Crop production

Level II

Learning Guide #35

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO1-LG-35

TTLM Code: AGR CRP2TTLM 0919v1

LO 1: Prepare field crop establishment Operation

Instruction Sheet	Learning Guide #35

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

- Interpreting and clarifying instructions about planting
- Selecting and preparing machinery, equipment and tools
- Identifying , risks assessing and reporting OHS hazards
- Identifying and discussing the environmental implications of the crop production plan
- selecting, using and maintaining suitable PPE

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 –

- Instructions about planting are interpreted and clarified with the supervisor.
- Machinery, equipment and tools are selected and prepared for the task being undertaken.
- OHS hazards are identified, risks assessed and reported to the supervisor
- The environmental implications of the crop production Plan are identified and discussed with the supervisor.
- Suitable PPE are selected, used and maintained

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
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 4 and Self check 5” **in page -2, 4, 5,7 and 10** respectively.

Information Sheet-1	Interpreting and clarifying instructions about planting

Planning for field crop establishment

Definition of field crop

Field crops are also called “Agronomic crops”. They are mostly annual herbaceous plants that are grown under extensive or large-scale culture. The usable products are usually in high dry matter form.

Classification of field crop

Cereals, seed legumes, oil crops, root and tuber crops, sugar crops, latex and rubber crops, pasture and forage crops, and fiber crops are classified under field crops

Careful planning for establishment of field crops is an essential part of good production of field crops. During establishment of field crop one of the earliest decisions that must be taken is where to locate the farm (correctly selection of the site).

Self-Check 1	Written Test

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

1. What is field crop? 4 pts
2. List the classification of field crop. 6 pts

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

1.1 Selecting and preparing machinery, equipments and tools

Before starting to establishment of field crops, all necessary tools and equipments should be gathered. These should include a minimum of:

- Tractors and associated land preparation
- Seeding equipment,
- Cultivators and Fertilizer spreaders,
- Seeding or planting machinery bagged or bulk seed,
- Field tool boxes, cane knives, and planting trailers.

1.1.1. Preparing machinery

Machineries: The use of bulldozers for clearing is very common to establish large scale farms. The Bulldozers operate by uprooting the trees, shrubs and pushing the plant material to some designated trash areas of the field to perform burning.

The disadvantages of bulldozers are:

- Bulldozers are heavy machines & cause considerable soil compaction.
- Bulldozer operation reduces organic matter from the soil.

Plough implements: - Modern ploughs are used to open the soil & pulverize it. Ploughs are also used to incorporate the crop residues & manures. Implements may be of animal drawn or power operated.

1. **Mould Board plough**: - It is an improved tillage implement over local country plough. It used for departing a layer of soil from the under lying subsoil and is inverted.
2. **Disc Plough**: - Have steel disc of 50-90 cm diameter. The discs are made of hard high carbon steel & have sharp cutting edge. The discs are set at an angle to the direction of travel. It is very suitable where soils having hard plough pan. It works where M.B. plough does not work, particularly in sticky soils. It is a tractor drawn because of their weight & size.

3. **Harrows**: - it is suitable for the preparation of land after ploughing in grassland & virgin lands & also for incorporation of manures.
4. **Cultivators:** - Secondary tillage implements used after initial ploughing of the soil. They are used for pulverization & to bring the soil to desired tilth. They destroy weeds & mix manures & fertilizer with the soil.

5. **Ridging plough**: - A double MB plough having adjustable wings with which the width can be suitably altered at the rear. May be animal or tractor drawn.
6. **Paddling plough**: - used for paddling in wet lands.
7. **Dry land welders**: - manually operated and used for removing weeds in line sown crops under dry land condition.

1.1.2. Preparing tools

1. **Spade** :- used for digging the soil & making bunds & ridge
2. **Axes and saws**: - The shrubs and trees are cut down with axes & saws and removed from the field manually or by animal drawn carts.
3. **Cutlass or machetes** :- to lift root crops & to weed
4. **Hand hoes**: - used for weeding, available in different shapes of blades.
5. **Sickle**: - Most common hand tools used through Asian & African countries to cut the grasses & for harvesting the crops.
6. **Shovel** :- for working with loose soil modified animal drawn implements
7. **Mould board Plough**: - Improved tillage implement over the country plough.

Self-Check 2	**Written Test**

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

1. List tools and equipments during field crop establishment. 8 pts
2. What is the function of mould bold plough? 4pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Identifying OHS and environmental hazards

During establishment of field crops, some activities can be potentially toxic or hazardous to human beings and pollutant environmental conditions. Occupational and environmental hazards may be occurred through

- ⇨ Use of machinery
- ⇨ Moving machinery and machinery parts from one place to another
- ⇨ Plant debris
- ⇨ Chemicals and hazardous substance
- ⇨ Manual handling
- ⇨ Solar radiation
- ⇨ Dust, and noise
- ⇨ 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.

Self-Check 3	Written Test

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

1. What are the hazards that may happen during field crop establishment? 6 pts

Note: Satisfactory rating – 4 points and above **Unsatisfactory - below 4 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Identifying environmental implication

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 equipments 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.

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

Note: Satisfactory rating –15 points and above Unsatisfactory - below 15 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-5	Selecting, using and maintaining suitable personal protective equipments

During establishment of field crops you should have to follow safety required to avoid hazards. Skin contact with crop residues which may be toxicants during clearing, working with sharp machinery and use of other chemical substances must be avoided. Wearing of persons engages like: -hat, boots, overalls, gloves, goggles, respirator or face mask, hearing protection, and sunscreen lotion is a must.

5.1 Personal protective equipment

Personal protective equipment is to include that prescribed under legislation, regulations and enterprise policies and practices. Face masks are available for rubbing back and painting.

Selecting personal protective clothing and equipment

Suitable personal protective clothing and equipment is selected, used, maintained and stored in accordance with Occupational Health and Safety requirements.

5.2 Select PPE based on the PPE Hazard Assessment

Consider these factors when selecting PPE:

- Type of hazardous materials, processes, and equipment involved
- Routes of potential exposure (ingestion, inhalation, injection, or dermal contact)
- Correct size for maximum protection
- Minimal interference with movement

Personal protective clothing and equipment may include:

- Boots
- Hat/hard hat
- Overalls
- Gloves
- Protective eyewear
- Hearing protection]
- Respirator or face mask
- Sun protection, e.g., sun hat, sunscreen

5.3 Different types of PPE are described below

Foot protection

Workers must wear closed-toe shoes at all times to protect feet from chemical spills and sharp objects. Steel-toed footwear and puncture-resistant soles. Slip-resistant shoes for anyone who works in wet environments.

Eye protection: Use safety glasses for minor splash hazards, goggles for moderate hazards, and goggles combined with a face shield for severe hazards.

Hand protection: Hand protection is indicated for the possibility of severe cuts, lacerations, or abrasions, punctures, temperature extremes, and chemical hazards. (Nit rile loves are usually a good choice for general use.) Use heavy-duty gloves for non-incidental contact and gross contamination.

Body protection: Protective clothing includes lab coats, smocks, scrub suits, gowns, rubber or coated aprons, coveralls, uniforms, and pierce-resistant jackets and vests.

Head protection: Hard hats must be worn by electricians, construction workers, and any other workers when there is a danger of objects falling from above.

Self-Check 5	Written Test

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

1. List PPEs used during field crop establishment? 8 pts
2. What are the factors that to be considered during PPE selection? 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Crop production

Level II

Learning Guide #36

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO2-LG-36

TTLM Code: AGR CRP2TTLM 0919v1

LO: 2 preparing the site for crop establishment

Instruction Sheet	Learning Guide #36

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
- Applying Soil treatments/amendments
- Working site according to the crop production plan
- Marking out the planting pattern according crop

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 –

- Old crop and other waste materials are removed and disposed of in full consideration of environmental Implications.
- Soil treatments/amendments are applied according to soil test results and the supervisor's instructions.
- Site is worked according to the crop production plan.
- The planting pattern is marked out according to the crop Production plan.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -14, 19, 21 and 23** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page -23.**

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

1.1 **Disposing of old crops**

Once the site for the farm has been selected and acquired, the farmer proceeds with clearing. This involves cutting down the vegetation that is growing on the land and then removing the dead plant material (old crops) from the cropping area. In traditional practice, the plant material is cut down with cutlasses, axes and saws.

- Purposes of clearing:-
  - Avoiding competition of nutrients , water light and air
  - Reduction of shading
  - Eliminating the shelter of pests and diseases
  - Enhancing good crop development

Clearing**:-**this involves cutting down of vegetation and removing the dead plant material from the cropping area. The purpose of clearing is to do tillage operation for seedbed preparation to perform sowing in order to produce crop. While clearing the land some trees are left standing which fall into three groups: -

1. Any economic trees such as oil palms.
2. Slender up right shrubs that will serve as live stacks for various climbing crops like cucumbers.
3. Very high trees such as silk cotton, which are spared due to high felling cost.

Burning is the most common method of clearing plant debris. But it has positive and negative effects.

- Benefits of burning:-

1. It may kill harmful pests& weed seeds.
2. It leaves an alkaline ash that serve as soil amendment and nutrient source such as K & Ca.

1.2 Removing waste materials

The purpose of land preparation is to provide condition that is favorable for the germination and growth of the seeds to be planted.

Before seeds is planted, the land must be prepared well to provide an adequate seed beds. Land preparation entails removing vegetation and losing the soil to facilitate seed germination and root penetration.

The extent of soil disturbance is depends on the types of technology, knowledge of the producer, and the environment. Plowing is an age-old method of land preparation for seeding. Site Tillage system has changed over the years.

- Materials to be removed from the field crop:-
  - Unwanted vegetation (trees, bushes, weeds , etc)
  - Tree roots
  - Stones
  - Stumps
- Clearing Operations:-
  - Removing shrubs and trees
  - Cutting, burning, burying all diseased vegetation
  - Removing stones and larger pebbles
  - Keeping few trees to provide shade fro compost heaps and the nursery
- Avoiding cleared materials from the site:-
  - Burning waste, woods and diseased vegetation
  - Use the crop trash for making compost heaps
  - Construction materials

Advantages of removing waste materials

- It helps in loosening the compact layer of soil and pulverizing it, thereby improving aeration & the growth of plants.
- The harmful insects, pathogens and weeds harboring in the soil are exposed to the sun & killed.
- It helps in proper & uniform germination of seeds.
- It helps to bury surface vegetation and crop residues from the previous seasons crop ; so as to make it easy to plant & resulting in the addition of organic matter into the soil.

Self-Check 1	**Written Test**

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

1. Why site clearing during? 4pts
2. What are the activities that included under clearing of the site for field crop establishment? 5 pts
3. List waste materials to be removed during site clearing of field crop establishment. 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-2	Applying Soil treatments/amendments

2.1 Definition: Soil amendment is the process of modifying soils to provide what the native or existing soils do not naturally provide. The amelioration required can vary depending upon the existing soil and the traits of the soil that require alteration, be it improving the drainage of a heavy clay soil, increasing the nutrient holding capacity of a highly sandy soil or repelling the negative effects of a saline soil near the coast with the application of calcium.

2.2 **Improving soil conditions**

- **Soil conditioning: -** Any crop gives its best yields **in suitable soil conditions** in regard to texture, water holding capacities, nutrients, pH and so on.
- **Organic manuring**: - Apart from supplying some of the plant nutrients, organic manures play other significant roles. These include the improvement of soil structure and water retention capacity within the root zone, increase aeration of the rooting medium, lower bulk density and increases holding of other major nutrients like nitrogen and phosphorus.
- **Chemical fertilizers:-**. Compound fertilizers like Diamonium phosphate (DAP) and Urea are useful for field crop growing.
- **Cover crop:** - This is an essential practice for improving soil fertility and in preventing the buildup of soil borne organisms. It has been shown that in areas where manure or fertilizer is not available in large quantities, the inclusion of two-year legume provides sufficient fertility and organic matter for continuous cropping
- **Liming**

- Soils with a pH below 5.0-5.5 (depending on the soil) can adversely affect crop growth in four ways:
- Aluminum, manganese, and iron toxicities: These three elements increase in solubility as soil pH drops and may actually become toxic to plants at pH's below 5.0-5.5. Beans are especially sensitive to aluminum toxicity which is the crop's biggest yield limiting factor in some areas. Many soils labs routinely test for soluble aluminum levels in very acid samples. Manganese and iron toxicities can be serious, too, but usually are not a problem unless the soil is also poorly drained.

- Very acid soils are usually low in available P and have a high capacity to tie up added P by forming insoluble compounds with iron and aluminum.
- Although very acid soils usually have enough calcium to supply plant needs (except for peanuts), they are likely to be low in magnesium and available sulfur and molybdenum.
- Low soil pH depresses the activities of many beneficial soil microbes such as those that convert unavailable N, P, and S to available mineral forms. Low soil pH depresses the activities of many beneficial soil microbes such as those that convert unavailable N, P, and S to available mineral forms. Maize and cowpeas may tolerate soil acidity in the pH 5.0-5.5 range depending on the soil's soluble aluminum content. Sorghum is somewhat more tolerant than maize to soil acidity.

Soil ph is not the sole criteria for determining if liming is needed. The soil's content of soluble aluminum (called "exchangeable" aluminum) is probably even more important, and the portable pH kits cannot measure this. A soil with a pH of 5.0 or even lower might still be satisfactory for the growth of most crops if its exchangeable aluminum content is low. On the other hand, another soil with a pH of 5.3 might need liming because of too much aluminum. Only the soils lab can tell for sure.

The amount of lime needed to raise soil pH one unit varies greatly with the type of soil involved. One soil may require 810 times more lime than another to achieve the same rise in pH even though both have the same initial pH. The amount of lime needed depends on the soil's amount of negative charge which varies with its texture, type of clay minerals, and amount of humus. Only the soils lab can determine this.

How, When, and How Often To Lime

Lime should be broadcast uniformly over the soil and then thoroughly mixed into the top 15-20 cm by plowing or hoeing. Harrowing alone will only move the material down about half this distance. A disk plow or moldboard plow should be used, not a wooden or chisel plow. If spreading lime by hand, the amount should be divided in half and one portion applied lengthwise and the other widthwise. Wear a mask hydrated (slaked) lime and burned lime can cause severe burns. Liming may be needed every two to five years on some soils, especially if high rates of nitrogen fertilizers, manure or compost are used. Sandy soils will need more frequent liming than clayey soils since they have less buffering capacity, but sandy soils also will require lower rates.

‘DO NOT OVERLIME’

- Never raise the pH of soil above 6.5 when liming.
- Never raise the pH by more than one full unit at a time (i.e. from 4.6 to 4.6, etc.). It is only necessary to raise the pH up to 5.5-6.0 for good yields of an aluminum sensitive crop like beans. Over liming can be worse than not liming at all for several reasons:
- Raising the pH above 6.5 increases the likelihood of micronutrient deficiencies, especially iron, manganese, and zinc; molybdenum is an exception.
- Phosphorus availability starts declining once pH rises much above 6.5 due to the formation of relatively insoluble calcium and magnesium compounds.
- Liming stimulates the activity of soil microbes and increases the loss of soil organic matter by decomposition.

Green manure

Crop grown for the purpose of restoring or increasing the organic matter content in the soil are called green manure crops. Their use in cropping system is called “green manuring” where the crop is grown in situ or brought from outside and incorporated.

Various nitrogen fixing leguminous and non-leguminous species, particularly trees, creepers, and bushes can be used as green manures. The criteria for selection of plants as green manure is:-

- ✓ High biomass production, Deep rooting system , Fast initial growth , More leaf than wood , Low C/N ratio , Nitrogen fixing ability, Good affinity with mycorrhiza, Efficient water use, Non host for crop related pests and diseases, Easy and abundant seed formation

Advantages Green manuring:-

- Green manuring has a positive influence on the physical and chemical properties of the soil.
- It helps to maintain the organic matter status of arable soils
- Green manure serves as a source of food and energy for the soil microbial population which multiplies rapidly in the presence of easily decomposable organic matter.
- The enhanced activities of soil organisms not only cause rapid decomposition of the green manure but also result in the release of plant nutrients in available forms for use by the crops.
- Green manuring improves aeration in the rice soils by stimulating the activities of surface film of algae and bacteria.
- Many green manure crops have additional use as sources of food, feed and fuel.

In soil structure and tilth improvement

- Green manuring builds up soil structure and improves tilth.
- It promotes formation of crumbs in heavy soils leading to better aeration and drainage.
- Depending on the amount humus formed, green manuring increases the water holding capacity of light soils.
- Green manure crops form a canopy cover over the soil and reduce the soil temperature and protect the soil from erosive action of rain and water currents.

In fertility improvements of soils

- Green manure crops absorb nutrients from the lower layer of soils and leave them in the soil surface layer when ploughed in for use by the succeeding crops.
- Green manure crops prevent leaching of nutrients to lower layers.
- Leguminous green manure plants harbor nitrogen fixing bacteria, rhizobia in the root nodules and fix atmospheric nitrogen.
- Green manure crops increase the solubility of lime phosphate; trace elements etc., through the activity of the soil microorganisms and by producing organic acids during decomposition.
- A crop of green manure on an average is reported to fix 60-100 kg nitrogen /ha in single season under favorable conditions.

In amelioration of soil problems

- Green manuring helps to ameliorate soil problems. Sesbania aculeate, when applied to sodic soils continuously for four or five seasons, improves the permeability and helps to leach out the harmful sodic salts. The soil becomes fit for growing crops
- Green leaf manure from sources such as Argemone mexicana and Tamarindus indica has a buffering effect when applied to sodic soils. **In improvement of crop yield and quality**
- Green manuring increases the yield of crops to an extent of 15 to 20% compared to no green manuring.
- Vitamin and protein content if rice have been found to be increased by green manuring of rice crop.

The major ameliorations performed are:

- Pre-plant fertilization – either an organic or slow release elemental form placed into the planting hole or pot.
- Soil structure modification – the addition of a peat type product to a sandy soil to increase moisture and nutrient holding abilities or the addition of sand or gravel to a highly clay soil to improve drainage and pore spaces to the root zone.
- Soil importation – where the site to be planted does not have suitable soil and a prepared and suitable soil is imported to the site.

Self-Check 2	Written Test

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

1. What is soil treatment? 4 pts
2. List the methods of soil treatment? 6 pts
3. Define liming. 6 pts
4. Describe the advantage of green manuring. 4 pts

Note: Satisfactory rating – 16 points and above Unsatisfactory - below 16 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Working site

Implementing land preparation activities

After the land has been cleared various tillage operations should be carried out. Tillage includes all operations and practices used for the purpose of modifying the physical characteristics of the soil. These are:-

a) Plowing/Digging: plowing is initially done to open the compact or hard soil. During this operation the soil is inverted, weed uprooted and stubbles incorporated into the soil. The depth of digging varies from 10 to 30 cm. It has different **purposes** like

- Cutting and turning the soil
- Loosening the soil and good root penetration
- Aerating the soil and making it permeable
- Reducing weeds and insect infestation
- Incorporating organic matter and soil amendments to improve the structure of the soil
- Shaping soil: - tillage is done to create raised beds for planting or to create furrows for irrigation.
- Erosion control:- like in conservation tillage

b) Harrowing/pulverizing: if the lumps (clods) of soil left after digging are too large, they must be broken up before planting/sowing if broadcasting and before furrow preparation if row methods of sowing. **Purpose of harrowing is**

- Cutting the clods and sods to a considerable depth
- Producing fine seedbed and leveled soil
- Obtaining weed free soil

c) Leveling: - is done to improve surface drainage, for installation of irrigation equipment, or to facilitate the use of farm machineries and equipment.

Self-Check 3	Written Test

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

1. What is plowing? 4 pts
2. What are the purposes of plowing? 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Selecting planting pattern

Many field crops are direct seeded in the fields. Field or agronomic crops such as cereal grains, grain legumes and forage crops and oil crops are generally direct- seeded, that is the seed are placed where they will grow and develop to maturity. This is opposite to transplanting, where seedlings are raised in the nurseries and then transplanted to permanent location in the field. After selecting the appropriate cultivar and prepare the seeds beds the procedure has the following major decisions to make towards crops establishment. These are depth of seed placement, seed rate, plant spacing, and time of sowing and methods of planting.

Broadcasting: - the seeds are spread uniformly over well prepared land by plowing or planking.

It may be done by hand mechanically spreader

It is suitable for close planted that do not require specific crop or plant geometry.

When the number of plant per unit area is more important than definite spacing from plant to plant, this is usual method of sowing.

Limitation of broadcasting:

- When seeds fall at different depths it results in the uneven stand. Seeds at shallow depth emerge early if moisture is available. Seeds fallen deep in the soil may not germinate or may emerge after a considerable period of time and thus there is a lot of wastage of seeds.
- Difficult to manage, like weeding, hoeing, Earthining up etc
- Wastage of fertilizer

Drilling sowing

Drilling: - is the practice of dropping the seeds in the rows or lines. Furrows at specified distance, covered with soil and are compacted.

Limitation of drilling: - Require more time, more energy and more cost

Advantage of drilling

1. Seeds and fertilizer both can be drilled together with the use of seed-cum fertilize drill
2. Maintain a uniform plant population
3. Reduce seed rate
4. Reduce plant competition

Self-Check 4	**Written Test**

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

1. List the types of sowing/planting methods? 5 pts
2. What are disadvantages of broadcasting? 5 pts
3. Describe the advantages of drilling. 5 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Operation sheet 1	Prepare site for field crop establishment

Procedures to prepare site for field crop establishment operations follow the following

Step1. Select the site for field crop establishment

Step2. Prepare the materials which use for field crop establishment

Step3. Identify and asses OHS hazards and risks of site preparation

Step4. Use properly personal protective equipments

Step5. Clear the selected site

Step6. Prepare site depend on crop production plan which is feasible with environment

Step7. Clean, maintain and store used tools, materials and equipments for site preparation for field crop establishment.

Step8. Complete site preparation for field crop establishment.

Crop production

Level II

Learning Guide #37

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO3-LG-37

TTLM Code: AGR CRP2TTLM 0919v1

LO 3: Carry out establishment operations

Instruction Sheet	Learning Guide #37

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

- Selecting planting material
- Treating planting materials
- 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 –

- Planting material is selected according to the type of Crop and enterprise quality standards.
- Planting material is treated according to the crop and Supervisor's instructions.
- Planting material is handled and transported to the site with no signs of transport damage.
- Planting is carried out according to the planting plan

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information "Sheet 1, Sheet 2, Sheet 3 and Sheet 4".
4. Accomplish the "Self-check 1, Self-check t 2, Self-check 3 and Self-check 4" **in page -28, 32, 33 and 37** respectively.
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 2 " **in page -37**

Information Sheet-1	Selecting planting materials

1.1 Seed selection: basic considerations

Start by choosing carefully the location and actual plants from which you collect seeds.

- ❖ Collect seeds from plants growing in sites similar to the ones you are going to plant the seedlings on.
- ❖ Collect seeds from plants with the characteristics you want (e.g. good rooting): seedlings grow like their parents.
- ❖ All seed plants should be healthy and growing vigorously.
- ❖ Always collect seed from at least 10 plants, to increase the genetic diversity.

1.2 Methods of seed selection and collection

How to select and collect seeds

Whether you are going to collect flower, shrub, or tree seeds, the basic methods apply to each is the same.

- Select adult plants which are healthy, strong, and free from disease or insect infestation, from which to collect seeds.
- Collect the seeds during the time of seed production.
- Select species which grow in the same kind of environment as that in which the seedlings will be planted.
- Select mature seeds.
- Select seeds which are of the same color, size and shape.
- Be certain that the seeds are free from disease.
- Dry the seeds well before storing them. Those seeds which are naturally moist or sticky should be washed well before drying.
- Do not mix seed of different plants. Put them in jars or envelopes, labeling each by name, date and plant location.
- If needed, a dust insecticide such as Malathion can be mixed with the seeds to control insect pests.
- Keep the seeds in a cool, dry place.

General seed selection criteria

- Fitting within the usual period of the raining season
- High and stable yield

- Resistance to insect pests and diseases
- Uniform heading and fruiting
- High oil, protein or starch content
- Moderate one thousand seed or grain weight

Type of crop	1000 weight(g)	Grain numbers per Kg
Wheat	17-25	50000-55000
Maize	350-550	2000-3000
Sorghum	22-220	8000-10000

Table1. Main crop on 1000 weight and grain number

1.3 Selecting planting materials

Seeds are the pre-operational unit of flowering species and the economic part of grain crops, consists miniature plant called embryo. To produce high quality and quantity of field crops selection of good seeds are very important. Good seeds have the following characteristics: -

- ❖ Pure(true to type)
- ❖ Viability/good germination capacity
- ❖ Matured, well developed, uniform size, shape, color , texture etc
- ❖ Health, clean, and free from inert matter
- ❖ Free from other crop seeds
- ❖ Free from any pest and seeds borne diseases
- ❖ Should be whole, not broken, crushed, shriveled, rotten etc
- ❖ Should contain the required amount of moisture
- ❖ Fitting within the usual period of the raining season
- ❖ High and stable yield
- ❖ Resistance to insect pests and diseases
- ❖ Uniform heading and fruiting
- ❖ High oil, protein or starch content

Seed damage may be caused by mechanical injury, insects, fungi, and bacteria.The quality of seed is governed by its purity, viability, germination capacity, seed health (pathogens) test, genetic purity test etc. If seed lacks in any of the characteristics it may becomes unfit for sowing.

a. **Seed purity test (Physical purity test):** -Seed purity is the percentage of pure seed (only the seed of the desired kind without contaminants) in the sample tested. The contaminants includes:-

1. Seed of others: - like wheat seed may be found in barley seeds.
2. Weed seed
3. Inert materials: - includes materials (foreign matter) such as small stones, pieces of wood, and other plant materials.

b. Seed viability test: - Seed viability is the capacity of seeds to germinate.A viable seed is one capable of germinating to produce a health, normal seedlings. It is not enough to tissues in the seed to be viable; the seed must able to grow to produce seedlings.

c. Seed germination test: - See germination is the sequence of events in a viable seed starting with the absorption of water that leads to growth of the embryo and development of seedlings. When the seeds are placed in proper conditions of moisture, temperature and oxygen, the growth of embryo or germination commence. The degree to which germination has been completed is usually expressed in percentage, normally determined at time intervals of germination period in terms of germination power and germination capacity.

$$\text{Germination \%} = \frac{\text{Numbers of germinated seeds}}{\text{Numbers of planted seeds}} \times 100\%$$

d. **Seed health (Pathogen) test**: -It evaluates the presence of insect on the seed like change in color, presence of spots etc, and then placed under optimum germination condition for germination to occur.

Self-Check 1	**Written Test**

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

1. What are the methods of seed selection and collection? 5 pts
2. List the characteristics of good seed. 6 pts
3. What is seed viability? 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	Treating planting materials

Seed treatment is the process of applying physical, chemical or biological treatment to the seed to keep it viable and health.

Seed treatment

2.1 Objectives of seed treatment;-

- ✓ To prevent the seed against pest and diseases infestation.
- ✓ To break seed dormancy and to induce higher germination percentage.
- ✓ To inoculate the seed with rhizobium bio fertilizer.
- ✓ To induce tolerance to salinity, drought frost etc..
- ✓ To promote nitrogen fixation by treating it with rhizobium

2.2 Important of seed treatment

Seed treatment is the process of applying physical, chemical or biological treatment to the seed to keep it viable and health.

2.3 Types of seed treatment

1. Physical treatment
2. Biological treatment
3. Chemical treatment

1. Physical seed treatment

- It includes subjecting seeds to solar exposure, immersion in conditioned water etc.
- To induce higher germination, the seeds may be soaked in water before sowing or may be exposed to warm temperature. Early rooting may be induced by treating seeds with IBA or GA solutions.
- To induce or facilitates sowing and better germination in cotton seed treated with
- Sulphuric acid (H_2SO_4).

2. Biological Seed treatment

   It includes the treatment of seeds with microbial cultivars such as that of Rhizobium to inoculate the seeds with microbial cultivars, to fix atmospheric nitrogen and release to the soil.

3. Chemical seed treatment

   It includes treating seeds with fungicides, insecticides, nematocides etc.

   Types of chemical used for seed treatment

   1. Insecticides:- Parathion, phorate, chlorphriphos, furadan, dimethoate etc
   2. Fungicides:- Thiram , thiophante(topsin), carbendazim, vitavax, dexon etc

Seed treatment methods

i. The infection of insects pests, and diseases can be prevented by such drying, sieving, winnowing and by mixing with inert materials such as sand ash etc, also done by coating or treating the seed with calcium phosphate, dried Neem leaves, tobacco, lime etc.

ii. The infected seeds with insect pests and diseases is treated by dipping dressing or coating the seeds with fumigation. Example, Termites is controlled by treating the soil with Endosulfan 35EC.

Dressing seeds with chemicals

I. Insecticides for stored seeds

Only use them with clean dry grain in good place. The seeds must be clean and dry in order to keep the high percentage of live seeds that will geminate.

Selection of insecticides: - The kinds of insecticides for fumigation may be used for stored seeds. Fumigants may kill many kinds of pests in store house by releasing toxic gas. Commonly used are:-

a. Phostoxin (AIP):- used for 1-4 pieces/m^3 in store, and 4-12 pieces /m^3 in open bam. Every pieces of space should be more than 2cm, avoid contact with water and keep the fire off.
b. Methyl bromine (CH_3Br):- suitable for condition of low temperature, spray for 0.5 Kg/37/m^3. The store house must be strictly sealed in.

II. Seed disinfectant

- **Fungicides**: - for seed dressing, fungicides to seeds ratio is 0.3-1.0:100 for 10 to 48 hours.

For seed soaking, fungicides to seeds ratio is 1:500-1000 for 10 to 48 hours.

- **Insecticides**: - quantity of usage is based on the insecticides but every seed should be coated with distributed insecticides used for seed coating.

  Insecticides, water and seed ratio is 1:50:50 suffocating for 4 to 6 hours

- **Fumigants: -** look at insecticides used for stored seeds. **Way of application**

a. **Seed dressing**: - is mixing of seeds with the pesticides powder or liquid evenly, like high concentration of powder or WP, EC etc.

   Usage

   Powder: - dry dressing by man or in the mixer(Drum)

   Wettable powder or emulsion: - Prepare chemicals before seed dressing from 0.3% to 1.0% of the weight of the seeds.

b. **Seed soaking**

   It is soaking of the seeds into the solution for certain time. Prepare the solution usually 500- 1000 times solution. Soak the seeds into the solution for certain time, from 10 minutes to 48 hours. Spray out the seeds and dry the moisture of the surface of the seeds.

c. **Rinsing: -** is just like the soaking, only the time of seed in the solutions is much shorter than that of soaking, aims to kill the pest on the seeds.

d. **Seed suffocating: -** compounds the seeds with pesticides and suffocate for several hours.

   Usage:-

   - Chemical, water to seed ratio is 1:50:50
   - Mix the seed with the solution evenly
   - Pile with a cover of cloth, plastic film or sacks for several hours
   - Sow the seeds after drying the moisture on the surface of seeds

Methods of seeds dressing

- Container with punching holes for rinsing
- Mixing with shovel for seed soaking
- Using cloth, sack or plunger, dusters for seed suffocating

Self-Check 2	Written Test

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

1. What are the types seed treatments? 5 pts
2. Define biological seed treatment. 5 pts
3. Explain seed suffocating. 4pts
4. Discuss seed soaking method of seed treatment. 4pts

Note: Satisfactory rating –15 points and above **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Handling and transporting planting materials

Seed handling

Seeds used for planting require more careful handling than those used for grains (i.e., food or feed). Good quality seed spells good field emergence, seedling stand, crop growth, yields and healthy vigorous seeds.

Seed handling is the procedure of **drying, cleaning, grading, treating and storing seeds**.

Care to be taken during drying sowing seeds are: -

- Temperature is controlled under 40^0c
- Do not dry seeds too fast
- Don't make seeds over dry
- Avoid seed mechanical damage

For storage of sowing seeds the following condition should be fulfilled:

- Low seed moisture content (wheat and barley (13%), maize (14%), oil crops (10 %) etc.
- Maintain low temperature by installing ventilators
- Effective pest control
- Low relative humidity

Self-Check 3	**Written Test**

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

1. What is seed handling? 5 pts
2. List cares to be considered during drying sowing seed. 5pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Carrying out planting

Planting is also the placement of the specific quantity of seed in the soil at optimum position for germination & growth. The establishment of good plant stand depends upon time, seed rate, plant spacing, depth & method of sowing

After selecting the appropriate cultivars and preparing the land, there are four major procedure/decisions to make towards crop establishment.

4.1 Depth of seed placement (sowing depth)

If seeds are sown at **different depth** , germination will be uneven, resulting an uneven crop stand, which will, in turn affect later crop production activities such as harvesting(crop mature unevenly).Shallow or deep sowing result in lesser population, as all seeds will not germinate together. The crop shows uneven spread of plant with large number of gaps, and serious weed problem. It is therefore, essential to sow the crop at optimum depth for obtaining good crop stand. Generally, the depth of seed placement **twice** of seed size.

Factors that influence the sowing depth

a. **Seed size**: - large seeds have more food reserves and can emerge from lower depths, in the soil while depending on stored energy. Small seeds have limited food reserved and are placed at shallow depths.
   - Bigger seeds like groundnut, castor bean can be planted deeper
   - Small sized seeds like teff, tobacco have to be planted at shallower depth.
   - The optimum depth of most field crops is 3-5cm

b. **Types of seedling emergence**: - species with epigeal germination need to emerge above the soil, to commence seedling establishment. If placed too deeply in the soil, emergency may be greatly delayed and seeds may rot in the process.

c. **Soil type**: - heavy soil (clay) is poorly drained, poorly aerated, and prone to crusting. Light soil(sandy) drain freely and are prone to drying so that seed may be planted deeply

d. Depth of soil moisture

e. **Economic factor**:- cost of seeds

f. **Quality of seed bed:-** on fine seed bed fine seed is planted

g. **Plant factor**:- like rate of root penetration, type of root system(tap root or fibrous root) etc

4.2 Determining Optimum Sowing Time

Field seeding should be done at the appropriate time. Field cropping is a seasonal operation. Weather conditions are not conducted for cropping all year round. Many crop production regions have a large major cropping season, and a shorter minor cropping season. Time of seeding is especially critical if production is to be rained. The optimal time of seeding is chosen for several reasons.

Factors that affect time of sowing

1. Optimal soil condition for germination:-at certain times in the growing season.
2. Occurrence of disease and insect pest: - is diseases and pest that destroy seeds and seedlings are more prevented at certain times in the growing season.
3. Rain fall has a dominant influence in crop production: - the effect of moisture on crop grown can be attributed to at least two of its aspects.
4. Distribution of rainfall: during germination and emergence of seedling, the amount of moisture needed is much less but sensitive
5. Temperature**: -** temperature is also an important factor in limiting the growing of certain crops. Each plant has its own temperature range i.e. minimum, optimum, and maximum for growth
6. Day length:-long day plant need relatively long flowering time, but they increase their vegetative growth at short day. Short day plants need short interval of light for flowering
7. Market
8. Cropping system
9. Availability of labor
10. Time taken to maturity

4.3 Deciding Recommended Seedling Rate

Factors that influence plant population (seed rate)

- **Size of the cultivar:-** Dwarf, determinate, indeterminate growth habit, tillering, and non-tilleringetc
- **Amount of moisture available**:-most crops are seeded at greater rates under dry land than under humid or irrigation conditions.
- **Soil fertility**: - on fertile soil less seeding rate is needed.

- **Number of crop grown together**: - the number of crop crowns together, the more rates of seed needed.
- **Planting methods**: - broadcasting need more seeding rate than other methods.
- **Germination capacity of the seeds**:- if the germination capacity of the seed is higher, the lesser seeding rate needed.

4.4 Methods of Sowing / Planting

Broadcasting, drilling & dibbling

Direct Sowing: - On well prepared land. Eg. Many field crops.

Transplanting: - First sown in the nursery & then seedlings are transplanted to field. Eg. Rice, vegetables and fruit crops.

Advantages of Direct Sowing

1. Crop sown in time (If irrigation facility exist)
2. Plant population can be maintained particularly row to row & plant to plant
3. Optimum seed rate can be used
4. Proper sowing depth can be maintained.

Disadvantages

1. Crop sown only if optimum moisture level present otherwise rooting & sprouting will not occur.
2. Frequent light irrigation is required for rooting.

Time of Sowing / Planting

Time of sowing: - Early sowing is the most cost effective ways of increasing crop yield because it minimizes cost production.

Factors affecting sowing time

- Rainfall
- Temperature
- Day length
- Occurrence of Disease & Pest
- Marketing
- Cropping system
- Availability of labor & equipment Time taken maturity

Self-Check 4	Written Test

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

1. Describe the factors that determine sowing depth of seed. 5 pts
2. Define seed rate and list factors that determine seed rate. 5 pts
3. What are the factors that affect sowing time of seed? 5 pts
4. Explain how soil type affects sowing depth of seed? 3pts

Note: Satisfactory rating – above 15 points Unsatisfactory - below 15 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Operation sheet 2	Carry out field crop establishment operations

Procedures to carrying out field crop establishment operations are:-

Step1. Select and use tools, materials and equipments use for field crop establishment

Step2. Identify and asses OHS hazards and risks of site preparation

Step3. Prepare planting materials based on characteristic of good planting materials

Step4. Determine optimum sowing time based on types of crops and other factors

Step5. Decide recommended seeding rates based on types of crops and other factors

Step6. Select proper sowing/planting methods which are suitable for crops

Step7. Sow/plant planting materials on prepared site based on the site of crops

Step8. Complete field crop establishment operations

Crop production

Level II

Learning Guide #38

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO4-LG-38

TTLM Code: AGR CRP2TTLM 0919v1

LO 4: Prepare for field crop maintenance operations

Instruction Sheet	Learning Guide # 38

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

- Interpreting and clarifying instructions about field crop maintenance activities
- Identifying and discussing the environmental implication of agricultural crop maintenance plan
- Carrying out pre-operational and safety checks

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 –

- Instructions about field crop maintenance activities are interpreted and clarified with the supervisor.
- The environmental implications of the agricultural crop maintenance plan are identified and discussed with the supervisor.
- Pre-operational and safety checks are carried out on crop thinning tools according to manufacturer's specifications and enterprise work procedures

Learning Instructions:

3. Read the specific objectives of this Learning Guide.
4. Follow the instructions described below 3 to 6.
5. Read the information written in the information "Sheet 1, Sheet 2 and Sheet 3"
6. Accomplish the "Self-check 1, Self-check t 2 and Self-check 3" **in page -41, 45 and 47** respectively.

Information Sheet-1	Interpreting and clarifying instructions about field crop maintenance activities

Field crop maintenance needs same work procedure this includes

1. Check the crop ether maintenance is necessary or not. Then Prepare the area and equipment selected to maintain the crop. The type and the arrangement of work must be prepared.

2. Use a moderate quantity of a natural manure to fertilize the soil and ensure proper growth of the crop stalks. Throw fertilizer in the furrows using a semi circular movement of your wrist or attach a fertilizer drill to a tractor to distribute fertilizer. For a dry area, sprinkle a small quantity of fertilizer. A heavily cultivated crop uses up the water in the ground more quickly.

3. Managing weed the major goal of weed control is to reduce the competition with cultivated crops. The elimination of weeds from a field is impossible. Often when one pesky species is controlled, another arises to fill its niche. Practical control is achieved through one or a combination of methods.

Reason for weed management

1. Weeds reduce yield by competing with the crop for sunlight, moisture and soil nutrients.

2. Fertilizer application in weedy fields may prove wasteful because weeds absorb the fertilizer (especially N) more effectively than the crop.

3. Weeds may serve as alternate hosts for crop pests.

4 Water the field two to three times during a dry summer season(example for wheat crop). .Water is almost always a problem with small-scale agriculture in the tropics. The availability of water will determine what crops can be grown and at what seasons. However, availability of water to the plant is conditioned by many factors, especially the nature and treatment of the soil. Consider irrigating the cultivated land by using commercial sprayers on wheels.

5. Apply a light insecticide/pesticide spray to the harvested field if you spot any infestation on the crop. Discuss appropriate products with an agricultural expert and read the manufacturer's instructions carefully before administering any spray.

6. Monitor the crop field regularly. Use a scythe to cut the crop once the stems turn yellow and the crop are fully dried up. Or use a "combine" machine to cut off the crop in a neat quick manner .to protect the crop from livestock grazing the field must bounded by fence (compounded).

Self-Check 1	**Written Test**

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

1. What are the procedures of field crop maintenance? 5 pts
2. List the benefits of weed management in field crop maintenance. 5 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-2	Identifying and discussing the environmental implication of agricultural crop maintenance plan

A) Chemical Loading of Soil and Ground/Surface Water

An important potential impact from beanery feedstock production is the introduction of agricultural inputs into the environment. Inputs such as fertilizers and pesticides

(Including herbicides, fungicides, insecticides, and infanticides) are likely to be used for growing perennial, beanery feedstock, although to a lesser extent than for annual row

Crops .Fertilizers can lead to nutrient overloading of surface waters and accelerate the growth of algae, while inhibiting the growth of other aquatic species. Persistent

Toxins in pesticides can bio-accumulate and poison wildlife, workers, and communities, with human impacts ranging from cancer to immune disorders to hormone disruption.

Resistance to these same chemicals can appear in pests, making them all the more difficult to control. Globally, at least 450 species of insects and mites, 100 species of plant Pathogens, and 48 species of weeds have become resistant to one or more pesticide products.

As they have come to recognize the environmental and health impacts of agricultural chemicals, farmers and agronomists have developed a range of management practices to

Minimize the need for such inputs. These practices should be applied to beanery crops, even though they already have lower chemical input requirements. One example is integrated pest management (IPM), which relies less on chemical inputs and more on nature's species diversity, adaptability, and nutrient cycling capability .

Farmers in many places are demonstrating that IPM is an ecological and cost-effective alternative to conventional chemical-intensive practices for a wide array of crops and regions - contrary to the expectations of some conventional farmers and researchers. In many cases, IPM has proven to be more profitable, although farmers sometimes bear the costs of a transition period of one or two years.

Farmers in many places are demonstrating that [integrated pest management] IPM is an ecological and cost-effective alternative to conventional chemical-intensive practices for a wide array of crops and regions - contrary to the expectations of some conventional farmers and researchers.

Several steps can be taken to reduce reliance on fertilizers. Using nitrogen-fixing species and using green manure (including crop residues and compost) can maintain or

Enhance soil fertility without the use of fertilizers. Rotation of crops can slow or prevent the depletion of nutrients, as well as the spread of diseases and pests. Intercropping

(Growing two or more crops simultaneously), cover crops (crops that cover and protect the soil during periods when it would otherwise be bare), crop residue management, and changes in tillage practices can improve soil quality and enhance nutrient availability.

Similarly, many options are available for eliminating or reducing the use of pesticides. Where labor is readily available, farmers can employ labor-intensive methods of applying inputs and controlling weeds that use inputs more efficiently than methods typically used in highly mechanized agriculture. Very effective non-chemical traps have been developed for many insects. For example, a program in Kenya reduced tsetse flies populations by more than 95 percent with non-chemical traps, greatly reducing the incidence of trypanosomiasis infections in cattle. Steps can be taken to increase the diversity of beneficial insects and to restore the natural predator-prey interactions in crops. For example, if some portion of the land is set aside and preserved in its natural state, it can function as a habitat for predators that reduce. The need for pesticides on adjacent cropland. Traditional plant breeding can also be used to develop more pest-resistant strains.

Beanery crops can also help mitigate the impacts of chemical use from agricultural cropland. Well-planned sitting of beanery crops can help to filter agricultural chemicals in runoff from annual row crops.

B) Effect of fertilizer on soil ph

Fertilizers can be acid, basic, or neutral in their effect on soil pH:

Large applications of manure or compost also have a gradual acid-forming effect.

The Practical Implications of Acid-Forming Fertilizers Continued use of acid-forming fertilizers over the years will eventually lower soil pH enough to require liming, unless the soil is very alkaline.

The rate that soil pH will fall depends on the kind and amount of fertilizer applied and the buffering capacity (negative charge, C.E.C.) of the soil .Since clayey soils or those high in organic matter tend to have more buffering capacity, they're usually more resistant to pH change than sandy soils.

Why not add lime to acid-forming fertilizers?: Some fertilizer labels state the amount of lime required to neutralize the acidity produced per 100 kg of the fertilizer, but this is just a legal requirement. Mixing in lime with such a fertilizer will convert much of its ammonium into ammonia gas which is then lost to the air. Don't add lime to the soil after each fertilizer application, either; it's unnecessary and time consuming. At any rate, most limited-resource farmers won't be applying high enough rates to markedly lower the pH in a year or two.

C) Nature of irrigation-induced salinity

Water serves as the vehicle by which salt is transported into and out of the root zone. The amount of water in the root zone is a function of the level of rainfall, irrigation applied,

Seepage from irrigation canals, and drainage; the rate of evaporation and transpiration the depth of the water table; and the area's proximity and elevation relative to natural bodies of water. The salt content in the root zone of plants is therefore Controlled by the difference between the volume and salt concentration of the water supplied to the production area and the volume and salt concentration of the water discharged from the same area.. Irrigation-induced salinity can arise as a result of the use of any irrigation water, irrigation of saline soils, and rising levels of saline ground water. When surface or ground water containing mineral salts is used for irrigating crops, salts are carried into the root zone. Most of the water returns to the atmosphere through transpiration by plants and through evaporation from the soil surface. In the process, the salt is left behind in the soil, since the amount taken up by plants and removed at harvest is quite negligible. The more arid the region, the larger is the quantity of irrigation water and, consequently, the salts applied, and the smaller is the quantity of rainfall that is available to leach away the accumulating salts.

The amount of salt which accumulates is further influenced by the water table depth, the capillary characteristics of the soil, and the management decisions regarding the amount of water applied in excess of plant vapor transpiration to leach the salt away In many arid and semi-arid areas, the soil strata are naturally saline. When these areas are developed for irrigation, the salt in the soil is mobilized by seepage water from canals and irrigation. If the volume of water applied is less than the volume of water needed to leach the salt away, the salt concentration at the root zone increases.

In some cases application of irrigation water results in rising saline ground water levels. When the water table approaches the bottom of the root zone, capillary action results in the Stalinization of the root zone and the surface soil.

A problem closely related to the problem of irrigation-induced salinity is that of alkalinity or sodality; its impact is manifested by the degradation of the soil structure. The application of irrigation water to areas with abundant salts (common in arid and semi-arid areas) and more than 15% exchangeable sodium lead to the formation of "alkaline' Or "soda" soils, through the process of alkaline hydrolysis. If the soil has a low chloride and calcium content and if the soil and/or irrigation water applied have abundant

Exchangeable sodium bicarbonate and/or sodium carbonate (over 15% exchangeable sodium), the clay particles in the soil adsorb the sodium and magnesium salts and swell.

The soil loses its permeability (ability to conduct air and water) and filth (friability of the seedbed). When this occurs, water infiltration is hindered and plant roots/soil organism may be starved .

D) Soil compaction

Soil structure can be damaged by use of heavy farm machinery which compact the soil and reduce its permeathty.

Self-Check 2	**Written Test**

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

1. Define field crop maintenance plan? 3 pts
2. What is the effect of fertilizer on PH of the soil? 4 pts

Note: Satisfactory rating – 5 points and above **Unsatisfactory - below 5 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Carrying Out pre-operational and safety checks

3.1 Checking machinery

A very good safety habit to adopt is to conduct daily **pre-operational checks** of machinery and equipment each day before you use them. Pre-operation checks are not only a good safety practice, they can also save you a lot of money in maintenance and downtime costs.

If you find any problems during your pre-operational check, make sure you correct the problem before using the machine.

For example before operating a machine it is important to;

- ✪ Walk around and **look at all fluid levels** such as engine oil, coolant, fuel, and hydraulic fluid.
- ✪ Look underneath the tractor; do you see any big leaks or puddles of fluid that have accumulated under the tractor?
- ✪ Look closely at the tires. Do they look properly inflated?
- ✪ Check the batteries to make sure they are securely held down, the connections are clean and the electrolyte level is good.
- ✪ As you are walking around, **look for any obvious damage** like cracked or broken parts, leaking or damaged hoses.
- ✪ Make sure that the steps are **clean** of any grease or mud that could cause you to slip.
- ✪ Check to see that the operator's platform or cab is free of any objects that could interfere with the operation of the tractor. If you have a cab tractor, keep the windows clean for good visibility.
- ✪ Properly adjust the seat for a comfortable position. Check the seatbelt to see if it is functioning

Identification of unsafe and faulty machinery and equipment

Any piece of equipment (including tools and furniture) identified as unsafe, either in normal day-to-day activities or during a safety inspection, must be promptly tagged using a tag out **(DANGER) tag**. Then further action must be taken for repair or disposal.

Equipment identified as faulty should be **disconnected and tagged**, and appropriate service people contacted to arrange repair or replacement.

Think, plan and check

- Lockout procedure must be employed whenever a piece of equipment is being repaired and there is the possibility of that equipment being switched on without the knowledge of the repairer.
- **Identify all parts of any equipment** or system that needs to be shut down.
- Find the switches, valves or other devices that need to be switched off.
- **Follow the correct procedure** for the shutdown of equipment so you don't endanger anyone.

3.2 Receiving instruction

- Tell all staff potentially affected by the tag out of that piece of equipment
- **confirm all equipment located**
- Make sure all personnel are informed of any potential danger.
- Verify that the main disconnect switch or circuit breaker cannot be accidentally turned on.
- Only an authorized person who has been directly notified of the repairs by the service person should remove the tag out tag and lockout device.
- Notify all users of the equipment that the tag out tag has been removed.
- Unsafe equipment should be reported by the staff member to their supervisor.

Self-Check 3	**Written Test**

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

1. Describe pre-operational and safety check before machinery use. 6 pts

Note: Satisfactory rating – 4 points and above **Unsatisfactory - below 4 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Crop production

Level II

Learning Guide #39

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO5-LG-39

TTLM Code: AGR CRP2TTLM 0919v1

LO 5: **Undertake crop thinning**

Instruction Sheet	Learning Guide #39

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

- Determining the purpose and methods of thinning
- Identifying plants/ plant material that require thinning
- Locating services using site plans
- Determining access to the site
- Erecting safety equipment
- Undertaking the crop thinning program according to OHS requirements
- Selecting crop thinning machinery, equipment and tools
- Operating crop regulation tools, equipment and machinery are
- Recorded and reporting signs of diseases and pests

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 –

- The purpose and methods of thinning are determined according to enterprise work procedures.
- Plants/ plant material that require thinning are identified according to enterprise work procedures and the crop regulation program.
- Services are located using site plans and in consultation with the supervisor.
- Access to the site is determined in consultation with the supervisor.
- Safety Equipments are erected around the crop thinning site during and between work periods.
- The crop thinning program is undertaken according to enterprise work procedures and OHS requirements.
- Crop thinning machinery, equipment and tools are selected according to enterprise work procedures.
- Crop regulation tools, equipment and machinery are operated safely and effectively. Signs of diseases and pests are recorded and reported to the supervisor

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4” “Sheet 5, Sheet 6, Sheet 7, Sheet 8 and Sheet 9”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check 4, Self check 5,Self check 6, Self check 7,Self check 8 and Self check 9” **in page -54, 57,58,59,65,67,68,69 and 76** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 3” **in page -76.**

Information Sheet-1	Determining the purpose and methods of thinning

Thinning is a term used in agricultural sciences to mean the removal of **some plants**, or **parts of plants**, to make room for the growth of others.

In agriculture and gardening, thinning is the selective removal of **flowers**, **fruits**, **shoots**, and **seedlings** or **young** plants to allow adequate space for the remaining organs/plants to grow efficiently. In large-scale farming, techniques like precision seeding and transplanting can eliminate the need for thinning by starting plants at their optimum spacing. On a smaller scale, such as a home vegetable garden, thinning can be used as a way to make maximum use of space for certain crops. For example, beets, carrots, green onions and others can be planted densely, and then thinned to make room for continued growth of the plants left in the soil, and also as a harvest of baby vegetables (beet greens, baby carrots, baby onions).

In agriculture, **precision seeding** is a method of seeding that involves placing seed at a precise spacing and depth. This is in contrast to broadcast seeding, where seed is scattered over an area.

In commercial production, precision seeding is an alternative to placing larger quantities of seed in a row, by dribbling seed or setting several seeds in each position. Depending on the device, precision seeders may place only one, or a very few seeds per position.

This is an advantage, in that it saves seed and it avoids crowding, or the need for thinning, allowing plants the space to grow efficiently. On the downside, by placing fewer seeds, a very high germination rate is required to make full use of the seeded area.

The purpose & method of thinning

The goals of thinning may include to shape, form, correct or control growth, provide clearance for services, access or cultural practices, prevent disease or damage, promote health, control capacity and vigor, manage the canopy and fruit and flower production, and to control yield and quality to meet market requirements.

The goal of thinning is to control yield and quality to meet market requirements.

Thinning operation is the removal of surplus seedlings from stands of crops which have grown too closely together, possibly as the results of sowing too thickly. In some instances, however, seeds are intentionally sown more densely than required particularly when the farmers is not sure of the germination percentage of the seeds he is sowing.

He may for example, sow 3-4seed per stands of maize& later thin them out to leave one or two of the most vigorous seedlings. This practices is particularly important when the seed sample is mixed or of variable quality so that the vigor of individual seedlings cannot be estimated in advance.

The farmer also has to make allowance for the field factors which affect the germination of the seeds. Even if the germination test has been carried out , he still has allow for losses by birds, soil insects , & fungi, uneven depth of sowing & the weather, including very wet& very dry conditions which may occur shortly after the seed have been sown.

Crop thinning is used to achieve yield and quality goals. Crop thinning is the term used for removal of flower and/or grape clusters on the grapevine. It allows the grower to modify vine balance (fruit to vegetative growth). In cool climate winegrowing regions, crop restriction is sometimes required on certain cultivars to ripen fruit adequately, due to a limited season and heat units. The intensity of crop thinning is highly dependent on the cultivar, vine health, and climate. Some cultivars may require annual crop thinning to maintain adequate vine strength. When thinning clusters, one must consider when and how much to thin the crop.

Beneficial Effects of Thinning

- ✓ The purpose of thinning is to increase economic gain. The gain may be achieved by offsetting the expense of carrying establishment costs to rotation age, increasing the value of the product, and/or increasing stands utilization.
- ✓ Risk reduction for insect infestations, disease epidemics, and damage from a biotic agents. The mechanics by which thinning reduces these risks is not fully understood.
- ✓ Increased Growth
- ✓ Increased Utilization

Increased utilization through the removal of suppressed crop increases economic gain from managed crops.

- ✓ Reduced Susceptibility to Diseased and Insects

If thinning is properly performed, they will have beneficial effects, not only in the form of increased product values and increased stand utilization, but in terms of increased resistance to damage by both biotic and a biotic agents as well as genetic improvement. Increased values and resistance are largely due to increased growth rates and improved vigor of the residual stand. The end result is increased economic gain.

In addition, in forestry the changed forest environment resulting from thinning is usually considered beneficial for wildlife habitat management, watershed management, recreational uses, grazing, and other amenities.

- ✓ Genetic Improvement

Some genetic improvement may also be achieved through thinning. Trees removed in thinning from below are usually less vigorous (not growing as well), diseased, or have undesirable form, sometimes due to genetic factors. By removing such trees prior to regeneration of the stand, the forester can minimize undesirable traits.

- ✓ Other Benefits

In forestry, Thinning changes the environment of the forest. The penetration of light, the temperature of mineral soil, and the availability of moisture and nutrients are all increased (Blair 1969). Understory vegetation quickly responds to these changes, producing a more favorable habitat for wildlife and cattle (Blair 1967; Halls and Schuster 1965). A relationship between forage increase and reduced basal area has been demonstrated.

The diminished canopy that results from thinning allows greater amounts of rain to reach the forest floor, which increases the quantity of water from the watershed (Rogerson 1968; Ursic 1974).

Methods vary with the plant

Thinning by removal of crops using hands, sticks, shakers and thinning sprays,

Methods

Two considerations are paramount in choosing a thinning method for southern pine plantations: 1) The growth response and quality of residual trees, and 2) the costs involved in marking and harvesting. Unfortunately, the method that results in the greatest growth response and best quality trees may also be the most expensive. The best choice will often represent a compromise between cost and quality.

Thinning methods for the southern pines include:

Selective methods: - Trees to be removed are marked individually based primarily on their position in the crown canopy, although other considerations (e.g., damage from disease, insects, and wind) may take precedence. These are the classic European methods of low, crown, and selection thinning, or some combination of the three ("free thinning").

Mechanical methods:-Trees are removed strictly on the basis of spacing with little or no regard to crown position. Row or corridor thinning are the primary examples of this type of thinning. Leave-tree or D + x thinnings[3] are also mechanical-type thinning, but some emphasis is placed on selecting better trees for the residual stand.

Mechanical plus selective method: - In this technique, the stand is first thinned mechanically, usually by rows, and then selectively within the leave rows.

Self-Check 1	**Written Test**

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

1. What is crop thinning? 5 pts
2. List the advantages of crop thinning. 7 pts

Note: Satisfactory rating – 10 points and above **Unsatisfactory - below 8 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-2	Identifying plants/ plant materials that require thinning

Before undertaking thinning, identifying **plant materials** that require regulation activities is important.

Plants that require crop regulation are:-

- ✓ vegetables,
- ✓ fruits,
- ✓ ornamental and shade trees when they are victim of overloading of flower and fruits,
- ✓ Lack of sunshine and overgrowth problem that may reduce final yield and quality.

Also plant regulation is required to remove diseased or insect-infested wood, to increase airflow and reduce some pest problems, and removing crossing and rubbing branches.

Based on function of crop regulation, identifying plants that require crop regulation is important element of crop regulation.

To improve plant shape; influences growth behavior ; flowering & fruiting; improves quality of fruits; gives more mechanical strength; remove damage; diseased & dead plant parts; causing dwarfing which intern increases in vigor; remove water sprouts; & suckers; & reduces the number of flowers & shoots, for current season.

The maximum **thinning** of trees is done during the first few years of growth& their frame work is built during early period. **thinning** has little effect on amount of fruiting but a factor in determining the quality of fruits, because it expose the plants for proper insect pest & disease control. In certain fruits, shape & openness of the tree is important in influencing the coloration. It reduces production cost by facilitating tillage operation, soil treatment, spraying, harvesting etc…

Crop thinning program

Thinning of the seedlings

Sorghum: - Direct sown crop

Thin the seedlings and gap fill with the seedlings thinned out. Maintain a spacing of 15 cm between plants after the first hand weeding on the 23rd day of sowing.

Thin the pulse crop to a spacing of 10 cm between plants for all pulse crops except cowpea, for which spacing is maintained at 20 cm between plants.

Maize:-

i. If two seeds were sown, leave only one healthy and vigorous seedling per hole and remove the other on the 12-15 days after sowing.

ii. Where seedlings have not germinated, dibble presoaked seeds at the rate of 2 seeds per hole and immediately irrigate.

Sesame: - Thin out the seedlings to a spacing of 15 cm between the plants on the 15th day of sowing and 30 cm on 30th day of sowing. This operation is very important for the crop in order to induce basal branches.

Safflower: - Thin out the seedlings to a spacing of 15 cm between plants on the 15th day of sowing.

Sunflower: - Thin out seedlings leaving only one healthy and vigorous seedling in each hole on the 10th day of sowing.

Niger: - Thin out the seedlings to a spacing of 10 cm between plants on the 15th day of sowing.

Cotton: - Thin out the seedlings on the 15th day of sowing. In the case of fertile soils, allow only one seedling per hole, whereas in poor soil allow two seedlings per hole.

Gap filling for cotton

a. Take up gap filling on the 10th day of sowing.

i) In the case of TCHB 213, raise seedlings in polythene bags of size 15 x 10 cm.

ii) Fill the polythene bags with a mixture of FYM and soil in the ratio of 1:3.

iii) Dibble one seed per bag on the same day when sowing is taken up in the field.

iv) Pot water and maintain.

v) On the 10th day of sowing, plant seedlings maintained in the polythene bags, one in each of the gaps in the field by cutting open the polythene bag and planting the seedling along with the soil intact and then pot water.

b. In the case of all other varieties, dibble 3 to 4 seeds in each gap and pot water.

SMALL MILLETS (varies with varieties)

Thinning: Before 20 DAS or thinning is done soon after weeding

Self-Check 2	**Written Test**

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

1. Define thinning characteristics of different field crop? 6 pts

Note: Satisfactory rating – 4 points and above **Unsatisfactory – below 4 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Locating services using site plans

Different services may damage during crop maintenance activities, therefore we have to identify and save them from damaging.

Services May include:-

- Above ground outlets for water supply,
- irrigation fittings,
- low overhead power (electricity)

Self-Check 3	**Written Test**

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

1. What are the services that may damage during crop maintenance? 4 pts

Note: Satisfactory rating – 4 points and above **Unsatisfactory - below 4 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Determining access to the site

Hazards may include:-

- ❖ sharp hand tools and equipment,
- ❖ falling tree limbs,
- ❖ strain on the back and neck,
- ❖ wood dust and shavings falling into the eyes,
- ❖ cuts and bruises, exposure to sunlight,
- ❖ spike injuries,
- ❖ insect attacks (e.g. wasps, bees and ants),
- ❖ spider or snake bites,
- ❖ Ladders or repetitive strain injury (RSI).

OHS hazards may be dealt with by:

- identifying hazards;
- assessing and reporting risks;
- actions such as cleaning, maintaining and storing tools and equipment;
- appropriate use of PPE including sun protection,
- drinking to avoid dehydration;
- safe operation of tools and equipment; machinery
- use and storage of chemicals and hazardous substances; correct manual handling;
- basic first aid;
- personal hygiene,
- Identifying and reporting hazards to supervisor

Self-Check 4	**Written Test**

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

1. List the source of hazards during field crop maintenance? 4 pts
2. Describe the way of hazard managements during field crop maintenance. 4 pts

Note: Satisfactory rating – 6 points and above Unsatisfactory - below 6 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-5	Erecting safety equipment

Safety equipments that are used during undertaking field crop maintenance must be erected around field crop maintenance site.

These safety equipments may include:

- A structure such as a fence that is intended to prevent access or keep one place separate from another.
- These safety equipments are basically required to separate one working area from another. It is important to avoid disturbance, damage and limit operational areas where the work to be taken place.
- Also these safety equipments are used as boundary between two task areas. For example, **signage** and **barriers** are common safety equipments.

Protective clothing and equipment

Protective clothing and equipment are necessary in the handling and use of most pesticides on the farm, and in view of the rough treatment they may be subjected to during field Work, such clothing and equipment require to be specially selected for their ruggedness.

Depending on the nature of the operation and the degree of pesticide toxicity, the clothing and equipment required may include overalls (without cuffs, turnips, or external Pockets), headwear, gloves, boots and aprons made of rubber or other suitable material, goggles or face mask and approved respiratory protective equipment.

The appropriate equipment should be worn throughout the period of potential exposure. After work, it should be washed to remove all traces of pesticide and then stored in well ventilated accommodation, separate from cloakrooms for personal clothing, until next required. Workers should not be allowed to wear home any clothing or equipment used for pesticide work.

Sanitary standards

(1) Workers regularly exposed to pesticides (particularly the more toxic ones) must adhere to rigid sanitary standards and use protective gear

Consistently to avoid poisoning, as follows:

(a) Workers handling pesticides should shower and shampoo at the end of each work day, and put on a freshly laundered coverall at the beginning of each work day;

(b) Food and drink should never be consumed at the worksite. Hands must be washed scrupulously before meals to avoid contamination of

Food, drink and smoking materials; and

(c) Workers in close proximity to concentrates or dusts containing very toxic pesticides must wear adequate respiratory protective gear. The equipment must be carefully selected to ensure that the system of air purification is suitable for the tasks at hand (whether dusts, aerosols Vapors or gases). Face masks must fit snugly to be effective, and the inner surfaces must be cleansed frequently with clean water (or rubbing alcohol) to ensure freedom from pesticide contamination. Air filter cartridges must be changed regularly (the interval will depend on the level of air contamination) to be effective. Air supplied to helmets must be free of toxic substances (including carbon monoxide and oil vapor from compressors).

(2) Outer protective gear (suits, aprons, boots, goggles, hats, gloves) must also be cleaned and maintained. When cracks, holes and worn areas appear, equipment must be replaced. Gloves and boots must be cleaned inside and out periodically to remove contaminating material.

(3) The selection and use of protective gear must take intelligent account of the safety requirements of the task at hand and the work environment. Chemically impervious protective gear (such as rubber suits) is also heat impervious, and cannot be worn for indefinite periods in hot environments. Work with highly toxic Pesticides must therefore be interrupted regularly to allow relief from heat stress and fatigue. The provision of ample clean drinking water and electrolytes and adequate rest periods are essential to safety in these circumstances. Many pesticides having low toxic and irrigative potential, or present in low concentration, can be handled safely without the use of elaborate protective gear, provided that commonsense standards of hygiene and cleanliness are observed.

Safe working procedures

Even on small farms, it is preferable to have a specially designated area for handling and mixing concentrated pesticides -often the most hazardous operation. It should preferably have a floor where spillage can be dealt with effectively and a supply of water for washing in the event of body and clothing contamination. Even when a pesticide can be applied with a minimum of protective equipment, more elaborate equipment will be needed for mixing; this operation should be supervised.

Once machines and applicators have been filled with pesticide, external contamination should be removed.

Application of pesticides on open fields is intrinsically less hazardous than similar work in enclosed spaces; however, high winds and intense sunlight may increase the dangers, and application should be avoided under such conditions. Use may be Bade of light winds, since by working up-wind of the application area the risk of personal exposure is reduced.

This is particularly important when spraying overhead such as with hops and fruit trees. In hot climates, it is often advisable to apply pesticides early or late in the day when temperatures are lower and personal protective clothing and equipment can be worn with greater comfort.

Medical supervision and emergencies

Every farm or agricultural employer using pesticides should make arrangements for the medical supervision of his workers and post the address of the responsible medical Service for use in case of emergencies.

Agricultural workers entrusted with pesticide operations should be carefully selected to ensure that they are not suffering from any health condition that may make them particularly susceptible to the action of pesticides. They should be persons who can appreciate the responsibility involved in the handling of these chemicals and the hazards that exposure may mean for themselves, their colleagues, the general public, animal life and the environment.

Persons under 18 years of age and expectant or nursing mothers should not be allowed to handle pesticides. They should be instructed in pesticide hazards and trained in safe handling and working procedures and action to be taken in the event of emergencies or poisoning.

Access to pesticides stored on the farm should be restricted and, depending on the quantities of chemical involved, this may entail facilities ranging from a locked cupboard to separate storehouse at a distance from other farm buildings. All pesticides brought onto the farm should be adequately labeled.

Procedures must be laid down and enforced by the employer or a designated supervisor for removing pesticides from the store, mixing of concentrates, filling of applicators, application itself and disposal of empty containers and surplus chemicals.

Protective clothing and equipment suitable to the climatic conditions and the nature of the hazard should be provided, maintained and replaced whenever necessary; its use should be supervised. Workers should be informed of the importance of personal hygiene, and adequate Mashing facilities should be made available mention.

In any activities, selecting proper personal protective equipments needs attention miss-selection of **PPE** result in unsafe work condition.

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, while using PPE, we have check for safety and purpose.

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 compatible with any other PPE that has to be worn. Safety spectacles may interfere with the fit of some respirators.

To use the equipment effectively, workers need suitable information, instruction and training. Make sure all equipment is checked before use and cleaned, maintained and stored in accordance with the manufacturer's instructions.

Personal protective equipments that may be used for crop regulation activities include:

- Hat.
- Boots.
- Overalls.
- Gloves.
- Halter.
- Waterproof or spray clothing.
- Goggles.
- Respirator or face mask.
- Face guard.
- Hearing protection.
- Sunscreen lotion and hard hat.
- Dust masks

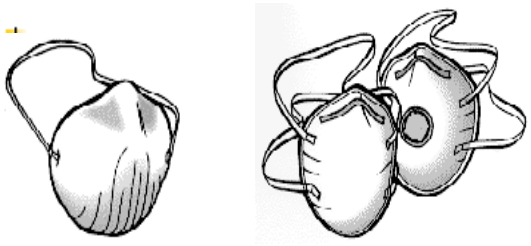


Fig1.1Dust Masks

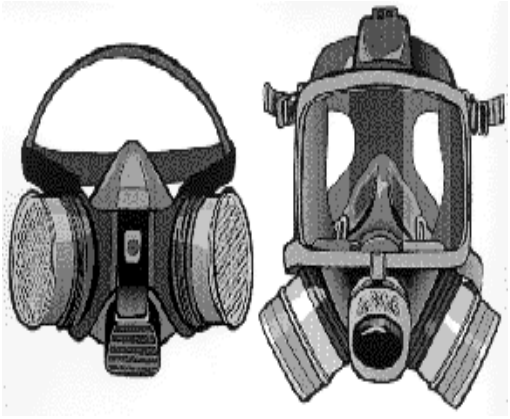


Figure 1.2 Cartridge type respirators **Figure 1.3 a powered air protection respirator (PAPR)**

Self-Check 5	Written Test

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

1. Discuss different criteria that should be considered before using PPEs during field crop maintenance. 5 pts
2. List all PPEs used during field crop maintenance. 7 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-6	Undertaking the crop thinning program according to OHS requirements

Supervisors and foremen are the key persons. They should ensure that the work runs smoothly in the field. The bigger the work force the greater the need for supervision. One foreman is usually needed for ten to fifteen workers and one supervisor, usually a technician, has to be appointed for each worksite.

The supervisor is responsible for organizing the workers, for giving clear instructions on the work to be done, for motivating and encouraging workers to perform well, and for controlling and correcting the work. The supervisor must know the methods and techniques used arid be able to demonstrate them.

The supervisor and/or the foremen should be responsible for controlling the quality of the work, the presence of the workers, instruction and training, the work achieved and the stock and maintenance of tools. The supervisor should also be responsible for checking that safety rules are kept, that working conditions are appropriate and that first aid equipment is available at the worksite. To effectively supervise the work, inspections have to be carried out on a regular basis at least once or twice a day.

The work should be regularly checked and corrected. The better the control, the easier it is to correct problems when they are still minor. To improve planning and coordination of the work, there must be regular feedback from the supervisors on the sites to the planners.

Instruction and procedures of crop maintenance activities are received

Instruction includes:-

- Standard Operating Procedures (SOPs),
- company policy and procedures in regard crop maintenance,
- specifications, work notes,
- Material Safety Data Sheets (MSDS),
- manufacturers' instructions, product labels,or
- verbal directions from the manager, supervisor, or senior operator.

Self-Check 6	Written Test

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

1. What are OHS instructions and procedures considered during thinning? 6 pts
2. List the role of supervisor during thinning activities. 4 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-7	Selecting crop thinning machinery, equipment and tools

At the time of undertaking thinning activities, we use different tools and equipments. Before thinning operation, we have to collect those materials required. Application equipment and machinery may include:

Backpack spray equipment; tractors and trailed or 3-point linkage spray equipment, pumps and pump fittings.

Thinning tools, equipment and machinery may include

- ✓ knives,
- ✓ handsaws,
- ✓ hand and battery-powered secateurs,
- ✓ pneumatic snips and compressor,
- ✓ hedge trimmers both manual and powered,
- ✓ small chainsaws,
- ✓ specialized mechanical pruning machinery,
- ✓ chippers,
- ✓ ladders,
- ✓ picking platforms,
- ