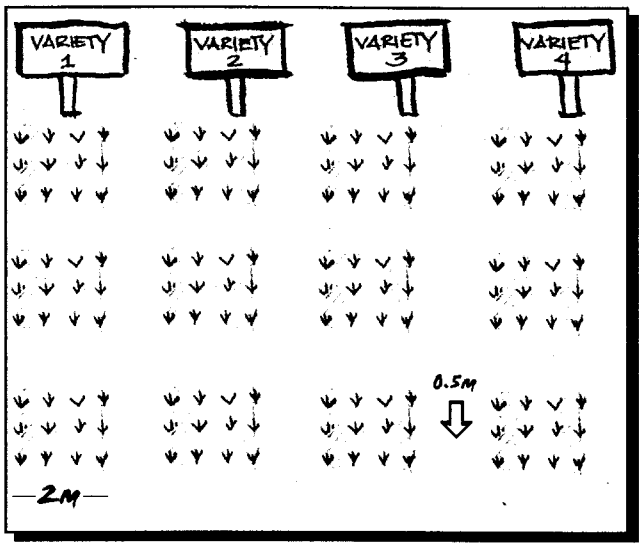
Sow seeds three times at an interval of seven days. This is to facilitate selection of male and female parent plants that will flower at the same time.

Density of transplanting

Using the straight transplanting method, transplant 1 plant per hill at a distance of 20 cm x 20 cm. Transplant at least 100 plants/plot from one sowing date of each parent variety. The total number of plants/parent variety will be 300 planted in 3 plots according to date of sowing.

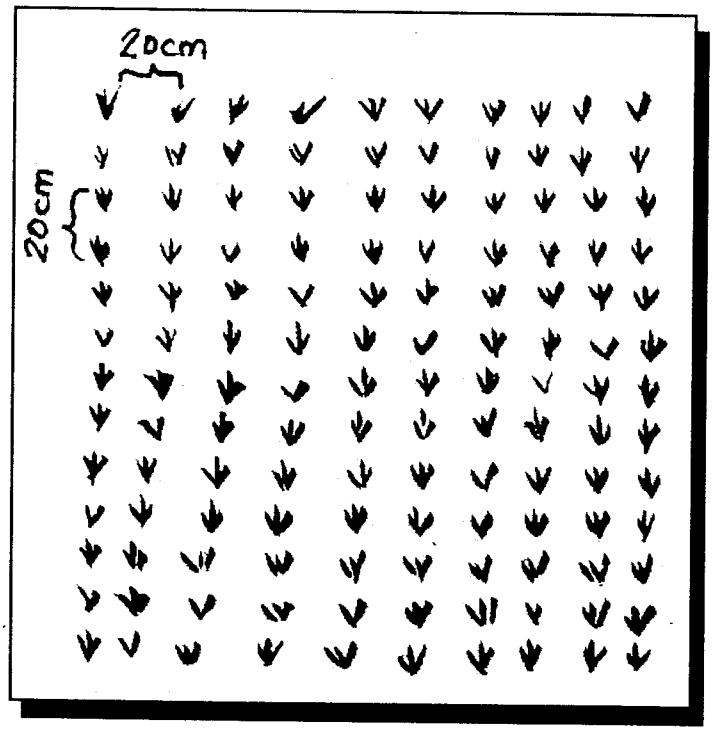
Study Layout

Label the fields to know the location of the variety planted, and make a map of the field, to indicate the location of the plants. The study can be set up in the following way:

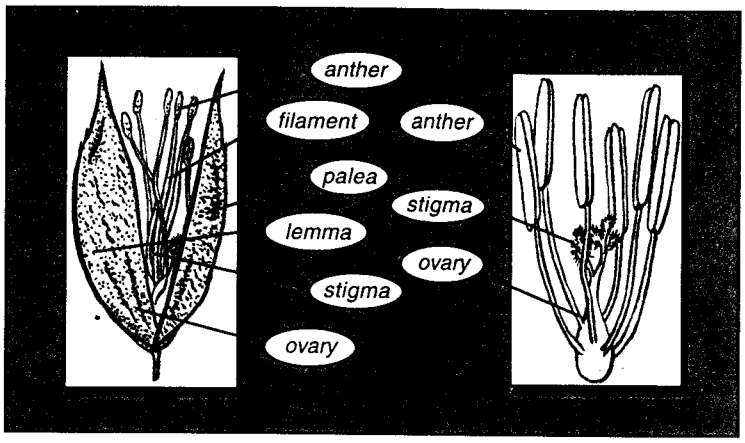


Procedure

1. At the beginning of the season, farmers should develop the criteria, i.e., define the preferred characteristics, of the variety that they want to use for the season. The exercise on **Criteria for Selection of Varieties** in the section on **Special Topics** of this field guide may be used.
2. Parent materials should be prepared based on the criteria defined by the farmers' group.
3. As mentioned under the section on preparation of seedlings, soak seeds in tap water for about 24 hours to enhance germination.
4. Sow seeds three times at an interval of seven days to facilitate selection of male and female parent plants that will flower at the same time.
5. Using the straight transplanting method, transplant 1 plant per hill at a distance of 20 cm x 20 cm. Transplant at least 100 plants/plot from one sowing date of each parent variety. The total number of plants/parent variety will be 300 planted in 3 plots according to date of sowing.



6. Prepare equipment and set up the other requirements for crossing:
   - ❑ Scissors, pins, glassine bags (a kind of waxy paper bag), pens, etc.
   - ❑ Select a non-windy place for pollination
7. Prior to carrying out crosses, the special topic on **Techniques in Rice Breeding** should be discussed (see section on **Special Topics**). This exercise should allow farmers to practice making crosses.
8. Fifteen days before the flowering stage, select healthy plants (male and female parents) of the same development stage, i.e., that flower at the same time.
9. Select female parent plants and grow in pots. Plant 2 – 3 hills/ pot. Prepare three pots equivalent to three replications.
10. Maintain appropriate moisture in the pots. Remove other tillers and retain only the best 4 – 5 panicles per pot.
11. Take care of and monitor plants as usually done but observe carefully and note when the plant flowers.



12. Emasculate the female parent plants when one-third of the panicle is exerted. Carry out emasculation between 2 P.M. – 5 P.M. following the procedure below:
    - Select plants with healthy, big panicles that will open the next day. These plants will serve as the female parents of the cross.
    - Remove the flag leaf of the panicle to be emasculated, avoid breaking the stem.
    - Use scissors to cut off all florets that have already shed their pollen. These florets (grain) appear translucent and usually have the anthers clinging to the outside.
    - Cut off young florets at the bottom of the panicle. Retain 20 - 30 florets in the middle of the panicle.
    - Obliquely (diagonally) cut away one-third of the tissue of the remaining florets to expose the anthers.

Emasculation *is the removal of the anthers from a bud or flower before pollen is shed; removal of male flower parts or rendering them non-functional; a preliminary step in crossing to prevent self-pollination.*

- Remove anthers with forceps. There are six anthers per floret.
- Cover emasculated panicle with a glassine bag.
- Close bag by folding the open edge diagonally and fastening with paper clip.
- Write the variety name of the female parent, the date of emasculation and the name of the person who did emasculation on the glassine bag.

Glassine bag *is a kind of waxy paper bag.*

13. Make crosses the next morning. Select a good panicle that is partially opened and cut the panicle at the base between 6 A.M. - 7 A.M.
14. Prepare male parent plants (pollen provider). Allow the panicle to stand in a glass of water and put it near the female parent plant until the pollen sac opens. Using warm water or exposing the glass of water to the sun can affect the time of opening of the pollen sac.
15. Remove glassine bag covering the female parent plant. Put the male parent plant close to the female plant. Tap male parent lightly so that the pollen falls on the florets of the female parent. The place for making the crosses should be protected from the wind as this may carry off the pollen and there will be none left for pollination.

Test by putting a finger close to the plant. If yellow powder is observed on the finger, that means that the pollen sac is open.

16. Cover female parent plant again with the glassine bag.
17. Label by designating a cross number and writing down the names of the female and male parent plants, date of pollination, and the name of person who made the cross. Fix the plant on a bamboo stick to prevent the panicles from falling down.
18. After 7 – 10 days, check for percentage of successfully pollinated seeds. This can be distinguished by the appearance of the white endosperm from the floret. Compute using the following formula:

$$\% \text{ set seed} = \frac{\#\text{ florets with seeds}}{\#\text{ of pollinated florets}} \times 100$$

19. Check regularly to make sure that the panicle will not be damp or moldy.
20. Expose plant to enough sunlight.
21. Harvest, dry, and carefully store ripe seeds. Store seed in waterproof bags in a safe environment, i.e., away from ants. It will also help to put cotton inside the bags to absorb moisture. An alternative for storing seeds is to put them in fiber bags and hang the bags above the cooking stove. This will protect the seeds against weevils and other storage pests.

Observations

From transplanting period to flowering stage

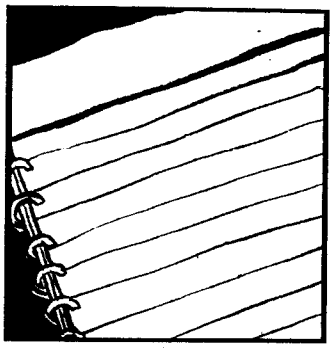
1. Observe weekly. Randomly choose five hills for each line to observe and record:
   - ❑ Crop development (like plant height, number of tillers, number of green leaves)
   - ❑ Morphological characteristics (like leaf color, leaf length, width of the leaf under the flag leaf, width of flag leaf, angle of flag leaf, tiller angle, plant type, angle of leaves, stem type, leaf width)
   - ❑ General appearance, like uniformity of each variety
   - ❑ Insect pests and disease development

- ❑ Natural enemies
- ❑ Water level
- ❑ Weather conditions are observed

As usually done in ecosystem observations, present drawings and observations on newsprint. Also make field management decisions.

2. Use a sheet to collect all data as indicated below. Trainers and farmers are encouraged to add other observation criteria, as needed.

Each group should have ***one notebook for recording all data from observations*** *of each hill.*



At flowering stage

Observe everyday to determine flowering date of both male and female parent plants and to prepare for breeding.

At the end of the season

1. Collect data on the number of grains obtained per cross.
2. Compute for percentage of success using the following formula:

$$\% \text{ success} = \frac{\text{\# of set grains}}{\text{\# of emasculated grains}} \times 100$$

3. Organize a workshop/field day for farmers to present their plant breeding experiences.

Discussion

Weekly

1. Describe the general condition of plant development for each line. Do the different lines develop in the same way? How did the weather conditions influence plant development? (Was it sunny or cloudy?)
2. What fertiliser and other management practices were applied during the week? How did these affect crop development for each line?
3. Compare the pest and disease situation to the previous week? Are there more insect pests and diseased plants? Why? Is the insect pest damage

or disease infection more severe? Why? Is the development of insect pests and disease the same on all lines? Why? Are there some lines that have few insect pests or little disease infection and that remain like that compared to the weeks before? Why?

At the end of the season

1. How did you select parents for breeding?
2. What are your preferred traits for rice for this season? What is the reason for each preference? What are the implications of each? (This is taken up in detail as one of the weekly activities.)
3. Discuss the same issue with regard to the other cropping seasons. What traits should be different for the different seasons?
4. Why is it important to understand the characteristics of each variety in the study? Why is it important to approximate the time of flowering?
5. Note and discuss specific problems observed for each entry. Were these covered by the traits discussed early in the season?
6. Did you have to modify your breeding objectives? Why? How can you link the breeding objectives set early in the season to the selection of parents and carrying out crosses? How does this link to subsequent selection?
7. How would you set up a study if the farmers group decides to cross a photosensitive with a non-photosensitive variety?
8. How can we improve the study for next season?

