Refresh your memory

Farmer Field Schools for IPM

IPM DANIDA
This guide has been designed as a collection of suggestions to refresh the memory of FFS facilitators who graduated from a season-long TOT, providing them with some practical information and tips for planning, running, and evaluating their FFS. It is not meant to be a training manual for new facilitators.

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The overall objective of the project is to promote good agricultural practices in order to improve the environment and the safety of farmers and to protect consumers from the hazardous uses of pesticides.

More information and PDF versions of this document can be found at:

www.ipmthailand.org
**Table of Contents**

- Foreword for policy makers 4
- Activity flow in IPM programs 5
- What is IPM? 6
- Pest control or pest management? 7
- Principles of IPM 8
- Basic concepts and assumptions 10
- Advantages of IPM 12
- AESA instead of ETL 13
- What is a Farmer Field School? 16
- Why season-long training? 18
- Introducing the FFS 20
- Preparing for the FFS 22
- FFS session 24
- Agro-Ecosystem Analysis (AESA) 25
- AESA methodology 26
- AESA: some questions that can be used during the discussion 27
- Formal or non-formal education? 28
- Seating arrangement in the FFS 29
- Facilitators / facilitation skills 30
- Training materials 31
- Field experiments 32
- Examples of field experiments 33
- Data recording 36

- Special topics 37
- Ballot box test 38
- Insect zoo 39
- Learning objectives 40
- The plant 41
- Seedling health 41
- The crop 42
- The ecosystem 43
- Plant compensation 44
- Soil 44
- Collecting insects 45
- Insect identification 46
- Insect pest management 47
- Diseases 48
- Disease management 49
- Weed management 50
- Pesticides 51
- Natural enemies 52
- Problems caused by pesticides 53
- Indicators for quality of the FFS 54
- Field day 56
- FFS reporting and planning 57
- Abbreviations and Acronyms 58
- References 59
To run an IPM Farmer Field School (FFS), experienced facilitators are needed, who have sufficient background knowledge of IPM, a good understanding of the crop, and who above all have the skills and the right attitude to make it a practical and participatory learning experience for the farmers.

Many extension workers have received their own training in a rather formal setting. They attended lectures in a classroom and studied theoretical facts from books. As a result they will have a tendency to train farmers in the same way. They lecture the farmers and provide them with theoretical information while giving top-down recommendations.

To organize farmer field schools it is necessary to first develop the people who are acting as “teachers/trainers” to make them become “facilitators”. Long experience in many countries has shown that this can only be achieved through season-long “training of trainers” (TOT) courses. Often such a course will have a duration of 3 months or even longer so that it can accommodate an entire crop cycle.

The season-long training (from seed to harvest) provides the opportunity to get a deeper understanding of IPM during all stages of the crop and it also allows sufficient time to develop the appropriate approach and to practice the required skills. The TOT participants have to practice these new skills several times with real farmers while being guided by experienced master trainers. The knowledge and skills they need cannot be learned in shorter courses of just a few days and can certainly not be learned from a book.

This guide is therefore clearly not meant to be a training manual for new facilitators. It is designed as a collection of suggestions to refresh the memory of existing facilitators (who graduated from a season-long TOT), providing them with some practical information and tips for planning, running, and evaluating their FFS.
**Activity flow in IPM programs**

- **Training of Trainers (TOT)**: Season-long technically sound facilitator training
- **Farmer Field Schools (FFS)**: Basic field course, Group organization, Research methods
- **Community Action**: IPM clubs, Farmer to farmer study, Farmer forums

**Principles of IPM**

- **Conserve natural enemies**
- **Biological control**
- **Cultural control**
- **Grow a healthy crop**
- **Observe crops regularly**
- **Input analysis**
- **Human resources development**
- **Farmers become experts**
**What is IPM?**

Let’s first have a look at the definitions of “Integrated Pest Management” and “Pest”.

**A definition of IPM**

*Integrated Pest Management* means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.


**A definition of “Pest”**

The term Pest is often used for animals causing damage or annoyance to man, his animals, crops or possessions, such as insects, mites, nematodes, rodents, birds. However in phrases such as “integrated pest management” and “pest control”, the term pest is used in a broader sense to mean all harmful organisms including fungi, bacteria, viruses and virus-like organisms, and weeds.
What is the difference between “pest control” and “pest management”?

Many years ago, Integrated Pest Management (IPM) started as Integrated Pest Control (IPC). The word “control” refers to killing the pest (usually with a synthetic pesticide). It does not consider prevention of the pest problem. Pest “control” is just meant to solve a problem after it occurs (curative method). Usually it has no long-term effect; the pest problem will come back after some time.

Over time, the word “control” was replaced by “management”. The goal of a pest “management” program is to prevent pests from damaging the crop. Pest management does not necessarily mean eradication of a pest but rather preventing pest numbers from building up to a point at which they become a problem.

In IPM, pest management decisions are always based on need and effectiveness rather than a schedule. A key element of IPM is planning ahead, to monitor and anticipate and prepare for pest problems before they occur.

It is important to realize that IPM is not only meant to manage pests, but rather to manage the entire agro-ecosystem system in a balanced way and to preserve bio-diversity on the farm.
Principles of IPM

Grow a healthy crop

Healthy plants are stronger and thus better equipped to withstand attacks by pests and diseases. Many factors have an effect on the health of the crop:

- Good variety
- Healthy seeds and healthy seedlings
- Land preparation
- Correct spacing
- Soil improvement
- Fertilizer management
- Water management
- Crop rotation

Understand and conserve defenders

The term “defender” is sometimes used instead of “natural enemy”, because a natural enemy of a pest is a defender of the crop. In Integrated Pest Management farmers:

- Know defenders and understand their role through regular observations of the agro-ecosystem
- Avoid the use of poisonous chemicals that kill the natural enemies of pests
Principles of IPM

Observe the field regularly
In Integrated Pest Management farmers manage the crop based on information about the actual field situation. They don’t use “calendar spraying” to control pests. Therefore farmers:

• Monitor the field situation at least once a week (soil, water, plants, pests, natural enemies, etc.)
• Make decisions based on the field situation
• Take direct action when needed (e.g. collect egg masses, remove infested plants, etc.)

Farmers become experts in crop management
Farmers have to make daily decisions about the management of their crops. IPM farmers have learned to make these decisions based on observations and analysis of the field situation. But as field conditions continue to change and new technologies become available farmers will need to continue improving their skills and knowledge:

• Farmers are capable of improving farming practices by experimenting
• Farmers can share their knowledge with other farmers
Basic concepts and assumptions

When we talk about IPM we should understand some basic concepts and assumptions:

- IPM is a process of decision making and farming which is gradually improved with greater ecological knowledge, and observation skills. It is not a "packaged technology" that is "adopted" by farmers.
- IPM skills and concepts are best learned, practiced, and discussed in the field. The field is the classroom. Plants and pests are the training materials. Avoid air-conditioned classrooms and PowerPoint presentations. Go to the farms instead.
- Season-long training courses allow all plant, insect, disease, and weed development processes and management to be observed and validated over time. IPM training must be carried out over all crop stages.
- Local or indigenous knowledge of the environment, varieties, pests, etc. must play a major role during decision making. Farmers must actively participate and share their experiences during training to achieve maximum interest and effectiveness.
- IPM trainers must not lecture, but should facilitate a learning process. Trainers do not convince farmers or give recommendations, but rather provide structured experiences so that farmers can test IPM methods and convince themselves about which are useful and which are not.
- Trainers use methods of working in a respectful manner in groups that often include persons older and more experienced than themselves.
The content of IPM training programs for extension staff and farmers is not limited to only "plant protection methods" (e.g. mechanical, biological, cultural, chemical) but also includes the following:

- Crop development and physiology
- Agronomic methods for a healthy and profitable crop
- Varietal impact on pest management
- Soil fertility management
- Biology of pest insects, diseases, and weeds
- Natural enemies of insects and diseases
- Field observation skills
- Pesticides, including environmental, health and handling issues
- Economic management skills
**Advantages of IPM**

We often hear the question “what are the advantages of IPM?”. Think of this:

- More regular crop quality and quantity
- Healthier plants
- Reduced risk of farmers from contamination with chemicals
- Reduced contamination of the crop with chemical residues
- Better use of natural resources
- Reduced contamination of the environment
- Reduced use of pesticides
- Reduced input costs
AESA instead of ETL

IPM is not a static concept but has been evolving over the past years and it is still changing as new experiences are used to fine-tune the concept.

The Economic Threshold Level (ETL) used to be part of IPM many years ago, but in modern IPM it has been replaced by Agro-Ecological System Analysis (AESA) where farmers take decisions based on a larger range of observations.

Unfortunately, even today, there are still many “specialists” who still recommend ETLs to farmers, presenting this as an IPM method. But there are many reasons for not using an ETL.

One of the problems of the ETL is that it is based on parameters that are changing all the time, and that are often not known. An ETL is calculated from:

1. the management cost (Baht/rai)
2. the price of the farm produce (Baht/kilo)
3. expected damage or yield losses (kilo/rai)

Management cost could be estimated, but when the crop is still in the field, it is usually not possible to know what the price per kilo will be at harvest time.

The damage or losses caused by a certain density of insects can not be predicted at all. It depends on many other factors, such as crop variety, weather conditions, availability of water and nutrients, plant stage, etc. It also depends on the availability and performance of natural enemies. There is a big difference between “a bean plant with 20 aphids” and “a bean plant with 20 aphids and 1 hover fly larva”.

This is why ETLs that are "recommended" in all kinds of manuals for farmers can never be applied in a farmer's field. Farmers cannot base their decisions on just a simple count of pests. They will have to consider many other aspects of the crop (crop ecology, growth stage, natural enemies, weather condition, etc.) and their own economic and social situation before they can make the right crop management decisions.

Another important consideration is that good crop management does not only depend on controlling pests, but even more on the prevention of pests. Over a period of time, IPM specialist have realized the limitations of ETLs and gradually developed the Agro-Ecosystem Analysis (AESA) as a much more flexible tool to make crop management decisions.
In modern IPM the use of ETL has been abandoned in favor of Agro-EcoSystem Analysis (AESA)

<table>
<thead>
<tr>
<th>ETL</th>
<th>Agro-Ecosystem Analysis (AESA)</th>
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<tbody>
<tr>
<td>cost of control</td>
<td>growth stage of the crop</td>
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<tr>
<td>harvest value of crop (estimation)</td>
<td>weather conditions</td>
</tr>
<tr>
<td>loss of income due to pests (estimation)</td>
<td>crop development factors</td>
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<td>(incl. compensation ability)</td>
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<tr>
<td></td>
<td>type and number of insect pests</td>
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<td></td>
<td>type and amount of diseases</td>
</tr>
<tr>
<td></td>
<td>type and number of natural enemies</td>
</tr>
<tr>
<td></td>
<td>type and amount of natural disease control agents (if applicable)</td>
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<td></td>
<td>type and amount of weeds</td>
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<td></td>
<td>water availability (irrigation, drainage)</td>
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<td>soil fertility status</td>
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<td>fertilizer applications</td>
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<td></td>
<td>activities in the field since last week</td>
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<td></td>
<td>other observations</td>
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</table>
The AESA drawing shows all the observations that were made by the farmers.
A Farmer Field School (FFS) is a season-long training activity that takes place in the field. It is season-long so that it covers all the different developmental stages of the crop and their related management practices. The training process is always learner-centered, participatory and relying on an experiential learning approach.

The basic elements of an FFS for Integrated Pest Management include:

- The FFS consists of a group of 20 to 25 farmers.
- The FFS is field-based and lasts for at least one cropping season (from seeding to harvest).
- The FFS farmers have regular (weekly) meetings during the cropping season.

In the FFS, farmers conduct a study comparing IPM strategy with common farmers’ practice. They have an IPM plot and a Farmers’ Practice (FP) plot.

- The FFS includes other field studies, based on local field problems.
- The FFS includes special topics that deal with specific issues selected by the farmers.
- Each meeting includes at least an agro-ecosystem analysis activity conducted in the field (AESA) ending with a discussion of crop management decisions.
- FFS educational methods are experiential, participatory, learner-centered, and based on non-formal education.
- The FFS group is guided by at least one facilitator offering experiential learning opportunities, rather than delivering top-down instruction.
Why season-long training?

An FFS is a season-long training for a number of reasons:

- Each stage of the crop has different pest problems. This makes it necessary to spread the training over at least one entire season, covering all stages of the crop.

- Each stage of the crop has different requirements (water, fertilizer, mulching, weeding, thinning, pruning, etc.). Crop management therefore depends on the development of the crop.

- Some processes that need to be observed (population dynamics of an insect, disease epidemics, possible plant compensation, etc.) develop gradually over the course of the entire cropping season.

- The results of crop management decisions made during one crop stage can only be observed at a later stage of the crop. It is especially important to be able to observe how each action has an effect at the time of harvest (e.g. yield and quality, economic factors).
One or more seasons?

Only a season-long training can cover all the crop stages. But pest problems can also vary from season to season. A vegetable crop grown during the cool dry season (November-January) has different pest problems than a crop during the hot dry season (March-May) or during the rainy season (June-September). Therefore, in many cases even more time is required to become familiar with all aspects of the crop. Second and third season FFSs are advisable. The role of facilitators during these follow-up FFSs can gradually diminish as farmers become more experienced in the learning process.
When a group of farmers has been selected to start an FFS the first step is to organize an introductory meeting. During this meeting the facilitators and farmers get to know each other and start exchanging information:

- Introduce the concept of IPM
- Explain the training process: It will be a style of training they have never experienced before:
  - Participatory
  - Practical
  - Learning by doing
  - Experimenting
- Explain about comparing IPM plot with Farmers’ Practice (FP) plot:
  - Management IPM plot will be decided in FFS (using AESA)
  - Management FP lots is the same as farmers in the area
- Start finding out how the farmers are currently managing their crop
  - Make cropping calendar
  - Get baseline data:
    - Field size
    - Type of crops / varieties
    - Inputs (pesticides, fertilizers, labor costs)
    - Outputs (production kg/rai, price Baht/kilo)

* Comparing an IPM plot with a FP (Farmer Practice) plot is essential in an FFS where participants are farmers with intensive pesticide use. However, sometimes an FFS could have participants who are not using pesticides (for example an FFS with the objective to teach rural women to grow homestead vegetables). That type of FFS would have only the IPM plot but no FP plot. But of course it would have several other experimental plots to provide additional learning opportunities.
• Discuss about possible experiments (based on problems mentioned by farmers).
• Start planning some (small scale) experiments, for example:
  ◊ Compare crop varieties
  ◊ Fertilizer experiment
  ◊ Use of bio-pesticides
  ◊ Plant compensation experiment
  ◊ Etc.
• Get commitment of farmers to be participants in the FFS. Talk about their expectations.
• Discuss some practical aspects
  ◊ Which field to use for IPM and FP plots
  ◊ Snacks during meetings? Who is responsible?
  ◊ Agree place and time of meeting. Get commitment to be punctual.
• Together visit the site where IPM plot will be and see the FFS meeting place.
• During this first meeting also include a group dynamics exercise or ice-breaker to create a comfortable atmosphere in the group
Preparing for the FFS

Facilitating an FFS means you have to prepare yourself in advance for each session. If more than one facilitators are running the FFS together, they should meet before each session to prepare and divide responsibilities:

- Prepare the program for the next FFS session
  - Planning for routine activities
    - Prepare for the next AESA
    - Make a summary of last week data
  - Special topic (indicated by farmers in previous session)
    - Prepare yourself
    - Bring materials
    - Invite somebody to help if needed
  - Planning of exercises
    - Background information
    - Objective
    - Time needed
    - Materials
    - Procedure to follow

- Prepare materials needed for the next FFS session
  - Paper, pencils, crayons, flip charts
  - Inputs for experiments
  - Traps, sweep nets, hand lenses
  - Bio-pesticides
  - Etc.
  (see also page 31)

- Prepare documentation needed for next session
  - Ecological guides
  - Identification manuals
  - Posters
  - Etc.

- Make other preparations
  - Snacks
  - Meeting place
  - Signboards
  - Etc.
To prepare for FFS sessions, facilitators can make use of a wide range of ecological guides which offer background information and practical exercises that can be used with the farmers. Illustrated identification guides are an aid in recognizing pests and natural enemies.
**FFS session**

A typical FFS session will take 3 to 4 hours and will have the following schedule:

- **Introduction**
  - Summarize what was done last week and present today’s program

- **Field visit / Field observations**
  - IPM plot
  - FP plot
  - Field experiments
  - Collect data
  - Collect samples
  - Start analyzing the field situation. The facilitators observe the field together with the farmers and ask questions to start discussions.

- **AESA drawing / discussions within small group**
  - Detailed analysis of the field situation.
  - The facilitator asks questions to stimulate critical thinking.

- **AESA presentation**
  - Decision making for IPM plot
  - Agree on work to be done.
  * Who is responsible?
  * When will it be done?

- **Set up insect zoos**
  - Observe and record insect zoo activities

- **Group dynamics exercise**

- **Special topic**

- **Summarize and plan for next week**
  - Special topic requests
The health of a plant is determined by its environment. This environment includes physical factors (i.e. sun, rain, wind and soil nutrients) and biological factors (i.e. pests, diseases and weeds). All these factors can play a role in the balance which exists between herbivore insects and their natural enemies. If we understand the whole system of interactions, we can use this knowledge to reduce the negative impact of pests and diseases.

Decision making in Integrated Pest Management requires a thorough analysis of the agro-ecosystem. Participants in IPM training will have to learn how to observe the crop, how to analyze the field situation and how to make the proper decisions for their crop management. This process is called the Agro-Eco-System Analysis (AESA).

When participants of IPM training learn to do an agro-ecosystem analysis (AESA) they will make a drawing on a large piece of paper, in which they include all their observations. The advantage of using a drawing is that it forces the participants to observe closely and intensively. It is a focal point for the analysis and for the discussions that follow, and the drawing can be kept as a record.
AESA methodology

The following methodology was used in IPM training where the participants were learning to do an AESA in rice. For other crops, the approach could be slightly different, but the basics are the same.

- Go to the field in groups (about 5 farmers per group). Walk across the field and choose 10 plants randomly. Observe keenly each of these plants and record your observations:
  - Plant: observe the plant height, number of tillers, crop stage, deficiency symptoms, etc.
  - Pests: observe and count pests at different places on the plant.
  - Defenders (natural enemies): observe and count parasitoids and predators.
  - Diseases: observe leaves and stems and identify any visible disease symptoms.
  - Rats: count numbers of plants affected by rats.
  - Weeds: observe weeds in the field and their intensity.
  - Water: observe the water situation of the field.
  - Weather: observe the weather condition.

- While walking in the field, manually collect insects in plastic bags. Use a sweep net to collect additional insects. Collect plant parts with disease symptoms.

- The group talks about the crop situation. The facilitator will ask questions to initiate the discussion and to stimulate critical thinking.

- Find a shady place to sit as a group in a small circle for drawing and discussion.

- If needed, kill the insects with some chloroform on a piece of cotton.

- Each group will first identify the pests, defenders and diseases collected.

- Each group will then analyze the field situation in detail and present their observations and analysis in a drawing (the AESA drawing).

- Each drawing will show a plant/hill representing the field situation. The weather condition, water level, disease symptoms, etc. will be shown in the drawing. Pest insects will be drawn on the left. Defenders (beneficial insects) will be drawn on the right. Write the number next to each insect. Indicate the plant part where the pests and defenders were found. Try to show the interaction between pests and defenders.

- Each group will discuss the situation and make a crop management recommendation.

- The small groups then join each other and a member of each group will now present their analysis in front of all participants. A different person will present each week.

- The facilitator will facilitate the discussion by asking guiding questions and makes sure that all participants (also shy or illiterate persons) are actively involved in this process.

- Formulate a common conclusion. The whole group should support the decision on what field management is required in the IPM plot.

- Make sure that the required activities (based on the decision) will be carried out.

- Keep the drawing for comparison in the following weeks.
Some questions that can be used during the discussion

- Summarize the present situation of the field?
- What aspect is most important at this moment?
- Is there a big change with last week? What kind of change?
- Is there any serious pest or disease outbreak?
- What is the situation of the beneficial insects?
- Is there a balance in the field between pests and defenders?
- Were you able to identify all pests and diseases?
- Do you think the crop is healthy?
- What management practices are needed at this moment?
- When will it be done? Who will do it? Make sure that responsibilities for all activities are being discussed.
- Are you expecting any problems to emerge during the coming week? What problems? How can we avoid it? How can we be prepared?
- Summarize the actions to be taken.

AESA involves three steps
Observation → Analysis → Decision-making
The type of training that takes place in a Farmer Field School is often referred to as “non-formal adult education”. What is the difference between formal and non-formal education?

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<thead>
<tr>
<th>Formal Education*</th>
<th>Non-formal Education</th>
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<tbody>
<tr>
<td>Teacher</td>
<td>Facilitator</td>
</tr>
<tr>
<td>Teacher is the center of instruction</td>
<td>Participants can give inputs</td>
</tr>
<tr>
<td>Information ‘push’ (teacher decides what trainees are being taught)</td>
<td>Information ‘pull’ (focus on actual information needs)</td>
</tr>
<tr>
<td>Teacher is responsible to deliver contents from the curriculum</td>
<td>Facilitator ensures that participants learn basic contents and involves participants to determine additional learning goals</td>
</tr>
<tr>
<td>Teacher has to prepare all sessions</td>
<td>Informal, open exchange; equal chance to participate</td>
</tr>
<tr>
<td>Teacher forced into being ‘expert’</td>
<td>Active cooperation and collaboration from all participants</td>
</tr>
<tr>
<td>Teacher lectures trainees.</td>
<td>Facilitator is a group member</td>
</tr>
<tr>
<td>Trainees are passive receivers of information</td>
<td>Facilitator can use inputs of the group</td>
</tr>
<tr>
<td></td>
<td>Questions from the group can be answered BY the group (discussion/sharing of experiences, setting up experiments, inviting resource persons, etc.)</td>
</tr>
<tr>
<td></td>
<td>Working in small groups</td>
</tr>
<tr>
<td></td>
<td>Facilitator stimulates critical thinking.</td>
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</tbody>
</table>

* Modern “formal education” is increasingly using some of the non-formal facilitation skills, placing more emphasis on working in small groups, and stimulating critical thinking and active involvement by the trainees.
Participatory training aims at increasing communication and sharing of knowledge between participants. The seating arrangement in the FFS is important. An FFS is never a classroom style training. Instead we work in small groups or we use a U-shape seating arrangement that allows everybody to participate in the discussions.
Facilitators / facilitation skills

Role of a facilitator

- Prepare for the FFS sessions
- Prepare materials, visual supports, etc.
- See and use learning opportunities
- Stimulate thinking
- Stimulate interaction between farmers
- Stimulate experimentation
- Guide the learning process
- Create a good learning environment
- Manage effective discussions

Good habits

- Smile
- Eye contact
- Clear speaking
- Use local language
- Respect moments of silence
- Respect differences
- Listen carefully
- Use open questions
- Support participation
When planning the next FFS session, it is necessary to make sure that the required training materials will be available. Here is a list of materials that are often needed in an FFS:

- Paper (newsprint / flipchart for AESA drawing)
- Notebooks and pens (for each participant)
- Pencils / crayons / markers (need extra green colors)
- Rulers / scale
- Tape / glue
- Hand lenses
- Sticks / ropes / signboards
- Materials to prepare insect zoo
  - Boxes
  - Bottles
  - Mosquito netting
  - Cotton, elastic bands, tape
  - Pots
- Plastic bags / elastic bands
- Stand for flip chart
- Sweep nets (not only in rice FFS, but also in other crops. Used to catch flying insects, adult butterflies, dragonflies, hoverflies, etc.)
- Aspirator (make one yourself to catch small insects)
- Knife / scissors
- Chairs / plastic sheet
- Inputs for field experiments
  - Fertilizer
  - Seed / seedlings
  - Bio-control agents
  - Neem
  - Sticky traps
  - Signboards
- Sometimes special designed forms to take data (e.g. in a small field experiment)
Field experiments

In each FFS we always have an experiment comparing an IPM plot (managed according to the AESA) with a Farmer’s Practice plot (FP plot). But an FFS is not complete without one or more other field experiments.

Carrying out experiments with farmers serves two purposes. First of all, it helps them to learn through experience. They carry out the experiment and discover a lot of new knowledge by themselves. This is a much more powerful way of learning than just hearing it in a lecture or being told what to do. Secondly, by carrying out experiments, the farmers learn how to test new crop management methods and how to find answers to their questions. It opens the way to future learning and to start “science by farmers”.

However, experiments that are carried out during the first-season FFS are often not meant to discover new things. In the FFS we rather start with well-known experiments that are used by the facilitator as a tool to learn about the crop, the pests, and natural enemies.

The learning cycle

- Question
- Hypothesis
- Design
- Observation
- Analysis
- Evaluation
Examples of field experiments

There are many experiments that could be carried out by farmers during an FFS. It will depend on the situation which experiments are the most appropriate. The facilitator will consider the questions asked by farmers during the first meetings and based on this select, together with the farmers, one or more field experiments. Here are some examples of experiments that are often used during field schools:

Crop compensation
Simulate insect damage by cutting parts of the leaves or by removing shoots or tillers. This type of experiment demonstrates that crop plants can compensate for some damage, by producing new leaves or shoots. Farmers who experience this will be more confident to tolerate some damage.

Use of traps
Set up some traps to study insect populations. For example light traps, yellow sticky traps, or pitfall traps. This can be used to monitor pest populations, but it could also be used as an experiment to see if pests can be controlled with the traps (e.g. control flea beetles in Chinese kale with yellow sticky traps).

Field cages
Discover how natural enemies can keep pest populations under control. Set up two or more field cages; one with only pests (e.g. Brown Plant Hoppers on rice), and one with pests and natural enemies (e.g. Brown Plant Hoppers together with some spiders).
Examples of field experiments

Use of botanical pesticides and bio-pesticides

Study how botanical pesticides (e.g., Neem) or bio-pesticides (Bt, NPV, Steinernema, Trichoderma) can be used to manage pest populations. For example set up small experiments where Neem is compared with plots that are unsprayed.

Mulching

Compare plots with and without mulching and see how this has an effect on the development of plants, insects, and diseases.

Plant spacing

Compare different levels of plant spacing and see how the crop plants develop under different conditions. The differences in plant density have an effect on the micro-climate and we can learn how this has an effect on development of pests and diseases.
**Examples of field experiments**

**Fertilizer experiments**
Set up small plots with different levels of fertilizer use. Compare use of synthetic fertilizer (NPK) with organic fertilizers (compost or manure).

**Release of natural enemies**
Use predators or parasitoids that are available from pest management centers (PMC) and release them in the IPM plots. Use for example: earwigs, assassin bugs or *Trichogramma* wasps.

**Compare crop varieties**
Compare different varieties of the same crop and study how they differ. Pay special attention to differences in pest resistance or tolerance.

**Intercropping**
Compare monoculture with multiple cropping systems. Try intercropping with plants that are known to stimulate natural enemies (e.g. beans or other flowering plants) or use plants that repel insects (e.g. citronella).
Data recording

Why keeping data?
When observing the crop (IPM plot, FP plot, field experiments) or the insect zoo, we need to record data:

- to keep records of what has happened
- to help us making an analysis and draw conclusions

How to keep data?

- Notebook
- Drawings

What data?

- Plant growth (weekly)
  - Height of plant
  - Number of leaves
- Crop situation (e.g. for AESA)
  - Plant health
  - Pests, diseases, weeds
  - Natural Enemies
  - Soil
  - Water
  - Weather condition
- Inputs costs (Baht/rai)
  - Seeds
  - Fertilizer
  - Pesticides
  - Labor
- Harvest
  - Yield (kilo/rai)
  - Price of produce (Baht/kilo)
Special topics

In each FFS session we will have one (sometimes two) “special topics”. Usually these topics are a response to what happened in the previous FFS session. For example, if during field observations we saw that a certain pest is causing a lot of problems, then the next week’s special topic could be to learn more about this specific pest. Or farmers could have come up with a question, and the facilitator decided to prepare a special topic related to that question. It is always a good idea to let the farmers decide what special topic we need to include in the next session.

Examples of special topics

- Components of the Ecosystem
- Energy flow in the Ecosystem, food chains, food web, etc.
- Soil health, micro-organisms, nutrients, etc.
- Fertilizer management, soil testing
- Composting and mulching
- Weed management
- Quality seeds (germination test, selection of varieties, etc.)
- Life cycle and management of an important pest (use insect zoo)
- Life cycle and behavior of an important natural enemy (use insect zoo)
- Bio-extracts (farmers prepare and set up experiments to test them)
- Hazards of pesticides
- Risk reduction
- Disease management of an important disease
- Bacillus thuringiensis (set up experiments to learn how it works, field and/or insect zoo)
- Soil-borne diseases, use of Trichoderma
- Etc.

Preparing for special topic

Before the next session we need to prepare well for the special topic that was selected by the farmers:

- Collect background information
- Prepare materials (pest specimens, flip charts, etc.)
- If needed, invite a specialist to help you with the special topic
- Design exercises about the special topic to carry out with the farmers
- Prepare guiding questions that help you to facilitate the discussion
Ballot box test

To test farmers at the beginning of an FFS we use a “ballot box test”. It is not really about testing the farmers’ knowledge, but rather a way of showing them the gaps in their knowledge as a way of preparing them for what they can expect to learn during the coming FFS sessions.

Usually a test consists of about 20 questions. Farmers answer each question by choosing between 3 answers. They select their answer by putting a piece of paper in the ballot box. The paper could have the name of the farmer on it, but this is not really necessary because we are not testing the individual but rather we want to find out how many farmers knew the correct answer and how many did not. The results of the test can then immediately be used to start discussions about these topics.

The questions are presented by using actual organisms and symptoms which can be examined by the farmers (not by using pictures).

Design three types of questions in such a way that they can measure:

◊ Understanding of ecology and natural control mechanisms.
◊ Ability to identification pests, natural enemies, diseases, and damage symptoms.
◊ Knowledge of crop management methods

Example questions

- Show one pest insect and three different natural enemies. The farmers have to indicate which natural enemy can help control that pest.
- Show one pest insect and three types of crop damage. The farmers have to indicate what damage was caused by the insect.
Insect zoo

Many questions about insects can be answered by setting small experiments in an insect zoo. Use transparent boxes with fresh leaves. Or use potted plants inside a small cage. Always make sure that the insects have fresh food. Keep the zoo in a shaded place to avoid high temperature. Take care that the environment inside the zoo does not get too dry or too humid.

Assign responsibility for the zoo to one or more farmers. They have to make sure that the insects have sufficient food, and they have to make daily observations.

Use insects zoos for:

- Study the life cycles of insects
  - Keep caterpillars and see how they feed and how they pupate and develop to adult butterflies
- Study feeding behavior of insects
  - What do they eat?
  - How do they eat?
  - How much do they eat?
- Study predators
  - How do they feed?
  - How many insects can they eat in one day?
- Study parasitoids
  - Keep larvae and pupae of insects and see if they are parasitized
- Other experiments
  - For example study the effect of Bt (insect don’t die quickly but they stop feeding).
Learning objectives

From a farmer who has participated in an FFS we expect that he has a good basic knowledge of what is going on in his field. He knows his crop, understands relationships between pests and natural enemies, and has started to increase his skills in crop and pest management. The FFS curriculum therefore deals with many different topics:

- The plant
- Seedling health
- The crop
- The ecosystem
- Plant compensation
- Soil
- Collecting insects
- Insect identification
- Insect pest management
- Diseases
- Disease management
- Weed management
- Pesticides
- Problems caused by pesticides
- Etc.
In the FFS farmers learn about:

The plant

Plant parts
- Drawings of plants and plant parts
- Understand their function

Crops stages, crop cycle
- Seedling
- Vegetative
- Flowering
- Fruit setting
- Ripening stage

Plant growth
- Energy / energy flow
- Nutrients / nutrient cycle
- Photosynthesis
- Water

Seedling health

Soil preparation
- Plowing or no-tillage
- *Trichoderma*
- Fertilizer
- Manure
- Etc.

Healthy seeds
- Variety
- Seed treatment
- Germination test

Crop management
- Spacing / seeding rate
- Water management
- Weed management
- Shade
- Mulching
- Transplanting
In the FFS farmers learn about:

The crop

Know the crop

- Understand the different crop stages
- Make drawings
- Which pests are important in each crop stage?

Crop stages

- Planting
  - Seed
  - Seedling
- Growth
  - Vegetative stage
  - Flowering stage
- Harvest
  - Ripening
  - Fruiting

Crop management

- Sowing
- Transplanting
- Weeding
- Fertilizer use
- Pest management
- Pruning / thinning
- Harvesting
In the FFS farmers learn about:

The ecosystem

What is an ecosystem?
- Farmers make drawing of ecosystem

Elements of ecosystem
- Physical
- Biological

The agro-ecosystem
- Discuss about agro-ecosystem as preparation for AESA
- Weather
- Soil
- Water
- Plant / crop
- Pests
  ◦ Insects
  ◦ Diseases
  ◦ Weeds
- Natural enemies
  ◦ Predators
  ◦ Parasitoids
  ◦ Pathogens

Balanced ecosystem
- Population growth
- Population dynamics
- Interactions between species
- Interdependence
- Food webs
- Interaction between pests and defenders
- Resurgence mechanisms

- Intercropping
- Value of weeds
- Bio-diversity

Energy flow in 3 (or 4) feeding levels
- Plant
- Herbivore
- Predator / parasitoid
- (Hyper-parasitoid)
In the FFS farmers learn about:

**Plant compensation**

Discuss how plants can compensate for damage by pests

Set experiments:

- Simulation of insect damage to observe crop compensation
  - Rice
    - Tillers
    - Leaves
  - Vegetables
    - Leaves
    - Shoots / branches

Create understanding that some damage can be tolerated

---

**The soil**

Soil structure

Organic matter

Nutrients

- NPK
- Micro-nutrients
- Soil testing

Soil health

- Micro-organisms

Soil improvement

- Manure
- Compost
- Mulching

Water
In the FFS farmers learn about:

Collecting insects

How to collect insects?

- By hand
  - Provide plastic bags or boxes
  - Use an aspirator for collecting small insects
  - Use a water pan
  - Search all plant parts and near plants
    - Stem
    - Leaves
    - Flowers
    - Fruits
    - Roots
    - Soil
    - On weeds
- Sweep nets
  - Use them to catch flying insects
- Traps
  - Use sticky traps to discover small insects (pests, natural enemies, neutrals)
  - Pitfall trap to catch insects that walk on the ground
  - Light traps

Why collect insects?

- For identification
  - Know what is there: pests, natural enemies, neutrals.
- For insect zoo.
  - Study life cycles
  - Study behavior: feeding habits, parasitization, etc.
  - Set small experiments
- For preservation.
  - Make a reference collection
In the FFS farmers learn about:

Insect identification

When we collect insects from the field there is a lot we want to learn about them:

**Naming the insect:**

- Don’t use scientific names when talking with farmers
- Use common names; preferably local names used by the farmers
- Invent names if needed

**Recognizing the insect:**

- Study the body part:
  - Shape
  - Color
  - Function
- Use identification guides or manuals
  - Photos, drawings
- Know the life cycle
  - Egg
  - Larva or nymph
  - Pupa
  - Adult
- What is its function in the ecosystem?
  - Herbivore (is it a pest?)
  - Predator
  - Parasitoid
  - Neutral
- Study its behavior
  - Activities, movement, dispersal in the field
  - Searching behavior
  - Feeding behavior
  - Where do they hide or rest?
- Keep records
  - Make drawings
  - Keep specimens for reference
  - Note down what you learned
- Start experiments to learn more
  - Insect zoo
  - Field cages
  - Use of traps
- Training materials to study insects
  - Hand lenses
  - Plastic bags
  - Sweep nets
  - Aspirator
  - Insect zoo
  - Traps
In the FFS farmers learn about:

**Insect pest management**

There are many methods to manage pests. For many farmers the most obvious method is chemical control with synthetic insecticides. But this is also the most dangerous and destructive method, causing health and environmental problems. Synthetic pesticides should be used only as a very last choice, when all other options have been tried first.

Insects can be managed by:

- Use of resistant or tolerant varieties
- Crop rotation
- Intercropping
- Botanical pesticides (e.g. neem)
- Bio-control agents: insect pathogens
  ◦ Bacillus thuringiensis (Bt)
  ◦ NPV
  ◦ Steinernema
  ◦ Beauveria
- Biological control
  ◦ Predators
  ◦ Parasitoids
- Trapping
  ◦ For example yellow sticky traps
- Managing the micro-climate
  ◦ Pruning
  ◦ Thinning
  ◦ Watering
  ◦ Mulching
- Chemical control
  ◦ Only to be used as a last option
  ◦ Select the least toxic product available
  ◦ Never use class Ia or Ib chemicals
  ◦ Avoid organophosphates and carbamates
  ◦ Don’t use chemicals that are known to cause cancer, or to disrupt the endocrine system
  ◦ Before using any chemical, first collect information about it (e.g. www.pesticideinfo.org)
  ◦ Use spot applications. Do not treat the entire filed, but only the parts where pests are causing problems. Keep other areas free of pesticide as a refuge for natural enemies.
In the FFS farmers learn about:

Diseases
Recognizing and identification
- Use identification guides
- Photos
- Drawings
- Invite experienced persons to help

Disease outbreaks
- How does a disease arrive in the crop?
- How do diseases spread within a crop?

Relation to weather conditions
- Humidity
- Temperature
- Micro-climate in the crop

Resistance and tolerance
- Crop varieties
- Grow a healthy crop
In the FFS farmers learn about:

Disease management

Although fungicides and bactericides are generally less toxic than insecticides, we have to try to reduce their use as much as possible. In IPM, other methods to manage diseases should be explored first:

Diseases can be managed by:

- Crop rotation
- Sanitation
- Antagonists
  - Trichoderma
- Healthy plants
  - Good seed, strong seedlings, seed treatment
  - Fertilizer management
  - Water management
- Varieties
  - Resistance
  - Tolerance
- Manage the micro climate
  - Humidity
  - Temperature
  - Pruning
  - Thinning
  - Mulching
- Fungicides / bactericides
  - Only to be used as a last option
  - Select the least toxic product available
  - Never use class Ia or Ib chemicals
  - Don’t use chemicals that are known to cause cancer, or to disrupt the endocrine system
Weeds compete with the crop for water, nutrients, space and light. But weeds also provide shelter for natural enemies. Flowering weeds provide food for adult parasitoid wasps. When weed control is needed, always consider if it is necessary to remove all weeds. It may be useful to keep some pockets of weeds as a refuge or food for natural enemies.

Weeds can be controlled in various ways. In IPM, chemical control should only be used as a last option. Especially the use of non-selective herbicides should be avoided because they destroy biodiversity.

Methods to manage weeds include:

- Mechanical control
- Use of cover crops
- Use of mulch
- Water management
- Chemical control
  - Only to be used as a last option
  - Avoid Paraquat, it is the most dangerous herbicide
  - Select the least toxic product available
In the FFS farmers learn about:

**Pesticides**

Types of pesticides
- Insecticides
- Fungicides
- Herbicides

Chemical families of pesticides
- Organophosphates
- Organochlorines
- Carbamates
- Pyrethroids
- Paraquat
- etc.

Health effects / Toxicity
- Acute toxicity
- Chronic toxicity
  - Carcinogenic
  - Endocrine disrupt
  - Developmental toxins

Exposure to chemicals
- Skin
- Mouth
- Breathing

Understanding the labels
- Protection during application
- Safe storage
- Waiting periods

Effects on pests
- Development of resistance

Cost
- Financial cost
- Environmental cost
- Health cost

Side effects
- Natural enemies
  - Resurgence of pests
  - Secondary pests
- Birds
- Fish
Integrated Pest Management consists of strategies that conserve and augment natural enemies. In the Farmer Field School we learn to recognize natural enemies and to understand their role in the ecosystem. Every crop management decision we take is aimed at conserving natural enemies (e.g. avoid pesticides) and creating an environment in which they can survive and multiply.

**Natural enemies**

Integated Pest Management consists of strategies that conserve and augment natural enemies. In the Farmer Field School we learn to recognize natural enemies and to understand their role in the ecosystem. Every crop management decision we take is aimed at conserving natural enemies (e.g. avoid pesticides) and creating an environment in which they can survive and multiply.
In the FFS farmers learn about:

Problems caused by pesticides

Many farmers know that pesticides are efficient in killing pests but they are often not aware of the many problems that are caused by pesticides.

A decision to use pesticides should only be made after carefully considering all these effects.

Problems caused by frequent pesticide use:

- Natural enemies are killed
- Pests become resistant
- Minor pests can become more serious than key pests
- Toxic pesticide residues on the crop
- Unnecessary use increases costs
- High risk for the health of farmers and their families
- Pollution of the environment
**Indicators for quality of the FFS**

It is a good habit for a facilitator to look back after each FFS session and reflect upon the quality of the training. Here are some questions that can help evaluating the session so you can better prepare for the following weeks.

- **Did at least 80% of the farmers participate in today’s session?** Why did some farmers not attend? How can you get better attendance?

- **Where paper, colored crayons, plastic bags, sweep net, hand lens, materials for insect zoo available?** What was missing?

- **Did you start the FFS with a summary of last week’s session and a presentation of today’s program?** Did you involve farmers in refreshing their memory about last week’s session?

- **Were all AESA drawings of previous sessions available?** Did farmers use these older AESA drawings to compare changes in the crop situation?

- **Did all farmers spend time in the field observing the IPM plot, the FP plot and field experiments?** During the field observations did you ask questions about what they observe?

- **Had the IPM plot been managed according to the decisions of last week’s AESA?** If not, then what went wrong? How can this be avoided next time?

- **Did farmers collect life specimens (insects, disease symptoms, weeds) from the field for use in the AESA?**

- **Did 100% of the farmers participate in the AESA and analyzing the field situation?** Did you make sure that even shy or quiet farmers participate? How did you do that?

- **Did at least 3 farmers lead discussions during the AESA presentation?** How did you stimulate them to take the lead?

- **Were 100% of the farmers involved in decision making for the IPM plot?** Did you agree who is responsible for carrying out decisions?
### Indicators for Quality of the FFS

<table>
<thead>
<tr>
<th>Question</th>
<th>Evaluation</th>
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<tbody>
<tr>
<td>Did you stimulate farmers to share their experiences in response to what they learned today? How did you make sure that farmers are prepared to share their knowledge?</td>
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<tr>
<td>Did you stimulate farmers to come up with questions that can be used for further learning? How did you respond to these questions? Did you use these learning opportunities?</td>
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<tr>
<td>Did you summarize today’s observations of IPM-FP plot and other field experiment plots?</td>
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<tr>
<td>Were all insect zoos maintained in good condition? Did 100% of the farmers observe the insect zoos?</td>
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<tr>
<td>Did you start more insect zoos, based on field observations or questions by farmers? How did you make sure that all farmers share responsibilities in taking care of these insect zoos?</td>
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<tr>
<td>Did you have a group dynamics activity? Did the farmers enjoy it? Did it contribute to group building?</td>
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<tr>
<td>Was the special topic selected by the farmers? Were you well prepared on that topic (materials, questions, exercises)?</td>
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<tr>
<td>Did you agree with the farmers on time and location for next meeting? Are all farmers committed to this?</td>
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<tr>
<td>Did you feel 100% satisfied about this session? Did you run this session as a facilitator, or did you lecture? Was your time management ok? Did the farmers enjoy learning? What were the problems you faced during this session?</td>
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</tbody>
</table>

Make a list of “things to do” for the next FFS session!!!
Towards the end of the season we start planning a field day. During the field day the FFS farmers get the opportunity to show what they have learned to other farmers in their community. Also we can invite some key persons (e.g. local politicians, governors, school teachers, etc.) who can help promote IPM and who can play a role in setting up more field schools in the next seasons.

The best moment to organize a field day is at the end of the season, just before harvest with the crop still in the field. Our visitors can then observe the IPM plot and the FP plot and other field experiments that were carried out by the farmers.

Don’t forget to prepare some insect zoos with pests and natural enemies, so that we have life examples to show to our guests.
FFS reporting and planning

Reporting

Don’t forget to prepare a beautiful report about your FFS. The report is not only useful for yourself, but will also help you to get future support from your superiors, funding agency.

A complete FFS report will include:

- **Index and Summary**
- **Location of the FFS**
- **List of FFS facilitators and FFS farmers, their addresses and telephone numbers**
- **Baseline data of the farmers**
  - Planting calendar (Farmers’ Practice)
  - Agricultural problems (e.g. diseases, pests, soil, water)
- **Overview of all weekly FFS activities for the whole season**
- **Map showing the field with layout of IPM plot, FP plot, field experiments**
- **IPM plot and FP plot calendar (a drawing with timeline, showing the plant growth and the weekly activities/applications)**
- **Comparison between IPM plot and FP plot**
  - Plant growth /pests / natural enemies / diseases
  - Cost and profit
- **Field experiments**
  - Purpose of the experiment
  - Methodology
  - How data were collected
  - Results (data) and analysis
  - Conclusion
- **Overview of FFS budget and expenses**
- **Recommendations**
- **Drawings and photographs of your AESA and field activities, experimental plots, etc.**
Planning for after FFS

The last FFS session(s) will be used to make plans for the next season. We want the farmers to continue working and learning as a group.

Let’s discuss what we have learned and which questions we need to answer in the next season. Let’s make plans for new field experiments. Let’s divide tasks and decide when we meet again.

The last FFS session should not be the end, but it is the beginning of our next season activities.

If FFS facilitators will not be available for a second season, then one or more leading farmers can take their role and become the facilitators during the next season.

**ABBREVIATIONS AND ACRONYMS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>DANIDA</td>
<td>Danish International Development Assistance</td>
</tr>
<tr>
<td>DOA</td>
<td>Department of Agriculture</td>
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<tr>
<td>DOAE</td>
<td>Department of Agricultural Extension</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>FFS</td>
<td>Farmer Field School</td>
</tr>
<tr>
<td>FP</td>
<td>Farmers’ Practice</td>
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<tr>
<td>IPM</td>
<td>Integrated Pest Management</td>
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<tr>
<td>MOAC</td>
<td>Ministry of Agriculture and Cooperatives</td>
</tr>
<tr>
<td>MOPH</td>
<td>Ministry of Public Health</td>
</tr>
<tr>
<td>NFE</td>
<td>Non-Formal Education</td>
</tr>
<tr>
<td>RPF</td>
<td>Royal Project Foundation</td>
</tr>
<tr>
<td>TEF</td>
<td>Thai Education Foundation</td>
</tr>
<tr>
<td>TOT</td>
<td>Training of Trainers</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
REFERENCES


Websites:
- IPM Thailand: www.ipmthailand.org
- PAN pesticides database: www.pesticideinfo.org
- Community IPM: www.communityipm.org
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