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FARMERS FIELD SCHOOL FACILITATORS' MANUAL

ON

INTEGRATED MANAGEMENT OF POTATO LATE BLIGHT /IDM-LB/

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INTRODUCTION TO FARMER FIELD SCHOOL /FFS/ APPROACH

What is FFS and why it is needed?

The Farmer Field School aims to build each farmer's capacity to analyze their knowledge of nutrient management practices for potato, to identify the main constraints and to test the possible solutions on their field, eventually identifying and adopting the practices most suitable to their farming system. The purpose is to assist farmers in developing their ability of making critical and informed decisions that render their nutrient management systems of ware potato more appropriate. Through their participation in FFS activities, farmers become experts in their own fields. The FFS uses non-formal adult education methods, particularly experiential learning techniques. Typically a group of farmers meet regularly during the course of an experiment. The school is not meant to teach farmers new technologies developed outside their environment but to provide them with tools which will enable them to analyze their own production practices and identify possible solutions.

The role of a facilitator: A facilitator facilitates the school. The topics of each meeting are related to the stage of the experiment at a particular time. The activities are highly practical involving careful observations of factors and testing of solutions that fit their typical physical and socio-economic situation. There is much sharing of experiences among the farmers with a minimum of lecturing.

The role of a scientist: The role of the scientist is to provide backstopping support to the school. The scientist role is that of a colleague and advisor who brings new ideas and or unknown technologies to the communities.

One of the very important elements contributing to the success of farmer field schools is creating a common understanding about FFS among the school participants. FFS can only become a success with active participation of the farmers. Since FFS approach is new for a large proportion of the farmers, there is a strong need to introduce what FFS is and why it is needed. This is because, it contributes considerably for the successful development of the school and also to know the expectations of the farmers from the school. The overall objective this manual is therefore to assist the facilitator in FFS by providing the basic framework and materials for the implementation of the school. In scheduling the school, the facilitator should be aware of farmers' availability and it is important to involve participants in setting the time and schedule of meetings.

Learning outcomes

- The farmers will be aware of the principles of FFS, its advantages and contribution for improving the productivity of potato
- The expectations of the farmers from the school will be identified and known

- The farmers will have an awareness of how the organization of the school and the sessions selected for the learning processes

Notes for the facilitator

Before starting awareness creation sessions, first there is a need to note the farmers' level of understanding about FFS. This is because; there has been an FFS approach in some of the localities in previous times. Hence, the farmers might have been aware of this approach and it is better to start with their level of understanding. This helps to design appropriate learning process taking into consideration of their knowledge levels. When designing teaching practices in the field, there is also a need to clearly differentiate between the formal school which is run under classrooms and the informal school which is designed to be run in the fields. Since the farmers have a wealth of knowledge on the different farming practices, in general, and on the ware potato storage techniques, in particular, there is also a need to know the differences between the approaches to teach the farmers and the children. The objective of the FFS is, therefore, not to teach the farmers on the theoretical aspects but to facilitate them in discovering the concepts using their ability and capacity for observation, experimentation and deduction. This implies that there is no need to design a type of school in such a way that the facilitator is a professor and the farmer is a student. The principle of the learning process is that one can learn from another. Multi-way discussion should therefore be the central point of communication between the facilitator and the farmer. The facilitator should be able to answer the questions raised from the farmers with practical examples and exercises rather than giving direct answers. This is because; the exercises are helpful to strengthen learning by discovery approach. We should note to all the school participants that 20% of the people learn by listening, 40% by seeing it and 80% learn by doing it or discovering it. The exercises should focus directly on the surrounding environment, local materials and specific agricultural problems of the farmers. The farmers should be encouraged to actively participate in the learning processes. All these processes contribute for the learning process to be more effective and successful. The facilitator should explain for the group that we can learn from experiences of each other. In every stage of the sessions, the learning process should be designed in such a way that the discussion is attractive, attentive and pleasant by supplementing with practical examples, exercises, samples, drawings or photographs. Two or more facilitators could be used where appropriate to share responsibilities and create enabling environment for the free discussion of sub-groups during exercises. There should be agreement among the school participants and the facilitator on the time required for each session, frequency of meeting for the school and the date of learning. In general, it is important to note that the learning process should focus in sharing what we know and discovering what we do not know.

Time needed: 2 - 3 hours

Materials required: Flip charts, pencils, markers, flat files

Steps

1. Explain the objectives and outcomes of the FFS approach and the learning processes to the school participants
2. Describe the differences between learning in the field and learning in the classrooms
3. Ask the participants to form small sub-groups of about 4-5 persons each for group exercises
4. Activate the sub-groups to discuss on the following points:
    a. List down on what they would like to learn from the school
    b. What are your expectations out of the school
    c. Suggest what should happen and what should not happen during the learning processes in the school
5. As the end of the exercises, ask one group to present their group works for the other group
6. Activate a discussion among the groups on the presentations. Discuss in detail and reach consensus on the expectations that could be met and that are not likely to be met in this school.
7. Following the presentations of the groups, the facilitator will present and explain the basic principles and approaches of the school, its advantages and contributions for strengthening knowledge and skills, previous experiences and success stories of the school and the sessions suggested in this school
8. Activate a discussion on the facilitators presentations
9. Discuss on the future plan and frequency of meeting for the school, dates and time of meeting, and length of the learning process in a day.
10. Get feed-back from the participants about the session and the learning processes
11. Wrap-up the session of the day by summarizing the main points discussed during the exercises and the outputs obtained
12. Close up of the session by reminding the theme of the next session, date and time of next meeting

Some suggestions to facilitate group discussion

- Does learning by theory or practical help some one better to learn? Reasons.
- Is learning process in the classrooms or in the field better to gain practical knowledge and skills?
- Should there be classes once in a week or once in two weeks?
- At which season should each session be better learnt?
- Should there be classes for the whole day or for half day?
- What do you expect from the school?
- Can one learn better through theory in the classes or by conducting practical experiments in the fields?

Responses for such questions can help activate and orient the discussions to explain the need for FFS approach further. It would contribute that learning with observations and experimentation is better than learning just by theory.

Session 1

Introduction to the Farmer Field School (FFS): Initial Diagnosis of Knowledge of the Participants on Diseases and Insects of Potato and the Practices of Control

General Objectives:

- To facilitate and encourage farmers
- To compare and contrast the local potato varieties with the improved ones
- To discuss the unknown aspects of late blight & other constraints
- To exchange knowledge

1) Purpose

To facilitate farmers in IPM-late blight of potato so that they can elect the most appropriate components of management and adjust them to their conditions and use these to improve / increase yield.

2) Specific objectives

a) Understand the biology of the pathogen (late blight). On the completion of the FFS, the farmers should be able to:

- Recognize fungal spores on diseased potato leaves in fields (indicative that fungus is active)
- Discuss how the pathogen reproduces asexually
- Discuss sources of inocculum (seed, near-by diseased fields, etc)
- Explain the conditions favorable for development of late blight disease (moisture, temperature etc)
- Distinguish field symptoms of late blight in leaves, stems or tubers

  Discuss the importance of quality seed

Principles of management (IPM-LB)

- Exchange views on the differences between susceptible varieties, varieties with horizontal resistance or vertical resistance, & resistance that has been overcome.
- Name sanitary measures and explain their importance in late blight management.
- Discuss the differences between a fungicide and an insecticide
- Discuss the mode of action of systemic fungicide and contact fungicides
- Measure correct dose of fungicides per knapsack sprayer and apply fungicide correctly
- Exchange ideas on the principles of integrated management (IPM-LB)
- Understand the costs and profits of different control options

Notes for the facilitator:

At the end of the activity the participating farmers will have a clear idea of the objective of the schools, field activity and the form of work as well as the timetable of activities.

Before beginning to explain to the participants about the activities of the field schools, we should be certain on some key issues. First, it is necessary to establish the difference between teaching oriented for children and the teaching of the adults. In the case of children, they learn by discovering the world little by little. However, in case of the adults, the are already full of knowledge and experience. The farmers, for example, know a great deal about the management of the farms, crops and animals; but they also poorly understand or confuse several aspects on the problems of crop pests & animals of the farms. For example, they may not know what a fungus is, nor much about the specific causes of diseases of the potato plants but may know that something causes it or may have other peculiar explanation of it. They may not know or no one have explained to them in practice the real origin or causes of some of these problems, and how solve them.

The objective of the schools is exactly facilitating the farmers "in discovering" the concepts using their ability and capacity for observation, experimentation and deduction. As a result, it does not involve planning classes where the extension agent (facilitator) is the professor and the farmers the students. It should involve participation at all times and avoid the extension agent or facilitator from answering questions and explaining directly what happens. Actually the extension agents (that from now on we will call facilitator) answers the questions with examples, exercises, experiments, in such a way that the farmer finds the responses from these. In this way the learning will be more effective. The field schools are based on the "exercises based on learning by discovery", that is the farmers upon participating actively are "discovering" the concepts. We should remind everyone that 20% of people learn by listening, 40% learn by seeing it, and 80% learns by doing it or discovering it.

Another fundamental principle of the field schools is that it utilizes the surrounding / nature and this is the same as field or crop in fields as the principal educational materials. Any exercise of teaching that we design will help to us demonstrate the basic technical principles of the agricultural problems. This means that we will need to continually observe the crop fields agro-ecosystem, especially before beginning any discussion or teaching activity.

From now on every session will have sections and every section has several activities. The facilitator will elect the activity that is more appropriate for that subject matter and for the group of farmers. If there no activity of teaching-learning is appropriate, the facilitator should use his / her creativity or ingenuity to design, techniques that involve conceptualizing or defining the subject matter that is being dealt with for the benefit of the farmers.

Activity: Presentation by volunteers:

Materials: 3 or 4 volunteers, script, and scenarios.

Procedure:

- Choose 3 or 4 volunteers based on their experience and success on potato production

Scenes:

- Allow the farmers to talk about their experience on potato production and problems and success of their activity and any related work.
- Then the facilitator can explain to the group that we can learn from the experience of each other.
- The group and facilitator then prepare its timetable of activities, set the date of meetings, and the hour. In this part they are also explained the various parts of the experiments (test / or set of varieties and fungicides) which will be used in the experiments.
- After the presentation by the volunteers, the facilitator can initiate the group to analyze the differences between a formal school (where there are classrooms, professor, files, chalk, etc.) and the field school where aspects of learning are conducted infields of potato crops.

