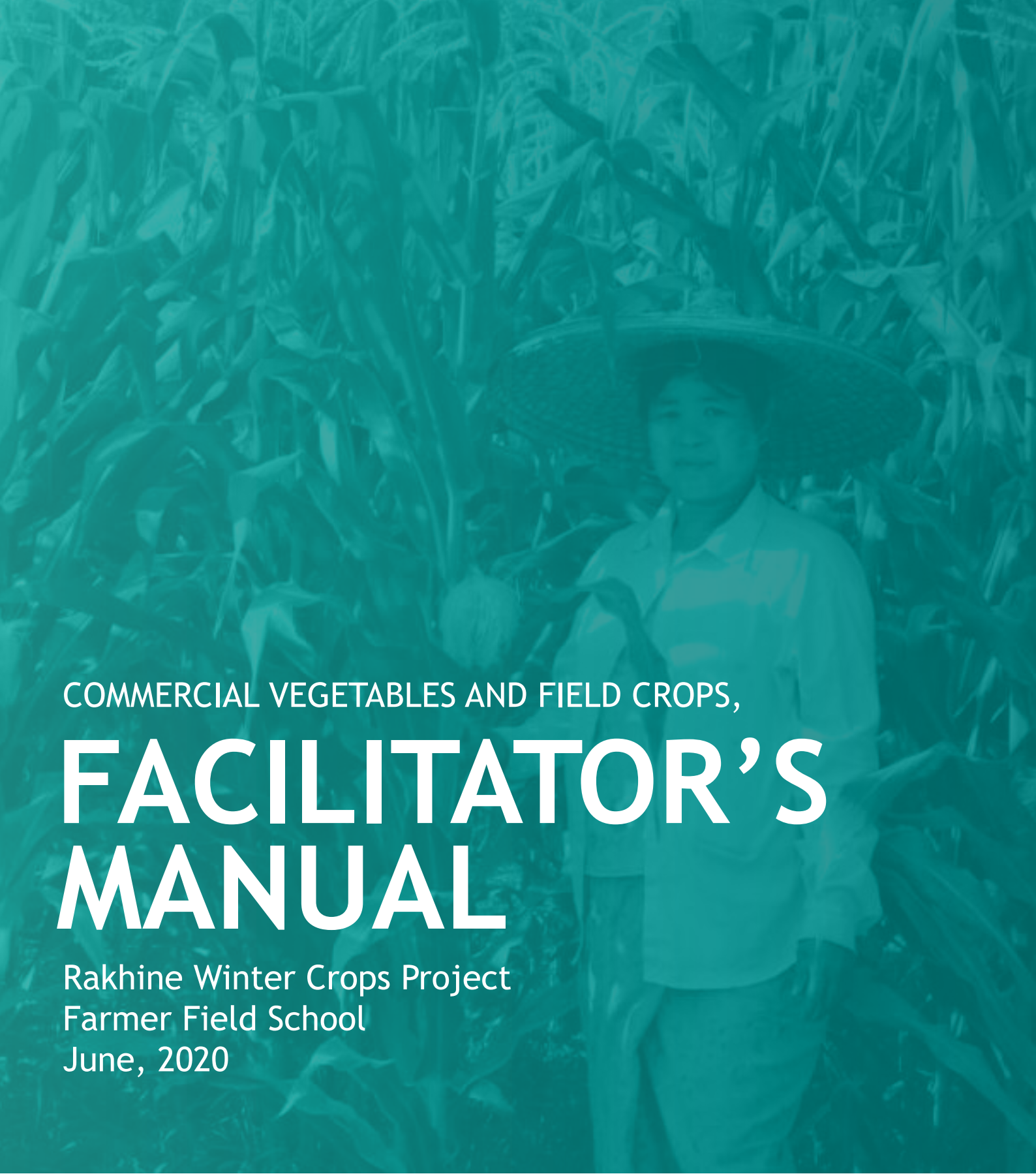

COMMERCIAL VEGETABLES AND FIELD CROPS,

FACILITATOR'S MANUAL

Rakhine Winter Crops Project
Farmer Field School
June, 2020

RAKHINE WINTER
CROPS PROJECT

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme

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REFERENCES:

This publication has drawn upon the following references:

1. Draft Farmer Business School Training Manual – FAO MALIS Project Cambodia 2012
2. Rakhine Winter Crops Project – ASI Participant Manual Small Scale Vegetable Production – Sittwe; March 2016 - Egberto Soto - International Consultant Tropical Agronomy, Plant and Food Research New Zealand, and Bruce Searle, Project Manager – Plant and Food Research NZ

PART 1: FFS PLANNING & MANAGEMENT

1. **Introduction:** In cooperation with the Ministry of Agriculture, Irrigation and Livestock (MoALI), the Rakhine Winter Crops Project (RWCP) has been implementing a program aimed at the improvement of agricultural extension services by private and government sectors to improve the yields and income of farmers. This manual targets Commercial Vegetable (CV) and Commercial Field Crop (CFC) Lead Farmers (LFs) from village clusters who want to lift their standard of agriculture through adopting a commercial farming approach using Good Agriculture Practice (GAP). This manual guides discussion and practice in various technical, methodological and management topics during a Farmer Field School (FFS) process. The manual includes detailed step by step participative learning activities that can be facilitated by those with little or no agriculture or training background.

2. **Objectives of the CV/CFC program and evaluation of results:** There are 4 main objectives of this commercial training program:
   i. To approach farming as a business by improving net incomes that can contribute to improved food security and nutrition and other living needs. Evaluation surveys continually show that 73% of CFC farmers and 84% of CV farmers improved their net incomes by an average of 46% for CFC farmers and 41% for CV farmers. Additionally, 54 % for CFC farmers and 59% for CV farmers achieved 100% and 98% food security respectively.
   ii. To introduce more modern sustainable GAP to improve yield and income. Evaluation surveys show that 93% of CFC and 92% of CV farmers increased their yields by an average of 58% (CFC) and 72% (CV).
   iii. To increase crop diversity to reduce the risk of market failure, disease in crops, and deterioration of the soil by mono-cropping. CV farmers are encouraged to grow at least 4 crops in rotation, while CFC farmers have been encouraged to grow at least 2 crops. Evaluation surveys show crop diversity has increased for CV farmers from 2.7 crops to 4.1 (+52%), while CFC farmers increased crops from 1.6 crops to 2 (+25%).
   iv. To improve efficient access to irrigation water for cropping in the dry winter/summer season. Evaluation surveys show that 62% (CFC farmers) and 66% (CV farmers) reported their access to water has improved.

3. **FFS training and monitoring schedule:** The FFS manual guides facilitators to conduct theory sessions in a classroom setting for around 1.5 hours and field work for 1.5 hours with topics related to the timing of the cropping cycle. The sessions are generally spaced 1-2 weeks apart but timing should be flexible according to crop development needs. When Field Officers (FOs) are not conducting FFS formal sessions, they should be free to visit and monitor individual plots in village discussion groups to record farmers' progress and to help farmers to learn from each other during discussions.

4. **FFS facilitation process:** This manual guides facilitators step by step through the cropping cycle, following a participative training process using brainstorming, sub groups, and some individual exercises as the main training methods. The Exercises in this 'Facilitators Manual' are copied into a 'Farmer's Work Book' so the participants have the main notes already written for them, with some blank lines to add additional notes. In this way, participants can listen and discuss, without worrying about writing notes. Facilitators with limited agriculture knowledge can use this manual, as the technical information is already presented in the manual and workbook, and the participative training approach means farmers talk 80% of the time, with facilitators just summing up and adding a few more points for 20% of the time. This process takes pressure off facilitators who sometimes think they have to be an agriculture expert

to be a trainer. However, facilitators should try to have a general knowledge of agriculture, and study the manual before each session to make sure they are comfortable with the flow and content of each session and activity.

5. **Cluster versus Individual Village approach:** The project targets the 5 best farmers from each of 5 villages in a cluster to attend the FFS training. These Lead Farmers (LF) are expected to be 'early adopters' and return to their villages to practically demonstrate GAP techniques on their plots and to train others. Demonstration materials are provided by the project. Actual transport costs (not an attendance fee) are paid so that transport is not a constraint to attending training at a central location. The lead male and female farmer of each family are registered at the beginning of the training, and the 'doer' of the tasks covered in the training is invited to attend, ensuring that the training is specifically relevant to them. Households which attend greater than 80% of the trainings receives a certificate. The project has 90-95% attendance at trainings, reflecting the effectiveness of this approach.

   Staff members' past experience has shown that when using an individual village approach many farmers initially put their hands up to join because this is something new and they think that they are interested. Often however, half way through the training, farmers start to drop out as they find vegetable growing is too difficult and time consuming for them. The result is that there are only around 5-10 farmers per village remaining at the training who are really dedicated and respond well to the training. This is why training the best 5 Lead Farmers first, then asking these LFs to train other Non-Lead Farmers (NLFs), as mentioned in the cluster approach above, is more successful. Evaluation of Lead Farmers training other farmers has shown high levels of satisfaction of empowerment for LFs as well as increases in knowledge and better farming results by NLFs.

6. **Refresher training:** Farmers are often slow to adopt new technologies, even when LFs are targeted. The project has found that a 'refresher' training approach providing training 2-3 times develops stronger results. Refresher trainings do not involve repeating a full FFS again, but follow a less formal 'walk and talk' approach, with facilitators visiting each village for about 2 hours per refresher session. Facilitators can cover 2-3 villages in one day. Facilitators can start with group discussion in a classroom or under a tree, talking about the farmers' priority information needs at that time of the cropping cycle. Facilitators also add points that they see as relevant and can refer to the Farmer's Work Book for answers or to other document resources. Facilitators then move on to the field for discussion around different farmer's plots asking what is going well, not so well, and how can the farmer improve their performance. Evaluations have shown that farmers who have refresher training have better results. However, refresher trainings cost money without recording extra beneficiaries, and planners have to take this into account when considering value for money when using this development option.

7. **Winter and Monsoon training:** The winter/summer season is the targeted period for this training, but depends on the availability of water. In Rakhine, the very wet monsoon season (5 meters of rainfall over 5 months) limits the potential for monsoon cropping because of the high risk of flooding, erosion, and disease. However, some leader farmers have shown that selected high moisture tolerant crops can be successfully grown in the monsoon, sometimes under plastic covers, leaving the door open for further adaptive research in monsoon cropping. In addition, CV/CFC crops show much higher profits per acre if they can be successfully grown in the monsoon period. Extending improved options for monsoon rice farming can also keep staff involved during the monsoon period.

8. **Demonstration material provision and subsidies:** The project has provided demonstration materials to all LFs and NLFs on a sliding scale of 90% in the first year, 50% in the second year and 25% in the third year. This sliding scale of subsidy, and 3 years of training/refresher training, help farmers to gradually change their behavior and become successful in the use of GAP. Evaluation surveys have shown that 100% of farmers in project areas are adopting 5 or more GAP interventions after 3 years.

9. **Gender participation:** While the CV/CFC training is open to participation by both males and females, it is expected that males should attend most of the training as they are most often the ones who take care of the commercial scale farms. The reason for this is that the CV/CFC farms are usually a little far from the home, take a lot of time to manage, and are therefore not so suitable for equal participation by men and women as women tend to stay close to home to attend to time consuming traditional home duties. The RWCP does however register both men and women at the beginning of the training, and invites the 'doer' of the tasks to attend, making the training open to both men and women. At the end of the FFS, the project writes the name of both the male and female farmers in the family on the graduation certificate, to acknowledge that agriculture is a joint family enterprise. RWCP has had an average of 24% women and 76% men participating in the CV/CFC FFS training over 4 years.

10. **Place and timing for training:** The field team should choose a place and time that suits both men and women. Ethnic preferences should also be considered. Typically, training is held in a monastery or school building, or under a shady tree or tarpaulin. Field work sites should be close to the theory training location to save time moving from the classroom to the field. As FFS participants are usually busy in the morning, the timing of training is usually from 12noon to 3pm and sometimes goes on to 4pm if sessions take longer than planned or inputs are being distributed.

11. **Monitoring and evaluation:** An attendance sheet is filled in to record participation in training and field monitoring. An adoption form to guide and record results during field monitoring is included in this manual. The final session evaluates the FFS and results, and calls for lessons learned and suggestions for improvement.

12. **The manual development process:** This manual was developed by a 'working group' of people from different levels, backgrounds and knowledge bases, and revised over a period of 4 years. It is proposed that the manual be shared with other organizations to maximize use in Myanmar in the years to come.

    The initial working group included:

Harold Gray	Team Leader – Rakhine Winter Crops Project
Philip Tun Hla Aung	Deputy Team Leader - Rakhine Winter Crops Project
Saw Aung Hla Htwe	Field Officer Rathedaung -Rakhine Winter Crops Project
Cho Mar Thet	Filed Officer Thandwe - Rakhine Winter Crops Project
Aye Myat Thwe	Field Officer Rathedaung - Rakhine Winter Crops Project
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    Technical notes (excluding organic approaches) and an initial draft were guided by:

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The following people contributed to various manual revisions:

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U Aung Than	Irrigation Infrastructure Coordinator
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Bo Thein Maw	Field Officer, Taungup
Aye Ko	Field Officer, Taungup
Ye Naing	Field Officer, Taungup
Htun Naing Lin	Field Officer, Thandwe
Ye Tun Myint	Field Officer, Thandwe
Soe Myint	Township Manager, Taungup
Aung Thu Han	Field Officer, Taungup
Soe Thi Ha	Field Officer, Taungup
Si Tar Win Myint	Field Officer, Taungup
Aung Kyaw Htay	Field Officer, Taungup
Myint Myint Thein	Township Manager, Thandwe
Su Myat Phyoe Naing	Field Officer, Thandwe
Thant Lwin Maung	Field Officer, Thandwe
Maung Win Aye	Field Officer, Thandwe
San Tun	Township Manager, Gwa
Naung Naung	Field Officer, Gwa
Thaw Zin Oo	Field Officer, Gwa
Ei Zar Chi Mon	Field Officer, Gwa
Yu Yu Yan	Field Officer, Gwa

PART 2: INTRODUCTION

2.1 Good Agriculture Practice (GAP) training

This manual guides facilitators of FFS extension activities to train farmers to implement a more commercial approach to agriculture. It will assist facilitators to guide growers to produce a wide variety of crops following GAPs that are economically viable, environmentally sound, and socially just and humane. The FFS extension approach covers crops from planting to harvest using theory and group discussion followed by the practical application of GAP in demonstration sites in the field.

2.2 About the Manual and Workbook

The Commercial Vegetable /Commercial Field Crop (CV/CFC) Farmer Field School (FFS) has 2 manuals that support the farmer training delivery process. These documents include a Facilitator's Manual (this document) and a Farmer's Work Book. The Facilitator's Manual is intended to guide facilitators to strengthen farmers' capacity in Good Agriculture Practice technical and management skills through a group discussion and "learning by doing" approach. It outlines the session objectives, duration, resource material requirements, and describes a series of discussion topics and practical exercises that focus on GAP techniques. Participants will be given their own Workbook, with exercises and notes that correspond to the Facilitator's Manual topics. The CV/CFC FFS process helps farmers to learn from each other, in small groups, about topics relevant to their own farming environment. Facilitators and invited guests then supplement farmer knowledge with new GAP ideas.

The materials for the CV/CFC FFS are specially designed to work with a group of entrepreneurial farmers with a "can do attitude" who have the resources for a higher level approach to commercial agriculture production. While there is an emphasis on the use of organic inputs, it is acknowledged that additional chemical inputs are sometimes needed to support agriculture on a commercial scale. Although participants need to be basically literate and numerate, they do not need to have had any significant formal education. Participants will be encouraged to form subgroups of 3-5 people, with each subgroup having someone who is literate, numerate and a fast writer. In this way, exercises can be completed and notes written within each subgroup, where the main learning experience occurs through listening and discussion. Those within the subgroup who have not kept pace with the numeric and written exercises, can catch up with assistance from subgroup leaders after the sessions, in their own time. Thus the pace of the meetings can keep moving, and the subgroup leaders learn to become informal facilitators and extension leaders themselves.

A core principle of the CV/CFC FFS process is that 'facilitation' is preferable to 'teaching'. The differences between both approaches are highlighted below:

2.3 Teaching versus Facilitation

The aim of the tables below is to help facilitators to examine their own teaching/facilitation styles and guide them more toward a participative facilitation approach rather than a teaching approach. Facilitation recognizes that the participants themselves have valuable knowledge and experience that they can bring to the group for discussion and learning from each other. The facilitators also have the chance to contribute to the discussion with new ideas not already discussed by the participants. In this way everyone learns from each other and the participants learn not to rely on the facilitators (nor visiting experts) for all of the answers. Thus participants learn to solve many of their problems or opportunities amongst themselves.

Teaching	Facilitation
Teaching starts from teacher's own knowledge	Facilitator starts by assessing the knowledge of the group
Teaching follows a pre-set curriculum	Facilitator addresses issues identified by the group or their community and adopts new ideas to the needs and culture of the group
Teachers deliver lectures to a group of students – usually from the front of the room.	Facilitators use practical, participatory methods, e.g. group discussions and activities in which all members of the group participate
Information flows in just one direction, from teacher to student	Information flows in many different directions between the facilitator and participants and between individual group members
Teachers are concerned with students understanding the right answer	Facilitators encourage and value different views
Teachers have a formal relationship with students, based on the status of the teacher	Facilitators are considered as an equal to participants, and develop relationships based on trust, respect and a desire to serve

Facilitation skills and training techniques

Be ready	Develop and practice your session plan in advance
Be clear	Clearly identify and state your session's objectives and deliver it
Show respect	Through your effective communication skills (verbal and non-verbal)
Be friendly	In responding to questions and relationships
Be honest	Through a confident professional manner
Encourage participation	Encourage quieter participants to share ideas and questions and allow participants to talk more - use open ended questions frequently rather than questions which simply require a "yes" or "no" answer
Communicate effectively	Use simple appropriate words and tones - maintain eye contact and actively listen
Pay attention	Address the needs and feelings of the group
Be time sensitive	Make sure your session plan fits with the group's time available
Use multiple channels	Use different relevant training materials and tools to assist in conveying messages
Summarize	Go over the main session points during and at the end of the session

PART 3: MOBILIZING THE COMMUNITIES

3.1 Contacting the Participants

a) Invitation to the leader of the group of participants
   1. Find out the person to contact (look in the list of contacts in the data base of the organization or ask the Department of Agriculture for information).
   2. Get an official invitation letter to support the first meeting if required.
   3. Ask an official to attend the meeting to introduce the facilitator and the project if required.
   4. Provide a short information pamphlet explaining the project to the officials
   5. Call the contact person(s) by phone or make a personal visit. Tell the village administrator that for proportional inclusion we are expecting a minimum of 50% household attendance of the target group including 50% female attendance; or 50% of different ethnic groups; otherwise there will need to be a second meeting for those who did not attend.
   6. Explain the topic of the proposed visit and arrange a date to visit the village.

b) Confirmation of the meeting
   Call the contact person 2 days before the meeting to confirm the visit. If needed, repeat the phone call one day before the meeting as well.

3.2 Trip preparation

a) Transport
   1. Be sure you follow the safety procedures for your personal security.
   2. Organize accommodation if needed.

b) Budget for the meeting
   Estimate the cost of all expenditure you will need during the trip

c) Coordination with other facilitators if working together
   1. Prepare the work plan with the other facilitators.
   2. Discuss the needs of sharing training tools.

d) Timing of the meeting
   1. Estimate the time needed for the facilitator's travel (return trip).
   2. Estimate the time expected for the mobilization meeting (around 1-2 hours). Select a time when most people (men and women), especially those with access to small areas of land, can attend.

3.3 First Mobilization Meeting: Project Overview

Duration: 60 minutes
Objectives:
a) To explain the 5 RWCP project components
b) To explain in more detail Component 1: CV/CFC model (aims, target group and inputs)
c) To explain the FFS process
d) To invite interested potential CV/CFC participants to the next meeting

Materials: Letter authorizing the meeting; Vinyls: #1 Explaining about the RWCP components; #2 The CV/CFC model (selection criteria); #3 The FFS process; small papers to write names of potential FFS participants on.

Activity 1: To explain the RWCP, CV/CFC model and inputs to all village members who attend, not just CV/CFC farmers (40 minutes)

a) Start with general chatting and local issues before the meeting starts
b) Ask the official to welcome the attendees and introduce you, the facilitator
c) Explain the agenda topics and the duration of the meeting
d) Explain about the RWCP components, the CV/CFC model (on prepared vinyl or flip charts)
e) Answer and discuss the questions the participants have

RWCP's 5 Components:

1. GAP training and demonstration for Commercial Vegetables and Field Crops (Larger land holders)
2. GAP training for Small Scale Vegetable Production (Home gardeners)
3. Irrigation development
4. Market linkage and value chain strengthening
5. Cooperation with the MOALI

Commercial Vegetable and Commercial Field Crops Production Target Group Selection Criteria:

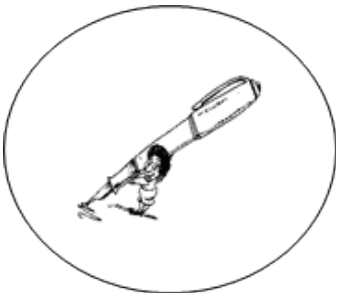
1. **A proportional inclusion approach that targets successful "Early Adopter" farmers** (Husband and Wife or single headed households) who want to grow vegetables, especially for sale, using modern GAP techniques.
2. Have a "**Can do**" attitude, not a "Cannot do because" ……. . Must have money to pay for ongoing GAP, not say "I cannot continue with high GAP inputs because I have no money".
3. **Natural leaders/advisors** to whom other families come for advice
4. Willing to organize in sharing the technology with 2-3 contact farmers who are interested to apply the technologies.
5. Selected farmers should **be literate and numerate** so they can understand and participate in the FFS more effectively.
6. Leader farmers must be willing to attend around 16 x 3 hour trainings once a week. The training will be held in a central village in a cluster of villages. The project will support actual travelling costs.
7. Must have access to suitable land (owned or rented).
8. Must have existing or potential access to irrigation for winter cropping.
9. Must be willing to grow 4 types of vegetables or at least 2 kinds of commercial field crops in rotation to suppress soil-borne diseases, loss of nutrients and reduce market risk.
10. Willing to contribute at least 10% of input costs at the start of the program (e.g. 25,000 MMK for demo plot plus 10% for irrigation depending on the irrigation system)
11. Willing to complete expense and income record books to calculate profit/loss.
12. If possible, join a group for 'group buying' of inputs at discount prices, revolving funds for saving and internal lending, and consider group selling of produce for higher prices. Note: If you select 25 farmers from the same village it is likely that some will not be literate and numerate. In this case some of these farmers can join the training but they must work in subgroups with at least 1 literate and numerate person who can record their ideas and report back to the plenary.

Activity 2: To explain the process of a Farmer Field School (20 minutes)

a) Explain the FFS approach to implement the CV/CFC model
b) Answer and discuss any questions the participants have
c) Invite those attending this meeting who fit the selection criteria, to attend the next meeting
d) Confirm the date, time and place for the next meeting. Make sure the time and place are suitable to both men and women
e) Thank all the people for attending the meeting

Farmer Field School Process:

Around 16 technical training sessions of 3 hours in duration, with one session every 1 or 2 weeks. The sessions follow crop cycles from planting to harvest. The sessions are normally broken up into: (i) classroom discussion and expert GAP presentations; (ii) visits to a good GAP demonstration site to discuss problems and solutions, and to practice the theory they just learned in the classroom session; and (iii) if time allows have a "walk and talk" session visiting other farmers fields discussing their immediate problems, solutions and opportunities.



TIP for Facilitators

Make sure that those at the meeting understand that this manual targets successful farmer with a "can do" attitude who are willing to extend to others, and who are literate and numerate. Also explain that component 1 provides only training and some demonstration plot input, not irrigation equipment, tools, credit or other inputs which may be provided by other components of the project.

3.4 Second Mobilization Meeting: Identification of Participants - (Just potential CV/CFC participants attending)

Duration: 75 minutes

Materials: Flip chart paper; pens; vinyls for 2nd meeting: #1 CV/CFC model; #2 FFS process; #3 Selection criteria; small papers to write name of potential FFS participants on.

Objectives:

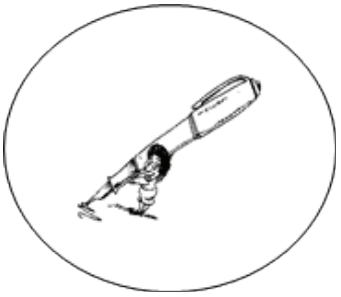
a) To explain again the CV/CFC model (target group and aim) and inputs the project will provide
b) To explain again the process of a FFS
c) To select the participants (25 direct beneficiaries and 75-125 secondary beneficiaries) in the village to work with CV/CFC

Activity 1: Review the CV/CFC model (30 minutes)

a) Explain Component 1, Commercial vegetable and field crops production in detail, (pre-prepared on vinyl or flip chart)

Activity 2: Review the FFS process (5 minutes)

a) Go over the FFS process on a vinyl or flip chart



Review the selection process below before proceeding.

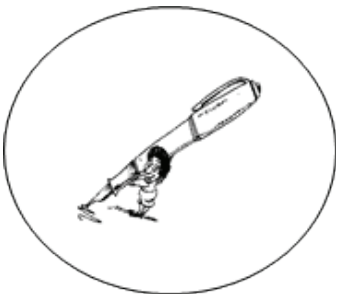
Selection Process in detail

1. While you as facilitators are conducting your SSVP FFS you have the opportunity to informally talk with many participating farmers. You have been asked to informally ask these farmers to nominate leading CV and CFC early adopter farmers in their villages. Write these leaders' names down for reference later on when you can try other ways of finding the right farmers for the FFSs.
2. While reviewing the SSVP adoption and results, there may be 2-3 very good landless farmers who are interested in graduating to CV/CFC or CFC using rented land. Write these people's names down and ask them if they would be interested in being part of the CV/CFC or CFC on rented irrigable land.
3. We have also discussed a strategy of having a community meeting to talk about the project at the mobilization stage, and at that time ask the community to vote for their best village lead farmer representatives following the selection criteria discussed before. This voting process can give you names identified by the community.
4. Talk with authorities to confirm your selection but be careful if discussions result in them giving their own name or the names of their friends and families. Using authorities as an approach is however another way of identifying the right person to join the FFS, so is worth trying in combination with the other selection methods.
5. We are now asking farmers to contribute a minimum of 10% toward input and irrigation costs. Their agreement to this should show their commitment to GAP and their ability to pay for inputs in the future.
6. Compare all of your answers and make a short list of potential FFS members for a personal interview by the Field Officer (FO). At that time you can make the decision who should join your FFS to achieve the best long term results for them and the project.

Activity 3: Selection of interested people (30 minutes)

a) Show the participant selection criteria (on a vinyl) chart and explain the requirements.
b) Ask participants to nominate on a small piece of paper, 2 names of those who they think should be Lead Farmers and attend the FFS. Assist those who cannot write.
c) Write the names on a flip chart, highlighting those who are the most popular choices.
d) Confirm that those selected want to attend the FFS. If not, select the next person on the list.
e) Confirm their selection with the village leader.
f) FOs should balance their opinions with the others ideas to make the final list.
g) Obtain the husband's and wife's names, village, and contact details and record them on the registration form below.

h) Record their previous crop type grown before RWCP in the winter season, as well as the area, yield, income, expenses, and net profit.
i) If appropriate, ask the selected Lead Farmers to go home and select 3-5 others who they will informally train and who will receive inputs as Non Lead Farmers.
j) Agree on a time and place for the next meeting.



TIPs for facilitators

1. **Place for the FFS meeting should be a central place in the cluster so people do not have to travel too far.**
2. **Select a large demo plot or 3 smaller demo plots for field practice dividing the 25 participants into 3 groups of 8 or 9 people**

Commercial Vegetable and Commercial Field Crops Production Target Group Selection Criteria:

1. A proportional inclusion approach that targets successful "Early Adopter" farmers (Husband and Wife or single headed households) who want to grow vegetables, especially for sale, using modern GAP techniques.
2. Have a "Can do" attitude, not a "Cannot do because" ……. . Must have money to pay for ongoing GAP, not say "I cannot continue with high GAP inputs because I have no money".
3. Natural leaders/advisors to whom other families come for advice
4. Willing to organize in sharing the technology with 2-3 contact farmers who are interested to apply the technologies.
5. Selected farmers should be literate and numerate so they can understand and participate in the FFS more effectively.
6. Leader farmers must be willing to attend around 16 x 3 hour trainings once a week. The training will be held in a central village in a cluster of villages. The project will support actual travelling cost.
7. Must have access to suitable land (owned or rented).
8. Must have existing or potential access to irrigation for winter cropping.
9. Must be willing to grow 4 types of vegetables or at least 2 kinds of commercial field crops in rotation to suppress soil-borne diseases, losses of nutrients and reduce market risk.
10. Be willing to contribute at least 10% of input costs at the start of the program (eg. 25,000 MMK for demo plot plus 10% for irrigation depending on the irrigation system)
11. Willing to complete expense and income record books to calculate profit/loss.
12. If possible, join a group for group buying of inputs at discount prices, revolving funds for saving and internal lending, and consider group selling of produce for higher prices. Note: If you select 25 farmers from the same village it is likely that some will not be literate and numerate. In this case some of these farmers can join the training but they must work in subgroups with at least 1 literate and numerate person who can record their ideas and report back to the plenary.

Lead and Non Lead Farmer Registration Form

Village	#	Participants Name	Sex	LF or NLF	Farm Land area Owned (O) or rented (R)	Crop/Yrs Experience in CV/CFC. Eg. Chili/2yrs	Age	Education	Water Source and Duration	Ethnicity
Shin Saw Pyin	1.	Husband	M	LF	1 acres (o)	Groundnut/ 10yrs	43	5 yrs	Stream 5 months	
		Wife	F	LF						
	1.1.	Non lead Farmer name		NLF						
	1.2	Non lead Farmer name		NLF						
	1.3	Non lead Farmer name		NLF						
	1.4	Non lead Farmer name		NLF						
	1.5	Non lead Farmer name		NLF						
	2.	Husband								
		Wife								
	2.1	NLF								
	2.2									
	2.3									

Background History of Crop Production Data Prior to the RWCP Project

Township ---------- Cluster ---------- Date of Data Collection ----------

FO ---------- Village ----------

If collecting the data for RWCP winter crop, collect only the data of the winter crop cultivated before RWCP to compare the same winter crops after RWCP GAP was used during the final evaluation session)

Farmer Name ----------

Crop Type before RWCP	Area (acres)	Yield (A) (Consumed/ donated/ sold/crop left in the field)	**Crop Harvest Units**	**Average Price (B)**	**Total Estimated Income (A x B)**	**Total Estimated Expense (C) (Seed, fertilizer, Other)**	**Estimated Outside Labor (D)**	**Net Income (AxB) - (C+D)**
Crop Type in this last season after RWCP								

Adoption monitoring: Most projects require some form of progress monitoring and evaluation of results. The form below enables the field team to monitor progress of adoption of key GAP interventions. As some interventions have many steps – e.g. nursery establishment and care has about 10 steps – it makes sense to ask the farmer (or observe) what steps s/he has taken and write down the percentage of the total steps that have been followed – e.g. 7 out of 10 steps is 70%. The individual farmers' scores for each intervention can be added together at the bottom of the sheet and divided by the number of farmers, to give the average adoption of this intervention across the whole FFS. As there are only 25 lead Farmers, this higher level of monitoring is possible. But for the high number of Non Lead Farmers (up to 125 farmers), the overall visual results assessment described below is more appropriate than assessing each one of the GAP steps to save time.

Results evaluation: The form provides a column for a visual qualitative assessment of each of Lead and Non Lead Farmer's plots giving a number score – 5 for excellent; 4 for very good; 3 for average; 2 for fair; and 1 for poor. We can similarly add the total scores together and divide by the number of farmers to give the average result in the garden plots across the whole FFS. This is useful for results evaluation purposes.

Monitoring process: This form can be printed out with the farmer's names in the left had column. The field team can carry the form around each day on a clip board, and when they visit any of the plots, they can make a quick assessment. As interventions are only implemented step by step, the field team only have to assess 2-3 interventions each visit, so it does not take too much time. As the season progresses, the form is gradually filled in, and at the end of the season it should be completed and ready for the simple analysis described above.

Adoption Monitoring and Results Evaluation Form

Interventions #		1	2	3	4	5	6	7	8	9	10	LF Rating	NLF Rating	
Field Officer Initials:		Fencing	Quality Seed	Raised Beds	Nursery Seedlings	Em Bokashi	Basal fertilizer	Trellising	Water management	Pest & Disease control	Pre- Post harvest	Visual Assessment: Excellent(5) Very Good(4) Average(3) Fair(2) Poor(1)	Visual Assessment: Excellent(5) Very Good(4) Average(3) Fair(2) Poor(1)	Remarks
Location:														
LF & NLFs Names:	Village													
1														
2														
3														
4														
5														
6														
7														
8														
Overall %														

PART 4: FFS SESSIONS

Session 1: Introduction to the Commercial FFS and Crop Selection Criteria - (Only the Leader Farmers (total 25) from cluster villages attending)

Duration: 3 hours (in the classroom)
Objectives
At the end of this session participants will be able:

Objectives:
1. To know each other better and to learn from each other
2. To know about the Facilitator's Manual and Farmer's Work Book
3. To understand the meaning of GAP
4. To think about being a commercial farmer instead of growing crops mainly for subsistence
5. To understand different criteria for the selection of crops to grow
6. To review the ground rules, time and place for the training course

Materials: White board; marker pens; tape; Flip charts, Crop Calendar vinyl

Activity 1: Getting to know each other (10 minutes)

1. Welcome participants to this introductory meeting.
2. Ask participants to tell the group their name, spouse's name (if married), and which village they come from. Check their names in the register. (See Attendance Register in mobilization meeting 2).
3. Inform the participants that we will now look at the years of experience in vegetable growing of the whole group. Do this by asking each participant to call out the number of years they have been farming. Write the numbers on the board. Ask the farmers to slowly call out the numbers so the facilitator can use a calculator to add the numbers up and write down the total. E.g. 730 years.
4. Conclude this exercise by saying that this is the total years of experience of the group, so all the participants combined have a lot of knowledge and field practice skills. They therefore should actively contribute their ideas in group discussion as we all have a lot to learn from each other.

Activity 2: To learn about the Farmer's Work Book (10 minutes)

1. Explain to the farmers that to facilitate the FFS we will use 2 documents: A Facilitator's Manual and a Farmer's Work Book.

A Facilitator's Manual	A Farmer's Work Book
This provides facilitators with technical back ground notes and guides them step-by-step through the CV/ CFC FFS Farmer Field School Training Program	The Farmer's Work Book provides key concepts and technical notes. It also provides spaces for participant's exercises

2. Hand out workbooks to all participants.
3. Tell the participants that they do not have to write much down during the FFS because most of the notes for the training are in the workbook already. Say that there are some spaces to add more notes if they want to, or to complete exercises as directed to do so by the facilitator.

4. Invite participants to write their names on their books.
5. Tell them that they must bring this workbook to each FFS session.

Activity 3: Expected Results from the CV/CFC Production component of the project (20 minutes)

Individuals

1. Ask participants to write down their expected results from the CV/CFC component in their workbooks Exercise 1.1. Go around the room to help them if needed. (10 minutes)

Exercise 1.1: Farmer's Expected Results After Attending the FFS Sessions

Expectations:	Circle: 1 Low: 5 Medium: 10 High
1.....	1; 2; 3; 4; 5; 6; 7; 8; 9; 10
2.....	1; 2; 3; 4; 5; 6; 7; 8; 9; 10
3.....	1; 2; 3; 4; 5; 6; 7; 8; 9; 10
4.....	1; 2; 3; 4; 5; 6; 7; 8; 9; 10
5.....	1; 2; 3; 4; 5; 6; 7; 8; 9; 10
6.....	1; 2; 3; 4; 5; 6; 7; 8; 9; 10

2. Ask participants to write in Exercise 1.2 in their workbooks the crop names, area, yield, price, total income, less expenses to give profit/loss for their farming enterprise, prior to RWCP. This information should have already been gathered on a separate piece of paper at the registration time of the FFS in the Mobilization Session 2.

Lead and Non Lead Farmer Registration Form

Crop Type before RWCP	Area (acres)	Yield (A) (Consumed/donated/ sold/crop left in the field)	Crop Harvest Units	Average Price (B)	Total Estimated Income (A x B)	Total Estimated Expense (C) (Seed, fertilizer, Other)	Estimated Outside Labor (D)	Net Income (AxB) - (C+D)
Crop Type in this last season after RWCP								

Plenary

3. Tell participants that at the end of the FFS we will look back at their expectations and evaluate if they achieved their expectations or not.
4. For discussion on the project's expected results, refer participants to Exercise 1.3 in their workbooks (10 minutes)

Exercise 1.3: The project's CV/CFC Expected Results

1. Improved agronomic theory and field practice for those who want to become commercial farmers with access to land and sufficient water resources
2. Focus on winter production of vegetables and commercial field crops for consumption and sale
3. Increased net income
4. Greater diversity of crops to reduce disease and market risk and to improve nutritional intake
5. Motivation for farmers to extend GAP to other farmers

Activity 4: Explain the concept of GAP (15 minutes)

Plenary

1. Facilitator talks about the concept of GAP starting with the definition and then explaining the umbrella diagram in Exercise 1.4 in the participant's workbook. (5 minutes)

Exercise 1.4: Explanation of GAP

1. As shown under the umbrella below, when a farmer is protected by GAP practices, the food is safe to eat, the practices are safe for farmers and farm workers, they protect the environment, and their farms are more profitable. If farmers do not follow GAP (outside the protection of the GAP umbrella), their produce may be unsafe to eat, farm workers may get sick, the environment might be destroyed and farmers may get low profits

2. Facilitators asks farmers to read and discuss as a group or by selected individuals the Myanmar GA

protocols in Exercise 1.5 in their workbooks. If there is not enough time, read half of the points, then ask the farmers to finish reading the list for homework. (10 minutes).

Exercise 1.5: Myanmar GAP protocols

MYANMAR GAP PROTOCOLS

1. Site Selection
   - The selected site and the surrounding area must be free from chemicals and biological hazards. Site plan and Crop Type Record should be kept.
2. Water
   - Water for agricultural use should be analyzed. Water from animal farms, hospitals, industrial and municipal wastes are harmful to the environment soshould not be used. (If using recycled water, follow WHO guidelines.)
3. Seed/ Seedlings
   - Seeds free from pests and diseases and well adapted to the current location should be selected.
   - The source, the amount, the date of receipt of the seedlings and propagated plants, should all be recorded.
4. Fertilizer and Soil Additives
   - Fertilizer and soil additives used for a specific crop should be free from chemical and biological contamination.
   - Use only well decomposed organic fertilizers.
   - Mixing, storing of fertilizers and composting the organic fertilizers should not be done on land near a water source, to prevent contamination.
   - The purchased fertilizers and soil additives should be from Government Approved Lists and Records should be kept on what fertilizer was used, how much and when.
5. Agricultural Chemicals and Other Chemicals
   - Follow Integrated Pest Management (IPM) to reduce the use of chemicals.
   - For health and environmental safety, pay full attention to Pesticide and Fertilizer Law and Regulations.
   - Only when necessary, use only the approved chemicals.
   - Strictly follow the Pre-Harvest Interval (PHI), according to the chemical used.
   - Know how to handle and use pesticides.
   - Purchase, storage, use and disposal of chemicals should be done according to regulations, and records should be kept.
   - Fuel, lubricants and non-agrichemicals should be used, handled, stored and disposed of properly to prevent product contamination.
6. Crop Care
   - Crop care should be done according to the specific needs of each crop.
7. Agricultural Tools and Materials
   - Agricultural tools and materials should not contaminate produce.
   - The tools and materials which were used in storing chemicals should be well labeled.
   - Do not use the above-mentioned tools and materials when storing other materials or products.
8. Harvesting and Post- Harvest Process
   - Harvest the crop at the right time with the right means.
   - Do not put produce directly on the ground, on the floor of packaging facility, or on the floor of the warehouse.
   - Water used in cleaning produce should be clean.
   - Grade and pack produce according to market specifications.
9. Storage and Transportation
   - Keep, store and transport produce away from chemicals, biological and physical damage.

- Do not keep or store produce with fuels, pesticides, fertilizers and farm tools and materials.
- Before transporting produce, ensure the vehicle is free from chemical spill, pests and diseases.

10. Construction
    - To minimize damage to produce, ensure that packaging, handling and storing facilities have been constructed to specifications and are in an approved place.
    - The facilities should be well maintained.
11. Control of Farm Animal and Pets
    - Domesticated and farm animals should not be in contact with harvest, packaging, and storage areas.
12. Evidence and Records
    - The producer should keep GAP records for at least two years.
    - Daily activities and practices should be noted down on the relevant forms.
13. Traceability
    - Significant marking and registration should be kept with the produce for traceability purposes.
    - Keep a separate record for the destination and delivery date of each produce.
14. Training
    - Both the producer and the worker should attend GAP training to attain good skills and knowledge in their respective fields.
15. Evaluation
    - The producer should conduct an annual evaluation on GAP protocols.
    - The producer should settle complaints and keep a complaints record.
16. Personal Hygiene and Welfare of Workers
    - Advice on personal hygiene, in bold letters, should be put in a common place, so every worker can see it, (or) distribute the advice to every worker.
    - Sanitary water and waste water should be carefully disposed of.
    - Pay full attention to the health and well-being of workers.

Activity 5: Commercialization of farming: (Total time: 12 minutes)

Plenary

1. Ask participants the question: “What does the word commercialization mean?”
2. Write participants’ ideas on a flip chart and compare their answers with the definition in Exercise 1.6 in their workbooks (2 minutes)

Exercise 1.6: Commercialization of Farming

Definition: Commercialization means growing agriculture crops to sell for a profit, not just for family consumption.

In Pairs

1. Ask the participants to discuss together the two questions in their workbooks Exercise 1.7: “Why are you a farmer?” and “What do you use your income for?” and then to write their own answers to the questions in their workbooks. (8 minutes)
2. Invite participants to share their answers with the group. (2 minutes)
3. Tell them that this FFS will guide them toward growing crops for a good profit.

Exercise 1.7. Review your family situation regarding farming

Why are you a farmer?

1. Is it just to produce food for yourself and your family? Circle: Yes/No
2. Is it just to earn more cash? Circle: Yes/No
3. Or is it for both food production and for money? Circle: Yes/No
4. Is earning money more important to you than just producing food? Circle: Yes/No

What do you use the money for?

1.....
2.....
3.....
4.....
5.....
6.....
7.....
8.....

Activity 6: Crop Selection Criteria (10 minutes)

Subgroups

1. Ask participants to form 5 subgroups with people from their same village. Suggest that at least one member in each group should write the group ideas in a note book for reporting back later on.
2. Ask the farmers to discuss the question – "What criteria do they use to select the crops that they want to grow for the next season?" Write their ideas on a flip chart after 10 minutes.
3. Go over the crop selection criteria in Exercise 1.8 in their workbooks. Invite them to add any other of their ideas that have not already been listed in the table in the space provided.
   (10 months)

Exercise 1.8: RWCP Crop Selection Criteria:

Selection of vegetables to grow:

1. What season can the crops grow – Cropping calendar
2. Diversity of crops to lower risk and to protect the environment
3. Crop rotation requirements for soil improvement and disease control
4. Price and timing of planting and harvest to get the best price
5. Market – What do the buyers want
6. Suitable site - free from flooding, contamination etc.
7. Soil type preferences or tolerances e.g. acid, neutral, alkaline
8. Labor requirements
9. Water requirements and availability
10. Profitability
11. Impact on males and females – if too negative, don't do it!
12. Impact on the environment – if harmful, don't do it!

13. Know how to grow the crop
14. Availability of quality inputs and reasonably priced inputs
15. Acceptable risk (of loss) from flooding, drought, pest and disease etc.

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Activity 7: Selection criteria in more detail - Seasonal Calendar, Diversity, Crop Rotation, Price and Timing of planting, and linking with the buyers (Total 45 minutes)

Plenary

Tell the participants that now we will look in more detail at the first 5 selection criteria - (i) Seasonal Calendar (ii) Diversity (iii) Crop rotation (iv) Price and timing of planting, and (iv) Seasonal Calendar: (10 minutes)

1. Refer them to the cropping seasonal calendar (pre-prepared vinyl Intro #2) with many options for crop growth in the different seasons in Exercise 1.9 in their workbooks.
2. Ask participants to identify crops that can be grown in the winter/summer season. Point out that some crops can be grown all year round while others can be grown only in the dry season.

Exercise 1.9: Calendar of Crops for the Different Seasons

Crops	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Group - 1												
1. Yard-long Bean												
2. Okra												
3. Onion												
4. Carrot												
Group – 2												
5. Chili												
6. Tomato												
7. Egg-plant												
8. White Egg-plant												
9. Coriander												
Group – 3												
10. Cabbage												
11. Cauliflower												
12. Broccoli												
13. Radish												
14. Water spinach												
15. Sweet Corn												
16. Mustard												
Group – 4												
17. Bottle Gourd												
18. Snake Gourd												
19. Ridge Gourd												
20. Bitter Gourd												
21. Cucumber												
22. Water Melon												
23. Pumpkin												
Field Crops												
1. Goundnut												
2. Chili												
3. Corn												
4. Watermelon												
5. Onion												

Remark:

- Good growing period
- Difficult growing period

(ii): Crop diversification (10 minutes)

Plenary

1. Remind the participants that they cannot grow the same high value crop on the same land all the time. Say that it is better to select a range of crops. Ask them why you say this? Write their answers on a flip chart.
2. Compare their answers with those in Exercise 1.10 in their workbooks. Invite participants to add any of their own ideas that are not already on the list.

Exercise 1.10: Why should you choose a range of crops, not just one crop?

It is risky to have just one crop because:

1. Disease might destroy your whole crop. It is better to spread the risk of diseases among a diversity of crops so you do not lose all your crop from the one disease at the one time.
2. The price might go down so you get a low price from all of your land. It is better to have different crops to spread the price fluctuation risk.
3. The maturity date is the same so you get your income all at one time. For your family cash flow it is better to spread your income so the produce from one crop can pay for the inputs for the next one.
4. If everybody grew the same high value crop the supply in the market would be too much and the price would go down. Better to have many crops to smooth out the supply/demand price fluctuation effects.
5. .....
6. .....
7. .....

(iii) Crop Rotation (Total time 5 minutes)

1. Tell participants that a very important feature of GAP and sustainable agriculture is crop rotation.
2. Also tell them that the project expects them to grow in their demonstration plots at least 4 crops, one from each crop family in rotation. They can select 1 or 2 crops within one crop family but no more than 6 crops in total. This is because it is confusing and difficult to grow too many crops at one time, especially if participants follow the many recommended GAP techniques for each crop. Say we will discuss this in detail next.

Plenary

1. Brainstorm the following questions, writing participants' answers on a flip chart: (5 minutes)
   (i) What is crop rotation?
   (ii) What are the benefits of crop rotation?
2. Refer to Exercise 1.11 in participants' workbooks and go over the exercise asking some farmers to read parts of the information to liven up the presentation. (10 minutes)

Exercise 1.11: Definition and Benefits of Crop Rotation

Definition of crop rotation:
Moving similar family crop groups from one location to a new location each year
Benefits of Crop Rotation:

1. **Disease Prevention:** Disease organisms can build up over time, resulting in eventual crop failure. Rotating crops reduces the same disease buildup.
2. **Insect Control:** Crop rotation also helps reduce insect infestations.
3. **Nutrient Balance:** Different families of plants require different nutrients. By rotating your crops, you keep the soil from being depleted of the same nutrient every time.
4. **Nutrient Enhancement:** Some plants actually improve the soil (like groundnut or beans), so rotating them around the vegetable plots can produce organic soil conditioning for free (without additional cost).
5. **Reduce risk:** If one crop dies you have other crops from which you can still get income

The Principals of Crop Rotation
Optimizing nutrient requirements:
1. Legumes (groundnut and green gram or beans) can be grown to replenish the nitrogen in the soil.
2. Leafy plants have a high demand for nutrients, particularly nitrogen, and should follow the planting of nitrogen producing legumes.
3. Fruiting plants such as tomato, eggplant, chili, okra and pumpkin should follow the planting of leafy plants because fruiting plants have a high demand for phosphorous and too much nitrogen stops them from fruiting properly.
4. The root crops e.g. onion and shallot, should follow the leafy or fruiting crops because they do not need as much phosphorous or nitrogen.

Reducing the buildup of pests and diseases
1. Plants that are related to each other suffer from the same problems with pests, weeds and diseases
2. It is important not to grow plants from the same family in a plot year after year, to prevent the buildup of pests and diseases.
3. Tomato and plants related to tomato (chili, eggplant) are very susceptible to the same pests and diseases
4. Cabbage and cauliflower are related to each other. Onions and shallots are related to each other.
5. A gap of three growing seasons should be left between growing these crops.
6. For short term crops e.g. salad and spring onions, you can grow them time after time in the same year and then leave a 3 to 4 year gap.
7. When the soil is left bare, nutrients can easily be washed out, especially during heavy rains in the wet season. If no crop is growing during this period, it is well worth sowing a short-term cover crop such as velvet bean (Mucuna) as this prevents large amounts of fertility being lost from the soil.

Flexibility.

Don’t be too rigid with your rotation plan. If plants are showing signs of pest or disease damage you may need to change the plan or remove the crop. Or if a field in a rotation has a long standing weed problem, it may be necessary to change the plan to avoid growing weed susceptible crops there.

In Pairs

- Ask each pair to discuss which crops they would like to grow in each sub plot according to the rotation guidelines in Exercise 1.12 in their workbooks (5 minutes).
- Invite some participants to tell the group which crops they selected and why (5 minutes)

Exercise 1.12: Example of a 4 season crop rotation on a plot of land

Group - 1	Group - 2
1. Yard-long Bean	1. Chili
2. Okra	2. Tomato
3. Onion	3. Egg-plant
4. Carrot	4. White Egg-plant
	5. Coriander
Group - 3	**Group - 4**
1. Cabbage	1. Bottle Gourd
2. Cauliflower	2. Snake Gourd
3. Broccoli	3. Ridge Gourd
4. Radish	4. Bitter Gourd
5. Water spinach	5. Cucumber
6. Sweet Corn	6. Water Melon
7. Mustard	7. Pumpkin

(iv) Market Prices: (20 minutes)

1. Invite participants to look at the price information tables for the 24 crops specific to each location in Exercise 1.13 in their workbooks. Each location uses different units and has different prices so we have to have different tables.
2. Invite one participant to explain their table layout and what the table shows them. Key points to note are: (i) the prices change throughout the year, and (ii) there are general patterns when prices are low and prices are higher. What are these patterns? (Example: February and March are low price periods when everybody is harvesting their local crops at the same time – high supply, low price. Crops harvested outside these high supply periods generally get higher prices).
3. Ask participants to circle the high price periods in the table for 4 crops they might want to grow.
4. Then ask them to count back the number of days to grow the crops they have selected to find the planting date to get the maximum price. Tell them they should consider growing these crops at this time. However, warn participants that if they propose to grow crops in the hot summer time, they should select heat tolerant crops and be sure they will have enough water to finish growing the crops.

Exercise 1.13: Average monthly price per unit at

Crops	Unit	10	11	12	1	2	3	4	5	6	7	8	9	Duration
Group - 1														
1. Yard-long Bean	Bunch	100	80	80	80	100	120	150	150	100	120	100	10	50-60 days (Akari 111)
2. Okra	Bunch	60	80	80	80	100	120	100	120	120	120	120	120	50-60 days Kirti
3. Onion	Viss	2000	2000	3000	3500	2000	1200	1200	1200	1500	1500	1500	1800	90-150 days
4. Carrot	Viss	3500	2800	2800	200	2500	3000	3000	3500	3500	3500	3500	3500	90 days Chike
Group - 2														
5. Chili	Tin	250	200	200	150	150	200	200	200	250	300	300	250	85-90 days Demon and Tongla692
6. Tomato	Viss	1300	1300	1000	600	500	1000	1200	1200	1200	1200	1200	1300	75-90 days Nirvana 044
7. Egg-plant	Bunch	300	300	250	250	300	400	400	400	500	400	400	300	80-90 days Runako
8. White Egg-plant	Fruit	20	20	20	20	20	20	20	20	20	20	20	20	70-80 days White Color
9. Coriander														30-60 days
Group - 3														
10. Cabbage	Head	1500	1000	800	500	400	400	800	1000	1500	1500	1500	1500	85-90 days Nuzaka
11. Cauliflower	Flower	1500	1000	800	500	400	400	800	1000	1500	1500	1500	1500	85-95 days Poornima 088 (winter) 75 days Atria153 (Hot)
12. Broccoli	Flower	900	900	800	600	500	700	900	900	1000	1000	1000	1000	
13. Radish	Bunch	250	250	250	200	100	50	80	100	100	150	200	200	45 days Ural
14. Water spinach	Bunch	30	30	30	30	30	30	30	30	30	30	30	30	45-55 days Liao, Yangtze
15. Corn	Ear	150	150	200	200	120	120	150	200	200	200	200	150	70-90 days
16. Mustard														40-45 days
Group - 4														
17. Bottle Gourd	Fruit	1500	800	500	400	400	800	800	1000	1500	1500	1500	1500	65 days Anmol
18. Snake Gourd	Fruit	100	200	200	100	100	100	200	250	250	250	100	100	65 days
19. Ridge Gourd	Fruit	100	150	300	300	100	100	300	300	300	250	100	100	65 days
20. Bitter Gourd	Bunch	150	150	150	120	150	150	150	200	200	150	150	150	65 days
21. Cucumber	Fruit	150	150	100	80	80	100	150	150	150	100	100	150	60-70 days Shweyati 777

22. Water Melon	Fruit	2500	2000	2000	2500	2000	1000	2000	2500	2500	2000	2500	2500	90-100 days Padamya 824
23. Pumpkin	Fruit	1000	1200	1200	1500	1500	1200	1000	1000	800	1000	1000	1000	85-90 days Arjuna
24.														
25.														

*(*Source: East West Seed)*

Activity 8: Grow what the market wants (5 minutes)

Plenary

1. Ask participants – "How do you find out what crops the buyers want?" Write their ideas on a flip chart. (2 minutes)
2. Refer participants to their workbooks Exercise 1.14 and read out the answers. Tell participants to add any other comments in the spare lines in the exercise table. (3 minutes)

Exercise 1.14: How do you know what crops buyers want?

Some ideas:

1. Visit buyers and ask them
2. Ring them
3. Invite them to come and talk with your group. They may not come to see one individual, but might come if they can talk to a whole group.
4. Analyze prices – high price at high demand, low supply periods

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3. Say that we want to invite some buyers to come to the next FFS session so that the farmers and buyers can talk together to find out what buyers want and if there is a chance of making a sales agreement with them.

Activity 9: Sales Agreements (20 minutes)

Plenary

1. Ask participants – "What do they understand by the word 'agreement'?" Write their ideas on a flip chart. **(2 minutes)**
   Then refer participants to Exercise 1.15 in their workbooks to see the definition.

Exercise 1.15: Definition of an agreement

Agreements are formal written contracts or informal verbal agreements made between individuals or groups for products and services.

2. Ask participants to give examples of when they have made formal or informal agreements?

What type of products or services were provided under the agreement examples? (3 minutes)

Sub groups (10 minutes)

3. Ask participants to discuss the following questions, writing their answers in Exercise 1.16 in their workbooks.

Exercise 1.16: Questions about Agreements

What are the benefits of having a written sales agreement with a product buyer?

……

……

……

What are the benefits of having a verbal sales agreement?

……

……

……

Would a written agreement be better than a verbal agreement? Why?

……

……

What are the negative aspects of having a sales agreement?

.....

.....

.....

4. Invite sub group leaders to share their ideas with the plenary. (10 minutes)

Activity 10. Agreement Formation: (Total 20 minutes)

Plenary

1. Refer participants to the following points listed in Exercise 1.17 in their workbooks

In pairs

2. Allocate 1 question to each pair. Tell participants that they should ask these questions to product buyers when they come to visit them next session. Ask each pair to discuss their allocated question (5 minutes)
3. Invite pairs to explain their understanding of each question to the plenary. Encourage discussion. Give help when required. (15 minutes)

Exercise 1.17: Factors to look for in a Sales Agreement

1. What products do you want to buy? Describe your product clearly.
2. How much product can you buy? For example, 5 baskets per farmer, or 100 baskets from the whole group.
3. What is the time period when the buyer wants to buy the produce?
4. What quality standards are required? For example: size, color, moisture content and grade.
5. What GAP cultivation practices are required to market produce as 'GAP produce'?: This refers to how the crop was produced, for example: (i) Safe for the consumer – sold after chemical withholding periods; (ii) used less chemicals, more organic; (iii) used government approved chemicals only; (iv) not harmful to the environment; (v) not harmful to the farmer and the workers; (vi) used quality seed from pure varieties; and (vii) harvested, stored and transported properly so there is a long shelf life. Remind participants of the other government GAP requirements outlined in the GAP definition in their workbooks.
6. How and where should the products be delivered? For example, specific locations, time, mode of transport, packaging, who pays for transport. Perishable products like fruit and vegetables may need special packaging, ripeness, storage and transport requirements.
7. What price will be paid and under what conditions? For example, price based on quality and price based on quantity. Ask about individual farmer price and group price for a larger volume of sales and better prices.
8. What payment procedures?: How and when will the farmer be paid by the buyer; for example cash on delivery, payment after some days or months, paid by cheque?
   Does the buyer offer technical support: Examples might be a leaflet or a personal visit to advise on quality standards.

9. Other incentives: These are extra benefits the seller or buyer can offer. For example, if you sell me more than 10,000 baskets of products, I can give you credit for inputs (pre financing), or a free motorbike or other promotions. This especially applies to group buying/selling of large volumes.
10. If there is disagreement between buyers and sellers, how can these problems be solved?
11. How is the product insured against risks like fire, flood, drought, damage in transport? Who is responsible for organizing and paying for this?
12. Are there any penalties if either party breaks the agreement?

4. Tell participants that next session we will ask buyers to present their ideas about forming agreements or guidelines for what crops to grow and what they want to buy, plus answers to the above questions. They will be asked to give their names and contact numbers and farmers can negotiate their own contracts with them if they want to after the session.

Activity 11: Ground Rules of the training course (8 minutes)

Plenary

1. Brainstorm with the participants about ground rules during the course. Write their ideas on a flip chart. Refer them to the list in Exercise 1.18 in their workbooks.

Exercise 1.18: Example of Ground rules:

1. Be on time.
2. Participate actively.
3. Listen to what other people have to say without interrupting them.
4. Raise your hand to ask a question or to say something – wait for your turn.
5. Be willing to share experiences and learn new things from others.
6. ……
7. ……
8. ……

Activity 12: Evaluate the Session: (5 minutes)

Plenary

1. Ask participants the following questions and write their answers in your notebook for future reference.
1. What worked well in the lesson?
2. What did not work so well?
3. How could the lesson be improved?

Activity 13: Summary and Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Summarize the session, reminding the participants of the main points.
2. **Check the schedule** with the participants and agree on the topics, dates, timing and where to have the training. Pay special attention to the suitable timing and place for women who may not be so flexible because of home duties, social and cultural practices.

3. **Who should come to the training:** Tell the participants that you want the 'doer' of the tasks to come to the training so that they get the information first hand and not passed on from one to the other when information can be lost or reported incorrectly.

   (Optional: Play the whisper game where you stand the participants in a circle and whisper a message to the first participant such as: Saw Hla Htwe bought 2 bags of 15:20:0 fertilizer, 6 seed varieties from EW and Golden Seed Companies, a bucket and hoe for cultivating his new garden at the market on Wednesday. Or, It is recommended to spray 12mls/liter of XX spray in the evening or early morning to prevent mealy bug and mite damage on cucumbers and pumpkins. The first participant then whispers the message to the second participant, who then whispers the message to the third participant and so on, until all participants have heard the message. The last participant then tells the group what she or he thinks the message is. Note that by the time these messages get to the end of the group they will have changed a lot from the original message. This shows that information passed on from one person to another can often be only partly correct. It is better to have the person to whom the information is most relevant (male or female) attend the training so that they get correct information first hand. (Note: You can split into 2 groups of 10-12 people to speed up this whispering process)

Session 2: Buyer Led Workshop

Duration: 3 hours in the classroom, no field work

Materials: Flipchart, markers, tape, Attendance Register form; vinyl # 1: Cropping calendar;

Objectives:

1. To know what invited buyers want farmers to grow and when
2. To encourage buyer contracts or pre financing
3. To encourage buyers to provide extension advice
4. To encourage buyers to provide recommended seed varieties to suit market requirements

Activity 1: Preliminary work before the workshops:

Plenary

1. Identify cooperating product Buyers – could be collectors, wholesalers, market sellers. While wholesalers know a lot about the general market because they buy a lot of vegetables and distribute them daily to many sellers, often farmers do not like them because they often offer lower prices than local market sellers. Therefore, try to get one or two local market sellers to present their vegetable preferences and timing at the workshop, and if they cannot come, ask a wholesaler. The participants should choose who should come. Stagger their timing, say half hour for one, then another half hour for another, not both at the same time. That way buyers can speak more freely without competing in front of each other.

Individuals

2. Discuss with the Buyers how they can link with project farmers – 'win-win' arrangements – ideas could be contract farming, pre-financing, written contracts of verbal flexible agreements, or no agreements but just guidelines to help the farmers choose their crops.
3. Ask the buyer if Group Selling is an option for them. If so, conduct an assessment of the whole group's ideas for which crops to grow, with the CCBG (Cluster Co-operative Business Group) (and wider groups of farmers if appropriate) or the FFS group. Giving the buyer a chance to buy from the whole group may help to get a better or more stable contract price for a high volume of products e.g. The RWCP 999 Quality Seed Multiplication group obtained double the normal price, and chili groups selling/buying has given a moderate but stable contract price.
4. Invite product Buyers to prepare flip charts or vinyls giving answers to the questions listed below.

Activity 2: Questions to discuss at the workshop

Plenary

1. Tell participants of the purpose of the Buyer Led workshop. Say that Component 4 of the project facilitates linkages between farmers and other value chain actors in a way where they both benefit – a 'win-win' situation. In this way, the linkages are more likely to continue beyond the life of the project. Tell participants that this session links produce buyers and farmers formally or informally and acts as a guide to farmers about what crops they should grow to meet market demands.
2. Ask buyers to discuss their answers to the questions in Exercise 1.16 with the irrigation cluster FFS farmers (and perhaps others farmers outside of the FFS). The more farmers that join group sales agreements, the better it is for both parties.
3. Ask buyers to leave these flip charts with the farmers. This enables farmers to study them afterwards and get back to the buyers with their ideas for a contract or informal agreements:

Exercise 2.1: Factors to look for in a Sales Agreement

1. What products do you want to buy? Describe your product clearly.
2. How much product can you buy? For example, 5 baskets per farmer, or 100 baskets from the whole group.
3. What is the time period when the buyer wants to buy the produce?
4. What quality standards are required? For example: size, color, moisture content and grade.
5. What GAP cultivation practices are required to market the produce as 'GAP produce'?: This refers to how the crop was produced, for example: (i) Safe for the consumer – sold after chemical withholding periods; (ii) used less chemicals, more organic; (iii) used government approved chemicals only; (iv) not harmful to the environment; (v) not harmful to the farmer and the workers; (vi) used quality seed from pure varieties; and (vii) harvested, stored and transported properly so there is a long shelf life. Remind them of the other government GAP requirements outlined in Exercise 1.3 in their workbooks.
6. How and where should the products be delivered? For example, specific locations, time, mode of transport, packaging, who pays for transport. Perishable products like fruit and vegetables may need special packaging, ripeness, storage and transport requirements.
7. What price will be paid and under what conditions? For example, price based on quality and price based on quantity. Ask about individual farmer price and group price for a larger volume of sales and better prices.
8. What payment procedures?: How and when will the farmer be paid by the buyer; for example cash on delivery, payment after some days or months, paid by cheque?
   Does the buyer offer technical support: Examples might be a leaflet or a personal visit to advise on quality standards.
9. Other incentives: These are extra benefits the seller or buyer can offer. For example, if you sell me more than 10,000 baskets of products, I can give you credit for inputs (pre financing), or a free motorbike or other promotions. This especially applies to group buying/selling of large volumes.
10. If there is disagreement between buyers and sellers, how can these problems be solved?
11. How is the product insured against risks like fire, flood, drought, damage in transport? Who is responsible for organizing and paying for this?
12. Are there any penalties if either party breaks the agreement?

Activity 3: Summary of the workshop

Plenary

(i) FOs should write the names and contact details of the buyers on a flip chart for farmers to copy into their notebooks.
(ii) Thank the buyers for coming and giving their presentations
(iii) Thank the farmers for coming and considering the marketing options that have been presented.
(iv) Invite the farmers to informally discuss marketing agreements with the buyers, either after the workshop or to contact the buyers and meet with them at another time.
(v) Ask farmers to consider what they have learnt today, discuss this information with their family, and decide which 4-6 crops they want to grow from a marketing perspective.

Note:

1. Remind the farmers that if they all grow the same crops at the same time there may be an oversupply, resulting in a low price. Suggest farmers grow a diversity of crops to spread the risk of low prices, and

if practical, grow crops in low supply and high demand periods when prices are high.

2. Ask buyers if they are able to link with other buyers in other regions, so that if the price is low in their local region, the buyers may be able to sell for a higher price in another region. That way the buyer still gets the farmer's business (and profit for themselves), and the farmer gets a better price. A 'win-win' situation!

Activity 4: Evaluate the Session: (5 minutes)

Plenary

1. What worked well in the lesson?
2. What did not work so well?
3. How could the lesson be improved?

Activity 5: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind them of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. Therefore, there is a better chance they can apply it properly in the field work. If the trainee is one person, but the 'doer' is another person, the 'doer' may get the wrong information.

Session 3: Crop Selection (continued)

Duration: 220 minutes in the classroom, no field work.

Objectives:

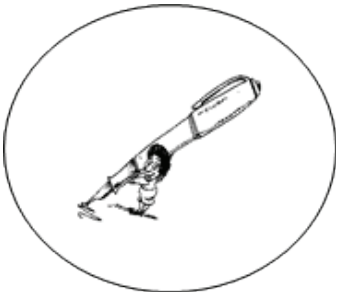
1. To summarize the previous session
2. To identify suitable sites for CV/CFC production
3. To assess the participant's soil suitability and GAP soil care requirements
4. To assess participant's labor needs and availability
5. To assess participant's crop water requirements against water availability
6. To recognize that different crops have different profitability according to yield and price
7. To assess the benefits and negative effects of CV/CFC on both males and females to see if participants should move forward with CV/CFC or not
8. To assess the impact of CV/CFC growing on the environment
9. To recognize participant's need for technical knowledge to grow the crops following GAP
10. To recognize that input availability assessment is important before moving ahead with CV/CFC growing
11. To know how to do a risk assessment
12. To summarize crop selection

Activity 1: Review Session 1 and 2 and topics for this session (Total time 10 minutes)

Plenary review

1. Invite participants to say what they learnt in the last 2 sessions. Write their ideas on a flip chart (8 minutes)
   - Getting to know each other
   - Explain the concept of GAP
   - To learn about the Workbook
   - Commercialization of farming
   - Crop selection criteria
   - Crop selection in more detail -Seasonal Calendar, Diversity, Crop Rotation, and Market Price
   - Grow what the market wants
   - Sales Agreements
   - Agreement Formation
   - Ground rules for FFS
   - Buyer Led Workshop

2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session. (2 minutes)



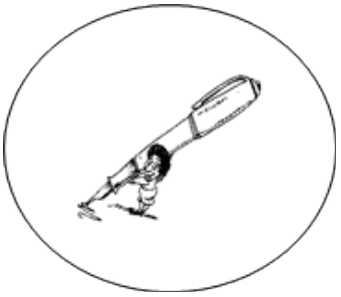
Tip for the Facilitator:

This activity gives participants experience in using the Table of Contents so they can more easily find information when they are back in their homes.

Materials:

Flipchart, markers, tape, Attendance Register form; vinyl # 1: Cropping calendar;

Activity 2: Crop Selection criteria continued - Site selection (Total time 10 minutes)



Tips for the Facilitator:

Remind the participants that the project is providing 90% funding for a demo plot (1/4 acre). If participants want to have a larger plot and grow different vegetables than those supported by the project, that is okay, but participants must pay their own expenses for a larger plot.

Plenary

1. Refer participants to the crop selection criteria in Exercise 1.6 in their workbooks.
2. Tell them that now they will move on to study the next criteria – Site Selection
3. Brainstorm "What criteria do you consider for vegetable crop Site Selection?"
4. Write participant's ideas on a flip chart **(5 minutes)**

Individual

5. Refer to Exercise 3.1 in their workbooks and invite participants to write their ideas from the flip chart into the blank spaces provided if their ideas are not already in the list.
6. Ask them to evaluate their own sites by putting a tick (for 'yes') or cross (for 'no') in the site evaluation column in the table. Tell them if they have too many crosses, then their site is not suitable. **(5 minutes)**

Exercise 3.1: Farmers site selection evaluation:

Criteria	Your Site Evaluation (Tick for 'yes', or cross for 'no')
1. Not far from home to enable regular visits	
2. Free from flooding	
3. Near a sufficient contaminate free water source	
4. Free of pests or disease from their field and neighboring fields	
5. Soils are suitable for vegetables or field crops	
6. Soils free from contamination by poisonous heavy metals like chromium and arsenic.	
6. Previous history of suitable land use	
7. Have some shade trees but not too many	
8. Have good access to market links e.g. collectors and buyers	
9.	
10.	
11.	
12.	

Activity 3: Soil characteristics and management (Total Time: 65 minutes)

Plenary

1. Brainstorm the following 2 questions: (5 minutes)

I. "What do you think soil is made of?"

II. "What does a good soil for growing vegetables look like?" Write these questions on a flip chart followed by the participants' ideas.

2. Go over the soil characteristic notes in Exercise 3.2 in particpants' workbooks. Ask participants to add their ideas in the blank lines in their workbooks if their ideas are not already on the list. (10 minutes)

Exercise 3.2: Soil components

Question 1: What are the main components of soil?

- Big and small particles of mineral substances (45%),
- Organic matter, micro-organisms (5%),
- Air (25%)
- Water (25%)

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Question 2: What does a good soil for growing vegetables look like?

- Black, brown or red top soil
- Good smell
- Crumbly texture but not too fine
- Moist but not too wet
- Rich in organic matter which is the home for nutrients and micro organisms

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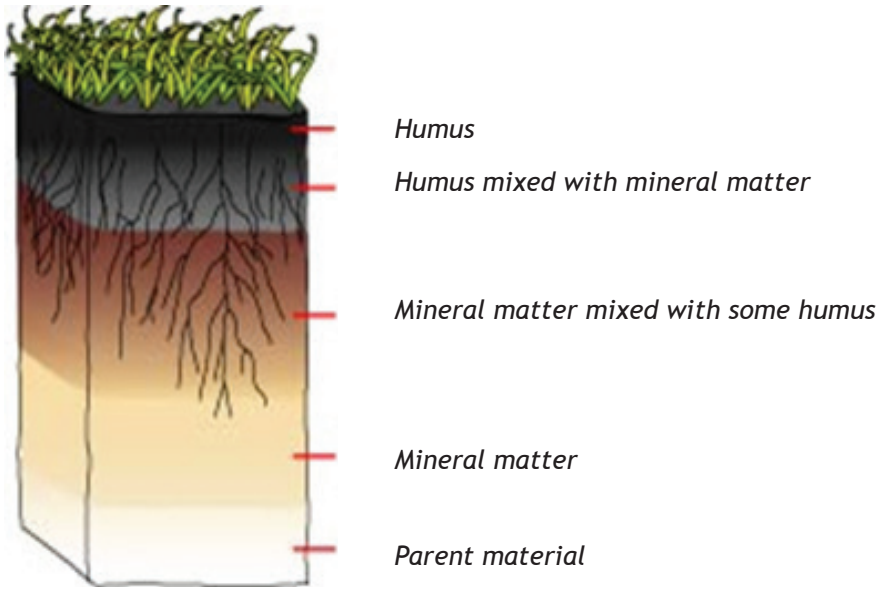


Plenary review

3. Go over the soil analysis steps in the table below with participants. It can be found in Exercise 3.3 in their workbooks. Ask individual participants to read some lines, or the whole group to read some lines to keep participants actively involved. (10 minutes)

   Note: If you have time you could bring in examples of silt, clay and sandy soils and get groups to identify them following point 6 in the table below.

Exercise 3.3: What to look at while analyzing the soil

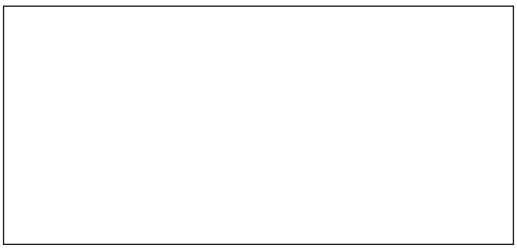
1. Soil structure and texture determines what sort of plants we can grow. Important properties are:
   - Clay – binds nutrients and water
   - Humus – helps aeration and root growth
   - Sand – increase porosity (porosity is defined as being full of tiny holes so that air or water can pass through)
2. Soil structure is defined by the way individual particles of sand, silt and clay, are assembled to form larger particles. Sand is the biggest particle, clay is smaller and silt is even smaller.
3. Soil Texture is how the soil feels in the hand and behaves when it is cultivated. The relative percentages of sand, silt and clay are what give soil its texture.
   - Sandy soils feel gritty, are easily cultivated, and are free draining, but don't hold water in the dry season.
   - Silt soils are very fine and hold moisture but compact with cultivation
   - A clay soil feels sticky, does not drain well and gets hard when dry
4. Soil color is determined by the amount of minerals and organic matter in it. Soils high in iron are deep orange-brown to yellowish-brown. Soils that are high in organic matter are dark brown or black. Color can also tell us how a soil "behaves" – a soil that drains well is brightly colored and one that is often wet and soggy will have a mottled pattern of greys, reds, and yellows.
5. Other soil characteristics.
   - Plant and animal life in the soil like earthworms and other biota
   - Roots.
6. Identifying your soil type. Wet a handful of soil and rub the soil between your fingers. The soil can be classified on how it feels.
   - Clay: sticks to fingers, is cohesive (particles stick together), has a high plasticity (can be shaped or formed easily) and has a shiny surface after squeezing between fingers.
   - Silt: is non-sticky, only weakly formable, has a rough surface after squeezing between fingers and feels like flour
   - Sand: cannot be formed, does not stick to fingers and feels very grainy.

Individual exercise

4. Ask participants to draw a horizon profile of their main soil type and answer the questions in Exercise 3.4 in their workbooks. **(10 minutes)**

Exercise 3.4: Horizon of the farmer's own soil

1. Draw a horizon profile of your most popular vegetable soil



2. Describe the feel of the soil in the growing zone

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3. Describe the color of the soil in the growing zone

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4. Describe other characteristics of the growing zone

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Plenary session

5. Go over Exercise 3.5 in particpants' workbooks. Invite individual farmers to read one line each or the whole group to read to encourage their participation and reading of the workbook. (10 minutes)

Exercise 3.5: Matching crops to preferred soil type

Crops	Soil type	Tick or Cross Suitability
Group - 1		Your Farm
1. Yard-long Bean	Best in friable (easy to crumble), well drained soils such as silts	
2. Okra	Will grow in silts but like high organic matter	
3. Onion	Will tolerate a wide range of soils including silt loam	
4. Carrot	Will grow in silt loam but can tolerate heavy clays	
Group – 2		
5. Chili	Best in friable well drained soils such as silt loam but tolerant of a range of soils	
6. Tomato	Best in friable well drained soils such as silt loam but tolerant of a range of soils	
7. Egg-plant	Best in friable well drained soils such as silt loam but tolerant of a range of soils	
8. White Egg-plant	Best in friable well drained soils such as silt loam but tolerant of a range of soils	
9. Sweet corn	Best in friable well drained soils such as silt loam but tolerant of a range of soils	
Group – 3		
10. Cabbage	Will grow in silt loam but can tolerate heavy clays	
11. Cauliflower	Will grow in silt loam but can tolerate heavy clays	
12. Broccoli	Will grow in silt loam but can tolerate heavy clays	
13. Radish	Will grow in silt loam but can tolerate heavy clays	
14. Water spinach	Will grow in silt loam but can tolerate heavy clays	
Group – 4		
15. Bottle Gourd	Will grow in silt loam but likes high organic matter	
16. Snake Gourd	Will grow in silt loam but likes high organic matter	
17. Ridge Gourd	Will grow in silt loam but likes high organic matter	
18. Bitter Gourd	Will grow in silt loam but likes high organic matter	
19. Cucumber	Will grow in silt loam but likes high organic matter	
20. Water Melon	Will grow in silt loam but likes high organic matter	
21. Pumpkin	Can tolerate heavy clays with some organic enrichment	

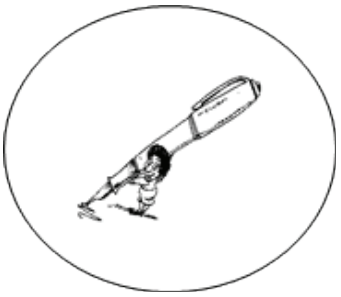
In Pairs

6. Divide participants into pairs and discuss the question in the right hand column of Exercise 3.5 together – "Is their farm suitable for the different crops or not?" Ask participants to put a tick in their individual workbooks to show if their farm is suitable, and a cross if not suitable against each crop. (10 minutes)

Group Exercise: Causes of Soil Degradation (10 minutes)

7. Ask participants: "What are the causes of soil degradation?"
8. Write their answers down in column 1 on a flipchart
9. Brainstorm how they could solve these problems and write their ideas in column 2 of the flip chart

10. Refer them to the soil degradation and solutions table Exercise 3.6 in their workbooks. Compare their answers with those in the workbook and invite them to add any answers if they want to.



Tips for the Facilitator:

Instead of the facilitator reading the tables in the manual line by line, the facilitator could ask participants or the whole group to read some of the lines to help them better understand by "doing" rather than just listening. Having different people speaking can also make the presentation more interesting.

Exercise 3.6: Soil Degradation Causes and Solutions

Soil Degradation Causes	Solutions
1. Mono-cropping drains all nutrients specific to that crop	Use a rotation with different crops
2. Burning surface cover damages organic matter	Dig in green (wet) and dry materials to decompose and make the soil fertile
3. Only using chemical fertilizer results in lower fertility and yield in the long term	Use organic matter or a mixture of chemical and organic matter
4. Water erosion causes loss of soil and nutrients	Select flood free sites, have free draining soils, have raised beds and drainage channels
5. Direct sunlight on the soil causes high temperature, erosion, evaporation of soil nutrients and water	Cover the soil with straw, plastic, or a cover crop and have filtered shelter
6. Strong wind causes soil erosion and water evaporation	Have filtered shelter to reduce wind speed. Some air flow is good.
7. Compacting the soil breaks down soil structure and makes it become hard	Use low impact cultivation and plant care techniques
8.	
9.	
10.	

Activity 4: Labor availability (15 minutes)

Plenary discussion

1. Brainstorm with participants: "Why is it important to have a labor participation plan?"
2. Write their ideas on a flip chart.
3. Refer participants to Exercise 3.7 in their workbook and go over the table. Invite them to write ideas mentioned by the group but which are not on the list, in the blank lines in the table.

Exercise 3.7: Labor participation planning

A labor participation plan helps to:

1. Calculate total labor requirements
2. Assess family labor availability and preferred tasks. For example, males do some heavy jobs like cultivation while females specialize in lighter work like weeding. Other tasks are shared between men and women.
3. Hired labor from outside may be needed if there is not enough family labor.
4. Cost of labor - Family labor is usually for free (but share in the profit), while outside labor has to be paid for and should be included in the budget costs.

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Activity 5: Water requirements (Total 10 minutes)

Plenary (2 minutes)

1. Tell participants that different crops have different water requirements and therefore water delivery costs. Some need a lot of water while others just a little. Review the following table Exercise 3.8 in their workbooks.

In pairs (8 minutes)

2. Ask participants to give a ranking of 1 for lowest water requirement per crop family, 2 for the next lowest water requirement etc. within each crop family.
3. Summarize by telling participants that if there is limited water available, especially from dams, then farmers should consider growing crops with low water requirements, because if they run out of water, their crops will die.

Exercise 3.8: Crop water requirements

Crops	Water Requirements (L/ square yard)	Ranking 1 for the least water requirement, 2 for second least water requirement etc.
Group - 1		
1. Yard-long Bean	319	
2. Okra	425	
3. Onion	637	
4. Carrot	319	
Group – 2		
5. Chili	637	
6. Tomato	531	
7. Egg-plant	743	
8. White Egg-plant	743	
9. Coriander	334	
Group – 3		
10. Sweet corn	743	
11. Cabbage	637	
12. Cauliflower	637	
13. Broccoli	531	
14. Radish	212	
15. Water spinach	319	
Group – 4		
16. Bottle Gourd	212	
17. Snake Gourd	212	
18. Ridge Gourd	212	
19. Bitter Gourd	212	
20. Cucumber	531	
21. Water Melon	425	
22. Pumpkin	637	

Activity 6: Profitability and Breakeven analysis (Total 60 minutes)

Plenary

1. Brainstorm session: Write the following questions as well as participants' answers on a flip chart (i) What is a budget plan? (ii) Why is it important to measure if you will have a profit or not? (iii) What is breakeven analysis? (3 minutes)
2. Go over the definitions of budgets, profit and breakeven analysis in Exercise 3.9 in their workbooks. (12 minutes)

Exercise 3.9: Definitions of a budget and breakeven analysis

A budget plan is a method of measuring the Profit or Loss of an enterprise before you start.
It records **INCOME** minus **EXPENDITURE** = **PROFIT OR LOSS**.
It is important to estimate if you will get a Profit or Loss BEFORE you grow your crop. There is no point in growing something that is likely to make a loss. Better to save your money and NOT grow that crop, and instead find another crop that is likely to be profitable.
Breakeven analysis shows us at what price the farmer will break even - that is, no profit and no loss. If you think the price will go below this amount then you will make a loss. You should therefore NOT GROW this crop at this time.
Break even calculation: **TOTAL EXPENDITURE** divided by the **YIELD/UNIT** to give the **BREAKEVEN PRICE PER UNIT**. For example, it costs 55,000 kyat to produce 500 viss of tomatoes. Divide Cost (55,000) by total viss (500) to get the breakeven price (110 kyats/viss).
Note 1: Profit, loss and breakeven estimates at crop selection time are your best estimates (calculated guesses) of the financial outcome. You can never be sure if you will get the yield you want or if the price will go up or down, because you do not know the future for sure. You can however try hard to carry out the activities that you have put in the budget so that you will have a good chance of getting the result you planned. Aim for a high yield and good price to get the income, by using the listed inputs along with the correct application timing, amount and costs, to achieve your target expenditure. Costs should include the cost of production like seeds and fertilizer, and also hired labor, harvesting and marketing costs. Do not cost family labor because the family can share in the profit.
Note 2: In farming budgets, do not include personal costs like school fees, house repairs, etc. These can be recorded in a separate family budget if you want.

In Pairs

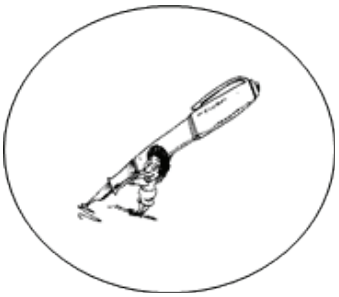
3. Ask participants in pairs to look at the table Exercise 3.10 in their workbooks. It shows the proposed GAP profit at average yield and price for each of the 28 selected crops. (10 minutes)
4. Ask the pairs to rank the crops in each rotation group giving a 1 for the highest profit and a 2 for the next highest etc. This should show which crops are the most profitable in each family.
5. Ask different individuals to tell the group which are the most profitable crops.

Exercise 3.10: What is the order of profitability of the different crops using the recommended GAP?

Crops	Profit per 0.06 acres	Profitability Ranking Rank 1 for the most profitable, 2 for second most profitable etc.
Group - 1		
1. Yard-long Bean	93800	4
2. Okra	89500	3
3. Onion	162552	2
4. Carrot	114800	1
Group – 2		
5. Chili	139200	3
6. Tomato	198800	1
7. Egg-plant	110200	4
8. White Egg-plant	91600	5
9. Coriander	168000	2
Group – 3		
10. Cabbage	130550	2
11. Cauliflower	125075	4
12. Broccoli	149075	3
13. Radish	86225	5
14. Water spinach	139700	1
15. Corn	95900	6
16. Mustard	63400	7
Group – 4		
17. Bottle Gourd	146075	2
18. Snake Gourd	110375	4
19. Ridge Gourd	117075	3
20. Bitter Gourd	82425	7
21. Cucumber	181820	1
22. Water Melon	96125	6
23. Pumpkin	145750	5
Field Crop	1 Acre	
24. Corn	887520	4
25.Chili	1950800	1
26.Groundnut	304087	5
27.Water Melon	1963900	3
28.Onion	1911830	2

Plenary

6. Hand out Crop Management Tips (CMT) Expected Budget books for the farmers' reference. Tell participants that the profit in the previous exercise came from these budgets. Discuss the following **(10 minutes)**
7. Show participants the format of the budgets, going over the income, expenditure, profit/loss. Tell them that the price used in the budget example is for the average farmer at the average price. Also tell them if they work hard and are above average farmers, and aim for high price periods, then they will get a better profit.
8. You can see this in the table showing how the profit changes with changes in yield and price. You could say the lazy farmers might get low yield and profit, while the hard-working farmer should get the high yield and profit estimates? Ask them which type of farmer are they?
9. Point out the breakeven price calculations based on the average price and yield.
10. Also ask them to look at the expenditure: income ratio. Tell them they calculate this ratio by dividing the gross income by the expenditure. The answer is written as a ratio – spend 1: and get how many MMK back e.g. a 1:3 ratio means spend 1 MMK and get 3 back. Guide participants to look at the expenditure: income ratios in their budget books.
11. For homework, ask participants to look at the GAP inputs required for each crop, the expected income and expenditure, profit, breakeven price, and expenditure: income ratios. Tell them that this study should help them to select which crops to grow to maximize profit.



Tips for the Facilitator:

The facilitator should tell the group that they will not always get the highest price when everyone is selling their product at the same time because there is an oversupply in the market and the price will go down. The farmers will have to work out their breakeven price and not grow the crops at times when the price is lower than this or they will make a loss.

Activity 7: Impact on Males and Females (Gender impact analysis) (Total 15 minutes)

1. Tell the participants that in most farming families men and women work together to produce their crops. Say that if they decide to grow new crops with new or improved irrigation it will change the life of both males and females. We therefore have to assess whether the lives of both men and women will improve or worsen with the new crops and irrigation.

In pairs

2. Ask participants to fill in the effects of CV/CFC with irrigation on men and on women in the following table - Exercise 3.11 in their workbooks. Explain the meaning of Practical and Empowerment needs and ask participants to consider in what ways CV/CFC with irrigation might affect these needs. For example, does this GAP intervention cause the farmers to have less benefit than before, reach a higher degree of benefit than before, or is there no change (same level of benefit before and after the intervention was introduced).

Exercise 3.11: Impact on Men and Women of CV/CFC with Irrigation:

Male		Female	
Practical needs: (Support food, shelter, income and other family basic needs)	**Less: Same: More**	**Practical needs: (Support food, shelter, income and other family basic needs)**	**Less: Same: More**
Access to food		Access to food	
Access to income		Access to income	
Work load		Work load	
Empowerment needs: (Strengthen the individual person's status and feelings about themselves)		**Empowerment needs: (Strengthen the individual person's status and feelings about themselves)**	
Control of decision making		Control of decision making	
Learning opportunities		Learning opportunities	
Leadership opportunities		Leadership opportunities	
Status/Self worth		Status/Self worth	
Other Effects		**Other Effects**	

Summary of Impact on Males and Females

Question: "Overall, having considered the above, do both men and women in their family agree to follow GAP to grow their selected crops with new or improved irrigation?" Circle Yes/No.

Activity 8: Impact on the environment (Total 10 minutes)

1. Tell participants that sometimes farming can damage the environment. Brainstorm some harmful effects of farming on the environment. Write participants' ideas on a flip chart.
2. Go over the table in Exercise 3.12 regarding possible effects of farming on the environment and mitigation measures (ways to reducing any negative effects) or solutions to solve the problems.

Exercise 3.12: Environmental problems and mitigation measures

Environmental Problems	Effects	Solutions
High disease	High chemical use, low yield.	Use disease resistant varieties, crop diversity, rotations, good air flow lowers moisture around crops and reduces disease.
High chemical use	Destroys soil, high cost, harmful to farmers and consumer health.	Use less chemical and more organic approaches.
Inefficient water use	Wastes water causing crop losses and high irrigation costs. Can cause leeching and erosion.	Use water more carefully using water saving technologies like a shower rose, or drip instead of flood irrigation.
Low organic matter in the soil	Poor soil structure and nutrient uptake.	Use more organic matter.
Imbalanced soil nutrition – taking more out of the soil than putting in.	Gradual reduction in yield and soil breakdown until you have to stop farming.	Apply GAP levels or chemical and organic fertilizer according to each crop and yield requirements.

Activity 9: Technical Knowledge (Total 2 minutes)

1. Tell the farmers that during the FFS they will be taught technical knowledge on how to grow many different crops selected by farmers and advisors, and crops that are most suited for southern Rakhine.

Activity 10: Availability of inputs (Total 3 minutes)

1. Tell participants that they should investigate if inputs like seeds and fertilizer are available before finally selecting their crops.
2. Tell participants that we will look into input supply in detail in the next session.

Activity 11: Risk (Total 15 minutes)

Plenary

1. Brainstorm: “What is the meaning of the word “Risk”? Write participants’ ideas on a flip chart.

Refer farmers to the definition of risk in their workbooks, Exercise 3.13.

Exercise: 3.13

Definition of Risk
Risk is the probability of a harmful activity happening. Example: High probability of floods in the monsoon.

Brainstorm what risks there are in commercial vegetable & field crop growing (e.g. pest outbreak, drought, flood, low market price, climate change). Write participants’ ideas on a flip chart.

Refer participants to the table in Exercise 3.14 in their workbooks to review the risks and mitigation measures. Add any ideas from the brainstorming discussion into the table.
Ask the participants to put the 'frequency' of risk at their farm sites by writing Low, Medium, or High in column 2 next to the Risk mentioned in column 1.

Exercise 3.14: Risk Assessment

Environmental Problems	Effects	Solutions
Not enough water (drought)		Have irrigation with enough water. Use water efficient application methods
Salty water		Find ways to stop the flow of salty water Grow in salt free soil
Hot weather		Grow in cool periods Grow heat tolerant crops
Pest outbreak		Crop rotation Crop diversity Check crops regularly and take control steps early Use organic prevention and controls where possible to protect friendly insects Only use chemicals when absolutely necessary
Disease		As immediately above Keep crop surfaces dry to reduce fungal disease
Flood		Grow in flood free periods Grow on high flood free ground Use raised beds above flood levels
Storm		Grow in storm free periods Provide crop shelter
Low market price		Grow what the market wants Grow in high price periods Diversify crops to spread risk Develop marketing networks in different regions Develop purchase agreements

Activity 12: Summary of Crop selection: (Total 15 minutes)

Plenary

1. Refer participants to the crop selection criteria discussed in Session 1 that are indicated in the table under Exercise 3.14 in their workbooks.
2. For homework, ask participants to review these criteria and discuss with their family which crops to grow.
3. For homework ask participants to list the crops their family has selected in the left hand column.

4. For homework ask participants to put a tick or a cross against the selection criteria. A tick means ‘yes’ and a cross means ‘no’. If they have ticks against all criteria, then they should be happy with the crops they have selected and be ready to start growing these crops.
5. For homework, ask participants to go home and measure the fields where they want to grow their crops. They should try to find an area suitable for the 0.25 acre demonstrations split into 4 x 0.06 acre blocks. Draw this on the white board.
6. Tell the participants that sometimes their small fields may be more or less than 0.06 acres. This is alright, but the project will only partly fund a demonstration plot on 0.25 acres in total for CV and 1 acre for CFC. The farmers will have to pay for inputs for any area larger than this, themselves.

Exercise 3.15: Crop Selection for the coming season – under all headings in the columns, tick for alright, or cross for not so good

Crops	1. YLB	2. Okra	3. Carrot	4.	5.	6.								
Can grow in the season														
Diversity														
Rotation														
Price														
Market Buyer Recommendation														
Site														
Soil														
Labor														
Water														
Profit														
Males & Females Agree														
Not harmful to the environment														
Have technique														
Have access to inputs														
Risk														

Activity 13: Summarize the session (5 minutes)

Plenary

1. Brainstorm with the participants what you have discussed in the session. Write their ideas on a flip chart. Field Officers should fill in the gaps that the participants did not mention. (Note: Do not spend too much time on this. Just note the headings. You do not have time to facilitate the whole session again!)

Activity 14: Evaluate the Session: (5 minutes)

1. What worked well in the lesson?
2. What did not work so well?
3. How could the lesson be improved?

Activity 15: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 4: Irrigation Construction and Equipment Requirements

Duration: 3 hours

Objectives:

1. To improve current knowledge of irrigation water sources
2. To learn about construction options to access water
3. To discuss or practice some control methods in the field

Materials: White board; marker pens; tape; blank flip charts

Plenary discussion

Activity 1: Review of previous session and this session's topics. (5 minutes)

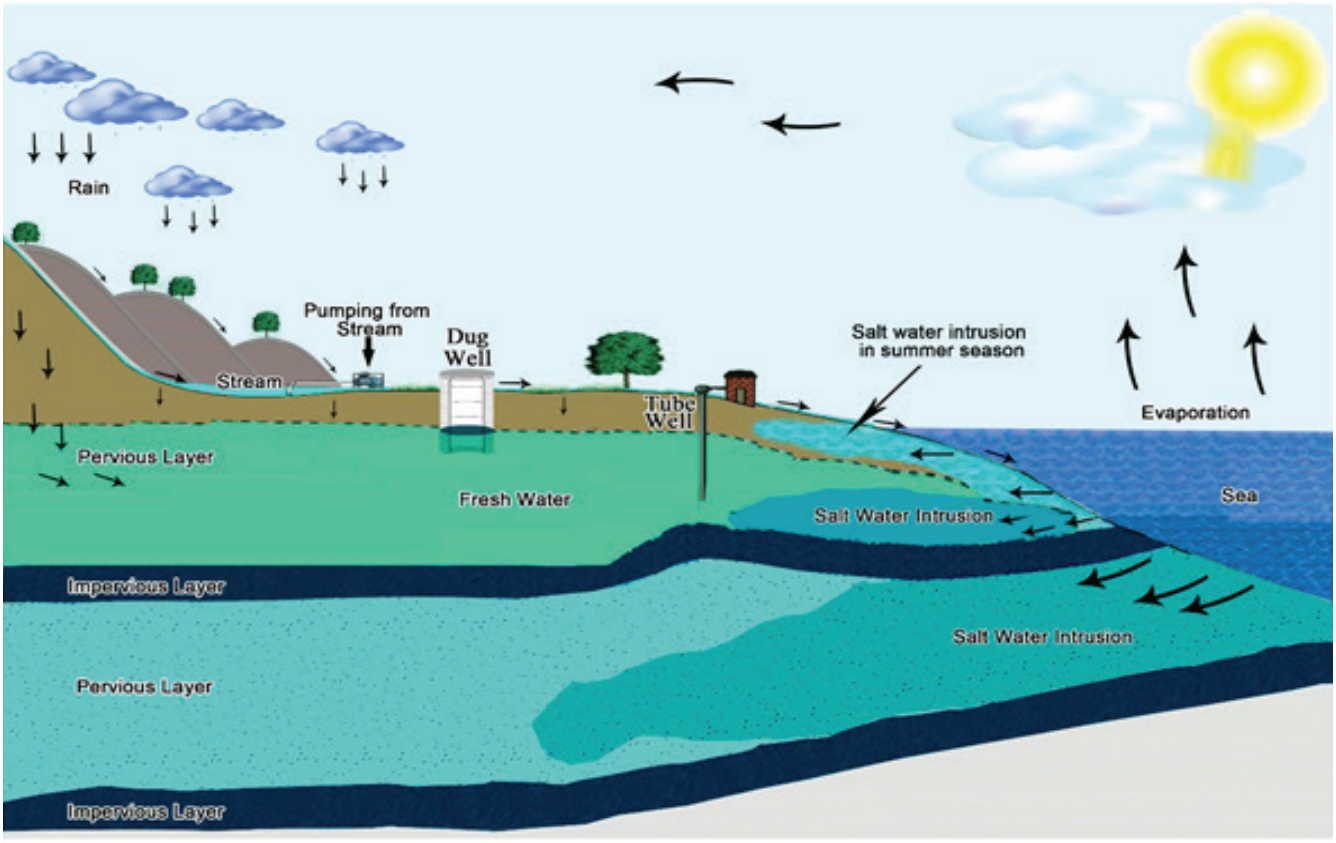
1. Invite participants to say what they learnt last session. Write their ideas on a flip chart.
2. Ask them to look at the Table of Contents in their workbooks and to read the topics aloud for this session:

Activity 2: Water resource in relation to rainfall, land surface, underground sources and the sea (15 minutes)

Plenary

1. Brainstorm with farmers: "Describe the relationship between rainfall, land surface and underground features and the sea?" Write their ideas on a flip chart.
2. Refer them to Exercise 4.1 in their workbooks and go over the answers in comparison with their answers. Congratulate them on the points they have made.

Exercise 4.1: Irrigation water hydrology and salt water intrusion



Activity 3: Structures & equipment needed to get access to the water resource (45 minutes)

Plenary

1. Brainstorm with the participants: "What structures and equipment are needed to get access to the water sources?" Write their ideas on a flip chart. Facilitator to add answers if the main options are not mentioned. (Main answers: Pumps and pipes from streams; shallow dug wells (20 feet deep & pumps and pipes); shallow tube wells (40 feet deep) plus pumps and pipes; ponds; deep tube wells (65 feet); spring fed gravity flow structures.) (5 minutes)

Sub groups

2. In one sub group per structure, ask participants to list the advantages and disadvantages of each water access type. (10 minutes)
3. Request leaders in each group to report to the plenary their ideas. (10 minutes)

Plenary

4. Refer participants to Exercise 4.2 in their workbooks and go over the guidelines in comparison with their answers. Congratulate them on the points they have made. (20 minutes)

Exercise 4.2: Structures & Equipment needed to access irrigation water

Structure or Equipment	**Cost MMK per structure (June 2020)**	**Advantages**	Dis-advantages
Pumping from streams	Zero cost. No structure.	No construction cost Plenty of water most of the time Sub surface and surface pumping	Sometimes end of season water dries up High lift, high pumping cost Could be a long way from their field
Shallow 3' diameter dug wells (18' deep)	720,000	Long lasting (20yrs+) Small construction site Low maintenance High refilling rate so can irrigate 2-3 sites at one time Can do manual or machine water lifting Sub surface and surface pumping Operation and Maintenance by local expertise Can increase the depth if water dries up	Only access water maximum 20-25 feet Risk of things falling into the well Could damage by flood without cover Not so pure water especially for drinking
Shallow 4" tube wells (50' deep	520,000	Very small construction site Can access water at greater depths Cost is low compared with other structures Access to pure water Easier to protect from flooding and impurities	Silting up after around 5 years Higher operation and maintenance to flush silt by outside skilled technicians Only access by surface pumping Can have problems pumping from greater depth

Ponds (32' x 32' x 9')	720,000	Can take advantage of top soil clean water discharge over salty water below Can fill with rain when no groundwater Water quality is good Can have big or small ponds depending on demand Can be dug by hand rather than machine only Sub surface and surface pumping	Takes more land than dug or tube wells Sandy area cannot make ponds and water leaks away Rain can erode sandy soil banks Water wastage by evaporation and percolation (20-25%) Open to impurities like animal waste Construction cost is high Flooding can damage ponds

Activity 4: Pump options to consider (40 minutes)

1. Brainstorm with the participants: "What pump options can the farmers consider before deciding on what pump to buy?" Write their ideas on a flip chart. Facilitator to add answers if the main options are not mentioned. (Main answers: 5.5 HP petrol pumps; small diesel pumps; electric submersible pumps; Solar surface and submersible lifting pumps; Solar DC pumps for deep wells)

Sub groups of participants

2. Divide the participants into subgroups and allocate one pump method per sub group. In sub groups , ask participants to list the advantages and disadvantages of their allocated water access type. (10 minutes)
3. Request leaders in each group to report to the plenary their ideas (20 minutes)
4. Tell participants that RWCP has tested 100% green pumping with solar lift pumps pumping directly to the field or through solar bilge pumps to drip systems if fields are more than 150 feet from the water source. Say that farmers should consider solar to save on pumping cost, ease of use for men and women, and less harm to the environment.

Plenary

5. Refer participants to Exercise 4.3 in their workbooks and go over the answers in comparison with their answers. Congratulate them on the points they have made.

Exercise 4.3: Types of pumps to access irrigation water

Types of Pumps	**Cost MMK per structure (June 2020)**	**Advantages**	Dis-advantages
5.5 HP petrol water lifting pumps	200,000	Small so can carry Available anywhere Easy to operate High discharge High water lifting capacity in short time	Fuel cost 1-2 litres/day Easy to maintain when not old Costly to maintain when older Not more than 25' suction height Environmental damage

Small diesel water lifting pumps	260,000	Fuel consumption lower than petrol High water lifting capacity in short time Easy to operate Spare parts available locally	Higher purchase cost Fuel costs Heavy to move Repair and maintenance difficult and costly Need mechanic to maintain Not more than 25' suction height Environmental damage
DC solar submersible pumps **Solar panel (200- 300watts)**	380,000 120,0000	No fuel cost No noise Easy to operate Easy to move No repairs and maintenance Becoming more easily available Environmentally friendly	Must replace pump when broken Not more than 25' suction height Small area watering capacity
Solar surface water lifting pump **Solar Panel (200 -300 watts)**	45,000 120,000	Low cost No fuel cost No noise Easy to operate Easy to move No repairs and maintenance Becoming more easily available Environmentally friendly	Must replace pump when broken Not more than 25' suction height Small area watering capacity
Solar deep well pumps **Solar panel 100 watts** **Battery 70 Ah**	200,000 70,000 80,000	Can pump 100' or more depth No fuel cost No noise Easy to operate Easy to move No repairs and maintenance Becoming more easily available Environmentally friendly	Initial cost high Must replace pump when broken More than 25', Up to 65' suction height and above on pump capacity Small area watering capacity
Bilge horizontal watering pump **Solar panel 100watt**	26,000 70,000	Low cost No fuel cost No noise Easy to operate Easy to move No repairs and maintenance Becoming more easily available Environmentally friendly	Low pressure horizontal flat land pumping only Must replace when broken Not more than 14' Total head Suction from ground level Small area watering capacity (up to 1.0 acre in stages)

Activity 5: Irrigation methods (Total time: 25 minutes)

Plenary

1. Brainstorm the question": "What are the different water application techniques which the participants know of?" Write their ideas on a flip chart. (2 minutes)

Sub groups

2. Divide the participants into subgroups and allocate one irrigation method per sub group. Ask them to draw up a flip chart into 2 columns: Advantages and Disadvantages. Ask them to list the advantages and disadvantages of their group's irrigation method on the flip chart. (5 minutes)
3. Ask the groups to present their findings. Compare their findings with Exercise 4.4 in their workbooks in the table below (18 minutes)

Exercise 4.4: Irrigation methods

Advantages	Dis-advantages
Furrow irrigation	
• Low operational costs • Easy distribution in soils with high water holding capacity	• Need level field to get even water distribution • High set up costs to level fields • Uses a lot of water • Encourages weed growth • Erodes sides of beds • Can result in build-up of salts by evaporation
Sprinkler Irrigation	
• Low operational costs for wide coverage • Can be used for frequent short term application on soils with low water holding capacity • Price varies with quality of material • Movable increases flexibility and reduces cost	• High set up costs • Requires high pump pressures • High losses from evaporation • Leaching of nutrients from plants and soil • Increases risk of disease because water is on the leaves • More weeds
Drip irrigation	
• Very efficient use of water • Equal distribution of water to all plants • Reduced weed growth • Can be used on uneven fields • Price varies with quality of material • Movable increases flexibility and reduces cost • Saves labor • Can apply fertilizer by fertigation (through drip irrigation)	• High set up costs • Tubes can become blocked • Difficult to change layout for different planting layouts • Tubes deteriorate in the sun unless under mulch
Shower rose in 8" x 4" furrow between rows on top of beds	
• Low cost fitting on end of hose • Can use with varying water pressures • Can direct water to the furrow where it can gradually seep into the bed rather than run off, reducing water waste and weed growth. • The rose lowers pressure & reduces erosion • Takes little time per bed if reasonable pressure	• Need level beds for even distribution of water
Watering can	
• Low set-up costs • Reasonably low use of water if directed at base of plants and not all over the land. • Can regulate spread and application point • Can be used on uneven fields in plant holes • Reduced weed growth if directed only at root zone and not all over the field.	• More labor intensive than other methods • Difficult to apply enough water

Furrow irrigation

Sprinkler irrigation

Furrow irrigation

Sprinkler irrigation

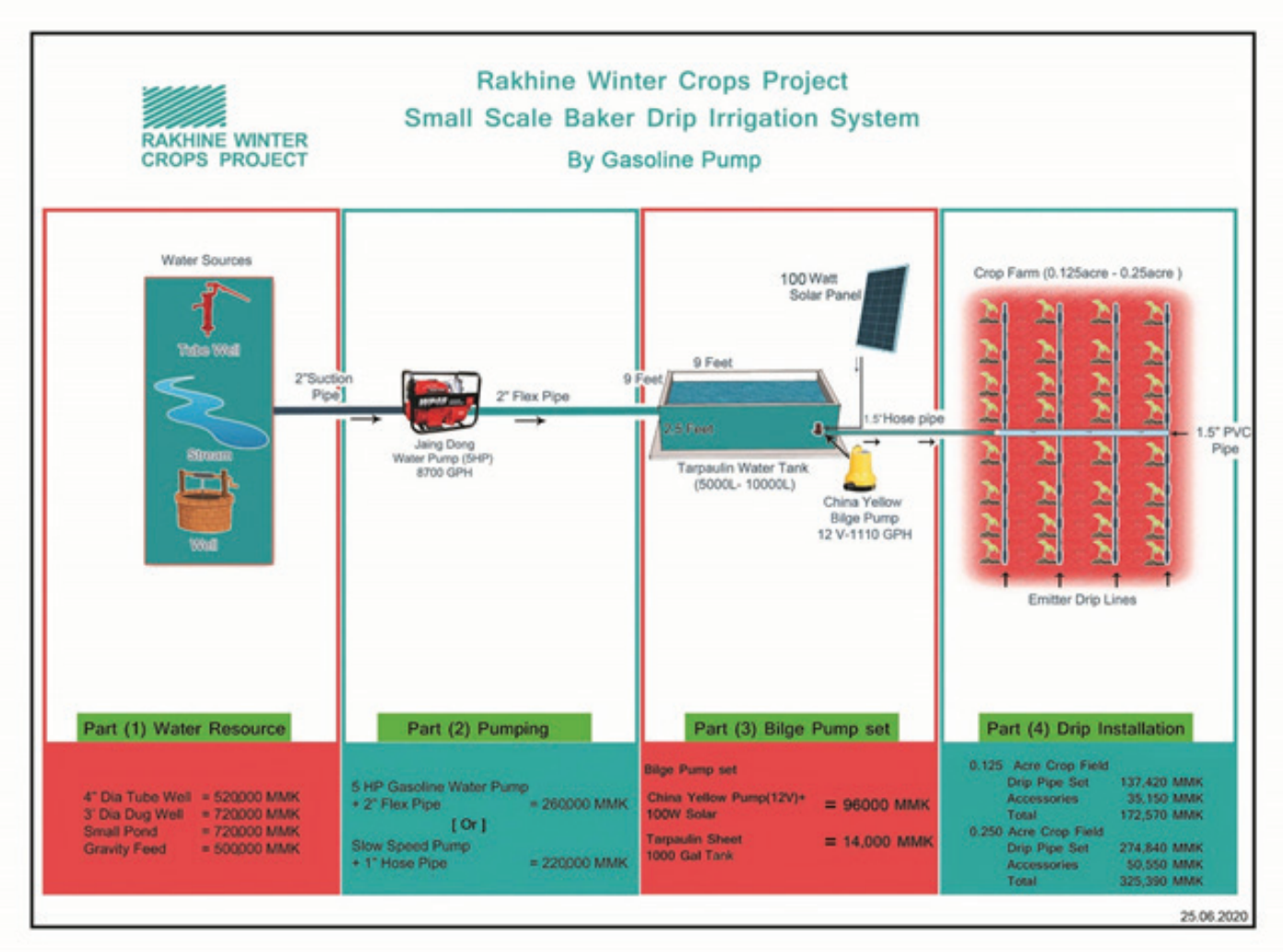
Shower Rose Inter Row on top of Bed

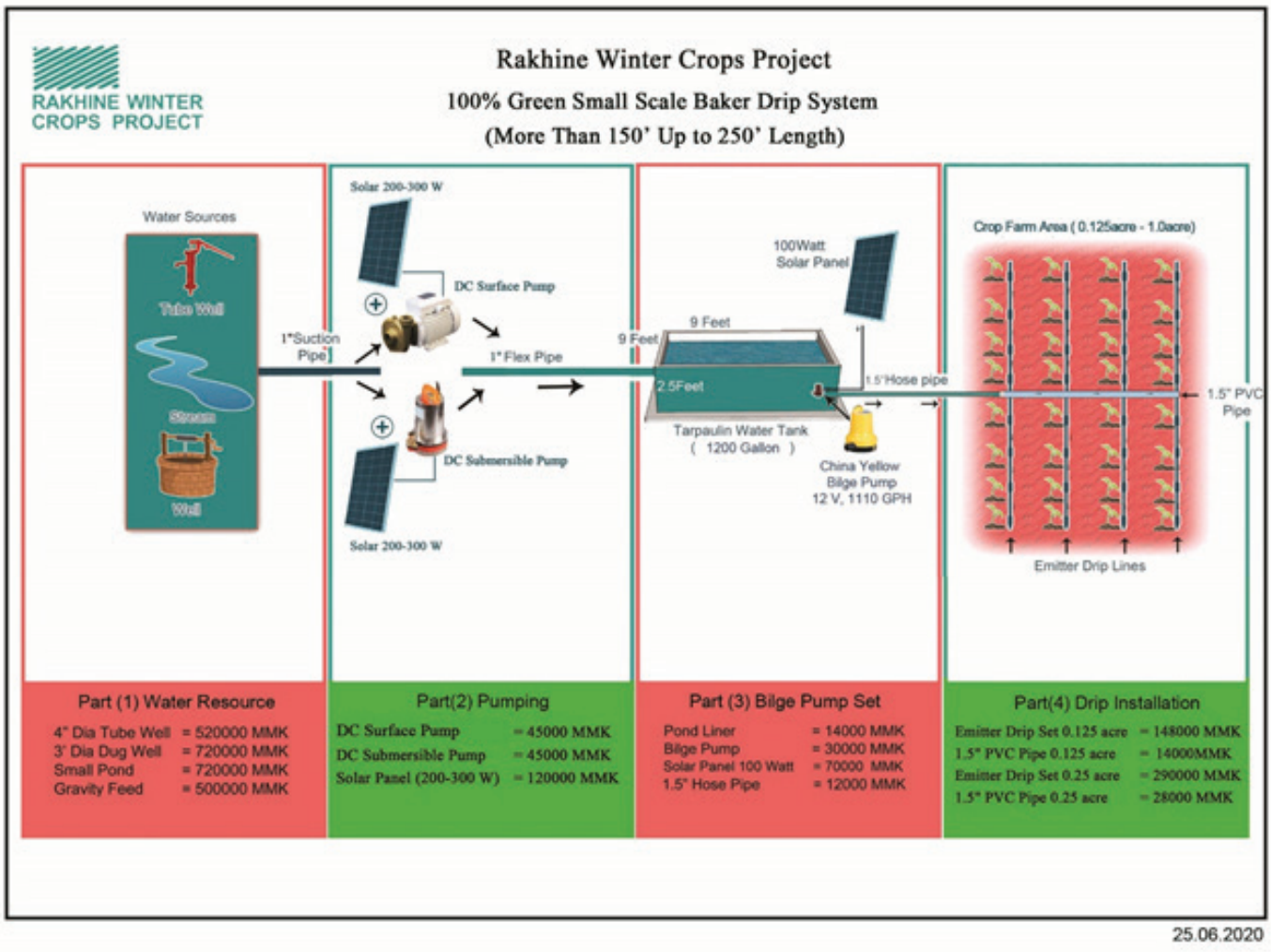
4. Summarize by asking the farmers: “What irrigation system is best for their situation?” Tell them that they should consider water sources, reliability, cost, labor available, lending sources available for irrigation, skills required to operate, Operation and Maintenance costs.

Activity 6: Baker Drip System (BDS): (20 minutes)

1. Tell the participants that in 2019 an Australian consultant introduced the ‘Baker Drip System’ (BDS) to Myanmar. Briefly go over the diagram (see the Exercise 4.5, 4.6 and 4.7 diagram) that shows the layout and approximate cost of the baker drip system, and also the guidelines for setup and operation and maintenance in Exercise 4.8, 4.9 and 4.10. If not enough time, ask participants to read these Exercises for homework. Say that if they need further clarification from the facilitator, they can ask in future sessions during field visits.

Exercise 4.5: Baker Drip System (BDS) layout





Exercise 4.6. Cost of the Baker Drip System
Total Cost for 0.125 Acre Drip Set

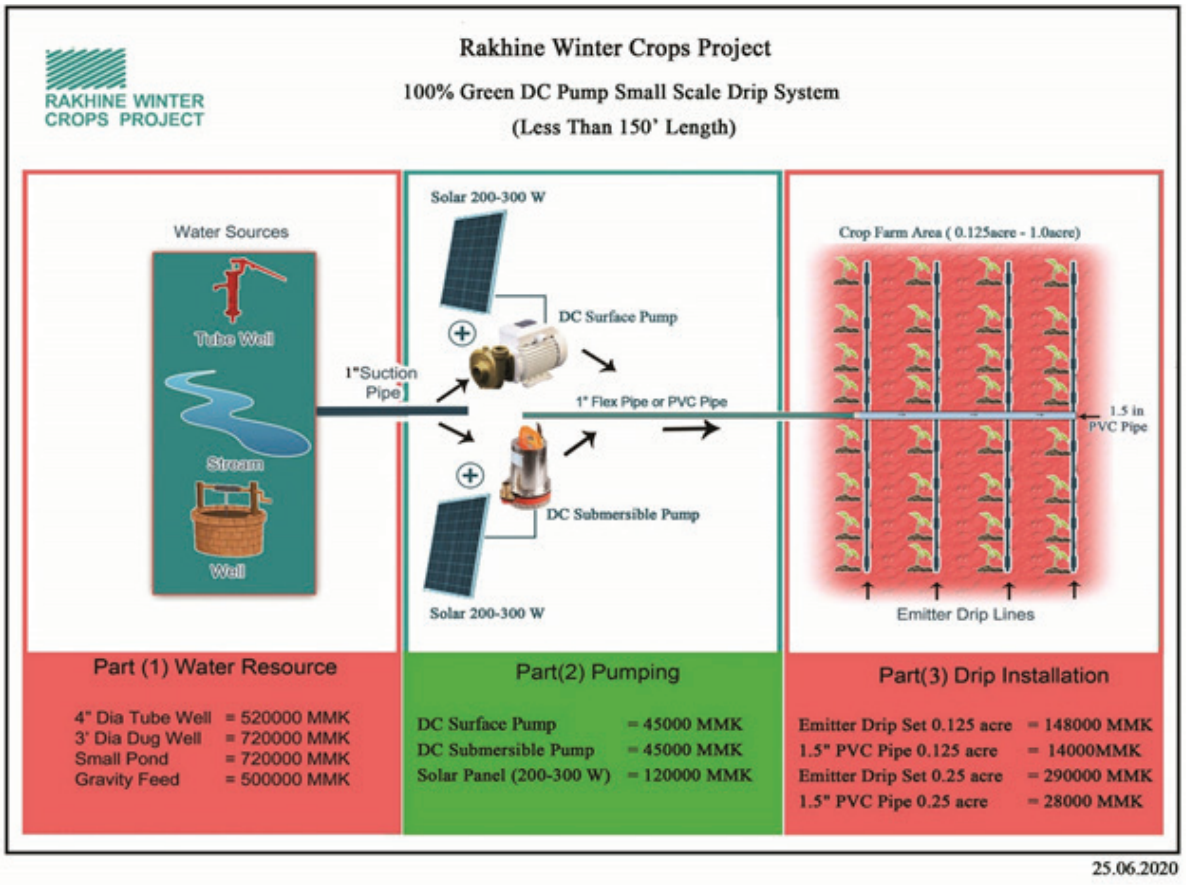
Item No	Particular	Rate	Per unit	Qty	Amount MMK
1	1.5" PVC Pipe	4800	pipe	3	14400
2	1.5" to 0.75" Reduced Socket	450	socket	1	450
3	1.5" Bell End Adaptor	450	adaptor	1	450
4	1.5" Valve PVC	1950	valve	2	3900
5	1.5" Socket PVC	500	socket	3	1500
6	PVC Glue	1550	Tin	1	1550
7	Water Tape	200	coil	2	400
8	Bilge Pump (Yellow China Bilge Pump) 12V, 1110 GPH	26000	pump	1	26000
9	Solar 100 watts	70000	panel	1	70000
10	Pond Liner (Tarpaulin Sheet 15'X15')	14000	sheet	1	14000
11	Take off Tap	565	tap	44	24860
12	Rubber Grommet	140	grommet	44	6160
13	0.75" Hose Pipe (30m)	25000	coil	0.5	12500
14	Emitter Drip Pipe (Irritec Co; ltd, Italy)	133	meter	800	106400
	Total				**282570**

Rakhine Winter Crops Project
Total Cost for 0.25 Acre Drip Set **June 2020**

Item No	Particular	Rate	Per unit	Qty	Amount MMK
1	1.5" PVC Pipe	4800	pipe	5	24000
2	1.5" to 0.75" Reduced Socket	450	socket	2	900
3	1.5" Bell End Adaptor	450	adaptor	2	900
4	1.5" Valve PVC	1950	valve	4	7800
5	1.5" Socket PVC	500	socket	5	2500
6	PVC Glue	1550	Tin	1	1550
7	Water Tape	200	Coil	2	400
8	Bilge Pump (Yellow China Bilge Pump) 12V, 1110 GPH	26000	pump	1	26000
9	Solar Panel 100 watts	70000	panel	1	70000
10	Pond Liner(Tarpaulin Sheet)	14000	Sheet	2	28000
11	Take off Tap	565	tap	88	49720
12	Rubber Grommet	140	grommet	88	12320
13	0.75" Hose Pipe (30m)	25000	Coil	0.5	12500
14	Emitter Drip Pipe (Irritec Co; ltd, Italy)	133	Meter	1600	217000
	Total				**453590**

Exercise 4.7 Solar Pumping Directly to the Drip System

Farmers can pump directly to the field using solar as long as the field plots are not longer than 150 feet away from the water source.



Exercise 4.8: Taking care of the Baker Pump and drip system

The Baker pump system is made from three components

- The Solar panel
- The Bilge pump
- The Drip irrigation tubing

100 Watt Solar Panel

1. Keep the panel clean of dust by wiping with a clean dry rag once per week.
2. Move panel to catch the most sun. Between 9am and 3 pm this will generally mean laying the panel flat and facing the sun
3. Small amounts of shade will reduce the effectiveness of the panel.

The Bilge Pump

1. Carry the pump in a bag. Do not carry by the wire cord as it may lose the connection.
2. Take care to pump clean water or try to filter unclean water
3. Ensure that the pump sits above any mud by placing it on top of a few small rocks or on a small frame
4. Enclosing the pump in mesh like a mosquito net or a rice or fertilizer bag can act as a filter.

The drip system

Installation

Ensure that all of the drip lines are installed so that the lines are straight and the emitters are facing up:

Every day checking

Five minutes after turning on the drip system, farmers should check to see that the drip system has even firm pressure within the lines. Squeeze the lines at the closest and furthest point from the pump to check that the pressure is consistent. If pressure is weak or uneven then check that the pump is working properly, that there are not too many lines open at the same time, and that the system is not leaking from disconnected lines or major leaks.

Walk next to the lines and check for leaks. Fix any leaks with a 4 inch sleeve of drip tape.

Regular checking

If water quality is good, check every 2 weeks. If dirty water, check more regularly.

Checking is achieved by opening the ends of the drip lines (one line at a time) and running the water for about one minute or until the water flows clear.

End of Season Storage

1. At the end of each season ensure that the tape is retrieved by rolling it back onto a reel. Join the ends of drip lines with a piece of sticky tape.
2. Make sure that the drip lines are not folded or twirled when rolling up.
3. Store undercover for next season

Exercise 4.9: Check list for FOs and farmers

Before we start…

- Is the mini dam at the highest point in the field?
- Can the Solar panel access full sun?
- Has the farmer placed his compost and fertilizer in the soil beneath the drip irrigation tape?
- Is the farmer using sufficient mulch?
- Has the farmer access to good quality seed and seedlings?

If yes then we can proceed!

The following checks are routine when visiting the farmer or are a good trouble shooting guide for any problems that may occur with the Baker Irrigation system

District	**Village**	**Date**	Farmer
RWCP Staff member name			
Check list	**Yes/no**	**Corrective action/Comment**	
1. Is Solar panel clean	Y/N		
2. Solar panel maximizing light reception	Y to the south/N	Keep in full sun at 22 degrees	
3. Mini dam clean and clear of debris	Y/N	Minimize the amount of dirt pumped by enclosing pump in rice bag and perching on rocks	
4. Check Pump performance If flow rate is lower than at installation	Impeller is clean? Y/N Impeller broken? Y/N Leak from hose? Y/N Wires connected? Y/N Solar panel clean? Y/N		
5. Pipe length and diameter	Is pipe diameter at least 1” Y/N		
6. Check lines Look for puddles	Y/N	If puddles then locate leak and repair	
7. Are the drippers all facing up?	Y/N	Check for twisted lines or lines that are upside down. Drippers must face up. Walk up and down every three rows and check each line	
8. Are the ends of the drip lines secured with small sleeves?	Y/N	If leaking then line ends may need to be folded an extra fold	
9. Are the ends of the lines tied off to stakes?	Y/N		
10. Flush lines with farmer	Is water clear ?Y/N	If water is not clear then farmer needs to flush all lines. Establish a weekly, fortnightly or monthly flushing schedule depending on water cleanliness. Explain why he must flush the lines regularly (i.e. to stop emitters blocking)	

11. Are there any leaks that need fixing?	Y/N	
12. Inspect crop	Crop is healthy or stressed?	Check at lunchtime. If crop is stressing then crops need more water. Do not forget that crop water use increases with crop leaf area
13. If the water is collecting in the furrows	Y/N	If yes then farmer is watering too much. Apply less water
14. Are drippers all facing up	Y/N Yes…. no problem	Are any lines twisted? Make sure that all lines are facing up
15. Check line pressure	Firm/not firm to touch?	
16. Is the line pressure strong and consistent throughout the crop?	Y/N Too many lines open?	Can check with water cups under 4-5 drippers randomly though the crop
17. Variation in crop size	Y/N	If variation is present is it due to irrigation or some other cause? Seedlings? Crop nutrition?
18. Farmers thoughts?		Is the farmer comfortable with managing the drip system or is he/she having problems? What further training is required?

Exercise 4.10: Directions for Drip Tape Collection and Storage at End of Season

1. After the end of the season we need to collect and store the drip irrigation tape for long term use year by year without damage. Please follow the guidelines below:
2. Wash the dust and earth off on the inside and outside of the drip lines
3. Dry the lines in the sun after washing
4. Roll the tape onto the original roll or on a big diameter piece of bamboo
5. Join pieces together by stapler or plastic tape or sleeve of drip tape to fix leaks
6. Store in the shade as sunlight destroys the tape over the longer term
7. Store off the ground
8. Protect from destruction by rats and dogs
9. Write a list of all the irrigation materials stored so you can refer to the list next year

If you follow the guidelines you can use the tape for many years

Activity 7: Ordering Form for Irrigation Inputs (10 minutes)

Plenary

1. Brainstorm with participants the question: “What key things do you have to consider before ordering irrigation inputs?” Write their answers on a flip chart.
2. Refer participants to the suggested irrigation order form format in Exercise 4.8 in their workbooks. Review the headings and how to copy and fill in such an order form for their future irrigation input requirements.
3. Tell participants they should draw their own form on a piece of paper, copy their construction and equipment inputs requirements and costs from the tables in Exercises 4.2 (construction); 4.3 (pumps),

4.5 & 4.6 (materials and equipment), and then present this order form to their local irrigation dealer. The dealer can confirm input requirements and costs, and order the materials for them. They should check with more than one supplier to make sure the costs quoted by their local dealer are reasonable compared with other suppliers. Participants can do this by inviting more than one supplier to the upcoming irrigation/agro inputs supplier workshop (see Session 6.) Alternatively, they can ring suppliers to check the costs for comparison.

Exercise 4.11: Irrigation input order form format

Water Source	Input Description	Number of Units	Cost per Unit	Total Cost

Activity 8: Summary (10 minutes)

1. Summarize the activities of the day

Activity 9: Evaluation (5 minutes)

a) Ask participants what they thought was good and interesting during the training
b) Ask participants what was not so good about the training
c) Ask them how the training could be improved
d) Write their ideas in a notebook for review the training notes and processes later on

Activity 10: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 5: Calculating Agro Inputs and Making Nursery Seedling Mix

Duration: 3 hours

Objectives:

- To have a vision for the future
- To know the preferred site layout for crops
- To calculate individual input requirements
- To know about the source and quality of inputs
- To prepare for the next session - agro dealer workshop
- To know how to make nursery seedling mix

Materials: White board; marker pens; tape; 4 x blank flip charts; 1 x 3 column flip chart, cow dung, rice husk charcoal, top soil

Activity 1: Review Session 3 and topics for this session (Total time 10 minutes)

Plenary

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart (8 minutes)
   - Site selection
   - Soil characteristics and care
   - Labor availability
   - Water requirements
   - Profitability and breakeven
   - Impact of CV/CFC with irrigation on males and females
   - Impact of CV/CFC with irrigation on the environment
   - Technical knowledge
   - Availability of inputs
   - Risk
   - Crop selection table

2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session. (2 minutes)

Activity 2: Site Layout (Total 15 minutes)

1. Ask participants to write down their final crop names and cropping areas. Check that for CV they have at least 4 crops, one from each family for rotation, and no more than 6 crops, as having too many crops is difficult to manage. For CFC, invite them to select at least 2 crops.
2. Ask participants to draw a plan of their own site, their chosen crops, proposed cropping areas, and where they will grow their chosen crops in their workbooks at Exercise 5.1.

Exercise 5.1: Site layout

Some guidelines:

1. Consider crop history. You should not grow the same crops in the same place each season.
2. Select small plots for the other seasonal vegetables on a crop rotation basis.
3. Make sure there is room for an entry path, and about 0.5m between the plots so you can walk around to take care of the crops.
4. Leave room for a trench around the outside of the field to drain surplus water or store water for later use.

Example of Site Layout

Example of crop rotation of yard long bean, chili, cabbage and cucumber.

Activity 3: Seed Types (Total 10 minutes)

Plenary

1. Tell participants that there are 2 main types of seeds – Open Pollinated seed and Hybrid seed.
2. Refer them to Exercise 5.2 in their workbooks for definitions and read together the extra information.

Exercise 5.2: Types of seeds

1. Open pollinated seeds

Open pollinated (OP) seeds are produced by traditional and native plants crossing with each other by self, wind or insect pollination.

In this uncontrolled environment the characteristics of the plant are randomly crossed and the new plants may not look like the parents. Therefore, the high yield or disease resistance characteristics of the parents may not be the same in the new plants.

2. Hybrid seeds

Hybrid seeds are produced in controlled laboratory or seed production farm conditions where the new plant carries the beneficial characteristics like high yield and disease resistance of the selected parent plants.

Seeds shouldn't be replanted next year from hybrid plants. They will either be sterile or the plants of the next generation will probably not have high yield or disease resistant characteristics, because you do not know with which other plant from your field or someone else's field they have pollinated.

F1 or F2 show the hybrid category. F1 is first generation, and F2 is second generation, therefore F1 is closer to the parents' characteristics.

Summary of Open Pollinated seed compared to Hybrid seed

	Advantages	Disadvantages
Open Pollinated Seeds	1. High resistance to local diseases 2. Farmer can produce own seeds 3. Low cost 4. Local market sometimes prefers local varieties	1. Low resistance to new diseases 2. Low yield, low quality 3. Low germination
Hybrid Seeds	1. High yield and high quality 2. High germination	1. Expensive compared to local seeds 2. Farmer can't produce own seeds 3. Local market sometimes does not prefer new varieties

Activity 4: Seed quality (Total 15 minutes)

Plenary

1. Brainstorm with participants: "How can you assess seed quality?" Write their ideas on a flip chart.

Refer to Exercise 5.3 in their workbooks and read as a group

Exercise 5.3: Seed Quality

Look at seed quality by:

1. Looking at the category of seed, for example F1 or F2 Hybrid or open pollinated to judge the quality. F1 & F2 should be of higher quality.
2. Checking for the purity of seeds by size, shape, color. This can be expressed as a percentage.
3. Reading the germination test and date of testing on the seed packet or report from the seed seller, or by doing a germination test yourself.
4. Reading the expiry date of the strength of seeds.
5. Noting if the seeds have chemical treatment.
6. Looking for pests and seed-borne diseases by visual examination with the naked eye, or magnifying lenses 15 times strength.
7. Spreading the seeds on contrasting colored paper. Gray or white coloration on the seed surface indicates fungal contamination.
8. Looking for shriveled, small, irregular shaped and other colored seeds might correspond to specific mutations.

2. Brainstorm ideas for good seed storage. Write participant's ideas on a flip chart.
3. Go over seed storage ideas in Exercise 5.4 in their workbooks.

Exercise 5.4: GAP seed storage techniques

Storage of seeds

1. Note that sealed packets of seed store the best as they prevent moisture, pests and disease infection.
2. Dry non-sealed packs or newly harvested seeds before storing. If the seed contains moisture, it can lead to damage.
3. Store seeds in a cool, dark, dry place such as a clay pot or basket with a lid.

Storage Type	Dark	Light	Humidity	Heat
Unsealed seeds	Good germination	Reduces germination	High reduction in germination	Reduces germination
Sealed Seeds	Very good germination	Transparent pack reduces germination	No effect on germination	Reduces germination

Seed germination testing:

4. Brainstorm the questions: “Why is knowing germination rate important?”” and “How do you test germination?” Write their ideas on a flip chart.
5. Refer participants to Exercise 5.5 in their workbooks asking them to add any of the group’s ideas not mentioned in the table.

Exercise 5.5: Germination

Question: Why is knowing germination rate important?
Answers:

- To know the quality of the seed.
- To know how many seeds you have to buy to get enough seeds to fill your field – Example: if the germination is 66%, then you need around 50% more seeds to add up to 100% of seed requirements.

Question: How do you test germination?
Answer:
Get a cloth or tissue and mark it with a grid pattern of 20 squares

1. Put the cloth or tissues on a tray and wet it so it is just moist but not too wet
2. Put 1 seed in each square (or just spread some seeds randomly on the tray)
3. Cover with another wet cloth or tissues
4. Put in a warm dark place
5. Check daily to keep the seeds moist
6. Count the number of seeds that have germinated after a reasonable time
7. Multiply by 5 the number of germinated seeds to get the percentage of the 20 seeds that are being tested or divide the number of germinated seeds by the total number of seeds to get the percentage germination. Example 80 seeds out of 100 seeds = 80%).

Summary of germination

1. Read the seed packet or test germination before buying seed
2. Buy enough seed to allow for the seed that does not germinate
3. Plant seed in a firm, fine, moist seed bed
4. Plant the seed at the right depth – 2 times the diameter of the seed.
5. Planting too deep or too shallow means the seed may not germinate. Then blame the farmer, not the seed!
6. Report bad germination to the seed seller so the seller can report back to the supply company.

Activity 5: Calculating individual farmer inputs requirements (Total 15 minutes)

Plenary

1. Ask farmers to refer to their CMT Expected Budgets and review what inputs they need if they grow exactly 0.06 acres of each crop. Go over one crop to make the inputs required clear for them. **(5 minutes)**
2. Tell them if they grow more or less area than the 0.06 acre then they will have to change their input requirements according to the specific area.

Individual exercise

3. Refer to a blank crop ordering form Exercise 4.6 in participants' workbooks. Help participants to copy the input requirements for one of their selected crops from the CMT Expected Budget Book.
4. Ask participants to write the crop area they propose to plant. (Note: It might be different from the 0.06 acre example from their CMT Expected Budget Book. Then ask them to divide the actual area Eg. 0.12 acres by the CMT standard area (0.06ac) to get a multiplier number (0.12ac/0.06ac = 2), then multiply the standard 0.06 acres input requirements x 2 to get their true area input requirements.)

Exercise 5.6: Farmers need to fill up Crop types and Area

Farmer Name.....	**Village.....**
Crop Name	**Area**
1.	
2.	
3.	
4.	
5.	
6.	

Activity 6: Source and quality of inputs (Total 20 minutes)

Plenary

1. Refer participants to column 1 in Exercise 5.7 in their workbooks. Ask them all to read the example input list as a group, so they are all focused on this.

In pairs

2. Ask participants in pairs to discuss and write in the workbooks in column 2 where they will get their inputs – from their own resources or from outside?
3. Summarize by saying that it is better to source inputs from local suppliers as they are more easy to access and you can see the quality and discuss the price with them. However, it is also a good practice to check to see if prices and quality are better from outside the local area.

Exercise 5.7: Type of Inputs required for GAP

Input Name From CMT Budgets	**Available From**		**Quality (Insert Low; Medium: High)**
	Own Farm	**Outside (State where from?)**	
Seed			
EM (for Bokashi)			
Molasses			
Rice Bran			
Trichoderma			
Compound fertilizer (15:15:15)			

Urea (for Basal)			

Activity 7: Quality of inputs (10 minutes)

1. Ask participants if it is important to have quality inputs? Why? Why Not? Write their ideas on a flip chart.
2. Refer to Exercise 5.8 in their workbooks. Ask the farmers to read the story and write their answers to the question.
3. Invite some participants to share their answers with the plenary.

Exercise 5.8: To compare quality and price

A story:

Saw Hla Htwe is a farmer who always wants to save money. The seed he buys is low quality, has low yield potential, and is less resistant to pests and disease. He therefore gets lower yields, poorer quality crops with lower prices, and spends more money and time on pest and disease control. He also finds that the other inputs like cheap fertilizer do not work so well, and cheap machinery does not last so long, so he has to repair and replace it more quickly.

Question: What can Saw Hla Htwe do to improve his input purchasing strategy? Write your ideas in the space below.

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Activity 8: Preparation for Agro/irrigation dealer Led Workshop (40 minutes)

Plenary

1. Tell participants that the project tries to facilitate improved services between farmers and other value chain actors in a way where they both benefit – a 'win-win' situation. In this way, the services are more likely to continue beyond the life of the project.
2. Tell participants that in the next session - Agro/irrigation dealer Workshop - the project will invite agro/irrigation dealers to come and present what inputs they have for sale and other services and incentives they have to offer to attract the farmers to come and buy inputs from them. Say that at the end of the workshop the farmers are expected to decide which agro/irrigation dealer they will buy their inputs from. Participants will then present their list of inputs to the dealer and the dealer will get the inputs for them. (5 minutes)

Plenary

3. Ask participants: "What questions should you ask the Agro/irrigation dealers who will come to the workshop during the next session?" Write their ideas on a flip chart. **(5 minutes)**
4. Compare their answers with those in Exercise 5.9 in in their workbooks. Add any other questions from the flip chart that are not on the list. **(5 minutes)**

In pairs

5. Allocate 1 question to each pair. Tell participants that they should ask these questions to agro/irrigation dealers when they come to visit them next session. Ask participants to discuss their allocated question together in their pairs to practice. **(5 minutes)**

Plenary

6. Invite the pairs to explain their understanding of each question to the plenary. Encourage discussion so that each pair understands their question. Give help when required. **(20 minutes)**

Exercise 5.9: Factors to know for input buying agreement

1. Product names: "Describe what inputs you sell?"
2. Product amounts: (i) "How much product do you keep in stock in your shop and how much do you order from outside? (ii) Can the agro/irrigation dealer supply required amounts for small orders and large amounts for group orders?
3. Timing: (i) "Can the agro-dealer supply inputs on time?" (ii) "How long between ordering the product and pickup time for small orders and for large group orders?"
4. Quality standards: (i) "What is the quality of the products you sell?" (ii) "Do you have test results to show their quality?" E.g. seed germination, size, color, moisture content and grade.
5. Product delivery arrangements: "Where, when, who and how will the inputs be delivered? E.g. specific locations, time, mode of transport, packaging, who pays for transport. Note that perishable inputs like rhizobium may need special packaging, storage and transport requirements.
6. Pricing arrangements: "What price will be paid for the different inputs and under what conditions?" For example, price based on quality and price based on quantity. Are there discounts for large group purchases?
7. Payment procedures: "How and when should the agro/irrigation dealer be paid?"E.g. cash on delivery,

payment after some days or months, etc. Does the agro/irrigation dealer offer products on credit for payment after harvest (e.g. pre-financing)?

8. Technical support: "Does the agro/irrigation dealer offer technical support?" Examples: Advisory services like pamphlets or a personal visit to show how to apply fertilizer or pesticide correctly, or are there mechanics available who can fix machinery or other technical problems.
9. Other incentives: "Does the agro/irrigation dealer offer other incentives?" These are extra benefits the seller can offer. For example, a free motorbike if you buy more than 100 ton of fertilizer, or special promotions like free samples of products.
10. Return of products: "Can the farmer return products if not satisfied with them?"
11. Disputes: "Is there anywhere that the farmer and agro/irrigation dealer can go to settle disputes?"

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Activity 9: Making Seedling mix (10 minutes)

Plenary

1. Tell the group to look at the timing for planting. Write this heading on a flip chart.
2. Then trace back 3 weeks for seedling growth in the nursery. Tell the participants that this means they have to start at this time to prepare their seedling nursery.
3. Brainstorm with farmers: "What materials do you use to make nursery seedling mixture?" Write their ideas on a flip chart.
4. Tell the farmers that we want to introduce them to a simple method of nursery seedling mix recommended by high level agronomists. Suggest they try this seedling mix and their own methods and then compare which is best. Refer them to Exercise 5.10.

Exercise 5.10: Making seedling mix

Material needed in equal portions

1. Well decomposed cow-dung - 1 portion
2. Rice husk charcoal - 1 portion
3. Top soil - 1 portion

Making Process

1. Mix together equal portions of well decomposed cow-dung manure, rice husk charcoal and top soil.
2. Put the mixture in a sealed plastic bag (black color) and heat up for fermentation in the sun light for 3-4 hours. The heat in the plastic bag can also kill some soil diseases.

4. Tell participants that you will now as a group make seedling mix for the FFS demonstration plots. This will give them experience before they go back to their homes to make seedling mix for their own demonstration plots.

Activity 10: Field Work (20 minutes)

Sub groups

Practical work procedure:

1. Divide participants into three groups of about 8 people. Each group should be led by a FFS village demo farmer. Say that participants will stay in these groups doing practical work on the same demo plot throughout the FFS. There will be a competition to see who has the best demo plot at the final FFS evaluation time.
2. Ask 1 farmer to read the instructions to make the seedling mix from Exercise 5.10 in their workbooks while the others do the tasks. Say that in 3-4 weeks' time the 'bokashi' will be ready to mix into the soil as quality compost.
3. Go back to the training room to finish the session.

Activity 11: Summarize the session (5 minutes)

1. Summarize the session noting the main activities and key points.

Activity 12: Evaluate the Session: (5 minutes)

- What worked well in the lesson?
- What did not work so well?
- How could the lesson be improved?

Activity 13: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 6: Agro Dealer and Irrigation Dealer Led Workshop

Duration 3 hours

Activity 1: Preparation before the workshop

1. Identify cooperating agro/irrigation dealers – ideally at least 2 from each township or their agents from the village clusters. This will bring input services closer to the farmers and encourage farmers to use more GAP inputs than before.
2. Discuss with the agro/irrigation dealers the positives and negatives of how they can link with the project and project farmers – find 'win-win' arrangements so that both agro dealers and farmers benefit.
3. Invite the dealers to come at different times E.g. one for half an hour, then that dealer leaves the meeting and another dealers comes for the next half hour. In this way they dealers have an equal chance to speak and do not have to compete in front of each other.
4. Invite the selected agro/irrigation dealers to prepare flip charts or vinyls that give answers to the questions listed in Exercise 5.9 above.

