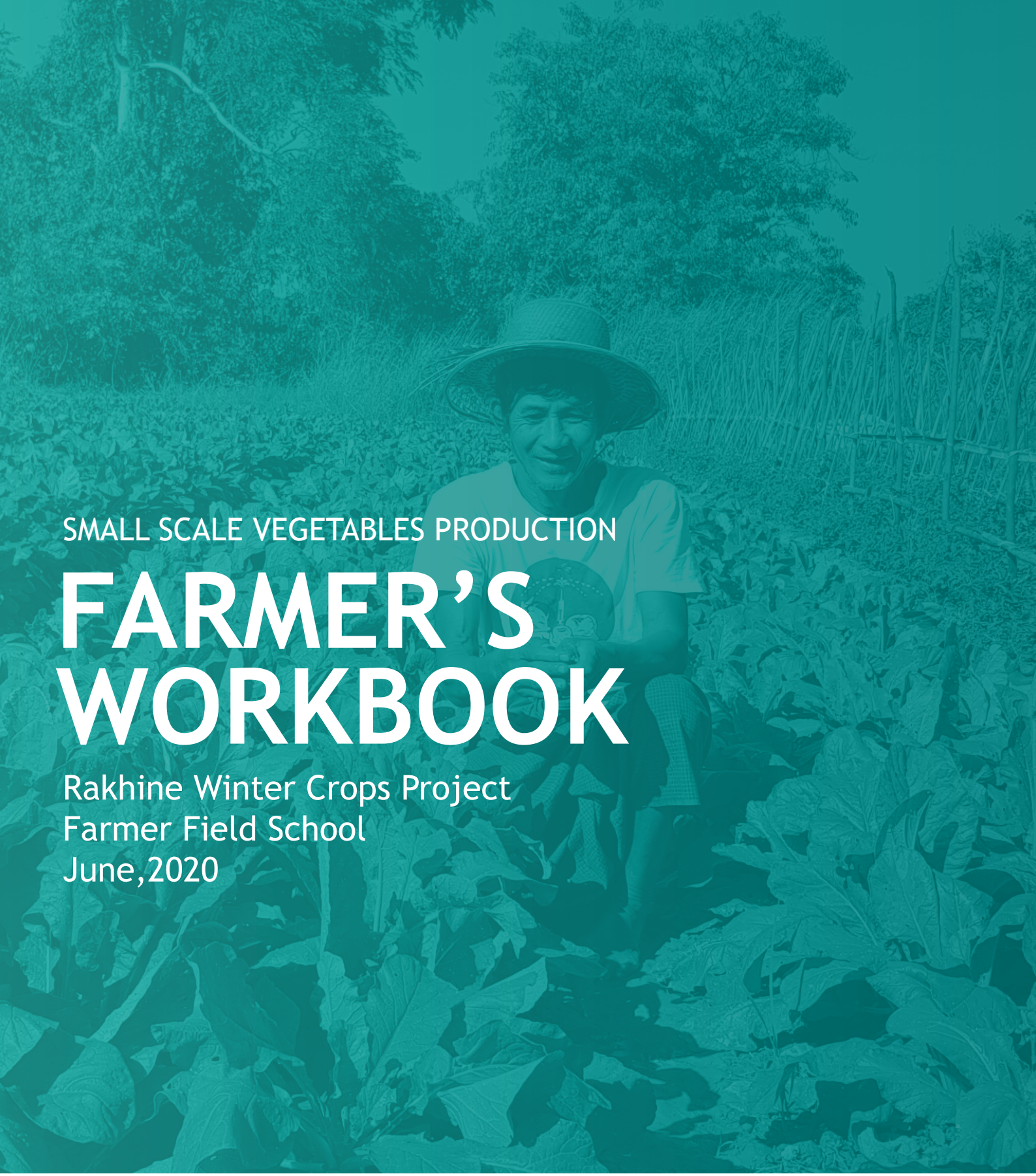


SMALL SCALE VEGETABLES PRODUCTION

FARMER'S WORKBOOK

Rakhine Winter Crops Project
Farmer Field School
June,2020

RAKHINE WINTER
CROPS PROJECT

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme

Introduction:

The Rakhine Winter Crops Project (RWCP) supports extension activities for the implementation of a Small Scale Vegetable Production (SSVP) program to provide fresh and healthy food to the grower and a potential source of income for their family. Additionally, it is hoped that being part of the SSVP Farmer Field School (FFS) will encourage small holders to become commercial growers in the near future. This 'Farmer's Work Book' should assist farmers to produce a set of crops following Good Agriculture Practices (GAP) that are economically viable, environmentally sound, and are socially just and humane. The facilitation process is based on a FFS extension approach which follows the cropping cycle from planting to post harvest using theory and group discussion followed by the practical application of GAP in demonstration sites in the field.

While 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 sub group 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. Participants should write their notes in spare lines in this book, so all ideas about farming are in one place for easy reference.

Leader Farmers are encouraged to tell other farmers what they have learned. They can do this by explaining the notes in this book to others, as well as helping them practice these improved farming techniques in the field. In this way you can spread the benefits of your training to many other farmers, improving their lives as well as your own. The project wishes you well with your training and field results.

Session 1: Introduction to the SSVP FFS

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 SSVP FFS Farmer Field School Training Program	The Farmer's Work Book provides key concepts and technical notes. It also provides spaces for participants' exercises

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

Exercise 1.2: The project's SSVP Expected Results

1. Improved agronomic theory and field practice for those with access to small land areas suitable for home gardens)
2. Year round production of vegetables for home consumption and sale
3. Increased net income
4. Greater diversity of crops to reduce risk and improve nutritional intake
5. Motivation for farmers to graduate to becoming larger scale commercial growers using rented or own land

Exercise 1.3: The project's Crop Selection Criteria:

Selection of vegetables to grow:

1. Market demand, price and timing of planting and harvest to get the best price
2. GAP best practice expected budget analysis to work out the potential profit
3. Family consumption preferences and nutritional value
4. Seasonal planting calendar for many potential crops with consideration for climate variations especially temperature and water availability
5. Soil type preferences or tolerances e.g. acid, neutral, alkaline
6. Availability of quality and reasonably priced inputs
7. Prefer to have one crop from each crop group for crop rotation requirements for soil improvement and disease control
8. Environmental impact
9. Risk assessment
10. .....
11. .....
12. .....

Exercise 1.4: 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												

Remarks:

Good growing period

Difficult growing period

Exercise 1.5: Crops Selected and Reasons for Selection

	Crop	Season	Reasons Why Selected
1	Yard Long Bean	Monsoon & Winter	Good market & price; popular to eat; good nutrition; input availability; suitable for many soil types; good for crop rotation & environment; low risk
2	Cucumber	Monsoon & Winter	Good market & price; popular to eat; input availability; suitable for many soil types; good for crop rotation & environment; low risk
3	Radish	Winter	Good market & price; popular to eat; nutritious; input availability; suitable for many soil types;
4	Bitter gourd	Winter	Good market & price; popular to eat; nutritious; input availability; suitable for many soil types; low risk

5	Okra	Winter	Good market & price; popular to eat; nutritious; input availability; suitable for many soil types; good for crop rotation & environment; low risk
6	Chili	Winter	Good market & price; popular to eat; nutritious; input availability; suitable for many soil types; good for crop rotation & environment; low risk
7	Onion	Winter	Good market and price. Popular to eat. Nutritious. Input availability.
8	Carrot	Winter	Popular to eat. Good market and price. Suitable to sandy loam.
9	Tomato	Winter	Popular. Good market and price. Suitable to sandy loam.
10	Eggplant	Monsoon, Winter	Popular. Good market and price. Suitable for many soil type.
11	White eggplant	Monsoon, Winter	Popular. Good market and price. Suitable to loamy soil.
12	Cabbage	Winter	Popular. Good market and price. Suitable to loamy soil.
13	Cauliflower	Winter	Popular. Good market and price. Suitable to loamy soil.
14	Broccoli	Winter	Nutritious. High price. Suitable to loamy soil.
15	Water spinach	Whole year	Popular. Suitable for many soil types.
16	Bottle gourd	Winter	Popular. Good market and price. Suitable for soil with high compost.
17	Snake gourd	Monsoon, Winter	Popular. Good market and price. Suitable for soil with high compost.
18	Ridge gourd	Monsoon	Popular. Good market and price. Suitable for soil with high compost.
19	Pumpkin	Monsoon, Winter	Popular. Good market and price. Suitable for soil with high compost.
20	Water melon	Winter	Popular. Good market and price. Suitable for soil with high compost.

Definition:

When a farmer follows GAP the food is safe to eat, the practices are safe for farmers and farm workers, the practices protect the environment, and they are profitable.

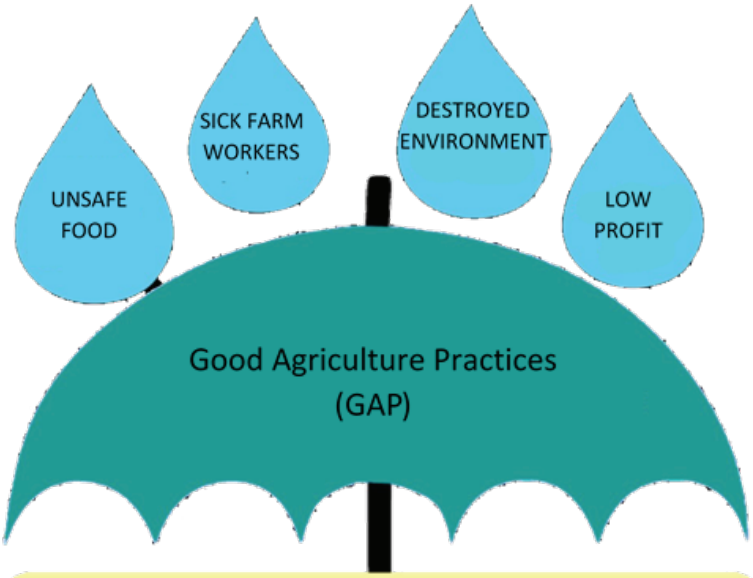
Exercise 1.6: Explanation of GAP

Exercise 1.7: Myanmar GAP protocols

MYANMAR GAP PROTOCOLS

1. **Site Selection**
   - The selected site and the near-by must be free from chemical and biological hazard. Site plan and Crop Type Record should be kept.
2. **Water**
   - Water for agricultural use should be analyzed. Water from animal farm, hospital, industrial and municipal waste are harmful to the environment. Should not be used. (If use the 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 and received date of the seeds, seedlings and propagated plants should be recorded.
4. **Fertilizer and Soil Additives**
   - Fertilizer and soil additives which use 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 the land near a water source, to prevent contamination.
   - The purchased fertilizers and soil additives should be from the 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 environment safety, pay full attention to Pesticide & Fertilizer Law and Regulations.
   - Only when necessary, use only the approved chemicals.
   - Strictly follow the Pre-Harvest Interval (PHI), according to the chemical used.
   - To know how to handle and use the 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 properly in regards to the prevention of product contamination.
6. **Crop Care**
   - Crop care should be done accordingly to the specific needs of each crop.
7. **Agricultural Tools and Materials**
   - Agricultural tools and materials should not contaminate the products.
   - 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 right means.
    - Do not put the products directly on the ground, on the floor of packaging facility, or on the floor of the warehouse.
    - Water used in cleaning the products should be clean.
    - Grade and pack the products according to the market specifications.
9. **Storage and Transportation**
    - Keep, store and transport the products, away from chemicals, biological and physical damage.
    - Do not keep or store the products with fuels, pesticides, fertilizers and farm tools and materials.
    - Before transporting, inspect the vehicle is free from chemical spill, pests and diseases and other litters.
10. **Construction**
    - To minimize the damage to the products, packaging, handling and storing facilities should be constructed to specifications and 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 harvest, packaging, and storing area.
12. **Evidence and Records**
    - The producer should keep the GAP record at least two years.
    - Daily activities and practices should be noted down on the forms.
13. **Traceability**
    - Significant marking and registration should be kept with the product for traceability purposes.
    - Keep a separate record for the destination and delivery date of each produce.
14. **Training**
    - Both the producer and the worker, to attain good skills and knowledge in their respective fields, should attend GAP training.
15. **Evaluation**
    - The producer should conduct an annual evaluation on GAP protocols.
    - The producer should settle complaints and keep a complaint 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 (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 the workers.



1. SAFE CONSUMPTION
2. SAFE FOR FARM WORKERS
3. SAFE FOR THE ENVIRONMENT – disease resistant seed; less chemical more organic; balanced soil nutrition; efficient water management
4. PROFITABLE
5. EXTRA FOOD SAFETY REQUIREMENTS FOR EXPORT

Exercise 1.8: Making EM bokashi compost

Steps in making Super EM Bokashi (20' x 40')

Materials needed

Rice Husk	-	1 bags
Cow Manure	-	1 bags
Rice Bran	-	1/2 bag
Instant EM	-	1/2.1 Liter
Molasses	-	1/2 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, then pour it over the dry material and mix well.
5. Add enough water so the mixture can stick together in a ball shape. This will 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 3-4 weeks from preparation, when the mixture has a sweet-sour fermented smell and forms white fungi filaments on the surface, it is ready to use.
10. If you do not use the bokashi immediately, you can store it in bags in a dry cool place for up to 6 months.

Exercise 1.9: 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, 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.

Exercise 1.10: How Lead Farmers can train other farmers and the benefits of being a Lead Farmer

How to train other farmers:

1. Invite other farmers to come to the Lead Farmers plot and altogether they help the Lead Farmer with practicing GAP – 'learning by doing'.
2. The Lead Farmer then visits the other farmers plots and helps them with developing their gardens following the process they learned during the training.
3. Lead Farmers can sit under their house or a shady tree and have a discussion group with other farmers, talking about what was learned during the FFS training.

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Benefits of being a Lead Farmer:

1. Gain more knowledge by going to the FFS training.
2. Make strong connections with other participating Lead Farmers during the training, especially those in their same village. Can continue to learn from these farmers after the training finishes.
3. The Lead Farmers gain status in the village by selecting the Non Lead Farmers and being a trainer.
4. Can gain from sharing knowledge and experiences with the Non Lead Farmers.

Lead Farmers and Non Lead Farmers working together in a small plot

Exercise 1.11: Example of Ground rules:

1. Be on time.
2. Participate actively.
3. Listen to what other men and women 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 thing from others.
6. .....
7. .....

Session 2: Getting Started with Vegetable Growing

Exercise 2.1: Site selection criteria:

Site selection criteria for: (i) sites close to home (shady) and (ii) in the field (open sites)

1. Not far from home to enable regular visits
2. Free from flooding
3. Near water source
4. Free of pests or disease contamination from their field and neighbors
5. Prefer some shade trees but not too much
6. Suitable size for family consumption and labor availability
7. .....
8. .....
9. .....
10. .....

Exercise 2.2 Why is fencing important?

GAP reasons why is fencing 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 protect workers, children and animals from rubbish (old plastic bags, spray containers etc.).
5. .....
6. .....
7. .....
8. .....

Exercise 2.3: Fencing Materials 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	Get fruits, leaves for consumption and compost, fire wood source	Requires maintenance, shady and takes nutrients from the soil

Exercise 2.4: Soil Characteristics

Question: What are the main components of the soil?

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

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

- Black, brown and 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, micro and macro organisms

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Exercise 2.5: Preferred pH levels for plants

A value of 1 – 7 pH is acidic, while a value of 8 – 14 is alkaline (non-acidic). Apply lime to get proper pH of the soil (optimal is 5.5 – 7 pH), so that plants can take up the nutrients.

Exercise 2.6: Soil Degradation Causes and Solutions

Soil Degradation Causes	Solutions
1. Mono-cropping (only having one crop) drains all nutrients specific to that crop	Grow a rotation of different crops
2. Burning surface cover such as leaves and roots kills organic matter	Dig in dried surface matter to decompose and add fertility to the soil
3. Only using chemical fertilizer results in lower fertility and yield in the long term	Use organic fertilizer or a mixture of chemical and organic fertilizer
4. Not covering the soil results in soil erosion, high soil temperature and evaporation	Cover the soil with straw, or plastic. Grow a cover crop between seasons
5. Too much water washes soil and nutrients away	Select flood free sites, have free draining soils, have raised beds and drainage channels
6. Sunlight on the soil results in evaporation of soil nutrients and water	Cover with straw, plastic or a cover crop and have filtered shelter
7. Strong wind causes soil erosion and water evaporation	Have filtered shelter to reduce wind speed. Some air flow is good.
8. Compacting the soil breaks down soil structure making it go hard	Use low impact cultivation and plant care techniques
9.	
10.	

Exercise 2.7: Site Layout Steps:

1. Select a site for annual plants such as Moringa (Drumstick tree), Lemon Grass, Turmeric, and others.
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 garden to drain surplus water or store water for later use.
5. On the eastern (cooler morning sun) side grow low shade crops like sponge gourd, wax gourd and bottle gourd, allowing some sunlight to reach the other plants
6. On the western (hotter afternoon sun) side grow taller shade trees like papaya, Drumstick tree and winged bean.

Draw your own Site Layout Plan:

Example of Site Layout
Greens, onions

Example of crop rotation of beans, salad

Exercise 2.8: Land Preparation Tips and Reasons

Tips	Reasons
1. Clean tools 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 drier 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 plowing - zero tillage or direct drilling approach	This techniques 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 12 inches deep and leave the soil for 7-14 days exposed to the sunlight	The upper layer of the soil is rich in macro and microorganisms and nutrients, so do not mix it with the lower layer which has few organisms and nutrients. Exposure to sunlight can kill diseases in the soil
5. Dig the soil a second time incorporating 1viss 20 Tical /meter of compost, and 8 Tical/meter of lime	For improved aeration, drainage, micro- organism development, nutrient uptake. The lime reduces acidity.
6. For annual crops such as Moringa, Lemon Grass, Turmeric, Sponge Gourd, Wax gourd, and others, dig 12 inch x 12 inch x 15 inch holes. Put 5-6 pounds of compost and dried small pieces of coconut husks into the holes	These plants need deeper holes for root anchorage deep down.
7. For short term seasonal crops (carrot, radish, beans, etc.) pulverize (pound and mix up) the soil into a firm, fine seed bed (but not too fine)	This allows anchorage and protection of the seed, but still provides spaces in the soil for aeration and water holding capacity and drainage
8. For seasonal crops make raised beds about 24 inches wide, 10 inches high with 18 inch furrows between the beds. You could put palm frond walls around the beds to prevent the soil falling down	Raising the plots a bit higher than the rest of the land improves drainage, water efficiency and helps release any excess water away from plant roots reducing flooding risk, and improving aeration, root growth and nutrient uptake
9. Use dry organic matter such as rice straw or sugarcane leaves to cover the bed	Conserves moisture, keeps soil temperature down, and stops the light reaching the soil, thus preventing new weed growth

Exercise 2.9: Control of soil borne disease

Organic control:

1. Plough 14 days before planting to let the sun shine on the soil and kill the disease
2. Use trichoderma fungus (bio agents) application to kill the disease.

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Exercise 2.10: How to make organic pesticide

Option 1: Local inputs only

- Put 10 pounds of organic materials (kitchen waste, cow dung, chopped up 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 mosquitoes laying eggs, houseflies and bad smells
- Stir the mixture in the jar twice a day for 2 months until it does not smell so bad
- Apply the pest disease control mixture every 4-5 days during the crop cycle. Dilute with water 1:20 (1 part organic waste to 20 parts of water) for young plants and 2:20 for older plants

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

Concentrated Alcohol	-	100 cc
Vinegar	-	100 cc
Molasses	-	100 cc
Concentrated EM	-	100 cc
Water	-	600 cc

- Mix all materials 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 and re-apply weekly.
- The rate is 1:500-1:1000 (EM-5: Water) to apply.
- To suppress diseases and pests in early phases of infection: Spray on to plants at a dilution of 1:100.
- It is not a pesticide, only a repellent.
- It can be used for up to 3 months before it is no longer effective.

Session 3: Preparation for Planting

Exercise 3.1: Advantages and Disadvantages of Seedlings and Direct Seeding

	Seedlings	Direct Seeding
Amount of seed used	Less	More
Water application	Less amount used	More amount used
Weather/pests effect	Easy to control, low impact	Difficult to control, high impact
Productivity	High productivity, good uniformity in quality	Uneven productivity in plants; lower quality
Crop season in field	Shorter	Longer

Exercise 3.2: 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.	For improved aeration, drainage, micro- organism development, nutrient uptake. The lime reduces acidity.
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.	These plants need deeper holes for root anchorage deep down.
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 2 x 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 leaf 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.

Exercise 3.3: 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.
5. .....
6. .....
7. .....

Exercise 3.4: Factors that affect nutrient availability for plants are:

	pH Level	Soil texture	Soil Moisture	Temperature	Saltiness
Not good For Plants	Acid (value below 5) or alkaline (value over 7)	High in Silt	Uneven	Over 35°C	Very salty
Good For Plants	Neutral (value of around 5.5-7.5)	Sandy to Loamy	Constant	Under 30°C	Low salt

Exercise 3.5: How to change bad growing conditions to good growing conditions

1. Reduce acidity by adding lime which is alkaline – Show them some lime that you will use in the field work.
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 & do not use salty water

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Exercise 3.6: The most important chemical fertilizer requirements for plants are:

1. Phosphorous (P) is the most needed nutrient and is good for roots, flowers, fruit setting
2. Nitrogen (N) is the second most important nutrient and is good for growing leaves, branches and fruits, and
3. Potassium (K) is the least needed but is useful in regular small amounts for all growth stages

Additional fertilizer elements that may be useful as side dressings.

1. Calcium is used for better growth of plants.
2. Magnesium is a component of chlorophyll that makes the leaves green for efficient photosynthesis
3. Sulphur is sometimes used for better general growth of plants.
4. Other nutrient elements that can be useful are boron, chlorine, copper, iron, molybdenum, nickel, zinc, silica and manganese.

Exercise 3.7: 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.	Neutral (value of aro Some markets do not supply the full range of quality fertilizers. und 5.5-7.5)	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 that 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 acidic (less than 5.5 pH) and require lime to be added.	Have to buy the lime	3-5lbs per 25 yards squared, to raise pH by 0.5 pH unit.
Chemical fertilizer feeds the plant, but 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 joint fertilizer effectiveness.

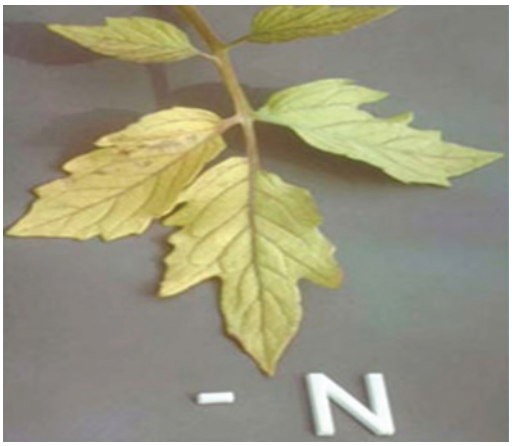
Most chemical fertilizers are natural products like phosphates, lime, and potassium and in limited amounts, are not directly harmful to the soil.	Some fertilizers are artificially made like Urea from the underground gas refining process. This fertilizer is harmful to the organic matter in the soil in the long term. Fertilizer can be washed into streams creating problems for fish and other river life.	Do not use artificially made fertilizers. Do not use too much fertilizer, especially close to waterways.
Organic fertilizer:		
Organic fertilizer feeds the soil so that 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 long 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. Never 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.
Organic fertilizer is made from many dangerous raw materials like cow dung, rotten leaves etc.	Organic material remains toxic during the decomposition process until it is fully decomposed. During the decomposition process, sometimes toxic water can drain into the garden or waterways, and people and animals can touch the decomposing compost and get sick.	Keep the compost pit away from the garden. Do not use human waste. Fence the compost pit to keep humans and animals away. Do not let toxic waste water from the process drain into waterways or 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.	Sometimes it cannot be bought in local agro dealer shops and has to be ordered from outside suppliers.	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 1:100 and still be effective.	Some people dilute it too much and 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 bokashi compost which is fermented under black plastic for only 2-3 weeks.	Farmers often do not follow the guidelines correctly so it is not so effective.	Follow the EM guidelines correctly.
EM (500ml), molasses (500ml) and 4kg fresh chopped up plant material can be mixed with 20 liters of water in a sealed container to ferment for 3 weeks to make a liquid organic fertilizer and pest control product.	Some farmers do not prepare it properly and then it is not so effective.	Follow the EM guidelines closely.
EM decomposed faster than organic compost and is less toxic	Cost around 3,000 MMK/liter to buy	Much quicker decomposition time, is safer for humans, animals and the environment.
Crop rotations		
Crops should be rotated every year 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 are not clear about rotation management.	Follow GAP and record where and when you have grown your crops and rotate them every 1 year.
Grow crops that improve the soil structure and nutrients like legumes (groundnut, mung bean, soy bean) which put back 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 always be seem.
Keep records.	Farmers usually do not keep records.	Keep records of chemical and organic fertilizer application and crops rotations so you know what has gone into your soil and what crops you have grown. People who eat the products can be shown how your crop was grown.

Exercise 3.8: Nutrient imbalance symptoms.

Common examples of incorrect nutrient balance:

- Too much foliage and poor fruit set is related to excessive nitrogen.
- Too much fruit but small in size indicates potassium deficiency.
- Good number of fruits but inconsistent size or them being misshapen is caused by potassium deficiency.
- Few female flowers and too many male flowers and yellow leaves can show nitrogen imbalance.



Nitrogen deficiency – yellowing

Healthy plant – green color

Session 4: Crop Care

Exercise 4.1: 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. This is where the water is applied and where the roots will grow towards the water. Basal lime, NPK or compost should be applied in this furrow 1-2 weeks before planting. All fertilizers 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. Fertilizer will burn the roots if it comes in direct contact with them so it has to be placed a little away from the roots, especially those of young plants.
2. **Side dressing**
   This is used in sandy soils which do not hold nutrients well and when plants require additional nutrients for growth eg when flowering. Side dressing can be made either in a narrow furrow 6" away from the row of plants or applied around each plant or mid way between each plant. 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.

Exercise 4.2: Mulching

Definition of mulching:

Mulching is the covering of the soil to prevent stress to the plant.

Question: Why should farmers use mulching?

1. To prevent the soil temperature rising, causing stress to the plant and reducing nutrient uptake
2. To prevent water loss through evaporation
3. To protect the soil from wind erosion
4. .....
5. .....
6. .....

What different types of mulching are there?

Organic mulch Plastic mulch

Note: Organic mulch should be 6" deep at the beginning. It will collapse down to 1-2" in a few days' time and is much more effective than a thin layer of mulch from the beginning. Plastic much is expensive and is not good for the environment.

Exercise 4.3: Planting methods

Transplanting

1. Two days before transplanting, wet field beds until saturation and add trichoderma.
2. Prepare the trichoderma solution mixing 7g trichoderma in 10 liters of water. Slowly add 40 ml of trichoderma solution to each seedling pot; don't let the solution drain out of the seedling pot.
3. Transport the seedlings carefully to the field. Select only the healthy seedlings for planting.
4. Make a hole in the mulch and soil bed 2 inches wide and deep enough for the seedling to rest at ground level (not below ground level). Space plants the width of the adult plant. If you plant too close, you get thin weak plants; if too wide, weeds can grow fast stealing plant nutrients and light. If you plant to deep, water can fill the hole causing stem and root disease and reduces oxygen.
5. Take the seedling from the pot by the crown of the plant without bending or pressing too hard. Drop the seedling into the hole at the same level as the soil. ***Cover the seedling completely with soil; add water to make the soil wet; gently press with your hands up and down around the wet ground around the seedling to wash the soil close to the roots.***
6. **Try to transplant seedlings after 3:30 pm to avoid dehydration.**

Direct Seeding:

1. Mark straight lines using string or another technique.
2. Make a groove in the soil at twice the seed diameter in depth, following a straight line.
3. Plant seeds carefully trying to get the correct spacing.
4. Gently cover the soil over the seeds and press firmly.

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Exercise 4.4: Plant water requirement through their growth stages

Exercise 4.5: 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 4 inches below the soil and squeeze it. Drop it from 4" above the ground. If the soil holds together it has enough water. If it crumbles it needs more water (See diagram 4.6 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 seeded, soak the seeds overnight.
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 water every day from week 5 onwards until harvest. Generally, the more leaf area, the more water is required.
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-bed furrow irrigation the beds should not be too wide as water cannot spread into the center of these wide beds.
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!
15. In the monsoon, drainage is more important than watering. Plant on flood free low land or sloping higher land in high reinforced raised beds, draining water away from the beds.

Exercise 4.6: 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 then 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.

Exercise 4.7: Advantages and Disadvantages of Plastic Tents

Option 1: Full cover – suitable for sheltered areas as this is susceptible to wind damage

Option 2: Half cover suitable for exposed sites. Wind can more easily escape with open sides.

Advantages	Disadvantages
1. More crop diversity possible 2. High profit from high value crops 3. Structure lasts 2-3 seasons if looked after well.	1. Cost (around 50,000 MMK 20' x 20') 2. Sometimes difficult to build 3. Structure only lasts 1 season if not looked after well. 4. Wind and water collecting in the plastic can destroy the roof. Has to be well constructed and maintained. 5. Need to grow high value crops to get the maximum benefit. 6. Suitable only for the best farmers as it takes time and dedication to be successful.

Exercise 4.8: Analysis of Trellis Designs

Vertical Bamboo Trellis	Net trellis	String Trellis	Horizontal Trellis
			
Low cost if bamboo is easily available but labor intensive to build. Usually need new bamboo each year.	Easy to manage and handle. This is a substitute for bamboo if bamboo is not easily available. Can use for a few years. Expensive compared to bamboo but saves on labor.	Easy to handle and low cost in materials and labor.	Suitable for gourds but can be costly as a lot of material and labor required.

Exercise 4.9: Weeding

TIPS REASONS

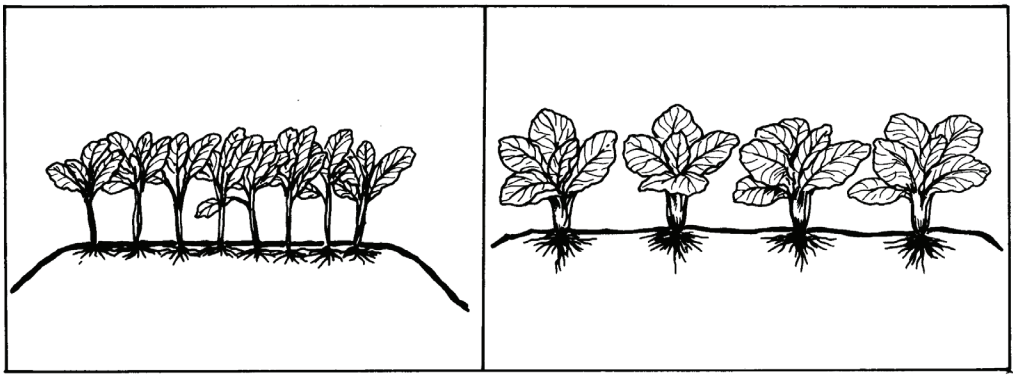
1. **Definition:**
   A weed is a plant that is in the wrong place at the wrong time. If you are selling your crop, buyers want single species products, not mixed with other products so you have to 'weed out' the species that is in the wrong place at the wrong time.
2. **Why is weeding important?**
   Weeds compete for light, nutrients, and can be hosts for pests and disease.
3. Pull weeds by hand or dig them out with a hoe or other tool. Manual weeding loosens the soil and in this way improves aeration and plant growth. Weeding also reduces competition amongst vegetables for nutrients and light.
4. Make sure the weeds are not tangled up in the seedlings. When you pull 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. Laying weeds without seed heads on the soil surface allows the sun to kill these weeds and provides shade to the soil to prevent water loss and soil temperature increase. Over time these 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.
   Too difficult to hand weed a large area. Follow the instructions on the container on how to mix and use the chemical safely.
8.
9.

Hand Tools for weeding:

Exercise 4.10: Methods and Purpose of Thinning

TIPS	REASONS
1. When planting small seeds, mix them with fine sand and then plant them.	Reduces the amount of seed planted and thinning requirement.
2. Pull out carefully 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 together result in small weak plants because they compete for nutrients, light and water.
3. Leave plants at a spacing that is the same as the fully grown adult plant.	This provides enough room for sufficient nutrients, light and water for good plant growth, and maximizes the amount of plants per plot maximizing yield and income.
4.	
5.	
6.	

Too close making plants thin **Good spacing resulting in strong plants**



Session 5: Pest & Disease Control and Water Management

Exercise 5.1: Insect, Pest and Disease control

Important Note for Participants:

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 the pests and diseases in the crops early and how to control them. (See Pest and Disease Handbook)

TIPS	REASONS
1. Prevention: It is a good idea to reduce the chances of insect, pest and disease attack by: (1) crop rotation; (2) sterilizing the soil by burning rice husk on top; (3) having enough air ventilation to dry the vegetable leaves since disease forms in wet conditions; (4) sterilizing seeds by treatment with EM solution (dilution 1:1000, soak 2-3 hrs.)or buying chemically treated seeds to protect the seeds from disease; (5) using disease resistant seeds and varieties; (6) planting at a time of year when there is less disease; (7) transplanting only healthy seedlings so they are strong enough to fight disease and pest attack; (8) protecting young plants from extremes: not too hot, not too wet, physical damage from animals; (9) inspecting your crop regularly to detect and control problems early, not when it is already too late; (10) removing weeds as they can be hosts for pests and disease; (11) flooding the field before sowing to drown insects; and (12) leaving a week between cultivations for the sun to dry the soil and kill some disease.	Prevention is easier and less costly than having to find a cure and reduces the chance of losing some of the crop.
2. Companion planting: Some plants have natural substances in their roots and flowers that can repel or attract insects. They can also provide nutrients to the plants beside them. Open cupped flowering plants are most attractive to beneficial insects. Examples are: marigold (repellant) and sunflower (attractant)	This is a good natural way to protect your plants from pests and diseases. Companion planting provides balance to the environment and can even make your crops taste better.
3. Physical/mechanical control: 1. In small gardens you can look around each plant and squash the bad insects between your fingers or cut off the diseased part of the plant. Remember to leave the good insects. 2. Remove and burn the diseased plants. 3. Use light and water bucket insect traps.	These methods do not harm the environment and cost very little.
4. Organic control: In small gardens it is better to use only organic control. Some examples are: neem extract, fermented plant juice, Fermented Fruit Juice, Tobacco, soap solution and EM5.	Creates a balance in the environment, is low cost and not dangerous to your family's health if applied properly.

5. Chemical control: Use only as a last resort when pest and disease levels are very high and other methods of control are not working. Remember that chemicals kill both good and bad insects, and are dangerous to the environment and your family's health. The main steps for control are: (1) Identify the pest or disease and select the chemical suited to control that specific problem. (2) Buy only as much chemical as you need. It is dangerous to store poisonous chemicals around the house. (3) Follow the instructions on the labels on the containers. If you put on too much it is a waste of money and bad for the environment: too little and it will be ineffective. (4) Use registered/permitted agro-chemicals only. (5) Expired or deteriorated chemicals should never be used. (6) Keep children and pregnant women away from agro-chemicals. (7) Use protective clothing when using agro-chemicals. (8) Wash your body and spraying equipment after chemical application. (9) Timely observation and action reduces the amount of agro-chemicals to be used. (10) Respect agro-chemicals' pre harvest interval (PHI). (11) Do not enter into the crop area immediately after applying chemicals. (12) Store small amounts of chemicals in a sealed container away from children or animals, and larger amounts of chemical in a separate, lockable, well ventilated shed with hazard warning signs. (13) Store chemicals separately from fertilizers and other inputs. (14) Wash old chemical containers three times, then make holes in them so no other person uses them. (15) Dispose of old containers in a deep hole or at an approved disposal site.	At times the level of pest and disease is so bad you have to use chemicals or risk losing the whole crop. However, you must be careful handling chemicals to protect the health of the farmers, the consumers and the environment.
Additional note: Recording: Write down the type of organic and chemical pest & disease application and date in a record book.	Accurate records let your family or a product buyer know what was put on the crop and when to make sure the crop is safe to eat. You may get a higher price for your crop if you have cared for it safely.

Exercise 5.2: Safe Use of Pesticides

Session 6: Pre & Postharvest Crop Care

Exercise 6.1: Pre and Postharvest Techniques

GAP Tips	Reasons Why
1.Quality standards:	
1.1 Produce should meet the standards demanded by the market sellers and consumers. Find out what the standards are, and make sure your produce meets these standards.	Higher demand and higher price for your quality products.
1.2 Pre Harvest Interval (PHI). If you use chemical spray or animal manure you should not harvest the crops until 1 or 2 weeks after your last application. Check the chemical labels for specific PHIs.	So you do not poison the consumer with spray or manure until it has broken down to a harmless state.
1.3 GAP records showing fertilizer (both chemical and organic) applications and timing should be kept for each crop.	The record shows the buyer or consumer what has been applied to the crop and when. If they see you have followed the GAP rules for chemical and organic inputs they may pay a higher price!
	
2. Harvesting:	
2.1 Handle crops carefully. Do not throw them or drop them.	Prevents bruising and other damage.
2.2 Harvest at the cool morning part of the day.	Produce is fresh and not dehydrated.
2.3 Do not harvest in the afternoon.	Produce has dried out during the hot day.
2.4 Cut the stalks a quarter inch up from the fruit.	If you break the fruit off at the fruit body disease can enter the hole left by the stem.
2.5 If wet or humid, dry produce in a shady place.	Moisture can cause disease and your produce will spoil.

	
3. Cleaning & Sorting:	
3.1 Pickers should have clean hands free of disease.	Disease can spread through the produce causing ill health to customers.
3.2 Do not pick and pack produce that has been on the ground. You have to clean it first.	The produce could be contaminated by contact with the soil causing ill health or disease in the produce during storage.
3.3 Spread produce on a flat clean surface to help heat to dissipate before packing.	Heat causes dehydration and a reduction in quality.
3.4 Remove leaves, long stems, flowers, damaged or diseased produce.	Cleaned disease-free produce is more attractive and can sell more easily at a higher price.
3.5 Sort into grades according to market requirements.	You may get a higher price overall if you do this.
3.6 If washing produce, make sure it is dry before packaging.	Moisture attracts disease.
4. Packing:	
4.1 Put in well ventilated basket 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.
4.2 Avoid over filling the crates or baskets and stacking on top of each other unless they fit exactly on top.	Can cause bruising, disease and overheating resulting in dehydration and low storage life.
4.3 Canvas 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.
	

5. Transporting:	
5.1 Vehicles should have a roof or cover over the produce.	Provides shade.
5.2 Vehicles should have separate shelves so produce is not stacked on top of each other.	Stacking can cause bruising and low price.
5.3 Transporters should handle produce carefully.	Prevent bruising and other damage.
5.4 Transport quickly after harvest in the cool parts of the day or at night.	Reduces dehydration and crop spoilage.
5.5 Produce should be kept separate from contaminants like fertilizer, pesticides, animals etc.	You don't want to poison the produce or the consumer.
	
6.Storage:	
6.1 A wet cloth over a storage basket can reduce the temperature.	Prevents dehydration.
	

Exercise 6.2: Difference between Open and Cross Pollinated and Hybrid Seeds

Open pollinated / Cross Pollinated Plants	Hybrid Packet of Seeds
	
Open/cross pollinated seeds carry the characteristics of the parent plants, just like a baby carries the characteristics of the mother and father.	Produced in the laboratory by scientists. Farmers cannot produce these seeds with the same characteristics themselves. Need to buy new seeds each year.
Seeds can be kept each year but after 2-3 years their characteristics can differ widely from the parent plants.	If farmers kept hybrid seeds for the next year, the characteristics would not be the same. They would have low germination, low yield and low disease resistance. DO NOT KEEP HYBRID SEEDS FOR THE NEXT CROP.
1.3 GAP records showing fertilizer (both chemical and organic) applications and timing should be kept for each crop.	The record shows the buyer or consumer what has been applied to the crop and when. If they see you have followed the GAP rules for chemical and organic inputs they may pay a higher price!

Exercise 6.3: Advantages and Disadvantages of Open and Cross pollinated seeds and Hybrid Seeds.

	Advantages	Disadvantages
Open/Cross Pollinated seeds	1. good tolerance/resistance to local diseases 2. Farmer can produce own seeds	1. Less tolerance/resistance to imported diseases 2. Low production
Hybrid seeds	1. High production and high quality 2. Highly resistant to most pest and diseases	1. Limited access to sellers and have to pay 2. Farmer can't keep their own seeds for next season

Exercise 6.4: Seed Collection Tips

GAP Seed Collection Tips	Reasons Why
The fruits that will be kept for seeds should be healthy, have a good shape, and be mature but for most fruits they should not be left in the field for too long.	Hopefully the good characteristics of the parent fruit will be passed on to the seeds.
Wax Gourd and Pumpkin can be harvested for seed when the fruit has a white powder covering. One week after harvesting, remove the seeds and soak them overnight, then clean and dry them for 2-3 days, but not under strong sunlight.	
For Egg Plant, Cucumber, Bitter Gourd, Tomato and Chili, the fruits should be kept until the color has turned red or yellow. After harvest, immediately remove the seeds from the fruits, soak overnight, clean well and then dry for 2-3 more days before storage.	
Pak Choi (Chinese Cabbage), Green Mustard, Lettuce, Yard Long Bean are partly dry when ripening in the pods or seed heads. After harvesting, sun dry the pods for 1 or 2 more days. Then remove the pods and any unfilled or damaged seeds. Continue to dry for another 2-3 days before storage.	
For Wing Bean, Sponge Gourd, Rigged Gourd, Bottle Gourd, the fruits need to very mature before harvesting for seed. Dry and keep the whole fruit for 2 or 3 days, without removing the seed from the fruits.	
Damaged seed (pests and seed-borne diseases) can be detected by visual examination with the naked eye, or by using magnifying lenses (15X). Spread the seeds on contrasting color paper. Gray or white coloration on the seed surface indicates fungal contamination. Remove these seeds. Shriveled, small, irregular shaped and other colored seeds should be rejected as they might correspond to specific mutations.	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Exercise 6.5: Storage of seeds

Seed storages tips

Dry all non-sealed packs and newly harvested seeds before storage. This helps to prevent moisture caused deterioration of the seeds.

Store seeds at low temperature (below 15°C) and low humidity (8%) preferably in an air tight container. Write the date of storage on it. Place the container in a dark place, for example in a clay pot or basket with a lid.

Factors that affect the seed germination in unsealed and sealed containers

	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

The table above shows that it is better for germination to have seeds stored in sealed non-transparent containers rather than in unsealed packets or containers.

Unsealed Storage

Sealed storage methods

Session 7: FFS Evaluation Session Plan

Exercise 7.1: Calendar of Crops for the 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. 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												
Other Crops:												

Remarks:

Good growing period

Difficult growing period

RAKHINE WINTER
CROPS PROJECT

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme