

Participatory training and curriculum development for Farmer Field Schools in Guyana and Suriname

A field guide on Integrated Pest Management and aquaculture in rice

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CURRICULUM FOR FARMER FIELD SCHOOL ON INTEGRATED PEST MANAGEMENT AND AQUACULTURE IN RICE-BASED FARMING SYSTEMS IN GUYANA AND SURINAME

PREPARED AND PRODUCED BY THE TRAINEES AFTER THE SEASON-LONG TRAINING OF TRAINERS CONDUCTED AT THE NARI/GRDB RESEARCH STATION, LESBEHOLDEN VILLAGE, BLACK BUSH POLDER, CORENTYNE, EAST BERBICE, GUYANA (5 DECEMBER 2004 TO 18 MARCH 2005)

Preface

"I.P.M is not for trainers. It's by trainers."

This curriculum, developed and edited by the trainees of the IPM rice-fish ToT, is not a cooking recipe, but an inspirational document which is free for modifications based on local needs. Its contents are a blend of actual ToT experience and other sources, prepared under the guidance of the two FAO TCDC consultants for IPM and aquaculture, and the participants of the season long IPM/FFS training program held in Guyana from 5 December 2004 to 18 March 2005.

This curriculum emphasizes the strategy of integrating fish into rice production systems in Guyana and Suriname, through IPM, under the Farmers Field School participatory approach.

This curriculum presents procedures of activities to be undertaken aimed at providing an opportunity for rice farmers in realizing additional income, higher crop yield and reduced cost of production, by reducing their spending on the purchase of pesticides, through farmer education based.

It is hoped that both trainees and facilitators of FFS would find this curriculum enlightening and handy to use.

H. Ramlall
Participant
Training Program

Acknowledgement

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Special thanks are likewise extended to the Ministries of Agriculture of Guyana and Suriname, Guyana Rice Development Board, and the Guyana Rice Producers Association for sending its extension officers to attend and become a part of this training program.

Most of all, thanks to our two dedicated and hard working consultants: Mr. Godardo Juanich, Aquaculture Specialist, and Mr. Wahyu Sutisna, IPM/FFS Specialist, for conducting this training in a simple, memorable and enjoyable way.

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PART I

CURRICULUM FOR INTEGRATED PEST MANAGEMENT (IPM) AND FARMER FIELD SCHOOL (FFS)

General Topics

1. BACKGROUND

The Farmer's Field School (FFS) has been an ongoing program for the past four seasons in Guyana. During this time facilitators have encountered problems with the poor attendance of farmers because of the limited knowledge in the management of the farmer's field school. A training program was conducted to enable facilitators to better conduct and correct difficulties encountered during the past FFS. As a part of the Training of Trainers (TOT) program it was envisaged that there should be better planning of the pre and ongoing FFS activities. This curriculum consists of two major parts: Pre and On-Going FFS. It was recommended that the following activities should be carried out before commencing the FFS:

- Site Selection
- Identification of Farmers
- Learning Contract
- Training Needs Assessment
- Regional Support System

2. SITE SELECTION

Site Selection is important to the farmer's field school because of the various factors that have to be considered. Inappropriate site selection would hamper the farmer willingness to participate. However site selection should satisfy the following criteria:

- Rice growing area;
- Area - large concentration of farmers;
- Meeting place- should be comfortable for farmers;
- Farmer/cooperator - farmer should be cooperative, influential, have good leadership quality and must be willing to work with other farmers;
- Site - should be suitable for fish pond, have adequate drainage and irrigation;
- Rice/Fish plot-must be easily accessible.

3. IDENTIFICATION OF FARMERS

Persons selected for participation in FFS should be interested in learning new technologies, must be willing to share their knowledge with other farmers and be able to participate fully throughout the entire FFS.

Some additional points to consider when selecting persons are:

- participants can be either male or female;
- participants should be full time rice farmers;
- young farmers are preferable;
- any other interested persons.

4. METHOD OF IDENTIFICATION

There are several methods for identifying and selecting farmers for the FFS. However, it is important to use the most effective method, since FFS is a fairly new process.

Methods of selection are as follows:

- notification by individual contact;
- invitation of all prospective farmers;
- commitment of persons through a learning contract.

5. LEARNING CONTRACT

The Learning Contract is a meeting with prospective and potential FFS candidates in the community where the FFS will be conducted. The contract is a consensus between facilitator and farmers to better organize, to achieve goals.

The learning contract should convey the following:

- It is intended to make a compromise between the facilitator and farmers.
- The advantage should be given to farmers by facilitator to participate fully.
- The facilitator should explain to farmers that the FFS would be on going for the entire season, to enable them to learn all aspects of rice cultivation and the reduction of pesticide use. Trials would be done to examine crop performance for specific treatment. The farmer will be responsible for all activities pertaining to the trial.
- Facilitators should propose regular meetings each week (one day, for three hours).
- The facilitator should let farmers fix a day and time suitable for them.
- The facilitator should interact with farmers about what will be delivered and farmers should contribute and participate fully.
- The facilitator should inform farmers that all materials will be provided.
- Facilitators and farmers should be committed to the contract by consensus;
- The farmers should elect a contact person, who will remind all participants of the FFS.

The following activities should be carried out every week: AESA, Special topic "Rice/Fish", Group Dynamics, and evaluation.

6. PLANNING FOR THE FARMERS FIELD SCHOOL

Based on the life cycle of the crop, the FFS will be conducted for fourteen (14) sessions (four sessions before the crop and ten during the crop). Each session should be a maximum of three (3) hours and will consist of four parts:

- Agro Ecosystem Analysis 1 hour
- Special Topic "Rice" 1 hour
- Special Topic "Fish" 45 Minutes
- Group Dynamics 15 Minutes

Each special topic for Rice or Fish should be done at the relevant stage of the crop. The FFS will also consist of on farm trials. Each school should not exceed four (4) trials.

It should be explained to the farmers that they will be placed into groups and will be responsible for the monitoring and collection of data for each trail plot. Each group will be responsible for one trial.

7. REGIONAL SUPPORT SYSTEM

If the FFSs are located far from each other, it will be difficult to provide timely support. Long travel times and a lack of easy access are other constraints.

For this reason, it is advisable to set up a regional representative, who will be responsible for facilitating the FFS needs, and liaising with the overall coordinator. This system is also useful if progress reports are required.

8. TRAINING NEEDS ASSESSMENT (TNA)

The training needs assessment will enable the facilitator to have a better knowledge of the management practices of the farmers, and the constraints that need to be addressed in the area where the FFS will be taking place. This will help in the proper planning of the fourteen session's schedule of the FFS.

9. T.N.A. QUESTIONNAIRE

The following questionnaire can be used to easily gather the required information for the TNA:

Name of farmer:

Address:

Acreage:

Variety:

Burning of straw: Yes ☐ No ☐

Land preparation:

Plough	…..
Chip	…..
Rake	…..
Back blade	…..
Level	…..

Date sown:

Seed Rate:

Fertilizer:

Age of crop	Type	Rate

Crop protection:

Insect	Type	Method of control Amount	Chemical used
Weeds			
Disease			

Harvest Date:

Average yield per acre:

Grade:

10. MATERIALS AND SUPPLIES

The adequate and timely supply of materials will greatly assist the FFS in achieving its goals.

The following materials and supplies are required for each FFS:

a. Materials

- Flip charts
- Packs of crayons
- Meter ruler
- Plastic bags
- Pens
- Pencil sharpeners
- Magnifying glasses
- Box rubber bands
- Calculator
- 20 ft Length ½ inch pipe P.V.C.
- Sweep nets
- ½ Length 3-inch P.V.C pipe
- Supplies
- Markers
- Rolls of paper tape
- 30 cm Ruler
- Note books
- Lead pencils
- Pair scissors
- Ream paper
- Sheets of cardboard
- Knives
- ½ inch P.V.C. bends
- lbs polythene cord
- 3-inch P.V.C. bend
- Snacks for 15 persons

b. Inputs for use on the farm

The following materials are required at the Regional level for FFS:

- 30 meter measuring tape
- Spring scale
- Camera
- Lift net
- Roll barbed wire
- Buckets
- Gram scale
- Computer system
- Plastic mosquito Sprayer
- Happa net
- Scoop net

11. FISH POND

A fish pond 500 m² needs to be constructed, and 1 000 fingerlings need to be sourced. Feed for the fish should also be provided.

Materials and finance should be made available through the regional representatives and must reach the facilitators prior to the FFS session for which they are required.

12. ON-GOING FFS

a. Background

The Farmer Field School (FFS) is farmer education based, lasts for the entire cropping season and targets a group consisting of 10-15 farmers. The FFS consists of informal activities, which are hands-on and oriented towards improved decision making. FFS will have a better impact when it is well planned.

This FFS is specially designed to address the two issues of rice and fish. In short, this FFS will meet to the following objectives:

- Introduction of rice-fish farming practices;
- Improvement in the knowledge of rice cultivation based on IPM concepts.

b. Group formation

The FFS is group based, rather than individual contact based, because this approach has several advantages. The group formation is important to disseminate technology amongst the farmers. The following advantages result from group formation:

- Groups from a similar community facilitate better communication;
- Groups are useful for scaling up future activities;
- Groups are formed based on similar interests of farmer.

c. Field Study

It is important to conduct a field study along with FFS to provide wider knowledge about Integrated Pest Management (IPM). A field study does not serve research purposes but offers farmers first hand information on IPM by giving them the opportunity of setting up and managing their own study.

This study was designed as an "On-farm Study" to demonstrate the principles of IPM. This is considered essential to provide the farmer with relevant knowledge.

The following field studies are the examples how basic IPM could be applied by farmers.

i. Reduced tillage

Farmers in general practice 5 to 6 passes in preparing land for rice cultivation. In some areas farmers also do not pay enough attention to land leveling, which is a very important activity that leads to a healthy crop. This study is designed to give farmers wider experience about advantages in respect to passes.

1. Compare normal practices with reduce tillage;
2. Compare well level with normal practice.

ii. Seeding Rate

In general farmers are well aware of the different seeding rates applied in their own plots. Some of them reported the use of both more or less than the recommended rate. With regard to IPM concepts, both of these actions have advantages and disadvantages. Through this study, farmers will learn both, and make the correct decision accordingly. The field study will be set up during FFS period, so the farmer can learn about the effect of seeding rate on disease infestation, insect population and ultimately, to yield.

iii. Nitrogen

Nitrogen is an essential nutrient which boosts rice growth and increases yield. General farming practices indicate that farmers apply both less and more than the recommended dose. With regard to IPM concepts, both of these actions have advantages and disadvantages. If the dosage is too high, the crop becomes too succulent and therefore susceptible to insects and diseases. If the dosage is too low, the crop growth is retarded. Therefore, farmers should be encouraged to apply an adequate rate at their own plot for best results.

The study will be set up with different rates, as shown below:

- 25 % below recommended rate;
- 25 % above recommended rate;
- same as the recommended rate.

iv. Phosphate

Phosphate in form of Triple Super Phosphate (TSP) enhances crop growth by stimulating root development. Phosphate requires a long time to be fully absorbed by the soil and usually not all is absorbed by the time the crop is ready to be harvested. This leaves some of the phosphate in the soil for the next crop. Therefore, phosphate is not recommended for application every cropping season.

Is was reported that farmers were ignorant of this. Nevertheless, this study was designed to observe the effect of TSP on insects, disease infestation, yield and profit. The simple study could be set up as follows:

- plot treated with TSP at a rate the farmer normally applies;
- plot not treated with TSP.

v. Sequences and schedule

The FFS is carried out and lasts for the entire cropping season, following the crop stages. However each subject should be linked and interrelated to the real field situation.

To ensure farmers gain adequate knowledge, the FFS sessions will be following the farming schedule as indicated below.

Week	Subject Matter
1	Land preparation Special topic: • Snail identification • Introduction of Rice-Fish culture
2	Land preparation Special topic: • How to control weeds • Construction and modification of rice-fish farming
3	Land preparation Special topic: • Water management and leveling • Transporting of life fish and stocking
4	Sowing (broadcasting) • Identifying and control of water weevil • Construction of nets for use in rice-fish culture
5	Special topics: • Seeding rate and method of germination • Fish feed and feeding
6	General (Agro Ecosystem Analysis) Special topic: • Water management
7	AESA (Agro Ecosystem Analysis) Special topic: • Seedling anatomy • Pond and rice field fertilization
8	AESA (Agro Ecosystem Analysis) Special topic: • Early vegetative stage • Fertilizer application; TSP and urea • Fish predators and other pests
9	AESA (Agro Ecosystem Analysis) Special topic: • Tillering ability of the rice plant • Pond and rice fish culture system

10	AESA (Agro Ecosystem Analysis) Special topic: • Life cycle and food web • Fish stocking density
11	AESA (Agro Ecosystem Analysis) Special topic: • Root and plant vessels • Production of tilapia fry and fingerlings
12	AESA (Agro Ecosystem Analysis) Special topic: • Primordial stage • Second application of fertilizer • Fry nursing
13	AESA (Agro Ecosystem Analysis) Special topic: • Insect and spider identification • Fish pond rice field management
14	AESA (Agro Ecosystem Analysis) Special topic: • Insecticide effect on insects • Pesticide (beware of poison), avoid direct exposure, insect damage prevention • Fish harvesting
15	AESA (Agro Ecosystem Analysis) Special topic: • Weather effect on crop, disease and insect development • Post harvest technology
16	Special topic: • Ripening and harvesting • Cost and return analysis of rice-fish culture

vi. AESA, Special Topic and Group Dynamics Guidance

Agro-ecosystem analysis (AESA) is a tool to assist farmers to develop skills and knowledge about rice ecosystems and consequently, how to make better decisions. Working in the full group of 15 farmers:

- observe field situations;
- make notes about components seen e.g., rice crop, insects, diseases, weed, water, weather etc.;
- put in a pictorial sheet the situation that has to be examined and action decided upon;
- decide what practices should be applied.

The AESA is comprised of various components, with presentations in the form of drawings, as follows:

- Location
- Crop age (DAS)
- Beneficial insects
- Disease
- Plant height
- Average tillers
- Other specified factors
- Date
- Variety
- Harmful insects
- Weeds
- Water depth
- Weather conditions

vii. Special Topics

Special topics offer support to the AESA, where very simple demonstrations will carried out, either in the field or at the meeting place. The topic could be selected from the list provided, but an innovative and creative facilitator can develop more topics relevant to the farmer's needs. Therefore, it is suggested that some topics should be added to enrich this curriculum. The special topics proposed in general covers the following:

- Rice crop physiology
- Spiders
- Fish technology
- Insects (harmful and beneficial)
- Pesticides
- Diseases

viii. Group Dynamics

Group dynamics is that part of the FFS activities which helps to strengthen group cohesion and enhance cooperation. Various ways could be formulated that help the group to become enlivened and motivated, such as role playing, brain teacher, case story and short drama. The messages contained within the group dynamics comprise of communication, leadership mobilization, problem solving and planning. Below are examples of group dynamics that can be used for FFS:

- Nine dots
- Landing on the moon
- Broken square
- Sale of sheep
- Handcuff
- Story telling

ix. Field Day

A field day is an occasion organized by FFS farmers for the purpose of presenting and exposing all activities and achievements to other farmers in the community who did not participate in the FFS. The field day could also be a forum for interactions and sharing experiences. The field day is also useful in raising willingness and can facilitate increased activities and scaling up in the future. To make the field day more useful, the following should be followed:

- Venue: At the FFS site where most of the activities were done:
- Date: Determined by farmers, but at a time when the rice reaches maturity stage;
- Time: Within FFS period, preferably during rice maturing stage;
- Location: The FFS group leader should decide on the location and invite farmers from the surrounding community.

x. Exchange Visit

An exchange visit is an important part of the FFS. The purpose is to build up the relationship within the FFS group. During the exchange visit, the farmers can compare progress, achievements and even constraints. To some extent, exchange visits also disseminate new findings to other farmers for their benefit.

The exchange visit could be organized based on the local situation such as:

- FFS to FFS within district;
- FFS to FFS within region;
- FFS to FFS inter region, and
- FFS to FFS inter-country.

13. GENERAL AGRO-ECOSYSTEM

a. Background

Integrated Pest Management (IPM) is based on interaction among crops, pests, diseases and the surrounding environment (insects, diseases, rats, weeds, mollusks), and their natural enemies (spiders, parasites, snakes, birds and others). A healthy crop is determined by the surrounding environment (weather, soil, water, nutrients). In a sound agro-ecosystem, natural enemies will accompany harmful insects.

The rice ecosystem developed a long time ago. There are interactions in the rice ecosystem that have developed over the decades, and it can easily loose its strength by:

- practicing an intensive farming system;
- an imbalance between soil and crop;
- an imbalance between harmful insects and their natural enemies.

Fertilizers make the crop take up more nutrients from the soil, but pesticides kill natural enemies.

In understanding these factors and their interaction, it is important to know the ecosystem's contribution to crop yield. During the training we will look into these interactions within the rice crop.

The basic principles are:

i. The ecosystem is comprised of dynamic characteristics in terms of number, position, role, and intensity of each element/substance. It continues to develop and change constantly, as a living system.

ii. Every ecosystem is determined by a structure and a hierarchy. For example: the crop is the food source of insect pests. They feed on crops in various ways (sucking, chewing). Insect pests again are food for their natural enemies. In this regard, natural enemies are located at a higher position in the food chain of the rice ecosystem. Without them, the rice crop will not attain a good yield. However, without insect pests, the natural enemies will also disappear.

iii. These three components (crop-pests-natural enemies) in rice ecosystem are inter-related and inter-dependent. Our task as good farmers is to maintain the balance of these components and to ensure the crop gives the expected yield while the environment is also maintained

b. Objective:

To be able to describe and comprehend the balance of the ecosystem components in rice fields.

c. Materials

- Large plain sheet
- glue
- cardboard
- sweep net.
- marker pen
- board
- crayon

d. Procedure:

i. Each group enters the rice field at different places, and for one hour, closely observes

and records plants (rice), insects (terrestrial and aquatic insects), spiders (if none are found inside the field, then find from the field dikes), mollusks, etc. A sweep net is used to catch flies and tiny insects.

ii. Each group then goes to a shady place and draws and writes on a small piece of paper (2 inches wide and 4 inches long) what they have seen and recorded in the rice field.

iii. Each group then writes and draws on the same size of paper the following: "Hot Weather", "High Fertilizer Rate", "Cool", "Low Fertilizer Rate", "Sunny", "Cloudy", "Rainy"

iv. Each group then sticks those components that were written on the large plain sheet, and connect crop to pest and pest to predators, using arrows. The group then discusses amongst themselves how these components are related to each other.

v. Later, the groups discuss the consequences/situations given below during rice crop season:
   - Pesticides sprayed kills beneficial insects and spiders, and later pests migrate to the rice field.
   - If crops resistance to insect pests in the rice field is low, what will happen?
   - If the crop has been subjected to a high fertilizer rate, and hot weather (sunny days), what will happen?
   - If the crop has been subjected to a low fertilizer rate, and cool weather (cloudy and rainy days), what will happen?
   - If the crop has been subjected to a high fertilizer rate, and cool weather (cloudy and rainy days), what will happen?

vi. Each group then presents its opinion to the plenary group.

e. Questions

i. Why is it important to conserve natural enemies and maintain balance in the ecosystem?

ii. Why must the rice crop be monitored weekly?

iii. Why should pesticides be used wisely and as last resort?

14. AGRO-ECOSYSTEM ANALYSIS

a. Background

Decision-making in IPM requires analytical skill to correctly assess the field situation. The ecosystem analysis is field practice which is intended to focus on examining each component and taking the correct steps. We have discussed how these components are inter-related. We will now use a method of ecosystem analysis to lead discussion and make decisions.

Ecosystem analysis will be done on a weekly basis along with a list of activities such as field observation and carefully monitoring the rice ecosystem components. The result will be drawn on a large sheet of paper and use it to discuss with participants.

Group members must be actively taking part in each of the following steps: field observation, drawing, discussion and presentation. The presenter must be rotated each week, so everyone has equal chance to learn how to facilitate the session.

b. Objective

To monitor and familiarize participants with the rice crop situation, by making observations, drawings and participating in discussions. After these activities are completed, each group must be able to make decisions regarding the crop management for the week

c. Materials

Data from rice field, large sheet of paper, marker pen, crayon, sweep net, transparent plastic bags.

d. Procedure

i. Enter the rice field and walk diagonally; take samples of 1 meter square each, for a total of three samples at three different places, with one sample at the center. Each sample has to be observed and the result recorded, following the method below:
   - *Insects and snails*: Look at the bottom of rice crop for hoppers, water weevils and snails. Then observe the middle to upper part of rice plant for caterpillars, stem borers, egg masses, seed flies, paddy bugs and sucking insects. If leaves are damaged, open the leaves, find the cause and estimate the damaged percentage. Collect any eggs found and put into plastic bag for preservation to determine if it is a parasite.
   - *Diseases*: Observe the leaves, leaf sheath and stem if there is any deficiency symptom or diseases. Estimate the damage percentage, and record results.
   - *Natural Enemies*: Count the number of each natural enemy found, and the number of larva parasites.
   - *Tillers*: Count the total tillers per each sample site.
   - *Weed Density*: Record the type of weeds and densities of each.
   - *Water Level*: Estimate the water level in inches.
   - *Fish*: Examine the fish either caught in the rice field or fish pond; collect water sample to determine presence of plankton, aquatic insects, fish food and turbidity.

ii. Go back to shady place and sit in groups (four members each) along with data, and crayon.

iii. Following the steps below, draw pictures on a large sheet:
- Draw the rice crop with the average tillers from the three sampling sites that have been observed. A healthy crop will look greener and an unhealthy crop with disease infestation or nitrogen deficiency will look yellowish. Draw dried leaves using yellow colour.
- For weeds, draw estimated population and size in relation to rice crop, including weed type (broad leaf, grasses, or sedges).
- For insect pests, draw the insect found in the field on the right side of rice. Make tabulation at right edge also.
- Draw natural enemies and spiders as well as insect pests, but put at the left side of the rice. Make tabulation at the left edge also.
- If this week is sunny, draw sun at full; if sunny and cloudy draw sun half covered by cloud; if it is cloudy always, draw a dark cloud.
- If rice has been fertilized, draw hand-applying fertilizers. The picture should be above the rice.
- If pesticide has been used, draw sprayer with nozzle spreading drifts. Write what kind of pesticide has been used. If granular insecticide has been used, draw hand-applying pesticide.
- If the fishpond has been fertilized with manure, draw manure being applied. If supplementary feed has been used, draw to show this.

iv. Now discuss the following questions at each rice stages. One group member should be appointed as the interviewer. This person would pose questions to others within the group. (Please rotate each week).

v. After steps 2-3-4 have been completed, come to the plenary discussion where each group will present their results to another group and questions may be raised.

vi. Decisions requiring immediate intervention or steps that have to be taken will be made during plenary session. The group decides and concludes any activities that must be taken in the field relating to the IPM principles.

vii. Each group has to keep their drawing and use it in the following week as a reference.

15. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA) VEGETATIVE TO GENERATIVE STAGE (WEEK 1)

The following questions are expected to help participants improve their ability and interest to carry out agro-ecosystem analysis, while also maintaining learning enthusiasm. Participants are also expected to add any relevant questions based on their own farm experiences and other sources. Creative facilitators should take the initiative to develop other questions which are related to crop stages. The questions should cover key issues of agro-ecosystem components.

i. Did rice seeds germinate evenly? If so, do young leaves emerge? If seeds have not germinated evenly, ask a group member why.
ii. Did you find the young crop yellowish or stunted? If so, why? Do you think quality seed is the key point and important for direct seeding?
iii. Why it is important for crops to develop leaves rapidly?
iv. Did you find deficiency symptoms or disease infestations? What water level is needed at this stage? Too much or too little?
v. What effect does the weather have on crop development?
vi. Did you find snails and water weevils? What is the population? How much damage do they cause? Do you agree that only water weevil did not cause the damages? How about seed rotten due to mud depth?
vii. What kind of natural enemies did you find? How much was the population? Where did they come from? What do they eat before entering to rice field? Did you find any egg masses? Does the insecticide that was used kill them? It is important to enhance their population in this stage? How do you enhance them?
viii. What kind of insect pest was found and how much population is there? How important is the pest at this stage? What strategy is required to reduce their population? (Drain water, add water, add fertilizer, use pesticide, others) what is the reason behind this? What is the situation in the surrounding rice field? Do other rice crops influence yours?
ix. Pertaining to both insect pests population and natural enemies, does insecticide need to be applied? Why?
x. What is the general rice situation compared to last week?
xi. What do we expect next week? What needs to be carefully observed?
xii. What is your management plan for the rice crop this week?
xiii. Fish: How does fish grow? Is it healthy? Look into head part, belly and whole body. Does plankton grow in the fish pond and rice field? What will happen to fish and plankton if pesticide is used?

16. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA)-WEEK 2

i. At the moment do you find the crop stunted? If yes, what is a cause? Do you think it could survive and grow like a normal crop?
ii. How many plants did you find per m^2? Do you think the population is adequate? If not, how do we increase number of plants?
iii. Did you find any deficiency symptoms or diseases infestation? What is water level needed at this stage?
iv. Do you think weather affected the crop development at this stage?
v. Did you find water weevil at this stage? If yes, what is the population found? If not, where did they migrate?
vi. Why does seed fly mostly affect the young plants at lowest spots of the field? Why are some natural enemies late in coming to the field?
vii. What kind of harmful insects and beneficial insects are mostly found at this stage?
viii. What is a proper strategy to reduce insect pest damages and their population? (Blow water in, apply fertilizer, clean up the dikes, spray pesticides)
ix. What is a general situation compared to last week?
x. What do we expect in forthcoming week? What are the specific things that should be closely observed?
xi. What is your management plan for the crop in this week?
xii. Did you observe how the fishes are growing? Did you find plankton growing in the fish pond?

17. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA)-WEEK 3

i. Does the crop grow fully and produce new tillers? Did the old bottom leaf die? Assuming that the crop does not develop and new leaves do not emerge, what might be the cause?
ii. Do you see any disease symptoms or leaves looking abnormal in growth (yellowish, brownish or reddish)? If yes what was the cause? Ask what was the disease situation during the last crop season.
iii. What kind of natural enemies were found in the field? Do you think the population is enough? If too little, how can we stimulate them?
iv. What kinds of insect pests are found in the field? Which is the most adundant species? Where did they come from? (Look at surrounding vegetation "too bushy, plenty of weeds"). Some weeds are used as temporary shelter for both natural enemies and insect pest before entering to the rice field searching for the main host.
v. Do you think sanitation (clean up dikes, remove unwanted rice, weeding) is part of the IPM method? If yes can you explain what the advantages are?
vi. Specifically for Paddy Bug, did you find an early population? If yes, why do they come so early and what food do they take?
vii. What is the general crop situation this week (better, same as last week, worse)?
viii. What are the most important management practices for this week? (Water, sanitation, fertilizer, pesticide application)?
ix. How does the crop look compared to last week?
x. What crop situation do you expect in the forthcoming week?

18. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA)-WEEK 4

i. The rice crop has reached panicle initial stage. Where does the panicle develop inside the stem? Water and nutrient availability, presence or absence of diseases and insect infestation will contribute to the yield. However, continuous field observation and assessment is essential. With respect to this stage, what are some of the aspects needed to be assessed regularly?
ii. The local crop environment is fluctuating, sometimes with rain and low temperature, but mostly hot and sunny with a little cloud. As we know, some diseases and insects prefer this climate. What would be workable prevention to minimize the damage that might occur?
iii. Following the field observation, did you find any significant changing of specific insect or disease population?
iv. What issue needs more attention during the forthcoming week?
v. How many panicles on average of each sample were observed? And how many grains on average did each panicle contain?
vi. Why are some grains not filled?
vii. Can you explain why some do not reach the same number? Where were the numbers in some of the other tillers?
viii. Can you explain the advantages of practicing two and three urea doses in this crop season?
ix. What steps have to be taken for better rice at next crop?
x. Do you think the number of tillers at the site you been observed has a similar number of panicles?

19. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA)-WEEK 5

If AESA was done at two different crop stages (generative and vegetative), facilitators will have to develop questions to accommodate both. For example: in our plot the crop is still producing tillers, new leaves are being developed and the flag leaf is not yet present. In the farmer's field, new leaves are not being produced anymore and the present leaves will remain until the crop is harvested. Only few leaves will emerge and these leaves contribute to good yield. Healthy tillers in this stage are predicted to have high yield.

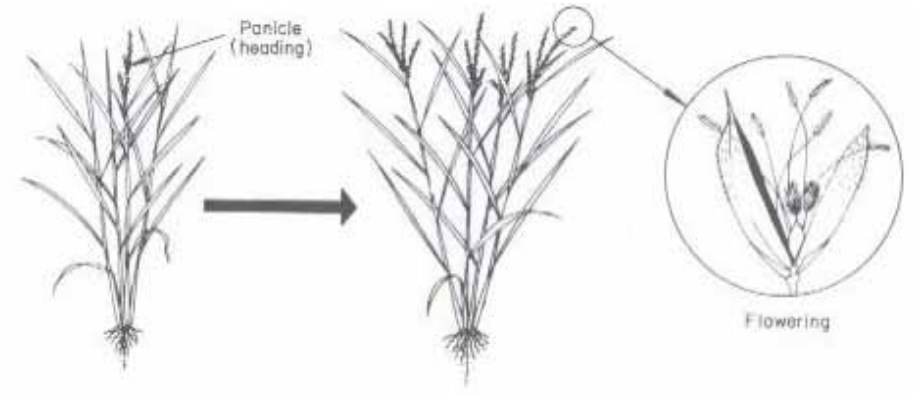
i. How is the water in the field? Does the soil have enough humidity or excess water? Fertilizer has been applied and water should be there. Why? Are weeds present in the field? How is the weed threshold in your opinion?
ii. How many total tillers did you find? Do the leaves seem dark? What will happen if other tillers become less active? Does another compensate or compete?
iii. Do pests attack, and in what level? Are there other insects called pests? Does the population increase, decrease or remain at the same level? Do you find rotten material in the soil? Preserve egg masses in a vial to examine the presence of parasites.
iv. What disease appeared this week? Do you think the weather condition is suitable for disease infestation? (Humid, windy, too hot or too cool)
v. What happened to the spider?

20. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA)-WEEK 6

i. Can we find the early primordial stage in the field? If not, can you predict when it will occur? What is the most important crop management practice during the primordial stage?
ii. Do you think any damages contribute to reduced yield when the crop is in the flowering stage? Is this a crucial stage?
iii. In reference to question ii, can you list what are the most important insects and diseases that might occur? (examine the general weather situation, rainy and sunny, short hot period and long wet, humid and windy, water stagnant in field)
iv. In reference to question i, do you think the rice crop is still producing leaves? How many leaves are expected? Why new leaves must be emerging? (After primordial stage the rice only produce 2 or three more leaves, including the flag leaf)
v. Can you explain, if no more leaves have grown or leaves have been damaged, and you apply the last top dressing, what happened to the nutrients?
vi. Are weeds too dense or not, what are the key factors that contributed to this? (Farmers sprayed herbicides more then once, soil ploughed using three passes, water kept stagnant, straw burned, crop dense)
vii. Can you explain weed characteristics (take one species, examine and discuss), root performance, reproduction system, leaf formation, dormancy period, and competitiveness to rice crop.
viii. With respect to some of the questions above, what are bad culture practices and how can they be addressed?
ix. Did you find a particular insect at a high population? Did you find or see pupa in the field? What is the role of parasites at this stage?
x. Did you find a particular disease infestation?
xi. How is the crop performance compared to last week?
xii. What is your decision in this week?

21. QUESTIONS LIST OF AGRO ECOSYSTEM ANALYSIS (AESA)-WEEK 7

i. In the rice plot, do you think that the rice is near primordial stage? If so, what is the most important management practice that must be done this week? (Please check the water level, weeds density, insect population and disease infestation.)
ii. If you will apply herbicide, what type will it be (broad spectrum or systemic)? If you decide to use it, can the herbicide affect the rice growth?
iii. If you delay applying the herbicide, do you think the second dose of fertilizer will have a positive impact on the rice crop?
iv. Some herbicides have a negative impact on the rice plant if applied at panicle initiation stage. Since our rice crop is at the early primordial stage, do you think that delaying weed control can also have similar effect?
v. In the case of the booting stage, did you find tillers that are not producing panicles? If yes, what is the cause?
vi. Do you think that diseases can be a major problem in the field? What disease might occur?
vii. Did you find filled grains? Which part of the panicle still has unfilled grains (basal, middle, tip)?
viii. What is the insect population in this week?
ix. In which week do you expect the rice to be harvested?
x. What is the crop situation compared to last week?
xi. What management practice should be applied this week?



Special Topics

22. INSECT COLLECTION AND IDENTIFICATION

a. Background

There are many insects commonly found in rice fields, ranging in size, characteristics and their role in the rice ecosystem. Some are living in the ground and above the ground (terrestrial insects), but some of them are also living in the water (aquatic insects). Some of them may eat small parts of the plant, but most of them are beneficial insects who are consumers of other insects, including those that eat the rice plant. Beneficial insects can be categorized into two big groups; predators and parasites. The others are detrivores or decomposers and can also be found in the field.

Spiders can be found as well. Often, spiders are predators that catch prey by hunting directly, but some of them also make webs to catch their prey. Aquatic insects catch their prey only in the water, but can also take their prey if it falls into the water. All of them are useful, and a low population of plant feeding insects provides food for beneficial insects.

b. Objective

Participants will be able to identify beneficial insects that help protect the rice crop.

c. Time Required

One to two hours.

d. Materials

Transparent plastic bag, sweep net, discarded plastic bottle, alcohol and cotton.

e. Procedure

- Each group enters the rice field and examines the bottom area to catch ground insects and spiders. The insects are collected, placed into a plastic bag and killed with cotton wetted in alcohol.
- Aquatic insects are also captured using a plastic bottle, and placed into another plastic bag. Collect as many as possible.
- Each group then returns to the classroom or a shady place, and places the insects onto a large paper.
- The insects and spiders, are then separated, and grouped based on similarity of physical characteristics.
- The specimens are then identified based on their local name and their function in the rice field; an entomologist is asked for names and functions of unknown insects.
- A table with two columns is made on the paper, and specimens are listed based upon their functions. A count is made for the number in each group.
- Specimens are preserved in vials and labeled.

f. Questions

i. How many of them are categorized as plant feeder insects?
ii. How many of them are categorized as beneficial insects?
iii. How many spiders did you catch?
iv. What will happen if there are no beneficial insects and spiders in the field?
v. Why it is important to conserve natural enemies?
vi. What will happen to them if pesticides are being used excessively?
vii. What lesson is learnt from this exercise?

23. SEEDLING ANATOMY

a. Background

In the early stage, rice has special characteristics and the ability to minimize the effect of leaf damage. As the leaves grow and die, new leaves emerge rapidly to replace the infected and damage ones. Attention should be paid to this stage, where sufficient water and nutrients are needed to grow a healthy plant and to utilize and compensate for the insect pests and diseases damages as well.

b. Objectives

i. To be able to describe early vegetative stage, leaf growth and dead leaves.
ii. To be able to describe rapid leaf development that compensates for the damages caused by diseases and insects.
iii. To be able to describe the importance of proper management that supports rapid growth and development.

c. Time required

One hour.

d. Materials

Rice crop of 20 DAS, 40 DAS and 50 DAS; magnifying glass, paper and pencil.

e. Procedure

i. Collect rice plants, examine them closely and draw each one as it is, at the different stages. Dissect the stems to examine the inner part.
ii. Pay attention to the new and old leaves of the plant.

f. Questions

i. How many leaves are there at each of the three different crops' age? Do the old leaves dry and die? What are the advantages of rapid leaf growth?
ii. What do we do if the young leaves die at the early stage? Do you think leaves can compensate for the damages caused by seedling flies?
iii. Do you think using pesticides at this stage is advisable?

24. LIFE CYCLE AND FOOD WEB, PART 1

a. Background

In the ecosystem section we have discussed the concept of interactions amongst associated factors. For instance, natural enemies attack harmful insects feeding on the crop.

This exercise will be used to help participants understand the interactions within a specific time frame. For example: the life cycle of the paddy bug begins with the egg stage on the crop; next is the nymph stage that sucks grain liquid; later is the adult stage that also sucks the same grain liquid. At the adult stage they mate and lay eggs in the same crop or migrate to other plots. Various natural enemies also attack each stage. During the egg stage, parasites (egg, larva, pupa, adult) feed inside the eggs and destroy them. During the nymph and adult stage, spiders, ladybird beetles, dragonflies, birds and other parasites also kill the paddy bug.

A combination of crop stage, paddy bug and natural enemies that interact, provides a perspective about the dynamic system of the rice crop. For example: spiders depend on available food (hopper, bug, etc). When there is no food available, the spider will not protect the crop. Therefore, insect pests at a low population level are required to keep natural enemies in the field. Do you think that the caterpillar is helping the farmer? It depends on how much is in the field.

For this exercise we have to think in terms of "guilds". Guilds are groups of organisms that have similar life cycles and share food; the paddy bug is an example.

b. Objective

To be able to describe the ecosystem using a life cycle and a food chain for at least one guild of insect pest.

c. Materials

Paper, pencil, crayon and source text.

d. Time Required

Two hours.

e. Procedure

i. Each group has to select one guild to be analyzed.
   - Group 1: Stem borer
   - Group 2: Caterpillar
   - Group 3: Heart worm
   - Group 4: Paddy bug

ii. Draw a big cycle and write the insect stages from the guild near to the relevant part of the cycle (see sample).

iii. In another part, write the insect stages on one column, and use the other column to make a list of natural enemies (with guild) that attacks every stage.

iv. On that cycle, draw another cycle for each of the natural enemies that attack in that particular pest stage. Also write their life stages. If there is natural enemy, make a third cycle for this.

v. Present your finding to other groups to share ideas.

f. Questions

i. What will happen to the system if pesticides are used indiscriminately?
ii. Why is it important to keep this system working?
iii. How do you maintain balances in the rice ecosystem?

25. LIFE CYCLE AND FOOD WEB, PART 2

This activity should be carried out at the rice field the following week.

a. Background

This training is designed to create a technically sound and professional field trainer who will be able to convince farmers through FFS. However, practice is essential to sharpen concepts, perspectives and skills that are essential in carrying out related jobs. This exercise provides opportunities where these concepts are tried and simulated to ensure participants meet the abilities needed.

b. Materials

Life cycle and food web drawing, live insects, source text.

c. Time Required

Two hours.

d. Procedure

i. Break down each group into two sub groups.
ii. Each sub-group enters into the rice field or the nearby plot. Each group has to find 2 insects species for analysis.
iii. One participant will act as a trainer, another pretends to be a farmer who is experienced and is a retired head of a research center, another an extension officer. All will raise the following questions:
   - What will happen to natural enemies if there is no pest insect?
   - Do you think insects pest are useful at a particular population?
   - What will happen if a broad-spectrum insecticide is sprayed?
   - How do we convince farmers?
iv. Rotate the trainer, repeat activities and create other questions related to the subject.

26. TILLERING ABILITY OF RICE AT THE VEGETATIVE STAGE

a. Background

During the vegetative stage the rice crop develops rapidly and produces tillers. High yielding varieties produce more tillers compared with local varieties. The advantage of having more tillers is in reducing the risk of damage caused by insects or diseases. New tillers have a stem, leaves, and roots and develop other tillers. This new tiller is classified as a primary stem; others that develop from them are called secondary and tertiary tillers, which then produce panicles. At this stage the rice crop is able to cure the damages, due to the production of more tillers. If some of them are damaged, the new ones can replace them, so that stem borer attack can be tolerated. Leaf damage can be tolerated as well, because the new leaves rapidly develop. Tiller and leaf development is determined by several factors including seed rate, water supply, rice variety, sun light and nutrients.

b. Objective

To be able to describe the crop's vegetative stages as well as tiller and leaf development.

c. Time Required

One hour.

d. Materials

Rice crop of 40 DAS and 50 DAS, cutter, paper and pencil.

e. Procedure

i. Collect samples of both rice crops and remove the soil from them.
ii. Observing the basal area, find the main stem, locate a primary tiller and separate it from the main stem. Find the secondary tiller from primary tiller and also separate. If the secondary tiller already has a tertiary tiller, separated this also. Continue this step until you have a tillering pattern.
iii. Look also at the leaves of each of the tillers (primary, secondary, tertiary).
iv. Draw the various tillering patterns on the paper, including the number of leaves of each tiller.
v. Have each group explain the crop structure to others.

f. Questions

i. Explain the crop tillering pattern from early growth until the vegetative stage.
ii. Why is continuous tillering important at the vegetative stage?
iii. What is the advantage of more tillers?

27. PLANT ROOTS AND VESSELS

a. Background

Nutrients and pesticides are usually applied to the rice field. How do these substances move into the crop? To get inside the crop, chemical components must be disolved in water. Without water the roots cannot absorb and distribute these components from the soil into the crop. After getting into the crop, these substances will move through two systems; the water moves up inside the crop and is processed through photosynthesis to become glucose. Glucose moves down and is distributed to all parts of the crop.

Systemic insecticides can control sucking insects as well as chewing insects, because the insecticide is present inside the entire plant.

After water moves inside crop tissues, at evening time, some of this water drips down from the tip of leaves. If insecticide has been applied, it can be present in this water, called gutation water, as well. Both harmful and beneficial insects can die if they drink this water.

b. Objectives

- To be able to describe how the systemic pesticides move through crop tissues.
- To be able to describe why systemic pesticides can control sucking and chewing insects.

c. Time Requirement

Two hours.

d. Materials

Water, food dye, two plastic cups for each group, crop and straw.

e. Procedure

i. Collect plant including rice seedlings, spinach, grass or others, ensuring that the roots are not cut off.
ii. Put water inside a plastic cup and several drops of food dye, until the water becomes red.
iii. Put the plants inside the cup with the roots in the water, place in the sunshine and wait for 90 minutes.
iv. Put the straw into another cup.
v. After the time is complete, observe crops color in the stem, roots and leaves. How does the red color move into the crop?
vi. Discuss following questions.

f. Questions

i. What is your opinion on the use of granular systemic pesticides? Are they safe? What happens to the insects that drink gutation water?
ii. Can you explain the advantages and disadvantages in using systemic insecticides?

28. THE EFFECT OF INSECTICIDES ON INSECTS

a. Background

Insecticides are poisons used to control harmful insects. In reality, insecticides also kill beneficial insects and other organisms like fishes, frogs, birds and even human beings. Based on the type of poison, insecticides are divided into two major groups: broad spectrum insecticides kill all insects; narrow spectrum insecticides kill only specific, targeted insects. Narrow spectrum insecticides are less toxic compared with broad spectrum insecticides. But they are still poisonous and can kill non-target organisms at high dosages. Therefore, there is no safe pesticide.

b. Objective

To demonstrate the effect of broad spectrum and narrow spectrum insecticides on insects and other non-target organisms.

c. Time Required

Two hours.

d. Materials

Insecticides (Monocrotophos and Bacillus thuringensis [BT]), plastic mosquito sprayer, plastic cup or discarded water bottle, mesh net, rubber band, insects and fish.

e. Procedure

i. Collect insects (harmful and beneficial insects), spiders, caterpillars and fish.
ii. Put insects into two different plastic cups (harmful and beneficial); also put spiders, caterpillars and fish into another cup, cover with mesh and tie with rubber bands. Use two cups each.
iii. Dilute insecticide into water at the recommended rate, and put into two different mosquito sprayers.
iv. Spray a cup with Monocrotophos and another with BT; apply similar treatments to all cups.
v. Examine the result after one hour.
vi. On a large paper, make two different tables (Monocrotophos and BT) and list how many organisms die and how many remain alive.
vii. Present your result to other group.

f. Questions

i. Which insecticide kills both target and non-target organisms?
ii. As a last resort, why should we encourage farmers to use only narrow spectrum insecticides?
iii. What will happen to beneficial insects and non-target organisms if broad spectrum insecticides are used excessively?
iv. What will happen to environment if too much insecticide is used?

29. PREVENTION OF INSECT DAMAGE

a. Background

Prevention is any means or effort that could be applied to prevent the crop from unexpected damages. Some farmers use pesticides as prevention against weather, insect or disease damages, to protect the crop. This kind of management however is not correct and leads to misuse of insecticides and waste of inputs. From an IPM perspective, prevention should be looking comprehensively at approaches where all means or measures are utilized to minimize the damages. The prevention components should be listed, arranged and practiced during the entire cropping season because this cropping season will be followed by another season. This topic can be discussed in mid-season, when damages occur in the field. "Next season prevention is better if it begins now."

b. Objective

To be able to describe workable prevention methods to minimize crop damage in forthcoming crop seasons based on current crop status.

c. Time required

One hour.

d. Materials

Large sheet of paper, marker pen.

e. Procedure

i. Record associated factors that could hamper crop growth development and physical performance, such as pest population, plant variety, nutrient status, etc..
ii. Record controlled ecosystem factors and management decisions.
iii. Describe both advantages and disadvantages, and therefore, constraints of decision making.
iv. Determine when the decision is to be carried out.
v. Select the proper time when each decision should be extended to the farmers.
vi. Based on the list of arrangements, make a definition of prevention.
vii. Present your group findings to others.

f. Questions

i. What do you think about prevention?
ii. Can farmers implement a comprehensive prevention strategy?
iii. Do you think prevention is part of crop management? If yes can you explain why?
iv. With respect to extension officers, how can you ensure farmers perceive this concept?
v. If the farmer is asking about spraying to prevent crop damage, what are you going to do?
vi. If the farmer asks which insecticide is better to spray for any insect, are you going to advise "use this or use that"?

30. PESTICIDES (POISONS) AND AVOIDANCE OF DIRECT EXPOSURE

a. Background

Applying pesticide requires skill in order to minimize the exposure of poison to the user, but ensuring that it properly reaches the targets. The best way to escape from exposure is to avoid direct contact as much as possible. If the field really needs treatment, use only a narrow spectrum insecticide in particular.

A pesticide's killing ability is determined by the LD 50 (Lethal Dosage). You should know about the LD 50 of pesticides usually recommended. LD 50 is represented in milligrams of active ingredient per kg body weight (mg/kg). Example: LD 50 of Monocrotophos is 20; this means to kill a target that has 50 kg body weight, 1 000 mg of Monocrotophos is needed.

Considering the danger of exposure, in order to avoid direct contact, proper uses must begin from: (1) transporting from market to the house and field, (2) putting into sprayer, (3) measuring from container before mixing, (4) mixing with water, (5) spraying and (6) washing sprayer after use.

This session is to demonstrate the LD 50 of common pesticides used and assess the ways of avoiding direct exposure during spraying.

b. Objective

To know the LD 50 of pesticides commonly used by farmers, and assess the way how to avoid direct exposure.

c. Materials

Sprayer, spoon, bucket, glove, plastic bag, food dye, weighing scale.

d. Procedures

i. Examine the pesticide list and find the pesticides commonly recommended or those available in the market.
ii. After finding the pesticides, determine the LD 50, and compute how much active ingredient is required to kill yourself (kg your body weight); compute for oral and dermal LD 50.
iii. Weight any objects around you, at different sizes (find stone, a spoon of soil, etc). Compare the weight of objects to the active ingredients that can kill yourself.
iv. Which active ingredients is the most hazardous? Can you find a pesticide which has a similar active ingredient but higher LD 50?
v. If you recommend that farmers apply a pesticide, while they have no adequate protective gear, who is responsible in case of poisoning? The extension officer or the farmer himself?

e. Avoiding Direct Exposure

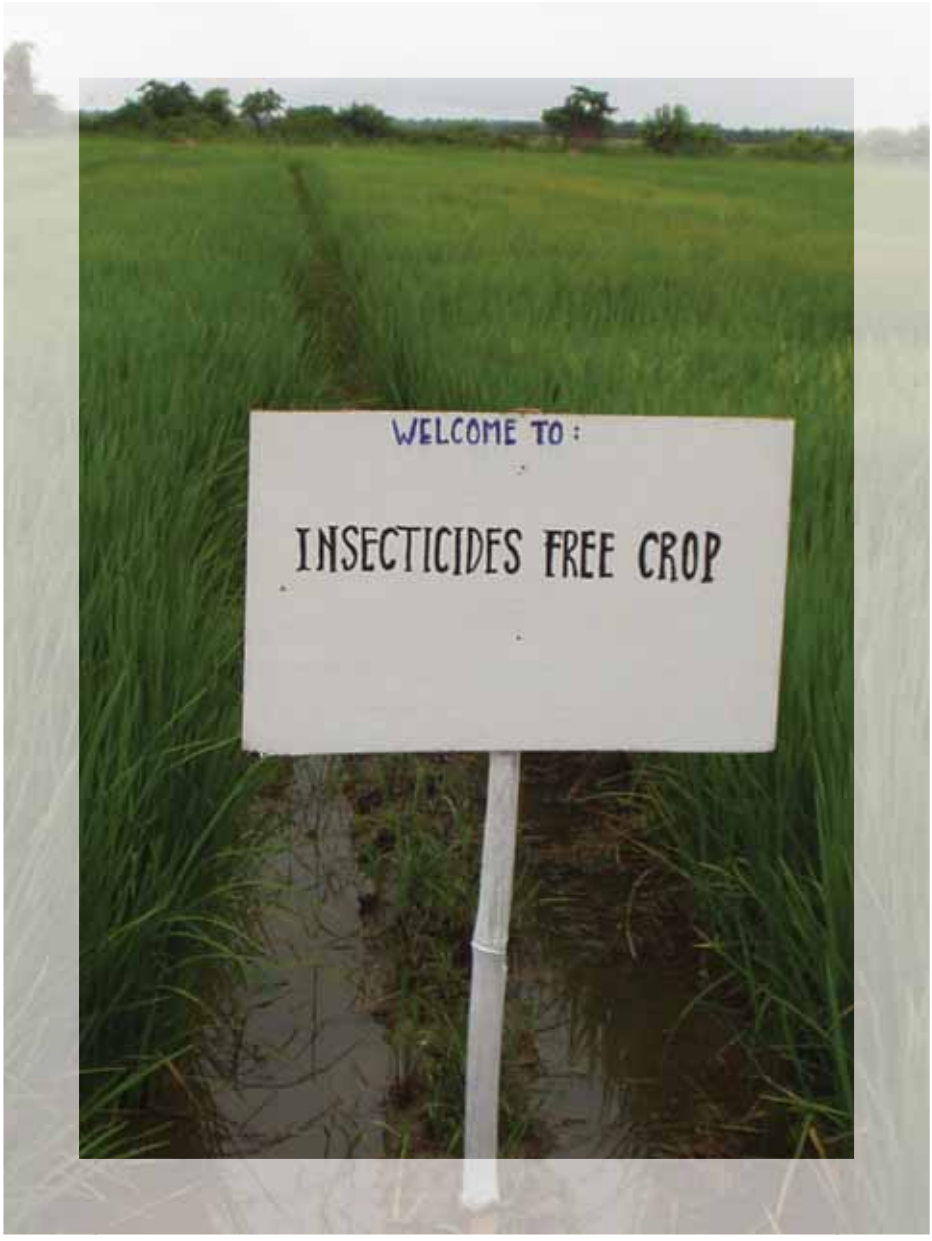
i. Select three persons from the group and assign them as "Safety Instructor." Give them a badge titled "Healthy and Safety Inspector".
ii. Select two other persons as "Sprayers" and give them a badge also.
iii. The Sprayer needs to prepare a knapsack sprayer, using a dose of 2 ml/liter and

500 liter/ha for a plot of 400 m². Compute the pesticide required correctly, mix with water and put into knapsack sprayer.

iv. The duty of Inspectors is to assess and monitor steps being taken by Sprayer, and make notes regarding exposures to the body, since preparations and operations began. Based on the notes being made, recommend improvements in each of the steps on how to avoid direct exposure.

v. Inspectors should present their finding and advise how to spray properly.

vi. Use red food colouring dye as a pesticide substitute.



31. EFFECT OF WEATHER ON DISEASE DEVELOPMENT

a. Background

We have already learnt about the development pattern of diseases. Weather is also a key component for disease infestation. Light intensity, local humidity and wind velocity are weather parameters that contribute to disease development and spread.

In addition, surface water is important for root growth, insects, and pathogen development. Water in the air in the form of dew contributes to humidity. Low humidity means dry air, and high humidity means more water in the air. Therefore, humidity is a key ingredient in the development of micro-organisms like fungi and bacteria.

Pathogens (sources of diseases) comprise bacteria, fungi, viruses and sometimes nematodes. Weather contributes a lot to the diseases' life cycle. The disease infection process is as follows:

i. Movement: Pathogen is transferred by air, rain drop, water flow, ground water or plant. Humidity, temperature and sunlight affect the life of the pathogen during movement before the host is infested.
ii. Germination: This is determined by host suitability. Germination ability is also determined by temperature, humidity, and surface water after rain fall or night dew, and radiation. Fungi and bacteria germination is a next step after infection, where the pathogen develops after entering the opened crop tissues or wounded part of the plant.
iii. Inoculation: Success or failure depends upon the host's growth velocity and resistance. If the pathogen develops more rapidly than the host, the host will be easier infected. If the host develops more rapidly than the pathogen, the pathogen could die before infecting the host.
iv. Incubation: Incubation is the time span required before symptoms appear. Symptom development is depending upon the type of crop and its situation. During development there is competition between the host and pathogen. If the weather is more suitable for the crop, the crop will not show major symptoms; if the weather is more suitable for the pathogen, it can develop quickly and symptoms will appear quickly on the crop.
v. Development: Influenced by temperature, humidity and radiation.

The above development steps are always repeated if there is disease infestation in any crop. In this session, we will assess the effect of weather on the appearance of diseases in the crop.

b. Objective

To be able to describe the effect of weather towards disease development in the rice crop (at least one pathogen).

c. Materials

Large sheet of paper, marker pen, plain paper.

d. Time Required

Two hours.

e. Procedure

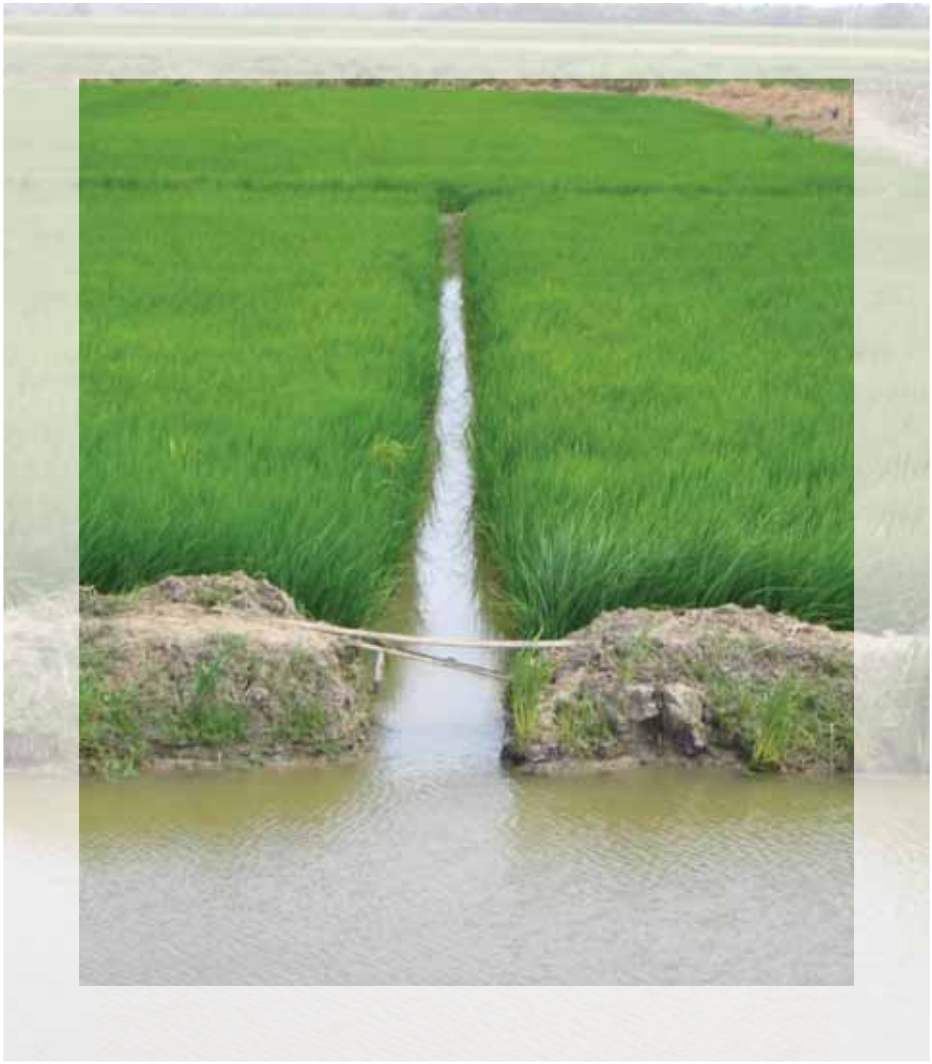
i. Select one important rice disease
   - Blast
   - Brown spot
   - Bacterial leaf sheath
   - Other local diseases

ii. On a large sheet of paper, write at the left side " process of diseases appearance" and list the whole process.

iii. At the right side, write "effect of weather", and state the effect of weather effect on the appearance of each disease. For example: wind affects the spore or conidia movement from leaf to leaf, and from the first plant to another.

iv. Complete both lists and analyze their relationship.

v. Present your finding to another group and lead discussion.



32. PRIMORDIAL STAGE IN RICE

a. Background

The primordial stage begins when the rice crop produces the initial flower inside the stem. This is the most crucial stage of rice crop, because the panicle formation also begins.

The length of the panicle, number of grains and flower quality are also being developed and will determine the ultimate yield. During this stage, crop growth and development is changing.

Leaves are the main energy producer; therefore, heavy leaf damage contributes to unfilled grains. Leaves will remain alive for about two months.

b. Objective

To be able to describe the rice primordial stage and take measures to protect the crop.

c. Time Requirement

One hour.

d. Materials

Rice crop, magnifying glass, cutter, paper and pencil.

e. Procedure

i. Determine the time of maximum tillering of the rice crop (crop duration minus 65 days); each variety may have different duration.
ii. Enter the rice field and select the highest plant, then search for the oldest tiller which has the highest leaf (it is better to remove a whole plant, for then you can see whether all the tillers are forming the primordial stage at the same time or not).
iii. Remove them carefully and bring to a meeting place, then gently dissect the stem using a cutter. Look into the upper internode and, observing closely with a magnifying glass, search for the ovule, which is usually like soft cotton, a few millimeters in length.
iv. Draw your findings on the paper.

f. Question

i. Can you predict the date of the primordial stage?
ii. Why does the primordial stage not occur at the same time, even on the same plant?
iii. What is the most important crop management factor at the primordial stage?
iv. Do you agree with the statement "fertilizing at this stage will lead to more broken grains"? If not, can you explain why?
v. If the weed population is dense, do you think competition will be a problem?
vi. Especially for duck weed, do you think it will take more nutrients than the rice crop? If yes, why? (Take duck weed from the field and examine the root system)
vii. How about your rice field? Do you think removing weeds now is a part of crop prevention strategy? Please explain.
viii. If you agree to question # vi, what are you going to do to your field?

33. EFFECT OF WEATHER ON CROP DEVELOPMENT

a. Background

We have discussed about the effect of weather on disease and insect development, and we also discussed prevention strategies. We begin by making a general pattern of insect development (egg, larva, nymph, pupa, adult) and disease development (movement, germination, inoculation, incubation, development).

However, we must take into account the whole process. Why this approach? The first thing we have to learn is to simplify a common problem, so as to have it become a specific problem. The second is proper composing or formulating, relating to the goal. No matter how much we have read about both issues, the important thing is how we compose the elements into a pattern that is interlinked with each other.

The major issue in this guide is more complex. However, it is expected that you will get more knowledge and skills. In this session we will assess the situation of importance to crop development and discuss this relationship to the weather effect.

b. Objectives

To be able to describe the crop development pattern and its relationship to weather effect.

c. Time Required

Two hours.

d. Materials

Large sheet of paper, marker pen, plain paper.

e. Procedure

i. On the large paper, make three columns “Crop development” “Weather patterns” and “Effect of Weather”.
ii. Under crop development write crop stages, like germination, vegetative stage, booting stage, flowering, ripening.
iii. Under weather parameters, write sunny and hot, cloudy and rainy, high humidity, low humidity.
iv. Under effect of weather, write the possible effects on crop stages.
v. Discuss within your group before sharing at plenary group.
vi. Select only one specific crop (rice).

34. INSECT ZOO

a. Background

Natural enemies kill their host in several ways. Predators are free-living organisms and consume a number of pests. Spiders prefer hunting and killing their prey, but some make webs over the crop to catch and suck body fluid out of their prey. Some organisms catch prey and consume the whole or a part of it.

Parasites do not eat prey; they are living at the expense of another organism. The adult female usually lays eggs inside host body by sticking the ovipositor into the host body; or, they put their eggs close to the insect host body. The larva hatched from their eggs feeds on host body, either externally or internally, usually killing their host during development. In the rice crop, we find a range of parasites, from wasps, flies, fungi and bacteria.

b. Objective

To understand how predators and parasites work to control insect pests by rearing them inside a cage or vial.

c. Materials

Rice crop, mesh net, stakes, vials and buckets.

d. Time Required

Depends on type of zoo.

e. Procedure

i. Predator zoo: Cover a one m^2 rice crop with a mesh net cage erected with sticks about one meter high. Remove insects from inside the cage, as well as a spider. Do not feed for up to two days. Put inside some insects inside the cage as prey, with the spider. Observe the cage twice a day morning and afternoon to examine the remaining prey. Record prey consumed during observation. This zoo is only for predator insects or hunting spiders. To demonstrate small predators like lady bird beetles use a vial or a discarded mineral water bottle following the method of the predator zoo.

ii. Parasites zoo: Collect larva, pupa, nymph or eggs found from the field and put inside vials or transparent plastic bags/cups. Place wetted cotton inside to maintain moisture. Cover with a mesh net and tie with a rubber band. Put them at the same place. Observe twice a day to examine hatching insects. Each vial or plastic bag should be used only once.

iii. Observation: Observe and make records on the individuals inside the cage or vial.

35. EFFECT OF WEATHER ON INSECT DEVELOPMENT

a. Background

We have discussed the effect of weather on disease development. Now, we will discuss these effects on insect development. Like pathogens, insects also need special conditions to grow and develop, such as humidity and temperature. The temperature is specific to where the insects are living e.g., the growth rate of insects that are living in a high temperature area is hampered when they live in a low temperature area. Therefore, they have their own suitable tolerable environment to support their life.

Another factor is wind, which also determines population. Wind contributes to the transfer of insects from one place to another. Also, the wind brings the smell of hosts, or the scent of females, to attract males. Crop fragrances also assist insects to find a host, e.g. wind blows cabbage fragrance where the natural enemies of cabbage caterpillar (*Plutella*) can smell, and therefore search for a main host.

Rain is an important part of the weather system, and has a large influence on insect development. Rain can also kill tiny insects. The first rain after drought makes nitrogen available for absorption, and the crop suddenly becomes greener, positively attracting insects. This session will discuss the effect of weather on insect development.

b. Objective

To be able to describe the effect of weather on crop and insect population development.

c. Materials

Large sheet, marker pen, plain paper.

d. Time Required

Two hours.

e. Procedure

i. Divide a large sheet of paper into two columns. In the left column write "Insect development process" and some other headings e.g.:
   - Migration (long distance)
   - Movement (short distance)
   - Fecundity
   - Mortality
   - Life cycle velocity
   - Hibernation

ii. In the right column, write the weather parameters and the effect of each insects' population and development.

iii. After all have been completed, discuss within your group before presenting to another at plenary session.

iv. In addition to this, try making a big drawing expressing the relationship between crop development, insect development and weather situation. For example, will it be different if: weather is drier, wetter, hotter or cooler? Discuss these differences and try making a forecasting model for one insect species (paddy bug).

36. ASSESSING THE SNAIL POPULATION DURING FALLOW SEASON

a. Background

Snails (*Panacea*) or Creketae, occasionally damage the eye of pre germinated seeds sown in flooded fields, resulting in very poor emergence. In some cases fields have to be re-sown. Snails can also cause complete destruction to the crop. Snails feed on dead leaves for about 6 weeks.

Most of the damage occurs in the deep area of the field. An adult snail is about 5 cm when fully grown, and it has a dark striped shell. The snail emerges from the water during the night and lays their eggs on the stem of the rice plant and on weeds such as beezibeesie, soap bush and on small pieces of wood located in the canals.

The colour of the egg mass is pink, containing 60-260 eggs, and will hatch in 17-20 days. The young snails fall into the water and start to develop, in a process which can last up to two years. Snails can get into the field through pumping of irrigation water.

b. Objectives

To enable farmers to perceive and take action to prevent snail the damage during the next crop, based upon observations in the current crop.

c. Time

Two hours.

d. Materials

Meter square, spade, shovel, field, bucket and water.

e. Procedure

i. Take a one $1m^2$ sample on a diagonal line, on low and high spots.
ii. Dig soil and smash it until you find a snail.
iii. Collect snail, put in bucket and cover with cloth mesh.
iv. Place bucket in cool place and observe for twenty four hours.
v. Record live and dead snails.
vi. Present to class.

f. Discussion

i. What action should be taken before cultivation?
ii. Screen with mesh during irrigation.
iii. Dry tillage assists in killing snails during land preparation.
iv. The tillage must be properly done.

37. WEED SEED BANK

a. Background

Weed seeds are present at different layers in the soil. Some weed seeds have a very long dormancy period and can remain in the soil for over 20 years e.g. red rice. Weeds usually emerge after broadcasting and can compete with the rice plant for sunlight, nutrients and space. In a highly weed-populated rice plot, the yield can be significantly reduced. Some weeds also serve as alternative host for either diseases insect pests. For effective weed control, farmers should know about weed types and the management practices to minimize the population.

b. Objectives

To determine the type of weed seeds present in the soil and at what depth.
To determine the dormancy of weed seeds.

c. Materials

Rice soil, fork, spade, shovel, cutlass, ruler, plastic bag, and soil box.

d. Time

Two hours.

e. Procedure

i. Dig the first layer of soil to two inches depth.
ii. Dig the second layer of soil to six inches depth.
iii. Dig the third layer of soil to nine inches depth.
iv. Place each layer of soil into separate plastic bags.
v. Take three samples diagonally in the field.
vi. Mix each layer together.
vii. Place in seed box, wet and observe for seedling emergence.
viii. Record the type of weed seedlings as they emerge.

f. Discussion

i. What cultural practices can minimize weed population?
ii. Weed control can be done by leveling the field, getting seed free of weeds, proper water management and the application of a pre-emergence herbicide.

38. THE PADDY BUG

a. Background

Paddy bug known as Gandhi, is very detrimental to the rice crop at the dough stage. The paddy bug has the capability of depositing two to three hundred eggs. The eggs are shaped like a barrel, and when deposited on the leaf or stem of rice plant, they are grayish. Their colour changes seven days after depositing, when they are about to hatch.

The young bug stage is called the nymph stage. Fourteen days after hatching, the paddy bug becomes a pest to the rice crop and attacks the grain in the dough stage. To differentiate from other bugs, the following can be used:

- the Paddy Bug stinks;
- the Paddy Bug has a shield shape on its back.

The life cycle of the bug can last up to forty five days, which is dangerous to the rice crop in terms of multiplication.

b. Objective

To determine if biological control is more effective then chemical control.

c. Materials

Sweep net, meter square, insect zoo mesh, stick, chemical, sprayer, plastic bag and bucket.

d. Procedure

i. Measure four one-meter square plots and demarcate with stick.
ii. Set up insect zoo in each one meter square plot that has been demarcated.
iii. Catch Paddy Bug nymph and natural enemy, e.g., damselfly, braconids, spider and lady bird beetle.
iv. Put Paddy Bug in each zoo along with one natural enemy.
v. Spray around one zoo with chemical and leave the other for biological control.
vi. Leave and observe on a twenty-four hours basis and record findings.

e. Discussion

i. Discuss findings with farmers and make recommendations or proposals about the experiment.
ii. What population of Paddy Bug can be a serious pest to the rice, which reduces yield economically?