Crop Production Level – II

Based on Version 3 March 2018

OS.

Training Module –Learning Guide 41-44

Unit of Competence: Assist Horticultural, Stimulants and Spice Crops Establishment

Module Title: Assisting Horticultural, Stimulants and Spice Crops Establishment

TTLM Code: **AGR CRP2 M10 0919v1**

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This module includes the following Learning Guides

LG 41: Prepare for crop establishment operations

LG Code: AGR CRP2 M10 LO1-LG-41

LG 42: Prepare the site for planting

LG Code: AGR CRP2 M10 LO1-LG-42

LG 43: Carry out planting operations

LG Code: AGR CRP2 M10 LO1-LG-43

LG 454 Care for young plants

LG Code: AGR CRP2 M10 LO1-LG-44

INSTRUCTION SHEET 1	Learning Guide 41

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Interpreting and clarifying instruction about establishing the crop
- Selecting and preparing machinery, equipment and tools
- Identifying, assessing and reporting OHS hazards
- Identifying and discussing environmental implication of crop establishment program

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Interpret and clarify instruction about establishing the crop
- Select and prepare machinery, equipment and tools
- Identify, assess and report OHS hazards
- Identify and discuss environmental implication of crop establishment program.

Learning Instructions:

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described
3. Read the information written in the information “Sheet
4. Accomplish each “Self-check respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to the next or “Operation Sheet
6. Do the “LAP test”

Information Sheet-1	Interpreting and clarifying instruction about establishing the crop

There are some common stimulants and spice crops which grown throughout the world.

- ✪ Coffee
- ✪ Tea and
- ✪ Cocoa are the ***major stimulant crops*** where as
- ❖ Ginger
- ❖ Korarima
- ❖ Cinnamon
- ❖ Turmeric and
- ❖ Black pepper are the ***major spices***.

1.1 Interpreting and Clarifying Instructions about establishing the crops.

There are different instructions in undertaking different agricultural activities.

Instructions that should be considered in crop establishment may include

- ❖ Standard Operating Procedures (SOPs),
- ❖ Company policy and procedures in regard crop establishment
- ❖ Specifications
- ❖ Work notes
- ❖ Material Safety Data Sheets,
- ❖ Manufacturer's instructions
- ❖ Product labels or verbal directions from the manager, supervisor, or senior operator.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. ***Write major stimulant crops***? 4 pts
2. ***Write major spices crops?*** 6 pts

3. ***What are***Instructions that should be considered in crop establishment? 4 pts

Note: Satisfactory rating – above 12 points **Unsatisfactory - below 12 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-2	**Selecting and preparing machinery, equipment's and tools for the task being undertaken**.

Selecting proper tools and equipment are essential for the effective operation of any agricultural operations. Equipping the agricultural site with the correct tools and equipment plays an essential role in achieving timely and good quality results. For every agricultural activity, there is an optimal combination of tools, equipment and labor. Depending on the nature and content of the works, the technical staffs needs to know which tools to use and how to effectively combine them with manual labor. Site supervisors need to know how to use the tools and how to operate the equipment in order to secure good work progress and the expected high quality results

Faulty equipment is a common reason for delays on agricultural activities. A major responsibility of field supervisor is to ensure that tools and equipment are maintained in a good condition and are readily available when required for the various work activities.

In order to utilize the equipment and labor in the most effective way, the use of equipment needs to be carefully coordinated with the output of the work ranges.

It is also important that staff know the full potential, as well as the limitation, of the use of manual and equipment-based works methods.

Finally, tools and equipment need regular maintenance, requiring good workshop facilities, a reliable supply of spare parts and qualified mechanical staff.

Machinery, equipment and tools which are required for crop establishment may include:

- Tractors.
- Rotary hoes.
- Cultivators.
- Fertilizer spreaders.
- Surveying and measuring equipment.
- Seeding or planting machinery.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. WhySelecting proper tools and equipment are essential? 4 pts
2. List Machinery, equipment and tools which are required for crop establishment? 6 pts
3. ***what is*** a common reason for delays on agricultural activities?. 4 pts

Note: Satisfactory rating – above 12 points Unsatisfactory - below 12 points

You can ask your teacher for the copy of your answer Name: _____ Date: _____

Information Sheet-3	**Identifying OHS hazards and assessingrisks**.

Production agriculture is associated with a variety of occupational illnesses and injuries. Agricultural workers are at higher risk of death or disabling injury than most other workers. Shocking injury commonly occurs from working with machinery or animals. Respiratory illness and health problems from exposures to ***farm chemicals*** are major concerns, and dermatomes, hearing loss, certain cancers, and ***zootoxic infections*** are important problems. Innovative means of encouraging safe work practices are being developed. Efforts are being made to reach all groups of farm workers, including migrant and seasonal workers, farm youth, and older farmers.

Respiratory disorders develop from the inhalation of grain dust, other types of organic dusts, and work in animal confinement facilities. ***Hearing loss*** is an important problem in settings where machinery is in use. ***Skin cancers*** caused by sun exposure are a

serious problem. Irritant and ***allergic dermatomes*** occur from exposures to plants and farm chemicals. Zootoxic infections can cause life-threatening illness

Also ***pesticide exposure*** can cause serious illness and death. Illness from pesticide exposure is likely frequently not recognized or reported as being linked to this exposure. Various pesticides can cause acute illness. So that, identifying different OHS hazards and related risks with a certain agricultural activities essential to ensure safe work conditions.

Self-Check -3	**Written Test**

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

4. Why Agricultural workers are at higher risk than others? 4 pts
5. When Shocking injury commonly occurs? 6 pts
6. ***When Respiratory disorders*** develop. 4 pts

Note: Satisfactory rating – above 12 points Unsatisfactory - below 12 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Identifying the environmental implications of the crop establishment

Negative environmental implications of crop establishment may include the

- Contamination of off-site ground water or soils from solids
- Debris, nutrients or chemicals
- Land disturbance
- Spread of noxious weeds, and water run-off.

4.1 Climate factor

Climate largely determines the type of vegetation that grows naturally in any part of the world and the kinds of agriculture that are possible. The three most important factors in climate from the standpoint of plant response are temperature, water supply/precipitation/ and light.

There are also other factors like humidity, solar radiation, wind and atmospheric gases but generally they are of less influence than the three mentioned.

a. Temperature: - is often the factor limiting the growth and distribution of plants. It influences the rate of growth, development and number of flower that produce seeds. When temperature is below 15 ^{o}C frost or pale-yellow color of the plant parts occur. In any given locality, the length of growing season is known to vary as much as 30 days for different years. The ranges of maximum growth of the plant are 15-32 ^{o}C.
b. Water supply/irrigation availability:-water supply is the most important factor in determining the distribution of a crop plant. Although total annual precipitation is important, its distribution plays an essential role in crop production.
c. Light:-light affects the development of crop plants mainly through affecting their structural development, their food production and the time required for certain species or varieties to produce seeds. Many plants are influenced by the length of day, especially in regard to flowering, fruiting, and the production of seed. This effect of light on plants is known as photoperiodism. Some plants are known as long day plants and other as short day. The long day plants need a comparatively long day for

flowering and their vegetative growth increases when the days are short. Wheat and oats are among the long day plants. The short day plants such as maize, soybean and sorghum achieve their vegetative growth when the days are long and flower and produce seed when the days are short.

4.2 Soil factor

Soil factors are nutrients and water, soil moisture, soil temperature, soil air, soil reaction (acidity or alkalinity).

a. Soil moisture: - the amount of soil moisture has impact on performance of individual plants. If soil pores are completely filled with water, water logging condition is happen. Then water logging resulting in shortage of oxygen, leaching of plant nutrients, poor germination or nil, stunted growth, failure of seed formation, yellowing of leaves etc.
b. Soil temperature: - it is another soil factor that determining the growth of plants. It influences the rates of absorption of water and solutes, germination of seeds, growth of seeds, growth of roots, and decomposition of organic matter.
c. Soil reaction (soil acidity or soil alkalinity): - Some soils contain such as an excess of soluble salts that they interfere with crop growth. Plants are varying in their tolerance of alkaline soil or acidic soil. Among the tolerant crops are sugar cane, sugar beet, cotton, rye and many of the grasses. Grasses or cereals seem to be more tolerant than the legumes.Many crops are tolerant to acidic soil conditions and often make satisfactory growth.

4.3 Altitude/Elevation factor

The choice of a crop to be cultivated in a given locality is determined by its altitude. Based on altitude or elevation field crops are classified in to different groups. These are: -

- Wurch: - greater than 3500m a.s.l.
- High land (Dega):- 2500-3500m a.s.l.
- Medium land (Woynadega):- 1500-2500m a.s.l.
- Low land (kola):- 500-1500m a.s.l.
- Desert (harrur):- less than 500m a.s.l.

4.4 Pests: - the presence or absence of particular diseases or pests that attack the proposed crops should be checked.

4.5 Availability of inputs and other materials, tools and equipments

Different inputs like land, planting materials, labor, etc and other materials like tools and equipment's should be available.

4.6 Accessibility: - The site should be accessible to all times and preferably be near the road, markets, processing facilities and ease for supervision.

Self-Check 4	**Written Test**

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

7. List the soil factor that affect field crop establishment? 4 pts
8. What are the environmental factors that affect field crop establishment? 6 pts
9. Define altitude/elevation. 4 pts
10. How light affects plant growth and development? 4pts

Note: Satisfactory rating – above 18 points Unsatisfactory - below 18 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-5	Selecting, using and maintaining suitable PPE

5.1 Selecting, using and maintaining suitable personal protective equipment (PPE)

When selecting PPE, remember:

- You need to consider and introduce other means of protection first. Provide PPE **only as a last resort** after taking all other reasonably practicable measures;

- engineering controls provide long-term solutions and are often cheaper than providing, replacing, maintaining and storing PPE;
- controls at source protect all workers in the area, while PPE only protects the wearer;
- It is essential to involve your workers in the selection process, as they often have detailed knowledge of the way things work or the way they do tasks, which can help you.

Also make sure that PPE:

- is ***effective and gives adequate protection*** against the hazards in the workplace;
- is ***suitable and matches the wearer***, the task and the working environment, so it does not get in the way of the job being done or cause any discomfort;
- does not introduce any additional risks, e.g. limits visibility;
- is ***certified*** equipments marked to confirm that it has been made to an appropriate standard;
- Is ***compatible*** with any other PPE that has to be worn?

Make sure all equipment is checked before use and cleaned, maintained and stored in accordance with the manufacturer's instructions. Remember that employers are not permitted to charge their employees for personal protective equipment provided for use only at work.

Wearing of personal protective equipment is required when working to minimize the health hazards.Always wear the protective equipment that is necessary for the respective task when working.

Follow the instructions on personal protective equipment that is posted in the work area.

Wear generally wear for all kind of work:

Protective clothing is close fitting, with low resistance to tearing, with narrow sleevesand without protruding parts. It mainly provides protection againstbeing entangled by moving machine parts.

Do not wear any rings and other jewelers.

Safety boots to protect against heavy parts falling down or slipping on slipperyground.Also, there is some personal protective equipment for special tasks. When performing special tasks, it is necessary to wear personal protective equipment. These special protective equipments are explained below:

Ear defenders to protect against hearing damage

Hard hat to protect against parts and materials falling down and flyingaround

Protective gloves to protect the hand against friction, graze, punctures or deep cutsas well as contact with hot surfaces.

Safety goggles to protect the eyes against parts flying around or squirts of fluids

Self-Check -5	**Written Test**

Directions: Answer the following questions. Each question holds 7.5 marks.

1. List down at least 3 OHS hazards that may occur in establishing crops?

2. Write at least 4environmental implication of crop establishment?

Note: **Satisfactory rating –12.5 points and above Unsatisfactory - below 12.5points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

INSTRUCTION SHEET 1	Learning Guide 43

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- .Removing and disposing old crop and other waste materials
- Taking samples and test
  - Testing soil pH, testing soil salinity &testing proportion of organic matter
- Applying soil treatments or amendments
  - Interpreting soil test results to determine treatment application
- Preparing growing media for crop establishment
- Implementing crop protection
- Marking out the planting pattern
- Operating machinery, equipment and tools

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Remove and dispose old crop and other waste materials
- Take samples and test
  - Test soil pH, test soil salinity &test proportion of organic matter
- Apply soil treatments or amendments
  - Interpret soil test results to determine treatment application
- Prepare growing media for crop establishment
- Implement crop protection
- Mark out the planting pattern
- Operate machinery, equipment and tools

Learning Instructions:

1. Read the specific objectives of this Learning Guide.

2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 Sheet 4, sheet 5, sheet 6 and sheet 7”.
4. Accomplish the “Self-check 1,Self-check t 2, Self-check 3,Self-check 4 self-check 5, self-check 6 and self-check 7” **in page -15, 17, 20, 22, 28, 29 and 31** respectively.

Information Sheet-1	Removing and disposing old crop and other waste materials

1.1 Removing and disposing old crop and other waste materials

Dropped leavesthat are collected seasonally, other vegetationsuch ***as grass clippings, woody debris and dead plants and shrubs*** that are collected at different times should be removed and disposed. Also, ***Deicing sands and gravels***found at farm site, snow and ice should be removed and disposed from farm site before establishing the crops.

Also, for cultivated farm areas, we have to remove ***old crop residues*** of previous season before starting the next season farming activities.

Disposing waste

After completion of all field crop establishment activities all containers, leftover fluids, waste and debris should be disposed safely and appropriately. Waste materials which may be toxic to human beings or pollutants environmental conditions should be properly disposed to minimize hazards.

Self-Check -1	Written Test

Directions: Answer the following questions. Each question holds 7.5 marks.

1. What are waste materials that may occur in establishing crops?

2. Write at least 4 waste materials of crop establishment?

Note: **Satisfactory rating – 12.5 points and above Unsatisfactory - below 12.5points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

Information Sheet-2	**Taking soil samples for testing where soil is growing media**materials

Soil testing is used to determine if any nutrients need to be added to the soil, or if the acidity needs to be adjusted, before any vines go into the ground.

Soil sampling should be done no later than the year before planting and preferably earlier if possible. This will allow enough time for any recommended nutrient additions or pH adjustments to be made before final field preparations such as planting a winter cover crop.

Taking a Soil Sample

If the site is ***uniform and flat, a single soil sample can be taken*** that will represent the entire site. As the amount of variation in the soils and topography increases, so should the number of samples that are taken.

While soil maps can give you a sense of the variability of soils on your site, the only way to truly understand soil characteristics is to take soil samples. When sampling before planting a vineyard, both ***the surface soil (0-8" depth)*** and the ***subsoil (8-16" depth) should be sampled***. Conditions in the subsoil can be quite different from those on the surface, and it is here where most of the vine's roots will be found. It is therefore a good idea to try to correct any deficiencies at the subsoil level as well as those in the topsoil. This is only realistically possible before the vines are planted as it requires deep plowing that would disturb the vines and trellis if they were already in place.

Soil sampling and testing provides ***an estimate of the capacity of the soil to supply adequate nutrients t***o meet the needs of growing crops. The test results are compared to standard response data to estimate the need to supply additional nutrients for optimum crop production. Traditionally, the goal of soil sampling was ***to develop a***

representative estimate of the average nutrient needs for a field so that the best single rate of application could be determined.

Self-Check -2	**Written Test**

Directions: Answer the following questions.

1. What is soil testing? 5 point
2. When ***Soil sampling*** should be done?5 point
3. What is the advantage of Soil sampling and testing? 5 points

Note: **Satisfactory rating – 12 points and above** **Unsatisfactory - below 12points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

Information Sheet-3	Applying soil treatment/ amendments according to soil test results

Soil Amendments and Adjustments

There are three types of adjustments that you may need to make to your site based on the results of your soil tests:

- ***Soil acidity (pH)***
- ***Plant nutrients (e.g., potassium, phosphorus, magnesium, etc.)***
- ***Organic matter***

Adjusting Soil pH

Adjusting your site's soil pH prior to planting the vines is one of the most critical steps in site preparation. Soil pH plays an important role in the availability of nutrients like potassium, phosphorus, magnesium and micronutrients. It also influences the availability of aluminum in the soil, which is toxic to vine roots.

Lime moves very slowly through the soil profile, so it needs to be plowed into the soil in order to get to the depth of the subsoil. Obviously, this can only be done when there are no vines or trellis in the ground, so this work needs to be done at least one year prior to planting.

If the tests recommend the addition of large amounts of lime, and time allows it, it might be preferable to split the lime application over two years instead of making one very large application the year before planting.

There are ***two types of lime*** that you can use to adjust soil pH:

1. **Calcite ('calcium') lime** - Lime that is almost purely calcium carbonate, with very little other materials.
2. **Dolomite ('mag') lime** – Limestone that contains carbonates of both calcium and magnesium.

Both are able to raise soil pH, but dolomite lime can be used to adjust magnesium levels in soils as well. If magnesium levels in the soil are adequate, calcium lime can be used instead. Availability of these materials may depend on location, but both should be fairly easy to get in areas where there is agriculture.

Adjusting Plant Nutrients

While nutrient deficiencies identified in soil tests can be addressed after planting, it is much easier to make adjustments.

The ***nutrients that most often require adjustment prior to planting*** are:-

- ✪ Potassium (K)

- Magnesium (Mg) and
- Phosphorous (P).

Organic Matter

Organic matter in the soil comes from the ***breakdown of organic materials*** such as plant and animal matter. As the microbes and other organisms in the soil break down organic matter, they release nutrients into the soil that plants can take up for their own use, primarily nitrogen, sulfur and phosphorous. In fact, the breakdown of organic matter is the primary source of nitrogen in most vineyards.

Figure 2.2 Organic matter can be improved by adding compost or other organic materials.

Having adequate levels of organic matter in soils has multiple benefits for vineyards, including

- Supplying nutrients to the vines,
- Improving both water holding capacity and internal drainage and
- Helping soils to resist compaction.

Self-Check -3	Written Test

Directions: Answer the following questions.

1. What is soil amendment? 5 point
2. What is organic matter?5 point
3. What is lime and what is the function of it for soil? 5 points

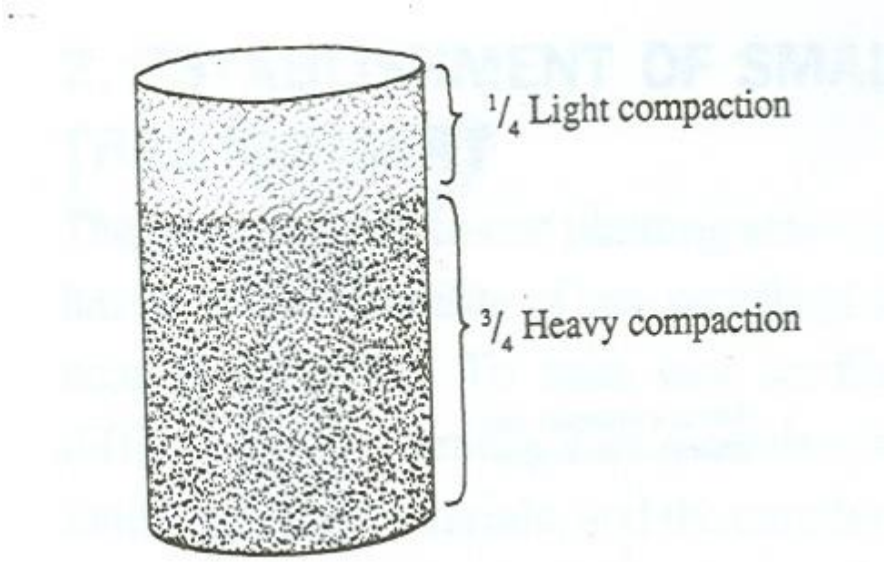
Note: **Satisfactory rating – 12 points and above** **Unsatisfactory - below 12points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

Information Sheet-4	Prepare growing media for crop establishment

Potting mixture ***(soil, sand and compost/manure)*** should be moistened and then pressed into containers to a depth of about three-quarters of the height of pots. Pots should then be topped up more loosely with mixture and pressed down slightly to about 2 cm below the top. Heavy ***compaction should be avoided at the top of pots because it will inhibit root penetration***.



Before planting seed, containers should be watered lightly. Sometimes, more than one seed can be planted in a pot and then, if more than one germinates, seedlings can be removed to leave a single individual. This approach might be used if germination rate is expected to be quite low

By using backfill soil as the tree is planted, the tree develops a tolerance to the natural surrounding soil.

1***. Dig the planting hole two to three times the diameter of the tree's root ball,*** and only as deep as the height of the root ball.

2. be sure to ***remove any container or packaging material around the root ball***, taking care to not disturb the root ball. Remove the burlap around the trunk. All string, wires, and ties should be removed completely. Place the plant in the centre of the hole.

3. ***Fill the planting hole with soil and tap lightly***. Make sure to cover any exposed areas of the root ball with soil, tapering the soil to the existing grade.

4. ***Water the tree slowly and thoroughly***, and then apply at least one inch of water weekly during the establishment period. Irrigation is not necessary if sufficient rainfall occurs.

Self-Check -4	Written Test

Directions: Answer the following questions.

1. What are soil mixture? 5 point
2. What is the reason Heavy compaction should be avoided at the top of pots?5 point

Note: **Satisfactory rating – 8 points and above** **Unsatisfactory - below 8points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

Information Sheet-5	Implementing crop protection

Crop protection required for crop establishment may include

- ✓ Wind protection such as artificial structures
- ✓ Permanent shelter belts or temporary plantings of cereals
- ✓ Stakes; and mulch, including straw, plastic, cover crop or any vegetative material.

PESTS OF FIELD CROPS

Pests:- are organisms that compete with people for food, interfere with raising of crops and live-stock.

Plant pests include all life forms that are destructive to plants.

Plant pests include weeds, insects, disease and other animals such as wild animals, birds, rodents that are destructive to plants.

PLANT DISEASE

Disease in plant is any deviation from normal physiological function of the plant. Physiological functions include photosynthesis, respiration, absorption, transpiration, translocation, cell division etc.

Disease triangle:- The interaction of 3 element is necessary for plant disease to develop.

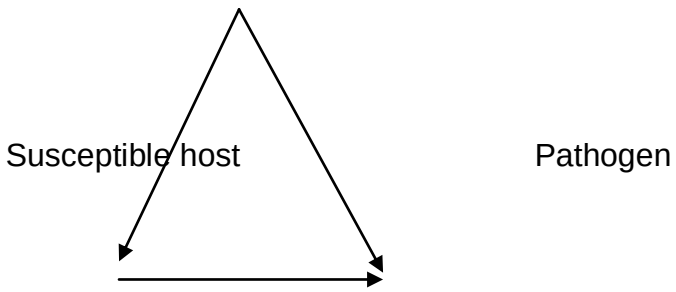
1. A susceptible host (plant) must be present
2. A pathogen (disease causing organism)
3. Favorable environmental condition for the pathogen

The relationship of these 3 factors is known as disease triangle.

The interaction of the 3 element of disease is expressed as a triangle which is referred to as disease triangle.

For a disease to occur these 3 conditions have to be fulfilled at the same time .If one of the 3 appears late, early or missing the disease will not occur.

Any practice which disturbs any of the 3 conditions or break the triangle will be considered as a disease management practice.



Effects of disease on crop

1. Diseases are capable of wiping out entire crop in a given area

2. Reduce yields and qualities of crops produced
3. May cause a change in the normal function of a crop
4. Certain disease will interrupt the plant activities and reduce the value of the crop
5. Increase price to the consumer
6. Cause economical loss to the grower through increasing cost of production.
7. make plant products unfit for consumption by contaminating them is poisonous substance
8. Limit the kind of plants that grow in an area.

Causal agents of plant disease: the agents that cause disease can be classified in to two groups i.e living and non-living agents**.**

When a disease is caused by living factor it is called infections (transmitable disease)**.**

When a disease is caused by non-living or environmental factor it is called non-infections disease.

The biotic (living) agents include bacteria, fungi, virus and nematodes.

Abiotic (non-niving) agents are

- Nutrient deficiency
- Air pollution
- Too high or too low temperature
- Excess or lack of moisture

Control methods of plant diseases

1. **Cultural (agronomic) control**

a. Use of healthy seed from know source (use of disease free seed)

b. Crop rotation:-will rarely eliminate a pathogen because it may break the pathogen life cycle.

The use of non host plant will reduce the survival of plant pathogen between seasons. Most pathogens do not survive well if a host plant is not available. Crop rotation will thus reduce the pathogen level in the soil.

c. removal of crop residues**:-** because many pathogens live is residues.

d. Modification of planting time (early or late) planting

e. Proper plant population

2. Mechanical control

a. Proper tillage practice:- such as removal of crop residues and cleaning the land with tillage is good farming partice.

b. Removing and burning of diseased plants may prevent pathogen from spreading to the healthy plants.

3. Use of resistant varieties: is the most effective control method**.**

4. **Use of chemicals**:- Which inhibit growth and multiplication of pathogen.

Most of the chemicals used in the control of pathogens are classified as fungicides, bactericides, nematicidesetc

5. **Biological**: - use of parasites or predators to kill pathogens.

5. **Integrated pest management (IPM**) which involves the use of all control measures in an integrated manner.

WEEDS:

weed is a plant that is growing where it is not wanted and doing more harm than good. It is a plant growing out of place.

Characteristics of weeds: The Common characteristics of weeds are:

1. Weeds are persistent (ability to invade an environment repeatedly) and resists to control and eradication.
2. They can produce large number of seeds
3. Weed seeds remain viable or dormant for a long duration.
4. Most of the weed are hardy and able to withstand adverse soil, climatic and disease condition (Heat, drought, light, pests) than cultivated plants
5. A few weeds have very deep root system (8-10 m)
6. Some weed seeds are similar to crop seeds in shape and size their separation becomes difficult.
7. Many weeds have morphological similarities with crop plants and hence difficult to control them at early growth stage.

Harmful effect of weeds on crops

1. Weeds reduce crop yields by competing with the crop for nutrients, moisture, light and space.

2. Harbor insect pests and disease (Rodents). Many weeds act as host for disease and insect pests
3. Weeds increase the cost of production, cause additional cost.
4. The quality of crop products is reduced (market value is reduced)
5. weeds interfere with crop harvesting
6. reduce land value
7. Injury effect on humans and animals (Poisonous chemical production)
8. Some weeds secret chemical substances which can inhibit plant growth. When these chemical are released in to the soil, the germination rate of some crop seeds is reduced and the growth rate will be retarded.
9. Weeds reduce aesthetic value of an area.

Mechanism of weeds to compete with the crop:-

1. The ability to flower and produce seeds in a short period of time
2. The ability to produce large number of seeds
3. Seed dormancy mechanism so that weeds can survive in a dormant state for many years.
4. Efficient mechanism of seed disposal (water, wind, animal)
5. Ability to resist chemicals
6. Ability to propagate vegetatively.
7. Ability to survive in a wide range of agro-climates.

Controlling weeds

Methods of Weed control

A. **Preventive method**:- Comprise all measurable taken to prevent the introduction and spread of weed such as;

1. Production of Weed free crop seed
2. Use of clean seeds
3. Keeping seed bed free from weeds
4. Keeping tools and machinery clean
5. Control of weed before they attain reproductive stage or setting seeds

Preventive measure reduce the farmers effort for controlling during post infestation stage and also reduce the cost of physical, chemical and other methods.

B. **Control methods:**

Weed Control:- is the process of limiting weed infestation and severity of weed problem to such an extent that crop can be grown profitability. There are various methods of weed control mainly

- Mechanical (Physical) control
- Cultural (agronomic) control
- Biological control
- Chemical Control
- IPM(Integration pest management)

1. **Mechanical method**:- Include hand pulling, hoeing, cultivation (Clean tillage and ploughing) burning, mowing and smothering with plastic mulches.

2. **Cultural (Agronomic) Method**:- include choice of crop variety, planting density intercropping and crop rotation.

a. **Crop Verities**:- Some of the crop grow quickly and produce canopy early resulting in shading thus reduce weed growth.

This prevents the establishment and spread of weeds.

Fast growing crops and their varieties compete better with weeds than slow growing crops. Fast growing crops achieve great canopy in short period and cover the ground surface quickly which smothers the weed spp. This prevents the establishment and spread of weeds.

b. **Proper plant population:-** use of optimum quantity of good seeds results in uniform germination of crop seeds which provide adequate plant population.

It will not leave sufficient space for weeds to germinate and grow. Under poor and uneven plant population greater availability of space and other environmental resources results vigorous growth of weeds.

c. **Intercropping:** - Suppresses weeds better than sole cropping. Inter-cropping results more complete crop cover of the land and high plant population thus reducing germination and growth of weeds

d. **Crop rotation:-** Plays a role in the management of practice of weeds e.gstriga and orbanche.

Some weeds are associated with specific crops hence crop rotation helps to prevent weeds which are associated with specific crops.

If a crop is grown rapidly on the some land, a particular type of weed will continue to multiply and weed problem would become sever.

3. **Biological control method**:- Which is control of one organism by another organism using their natural enemies e.g use of insect ,pathogens, birds, and their toxic products.

The objective of biological control is reduction of the weed population not eradication. Insects kill the plant by exhausting plant feed reserve and destruction of photosynthetic organs such as leaves. Bio-herbicides (pathogens) are cultured artificially and spread like post emergence herbicides.

4. **Chemical weed control:-** Involves use of herbicides. Herbicides are chemical used for killing weeds.

They are chemicals used for killing plants or inhibiting or interpreting the normal growth process of plants (weeds).

5**. Integrated Weed management:-** Involves utilization of a combination of mechanical, cultural, biological and chemical methods of control simultaneously or at different time.

It involves the use of all available control options.

It is the most effective control method. It provides greater, more rapid and long lasting control of weeds compared with any other method used in isolation.

By combining two or more of these methods suitable for crop and weed situation weeds can be controlled effectively especially for controlling of noxious or pathogenic weeds.

Time of weed control

The weed control measures must be carried out in the period from the time of preparing land to the time before weeds maturing, the earlier the better.

Control method must be carried out ahead of weed seed formation to prevent yield loss and harvesting difficulties.

For chemical control within the first 10 days after the weed emergence.

The weeds should be treated within the first 10 days after emergence because most herbicides give inadequate control of older leaves. Biological control methods are effective when applied season to season and year to year.

Self-Check -5	Written Test

Directions: Answer the following questions.

1. What is pest? 5 point
2. What is disease triangle?5 point
3. What is plant disease? 5 point
4. What is weed and how to control it? 5point

Note: **Satisfactory rating – 12 points and above** **Unsatisfactory - below 12points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

Information Sheet-6	Marking the planting pattern

Before planting crops on selected site, planting pattern must be marked. Basically, there are five planting patterns:

A. Square planting system

B. Rectangular planting system

C. Hexagonal planting system

D. Quincunx or diagonal systems

E. Contour systems

Based on the crop to be planted, the grower must select planting pattern which is suitable for efficient use of resources. Selection of different planting methods is important that it enables correct positioning of plants according to standardized spacing. Also, it is important to avoid wastage of agricultural lands and makes supervision easy and fast.

Self-Check -6	**Written Test**

Directions: Answer the following questions.

1. What is planting pattern? 5 point
2. List planting pattern? 5 point
3. What is the advantage of planting pattern? 5 point

Note: **Satisfactory rating – 12 points and above** **Unsatisfactory - below 12 points**

You can ask your teacher for the correct answers.

Name: _____ Date: _____

Information Sheet-7	**Operating machineries, equipment's and tools**

Operating and monitoring - Watching indicators to make sure that equipment is working properly and controlling operations of equipment or systems. Determining causes of operating errors and repairing machines or systems using the needed tools

Performing routine maintenance on equipment and determining when and what kind of maintenance is needed. Appropriate maintenance for tools and equipment's is important to undergo successful crop establishment activity.

After the election of appropriate tools, equipment's and machineries which are important for crop establishment, carrying out pre-operational and safety checks on tools, equipment and machinery is an essential part of crop establishment.

Check all the tools and equipment's before use.

- Are all the materials functional and sufficient enough in number?
- Are all free from any contaminants?
- Is there any material which needs maintenance?
- Is the material function coincides with the given crop?

Then check and report to your supervisor the condition of these materials. After reporting the condition of materials, your supervisor will guide you what to do if there is insufficient of materials to perform this particular work.

Self-Check 7	**Written Test**

Name: _____ Date: _____

Directions: Answer all the questions listed below.

1. Define operating and monitoring? 5pts
2. List tools, equipment's and materials for crop establishment? 5pts

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

INSTRUCTION SHEET 1	Learning Guide 44

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Selecting planting material
- Treating planting material
- Maintaining planting material until planting
- Handling and transporting planting materials
- Carrying out planting

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to –

- Select planting material
- Treat planting material
- Maintain planting material until planting
- Handle and transport planting materials

- Carry out planting

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and sheet 5”.
4. Accomplish the “Self-check 1,Self-check t 2, Self-check 3,Self-check 4and self-check 5” **in page -35, 37, 38, 39, and 49** respectively.

Information Sheet-1	**Selecting planting material**

2.1 Selecting planting materials

Planting materials should be

- High yielding
- Resistance to drought
- Resistance to diseases and pests
- Well mature
- Physiological fitness
- True to name
- True to type
- Widely adaptable
- Vigorous
- Tolerant to stress

Furthermore, plants differ in their ***soil preferences*** so if you have a particular plant already picked out for a certain location, it would be in your best interest to figure out what type of soil the plant likes and Whether planting a single tree on a residential property, or developing an entire landscape design, the most important factor is the selection of an appropriate tree for the location.

Adaptability - Most importantly, analyze the ***environmental conditions of the site*** before the selection process begins (***sun/shade, moisture, drainage, exposure to the elements throughout the seasons, and soil type).***

Culture - Select ***healthy, pest-free trees*** from a reputable nursery. Check on the tree's resistance to insects and disease and tolerance to the conditions in the landscape. Consider the maintenance of the tree through its life cycle (litter, weak wood, poisonous fruits, etc.), rate of growth, and expected mature size.

Scale - Make sure the scale of the tree is complementary to the scale of the surrounding structures and landscaping. Maintain a comfortable ***ratio between trees and structures***.

Shape - Consider the shape (or form) of your tree as it matures to ensure the design intent is achieved in your site.

Globular trees require more distance between them than columnar species. To determine spacing requirements, know the ***tree's width at maturity***.

Self-Check -1	**Written Test**

Directions: Answer all the questions listed below.

1. What is the criteria of planting materials? 5pts
2. What is adaptability5pts
3. Why we need to know the *tree's width at maturity 5 point*.

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Information Sheet-2	Treating planting materials

Treating planting material is vital when it comes to ***avoiding a diseased crop***. It is very important to treat the plant material to make sure that you have a successful crop and ***to prevent illness in animals, insects and humans***. There are a variety of ways to treat plant materials. You can use ***fungicides or insecticides***, and some treatments simply ***use hot water***.

Hot water treatment

Step 1

Use the cloth to loosely wrap the seeds. Use a rubber band to seal the cloth so the seeds will not fall out.

Step 2

Warm the seeds for 10 minutes at 100° F.

Step 3

Place the seeds (still in the cloth) inside cold water for 5 minutes.

Step 4

Remove the seed from the cloth and spread out on the screen to begin drying out.

Step 5

Sprinkle ***Thiram***over the seeds after they are dried. Use 1 tsp/1 lb of seed. On the other hand, when our planting materials are prepared from cutting of roots, leaf, stem and bulbs, we have to apply chemicals to cut materials to avoid viral and fungal infection.

Self-Check -2	**Written Test**

Directions: Answer all the questions listed below.

1. What is theadvantage of treating planting material? 5pts
2. What is hot water treatment5pts
3. what are the ways to treat plant materials*5 point*.

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Information Sheet- 3	Maintaining planting materials until planting

3.1Maintaining planting materialsunder conditions that will ensure maximum viability

Maintaining plants may include

- keeping seeds and tubers dry and cool,
- keeping plants and plantlets cool and moist to prevent dehydration

Treating and preparing planting material (Seed)

Seed treatment is an aid in controlling damping off and the rotting of the seed if germination is delayed. Before sowing, seeds should be treated with chemical and/or with hot water etc. Treated seeds have better germination. To enhance germination, seeds may be treated with hot water, cold water and with chemicals.

Hot water treatment

Seeds with hard coats may be soaked in water for 18-24 hours at room temperature depending upon the kind of seeds. It is advantageous if seeds are soaked in lukewarm` water. Some seeds take longer time for germination and produce weaker sprouts if are not soaked, especially if the soil becomes crusted after drying.

Seed treatment with chemicals

- Seed treatment with chemicals is done to prevent seeds from diseases and to enhance germination.
- It is commonly done with dust or in solution of the fungicide chemicals.
- The common seed dressers are ceresin, thiramcaptan, agrosan G.N. However, compounds like ceresin as seed treatment are known to cause damage to some seeds so care should be taken.

When seeds are treated with dust of a chemical, required amount of dust (2-3gm of chemical powder per kg. of seed) should be placed in a container which is closed tightly and shaken vigorously to assure even coating of every seed.

Self-Check -3	Written Test

Directions: Answer all the questions listed below.

1. Maintaining plants may include? 5pts
2. Maintaining planting materials? 5pts
3. What is hot water treatment5pts

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Information Sheet-4	**Handling and transporting planting material**.

4.1 Handling and transporting planting material.

When using different tools and equipment's we have to handle carefully and also take special care while transporting form one place to another.

A good care should be taken of the tools and equipment, which would then have a long life. It is not wise to keep workers sitting idle at critical periods of work because of shortage of tools. Rules in handling tools and equipment are:-

- Used all tools for what they are designed or constructed.
- Clean the tools and equipment always before storing them away.
- Store them in a neat dry place.

Materials may include preservatives, chemicals, gases, cleaning agents, packing materials and containers, labels adhesives and performs .Tools, equipment and machinery may include: tractors, trailers, light trucks, fork lifts, snips, knives, gloves, containers, grading machinery, washers, brushes, dryers, chemical applicators, gassing chambers, labeling devices, packing tools, scales, pallets hand trolleys and lifting aids, cool-rooms and dedicated storage facilities.

Self-Check -4	**Written Test**

Directions: Answer all the questions listed below.

1. Why care should be taken of the tools and equipment? 5pts
2. What is Rules in handling tools and equipment? 5pts
3. What is handling of? 5pts

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Information Sheet- 5	Carrying out planting operations

5.1 Planting stimulant crops

A. Planting coffee

Coffee plantation

Clearing the site

When the site selected is on a wooded land, ***remove all unwanted trees bushes, grass, weeds and stones*** leaving those which could be used as shade tree and windbreaks. Site clearing should start 6 months before the planting time. If planting is on steep slopes start clearing from the top.

Lining the site for planting

Immediately after site clearing, lining should be undertaken. To perform this, you should use short marker stakes to indicate the position of planting coffee seedlings and longer stakes for the position of planting shade trees, where no old trees for shade exist. ***The spacing of planting vary with the type of cultivar used (open, compact), slope of the site, cropping system (sole, or mixed type), soil fertility etc.***

Preparing planting holes

Holing is done 3 months before the expected date of planting. Usually size of planting holes should be ***60cm*** but this vary with rainfall amount of the area, where on less rainfall areas farmers dig holes of larger size ***(1m*1m).*** The top soil and sub-soil are placed in opposite sides of the hole and the top soil is marked with a stick.

Figure 3.1 Procedure to follow when preparing the holes

Refilling planting holes

Refill the hole with the top soil, by mixing ***compost/animal dung (5kg/hole)*** or well decomposed coffee husk or pulp. If available mix 60gm of DSP (double super phosphate) or DAP fertilizer per hole, the soil surface of the hole should be raised 3cm higher than the surrounding soil level. At the end of the refilling operation mark the centre of the refilled hole with a short marker stick.

Selecting and preparing safe life nurseries

Before transporting potted seedlings too far away planting sites, temporary (safe life nurseries) should be selected and prepared. At these safe life nurseries, there should be big trees for shade purpose and water. The place should be leveled and roads to the site should be maintained.

Check and select vigorous seedlings

Before transporting coffee seedlings to planting sites, select vigorous, healthy grown-up seedlings in the nursery. This operation is done both for seedlings in poly-bags and bare rooted seedlings on soil beds. Coffee seedlings should be well watered and if available apply foliar fertilizers as a starter solution one or two days before delivery to planting sites.

Figure 3.2 .Unsuitable plants with a twisted root system

Hardening off seedlings

Seedlings will be ready to be transplanted when they have 5-7 pairs of leaves. The optimum time is likely to be when the seedlings are 8-9 months old. Therefore, at 16 weeks from the expected date of transplanting to the field i.e. 4-5 months after sowing start to thin the shade cover by removing one quarter of the shade density each month to harden off the seedlings.

Planting coffee seedlings

Early planting i.e. as soon as possible just after the beginning of the small rainy season (Belg) in April and May in Ethiopia is highly recommended. Avoid planting late towards the end of July or August this will give short time/days for the seedlings to become established, before the onset of the dry season. Choose ***dull (cloudy) rainy days*** to do the transplanting, ***avoid dry and sunny days.***

Planting potted seedlings

Remove the marker stick and dig a hole large enough for the ball of soil and root in the poly-tube. Then insert the poly-tube in to the hole, cut the poly-tube in opposite direction with sharp knife and remove the polythene carefully with cut dislodging the soil from around the roots. Fill back the soil, press it and make sure that the top of the hole is about 3cm higher than the surrounding soil surface. After planting put mulch of 5cm thick without touching the stem and extend to 30cm radius from the stem.

Planting bare rooted coffee seedlings

Remove the soil from the hole just at the position of marker stick; check the hole is proportional to the length of axils and lateral roots. Insert the bare rooted seedling in to the hole by spreading the lateral roots in their correct position and fill the hole carefully and press the soil layer, and put mulch around the newly planted coffee seedling on the same way as described above for potted seedlings. After planting in addition to mulching it is also advisable to put shade in the east-west direction, to protect the newly planted coffee seedling from direct sun rays.

↳ **Planting procedure**

Figure 3.3 Planting procedures - planting, mulching, and ground covers

2.Tea plantation

Training mother bushes

Mother bushes should be given fertilizer at a higher rate than the normal field; for example, double the normal application is recommended. Mother bushes are pruned 35-40 cm above ground in advance to induce juvenile shoots. Tipping of shoot hardens the cuttings 7-10 days before the cutting time.

Time of taking cuttings

Cuttings should preferably be taken from the shoots which have 6-7 leaves and the axillaries bud in the leaf remains dormant or in a slightly swollen stage after tipping the dormant apical bud.

Cuttings are generally collected in the ***morning hours*** for keeping moisture and fresh.

Preparing single-leaf cuttings

The cuttings are tested by flexing between the thumb and fingers-the soft portion at the top and the rigid portion at the bottom are not suitable. Good single-leaf cuttings come from the flexible middle portion.

Single-leaf cuttings are made by a ***sloping cut above each leaf***. Each cutting is 3-4 cm cong with a healthy mother leaf and an active auxiliary bud. Very long internodes can be shortened by another sloping cut.

Finished cuttings must be placed in ***shade or water*** until planted in the nursery. The proportion of

cuttings that survive falls if they are allowed to dry-out.

Figure 3.4 leaf cuttings

Preparing nursery bed

Size: nursery beds should be ***east-west oriented***. The width of the bed is 1 m with 15-20 cm height. The length is decided by the land shape. The width between two beds is about 50 cm.

Soil: it must be acid-optimum pH ranges is 4.8 to 5.0-and have a low content of organic matter. Red-yellow fine subsoil is very suitable for preparing nursery bed especially in the top of the bed about 4-5 cm deep because this kind of soil is beneficial for cuts healing up and forming callus and rooting.

Compacting the soil and marking the setting traces: press the nursery soil surface with the back of the spade or stick and make the soil of the bed fine and compact. Then mark out the setting traces in lines with a stick in the bed according to row distance (general the leaves length) from one side to the other side of the bed. Setting density is decided by the normal size of leaves which are not overlapping after setting. The leaves of big leaf variety can be cut a part to reduce the evaporation area. Usually the row distance is 8-10cm, and the plant distance is 2.5 cm.

Setting single-leaf cuttings

The cutting is inserted so as not to damage the cut point and the soil near the cutting is compressed with fingertips to eliminate air. A good test for good setting is when the leaf is bent; the stem does not come up.

When full, the bed is watered and then covered by a plastic sheet over light frames to keep it clear of the plants. This sheet is sealed into the soil at the edges of the bed so that the plants are totally enclosed. Shade must be constructed at a high level to reduce the light intensity at the beds. Beds which are not sealed just shaded with thatch or other material need frequent watering or misting.

3.5.2 Spice plantation

Turmeric

Turmeric belongs to the family: ***Zingiberaceae.*** Turmeric is an ***erect perennial herb, grown as annual, leafy shoots rarely, bearing 6 - 10 leaves, leaf sheath form pseudo stem, leaf 30 cm long, 7 – 8 cm width.*** Turmeric is a ***tropical crop***.

Annual rainfall: longer rain season, 1000-2000mm, below this requires irrigation Sunlight: Turmeric is a ***full sunlight loving crop***, can be intercropped with some annual crops provided that no light interception problem has certain level of shade tolerance. ***Soils***: grows best in soils rich in organic matter, sufficiently moist and not water logged. Coarsely, gravely, stony or marshy soils impede the rhizome growth. Turmeric thrives best on medium loams or alluvial loose, friable, and fertile soils with a good supply of humus.

Planting and Aftercare

- ***Site selection***: free of frost; slightly slant land, not marshy, no water logging. The soil should be very fine and land preparation should be completed before rain starts
- ***Planting system***: Planting on raised bed in rain fed condition. Ridge planting for irrigation (below the required rainfall distribution)
- ***Planting time***: March and April
- ***Spacing***: on raised bed 15cm x 30cm or ridge planting 15cm x 45cm
- ***Weed control***: Careful weeding for the first 2-3 months; Manual of herbicide (2,4-D) as pre-emergence; Mulching using vet bar grass very important
- ***Irrigation frequency***: depends on soil moisture retention capacity, good soaking during planting; Germination takes 2-4 weeks after planting; earthning up may be necessary 8 weeks later.
- ***Crop Rotation***: Possible to use rotation by annual cereals, legumes
- I***ntercropping***: Possible with maize, onion, tomato

Black pepper

Pepper from P. nigrumis one of the oldest and the world's most important spice ***(king of spices)***. Three main producers are: India, China and Indonesia. It has extensive ***culinary uses*** and is used in meats, soups, fish, pickles, etc. Its use as a spice was very well known, thus it is common to use pepper ***as a condiment*** in most of Ethiopian dishes.

Pepper belongs to the family Piperaceae. It is a ***perennial glabrous woody climber up to 10 m or more in height clinging to its support***. Two types of roots: ***adventitious aerial roots*** (means of attachment) and ***underground functional roots***.

Two major stems: ***orthotropic stems and plagiotropic stem***. Spikes are born opposite to the leaves on the plagiotropic branches 3 – 15 cm long with 50 – 150 minute flowers. Flowers may be unisexual (with monoecious or dioecious forms), hermaphroditic in most cultivars.

Land preparing

The field is better to be slightly slanted; land clearing and burning (if covered with forest) should be done. Supporting trees are planted sometime before field planting.

Field Planting

Planting time varies from country to country, in our case ***(Teppi and Bebeka)*** planting can be done at the ***onset of regular main rain season*** (June or July). Cuttings from the nursery are planted in pits (40 cm deep and wide, 15 cm away from the support tree (2.4 m X 2.4 m)). The pits are filled with loam soil mixed with compost. It is necessary to direct the vines towards the support. Usually productive life time is 12 –15 years

Figure 3.5 Black Pepper usable parts (left) and plant (right)

Ginger (Ginger Officinale)

Ginger

Its fresh or dry rhizomes are esteemed for their ***aroma, flavors and pungency***, widely used in ***Culinary Purpose*** in ginger bread, biscuit, cakes, puddings, in production of ginger beer, ginger wine etc. Ginger belongs to the family Zingiberaceae, is ***slender, perennial herb, usually grown as annual (30 - 40 cm) tall, and has robust branched rhizomes borne horizontally n***ear the surface of the soil bearing leafy shoots close together. Aerial pseudo stem bears 8 - 12 leaves (regularly arranged in two opposite rows on either side of the stem).

Propagation

Ginger is propagated by portions of rhizomes known as ***seed pieces/seed sets***. Seed sets can be stored in different ways in the different localities.

Field planting

Seed sets or seed pieces are used for planting. During planting ginger, worrying about spacing not this much important, because, close spacing has not significant effect on productivity of it. The most important point to be considered is that planting should be conducted in uniform and spaced equally.

Figure 3.6 ginger usable parts (left) and partial parts of plant (right)

Cinnamon

Cinnamon is the dried bark of Cinnamomumverum.

Cinnamon spice is used ***for bakery and pickling purposes in pharmaceutical products***, in ***perfumery and flavorings***. Cinnamon belongs to the family Lauraceae. It

is an ***evergreen tree 8 – 17 m long in wild state. Bark and leaves are strongly aromatic***. A dense bush growth with a number of leafy coppiced shoots to a height of 2 – 2.5 m. young leaves are reddish in color, later turning to dark-green.

Planting Cinnamon

Cinnamon is planted in the nursery 2.5 cm deep and 15 cm X 20 cm and is mulched. **Cinnamon** germinates completely within 15 – 20 days after seed sowing. It is transplanted to pots when 12 cm height 11 – 12 months after planting ready for field planting.

Figure 3.7 Cinnamon usable parts (left) and plant (right)

Korarima

Korarima is an indigenous and important cash crop for Ethiopia. It grows abundantly in the natural forest. The spice has been a part and parcel of each and daily Ethiopian dish, in preparation of ***curry powder*** for culinary purpose. Ground and mixed with other spices Korarima seeds are used in ***cooking 'wet'***, to flavors coffee sometimes tea and bread.

Besides the large domestic consumption it has been used worldwide substituting cardamom. Korarima belongs to the family Zingiberaceae. It is a ***perennial herb*** which grows not more than 2 m in height and is very ***similar in vegetative growth with cardamom.***

PlantingKorarima

It is usual to sow selected seeds in nursery bed, then transplanted it to pots or can be directly sown in pots.

Figure 3.8 Korarima usable parts (left) and plant (right)

Self-Check -5	**Written Test**

Name: _____ Date: _____

Directions: Answer all the questions listed below and try to evaluate yourself

1 List some criteria used to select planting materials? 5pts

2 Why treating planting material is needed? 5pts

3 What is `importance of studying adaptability while selecting planting materials? 5pts

4 What is the chemical which is used while treating planting materials? 5pts

Note: **Satisfactory rating –20 points Unsatisfactory - below 20points**

You can ask your teacher for the copy of the correct answers.

INSTRUCTION SHEET 1	Learning Guide 45

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Applying treatments to plants
- Applying water to plantings
- Training plantings

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to –

- Apply treatments to plants
- Apply water to plantings
- Train plantings

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2 and Sheet 3”.
4. Accomplish the “Self-check 1,Self-check t 2 andSelf-check 3” **in page -53, 56 and 59** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” **in page 60,61 and 62 .**
6. Do the “LAP test” **in page – 63** (if you are ready).

Information sheet-1	Applying treatments to plants

Treating and preparing planting material (Seed)

Seed treatment is an aid in controlling damping off and the rotting of the seed if germination is delayed. Before sowing, seeds should be treated with chemical and/or with hot water etc. Treated seeds have better germination. To enhance germination, seeds may be treated with hot water, cold water and with chemicals.

Figure 1. Seed germination in plastic box placed in a green house.

Hot water treatment

Seeds with hard coats may be soaked in water for 18-24 hours at room temperature depending upon the kind of seeds. It is advantageous if seeds are soaked in lukewarm` water. Some seeds take longer time for germination and produce weaker sprouts if are not soaked, especially if the soil becomes crusted after drying.

Seed treatment with chemicals

- Seed treatment with chemicals is done to prevent seeds from diseases and to enhance germination.

- It is commonly done with dust or in solution of the fungicide chemicals.
- The common seed dressers are ceresin, thiramcaptan, agrosan G.N. However, compounds like ceresin as seed treatment are known to cause damage to some seeds so care should be taken.

When seeds are treated with dust of a chemical, required amount of dust (2-3gm of chemical powder per kg. of seed) should be placed in a container which is closed tightly and shaken vigorously to assure even coating of every seed.

Self-Check -1	**Written Test**

Directions: Answer all the questions listed below.

1. What is Seed treatment? 5pts
2. Why seedis treat with chemicals? 5pts
3. List the common seed dressers? 5pts

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Information sheet-2	Applying water to plantings according to the irrigation schedule

Applying water to plantings according to the irrigation schedule

Applying water to plants is an essential element of crop establishment activities. Water may be applied using irrigation systems, which may include drips; overheads, central pivot, micro irrigation, under tree, and flood.

Spices are living things and do require water for their survival, as do human beings require. Their requirement of water varies with their type and at different times, till they grow up completely. Water is normally supplied to these plants by nature through direct rain or through the flood water of rivers.

Most spice like cardamom requires wet root zone areas and humid areas.

Importance or necessity of water

- ❖ Increases the crops yield
- ❖ For seed germination
- ❖ Keeps the plant cool in summer and warm in winter
- ❖ Make the soil soft and helps the roots to spread easily
- ❖ Controls insects like white ants and termites
- ❖ Help in transportation of nutrients
- ❖ Dissolves solid substances in soil

Generally water management is essential for spice production and the area to be watered should have drainages hole to avoid water logging and root damping off.

Applying Water

Water is applied in required quantity and in an appropriate method specified by enterprise work procedures. Work procedures will be based on sound horticultural principles and practices and may include

- Supervisors oral or written instructions
- Plant care program
- Enterprise standard operating procedures (SOPS)
- Specifications
- Production schedules
- Routine maintenance schedules
- Work notes
- Product labels and material safety data sheets (MSDSS)
- Integrated pest management (IPM) programs
- Manufacturers service specifications and operators manuals
- Waste disposal
- Recycling and re-use guidelines
- OHS procedures.

Disinfecting irrigation water

Household bleach usually has a strength of 3.5% or 35 000 ppm ***NaOC***l. It contains 24, 000 ppm chlorine ***(Cl2).*** To make 1 L of a 1 ppm Cl2 dilution, 0.042 ml (or 42ul) of household bleach is needed. Generally, a good supply of water is indispensable for the growth of seedling but too much water can be harmful. Water should be clean, of pH value ranging from 5.5 to 6.5. Newly sown containers seed trays or nursery beds must never dry out, but kept continually moist though not soaking wet.

Frequency of watering

There is no fixed rule about the intervals between watering and quantity of water required, because this ***varies with species, soil conditions, age of plants, weather***

condition, etc. Watering should be done frequently, at least ***twice a day*** in small quantities. Seedlings are watered immediately after transplanting. Therefore, light watering is carried out 2- 4 times a day depending on the progress of the seedlings.

Time of watering

The watering should do ***early the morning, before 10.00 a.m. & in the afternoon after 4:00 p.m***. This will enable the seedlings to utilize efficiently with the water sprayed on to them without being lost.

Methods used to apply water

Methods used to apply water may be applied ***manually or by operating the irrigation systemtoo heavy watering*** should be avoided, as this causes ***pudding of soil and poor aeration,*** which creates favorable condition to damping off-fungi. Every nursery manager should find out the best possible watering regime himself/herself.

Fine – hose watering cans must be used in watering of seedbeds without grass mulch. If not available, try to use grass much.

Self-Check -2	**Written Test**

Directions: Answer all the questions listed below.

1. What is the Importance or necessity of water**?** 5pts
2. Discus Time of watering? 5pts
3. Discus Methods used to apply water? 5pts

Note: Satisfactory rating - 10 points and Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Information sheet-3	Training plantings

Training is important operation in established crop farm in order to ***maintainshape and direction*** of crop growth. Training may be done by using ***thinning, trimming, staking or trellising.***

A primary objective of training and pruning is to develop a strong tree framework that will support required production.

Proper tree training also ***opens up the tree canopy to maximize light penetration***. For most stimulant crops, especially coffee and tea require training to give maximum product. Light penetration is essential for strong flower bud development and optimal fruit set, flavors, and quality. Although a mature tree may be growing in full sun, a very dense canopy may not allow adequate light to reach 12 to 18 inches inside the canopy. Opening the tree canopy also permits air movement through the tree, which promotes rapid drying to minimize disease infection and allows thorough spray penetration.

Pruning

Root Pruning is a standard in most Ethiopian nurseries. Root pruning involves ***cutting of the taproot***, in some cases also of ***lateral roots***, to encourage the ***development of fibrous root system***. This kind of root system gives the seedlings the best possible start in plantation. Root pruning also ***controls depth of root penetration*** and makes lifting of seedlings easier and less harmful.

Root pruning helps the seedlings to have ***a balanced root-shoot ratio***.

It also helps the seedling to have an ***adequate root collar diameter*** (because of the slowdown of the top growth).

Methods of root Pruning

Root pruning can be done in several ways:

A) Pruning with knife or secateurs

This is the most common method with potted seedlings. Each pot is lifted up & the protruding roots are snipped off. Consume time as a single person can only prune 500 seedlings a day. If root pruning is done using this method, it is good to leave some 30cm of the storage bed without pots at one end.

B) Root wrenching /shocking/

Pots are only lifted off the ground to snip or pull roots which has grown in to the ground. It is much faster than knife pruning and the operation can be combined with weeding or cultivation. As this method is not sufficient to use it alone, roots should be cut with knife or secateurs every 4-6 weeks between root wrenching.

C) Pruning with piano wire

This method can be applied to potted seedlings, which are kept in raised beds framed with reverting boards, and to bare rooted seedlings.

Frequency of root pruning

Depends on: -

- The growth rate of seedlings
- Species and
- Environmental condition of the nursery.

Weekly pruning is recommended for fast growing seedlings like eucalyptus. With pines and cypress, the interval between prunings is about 2 weeks.

Care of seedlings during pruning

- It is best to do root pruning on a dull, cloudy or during the cool hours of the day.
- A clean cut with a sharp blade will favor proper healing of the pruned roots.
- Immediately before and after root pruning the container bed should be watered thoroughly to soften.

- Some Eucalyptus or other species show symptoms of wilting after pruning and it may be necessary to put them under shades for a couple of days after prune

Staking

Stacking refers to arrange nursery seedlings in an order pile/straight up to avoid growth of root deformity.

Spacing

Avoid very dense spacing in germination and nursery beds, because diseases can spread easily. Close spacing can also lead to etiolated and weak plants which are susceptible to disease.

Thinning

Thinning in nursery refers to the way of reducing the density of seedlings for different purposes.

- ✪ To strengthen the vigor and health of plants.
- ✪ To reduce completion (water, air and nutrients).
- ✪ To minimize disease transmissions.
- ✪ To avoid deformed plants.
- ✪ To use nursery stock (cuttings and rooting) for duplication

Self-Check -3	**Written Test**

Instructions: Answer all the questions listed below

1. List some common spices and stimulants? 5pts
2. What is major importance's of spices? 5pts
3. What is the importance's of hardening off? 5pts
4. What is the importance's of training plantings? 5pts

Note: Satisfactory rating - 20 points Unsatisfactory - below 20points

You can ask your teacher for the copy of the correct answers.

Name: _____ Date: _____

Operation Sheet1	Establishing spice nursery

Objective:to enable the trainees

- ✓ How to select site to establish spice nursery.
- ✓ How to prepare land
- ✓ Prepare different types of nursery beds and containers.
- ✓ Sow seeds and grow seedlings in nursery beds and container

Materials:

- Hoe
- Spade
- Meter
- Mulching material (thatching grass)
- Temporary shade
- Water can
- Compost & sandy soil

Procedure

Once the site was selected, the land will be prepared for the nursery as follows

1) Site clearing (clear the land of all the plant woody materials stumps and roots).
2) Ploughing & digging (dig a ditch of 5m deep and 5m wide on the up slope side of the nursery site).
3) Build up the soil as a ridge on the down slope of the ditch to prevent the nursery from flooding.
4) Plant vetivar grass on the ridge to minimize erosion and provide a suitable fine grass for mulching the seedling bed.

5) Build fence around the perimeter of the area strong enough to stop live stock entering and have a single entrance wide enough for vehicle access.
6) Construct a simple store for tools, rolls of poly tube material and fertilizers/chemicals.
7) Finally, plant cuttings according to recommended spacing and planting procedures

Precautions

- ❖ Take care while selecting nursery site
- ❖ Check tools and equipments before and after undertaking tasks

Operation Sheet2	**Preparingplanting material**

Objective: to enable the trainees

- ✓ Selecting the planting material to prepare planting materials
- ✓ Prepare tea cuttings to suitable height

Materials:

- Spice plant
- Cutting knives
- Water
- Basket
- Treating chemicals (disinfectant chemicals such as fungicide)

Procedure

1. If mother bush have aphid infestation, they should be thoroughly sprayed with an insecticide before the cuttings are taken to the nursery site.
2. Shoots taken from aged and flowering bushes are less suitable than those in their youthful vigor- about five-seven years old, before growth difficult.
3. Younger tender leaves should avoid, and only leaves that are hard should be used .thus the top three to four (3 to 4) leaves should be discarded.

4. The remaining good portion of the stem will consists of a series of leaves each with a bud in the axils. The stem is then cut in to individual cuttings with an angle of approximately 45 ^{0}and a length of about 3-4 cm using sharp knife. The cutting consists of a leaf, about and 3 to 4 long internodes.
5. The cuttings are placed in buckets of water or way be sacked for 30 minutes in insecticidal and fungicidal solution. And then they are transported to the planting farm.

Precautions

- Avoid careless handling of planting materials while transporting.
- Use proper materials to handle prepared planting materials.
- Improper selection of mother plant results in preparing poor quality planting materials

Operation Sheet -3	**Planting different spices crops**

Objective:- to acquaint the trainees with the methods of land preparation & sowing of spices crops.

Materials:-

- ginger,
- coriander,
- turmeric,
- cardamom,
- Korarima,
- tap meter
- urea,
- DAP
- rake
- Spade

- Hoe & mulching material.

Procedures

1. Prepare the land to bring the soil into fine till according to the types of crops.
2. lay out the area according to their spacing
3. Have planting sources of ginger, coriander, turmeric, cardamom &Korarimaat the appropriate size (ginger L=2.5-5.6cm with one or two buds on each pieces.
4. Plant/sow the planting sources of those crops according to their planting method and depth.
5. Apply fertilizer according to their need.
6. Give other management activities.

Precautions

- ✓ Avoid too deep and too shallow sowing or planting
- ✓ Water the planted crop continuously until they are established; unless they will face transplant or planting shock.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform any of the following task:
   - Planting some selected spice crops according to their recommended spacing and procedures
   - Fertilizing
   - prepare planting materials

2. Request your teacher for evaluation and feedback on your task