Activity 2: Questions to ask at the workshop

1. Tell participants that the project tries to facilitate linkages between farmers and other value chain actors in a way where they both benefit – a 'win-win' situation. In this way, the linkages are more likely to continue beyond the life of the project. This session links agro/irrigation dealers and farmers formally or informally and acts as a guide to farmers on where to buy their inputs.
2. Ask the agro/irrigation dealers to present their answers to the questions in Exercise 5.9. Invite each pair of farmers to lead discussion on their allocated question (given to them in the previous session).
3. Ask agro dealers to leave their presentations (list of inputs and their prices and other incentives) with the farmers. This enables farmers to study these afterwards and to choose the agro/irrigation dealer they want to buy their inputs from.

Activity 3: Summarize the workshop

Summarize the workshop by:

(i) Thanking the agro/irrigation dealers for coming and giving their presentations

(ii) Thanking the farmers for coming and considering which inputs supplier they will work with.

(iii) Inviting the farmers to informally discuss input buying agreements with the agro/irrigation dealers after the workshop to clarify their input requirements and costs.

Activity 4: Evaluate the Session: (5 minutes)

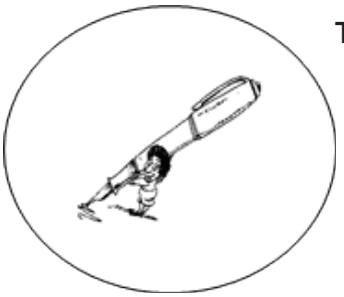
- What worked well in the lesson?
- What did not work so well?
- How could the lesson be improved?

Activity 5: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 7: Rodent Control



Tips for the Facilitator:

1. This session is important for areas where there are problems with rodents. If there are no rodent problems, you do not have to conduct this session.
2. This session timing should be in line with rice harvest time because community control of rodents is most effective at rice harvest time when baby rodents can be identified and killed while they are nesting in the rice straw.

Duration: 3 hours

Objectives:

1. To improve current knowledge of rodents and the damage they cause
2. To learn about current methods of control and new methods
3. To discuss or practice some control methods in the field

Materials: White board; marker pens; tape; blank flip charts

Plenary discussion

Activity 1: Review of previous session and this session's topics. (5 minutes)

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart.
2. Ask them to look at the Table of Contents in their workbooks and to read the topics aloud for this session:

Activity 2: Identifying different rodent species and their behavior (45 minutes)

Plenary

1. Brainstorm the question written on a flip chart: "What is a rodent and what types of rodent do participants know of?" Write the participants' ideas on the flip chart.
2. Then invite participants to turn to Exercise 7.1 in their workbook and read the definition

Exercise 7.1: Definition of a Rodent

Rodent Species in Myanmar

All rodents have one pair of upper and one pair of lower incisors, which continue to grow throughout their life. To keep the incisors short, they spend a lot of time gnawing hard objects to wear their teeth down, including cutting of rice plants and other harder objects.

Rodents make up 42% of all mammals in the world with more than 2,270 species worldwide. There are 17 species of rodent in Myanmar that belong to the following families:

1. Rats and mice
2. Bamboo rats
3. Squirrels
4. Porcupines

Sub groups

3. Split participants into same village subgroups
4. Refer them to the color printed photos of different common rodent species in their workbooks Exercise 7.2 – allocate one different rodent species for each sub group to focus their discussion on.

Exercise 7.2: Common rodent species in villages and fields

Insert only the common rodent species photo and details. Include the control methods underneath type.

E.g.
(1.7) Short -tailed -rice -field mouse (Mus cervicolor)

Litter Size	Nothing known
Breeding Season	Nothing known
Habitat Use and Damage to crop	It can be found in rice field.
Behaviour	Group
Control methods:	1. Synchronous planting 2. Sanitation (in and around field) 3. Reduce bund size (<1 feet)

5. Write the following question on a flip chart and ask the sub groups to write down their answers on their own group flip charts. Question: "What problems do you have with your specific rodent? What crops do they eat, how much damage do they cause, and at what time of the year?"
6. Invite group leaders to present their ideas to the plenary.
7. Refer the participants to Exercise 7.3 in their workbooks that lists the problems and timing

Exercise 7.3: Problems caused by rodents and timing of damage

Crop	Problems caused	How much damage do they cause (%)	Timing of damage occurring

Activity 3: How to control rodent damage (55 minutes)

Plenary

1. Brainstorm the question: "How do you control rodents in your village? Write their ideas on a flip chart and discuss.

Sub groups

2. Write the following control measure on a flip chart and put up in front of the group:
   1. Synchronous planting
   2. Sanitation (in and around field)
   3. Reduce bund size (<1 feet)
3. Invite participants to split into 6 groups, 2 groups per type of control method. Invite them to write how they think they should implement each method. Invite one leader of each type to present their ideas to the plenary.
4. Refer participants to their workbooks Exercise 7.4 with an explanation of each type of control method comparing the farmers answers with those in their workbooks.

Exercise 7.4: Implementation steps for each type of control method.

1. Synchronous planting

- All farmers planting within two weeks to limit breeding periods around harvest.
- Breeding of rodents is strongly linked with food availability. Spread out planting can extend the food supply for rodents and that leads to higher rodent populations.

2. Sanitation (in and around field)

- Vegetation can provide both shelter and alternative food sources for rodents.
- Cleaning vegetation (weeds, bushes, grasses) in and around field prior to the reproductive stage of crop limits rodent nesting and alternative food opportunities.

3. Reduce bund size (<1 feet)

- Larger bunds can provide the shelter for rodents (especially for the Bandicota sp.).
- Smaller bund size can restrict rodent's ability to make their burrows.

Activity 4: Field work (60 minutes)

Go to the field and see if you can find rodent damage or their living sites and discuss or implement the control measures previously discussed.

Activity 5: Summary (10 minutes)

1. Summarize the activities of the day

Activity 6: Evaluation (5 minutes)

1. Ask participants what they thought was good and interesting during the training
2. Ask participants what was not so good about the training
3. Ask them how the training could be improved
4. Write their ideas in a notebook for review the training notes and processes later on

Activity 7: Next session topic(s), Timing, Location and Who Should Come (5 minutes)

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 8. Record book training and composting

Duration: 150 minutes in the classroom, 50 minutes compost making - practical field work

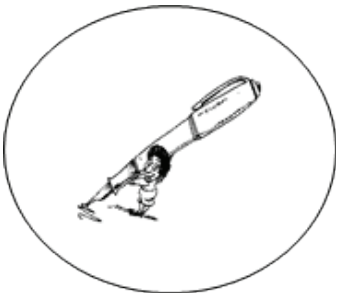
Objectives:

1. To know the purpose of a record book
2. To know how to make a record book
3. To know about the importance of composting
4. To practically know how to make bokashi compost

Activity 1: Review previous session 7, and topics for this session (Total time 10 minutes)

Plenary

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart (8 minutes) e.g.
   - Vision
   - Results and Specific Activities
   - Site Layout
   - Calculating for individual farmer
   - Inputs requirements
   - Source and quality of inputs
   - Preparation for Agro Dealer Led Workshop
   - Making coconut peat for nursery seedlings
   - Agro dealer workshop
2. Ask participants to turn to the table of contents in their workbooks and ask them as a group to read the topics for this session. Say that we have to make compost this session as it has to ferment and be ready for putting on their field in 3-4 weeks' time. (2 minutes)



Tip for the Facilitator:

In the past, many organizations have had special record books printed or bought special accounting books for farmers to keep records. However, farmers have been afraid to make mistakes filling in the beautiful and expensive books so they have not used the books. To solve this problem, RWCP will help farmers make their own record books by using cheap school books. Farmers should not be afraid to fill these in, and if they make many mistakes, they can make themselves a new book. They can also make themselves a new book for the next year rather than buy an expensive accounting book.

Materials:

Flipchart, markers, tape, Attendance Register form; Example record book to pass around to show participants; Flip chart with introductory questions (Activity 2); school exercise book preferably with vertical and horizontal lines like wide scale graph paper, a ruler, scissors, pencils, and eraser for each participant; compost making inputs (for 3 demo sites)

Activity 2: Why have a record book? (Total 10 minutes)

In Pairs (5 minutes)

1. Asks participants to answer the following questions: Have the questions listed on a flip chart.
   - • What was the yield of each crop last year?
   - • What exact prices did you get for each crop last year?

- How many inputs did you use for each crop?
- What were the exact crop expenses for each crop?
- What was the exact income for each crop?
- How much profit or loss did you make?
- What crop growing problems did you have last year?
- How did you solve these problems?

2. Walk around the participants and encourage them to write the answers. Note how difficult it is for them. Stop after just a few minutes and say: "It looks like you are having trouble answering the questions. Let me help you." Then refer them to Exercise 6.1 in their workbooks.

Plenary

3. Ask participants to read the question in Exercise 6.1.**"How can I know the exact details of my crop practices, production and profit?"**

Expected answer: By keeping good records. Ask participants to write this answer in their workbooks.

Exercise 8.1: Why have a record book?

Question: How can I know the exact details of my crop practices, production and profit?
Answer: .....

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4. Ask participants to describe: "What is a record book? List participants' ideas on a flip chart.
5. Then ask them: "What types of records should be kept in farm record books?"
6. Refer them to Exercise 8.2 in their workbooks. Ask them to read the definition of a record book, and what type of records they should keep in their record books. Add farmers' ideas if not already mentioned. Tell them that they will study each type of record in more detail during this session.

Exercise 8.2: What is a farm record book?

Definition: A record book is written proof (evidence) of what has happened on your farm.

Question: What kind of records are kept in farm record books?

1. Site layout records for crop rotation mapping
2. Crop growth information records
3. Labor participation records
4. Production records
5. Expenses records
6. Income
7. Profit/Loss records

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7. Tell participants that the next exercise will explain these records in detail.
8. Hand around your example record book so that all participants have a vision of what the book should look like.
9. Hand out the school exercise books, rulers, scissors, a pencil and eraser so that they can use these to make their own Record Books. Tell them to write in their record book in pencil, so that if they make a mistake, they can rub it out and write the information correctly. In this way they will have a tidy record book.
10. Ask them to write their names, the year and season on the front of their books.

Activity 3: Site layout record (5 minutes)

Plenary

1. Ask participants to open the book and write on top of the first page "Site Layout"
2. Tell participants that in the previous Session 3 we already discussed the importance of site layout, especially for planning crop rotations. Say these site plans can be written in their record books and be compared each year to make sure the correct crop rotation plan is being followed.
3. Ask them to leave 2 sides of paper (1 page) for site layout plans for this and perhaps future seasons.

Activity 4: GAP crop growth information records (10 minutes)

Plenary

1. Ask participants the question: "What crop growth information records do you think are important to collect?" Write their ideas on a flip chart.
2. Refer participants to Exercise 8.3 in their workbooks. Tell them to add other information from the group ideas if these ideas are not already on the flip chart.
3. Tell them to record this information in their record books to help them know what they have done in their crop beds, and to make better crop care decisions in the future.
4. Say, when selling their crop, that they could give a GAP crop care summary to the buyer to show the buyer that the crop has been safely produced. They may get a better price with this record.

Exercise 8.3: GAP crop growth information records

1. Planting date
2. Seed source and germination rate
3. Plant emergence (days)
4. Infills (spaces left by dead seedlings or non-germinated seeds) required (%)
5. Organic and chemical pesticide applications dates
6. Pests and diseases, and control methods for each of these

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Activity 5: Labor record (20 minutes)

1. Tell participants that they previously talked about free family and hired labor requirements in Session 1. Say that it is important to write down how much time the family spends on free family labor to recognize the contribution that both male and female members of the family make to their agriculture production work, and to calculate if it is worthwhile being a farmer or not, compared with other income earning opportunities.
2. Tell participants that they should record the number of hours or part hours spent on each task: e.g. 2 hours watering, ½ hour weeding, etc. and at the end of the season add up all their free family labor to see how many days' work (1 day equals 8 hours) it takes to grow all of their vegetables for the season. They can then divide the total profit from each of their crops by the total number of free family labor days to get the return (amount of profit) per labor day. They can compare this with the income they could earn outside of farming to understand if it is worthwhile being a farmer, or if it is better to go somewhere else for a job.
   Example: 1,500,000 MMK combined profit for all crops for the season divided by 100 free family labor days equals 15,000 MMK/day. This is double the salary compared to working in construction in Myanmar (7,000 MMK/day).
3. Tell participants it is also good to separate male and female labor days to see how much work each sex does in farming, and what kind of work that males and females do. Say that it is important for them to recognize the vital roles both men and women participate in while growing their crops, so that they can understand the reasons why men and women spend this amount of time on tasks. They will then know the different problems which males and females face in their different tasks, and think about possible solutions to these problems together.
   Note: Tell participants that they should record the hired labor days in the expenses record, not in the family labor record because hired labor costs something, while family labor is for free.
4. Go over the example labor record layout Exercise 6.4 in their workbooks
5. Ask them to leave 6 sides of paper (3 pages) for the labor record as they need at least 90 days labor record for one crop cycle. This way they will have sufficient space in their books to record the labor spent on each crop.
6. Ask them to rule up one page following the layout in Exercise 8.4 to give them practice deciding on the width of the columns, ruling the lines and writing the headings. Say that after this exercise they can complete the other headings described later in the session for homework.

Exercise 8.4: Free Family Labor Record

Question: "Why have a free family labor record?

Answers:

1. To know how much time males and female family member spend growing the crop
2. To compare with last season and with other farmers as a guideline
3. To compare the time and effort spent against the profit earned to see if it is worthwhile being a farmer compared with other outside work by calculating the return (profit) per labor day.

Example: 1,500,000 MMK combined profit for all crops for the season divided by 100 free family labor days equals 15,000 MMK/day. This is double the salary compared to working in construction in Myanmar (7,000 MMK/day).

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“What should you note for a labor record? For example:

Date	Activity	Male Labor (Hours)	Female Labor (Hours)	Total Hours
12.11.17	Weeding	1	4	5

Activity 6: Making separate crop records (15 minutes)

1. Ask participants to count the number of pages remaining in the book after the Site Layout Plan using 2 sides (1 page) and Labor Record using 6 sides (3 pages). They should divide the number of remaining pages into equal sections according to the number of crops. Example. 25 pages remaining and five crops selected for growing so divide 25 by 5 to get 5 pages per crop.
2. Ask participants to measure the length of the book and divide by the number of crops. For example, 10 inches divided by 5 crops equals 2 inches per crop
3. Ask them to rule a ¼ inch margin down the right hand side on the front page of crop 1. Then measure down 2 inches and rule a line. Cut the bottom piece (8 inches x ¼ inch) of the page out with the scissors for all of the 5 pages (or whatever is their situation) so these pages are the same for crop 1.
4. Ask them to write the name of their crop in the ¼ inch x 2 inch margin remaining.
5. Explain that they should do the same for crop 2 but measure down 4 inches, then for the third crop measure down 6 inches, and so on to fit the 5 crops down the margin (for homework)

Activity 7: Production record (15 minutes)

Plenary

1. Ask participants the following questions written on a flip chart.

“Why have a production record?

“What should you measure for a production record?

2. Write participants’ ideas on the flip chart.
3. Refer them to Exercise 8.5 in their workbooks and review the points noted there.
4. Tell participants to rule their Production page on 2 sides of paper (1 page) according to the example layout in Exercise 8.5.

Exercise 8.5: Production Record

Question: "Why have a production record?

1. To know when you produced the crop
2. To know how much crop you produced including what you consumed and what you sold
3. To know the production per area to compare with last season and with other farmers

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"What should you measure for a production record? Example:

Date	Crop	Unit	Quality/Grade	Area	Total Yield	Yield/Area
12.04.17	Carrot	Bunch	A	0.06	300	4800 bunches/acre

Activity 8: Expense record (15 minutes)

1. Ask participants the following questions written on a flip chart.

"Why have an expense record?

"What should you measure for an expense record?

2. Write their ideas on the flip chart.
3. Refer them to Exercise 8.6 in their workbooks and review the points noted there.
4. Tell participants to rule their Expense page on 4 sides of 2 pages according to the example in Exercise 8.6.

Exercise 8.6: Expense Record

Question: "Why have an expense record?

1. To know when you had the expenses
2. To know how much you spend
3. To know the cost of each item purchased
4. To know the quality of the inputs and services which you spent your money on, so you can consider if growing that crop was worthwhile or not

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"What should you measure for an expense record? Example:

Date	Activity	Unit	Source and Quality/grade	Quantity	Cost/Unit spent	Cost/Unit spent
12.04.17	15:15:15	50kg Bag	U Kyaw Moe A grade	3	30,000	90,000

Activity 9: Income record (15 minutes)

Plenary

1. Ask participants the following questions written on a flip chart:

"Why should you have an income record?

"What should you measure for an income record?

2. Write their ideas on the flip chart.
3. Refer them to Exercise 8.7 in their workbooks and review the points noted there.
4. Tell participants to rule their Income table according to the example in Exercise 8.7.

Exercise 8.7: Income Record

Question: "Why should you have an income record?

Answers:

1. To know when you sold your crop
2. To know how much you got for your produce and compare prices at different dates
3. To know the total income for the crop to compare total income/area with other crops
4. To know the quality of the crop sold and compare this with the price of each quality crop

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"What should you measure for an income record? Example:

Date	Crop	Unit	Where sold Quality/grade	No. of Units	Price/Unit earned	Total Income earned
12.04.17	Carrot	Bunch	Daw Myint Win A	300	300	90,000

Activity 10: Profit/Loss (15 minutes)

1. Ask participants the following questions written on a flip chart:

"Why measure profit and loss?

"How should you measure profit and loss?

2. Write their ideas on the flip chart.
3. Refer participants to Exercise 8.8 in their workbooks and review the points noted there.
4. Tell participants to rule their Profit/Loss page according to the example in Exercise 8.8.

Exercise 8.8: Profit/Loss Record for each crop

Question: "Why have a profit and loss record?

Answers:

1. To know which year you made the profit or loss to compare year by year results
2. To know how much profit you made on each crop
3. To know the profit or loss per area to compare with last season and with other farmers
4. To know the total profit adding the profit for all crops together

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"What should you note for a labor record? For example:

Date	Area	Total Income	Total Expenditure	Profit/Loss per Area	Comments why low or high profit/loss

5. Tell the participants that this is the end of the record book training. Ask them to sit with their family and make a Record Book together for homework. In this way they all learn about keeping records and they will understand more about the family money situation and why they may have no money sometimes (when they have spent it all on inputs) and have a lot of money at other times (when they sell their produce). Say that they have to learn to manage their money to save enough for next year's inputs, but also have enough for the family to live on.
6. Tell them that they must now think of making bokashi compost because it takes 2-3 weeks to mature so they have to start now to be ready to apply it at planting time.

Activity 11: EM bokashi & preparation of compost (Total time 45 minutes)

Plenary

1. Brainstorm with the group:
   (i) "What is compost?"
   (ii) "Why use compost?"
   (iii) "What different types of compost do they know of?"
2. Write their ideas on a flip chart
3. Refer them to Exercise 8.9 in their workbooks for some ideas (10 minutes)

Exercise 8.9: What is composting and why use it?

Definition of compost:

Compost is a mixture of dry and wet organic materials that have fermented and decomposed at high temperature over a period of time to form a fertile nutrient and micro-organism rich substance to add to the soil.

Question: Why use compost?

(i) Adds fertility and essential micro organisms
(ii) Creates a good structure for air and water to be retained in the soil to promote good plant growth
(iii) Improves drainage, reducing excess water and damage to crops
(iv) Helps to reduce disease in the soil and the plants

Question: What types of compost are there?

Two main types are:
(i) Effective Micro-organism (EM) bokashi compost – takes 3 weeks to be ready to use
(ii) Organic waste compost – takes 3-6 months to be ready to use

Other types include:

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Plenary

4. Tell participants that they will soon make bokashi compost which should be ready to use in their vegetable plots in 3-4 weeks' time.

5. Explain the steps for making bokashi in Exercise 8.10

Exercise 8.10: How to make EM Bokashi compost

Steps in making EM Bokashi for 1/16th acre (0.06ac)
Materials needed

Rice Husk	-	2 bags
Cow Manure	-	2 bags
Rice Bran	-	1 bag
Instant EM	-	1 Liter
Molasses	-	1 Liter
Water	-	40% moisture

Procedure:

1. Find a shady flood-free site big enough for your bokashi making. You need to use at least 600 viss of compost for 1 acre.

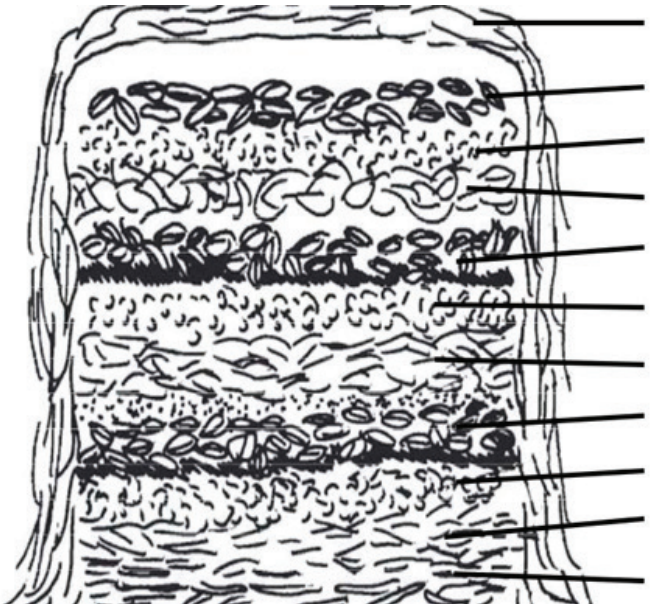
2. Water the ground thoroughly before making the compost. Dry soil can suck the moisture out of the compost and it will not be successful.
3. Sprinkle the rice husk on the ground, then mix in the cow manure and bran.
4. Mix the EM and molasses together, pour it over the dry material and mix well.
5. Add enough water to make a ball to bring the moisture up to 40%.
6. Cover with black plastic or dark colored tarpaulin to prevent light from reaching the mixture. The micro-organisms do not like the light.
7. Bury the edges of the black plastic or tarpaulin to prevent air getting into the mixture because the micro-organisms work better without air.
8. Add some water every 10 days if the mixture is getting dry.
9. After preparation, when it has a sweet-sour fermented smell and forms white fungi filaments on the surface, it is ready to use.
10. The bokashi should be ready after 3 weeks.
11. If you do not use the bokashi immediately, you can store it in bags in a dry cool place for up to 6 months.

6. Tell participants that together as a group they will read the guidelines of compost made with Organic Material Waste compost in Exercise 8.11. Tell them that this compost takes 3-6 months to make and is a lot of work. Most farmers prefer to use bokashi because it is easy to make and takes less time. However, if you do not have EM and the other ingredients, you can make organic compost just with materials around the house and garden. There is no need to buy extra materials. **(10 minutes)**

Exercise 8.11: How to make compost with organic waste materials

For a good result, include a mixture of old and tough materials ("brown materials") with young and juicy materials ("green materials"). There needs to be about half "browns" and half "greens" by volume. You can adjust this ratio depending on the quantity and quality of the materials you have at hand.
Making the heap. Make a base (6 (foot) x 6(foot)) of sticks about 1 foot deep on top of soil. This will ensure good air circulation and drainage.

1. The heap should be built on a raised soil bed to prevent flooding.
2. Make a heap of organic materials in a series of layers - each layer is about 6 inches- 10 inches thick.
3. The first layer should be with coarse and woody materials such as thin sticks or twigs. This will ensure good air circulation and drainage.
4. Add a layer of harder, more difficult to compost, materials ("browns"), such as rice straw, rice husks or leaves and stems of maize
5. Add the animal manure (wet) to cover the plant material
6. Add the "green" material that is easily composted, such as fresh grass, leaves, vegetables and fruit residues
7. Ash and cow or chicken manure can then be lightly sprinkled onto these layers, to accelerate the process of decomposition.
8. Repeat all these layers except the first layer of coarse material, until the heap reaches a height of 3 feet - 3.5 feet. The last layer is again green material.



The layers of a compost heap

Procedure for practical work: (25 minutes)

1. Divide participants into three groups with 8 people in each group. Each group should be led by a FFS village demo farmer. Say that participants will stay in these groups doing practical work on the same demo plot throughout the FFS. There will be a competition to see who has the best demo plot at the final FFS evaluation time.
   Have material already laid out for the 3 groups to make bokashi compost. Ask 1 farmer in each group to read the instructions in Exercise 8.10 above while the others do the tasks.

Activity 12: Summarize the session (5 minutes)

1. Briefly review the session's key points

Activity 13: Evaluate the Session: (5 minutes)

1. What worked well in the lesson?
2. What did not work so well?
3. How could the lesson be improved?

Activity 14: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.
   Note: Remind participants to complete making their record books for homework and to bring them to each meeting to show the facilitator that it is being regularly filled in and how their business is going.

Session 9: Preparation Before Planting

Duration: 3 hours (in the classroom)

Objectives

At the end of this session participants will be able to:

1. Describe the principles of crop rotation
2. Draw a map of their site layout showing areas for planting each crop and how crops will be rotated
3. Describe how to prepare land for planting
4. Describe how to establish a nursery for growing seedlings

Materials: White board; marker pens; tape; flip chart paper,

Activity 1: Review previous session and topics for this session (Total time 10 minutes)

Plenary

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart **(8 minutes)**
   1. Purpose of the record book
   2. How to make a record book
   3. Composting
2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read aloud the topics for this session. **(2 minutes)**

Activity 2: Land preparation (Total time 30 minutes)

Plenary

1. Brainstorm "What are the different methods of cultivation they know about?" Write participants' ideas on a flip chart (e.g. by hand; cow; hand tractor; tractor disc plough; tractor rotary hoe; direct drilling) **(2 minutes)**

Sub groups

2. Divide participants into small groups (one group per method) to discuss the advantages and disadvantages of each method. After 10 minutes, invite them to report to the plenary.

3. Refer them to Exercise 9.1 in their workbooks and invite them to add any of their ideas not already listed. **(13 minutes)**

Exercise 9.1: Cultivation methods – Advantages and Disadvantages

Advantages	Disadvantages
By hand: Inexpensive tools; can study the soil closely as you are working.	**By hand:** Needs a lot of labor; hard work; takes a long time; perhaps cannot go deep enough.
By cow: Some families have cows and implements for ploughing. Cow dung (manure) can also be used for natural fertilizer.	**By cow:** Hard work controlling the animals while ploughing; a lot of work feeding the animals all year round when you only need them for a short time; cows close to the house can cause family health problems by attracting flies and providing contamination from dung and urine.

By hand tractor: Not too expensive for a commercial farmer to own a hand tractor for cultivation and transport; quick; efficient; can have joint ownership to reduce costs; can hire a contractor at reasonable cost.	**By hand tractor:** Too expensive to buy for some farmers; need money for fuel and repairs. Sometimes contractors hard to get on time
Furrow plough Able to deep plough. Can break hard ground to improve drainage.	**Furrow plough** Heavy weight of tractor can destroy soil structure Turns the surface organic matter to the bottom and lifts less fertile subsoil to the top.
Tractor disc plough: Can easily cut already broken ground into smaller pieces Can also cut new ground but to a shallower depth than furrow plough Keeps fertile top organic layer close to the surface root zone.	**Tractor disc plough:** Heavy weight of tractor can destroy soil structure, May not go deep enough to improve drainage.
Tractor rotary hoe: Breaks up tough soil structures and produces a fine seed bed, Assists in incorporating organic matter. Reduces number of in soil-borne insect pests.	**Tractor rotary hoe:** Slow moving so takes a long time and high cost Soils with poor structure become more compact, Fine structure can become hard and crusty when it gets wet. Not as deep as a furrow plough.
Harrows: **Breaks up the soil into finer pieces** **Improves drainage and aeration** **Easy to pull with cow or tractor**	**This is an extra task which cost more money to do**
Levelling: **Important for even water distribution and plant growth** **On a small scale can be done easily by dragging a log or steel bar behind other equipment like harrows so not an extra task**	**Levelling:** **On a large scale moving large amounts of soil from one part of the field to another is difficult and expensive.**
Rolling: **Useful for breaking up larger lumps of earth and making a firm seed bed** **Can be pulled behind other equipment like harrows to reduce cost as an extra task**	**Rolling:** **Can be expensive to buy if not home made.**
Direct seeding: Maintains soil structure and water holding capacity. Reduces weed problem as it does not expose new weed seeds.	**Direct seeding:** Crop residues slow breakdown and may carry diseases, Hard top soils make it difficult for root penetration.

Tractor disc plow

Mynamar cow plow

Myanmar 2 wheels' tractor disc plow

Tractor rotary hoe

Simple direct seeder

Large scale direct seeder

44. Go over the cultivation steps Tips and Reasons Exercise 9.2 in participant's workbooks, discussing in more detail the methods as you go along. Invite farmers to read the headings to keep them involved and alert. **(15 minutes)**

Exercise 9.2: GAP steps for land preparation

Tips	Reasons
1. Clean tools very well before use.	This helps to prevent contaminants such as diseases being transferred from one place to another.
2. Clear the land of weeds and keep dry for 1 week.	After one week the dry soil will break up more easily during cultivation.
3. If there is a good layer of top soil rich in organic matter you can plant directly without ploughing.	This technique keeps the top soil from mixing with the less rich lower soil and enables more nutrients to be available for the crops.
4. Normally roughly plough only 6-8 inches deep and leave the soil for 7-14 days exposed to the sunlight.	The upper layer of the soil is rich in micro-organisms and nutrients, so do not mix it with the lower layer which has few organisms and nutrients. Exposure to sunlight can kill pests and diseases in the soil.

Activity 3: Fencing

Plenary discussion

1. Ask participants: "Why is fencing important?" Write their ideas on a flip chart.
2. Then go over the table Exercise 9.3 and 9.4 (10 minutes)

Exercise 9.3: Why is fencing important?

GAP reasons why fencing is important

1. To prevent damage by animals
2. To prevent contamination by animals
3. To protect chemically sprayed areas from children and others entering the field and becoming contaminated
4. To safeguard worker health and protect the environment - Make a small child proof enclosure for rubbish (old plastic bags, empty pesticide bottles etc.) and dispose of the rubbish regularly and safely.
5. .....
6. .....
7. .....
8. .....
9. .....
10. .....

Exercise 9.4: Methods of fencing and their advantages and disadvantages

Fencing Materials	Advantages	Disadvantages
Old fishing net	Small mesh provides good protection; Easy to erect	A little hard to get; a little expensive
Bamboo	Can mostly find in the forest or around the home	Hard work to cut and make the fence; Expensive in some areas
Live fencing	Provides fruits, leaves for consumption and compost, fire wood source	Requires maintenance, shady and takes nutrients from the soil
Other ideas:		
Community policy and taking action against wandering livestock		
Lobby for a national rule for no wandering of livestock as in Vietnam		

Bamboo fence

Fencing with Gliricidia Plants

Note : Farmers should think about growing Gliricidia plants which grow fast and provide nitrogen for the soil. Leaves can be used as natural fertilizer, flowers for food, and sticks for fire wood.

Activity 4: Control of soil borne diseases (Total time 15 minutes)

Plenary

1. Brainstorm the following 3 questions, writing participants' ideas on flip charts.
   (i) What do you know about soil borne diseases?
   (ii) What problems do soil borne diseases cause?
   (iii) How can soil borne diseases be prevented?
2. Review GAP control measures in Exercise 9.5 in their workbooks inviting participants to add any ideas not already noted in the workbook list.

Exercise 9.5: GAP controls for soil borne diseases

Natural control:

1. Plough 14 days before planting to let the sun shine on the soil and kill the pests and diseases
2. Spread black plastic over the soil for 2 weeks in summer to raise the temperature and to kill some harmful pests and diseases
3. Add Trichoderma fungi to control harmful diseases in the soil

Integrated Disease Management

1. Do not go from disease areas to clean areas without washing your boots and tools first.
2. Keep the crop free of weeds. Some weeds are hosts for crop pests and diseases
3. Only use compost that has been made using high temperatures that kill pests and diseases
4. Using mulch provides a protective barrier between the soil and foliage by preventing water from splashing on the foliage
5. Improve the drainage by using raised beds
6. If possible, use drip irrigation so plants are not too wet, as dampness attracts disease
7. Use seeds that are resistant to disease. Hybrid seeds are more resistant to most diseases.
8. Changing acid soils to more alkaline may make conditions difficult for some diseases to develop. For example, club root disease in cabbages and some types of wilt in tomatoes.
9. Too much or too little fertilizer can also increase disease problems in plants.

Chemical control:

1. Seed treatment with a fungicide helps control the development of damping off in seedlings but does not protect the plant as it gets bigger
2. Soil treatment with a fungicide drench helps control root rots and crown rots but needs to be done frequently
3. Some chemicals can evaporate when they are applied to the soil. These are used to control nematodes but are often very toxic so their use is not encouraged.

Other ideas:

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Activity 5: Nursery Preparation (Total time 30 minutes)

Plenary

1. Brainstorm the question: “Why are farmers changing from planting directly into the field to planting in a nursery?” Write their ideas on a flip chart. (5 minutes)
2. Then refer them to Exercise 9.6 in their workbooks and review the answers.

Exercise 9.6: Reasons for changing from direct seeding to seedlings in a nursery for transplanting

1. Use of less seed means you can afford to buy expensive high quality seed
2. Use less water in nursery than in the field, so can save water costs and effort
3. Easier to protect young plants from extreme weather by using 30% shade
4. Can more easily control pests in nursery plants because in a small area you can take more care
5. Higher success in germination and young plant growth
6. Can start 3 weeks early during the rainy season under cover so you can catch a high early season prices at harvest time
7. Can transplant only healthy plants giving greater success in the field

2. Go over the table below (Exercise 9.7) that shows which plants can be transplanted, which plants can be direct seeded, and which plants can be transplanted or direct seeded (5 minutes)

Exercise 9.7: Plants preferred planting method

Plant Name	Transplanted: Direct Seeded: Both
Group – 1	
1. Yard Long Bean	Direct seeded
2. Okra	Direct seeded
3. Onion	Direct seeded / Transplanted
4. Carrot	Direct seeded
Group – 2	
5. Chili	Transplanted
6. Tomato	Transplanted
7. Egg-plant	Transplanted
8. White egg-plant	Transplanted
9. Coriander	Direct seeded
Group – 3	
10. Cabbage	Transplanted
11. Cauliflower	Transplanted
12. Broccoli	Transplanted
13. Radish	Direct seeded
14. Water spinach	Direct seeded
15. Mustard	Direct seeded / Transplanted
16. Corn	Direct seeded
Group – 4	
17. Bottle Gourd	Direct seeded / Transplanted
18. Snake Gourd	Direct seeded / Transplanted
19. Ridge Gourd	Direct seeded / Transplanted
20. Bitter Gourd	Direct seeded / Transplanted
21. Cucumber	Direct seeded / Transplanted
22. Watermelon	Direct seeded / Transplanted
23. Pumpkin	Direct seeded / Transplanted

Commercial Field Crops	
24. Groundnut	Direct seeded
25. Chili	Transplanted
26. Corn	Direct seeded
27. Onion	Direct seeded / Transplanted
28. Water Melon	Direct seeded / Transplanted

Plenary

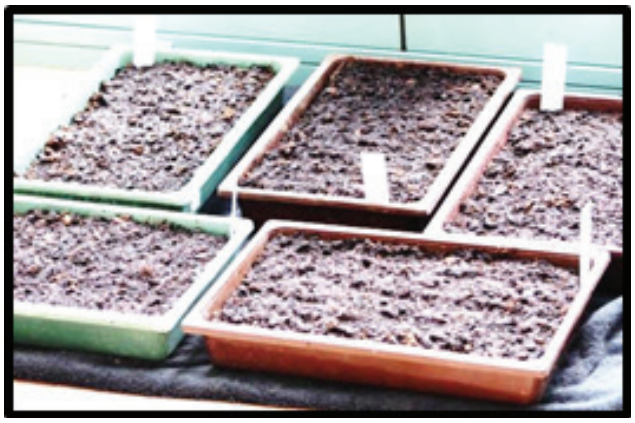
3. Go over the following table (Exercise 7.8) asking individual farmers to read various sections to keep them actively involved. (20 minutes)

Exercise 9.8: How to Establish and Maintain a Nursery

TIPS	REASONS
1. Select a raised or slightly sloping, secure site close to water.	Water can run off to prevent flooding. Fencing protects plants from damage. Water is essential for plant growth.
2. Do not put your nursery close to guava or banana plants.	These plants harbor pest and disease.
3. Build a nursery table from local materials to save cost.	
4. Put shade cloth or palm leaves on top of the seedling table for 30% shade and plastic for protection from rain. 	Direct sunlight dries the soil quickly and high temperature stresses the young seedlings. The rain can wash out the seedlings. Too much shade makes long stemmed weak seedlings, while too much light stresses young plants and they do not grow well. Airflow from the sides reduces moisture and disease.  *Too much shade produces elongated seedlings*

5. Put a ring of an ash and oil mixture around the nursery seedbed to prevent ant invasion.	Ants can destroy the seedlings
6. Grow seedlings in separate small pots with water drainage holes like a plastic seed tray, bamboo joint, newspaper, or other small homemade containers with holes in the bottom.	This method reduces competition for light, nutrients and root development between plants. Plants can also be easily taken out of the pot and transplanted without disturbing fine roots and the plant next to it in the nursery.
7. Seedling Mix and seed planting: i. Put together equal portions of well decomposed cow-dung manure, rice husk charcoal and top soil. ii. Put the mixture in a sealed plastic bag (black color) and heat up for fermentation in the sun light for 3-4 hours. iii. Gently sprinkle the mixture into a seed tray or other container. Don't press the soil mixture, but shake the container 3-4 times after putting the mixture to help it settle. Fill up the mixture to the top of the container. iv. When the seedling mix is ready, poke a hole about twice the seed diameter below the surface with a sharp stick, then plant and cover the seed. v. Water the soil by using a gentle sprayer until very wet. vi. Transfer the seed containers to the nursery house and cover the trays with nipa palm leave or tarpaulin or newspaper sheet until germination. Then remove the cover with part (30%) shade for the young seedlings.	Special seedling mix helps germination and healthy seedlings to grow. Seed depth is important – too deep or too shallow and the seed will not grow well. A wet, warm, dark place is ideal for stimulating seed germination. 
	
8. To get weekly income from seasonal vegetables, stagger your sowing time in the nursery so that seasonal vegetables will not be competing in the market. Selling over a long period evens out fluctuations in income, rather than selling all at one time for one price.	This method grows just enough to eat each week over a number of weeks. Not have every plant ready for harvesting at the same time.
9. Keep the nursery seedlings moist by lightly watering 2-3 times per day. Make sure the seedlings are not too wet or too dry, just moist. Check for, and control for pests and disease by picking up and destroying them manually.	Plants need water for growth but too much water rots the roots and base of the stems and attracts disease.
10. Seedlings are ready to transplant when there are 3 fully open leaves (do not count the first round leaves)	If seedlings are planted too early they are weak with small root development, while old seedlings can develop tangled roots which restricts growth.
11. 2 days before transplanting, reduce watering to 1 x per day and increase the light exposure.	Helps adjust the seedling to life outside the nursery.

Note: When transplanting from seed trays, the plants grow fast because the roots are not damaged.



Seedling tray

Seed Trays with cells

Open Ground

Plenary

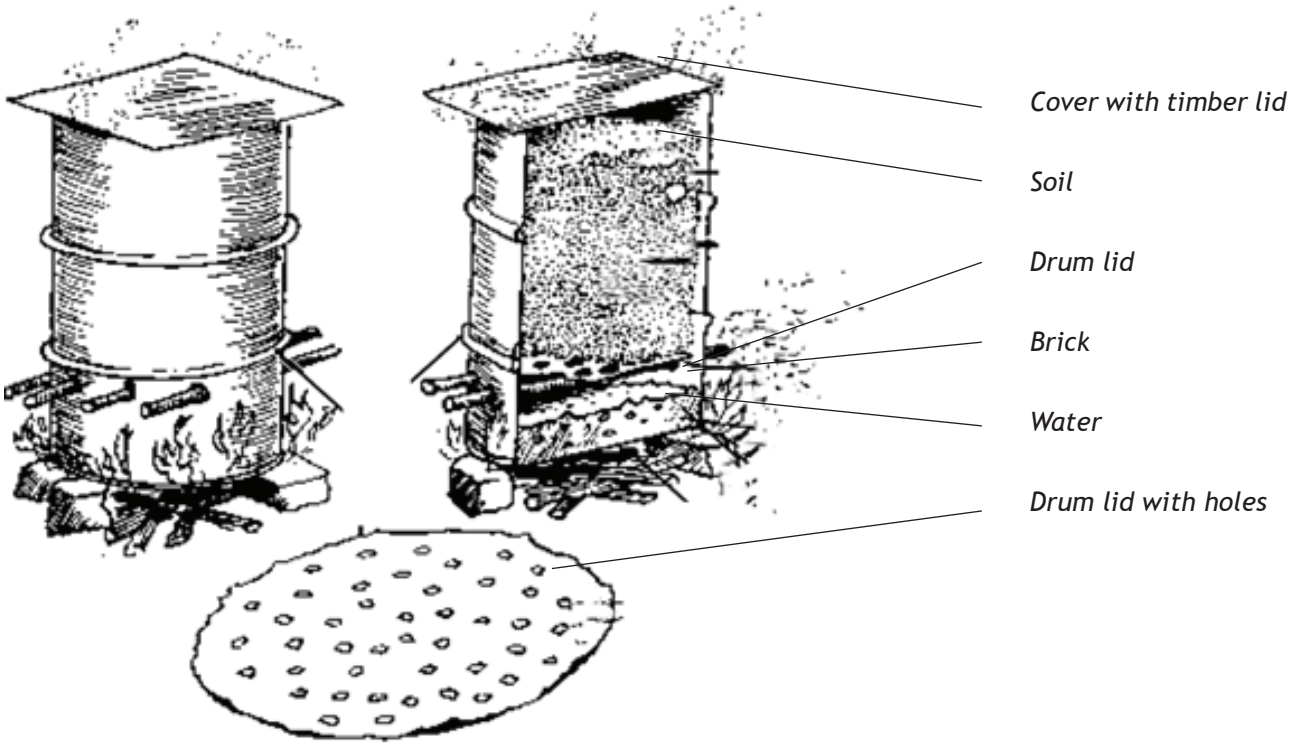
4. Ask the group to read together so they all participate and learn about Exercise 9.9 which discusses a method to sterilize the soil for nurseries.

Exercise 9.9: Sterilizing soil for nurseries

Well-made compost should be sterilized but if you mix the compost with ordinary soil it should be partially sterilized to kill harmful organisms and weed seeds. Soil to be sterilized can either be placed on a corrugated iron sheet over a heated grill or in a container made from a metal drum (see diagram below). Put some holes in the lid of the drum and lay it on 3 bricks placed inside and on the bottom of the drum. Fill the drum with water until it reaches the top of the bricks. Add the soil on top of the lid inside the drum, and place a new timber lid on the top of the drum. Light a fire under the drum and heat the water for one hour. The steam will go through the soil and sterilize it.

The soil to be heat-treated should be relatively dry and fine in texture. Heat will take longer to penetrate any lumps and may leave pockets of unsterilized soil.

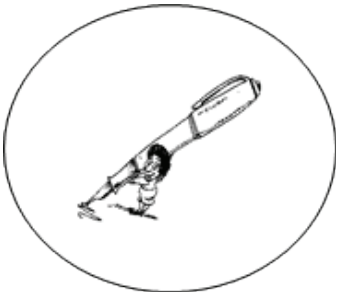
A cassava root can be placed in the soil to test the time required for heating. When the cassava root is cooked then the soil will be sterilized.



Activity 6: Field Practice (or in the classroom if raining): (25 minutes)

Practical work procedure: Divide participants into their three demo groups. Each group should be led by a FFS village demo farmer.

Each group should prepare the seedling containers, filled with the recommended seedling mixture in Exercise 9.8 in their workbooks. If you have the time and materials you could also demonstrate sterilizing the soil.



Tips for the Facilitator:

Make sure that you have all of the demonstration materials ready for 3 field practice sub groups and that the FFS demo farmer group leaders know what to do. Circulate around the groups to make sure that they are following the correct procedure.

Activity 7: Summary (Total time 5 minutes)

1. Summarize the activities of the day

Activity 8: Evaluation (Total time 5 minutes)

a) Ask participants what they thought was good and interesting during the training
b) Ask participants what was not so good about the training
c) Ask them how the training could be improved
d) Write their ideas in a notebook for reviewing the training notes and processes later on

Activity 9: Next session topic(s), Timing, Location and Who Should Come (5 minutes)

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 10: Making raised beds and plant nutrition

Duration: 3 hours
Objectives

At the end of this session participants will be able to:
1. Describe how and why to make raised vegetable beds
2. Know crop nutrient requirements and the advantages and disadvantages of organic verses chemical nutrition
3. Recognize nutrient deficiencies in crops
4. Summarize crop nutrient and water requirements in GAP crop management tips

Materials: White board; marker pens; tape; 4 x blank flip charts

Activity 1: Review last session and topics for the next session (Total time: 10 minutes)

Plenary

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart (8 minutes)
   Example:
   1. Crop rotation
   2. Site Layout
   3. Land Preparation
   4. Control of Soil Borne Pests and Diseases
   5. Composting
   6. Nursery establishment

2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session. (2minutes)

Activity 2: Making Raised Beds (Total 10 minutes)

Plenary discussion: Importance of planting in raised beds (2 minutes)

1. Brainstorm with the group the question: "Why is it important to make raised beds?" Write their answers on a flip chart and discuss.
2. Review the answers in Exercise 10.1 in their workbooks, inviting participants to add their own comments in the blank spaces provided. (8 minutes)

Exercise 10.1: Why is it recommended to have raised beds?

It is recommended that farmers have raised beds because:

1. Soil is loosened while making raised beds. This creates more spaces between the soil particles for air, so the roots can breathe more effectively.
2. Excess water can initially drain away from the plant reducing the chance of disease and water logging stress, and excess water does not block air spaces.
3. The excess water that drains into the furrows can slowly soak into the bottom of the bed and then move up towards the plant roots. Therefore, the excess water is not lost.
4. Roots can grow quickly toward the water in the bed. Long roots improve the feeding and production of the plant.

.....

Forming raised beds for tomato

Black plastic cover on raised beds

Plenary

2. Discuss the different types of raised beds described below. **(Time: 10 minutes)**

Exercise 10.2: Raised bed designs

Note that these are optimum sizes for different plants. Farmers will need to consider the method of irrigation (furrow), drip or hand watering and the labor involved in making each bed.

a) Method 1 - for climbing plants requiring trellises like cucumber, gourds, and yard long beans, beds should have a flat surface not wider than 10 inches, but with enough space for placement of the seed and the drip line. The base of the bed should be 3 feet and the height 1 foot.
b) Method 2 - two rows per bed, suitable for crops like corn, cabbage, cauliflower, chili okra. The top should be about 2 to 2.5 feet in width, 10 inches in height with a bed base of 3 feet. If using drip irrigation then one drip line is used per bed placed between the two planted rows for clay loam soil, and 2 drip lines for sandy loam.
c) Method 3 - three rows per bed, suitable for salad vegetables. The shape of the bed is similar to Method 2: a bed base of 3 feet, top of 2-2.5 feet, and height of 10 inches. If using drip irrigation use two drip lines per bed.
d) Method 4 - four rows per bed, suitable for small vegetable crops like onions and shallots.

Activity 3: Plant Spacing (Total Time 15 minutes)

Plenary discussion

1. Brainstorm with the group: "Why is plant spacing important?" Write participants' answers on a flip chart. Then go over the table below, asking individuals or the whole group to read the information to keep them actively involved. **(Time 15 minutes)**

Exercise 10.3: GAP plant spacing tips

TIPS	REASONS
1. Plant at suitable spacing (according to grower instructions on seed packets)	Reduces the need for thinning, saves seed
2. When planting small seeds, mix them with fine sand and then plant them.	Reduces the seed rate and thinning requirement
3. Transplant healthy seedlings at suitable spacing	This results in fewer gaps and no or infilling requirements
4. Calculate your plant spacing to maximize your yield per land area. Fill in gaps with reserve seedlings or direct seeding	This maximizes your plant population and increases your profit per land area
5. Space the plants according to the size of produce that the market wants. See onion example in the photos below	The market may pay a high price for a certain sized product. Grow to market requirements
6. Space the plants evenly so you get an even sized crop. For example, to get large onion bulbs the plants should be about 3-4 inches apart. Smaller bulbs can be obtained from a closer plant spacing of 1.5 – 2 inches apart (see photos below)	Buyers want even sized produce according to market requirements. Buyers may pay a low price if the sizes are all mixed up
7. Plants must be spaced so they can access the water	This gives the plants a chance to grow. E.g. Do not plant in areas where sprinkler irrigation does not reach

Even plant spacing

Even spacing = even size bulbs

Uneven spacing = uneven mixed size bulbs

Activity 4: Fertilizer Options and their Use (Total time 115 minutes)

Plenary

1. Ask individual participants or the whole group to read out aloud from the table (Exercise 10.4) in their workbooks about the main nutrient requirements for plants and how these nutrients contribute to plant growth. Discuss the points to make them clear. **(10 minutes)**

Exercise 10.4: The major nutrient requirements of plants

There are six major nutrients that plants require. Plants get the first three—carbon, hydrogen and oxygen—from air and water. The other three are nitrogen, phosphorus and potassium from the ground.

1. Nitrogen (N) helps plants make new leaves, stems and roots, and helps to develop the proteins they need to produce new tissues. Nitrogen is often in short supply so plants take up as much as they can. If too much nitrogen is available, the plant may grow too many leaves and not produce flowers or fruit.
2. Phosphorus (P) stimulates root growth, helps the plant set buds and flowers, improves vitality and increases seed size. To absorb phosphorus, most plants require a soil pH of 6.5 to 6.8. Organic matter and the activity of soil organisms also increases the availability of phosphorus.
3. Potassium (K) improves overall vigor (health) of the plant. It also helps the plants make sugars and provides disease resistance.

Secondary important nutrients:

1. Calcium is used by plants at their growing points.
2. Magnesium is needed to make the green color in the leaves and stems and plants use it to absorb sunlight.
3. Sulfur is needed to build strong plants (e.g. Onion need large amount of sulfur)
   Micro nutrients are very important but are needed only in very small amounts so generally do not require supplementation.

Plenary

2. Brainstorm with the group: “What different fertilizer options do you know of?” Write their ideas on a flip chart. The main headings we are looking for are: Chemical: Organic: and Crop rotations. (2 minutes)
3. Go over different types of fertilizers described in Exercise 8.5 in their workbooks. Ask individuals or the whole group to read parts of the script for variety. (8 minutes)

Exercise 10.5: Different types of fertilizer

1. **Single element fertilizers:** These can be used when there is a deficiency of just one nutrient and can be used as side dressings. For example, urea contains 46% nitrogen. Muriate of potash contains around 50% potassium. Bitter salt contains 50% magnesium. It is important that these fertilizers are used in small amounts only and should not be placed in direct contact with the plant stem or roots. It is best if they are applied mixed with water.
2. **Compound fertilizer (N:P:K):** This compound fertilizer is commonly used as a basal dressing and contains all three major nutrients in different amounts. For example, a 20: 15: 10 fertilizer will contain 20% nitrogen: 15% phosphorous: 10% potassium. Compound fertilizers are strong and will not easily mix with water. It is best if they are applied and mixed in with the soil before seeds are sown or transplanting takes place.
3. **Liquid fertilizers (foliar):** These can be sprayed on the leaves or poured directly onto root systems. Because they are water soluble, they can be immediately absorbed into the plant's root system to give a quick boost to the plant. If sprayed on leaves liquid fertilizers need to be watered down to avoid burning. Liquid fertilizers are used as supplements to solid fertilizers.

Sub group

4. Divide participants into 3 groups (1 topic per group) to discuss the strengths and weaknesses of: (i) Chemical fertilizer, (ii) Organic fertilizer, and (iii) crop rotation fertilizing options. (10 minutes)
5. Ask leaders of the groups to report back to the plenary. Write their ideas on 3 flip charts divided into 2 columns (1) Strengths and (2) Weaknesses. (10 minutes)

Plenary

6. Go over the table, Exercise 10.6 in their workbooks. Do this by asking participants to read individually or as a group to keep everyone involved. Congratulate them on the points they have already listed on the flip charts, and focus discussion on GAP ideas that have not been discussed already. Ask participants to add any other points not mentioned, in the blank spaces provided, after the session. (15 minutes)

Exercise 10.6: Fertilizer types, their strengths, weaknesses, and GAP application recommendations:

Fertilizer Type - Strengths	Weaknesses	GAP Recommendations
Chemical Fertilizer:		
Usually there are many different chemical supplements available to buy.	Some markets do not supply the full range of quality fertilizers.	Form linkages with quality suppliers so you can get the fertilizers you need.
Farmers do not have to spend time making the fertilizer. They can buy it.	The cost is usually quite high.	Use the minimum amount of fertilizer specific to the crop and soil needs, so you do not waste money on too much fertilizer.
Very effective if applied at the right time in the right amount	Farmers do not know how or when to apply the fertilizer.	Use multi-nutrient or single nutrient fertilizer at the right planting time to stimulate root, leaf and fruit growth.
Rakhine soils are acid (less than 5.5 pH) and require lime to be added	Have to buy the lime	3-5lbs per 25 square yards to raise pH by 0.5 pH unit

Chemical fertilizer feeds the plant, not the soil.	Chemical fertilizer does not encourage improvements in soil structure, or make a home for beneficial micro and macro organisms, nor does it develop long term natural nutrient growth.	Combine chemical fertilizer with organic matter to promote natural soil health and combined fertilizer effectiveness.
Most chemical fertilizers are natural products like phosphates, lime and potassium and are not directly harmful to the soil in limited amounts.	Some fertilizers are artificially made like Urea from the underground gas refining process. This fertilizer is harmful to the organic matter in the soil in the long term. Fertilizers can be washed into streams creating problems for fish and other aquatic animals.	Do not use artificially made fertilizers whenever possible.
Organic fertilizer:		
Organic fertilizer feeds the soil so the soil can produce its own nutrients for a long time.	It is difficult to make the large amounts of organic fertilizer required to meet all of the plant needs.	Make as much organic fertilizer as possible and supplement it by chemical fertilizer if required.
The solid form (compost) can be made for free in a pit filled with chopped up natural plants, mixed with animal manures, water and air.	Takes a lot of work and time (3-6 months) to make.	Follow the GAPs for making organic fertilizer efficiently (sweet smell with a crumbly dry texture). Do not apply raw manure directly to the crop as it has harmful bacteria and can make you sick. Do not use human waste as this can be very dangerous for your health.
The liquid form is a mix of the above but is put in a large container fermented for a specific period. It can be applied as a foliar fertilizer.	Takes time to make and the farmer has to buy a sealed container.	Follow the GAPs for making organic fertilizer efficiently. Only apply organic fertilizer when it is fully composted.
Solid and liquid organic fertilizer can cause contamination.	Organic material is toxic during the early part of its decomposition process. Sometimes the toxic water can drain into the garden or waterways.	Keep the compost pit way from the garden. Do not use human waste. Keep children and animals away from the compost pit. Do not let toxic waste water from the process drain into waterways of touch the vegetables.
Effective Micro-organisms (EM):		
Farmers can buy this liquid product as a concentrated mix of beneficial micro-organisms made from the fermenting of special bacteria, lactic acid and yeast.	Can be difficult to buy it locally. It costs around 3,000MMK per litre which is expensive for some farmers.	Improve linkages with the supplier so that it is easy to get. Buy in bulk so it is cheaper.
The concentrate can be diluted up to 1:1000 and still be effective	If dilute it too much it loses its effectiveness	Follow the recommended dilution guidelines according to the use of EM.
EM can be added to rice husks and molasses to make good super nutrient compost which is fermented under cover from sunlight for only 2-3 weeks.	Farmers often do not follow the guidelines properly so it is not so effective	Follow the EM guidelines

A mixture of EM and FPJ (Fermented Plant Juice) can be applied to control pests.	Some farmers do not prepare it properly and then it is not so effective	Follow the guide lines of EM preparation
Crop rotations		
Crops should be rotated every 1-2 years so the soil is not stripped of the same nutrients every year and disease cannot be transferred between the same crops.	Farmers do not take care to record the crops and areas where they have been grown so don't clearly remember.	Follow GAP and record where and when you have grown your crops and rotate them every 1-2 years
Grow crops that improve the soil structure and nutrients like legumes (groundnut, mung bean, soy bean) which put nitrogen into the soil	It takes time and money to grow these crops.	GAP recommends the growth of legumes such as beans and groundnut from which you can make a profit and improve the soil at the same time.
Cover crops can be grown to conserve soil water and control temperature, and before they are mature you can dig them into the soil to form compost over the next few months.	It takes time and cost money to grow and dig back in cover crops with no apparent immediate return.	Understand that cover crops are good for the long term benefit of the soil and crop yields, even though in the short term the benefits cannot be seem.
Keep records	Farmers usually do not keep records	Keep records of chemical and organic fertilizer application and crop rotations so you know what has gone into your soil and what crops you have grown. People who eat the products also know how your crop was grown.

Plenary

7. Tell participants that together we have been discussing what nutrients plants require, but sometimes even when we give the plants the nutrients the plants need, they still do not grow well. Why?
8. Brainstorm the question: "What affects nutrient uptake by plants?" Write participants' ideas on a flip chart. Go over the answers in Exercise 10.7 in their workbooks. **(15 minutes)**

Exercise 10.7: Factors that affect nutrient availability for plants are:

	pH	GAP Recommendations	Soil Moisture	Temperature	Saltiness
Not good for Plants	Acid or alkaline	High in Silt	Uneven	Over 35ºC	Very salty
Good for Plants	Neutral	Sandy to Loamy	Constant	Under 30ºC	Low salt

9. Brainstorm "What are the solutions to the above nutrient uptake problems?" Write participants' answers on a flip chart. Then ask them to write the answers from the flip chart in the spaces provided in Exercise 10.8 in their workbooks. **(5 minutes)**

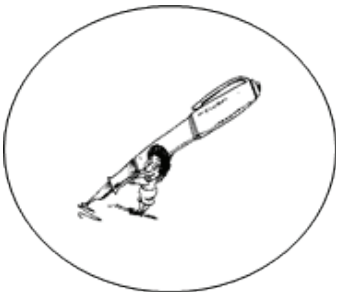
Exercise 10.8: How to improve nutrient uptake by plants

1. Reduce acidity by adding lime.
2. Improve soil texture by adding compost.
3. Improve soil moisture by regular watering. Not too much, not too little.
4. Reduce soil temperature by mulching.
5. Reduce salinity by selecting low salt soils & not salty water.

Explain that the participants will follow these steps 1-5 in the field work to improve nutrient uptake by plants.

Plenary

10. Brainstorm with participants the question: "What evidence can you see in the field that shows there is a nutrient deficiency in your crops? Write their ideas on a flip chart.
11. Read together the symptoms of nutrient imbalance in Exercise 10.9 in their workbooks and look at the examples in the photographs below the table. **(15 minutes)**



Tips for the Facilitator:

Try to bring in some real life examples of perfectly shaped vegetables and vegetables indicating nutrient imbalance to show participants the difference.

Exercise 10.9: Symptoms of nutrient deficiencies in plants

Deficiency Symptoms of Nitrogen

2. Leaves become pale green and then turn yellow
3. There is poor growth and development of leaves, stalks and branches, resulting in stunting
4. Roots, shoots and fruits are smaller

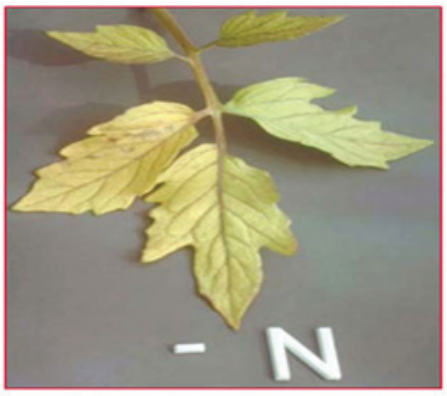
Deficiency Symptoms of Phosphorus

5. Growth of shoots and roots is stunted
6. There is poor formation of lateral shoots and buds
7. Flowering is reduced and bud and leaf formation is delayed
8. A bluish-green color is visible on the leaf surface

Deficiency Symptoms of Potassium

9. Leaves curl and the upper surface of leaves become wrinkled
10. Slight browning (scorching) occurs starting with the older leaves
11. Growth is reduced and stunted, with short internodes and bending of main stem toward the ground
12. The fruit often ripens unevenly

Look at the following photographs and see the signs of nutrient deficiency.



Tomato: Nitrogen deficiency

Tomato: Nitrogen deficiency

Tomato: phosphate deficiency

Tomato: phosphate deficiency

Cabbage: potassium deficiency

Cabbage: nitrogen deficiency

Corn: nitrogen deficiency.

Corn: phosphate deficiency

Corn: Potassium deficiency

Cucumber: nitrogen deficiency

Cucumbers: potassium deficiency

Plenary

12. Discuss fertilizer remedies for nutrient deficiencies in Exercise 10.10in their workbooks **(5 minutes)**

Exercise 10.10: Remedies for nutrient deficiencies

1. Nitrogen: Is easily washed from the soil so needs to be continually added. Compound fertilizers provide a slow release. A short-term boost can be provided by liquid fertilizers. Organic mulches help to reduce the loss of nitrogen from the soil.
2. Potassium: Shortages are more likely on light sandy soils. Apply muriate of potash. Do not use sulfate of potash as it will make the soil more acid.
3. Phosphate: Is not very soluble (doesn't dissolve well in water) so it is best to apply superphosphate (which is more soluble) before planting
4. Magnesium: Mix a solution of bitter salt using a table spoon per pint and water plants

Plenary

13. Divide into same village subgroups and ask participants to write down how they apply the fertilizers they use in the table in Exercise 10.11 (5 minutes)
14. Invite group leaders to present their answers for plenary discussion. **(5 minutes)**

Exercise 10.11: How farmers apply their fertilizer and at what stage of crop growth

Fertilizer	Method of Application	When is fertilizer applied? (At what stage of the crop cycle)

Plenary

15. Go over the notes about how to apply fertilizer in Exercise 10.12 in their workbooks. Invite individual participants to read or the whole group to read to keep them involved rather than just listening. **(5 minutes)**

Exercise 10.12: Applying fertilizer

1. **Basal dressing**
   Basal fertilizer is applied in a 10' wide furrow, 4 inches below the surface line where you want to plant. If lime is applied to increase pH, and superphosphate for general nutrition, these fertilizers should be applied 2 weeks to 1 month before planting. All fertilizers including compound fertilizer (N:P:K) and simple fertilizer (muriate of potash) should be covered by the soil to prevent chemicals being lost by evaporation from the heat of the sun. It is also important that the soil is kept moist. Fertilizer does not release nutrients if the soil is too dry or too wet. The fertilizer can be broadcast over the land or placed in bands. Fertilizer will burn the roots if it comes in direct contact with them.
2. **Side dressing**
   This is used in sandy soils which do not hold nutrients well and when plants require additional nutrients for growth e.g. when flowering. Side dressings can be made either in a narrow furrow 6 inches from the row of plants and 2 inches deep, or applied in a furrow mid-way between more mature plants and 6 – 8 inches away from younger plants. Side dressings should also be covered by the soil to prevent evaporation of nutrients. An N:P:K 5:5:5 is a good general purpose choice for fruiting crops. Use 1 or 2 tablespoons / plant or 1 – 2 lbs for every 25 feet of row. For leafy greens use a fertilizer with more nitrogen eg N:P:K 20:5:10 .
3. **Important tips:**
   1. Too much fertilizer can be more harmful than too little. Excess fertilizer accumulates in the soil in the form of salts and damages plant roots.
   2. Don't add fertilizer during a dry period of weather if you can't irrigate your field, because without adequate soil moisture, roots can't take up nutrients.

Plenary discussion

16. Go over the timing of fertilizer advice given in Exercise 10. 13 in participants' workbooks. **(5 minutes)**

Exercise 10.13: Timing of fertilizer applications

1. **Nitrogen:** Apply higher concentrations of nitrogen in the early growth stage as it provides for leaf and root growth. High levels of nitrogen result in a lush, green plant. However nitrogen can also burn your plants so avoid direct contact to leaves and vines. Too much nitrogen also can reduce or delay the emergence and number of flowers and fruit and can cause wilting (due to burning) of your plants.
2. **Phosphorous:** Apply just before the start of flowering. Phosphorous is important for flowering and root growth, does not burn your plants and it is difficult to damage your plants from applying too much.
3. **Potassium:** Apply as fruiting starts. Like Phosphorous, it will not burn your plants but too much may reduce the ability of your plants to take up other nutrients.

Activity 5: Crop Management Tips (CMTs): (Total time: 15 minutes)

Plenary

1. Hand out copies of the RWCP Crop Management Tips
2. Go over ONE (1) of the Crop Management Tips (CMTs) column by column to explain their format and types of information they contain, especially the fertilizer sections. Explain that the farmers can read the other crop management tips in their own time after the class. Invite questions to make sure everyone understands the format of the CMTs and the advice provided. Explain to participants that they will be using the CMTs in the field work so they will become more familiar with the CMTs as they come to each future session.

Activity 6: Summary

1. Summarize the activities of the day (5 minutes)

Activity 7: Evaluation (5 minutes)

1. Ask participants what they thought was good and interesting during the training
2. Ask participants what was not so good about the training
3. Ask them how the training could be improved
4. Write their ideas in a notebook for review the training notes and processes later on

Activity 8: Next session topic(s), Timing, Location and Who Should Come (5 minutes)

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 11: Mulching, Transplanting and Direct Seeding

Duration: 3 hours. Classroom 1.5 hours. Field 1.5 hours
Objectives

At the end of this session participants will be able to:

1. Describe the benefits of mulch and how to use it
2. Know the advantages and disadvantages of direct seeding verses transplanting
3. Know plant water requirements and water budgeting
4. Know how to use different trellising techniques
5. Know how to prepare Effective Micro-organism (EM) insect repellent and organic fertilizer

Materials: White board; marker pens; tape; 4 x blank flip charts; 1 x 3 column flip chart – Materials- Hand out of an East West pamphlet on mulching and trellising; 1 x 2 column flip chart – 3 x blank flip charts; EM culture materials

Activity 1: Review of last session and topics for this session (Total time: 10 minutes)

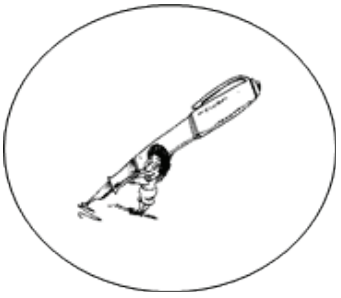
Plenary

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart **(8 minutes)**.

Example:

- Making Vegetable Raised Beds;
- Layout of beds;
- Plant Spacing;
- Organic and Chemical Plant Nutrition;
- GAP Crop Management Tips for the selected crops.

3. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session. **(2 minutes)**



Tips for Facilitators

Guiding participants to use the table of contents helps them to look up information in their 'Farmer's Work Book' more easily when they are at home.

Activity 2: Mulching (Total time 15 minutes)

Subgroup and plenary discussion

1. In the same village subgroups ask participants to answer the following questions which should be written on a flip chart: (5 minutes)
   (i) "What is the meaning of mulching?"
   (ii) "Why should farmers use mulching?"
   (iii) "What different types of mulching do they know of?"
2. Ask group leaders to present their answers to the plenary. Write a summary of the ideas on a flip chart. **(5 minutes)**

3. Refer participants to Exercise 11.1 in their workbooks, focusing on the ideas they have not covered already and the photos showing different types of mulch. If you have it, hand out an East West pamphlet on mulching and trellising. **(5 minutes)**
4. Tell the participants that you will be mulching in the demo plots later in the session.

Exercise 11.1: Mulching

Definition of mulching:
Mulching is the covering of soil to prevent stress to the plant.

Question: Why should farmers use mulching?

1. To prevent the soil temperature rising and causing stress to the plant, and prevent the reduction of nutrient uptake
2. To prevent water loss through evaporation
3. To protect the soil from wind and water erosion
4. To prevent weed growth that competes with the crop for nutrients and light
5. To prevent soil disease from splashing up to the plant
6. .....
7. .....

Warning: Keep mulch away from the plant stem because the moisture in the mulch can attract disease. If mulch has contact with the stem it can pass on the disease to the plant.

Rice Straw Mulching

Mulching with Sugar Cane Leaf

Mulching with Plastic

Mulching with Newspaper

Activity 3: Direct Seeding and Transplanting Options (Total time: 15 minutes)

Plenary

1. Invite participants to review the benefits of transplanting verses direct seeding from Exercise 11.2 in their workbooks. **(5 minutes)**

Exercise 11.2: Advantages and disadvantages of direct seeding and transplanting

Activity	Transplanting	Direct Seeding
1. Cost	High cost	Very low cost
2. Water application	Use less amount	Use more amount
3. Weather/pests impact	Easy to control in smaller nursery, low impact	Difficult to control, high impact
4. Productivity	High productivity, good uniformity in quality	Uneven productivity in plants; lower quality
5. Crop season in field	Shorter	Longer

2. Invite participants to turn to Exercise 11.3 for transplanting seedlings and Exercise 11.4 for direct seeding guidelines. Ask individual farmers or the whole group to read the directions aloud to keep them actively involved. **(10 minutes)**
3. Explain that they will learn the transplanting process by doing it in the field in the demonstration plot.

Exercise 11.3: Steps for transplanting seedlings into the field

Transplanting

1. Two days before transplanting, wet beds until saturation and add Trichoderma.
2. Prepare the Trichoderma solution mixing 7g of tricoderma in 10 liters of water. Slowly add 40 mls of trichoderma solution to each cell and don't let the solution drain out of cell.
3. To each hole, add N:P:K, compost and trichoderma according to crop management tips.
4. Transport the seedlings carefully to the field. Select only healthy and stout seedlings for transplanting.
5. Make a hole in the soil where you are going to transplant, according to the crop management tips. If you plant too close, you will get thin weak plants and if you plant too far apart, weeds can grow fast, stealing plant nutrients and light.
6. Take the seedling from the pot by the crown (around the head) of the plant without bending or pressing too hard and lift it completely out of the seed bed tray. Drop the seedling into the hole at ground level and cover the seedling roots with soil; Gently firm the soil around the plant pressing up and down ('puddling in') so the air and water will reach the young roots.
7. As soon as transplanting is finished, water the row.

Tips:

1. Transplant seedlings level with the soil surface, not below the surface which could cause water to gather and flood the plant, reducing oxygen and causing stem disease.
2. Onions, tomatoes, eggplant and chili can be planted deeper to encourage root growth.
3. The soil around the roots should be pressed firmly to prevent the roots from drying. Try to transplant seedlings after 3:30 pm to avoid dehydration.

Exercise 11.4: Direct Seeding guidelines:

1. Mark straight lines using string or another technique
2. Make a shallow trench in the soil about 10 inches wide and 4 inches deep, along the line of the crops, add N:P:K, compost and trichoderma according to the Crop Management Tips. Cover with soil.
3. Make a small furrow in the top soil, generally at a depth of 2 times the diameter of the seed.
4. Place seeds at the spacing recommended by the Crop Management Tips.
5. Gently cover the seeds with soil and press firmly. As soon as seeding is finished, water the row.
6. .....
7. .....
8. .....

Direct Planting Corn Seeds

Activity 4: Making Organic EM Insect repellent/foliar fertilizer 3 weeks before planting. (15 minutes)

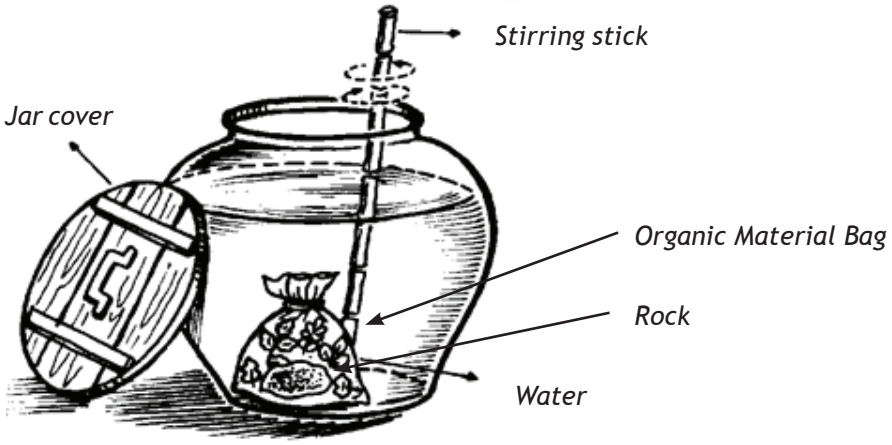
Plenary

1. Tell participants that to protect the environment, farmer health, and to have more healthy food to eat, it is better to use natural insect/pest control than using chemicals. Say that we will talk about organic and chemical control of pests and diseases in more detail in a later session, but at this time we have to make the organic insect repellent to give it time to ferment, so we can use it in 2-3 weeks' time.
2. Go over the guidelines for natural insect repellent in Exercise 11.5 in their workbooks.

Exercise 11.5: How to make organic pesticide

Option – 1 Garden waste repellent (takes 2 months to mature)

- Put 10 pounds of organic materials (kitchen waste, cow dung, chopped up strong smelling plant material) and a heavy piece of rock in an open weave bag and put that bag at the bottom of a jar
- Pour 20 liters (or 5 gallons) of water into the jar.
- Cover the jar with a wooden lid to avoid eggs from houseflies, and bad smells
- Stir the mixture in the jar twice a day for 2 months until it does not smell so bad
- After 2 months, apply the pest disease control mixture every 4-5 days during the crop cycle. Dilute with water 1:20 for young plants and 2:20 for older plants



Option 2: EM-5 Repellent (takes 2 weeks to mature)

1. Concentrate Alcohol - 100 Cc
2. Vinegar - 100 Cc
3. Molasses - 100 Cc
4. Concentrated EM - 100 Cc
5. Water - 600 Cc

- Put all materials in the above order in a 1 Liter bottle and seal tightly from air.
- Keep it in dark, dry, cool place.
- Start to use as repellent after 2 weeks.
- Apply at a rate of 1:500-1:1000 (EM-5: Water).
- Note: This is not pesticide, only repellent.
- It can be used for up to 3 months.

Activity 5: Go to the demo farmer's field for more discussion and field practice of GAP (110 minutes)

1. Tell participants that in the demo plots they will now undertake:
   1. Basal fertilizer and compost application. Refer to new Crop Management Tips
   2. Mulching
   3. Transplanting seedlings and perhaps direct seeding.
   4. Young crop care, especially fertilizer and water management shown in the Crop Management Tips.
   5. Making EM pest/disease repellent for use in 2-3 weeks' time.

Activity 6: Summarize the session (5 minutes)

1. Summarize the session, emphasizing the main learning points. Ask if there are any questions.

Activity 7: Evaluate the Session: (5 minutes)

1. What worked well in the lesson?
2. What did not work so well?
3. How could the lesson be improved?

Activity 8: Next session topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.
   Close the session and hand out demo materials if appropriate.

Session 12: Watering plants

Duration: 3 hours in classroom

Objectives

At the end of this session participants will be able to:

1. Describe how water is gained and lost from a field
2. Know about water usage in plant growing stages. Basic irrigation methods.
3. Understand water requirement in different crops.
4. Compare advantages and disadvantages of irrigation methods.
5. Estimate how much water they have available for irrigation
6. Estimate how much water they need for their crops
7. Know how to calculate how much water they can deliver to their plants per hour

Test soil moisture and water flow in the field

Materials: White board; marker pens; tape; 4 x blank flip charts; soil samples for groups to do a moisture test.

Activity 1: Plenary review of last session and topics for this session (Total time 10 minutes)

Plenary

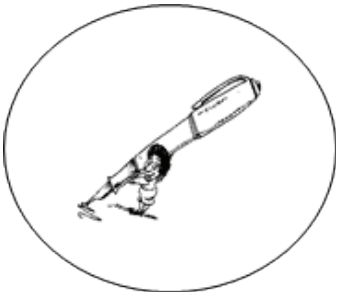
1. Invite participants to say what they learnt last session. Write their ideas on a flip chart (8 minutes).

Example:

1. The benefits of mulch and how to use it
2. The advantages and disadvantages of direct seeding verses transplanting
3. The preparation of EM insect repellent and organic fertilizer

Review topics for this session (2 minutes)

2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session.



Tips for Facilitators

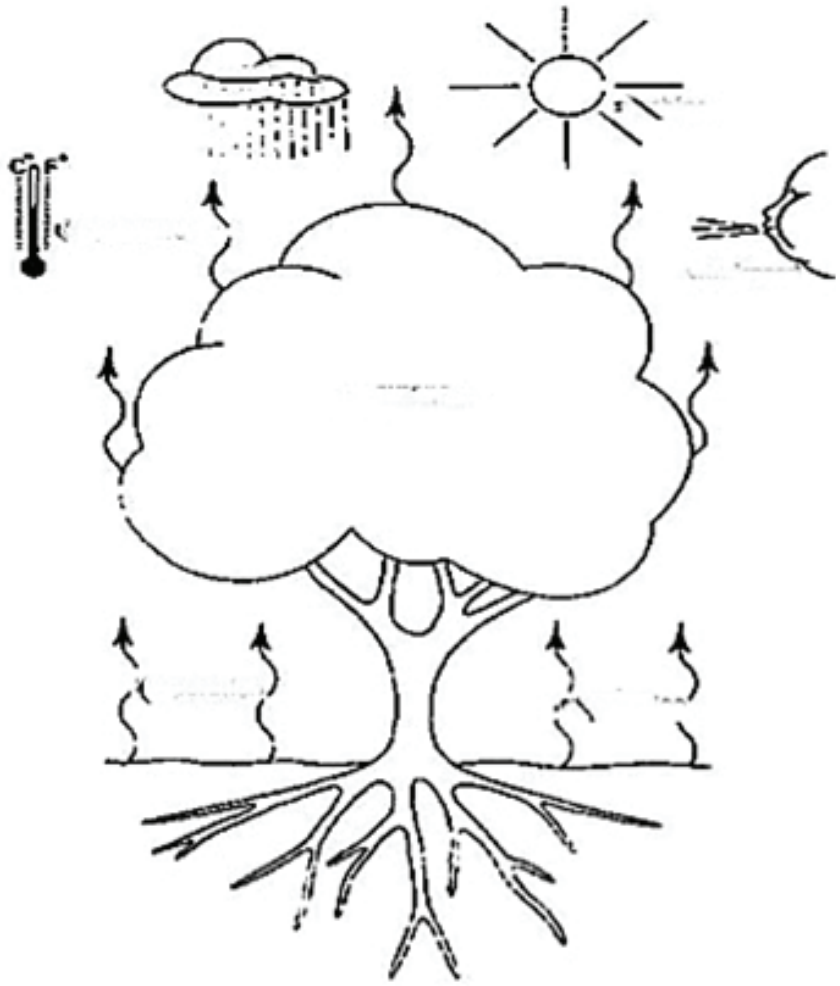
Guiding participants to use the table of contents helps them to look up information in their 'Farmer's Work Book' more easily when they are at home.

Activity 2: How is water gained and lost (Total time 5 minutes)

Plenary

1. Ask the participants: "What does the picture Exercise 12.1 in the workbooks tell you about how water is naturally gained or lost from fields and crops"?
2. After 2 minutes invite some answers and write the ideas on a flip chart and discuss. (**Answer**: Rain falls and provides water to the plants and the ground; the sun increases the temperature and causes evaporation of water from the plants and the ground; a warm wind can dry the plants and the ground) **(5 minutes)**

Exercise 12.1: Causes of water gain or loss in your fields



Activity 3: How much water do the farmers have? (Total time 15 minutes)

Plenary

1. Brainstorm the question: What are the different sources of water for irrigation that participants know of? Write their answers on a flip chart. Compare their answers with those in the first column of Exercise 12.2 below. (5 minutes)

Activity 4: Farmers to write the different sources of water for irrigation on a flip chart. Compare their answers with the table below. (10 minutes)

Exercise 12.2: Sources of water for irrigation

Sources of Water	Months available	Reliability – "sure" or "not sure"
1. Streams		Very low cost
2. Ponds		Use more amount
3. Dug wells		Difficult to control, high impact
4. Tube wells		Uneven productivity in plants; lower quality
5. Gravity fed springs		Longer
6.		
7.		
8.		

Notes:

Individually

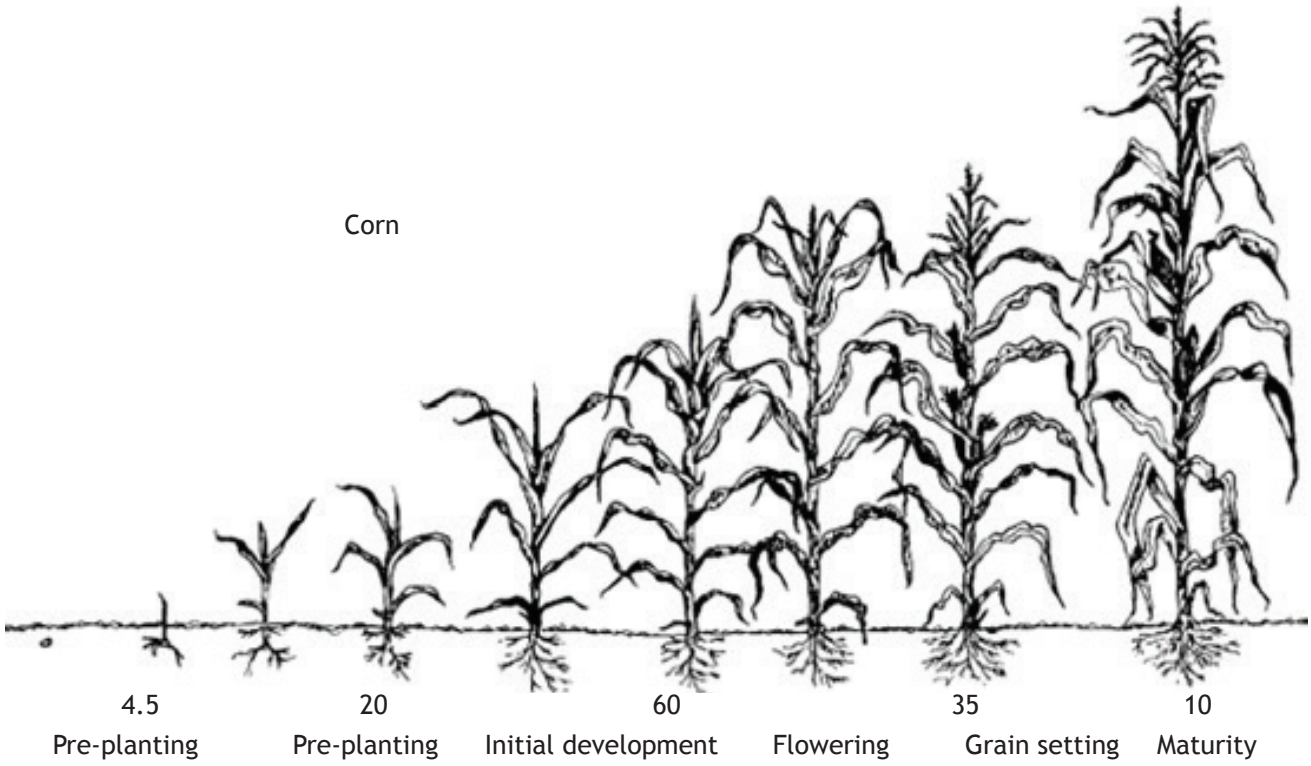
1. Ask farmers to write in the middle column when suitable quality water for crop irrigation is available on their farm. (e.g. mid October to mid February). **(5 minutes)**
2. Then ask them to write "sure" or "not sure" in the right hand column to show how confident they are about the reliability of their water source E.g. October to February (sure), March and April (not sure). (5 minutes)
3. Important note: Advise them that if they are not sure about their water reliability, they should not grow during this time or they may lose their crops.

Activity 5: How much water do you need? (Total Time 60 minutes)

Plenary

1. Ask participants to look at the pictures of corn plants in their workbooks Exercise 10.3 and ask one farmer to tell the group what it means. (Answer: Plants have different water needs through the growing cycle. E.g. Soak the soil thoroughly at the beginning, then after "puddling in" new seedlings, the need for water is low for young seedlings, then rapidly increases from the young plant stage to flowering and fruiting. Requirements generally reduce close to harvesting. **(5 minutes)**

Exercise 12.3: Plant water requirement through their growth stages



Water use in liters / 9 square feet/ 3 days

In pairs

1. Refer participants to Exercise 12.4 in their workbooks – Basic guidelines for plant watering
2. Facilitator explains the first paragraph then asks different pairs of farmers to read each of the watering guidelines and discuss together. (20 minutes)

Plenary

Summarize by asking the group all together to read the guidelines again. Stop to ask for questions at the end of each step. Also discuss the soil moisture test Exercise 10.5. (20minutes)

Exercise 12.4: Basic guidelines for plant watering

Amount of water:

The total amount of water needed to produce a crop depends on the specific requirements of the crop, the growing time and the characteristics of the soil. There are some rules to follow for water but farmers also need to learn how to read their plants and the soil conditions to best judge when and how much to water.

Guidelines for plant watering:

1. Watering is best in the early morning because water will be available to the plants as the sun gets hotter and the plants start to draw more water out of the soil

2. At regular intervals take a handful of soil 2 inches below the soil and squeeze it. Drop it from 10" above the ground. If the soil holds together it has enough water. If it crumbles it needs more water (See diagram 12.5 in their workbooks). And, as a general rule, look at the plants at mid-day, and if they look thirsty, water some more.
3. Sandy soils need more water than soils with clay
4. If direct seeding, soak the seeds over night
5. Fully wet the soil before direct seeding or transplanting
6. Puddle water around newly transplanted seedlings to push the soil close to the roots
7. After that, as a simple guideline, young plants need to be moist but not wet, watering every 4 days for 1-2 weeks, then every 3 days in week 3, every 2nd day in week 4, then water every day from week 5 onwards until harvest. Generally, the more leaf area, the more water is required. See CMTs for a guide for each crop
8. Keep the soil around the plant loose so that water is easily absorbed
9. Crops that are harvested dry should not be watered as harvest approaches
10. Too much water during fruiting may cause fruit splitting
11. Watering the leaves of some plants e.g. okra, may cause rotting
12. If using inter-row furrow irrigation on top of the beds, the beds should not be too wide as water cannot spread from the center of these beds to the plants
13. If plants are too dry the leaves will wilt but they will recover quickly when watered
14. If plants are overwatered the leaves will wilt because the roots have become rotten and they will not recover quickly. Try to avoid over watering!

Exercise 12.5: Soil moisture test

Soil Moisture test:

a. Select at random (in different rows) at least 6 points to check the soil for moisture.
b. Select a point between two plants and about 8 inches away from the line of plants.
c. Dig a hole 4 inches deep and the pick a little sample of soil between the fingers.
d. Squeeze the soil sample very hard (don't rub it).
e. Drop the sample into your other hand from about 4 inches. If the sample:

- Blows as dust, the soil needs water immediately
- Brakes in small pieces, it will need water in less than 4 hours
- Doesn't break and falls in one piece, the soil has moisture for at least 24 hours.

Plenary

- Refer farmers to their Crop Management Tips and the watering recommendations under the heading "Irrigation" and water amounts in the right hand column, and ask them to read. Tell them they should use these guidelines for their water management. (5 minutes)

Activity 6: Calculating how much water you can deliver to plants. (Total time: 30 minutes)

Sub groups

1. Ask the participants to split into sub groups, according to the type of watering system they use – those who are using drip, sprinkler, shower rose on bed rows, inter-bed furrow, inter row furrow and watering can. If there are more than 5 people in one group, split them into smaller groups of up to 5 people. **(2 minutes)**
2. Write the following questions on a flip chart and ask the farmers: "How can you measure how much water you can deliver to the plants per day using your irrigation method?" Ask the groups to discuss this questions and a member of the group to report back to the plenary. (5 minutes)
3. Then refer participants to Exercise 12.6 and the table below. Ask them to calculate how much water they need for their type of irrigation. Ask them to report their answers to the plenary. **(23 minutes)**

Exercise 12.6. Plants and water requirement

Wing bean	Uniform watering is required the whole crop life. Wing bean does not like too much water.
Broccoli	Uniform watering is required to prevent early flowering.
Cabbage	No water shortage. Irregular watering leads to splitting of cabbage head.
Cauliflower	Regular watering is required to prevent early flowering.
Chili	Gradual increase of watering is required, from planting to fruit maturing of chili.
Corn	Corn is.tolerant to drought. However water shortage during flowering time leads to decreased yield. The reason is a dry anther and early pollen production.
Cucumber	Gradually increase the amount of water from planting to flower formation, fruit setting and fruit maturity.
Egg plant	Gradually increase the amount of water from transplanting to fruit forming. Regular watering is required for good fruit formation.
Water spinach	Uniform water for the whole crop life. Water spinach is a leafy vegetable and because of a shallow root system, it requires frequent watering.
Salad vegetable	Uniform water for the whole crop life. Salad is a leafy vegetable and because of a shallow root system, requires frequent watering.
Onion and Shallot	Regular watering is required for these fibrous root crops. Provide water at bulb formation but do not water when leaves are dried.
Pumpkin	More water is needed at shoot forming, flowering and fruit development periods.
Tomato	Regular water is needed at flowering, fruit setting and fruit development periods. More water for plants with no mulch. For variety long-season-tomatoes, water requirement is low at picking time. Irregular watering at fruit development period leads to fruit cracking so water regularly during this time.
Seed germination	Frequent watering to moisten the soil. Take care of seeds washing away.
Seedlings	Keep the seedling moist. Too much moisture may lead to damping off. Do not let the seedling wilt.
Transplanted seedlings	Uniform moisture for the transplanted seedlings. Keep watering to prevent young plants from wilting. Watering is good for early root development. Prioritize watering in the first five days.

Activity 7. When to water the plant? (25 min.)

Plenary

1. Tell the farmers that they should know when the plants need water.
2. With the farmers, study the following table. Some plant disease symptoms and symptoms related to water stress or drought seem the same but farmers should differentiate the causes. **(5 min)**

Exercise 12.7. Symptoms of plants related to water

Symptoms	Causes
1. Normal at morning. Wilt the rest of the day.	Water shortage
2. Normal at morning. Wilt the rest of the day.	If the plants do not recover in the afternoon, it may be a root rot problem.
3. Fallen flowers	Too much water or water shortage
4. Fruit crack	Too much water after water shortage.
5. Yellow leaves on the upper part of the plant	Too much water or too short of water

Exercise for subgroups

3. Form subgroups and tell them to test the soil samples which are provided by the facilitator. Ask them to report back the findings. (20 min.)

Activity 8. Watering methods (25 min.)

Subgroups discussion

1. Brainstorming: What do participants know about watering? Write down their ideas on the flip chart. **(2 min.)**
2. Form subgroups, with each group discussing one method of watering. Draw two columns on a flip chart, one for advantages and the other disadvantages, and ask the participants to list these for their method of watering.
3. Ask them to present their ideas. Compare with the following table. **(13 min.)**

Exercise 12.8. Watering Methods

Advantages	Disadvantages
Furrow Irrigation	
Low cost. Use rainwater efficiently. Good water dispersing in moisture sustained soil. No runoff.	High cost in making furrow. Salt deposit due to evaporation. Large volume of water.
Sprinkler Irrigation	
Low cost to operate. Cover large area. Good for frequent irrigation in soil with low moisture holding capacity. Good materials, high price. Movable and low cost.	High cost in installation. Need high pressure. Water loss due to evaporation. Nutrient loss from both plant and soil. Water drops on leaves can cause leave diseases. Fix installation, low labor. Same operation area, high cost. High weed incident.

Drip Irrigation	
High efficiency in water usage. Low weed incident. Can use in undulating field. Good quality materials, high price. Movable and low cost.	High installation cost. Drip pipes may be blocked. Limited water dispersing area. Multi-cropping pattern, unchangeable. Without covering, pipes may be damaged due to hot Sun.
Can watering	
Low initial cost. High water usage efficiency. Can manage watering place and volume of water. Can use in undulating field. Low weed incident.	High labor cost.

Furrow irrigation

Sprinkler Irrigation

Drip Irrigation

Can watering

Activity 9: Water requirement for crops

Subgroups

1. Form 5 groups and ask each group to choose one crop (except Tomato) from the GAP Crop management Tips book.
2. Refer them to the water requirements of tomato as an example of how to fill in the table, and ask them to calculate the water requirement of their crops on a weekly basis and in total for 1000 plants. **(25 min.)**

Exercise 12.9. Calculation of Water requirement of Tomato

Week	Estimation- water liter/plant	Water requirement in total/week (1000 plants)
4th week	2 liters/plant, 1 day interval	7000 liters
5th week	2 liters/plant, 1 day interval	7000 liters
6th week	2 liters/plant, 1 day interval	7000 liters
7th week	2 liters/plant, 1 day interval	7000 liters
8th week	3.5 liters/plant, 1 day interval	12250 liters
9th week	4 liters/plant, 1 day interval	14000 liters
10th week	4 liters/plant, 1 day interval	14000 liters
11th week	4 liters/plant, 1 day interval	14000 liters
12-15th week	3 liters/plant, 1 day interval	31500 liters
Total Water Requirement		113750 liters

Plenary

3. Ask the groups to present their answers and discussion. Write down their ideas on the flip chart. **(10 min.)**

Subgroups exercise: Water Budget

4. Divide the subgroups. Refer them to the pre-prepared flip chart on the water budget.
5. Ask them to answer the questions on their chosen crop and write them down on the chart. (8 min.)
6. Invite one of the participants to present the group's ideas and welcome the group discussion. (15 min.)

Exercise 12.10. Water source registration and budget

Crop	Water requirement for one crop season(from Exercise3.8)	Availability of water (volume)	The best irrigation method and reasons	Cost per one crop per season
1				
2				
3				
4				
5				

Exercise 12.11: How to measure water flow

Water Delivery Method	How to measure the amount of water delivered
1. Inter bed furrow flood irrigation	Record the time it takes to fill a bucket of known volume. Calculate the result in litres per hour. Then estimate how many plants you can water in one hour according to plant demand. Remember you need about 50% more water for flood furrow irrigation because of evaporation, infiltration and waste.

2. Sprinkler	Record the time it takes to fill a bucket of known volume. Calculate the result in litres per hour. Then estimate how many plants you can water in one hour according to plant demand. Remember you need about 30% more water for sprinkler because of evaporation, coverage over all land including footpaths, infiltration and waste.
3. Shower rose	Record the time it takes to fill a bucket of known volume. Calculate the result in litres per hour. Then estimate how many plants you can water in one hour according to plant demand. Remember you need about 20% more water for shower rose irrigation because of evaporation, infiltration and waste.
4. Inter row (on top of beds) furrow irrigation	Record the time it takes to fill a bucket of known volume. Calculate the result in litres per hour. Then estimate how many plants you can water in one hour according to plant demand. Remember you need about 10% more water for inter row furrow irrigation because of evaporation, infiltration and waste.
4. Watering can	Take the time it takes to fill a watering can of known volume and how much time it takes to meet crop demand while walking and watering in the field for one hour. There is about 10% waste with careful use of a watering can directing water at the base of the plant.
5. Baker Drip at 0.4 bar	Put small dishes under drip emitters at the beginning, middle and end of rows. Pour these into one container and get the total volume per hour. Calculate how many plants you can water in 1 hour. There is little or no waste with drip (and mulching) so you do not have to calculate for extra water.

Activity 10: Field Work: (50 minutes)

Sub groups.

1. Split into field work subgroups. Each subgroup is to perform the water moisture test described above in Exercise 12.5 regarding soil testing.
2. Review the plants and see if there are any signs of water stress – too little or too much.

Activity 11: Summarize the session (Time: 5 minutes)

Activity 12: Evaluate the Session: (Time: 5 minutes)

- What worked well in the lesson?
- What not so well? and
- How could the lesson be improved?

Activity 13: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 13: Trellising, Weeding, Pest and Disease Control

Duration: 3 hours

Objectives

At the end of this session participants will be able to:

1. Describe what a weed is and how to control weeds
2. Describe the importance of thinning plants
3. Know different methods of trellising
4. Identify important pests and diseases in prioritized crops
5. Know about the organic and chemical options for controlling pests and diseases
6. Demonstrate the use of EM extract and chemical control in the field

Materials: White board; marker pens; tape; 4 x blank flip charts; 1 x 3 column flip chart – 1 x 2 column flip chart – 3 x blank flip charts; pest and disease identification charts; spray application equipment

Activity 1: Review last session and this session topics (Total time 10 minutes)

Plenary

1. Invite participants to say what they learnt last session. Write their ideas on a flip chart (8 minutes).

Example:

1. How water is used
2. When to water
3. Irrigation methods
4. Calculating the water needs for a crop

Plenary review of topics for this session

2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session. **(2 minutes)**

Activity 2: Weeding (Total Time: 35 minutes)

Plenary

1. Ask participants to define what a weed is. Write their ideas on a flip chart. **(2 minutes)**
2. Refer them to the definition of a weed in their workbooks Exercise 13.1 in their workbooks **(2 minutes)**
3. Brainstorm "Why is weeding important?" Write their ideas on a flip chart. **(2 minutes)**

Sub groups

4. In same village subgroups discuss how they weed their crops and fill in the table from Exercise 13.1 in their workbooks. **(9 minutes)**

Exercise 13.1: Farmers' current weeding practice

Definition of a weed:

"A weed is a plant that is in the wrong place at the wrong time". For example, a rice plant is a weed in a corn field; corn is a weed in a rice field.

Answer the questions below in the spaces provided.

1. How do you remove weeds from your crops?

.....

.....

.....

2. How often and how many hours do you (or other laborers) spend weeding on a ¼ acre plot?

.....

.....

.....

3. Which methods do you find most effective to remove weeds and why?

.....

.....

.....

Note: It is recommended not to use herbicides, but to remove weeds by hand or by using a weeding hoe. Always remove weeds before the weeds develop flowers. If removing weeds is done by hand, moisten the soil first to make it easier to pull out the weeds with its roots; and be careful not to pull or damage the crop roots.

5. Go over Exercise 13.2 in participants' workbooks that shows the main Tips and Reasons for weeding (removing weeds). Ask participants to add their ideas in the blank lines on the handout if not already on the list. **(15 minutes)**
6. Tell them that later they will go to the field to practice weeding.
7. Say that it is better to weed manually for aerating the soil. Suggest they avoid chemical weeding if possible because chemicals are not so good for the farmer's health or the environment.
8. Look at the pictures of weeding implements and discuss how they might be used. **(5 minutes)**

Exercise 13.2: GAP Weeding Tips

TIPS	REASONS
1. Definition: A weed is a plant that is in the wrong place at the wrong time.	If you are selling your crop, buyers want single species products, not mixed with other products, so you have to 'weed out' the species that is in the wrong place at the wrong time.
2. Why is weeding important?	Weeds compete for light, nutrients, water and can be hosts for pests and disease.
3. Pull out weeds by hand or dig them out with a hoe or other tool. With weeds that have deep roots, take care to dig out all the underground parts.	Manual weeding loosens the soil and in this way improves aeration and plant growth. Weeding also reduces competition with the vegetables for nutrients and light.
4. Make sure the weeds are not tangled up in the seedlings.	When you pull out the weeds you may pull out the seedlings as well.
5. Leave the weeds without seed heads laying down on the surface of the soil. Take weeds with seed heads away and burn them.	This allows the sun to kill the weeds and to provide shade to the soil to prevent water loss and soil temperature increase. Over time, the weeds will break up into compost and improve the soil.
6. Keep some strong smelling weeds to chop up to make organic EM insect repellent.	Strong smelling weeds are good ingredients for this mixture.
7. Chemical control: spray weeds with a selective herbicide if other methods of control are not possible.	When it is too difficult to hand weed a large area, follow the instructions on the container about how to mix and use the chemical safely.
8. Some crops do not like their roots being disturbed so take care when weeding around them	Hand weed around the crop stems
9. Seedlings do not compete well with weeds.	It is very important to keep seedlings clear of weeds for the first 2 – 4 weeks

Chip Hoe

Push Hoe

Tine Hoe

Typical Rakhine weeding tool

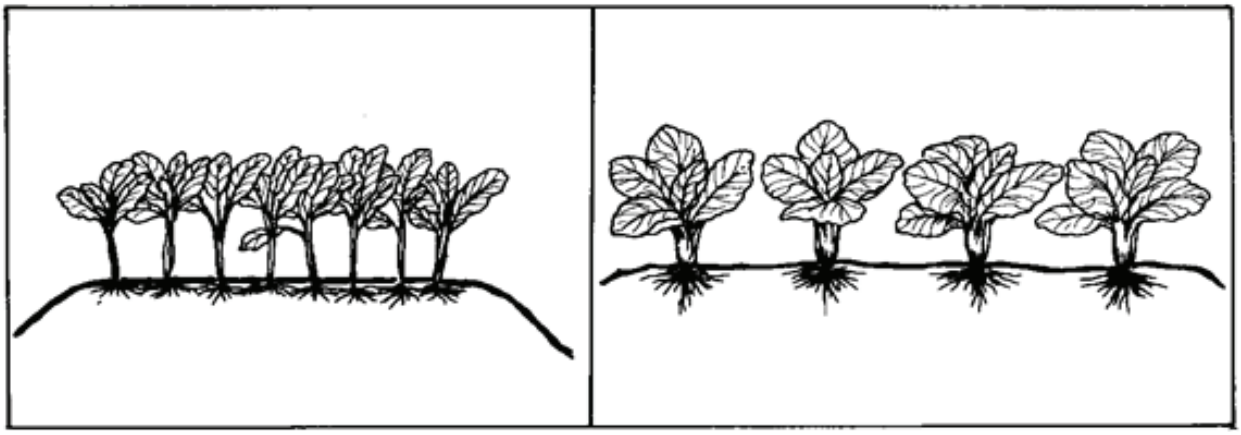
Activity 3: Thinning (Time 10 minutes)

Plenary session

1. Ask participants: “Why is thinning important?” Write their answers down on a flip chart
2. Review the thinning tips from Exercise 13.3 in their workbooks. Compare their answers and ask them to write the ideas on the flip chart that are not already written in their workbooks.

Exercise 13.3: Methods and Purpose of Thinning

TIPS	REASONS
1. Thinning is important.	So that you can get an even product size that the market requires (better price). Thinning also maximizes yield and income per area, and reduces competition from weeds in open unused spaces.
2. Carefully pull out the plants that are not at the correct spacing. Try not to disturb the plant that is left behind too much.	Plants that are too close result in small weak plants because they compete for nutrients, light and water with each other.
3. Leave plants at a spacing that is the same as the fully-grown plant.	This provides enough room for sufficient nutrients, light and water for good plant growth
4. Fill in the gaps with new plants	This maximizes yield and maintains an even spacing



Too close making plants thin

Good spacing allows strong plants with no gaps

Activity 4: Trellising (Total 10 minutes)

Plenary

1. Brainstorm with participants the question: “Why is trellising important for some crops?” and “Which crops are suited to trellising?” Write their ideas on a flip chart.
2. Ask them: “What different types of trellising they know of?” Write their ideas on a flip chart.
3. Refer participants to photos in their workbooks from Exercise 13.4 that show different trellising methods. Discuss the advantages or disadvantages of the methods. Inform participants that you will practice trellising in the field later in the session.

Exercise 13.4: Trellis Designs

Tomatoes on Bamboo Stakes

Cucumbers on Bamboo Stakes

Tomatoes on Bamboo Stakes

Cucumbers on Bamboo Stakes

Tomatoes on Bamboo Stakes

Cucumbers on Bamboo Stakes

Activity 5: Pest and Disease Control (Total Time: 25 minutes)

Important Note:

1. Use preventative and organic methods of control where possible. Only use chemicals as a last resort because chemicals are dangerous for the farmer's health, can be dangerous for the consumer's health, and they are also dangerous for the environment.
2. Learn which are the good insects and which are the bad insects. Only kill the bad insects.
3. Recognize pests and diseases in the crops early and how to control them. (Use the Pest and Disease Handbook if you have them to help you)

Plenary

1. Hand out and quickly go over the Pest and Disease booklets if you have them (from the DoA or other source).
2. Tell the group that the most important step is to identify the important pests and diseases of the prioritized crops so that you know how to control these pests and diseases. Look at and discuss the photos below – do they know these pests and diseases? **(Time: 10 minutes)**

Aphids: Okra

Leaf Miner tomato

Downy Mildew: Cucumbers

Neck Rot: Onions

Plenary

3. Brainstorm with participants the question: "What are the different ways of controlling pests and diseases?" Write their ideas on a flip chart. (Time: 5 minutes)

Plenary

4. Go over the following table, Exercise 13.5, in their workbooks. Ask some farmers to read and comment or ask the whole group to read and one participant to comment. Encourage questions. (Time: 10 minutes)

Exercise 13.5: Methods of controlling pests and diseases

Behavioral Methods

1. Use clean seed and planting materials
2. Treat the seeds by exposing them to sunlight before planting.
3. Plant when the soil is not too wet
4. Use crop rotation method

Mechanical Methods

1. Remove diseased plants
2. Remove pests with fingers
3. Use ash to prevent crawling pests
4. Plant on raised beds
5. Use insect traps
6. Use of nets to cover fruit

Biological Methods

1. Use of organic pesticides e.g. EM and Trichoderma, Neem seed extract
2. Use of biological parasites for controlling insect pests
3. Companion planting e.g marigolds and inter-planting with onions and garlic

Plenary

5. Tell participants that IPM is a method of understanding how they can manage pests in their crops in an integrated way so they do not have to spray all of the time.
   Invite participants to read as individuals or as a group the following table, Exercise 13.6. **(10 minutes)**

Exercise 13.6: The principles of IPM

1. There are good insects that are natural enemies of pests so you do not have to kill every insect. The good ones can kill the bad ones.
2. It is acceptable to have a few pests and the farmer does not have to try to kill them all.
3. Preventive cultural practices: removal of diseased plants; good drainage; use of disease free seed.
4. Monitoring: Regularly observe the plants to look for an increase in insect numbers and spread of diseases.
5. Mechanical controls: Hand picking; barriers (ash); insect traps
6. Biological controls: use of parasitic insects and micro-organisms.
7. Responsible use of chemical pesticides. Avoid very toxic chemicals. Use those that are based on naturally occurring substances e.g. nicotine (from tobacco) and pyrethrum (from daisies).
8. Explain the idea of using chemicals only when the pest/disease incidence has reached the economic threshold. That is, when the cost of spraying is less than the amount of damage. E.g. Spend 20,000 MMK to save 100,000 MMK. That is, you are 80,000 MMK better off. If there are just a few plants infected you do not have to spray the whole crop. Just deal with the individual plants. This saves money, your health and the environment.

Activity 7: Safe Use of Pesticides (Total Time: 10 minutes)

Plenary

1. Brainstorm with participants: "What are the "Do" and the "Do Not" procedures for safe handling of pesticides?" Write their ideas on a flip chart.
7. Then compare their ideas with those in the flip chart below (Exercise 13.7).

Exercise 13.7: What are the "Do" and "Do Not" procedures for handling pesticides?

Do	Do Not
Check with your agriculture advisor for a list of banned chemicals.	Use banned chemicals. They are harmful to humans and the environment.
Store in a locked cupboard away from the home.	Harvest before the recommended Pre Harvest Interval (PHI).
Read the label carefully and follow directions for mixing.	Use your hand to mix the pesticide.
Check that the sprayer is operating correctly first and is not leaking.	Smoke or drink or eat food while you are mixing or applying pesticides.
Wear clothes that cover the whole body, gloves, and a protective mask to cover the mouth and nose at all times for mixing and applying pesticides.	Spray if it is windy or if it is a very hot day.
Mix the pesticide properly. For powdered pesticides: - pour the water into the sprayer first - mix the correct amount of powder with a little water in a separate container - pour this solution into the sprayer -	Wash the sprayer or dispose in chemical containers in ponds or rivers
Do wash yourself immediately if you spill chemicals over yourself	
Do wash yourself with soap and change into clean clothes after using chemicals	

IMPORTANT

STOP SPRAYING IF YOU FEEL ITCHY ON YOUR SKIN, DIZZY, HAVE STOMACH CRAMPS OR NAUSEA. WASH YOURSELF THOROUGHLY AND CONSULT WITH YOUR HEALTH CENTRE.


ဓါးသတ်ဆေးများကို အန္တရာယ်ကင်းစေရေး အသုံးပြုခြင်း

Activity 8: Field work preparation:

Plenary Discussion:

1. Discuss in the classroom the following organic control measures in Exercises 13.8 to 13.12. (20 minutes)

Exercise 13.8: Solution for powdery mildew and downy mildew:

Ingredients:

Copper Sulphate	- 28 tickles
Lime	- 28 tickles
Water	- 10 gallons

Preparation

- Add copper sulphate (28 tickles) to water (5 gallons) and stir thoroughly in plastic bucket A.
- Add lime (28 tickles) to water (5 gallons) and stir thoroughly in plastic bucket B.
- Then mix the two solutions in a third larger bucket and stir.
- Sieve the solution in a strainer so larger particles can't pass through. Always stir thoroughly before spraying.
- This mixture can be used within 24 hours.

Note -Use a bamboo or plastic stick. Do not use iron, zinc or metal buckets because the copper will corrode them.

Exercise 13.9: Making natural pesticide to prevent sucking insects

Special Note: Must be used within a day.

Ingredients:

Green chili	-	10 Tickles
Garlic	-	10 Tickles
Ginger	-	15 Tickles
Basic Soap	-	10 Tickles
Mustard Oil	-	5 Spoons
Water	-	5 Gallons

Preparation:

1. Pound the garlic and keep it in the mustard only one night.
2. Next day add pounded ginger + green chili and mix all together.
3. Put all ingredients in the water and stir it.

Application:

Apply using a knap sack sprayer. Filter and remove particles before spraying.

Remind participants that they already have made EM5 in a previous session. Quickly review again the EM5 making process in Exercise 13.10 in their workbooks.

Exercise 13.10: EM 5 Repellent for general pest and disease control

Ingredients:

Concentrate Alcohol	-	100 Cc
Vinegar	-	100 Cc
Molasses	-	100 Cc
Concentrated EM	-	100 Cc
Water	-	600 Cc

Preparation:

1. Put all materials in the above order in a 1 Liter bottle and seal tightly from air.
2. Keep it in a dark, dry, cool place.
3. This mixture will be ready to use as repellent after 2 weeks.
4. The ratio of application is 1:500-1:1000 (EM-5: Water).
5. Note that this is not a pesticide, but a repellent.
6. The mixture can be stored and used for up to 3 months.

Application method:

Sprayer or fine hole watering can

Exercise 13.11: Making Instant EM solution (IEM)

Ingredients:

Concentrated EM (CEM)	-	1 unit
Molasses	-	4 units
Water	-	95 units

1. Stir thoroughly and seal tightly from air.
2. Keep the container in a dark, dry, cold place.
3. Open to the air each morning during the first 3 days.
4. Seal after three days.

Application to plants:

Apply 1 gallon of water + 1 spoon of (mixture) Instant EM for big plants.

Apply 1 gallon of water + ½ spoon of (mixture) Instant EM for small plants.

Exercise 13.12: Oil Sprays for Scale Insects (use local units)

Ingredients:

1. Dissolve washing soap used for clothes (not washing detergent or body washing soap) in a bucket by rubbing a soap bar in 10 Liters of water until water shows a froth (very soapy solution). Store this solution in a bottle.
2. Clean the sprayer very well. Do not use a sprayer that has been used with herbicides as some small herbicide residue may kill your plants even though you have tried to wash the sprayer thoroughly.

3. Fill half the volume of the sprayer with water. Add 100 cc of soapy solution to the water in the sprayer and shake well. Add 500 cc of oil to the sprayer mixture and shake vigorously for a couple of minutes. Add water up to near the neck of the bottle (leave one inch empty and shake it well).
4. Before spraying, shake the sprayer again; then pump the tank to a high pressure. This step is very important to obtain very small droplets of oil in the water.
5. Spray very lightly on small plants; do not overspray. If not sure about the amount, then first check on the surface of the ground to learn how much volume the sprayer releases.

Using oil Sprays

1. Spraying with oil after 5:00 pm is more effective.
2. Do not spray with oil when the temperature is below 5oC or above 32oC.
3. Do not spray with oil when plants show stress.
4. All the plants should not be sprayed for 2 weeks after transplanting.
5. Preferably use canola oil.

Application

For adult plants, and if the number of insects is large, you can increase the amount of oil up to 8 mL per 1 Liter of water.

Activity 9: Field Work - Demonstration of Spray Mixing and Application with a Knapsack Sprayer (Total Time: 35 minutes)

Group work in the field:

1. Go to the demonstration plot
2. Dress a farmer in safety clothing
3. Show farmers how to read the labels on chemical spray bottles
4. Show how to mix sprays
5. Show how to calculate the application rate
6. Show the correct application technique
7. Show correct storage of chemicals; cleaning of equipment; and how to dispose of used containers.

Activity 10: Summarize the session (5 minutes)

1. Summarize the session, emphasizing the main learning points. Ask if there are any questions.

Activity 11: Evaluate the Session: (5 minutes)

1. What worked well in the lesson?
2. What did not work so well? How could the lesson be improved?

Activity 12: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the ‘doer’ (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the ‘doer’ is another person, the ‘doer’ may get the wrong information.

Close the session and hand out demo materials if appropriate.

Session 14: Post Harvest Handling and Quality

Duration: 3 hours in classroom

Objectives: At the end of this session participants will be able to:

1. Understand the supply chain product flow
2. Understand the market quality requirements
3. Know the factors that affect produce quality after harvest

Materials: White board; marker pens; tape; 4 x blank flip charts.

Activity 1: Plenary review of last session and topics for this session (Total time 10 minutes)

Plenary

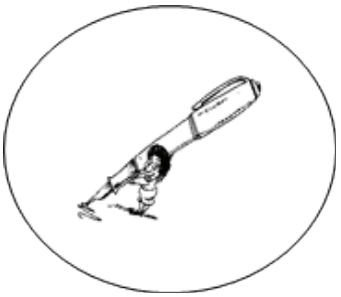
1. Invite participants to say what they learnt last session. Write their ideas on a flip chart (8 minutes).

Topics covered included:

1. Weeding
2. Thinning
3. Trellising
4. Pest and Disease Identification
5. Organic and Chemical Options for Pest and Disease Control (IPM approach)
6. Safe Use of Pesticides
7. Organic control measures for pests

Plenary review topics for this session (2 minutes)

2. Ask participants to turn to the table of contents in their workbooks and ask different participants to read the topics for this session.



Tips for Facilitators

Guiding participants to use the table of contents helps them to look up information in their 'Farmer's Work Book' more easily when they are at home.

Activity 2: Understanding the supply chain product flow (Total Time: 40 minutes)

Plenary

1. Brainstorm with the participants the question: "Why are we concerned with post-harvest activities? Write their answers on a flip chart. (5 minutes)
2. Refer participants to Exercise 14.1 in their workbooks and go over the answers, inviting participants to add answers from the flip chart if not already mentioned. (5 minutes)

Exercise 14.1: Importance of post-harvest handling

Question: Why is post-harvest handling important?
We need to meet the market requirements for:

1. Quality
2. Food Safety
3. Increase our profits by reducing our losses in harvesting, transport and storage
4. .....
5. .....
6. .....

Individual and Subgroup exercise:

3. Divide participants into 5 subgroups. Brainstorm the main actors in a supply chain map and write them on a flip chart. (Note: The map should show boxes with the headings: **Producer:Collector:Wholesaler:Market seller) After discussion**, write these words on a flip chart. Then ask the individual participants to write these main supply chain actors in the supply chain actor flow map in their workbooks under Exercise 14.2 and their answers to the following questions as a sub group, on a flip chart. (15 minutes)
4. Ask them in sub groups to discuss and write answers to the following questions on a flip chart: (i) How does produce get from the farm to the consumer? (e.g. Bags from the field; motorbike to wholesaler; truck to the market).
   (ii) What amount of time in days does it take for each part of the journey between the actors.
   (iii) At which point(s) in the supply chain do participants think the greatest crop loss or damage occurs?
5. Ask the participants to present their maps and answers to the whole group and discuss. Invite them to fill in their own tables with the ideas given in the discussion so they can refer to the discussion points at home. **(15 minutes)**

Exercise 14.2: Losses along the supply chain

1. Map of the produce supply chain

2. How does produce get from the field to the consumer?

....

....

....

3. Time taken between each stage in the chain?

....

....

....

4. Amount of produce destroyed or damaged in the supply chain?

....

....

....

Activity 3: Understanding the Market Quality Requirements (Total Time: 25 minutes)

Plenary

1. List the priority crops on a flip chart and brainstorm the question: "What are the market quality requirements for each crop?" **(5 minutes)**

Individual exercise

2. Invite participants to write their answers in their workbooks at Exercise 14.3 **(10 minutes).**

Exercise 14.3: Market Requirements for the listed crops

Crop	Market Quality Requirements
Yard Long Bean	
Okra	
Onion	
Carrot	
Chili	
Tomato	
Egg-plant	
White egg-plant	
Coriander	
Cabbage	
Cauliflower	
Broccoli	
Radish	
Water spinach	
Mustard	
Bottle Gourd	
Snake Gourd	
Ridge Gourd	

Bitter Gourd	
Cucumber	
Water Melon	
Pumpkin	

Plenary

3. Compare their answers with the key points listed in Exercise 14.4. (10 minutes)

Exercise 14.4: Market Quality Grading of Vegetables

1. Appearance
   - Check skin blemishes (spots, marks, scratches and cuts)
   - Is there surface contamination by soil, birds, insects
   - Are there broken leaves (leafy vegetables)
2. Shape
   - Is it the right shape for the variety e.g. cucumbers – straight or slightly curved
3. Color
   - Is the color similar at the same stage of development e.g. check tomato maturity and size
   - Deep glossy purple for eggplant
4. Condition
   - Leafy vegetables should not have wilting leaves
   - Okra should not have yellowing and tips should break off cleanly.
5. Size
   - Should all be of similar size
6. Texture and flavor
7. Chemical use.

Note: If you are using chemical sprays it is important to write down when the sprays were used and to show this record to the buyer to indicate that you have followed the Pre Harvest Interval (PHI) after spraying.

……

……

……

4. Invite the participants to comment on the quality and possible price of the products in the photos below.

Good Grading of Bitter Gourd

Good Grading of Eggplant and Yard Long Beans

Poor Grading of Tomato

Poor Grading of CucumbersBeans

Activity 4: Factors that affect quality after harvest (Total Time: 90 minutes)

Plenary discussion:

1. Ask the participants to look at the causes of produce deterioration in Exercise 14.5 in their workbooks. Ask different participants or the group as a whole to read the table and discuss each point. **(10 minutes)**

Exercise 14.5: Factors affecting vegetable quality

Factors Affecting Quality	Prevention
Mechanical damage Rough handling during harvesting and transport causes bruising (tomatoes), broken leaves (leafy vegetables) and water loss.	Mechanical damage - use a knife to harvest - pack into strong clean boxes with no sharp edges - put a layer of leaves under boxes to protect them on trucks
Temperature High temperatures cause produce to ripen too quickly and to lose water, causing leaves to wilt and resulting in weight loss.	**Temperature** - harvest early morning - pack in the shade - use wet sacks to cool and keep humidity high - cover boxes on trucks **Tip:** The temperature in the shade is usually 10-15 degrees cooler than in the direct sun.

Crop maturity If the crop is harvested too early it will not reach full maturity. If the crop is harvested too late it will deteriorate before it reaches the market.	**Time of harvest** - know the correct time to harvest
Rot and pests Rot develops after harvest causing rapid breakdown of produce. Insects may also affect produce in storage.	**Rot and pests** - dip in chemical solution to prevent rot - use mosquito netting in storage areas

Plenary

2. Brainstorm the following question: "What is the appropriate way to pack vegetables for transport?" Write participant's ideas on a flip chart. **(5 minutes)**
3. Review the table Exercise 14.6 in the workbooks and discuss the pictures below. **(15 minutes)**

Exercise 14.6: Packing materials - advantages and disadvantages

Advantages	Disadvantages
Card board boxes	
• **Readily available** • **Easy to handle and stack** • **Can be adapted to different types of products**	• Lose strength when wet • Need breathing holes • Cannot be recycled
Jute or string bags	
Low cost Can be recycled Can be moistened with water	No protection for soft products Heavy and may be roughly handled
Bamboo baskets	
Low cost Can be recycled Can get wet Strong support	Need to be lined to protect products Can be over filled Do not stack well

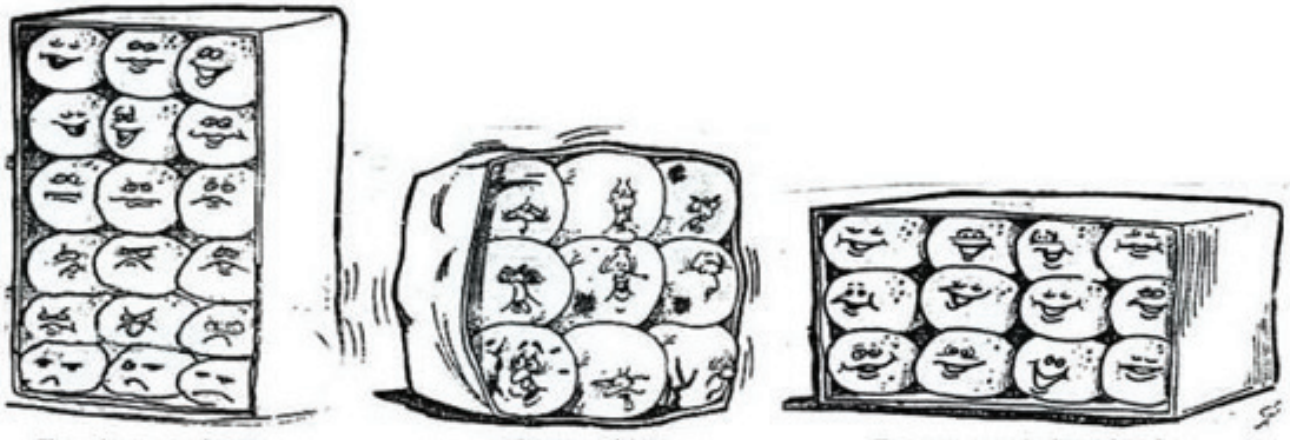
Not Good: Salad Greens Over Full Bamboo Baskets

Not Good: Tubers in Jute Bags

Good: Re-useable plastic crates

Good: Cardboard boxes in Storage

Tip 1: Cardboard boxes are very convenient however it is important not to pack them too deep or over fill the carton.



Too deep *Over filling* *Good*

Plenary exercise

4. Invite individuals or the whole group to read the vegetable cooling methods and reasons for these methods in the table below (Exercise 14.7). **(15 minutes)**

Exercise 14.7: Pre and Post-Harvest GAP Handling Methods

GAP Tips	Reasons Why
1. Harvesting:	
1.1 Harvest at the cooler morning part of the day.	**Produce is fresh and not dehydrated.**
1.2 Do not harvest in the afternoon.	Produce has dried out during the hot day.
1.3 If wet or humid, dry produce in a shady cool place.	Moisture can cause disease and your produce will spoil.
2. Cleaning & Sorting	
2.1 Clean and sort in a shady place	Reduces heat stress

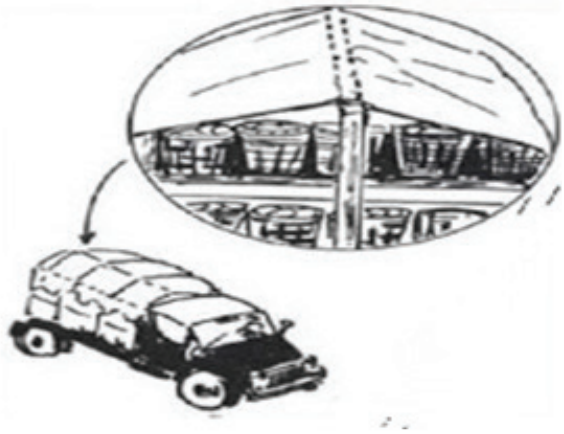
2.2 Spread produce on a flat clean surface to help heat to dissipate (decrease) before packing.	Heat causes dehydration and a reduction in quality.
3. Packing:	
3.1 Put in well ventilated baskets or crates using liners such as banana leaves or paper to protect the produce.	Produce can be damaged in transport or storage, resulting in disease, wastage, and a lower price.
3.2 Tarpaulin and polypropylene sacks should be avoided as they restrict ventilation. Wide weave containers that let air circulate are better.	Produce heats up and spoils quickly in tight weave containers.
3.3 Do not pack containers too tightly	Packing too tightly restricts air flow and causes heating and bruising of products
4. Transporting:	
4.1 Vehicles should have a roof or cover over the produce.	Provides shade.
4.2 Vehicle should have separate shelves so that produce is not stacked on top of each other.	Stacking can cause bruising and low price.
4.3 Transporters should handle produce carefully.	To prevent bruising and other damage.
4.4 Transport quickly after harvest in the cool parts of the day or at night.	Reduces dehydration and crop spoilage.
4.5 Produce should be kept separate from contaminants like fertilizer, pesticides, animals, etc.	You don't want to poison the produce or the consumer.
5.Storage:	
5.1 A wet cloth over a storage basket can reduce the temperature.	Prevents dehydration.

5. Ask participants to look at and discuss the pictures below. **(5 minutes)**

Not good: packing in the sun

Good: shade house for field packing

Not good: Uncovered produce on truck



Good: Produce covered with ventilation

Good: using ice to cool long beans

***Good: using a wet blanket to cool produce** – as the water evaporates it cools the produce*

Subgroup exercise

6. Ask participants to form into their 5 subgroups and to discuss and write down in their workbooks in Exercise 14.8 the answer to the question: "When are the listed crops ready for harvest?" Allocate 2 crops per group. **(5 minutes)**

Exercise 14.8: Harvesting at the right time

Crop	What does produce look like when it is ready to harvest?
Yard Long Bean	
Chili	
Okra	
Tomato	
Eggplant	
Coriander	
Cucumber	
Bottle Gourd	
Ridge Gourd	

Snake Gourd	
Bitter Gourd	
Pumpkin	
Watermelon	
Cabbage	
Cauliflower	
Broccoli	
Mustard	
Sweet Corn	
Carrot	
Onions	
Radish	
Water Spinach	
White Egg Plant	

Plenary Discussion:

7. Ask the groups to present their findings. Write their ideas on a flip chart.**(10 minutes)**
8. Give participants 10 minutes to copy the answers into their workbooks **(10 minutes)**
9. Discuss the pictures below. **(5 minutes)**

Tip: Quality cannot be improved after harvest, so produce must be harvested at the right time.

Okra: mature

Okra: over mature

Cauliflower: mature

Cauliflower: Over mature

1 *2* *3* *4*

Tomato at different stages of maturity

1 = not ready for harvest. 2 = can be harvested for distant markets.

3 = can be harvested for nearby markets. 4 = for local markets only.

Plenary discussion

10. Ask participants if they have ever experienced their produce rotting after harvest and what they think caused the rot. Write their ideas on a flip chart. (2 minutes)
11. Refer them to the following photos and the idea of dipping their produce in a solution to prevent rot. (3 minutes)

Explain to the group that produce can be dipped in solutions to prevent rots. The photos below show the difference that using dips can make. Discuss the photos.

Eggplant treated with bleach (top)
No treatment (bottom)

Cabbage no treatment (top)
Treated with lime (bottom)

Exercise 14.9: Dip in solution to prevent rotting

Bleach Dip.

1. Mix 4-8 tablespoons of bleach per 4 liters of water. This is effective for preventing rot in eggplant after harvest.
2. Baking soda. Mix 1 tablespoon of baking soda per liter of water. This is effective for preventing rot in tomatoes after harvest.
3. Lime. Mix lime (very fine) with water to make a paste. This is effective in preventing rot when it is painted on the end of the stems of cabbage and cauliflower.

Activity 5: Summarize the session (Time: 5 minutes)

Activity 6: Evaluate the Session: (Time: 5 minutes)

1. What worked well in the lesson?
2. What did not work so well?
3. How could the lesson be improved?

Activity 7: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.
   Close the session and hand out demo materials if appropriate.

Session 15: Market Buyer Led Workshop

Duration: 3 hours in the classroom, no field work
Materials: Flipchart, markers, tape, Attendance Register form;

Objectives:

5. To know what invited buyers want to buy from farmers
6. To encourage buyer contracts or pre financing
7. To encourage buyers to provide extension advice
8. To encourage buyers to provide recommended seed varieties to suit market requirements

Buyer Led Workshops Procedure

Activity 1: Preliminary work before the workshops:

1. Identify cooperating product Buyers – could be collectors, wholesalers, market sellers. While wholesalers know a lot about the general market because buy a lot of vegetables and distribute them daily to many sellers, often farmers do not like them because they often offer lower prices than local market sellers. Therefore, try to get two or three local market sellers to present their vegetable preferences and timing at the workshop, and if they cannot come, ask a wholesaler. The participants should choose who should come. Stagger their timing, say half hour for one, then another half hour for another, not all at the same time. That way they can speak more freely without competing in front of each other.
2. Discuss with the Buyers how they can link with project farmers – 'win-win' arrangements – ideas could be contract farming, pre-financing, written contracts of verbal flexible agreements, or no agreements just guidelines to help the farmers choose where to sell their crops.
3. Ask the buyer if Group Selling is an option for them. If so, conduct an assessment of the whole group's ideas on how to organize this with the CCBG (and wider groups of farmers if appropriate) or the FFS group if there is no CCBG. Giving the buyer a chance to buy from the whole group may help to get a better or more stable price for a high volume of products e.g. The RWCP 999 Quality Seed Multiplication group got double the normal price, and chili groups selling/buying has given a moderate but stable contract price.
4. Invite product Buyers to prepare flip charts or vinyls giving answers to the questions listed below.

Activity 2: Questions to discuss at the workshop

1. Tell participants that the purpose of the Market Buyer Led workshop is to facilitate linkages between farmers and other value chain actors in a way where they both benefit – a 'win-win' situation. In this way, the linkages are more likely to continue beyond the life of the project. Tell participants that this session links produce buyers and farmers formally or informally and acts as a guide to farmers about where they can sell their crops now, and to get advice on what crops they should grow next year to meet market demands.
2. Ask buyers to discuss their answers to the questions in Exercise 15.1 with the participants including FFS farmers (and perhaps others farmers outside of the FFS). The more farmers that join group sales agreements, the better it is for both parties.
3. Ask buyers to leave their information flip charts with the farmers. This enables farmers to study them afterwards and get back to the buyers with their ideas for a contract or informal marketing agreements:

Exercise 15.1: Factors to look for in considering sales agreements

1. What products do you want to buy? Describe your product clearly.
2. How much product can you buy? For example, 5 baskets per farmer, or 100 baskets from the whole group.
3. What is the time period when the buyer wants to buy the produce?
4. What quality standards are required? For example: size, color, moisture content and grade.
5. What GAP cultivation practices are required to market as GAP produce?: This refers to how the crop was produced, for example: (i) Safe for the consumer – sold after chemical withholding periods; (ii) used less chemicals, more organic; (iii) used government approved chemicals only; (iv) not harmful to the environment; (v) not harmful to the farmer and the workers; (vi) used quality seed from pure varieties; and (vii) harvested, stored and transported properly so there is a long shelf life. Remind them of the other government GAP requirements outlined in Exercise 1.4 in their workbooks.
6. How and where should the products be delivered? For example, specific locations, time, mode of transport, packaging, who pays for transport. Perishable products like fruit and vegetables may need special packaging, ripeness, storage and transport requirements.
7. What price will be paid and under what conditions? For example, price based on quality and price based on quantity. Ask about individual farmer price and group price for a larger volume of sales and better prices.
8. What are the payment procedures?: How and when the farmer will be paid by the buyer; for example cash on delivery, payment after some days or months, paid by cheque?
9. Does the buyer offer technical support: Examples might be a leaflet or a personal visit to advise on quality standards.
10. Other incentives: These are extra benefits the seller or buyer can offer. For example, if you sell me more than 10,000 baskets of products, I can give you credit for inputs (pre financing), or a free motorbike or other promotions. This especially applies to group buying/selling of large volumes.
11. If there is disagreement between buyers and sellers, how can these problems be solved?
12. How is the product insured against risks like fire, flood, drought, damage in transport? Who is responsible for organizing and paying for this?
13. Are there any penalties if either party breaks an agreement?

Activity 3: Summary of the workshop

(i) Field Officers (FOs) should write the names and contact details of the buyers on a flip chart for farmers to copy into their notebooks.
(ii) Thank the buyers for coming and giving their presentations
(iii) Thank the farmers for coming and considering the marketing options that have been presented.
(iv) Invite the farmers to informally discuss marketing agreements with the buyers, either after the workshop or to contact the buyers and meet with them at another time.
(v) Ask farmers to consider what they have learnt today, discuss this information with their family, and decide what strategy they should use for selling their crops.

Note:

1. Remind the farmers that if they all grow the same crops at the same time there may be an oversupply, resulting in a low price. Suggest farmers grow a diversity of crops to spread the risk of low prices, and if practical, grow crops in low supply and high demand periods when prices are high.
2. Ask buyers if they are able to link with other buyers in other regions, so that if the price is low in their local region, the buyers may be able to sell for a higher price in another region. That way the buyer still

gets the farmer's business (and profit for themselves), and the farmer gets a better price. A 'win-win' situation!

Activity 4: Evaluate the Session: (5 minutes)

4. What worked well in the lesson?
5. What did not work so well?
6. How could the lesson be improved?

Activity 5: Next Session Topic(s), Timing, Location and Who Should Come (5 minutes)

Plenary

1. Remind participants of the topics, time and place for the next session. The time and place should be suitable in particular to the women to minimize constraints to their participation. Invite the 'doer' (husband or wife) to come to the session so that they get the information first hand. They can then apply it properly in the field work. If the trainee is one person, and the 'doer' is another person, the 'doer' may get the wrong information.

Session 16: FFS Evaluation Session Plan

Duration: 3 hours (in the class room)

Objectives:

- To measure farmers' ideas about what they learned from the FFS process (Farmers' expected result)
- To measure FFS results against the project's indicators
- To make farmers aware of the project's future plans and activities and how current participants' villages could be further involved
- To discover farmers' plans for the next monsoon or winter seasons

Materials: Flip chart paper; marker pens; Attachment # 16.1: Achievement of Farmers Expectations; Attachment # 16.2: Achievement of outcomes against the project's indicators.

Activity 1: Introduction: (15 minutes)

Plenary

1. Welcome the participants to the final FFS meeting.
2. Congratulate those who attended 80% of the sessions for being eligible to receive their graduation certificates.
3. Quickly summarize the FFS process on a flip chart from the participants' selection process, through the formal sessions and other activities, study tours and field days where appropriate. Include mention of the process of distribution of inputs and linkages with other service providers.
4. Explain that the project wants to (i) learn from the farmers if they achieved their expectations with regard to what they achieved from the FFS and other activities, and (ii) gain suggestions for improvement to help the facilitators do a better job in the future.

Activity 2: Farmer's personal evaluation of the FFS results (40 minutes)

Individual

1. Ask participants to look at Exercise 1.1 in their workbooks (Attachment 1 below) to review their initial expectations that they had at the beginning of the FFS. Ask them to circle the number from 1 to 10 that best rates their achievement against their expectations. Say that if they achieved little then put 1 or 2, if medium around 4-6, and if very high 9-10. Walk around the class to make sure individuals understand this and are marking their achievement of expectations correctly. (10 minutes)
2. Ask individual participants to look at the Net Income amount BEFORE RWCP that they filled in when registering for the FFS (An example is shown in Attachment #2 below). Ask the participants to fill in their AFTER PROJECT income results from this last season in the bottom half of the form, copying the data from their record books. When they have finished, ask them to answer the questions: (i) 'What was the financial result from following GAP in comparison with before the project (Profit or loss difference)? (ii) "Was it up to expectations or not (yes/no)? (iii) If yes "why", if no, "why not"? (20 minutes)
3. To summarize, ask some farmers if they achieved their expectations or not. Discuss reasons why or why not in the plenary.
4. Optional:

   4.1 If the project wants to keep a record of the achievement of farmer's expectations, hand out a separate expectations and Net Income evaluation sheet provided by the facilitator. (See Attachments 16.1 & 16.2 below).

   4.2 Ask the farmers to copy their expectations ratings and Net Income onto the paper. Collect the papers when they have finished.

Activity 3: Review of the FFS process (15 minutes)

Subgroups

1. Ask the participants to form small groups and to answer the following questions:
   (i) What were the most important topics they learnt and why?
   (ii) What were the topics they prefer to leave out and why?
   (iii) What changes to the FFS do they suggest to make the FFS more effective?
2. Ask group leaders to present their suggestions to the whole group. Facilitators should take a record of these suggestions as lessons learned for improvement of the training process for next time.

Activity 4: Achievement of outputs against the project's indicators (30 min.)

Individuals

1. Explain to the participants that the donor has asked staff to measure the achievement of results from the FFS against key project results indicators.
2. Hand out Attachment 16.3: Achievement of outputs against the project's indicators. Explain the meaning of each heading to the plenary. Then ask individuals to fill in their answers to the questions. Move around the group and help them with their assessments.
   Note: If possible, get participants to specifically note by how much the indicators have changed and to explain their answer? E.g. Yield increase from 45 baskets to 65 baskets and the reason why this happened; or Food Security went up or down, and why it did. Circulate the room and assist participants when necessary.
3. Collect the individual papers for analysis and reporting later.

Activity 5: Description of the project's future activities – (Note: If the project wants to keep engaging with these farmers in the future) - (15 min.)

Plenary

1. Write key points about the project's future activities on a flip chart, and explain how the participants might be involved in these activities. (This shows that the project might not be leaving them now but is able to invite them to join future activities. It could also explain how the private and/or the government sector will continue to lead activities in the future.)

Activity 6: What are the current FFS participant's future plans? (30 min.)

Plenary

1. Refer to the cropping calendar in Exercise 16.1 in their workbooks. Invite farmers to circle what crops they might grow in the coming seasons.

Activity 7: Summary and closing question and answer session: (35 min.)

1. Summarize the lesson.
2. Ask participants if they have any further questions and provide answers where you can.
3. Thank participants for their attendance and participation. Hand out certificates if appropriate.

Close the FFS and wish them well for the future.

Attachment# 16.1: Achievement of Farmers' Expectations

Lead Farmer's Expectations of the FFS	Level of Achievement of Expectations
1.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
2.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
3.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
4.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
5.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
6.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
7.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
8.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
9.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
10.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
11.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High
12.....	Circle: 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 : 10 Low Medium High

Attachment# 16.1: Comparison of Net Income Before and After RWCP

Crop Type before RWCP	Area (acres)	Yield (A) (Consumed/donated/ sold/crop left in the field)	Crop Harvest Units	Average Price (B)	Total Estimated Income (A x B)	Total Estimated Expense (C) (Seed, fertilizer, Other)	Estimated Outside Labor (D)	Net Income (AxB) - (C+D)
Crop Type in this last season after RWCP								

Attachment 16.3: Achievement of outputs against project indicators

Indicator	Change (Circle)	If possible, write changes specifically in terms of how much change, or explain your answer and give a reason for the change Eg. From 45 baskets to 65 baskets; or food security increased by 2 months and reason.
1. Net Farm Income after costs	Less: Same: More	
2. Months of enough nutritious food to eat	Less: Same: More	
3. Amount of crops grown	Less: Same: More	
4. Labor required for farming	Less: Same: More	
5. Changes in land area cultivated	Less: Same: More	
6. Volume of crops sold	Less: Same: More	
7. Yield of crops	Less: Same: More	
8. Number of agriculture practices being used	Less: Same: More	
9. Private sector services – inputs supply, extension, finance etc	Less: Same: More	
10. Government extension services	Less: Same: More	

Exercise 16.1: Cropping Plan for Next Seasons.

Crops	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Group - 1												
1. Yard-long Bean												
2. Okra												
3. Onion												
4. Carrot												
Group – 2												
5. Chili												
6. Tomato												
7. Egg-plant												
8. White Egg-plant												
9. Coriander												
Group – 3												
10. Cabbage												
11. Cauliflower												
12. Broccoli												
13. Radish												
14. Water spinach												
15. Corn												
16. Mustard												
Group – 4												
17. Bottle Gourd												
18. Snake Gourd												
19. Ridge Gourd												
20. Bitter Gourd												
21. Cucumber												
22. Water Melon												
23. Pumpkin												
Field Crops												
1. Goundnut												
2. Chili												
3. Corn												
4. Watermelon												
5. Onion												

Remark:

Good growing period

Difficult growing period

RAKHINE WINTER
CROPS PROJECT

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme