



# ECHOES

## Integrated Cocoa Farming and Life Skills Curriculum

for Upper Primary and Secondary School Students



**USAID**  
FROM THE AMERICAN PEOPLE



**WCF**  
WORLD COCOA FOUNDATION



**WINROCK**  
INTERNATIONAL





## **ECHOES Project**

Empowering Cocoa Households with Opportunities and Education Solutions (ECHOES) is a Global Development Alliance between the United States Agency for International Development, the World Cocoa Foundation, the International Foundation for Education and Self-Help, Winrock International, and Making Cents International through Cooperative Agreement RLA-A-00-07-0045-00. ECHOES' objective is to strengthen cocoa-growing communities by expanding opportunities for youth and young adults through relevant education. ECHOES cocoa and chocolate industry partners are Fazer, ED&F Man Cocoa, The Hershey Company, Kraft Foods, Mars Inc., The Norwegian Chocolate Manufacturers Association, Olam International, Jacob's Foundation, Barry Callebaut and the Starbucks Coffee Company.

## **Curriculum development**

EcoVentures International (EVI) contributed to the development of this curriculum. EVI supports the development of sustainable enterprise opportunities through conducting market development studies, developing experiential training curricula, and supporting community enterprise development strategies, with a particular focus on youth. [www.eco-ventures.org](http://www.eco-ventures.org)

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# DEDICATION

This curriculum is dedicated to the thousands of children and youth, both students and those who are out of school, who have participated in Winrock's programs over the last four years and shown incredible enthusiasm, determination, and creativity. Their eagerness to learn and participate has been an inspiration to all Winrock staff.





# BACKGROUND

Young people in rural areas in Ghana and Côte d'Ivoire are facing a widening gap in access to quality, relevant education. While some agriculture education is included in the formal curriculum at senior secondary school, most rural youth never reach this level because schools are too expensive, inaccessible, or are not teaching lessons relevant to the lives and livelihoods of their students. As a result, some farmers do not see a benefit in sending their children to school and prefer that they help out on the farm. These circumstances create problems for rural intellectual reinvestment and threaten the future of small scale agriculture, the current source of livelihood for most cocoa farming communities.

In response, the World Cocoa Foundation and the United States Agency for International Development (USAID) joined in alliance to improve basic and vocational education in communities that base their livelihood on the production of cocoa. The collaboration resulted in the ECHOES Alliance, Empowering Cocoa Households with Opportunities and Education Solutions. The objective of the ECHOES Alliance is to strengthen cocoa-growing communities by expanding opportunities for youth and young adults through relevant education. Winrock's contribution to ECHOES focuses on the lives and livelihoods of the next generation of cocoa farmers in Ghana and Côte d'Ivoire through comprehensive vocational training and leadership development.

The ECHOES Alliance aims to mobilize government ministries; strengthen teacher capabilities; provide functional literacy training; establish and outfit community education resource centers; provide youth livelihoods education; grant family support scholarships; promote school-to-school partnerships; and increase the capacity of community groups to improve education. Winrock International addresses needs in youth livelihoods and vocational training, while the International Foundation for Education and Self-Help addresses basic education and Making Cents International provides enterprise training.

Winrock International is a non-profit organization that works with people around the world to empower the disadvantaged, increase economic opportunity, sustain natural resources and protect the environment. Created in 1985 with the merger of three institutions, Winrock offers sustainable solutions to the complex challenges people face worldwide. Integrated programs provide strategies to address problems comprehensively. With a proven record of success in more than 65 countries each year, Winrock is able to respond rapidly to changing economic, environmental and social conditions in developing countries.





# INTRODUCTION

The aim of this curriculum is to provide educators in Ghana and Côte d'Ivoire with a comprehensive manual they can use to teach students relevant information in agriculture, specifically cocoa-growing and vegetable gardening. This curriculum was designed to be child-friendly, and to include all necessary background information and resources so that community educators, whether as trained teachers or volunteers, can effectively pick up this curriculum and begin teaching their students.

The objective of this curriculum is not to force young students to become cocoa farmers; rather, it aims to provide the tools and knowledge to carry out the business of agriculture and learn entrepreneurship skills as well. It is designed to offer them training relevant to the main source of livelihood of their community so that in the future, if they choose to grow cocoa, they are able to do so in a way that reduces their labor and cost inputs, and results in quality cocoa that earns them a sustainable living wage. As a result, this curriculum not only includes agriculture methodologies, but also information on health, including HIV/AIDS, malaria and child labor prevention. These concepts are integrated into the curriculum so that as students learn how to maintain the health of their crops, they also learn how to maintain their own personal health.

This curriculum is designed to follow the cultural calendar of cocoa growing, and assumes teaching will begin in September-October, around the height of cocoa harvest. Thus, the modules are organized to start with training on harvesting methods, and continue throughout the school year, teaching one module a week, until the end of the crop cycle, which would be planting cocoa seedlings raised in a nursery. The curriculum was organized in this manner for two reasons: one, to follow the school calendar, and two, to provide additional learning opportunities for students so that they may practice on school farms and garden plots what they are learning in class. This is the essence of this curriculum, that students learn better when using their hands and while on the farm, and when possible, all class-time trainings should be followed-up on the farm.

Most modules run 30 minutes to 1 hour, and include suggestions for further learning through field trips, games, clubs, or other community events. Winrock highly suggests to future educators to include these additional learning opportunities in their lesson plans.





# CURRICULUM

Suggested Schedule

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
OCT	1 BASIC FACTS ABOUT COCOA	2 LEADERSHIP IN AGRICULTURE	3 CHILD LABOUR AND FARM SAFETY	4 HARVESTING
NOV	5 HIV/AIDS	6 MANAGING THE ECOLOGY	7 LAND SELECTION: TYPES OF SOIL	
DEC				
JAN		8 ESTABLISHING & MAINTAINING A COCOA NURSERY	9 WATER AND PLANT LIFE	10 SITE PREPARATION: LAND CLEARING AND BUSHFIRES
FEB	11 SITE PREPARATION: LINING AND PEGGING	12 MALARIA	13 SOIL IMPROVEMENT	14 INTRODUCTION TO VEGETABLE CROPS
MAR	15 SEED SELECTION AND GERMINATION	16 SETTING UP A VEGETABLE NURSERY	17 SETTING UP A VEGETABLE GARDEN	18 SEED SOWING METHODS
APR	19 PREPARING PLANTING BEDS			
MAY	20 VEGETABLE GARDEN MAINTENANCE	21 PLANTING COCOA IN THE FIELD	22 MAINTAINING A HEALTHY COCOA FARM	23 COCOA FERTILIZATION
JUN	24 COCOA PESTS	25 COCOA DISEASES	26 PESTS, DISEASES AND SPRAYING SAFETY	27 VEGETABLE GARDEN HARVESTING
JUL				
AUG				
SEP				





# MATERIALS REQUIRED

	FROM SCHOOL	FROM HOME	FROM A FARM																												
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Chalk & chalkboard	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Pencils & Paper	*				*																										
Soil samples	*									*																					
Transparent bottles	*	*								*																					
Water	*	*								*																			*		
Notebook	*									*																					
Bed nets		*													*																
Cleaning rag	*	*												*																	
Pegs/Sticks		*												*																	
Field measuring tape			*											*																	
Outlass			*											*																	
Bag or box with paper																															
Different cocoa varieties			*								*																				
Seedlings in poly bags			*																					*							
Basic local packaging material																						*								*	
Pictures of coca pests			*																								*				
Pest specimens			*																								*				
Pictures of diseased plants	*																											*			
Diseased plant parts		*	*																								*				
Knapsack		*																											*		
White paper and red dye and tape	*	*																											*		
Bowl		*														*			*												
Bag or box with paper	*						*																								
Animal droppings (for compost)		*	*													*															
Food waste (for compost)		*	*													*															
Twigs (for compost)		*	*													*															
Fertilizer		*	*													*															
Samples of cover crops			*													*															
Leguminous tree species samples			*													*															
Soil Types			*																*												
Demonstration sand box or	*		*																*												
Actual nursery bed outdoors	*		*																*												
Samples of local vegetables		*	*													*														*	
Molded or damaged seeds			*													*															
Slide			*													*															
Two containers			*																*												
Loamy soil (black soil)	*	*	*																*												





# BASIC FACTS ABOUT COCOA

## OVERVIEW

The history of cocoa in Ghana highlights the importance of the crop to the country and its people. Significant aspects of this history include the role played by missionaries and Tetteh Quashie in the dissemination of cocoa throughout the country and the establishment of Ghana Cocoa Board (COCOBOD).

### Time required

30 – 40 minutes

### Methodology

A large group discussion on the history of cocoa in Ghana

### Preparation

- Chalkboard and chalk

## GOALS

### Knowledge

- To learn about the importance of cocoa to the country, the community and the people
- To build an interest in the history of Ghana

### Skills

### Attitudes

- To gain respect for ancestors from whose work we have benefited

## CLASSROOM ACTIVITIES

### History of Ghana

1. Ask students to guess when cocoa beans first came to Ghana and from where they came.
2. Ask students to brainstorm as many products as they can that come from cocoa.
3. Ask students to guess all the areas to which the cocoa is exported (sold outside of Ghana).
4. Now share the correct information with the students, including:
  - How cocoa production began in Ghana (brief history)
  - Areas of production in Ghana
  - Where cocoa is exported to
  - What products can be obtained from cocoa
  - What benefits the community gets from cocoa production
5. After the talk, find out from the students:
  - What they have learned about cocoa production in Ghana
  - What they perceive to be the challenges/problems in cocoa cultivation in their community





## **PRACTICAL ACTIVITY**

### **Learning from a Cocoa Farmer**

Invite a successful or well known cocoa farmer from the area to share his/her experiences with the students and to generate interest in agriculture.

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## **PERFORMANCE ASSESSMENT**

### **Questions**

To assess students' performance, the facilitator can ask the following questions:

1. How important is the cocoa industry to Ghana and the community?
  2. What benefits do the district/community derive from cocoa production?
  3. How did cocoa farming start in Ghana?
  4. What are the different Ecological zones in Ghana and which areas are most suitable for cocoa production?
- 

## **BACKGROUND INFORMATION**

Cocoa was first introduced to Ghana in the early part of the 19th century. History has it that cocoa was first brought by the Dutch missionaries, but it was not until Tetteh Quashie, a native of Osu in Accra who had travelled to Fernando Po in Brazil and worked there as a blacksmith, returned with the Amelonado cocoa pod in 1879 that it began to spread. He became a prominent cocoa farmer and his farm served as the source of planting material for the surrounding areas. After 1892, commercial cocoa cultivation began and quickly spread to other parts of Ghana. Currently there are six cocoa growing areas, namely: Ashanti, Brong Ahafo, Central, Eastern, Volta and Western regions. Cocoa production has become a central part of the Ghanaian economy and relies largely on the Ghana Cocoa Board (COCOBOD). Founded by the government in the late 1940s, COCOBOD influences the price and quantity of cocoa produced throughout the country.





[http://upload.wikimedia.org/wikipedia/commons/e/e0/Cocoa\\_Pods.JPG](http://upload.wikimedia.org/wikipedia/commons/e/e0/Cocoa_Pods.JPG)



Flowering cocoa tree

### Contribution of the cocoa industry to the country

1. Supply of Raw Materials: Cocoa farming supplies the crucial raw materials to manufacturing companies in the cocoa industry.
2. Growth in National Economy: Ghana is the second largest cocoa bean producer in Africa (after Côte d'Ivoire). As a result, it exports large amounts of cocoa, generating revenue from external sources that is a vital component of the national economy.
3. Increase in Employment: The cocoa industry provides employment opportunities at several levels, ranging from buying cocoa beans from farmers to working with distributors across the country.

### Cocoa production areas

Ghana has varied vegetation zones that support cocoa production. These are:

- Rain forest
- Semi-deciduous forest
- Transitional zone

#### ***Rain forest***

The annual rainfall of the rain forest zone is generally between 1700mm and 2000mm, but can sometimes exceed this amount. Vegetation in this zone is evergreen due to the even distribution of rainfall and high temperature throughout the year. The major rainy season falls between May and June, and the minor rainy season falls around September.



### ***Semi-deciduous forest***

Semi-deciduous plants lose their foliage for a very short period of time, when old leaves fall off and new foliage growth starts. The Brazilian forests that are the origin of Ghana's cocoa plants are also semi-deciduous, which explains why cocoa grows well in Ghana.

### ***Transitional zone***

Where the forest and Savanna zones meet, the Transitional zone has characteristics of both zones.



[http://www.socwk.utah.edu/international/pic/Ghana\\_map.jpg](http://www.socwk.utah.edu/international/pic/Ghana_map.jpg)

Map of Ghana

### **Suitable cocoa growing areas (Details in cocoa cultivation guide)**

Cocoa can be successfully grown in areas with rainfall between 1100mm and 3000mm (45 and 80 inches) and areas that have heavy types of tropical rain forest. Too dry and extremely wet or swampy lands are not suitable for cocoa production. To achieve the best yields, the soil should be permeable (not rocky) and at least 1.2m deep. In Ghana, cocoa is grown in the forest areas of Ashanti, Brong Ahafo, Central, Eastern, Western and Volta regions, where rainfall is high.





# LEADERSHIP IN AGRICULTURE

## OVERVIEW

Students develop positive perceptions of careers in agriculture, and consider the characteristics and qualities they admire and seek to emulate to be leaders in agriculture. Students visualize the person they want to become, and are encouraged to set personal goals for their lives.

### Time required

30 – 40 minutes

### Methodology

A large group discussion and small group activities on the personal and professional qualities students admire and seek to emulate

### Preparation

- Chalkboard and chalk
- Paper and pencils/pens for students

## GOALS

### Knowledge

- To identify qualities of success in people involved in agriculture

### Skills

- To set personal goals for their lives

### Attitudes

- To develop positive attitudes to and perceptions of farming and agriculture

## CLASSROOM ACTIVITIES

1. Ask students to think about the different types of people and jobs involved in agriculture. These could be individual farmers, people who work for larger agricultural firms or even people who support agriculture such as extension agents, drivers, sprayers, etc. Write on the board the examples they give and any that you may want to add.
2. Divide students into small groups of 5 – 6 people each. Have students think about specific people they know or may have heard of who are involved in agriculture and whom they admire and see as successful. Ask the students to share the names of these people with their group.
3. Ask what characteristics or qualities demonstrated by the people chosen by the students. As the students to write down the characteristics or qualities as discuss them. This discussion could go on for about 10 minutes.
4. Ask students to share with the class some of the examples of characteristics of success that they discussed.
5. Get students, in their small groups, to discuss what they each want to do to become successful in agriculture.







## GOALS

### Knowledge

- To learn about child labour
- To discuss the hazardous forms of child labour

### Skills

- To follow proper safety practices when working on the farm

### Attitudes

- To respect the importance of adhering to child labour guidelines
- To respect the dangerous nature of farm work

## CLASSROOM ACTIVITIES



1. Explain to students the difference between normal household work and child labour. It is important to explain the implications of child labour on the well-being, health and schooling of a child.
2. Ask students if they can think of any activities in cocoa farming that may be hazardous to them. Divide them into small groups for this discussion and have each group share their thoughts with the class.
3. Describe the various hazardous activities in cocoa farming as they have been identified by the Republic of Ghana and explain why each of these are hazardous.



Discussing farm safety

## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What is Child Labour?
2. What is the definition of a child in Ghana?
3. How does child labour affect a child or a household?
4. What are the hazardous activities in cocoa farming?



**BACKGROUND INFORMATION**

**What is child labour?**



Many children carry out work that, far from being beneficial, impedes their growth and development and, in many cases, can do them harm. Children across the globe are being forced, either by circumstance or coercion, to undertake work that damages them psychologically and physically and deprives them of their childhood. This kind of work is carried out in violation of international core standards and national legislation and includes activities that are mentally, physically, and socially dangerous or morally harmful to children. It deprives them of schooling or requires them to assume the dual burden of schooling and work. This type of work is known as child labour.

Child labour can involve work that enslaves children, separates them from their families, and condemns them and their families to a downward spiral of poverty and deprivation. It undermines sustainable development and robs countries of one of their richest resources: human capital. It can be simply defined, therefore, as work that, by its nature or the conditions under which it is carried out, harms, abuses, and exploits the child, or deprives her or him of an education.

Not all work is considered child labour. Performing small tasks around the household or helping family around the farm, as long as it does not interfere with the development and education of a child, is not considered child labour.

**Child labour and poverty**

Child labour is both a consequence and a cause of persistent poverty. Keeping children out of school perpetuates the cycle of poverty and ignorance and maintains harmful social and cultural traditions that are factors in sustaining child labour. It is an outcome of social exclusion, discrimination, rural migration, and urbanization and has been considerably worsened by HIV/AIDS.

**Who is a child?**

According to the 1992 Constitution of the Republic of Ghana, a child is a person below the age of eighteen years.

**Impact of child labour on children**

Because children differ from adults in their physiological and psychological make-up, they are more susceptible to and more adversely affected by specific work hazards than adults. Not yet matured mentally, children are less aware of the potential risks involved in the workplace. The effects of hazardous working conditions on children's health and development can be devastating.

Dangerous work environments generally have a greater negative effect on children than adults. The impact of physically strenuous work, such as carrying heavy loads or being forced to adopt unnatural positions at work, can permanently distort or disable growing bodies. There is evidence that children are more vulnerable than adults to chemical hazards and that they have much less resistance to disease. The hazards and risks to health may also be compounded by the lack of access to health facilities and education, poor housing and sanitation, and an inadequate diet.





In addition, children are much more vulnerable than adults to physical, sexual, and emotional abuse and suffer worse psychological damage from being denigrated, humiliated, or oppressed and from working in environments that are exploitative, dangerous, and isolating.

Children who suffer ill-treatment, abuse, and neglect at the hands of their employers may, as a consequence, find it very difficult to form attachments with and have feelings for others. They may have problems interacting and cooperating with others and attaining a real sense of identity and belonging. They often lack confidence and have low self-esteem. These vulnerabilities are particularly true for the very young and girls.

Children who work do not have the opportunity to participate in activities that are a crucial part of growing up, such as playing, going to school, and socializing with their peers. They do not obtain the basic level of education that is needed to cope in life. When these activities are abandoned in favour of work, children are pushed into adulthood before they are ready.

All children, regardless of race or social and economic status, are entitled to enjoy their childhood years and to grow up fully and naturally. All have the right to love, education, and protection. Understanding these rights is the first step in preventing child labour and providing children with education so that they can look forward to a better future.

**Farm safety:  
Hazardous cocoa  
farming activities**

Safety on the farm is very important for the farmer and his/her family.

Hazardous cocoa farming activities (that may constitute child labour) include the following:

- Carting of fermented beans
- Carting of dry beans or other heavy loads
- Pod plucking (at a height or with sharp tools)
- Burning
- Mixing and loading fertilizers and other chemicals
- Application of fertilizer
- Spraying (application) of fungicide/other chemicals
- Spraying insecticides
- Land clearing
- Felling of trees
- Walking Long distances with loads (more than 4km)
- Using machetes while unsupervised
- Clearing virgin forest
- Climbing trees and manoeuvring among branches

To reduce the potential harmful effect of these dangerous activities, farmers must first know and understand the nature of the danger. Then, farmers must take steps to avoid or reduce the potential negative impact of these activities. For example, farmers can wear the proper protective gear, can avoid carrying heavy loads, and can take special care when using sharp tools. These steps will greatly reduce the chance of injury or death on the farm.





Always spray with your back against the wind



Never leave chemicals where children might touch them. Some pesticides can kill children through skin contact or inhalation.



***ILO Convention 182 Elimination of Worst Forms of Child Labour***

ILO Convention 182 defines the worst forms of child labour as the use of any individual under the age of 18 for the purposes of debt bondage, armed conflict, commercial sexual exploitation, drug trafficking, and other types of work identified as hazardous to children by ratifying members.

For the purposes of this Convention, the term "the worst forms of child labour" comprises:

- a. All forms of slavery or practices similar to slavery, such as the sale and trafficking of children, debt bondage and serfdom and forced or compulsory labour, including forced or compulsory recruitment of children for use in armed conflict;
- b. The use, procuring or offering of a child for prostitution, for the production of pornography or for pornographic performances;
- c. The use, procuring or offering of a child for illicit activities, in particular for the production and trafficking of drugs as defined in the relevant international treaties;
- d. Work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of children.

***ILO Convention 138 Concerning the minimum age for admission to employment***

Convention 138 aims to effectively abolish child labour by setting a minimum age for admission to employment or work not less than the age of completion of compulsory schooling.