After presentation of the two scenes the facilitator can discuss the advantages and disadvantages of each learning method using the following questions:

- How can one learn better: by theory or practical?
- Which one is better: to learn in the classroom, or is it better to go to the field & learn there?
- Should there be classes just for a single week or throughout the cycle of the crop?
- What advantages can learning session through-out the cycle of the crop have instead of a single talk?

- With what frequency should they meet for the classes?
- Can one learn better through theory in the classes or by conducting practical and experiments?

The responses can be used for orienting the discussions and an agreement toward the need for organizing a farmer field school in such a way that the farmers can observe and learn using the different problems that are presented.

Afterwards there should be discussion on the schedule of the sessions, the maximum time of the sessions should also be agreed upon. Usually about an hour at the beginning and then increased to three hours later. The frequency of the meetings should also be agreed upon e.g. that can be once a week.

In the flip chart the following should be recorded: The date of starting of the classes and the agreed upon timetable and other agreements on the operation of the school. An example of a timetable is observed in Table 1.

Joint work plan of activities involving farmers, facilitators and researchers

Table 1. – Schedule of weekly activity plan for FFS

Activity (Weeks) No. FFS	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Session 1		X													
Session 2			X												
Session 3				X											
Session 4					X										
Session 5						X									
Session 6							X								
Session 7								X							
Session 8									X						
Session 9										X					
Session 10											X				
Session 11												X			
Session 12													X		
Session 13														X	
De-haulming/ Harvest															X
Evaluations						X	X	X	X	X	X	X	X	X	X

Questions for the farmers

- What do you think about the mode of operation of FFS?
- Do you have any expectation or fears of the FFS?
- What would you like to share from the facilitators which have not been included in the work plan?
- Are there any difficulties they expect in participating continuously in FFS?

Fig.1: Participant farmers and facilitators discussing the mode of operation of FFS

Session 2

Knowledge, Attitude and Practices of participant farmers on Late Blight, tuber moth, Cut Worm and Other Insects Control practices in Potato Production.

1-Introduction

a) Before the commencement of FFS activity, the facilitator should determine knowledge of farmer on late blight. Activities can be adapted with reference to the answers obtained.

b) Better to conduct the question session into 2 sessions or groups.

c) Use of two trainers (facilitators) during this session.

2-Objectives:

a) Determine knowledge, attitudes, & practices of the farmers on diseases of potato and in particular to late blight

b) To enable farmers share their knowledge and ideas

At the end of this part of the session the farmers will have described their knowledge of insects and diseases of the potato, practices of control and aspects that would please them to know.

Notes for the facilitator:

We should not forget that the farmers have abundant experience on the potato crop, and therefore, need to listen to them and to learn from their experiences. We also need to know the extent of their knowledge on insects and the diseases of the potato. In this way we can identify aspects which they need to learn. In this way, the activities of the field school can better be oriented. We have to recall that at field schools the farmers are and will be the most important.

Since making a detailed diagnosis is not the objective of this session, the activities should be done so as to promote the discussion in a dynamic and pleasant way by using examples, samples, photographs or drawings.

It is better if two facilitators are involved at these sessions. One can handle the activity and promote the discussion and the other one can take note of the results of the session.

Exercise: Discovering what we know and we do not know.

Materials: Survey questionnaire, Checklist, Flip charts, markers / pens, adhesive tape, photographs of different disease symptoms, insects and, live samples (example, tubers bitten by insects, spoiled, leaves of potato with spots, etc), Insect pest specimen in case there is available.

Procedure:

- To form groups with each group consisting of 3 to 6 people, and may have between three to five groups. It is suggested that the farmers be divided into such a manner that there is similarity among them. The division could be done in accordance with the area (by vicinity), by familiarity or also by age or sex (for example a group of women). Each group will take a name.

Each group will be assigned a group name.

The Facilitator will write one of the questions for discussion (to see more before) in a large role or will explain out loud what is going to be discussed. The small groups discuss each question per 10 minutes. They write their ideas or make figures or use the samples to illustrate their ideas. The discussion should be opened and dynamic, with full participation of each members the group, contributing ideas. The facilitators will try to promote the discussion, but not offering opinions or information.

A representative from each group summarizes the finding of the group's discussion (~ 5 minutes). A proposed questionnaire for base line studies (farmer's knowledge/ practices) is annexed.

Session 3

Basic concepts of experimentation: Randomization, replication and Sampling.

Introduction:

One of the objectives of the field schools is that the farmers improve their ability & capacity to do their own experiments, tests or make comparisons, which implies that concepts and the purpose of doing research / field activity are clarified. In addition, it is important that the farmers know the concepts of treatments, repetitions, and randomization. Farmers will participate in a number of experiments during the potato growing season. The main experiment is to allow the farmers to differentiate or point out resistance / or performance of different potato varieties or advanced clones and how these require different fungicide treatments.

Subject: The experimental design:

Objectives:

- Give farmers some idea of the basic aspects of experimental design.

- Farmers should be able to raise questions & design experiments to answer them.

- Understand control treatments, & concept of repetitions or replications.

At the end of this part, the farmers will have a clear idea of the meaning and the reasons to do experimentation.

Notes for the facilitator:

The farmers usually are testing new ideas / technologies in their farms. For example, they test a new variety (several) during several years and often increase the seed in case the variety is well suited or adapted to their needs. However, the farmers do not know basic aspects on experimental design, repetitions, hypothesis, treatments, etc.

In the field schools, we try to improve the capacity of the farmers in order to carry out their own experimentation. For this reason, it is important that they understand the concepts and principles related to the experimentation.

First, it is necessary to recall that an experiment is designed when there are several alternatives or treatments and in which the best possible outcome or treatment is not known. For example, whether we have five new varieties of potatoes, we do not know which will be the best until they are tested or grown under the same conditions.

The hypothesis of an experiment is what we presume beforehand that it is going to turn out. For example, if of the five varieties that we are going to plant, we believe that there is two

that are resistant to late blight. Then our hypothesis will be that “two of the five varieties are resistant and as a result will yield more;” but this we will not know until we have the results of the experiment.

The treatments are the alternatives that we want to prove. Each variety of potatoes will be a treatment.

The repetitions are part of the experimentation that is used by us to know that the results are not due to accident (experimental error) but due to the fact that some treatments are better than others.

Exercise: Blocking (Establishment of blocks in field experiments)

- A family head having 5 children has to feed his wife and family everyday.

- Assuming he /she is feeding on potato, rice, Njera, sorghum, he would want to feed them in the best possible way

- To avoid bias, & allow his children grow strong and healthy, he will try to feed them equally well without jeopardizing the other.

NB: The facilitator should use this example to explain that the children treated equally with out bias and in principle the children's could be compared among them selves.

- In a similar manner, the blocking of experiments (establishment of Blocks) in field experiments with varieties are used to avoid bias – i.e. allow the varieties or potato clones an equal chance of growth / development to make comparison among and this is possible that is prepare small plots that are alike called block.

- If these are not done, then they would not be exposed to the same environmental conditions of soil – fertility gradients, water – moisture gradients, light or shading and it becomes difficult to compare the varieties and choose the best clones or varieties in terms of performance.

N.B: The facilitators should use examples such as that one can not compare children's from different families even if they are of the same age since different families have different management style

or that it is not possible to compare two different potato varieties grown on two farmer fields, since different farmers have different management methods and the two farmers could have different fertility level.

Fig. 8 Farmers planting potato by establishing experimental blocks

Randomization

Since the plots within a given block are assumed to be similar, the next step is to allocate the varieties by chance to the plots. That is within the blocks therefore, we randomize to allow them equal exposure to the environment so that they perform in the best possible way. This would allow us to compare the varieties science they are treated similarly.

- The probability of having a boy or girl from a married couple, is by chance. This is called random chance.

- Envelopes: Egg, sambusa, banana, mandazi, potato (6 of each)

  If they are packed, allow the farmers to pick each of them at random

  This will allow the samples to be obtained at random.

- Several farmers buy lottery tickets. The chance of winning a million birr from a lottery is random chance.

- That is the lotteries were randomly distributed to the farmers (no one know the wining number) initially. Therefore the process of allocation the process of allocation is purely by chance. If it is intended to compare two potato variety we said that the plots to which they are to be planted must be in the same fertility level & managed similarly. Yet, there still no guarantee that the two plots are exactly the same. Therefore, allocate each variety to the plots at random.

Replication

If we want to determine the average weight of a bull, of goat in Dendi District or the population.

- Therefore, you measure the weight of many goats: from Galessa, Koti e.t.c.

  Then get the average – which will be representative of that of Dendi District.

Sampling

You may ask the farmer to tell you how many tubers can a single plant produce without distracting the whole field (they may tell you several alternatives). The general principle is however to take a number of plants from different parts of the field and take average (You may argue that science different plants perform differently taking just one plant does not give representative one).

-Getting the average height of an Ethiopian. You will have to take samples (data) from some men & women in the various districts / provinces in Ethiopia.

Exercise: Randomization:

Suppose PA officials wanted to allocate the available five plots of land to 5 farmers. They wanted to be fair in their allocation. How do they do this? The facilitator may suggest that they use a lottery method and allocate the plots to farmers all with same chance of receiving any of the plots.

Exercise: The competition of the ants

Materials: For this part of the session there is a need for ants, sugarcoated bread, honey, and biscuits / cookies, salt, water.

Procedure:

- To begin, ask the farmers how they know things or how can one find answers to questions.

- Ask what they understand by experimentation, and in case some time they have done experiments, what results did they have. The responses will reveal to us some interesting aspects of knowledge of the participants.

- Ask the group what the ants prefer: sugarcoated bread, honey, biscuits / cookies, salt, water. These can be done by voting, count the number of respondents for each option. Then one will find out if they are certain, if they have verified it in some way or if only they are implying. If they say that they are implying, then it can be explained that that is a hypothesis that it needs to be verified.

Ask the group, how we could ascertain what the ants prefer. According to the responses, it can be done using a small experiment:

- Make a triangle on a flip chart in the soil.
- Put honey in a corner, biscuit in the other one and the potato in the third (you can put other food such as rice, potato, fish, etc – usually what is available in the community).
- Place a group of ants in the middle of the triangle.

- Leave the ants to loiter about for a while and then count how many have arrived and have remained in the honey, the biscuit and the potato.
- The 3-5 groups of farmers can repeat it and each will take note of the number of ants in each treatment. On this part the importance of registering data of the experiments should be emphasized. Otherwise one would depend only on his memory in order to know the results and to be able to find the number of respondents.

Then the results observed by each group can be discussed and evaluated if the experiment has been sufficient in answering our initial question of what is most preferred by the ants?