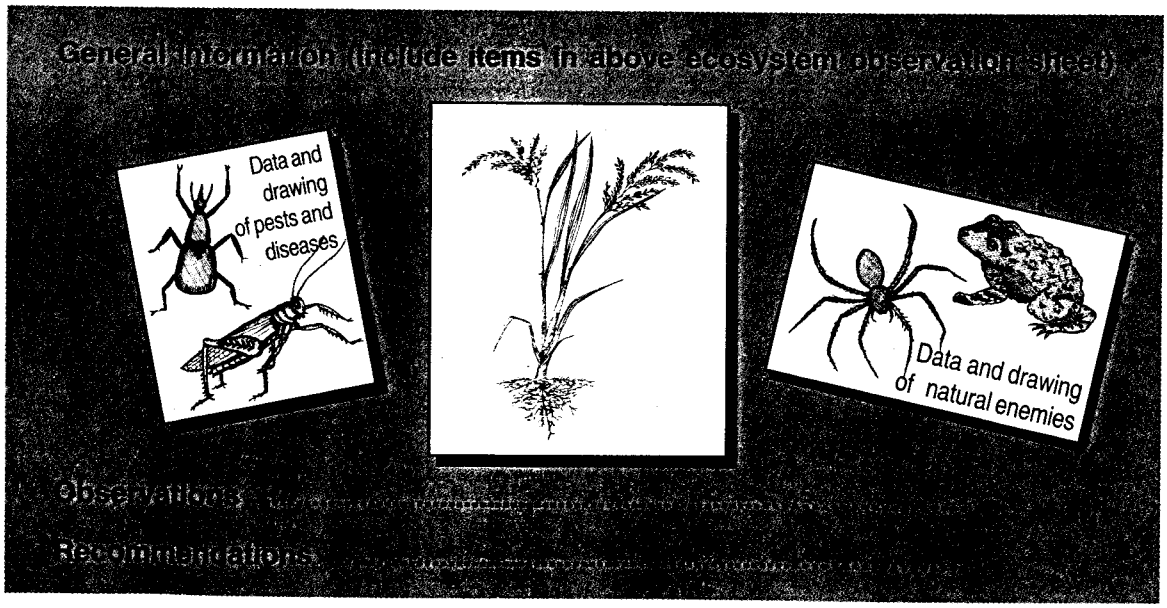
Ecosystem observation sheet (transplanting to flowering)
Date _____
Group _____

Week after transplanting/seedling	.....
Weather condition	.....
Plant development stage	.....
General appearance	.....
Water level	.....

Weekly ecosystem analysis form

Variety / Criteria	1	2	3	4	5	6	7	8	9	10
Plant development										
Pests										
Natural enemies										
Diseases										
Weeds										

Ecosystem analysis presentation
Date: _____
Group: _____

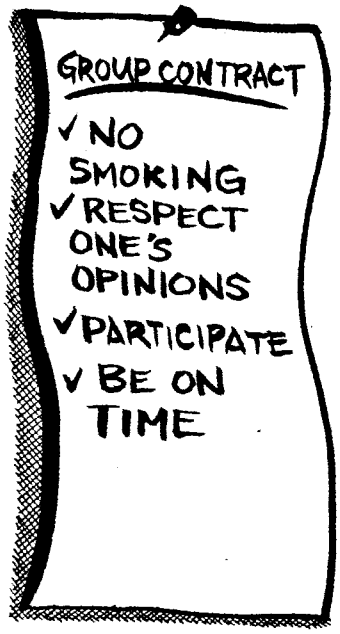


GROUP DYNAMICS

This section provides additional activities to break the ice and set the mood for group work. The success of the FFS depends on the cohesion of the group involved. Thus, it is important to ensure understanding within the group.

Group Contract

The group contract is the agreement that FFS participants will try to honour in the course of the field school. It details what attitudes will not be allowed and how they will cooperate to maintain the field. The idea of a group contract is to have collective accountability in running the FFS. It is also an exercise in consensus building where everyone agrees to the set norms and work together as a group with all their individual differences.



Objective

To set the group norm for the FFS

Materials

Newsprint, pentel pens

Procedure

1. In a newsprint, draw a scenario in the FFS where the trainer (with hands on the hips or with a pointing stick) commands the participants to do this and that. Alternatively, demonstrate the dominating character scenario through a drama. Be sure to highlight the dont's of facilitation, attitudes that will discourage people from participating and offending manners (e.g., blowing smoke in the face of another participant, etc).
2. Ask the participants what they observe from the picture or drama? In this kind of set-up, how would the participants feel? How will the group feel?
3. Ask someone from the group to list down their observations in a newsprint for everyone to see.

4. Ask participants, what they think of these attitudes and behaviour. Would they allow the attitudes and behaviour in their FFS?
5. Ask someone to list down what they would allow and what things they will not allow. What would they allow in the field? What would they not allow? What should a group do? What should a group avoid?
6. Build an agreement. Once the list of behaviour and attitudes that they allow and do not allow are complete, ask each of the participants if they agree on the contract. If they do, they have to affix their signature and this will be the group contract.
7. Punishments for violation of the contract can also be added and agreed upon by the group.

Experiencing Change

On-farm conservation and development of rice PGR is not new to farmers. However, the FFS on rice PGR will introduce new concepts and techniques which may change common perceptions and understanding of their community and farm situation. This exercise will set the mood of farmers for change and discoveries. There will be people who will resist change and there will be those that will readily embrace them. This is normal and should be appreciated.

Objective

To identify feelings of embracing and resisting change and to relate these to a 'different' approach to conservation

Duration

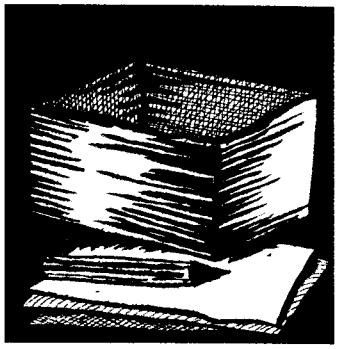
30 minutes

Procedure

1. Ask participants to find a partner. Ask them to stand and face each other and to carefully look at their partner for one minute.
2. Next, ask them to turn so that they are facing away from their partners and then change three things about their appearance. (Give examples - if you wear glasses, take them of, roll a sleeve up or down or take a shoe off.)
3. After a few minutes, ask the participants to face each other and see if they can identify what their partner changed.
4. Next, ask them to turn around again and change three more things. Repeat step 3.
5. Ask participants to change more things...when most of them begin to resist changing more things about themselves, ask them to be seated.

The Box

Objective



To illustrate how perceptions and decisions are affected by 'proximity' or 'closeness' (denotes affinity/attraction/fondness) to (or information about) any given situation.

Materials

- Newsprints, coloured markers, cardboard box.
- 10-12 familiar small objects including a pamphlet or a piece of paper with writing on it (something that can be completely recognised only through sight).
- Prepare 'the box' by placing the objects inside it and sealing it so that the objects do not fall out when the box is shaken.

Duration

20 minutes

Procedure

1. Open the activity by explaining that perceptions about a situation are often influenced by how close we are to it as well as by how much information we have about it.
2. Show the group the closed box and explain that the box contains several items which are familiar to them. During the next few minutes the participants will be asked to identify what is in the box.
3. Divide participants into Groups A, B and C and move them to different parts of the room or to adjacent areas such that they cannot see what the other groups are doing.
4. Allow members of Group A to briefly shake the box, then to discuss what they think is inside. Ask them to note down what they think is in the box. Ask members of Group B to feel objects inside by holding the box behind their backs and allowing them to briefly put their hands inside one by one. They should also discuss and note down what they think is inside.
5. Finally, allow members of Group C to touch and look inside, discuss, and note down what is inside the box.
6. Assemble the three groups together and ask Group A to call out what they think is inside the box. Note this on a flip chart. Repeat the process with Groups B and C.

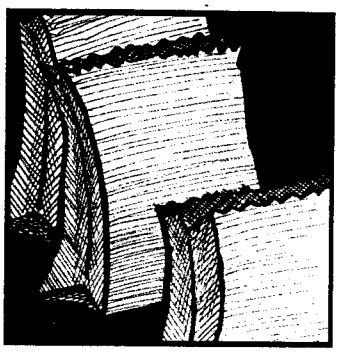
Discussion

1. What were the results of the activity? Why?
2. How did each group feel when they tried to describe the objects inside? Does this relate to situations in real life? Bring out the frustration of having to accomplish tasks or make decisions without adequate information.
3. How did the groups obtain information under the given constraints? How does this relate to real-life situations? Bring out importance of teamwork and discussions, also the importance of involving more partners/stakeholders in any task.

4. In your own situation, who could each group represent? Why? Bring out that often people who live 'close' to a resource often have the greatest amount of knowledge and information while those who are more 'distant' often make decisions based on inadequate information.
5. From this activity, what conclusions can you make about the importance of involving key stakeholders in a conservation and development initiative? Bring out that this activity suggest that those closest to the resource should play a major role in planning and implementing any initiative that are related to the conservation, utilisation and management of the resource.
6. How is this related to where decisions regarding conservation and development are made or should be made? Bring out the importance of decision-makers moving 'closer' to a situation before making any decisions.
7. How can an outside perspective also be useful? Bring out the importance of different perspectives. Groups that could not see the objects used different senses. This can be related to the importance of using different sources of information to understand a situation.

Paper Bag

Objectives



- To examine what people value as individuals and as a group
- To demonstrate the importance of understanding and appreciating different value systems

Materials

Small paper bags (one per participant)

Duration

30 minutes

Procedure

1. Distribute a paper bag to each of the participants and ask them to think about what they value most in their personal or professional lives.
2. Then ask them to look for something that symbolises what they value in life. They can look for their symbol in the training room or anywhere outside. They should return to the room in 10 minutes with their object in the paper bag, not showing it or discussing it with other participants.

3. After all have assembled, ask them to one by one take their object/symbol from the bag and place in the center of the room, explaining what it symbolises.
4. After all have placed and described their objects/symbols, initiate a discussion on the following:
   - ❑ What does this tell us about the individual and collective values of the group?
   - ❑ How do values change based on where one is at a given point in time and space? (Point out that many participants may symbolise their 'family' because they are away from them during the workshop.)
   - ❑ Why is it important to understand and appreciate different values when working with people on conservation and development? (Draw out how different values can affect the way people makes decisions; also that local communities and different stakeholders may value PGR resources in a different way as compared to conservationists.)
5. Close by examining the purpose of this activity and pointing out how quickly and clearly we have developed insight into what this particular group values.

Special Topics and Field Exercises

The following section presents the proposed weekly topics that the trainers can use in running the season-long FFS. Innovations should be encouraged and the weekly guides should only be taken as suggested topics and not imposed topics. Trainers are free to select the topics they think should be included in the FFS. The minimum topics that should be covered in the FFS are the baseline exercises, the topics on breeding cycle, selection of varieties, selection techniques and breeding.

Biodiversity and Plant Genetic Resources

In this exercise, farmers will be introduced to the concept of biodiversity and what PGR are. The importance of rice PGR will be discussed which will serve as the rationale for its conservation and development.

Plant Genetic Resources *is the diversity of genetic materials contained in plant species and varieties.*

Objectives

Biodiversity *is the variety and variability of life on earth. It is an abbreviation for biological diversity.*

- To introduce the basic concepts and issues about biodiversity and plant genetic resources conservation and development
- To provide a background and to understand the BUCAP

The different ***levels of biodiversity*** *are ecosystem, species, genetic diversity and cultural diversity.*

Procedure

Ecosystem diversity *- differentiation in the types and nature of the physical environment or habitats (e.g., forest ecosystem, irrigated rice ecosystem, and marine ecosystem).*

1. Group farmers and ask them to go to the field and draw a picture of their ricefield or their village.
2. From the drawings, ask them to identify the different components of the environment (mountains, lake, animals, plants, rice, etc).
3. Use their drawings to introduce the topic on biodiversity and the different levels of biodiversity.
4. Discuss about rice PGR and ask farmers what they think are the importance of plant genetic resources in their lives. List down their answers and discuss.
5. Ask the farmers what they think are the problems about plant genetic resources. List down their answers and discuss.
6. Summarise the discussion by presenting the importance and problems of plant genetic resources, and introduce how BUCAP aims to address some of the problems.

Species diversity *- variability between species (e.g., types of plants and animals).*

Genetic diversity *- variability within the species expressed as distinct varieties or differences in traits wihin the population of a variety.*

Cultural diversity *- refers to the diversity of peoples and communities that nurture and utilize biodiversity.*

Discussion

1. What do you observe in your environment? What can you see in a forest? In a river? In a ricefield?
2. Are the different things in the environment related? Do they interact with each other? Give an example?
3. The riceplant, for example what does it contribute to the environment? What is it used for?
4. Have there been changes with the riceplant over the years? What are these changes?
5. What are the effects of these changes? Are the changes necessary or not?

Understanding Loss of Biodiversity

The change in the country's economic strategies inevitably carries certain potential conflicts for sustainable development, i.e., the exploitation of natural resources in an attempt to increase agricultural productivity. It also brings with it institutional problems and constraints in 'mainstreaming' results of research and development, especially when viewed in the light of biodiversity and rice PGR conservation. For example, the use of hybrid varieties is being promoted even though their adaptability and suitability have not been tested extensively in individual localities. Another example is farmers' increasing use of high yielding varieties and reduction in the use of local traditional varieties resulting to the loss of many traditional varieties such as upland rice. It is important to raise the awareness of farmers about this issue and carry out discussions about what must be done about it.

Objectives

- To compare varieties 10 years ago and those currently used
- To collect information on other variety-related situation and services, e.g., access to varieties
- To validate baseline information on the biodiversity situation in the locality

Materials

Markers, tape, and newsprint

Duration

1 hour and 30 minutes

Procedure

1. Divide farmers into small groups according to sub-villages.
2. Summarise results from the baseline survey questionnaires collected from the sub-villages.
3. Using the format below, ask them to list down on newsprint the varieties which farmers used in their sub-village 10 years ago and what varieties farmers are using at present.

Summary of baseline survey results on variety use

NO.	10 YEARS AGO Varieties farmers used	NO.	AT PRESENT Varieties farmers use
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	

4. Compare results of baseline survey results with the results of group discussions as shown on the table.

Discussion

1. How many varieties were used 10 years ago? What were these?
2. How many varieties are being used currently? What are these?
3. How many of the varieties used 10 years ago are still being used at present? Why?
4. Why is there such a difference in the number and kinds of varieties between the two periods?

5. What are the preferred and the non-preferred characteristics of varieties which have disappeared? Why are these varieties not being used now?
6. What are the preferred and the non-preferred characteristics of varieties currently in use? What characteristics would preferably be added to them?
7. How do varieties deteriorate?
8. Do farmers breed seeds? How do they do it?
9. Who supplies varieties to the locality?
10. Why does each area have its own varieties? Are farmers able to keep their preferred varieties?

Review of Agroecosystems Analysis

Agroecosytems Analysis (AESA) is a way of assembling what we are studying and placing into a process useful for decision making based on many factors. AESA will lead participants through weekly sets of questions and illustrations. It is appropriate to conduct AESA as soon as there is a decision to make in the field and continue, as it is necessary. For example, for most crops, the analysis is done from seed germination to flowering.

__Agroecosystem__ is an ecological system modified by the people to produce food and other products for human use.

To improve decision-making skills, it is necessary to do regular observations, drawing what was observed as a form of documentation and processing the gathered data and critiquing what was observed in small and big groups. This process ensures that all relevant knowledge and experiences are considered in coming up with a decision. A skilled facilitator is necessary to guide the weekly conduct of AESA.

The AESA used for IPM was slightly modified for rice PGR CDU specifically as a decision tool to guide farmers in selecting their preferred varieties, and pedigree lines or bulk populations by systematically observing and recording plant characteristics.

Objectives

- To review agroecosystem analysis as a way to improve decision making skills through a field situation analysis
- To ensure that all relevant knowledge and experiences are considered in coming up with a decision

Materials

- 'Learning Field' notebook, ball pen, crayons, newspring
- Meter sticks, vials and plastic bags

Procedure

The participants will study the components of the crop agroecosystem: plant morphology, herbivores, diseases, and natural enemies of herbivores.

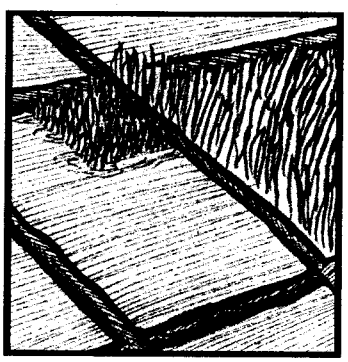
1. If the participants are familiar with AESA, ask why they do AESA?
2. Discuss how they will use AESA in deciding the best plant or the best variety they like in the field?
3. *Insects.* Discuss how the different varieties or pedigree lines or bulk populations should be examined for insects, insect symptoms, egg masses, in plant, on plant, above plant, etc. How should this be recorded? Bring the specimens back for drawing noting where they found them.
4. *Disease.* Discuss how the different varieties or pedigree lines or bulk population should be examined for disease, its symptoms, etc. How should this be recorded? How shall it appear on the drawing?
5. *Plant morphology and growth stage.* What is useful to record about the crop stage of the different varieties, pedigree lines or bulk populations (e.g., height, number of leaves, etc.)? How shall it appear on the drawing?
6. *General observations.* What else is important to notice (e.g., weeds, water, fertilizer, and water influence)? Is it generally a healthy variety, pedigree line, bulk population or not? How could this appear on the drawing?
7. Go to the field for 30 minutes and collect the data.
8. Go to the 'classroom' and draw the representative plant for the variety or pedigree line or bulk population with the correct average number of leaves. Write the number of leaves and average height and other agreed information somewhere in the paper. The drawing of the plant could also show the situation of the fertiliser, water, insect and disease symptom, etc. Use colour crayons to make it look real.
9. Draw the insect and non-insect pests looking at the actual specimens brought back from the field. They could be drawn, for example, on the left side of the plant. An arrow can clarify where on the plant they were found. If local names are known they can be added for the insects.
10. Draw the natural enemies or friendly insects on the other side of the plant as illustrated above.
11. Indicate the weather conditions, for example, by drawing a sun, clouds, rain, strong wind, etc.

12. Indicate with drawings or words the treatment and activities in the field since the previous week (fertiliser sacks, watering, etc.)
13. At the bottom could be made a list of important observations or characteristics they noticed about the variety, pedigree line or bulk population.

Discussion

The guide questions are just some of the discussion points trainers can raise. Trainers are free to develop their own questions and process to guide farmers in their selection.

Seedbed



1. Do the plants have a good start?
2. Are there differences in seedling growth among plants of the same group (plants of the same variety or pedigree line or bulk population or heterogeneous variety)? What do you notice?
3. Are there differences in seedling growth: among the different varieties, among the different pedigree lines, among the different bulk population, and among all the groups in the field studies? What do you notice?
4. What kinds of pests are present in the field? How are they distributed in the field?
5. Where did the pests come from?
6. What is the main pest?
7. What sort of damage do the pests do at this stage?
8. Are the different groups of plants (different varieties, pedigree lines or bulk populations) affected by pests in the same degree? Which plant group do the pests prefer?
9. What kind of natural enemies are present in the field? How are they distributed in the field, and in the different plant groups (in the different varieties, pedigree lines or bulk populations)?
10. What do the natural enemies eat? What do they eat before there were pests?
11. Are there any signs of rats? Any damage of rats? What can be done?
12. How does the condition of the field compare with the previous week?
13. What do you expect will happen next week?

After transplanting

General state and environmental condition

1. Have the plants recovered from transplanting?
2. Is there anything you will do with the seedbed next season?
3. Is the plant development as expected? Are there differences in plant development within the same variety, within the same pedigree line, within the same bulk population?
4. Are there differences in plant development: among the different varieties; among the different pedigree lines; among the different bulk population; and among the varieties, pedigree lines and bulk population? What are the differences and similarities?
5. What is the effect of the weather on the growth of the plant? Does the weather have the same effect on plants in the same variety (or pedigree line or bulk population)? Does the weather have the same effect on the different varieties (different pedigree lines and different bulk populations)?
6. Is irrigation needed now?

Disease management

1. Are some leaves dying? Why? Is this natural? In which plant group (in which variety, pedigree line or bulk population) is the incident more pronounced or observed?
2. Is there any disease in the field now?
3. How do the plants in the same variety or pedigree line or bulk population affected by the disease or diseases? How are the different varieties, pedigree lines or bulk populations affected?
4. How can the disease be managed or controlled?
5. How can spreading be prevented?
6. Does it influence yield qualitatively or quantitatively?

Pest management

1. What kind of natural enemies are present in the field? Are they present in all the different plant groups or are they in one variety only, one pedigree line?
2. How does the natural enemy population compare with previous week? Was the field sprayed with insecticide or other pesticides?
3. What is the importance of many natural enemies now?
4. What kinds of pests are seen? Are the pests present in all the plants or are they concentrated on a certain plant within a variety, within a pedigree line or within a population? Are the pests more in a particular variety or pedigree line or bulk population? Which plant group is the 'favourite' of the pests?
5. What sort of damage do the pests do at this stage?
6. What is the main pest?

7. Is there any way to prevent these from increasing in numbers in the field?
8. What is the condition of the other fields in the area?
9. Do the surrounding fields influence your field?
10. Are there any signs of rats? Any damage of rats? Which plant group (variety, pedigree line or bulk population) does the rats prefer? What can be done?
11. Are the pests and natural enemy population increasing or decreasing compared to previous week?

Management action

1. How does the condition of the field compare with the previous week?
2. What do you expect will happen next week?
3. Are there specific pests to monitor more carefully?
4. Considering the density of friendly insects and the density of pests, is there a need to apply insecticides? If yes, is there an alternative?
5. What is the management plan for the next week?
6. Is it generally a healthy crop? Which variety is most healthy? Which pedigree line is most healthy? Which bulk population is most healthy?
7. Based on your observations, what experiments like insect zoo or disease culture for different varieties, pedigree lines or bulk population would you make to learn more?

Before harvest

Select relevant questions from above (after transplanting) and add the following:

1. When is the expected harvest time? Is it the same for all plants within the same variety, within the same pedigree line, within the same bulk population?
2. Will the varieties be harvested at the same time? Will the different pedigree lines be harvested at the same time? Will the different bulk populations be harvested at the same time?
3. Why are there differences in harvest time? How can you determine differences in harvesting time?

At maturity and harvest

Select relevant questions from the questions set in 'after transplanting' and 'before harvest' and add the following:

1. How do you determine the right time to harvest?
2. Will you harvest all the plants in the same variety at the same time?

3. Will you harvest all the plants in the same pedigree line at the same time? How do you compare the harvest time of plants in the early generation crosses (F_2, F_3, and F_4) with that of the late generation materials (F_5, F_6, F_7, and F_8)?
4. What are the different characteristics you look for in selecting: the best variety; the best pedigree line; the best bulk population; the best plant within the variety; the best plant within the pedigree line; the best plant within the bulk population?
5. How did you observe and measure these characteristics in the entire growing period of the crop?
6. What measurements and observations will you take next season to guide you with your selection?
7. What can you do in your field now to prevent insect, disease and weed problem next season?
8. After harvest, what will happen to the natural enemies?
9. What could you do different to improve field management next season?
10. How can you assist other farmers next season?

Conservation of Plant Genetic Resources

Plant genetic resources has sustained needs of people in the country for food, fiber, shelter and medicine. It has contributed to trade and cultural traditions and serves as building blocks for future crop improvement. There exist threats to continued existence of rice PGR in the natural state. Because of these, efforts must be undertaken to ensure the continued existence of rice PGR. These efforts, of which there are several strategies and methodologies, are collectively called rice PGR conservation.

Importance of PGR:
• Has sustained needs of people in the region for food fiber, shelter and medicine
• Contributed to trade and cultural traditions
• Building blocks for future crop improvement

There are two main strategies for rice PGR conservation - *ex situ* and *in situ* conservation. *Ex situ* conservation means conservation outside of the species' natural habitat while *in situ* conservation means conservation of the species in its natural habitat. The two systems have their advantages and disadvantages. The idea is to combine the advantages of both systems to effectively support rice PGR community-based efforts of conservation and development.

In Situ Conservation *literally means on-site conservation; conservation of plants or animals in the areas where they developed their distinctive properties, i.e., in the wild or in farmers' fields.*

Objectives

Ex-Situ Conservation *literally means conservation off site. Conservation of a plant outside of its natural habitats, e.g., in a genebank, botanical garden or field genebank and stored as seed, tissue, entire plant or pollen.*

- To introduce and familiarise farmers with the two system of rice PGR conservation
- To motivate farmers to appreciate their own conservation efforts and strengthen it by linking with the formal institutions.

Materials

- Local genebank or farmers genebank
- Farmers field with diverse varieties planted

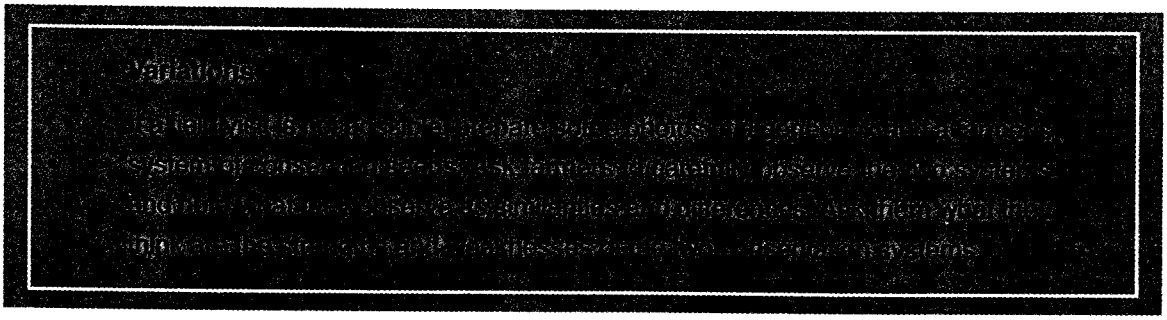
Procedure

1. Organise a field visit to a local genebank, a local school, local research station or local forestry station or even manages zoo or botanical garden nearby which by private organisations. If this is not possible, organise a field trip to a granary (or where farmers store their seed) of one of the farmer participant and a ricefield with many varieties planted.
2. Ask the farmers to observe and record how the seeds are kept, how long the seeds are stored and how are seeds selected for storage?
3. Form groups and ask each group to prepare their presentation by summarising their individual observations. Ask them what are the differences and similarities between the farmers' system and the field visited (genebank or forest reserve)? What do they think are the strengths and weaknesses of the two systems?
4. Present in the large group the summary for discussion.
5. Introduce the two types of conservation to the farmers using the initial discussion generated from the field visit .

Discussion

1. How are the seeds or plants kept? Are they in their natural habitat or were the seeds and plants collected somewhere and brought to the place?
2. Is the farmer planting many varieties in his farm similar to the genebank in conserving and maintaining some seeds? Why are they similar? Why are they different?

3. What do you think are the advantages and disadvantages of having seeds planted in their natural habitat with seeds kept out of their natural habitat?
4. If given a choice, which one would they prefer? Why?
5. Will it be possible to combine the advantages of both systems? How or why not?



The Plant Breeding Cycle

Farmers conserve rice PGR that are useful to them. For instance, farmers maintain and continue using certain traditional rice varieties over improved rice varieties probably because of its aroma, taste or cultural value. Rice PGR improvement or crop development is one conservation strategy aimed at improving the use of local landraces by creating new population or varieties which farmers prefer and find useful. Instead of merely discarding the traditional varieties in favour of improved varieties, the desirable genes of the landraces are improved with combination from other landraces, improved varieties or exotic cultivars. At the same time, the science, technique and practice of rice breeding are shared with farmers. In the process, strengthening farmers' control and direction of their own rice PGR system.

Objectives

- To introduce and familiarise farmers with the plant breeding cycle
- To motivate farmers to think through the improvement of their current crop development system

Materials

- The field where there is line selection study
- Normal farmers' field
- Paper, pens, and newsprint

Procedure

1. Go to the field where the line selection study is and ask farmers to group themselves and observe as a group the different generations or Fs? Ask farmers to draw the field layout and record their observations on the field layout.
2. Ask them to note specifically the similarities and differences within the same generation and the similarities and difference between different generation.
3. Ask farmers to observe and note the differences and similarities of the different generations with the standard check and the local check.
4. Return to the 'classroom' and ask each group to summarise their observations and transfer the field layout (with observations) in newsprint for presentation.
5. Present the results to the bigger group.
6. Trainers summarise the points at the end of the presentation and introduce the plant breeding cycle. From an initial cross, the seed will be called an F_1 (or the first generation material). When the F_1 is planted it becomes an F_2 and so on. Show in the field layout the different generation and explain why they are observing segregation in early generation and less in later generation. Emphasise that it takes several seasons to come up with a stable material. Introduce the normal breeding cycle used by NARC (where there is multilocation trial) and explain that what we are trying to do in the current field study is to shorten the breeding cycle by involving the farmers in the early assessment and selection of crosses and also teaching them how to make crossed of their own.

Discussion

1. What are the differences among plants within F_2 generation? What are their similarities? Do they have the same plant height, leaf colour, and other characteristics?
2. What are the differences: among plants within the F_4 generation, within the F_6 generation, within the plants of the local check variety, and within the plants of the standard check variety?
3. How will you compare the degree of similarities or differences of plants in F_4 and F_6, in F_4 and F_2, in F_2 and F_6 in F_6 and the local check, in F_2 and the local check, in F_4 and the local check?
4. What could be the reasons for the differences and similarities?

Two Systems of Plant Breeding

Professional plant breeders and farmers both carry out varietal selection and breeding. They may have the same objective, i.e., crop improvement but the processes that they use are very different. Formal institutions usually collect and conserve genetic resources in gene banks. This does not address the problem of improving the farmers' cropping system. On the other hand, farmers carry out on-farm rice PGR improvement and conservation which has several advantages. In farmers' fields, genes undergo farmers' selection as well as a natural selection resulting in materials with better resistance against pests and diseases and improved adaptation to the local environment. The farmers' system develops a heterogeneous genetic pool because of the presence of various local genetic sources. However, farmers are confronted with limited materials and unsystematic selection and breeding processes. This exercise will allow farmers to discuss ways to improve the two plant breeding systems.

Objectives

- To determine strengths and weaknesses of the two plant breeding systems
- To identify ways to improve the farmer and the government/ institution plant breeding systems
- To raise awareness that farmers can produce varieties

Materials

Markers, tape, small pieces of paper, and newsprints

Duration

2 hours

Procedure

1. Ask farmers to work in small groups to discuss strengths, weaknesses, and ways to improve farmer and government/ institution plant breeding systems.
2. Ask groups to use the following table to summarise and present their discussions.

Strengths, weaknesses, and how to improve farmer and government/institution plant breeding systems

NO.	CRITERIA	FARMER		GOVERNMENT/ INSTITUTION		HOW TO IMPROVE
		Strengths	Weaknesses	Strengths	Weaknesses	
1						
2						
3						
4						
5						
6						
7						

3. Compare the strengths and weaknesses of the two plant breeding systems.

Discussion

What measures should be done to help farmers produce varieties themselves?

The Rice Plant: Overview of the Agronomy, Morphology and Growth Stages

Farmers have indigenous knowledge of the rice plant and its characteristics. Supplementing that knowledge with information on the characteristics as it relates to rice physiology and production would assist farmers in understanding better their rice crop and would provide them guidance in observing keenly characteristics for selection and improvement.

Indigenous knowledge *develops in a particular area and accumulates over time through being handed down from generation to generation.*

Objectives

- To provide an overview of the morphology and growth stages of the rice plant
- To provide general ideas on changes that occur on the rice plant at various stages of growth and development

Materials

- Field with different growth stages of rice plant
- Field with single plant per hill and fields with more than one plant per hill
- Newsprint, pentel pens and crayons for each group
- Metre stick and magnifying lens for each group

Duration

1.5 hours

Procedure

1. Each group will be assigned a distinct crop growth stage to observe and collect in the field.
2. Each group will brainstorm on the observations on a particular growth stage.
3. Each group will lists down their observations and draws all recognisable plant parts from collected specimen.
4. Each small group presents their output to the big group to compare and consolidate observations for each growth stage.
5. Facilitate a discussion on understanding the changes in plant parts at different growth stages of the rice plant and relate to cultural yield management and yield potential.
6. As a special topic of interest, ask farmers to measure the first internode and label plants with long and short first internodes. Periodically observe the plants with long and short internodes throughout the season. Note how many tillers come out of the first and second nodes and how many will be productive tillers. Observe if there is a relationship between the length of the first internode with the number of tillers and the presence and growth of the first and second node with productive tillers.
7. Ask farmers to observe their one seedling per hill field and the neighbours' three seedling per hill. Ask them to note weekly what they observe.

Discussion

1. Collect specimen of rice plant at seedling and tillering stages and discuss their growth and development. Collect rice plant specimens at stem elongation and panicle initiation and discuss their growth and development.
2. Collect rice plants at flowering, milk, dough and mature grains stage and discuss their growth and development.

3. At what stage of the rice plant is most sensitive to stress such as low and high temperatures? Why?
4. What are the pests that are commonly observed during the different growth stages of the rice plant?
5. What are the differences in morphology and agronomic traits of rice planted at one plant per hill with other rice planted at three or more plants per hill?
6. Is there a relationship between the length of the first internode with the number of productive tillers? Why is this so?
7. What is the importance of knowing the morphology and growth stages of the rice plant?

Reproductive Characteristics of Rice

The reproductive phase, which takes about 35 days, begins at the start of panicle formation and ends at flowering. This phase is the most critical phase for rice improvement. Selecting the best lines and crossing are made during this stage. It is therefore important for farmers to understand the reproductive characteristics of the rice plant, the different characteristics of crosses and lines to guide them with their line selection and rice hybridisation.

Objectives

- To discuss characteristics of rice during the reproductive stage
- To identify the parts of the rice flower and their functions in the pollination process

Materials

- Rice panicle at flowering stage, knife, and magnifying lens
- Newsprint, scissors, coloured pens

Duration

2 hours

Procedure

1. Go to the rice field and find hills with flowering panicles. Note from what generation and lines are the flowering panicles from.
2. Count how many tillers have panicles and how many do not. How many panicles are heading and how many are flowering?
3. Collect some panicles (from different generations or crosses, if available) and return to the meeting room.
4. Draw the panicles and note grains which are at the flowering satge, and before or after flowering stage.
5. Dissect (open the flower) and draw the parts of the rice flower. Observe if there are differences among flowers from different varieties.
6. Collect flowers from other plants around the meeting room or rice field. Draw these flowers. Label the parts of the flowers.
7. Present the results of the small group and discuss with the rest of the class.

Discussion

1. Did all the plants in the field flower at the same time? Did the panicles from the same generation head and flower at the same time? Did the panicles from the same line (or row) head and flower at the same time? Is flowering time of the different crosses the same with the check variety? Which line or population have the same flowering time as the check variety? Why was any variation observed?
2. Do all tillers flower? Do all productive tillers flower at the same time? Describe the flowering process of a rice panicle - do the florets flower at the same time?

3. When do rice flowers open? What are conditions for flowering? Does flowering begin with the top or bottom grains?
4. What are the basic differences between: rice and maize flowers, rice and bean flowers, and rice and luffa flowers? What are the similarities in structure between rice flower and flowers of other plants?
5. What are the functions of the different parts of a flower? Which part of the rice flower becomes the grain?
6. How can you tell if the rice flower has been pollinated or not? What are differences between a pollinated flower from one that has not been pollinated?

Genes, Genetic and Phenotypic Segregation

Rice is rice. But not all rice plants are exactly the same. A variety is a group of plants that are all the same. In the field we can observe some of the differences with our eyes, for example, leaf size, shape, or height. We can find out about duration by growing the varieties. But some things can not be observed directly, for example: two varieties might look almost the same, but they can be different in resistance against lodging.

Gene *is the functional unit of inheritance controlling the transmission or expression of one or more traits.*

Genetic *is determined by the origin, development or causal antecedents of something.*

Phenotype *is the outward appearance of an organism.*

Half of the information on how a plant will be comes from the "mother", the other half from the "father." This is easy to observe in humans (and other animals). The parts of the body that give the information about how a person's hair or nose will look are called genes. Plants also have genes. For instance, genes tell the plant what plant type or resistance it will have. We can not see the genes but we can observe phenotypic characteristics (appearance) of the plant and relate these with the genetic characteristics. It is possible to make crosses between existing varieties to breed new varieties of rice that did not exist exactly the same before. It is still rice but it might have other characteristics such as different resistance against lodging compared to the parent varieties.

Objectives

- To discuss different phenotypic characteristics of rice varieties and relate with genetic characteristics
- To discuss maintenance of changes in phenotypes and characteristic of variety from this to next season
- To discuss necessity of varietal selection, rice improvement and seed rehabilitation

Materials

- Newsprints, ruler
- Seeds of one variety in various seasons
- Seeds of different varieties
- Rice plants of same variety in different fields
- Rice plants of different varieties (it should be collected at ripening stage)

Duration

2 hours

Procedure

1. Groups go to the field to collect some of the materials.
2. Groups observe the plants and the seeds (each group should have a complete set, if possible) and farmers take note of the similarities and differences in characteristics. Ask each group to explain why are there similarities and differences. Allow some time for group discussion.
3. Groups share their findings to the bigger group.
4. Summarise the results to explain about the concept of genes, genetic characteristics and phenotypes.
5. Use the rice samples as examples for easy understanding.

Discussion

1. Why are there differences and similarities among the plants of the same variety and plants of different varieties? What causes these differences? What causes the similarities?
2. Were there differences among individuals of the same variety? Why are there differences among individuals?
3. What is the benefit or loss if varietal phenotypic characteristic (appearance) remains the same from one season to the other? Why?
4. What is the effect of changes in phenotypic characteristics (appearance) after several seasons? Why?
5. Is it possible for us, using normal method of farming to change the appearance of varieties and the genetic composition? Why?

Selecting a Mate: Setting the Criteria for Parentals

This is an exercise intended to show farmers how each one has a selection criteria and how the individual selection criteria can be grouped to come up with a set of selection criteria approved by all. It is recommended to conduct this exercise prior to an actual exercise where farmers determine their criteria for selecting the best variety which will serve as parents for their rice breeding exercises.

Objectives

- To practice making individual and group decisions
- To discuss factors that determine individual and group decision making

Materials

- Male and female groups
- Record book, notebook and pen
- Newsprint and pentel pen

Procedure

1. Divide the group into two: males and females. The groups sit in two separate areas.
2. Ask for five volunteers from each group to sit in the inner circle while the rest sit in an outer circle.
3. From the five female volunteers, the male volunteers each select a partner.

4. From the five male volunteers the female volunteers each select a partner.
5. Each writes down the reasons for choosing the respective person as a partner.
6. The persons in the inner circle then discuss their individual decisions while those in the outer circle take note of the processes that take place.
7. On the basis of the individual decisions, the entire group of women formulate a set of criteria for selecting partners. The group of men do the same.
8. The men and women then compare their process of setting criteria for decision making.
9. The facilitators summarise and record the criteria in newsprint and the big group discusses about the criteria set. At the end, the facilitators level off the discussions.

Discussion

Relate this exercise in ***Establishing the Breeding Objectives and Selection Criteria of the Group,*** *also in* ***Selecting for Parents (or Mates) for their Plant Breeding Studies.***

1. How did individuals arrive at their decisions? What were the steps the groups went through to arrive at their decisions?
2. Did all the group members agree with the decision?
3. What factors influence individual and group decision-making?
4. What are the differences and similarities between individual and group decision making?

Techniques in Rice Breeding

This exercise is aimed to familiarise farmers with the steps of rice breeding. Ideally, farmers should set their breeding objectives and find varieties, which possess some of these desired characteristics (with the help of breeding institutions and genebanks), before the start of the planting season. The selected varieties are then planted and will serve as parents for their crosses.

Objectives

- To observe techniques and procedures in rice breeding
- To practice techniques and procedure in rice breeding

Materials

1. For emasculation
   Pots of plants (plants intended as female parent) in flowering stage
   Scissors, forceps, nylon bag, paper, pen, bamboo stick, etc.
2. For crossing
   Pots of emasculated rice plants (female parent), panicles of intended male parents, knife, magnifying lens, glasses, materials to protect against the wind
   Newsprint, scissors, colored pencils

***Note**: In cold weather conditions, sun light and temperature may not be sufficient to trigger pollen shedding, thus trainers should prepare warm water or put on an electric bulb for the flowers to open easily and shed pollen.*

Duration

1. Emasculation: 2 hours, from 2 P.M. to 4 P.M. of the day before pollination
2. Pollination: 2 hours, from 8 A.M. to 10 A.M. the following day after emasculation

Procedure

1. Divide the class into groups, with each group having 4 to 6 members. Trainers present farmers with the following scenario: If their farmers' group would develop a new variety what qualities would they look for?
2. Ask groups to also discuss what qualities they would prefer most? If they can only have two qualities present in a variety, what would these qualities be?
3. Ask groups what varieties possess these qualities and what varieties would be good to combine to get the preferred qualities?
4. If the identified varieties are available in the village, use these in setting up the exercise. For best results, two weeks before the scheduled session on this exercise select the female parents at booting stage. Get two to three plants (of the intended female parent) and transplant in a pot. Alternatively, trainers can also ask farmers to go to the field and select the female parent they prefer. Select healthy plants with good panicles that will open the next day. Transplant the plants in pots or perform the exercise in the field.
5. Trainers demonstrate emasculation. And let farmers practice the following steps below:
   - Remove the flag leaf of the panicle to be emasculated (the flag leaf of the female parent). Avoid breaking the stem.
   - Use scissors to cut off all florets that have already shed their pollen. These florets (grain) appear translucent and usually have the anthers clinging to the outside. They are usually found on the top of the panicle.
   - Cut off young florets at the bottom of the panicle. Retain 20 - 30 florets in the middle of the panicle.
   - Obliquely (diagonally) cut away 1/3 of the tissue (lemma and palea or the seed coat) of each of the remaining florets to expose the anthers.
   - Remove anthers with forceps or toothpick. Avoid damaging the ovary and the remaining lemma and palea (seed coat). Check that all the anthers are removed. There are six anthers per floret.
   - Cover emasculated panicle with a glassine bag.
   - Close bag by folding the open edge diagonally and fastening with paper clip.

***Glassine** bag is a kind of waxy paper bag.*

- Close bag by folding the open edge diagonally and fastening with paper clip.
- Write the variety name of the female parent, the date of emasculation and the name of the person who did the emasculation on the glassine bag.
- Fix the panicles on the bamboo stick to prevent panicles from stooping and breaking.

6. The following morning, trainers demonstrate pollination and let farmers practice following the steps below:
   - Go to the field to select the male parent early in the morning, about 6 A.M. – 7 A.M.
   - Select panicles that will open this morning. Cut panicles at the base.
   - Put panicles in a glass of water. Make sure that the base of the panicle is immersed in water.
   - Place the panicle near the pot with the female parent. Avoid windy areas as the wind may carry off the pollen and you will be left with no pollen to use for the cross.
   - When the flower opens and starts to release pollen (this can be determined by placing a finger under the male panicle if you notice some yellow powder on your finger), it means that it is time to pollinate the female parent.
   - Remove glassine bag covering the female parent.
   - Gently remove the pollinator panicles from water.
   - Shake them over the female panicle (notice the pollen dropping in the florets of female plants).
   - Replace glassine bag over the female parent.
   - Note the parents of the cross on the glassine bag. Label the cross by writing the name of the female and male parents (the name of the female parent should be on the left side), the date of the cross and who made the cross.
   - Fix the plant to a bamboo stick to prevent the panicles from falling down.

Note: *Emasculation should be done in the afternoon before crossing preferably between 2 P.M. and 4 P.M.*

7. If the group feels it is necessary, female parents may be re-pollinated the next morning. The stigma of emasculated spikelets remains receptive to pollination for at least five days.

8. After 7 – 10 days, check for percentage of successfully pollinated seeds. This can be distinguished by the appearance of the white endosperm from the floret. Compute using the following formula:

$$\% \text{ set seed} = \frac{\text{\# florets with seeds}}{\text{total \# of pollinated florets}} \times 100$$

9. To summarise the discussions, ask each group to write on a newsprint the following information:
   - ❑ Their breeding objectives
   - ❑ The process they went through
   - ❑ The requirements for plant breeding.
10. Present the information to the rest of the group.

Discussion

1. Why is it necessary for farmers to develop skills in plant breeding?
2. Why is it necessary to always refer to the breeding objectives when farmers carry out plant breeding?
3. What percentage of success did you get from the plant breeding exercise?
4. What did you find difficult in the exercise on plant breeding? What are your recommendations to improve the exercise?

Criteria for Selection of Varieties

Farmers consider many things before they select a variety to plant each season. For example:

- Yield under favorable conditions
- Yield under unfavorable conditions
- Resistance to diseases and pests
- Competitiveness against weeds
- Height
- Tiller production
- Panicles production
- Type of grains
- Taste
- Use of variety, if for home consumption or for the market
- Market price
- Domestic and commercial demand

This special topic will help farmers discuss what is important when choosing a variety and the characteristics that should be observed in the field when evaluating varieties. Likewise, the exercise will help farmers understand how to use a set of criteria for varietal evaluation and match these with breeding objectives that they themselves define.

Objectives

- To identify, monitor and evaluate plant characteristics
- To identify the relationship of phenotypic characteristics with yield and quality of variety
- To understand desirable and undesirable characteristics
- To select variety based on desired characteristics and objectives

Materials

- Rice plants of different varieties, 20 panicles selected for each variety at ripening stage
- Newsprint, marker, ruler

Duration

3 hours

Procedure

1. Briefly introduce the purpose, requirement of the study and tasks.
2. Introduce the rice descriptors' list, i.e., description of traits of rice plants, in the table at the end of this special topic.
3. Classify the traits related to yield, quality, pest resistance, etc. of the rice plant.
4. Groups go to the field to observe the different varieties and to collect plant samples of different varieties. If there are panicles, randomly select and cut 20 panicles per variety.
5. Groups characterise each variety using the descriptors' list. Farmers select the traits that are important for them including characteristics of the panicles that they looked at.
6. Ask each group to summarize the traits and the description of each variety on a table, as shown below.

NO.	TRAITS	STAGE OF RICE GROWTH	SCALE				
			Var 1	Var 2	.....	.....	Control
1	Growth						
2	Pests and diseases						
3	Yield component						

7. Discuss in the group the scale for each trait of each variety. Evaluate the qualitative traits by giving out concrete examples.
8. Present results of each group to the rest.

Discussion

1. What are the growth traits related to rice yield? Why?
2. Which of the traits are important to you? Why?
3. From the table presented what variety will you select? Why?
4. What variety above should again be evaluated in the next season? Why?
5. What traits above do not reflect the essence of the variety? What other important traits should be added for varietal evaluation?

Note: *Trainers can separately ask the opinion of men and the opinion of women, of old and young farmers.*

Selection Techniques for Segregating Materials

There are three methods for selecting segregating materials which shall be introduced in this special topic. Each one has its own advantages and disadvantages. Farmers' groups should choose the method they are comfortable with and try it out in the field.

Objectives

- To demonstrate and diagram the different selection methods for segregating materials.
- To explain the strengths and weaknesses of each method.
- To decide the line selection method to use in this season and next seasons.

Materials

- Newsprint, pen, ruler
- Seed dyed with different colors or pieces of paper with different letters representing the different segregating lines or coloured paper clips

Duration

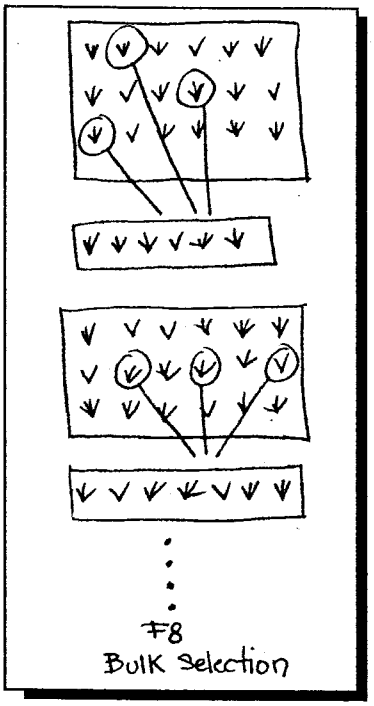
3 hours

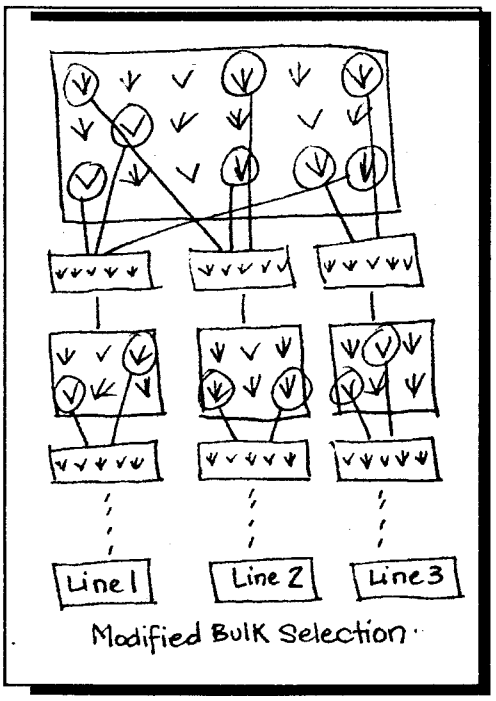
Procedure

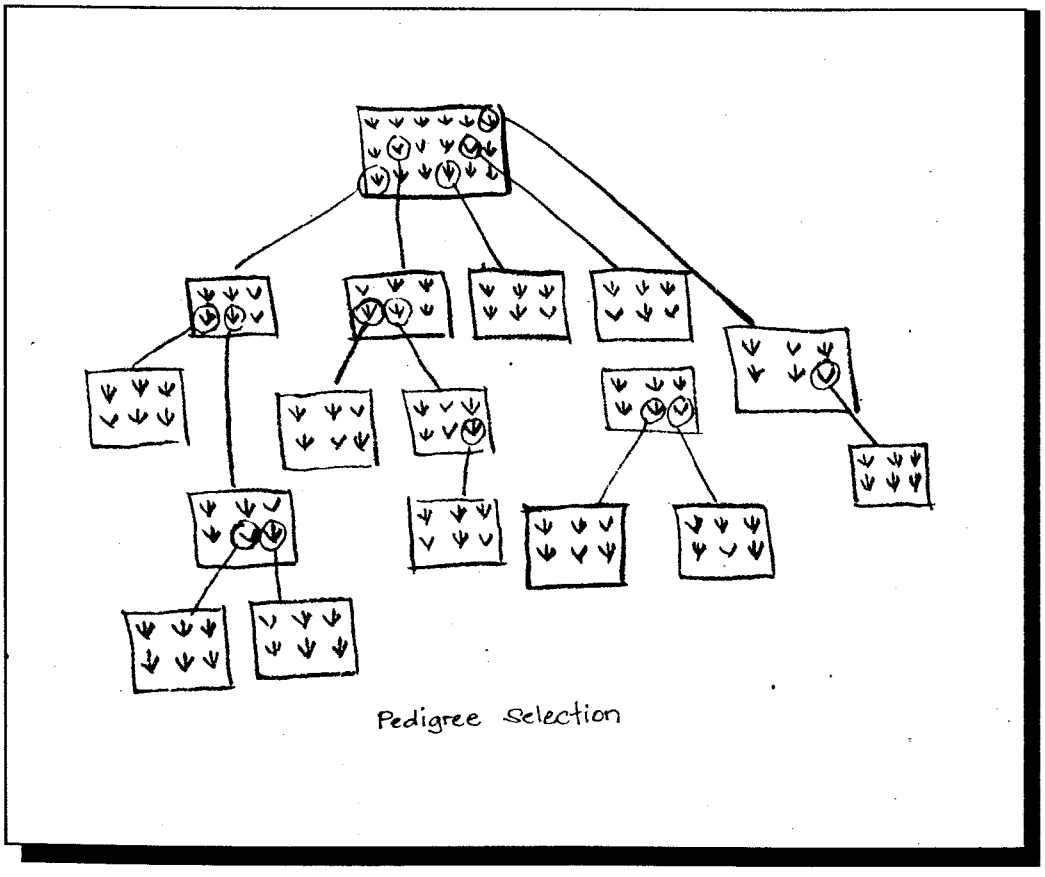
1. On the floor in the middle of the meeting room, layout three big newsprints for the demonstration. The trainer should demonstrate. Use the dyed seeds (or the labeled paper pieces or colored paper clips) to demonstrate bulk selection on one newsprint. On the other newsprint, demonstrate the modified bulk selection method. And on the third newsprint, demonstrate the pedigree method of selection. (Refer to the diagram on the next page.)
2. Divide participants into two groups. Provide enough materials (dyed seeds or labeled pieces of paper or colored paper clips) so that all group members can participate in the group work.
3. Ask the first group to try bulk selection and modified bulk selection methods from the first generation to the eighth generation.
4. Ask the other group to try pedigree selection from the first generation to the eighth generation.
5. From the results of the exercise, ask the groups to draw diagrams of line selection method that they used.
6. Ask the groups to note what they think are the strong and weak points of the method they used.
7. Ask the groups to present their diagrams and the list of strong and weak points to the whole group for discussion.

Discussion

1. Which line selection method is easy to implement? Why?
2. What method allows farmers to select a new variety in a shorter time? Why?
3. What method results in the most number of varieties? Why?
4. Which method do you prefer? Why?
5. Can you help other farmers select lines from a segregating population? Why or why not?


F8
Bulk Selection


Line1
Line 2
Line3
Modified Bulk Selection


Pedigree Selection

Pedigree Selection

GENERATION OF CROSSING	NUMBER OF PLANTS TO TRANSPLANT	NUMBER OF GROUPS PER LINE	NUMBER OF HILLS PER LINE AND NUMBER OF ROWS PER LINE	% OF POPULATION TO SELECT FROM	ACTIVITIES AFTER SELECTION	EXPLANATION
F1	10-20					
F2	5,000-10,000			20-30%		normally grown in population but can be grown in lines
F3	200-1,000		15-25 hills 1-2 rows	10-20% per line 5-10 hills per line		grow 15-25 hills per line after selection, select mor than 3 hills per line
F4	100-300	20-50	-do-	-do-	screening for resistance	
F5	50-100	10-20	-do-	5-10% 5-10 hills per line	-do- preliminary observation for yield trials if lines are already uniform	neary homogenous can be transfered to preliminary yiel trial
F6	10-30	2-5	-do-	10-20% 5-10 hills per line	screening for drought resistance preliminary observation for yield trials	
F7	10-30	2-5	-do-	20% 5-10 hills per line	compare with other varieties and trials in other location	select uniform and good yielding lines for multilocation trials
F8	10-30	2-5	-do-	-do-	demosnstration of good variety selected	
F9-Fn	10-20	2-4	-do-	10-20% 5-10% hills per line	production of breeder seed, foundation seed, seed multiplication and releases as certified seeds for further multiplication	

Winding Up Activities

Near the end of the season, evaluation and sharing activities are carried out to wind-up the season. The Farmer's Field Day (FFD) is usually carried out near the end of the season to share the results of the study to other farmers in the community. Likewise, FFD serves as a platform for farmers to do local advocacy work and generate support for their activities in the future while celebrating the completion of activities in the season. Group evaluation and planning for the next season are also carried out at the end of the season.

The Field Day

The field day is an occasion when farmers and facilitators show other people or the community what they have learned and the results of their studies. The field day may include such activities as field tour, exhibit and a program where local officials deliver speeches. Folk media prepared by farmers complete the celebrations.

The field day is also the training participant's affair. This means that they must plan for and implement the activity. For the FFS, the farmer-participants may choose to invite co-farmers from the same or neighbouring villages. For the facilitators, they may choose to invite their local chief executives or direct supervisors with the end view of orienting them on the program.

The best time to have a field day is when there is still standing crop that is nearing maturity in the 'learning field'. The field day is the culminating activity of an FFS. Although the field day is designed to convey desired messages (e.g., results of the trials), more importantly, the activity must also highlight the participant's experience on what can be accomplished by working together.

Objectives

- To define Field Day
- To discuss the reasons for holding a field day
- To discuss activities during a field day
- To plan, conduct and evaluate the field day as an end-of-the season FFS activity

Materials

- 'Learning field' at least two weeks before harvest
- Other supplies and materials for field day preparation

Duration

At least one hour each week for three weeks to devote on planning, brainstorming and discussion prior to the last week of preparation

Procedure

1. Discuss with farmer participants what is a field day? What are the reasons for holding a field day? What happens during a field day?
2. Write down the answers and use them as basis for planning the group's field day.
3. Plan the field day activities.
4. Conduct and evaluate the field days.

Discussion

1. Who should we invite in the field day? Why?
2. How do we solicit the involvement and commitment of local leaders in the community through the field day?
3. How do we share the knowledge and skills we learned in the FFS to other farmers and local officials?

Variations

There are variants of the field day. Some field days are done after the F. F. S. whereby farmer participants report back to the whole community their activity. A community meeting is organised and the FFS farmer participants report their studies and ask the rest of the villagers their comments and suggestions for the next season.

Some field days are held to coincide with the eating quality test for stable lines and varieties. Invited farmers and guests are also asked to rank the different stable lines or varieties according to their preferences (please refer to the section below on Eating Quality Evaluation for details). The whole activity takes on a festive character.

Suggestions for the field day

The field day for FFS rice PGR CDU is primarily the same as that of any regular field school in terms of objectives as well as activities. The activities may include the following:

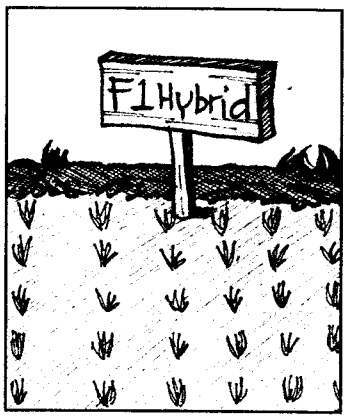
I. Field visit

Farmers present their studies, explain the methodology for carrying out each one as well as allow everyone to see the results of the studies.

II. In-door activities

A. Exhibits/display (may include)

1. Graphs showing results of:
   - Varietal evaluation study
   - Seed rehabilitation study
   - Line selection study
   - Plant breeding study
2. Pot studies on plant breeding
3. Drawing/illustrations of procedure on:
   - Seed rehabilitation
   - Line selection
   - Plant breeding



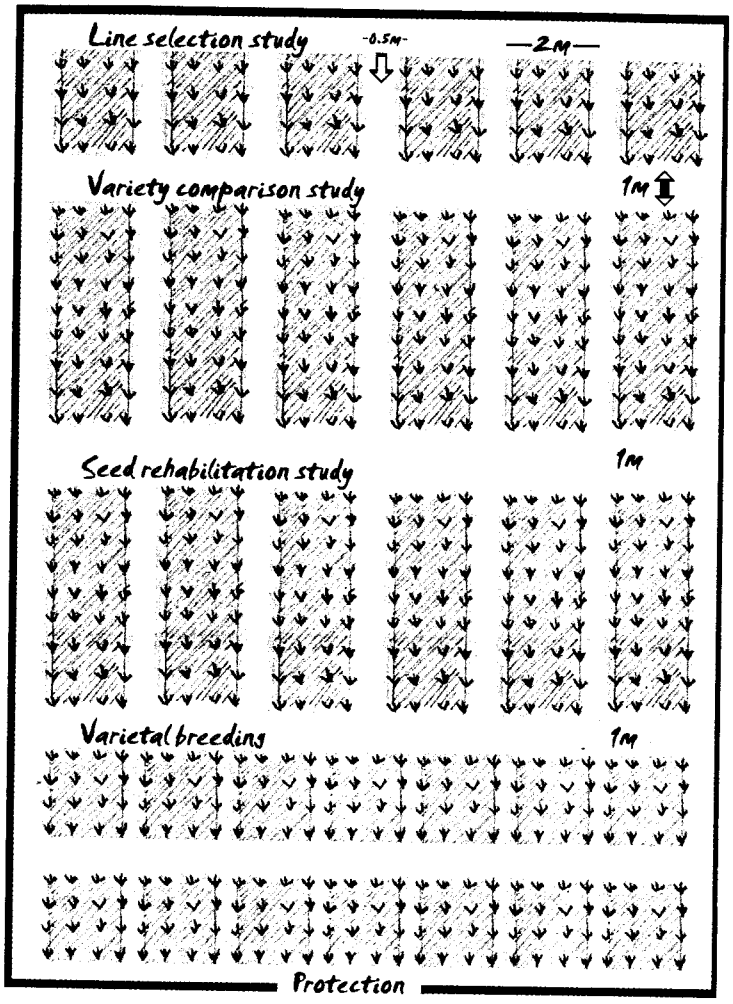
B. Program

1. General report

   A summary of information about the field school including information on:
   - The baseline establishment activities
   - The planning meeting
   - When the field school started
   - How participants were selected
   - The number of participants
   - The studies conducted
   - Other activities
2. Exchange of ideas between visitors and farmers
3. Presentation of plans for the next season
4. Speeches from guests

Suggestions for exhibits

Some materials that may be prepared for the exhibits or displays are described here. Data to be presented is gathered over the season and work on graphs is spread over several days to allow for sufficient time for preparation. Data for varieties that tend to shatter should be completed before ripening while data for other varieties may wait until later. For each study, the following materials may be considered for presentation:

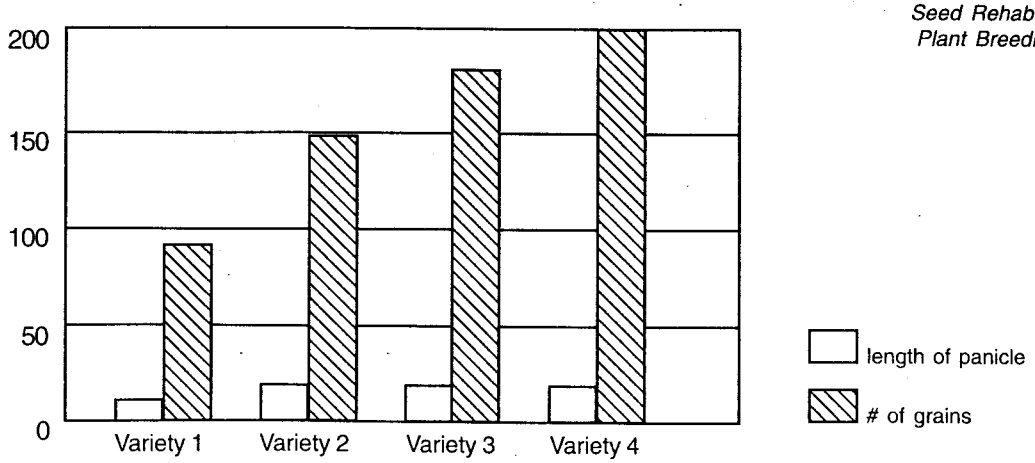


2. Summary tables on weekly observations for each study including general ideas and recommendations

OBSERVATIONS	VARIETIES									
Tillering stage	1	2	3	4	5	6	7	8	9	10
Diseases Pests Plant Development Etc										
Booting stage										
Diseases Pests Plant Development Etc										
Ripening stage										
Diseases Pests Plant Development Etc										
General ideas _____ **Recommendations** _____										

3. Graphs of crop cuts and yield component analysis for each treatment of the studies on Varietal Evaluation, Seed Rehabilitation and Line Selection. The legend should be indicated on the paper.

Note: This table may be used for data on ecosystem analysis in the Varietal Evaluation, Seed Rehabilitation and Plant Breeding Studies.



Eating Quality Evaluation

At the end of the season, farmers and trainers can carry out grain quality evaluation including a cooking quality/ gastronomic evaluation as part of the Field Day or as a special topic for the FFS. Only stable lines (F6 up) in good quantity are to be evaluated. Segregating lines at early generation are not yet stable (they still change in character especially eating quality and sticky character) so they are not suitable to be evaluated. Some promising lines (which will turn sticky at the later generation) may be discarded at once because it has not expressed the desired grain character during evaluation. To avoid this, it is advised to evaluate only the stable lines for eating quality and grain character.

Objectives

- To evaluate the grain character and eating quality of stable lines in the field trial
- To get an understanding of farmers' preferences and selection criteria

Materials

1. The first activity is to design the evaluation form. Ask farmers what they look for in the grains. What is a good grain for them?
2. List the criteria and rank them.
3. Ask farmers how they measure the different criteria - what are their classification scheme? Which is highest in the classification? On a scale of 1-5 with 5 as the highest how will they classify aroma and taste?
4. Use the evaluation criteria generated from this discussion to evaluate the gastronomic characteristics of the variety.

5. Prepare a form. The form can be something like:

Name: _____
Date of evaluation: _____

CRITERIA	1	2	3	...	10
Chalkiness					
Milling quality					
Consistency					
Aroma					
Scale-consistency					

1 = lowest
10 = highest

6. Trainers will cook the different varieties under the same condition and maybe even using the same water measurement. For ten varieties, the trainers have to prepare at least five stoves for cooking.

7. Place each cooked variety on a plate and line them on a table (keep the plate covered to maintain the freshness and moisture). Alongside the cooked rice, trainers can place the milled rice. Do not place the variety name for each entry, as farmers may be influenced by their earlier preferences, just number the cooked rice. Trainers keep the variety name for each entry or trainers can place the name under the plate for reference. After every two or three plates, trainers can place a glass of water for farmers to drink after tasting a couple of varieties.

8. Give farmers the evaluation form which they designed and ask them to form a line. Instruct the first farmer to taste the first entry and ask him to quietly fill his form. He then moves to the second entry while the second farmer tastes the first entry and so forth. After tasting the varieties, ask farmers to tally their scores and rank their preferences. Convene the group and tally the scores (or ranking) for each criterion. This is the individual evaluation result.

9. The facilitator can prepare in a big paper the evaluation form and ask each farmer to fill in their scores. The score for each criterion will be totalled and the varieties ranked. This will be the group evaluation result. Reveal the variety names. Trainers should keep the individual and group evaluation result.

   Farmers are usually excited at gastronomic evaluation and there can be surprises with their choices. Some varieties which are not preferred in terms of plant characteristics may be ranked well in gastronomic evaluation.

Planning and Evaluation Session

Towards the end of the season, discuss with the farmers the following questions:

1. What were the good and difficult things in each of the studies? Make a list together and give recommendations for improvement in the future.
2. Are the farmers interested to continue parts of the study in the next season? How would the plan for the study/ies look like? Try to make a study design together and decide what will be observed in detail?
3. What are the plans of the group to help other farmers in the village understand more about rice PGR CDU? What activities are planned for the next season?
4. Discuss specific plans per study. For example on Varietal Evaluation, discuss how they plan to use promising varieties in the village in the coming seasons? Are they just going to choose one? What might happen then? How could that be avoided as much as possible? What are the problems in organising this?
5. Do the same process for the other studies that farmer carried out this season.

   Summarise the plans together. Discuss what kind of support will be needed and how it can be obtained. The results of the planning and evaluation session may be presented during the Field Day to generate support from other farmers and local leaders.

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APPENDIX

Rice Descriptors' List
(Oryza Sativa L.)

I. Development stages of rice plant

Stage	Code
Germinating	1
Seedling	2
Tillering	3
Elongating *(Stem elongation)*	4
Booting	5
Flowering *(Heading)*	6
Milky	7
Dough	8
Mature *(Mature grain)*	9

II. Description of specific traits

ORDER	CONDITION	STAGE	SCALE	POINT
1	Length of the leaf just below the flag leaf	4-5	Actual measurement in cm	
2	Width of the widest portion of the leaf just below the flag leaf	4-5	Measure the widest part of the leaf in cm	
3	Color of the leaf blade	4-5	Light green Green Dark green	3 5 7
4	The allocation of other pigments	4-5	No pigment At the top At the rims With stripes Whole of the leaf	1 2 3 4 5
5	Ocular inspection of color	4-5	Light green Purple (violet)	1 2
6	Measure the angle between the primary tiller and secondary tillers.	4-5	Erect: < 30° Intermediate ≈ 45° Open ≈ 60° Spreading> 60° Procumbent (the culm or its lower part rests on the ground surface)	1 2 3 4 5

ORDER	CONDITION	STAGE	SCALE	POINT
7	[redacted] Color	5-6	Green With purple stripes Light purple Purple	1 2 3 4
8	[redacted] Degree of hair covering on the leaf just below the flag leaf (rub fingers from the tip down on the leaf surface)	5-6	Without hair Medium Hairy	1 2 3
9	[redacted] Measure the angle of the leaf below the flag leaf against the stem	5-6	Erect Horizontal Descending	1 5 9
10	[redacted]	5-6	Light green Green Purple	1 2 3
11	[redacted] The length of the ligule	5-6	In cm: from leaf neck to the top of ligule	
12	[redacted]	5-6	White Purple stripes Purple	1 2 3
13	[redacted]	5-6	Sharp to slightly sharp Split into two tops Looped top	1 2 3
14	[redacted] (when 50% of plants are booting)	5-6	Very early Early Medium Late Very late	1 3 5 7 9
15	[redacted] Measured near the collar as the angle of attachment between the flag leaf blade and the main panicle axis	5-6	Erect Intermediate Horizontal Descending	1 3 5 7
16	[redacted] The exertion of the panicle above the flagleaf shealth after anthesis. Rating is based on the majority of plants in the plot.	6	Well exerted: the panicle base appears way above the collar of the flag leaf blade Moderately well exerted: the panicle base is above the collar of the flag leaf Partly exerted: the panicle base is slightly beneath the collar of the flag leaf blade Enclosed: entirely enclosed within the flag leaf sheath	1 2 3 4
17	[redacted]	6-7	Count the total number of effective and ineffective tillers	

ORDER	CONDITION	STAGE	SCALE	POINT
18	[redacted] In cm: measure from the ground surface to the tip of the tallest panicle (awns excluded)	7-8	Semi-dwarf: -Lowland < 110cm -Upland < 90cm Intermediate: -Lowland < 110-130cm -Upland < 90-125cm Tall: -Lowland > 130 cm -Upland > 125 cm	1 5 9
19	[redacted] The outer surface of the internodes on the culm	7-9	Green Light Yellow Purple stripes Purple	1 2 3 4
20	[redacted]	7-9	Thin Medium Big	1 3 5
21	[redacted]	8	Measure from panicle base to tip in cm	
22	[redacted] Panicles are classified according to their mode of branching, angle of primary branches and spikelet density		Compact Intermediate Open	1 5 9
23	[redacted] The bending level of panicle axis	7-9	Straight up Much bending	1 2
24	[redacted]	7-9	Absent Short and partly awned Short and fully awned Long and partly awned Long and fully awned	0 1 5 7 9
25	[redacted] Fingers are rubbed on the grains	7-9	Glabrous Hairs on lemma Keel Hairs in upper portion Short hairs Velvetly	1 2 3 4 5
26	[redacted]	8-9	Absent Light Heavy	0 1 2
27	[redacted] (when 80% of grains on the panicle mature)	9	Very Early Early Medium Late Very Late	1 3 5 7 9
28	[redacted] The matured panicle is firmly grasped by the hand and a slight rolling pressure is applied with the palm and the fingers. Estimate the percentage of shattered grains.	9	Difficult:<1% of grain drop Moderately difficult: 1-5% Intermediate: 6-25% Loose: 26-50% Easy: 50%	1 2 3 4 5

ORDER	CONDITION	STAGE	SCALE	POINT
29	[redacted]	9	White Light Yellow Yellow Brown Red Purple Black	1 2 3 4 5 6 7
30	[redacted] Readings are made when the spikelets are approaching maturity	9	Straw yellow Yellow *(gold)* Red Purple	1 2 3 4
31	[redacted]	9	Short: <1.5mm Medium: 1.6-2.5mm Long: >2.5mm<husk shell Too long: ≥husk shell Not propotional	1 3 5 7 9
32	[redacted]	9	Circle Half circle Medium (half oval) Oblong	1 3 5 7
33	[redacted] Length of the rice grain	9	Short: <5mm Medium: 5.51-6.6 Long: 6.61-7.5mm Very long: >7.5mm	1 3 7 7
34	[redacted] Readings are made on dehulled rice	9	White Light brown Dark brown Red Purple	1 3 5 7 9
35	[redacted] Form of the grain (D/R ratio)	9	Circle: <1 Oval: 1-1.2 Medium: 2.1-3 Oblong: >3	1 3 5 7
36	[redacted] Degree of color fading	9	No fading Little (<10% area of the grain) Medium: (11-20% area of the grain) Much: (>20%)	0 1 5 9
37	[redacted] Reaction with K1-1 1%, hard grain turns brown, soft/glutinous grain turns black blue.		Non-glutinous/non-waxy Glutinous/waxy Intermediate	1 2 3
38	[redacted] (weigh the grain at a humidity of 13%)	9	Very low Low Medium High Very high	1 3 5 7 9

NOTES

BUCAP is a regional program on community based agricultural biodiversity conservation, development and use. It is currently implemented in Bhutan, Lao PDR and Vietnam. SEARICE, a regional non-government organisation based in the Philippines serves as the program coordinating unit. Financial support for the program comes mainly from the Development Fund of Norway with Oxfam-Quebec and NOVIB providing some assistance to Vietnam country project.

In general, the program aims to:

- Strengthen farmers' system of PGR CDU (plant genetic resources conservation, development and use);
- Increase agricultural biodiversity; and
- Develop capacity of local institutions to implement and support farmer's PGR CDU management.

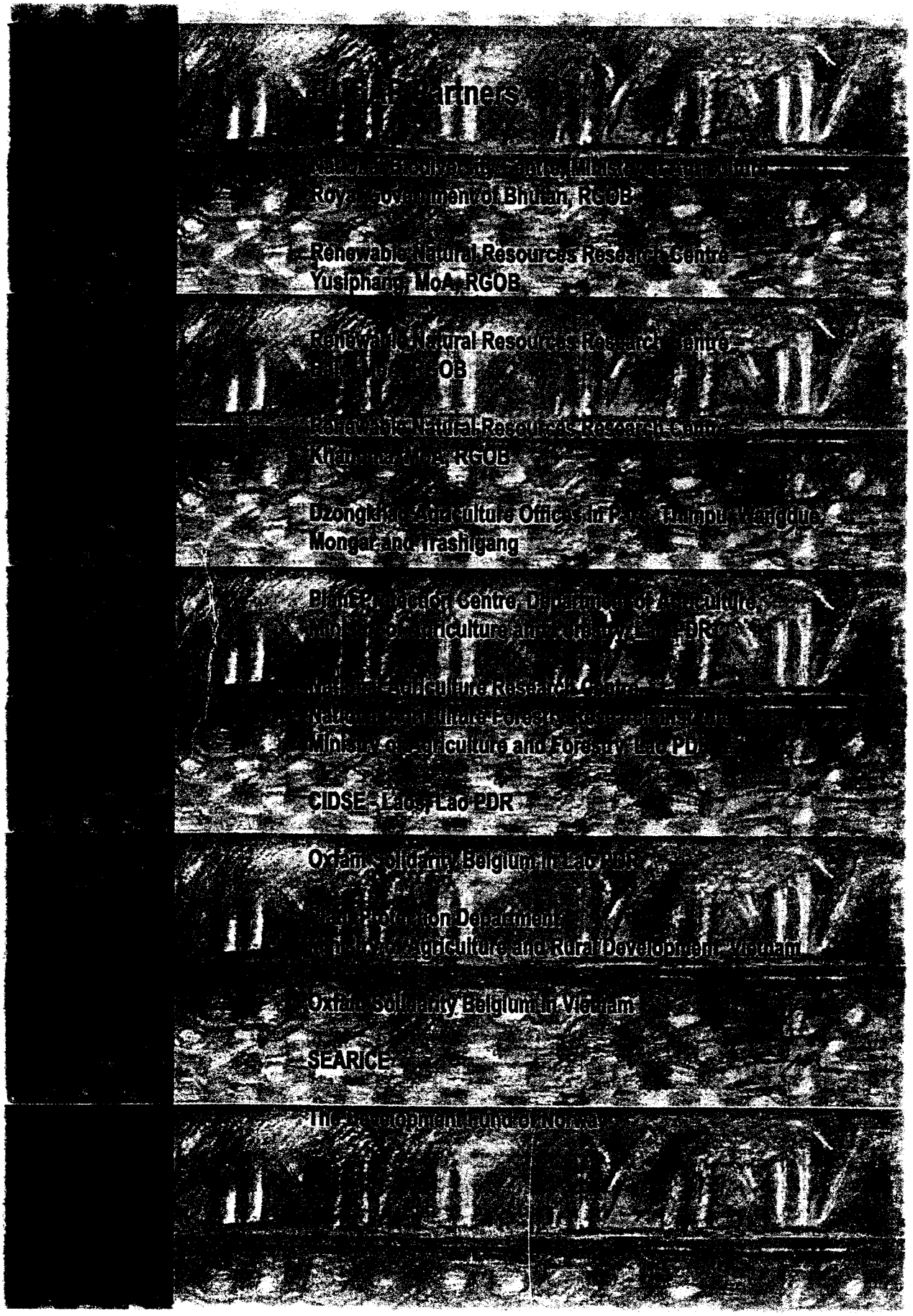
BUCAP was piloted in 2000 in selected sites in Laos and Vietnam. By 2001, field level implementation of BUCAP activities was in full swing in both countries. The pilot implementation in Bhutan was delayed for a year due to initial difficulties in securing national approval. BUCAP in the three countries have the status of a national program.

Currently, BUCAP is implemented in 42 villages from 14 provinces and one municipality in Bhutan, Vietnam and Lao PDR. The distribution is as follows:

- 21 villages in five provinces of Vietnam;
- 14 villages in four provinces and 1 municipality of Lao PDR; and
- 7 villages in five Dzongkhag (Provinces) of Bhutan.

BUCAP worked in direct partnership with 815 farmers comprising of 64 farmers from Bhutan, 261 farmers (27% women) from Lao PDR and 490 farmers (48% women) from Vietnam. All are small-scale farmers representing a cross-section of the community - across gender, age-group (from 15 to 75 years old), social status, ethno-linguistic group and educational attainment. A number of BUCAP farmer partners are tenants having less than one hectare of land per household. Some are even farm workers. In Bhutan, almost all the farmer partners are illiterate.

It is envisioned that in the next years, BUCAP will be more active in grassroots advocacy and policy development at the provincial and national level because its experiences on the ground are already well established. Meanwhile, alliance building work and consolidation of field work continues. Also, BUCAP Vietnam is expanding to 5 new provinces, namely: Dong Thap, Kien Giang, Yen Bai, Nghe An and Quang Binh.


Partners
Royal Government of Bhutan, RGOB
Renewable Natural Resources Research Centre –
Yusiphang, MoA, RGOB
Renewable Natural Resources Research Centre –
Khangma, RGOB
Dzongkhag Agriculture Offices in Pema Gatshel, Trongsa,
Mongar and Trashigang
Plant Protection Centre, Department of Agriculture,
Ministry of Agriculture and Forestry, Lao PDR
National Agriculture Research Centre
National Agriculture Forestry Research Institute
Ministry of Agriculture and Forestry, Lao PDR
CIDSE – Laos, Lao PDR
Oxfam Solidarity Belgium in Lao PDR
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