According to the ILO, the minimum age for admission to any type of employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardise the health, safety or morals of young persons shall not be less than 18 years.



# HARVESTING

## OVERVIEW

When the cocoa pods are ready to be picked from the tree, farmers will engage in a process of harvesting, which includes harvesting, fermenting, drying and storage of cocoa.



Learning to ferment cocoa

### Time required

90 minutes (30 minutes for classroom discussion and 60 minutes for visit to farm)

### Methodology

A participatory group discussion on the importance of harvesting correctly and what is involved in the process

### Preparation

- Chalkboard and chalk

## GOALS

### Knowledge

- To understand proper post harvest handling of cocoa
- To learn about harvesting techniques
- To learn the methods of cocoa fermentation techniques

### Skills

- To effectively and efficiently harvest cocoa

### Attitudes

- To respect the fragility of the cocoa crop
- To recognize the importance of proper harvesting techniques



## CLASSROOM ACTIVITIES

1. Give an introduction to harvesting and different methods of fermentation.
  2. Ask the students to think about different steps involved in harvesting of cocoa.
  3. Divide the class into groups (according to the size of the class) for every step of the harvesting, fermentation and drying process.
  4. Ask the students to describe what they have learned about the harvesting, fermentation and drying methods.
- 

## PRACTICAL ACTIVITY



### Field trip

Take students to a farm to observe local farmers harvesting the cocoa crop. Students should have access to the farmers to ask questions about the harvesting, fermenting, drying and storing process for the cocoa. Encourage students to interact as much as possible with the farmers and, if possible, to participate in the harvesting activities.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. When is the best time to harvest cocoa?
  2. What will happen if pods are not harvested on time or harvested incorrectly?
  3. What are the proper ways to harvest cocoa and the proper tools to use?
  4. Why is it not advisable to break the pods with sharp objects?
  5. What considerations must be made for child labour when harvesting, fermenting and drying the cocoa crop?
- 

## BACKGROUND INFORMATION

### Harvesting

Harvesting involves removing ripe pods from the trees and opening them to extract the beans. When the pods are ripened, they change colour from green to orange-yellow or from red to orange, particularly in the furrows. A long delay in harvesting cocoa may lead to germination of the beans inside the pods. It is advisable to harvest ripe pods within 3-4 weeks of the harvesting periods (see below).

### When to harvest

The major cocoa harvesting period falls between September and October, while minor harvesting can be done around April. Only ripe pods should be harvested for quality beans. A sharp cutlass should be used to cut pods within reach while knives could be attached to long poles to cut pods that are high on the tree. Hooks can also be used for pods up on the tree. Effort must be made not to damage the tree and the beans by cutting through the pods because a new pod will never grow in its place.





## What is the proper way to harvest cocoa?

Pods are removed from the tree by various forms. A knife, a short handled cutlass or a machete is often used for the pods within reach and special harvesting knives on long poles are used for pods in branches. Care must be taken to avoid damage to the flower cushion when pods are removed as wounds will provide entry for fungi and new pods cannot grow to replace damaged ones. To avoid damaging the cushion, only cut the stalks, which connect the pod to the tree, at the centre point.

## Cocoa Fermentation: curing of cocoa

If harvested pods are kept for more than 5 days, rotting and decaying may set in. Where pod diseases are prevalent, any further delay in opening the pods may lead to loss of pods.

Even though the use of a knife is the most common means of breaking cocoa pods, it is not recommended because it can result in some damage to the beans (as high as 5% of beans can end up with a cut seed coat, which provides an entrance for moulds and pests). To avoid this, pods can be opened by cracking them on a stone or with a wooden knife.

A cocoa pod husk can be used for several purposes:

- Animal feed:
- Potash for making soap

Curing is the process by which cocoa beans are prepared for the market, which requires beans of good flavour potential and good keeping qualities. The curing process is in two parts: fermentation followed by drying. During fermentation, a mass of beans heat up as a result of a chemical reaction in the pulp.

There are four fermentation methods practised in Ghana:

- Heap method
- Basket method
- Box method
- Tray method

### ***Heap method***

Heap the beans on a mat of banana leaves and cover the heap with more banana leaves. The heap must be turned and mixed on the 2nd and 4th days. Place them on fresh leaves after mixing. For normal-sized heaps of about 4-10 baskets, fermentation is complete after 6 days. Avoid fermentation in very large heaps. Always make smaller heaps of 4 – 10 baskets instead of one large heap.





[http://www.tava.com.au/res/processing\\_07ferment\\_heap.jpg](http://www.tava.com.au/res/processing_07ferment_heap.jpg)

***Basket method***

Cover the base and sides of the basket with banana leaves and place beans inside. Cover the basket with leaves and turn every two days until fermentation is ready (after 6 days).



<http://www.card.com.vn/news/Projects/013VIE05/Cocoa%20fermentation%20manual.pdf>

### **Box method**

This method can be used when you have a lot of cocoa beans to ferment. To use box fermentation, you need three (3) wooden boxes. Each box should measure 120cm long, 105cm wide and 83cm high. Each box should also have an opening of 45cm by 70cm on the shorter side with a gate which can be pulled up to open. Make well-spaced holes at the bottom and the sides to allow liquid from the beans to flow out.



[http://www.worldcocoaoundation.org/about/documents/MGilmour\\_Fermentation.pdf](http://www.worldcocoaoundation.org/about/documents/MGilmour_Fermentation.pdf)

Fill only the top box with wet beans. The box should be full while the other two boxes are left empty. Cover the top box with banana leaves and put pieces of wood on them. Allow the beans to ferment for 2 days. After 2 days, remove the banana leaves and open the gate of the box. Then use a wooden spade to move the beans into the next box. After filling the second box, cover it with banana leaves and allow the beans to ferment for another 2 days. After 2 days, open the gate and move the beans from the second box into the third box. Cover and allow the beans to ferment for another 2 days. As you move the beans from one box to another, you are mixing or turning. In all, the cocoa beans should ferment for 6 days. After 6 days, remove the beans and dry them on a raised mat.

### **Tray method**

For tray fermentation, gather trays with raffia mats at the bottom and two wooden boards. Each tray should be 122cm long, 91cm wide and 10cm high.

To set up a tray fermentation system, place the two wooden planks 91cm apart on the ground under a shed and place the wooden boards on top of the planks.

The first empty tray is placed on the wooden boards. The tray is not filled with beans at this time. This allows air into the other trays with beans. The second tray is placed on top of the empty tray and then filled with cocoa beans. Another tray is placed on top of the second one and filled with beans. The process is continued until there are about 12 trays. The 12 trays can take about one tonne of fresh cocoa beans. Cover the beans in the top tray with banana leaves and put pieces of wood on them to hold the leaves in place. If there are more beans, do the same as before on another stack of trays. Do not turn or mix the beans. The cocoa will be well fermented by the 5th day. After 5 days, collect the beans from the trays for drying.



[http://4.bp.blogspot.com/\\_adpuWzsO3QA/SV6S-nmlv9I/AAAAAAAAAsY/BuSaHQcbae4/s1600-h/Drying+Pods.JPG](http://4.bp.blogspot.com/_adpuWzsO3QA/SV6S-nmlv9I/AAAAAAAAAsY/BuSaHQcbae4/s1600-h/Drying+Pods.JPG)

**Drying and Storage**

Dry the beans daily in the sun on a raised mat or platforms (do not dry them on the floor or on cement, which can be toxic). Remove defective beans, such as flat beans, germinated beans and damaged beans. Remove the leftover pulp. Store dry beans in baskets, boxes or jute sacks that are raised from the ground.



# HIV/AIDS

## OVERVIEW

HIV/AIDS is a serious illness that cannot be cured. Once infected with HIV, a person's body is progressively weakened by the virus until it cannot fight disease any longer. HIV becomes AIDS when the immune system is seriously damaged. A person infected with HIV can appear or look healthy for many years before they may become ill.

HIV/AIDS has a substantial impact on the health of the individual who is infected as well as on the family members, who often become caretakers. HIV/AIDS also has implications for productive work on cocoa farms. A sick person may be unable to work on his or her farm, do less work or work more slowly.

### Time required

60 minutes (30 minutes for classroom discussion and 30 minutes for a game)

### Methodology

Quiz on facts and myths about HIV AIDS, either as a large class activity or in smaller student groups

Activity to allow students to understand the basics of how the HIV virus works in the human body

### Preparation

- Chalkboard and chalk
- Any bag or box with pieces of paper in it each describing a myth or fact (Each paper can contain one of the lines from the two 'Facts and Myths' sections below. **Do not write whether the statement is a fact or a myth.**)

## GOALS

### Knowledge

- To learn basic information about HIV/AIDS
- To gain an understanding of the importance of practices in maintaining their own health and avoiding HIV/AIDS
- To learn about how HIV/AIDS is transmitted from one person to another, the symptoms and prevention methods
- To discuss facts and to dispel any myths that students might have about HIV/AIDS

### Skills

- To take steps to prevent the transmission of HIV/AIDS

### Attitudes

- To recognize the seriousness of HIV/AIDS and the need to stop the spread of the virus





## CLASSROOM ACTIVITIES

1. Introduce the students to HIV/AIDS and the importance of learning about the virus.
2. Put all the pieces of papers containing different facts and myths about HIV and AIDS in a large bag or box.
3. Ask students to draw out a piece of paper from the bag or box and discuss whether they believe the information to be a fact or a myth.
4. Provide students with the correct answer and provide some more background information if applicable.

### ***Variations***

The facilitator could do this activity as a large class exercise with one student at a time drawing a piece of paper, reading the question to the class and the whole class discussing and then voting on whether the information is a FACT or a MYTH. The facilitator could have the two headings (FACT and MYTH) on the blackboard and write the correct point under each heading. Another variation could be to have the students write down on a piece of paper information on which they have a question to determine whether it is fact or a myth. This will help the students feel like their questions or concerns are being addressed.

Alternatively, the facilitator could divide the class into small groups of 4 – 6 students each and give each group a set of the same papers with a fact or myth written on each. As a part of their small group, students could decide on whether the statement is a fact or a myth. Then, the teacher can ask each group whether they believe a particular point to be fact or fiction. This will give the students more time to reflect on and discuss each point. If there is only limited time, the facilitator could write the correct answer on the back of the papers and ask each student to take turns to ask the rest of the group the question and then, after some discussion, give them the correct answer.

## PRACTICAL ACTIVITY:

### **The elephants and lions game**

Life Skills Manual.  
Peace Corps, 2001, page 65  
Used with permission.

The Elephants and Lions Game can be used to reinforce the learnings from this section. Be sure to substitute animal names more appropriate for your community.

The game is played like this:

1. Ask for one volunteer. Have the volunteer stand in the front of the room. This person is the baby elephant.
2. Ask for six more volunteers. These volunteers are the adult elephants. Their job is to protect the baby elephant. They should form a circle and join hands around the baby elephant. To show them the importance of their job, the facilitator should try to hit the baby elephant—you will find that the adult elephants quickly get the point and close ranks to avoid attack. The adult elephants should stand very close to the baby elephant.





3. Now, ask for four or five more volunteers. These people are the lions. Their job will be to attack the baby elephant—they should try to jab, hit, kick, punch—whatever they can do to hurt the baby elephant (the teacher should emphasize that the students should not seek to seriously hurt each other and should remain kind and respectful).
4. When the facilitator says, “Go!” the lions should try to attack the baby elephant. Let this go on for a few seconds—until the baby elephant has at least one contact from the lions—but the baby elephant should not be hurt.
5. Now ask the following questions (the volunteers should stay where they are):
  - What is the baby elephant? What does the baby elephant represent?
  - Answer: The baby elephant is the human body.
  - What are the adult elephants?
  - Answer: The adult elephants are the immune system. Their job is to protect the body from invading diseases.
  - So, what are the lions?

There may be a few people who say that the lions are HIV. That is not so. Ask another person to try to tell you the meaning of the lions.

- Answer: The lions stand for the diseases, illnesses and infections that attack a person’s body.
6. The facilitator now very dramatically goes to each of the lion volunteers—one by one. Say, “These diseases, such as tuberculosis (touch the first volunteer), malaria (touch the next person), diarrhoea, and cholera (touch another person) may attack the human body but are they able to kill the human body?” The answer should be “no.” The human body gets attacked by diseases and germs every day, but the immune system (point to the adult elephants) manages to fight them off and protect the body. The human body might get sick (such as the hit or kick that the baby elephant suffered), but it does not die, because the immune system is strong.
    - The facilitator continues: “But suppose I am HIV. I come to this body (the baby elephant), and I attack and kill the immune system.” At this point, the facilitator should touch all but two of the adult elephant volunteers and ask them to sit down. Touch each person as you remove them, acting as if HIV is killing the immune system.
    - The facilitator continues: “Now, will the baby elephant be protected? Will the human body be safe with the immune system gone?”
    - Next, the facilitator should again tell the lions to attack (touch only) on the word “Go!” The lions are able to easily get to the baby elephant this time.





7. Summarize the idea that HIV has killed the immune system. This lack of an immune system makes it possible for diseases like tuberculosis, diarrhoea, and so forth, to actually kill the person, rather than just make the person sick.
8. To be sure people have understood, you can ask: “Does HIV kill the person?” They should say, “No— The diseases killed the person.”

## PERFORMANCE ASSESSMENT

### Questions

To assess students’ performance, the facilitator can ask the following questions:

1. What is HIV/AIDS?
2. How is HIV/AIDS transmitted?
3. What are myths and facts of HIV/AIDS?
4. What are the symptoms of an HIV-infected person?
5. How can you avoid getting HIV/AIDS?

## BACKGROUND INFORMATION

### Why do we learn about HIV AIDS?

Good health is important for many reasons, including allowing farmers to work productively on their cocoa farms. A sick person will be unable to work on his farm, will do less work or work more slowly. HIV/AIDS can cause long-term sickness and a painful death.

### Definitions

**HIV** – Human Immunodeficiency Virus

**HIV positive** – A blood test result showing that a person has contracted HIV. This does not mean that they will necessarily get AIDS from the HIV.

**HIV Negative** – A blood test result showing that a person has not contracted HIV. They still need to be very careful not to contract HIV as they could still do so in the future.

**AIDS** – Acquired Immune Deficiency Syndrome

**AIDS positive** – A blood test result showing the HIV has become AIDS. This does not mean that they will necessarily die from the AIDS but they will get very ill.

**AIDS negative** – A blood test result showing that the HIV has not developed into AIDS. It could still develop into AIDS in the future.

**What is HIV/AIDS?** – HIV/AIDS is a serious illness that cannot be cured. We need to be very careful not to contract HIV as HIV can result in AIDS, which is a deadly disease. Once infected with HIV, a person’s body grows progressively weaker until it cannot fight the disease any longer. HIV becomes AIDS when the immune system is seriously damaged. A person infected with HIV can appear or look healthy for many years before becoming ill or might never become ill with AIDS.

### Facts & myths on how you can get HIV

#### FACTS

1. FACT: Africa has been more affected by AIDS than any other part of the world.
2. FACT: Although many people do not have access to expensive drugs to treat AIDS, there are medicines that can slow down disease progression.
3. FACT: UNAIDS estimates that over 300,000 people in Ghana are HIV positive.





4. FACT: Although treatments exist that can slow down disease progression, there is still no cure for AIDS.
5. FACT: Although HIV transmission is a risk for everyone, women and girls are often more vulnerable to HIV infection than men and boys. Women are at greater risk for biological reasons and because of social roles or cultural practices. Partners that travel to big cities are at a higher risk than those who stay in the village because they have a higher chance of having had sexual intercourse with an infected partner.
6. FACT: the only way to tell if you have HIV is through a blood test.

### **MYTHS**

1. MYTH: AIDS is a disease that mostly affects people of a particular skin colour. (Fact: AIDS is equally likely to infect people of any skin colour.)
2. MYTH: Since everyone dies of AIDS, it is better not to know if you have it. (Fact: Not everyone dies of HIV/AIDS. It is better to know you have HIV/AIDS as there are medicines that can help you to survive better with the disease.)
3. MYTH: You can be cured of AIDS by having sex with a virgin. (Fact: There is no cure for HIV AIDS. Only medicines can help you to survive better with the disease.)
4. MYTH: People in the United States have access to medicines that can cure them of AIDS. (Fact: No one in the world has access to medicines that can cure HIV AIDS. There are medicines that can make it easier to live with HIV AIDS.)
5. MYTH: No one has AIDS in Ghana. (Fact: Over 300,000 people have AIDS in Ghana.)
6. MYTH: Traditional healers or religious leaders in Ghana have cures for AIDS. (Fact: No one has a cure for AIDS. Only medicines can help with the symptoms of the disease, but not prevent or cure the disease.)
7. MYTH: AIDS is disease of immoral people such as prostitutes. (Fact: Anyone can get AIDS if exposed to infected blood or having unprotected sex. The disease does not only affect immoral people.)
8. MYTH: It has been proven that HIV does not cause AIDS. (Fact: The HIV virus causes AIDS, although not everyone who has HIV gets AIDS.)
9. MYTH: If you get HIV (your blood test shows that you are HIV positive) then you will die from AIDS. (Fact: Not everyone who has HIV then gets AIDS from the HIV. Not everyone who has AIDS dies from it, although many do.)
10. MYTH: If you do not currently have HIV (your blood test shows that you are HIV negative) then you will never get HIV in the future. (Fact: Even if you do not have HIV now, you need to be very careful not to contract it in the future.)
11. MYTH: If you do not currently have AIDS (your blood test results show that you are HIV negative) then you will never get AIDS. (Fact: HIV can become AIDS at any stage, even if your blood test result shows that you do not have AIDS now. It is important to continue having blood tests to check for this so that you can treat the AIDS symptoms if you contract AIDS.)
12. MYTH: if you wash immediately after sexual intercourse you can wash the AIDS off (Fact: HIV/AIDS cannot be washed off after sexual intercourse. You must use a condom if you want to be protected from HIV/AIDS during sexual intercourse.)
13. MYTH: AIDS comes from Cote d'Ivoire (Fact: Nobody knows for sure where HIV/AIDS originated).





## How do you contract HIV?

The most common ways to become infected with HIV are:

- Having unprotected sexual intercourse with somebody who has HIV (Unprotected sexual intercourse means having intercourse without using a condom. Occasionally, the condom can break or fall off, which would also mean that the people are unprotected.)
- Having contact with infected blood in situations such as:
  - Using the same syringe that an infected person used
  - Receiving a blood transfusion with infected blood
  - Re-using sharp objects that have pierced the skin of an infected person (such as at the hairdresser, during circumcision or when receiving a tattoo)
  - Receiving HIV from a mother – if a mother has HIV, there is a risk of transferring the virus to her child during pregnancy, delivery and breast-feeding

## What is safe?

You cannot get HIV through any of the following:

- Sharing the same bed with an infected person
- Eating from the same dish as an infected person
- Using the same latrines as an infected person
- Shaking hands with, hugging or kissing the cheek of an infected person
- Caring for a sick person
- Being near an infected person who is coughing or sneezing
- Carrying a sick person on one's back or arms
- Wearing clean clothes that have been worn by a person living with HIV/AIDS
- Receiving bites from mosquito or from flies (Fact: You cannot get HIV by receiving mosquito bites or from flies.)
- Eating food bought from the market
- Eating bush meat

## Symptoms of HIV

The progression of HIV/AIDS varies widely among individuals. Many people do not develop symptoms immediately after getting infected with HIV. Some people have a flu-like illness within several days to weeks after exposure to the virus. They complain of fever, headache, tiredness, and enlarged lymph glands in the neck.

After initial infection, you may have no symptoms. This state may last from a few months to more than 10 years. It is important to understand that HIV can be spread at this time, even if no symptoms show. During this period, the virus may continue to multiply actively and infect and kill the cells of the immune system (Normally, the immune system allows us to fight against the bacteria, viruses, and other infectious diseases).

The HIV/AIDS virus destroys the cells that are the primary infection fighters. Once the immune system weakens, a person infected with HIV can develop the following symptoms:

- Lack of energy
- Weight loss
- Frequent fevers and sweats
- Persistent or frequent yeast infections
- Persistent skin rashes or flaky skin
- Short-term memory loss
- Mouth, genital, or anal sores from infections





## Symptoms of AIDS

AIDS is the most advanced stage of HIV infection. Infections such as those caused by bacteria, viruses, fungi, parasites and other organisms are common in people with AIDS and nearly every organ system is affected. Many people do not think that people in their community die of AIDS because they believe that their deaths are as a result of a different virus (e.g. malaria or any other infection they are used to seeing). In fact, that person may have died of malaria, but it was because they had HIV/AIDS that the malaria was able to kill them.





# MANAGING THE ECOLOGY

## OVERVIEW

Farming and other agricultural practices can lead to poor soil quality and forest degradation. Sound practices in agriculture are crucial for their long-lasting impact on soil, water availability, trees, rainfall, and other natural processes. It is therefore important to follow ecologically-sound practices in agriculture to ensure sustainable production now and for future generations. Basic ecological management practices can help protect the soil from erosion, improve soil fertility, and prevent loss of forest cover and biodiversity.

**Time required**

60 minutes (30 minutes in the field and 30 minutes in the classroom)

**Methodology**

A field trip to view the consequences of erosion and a classroom discussion on ways to reduce ecological damage

**Preparation**

- Chalkboard and chalk

## GOALS

**Knowledge**

- To understand the ecosystem and certain practices that can damage it (e.g. cause soil erosion) or practices that help preserve it (e.g. soil maintenance practices, biodiversity conservation for sustainable cocoa production)

**Skills**

- To effectively manage the environmental and ecological impact of a cocoa farm

**Attitudes**

- To recognize the potential of a cocoa farm to negatively impact the environment and to respect the importance of managing the local ecology

## PRACTICAL ACTIVITY



**Field Trip**

Take the students outside the classroom to a place in the community that is suffering serious erosion problems. If there is no example location within a short walk, refer to a commonly-known place with an erosion problem.

## CLASSROOM ACTIVITIES

1. Ask the students what they think has happened and what consequences for crop production may arise if no action is taken to address the erosion.
2. Explain what soil erosion is and what effects it might have. Ask the students to suggest ways to stop soil erosion on the farm.





3. Discuss the different basic erosion control methods with students.
4. Summarize the topic and ask the students questions to assess whether they have understood the topic.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What is soil erosion?
2. What are the factors affecting soil erosion?
3. What are the different types of soil erosion (make reference to those within the community)?
4. What are the effects of soil erosion on cocoa production/garden crop production?
5. In what ways can we control soil erosion, especially on the farm?

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## BACKGROUND INFORMATION

### Soil erosion

Soil erosion is defined as the washing away of soil by a flow of water, wind, moving ice or people's activities. The removal can be harmful at times when the natural soil-forming processes are not able to replace the lost soil. Water and wind erosion are the main agents of erosion in Ghana.

### Effects of soil erosion

#### ***Loss of soil***

Soil erosion leads to soil loss because, once the soil is eroded and deposited into dam, lake, or other area, it cannot be returned to the field from where it was removed.

#### ***Loss of nutrients***

Soil erosion removes soil nutrients from soils. It also removes organic matter, which lowers soil fertility. The ability of eroded soils to provide nutrients and water to plants decreases, resulting in poor plant growth and lower yields.

#### ***Siltation of dams, lakes and other bodies of water***

Eroded soil causes silt (small particles between sand and clay in size) to be deposited in dams, lakes, and other bodies of water, which reduces the amount of water in these bodies. This then can lead to a shortage of water for domestic and irrigation purposes. Siltation also causes flooding, as excess water flows out of rivers after heavy rainfall.

#### ***High cost of crop production***

Eroded soil requires the addition of large amounts of organic matter and chemical fertilizers to replace the top soil and enable good crop growth. This result in high production costs.





### ***Desertification***

Soil erosion can turn forest lands into grassland, which may later become deserts. Agricultural activities cannot be carried out in such places because the environment is too dry and the land infertile.

### ***Destruction of pasture***

Soil erosion can strip natural pastures bare, making it difficult for animals to find food to eat.

## **Factors that lead to soil erosion**

### **Factors affecting soil erosion include:**

- Rainfall
- Topography
- Vegetative cover
- Human activities

### ***Rainfall***

Heavy rain drops remove more soil particles than light rain drops because heavy rain drops put a greater force on the soil than light rainfall. The longer the period of rainfall is, the more severe the soil erosion will be.

### ***Topography***

Topography is the shape of the surface of land. It determines the shape of the land – whether it is flat or steep. Water runs faster on steep slopes than on gentle slopes. Steep slopes therefore experience greater soil erosion than gentle slopes, where the water moves more slowly and erodes less soil. The greater the speed of running water, the greater the force with which it removes soil particles.

### ***Vegetative cover***

Bare soil surfaces experience higher rate of erosion than those with vegetative cover. This is because the plants growing on the soil bind the soil particles together with their roots, thereby preventing them from being removed by water. Roots act as fingers of a hand that can hold soil in place. The leaves of plants also prevent rain drops from hitting the surface of the soil directly, which reduces the impact of the rain on the soil.

### ***Human activities***

Certain human activities also cause soil erosion (e.g. clearing of forests, tillage (loosening the soil), bush burning, farming on hills along the slope, sand winning, surface mining, sweeping school compounds, and over-grazing). These activities expose the soil to direct contact with wind and water, which eventually results in erosion.

## **Soil erosion control**

The aim of any soil erosion control method is to:

- Reclaim already eroded land
- Improve the soil and keep it fertile and productive
- Maintain and increase crop yields
- Use rainwater properly
- Protect against the advancement of the Sahara desert





Soil erosion can be controlled by:

- Terracing
- Contour planting
- Strip cropping
- Cover cropping

### ***Terracing***

Terraces are a series of man-made slopes that are shorter and less steep than the original slope. Terraces slow down runoff and prevent water erosion. This technique has a number of advantages:

- It reduces the length of the slope and the amount and speed of run-off.
- It increases water infiltration (amount of water that enters the soil), reducing run-off.
- It discharges excessive run-off water slowly off the cultivated field without any serious soil erosion.
- It makes it possible to cultivate crops on steep slopes.



[http://4.bp.blogspot.com/\\_zzB\\_LTb\\_7gQ/RIFz75KteD/AAAAAAAAAB8K/cejcs5Uu\\_tc/s320/terracing.gif](http://4.bp.blogspot.com/_zzB_LTb_7gQ/RIFz75KteD/AAAAAAAAAB8K/cejcs5Uu_tc/s320/terracing.gif)

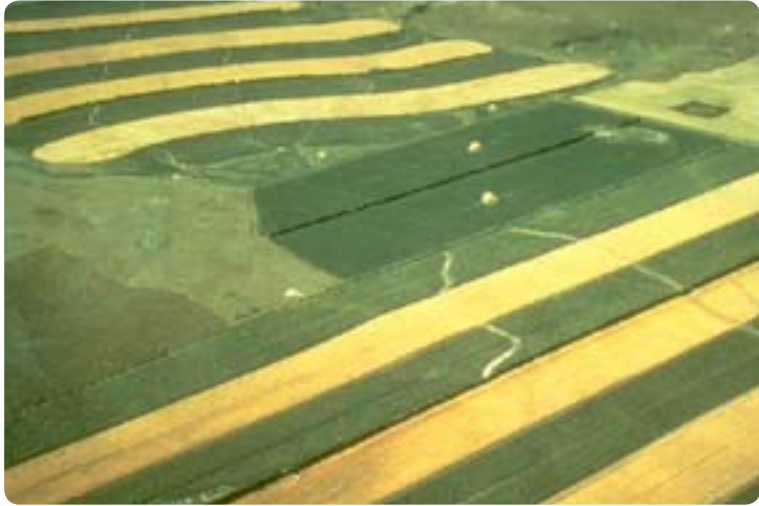
### ***Contour planting***

In contour farming, all activities (ploughing, hoeing, sowing, etc) should be done across (rather than up and down) the slope. This will reduce run-off, increase infiltration and reduce erosion.

### ***Strip cropping***

Strip cropping is a farming practice that involves planting various crops in rows and strips across the slope, reducing the speed of water run-off and limiting erosion. Alternate strips of grass, legumes, grains and root crops can also be used.





[http://www.weru.ksu.edu/new\\_weru/multimedia/control/big/lmg0013.jpg](http://www.weru.ksu.edu/new_weru/multimedia/control/big/lmg0013.jpg)

***Cover cropping***

Cover-cropping involves the planting of special crops or plants that grow to cover the soil surface and prevent the soil from direct impact of raindrops. Examples of good leguminous cover crops are: cowpea, groundnuts, and centrosema. In addition, trees can serve as cover for special crops and plants by preventing erosion and adding value to the quality of the soil.

***Other potential methods***

Maintaining good vegetative cover, preventing over-grazing, planting trees, mulching and cover cropping all help to prevent erosion.



# LAND SELECTION: TYPES OF SOIL

## OVERVIEW

In cocoa farming, the chosen method of land preparation can have an effect on the soil quality and, therefore, crop yield. Farmers should understand the nature of these effects and, as a result, the appropriate method and timing for preparing the field for cocoa production. Farmers can conduct simple soil tests that demonstrate the differences in soils and soil composition.

### Time required

60 minutes (30 minutes in the classroom and 30 minutes for a practical activity)

### Methodology

Classroom discussion and field trip to conduct soil tests to explore soil testing and preparation methods

### Preparation

- Chalk and chalkboard
- Soil samples from 3 different locations
- Transparent bottles
- Water
- Notebook

## GOALS

### Knowledge

- To learn about land preparation methods and different soil types

### Skills

- To test for different soil types

### Attitudes

- To gain an appreciation for the importance of adequate soil testing and land preparation

## CLASSROOM ACTIVITIES

1. Ask students what role soil plays and why it is important.
2. Explain why the type of soil and its maintenance is an important factor for a farmer to consider.
3. Explain the process of clearing the farm of weeds/bush. In the case of cocoa, explain why large and unimportant trees should be removed. Mention those that can stay and why.
4. Explain the rationale for not burning the debris when the land is cleared (except when there is too much of it that it may hinder other operations on the field). Explain that the heat not only burns the weeds but destroy beneficial organism in the soil.





5. Assist students to carry out the simple soil test (referred to above) to differentiate between the various soil types and also understand the soil composition (see background information).
6. Accompany students to the garden to help them identify the different types of soils, organic matter and soil organisms.
7. After the visit, ask the students to mention or write down what they observed as the major differences between the soil types. This will help students understand why they should not burn the farm to destroy the soil structure, organisms etc.
8. Explain to students that children under 18 (according to the 1992 constitution) should not engage in certain activities unless other adults are present to supervise them, as doing so could negatively affect their health. (Ask them to mention some of the activities they are not allowed to do: chopping wood, spraying chemical, burning, etc.)
9. Discuss important aspects of the topic and summarize the important points.

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## **PRACTICAL ACTIVITY**

### **Simple soil test**

To demonstrate that soil contains different particles and organic matter:

1. Bring soil samples from three different parts of your school compound or garden.
2. Fill three transparent bottles or measuring cylinders (one bottle for each of the soils samples) with soil to about half-way.
3. Fill the remainder of each bottle with water and block the end of each bottle with your palm.
4. Shake each bottle vigorously and allow it to stand for about 15 minutes.
5. Look carefully at the top of the water and sides of the bottle or measuring cylinders.
6. Record your observations in your notebook (the observations should be that no matter what the soil source, the humus will settle at the top, followed by fine soil, silt, gravel, and then heavier rocks/stones resting on the bottom). Considering that the top layer would be most desirable for cocoa farming, students should be able to recognize which source of soil would be best for their farm.

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## **PERFORMANCE ASSESSMENT**

### **Questions**

To assess students' performance, the facilitator can ask the following questions:

1. What is soil? Why is the soil important in crop production?
2. What are the different types of soils and how can they be identified? What soil is best for cocoa?





**BACKGROUND INFORMATION**

**What is soil?**

The soil is the thin layer of material on the earth’s surface in which plants have their roots. It is made up mainly of five things: mineral particles, organic matter, living organisms, soil water, and soil air. Soil is formed over a long period of time, during which these components constantly interact.

**Why is soil important?**

Soil is important as it plays a vital role in anchoring plants so that they are able to grow tall and not blow over or away. Soil is also very important in providing nutrients and water that nourish the plants.

All soil has some amount of sand, silt and clay. The proportion of the various particles (i.e. sand, silt, clay) present in a soil sample is called soil texture. The soil texture helps us to identify types of soil.

**Sandy soil**

Sandy soil contains more sand than silt and clay. Sandy soil has loosely packed particles and large pore spaces between the particles. This allows air and water to pass through very easily and also enhances root penetration. However, sandy soil cannot hold water for a long time and often dries up very quickly.

**Silt/loamy soil**

Silt/loamy soil has an average proportion of sand, silt and clay, and often includes more organic matter. It is well aerated, holds enough water for the use of plants and is easily penetrable by roots. This soil forms clods when dry but can easily be broken into a fine tilt (texture). Silt/loamy soil is good for cocoa farming.

**Clayey soils**

Clayey soil contains more clay than sand and silt. It drains very slowly, holds a lot of water and is not easily penetrable by roots. In this soil, plants may suffer from waterlog conditions in the rainy season.





# ESTABLISHING AND MAINTAINING A COCOA NURSERY

## OVERVIEW

The nursery is a portion of land set aside to raise seedlings or young plants before they are planted in the field. Farmers can either buy seedlings from a commercial nursery or build their own private nursery to raise their own cocoa seedlings before planting on the field.

Many cocoa farmers use their own seeds or seeds sourced from unapproved sources. Most of them also do not know the varieties that they plant and do not pay attention to the amount of seed they sow. Acquiring hybrid cocoa seeds/seedlings from a certified source has multiple advantages to getting seeds from other sources.



Yaletia Tayou Tolbert with a healthy cocoa nursery.

### Time required

30 minutes

### Methodology

A group discussion on the importance of a nursery and factors to consider in establishing a nursery

### Preparation

- Chalkboard and chalk
- Different cocoa varieties

**Tip!** Can be supplemented with a trip to the school farm or nursery (or a local farmer's nursery)

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## GOALS

### Knowledge

- To learn about setting up a cocoa nursery
- To learn about nursery management practices
- To recognize tools and materials necessary for a nursery
- To learn about different cocoa varieties and the advantage of the hybrid cocoa type over the other types

### Skills

- To set up a successful private nursery

### Attitudes

- To recognize the importance of nurseries to the cocoa farming industry
- 

## CLASSROOM ACTIVITIES

1. Discuss with students the reasons and methods for establishing a nursery.
2. Ask the students the questions listed below to see if they know the purpose of a nursery. Next, ask them the different factors that they need to consider when establishing a nursery.
3. Ask students to mention the types of cocoa varieties they know and from where they can be obtained.
4. Explain to students that there are 3 different varieties of cocoa (if possible get the types available in the area and the hybrid to show them).
5. Ask why students think it is good or bad to plant the local or hybrid cocoa.
6. Ask if they know anybody in the community who is planting the hybrid and what differences they have seen with that person's and other people's cocoa trees.



Two month old cocoa in the nursery

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Why do farmers grow seedlings in a nursery first?
2. What are the factors that one needs to consider when establishing a nursery?



3. What are the materials necessary to start up a nursery?
4. What are the activities done to maintain a nursery?
5. What are the different types of cocoa trees farmers can grow?
6. From where can the different cocoa varieties be obtained?
7. What are the advantages and disadvantages of planting the local (Tetteh Quashie) or the hybrid cocoa tree?

## BACKGROUND INFORMATION

### Establishing a cocoa nursery

The nursery is a portion of land set aside to raise seedlings or young plants before they are planted on the field. Cocoa seeds will have a greater likelihood of successfully reaching the seedling and then the plant stage when raised in a nursery. This is because a farmer can take better care of the seeds and seedlings while they are in the nursery. There are several factors to consider when deciding on the suitability of a place to establish a nursery.

#### Site

The site selected should be flat, preferably near a permanent source of water and not too far from the proposed farm. Avoid marshy areas, as they may encourage disease at the nursery stage.

#### Soil

Black Loamy soil (top soil) is preferred for filling polythene bags. Coarse, sandy and clayey soils should not be used. Sandy soil drains too quickly and clayey soils are too heavy for root penetration. Use only recommended polythene bags. Do not use water sachet bags as they are too small to support cocoa's root systems.

#### Soil treatment

The soil for the nursery should be treated to destroy pathogens (fungi, nematodes, etc.) and weed seeds in order to have healthy seedlings. Soil treatment can be done chemically with Furadan (see recommendation) or manually by burning debris on the soil before putting it in bags or pouring large quantities of hot water over the soil.



<http://en.wikipedia.org/wiki/File:Lehmgrube.jpg>



### Slope

Areas with a gentle slope or no slope are preferable and areas with a steep slope should be avoided. If the only land available for the nursery is steep, contours or stone bonds can be made to reduce the effects of erosion. Poly bags should also be arranged across the slope.

### Water source

It is always advisable to have the nursery close to a permanent water source so that there will be water for watering the young plants (even during the dry season).



Creating a water source for gardening



An improvised water source

### Shading

Young cocoa seedlings should be protected from direct sunlight. Erect a temporary shade (appata) using palm fronds or any similar material that is available. Use fencing poles to create a framework around the area of your nursery. The shade structure should be about as high as a man and big enough to completely shade all of the soil. Enough palm fronds should cover the top to make the shade dense. Palm fronds should also be added on the east and west walls of the nursery to protect the seedlings from the rising and setting sun.



Creating a shade structure for the cocoa nursery

### Cocoa varieties

The most important input in any cropping system is the planting material. Good planting material gives high yields of good quality beans. Cocoa is commonly propagated by seeds but, before selecting a seed variety to plant, there is the need to consider certain desirable characteristics, which includes the following: Vegetative vigour, early maturity, high yield, good bean weight with good shell and fat content, resistance or tolerance to pests and diseases, adaptation to withstand specific local conditions (dry season, flooding, strong winds or acid soils).

Presently there are about three different varieties of cocoa that farmers grow in Ghana and these are:

1. The Amelonado (Tetteh Quashie)
2. The Amazonia
3. The hybrid (Akokora bedi) – a cross between the Amazonia and the Amelonado

#### **Amelonado**

This variety takes a longer time to reach maturity and is highly susceptible to the swollen shoot virus. It also has a lower yield than the hybrid.

#### **Amazonia**

In comparison to Amelonado, the Amazonia has better growth vigour and can be established easily but may suffer greater losses due to Pod Rot – a disease caused by fungi (Phytophthora sp).

#### **Hybrids**

Hybrids are easy to establish, mature early, have a high yield, and are more resistant to disease and pests.



Always use hybrid disease resistant cocoa for planting material

### Using hybrid cocoa seeds/seedlings

Hybrid/improved planting material can be obtained from any seed garden of COCOBOD throughout the country. For farms near the Sefwi Wiawso area, they can be obtained from Boako and Bonsu Nkwanta. The purpose of these seed gardens is to produce a quantity of seeds of known parentage and proven performance to be supplied to farmers.

### How can a farmer obtain some of the seedlings?

To obtain seedlings, you must first check the number of seedlings you need for your farm and then make an order. This can be determined from the size of your cocoa plot or how many trees need to be replaced. (Information on sale of hybrid seedlings and pods can be obtained from the COCOBOD office or SPU –Seed Production Unit).



### Nursing of cocoa seedlings in polythene bags

Use poly bags measuring 18 cm wide and 25 cm high. Fill the bags with top soil that has been treated. Care must be taken not to fill the bags to the brim, otherwise there will be runoff from the top any time the bags are watered. Arrange the bags in rows 3-5 wide, leaving paths of about 45-60cm between the rows to make watering easy and to ensure healthy growth. Water the soil in the bags and allow it to settle before planting the seed.



Creating rows for cocoa nursery bags



### Seed extraction, treatment and planting

When possible, use only planting material from hybrid cocoa pods. Open the fresh pods gently by hitting them gently with a blunt object or on the ground to avoid cutting or damaging the seeds. Scoop the beans from the husk and plant them immediately (without rising off the pulp, which protects the seed from termites and excessive soil temperatures). Place in each bag 1 fresh bean with the pointed end up at a depth of 2cm (about a third of the fore finger) If in doubt which is the pointed end, place the bean flat at the same depth in the soil. Avoid sowing already germinated beans.

### Nursery management practices

Watering of the bags should be done every other day in the evening or in the morning. In the rainy season, the seedlings should be watered once a week. There should never be standing water in the polythene bags

#### ***Disease and pests***

In the case of a disease (damping off) or pest outbreak in the nursery, treat the seedlings using a recommended pesticides like Fungran\_OH. Weeding of the nursery should be regular so as to reduce pests.



If a costly sprayer isn't available, use a broom for nontoxic pesticides



**Shade Management**

Shade management is essential to the healthy development of the cocoa seedlings in the nursery. When the cocoa is first planted, the shade provided by the palm fronds should be dense so as to protect the newly germinated seeds from the burning sun. As the seedlings grow taller, the shade can be reduced slowly by removing the fronds gradually. Two weeks before transplanting, the shade should be almost gone so as to prepare the seedlings for life on the farm.

**Seedling arrangement**

As the cocoa seedlings start to grow, a good farmer will rearrange his seedling bags to group those seedlings of a similar height. The tallest should be placed near other tall seedlings, and the smaller ones should be placed together. This will ensure that all the seedlings will receive adequate light and air.



Arranging cocoa in a nursery



# WATER AND PLANT LIFE

## OVERVIEW

The use of water is of major concern in farm production. Farmers all around the world have developed and improved efficient systems to supply water to grow their crops. Plants get their needed supply of water either from natural rainfall during the seasons or from man-made water irrigation systems. It is important to have a good knowledge of local seasons in order to make the right decisions about when to clear the land, plant and carry out other important farm activities. Farmers can also reduce their dependence on continual water supplies by employing various water conservation methods.

**Time required**

30 minutes

**Methodology**

A group discussion on the importance of water and the different irrigation techniques

**Preparation**

- Chalkboard and chalk

## GOALS

**Knowledge**

- To understand the importance of water to plants and ways to conserve water
- To discuss the seasonal water supply in Ghana
- To learn the types of irrigation practices available

**Skills**

- To practice efficient water conservation methods

**Attitudes**

- To recognize the importance of water conservation on a cocoa farm

## CLASSROOM ACTIVITIES

1. Explain how water helps plants grow well.
2. Discuss with students the natural seasonal water supply in Ghana (see background info).
3. Explain to students that water can also be supplied to plants during the dry season through irrigation.
4. Explain the different types of irrigation techniques that are practiced by farmers in Ghana.
5. Discuss simple water conservation methods that can be practiced on the cocoa farm.
6. Explain flooding and its effects on crops/plants.
7. Discuss ways of preventing floods on the cocoa farm.





## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Does the water supply in Ghana vary by seasons?
  2. What types of techniques have you seen people in your family and in the village use to supply water to crops?
- 

## BACKGROUND INFORMATION

### Seasonal water supply: the Ghanaian climate

Climate is a very important factor in the success (or failure) of crop growth. There are 2 main rainy seasons in Ghana- the major rainy season from April to July and the minor from October to November. This is interspersed with the main dry season from December to March and a minor one from August to September. Vegetation receives abundant water from rainfall during the rainy seasons and a much smaller quantity during the dry seasons. Any given climate has seasons.

The crops are therefore grown according to the Ghanaian Climate.

### Types of surface irrigation systems

In surface irrigation systems, gravity moves water over the land, wetting it and sinking into the soil. These systems can be subdivided into furrow, border strip or basin irrigation.

### Basin Irrigation

In basin irrigation, water is applied to a completely level (sometimes called "dead-level") area enclosed by dikes or borders. This method of irrigation is used successfully for both field and row crops. The floor of the basin may be flat, ridged or shaped into beds, depending on crop and cultural practices. Basins need not be rectangular or straight sided, and the border dikes may or may not be permanent. This irrigation technique is also called by a variety of other names: check flooding; level borders; check irrigation; check-basin irrigation; dead-level irrigation; and level-basin irrigation. This technique is used for rice





<http://upload.wikimedia.org/wikipedia/commons/a/ae/LevelBasinFloodIrrigation.JPG>

Basin size is limited by available water stream size, topography, soil factors and degree of levelling required. A basin may be quite small or as large as 40 acres or so. Level basins simplify water management, since the irrigator need only supply a specified volume of water to the field. With adequate stream size, the water will spread quickly over the field, reducing the time it take for the water to sink in. Basin irrigation is most effective on uniform soils, precisely levelled, when large stream sizes (relative to basin area) are available. High efficiencies are possible with low labour requirements.

**Border Strip Irrigation**

Border strip irrigation uses land formed into strips, level across the narrow dimension but sloping along the long dimension, and bounded by ridges or borders. Water is turned into the upper end of the border strip, and advances down the strip.



[http://hercules.gcsu.edu/~sdatta/home/teaching/hydro/slides/furrow\\_1rr.jpeg](http://hercules.gcsu.edu/~sdatta/home/teaching/hydro/slides/furrow_1rr.jpeg)

After a time, the water is switched off, and a recession front, where standing water has soaked into the soil, moves down the strip. High irrigation efficiencies are possible with this method of irrigation, but are rarely obtained in practice due to the difficulty of balancing the advance and recession phases of water application.

## Furrow Irrigation

Furrows are sloping channels formed in the soil and made to carry water to irrigate the crop. The crop is usually grown on the ridges of the furrow. The Absorption of water occurs laterally and vertically through the wetted perimeter of the furrow. Systems may be designed with a variety of shapes and spacing. The best length for a furrow is dependant on the type of crop grown, type of soil, the intake rates of the soil and the size of the stream.



[http://hercules.gcsu.edu/~sdatta/home/teaching/hydro/slides/furrow\\_irr.jpeg](http://hercules.gcsu.edu/~sdatta/home/teaching/hydro/slides/furrow_irr.jpeg)

Furrow irrigation can be a highly uniform and efficient method of applying water. However, the uniformity and efficiency are highly dependent on proper management, so mismanagement can severely degrade system performance.

## Drip/trickle Irrigation

Trickle irrigation, also known as drip irrigation, is best suited for tree, vines, and row crops. The main limitation is the cost of the system, which can be quite high for closely-spaced crops. Complete cover crops, such as grains or pastures, cannot be economically irrigated with trickle systems.

Trickle irrigation is suitable for most soils, with only the extremes causing any special concern. On very fine-textured soils, trickle application rates may cause ponding, with potential runoff, erosion and aeration problems. On very coarse textured soils, lateral movement of water under the applicators will be limited, so more emission outlets per plant may be required to wet the desired root area. With proper design, and using pressure compensating emitters and regulators if required, trickle irrigation can be adapted to virtually any topography.

Trickle irrigation applies water slowly and directly to the roots of plants through small flexible pipes and flow control devices called emitters. Trickle irrigation uses 30 to 50 percent less water than hose or other spray mechanisms, and usually costs less to install. Since water is applied directly to the root zone, evaporation and runoff are minimized. Trickle irrigation is recommended for use on trees, shrubs, and flowers in the high- and moderate-water-use zones of the landscape to maximize efficiency and is especially useful in places with inadequate rains, like the north of Ghana.

Several types of trickle irrigation systems can be adapted to suit a variety of applications, from watering individual trees and shrubs to beds of annuals, herbaceous perennials, ground covers, or mixed border.

Drainage for the removal of excess water is an important factor to consider for all irrigation techniques. Many agricultural soils need drainage to improve production or to manage water supplies.



[http://www.ars.usda.gov/images/docs/3498\\_3682/surface\\_drip03jun.jpg](http://www.ars.usda.gov/images/docs/3498_3682/surface_drip03jun.jpg)



# SITE PREPARATION: LAND CLEARING AND BUSHFIRES

## OVERVIEW

Clearing the land of any obstacles to the cocoa trees is a vital step in preparing the cocoa farm for planting. Various methods exist for clearing the land, including manual removal and burning. Burning land is a damaging and potentially dangerous practice, as it can lead to bushfires. Bushfires can have a detrimental effect on soil quality and biodiversity. Cocoa farmers should have a solid knowledge of land clearing techniques and know the methods to prevent and mitigate the effect of bushfires.

**Time required**

30 minutes

**Methodology**

An interactive discussion with students on their experience and perception of land clearing and the impact of bushfires on soil and cocoa farming

**Preparation**

None

## GOALS

**Knowledge**

- To learn about land clearing techniques
- To learn about the impact that bushfires have on soil
- To learn the most common causes of fires
- To discuss ways to prevent them from happening in the future

**Skills**

- To reduce the likelihood of bushfires in and around the cocoa farm

**Attitudes**

- To recognize the danger and seriousness of bushfires

## CLASSROOM ACTIVITIES

1. Discuss the importance of land clearing and the different ways to clear a farm of obstacles to cocoa farming.
2. Mention and ask for any instances of bushfires that the students might have seen or heard about.
3. Discuss the causes, consequences and potential risk reduction strategies for bushfires.





## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Why is it important to clear the land before planting cocoa trees?
2. What are the ways that a farmer can clear land of obstacles?
3. Have you seen or heard about any bushfires?
4. What are the most common causes of bushfires? Why are they harmful?

## BACKGROUND INFORMATION

### Land Clearing

Land for cocoa should be cleared from December to February so that it can be ready for seedling planting by May or June. The actual timing of the clearing will depend on the nature of the land used for the cocoa plot. Virgin or secondary forest needs to be cleared in December to rid the land of pests and weeds. More fallow land or land that has been used for a long time should be cleared nearer to February (any sooner and the land risks getting burned by the sun). Clearing the land at this time will also enable the farmer to plant shade trees/crops on the farm.

Large and unimportant trees as well as those that harbour the swollen shoot virus and other pests should be removed. Only burn the land when absolutely necessary, as burning destroys the organic matter, kills beneficial organisms like worms and ants in the soil, causes erosion and leads to a loss of soil fertility. Fallow land should not be burned. However, land covered with thick, unwieldy brambles and large stumps can occasionally be burned (and only in that area) to make sure that termites and other pests are destroyed.

Recommended trees that are already on the land should not be removed. These trees are recommended because they do not harbour insects and diseases that are detrimental to cocoa and, with sturdy branches, they provide shade (recommended number of forest trees per farm= 6/acre).

Recommended tree species	
Scientific Name	Local Name
<i>Terminalia sp</i>	Amire
<i>Chrorophora excelsia</i>	Odum
<i>Albizia coriaria</i>	Semina/Awiemfo
<i>Alstonia boonei</i>	Nyame dua
<i>Pychanthus angolensis</i>	Otie
<i>Funtumia elastic</i>	Ofuruntum
<i>Entandrophragma angolense</i>	Adinam (cedar)
<i>Sesbania sp</i>	
<i>Spathodea campanulata</i>	
<i>Ceiba Petandra</i>	Onyina

These trees will provide shade to both young and old cocoa trees (more information on the importance of shade trees in cocoa farm will be discussed later).





Unwanted tree species		
Scientific Name	Local Name	Reason
<i>Ceiba Petandra</i>	Onyina	harbours insect pests
<i>Piptadeniastrum africanum</i>		has a dense canopy that dries the soil and competes for water
<i>Cola nitida</i>	Bese	emits a powdery substance that is considered bad for cocoa
<i>Celtis mildbraedii</i>		has a broad canopy which allows no dew to fall and competes for water
<i>Terminalia Superba</i>	Ofram	
<i>Carapa procera</i>		has leaves that prevent rain through-fall and the soil beneath tends to be too dry

**Note**

Although CRIG warns against *Ceiba Petandra* (Onyina) in cocoa farms because it harbours insect pests, farmers prefer the species due to its economic value.

**Biodiversity Conservation**

Biodiversity refers to the wide range of different types of organisms (animals and plants) in a given place at a given time. Biodiversity is the variety of life on earth, at all levels, from genes, through to individual organisms to species to vast and expansive habitats and the links and interactions between all of these.

Burning of debris after slashing or weeding the farm brings about the loss of biodiversity and soil nutrients held in plants. It also destroys soil organic matter and makes the soil bare, leading to drying of the soil. This makes the soil hard and difficult to cultivate. Burning also destroys useful soil organisms, like the earthworm, and kills wildlife, like grass cutters.

**Bush Fires**

Bush fires are uncontrolled fires that destroy cultivated and uncultivated land. Sometimes, bush fires destroy villages, thereby endangering livestock and human lives. There are two main types of bushfires (according to their causes): natural and man-made.

**Natural causes of bush fires**

The main natural cause of bushfires is lightning.

**Man-made causes of bush fires**

The man-made causes of bush fires include:

- Hunting for game
- Palm wine tapping
- Smoking
- Burning as a farming practice
- Using fire to cook on farm
- Honey hunting



***Hunting for game***

This constitutes about 90% of the causes of bushfires and is very common during the dry season. This happens when a group of people set fire to a piece of land to scare the animals they are hunting for. When the fire engulfs the animals, they are forced to escape. After killing the animals, the hunters do not put out the fire. It continues to burn, destroying large cultivated and uncultivated areas.

***Palm-wine tapping***

Palm-wine tapping could easily lead to the destruction of large hectares of land through fire outbreak. This happens when, after tapping the palm-wine, the fire used is not put out completely but is left to burn on. Alternatively, as the tappers move from one palm tree to another, some embers from their fires may drop. This will burn the dry leaves on the ground, slowly resulting in the fire spreading.

***Smoking***

Another way bushfires occur is through smoking. This way of causing bushfires is often ignored and even people who cause them are often unaware. Many cigarette smokers carelessly throw their butts on the ground without extinguishing it. These butts can then fall on dry leaves and ignite a fire. After some time, the fire can grow into a huge, uncontrollable fire that destroys vast areas of land.

***Burning as a farming practice***

Burning is one of the traditional methods of land preparation. When slashed vegetation is burned for cultivation, the fire can spread to other farms or uncultivated areas, resulting in considerable destruction.

***Fire used on farms for cooking***

This is another common cause of bushfires. Many farmers cook on their farm but usually do not put out the fire after they finish using it. The embers spread slowly to dry leaves, grass and other dry materials, resulting in bushfires.

***Honey-hunting***

Hunters usually use fire at night to drive bees away or kill them. Bees usually live in hollow trees. These trees are sometimes cut down by hunters to make it easier for them to gather honey.



Cocoa plot burned by unchecked forest fire





# SITE PREPARATION: LINING AND PEGGING

## OVERVIEW

Spacing cocoa using the recommended planting distance improves the efficiency of production and increases the yield of cocoa trees. Farmers use the techniques of lining and pegging to ensure that their cocoa trees are properly spaced.

### Time required

90 minutes (30 minutes in classroom and 60 minutes on farm)

### Methodology

A classroom discussion on spacing and a field visit to explore best practices for lining and pegging cocoa beds and planting cocoa

### Preparation

- Chalkboard and chalk
- Cleaning rag
- Pegs/sticks
- Field measuring tape
- Cutlass

**TIP!** A field or farm needs to be prepared/cleared in advance of this exercise.



Lining and pegging a cocoa plot



## GOALS

### Knowledge

- To understand why field crops should be spaced correctly

### Skills

- To line and peg a cocoa tree field properly (3m x 3m)

### Attitudes

- To respect the importance of proper spacing of a cocoa tree farm
- 

## CLASSROOM ACTIVITIES

1. Explain the importance of spacing to students. Mention the advantages of spacing for plants (e.g. enough food and rain for each plant, ample room for branching, easy identification of diseased plant parts, easier ability to work in the farm).
  2. Explain the methods for pegging the cocoa field (cocoa should be laid out 3m x 3m or 10ft by 10ft).
  3. Communicate current planting distance/spacing recommended by COCOBOD to students
- 

## PRACTICAL ACTIVITY



### Field Trip

1. Take students to the demonstration plot and talk them through the basic techniques to start the lining and pegging. Demonstrate the actual lining and pegging of the field, including how leguminous and temporal shade trees could be incorporated. (See background information for planting distances.)
2. Ask the students to find the base line and do the pegging. This will help to verify if students have learned the skill.
3. Adapt locally available materials for use where necessary, for example, twine, shoes, cutlasses, and sticks can help take certain dimensions.
4. After the field work, ask students to discuss the importance of lining, pegging and spacing as recommended.
5. Explain to the students the importance of initial shade to the development of young cocoa seedlings just planted on the farm.
6. Summarize and highlight the important areas covered.



Pegging a cocoa plot

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**PERFORMANCE ASSESSMENT**

**Questions**

To assess students’ performance, the facilitator can ask the following questions:

- 1. Why should we line and peg the farm before planting?
- 2. What are the different ways for laying out the field/farm?
- 3. What is the recommended planting distance for cocoa?
- 4. Why is initial shade important?
- 5. What kinds of trees can a cocoa farmer use to provide initial shade to his cocoa trees?

**BACKGROUND INFORMATION**

“Lining and pegging” means planning the positions of the trees correctly by taking measurements and putting small sticks (pegs) in a position that shows where each tree should be planted.

Lining and pegging the cocoa farm will lead to maximization of yield. If trees are planted too close, they will grow too tall and thin as a result of competition for light and soil nutrients. If trees are properly spaced, they grow healthy and have better yields.

It is recommended that cocoa trees are planted at intervals of 3m x 3m (10ft x 10ft) and that the cocoa trees are interplanted with other tree species (temporal and permanent) or crops. To line and peg a field, put a peg in one corner of the field as the starting peg. Put the next peg at a distance of 3m from the first peg. Continue down both the horizontal and vertical sides of the field. Ensure that no tree is less than 3m from any other tree (in all directions).



Measuring planting distances

### Initial shade

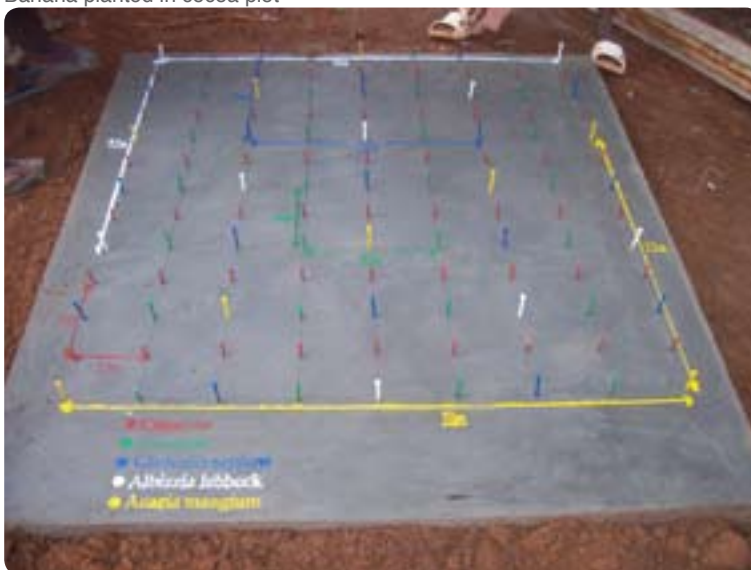
Cocoa can be intercropped with other trees or crops to provide temporal or permanent shade on the farm. For example, plantains/bananas/coco yams can be planted at 3m x 3m to provide temporal shade for the young cocoa seedlings.

Proper shade is very important to the health and development of young cocoa seedlings that have just been transplanted from the nursery. The young seedlings need to be protected from the harsh sun and other climate conditions, otherwise, they will burn. Therefore, it is necessary to plan for initial shade when lining and pegging. Once the pegs have been staked into to ground (representing where you'll plant your cocoa seedlings one day), plantains and coco yams need to be planted around the stakes at a distance of at least a meter. As the plantains and coco yams grow, their leaves will develop and provide ready shade for the seedlings once they are transplanted on to the field starting around May-June. It is important to plant this initial shade as soon as your cocoa plot is cleared so that there will be enough time for the plantains and coco yams' leaves to grow.

Leguminous tree species can also be planted at 6m x 6m (20ft x20ft).



Banana planted in cocoa plot



Reference map for integrating leguminous trees on a cocoa farm



# MALARIA

## OVERVIEW

Good health is very important for cocoa farmers. If farmers or youth working on a farm become ill, they will find it difficult to complete their farm responsibilities productively. Malaria is one of the main causes of ill-health in Ghana.

**Time required**

30 minutes

**Methodology**

A classroom discussion of malaria, including symptoms, effects and prevention strategies

**Preparation**

- Chalkboard and chalk
- Bed-nets (mosquito nets) from someone in the village

## GOALS

**Knowledge**

- To understand what causes malaria and how it is transmitted
- To learn about ways to avoid and prevent malaria
- To learn to recognize or suspect a malaria infection and how to treat it

**Skills**

- To take effective action to prevent and treat malaria

**Attitudes**

- To recognize the importance of malaria prevention and proper treatment for malaria

## CLASSROOM ACTIVITIES

1. Ask the students if they know anyone who has been infected by malaria in the past.
2. Ask the students to describe the symptoms of malaria.
3. Ask the students to brainstorm the implications that being ill from malaria has on their work in growing cocoa. Make sure that they consider the potential energy and time lost sowing seeds, maintaining the cocoa, harvesting the crop and going to the market. Make sure that they also consider the additional expenses medicines and travel to the clinic may cost them, which is money they can no longer use for seeds or equipment for their cocoa farming.
4. Ask the students to share any methods that they know of to prevent malaria infections.
5. Ask students what they should do or where they should go when they think they have malaria.



## PRACTICAL ACTIVITIES

### Hearing from a Health Care Professional

**OPTIONAL:** If possible, invite a health practitioner to the classroom to speak about malaria, how to avoid it and how to treat it.

### Interviewing Cocoa Farmers

**OPTIONAL:** Ask students to interview cocoa farmers to ask them if and how being ill has affected their work in running their cocoa farms. Students can then report their stories back to the rest of the class. Highlight the importance of preventing malaria to the students.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. How does having malaria affect your farming or gardening work?
  2. How does one get infected by malaria?
  3. What are the symptoms of malaria?
  4. How can malaria be prevented in communities?
  5. What do you do when you think you have malaria?
- 

## BACKGROUND INFORMATION

### Malaria in Ghana

With year-round transmission, malaria is present throughout Ghana; the entire population is at risk. A major cause of morbidity and mortality, malaria directly contributes to poverty, low productivity, and reduced school attendance.

According to the World Health Organization, between 3.1 and 3.5 million cases of clinical malaria are reported in public health facilities each year in Ghana. Out of these, 900,000 cases are in children under five years of age. UNICEF estimates that up to 20,000 children under five die from malaria in Ghana each year.

Malaria is present in all parts of Ghana and people are infected all year round, even more so during the rainy seasons. Because of the number of people who get infected every year by malaria, it has a large impact on productivity in cocoa farming. Malaria is transmitted through mosquito bites. Malaria is not caused by the sun or from being outside working too hard. Stress may increase the likelihood of contracting malaria, but stress is not the cause of the malaria. Instead, stress has only weakened the immune system (see HIV module) to allow the malaria to hurt the body.

Young children, old people and pregnant women are particularly vulnerable to becoming sick with malaria.





### Symptoms

1. Episodes of high fever associated with chills and sweats
2. Headache, muscle pain, vomiting or cramps

### Care during treatment

If someone has high fever, they should immediately see a health worker to see if they have malaria and get the right medicine. After taking the medicine, it is important for the patient to also drink plenty of water and eat extra food. Patients with a high fever should be wiped with a cool cloth to keep them cool (but not too cold) and to prevent their temperature from rising.

### How to prevent Malaria?

Although no immunization for malaria exists, communities can reduce the prevalence of the disease by taking a few simple steps to prevent its spread:

- Mosquitoes breed in stagnant water. Remove any standing water close to your house.
- Mosquitoes bite at night. Sleep under mosquito nets. Even if there are some holes in impregnated bed nets, they still offer protection.
- If there are not bed nets available, cover up with long –sleeved shirts, long pants and socks in the evenings.
- If outside at dusk, wear long sleeves and pants.
- Cover water storage containers to prevent mosquitoes from breeding in them.





# SOIL IMPROVEMENT

## OVERVIEW

Many farmers depend on chemical fertilizers to replenish lost soil fertility. Apart from being expensive, these chemical fertilizers do not improve the actual quality of the soil. In certain cases, they even cause soil acidity. Farmers should adopt some other practices that can help improve the soil to support plant life, including the use of compost, farm yard manure, green cover crops and leguminous trees.

### Time required

60 minutes (30 minutes in classroom and 30 minutes in courtyard)

### Methodology

A classroom discussion and activity to build compost in the school courtyard

### Preparation

- Chalkboard and chalk
- Materials to prepare compost (animal droppings, fertilizer, food waste, water, twigs)
- Samples of cover crops
- Leguminous tree species



Removing debris from a planting bed



## GOALS

### Knowledge

- To learn about the importance of soil improvement for plant growth
- To discuss different types of green manuring techniques

### Skills

- To build a compost pile for use on the cocoa farm

### Attitudes

- To recognize the variety of methods available for soil improvement

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## CLASSROOM ACTIVITIES

Have an initial discussion with the students on the importance of leguminous plants and manuring.

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## PRACTICAL ACTIVITY

### Building a compost heap / pit

This should be a separate activity—maybe for the clubs to do together. Out of school youth should learn this too when working on the gardens.

There are two main methods of making compost:

1. Heap method: ideal for high rain fall area
2. Pit method: ideal for low rainfall areas

The minimum size of a compost heap should be 1.2 m x 1.2 m x 1.2 m. Large heaps will be more economical, but the width should not exceed 1.5 m and the height 1.2 m (the length could be more depending on available materials).

First, spread the material for the compost evenly on the ground between 4 upright corner sticks, making the edges of the compost. When the layer is about 15cm thick, a layer of farm yard manure should be spread on top (use top soil urine or soluble nitrogenous fertilizer or liquid if farm yard manure is not available). This is used to water the heap. For a heap of a minimum size 1.2m, about 4.5 kg of nitrogenous fertilizer is recommended. It is advisable to add wood ash or lime before watering the heap.

Liquids are important because insufficient moisture prevents thorough fermentation/ decomposition; however, excess water should be avoided. Repeat this until the heap is about 1.2m high. The heap should be aerated periodically by turning the mixture with a shovel or stick or other available material. The type of materials composted will also determine the number of turnings required. Normally 2 turnings every 2 weeks should be sufficient if weedy substances are excluded. The compost is ready when it has turned into a soil-like substance, which will depend on several factors (temperature, material used, moisture etc).

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Do you know of any ways to make the soil fertile?
2. What is composting?





3. What is green manuring?
4. Why have leguminous trees been planted with cocoa on the school plot or in the village plots?
5. Do people use animal droppings on crops? If so, why?
6. Are there any other ways to improve soil?

---

## BACKGROUND INFORMATION

### Importance of Leguminous Trees/Plants

Leguminous trees/plants can be used for soil improvement. They represent an order of flowering plant that is easily recognized by its fruit, which is usually in the shape of a flat pod.

Using leguminous trees/plants on the farm is important to improve the quality of the soil by bringing in nitrogen needed for plant growth and food. The lack of nitrogen in a plant can be recognized by weak leaf development and/or leaves that are yellowish. Without much nitrogen, a plant will have difficulties performing its functions. Cocoa trees suffering from insufficient nitrogen will produce less pods, causing the overall harvest to decrease.



Leguminous trees can enrich the soil with their decaying leaves

Leguminous trees/plants are important sources of soil-improving nitrogen which can improve the size and quality of the harvest. Leguminous plants also improve soil quality by protecting it from too much sun, rain, and wind, by stocking carbon, and by increasing plant diversity. They also help in animal husbandry by protecting the animals from too much wind, separating them from delicate vegetables, or penning them.





High food prices and low crop prices have made it difficult to afford chemical and store-bought fertilizers. Using the technology of leguminous trees/plants, a farmer can reduce his fertilizer costs by planning and organizing the growth of leguminous trees/plants on his farm. Leguminous trees/plants should be integrated (planted) into the cocoa farm at a distance of 6 x6 meters or 20 x 20 feet.

The three recommended leguminous trees/plants for cocoa farms are Albizia lebbeck, Acacia mangium, and Glyricidia.

### Green Manuring

Green manure is a type of cover crop grown primarily to add nutrients and organic matter to the soil. Typically, a green manure crop is grown for a specific period and then plowed under and incorporated into the soil. Green manures usually perform multiple functions, including soil improvement and soil protection. Green manures increase the percentage of organic matter (biomass) in the soil, thereby improving water retention, aeration, and other soil characteristics.

Leguminous green manures such as *Vigna spp*, *Centroceama*, and *Mucuna* contain nitrogen-fixing symbiotic bacteria in root nodules that fix atmospheric nitrogen in a form that plants can use.

The root systems of some varieties of green manure grow deep in the soil and bring up nutrient resources unavailable to shallower-rooted crops. Cover crops prevent soil erosion and the growth of weeds. Some green manure crops, when allowed to flower, provide forage for pollinating insects.

Examples of leguminous cover crops
<i>Leucaena leucocephala</i>
<i>Dolichus lablab</i> (lablab bean)
<i>Vigna spp</i>
<i>Pueraria phaseoloides</i> (jack bean)
<i>Canavalia ensiformis</i>
<i>Cajanus cajan</i> (pigeon pea)
<i>Clitoria ternatea</i> (butterfly pea)
<i>Mucuna spp.</i> (Velvet bean)

### Animal manure

Animal manure (e.g. chicken, sheep and goat droppings), together with beddings or litter, is called farm yard manure and is considered a good source of organic matter. Its value depends on the kind of litter and the care of the manure.

### Composting

Composting is a natural process through which organic material is converted into a soil-like product called compost or humus. The process works with the help of micro-organisms, like bacteria and fungi, combined with air and moisture. Composting is done by placing organic waste material (vegetable peelings, left over food, crushed eggshells), crop residue or litter in a specific area and leaving it to decompose.





It is advisable to remove woody twigs, coarse grass, stalks from leaves and succulent parts before throwing organic waste material into the compost pile. The woody twigs and others can be burnt and the ashes added. Composting is an important way to produce a valuable soil amendment. Composting provides an almost constant source of free fertilizer which can help your plants grow well by loosening the soil and allowing better root entry.

The texture of compost improves the soil's ability to hold water and can reduce runoff. Unlike chemical fertilizers, compost has all the nutrients that plants require. Through regular use of compost, a farmer can greatly reduce or even get rid of the need for chemical fertilizers, pesticides and herbicides, which saves money and reduces contamination of our environment.





# INTRODUCTION TO VEGETABLE CROPS

## OVERVIEW

Vegetable gardening provides additional opportunities to complement cocoa farming. Cultivation of vegetables has the potential to improve the income levels of farmers, especially youth. Factors to consider before going into garden crop production include the vegetable preferences of the local market, materials needed, how to actually grow garden crops, and how to recognize different types and characteristics of vegetables.

### Time required

30 minutes

### Methodology

Small groups with students arranging vegetables to decide on which vegetables fall into which categories

### Preparation

- Four sets of the same 6 vegetables (each set will have 6 different vegetables, but all sets should have the same 6 varieties)
  - These could either be vegetables drawn on pieces of paper (which the teacher could prepare in advance or which the facilitator could ask the students to draw as part of the activity), or real vegetable examples brought into the classroom.
  - Using real vegetables where possible is always preferable. Complement with pictures as needed.
- Chalkboard and chalk

## GOALS

### Knowledge

- To know basic definitions related to vegetable farming
- To learn different methods to classify vegetables, which will help farmers make planting decisions

### Skills

- To classify vegetables according to multiple classification methods

### Attitudes

- To recognize the potential of complementary vegetable farming



## CLASSROOM ACTIVITIES

1. Divide students into groups of around 5 – 7 students each.
  2. Give each group of students one set of vegetables that are grown in their local area. (See 'Preparation' section above.)
  3. Explain that vegetables can be classified or grouped in different ways to help us to understand how they grow and why we would plant them.
  4. Explain that the first way to group vegetables is based on which parts of the plants are used for food. Write the following headings on the blackboard and explain what they mean: Leafy vegetable, Root vegetable, Stem vegetable, Fruit vegetable. Ask students to take the vegetable examples they have and to try to arrange them into these groups. Give them a few minutes to do so. Tell the students which vegetable would go into each group. (See 'Part of the plants used for food' section below.) Highlight which vegetables are particularly healthy to eat by drawing circles around them on the blackboard and writing down the names of additional ones that they may not have in the examples they are working with.
  5. Explain that the second way to group vegetables is based on how the plants are grown. Write the following headings on the blackboard and explain what they mean: Nursed then transplanted, Grown Directly, or either of the two. Ask students to take the vegetable examples they have and to try to arrange them into these groups. Give them a few minutes to do so. Tell the students which vegetable would go into each group. (See 'How the plants are grown' section below.) Ask students to now "plant" the 'transplanted' group in the 'grown directly' group to show how farmers would transplant the vegetables when they have grown enough to be transplanted.
  6. Explain that the third way to group vegetables is based on how long the plants live for. Write the following headings on the blackboard and explain what they mean: Annual, Biennial, Perennial. Ask students to take the vegetable examples they have and to try to arrange them into these groups. Give them a few minutes to do so. Tell the students which vegetable would go into each group. (See 'How long plants live' section below.)
  7. Ask the students to pretend that it is now the next season. They need to take out any of the vegetables from the group that would no longer be growing in the second season. (They would leave only those in the biennial and perennial groups.) Tell students that time has passed and it is now the next season. They need to move any of the vegetables that would no longer be growing in the third season. (They would leave only those in the perennial group.)
- 





## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Which types of vegetables are leafy vegetables, root vegetables, stem vegetables, and fruit vegetables?
  2. Which types of vegetables can be nursed then transplanted, grown directly, and either?
  3. Which types of vegetables have crops that are Annual, Biennial, and Perennial?
  4. Which types of vegetables are the healthiest to eat?
- 

## BACKGROUND INFORMATION

### Vegetables in Ghana

Vegetables are an important source of vitamins, minerals and other nutrients for rural dwellers in Ghana. They serve to thicken soups and increase the bulk of stews. Vegetables collected from the wild are an important food source in times of famine. A small number are marketed and thus contribute to household income. Vegetables are an important source of vitamins, minerals and other nutrients for rural dwellers in Ghana. They serve to thicken soups and increase the bulk of stews. Vegetables collected from the wild are an important food source in times of famine. A small number are marketed and thus contribute to household income.

Vegetables of national importance in Ghana
Okro or okra
Shallot
Pepper
Watermelon
Pumpkin or vegetable marrow
Bottle gourd
Vegetable sponge
Tomato
African cucumber
Chayote
Eggplant
Fluted pumpkin





Staking tomato plants



Purple eggplant

Local Vegetables in Ghana	
General	Wild amaranth (leaves also medicinal)
	Eddoes
	Moon flower
	Sweet potato
	Wild lettuce (including spinach)
	Cassava
	Wild date palm
	Purslane (also for ritual purification)
	Wine palm (palm cabbage)
	Water leaf
	Bitter leaf (bitter, also medicinal)
Cocoyam	
Northern tribes mainly	Silk cotton tree
	Desert date
	Rattan palm (young buds)
	Coconut palm
	Black plum
	Sesame
Ewe tribe mainly	Jew's marrow
Forest tribes mainly	West African black pepper
Abbiw, D.K. 1990. Useful Plants of Ghana. Intermediate Technology Publications and Royal Botanic Gardens, Kew, London.	



Cabbage ready to be harvested



## Plant classifications

There are different ways to classify vegetables to help us to understand how they grow and how we may decide to plant them. We can classify plants according to:

- Parts of the plant used for food
- How the plants are grown
- How long plants live
- Plant family

## Part of the plants used for food

Plants can be grouped based on which parts of the plants are used for food:

- Leafy vegetables
- Root vegetables
- Fruit vegetables
- Stem vegetables

### **Leafy vegetables**

Leafy vegetables are not just vegetables that have leaves – they are vegetables whose leaves we eat! The darker green the leafy vegetable is, the better it is to eat because it contains more Vitamin A, Vitamin C and calcium, which keep you strong and healthy. Green leafy vegetables should be eaten as much as possible and are even healthier when eaten raw.

Examples of leafy vegetables: Lettuce, cabbage, cauliflower, spinach, green onions, cocoyam, amaranthus, talinum

### **Root vegetables**

The term “root vegetable” refers to the plants of which we eat the underground parts. Some root vegetables are particularly healthy to eat because they contain important vitamins and minerals that make our bodies strong.

Examples of root vegetables: Carrot, radish, onion, potato, garlic, ginger, turmeric, cassava, yams

### **Fruit vegetables**

Fruit vegetables are plants that produce a fruit that people like to eat.

Examples of fruit vegetables: Pumpkin, watermelon, green bean, tomato, pepper, cucumber, corn, peanuts, okro, aubergine, french beans, sweet/green pepper, Garden eggs, chilli pepper

### **Stem vegetables**

Stem vegetables are plants that produce a stem that people eat. Although many leaf vegetables and root vegetables contain substantial amounts of stem tissue, the term is used here only for those vegetables composed primarily of above-ground stems.

Examples of stem vegetables: Asparagus, celery, bamboo shoots, wild rice, rhubarb.





## How the plants are grown

Plants can be grouped based on how the plants are grown (the method of cultivation used):

- Nursed then Transplanted
- Grown directly
- Either transplanted or grown directly

### ***Transplanted***

This refers to vegetables that can be transplanted by initially sowing them in a small container or area such as a nursery, removing them from the nursery once they have begun to grow, and transplanting them elsewhere (reasons for initially sowing vegetables in a nursery are covered in the Module on Nurseries).

Examples of transplanted vegetables: Cabbage, pepper, tomato, cauliflower

### ***Grown Directly***

This refers to vegetables that can be grown directly on the field and that do not need to be grown in a nursery first.

Examples of vegetables that can be grown directly: Lettuce, spinach, radishes, zucchini, beans, beets

### ***Either transplanted or grown directly***

This refers to vegetables that can be grown directly in the field or that can be transplanted. Most non-root vegetables (and small vegetables) can be transplanted or grown directly. All vegetables that can be transplanted can also be grown directly, but many have a better chance of survival if transplanted. Some larger vegetables or root vegetables, such as cucumber, squash and watermelon, may be difficult to transplant.

## How long plants live

Plants can be grouped based on how long the plants live (their life span):

- Annuals
- Biennials
- Perennials

### ***Annuals***

Annuals are crops that can be grown for only one season.

Examples of annuals: Onions, maize, beans, groundnut, tomatoes, carrot, cabbage, lettuce





***Biennials***

Biennials are crops that take two years to reach maturation and be ready for harvesting. Generally, after their second year, biennials die and must be replanted.

Examples of biennials: Cassava (some types), garden egg, pepper

***Perennials***

Perennials are crops that can be grown for more than two seasons Often, cash crops are perennials.

Examples of perennials: Coffee, cocoa, oil palm





# SEED SELECTION AND GERMINATION

## OVERVIEW

Germination is a process where the seeds start to sprout and grow when kept under the right conditions. The germination tests are used to differentiate good seeds from bad ones. The tests give an indication of how well the seeds will grow in the farm.

### Time required

30 minutes each (2 exercises to select from)

### Methodology

Demonstrate seed germination tests and seed sowing methods

### Preparation

- Chalkboard and chalk
- Mouldy or damaged seeds
- Bowl
- Slide. If slide is not available, use piece of wood/plastic

## GOALS

### Knowledge

- To learn how to select seeds

### Skills

- To identify and select good quality seeds

### Attitudes

- To recognize the importance of seed selection

## CLASSROOM ACTIVITIES

### Activity 1:

#### Germination Test 1

1. Explain how to select good quality seeds.
2. Explain the test that students should always do before sowing seeds to see whether the seeds are ready to germinate.
3. Demonstrate the test in the classroom as follows:
  - a. Place a slide filled with water in a bowl
  - b. Place twenty seeds on the slide and leave for a week.
  - c. Count the number of seeds that have sprouted. If out of twenty seeds, twelve have sprouted, then the seeds are good.





## Activity 2: Germination Test 2

1. Explain that students can do an additional test to see if seeds are good or bad.
2. Demonstrate the test in the classroom as follows:
  - a. Get seeds that look good and those that look mouldy or damaged.
  - b. Get two containers and put some loamy soil (black soil) in them.
  - c. Sow the seeds that look good in one container and the seeds that look mouldy in the other container (20 seeds in each).
  - d. For a week, water the seeds regularly and write down observations in a field notebook. If out of the twenty seeds, twelve have sprouted, then the seeds are good.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What should you do to select good quality seeds?
2. What tests can you conduct to ensure that your seeds will germinate?

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## BACKGROUND INFORMATION

### Seed Selection

Good quality seeds must be selected when planting a garden. For a good selection, it is necessary to:

- Buy new seeds from authorized dealers, or get seeds from another credible source. If you have a good selection of seeds from your own crop, you can use them as well.
- Learn/Read the instructions for the seeds and make sure they are not expired.
- Inspect the seeds to make sure that they are not moulded or that insects have not damaged or eaten into them.
- Inspect seeds to ensure that they are not immature (Immature seeds may have different shape or colour and look small in size or shrivelled).

**TIP!** Do not use old seeds or seeds stored improperly (in a place that's too wet or too sunny).





# SETTING UP A VEGETABLE NURSERY

## OVERVIEW

The nursery phase is the most important phase of vegetable gardening (as well as of cocoa production). This is where the plant will spend the first weeks of its life before being transplanted to the plot. A good, successful crop depends on the good health and quality of the young plants that come from the nursery. There are specific steps that can be taken to set up and protect a successful nursery.

### Time required

Variations: 60 minutes – 120 minutes if lesson is moved to outside the classroom (e.g. if real life nurseries are used or small pieces of ground are chosen to simulate the setting up of nurseries)

### Methodology

Discussion and demonstrations

### Preparation

- Chalkboard and chalk
- Soil Types
- Demonstration box or actual nursery bed outdoors

## GOALS

### Knowledge

- To learn about setting up a nursery in terms of location, preparing a nursery bed, soil sterilization, and sowing
- To learn about shade management, and maintaining the nursery

### Skills

- To successfully set up and run a nursery

### Attitudes

- To recognize the importance and potential of nurseries in both cocoa and vegetable farming

## CLASSROOM ACTIVITIES

1. Discuss the importance of nurseries.
2. Discuss the steps towards establishing a nursery: finding a suitable location; preparing a nursery bed; sterilising the soil; sowing; nursery protection.



**Activity 1:  
Preparing a  
nursery bed:**

1. Ask students what they think can be done in a nursery to achieve the following. Let them come up with several ideas.
  - preserve the seedlings from rotting
  - prevent disease from slowing down the growth of the plant (destroying the nursery)
  - stop the growth of weeds
  - destroy parasites like nematodes (harmful worms)
2. Explain how each can be achieved by using a small box of soil in the classroom or a piece of garden outside to demonstrate the topics as you inform the students.
3. If possible, do this entire lesson alongside an actual nursery bed if one is available.

**Activity 2:  
Soil sterilisation**

1. Ask students what they think soil sterilization is and why they think this is necessary.
2. Explain the three different methods of sterilizing soil to the students and ask which they think they would use. Ask students when they think they might use the other methods (Answers could include: When they are older, when they have more money, when they have more land and therefore greater potential to lose more crops.) Explain the hazardous and child labour implications.
3. If you are using a demonstration box, pour boiling water into it to demonstrate sterilization.



Established school garden

**PERFORMANCE  
ASSESSMENT**

**Questions**

To assess students' performance, the facilitator can ask the following questions:

1. Why is the nursery the most important phase of vegetable gardening?
2. What is the importance of having nursery beds?
3. What are the steps towards establishing a nursery?



4. What methods can be used to sterilize soil?
5. How do you know when seedlings should be transplanted?

## BACKGROUND INFORMATION

### Importance of nursery production

The nursery is the most important phase of vegetable gardening. This is where the plant will spend the first weeks of its life before being transplanted to the plot. A good, successful crop depends on the good health and quality of the young nursery plants. There are certain specific steps that can be taken to set up and run a successful nursery.

### Establishing a nursery

#### ***Preparing a nursery bed***

Young seedlings can be planted on raised beds. Nursery beds are raised, level portions of earth that will hold the seedlings as they start to grow. Nursery beds for garden crops should be raised to a height of 10 to 20 cm and 1 to 1.2 meters in width. Nursery beds should be about 50 cm away from each other.

The soil of a nursery bed must be loose and friable (feel free in your hand when you touch it). All remaining vegetation (weed and weed seeds) as well as stones should be removed.

#### ***Soil Sterilization***

After the beds are in place, the soil must be sterilized to destroy disease-causing organisms (small living things that we cannot see with our naked eyes) or parasites that may be in the soil.

Why is this important?

- Preserves the seedlings from rotting
- Prevents disease from slowing down the growth of the plant (destroying the nursery)
- Stops the growth of weeds (kills weed seeds)
- Destroys parasites like nematodes (harmful worms)

#### ***Control of nursery-bed infestations***

This is a process by which soil borne disease-causing organisms are killed before planting

Two methods can be used to disinfect the soil (see chart for an example of each method):

1. Chemical treatment
2. Hot water treatment





Product	Amount per m <sup>2</sup>	Waiting period before sowing	Precautionary measures
Basamid granules at 98 %	50 g /m <sup>2</sup>	15 to 21 days	Children under the age of 18 are not authorized to perform this work under the terms of the constitution of the Republic of Ghana
Boiling water	10 litres/m <sup>2</sup>	4 hours	Cover the nursery bed well after applying hot water. Stir the planting bed before use.

As with all chemical fertilizers and pesticides, the chemicals used for soil sterilization (Basamid, listed above, as well as Furaban, Manebe) can be very dangerous, even deadly, for humans. Care should be taken when using these chemicals and, when possible, safer alternatives found.

### **Sowing**

Before sowing the seeds, it is necessary to water the soil abundantly and let the water penetrate the soil layers completely. After watering, sow the seeds according to the appropriate methodology mentioned in the module on sowing seeds.

After sowing, cover the nursery bed with a light layer of thatch. Directly water the thatch cover, using approximately 10 litres of water per square meter. Remove the thatch five to ten days after sowing, when the seedling has started to rise out of the soil.



***Children under 18 and under adult supervision are allowed to sow seeds.***

### **Nursery Protection**

After the thatch is removed, the young seedlings still need to be protected from heavy rainfall, excessive sunshine, and strong winds. It is necessary to build a resistant, protective cover for the nursery. The cover can be made from thatch resting on wooden or bamboo stakes. It is set up about 50 cm above the soil of the nursery bed.

The cover is removed one or two weeks (the period varies with the crop variety) before transplantation, to allow the seedlings to strengthen and adapt to ordinary field conditions.





A student in Adzopé displays his protective cover

**Importance of nursery maintenance**

Maintaining the nursery is very important for protecting the young plants and ensuring their healthy development. A good, successful crop depends on the good health and quality of its young nursery plants.

**Maintaining a nursery**

**Weeding**

Refer to the section on Weeding in Module #20 or Weed Control Methods in Module #22 as this is relevant to Nurseries too.

**Pest Management**

Refer to the section on Pest Management in Module #20 or Integrated Pest Management in Module #24 as this is relevant to Nurseries too.

**Length of nursery stay**

Examples of vegetables and their length of stay in the nursery:

VEGETABLES	AMOUNT OF SEED SOWN PER NURSERY M <sup>2</sup>	LENGTH OF STAY IN NURSERY BED
EGGPLANTS	3 grams/m <sup>2</sup>	25 to 30 days
TOMATOES	1 grams/m <sup>2</sup>	25 to 30 days
CABBAGE	3 grams/m <sup>2</sup>	25 to 30 days
ONIONS	5 grams/m <sup>2</sup>	30 to 40 days
GREEN PEPPER	6 grams/m <sup>2</sup>	25 to 30 days



# SETTING UP A VEGETABLE GARDEN

## OVERVIEW

Vegetable gardening provides an important opportunity to complement cocoa farming. Vegetable gardening requires an understanding of the nature of the land, direct sowing, nurseries, site selection and plot preparation.

### Time required

30 minutes (with optional additional 30 minutes walking outside classroom)

### Methodology

Sharing information, students' drawing, and discussing, and a possible walk outside the classroom

### Preparation

- Chalkboard and chalk

## GOALS

### Knowledge

- To explore the nature of the land and how this impacts gardening
- To learn about how to prepare the plot, including plot clearance and soil preparation

### Skills

- To identify which vegetables require direct sowing and which require a nursery
- To select a good site for the garden

### Attitudes

- To recognize the importance of setting up and caring for a vegetable garden

## CLASSROOM ACTIVITIES

1. Explain the difference between direct sowing and nurseries and give examples of vegetables that require each type of cultivation. Ask students to draw a nursery and an outdoor garden and to draw pictures of the vegetables that can be planted in each (to help them to remember the information).
2. Ask students for ideas on what they should consider when selecting a good site for a vegetable garden (they should come up with at least 3). Then share some examples with them.
3. Tell students what is required to clear and prepare plots for a vegetable garden.





## PRACTICAL ACTIVITY

If possible, walk around outside the classroom and ask students to point out places that they think would be good or bad locations for a vegetable garden based on the considerations for selecting a site and what needs to be done to clear a site.

---

## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What do you want to consider when selecting a site for a vegetable garden?
  2. What is required to clear and plan plots?
- 

## BACKGROUND INFORMATION

### Factors to consider when growing vegetables

Many factors affect the growing of vegetables, including:

- Location
- The nature of the land
- The planting method used (direct sowing or nursing)
- Site selection
- Plot preparation
- Soil preparation

### ***Location***

The nursery must be placed at the best spot in the plot. This means that the area must be flat, not easily flooded, and be near a permanent source of water. Nursery soil must be rich in humus, well-aired, and of a light, powdery texture. Soils that have a lot of clay, gravel, stones, and sand aren't suitable for a vegetable nursery because they retain too much water or don't hold enough nutrients. The site must be cleared of obstructions and easy to access. Shaded areas should be avoided because young plants will become pallid and weaken.

### ***Nature of land***

Different types of land can be used for growing vegetables. Land should not have standing water on it as this will make it too wet. If the land is too steep it may be difficult to work on and more likely to have water, nutrients and soil wash away.

### ***Direct sowing or nursing?***

Direct sowing is the planting of seeds in one place where they will grow to full maturity. Nursing is the planting of seeds in a protected nursery until they start sprouting and then transplanting them into the full garden. (The module on Setting Up A Nursery covers the preparation of a nursery.)





Refer to the Module on the Introduction to Vegetable Crops for examples of seeds needing to be planted in nurseries first and those needing to be sown directly.

Vegetable	Direct Sow or Nurse?
Garden egg	nurse
Onion	Direct (shallots)
Green bean	Direct Sow
Carrot	Direct Sow
Tomato	nurse
Pepper	nurse
Cabbage	nurse
Cucumber	Direct Sow, nurse
Okra	Direct Sow
Lettuce	nurse

### **Site selection for a vegetable garden**

There are many factors that determine how suitable a site is for establishing a vegetable garden. These factors include:

- Accessibility: Is it too far to visit daily? Is it in a safe location?
- Market: Is it close to a market where people will buy the vegetables? How much will transport cost?
- Water: Will it be difficult to water your garden?
- Soil quality: Is your soil loose, deep (at least 20 cm deep), and does it have good drainage?
- Slope: Is your land too steep and therefore too difficult to work on and more likely to have water, nutrients and soil wash away?

### **Plot preparation**

Trees and other vegetation (shrubs, grass) are home to insects that can be harmful to vegetables growing in a garden. Their plant systems compete for nutrients and their shade can smother vegetables. Therefore, it is necessary to remove all trees and unwanted vegetation from the plot. When the trees are cut, the stumps and roots must be removed to keep the old roots from taking nutrients from the soil. A pickaxe is used to dig around the stump and a machete can be used to cut away roots.



**Children under the age of 18 are not authorized to perform this work.**

### **Soil preparation**

Depending on the vegetables to be cultivated, the soil must be plowed, or turned over with a hoe, a spade, or a pitchfork. Plowing the soil allows for good circulation of water, air, and humus in the ground, all of which help the plants grow well. To make the work easier, soil should be turned when the ground is moist. If it is rich, the soil should be turned at a great depth. If not, plowing must be shallow, avoiding turning over too much earth because the underlying layers have little humus.

If the soil is poor, fertilizers can be added during the soil preparation phase.



**Children under 18 and under adult supervision are allowed to plow soil.**





# SEED SOWING METHODS

## OVERVIEW

There are two main ways of growing plants: by natural means with the use of seeds and by artificial means with the use of plant parts (also known as vegetative propagation).

### Time required

30 minutes each (2 exercises to select from)

### Methodology

Demonstrate seed sowing methods

### Preparation

- Chalkboard and chalk
- Two containers/boxes
- Loamy soil (Black Soil)

## GOALS

### Knowledge

- To understand the various seed sowing methods

### Skills

- To know different ways to sow seeds

### Attitudes

- To recognize the appropriate sowing methods for the seeds

## CLASSROOM ACTIVITIES

### Activity 1: Seed sowing demonstration

1. Explain the different ways to sow seeds.
2. Bring seeds into the classroom and use a box of sand or a piece of land outdoors to demonstrate each method.
3. If possible, each student should be given seeds that they could plant in actual soil using each of the three methods. Students can then continue to water the soil to see which method works best for which seeds.

### Activity 2: Seed Identification

If possible, see if you can invite someone, such as an agricultural extension agent or someone who works in forest conservation, into the classroom to introduce students to the art of seed collection., Seed collection is a sellable skill and can lower input costs when running a vegetable garden.





## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What is the difference between direct sowing and nursing?
  2. What are the different ways in which seeds can be sown?
- 

## BACKGROUND INFORMATION

### Direct sowing or nursing?

Direct sowing is the planting of seeds in the place where they will grow to full maturity. Nursing is to plant seeds in a protected nursery until they start sprouting and need to be transplanted into the full garden.

Vegetable seeds that need to be planted in a nursery first:

- Garden egg
- Tomato
- Pepper
- Cabbage
- Cucumber (can also be directly sown)
- Lettuce

Vegetable seeds that can be sown directly into the ground:

- Onion
- Green bean
- Carrot
- Cucumber (can also be nursed first)
- Okra

### Seed sowing methods

To sow is to plant seeds into the soil so that they will germinate and sprout easily. Seeds can be sown using the following methods:

- Broadcast method
- Drilling
- Sowing in holes (Dibbling)

#### ***Broadcast method***

Broadcasting is the spreading or scattering of seeds evenly over the soil and then covering them with a thin layer of soil. The seeds are superficially buried by spreading the soil thinly over them using a rake or by hand. The broadcast method is the quickest of the three sowing methods, but can lead to substantial seed wasting (e.g. seeds not securely planted in ground, seeds land too close together).



**Drilling**

Drilling involves placing the seeds in furrows at a depth of 1 to 3 cm in a continuous manner at 10 to 20 cm apart. The furrows are then covered with a thin layer of sand, humus or soil. Drilling is a more secure sowing method, but requires more time than the broadcast method.



Planting lettuce using the drilling method

**Sowing in holes (dibbling)**

With a harrow or hand seeder, small holes are dug in the soil. About 2 to 5 seeds are placed in them. The depth of the hole should be about 2 to 3 times the thickness of the seed. This method requires the most time but has the greatest likelihood of success.



Sowing seeds using the sowing in holes/dibbling method



# PREPARING PLANTING BEDS

## OVERVIEW

Planting beds are areas of the garden, farm or around the house that are specifically prepared for growing vegetables. Planting beds are very beneficial for vegetable gardens. Planting beds offer more nutrients to the vegetables because the fertile layer of soil has been gathered up into a pile in different areas of the garden. Planting beds can be used for vegetable seedlings that have been raised in nurseries or for vegetable seeds that are directly sown into the planting bed. Vegetables can be either directly planted into the beds or transplanted from nurseries to planting beds.



***In accordance with the constitution of the Republic of Ghana and the children’s act 516, children under 18 need to be under adult supervision to be allowed to build planting beds.***

### Time required

30 minutes

### Methodology

Discussion about different scenarios to reinforce learning and remembering

### Preparation

- Chalkboard and chalk

## GOALS

### Knowledge

- To learn about preparing the planting bed

### Skills

- To build and use a planting bed

### Attitudes

- To recognize the importance of planting beds

## CLASSROOM ACTIVITIES

1. Discuss the importance of planting beds.
2. Ask students what are the things that would differ between a planned and an unplanned planting bed. What impact would this have on the growth of a vegetable garden.
3. Students should cover the following factors during the discussion: good soil aeration, better infiltration of water, vegetables planted orderly, vegetables easily accessible, good drainage, no excess water, healthy seedlings, good root development, and easy harvesting.





## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Why is it useful to use planting beds?
2. What are the steps for preparing a planting bed?

---

## BACKGROUND INFORMATION

### Importance of planting beds

A planting bed provides the vegetables with a better physical environment (good soil aeration, better infiltration of water) than they would have if directly planted into the field, which is good for root development. When harvest time comes, it will be easier to take the vegetables out of the ground because the vegetables will be planted orderly and be easily accessible. In addition, the risk of excess water, which would kill the seedlings, is reduced or prevented because of good drainage.

### Preparation of the planting bed

In order to prepare the planting bed, the land on the vegetable garden plot must be ploughed to prepare the soil for molding into planting beds. Ploughing is carried out with a plough that opens the soil and turns it over. Weeds and grass are rooted out, allowing the soil to breathe. It also results in a light soil surface that allows easy passage of rainwater and provides favourable conditions for seed planting and germination. It is important to remember that if the quality of the soil is poor, it shouldn't be turned too much because the rich humus/nutrients in the top layer of the soil will be lost.

### Creating the planting bed

#### ***Types of planting beds***

There are two main types of planting beds: Raised Beds and Sunken Beds.

#### ***Raised Beds***

As their name suggests, raised beds are raised above the surrounding surface and are generally used in areas that receive large amounts of rainfall. They improve drainage and help ensure that vegetables are not flooded during periods of heavy rainfall.

#### ***Sunken Beds***

As indicated by their name, sunken beds are lower than the surrounding surface and are mainly used in areas that receive little rainfall. Sunken beds can retain water for extended periods of time. Sunken beds are normally dug to 7.5cm – 15cm below the surrounding ground.





## Transplanting nursed vegetables

Transplanting is the process of moving young seedlings from the nursery to the garden (this process would be unnecessary in cases where the vegetable is directly planted into the soil, e.g. carrots). It is absolutely necessary to leave the seedlings in the nursery for the recommended length of time before transplanting them. If they are transplanted too soon, the seedlings may be too weak or too fragile to survive. If they are transplanted too late, they may already have established their adult root systems, which would get ripped out.

Once the vegetables are mature and ready for transplanting, their nursery beds should be watered first. This makes the soil loose and reduces stress on the plant. Once the seedlings are removed from the nursery bed, their roots should be dipped into a fungicide such as Manèbe. This helps avoid the spreading of any plant disease. Any wilted leaves should also be removed. Only health seedlings should be transplanted into the garden. Their transplant spacing and density depends on the species of vegetable





# VEGETABLE GARDEN MAINTENANCE

## OVERVIEW

Vegetables are fragile and should be tended with great care at all times. They need to be watered, weeded, fertilized, and hoed at regular intervals. Vegetable crops are also extremely sensitive to diseases and other damage caused by insects, worms, mildew, and mould.

### Time required

30 minutes

### Methodology

Simulation inside or outside the classroom, using a small box or patch of land

### Preparation

- Chalkboard and chalk
- Basic packaging material

## GOALS

### Knowledge

- To learn about different methods to maintain a healthy vegetable garden.
- To learn about different types of fertilizers

### Skills

- To successfully care for a vegetable garden, including identifying pests, identifying the need for fertilizers and applying the correct type of fertilizer

### Attitudes

- To recognize the need to tend a vegetable garden

## CLASSROOM ACTIVITIES

### Activity 1: Maintenance

1. Explain the different ways that vegetables can be maintained: watering, weeding, hoeing, pest management.
2. Ask students if they can guess why each is needed. After a few guesses, explain the reasons to them (See the Information section below.)
3. Tell students that they are going to simulate looking after their own vegetable gardens.
  - a. Either give them a box with some soil to each small group and ask them to role-play the steps of looking after their vegetable gardens, or find a small patch of land outside and ask them to role-play some of the steps. If there are weeds outside, they can spend some time weeding.





- b. **OPTIONAL:** If more time is available, take students to visit a real vegetable garden and see if they can participate in one or two steps of the actual garden maintenance.

**Activity 2:  
Fertilizers**

1. Tell students what the symptoms are for deficiencies of Nitrogen, Phosphorous and Potassium that may require the use of fertilizers. Now ask students to draw pictures of three plants that show symptoms of each of these deficiencies. (They could do this in small groups of 2 – 4 students each.)
2. Tell students about the different fertilizers and ask them to decide which they might use for each of their plants (there are no right or wrong answers here).

**PERFORMANCE  
ASSESSMENT**

**Questions**

To assess students' performance, the facilitator can ask the following questions:

***Maintenance***

1. What are key activities for maintaining a vegetable garden?
2. Why do we need to water in the mornings and evenings and not at mid-day?
3. Why is it important to remove weeds and grass from the garden?
4. Why do we need to hoe the soil?
5. What are the main causes of disease or damage to vegetable plants?
6. What are ways to control pests and diseases?

***Fertilizers:***

1. What types of fertilizers can be used in a vegetable garden?

**BACKGROUND  
INFORMATION**

**Garden  
maintenance**

Garden maintenance entails watering, weeding, hoeing and pest management.

**Watering**

Watering is the act or process of supplying water to the plant. When the climate is dry, plants must be watered twice a day (morning and night), preferably before it is too hot. If the vegetables are watered in the middle of the day, the water may evaporate (dry up and go into the air, rather than into the soil) more quickly, leaving less for the plants.

**Weeding**

Weeding or hoeing is important to keep insects at a minimum and to prevent nutrient competition between the vegetables and weeds. Weeding is also helpful because pulling out the grass and weeds breaks the crust that forms over the surface of the planting bed. This ensures good soil aeration as well as good water penetration while watering. Weeding and hoeing are done by hand, with a weeding hoe, with another appropriate forked tool or with herbicides (weedicides).

A herbicide is a chemical product that controls and destroys weeds and grass. Examples of herbicides:



- Kallach
- Touch Down
- Calriz



**Children should not use or have contact with herbicides.**

Advantages of herbicides:

- Herbicides reduce the amount of work required to control weeds and grass, thus making it easier to organize the cropping calendar.
- When applied at the right time, they will eliminate the competition from weeds for water and nutrients, especially important during the initial phases of starting a crop.
- Herbicide application over one hectare takes less than a day.



Disadvantages of herbicides:

- It is often much better to take the time to weed by hand so that we do not add chemicals to the vegetables and the soil. Chemicals from herbicides can sometimes be absorbed through the vegetables and into our bodies when we eat them, especially when used in large quantities, and this could make us ill over a long period of time.
- Incorrect application of herbicides can kill the vegetables
- Herbicides can be expensive

### Hoeing

Hoeing the soil turns and breaks up the soil on the surface around the plants. It permits soil ventilation and facilitates the penetration of water.

### Pest management

Vegetable crops are extremely sensitive to diseases and other damage caused by insects, worms, mildew, and mould. Plants have to be protected against their enemies so that the garden will remain productive and profitable.



School children in Adzopé hoeing under teacher supervision.

The main enemies of vegetable crops belong to three large groups:

- Insects
- Fungi
- Microscopic worms or parasites (Nematodes)

**Insects**

- Signs of Infection: leaves fall, diseases are transmitted, fruit and leaves have holes, flowers stop blooming

**Fungi**

- Signs of Infection : roots, stem and fruit affected by rot, wilting of leaves, drying of leaves

**Microscopic worms or parasites (Nematodes)**

- Signs of Infection: bumps or knots appear on the roots, roots affected by rot



Disease caused by Heliothis



Aphids



Meloidogyne



Brown mildew caused by *Phytophthora infestans*

## Control methods

Control methods to neutralize vegetable pests fall into three large categories:

- Chemical control
- Agronomical control
- Biological control

### **Chemical control**

Chemical control is the application of chemical products (by sprinkling, powdering or putting into the soil) in order to protect the plants.

(Note that the treatment should be repeated if there is rainfall within two hours of the first application.)



**Often children under the age of 18 are not authorized to perform work using pesticides**

There is a wide range of products used for chemical control:

- insecticides (kill harmful insects): Karaté, Orthène, Decis
- nematicides (kill nematodes or worms): Furadan, Basamid
- fungicides (kill mushrooms or fungi): Manèbe, Callicuivre
- acaricides (kill harmful spiders):
- mollusk killers: Caldéhyde

### **Agronomical control**

A number of agricultural, physical techniques are used to control pests:

- ploughing
- growing dissimilar crops on a site, which can interrupt the development cycle of insects, nematodes, and fungi
- weeding (destruction of pest hosts)
- use of pest-resistant crop varieties such as marigolds

### **Biological control**

Biological control uses the natural enemies (various insects, mites, viruses, fungi) of harmful garden pests in order to reduce their numbers in the crop.

For example, lady beetles eat aphids, whiteflies and other soft-bodied insects. Other beneficial insects include spiders, wasps, and dragonflies that eat insects but they don't damage crops.



## Fertilizers

Fertilizers become necessary when the vegetables in the garden are not getting enough of the nutrients (plant food) they need. If and how much of nutrients are needed depends on the nutrient content of the soil and the nature of the crop. The nutrients most often needed are:

- Nitrogen (N)
- Phosphorous (P)
- Potassium (K)

Plants can be deficient in any or all of these minerals.

### ***Signs of Nitrogen deficiency***

- Poor yields, stunted growth, small leaves, yellowing of leaves, flowers and fruits are often not formed well

### ***Signs of Phosphorous deficiency***

- Poorly developed root system, general growth disturbance, small leaves with greenish, reddish-brown, purple or bronze colour
- Retarded flowering and fruit ripening, seeds and fruits are small

### ***Signs of Potassium deficiency***

- Burning of leaf edges, beginning from the tips and extending to the stalk.
- Dry, scorched and twisted leaves

## Types of fertilizers

There are three basic types of fertilizer:

- Mineral fertilizer
- Manure
- Compost

### ***Mineral fertilizers***

Mineral fertilizers are either natural (produced by nature) or chemical (produced by industry).

### ***Manure***

Manure is the fermented mixture of animal dung and crushed straw. Common organic manure can come from cow dung, chicken droppings, or liquid pig manure. Two to three kg per square meters of manure is mixed in with the soil when the planting beds are being prepared.

### ***Compost***

Composting is an operation in which organic waste like food scraps, egg shells, and grass cuttings undergoes decomposition in the presence of oxygen provided by air. The material for compost is mixed together in a pile or in a container that allows air to pass. It is left for days to decompose. Once the material has fully decomposed, it becomes rich, black soil.

When collecting material for compost, do not include weeds because they will reproduce in your garden once the compost is added.





# PLANTING COCOA IN THE FIELD

## OVERVIEW

Early care of cocoa seeds, either direct sowing or nursing, is important to the long-term productivity of the cocoa tree. Following a proper planting procedure, including the time of year the seedlings are planted and the method used to plant the seedlings, is vital to the success of the cocoa farm.

### Time required

90 minutes (30 minutes in classroom and 60 minutes for field trip)

### Methodology

A participatory group discussion on planting cocoa

### Preparation

- Chalkboard and chalk
- Seedlings in poly bags

## GOALS

### Knowledge

- To learn about the proper seed/seedling rate

### Skills

- To properly plant cocoa trees in the field

### Attitudes

- To recognize the importance of following the proper planting procedures

## CLASSROOM ACTIVITIES

1. Explain to students why it is not good to plant cocoa seeds directly in the field. Tell them the advantages of nursing seeds before planting or the use of certified seedlings (seedlings properly grown from hybrid seeds)
2. Explain to them the importance of planting only one (1) seedling per hole so that they can grow properly (no competition for nutrients, space, sunlight, etc.).
3. Stress that it is incorrect to put more seedlings in a hole and cut some after they begin to grow—this method wastes planting material and does not encourage vigorous growth.



## PRACTICAL ACTIVITY



### Field Trip

Take the students to a local farm to observe the planting process. Ensure that the farmers use the lining and pegging system so students can see it in practice. Discuss with students the principles of lining and pegging and the best practices of planting seedlings in the farm

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. Why is it not advisable to plant cocoa seeds directly on the farm?
2. What are the benefits of planting seedlings instead of cocoa seeds directly?
3. How many cocoa seedlings should be planted in a hole and why?



## BACKGROUND INFORMATION

### Field planting

Generally the best time for planting cocoa is from May to July, which is the major season. However, due to changes in the weather conditions, it is advisable to plant when the “rains have come to stay.”



To plant cocoa seedlings or seeds, dig holes which are large and deep enough (diameter of 30-45 cm and depth of 30-60 cm) at 3.0m x 3.0m intervals. With a shovel or similar tool, scoop the top soil and the sub soil and put them aside. Before transplanting the cocoa from the nursery, water it very well. Remove the poly bags that hold the seedling carefully in order not to lose too much soil from the roots. In order to remove the bag, follow one of two methods: either carefully slice off the bottom of the bag, or wet the seedling, gently compress (squeeze) the soil until it's firm, then detach the perforated polythene bag. Place the seedling and the soil carefully into the hole. Cover the base of the seedling with the top soil and pack the soil down with the back of the shovel. The seedling should be at least 3 months old before transplanting. It is also not advisable to transplant overgrown seedling as this may injure the roots and cause stunted growth.

**Seedling rate**

Plant one cocoa seedling in each hole. This gives 1,111 seedlings per hectare (2.5 acres) and 444.4 seedlings per acre (4,000m<sup>2</sup>). Planting only one seedling per hole will prevent competition for light and soil nutrients among the young plants. Planting more than one seedling initially with the intention of later reducing to one seedling (generally done because of the likelihood that some will die) is not advisable because it is expensive and may lead to seedling wastage. Planting improved/hybrid seedlings will increase the likelihood of good plant establishment.





# MAINTAINING A HEALTHY COCOA FARM

## OVERVIEW

Planting cocoa trees well is not enough to ensure a good yield. Taking proper care of the cocoa plant from the time it is planted in the field until the time it is harvested will increase the likelihood of healthy growth and better yields. The cultural/agronomic practices that help the cocoa plant develop well include: weed control, shading, thinning, pruning and fertilizer application. Fertilizer application will be discussed in the next module.

### Time required

90 minutes (30 minutes classroom discussion and 60 minutes optional field trip to the farm)

### Methodology

A participatory discussion on the “enemies and friends” of cocoa crops

### Preparation

- Chalkboard and chalk

## GOALS

### Knowledge

- To learn about and understand the importance of cultural practices in maintaining a healthy cocoa plant

### Skills

- To gain the skills of proper ongoing care of a cocoa farm

### Attitudes

- To recognize the importance of ongoing care of the cocoa farm to the success of the farm

## CLASSROOM ACTIVITIES

1. Explain to students that everything/everybody has friends and enemies and it is important that we identify them so as to eliminate those that are bad for us (enemies) and encourage those that are good (friends). Ask them to list enemies and friends of human beings.
2. Explain that as a good farmer it is equally important to know the enemies and friends of your crops. Ask them to mention/list all the friends and enemies of cocoa that they know. (Do not interrupt by giving the correct answer. When they stop, ask them whether there is anything else).
3. Help students identify and discuss all the things that affect the growth of cocoa positively and those that affect it negatively.
4. Summarize the lesson and discussion.





## PRACTICAL ACTIVITY



### Field Trip

**OPTIONAL:** Follow the lesson up with a practical demonstration on the farm of thinning, pruning, weed control etc.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What practices would you consider as good (friends) of cocoa?
  2. What practices are not good (enemies) for cocoa? Why are they enemies?
  3. What should we do to eliminate the enemies in the cocoa farm?
  4. When is the best time to weed the cocoa farm? To prune?
  5. Which parts of the cocoa tree should we prune and why?
- 

## BACKGROUND INFORMATION

The following can hamper the growth and development of cocoa: weeds, nutrient deficiency, poor shading, overcrowded trees and seedlings, excessive heat and light intensity, water stress, disease and pests and many more. Proper agronomic/cultural practices must be carried out to ensure healthy plant growth.

### Weeds

Weeds are plants that you have not planted and do not want to grow in your farm/garden. Weeds take away light, nutrients and water from the plants in the farm. Similar to how malaria or HIV/AIDS can hurt children worse than adults, weeds cause more damage when the trees/crops are small and unable to compete for water and sunlight. Weeds also compete with plants for space, soil and air, and sometimes harbour insect pest and disease pathogens. Therefore, it is important to control weeds from the very beginning. The best time to control weeds is when they are young and have not developed seed. It is recommended that, to protect young plants, farmers brush the undergrowth of their cocoa farms as soon as weeds are seen on the farm. For old farms, weeding at least twice a year will help to reduce competition between plants and destruction of pods by rodents and to make harvesting and spraying easy.

It is important to understand that an undesired tree or plant, even if it is generally beneficial, is still a weed and should be removed because it can steal nutrients and water from the young cocoa seedlings and impede their growth.

Old cocoa farms should be brushed preferably in April-May and July. New cocoa farms should be brushed 3-4 times a year or whenever new weeds appear (except for dry season).

Weeding is the act of removing unwanted plants from the farm. Weeds are very troublesome and should never be allowed to grow on the farm. Weeds can be controlled on the farm with manual, chemical and mechanical methods.





## Weed control methods

### **Manually**

Use a hoe, cutlass or hand to remove the weed. It is important to till the soil well to remove weed seeds and cover the soil with mulch or shade to suppress weeds. In most cases, children can do manual weed control under supervision.

### **Chemically**

Use a herbicide or weedicide to kill the weed. Before using chemicals to kill weeds, consult the Extension officer in your area Sefwi Wiawso or Juaboso MOFA offices.



***Children must not use chemicals to control weeds because it is hazardous to their health and illegal.***

### **Mechanically**

Use machines (e.g. tractor, power tiller etc.) to remove the weeds.

All of these practices have both advantages and disadvantages and conditions under which they can be used.

## Thinning

Thinning is the act of reducing the number of trees in a farm or branches on a tree when they are overcrowded or removing excess seedlings to allow sufficient room for the remaining plants to grow well. Ideally only one (1) cocoa seedling should be planted per hole. The practice of planting more than one seedling only to destroy the rest after they are grown is not good and should be stopped, as it only leads to the waste of cocoa seedlings, overcrowding and weak stems due to lack of sufficient sunlight. It is important to remove weaker cocoa seedlings and plant only the strong and healthy ones.

## Pruning

Pruning is the act of removing dead, diseased or undesirable limbs from a woody plant. Pruning improves the passage of light and air and reduces disease incidence, thereby increasing yield.



***Tip! Young children should be advised against thinning and pruning.***

## Which part of the cocoa tree should we prune and how?

In a cocoa farm, pruning removes excess vegetation in the form of low hanging and unhealthy branches as well as parasitic mistletoe from the trees. Basal chupons from the ground and under the jorquettes (tangled branches) should also be removed.

All dead and diseased plants parts and any unwanted growth on the plant must be pruned.

**Tip!** Slant all cut surfaces to allow water to drip off and prevent stem rot.



### Shading

To protect the cocoa plant from too much sunshine, it is necessary to provide shade. Cocoa seedlings cannot bear too much heat or sunshine during their early stages, so there is the need to shade them. To protect the seedlings, initial shade should have been planted on the cocoa farm during the Lining and Pegging Module. However, total shade will result in tall, thin weak stems. Shade in cocoa farms needs to be reduced gradually as the plants grow, but total elimination of shade trees on the farm can be detrimental to the plant. When clearing new land for cocoa, leave some recommended economically important trees already on the land. Where there are not enough forest trees, plant quick growing tree species for desirable and undesirable tree species.



Scorched cocoa (lack of proper shading)



# COCOA FERTILIZATION

## OVERVIEW

Cocoa trees need nutrients to produce healthy crops. Fertilizers are the essential plant foods that, when added to the soil, increase the amount of available nutrients that enable healthy growth and development of the plants.

### Time required

30 minutes classroom discussion

### Methodology

A participatory discussion on the use of fertilizers and its application in a cocoa farm

### Preparation

- Chalkboard and chalk

## GOALS

### Knowledge

- To learn the different types of fertilizers and application methods
- To be aware of the safety procedures during application of the fertilizers

### Skills

- To gain the skills of proper application of different fertilizers

### Attitudes

- To recognize the importance of the use of appropriate fertilizer for the success of the cocoa crops
- To recognize the potential danger of exposure to fertilizers

## CLASSROOM ACTIVITIES

1. Explain to students that there are different types of fertilizers that can be used on the farm.
2. Help students identify different application methods for fertilizers and any safety precautions that need to be taken.

## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What are the different types of fertilizers that can be used on a cocoa farm?
2. What are the application methods that can be used?





## BACKGROUND INFORMATION

### Fertilization

Fertilizers are plant food which are added to the soil to increase the amount of nutrients in the soil for the plants. Fertilizers can be grouped into two:

- organic fertilizers, and
- chemical fertilizers (inorganic)

#### **Organic fertilizers**

Organic fertilizers are obtained from plant and animal remains. Dead plants, leaves and roots can be made to rot and used as plant food. Organic fertilizers can also be obtained from poultry, sheep, goats, cattle, kitchen waste etc. (Compost and manure will be discussed later).

#### **Chemical fertilizers**

Chemical fertilizers are designed to increase the amount of nutrients in the soil. Chemical fertilizers do not affect the physical condition of the soil and cannot be kept as reserves. Chemical fertilizers can contain one major nutrient (plant food), for example the super phosphates, or a mixture of different nutrients (compound), for example NPK (Nitrogen-Phosphorus-Potassium).

#### **Nitrogen**

Nitrogen helps the leaves of the cocoa plant grow well.

#### **Phosphorus**

Phosphorus is important for the growth of roots, young plants and shoots.

#### **Potassium**

Potassium helps in the production of flowers and fruits and keeps the cocoa plant healthy.

### Application methods

Chemical fertilizers produce quick results and promote high yields. Some methods of applying chemical fertilizers are:

- broadcasting
- placement
- ringing
- spraying

#### **Broadcasting Method**

For the broadcasting method, the fertilizer is spread uniformly over the field and mixed into the soil with a rake. It can be done before or just after planting.

#### **Placement Method**

For the placement method, fertilizer is laid on the ground around the plant at a distance where the root hairs will be able to absorb the fertilizer.

#### **Ringing**

For the ringing method, fertilizer is placed in a shallow trench made around the plant about 50cm from the stem.





### ***Spraying Method/Foliar Application***

For the spraying method, liquid fertilizer in the form of a dilute solution is sprayed on and absorbed by the leaves of the plants. Excessive and improper use of chemical fertilizers can cause the plant to be easily attacked by diseases and pests and can lead to soil acidity.

### **Types of fertilizer and rate of application**

Recommended fertilizers for cocoa are single or triple superphosphate and muriate or sulphate of potash.

### ***Example rates of application***

Triple superphosphate: For a .4ha (1 acre) farm, mix 1 bag of triple superphosphate thoroughly with either  $\frac{3}{4}$  bag muriate of potash or 1 bag sulphate of potash.

Single superphosphate: For a .4ha (1 acre) farm, mix 1 bag single superphosphate thoroughly with either  $\frac{3}{4}$  bag muriate of potash or 1 bag sulphate of potash.

### ***Instructions for application***

With gloves on, put the mixture in a plastic bucket and broadcast with your hand over a one acre of farm. The best time of application of this type of fertilizer is the beginning of the main rains (April/May). There is no need to remove leaves on the ground before application.

### ***NOTE!***

*You can increase the yield of cocoa by 30% by applying fertilizer on the cocoa farm. It is economical to use fertilizers on cocoa trees which are in the bearing stage (after 3 years). For fertilizers to be beneficial to the plants, good farming practices, such as removal of weeds, diseased pods, swollen shoot infected trees, mistletoes and capsids, must be carried out.*





# COCOA PESTS

## OVERVIEW

Over the years, cocoa production in Ghana has been greatly affected by pests that reduce cocoa quality and yield. As a result, these pests reduce farmers' income. Many farmers have very little knowledge about the causes and signs of these pests or about methods to control them. Even when they know about the pests, farmers sometimes use the wrong chemicals or approach to manage them.

### Time required

30 minutes

### Methodology

A participatory discussion on common cocoa farm pests

### Preparation

- Chalkboard and chalk
- Visual aids (pictures of pests)
- Pest specimens

## GOALS

### Knowledge

- To learn about pests that damage cocoa crops
- To know the various control options for the pests

### Skills

- To identify pests that damage cocoa crops
- To effectively control pests on a cocoa farm

### Attitudes

- To recognize the harmful nature of pests and the importance to control them

## CLASSROOM ACTIVITIES

1. Ask the students to mention or write down any cocoa crop pests that they know and how they could identify them (you can have them write their answers on the board).
2. Display the pest pictures or specimens you brought and ask the students to go around and see if their answers match any of the pests that you brought.
3. Ask if any of them have seen the pests on their family farm and, if so, to share their stories.
4. Get students together to discuss ways in which insects cause damage and why insects invade our farms.
5. Explain the different pests, their signs, mode of damage, the effect they have on cocoa yield and quality, and the effect they have on farmers' incomes.
6. Ask students again to identify the pests among the visuals you brought.
7. Ask them to imagine that they own farms that are affected by some of the pests. They should develop a plan as to what they could do to help protect the cocoa. (Bring the students together to discuss what they put down in their groups.)



8. Explain the different control measures that can be used to control all known pests of cocoa. (This should be adaptable depending on the school level. Perhaps with upper primary they can all do it together.)
9. Summarize the lesson, encourage students to ask questions and stress most important points.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What types of pests attack cocoa?
2. How will you know that a particular type of pest has attacked the cocoa? What signs should you look for?
3. What type of damage do the pests cause to cocoa?
4. How would you control the pests?

---

## BACKGROUND INFORMATION

### What are pests?

Pests are small insects that reproduce quickly, causing serious damage to crops on which they feed. Not all insects feed on plants; some feed on other insects and therefore help control pest infestations (natural enemies). These are known as beneficial insects. Other insects help with pollination and thus propagation of plants.

Harmful insects, or pests, almost always feed on plants. There are some things that can be done to control pests before they become a problem. Avoid the use of chemical insecticides that are very dangerous to your health and may kill all of the beneficial insects. It is better to reach a balance than to totally eliminate all the insects. One way of maintaining a balance is by using the IPM approach to pest management (explained later).

### Cocoa pests

The three primary cocoa pests are:

1. Capsids/Mirids
2. Caterpillars
3. *Bathycoelia thalassinia*

### Capsid/Mirids (Akate)

Capsids (Twi: Akate) are insect pests that feed on young shoots and pods of cocoa.

#### **Damage**

Capsids damage the soft young tissues of cocoa by piercing the young shoots and injecting poisonous saliva into the shoot in order to suck the liquid food from the shoot. Capsids may infest cocoa any time of the year, but they increase in numbers from August to March.

#### **Symptoms**

Young cocoa trees may die or shrink back to within a few inches of the ground.

#### **Prevention**

Provide shade to young cocoa plants and mature cocoa plants whose canopies have not yet closed.





### ***Chemical Control***

Use any recommended insecticide. Spray every four (4) weeks from August to October and once in December. If you see that more cocoa is infested by capsids at any time during the year, you can spray again to control the infestation.

### ***Recommended Insecticides***

1. Confidor: use 30ml in 11.0 litres of water
2. Akate Master: use 100ml in 11.0 litres water
3. ACTARA: use 17ml in 11.0 litres of water

Use a motorized sprayer to apply the chemicals. One full tank = 11.0 ml can spray, which serves half an acre (0.2ha) of mature farm.

### ***Cultural control***

Cultural control of capsids is by shading.



[http://www.gardenseeker.com/plant\\_pests\\_problems/plant-pests/capsid\\_bug\\_damage.htm](http://www.gardenseeker.com/plant_pests_problems/plant-pests/capsid_bug_damage.htm)



## Caterpillar

Caterpillars attack cocoa seedlings at the nursery stage and so should not significantly affect cocoa farmers as long as they ensure that the seedlings they receive from the nursery are not infested with caterpillars.

### **Chemical control**

Use recommended insecticide mentioned above.



[http://upload.wikimedia.org/wikipedia/commons/7/77/Papilio\\_machaon\\_caterpillar.jpg](http://upload.wikimedia.org/wikipedia/commons/7/77/Papilio_machaon_caterpillar.jpg)

## Bathycoelia thalassinia

*Bathycoelia thalassinia* (Twi: Atee) is a large green insect that feeds on cocoa pods. This insect uses its mouth to part the cocoa pod and then sucks out the contents. It lays its eggs on leaves, trunks and branches.

### **Control**

Hand-pick the insects off of the plant.

## Integrated Pest Management (IPM)

The management of pests requires a comprehensive strategy. In some cases, effective pest control will require a number of control strategies. The steps toward creating a comprehensive pest control strategy are discussed below.

### What is Integrated Pest Management?

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means and with the least possible hazard to people, property, and the environment.



The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides.

### How do IPM programs work?

IPM is not a single pest control method. Rather, it involves a series of pest management evaluations, decisions and controls.

The four steps of IPM include:

- Set Action Thresholds
- Monitor and Identify Pests
- Prevention
- Control

#### ***Set Action Thresholds***

Before taking any pest control action, IPM requires the farmer to first set an action threshold, which is a point at which pest populations or environmental conditions indicate that pest control action must be taken (sighting a single pest does not always mean control is needed). The level at which pests will become an economic threat is critical to guide future pest control decisions.

#### ***Monitor and Identify Pests***

Not all insects, weeds, and other living organisms are harmful or require action to control their prevalence. Many organisms are harmless and some are even beneficial. Farmers must monitor for pests and identify them accurately so the appropriate control decisions can be made in combination with the action thresholds. This monitoring and identification reduces the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used.

#### ***Prevention***

As a first line of pest control, IPM programs work to manage the crop to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. For cocoa, it will mean using a resistant/tolerant variety as well as other cultural practices (disinfecting plantain suckers, not planting fruit trees or maize in the cocoa plot (due to stem borer infestations), preventing the cocoa nursery from infestation, etc). These control methods can be very effective and cost-efficient and present little or no risk to people or the environment.





Disinfecting plantain plants before integrating them onto the cocoa farm

### Control

When the monitoring, identification and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, evaluate the proper control method both for effectiveness and risk. This process will help determine which control method is appropriate. Effective, less risky pest control methods are chosen first, including highly targeted chemicals, such as the pheromones to disrupt pest mating, or mechanical control, such as trapping or weeding. If further monitoring, identification and action thresholds indicate that these less risky control methods are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of nonspecific pesticides is a last resort.

### Safety

During control activities, particular attention should be paid to who is around during the spray operations. Exposure to Agro-chemicals can be particularly harmful for the health of young children. In addition, the pesticide containers need to be properly discarded after use to protect children and animals from coming into contact with harmful chemicals.



Cricket on tomato



# COCOA DISEASES

## OVERVIEW

Over the years, cocoa production in Ghana has been greatly affected by diseases, which reduce cocoa quality, pod yield and farmers' income. Many farmers have very little knowledge about the causes and signs of these diseases and how they could be controlled. Even when they know about the disease, farmers sometimes use the wrong chemicals or approach to manage it. It is vital for farmers to be able to identify and treat diseases that affect cocoa trees.

### Time required

30 minutes

### Methodology

A participatory discussion on common cocoa farm diseases

### Preparation

- Chalkboard and chalk
- Visual aids (pictures of diseased plants)
- Diseased plant parts (make sure to find them before class)

## GOALS

### Knowledge

- To learn about diseases that damage cocoa crops
- To know ways to control the disease

### Skills

- To identify diseases that damage cocoa crops
- To effectively control diseases on a cocoa farm

### Attitudes

- To recognize the harmful nature of diseases and the importance to control them

## CLASSROOM ACTIVITIES

Ask the students to mention or write down any cocoa disease that they know and how they could identify them (you can have them write their answers on the board).

1. Display the pictures or specimens of the diseases you brought and ask the students to go around and see if what they have put down matches any of the ones you brought.
2. Ask if any of the students have seen these diseases on their family farm and then to tell the class what caused it.
3. Discuss the ways in which diseases cause damage cocoa crops.
4. Explain the different diseases, their signs, modes of damage, the effect they have on cocoa yield and quality, and the effect they have on farmers' incomes.
5. Ask students again to identify the diseases among the visuals you brought.
6. Ask the students to gather in groups (about 4 per group).



7. Ask them to imagine that they own farm and that it is affected by some of the diseases. The groups should develop a plan as to what they could do to help protect the cocoa. (Bring the students together to discuss what they discussed in their groups.)
8. Explain the different control measures that can be used to control all known diseases of cocoa. (This should be adaptable depending on the school level. Perhaps with upper primary they can all do it together.)
9. Summarize the lesson, encourage students to ask questions and stress the most important points.

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What type of diseases affect cocoa plants?
2. What signs would you look for to identify a particular disease?
3. What conditions help the diseases to occur?
4. What type of damage can each disease cause?
5. How will you control each type of disease?

---

## BACKGROUND INFORMATION

### Cocoa diseases

The primary cocoa diseases are:

1. Swollen shoot disease virus (CSSV or cocoa sasabro)
2. Cocoa necrosis virus
3. Black pod disease
4. Other cocoa fungal diseases such as Stem Canker, Thread blight, Pink disease, Root rot, Cushion gall, Charcoal pod rot, Warty pod, Mealy pod

### Swollen shoot disease virus (CSSV)

The Cocoa swollen shoot disease virus (cocoa sasabro) is the most important viral disease of cocoa. It is caused by a virus known as the swollen shoot disease virus (CSSV) that is transmitted by many things, including insects like the mealy bug. In Ghana several strains (types) of the virus have been identified in all cocoa growing areas and given different local names (find the local name). Some are referred to as mild (Bisa, Worawora) while others are severe (New Juabeng, Kofi Pare, Nkwanta). There is no known cure for CSSV, which leads some farmers to call it the AIDS of cocoa.

### CSSV Symptoms

#### **Leaves**

Symptoms of the disease appear in almost all the parts of the cocoa plant. The main symptoms of CSSV are leaf symptoms and swellings on the stem and roots. Usually the first symptom to appear is red colour along the veins of a leaf. The reddening disappears as the leaves mature and may be followed by chlorosis (yellowing) along the veins. At a latter stage of the infection, a fern leaf pattern is produced and mature trees may have a yellowish appearance.





### **Roots**

Many types of the virus induce swellings on the roots, especially the tap root, and necrosis of the lateral roots.

### **Stem**

Swelling may develop at the nodes, internodes or at the apex of the stem. Die back [death of plant top down] may occur and lead to an eventual break in canopy and death of the trees.

### **Pods**

Infected Pods are smaller and have smoother surfaces than healthy ones. Such Pods contain only about half the normal weight of beans, which are flattened and often have pale cotyledon (seed coat). Pods become rounder and may, at times, become almost like a ball. Some green mottling may occur on the Pod surfaces.

## **Control of CSSVD**

### ***Cutting out infected trees***

To control the disease, farmers can cut out infected trees together with their apparently healthy 'contacts' trees at a distance of 5m around the tree if only 1-10 infected trees are spotted. If the number of infected trees is between 11-100, farmers should cut to a distance of 10m around the tree. If 100 or more infected trees are identified, farmers should cut to a distance of 15m around the trees. Diseased trees are identified through visual inspection carried out by trained field staff. Infected plants are burned after being cut down. COCOBOD will provide free assistance to farmers to cut out their infected trees.

### ***Use of resistant or tolerant varieties***

Currently the most tolerant variety being promoted to farmers is the Amazon hybrid. These can be purchased at the COCOBOD Seed Production Unit (SPU).

### ***Isolation/barrier cropping***

Farmers are encouraged to leave a 10m barrier between new cocoa establishments and existing farms. The barrier can be planted with cash crops that are resistant/immune to the swollen shoot virus such as oil palm and citrus. To reduce the risk of rapid infection of new plantings, farmers are advised to plant their cocoa trees in large-sized blocks with resistant/immune crops in-between the blocks.

### ***Elimination of alternative host plants***

Some forest trees have been identified as alternative hosts of CSSV. These trees must be removed before establishing cocoa farms because they can serve as sources of infection.





Examples of alternative hosts are:

Alternative host	Local name
<i>Cola chlamydantha</i>	Otweakote
<i>Adansonia digitata</i>	Odadee
<i>Ceiba pentandra</i>	Onyina
<i>Cola gigantean</i>	Owatapuo
<i>Canthium glabrifloru</i>	Ntetea – dupow
<i>Sterculia tragacantha</i>	Foto

### Cocoa Necrosis Virus

Cocoa necrosis virus causes dead leaf cells, defoliation and die-back, and the death of young seedlings. Plants that survive the acute infection later show leaves with irregular lesions along the major veins and leaf distortions. This disease does not induce stem swelling and can be transmitted through sap (water from the plant) to a wide range of hosts and through the seeds of some hosts, but not through insects or mealybugs.

### Control of Cocoa Necrosis Virus

CNV, like other viral infections, could be controlled by “cutting out” of visibly infected cocoa trees and their neighbours.

Control of CNV is generally achieved through isolation/barrier cropping and elimination of alternative host plants as described for CSSV (see above).

### Black pod Disease (Twi – Anonom)

The black pod disease is the most important fungal disease in Ghana. The black pod disease is a pod disease caused by fungus. In Ghana, two species of fungi (*Phytophthora palmivora* – the mild type – and *P. megakarya* – the virulent and destructive type) are known to attack cocoa. Black pod disease can result in pod losses of 5-20% when attacked by *Phytophthora palmivora* and 60-100% when attacked by *Phytophthora megakarya*.



<http://www.feedar.interconnection.org/images/disease.jpg>





<http://www.bspp.org.uk/archives/xmasdiseases.php>

### Symptoms

The disease starts as a small brown spot on the pod surface. This normally appears on the pod 2–3 days after infection and becomes darker and expands rapidly. Spores or seeds of the fungus are produced 3–5 days after the appearance of the first symptom. The whole surface of the pod turns black within 7–14 days, depending on the species involved, age of the pod and environmental conditions. The husk of *Phytophthora* infected pods would remain hard and firm at the early stages of infection.

### Conditions that favour the Black pod Disease

- Presence of weeds on the cocoa farm and chupons (side shoots) on cocoa trees
- Close sowing of seeds or close planting of seedlings of cocoa
- Excessive shade from shade trees
- Presence of mistletoes which parasitize on the cocoa trees
- Presence of stagnant water

### Control of Black pod Disease

#### **Cultural practices (crop sanitation)**

Inspect the farm frequently and remove all the infected pods on the trunk and in the canopy. Do not leave any pod on the tree, especially in the canopy, after harvesting season. Harvest ripe pods frequently, reduce overhead shade and brush (remove weeds) regularly to reduce damp conditions.

- Judicious reduction of shade – between 15–20 shade trees/ha or 6–8 shade trees/acre. These shade trees should be well distributed in the farm
- Removal of heavy cocoa canopy through pruning to admit adequate light into the farm
- Removal of chupons, mistletoes and epiphytes
- Regular weeding between 2–4 times in a year, depending on the cocoa canopy
- Planting at recommended spacing or thinning out to recommended spacing of 3m x 3m
- Draining stagnant waters



It is important to note that the black pod fungus spreads through the production of seeds (spores). Therefore, infected pods should be removed at frequent intervals (preferably once a week) before the fungus matures and starts producing seeds. An infected pod can produce as many as five million seeds. When infected pods are removed from the tree, they should be sprayed with any recommended fungicide and/or buried to prevent spore production.

### **Chemical control**

Chemical control involves the application of a recommended chemical to coat the pods, which stops the germination or growth of the fungal spores. The Pneumatic spraying machine is recommended for the application of fungicide. Currently, five fungicides have been recommended by Cocoa Research Institute of Ghana (CRIG) and approved by Ghana COCOBOD for the control of black pod disease.

Trade Name	Chemical Name	Dosage (gm/15l of water)	No of sachets/ spraying tank	Frequency of application
Kocide 101WP	Cupric Hydroxide	100	1	3 times/week
Champion WP	Cupric Hydroxide	100	1	3 times/week
Funguran-OH wp	Cupric Hydroxide	100	1	3 times/week
Nordox-WG	Cupros Oxide	75	1	3 or 4 times/week
Ridomil 66 Gold WP	Cupros Oxide & Mefonoxam	50	1	4 times/week

Source: Manual for the Identification and Control of Diseases of Cocoa, Technical Bulletin no. 16



**Children should not use or have contact with chemicals.**

### **Other Cocoa fungal diseases**

Other Cocoa fungal diseases include the following:

- Stem Canker
- Thread blight
- Pink disease
- Root rot
- Cushion gall
- Charcoal pod rot
- Warty pod
- Mealy pod

Farmers can treat these diseases by removing infected trees (or infected parts of trees) or by attempting to treat the disease directly on the tree with a natural or chemical compound. Keeping a close watch over the trees will allow farmers to quickly identify and control diseases before they spread throughout the farm.





# PESTS, DISEASES AND SPRAYING SAFETY

## OVERVIEW

Pests and Diseases can have a detrimental impact on cocoa farms. Practical knowledge and experience of how to identify and treat pest infestations and diseases on a cocoa farm is important for all farmers.

### Time required

60 minutes

### Methodology



Field trip

### Preparation

- A nearby farm to visit
- Knapsack (well-cleaned), water
- White paper, tape (thick), and red dye (or another colour if red is unavailable)

## REQUIRED

Module on cocoa pests  
Module on cocoa diseases

## GOALS

### Knowledge

- To review all the concepts that were learned on cocoa pests and cocoa diseases
- To learn the importance of wearing protective gear while spraying on a cocoa farm

### Skills

- To effectively use safety equipment when applying chemical fertilizers and insecticides

### Attitudes

- To recognize the danger of using chemical fertilizers and insecticides





## PRACTICAL ACTIVITY



### Field trip

Take students out to a nearby farm where they will identify signs, damage and types of diseases and pests.

Ask the farmers in your area if they would be interested in hosting the students on their field trip. Ideally, a few farmers can attend the field trip and show any infected cocoa pods to the students. Ask the students to ask any questions of the farmer about what he does and how much he has to worry about pests and diseases. If there are infected cocoa pods available, the facilitator should ask the students to identify the disease or pest and list ways to control the disease or pest.

---

## FARMER WRAPPING ACTIVITY

Using the red dye and water, the students will prepare a solution and fill the knapsack sprayers. They will then wrap each other in a white paper and spray their own crops with the sprayer filled with red dye. The amount and distribution of dye on the farmers' body will help demonstrate to the students the risk of applying chemical pesticides with a sprayer.



***For the above-mentioned spray activity, students under the age of 18 cannot spray, but can participate in activity.***

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## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. What are the pests and diseases that were seen in the field today?
2. Are there any other pests or diseases mentioned in the previous lesson that were not observed today?
3. What is the effect of pests and diseases on cocoa plants?
4. What are the control methods that the farmer has used?
5. Are there any additional methods that can be used to control pests and disease in a cocoa farm?





# VEGETABLE GARDEN HARVESTING

## OVERVIEW

Vegetables are fragile and should be tended with great care at all times. They need to be looked after carefully during and after harvesting.

### Time required

30 minutes

### Methodology

Simulation inside or outside the classroom using an assortment of vegetables

### Preparation

- Chalkboard and chalk
- Assortment of vegetables at different levels of maturity and ripeness, and with some vegetables that have already gone bad
- Basic local packaging material (baskets, paper, etc.)

## GOALS

### Knowledge

- To learn about harvesting, conditioning, storage and conservation

### Skills

- To identify, harvest, condition and store ripe vegetables

### Attitudes

- To recognize the importance of the final steps in vegetable gardening

## CLASSROOM ACTIVITY: HARVESTING

1. Explain that the time for harvesting varies between types of vegetables.
2. Explain the different things that they can do to condition, package, store and conserve vegetables.
3. Ask students if they can guess why each step (condition, package, store and conserve) are useful. After a few guesses, explain the reasons to them (See the Information section below.)
4. Tell students that they are going to simulate conditioning, packaging, storing and conserving their own vegetables.
  - a. Give each small group a selection of vegetables that are at different maturity, including some that are becoming bad.
  - b. Ask the students to condition the vegetables by taking out the ones that are turning rotten and by sorting them into groups of similar ages and types.
  - c. Ask the students to pack the vegetables into local packing materials. (You could lead a discussion on the cost, availability, ease of transport and appropriateness of different types of packaging.)





- d. Now ask the students to put the package in a dry place away from the sun, deciding which should go in a cold room and which should go in a well-ventilated space. (See Information section below.)
- e. Ask students what they could have done to the vegetables before storage to help to prolong the life of the vegetables, such as drying or preserving the vegetables.

## PRACTICAL ACTIVITY



**OPTIONAL:** If more time is available, take students to visit a real vegetable garden and see if they can participate in one or two steps of the actual garden harvesting, packaging or storage.

## PERFORMANCE ASSESSMENT

### Questions

To assess students' performance, the facilitator can ask the following questions:

1. When can vegetables be harvested? What are the signs that a vegetable is ready to be harvested?
2. What are the best ways to condition and package vegetables?
3. What are the best ways to store vegetables to conserve them for the longest time?

## BACKGROUND INFORMATION

### Vegetable garden harvesting

Vegetable garden harvesting entails harvesting, conditioning, storage and conservation.

### Harvesting

The vegetables are harvested when they have reached the desired degree of maturity. Usually, in vegetable gardens, vegetables are ready to be harvested after a specific period of time. Here are some examples of vegetables and their time to maturation:

Carrot:	65 – 90 days
Cabbage:	100 – 150 days
Green beans:	75 days
Onions:	110 – 130 days
Cucumber:	80 – 120 days
Okra:	80 – 100 days
Eggplant:	140 – 160 days
Tomato:	110 – 160 days
Zucchini squash:	130 days
Lettuce:	60 – 90 days





Cabbage harvested in Bonahouin

### Conditioning and packaging

Vegetables are highly perishable products. Harvested vegetables are given a longer life by “conditioning”, which means:

- eliminating rotten or damaged or non-standard individuals
- sorting them by group according to their degree of maturity and calibre

The final product can be packaged in nets, cardboard boxes or crates, preferably under a farm shed away from the sun.

### Storage and conservation

Conservation storage is the temporary storage of harvested products before they are sold. Fresh vegetables (such as tomatoes, eggplants, peppers) are kept in a cold room, and dry vegetables (such as onions, shallots, garlic) in a well-ventilated space.

### Processing

Processing the harvested products into semi-finished or finished goods lengthens the conservation period and gives better value to the lower vegetable grades. Examples could include: cooking tomatoes to make tomato paste, drying the vegetables in the sun, or making pickles or jams.

**Tip!** Agric clubs can try a processing activity.



# REFERENCES

This curriculum compiles general knowledge of cocoa farming practices, vegetable gardening and life skills. In particular, the curriculum draws on information on cocoa farming from the following sources:

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