There should be continued discussion by asking what another types of experiments could be done and how. For example, other experiments could be done with adults of the Andean potato weevil, for which the facilitator could have collected some adults of some other beetle.

The question to investigate will be:

To determine the number of beetles preferring the three types of food stuffs (honey, biscuit, potato) by placing them in the box at three corners and determining which corner the beetles go to.

Examples of the session:

Subject: The randomization:
Objective of this part: At the end of the session the farmers will have a clear idea of the concept of hypotheses, randomization, and repetition.
Notes for the facilitator:

Randomization helps us to determine if the results of some treatments are due to the fact that these treatments are better than others; or are they due to pure accident. It some cases treatments differences may be due to the advantage of the placement, or the soil or the climate where they were installed.

Activities: Competition of participants.

Materials: orange (good bad and spoiled)

Procedure:

Obtain 5 oranges, two of which are good and others are moderate or bad. Call 5 participants and give the two good ones purposely to Mr. X2 and X5 and the remaining to others. Repeat the same procedure and give the good ones to the same people.

In the second part 2 the experiment call the same 5 participants, but this time allocate the oranges based on latter method. Repeat the experiment again in the same way.

You must be able to observe that first part the experiment is baised since same people were favored twice, while the second set based on random allocation.

TASKS FOR THE NEXT SESSION:

- For the facilitator: To bring clean hoes / implements for weeding & crop management.

Session 4

Crop management and its Application to Potato: Weeding, Hilling/ ridging and Soil fertility management

Objective

The participants will learn the disease control & soil erosion management in contour farming

Activity: Field visit
The group should visit the field before any discussion.
The facilitator should initiate discussion on contour ridging and its impact on soil erosion control and disease spread by asking the following questions:

- What are the advantages & disadvantages of hilling, ridging / planting ?
  e.g. disease control (bacterial wilt), soil erosion control)/ improve fertility.

Crop emergence

Introduction
Crop emergence is an important aspect of plant growth. Poor emergence could be indicative of the poor status of seed health or the presence of soil-borne diseases. Delay in seed piece emergence could also be due to poor seedbed preparation e.g. hard or crusted soil or lack of rainfall. Generally, farmers should be aware of all the conditions related to seed bed or field preparation, timing of planting e.t.c

Of particular importance to seedling emergence are diseases and insects that affect seed germination. Pathogens and soil insects are some of the most important causes of delayed or uneven emergence. Potato diseases which affect germination or cause potato seed decay, seedling infections or root rot, may subsequently reduce crop yield substantially. These may include: *Fusarium*, *Rhizoctonia*, *Pythium*, *Phytopthora* spp., Bacterial soft rot, brown rot e.t.c . The soil is also home to thousands of insect species for part of or their entire life cycle.
This may include: wire worms, millipeds / centipeds, corn maggots, borers e.t.c. These may damage planted seed. It must also be noted that other micro-organisms and soil insects may be beneficial and of economic importance.

Materials
Flip charts, hand lens, markers, pens, diagrams of types of germinated potato, Viles Swift net, etc

Activity:

- The farmers should be encouraged to take note on the rate and total potato seedling emergence by counting the number of emerged potato seed. This could give clue as to the health status of the potato seed.
- If there are missing hills or seed pieces which have not emerged, dig it out and

  Examine the roots / & insects associated with it.
- Record and discuss factors associated with the lack of emergence.

Weeding / Hilling

Objective: To allow the participants (farmers) discover the optimum cultural practices for management of weed in potato fields

Introduction

Weeds compete with the potato crop for light, nutrients and water. Yields of tubers can be severely reduced. The amount of reduction will depend on the weed density and its competitive ability. The presence of weeds in potato field can also increase disease levels on potato by allowing the aphid populations to survive in. In small-scale farming systems, weeding can be done in several stages.

The time of planting of potatoes, the timing, type and frequency of cultivation, soil type, weather conditions and types of crops grown in rotation with potatoes can adversely affect weed dynamics.

Fig.: Farmers cultivating potato

Facilitator should initiate a discussion on the frequency of weeding practiced by farmers

First weeding: Generally weeding is accomplished at approximately 2 weeks after emergence. In some cases, if fields are planted after onset of rains, then weeding or removal of weeds can be accomplished immediately.

Second weeding: This may be done at 4 weeks after emergence (or within 2 weeks after the first emergence). At this time, hilling or ridging of potato plants may also be conducted. When hilling or ridging, care must be taken not to injure the root system of potato plants.

Fig. Farmers hilling potato planted on experimental plots

This is to avoid accidental transmission of soil-borne pathogens / diseases especially bacterial wilt.

In general, hilling of plants are also useful for other purposes e.g. enhancing the tuber bulking process, minimizes tuber blight infection should late blight disease develop.

Materials

Flip chart, hoe, markers

Activity:

The facilitator should introduce the topic by initiating a discussion on weed types

- The farmers will be requested to observe and take note on the weed types and dynamics in field plots (divide the farmers into groups of 4-6).
- Allow the farmers to collect weeds from various parts of the field.
- Draw the diagrams of various weeds types known (use local names).
- Classify the weeds according to weed types (useful weeds – Marigold) or weeds that

cannot be of much use. Ask the farmers which of the weeds are most difficult to control.

- Ask the farmers to list the factors affecting weed dynamics and discuss those factors.
- Record and discuss the various ways for weed management (tillage, hoeing, herbicide, rotation, inter-cropping).

Soil fertility & Organic and Inorganic fertilizer application

Objective: On completion of this session, the participants will discover the fundamental aspects of soil related to potato cultivation, and identify optimum management practices for soil fertility.

Introduction

Fertilizer is one of the most important elements for crop production. The right time, accurate dose and proper application method have a great role in potato production. In general farmers should have a good knowledge on fertilizer and its application process. Soil management and fertility is often one of the most neglected aspects of potato production by small-scale farmers. This is often so because of the lack of availability of inorganic fertilizers or the presence of inadequate amount of land which can be used for crop rotation. In some cases, other sources of nutrition such as manure / cow dung e.t.c, may harbor soil-borne pathogens diseases and therefore unsuitable for management of soil fertility. When adequate land is available and suitable rotational crop exists, poor fertility could be managed through the use of rotational crops.

Objective

The participants should be able to know the types of fertilizer used in potato production (including animal manure, compost e.t.c), when and how to apply

Materials

Flip chart, hoe, marker, bottle, fertilizer (urea, e.t.c)

Activity

Participants should be able to discuss and identify some aspects of fertilizer application, time of application and amount of application. The facilitator should provide all the necessary materials required for this aspect.

The facilitator should introduce discussion by asking several questions aimed at gathering information on current knowledge of farmers on fertilizer:

- What sources of fertilizers do you use to grow potatoes ?
- What sources of nutrients do they use ?
- What sources of fertilizer or plant nutrition do farmers use ?
- Write down the local name of N, P, K, or other fertilizers in use.

- What is the practical way of learning about fertilizer or manure / cow dung management

  (Field visit, by setting trials or study, discussing with expert, by studying books)
- Which of these sources of nutrients do they think is best and why ?
- Do farmers practice crop rotation ? What are the limitation ?
- What are the common rotational crops in the area ?
- Among the rotational crops: marigold, maize, potato and fallow, which ones are widely practiced.

Session 5

Potato seed quality: Selecting, handling and planting clean potato seed.

Introduction:

In this session, the quality of seed and its impact on the spread of diseases and insects will be dealt with the farmers. The idea is that they discover and understand that the quality of seed is very important in avoiding the introduction of diseases and insects to our farms.

First part of the session:

Subject: Seed quality

Objective of this part: At the end of the first part of the session the participants will know how to recognize a good potato seed. / & determine the characteristics of a good seed.

Notes for the facilitator:

The quality of the potato seed is very important to ensure a good production. A good crop starts with a good seed. Choosing seed that is both physically healthy and physiologically is important. Disease free seed is essential to a good crop. Speaking of late blight, the "seed" of potato can be diseased and transmit the disease to the new plants. Other different diseases can be transmitted through the tubers.

In this part of the session, the farmers will examine the seed health and general quality of different lots of tuber seeds. Preferably, they can inspect seed for disease symptoms and compare the quality of the seed provided by different farmers. We will also discuss how the farmers can ensure the health and quality of the seed during the storage.

As a form of reinforcement and motivation so that the farmers conduct their own experiments, it is important to establish mini-experiments using different qualities of seed (different physiological ages; different health, etc).

Exercise: Experiments in choosing a good & disease-free seed.

Materials: Samples of seed from different farmers will be used in this experiment, plastic containers and magnifying glasses / hand lens. The seed samples can come from the storage houses of the farmers, markets and also good quality seed (obtained from Holetta Research Station).

Procedure:

Divide the participants in groups consisting of 4 to 6 people per group. Every group should be requested to examine the seed for quality & symptoms of disease. Inspect the seed lot and see if any symptoms exist on the seed lot e.g. fungal or bacterial infections

Seed lots with more than one percent of the tubers showing soft rot symptoms should not be used. The presence of late blight lesions on tubers could act as inoculum for new crop infections. Generally, a "five percent rule" applies to any seed lots. A seed lot with five percent or more total defects is too high to use. Each farmer should strive to use the highest quality seed obtainable. Know the source, history of a seed lot.

Let the members of the group grade tubers on the basis of their seed health and what they consider suitable for planting.

Exercise: Experiments on the Physiological age of seed.

Materials: The physiological age of seed is an important factor in choosing potato seed. Factors affecting the physiological age of the tubers include: growing season, stress, storage temperatures, and time. Temperature is very important because warmer storage temperatures will speed the aging process of the tubers.

To determine the physiological age of the seed potatoes, gather sample, place indoors and allow them to sprout. Allow the three groups of a farmer's school to observe the sprouts that come from the sample to determine the physiological age of the seed.

Dormant seed - If the potato does not sprout at all, they may still be in a period of dormancy. Most potatoes undergo a dormant or resting period. The length of dormancy varies with the variety. There are chemical and non-chemical means to break or greatly reduce the dormancy period.

Young seed - Young seed is characterized by apical dominance. Young seed will have one or just a few sprouts. These sprouts emerge from eyes on the apical or bud end of the tuber. There is a strong, internal inhibitor that keeps eyes on the center and stem end of the tuber from sprouting. Eyes distant from the apical end may never sprout. Young seed will produce a plant with few stems. A low stem number leads to a low tuber set. Larger, but fewer tubers will be expected from young seed.

Middle-aged seed - Middle-aged seed will have multiple sprouts. All the eyes on the potato could sprout. There is no clear apical dominance. Eyes from the bud end, middle and stem end will sprout. Middle-aged seed produces plants with multiple stems that lead to high tuber sets.

Old seed - Old seed will have branched sprouts that can appear hairy. These sprouts are weak, and will not produce vigorous plant. Typically, plants from old seed will produce high tuber sets, but the plants lack the vigor to bulk the tubers to a desirable size.

Potato No Top – Seed can be so old that small tubers form on the sprouts once they emerge from the eyes. Potato no top is the name given to this disorder of extremely old seed. Any stress during the growing season produces potatoes that are physiologically older than that without the stresses.

Exercise: Experiments in the moist chamber.

Materials: Samples of seed of different quality, "moist chambers", plastic bags, absorbent tissue, sterilized water (boiled and cooled), previously inoculated tubers and incubated by the facilitator, photos of tubers with symptoms of late blight. Potato tubers with symptoms of soft rot, (if any available), photos of tubers with symptoms of blight, etc may be shown.

Procedure:

Activity: The quality of the seed.

Materials: Some potato seed samples of various qualities. These can come from the warehouses of the farmers, of the market and also of the quality seed that will provide the school. These materials should have been collected in advance to the session.

Procedure:

Divide the participants in groups of 4 to 6 people each. For every group, the facilitator should give samples of the seed to the farmers and discuss if the seed is good or bad. Identify all the problems that are associated with the seed quality.

Then the facilitator should request that each group explain or identify the advantages, disadvantages, and problems of the seed. According to the problems identified by the farmers, the facilitators can ask specific questions such as:

- Have they found any / some insects within the seed?

- Can the seed transmit diseases, such as late blight?

- How would they recognize if their seed has late blight?

- Is seed emergence an excessive problem or not, why?

- When the seed is very "dry" (dehydrated) is it a problem, why?

- With what frequency does the farmer purchase the seed?

- With what frequency does the grower select the seed from his / her own field, what type of tuber are selected for seed, and why?

- How many farmers will plant the same seed before purchasing again?

- Which is the price that the farmers pay for new seed, is it very expensive?

- How does the farmer store the seed of its field?

Each question should be discussed briefly in order to identify how much they know the farmers on the subject of the quality of the seed.

It is necessary to recall that the facilitator at no time should assume the talk and begin to say or explain to the farmers what is a good or poor seed. The farmers should go on discovering the concepts and exchanging of ideas and experiences among them, which will be clarified with the establishment of small experiments.

NOTE: Three weeks before the session, the facilitator should collect different seed types e.g. farmer seed samples, seed from markets. Of these samples, some of the tubers should be inoculated.

- Preparation of seed samples should be done using the normal procedure – choose clean and damage or diseased seed.
- Soak the paper towel with distilled water and place in plastic tray boxes. Place some tubers on the moist paper and leave them (incubate) through out the night.
- Before the session, the facilitator will review samples from clean seeds and unclean or diseased seeds in order to see if there is evidence of infection (by visual inspection).

The participants will be divided into groups from 4 to 6 people and to every group will be given the tubers of the samples. Every group will visually analyze the tubers and describe the observations they have made both on external and internal parts of tubers. Then each group will present its observations. The facilitators should be attentive in order to motivate the exchange of ideas. It is necessary to recall that with this exercise the farmers should deduce by themselves that the seed can transmit diseases e.g. bacterial soft rot, late blight.

If there are tubers with visual symptoms of bacterial maceration or soft rot (whitish discharge), these should also be taken to the session in order to analyze it with the farmers. If there are no tubers, it will be necessary to show the photos with the symptoms of maceration and ask whether the farmers have seen these symptoms, and whether they know what it could be.

Some questions will be raised for discussion; these key points can be used for future research, with reference to knowledge, attitudes, and practices of the farmers. These questions can be:

- Can the farmers detect late blight tubers?

- Do they know (the farmers) that this is the same disease that occurs in the foliage?

- What do the farmers do with the diseased tubers? (Do they burn them? Do they pile them up? Do they bury them?)

Second part of the session:

Subject: Small supplementary experiments

Objective: In the second part of the session, the farmers can propose or think of some supplementary experiments in order to test their understanding / hypotheses with regard to the quality of potato seed.

Notes for the facilitator:

Taking into account the subjects dealt with in the quality of the seed and the possibility that the diseases and insects can be transmitted through potato seed tubers, the farmers can have a number of questions and /or problems on the management of the seed-borne diseases and pests. For these cases, they can propose small experiment in the field in order to find the responses.

Supplementary experiments

- Planting of clean seed (non-infected seed) and infected or diseased / soft rot infected seed e.g. Awash or Menagesha
- Obtain soil and plant clean seed (non-diseased potato seed) as well as diseased seed (from infected plants)

N.B: It is necessary to recall that there are factors that influence the quality of seed other than late blight disease e.g. bacterial soft rot. Others include the pests transported by the "seed" (for example the potato tuber moth observed during harvest and of storage.

Supplementary Activity (Demonstration activity)

Site selection: History of the field (free of known soil-borne pathogens / bacterial wilt, previous crops)

- Seed bed preparation (timing of planting
- Planting (plant spacing & row width)
- Initiate discussion with the farmers on the best time for planting

Site selection (History & soil types)

The history of a field to be used in potato production is very important. The soil should have a history of no bacterial wilt or other soil-borne pathogens. The previous crops should not have solanaceous crops such as tomato, and egg plants.

Soil types and their management

Objective

Participants will observe and determine soil types suitable for potato production and know how soil types & management affect crop growth

Materials
Hoe, compost, spade, poster

Activity

- Farmer should collect soil samples from different parts of potato fields (top of hills, ridges, bottom of valley e.t.c.)
- Allow farmers to observe the soil samples & classify them according to their scheme
- Allow farmers to classify them based on color of soils
- Which of the soils do they think are suitable for potato cultivation? Can they distinguish good soil type based on color or texture?

Field or Seed bed preparation
A good field or seed bed preparation is a pre-requisite for quality seedling which is in turn a key factor for good yield.
Objective
Participants will understand the advantages of a good seed field (seed bed) and identify the materials required for clean field.

Materials
Hoe, marker, spade, poster, straw, compost / cow dung e.t.c.

Activity
Facilitator can introduce the topic by asking participants questions pertaining to their knowledge.

- Which fields / soil type is suitable for planting potato (seed bed)?
- What inputs & materials are used in field preparation (seed bed)?
- Do you use compost / cow dung in field or land preparation?
- Is good tilling or cultivation required for land preparation?

Questions for discussion – Crops, potato & diseases

a) What crops do they plant and the relative importance of the potato? What rotation do they use? Use the flip chart in order to write or draw the responses.

b) Which is the source of their potato seed? How many seasons do they plant new seed and its descendants?

c) Compile a list of diseases and insects they have found in their potato fields last year and classify them as harmful, or less / non-harmful.

d) Can they indicate where or how these diseases or insects appear or are present in their field of potato?

e) Do they know the difference between a disease and an insect?

f) What is late blight and what damages can it cause to the crop?

g) Can they recognize from these photos which ones are late blight and which ones are not ?

h) What parts of the plant can be attacked by late blight? Do they know that tubers can be affected by late blight? Does late blight damage occur every year?

i) Do they know other diseases such as bacterial wilt? What damage does it cause to yield?

j) For the list of insects and diseases that have been outlined above, how does it rank in terms of damage and in order of control?

k) For each insect or disease, can the farmers the control practices. If any chemical products are mentioned, ask the name, dose by bag and the number of applications. If varieties are mentioned as resistant or susceptible, write the names of the varieties. Try to ask the details on each control practice, and especially if they have obtained good results and why they believe that the results are good.

l) Do they know something on the effects of the pesticides against the health of the people and the animals? Do they take precautions when they apply?

Questions for discussion – Control of late blight disease

a) When does late blight attack occur ? In what season does it occur more ?

b) Does late blight (is the disease) more prevalent in some locations e.g. valleys or besides hills ?

c) What do they do for late blight control ? (Each member may state what they did for disease control in the previous season), why and how ?

This activity needs a great deal of care on from the facilitators, since its principal function will be to motivate the discussion and try to note what the knowledge, observations and the opinions of the farmers are. Let us understand that many of the things that the farmers say during this session can be used further on as examples at the subsequent sessions of training. It is important to collect all the flip charts, drawings, and notes of the farmers trying to identify them with the name of the group, the date, community and if it is possible the names of the participants.

N.B: The survey work (farmer's knowledge & practices) can begin during the week of session 2.

- Also use the control group of non-participants for the survey questionnaire

Session 6

Symptoms and Diagnosis of Late Blight and Other Potato Diseases

Introduction

This session gives the farmer the opportunity to recognize different types of symptoms on potato plants in the field and study them with the aid of a hand lens. Additionally, the farmers will incubate (put) the leaves with different symptoms in moist chambers (plastic containers) for observation.

1. Activity: Symptoms – Diagnosis of plant disease

a) **Purpose**:

For the facilitator:

- Agro-ecosystem analysis

- Determine if farmers can distinguish between symptoms & several types of diseases and insect pests on potato

- Determine the potato diseases in the area & how many farmers know about such diseases (e.g. late blight) as well as its management

- Encourage farmer's interest in learning about the disease

For the farmers:

- Learn to recognize and differentiate the typical symptoms of various classes of pests and diseases (bacteria, fungi, nematodes, or virus).

- Learn about the diseases present in their fields

Materials:

Potato plants with symptoms (one per pathogen type or one per group), colored markers (one set per group), magnifying glasses (one per group), poster paper and carton or board on which to draw (one per group) and plastic containers, Petridish.

Note to trainer:

This is a practical way for farmers to diagnose some common diseases, and it is also a good group building exercise. Participants should form a small group to permit more active involvement. Groups should study and draw diseased plants, present them, and compare findings. Drawing provides a way for people to internalize what they observed. Farmers study symptoms with their eyes, interpret what they see with their minds, and reproduce the effects of the disease with their hands.

Trainer can conduct the exercise in various ways. If there is ample time, all groups can study the symptoms in plants caused by the same pathogen type, for instance fungi and then bacteria e.t.c. Nevertheless, to save time, the FFS is usually broken up into four groups, assigning each a plant diseased by one of the four pathogen types (fungi, bacteria, nematodes & viruses). Later, to generate a dialogue / discussion on a particular pathogen, the corresponding group can present and explain their observations to the overall group.

It is suggested that the facilitator select specimens that revealed classical disease symptoms e.g. late blight. During pre-course visits, we identified plant material available at sites, and sometimes it is necessary to bring our own disease plants. Facilitators should demonstrate care & patience because some farmers may not normally see the details of extreme symptoms. A magnifying glass, careful questioning, and perhaps a youthful eye (many older people usually have poor vision) can help to reveal distinguishing details.

