
Teaching Methodology for Agricultural Life Skills Education for Teacher Training Centers

Part 3 Organic gardening

2013

Unofficial translation

Teaching Methodology for Agricultural Life Skills Education for Teacher Training Centers Part 3 Organic Gardening

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Preface

Implementation of life skills in agriculture is currently very attractive in the educational sector globally.

Starting from this context, strengthening life skills in agriculture related to daily livelihood is truly essential for student teachers and students in the present and future.

Therefore, in order to understand life skills, teachers who teach agricultural life skills should:

1. Understand the content and objectives, and know how to use materials.
2. Prepare adequate materials for each recommended activity.
3. Pre-practice by themselves before teaching in classes.

I hope all teachers will pay attention to use these materials for teaching and learning in order to improve education.

On behalf of the Ministry of Education, Youth and Sport, I profoundly thank the working group and VVOB's project technical assistance for compiling all documents.

Phnom Penh, 17 June 2013
Minister of Education, Youth and Sport

COMMITTEE OF AUTHORS OF AGRICULTURAL LIFE SKILLS MANUAL

A. Management Committee

His Excellency Nart Bunroeun

Secretary of State, Ministry of Education, Youth and Sport

B. Quality Assurance Committee

Mr. Leang Seng Hak	Director of Teacher Training Department
Mr. Eng Kim Ly	Director of Curriculum Development Department
Mr. Chan Sophea	Director of Primary Education Department
Mr. Ra Vuthy	Director of Vocational Orientation Department

C. Authoring Committee

Mr. Leav Ora	Director of Siem Reap Provincial Teacher Training Center
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Ms. Seng Sopheap	Teacher Trainer of PTTC Siem Reap
Mr. Heng Thyra	Teacher Trainer of PTTC Siem Reap
Mr. Sok Sethor	Teacher Trainer of PTTC Siem Reap
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Mr. Leng Kimsrong	Teacher Trainer of RTTC Kandal
Ms. Wanda Prins	VVOB SEAL Program Coordinator
Mr. Koy Maquis	VVOB SEAL M&E Officer and Facilitator
Mrs. Nadia Reynders	VVOB SEAL Program Coordinator
Mr. Ra Chanroat	VVOB SEAL Education Advisor

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Mrs. Thorng Chandavoin	Officer of Primary Education Department
Mr. Nay Sacha	Officer of Primary Education Department
Mrs. Ven Vandeth	Officer of Vocational Orientation Department

Preface Authors

The Organic Vegetable Gardening Manual is prepared in cooperation with the Ministry of Education, Youth and Sport and VVOB.

This book is prepared in order to explain about growing vegetables using by natural methods. It covers theories and practices in each lesson. The book will make growing vegetables easier and it requires less money, furthermore it is promoting quality of health and environment education in our country.

This Agriculture manual has been checked for accuracy by Cambodian Center for Study and Development in Agriculture (CEDAC). VVOB wishes to thank CEDAC for this support.

Even though agriculture experts provided technical assistance and materials and a big effort was made to do research of relating documents for this manual, the content may not be complete for teachers to teach their students. However, this manual is a guide for teachers to do more research and prepare lesson plans to fit the actual needs. We hope that this document will enable teachers to prepare teaching materials more effectively. We look forward to seeing your constructive comments and suggestions.

Authors Group

Note

This is the translation of វិធីបង្រៀនការអប់រំបំណិនជីវិតស្តីពីកសិកម្ម ផ្នែកទី ១ ការដាំដំណាំបន្លែសរីរាង្គ (the training manual Teaching Methodology for Agricultural Life Skills Education for Teacher Training Centers Part 3 Organic Gardening) which was issued in 2013 by the Ministry of Education, Youth and Sport (MoEYS).

This translation was made by VVOB (the Flemish Association for Development Cooperation and Technical Assistance and is not an official translation.

We hope it may be useful to External Development Partners of MoEYS and Teacher Training Centers who wish to consult the original Khmer manual in English.

INTRODUCTION TO TEACHING METHODOLOGY FOR AGRICULTURAL LIFE SKILLS

This Agricultural Life Skills Education Teaching Manual is divided into three parts:

- Part 1 Chicken raising
- Part 2 Fish raising
- Part 3 Organic gardening.

Every lesson of each part focusses on practical skills linked with theoretical background information.

This lesson manual together with the Agriculture Life Skills Content Manual and teaching aids such as posters, word cards, video clips provides you a range of ideas and methods that are suitable for agricultural education for student teachers.

The Teaching Manual contains lessons that stimulate a deeper understanding of agricultural issues, development of problem solving skills, decision making, persuading, critical thinking, etcetera. They also provide opportunities for action which can lead to behaviour change. By using hands-on practice and experiential based learning as main methodology, student teachers learn how to apply the methodology in their future primary schools with their pupils.

Definition of Life Skills

'The intellectual, personal, interpersonal and vocational skills that enable informed decision-making, effective communication, and coping and self-management skills that contribute to a healthy and productive life to ensure successfully solving daily problems'.

Policy for Curriculum Development 2005-2009, MoEYS

Objectives of agricultural education

According to the Training-Program for primary-level teachers, taken from the MoEYS curriculum agricultural education aims for students to:

- Obtain knowledge, life skills for daily livelihood; for example, skills in planting crops and farming animals to enhance families' living standards.
- Grasp skills and methodologies to impart them to primary school students through practice and experiment.
- Change the attitude and address social and economic challenges through the life skills, problems solving skills, thinking skills, decision making skills, cooperation, and accountability.

Student centered approach

This teaching manual provides ready to use methods and activities, accompanied by teaching aids such as posters, pictures, videos, materials for experiments. Important in all teaching activities is to apply a student centered approach. Examples of activities that motivate students to be involved in the lesson are demonstrative experiments, educational games, creative and performing arts, role play, discussion and debate, learning-by-doing, survey or small research. All of these approaches can be found in this manual. The lessons described have clear references to which teaching aids can be used for which activity and refer to paragraphs in the content manual. Each lesson description will take up around 40 minutes of the teaching time, which allows teacher trainers to spend 5 minutes at the beginning and 5 minutes at the end of the lesson to be able to teach the lesson according to the 5 steps of MoEYS.

Definition of Life Skills Education

"Life Skills based education is used to empower young people in challenging situations. It involves an interactive process of teaching and learning, which enables learners to acquire knowledge and develop attitudes and skills to support the adoption of healthy behaviours." UNICEF

Use of multimedia

Agricultural issues can also be brought inside the class room by video clips, PowerPoint presentations, photos, et cetera and provide different learning opportunities which focus on awareness building and attitude change. Multimedia will provide information only but a discussion afterwards is needed to give more understanding and more meaning to this lesson activity.

The 2 DVDs that go with this lesson manual provide documentary video clips and clips showing teaching activities described in the lessons. The clips provide a better understanding of how a practical skill should be demonstrated in the lesson, which helps the teacher trainer to prepare the lesson. The clips can also be shown in the lesson to the student teachers when there is no opportunity to practice a certain activity outside.

Where a video clip is available in a lesson the manual also offers ideas for a follow up activity that allows discussing the topic in class, which might help changing attitudes related to topics that are aimed to change students' behaviour such as the use of natural fertilizer and natural pest management.


 References to the DVDs can easily be found by this pictogram.

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CHAPTER 1 CHEMICAL PESTICIDES (2 LESSONS)

1.1 Background Information

Organic gardening is the kind of gardening that only employs materials from natural sources, using natural fertilizer, and avoiding the use of chemical substances which can be harmful for all living things on the planet while preventing pests. Chemical pesticides have been often used by farmers and this affects the environment, economy, our health, and the society. Most farmers use chemical pesticides that are imported from the neighbouring countries such as Thailand and Vietnam. These come without Khmer instruction and this is a problem for them.

The World Health Organization (WHO) estimates that 3 million people are poisoned by pesticides every year, most of them in developing countries. Every year about 20.000 people die because of this. Pesticides can be absorbed by contact with the skin, inhaled as dust or vapour or absorbed in contaminated food or water. Many people, children in particular, have been fatally poisoned by drinking pesticides by mistake because it is stored in bottles used for drinks. The WHO classifies pesticides by hazard into four classes “Ia” extremely hazardous, “Ib” highly hazardous, “II” moderately hazardous, and “III” slightly hazardous.

1.2 Objectives

At the end of this chapter the student teachers

Knowledge

- can list different kind of chemical pesticides that are most used by the farmers and which are prohibited
- can describe problems, causes and effects of pesticide use in Cambodia on the environment, health, economy, and society
- can explain the solutions on reducing the pesticide use and how to grow organic vegetable

Skills

- have improved their negotiation, listening, persuasion, presentation, decision making skills related to issues of chemical substances
- apply ways to reduce pesticide use and advise community farmers

Attitude

- may change their habit of using chemical substances in their vegetable garden
- promote to their family and community to reduce chemical pesticide use and explain how to use natural fertilizers properly

1.3 Teaching aids

Lesson 1 Spraying tank, water, food colouring/ink, clothes, gloves, face masks, and other tools for spraying, flipcharts for big group discussion

Lesson 2 Video clip “Toxic Trail” DVD 1 clip 1.4.2, DVD player/TV or laptop/projector, script of role play activity (make a copy for 2 or 3 student teachers), video clip “Role play about pesticide use and its impact” DVD 1 clip 1.4.2, DVD player/TV or laptop/projector, poster “Prohibited Agricultural Pesticides” in life skills box

Extra lesson Poster “Food Chain”

Scripts for role play for 1.4.2 Lesson 2 Negative impact of chemical pesticides

- **Nurse:** All of you have to stop using chemical pesticides from now on. If you continue, this will cause many health problems such as vomiting, diarrhea, dizziness and headache immediately. The long-term effect is a risk to get other diseases such as skin cancer, liver disease, intestinal problem, meningitis, lung problem, respiratory problem, etc. My idea is that all of you should stop using it because you will get sick in the future. I notice it is very difficult to buy vegetables from the market that are free of chemical fertilizer. I have my own organic garden at home. It provides healthy vegetables for my family, so the vegetables that we eat are not harmful for our health anymore.
- **Primary School Teacher:** I am a teacher in this village and I would like to share my idea with all of you here. I have met people from many NGOs and they interviewed some farmers about the impact of using chemical pesticides and fertilizer. As the nurse just mentioned we should grow our crops by using natural pesticides and fertilizer because it makes our crop well, the yield is the same as when using chemicals and especially it makes us healthier. We should grow multi crops for exchanging products with each other.
- **Farmer:** Mr. Som is a farmer in this village. His family income is depending on growing vegetables. He used chemical pesticides to kill pests that destroy his vegetables. He thinks that using chemical pesticide is necessary because if he doesn't use it his crop will not gain high yield. He normally sprays from the start of growing until one week before harvesting and then sells it to the market. He often has health problems, but he still keeps using it. He used to participate in a training course on the impact of chemical pesticides, but he does not believe it and he continues using it because other farmers do too.
- **High School Teacher:** Mrs. Pheap is 36 years old. She has been a geography teacher for ten years in a high school. She teaches her students about the impacts of chemical fertilizer on humans and the environment. For many years, most of farmers have not changed their behaviour of using chemical pesticides yet. She thinks that just teaching the students is not enough. We should ask students and their families to do changes habits in gardening and to show the effects of what will happen if we don't change and finally she encourages all farmers and the village chief to widely forward information in the village after they have gained knowledge from the training that was conducted by an agricultural organization, CEDAC.
- **Farmer:** Mr. Soa is a farmer who stopped using chemical pesticides 5 years ago. Even though he uses natural pesticides and compost fertilizer his vegetable growing has high yield. Moreover, he can sell his vegetables for a good price. His expenditure is reduced on buying chemical fertilizer from the market. More specifically, he observes that his health is getting better since he stopped using chemical pesticides. Since he realizes that chemical pesticides affect farmers' health he is worried for their future health. He wants everyone to stop using chemical pesticides like he did.
- **Agricultural officer:** According to a survey, in many areas in the country, like in Kean Svay district, Sa'ang district and areas along the Mekong we found that vegetable products are affected by the use of chemical pesticides. This causes health problems for farmers and consumers. I am an agricultural officer who visited those sites. I have gained experience on providing information about impact of using chemical pesticides to farmers in order to reduce the use of chemical pesticides. I also teach them how to make compost fertilizer based on natural techniques. I think that using compost fertilizer and applying the right techniques of planting can still create a high yield, gain family income and provide a positive impact on the environment and social and human health.



- **Seller:** Mrs. Nam, is 35 years old and has had a small shop in the village for five years. She likes her business of selling chemical pesticides because she gets high profit. She said that every country in the world is using chemical pesticides. If they do not use it how can they kill the insects? Before selling the products to farmers she always explains how to use it properly. If these products are not effective she cannot sell them well in this village. She thinks that using chemical pesticides does not lead to serious health problem because before we cook and eat vegetables we usually wash them. She does not want all farmers in the village to stop using chemical pesticides.
- **Village Chief:** He is the chairman of the meeting and he has to listen carefully to all participants' ideas before making a decision how to solve the chemical pesticides problem. "According to the discussion I agree that using chemical pesticides really effects human health, the social and economic environment of our village. I just want to confirm that Mr. Chek who lived in our village died last month; probably because he sprayed chemical pesticides for years without wearing protective clothes. Sometimes, he took the chemical pesticide tank to clean in a village pond. Do you remember once all of us in the village had diarrhea and vomit! So I would like to make a final decision that all farmers in the village should stop using chemical pesticides from now on because some of us have learnt on how to make compost fertilizer already. We all should follow Mr. Sao who grows vegetable by using natural pesticide and fertilizer. After this meeting we will visit his garden."
- **Farmer's Wife:** Before using chemical pesticides my husband never had any health problems. After he started using it without protective measures I observed that every time after he used it, he had noticeable symptoms like headache, dizziness and sometimes he also vomits. As a result his health starts deteriorating. So I tell him to stop using chemical pesticides because it seriously effects his health. We have get high yield in another way.
- **Farmer's child:** When I am free from school I always help my parents in their vegetable garden. I take out weed and prepare soil nearby the place where my father sprays chemical pesticides. I do not know why I often feel that my health is not so well. When I don't feel well I cannot go to school.
- **Farmer's child:** I have learnt about impact of using chemical pesticides at school and I realized that I am affected by chemical pesticides. When I came back home I told my parents about the impact of using chemical pesticides and asked them to stop using it and start using natural fertilizer and pesticide. Later on, I observed that my family's health is getting better, and the yield is still the same as before. Moreover, the vegetables are more delicious than before.

1.4 Teaching Procedure

1.4.1 Lesson 1 *Negative impact of chemical pesticides*

Content book 1.1 to 1.4

Activity 1: Demonstration of spraying chemical pesticides by famers (15 minutes)

- Go outside and ask the student teachers to stand in a circle. Then ask them the following questions:
 1. Do most of the Cambodian farmers use protective clothes for spraying pesticide? How do they use it?
 2. If no protective clothes are used, how do the chemical substances affect the sprayer?

3. How are chemical substances absorbed into the farmer's body?
- Preparation for demonstration
 1. Mix water with food colouring ink and put it into the spraying tank. The ink stands for chemical pesticide.
 2. Select 1 student teacher to wear protective clothes, and another student teacher to wear only trousers, but not a shirt.
 3. Ask both of them to demonstrate spraying the chemical pesticide. They can spray on some plants or grass as an example (not spray on vegetables). They should preferably do this activity when the wind is blowing.
 4. Tell the other student teachers to observe their activities.
 - Activity in classroom: conclusion of the demonstration.
 1. What did you see during the demonstration?
Expected answer: Chemical substances have a direct negative impact on the person that is spraying. It not only kills insects, but it also kills the predators. From head to toe the sprayer is absorbing chemical substances when he is spraying. Of course, it also affects other people who stay nearby or under blowing wind. The chemical substances pollute the air, soil, and water.
 2. How are chemical substances absorbed into body of the farmers?
Expected answer: mouth, skin, food, and respiratory system
 3. What will happen after a while when farmers keep spraying chemical pesticides without wearing protective clothes?
Expected answer: In the short term pesticides will cause fever, dizziness, headache, vomiting, skin rash and itchy eyes. In the long run it will cause cancers, hepatitis liver, lung problems or which might lead to death.
 4. Which category of the pesticide does the Ministry of Agriculture prohibit to use? How do we recognize those products?
Expected answer: Methyl parathion, Methamidophos, Endosulfan, Methomyl etc...these products have a red line label, a pictogram of a ghost head and other symbols.

Activity 2: Group discussion about the impact of pesticide use using problem tree (25 minutes)

- First of all, the teacher trainer explains what a problem tree is: The problem is written in the tree trunk, the causes are in the roots and the effects in the branches of the tree.
- Divide the student teachers into small groups (4-5 members for each group) and ask each group to draw a problem tree on their flipchart. Each group draws a big tree and writes one word "*Chemical Pesticides Use*" in the middle of the flipcharts, in the tree trunk. Then they fill in causes and effects.
- Ask the student teachers to present their findings. All flipcharts will be put on the blackboard or wall so everyone can see the different presentations.
- The teacher trainer concludes all ideas.



Picture 1 Problem tree activity

1.4.2 Lesson 2 Negative impact of chemical pesticides

Content book 1.1 to 1.4

Activity 1: Video on importing pesticides from the neighbouring countries (15 min)

- ☐ Play the video clip “Toxic Trail” on DVD 1 clip 1.4.2 and ask the student teachers to take notes on what they see (15 min).
- The teacher trainer asks the following brainstorming questions:
 - 1) What is the main idea of this video clip?
 - 2) Where are pesticide products that farmers use imported from?
 - 3) How do the farmers use these products?
 - 4) What are problems when farmers use chemical pesticides?
 - 5) What...etc ?

Activity 2: Role play about the impacts of pesticides use (15 minutes)

- Provide scripts of the role play to the student teachers (1 copy for 1 or 2 student teachers) (see 1.3 teaching aids section)
 - Explain the purpose of the role play. Decide who plays the role of village chief and explain what his task is. Make sure he/she can facilitate the discussion well and make conclusions.
 - Everyone presents their role to try to find solutions and advice to prohibit the community people from using chemical pesticides in the vegetable garden. The village chief has to write down all comments and ideas to collect possible solutions.
 - The teacher trainer concludes the result and selects the best solutions.
- ☐ DVD1 clip 1.4.2 Teaching activity: Video showing role play on pesticide use and its impact (14 min).

Activity 3: Pairs work (10 minutes)

- What is organic gardening?
Expected answer: Organic vegetable gardening refers to the naturally based growing practice of vegetables involving the use of natural elements and non-chemical substances, which may be harmful to health and environment.
- What is the importance of growing and consuming organic vegetable for health, economy, environment and society?
- Hang up the poster "Prohibited Agricultural Pesticides" and discuss.

Activity 4: Evaluation (5 minutes)

- What have you learnt/experienced from the role-play?
- Can role play as a teaching approach be used with basic education students?
- How will you teach it?

Picture 2 Prohibited agricultural pesticides



1.4.3 Extra activities: Negative impact of chemical pesticides

Content book 1.1 to 1.4

Activity 1: Educational game: Pesticide (10 minutes)

- Divide students into three groups to present 3 groups of animals as below:
 - Group 1: 02 student teachers : they are the pelicans
 - Group 2: 06 student teachers : they are the fishes
 - Group 3: 18 student teachers : they are the grasshoppers
- Put a label on each of the pelicans, fish and grasshoppers so they can be easily identified.
- Give each grasshopper a plastic bag, which presents their stomach.
- Ask the student teachers to close their eyes and spread thirty pieces of paper on the ground.
- The paper on the ground is food. The grasshopper group has only 30 seconds to collect the food and put it into their plastic bags (=stomach). The pelicans and the fish sit quietly on the side-line and watch the grasshoppers collecting the food.
- The fish group then catches the grasshoppers. The pelicans are still on the side-line quietly watching the activity. Any grasshopper caught by the fish must give the bag of food to the fish and then sit down on the side-line.
- The pelicans must catch the fish. The fish need to keep catching the remaining grasshoppers.
- Conclusion: Grasshoppers eat food which contains chemical substance. When the fish eat those grasshoppers they will be poisoned and if they eat too much chemical substances the pelicans will die.
- Hang up the **poster: "Food chain"**.
- Ask the student teachers to explain the food chain. Ask the student teachers again about the impact of using chemical pesticides to human beings and the environment.

Activity 2: Research-based learning: survey on using chemical pesticides at village

- Ask the student teachers to do a research at home.
- Students can make their own questionnaire or if there is no time to do so they can use the questionnaires below.
- They can present their findings in the next lesson.

Questionnaire for the farmer

- What kind of chemical pesticides have you ever used? Since when?
- How many per cent of farmers you think are using chemical pesticides?
- Where do you buy chemical pesticides?
- Why do you choose to use chemical pesticides?
- Who recommended you to use this product?
Who teaches or tells you how to use it?
- How much do you know about chemical pesticides? Do you know which one is the most toxic and which one is moderated toxic?
- Does the product have directions for use in Khmer?
- How many types of chemical pesticides do you mix together?
- How does using chemical pesticides help your crop? How does it kill pests?
- What are its effects on the farmers and their families?
- Has anybody provided you information on the consequences of using chemical pesticides? Who?
- Have you ever used natural fertilizer, animal waste, or compost fertilizer?
How effective is it?
- Do you think that using only natural fertilizer is enough?
- Do you want to continue using chemical pesticides? Why?
- ...?

Questionnaire for the chemical pesticide seller

- Since when have you sold chemical pesticides? How many kinds of it do you sell?
Which one do you sell most?
- Where do these chemical pesticides come from?
- Do you go to buy it yourself or do other companies distribute them to you directly?
- Do you think that your business is increasing or decreasing?
- Do you think that farmers can use chemical pesticides properly? Why?
- Do you know what problems are that can happen when using it?
- Have you ever explained to farmers how to use the chemical pesticides? If you have, in which way?
- Do you think fake chemical pesticides exist? Can you identify which one is the fake and which is original?
- Where did you learn how to use (or to mix) the chemical pesticides?
- ...?

Questionnaire for the Village Chief

- How many per cent of farmers are using chemical pesticides?
- Does the local authority cooperate with agriculture officers or NGOs to prevent using chemical pesticides in the village?
- If yes, since when? How often? How effective is it?
- Are the number of farmers who use chemical pesticides in this village increasing or decreasing?
- Have local authorities cooperated with agriculture officers or NGOs to encourage the farmers to use natural pesticides or fertilizer for their rice crops or vegetables?
- How many families are growing organic vegetable?
- What do you think about chemical use in your village?
- What are the difficulties for encouraging farmers to stop using chemical pesticide?
- Why do you encourage farmers to stop using chemical pesticide?
- ...?

CHAPTER 2 NATURAL FERTILIZER (2 LESSONS)

2.1 Background information

Natural fertilizer is the main factor to promote organic farming. In order to produce organic vegetables farmers have to ensure not to use chemical substances and only apply natural ways of vegetable growing according to agro-environment conditions. Some farmers work hard to replace chemicals with natural fertilizer. Producing natural fertilizer is quite easy and it doesn't cost much because farmers can find the necessary materials in or around their rice field or home.

One of the problems associated with the dependence of farmers on synthetic fertilizers results from the thinking that Nitrogen (N) Phosphorus (P) and Potassium (K) is all that a plant needs for food. In fact there are about 20 different nutrients that are necessary for plants to grow. Plants need N, P and K in a relatively large quantity and are therefore called macronutrients. Others, such as zinc and magnesium, are only needed in very little amounts, and are called micronutrients.

2.2 Objectives

At the end of this chapter the student teachers

Knowledge

- know the importance of nutrients necessary for the growth of plants and vegetables
- can explain reasons why farmers need to improve nutrients in the soil after harvesting
- can tell how to produce compost fertilizer

Skills

- can produce compost fertilizer by using materials around their school and house.

Attitude

- encourage their family members and community to stop using chemical substances in the garden and start using compost fertilizer, made by existing bio-degradable waste at home

2.3 Teaching aids

Lesson 1 Star-gravel (representing Nutrient “N”), small gravel (representing nutrient “P”) and short branch of tree (representing nutrient “K”) and 3 plastic bottles (cut them in half), video clip “N P K demonstration” on DVD 1 clip 2.4.1 and video clip “How to produce compost fertilizer” on DVD 1 clip 2.4.1 DVD player/TV or laptop/projector.

Lesson 2 Materials for producing compost fertilizer (animal dung, dry leaves, Tontreankhet leaves, cow's urine, etc.)

2.4 Teaching Procedure

2.4.1 Lesson 1 Nutrients N P K

Activity 1: Demonstration on important nutrients N P K (25 minutes)

- What kind of nutrients does the soil need? What are the most important nutrients to grow vegetables?
- The teacher trainer shows all the materials that are needed for the demonstration.
- The teacher trainer explains the following steps:

1. Put 3 bottles (cut into half) on the table and label them: 1 “soil”, 2 “plants”, 3 “harvest”
2. The star-gravel represents “N”, small gravel is “P” and short branch of tree is “K”.
3. Begin “The First Season” by putting 3 kinds of nutrients in the “soil” bottle. Then transfer some (P&N) from the “soil” bottle to “plants” bottle. Explain the student teacher that plants need to absorb all nutrients from soil to feed stem and leaves through its roots. In the growing stage, the plants need N&P more than in other stages.
4. Transfer all nutrients from the “soil” and “plants” bottles to the “Harvest” bottle. Ask the student teachers if the nutrients in the soil increased or decreased? Why?
5. Begin “The Second Season” by adding the nutrients (N P K) in the “soil” bottle and repeat the process.
6. Continue until the soil bottle is empty of nutrient. Ask the student teachers, what might be happened on harvesting at this time?

☐ **DVD 1 clip 2.4.1 Teaching activity: Video showing the demonstration on N P K (14 min)**

Activity 2: Group discussion on how to produce and use compost fertilizer (15 minutes)

– Discussion questions:

- 1) How to produce dry compost fertilizer? And how to use it?
- 2) How to make liquid compost fertilizer? And how to use it?
- 3) What are the advantages of using the compost fertilizer?

☐ Play video clip “how to produce dry and liquid compost fertilizer” DVD 1 clip 2.4.1 (15 min)

- The teacher trainer concludes and gives additional information: there are 3 kinds of natural fertilizer namely compost, animals dung, fresh fertilizers (add more contents of lesson according to the need of the teacher trainer).

2.4.2 Lesson 2 Compost fertilizer

Content book 2.2 – 2.5

Activity 1: Practice on producing compost fertilizer in the hole (40 minutes)

Divide the student teachers into groups to produce both dry and liquid compost fertilizers that will be used in the garden according to the instruction of last week’s lesson.



Picture 3 Preparing for making compost

CHAPTER 3 SOIL PREPARATION AND MANAGEMENT (4 LESSONS)

3.1 Background information

The different kinds of soil have a direct relationship with several important nutrients in the soil. For example, the soil's ability of absorbing and retaining water directly affects the storage of nutrients and affects the growth of plants. Soil which contains a lot of clay is called "heavy thick soil" and it can retain water for a long time. Soil which has a lot of sand is called "light soil", and it cannot retain a lot of water unless it contains a lot of fertilized substances.

The pH is a scale of measuring acidity and goes from 0 to 14. A low pH (0-6) is acidic, and a high pH (8-14) is "basic (No H⁺)". The range of 6-8 is considered roughly "neutral" pH (pH 7 is the actual neutral point).

Soil pores play a major role in water and air movement. Micro-organisms are also located in pores of soil. Soil that has a lot of micro-organism is fertilized soil. Most kinds of soil can store billions of microorganisms that are invisible. Soil is the shelter for bacteria, fungi, earth worm, insects, etc.

3.2 Objectives

At the end of this chapter the student teacher can

Knowledge

- name three types of soil (clay, sand and silt) and explain compositions in the soil such as air, water, organic and mineral substances.
- explain the relationship between the growth of plants and other factors such as soil layers, soil quality, soil water holding capacity, agro-environment and microorganisms, etc.
- explain the relationship between the pH of soil and the growth of vegetables.
- explain the cause of soil degradation and how to improve the soil quality for growing vegetable.

Skills

- do experiments to analyse types of soil, soil composition, water-holding capacity and micro-organisms.
- prepare the different shapes of vegetable beds such as common vegetable bed, high bed and the bed has groove in the middle.
- improve their observation skills, taking notes and analyse them.

Attitude

- are motivated to maintain the quality of soil based on natural ways by avoiding usage of chemicals.

3.3 Teaching aids

Lesson 1 Poster "pH indicators", different kinds of soil (sandy soil, soil contains sand, loam, clay soil, and full clay soil), upper layer soil, stove, small pan, piece of glass to cover the pan, water and plastic cup, pH meter, pH paper and plastic bottles, video clip "experiment on soil composition" and "pH measurement" on DVD 1 clip 3.4.1, DVD player/TV or laptop/projector

Lesson 2 1.5 litres plastic bottle, 3 rubber bands, 3 pieces of cloth, and 3 types of soil (sandy soil, clay soil, and soil richly contains microorganism)

Lesson 3 Newspapers, rulers, hoes, small spades, magnifier and living things observation sheet, video "Living things observation" on DVD 2 clip 3.4.3, DVD player/TV or laptop/projector.

Lesson 4 Hoes, seeds and water container.

3.4 Teaching Procedure

3.4.1 Lesson 1 Types of soil

Activity 1: Experiment on soil type (10 minutes)

Content book 3.1 and 3.2

- Make soil samples wet and then shape them to be an earthworm shape about 10cm with diameter 5 mm and bend it as a circle on the palm of your hand (example in content book).
 - 1) If the soil cannot be moulded, it is sand.
 - 2) If you can mould the soil to be a long shape, but it breaks to short pieces; it is sandy soil mixing with silt.
 - 3) If it can be moulded to be a long shape, but it cannot bend as a circle; it is loamy (good mix of sand, silt, and clay soil).
 - 4) If you can mould and bend the soil, but it has cracks; it is clay soil mixed with silt.
 - 5) If you can mould the soil to be a long shape and bend it as a circle and it does not have any crack; it is clay soil.

Activity 2: Experiment on soil composition (15 minutes)

Content book 3.3

- Ask a student teacher to do the experiment through the teacher trainer's instruction following these steps:
 1. **Experiment 1:** Put a sample of dry soil (upper layer soil) in half a glass of water. Observe the water and soil in the glass. What is happening? (*There are bubbles.*)
Conclusion: the soil contains air.
 2. **Experiment 2:** Put another soil sample into a small pan, put a piece of mirror to cover the pan and heat it on a stove/gas cooker and. A moment later the piece of mirror becomes brown because of steam from the soil.
Therefore, soil contains water.
 3. **Experiment 3:** We keep it heated, but we do not cover pot by the piece of glass anymore. A few minutes later, there is smoke coming out with burning smell. The burning smell is from organic substances in soil.
Therefore, in the soil there are organic substances
 4. **Experiment 4:** Put soil of experiment 3 into a clear glass with water and stir it well. Keep it for a moment to let the dust drop down to the bottom of the glass. At the bottom of the glass there is a sandy soil layer, and the next layer is silt soil and clay soil is in the upper layer.
Therefore, in the soil there is sand particle, silt and clay.
 5. **Experiment 5:** Take off 4-5 drops of clear water that stayed on the glass and put it on a piece of glass that is cleaned and then heat it. When all the water is evaporated we can see white powder sticking on the piece of glass.
Therefore, there are salt minerals in soil, which is mixed with water.
- **Conclusion:** from experiment 1 to experiment 5 we can conclude that soil contains air, water, organic substances, soil particles (sand, silt and clay) and mineral substances.

- ☐ **DVD 1 clip 3.4.1 Teaching activity: Video showing experiment on soil composition (11 min)**

Activity 3: Practice on measuring pH of soil (15 minutes)

Content book 3.4 A and B

- Hang up the poster “pH Indicators”
- Explain the student teachers that in a substance when every H^+ ion has one OH^- ion, then the acidity is “neutral” and the pH measure will point at number 7. If your glass of water is acid, then you have more H^+ ions than OH^- ion, and the pH measure will be less than 7. In contrast, if your glass of water is basic, you have a higher number of OH^- ions than H^+ ions and the pH measure will be higher than 7.
- Student teachers collect different types of soil and measure the pH using the digital pH meter (if available) or pH paper and they record their observations to report in the classroom. Ask following questions:
 - 1) Which vegetables grow very well and look healthy? What is the pH of the soil of these vegetables?
 - 2) What is the relation between pH of soil and the growth of vegetables?
Expected answer: if the pH of soil is not acceptable, vegetables will not grow properly.
 - 3) How can we improve the pH of soil for vegetables to grow better?
Expected answer: The farmers should know how to adjust the pH scale by using lime according to the requirement of crops (see more details in the content manual).

☐ DVD 2 clip 3.4.1 Teaching activity: Video showing the pH measurement

pH Scale					
1 Low pH Acidic		7 Neutral pH		14 High pH Basic	
OH^-	H^+	OH^-	H^+	OH^-	H^+
OH^-	H^+	OH^-	H^+	OH^-	H^+
OH^-	H^+	OH^-	H^+	OH^-	H^+
	H^+	OH^-	H^+	OH^-	
	H^+	OH^-	H^+	OH^-	
	H^+	OH^-	H^+	OH^-	
	H^+	OH^-	H^+	OH^-	
	H^+	OH^-	H^+	OH^-	

Picture 4 pH scale

3.4.2 Lesson 2 Appearance of fertilized soil

Activity 1: Experiment on soil water-holding capacity (15 min) Content book 3.5

- Cut 3 big plastic bottles (1,5 l) in half. Then tie a piece of cloth around the opening with a rubber band. Put the top of the bottle upside down in the bottom part.
- Put 3 soil samples into the 3 different bottles (each type should weigh 500 g) sandy soil, clay soil, and soil richly containing micro-organism).
- Fill each bottle with 0.5 litre of water.



Picture 5 Soil Demonstration

- Let the water flow across the soil sample. If one of the bottles has absorbed all the water you can add some more water.
- After all the soil samples have drained completely then take the 3 cups that store the water that came from the 3 bottles above to compare the results by asking following questions:
 - Which soil sample can let most water run through?
 - Why is water-holding capacity of soil important?
 - How can you improve the water-holding capacity of soil (high moist)?
 - What...?

Activity 2: Experiment on soil moisture (20 minutes)

- Divide the student teachers into 3 groups and go to the garden.
- Each group gets 1 m² of land:
 - 1) Group 1: pour water on common soil (no preparation like digging and covering)
 - 2) Group 2: pour water on soil which is raked (not use straw to cover it)
 - 3) Group 3: pour water on soil which is raked and then cover it with straw
- Ask each group to follow up what happens to the soil after a few hours and report a conclusion in the next lesson.

Activity 3: Evaluation and Enhancement (5 minutes)

- Ask the student teachers: What have you learnt from the content of the lesson and from the experiment? In which grades can these approaches be used in primary school? Why?

3.4.3 Lesson 3 Improving soil quality

Activity 1: Class discussion on causes of soil degradation (5 minutes)

Content book 3.6

- Discussion questions:
 - 1) What are the characteristics of good soil? What are the compositions of good soil?
 - 2) What are the causes of soil degradation (think about human and environmental factors)?
 - 3) How can we improve the soil quality?
- Each group representative reports.
- The teacher trainer sticks the content of the lesson on the blackboard on a flipchart or shows it in a PowerPoint presentation.

Activity 2: Living Things Observation¹ (25 minutes)

- Different groups of student teachers measure a piece of land, size: 30 cm X 30 cm.
- In groups they observe the different parts using the Observation Form as it is put below.
- Ask them to take dry leaves out and collect any insects they may find and note their finding on the form.
- Then they dig the soil with a depth of about 4-6 cm. Observe and record if there are tree roots.
- Then they take some soil out and spread it on a sheet of newspaper.
- Ask them to look for small insects with a magnifier. They may also find other things like eggs of insects, burrows of worms, spiders, etc. Count the number of living things at each place. After checking and counting, return them into their original places.

¹ From *Building Blocks From Environmental Awareness to Action: A teachers' manual*, Centre for Environment Education India, 2003

- Ask the student teachers:
 1. Are the results in the different soil samples the same? What are the differences between the various soil samples?
 2. Did you find any evidence of plant life in the soil?
 3. Which soil sample has the least living thing?
 4. How can micro-organisms improve the soil quality?
 5. What...?

☐ **DVD 2 clip 3.4.3 Teaching activity: Video showing living things observation**

Soil Life Chart

Section 1: Plants

Site: _____

1. In the soil there are

☐ No roots ☐ few roots ☐ many roots

2. Other signs of plants

include: _____

Section 2: Animals

1. I observed ____nr____different kinds of worms (e.g. earthworms)

2. I observed ____different kinds of larvae of insects (e.g. animals with 3 pairs of jointed legs)

3. I observed ____different kinds of snails (e.g. soft bodies animals; snails have shells, slugs do not)

4. I observed ____different kinds of insects (e.g. animals with 3 pairs of jointed legs)

5. I observed ____different kinds of spiders, mites, ticks (e.g. animals with 4 pairs of legs)

6. I observed ____different kinds of animals with more than 4 pairs of legs. (e.g. centipedes, millipedes)

7. Other creatures I found are:

Activity 3: Evaluation (10 minutes)

- The student teachers fill in the table below individually.

Question	Answer
1. In which soil layer do you find most organic substance?	
2. Where in the soil do you find the most micro-organisms?	
3. How many soil types are there?	
4. How many soil compositions are there?	

3.4.4 Lesson 4 Preparing the soil for growing vegetable

Activity 1: Brainstorming Questions (5 minutes)

Content book 3.7 A

- Brainstorming question: How can we prepare soil to grow vegetable properly?
Expected answers:
 1. Plough and dry soil at least 2 weeks in order to get rid of virus or diseases before making vegetable beds.
 2. Cut the grass and break the soil.
 3. Add more compost, animal's dung and fresh fertilizers.
 4. Prepare the vegetable beds upon the seasonal cultivation.

Activity 2: Real practice on soil preparing before making vegetable beds (35 minutes)

Content book 3.7 B and C

- The teacher trainer leads the student teachers to practice in the vegetable garden.
- The student teacher will work on ridge preparation, preparing ridges with a groove in the middle, raised and deep ridges according to the steps in the content manual.

Additional content on Water Management can be found in the content book 3.8 A to E.

CHAPTER 4 TECHNIQUES OF GROWING VEGETABLE (2 LESSONS)

4.1 Background Information

Plants can be raised from seeds (e.g. tomato, cowpea, beans) or from parts of roots, tubers, bulbs, upper branches or stems. Some crops are planted using planting materials, producing seedlings first and then transplanting them. For many types of vegetables it is better to produce seedlings first than directly sowing seeds.

4.2 Objectives

At the end of this chapter the student teachers

Knowledge

- can explain how to produce seeds from their own farm, preserve seeds and how to select good seeds for growing.
- can describe how to prepare vegetable beds.

Skills

- are able to prepare the raised and common vegetable beds to produce vegetable seedlings.

Attitude

- have a positive attitude towards practicing organic gardening.

4.3 Teaching aids

Lesson 1 Seeds (Morning glory), cup, flipchart, video clip 1 “How to sow and transplant” on DVD 2 clip 4.4.1, DVD player/TV or laptop/projector.

Lesson 2 Hoe, two handles-basket, compost fertilizer, bamboo and straw.

4.4 Teaching Procedure

4.4.1 Lesson 1 Seed selection

Activity 1: Discussion and experiment on identifying good seeds (20 minutes)

Content book 4.1 A to C

- Brainstorming question: What sources of seeds do we know? (*domestic and imported*)
- Divide the class into groups of 4 or 5 students. One group lists answers on 1 question only.
- Discussion questions:
 1. What are advantages and disadvantages of domestic seeds?
 2. What are advantages and disadvantages of imported seeds?
 3. Please describe how we can produce seeds from your own garden.
 4. How can we keep good seed quality?
- The teacher trainers asks the groups one by one to present their answer and adds information if necessary.
- Which seeds are good enough to grow? How could we recognize them?

Experiment on morning glory seeds:

- Put the seeds into a glass of water. The seeds that sink are of good quality, the seeds that float are not.

Activity 2: Video clip on sowing and transplanting (20 minutes)

- Ask students to keep in mind the following questions for discussion after watching the video clip.
 - 1) How should we sow the seeds to have healthy vegetable seedlings?
 - 2) What are techniques of sowing?
 - 3) How to pull and transplant vegetable seedlings?
- ☐ Play the video “How to sow and transplant seedlings” on DVD 2 clip 4.4.1 (12 min).
- The teacher trainer and the student teachers discuss the questions together.
- The teacher trainer summarizes the main points of the lesson. (sowing, pulling and transplanting)

4.4.2 Lesson 2 How to prepare a place for producing vegetable seedlings

Activity 1: Real Practice on how to prepare vegetable seedlings nursery (40 minutes) **Content book 4.2 A and B**

- Brainstorming question: why do we have to prepare a nursery for producing vegetable seedlings? What kind of vegetable seedlings nurseries are there?
- Outdoor practice: divide the student teachers into 2 groups. Group 1 prepares a place for producing seedlings on the ground and group 2 prepare a raised seedlings platform.

Activity 2: Real practice on sowing vegetable seed (10 minutes) **Content book 4.3**

- The teacher trainer instructs on how to sow the seeds.
- Ask the student teachers to practice at prepared vegetable beds above.



Picture 6 Vegetable beds

CHAPTER 5 PLANTING PREPARATION (2 LESSONS)

5.1 Background Information

Effective planting systems provide favourable conditions for growing a variety of vegetables, which is useful for eliminating devastation by pests, diseases and weeds. It contributes to effective growth, saving money, caring time and fertilizing. Examples of planting systems are a combination of vegetable planting, circle gardening, middle row planting, crop rotation, single and alternative crop planting.

5.2 Objectives

At the end of this chapter the student teachers

Knowledge

- know how to grow crops in many different ways and how to take care of crops.
- can explain advantages of crop rotation helpful for improving nutrients in soil.
- can list factors that can effect on the growth of vegetables.

Skills

- are able to grow vegetables in different growing methods such as circle gardening, crop rotation, combination and middle row vegetable beds.

Attitude

- are interested in growing vegetables and fruit.

5.3 Teaching aids

Lesson 1 Video clip “Planting techniques” on DVD 2 clip 5.4.1, DVD player/TV or laptop/projector, vegetable seeds (Amaranth, Chinese kale, eggplant, all kinds of condiments, bunching onion and lemon grass).

Lesson 2 Nutrients cards (1 set = 3 cards) N (Nitrogen), P (Phosphorus) and K (Potassium) 2 sets for each group of students

Extra activity Name cards of different vegetables attached to bamboo stick for garden practice.

5.4 Teaching Procedure

5.4.1 Lesson 1 Planting techniques

Activity 1: Video on planting techniques (20 minutes)

- Review question: What kinds of planting techniques did we apply?
- ☐ Play the video “Planting techniques” DVD 2 clip 5.4.1 (15 min).

Activity 2: Practice growing vegetable (20 minutes)

Content book 5.2 A to E

- Divide the student teachers into 5 groups and bring them to practice different techniques in the garden. One group practises one technique.

- 1) How to grow vegetables in a circle bed
 - 2) How to grow vegetable in a middle groove bed
 - 3) How to do alternative crop planting
 - 4) How to do combined crop planting
 - 5) How to do rotation planting
- Each group has several vegetable name cards on a stick to put them in front of the prepared vegetable beds.
- During practice each group should be aware of
- the space between vegetable plants
 - sun light and location.
- These factors are important for nutrients improvement in the soil, pests control and prevention and the growth of vegetables.
- Ask each group representative to show their point of view about advantages of each growing technique. Ask the student teachers to stand in a circle to share ideas with each other.
 - Additional content related to the seasonal growing is in the content book 5.3

5.4.2 Lesson 2 Facts that improve the growth of vegetables

Activity 1: Educational game on nutrients of vegetable (20 minutes)

- Divide the student teachers into groups of 6 students.
- Ask the student teachers what they want to grow. They can choose 1 item from this list: Cabbage, Salad, Mango, Orange and Carrot.
- Tell the student teachers that all vegetables/fruit trees need nutrients to survive. They take the nutrients from the soil, but not all vegetables need the same nutrients. Vegetables (leaves) need N, all the fruit trees need P and all the tuber plants (taro) need K
- Provide 2 sets of 3 nutrient cards: N (Nitrogen), P (Phosphorus) and K (Potassium) cards to all members according to the number of students in each group.
- Ask the student teachers to spread their cards on table. The student teachers take the cards they need, following their choice of vegetables or fruit. If the cards are gone, the nutrients in the soil are gone too. What problems will happen? And what will happen when next year you want to grow exactly the same?
- The teacher trainer asks student teacher to discuss question below:
How can this problem be solved?
 1. Rotation growing: plant different kinds of crops at one of part of the garden or
 2. Combination growing: different kinds of crop that need different kinds of nutrients.
- The teacher trainer explains more: Crop rotation and combination growing is not enough to respond to the problem that soil gets more unfertile because nutrients get absorbed. Therefore we have to put compost fertilizer to add nutrients to the garden soil.

Activity 2: Group discussion on taking care of vegetable (20 minutes)

Content book 5.4, 5.5 and 5.6

- Brainstorming question: Which month is best for growing vegetables? Why?
- Group discussion questions:
 - How can we ensure seedlings grow well?
 - What are the advantages of covering vegetable beds with straw for the growth of vegetable seedling?
 - What factors have a negative impact on vegetable growth?
- Presentation and conclusion.

CHAPTER 6 PEST MANAGEMENT (3 LESSONS)

6.1 Background information

An ecosystem is a biological environment consisting of all organisms that live in a particular area which includes living and non-living things and other factors of the environment which interact with the living things such as air, soil, water and the sunlight. In a particular ecosystem, plants through photosynthesis produce nutrients. An ecosystem can change from time to time. The food chain is part of an ecosystem.

6.2 Objectives

At the end of this chapter the student teachers

Knowledge

- know four levels of organisms which are producer, pests, enemy of nature and decomposer
- can explain the cycle of life and consequences of losing animal species in an ecosystem
- can name problems which are caused by overusing chemical fertilizer in the garden
- can tell the importance of micro-organisms and know how to increase its number

Skills

- can produce natural pesticide for using in gardens

Attitude

- are motivated to preserve useful insects for crops and only use compost fertilizer for gardens

6.3 Teaching aids

Lesson 1 Plastic bags, glue, flipchart, and sheet “cycle of chemical agriculture” 1 for 1 group

Lesson 2 Statement cards (1 statement for 1 pair)

Lesson 3 Materials for producing natural pesticides, video clip “How to produce natural pesticide” on DVD 2 clip 6.4.3, DVD player/TV or laptop/projector.

6.4 Teaching Procedure

6.4.1 Lesson 1 *Ecosystem in the garden*

Activity 1: Ecosystem observation in garden (25 minutes)

- Divide the student teachers into small groups and lead them to go to the vegetable garden.
- Each group has to collect micro-organisms, as much as possible in the vegetable garden (= ecosystem) such as: plants, ill plants, insects, spiders, rats, snakes, etc.
- Go back to classroom for discussion.
- Describe the roles of the found micro-organisms in the ecosystem like in this example:
 - "This is an insect that eats leave of plant. It is not really a bad insect, unless there are too many. There are many micro-organisms that eat this insect such as spiders

- and parasites." OR "This is a spider that eats insects and is a friend of farmers. We call this a "hunter" because it moves around the garden to look for bad insects".
- Stick them on the paper. If the student teachers are not sure about the function of the organisms, they can ask the teacher trainer, or write "not sure" down on the paper.
 - Show the found micro-organisms to other groups and compare with each other.

Activity 2: Group discussion on pests (15 minutes)

Content book 6.1 A and B

- Brainstorming question: What is the purpose of the outdoor activity?
- Discussion question:
- What are pests? Which types are there?
- What are the root causes of having pests in vegetable garden?
- The teacher trainer provides copies of the sheet "chemical agriculture cycle" to the student teachers and explains the cycle.

6.4.2 Lesson 2 Ecosystem in the garden

Activity 1: Educational game on ecosystem (20 minutes)

- Brainstorming question: What are the major components of an ecosystem?
Expected answer: 1) biotic or living components (e.g. plants, animals, micro-organisms) and 2) abiotic or non-living components (chemical and physical like water, air).
- Provide a statement card to each pair of students.
- The student teachers discuss in pairs to find reasons and effects of the statement on the cards below:

Statement cards:

a) Spraying pesticide can kill all insects and spiders after those pests migrate in the vegetable garden.
b) Overuse of fertilizer on crops during hot climate.
c) Farmer uses natural pesticide 1 to 2 times per week.
d) Farmer uses only compost fertilizer in his vegetable garden.
e) The plant is resistant to all pests, so there is no pest in the vegetable garden.
f) Overuse fertilizer on crops during cloudy and rainy climate.
g) Too much watering of the plants.
h) Plants die.



- The student teachers explain their cards and the teacher trainer explains more and gives feedback.

Activity 2: Explanation on pest prevention (20 minutes)
Content book 6.2

- Brainstorming question: Which pest prevention measures are there?
- The teacher trainer explains:
 - 1) What are the growing techniques?
 - 2) What are the mechanic measures?
 - 3) What are the Bio-measures?
- The teacher trainer shows the detailed content on the 3 questions on flipchart.

6.4.3 Lesson 3 Natural pesticide

Activity 1: Practice on producing natural pesticide (40 minutes)
Content book 6.3 A and B

- Divide the student teachers into 4 groups to produce different kinds of natural pesticide.
 - Group 1:** Natural pesticide to kill fleas and worms that destroys the trunk.
 1. Ingredients: cover or leave of neem (2 kg), Rumdeng (kind of ginger) (1 kg), lemon grass (1 kg), Washing powder 1 pack.
 2. Mixing method: Mix all components above then put medium water, next soak them for 1 night. We can take 1 first of natural pesticide to mix with water in between 15-20 times for using. The waste after used we can mobilize it as compost fertilizer.
 3. Direction: Spray it on worms every morning and evening.
 - Group 2:** Natural pesticide to kill flea, crow of worm, cotton-worm, fruit-worm, shoot-worm, signature-worm and white-flies
 1. Ingredients: Ginger 0.5 kg, Garlic 1 kg, young chili 0.5 kg, Oil 10 ml, Shampoo 12 ml, Water 3 liters.
 2. Mixing method: Soak the garlic in oil for 1 night then grinds them, ginger and chili. Mix all components with water 3 liters. Add shampoo and stir them properly and finally filter it for using.
 3. Direction: Spray it on worms every morning and evening.



Picture 7 Ingredients for producing natural pesticide group 2

Group 3: Destroy disease which is caused by bacteria on leaves

1. Ingredients: Lemon grass 0.5 kg and water 2 liters.
2. Mixing method: strongly beat lemon grass then soak it for 3 to 4 hours.
3. Direction: Filter it then spray on cabbage, salad, carrot and tomatoes.

Group 4: Destroy leave-worm, pair of ears and swing-worm

1. Ingredients: Tobacco 1/4, raped chili 1/4, yam bean 1/4 first and cover of custard apple 1/4.
2. Mixing method: Grind them together then soak it with water (25x the amount of ingredients is water) and soak for 1 week before using.
3. Direction: Spray it on worms every morning and evening.

- The teacher trainer gives additional explanation on different ways of producing natural pesticide.

- ☐ If there is no opportunity to practice this then show the video showing “How to produce natural pesticide” on DVD 2 clip 6.4.3 (14 min).

6.4.4 Extra lesson: Ecosystem

Activity 1: Analysis on ecosystem (40 minutes)

- Go to vegetable garden then select 10 bunches of vegetable (for instance 10 cabbages) from the same place. Each bunch of vegetable will be used for identifying, observing and recording the result:
 - a) **Vegetable:** Measure the size. Count the number of leaves (both green and yellow).
 - b) **Insects:** Look for kinds of insects and count the number of insects from trunk to base of vegetable and check if they have eaten parts of the vegetable and where.
 - c) **Disease:** Check leaves and branch. Observe the parts of vegetable which have diseases, and count the number of ill leaves. Estimate the per cent of ill leave.
 - d) **Enemy of nature:** Count the number of each type of predator and the number of leaves with parasites. Also collect insects from its net.
 - e) **Rats:** Count the number of plants which are damaged by rats.
 - f) **Grass:** Check the types of grass and count the number of it. (high or low density)
 - g) **Water situation:** Observe and record the water situation in the vegetable bed.
 - h) **Climate:** Record the climate situation.
- Each group should report on observation results.

Observation sheet on the next page.

Observation sheet

What to observe	Information to be collected	Notes
1. Vegetable	<ul style="list-style-type: none"> - Size - Number of leaves (green and yellow) 	
2. Insects	<ul style="list-style-type: none"> - Kinds of insects - Number of insects - Plants damaged by insect 	
3. Disease	<ul style="list-style-type: none"> - Leaves and branches affected by disease - Number of ill leaves - Percentage of affected leaves 	
4. Natural Enemies	<ul style="list-style-type: none"> - Number of predators - Number of leaves with parasites 	
5. Rats	<ul style="list-style-type: none"> - Number of plants damaged by rats 	
6. Grass	<ul style="list-style-type: none"> - Types of grass/weed - High or low density 	
7. Water situation	<ul style="list-style-type: none"> - Dry or wet 	
8. Climate	<ul style="list-style-type: none"> - Season - Dry or wet - Hot or cold 	

LIST OF MULTIMEDIA FOR ORGANIC GARDENING

DVD	Chapter/lesson	Video	Source
	Chapter 1 Chemical pesticide		
DVD 1	1.4.2 Lesson 2 Negative impact of chemical pesticide	Activity 1 Toxic Trail	TV/E
DVD 1	1.4.2 Lesson 2 Negative impact of chemical pesticide	Activity 2 Role play on pesticide use	Open Institute/ VVOB
	Chapter 2 Natural fertilizer		
DVD 1	2.4.1 Lesson 1 Nutrients NPK	Activity 1 N P K demonstration	Open Institute/ VVOB
DVD 1	2.4.1 Lesson 1 Nutrients NPK	Activity 2 How to produce compost fertilizer	VVOB ImAgE
	Chapter 3 Soil preparation and management		
DVD 1	3.4.1 Lesson 1 Types of soil	Activity 2 Experiment on soil composition	Open Institute/ VVOB
DVD 2	3.4.1 Lesson 1 Types of soil	Activity 3 pH measurement	Open Institute/ VVOB
DVD 2	3.4.3 Lesson 3 Improving soil quality	Activity 2 Living things observation	Open Institute/ VVOB
	Chapter 4 Techniques of growing vegetables		
DVD 2	4.4.1 Lesson 1 Seed selection	Activity 2 How to sow and transplant	Open Institute/ VVOB
	Chapter 5 Planting preparation		
DVD 2	5.4.1 Lesson 1 Planting techniques	Activity 1 Planting techniques	Open Institute/ VVOB
	Chapter 6 Pest Management		
DVD 2	6.4.3 Lesson 3 Natural pesticide	Activity 1 How to produce natural pesticides	Open Institute/ VVOB

LIST OF PICTURES

Picture	Title	Source
Picture 1	Problem tree	VVOB SEAL 2011
Picture 2	Prohibited Agricultural Pesticides	JICA/Ministry of Agriculture
Picture 3	Preparation of Compost making	VVOB SEAL 2011
Picture 4	pH Scale	
Picture 5	Soil Demonstration	VVOB SEAL 2011
Picture 6	Vegetable bed	VVOB SEAL 2011
Picture 7	Ingredients for producing natural pesticides	VVOB SEAL 2011

LIST OF POSTERS

Lesson	Title of poster	Source
1.4.2 Lesson 2 Activity 3 Negative impact of chemical pesticide	Prohibited Agricultural Pesticides	JICA/Ministry of Agriculture
1.4.3 Extra lesson Activity 1 Negative impact of chemical pesticide	Food Chain	Wikipedia; Campbell, N.A. and Reece, J.B. (2005) Biology , 7th edition, Pearson
3.4.1 Lesson 1 Activity 3 Types of soil	pH Indicators	John C. and Keith F., 1991, Chemistry and chemical reactivity, Saunders College Publishing, 2 nd edition and Wikipedia

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<http://www.unicef.org/lifeskills>