Depending on group dynamics, trainers or facilitators can alter rules to improve participation. For instance, we sometimes assigned one color (not to be exchanged) to

each member of a group. To develop communication skills, encourage observations & interaction among farmers.

Fig: Symptoms of late blight

Procedure (Activity):

• Field visit

Select disease specimens beforehand.

• Divide participants into small groups (4 to 5 people / group). Provide each group with markers, poster paper, drawing board, and magnifying glass.

• Late each group explain in different forms what they observe one diseased and one healthy plant (do not inform them of the cause of the disease), and ask them to study and compare the plants with the magnifying glass for 15 minutes. They should take notes on what they consider which environmental factors are associated with plant disease, including neighboring plants, insects, etc. Visit groups and ask questions that help reveal details.

• Ask each group to produce drawings of the disease symptoms, including important contributing factors. Each member draws. Visit groups to assure that they are noticing important details. Drawing takes about one hour.

• Later on focus the discussion on a particular pathogen type, the corresponding group presents its drawing to stimulate discussion of that pathogen.

E.g. Each group describes a type of symptom and notes its diagnosis / observation. What is this? What causes it? What is its damage to yield? What should be done for control?

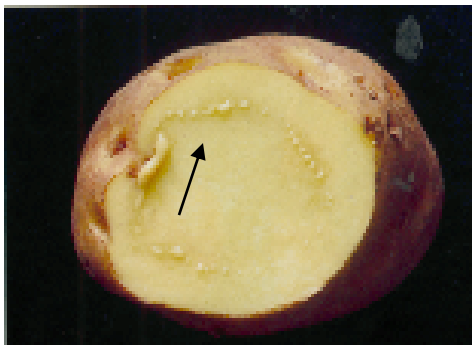


Fig : Symptoms of Bacterial wilt on the leaves and tuber

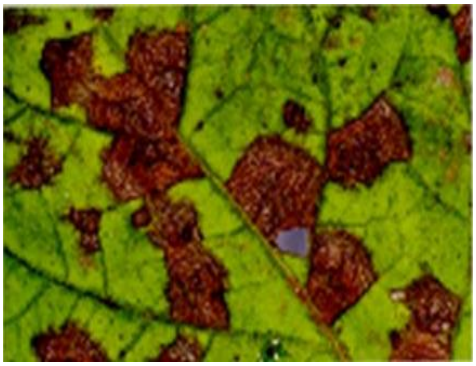


Fig : Symptoms of Early blight on leaves and tuber

Fig : Symptoms of Potato leaf roll virus

Fig: Symptoms of Potato virus A and Y.

Discussion:

- Divide groups into four smaller groups, and assign each a pathogen.
- Provide each group review material for each pathogen, poster paper, writing board, and markers.
- Ask each group to briefly review its pathogen for about fifteen minutes: Think about disease symptomology (Where do symptoms start? What do they look like?) and biology (How does it get around? How does it reproduce? What does it need?). Visit groups and respond to questions.
- Ask each group to select a recorder and to create a brainstorm of opportunities of managing fields to the favor of plants and suppress pathogens. Visit groups regularly and ask questions to stimulate more ideas.

Sessions 7

Late blight disease development and its relation to the environment

Introduction:

As it was indicated previously, the principal part of each session from now on will be the agro-ecological analysis or detailed observation of the potato farm. In this session the study of the environmental factors that influence late blight development, the concept of fungus and of its forms of reproduction will be introduced. In this session the concept of integrated pest management (IPM) will also be also be introduced.

First part of the session:

Subject: The "agro-ecological analysis" or detail observation of the farm.

Objective: To observe and analyze the agro-ecosystems and diversity of the potato field plots.

Notes for the facilitator:
This session will be conducted in order to create awareness in the farmer and habit of detail observations of what occurs in the potato field or plot. This is based on the fact that with good field observations, better management decisions and problem solving ability can be made by the farmers at their specific locations.

Activity: Learning to observe the farm (duration half an hour).

Materials: Paper, pencil or pen, boards, loupes, plastic bags or of paper, small plastic trays for the collection of samples.

Procedure:

The participants will be grouped into individuals of 4-6 people who are invited to visit the experimental field of the Farmer Field school. The groups will be the same those formed in the previous session. The groups should observe the same plot and draw the observations on the plant and surrounding of the plot.

It may be explained to each group that the activity consists of: drawing of a plant, the soil, the weeds, and the insects that are observed on the potato leaves or in proximity of the plant (the insects should be classified as good or bad - according to criterion perceived by farmers), the symptoms of diseases in the leaves or stems. They should try

to draw everything that they observe. They should also collect samples of the insects or symptoms that find.

After half an hour of observation in field, it is expected that all the groups should come together in order to present their drawings, observations and the collected samples. The other participants can ask questions or clarifications. The facilitators should be attentive in order to clarify some doubts or in order to propose with the farmers small tests in order to confirm the observations. In this part, it is important to make sure that the farmers are capable of and can distinguish among the symptoms of late blight and the symptoms of other leaf diseases.

In addition, it is important that the farmers begin to distinguish the symptoms related to the insect attack of the potato tuber moth or other insects e.g. leaf minor. This is clearly visible since there are readily observed in the potato leaf. It is possible also that insects such as caterpillar / cut worms, aphids or others, should be included in the observations. It is also important to distinguish the symptom related to insect attack on potato roots compared to bacterial wilt of potato.

At the end of the exercise of sharing of ideas / opinion among all the participants, some conclusions on the management of the field can be drawn. For example, if the climatic conditions are favorable for late blight (a great deal of rain, R.H. and low temperature) it is necessary to be attentive or to initiate the application of contact fungicides. However, it is necessary to recall that the conclusions that are drawn from the session should help the farmer to utilize appropriate practices for disease and pest control in their own potato plots.

Second part of the session:

Subject: Late blight and the environment.

Objective: At the end of this section the participants should identify the environmental factors that influence the development of late blight. They should have a clear idea of what the fungus is and how it reproduces.

Notes for the facilitator:

In this part of the session, the sharing of experiences should be aimed at learning of the factors that affect and facilitate the attack of late blight. Taking into account that late blight is caused by a fungus, the environmental conditions most favorable for their development are related to: excess of moisture caused by a great deal of rain, mist. The combination of moisture periods (high relative humidity) and sun (optimum temperature) seem to accelerate the development of the fungus and the disease.

Normally the farmers know the conditions that are favourable for disease development, however they do not recognize that a fungus is the causative agent of the disease. In this part, the discussion should be oriented to identifying the environmental factors or also factors of soil (very moist) or of a great deal of plant density and variety susceptibility that can favor the development of late blight. Afterwards we will go on to explain that the

true cause of late blight is a fungus and will involve it showing or observation of the fungus with the aid of hand lens or microscope.

Activity: The environmental factors that affect late blight disease and the causal agent of late blight.

Materials: Flip chart, markers, young foliage of potato plants with clear symptoms of late blight, hand lens / microscope and loupes, role and pens.

Procedure:

-To work in groups of 4 to 6 people. Each group should list the factors that favor late blight disease. The farmers should list factors that include climatic factors (rain, mist, temperature, etc), or other factors that in their opinion can influence in the development of the disease.

When a list of factors proposed by the participants is available, they can be separated into groups depending on whether they cause "more late blight" or "less late blight." Then questions to be asked can be as:

- What is the cause of late blight?

- Why is there more late blight when there is more rain?

- Is late blight caused by an insect?.

- If late blight is not cause by an insect, what causes it?

After having listened to the responses of the farmers to these questions, samples of potato leaves containing late blight symptoms can be delivered to each group especially with symptoms with heavy spore production.

-It is recommended that each member of the group observe the fungal sporulation on leaves with the assistance of hand lens and field microscope. This can be done by rinsing the spores from the tissues with spores in a little water and then the spores are observed with a hand lens or field microscope. The farmers should be asked to draw what they observe in the microscope.

When all the farmers have observed the fungus and have drawn it they can be asked about :

- What they have observed?

Possibly, none or few of the participants will say that what they observed was a fungus; as a result the facilitator should introduce the concept of fungus and try to explain that it is a type of usually very small plant that feeds on other plants, as the potato.

The facilitator can tell the farmers that there are other fungi that grow normally in the field, others grow in kept bread (common mold – *Rhizopus spp.*). There are also fungi that cause diseases on people, such as the fungi that grow in the feet, among the fingers, and cause a great deal of itching. The fungi usually grow in very moist places. Hence, late blight attacks more when there is more moisture.

After this, the facilitator may ask them again:

- What causes late blight?

It is expected that the farmers can deduce from this observations that late blight fungus is found on the leaves of infected potato plants and is activated by the moisture. In order to strengthen this conclusion, a large drawing based on the drawings of the farmers can be made in order to explain that late blight has a life cycle as all the live beings.

-It is necessary to explain that the cycle of late blight begins with a spore (that is the seed), it is small and easily dispersed wind and water. This spore is what the farmers have observed and drawn in the microscope. This spore needs moisture in order to germinate on the potato leaves, then that germinates and its "roots" (haustorium) penetrate the potato leaf and begins to feed on the leaf until they kill it, hence are seen as the brownish spots which eventually becomes the dead part of the leaves. As the fungus feeds on the leaf, it grows and also begins to reproduce. The fungus produces millions of new seeds or spores (that is the ash that the farmers have seen on the other side of the leaves). These spores or seeds are disseminated to other leaves of the same plant or of other potato plants dispersed by the wind and the rain and it begins again its cycle of life.

In order to strengthen the concept of life cycle of late blight, some small demonstrations can be caused that they consist in rinsing with water the slate blight pores from the surface of leaves. The spores can be used to inoculate healthy leaves and tubers of potato, which can be placed in plastic bags or plastic trays in which moistened paper towels are placed. Every group should take one or more plastic bags in order to observe what occurs and can submit a report in the following session.

Activity: Demonstration on the factors favorable for late blight development.

Materials: Several ply-cards, marker, flip chart, adhesive tape.

Procedure:
Cards are made available and in each card, a factor that favors or unfavorable for the susceptibility to late blight attack is written on it. The following are written on the:

- Sufficient rain.
- Little rain.
- A great deal of sun.
- Little sun.
- Mist / fog.
- A great deal of wind.
- Resistant varieties (to place the names of the varieties).
- Susceptible varieties (to place the names of the varieties).

Then the cards are distributed at random to each participant who reads it out aloud and the factor or criterion is placed in the column that better seems to be more appropriate and indicative of its role. The facilitator will do a reinforcement of the result of the cards.

As guide for the facilitator the results should be presented in the following table in a flip chart

More late blight	Less late blight
A great deal of moisture	Low relative humidity
Rain	No rain
Variety - Awash	Variety – Tolcha
Mist / fog	Dry air / clear skies
Heavy soil	Light soils
Low temperature	Dry season (high temp.)

Session 8

Fungicide Application: Nozzle Selection, Spray Equipment Calibration and Safety Precautions in the Use and Storage of Fungicides

Introduction:

The success of chemical control (fungicide application) of late blight and other diseases is dependent on the following:

- Products (chemicals) used
- How (methods) of applications
- Critical period of treatment (fungicide application)

Utilization of proper equipment, calibration of equipment sprayers (correct adjustment of nozzles) and uniform spraying is essential for proper success of the control measure.

Objectives

-Learn the correct calibration of the fungicide application equipment

-Utilization of adequate nozzles

-Improvement of fungicide application for late blight control (correct dose, application timing)

-Utilize proper protective equipment for chemical application & know the consequences for use of non- proper equipment.

First part of the session:

Introduction to the chemical control of diseases and insects

Objective: At the end of this part of the session, the farmers will have an idea on the advantages and disadvantages of the chemical pest control.

Notes for the facilitator:
Chemical control is one of the methods best known by the farmers for disease and insect control. In the first session a list of control practices used by the farmers, including the use of insecticides and fungicides were recorded. The facilitator should review the notes from the first session in order to be able to use the examples mentioned by the farmers.

The idea is to show that there are different types of chemical products used for disease and pest control. For example, that there are fungicides for fungi, and insecticides for insects e.t.c.

However, it is essential to be quite explicit in order to mention that the chemical control has some negative effects for the health of the people and of the animals. Actually it should be concluded that, pesticides are poisonous.

Materials

- Back-pack sprayer in good condition

- Sprayer in poor condition (cover does not close well, valves in poor condition, plugged nozzles)

- Nozzles: fan and solid types, ink

- Potato plants with late blight

Exercise 1- Procedure with nozzles (nozzle selection)

- Fill the good sprayer with clean water

- Install the fan nozzle (teach the farmers the correct form of placement)

- Spray a flat area at intervals showing coverage by the nozzle

- Change to a hollow cone nozzle and repeat the operation

- Discuss what is being observed

With regard to the types of nozzles, the farmers should be shown the types of cones that exist noting clearly the differences in the form and application coverage of the different types of nozzles.

Exercise 2 – Calibration of the back-pack sprayer

- Measure a defined area in the field where fungicide will be applied e.g. 30 m^2

- Pour into the sprayer a known volume of water

- Spray the defined area of the field (30 m^2) at constant pressure

- Measure the volume of water remaining so as to calculate the quantity utilized in the sprinkled area

- Repeat this procedure 4 times and calculate the average water used e.g. 1 liter of water for 30 m^2

- Determine water use per hectare (1 liter / 30 m^2)

10,000 m^2 = 333 lit / ha, so 333 liters of water are needed per hectare in order to apply the fungicide

Calculation of the quantity of water and fungicide needed to cover the area o be applied

e.g. Area to be sprayed : 0.5 ha; discharge of the sprinkler: 400 liter / ha

Exercise 3 – Demonstration of the consequence of the use of a sprayer in poor condition

- Fill the sprayer in poor condition with water mixed with ink
- The volunteer applying the product should put on a test clothes
- Spray the plants
- Observe if the mixture has spilled onto the worker's clothes and if it has been wetted by contact
- The worker's clothes should be submerged in water to wash them – observe the clothes
- Observe the upper and lower sides of the applied leaves
- Teach the correct maintenance of the sprinkler (washing sand storing)

Questions for discussion

- What types of nozzles should be used to apply fungicides to plants ?
- What happens if more or less quantity of fungicides is added ?
- Did the fungicide reach the underside of the leaves where the fungus sporulates ?
- Were the stains removed from the spots on the clothes used during the fungicide application ?
- What will happen if adequate clothes are not used ?

Session 9

Reaction of potato varieties to late blight under fungicide management strategy

Introduction

This experiment is the most important activity of the curriculum of the farmer field school. We will test a set of varieties / clones for resistance to late blight. We will use a fungicide for the control of the disease and find out which variety is better in the level of resistance under the environmental conditions of the locality of the farmers.

Objectives of the experiment

a) To test a set of promising `clones` and varieties of potato, under local conditions.

b) To monitor the disease and the environmental conditions through the data collection.

c) To use the experimental field as principal educational materials.

Materials

a) Seed for the following varieties

- CIP-392649.516
- CIP-392650.516
- CIP-386423.13
- Kp-90134.2
- Jalene /Standard check/
- Susceptible check

b) Fungicides:

- Ridomil MZ 63.2 % wp – 2kg/ha

Procedure:

a) Selection of the experimental plot for experiment.

b) Required space

→ Each experimental unit (variety) will consist of 100 plants. These will be planted in five rows of 6 meters each (30 cm between plants and 0.75m between furrow = 3.75 m x 6 m = 22.5 m^2)

→ We need some land, at least 0.25 hectare, in order to establish a seed multiplication farm for the participant farmers as a learning site and seed source.

c) The plots (s) should be reasonably located or desirable for the group; preferably near to the place of meeting for the group.

d) Establishment of the experiment.

- The experiment will be established in split plot design where fungicide is a main plot factor and the varieties/ clones as sub-plot factors.

e) There will be three replications.

f) The fertilization, weed control and other cultural practices will be the same as that used by the farmers.

g) Parameters for evaluation include:

1-Characteristics of the plant

→ Emergence dates of the plants / other growth parameters

2-Disease (late blight) parameters

→ Disease incidence on the foliage and tuber

3-Production / yield parameters

→ Weight of commercial tubers

→ Weight of tubers not-commercial

4- Quality and characteristics of potato tubers.

5- Data on the environmental conditions should be taken in order to better understand the results that we obtain.

Session 10

Insect Management in relation to Potato Production

This section with highlight the major insect pests of potato crop and their central measures to participant formers in addition, it will classify the effect of insect pests on the quantity and quantity of the produce, it will describe the importance of using integrated potato insect pest management in controlling potato insect pests.

10.1 Identification and classification of major potato insect pests

Objectives: - At the end of the session participants will identify major insect pests of potato crop and their ultimate effect on the yield of the crop.

Time Needed: 1hr

Materials: - plastic bags, Magnifying, insect damaged parts of potato plant and pictures showing them.

Activity

1. Revise the previous session and take opinions of participants
2. Brief the day's activity and procedure for participant farmers
3. Form 4 - 5 groups
4. Make each group visit the field session fields
5. Tell farmers to collect insects found on the crop during field visiting
6. Tell farmers to Categorize the insects collected in to beneficial and harmful.
7. Tell farmer to name the insects using their local name
8. Each group should collect the parts and make a discussion on the result.
9. Wrap-up the session of the day by summarizing the mach pots raised and consensus reached

Fig : Aphids

Fig : Signs of Potato tuber moth damage

Fig : Signs of cut-worms

Fig : Red ant damages on potato tubers

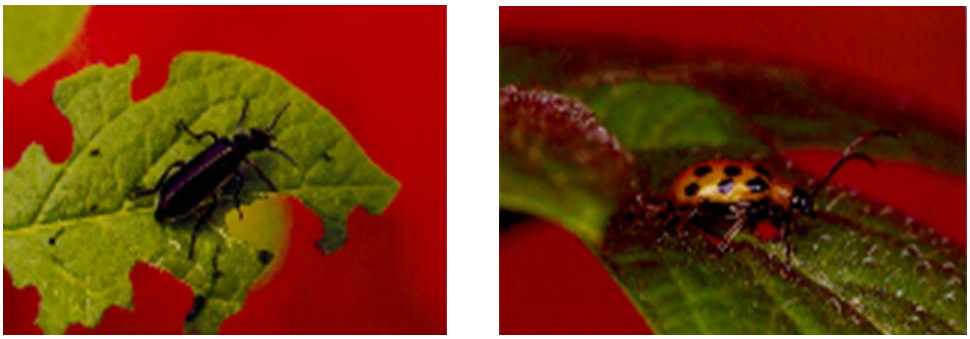


Fig: Potato beetles and their damage on leaves

Question for discussion

1. What are the major insect pests found in the area?
2. On which seasons are the pests active?
3. What kind of damage do the insect pests cause on the crop?
4. Are there any other host crops for the insect pests?
5. Where and how do the insect pests breed?
6. Which developmental stage of the insect pest will cause damage on the crop?

10.2 Control measures for major insect pests of potato

Objective: -

At the end of the training session participant formers will have good background on major potato pests and their control measures, and will inculcate this knowledge in their day-to-day activities.

Time needed: - 45 minutes

Materials: - flip chart, Markers, pictures of insect pests, damaged parts of potato by insects.

Activity:

1. Revise the previous session and take operation of participants
2. Brief the days activity and procedure for participant formers
3. Form four to five groups, with members from the past.
4. Group representatives should list the major insect pests raised in the past session.
5. Make a discussion for 20 minutes on control measures for major insect pests of potato.
6. Representative then raise major parts of the discussion and present it to the whole group.
7. Wrap-up the session of the day by summarizing the main parts raised and consensus reached.

Question for discussion

1. How can we control aphids culturally?
2. How can we control potato tuber moth culturally?
3. How can we control cutworms culturally?
4. How can we control other insect pests of potato>
5. How can we control red ants?
6. What are the prospects and constraints of controlling insect pests using chemicals?
7. What are major chemicals used to control insect pest?

The facilitator is expected to list the major discussion parts mentioned above and facilitate the discussion to crop-up the session the facilitator should demonstrate participants how we can collect cut-worms and identify tuber moths in the store.

Session 11

Positive Selection and other harvest Considerations

There are many considerations to take into account when harvesting and selecting seed materials that a farmer should consider. In most cases, seed that is generated from basic or pre-basic seed material obtained from the station (e.g. Holetta), are of good quality, clean or free of diseases.

Successive multiplication of these materials by seed farmers (farmer based seed systems) or planting by other farmers will inevitably expose them to various diseases, pests and stress. Therefore, it is important that precautions be taken with regard to plant health, proper harvest and post-harvest considerations are taken into account by seed and ware farmers.

First part of the session:

Subject: Positive selection

Objective: To train the farmer in the marking of healthy plants, in order to obtain good quality seed from the marked plants.

Notes for the facilitator:

A good field is required to generate healthy seed so long as it is free of viruses and the crop is planted and grown in an environment with low levels of disease such as late blight, and virus. The small farmers should obtain tubers of pre-basic material, basic or of any category of quality seed from Holetta Research Station and this material should serve as a basis for future seed multiplication. Seed selection should be done on healthy vigorous plants. In order to multiply seed successively, a combination of positive selection, negative selection, choose of good clones, and appropriate combination of good management practices.

- Store separately
- Deholme and harvest first healthy plants

Activity: Selection of good plants (good agronomic traits / lack of disease)

Materials: Field of potato, stakes of wood, plaster, or striking color threads.

Procedure

This activity should be carried out before the flowering, by selecting better plants / vigorous growth and free of virus symptoms. This is done by identifying these plants with a visible or clear form and by using wooden stakes or flags of very visible striking color. If the plants are not in good condition, it is better to do a negative selection, by eliminating those plants that do not have the desired characteristics. Therefore, in very good potato fields, these marked plants can be used to initiate clonal materials.

The observation of the plants should begin after the plants have emerged completely and its characteristics and health can be observed clearly. Those plants that show the non-desirable characteristics should be removed in later observations and new plants can then be marked. The eradication of diseased and atypical plants is important way of assuring sources of contamination and atypical plants are destroyed.

In a situation where there is positive selection within a field these marked plants should be harvested first and placed in separate bags.

<u>Second part of the session</u>

Activity: Observation and causes of tuber blight of potato

Materials: Moist chamber, clean tubers, cork borer, fungal isolate (late blight)

Participants will be required to inoculate potato tubers with late blight isolate, incubate / place in moistened chamber and observe the following week.

Facilitators should allow the participants to dig a few potatoes from end rows to check for the presence of tuber blight.

Questions should be raised concerning the causes of tuber blight, problems of tuber blight in storage and means for controlling tuber blight (e.g. hilling).

Session 12

Evaluation of Gains and Losses of the Experiment

Introduction:

At this session the results of the experiments will be analyzed in economic terms. That is it will be determined which treatment (variety or `clone` and dose of fungicide) is the best in economic terms for the farmer.

NOTE: Before beginning this session the facilitator should have done the calculations of production costs and the yields by parcel found expression in kg per hectare, or so that it is easier to visualize in number of sacks per hectare.

First part of the session:

Subject: The production costs.

Objective: The participants will understand how the production costs are calculated and which are the components of the cost.

Notes for the facilitator:

The farmers usually adopt a technology when it is more profitable than the traditional technology. In the case of control of late blight, the profitability can be observed in four aspects. First one is whether a new variety or `clone` yields more than the variety that is planted commonly in the area. Second, are the treatment with fungicides effective for the control of late blight in such a way that the variety treated yields more? Third, does a variety that is resistant needs less fungicide (saving of cost)? Finally (but not least important), what is the rate of the new variety acceptance in the market, and is the price competitive?

In this part of the session we will analyze the production costs in the treatments used in the experiments of the field schools.

Activity 1: What are the production costs?

Materials: A calculator, markers, flip charts, pencil, or pen.

Procedure:

Divide the participants in groups from 4 to 6 people each and to distribute to each a flip chart and a marker. Then to request them for a list of all the expenditures that have conducted in their fields of potato, from the preparation of the land up to the harvest.

After some 15 group work minutes, the farmers possibly have a list including aspects as:

- The land.
- The seed.
- The labor.
- The fertilizers (if they have been used).
- The "costs" insecticides and fungicides).
- The transportation.

In the labor, cost of the labor of the family (that does not receive payment) and the contracted labor (that receives payment in money or in product) can be separated. They can be asked to regarding their opinion, whether the labor of the family should be included in the production cost or it should not be included.

Activity 2: Calculating the production costs?

Materials: A calculator, markers, flip charts, pencil, or pen.

Procedure:

After the farmers have indicated the components of the cost. It will be proceeded with they themselves to calculate the cost of production of one of the treatments estimated per hectare. This can be facilitated if cardboard figures are made in order to represent the yoke (of oxen), the labor (example, a farmer with its shovel), sacks of fertilizers, sacks of seed (or potatoes seed) and the "remedies." Then it can go itself filling the data with following Table 1 (to pass the table to a flip chart).

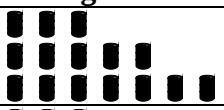
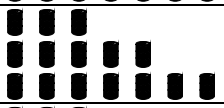
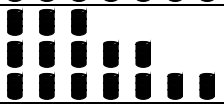
Table 1: Example of calculation of the production costs for each treatment (an example)

TREATMENT Nº 3: Variety Tolcha, with 6 contact applications.

Activity or input	**Unitary cost s/.**	**Used units**	**Cost s/.**
Preparation of the soil	15.00/day/yoke (of oxen)	6	90
Labor for soil preparation	8.00/wage	8	64
Seed	1.00/kg	1200 kg	1200
Fertilizers: - Urea - Other	 40/sack 10/sack	 4 20	 160 200
Labor for seeding	8.00/wage	10	80
First costs	8.00/wage	20	160
Second costs	8.00/wage	25	200
First fungicide treatment: - Dithane: - Labor	 30/kg 8.00/wage	 0.5 2	 15 16
Second fungicide application: - Dithane: - Labor	 30/kg 8.00/wage	 0.5 2	 15 16
Third fungicide application: - Ridomil: - Labor	 50/kg 8.00/wage	 0.5 3	 25 24
Fourth fungicide application: - Ridomil: - Labor	 50/kg 8.00/wage	 1 4	 50 32
Harvest	1bag of potato (s/. 4/wage)	20	80
Selection and transportation	8.00/wage	6	48
TOTAL			2721

After having done the calculation for a treatment, the facilitator will have list a table with the costs of all the treatments, so that it is clear what has been spent more. To use as an example Table 2.

Table 2: Example of Fungicide costs in the experiments.

Variety	Kilograms /for unit of fungicide/	Cost of fungicide
Jalene		
Tolcha		
Gudene		

<u>Second part of the session:</u>

Subject: Calculating the gains.

Objective: The participants will understand how the profits or net income are calculated according to the results of the experiments.

After calculating the production cost per hectare, the gross income would have to be calculated. To this end there is a need for knowing the yield of potato by plot and the price of sale of the potato at the time of the harvest and if there would be differences of price due to the sale at this time.

Example for calculating profits:

Table 3: Calculation of the net income by treatment.

Nº of treatment	Variety	Dose of fungicide	Gross income *	** control cost	Net income***	Relation Income gross/cost****
1	**Tolcha**		**525**	**357**	**168**	**1.47**
2	**Awash**		**560**	**357**	**203**	**1.56**
.						
.						
.						
.						
5	**Gudene**		**2100**	**600**	**1500**	**3.50**
6	**Menagesha**		**2100**	**357**	**1743**	**5.88**

* The gross income is calculated multiplying the total yield per hectare by the price of the potato. Example 1500 kg x 0.35 = 525.

** The cost of control plot is the calculated in Table 2.

*** The net income is calculated as the gross income less the cost of control.

**** The benefit cost is calculated by subtracting the cost of the control from the gross income. If the value is greater than it indicates that there is some type of gain, if the value is less then it indicates that there was a lost.

SCHOOL EVALUATION

1. Review of the previous school day
2. School evaluation
   a. evaluation of practices and technologies
   b. school evaluation
   c. farmers recommendation for future schools
3. Closing of the school

EVALUATION OF FFS

WHY EVALUATION OF FFS?

- To be able to further improve the school curriculum, the schedule, and the facilitation process the school should be evaluated at the end of the school season.

LEARNING OUTPUT

- Farmers and facilitator will have evaluated the school schedule and curriculum.

OBSERVATIONS IN THE TEST/STUDY PLOTS AND FARMERS'FIELD
Agro-Eco System Analysis (AESA)

In FFS the field is

- where experimentation takes place and where farmers exchange their views on what they see,
- research plot where Farmers move to observe, to monitor changes, compare results, exchange opinions,
- an important place in the field school, where there is much sharing of experiences among the farmers

In addition, during the field visit you may introduce/facilitate the discussion on previously selected specific topic related to one aspect of crop management

LEARNING OUTCOMES

- Farmers will have measured indicators, and recorded monitoring data;
- Farmers will have observed, exchanged views, and compared results;
- Farmers will be able to identify and explain the effect of the tested practices on crop performance;
- Farmers will have introduced a new topic of special interest for them (if applicable).

Time needed: up to 1.5 hours

Steps

1. Ask the participants to form sub-groups (each responsible for a different test/study) for the field visit.
2. Walk with the sub-groups to the test/study plots and observe the conditions.
3. Ask farmers what they observe.
4. Promote discussion amongst farmers based on what is being observed focus on crop management practices, crop performance, and other farming related issues.
5. Be curious. Ask farmers questions that will promote discussion and exchange of information and opinion amongst themselves.
6. Assist farmers to collect and record monitoring data (use of indicators).

SOME SUGGESTIONS FOR LEADING QUESTION

- Are the agreed practices correctly applied in the experimentation plots?
- Do you observe differences in crop performance?
- What practices do you observe that increase potato yield?
- Do you observe any problems in crop production? What do you think are the reasons?

DISCUSSION ARISING FROM THE FIELD OBSERVATIONS

Returning from the field visit farmers

- gather at the meeting place,
- further elicit on their views on what they have observed during the field visit,
- Promote farmer-to-farmer exchange.

LEARNING OUTCOMES

- Farmers will have exchanged information on what has been observed during the field visit;
- Farmers will be able to discuss the data collected;
- Farmers will have shared their knowledge and explain the effect of the tested practices on crop performance;
- Farmers' confidence in experimentation and monitoring will have been increased.

Time needed: up to half an hour

Steps

1. Explain learning outcomes and the procedure of this exercise to the participants.
2. Ask one farmer from each group to summarize what they have observed and discussed during the field visit.
3. Ask the selected farmers to present the monitoring date collected. Promote discussion of the data.
4. Identify key points of their presentation and promote discussion on them.
5. Share your experience and knowledge on the topic being discussed.
6. If during the field visit you have noted an important/relevant practice present it to farmers for discussion.
7. Wrap-up, summarizing the main points discussed.

SOME SUGGESTIONS FOR LEADING QUESTION

- Where did each group go?
- Are the practices being correctly applied in the experimentation plots?
- Which late blight management pr practice did you observed?
- Do you observe differences in crop performance? What are the reasons?
- What are your group observations/ comments?
- What practices did you observe that improve late blight control?
- Did you observe any problems in crop production?
- Did you observe any improvement in crop performance?
- Which other farming practice did you observe and discuss?
- What data has been collected? Comment on quantity and quality of monitoring data collected?

T-CHART

Time needed 1.5 hour

Materials: Large sheets of paper or board, pencils, markers

Steps

1. Explain the learning output and the procedure of this exercise to the participants.
2. On a large piece of paper, draw one line down the middle and one across the top to forma a "T". On the top of one column, write "Needs to be improved". On the top of the second column, write "It's good".
3. Now ask the group to make a list of items in the training that fit under each title. Each point can be considered as it is given. Or you may use it like a brainstorming session in which only phrases are written with no comments.
4. Then go back and ask for clarification of each point with further discussion.
5. The points under "Needs to be improved" should be discussed with the aim of finding solutions.
6. Wrap-up, summarizing the main points discussed.

Note. This exercise can be conducted in plenary session or by forming sub-groups.

SOME SUGGESTIONS TO FACILITATE GROUP DISCUSSION

- Was the duration of the school appropriate?
- Was the length of each meeting appropriate?
- Was the time of each meeting appropriate
- Was the meeting place appropriate
- Was the time of each meeting suitable, especially for the women?
- Was the field practice appropriate?
- What do you think about working in groups?
- Did you find the plenary discussion appropriate and useful?
- Where the learning objectives appropriate?
- Was each selected topic adequately studied?
- Were the on-farm tests useful for identifying solutions to production problems?
- Was the language used by the facilitator (or resource person) clear?

APPLICABILTY OF THE SCHOOL

Materials: Paper, pencil markers, small groups

Time needed: 2 hrs

Steps

1. Explain the learning outcome and the procedure of this exercise to the participants.
2. Ask the participants to form small groups, 3-4 person to a group and to think about.
   - What they have learnt from the school and
   - What they have used/applied from their attendance during the school.
3. Ask them to divide a blank sheet of paper into sections with each section sized to show the relative importance of an aspect of the school as it appeared to them. They should label each section to show the learning/knowledge they gained.
4. Repeat the above exercise asking participants to indicate what they have used/adopted or applied from what they have learnt during the school.
5. After all drawings have been presented summaries the results and promote a plenary discussion.
6. Keep records of the answers to help you to improve the next school.
7. Wrap-up, summarizing the main points discussed.

SOME SUGGESTIONS TO FACILITATE GROUP DISCUSSION

- Which topic or session of the school did you find important (mention some topics explained during the school sessions)?
- Why did you find these techniques useful (or not useful)?
- Was farmer-to-farmer sharing of experience/information important?
- Do you have sufficient confidence to adopt what you have learnt on your own farm/in your own fields?

ATTAINMENT OF LEARNING OBJECTIVES

Materials Cards, markers, pins, tape

Time needed 1.5 hours

Steps

1. Identify in advance and prepare a list of the school learning objectives you want farmers to evaluate.
2. Explain the learning outcome and the procedure of this exercise to the participants.
3. Prepare in advance cards containing one learning objective that was the focus of one of the school sessions (for example: ability to describe a soil profile, ability to measure indicators). Write each selected learning objective on a number of different cards. You should prepare as many card sets as the number of groups.
4. Distribute the set of carts to each sub-group.
5. Ask the groups to sort the cards congaing the learning objectives according to learning, use usefulness (have learn it, I have used it, it was useful)
6. Paste the cards according to the sorting on the board or large paper for all to see.
7. Explain the resultant ranking through plenary discussion
8. Keep records of the answers to help you to improve the next school.
9. Wrap-up, summarizing the main points discussed.

Note: this exercise could alternatively be done in a plenary session.

SOME SUGGESTIONS TO FACILITATE GROUP DISCUSSION

You can find the school learning outcomes in this manual on the firs page for each school session and at the beginning of each exercise.
Example: if you have chosen the learning objective “Farmers are able to describe the cause of late blight”.

- Were you able to learn how to identify clean seed?
- When you went back to your farm did you selected your seed before planting?
- In doing that did you discover something that you did not know before about potato?

Example: if you have chosen the learning objective “Farmers have prioritized crop production problems”.

- Where you able to learn what are the main crop production problems on your farm and in your community?
- Did you analyze your own production problems?
- Did you discover/ learn something that you did not know before about production problems?

QUESTIONNAIRE

When using a questionnaire:-

- Consider the literacy level of the group, and their knowledge of technical terms,
- Terms used in one village may not be the official names used nationally and this can lead to confusion,
- Written questions must be tested for clarify beforehand, and checked to ensure local applicability.
- Remember not to be academic about names, or definitions.
- Be practical and keep the questionnaire focused on real issues, skills, and knowledge.

Materials: List of questions, paper, pencils

Time needed: 1 hour

Steps

1. Prepare the questionnaire in advance.
2. Explain the learning outcome and the procedure of this exercise to the farmers.
3. Distribute the questionnaire to each farmer and allow time for clarification.
4. Collect the results and analyze them overnight.
5. Present the farmers with your observations and promote discussion so as to clarify and reach a consensus on each reply they gave in the questionnaire.
6. Alternatively (from step 2) you may also form sub-groups and ask each group to discuss and reply to the questions. Then ask each group to present their answers and promote discussion so as to clarify and reach a consensus on each question answered.
7. Keep the questionnaire for your records. This will help to improve your next school.

SOME SUGGESTIONS FOR QUESTIONS

In the manual look at the learning outcome of each exercise and ask questions to learn if the farmers were able to acquire the knowledge, skills or attitude specified by the learning objectives**.**

- Related to school curriculum and schedule:
- What did you like most about the school?
- What did you not like?
- Which was the most important lesson you learnt?
- What did you find difficult to understand?
- What main obstacle do you anticipate in applying what your have just learnt?
- What are you suggestions for improvement
- What do you consider was the most valuable experience you had at the school?
- Why is that?
- What aspects of the school could have been strengthened?
- How could that be done?
- What other comments do you have?

BEFORE AND AFTER PICTURE

Materials: Sheets of paper, pencils

Time: 2 hour

Steps

1. Explain the learning outcome and the procedure of this exercise to the farmers.
2. Give a large piece of paper to each person (or group)
3. Ask them to divide the paper in half. On one side draw something that represents your life before the training, and another item which represents your life afterwards.
4. After the drawings are completed, ask each person or a representative of each group, to explain their drawing.
5. The facilitator should record the explanations.

SOME SUGGESTIONS FOR QUESTIONS

- What did you like most about the school?
- What did you not like?
- Which was the most important lesson you learnt?
- What did you find difficult to understand?
- What main obstacle do you anticipate in applying what you have just learnt?
- What are you suggestions for improvement?
- What do you consider was the most valuable experience you had at the school
- Why is that?
- What aspects of the school could have been strengthened
- How could that be done
- What other comments do you have**?**

Annex: BASE LINE SURVEY QUESTIONNAIRE ON LATE BLIGHT AND CUT WORM AND OTHER INSECTS CONTROL AND OF POTATO PRODUCTION

Name:

Village:

Sub-county:

1. Have you ever grown potatoes? Yes/No

2. If Yes, since when? …….

3. What potato varieties do you grow? ……..., ……,

   ……..., ……, ……..

4. For each of the varieties grown, what is the source of the seed and what are the reasons for choosing
   those varieties?

Variety **Reasons**

a…….…….

b….....……

c……..……

d…….....……

e…….……

5. What problems do you face in growing potatoes? (In order of importance)
   a. b.

   c d

   e. f.

6. Name pests and diseases of potato in your fields in their order of importance.

a. Late blight	1. 2. 3. 4. 5. 6
b. Soft rot	1. 2. 3. 4. 5. 6
b. Bacterial wilt	1. 2. 3. 4. 5. 6
c. Alternaria	1. 2. 3. 4. 5. 6
d. Cut-worms	1. 2. 3. 4. 5. 6
e. Millepeds	1. 2. 3. 4. 5. 6
f. Potato tuber moth	1. 2. 3. 4. 5. 6
g. Aphids	1. 2. 3. 4. 5. 6
h. Others	1. 2. 3. 4. 5. 6

7. What other crops do you grow? In what sequence are they grown ?

a.	g
b	h
c	i
d	j
e	k

8. Do you keep some land under fallow? Yes/No. If yes, for how many seasons? 1, 2, 3, 4, >4

9. After fallowing, which crop do you grow in the first 3 seasons?

a. season 1
b. season 2
c. season 3

Crop Management Practices

10. Which of these do you practice? Give reasons

Practice **Reasons**

a. row planting ……..

b. hilling ……..

c. up-rooting volunteers ……..

d. chemical spraying.....……..

e. residue destruction……..

f. de-haulming..……..

f. fertilizer application.……..

11. What is the source of you potato seed?

Source **Associated problems in storage**

a. My previous harvest ……..

b. Neighbor (before sprouting) .....……..

c. Neighbor (after sprouting)……..

d. Market.....……..

e. Holetta Agricultural Research Center……..

f. Seed growers (UNSPPA)...……..

g. Others .....……...

Late Blight and Bacterial Wilt / Soft rot Control: ***(applicable if Late blight and Bacterial Wilt are a problem)***

Late Blight:

12. What is the cause of Late blight? …….....……

13. What environmental factors favour late blight?

a. low night temperatures
b. Warm days
c. Rainy days
d. Misty / foggy days
e. Others

14. How do you control Late blight?

    a. Resistance
    b. Hilling
    c. Chemical sprays
    d. Wide spacing
    e. Crop residue destruction
    f. Destruction of volunteer potatoes
    g. others

15. In which season do you experience severe Late blight attack?

    1st season 2nd season off-season (swamp)

16. Do you know a month in the potato-growing season in which you plant and avoid severe late blight damage?

a. 1st season	March	Apr.	May	
b. 2nd season	Aug.	Sept.	Oct.	Nov.
c. Off-season (swamp)	May	June	July	

17. If you use chemicals (fungicides), which ones do you apply? For how long have you been using them?

Chemical	**Duration of use**
…….	……
…….	……
…….	……
…….	……
…….	……

18. How do you decide which chemical to use?

Chemical

…….

…….

19. When do you make your first chemical application?

a. Before seeing any symptoms
b. After seeing first symptoms
c. Before first hilling
d. After first hilling
e. When plants are 4 inches tall (about 18-20cm)
f. Few days after emergence
g. When fungicides are available
h. Others

20. How many fungicide spoonfuls do you put in a sprayer?

Chemical	**15litre sprayer**	**20litre sprayer**
……	…….	…….
……...	…….	…….
……..	…….	…….

21. After how many days do you repeat you spray

a. If it is rainy ……
b. When there is less rain …….
c. When there is no rain …….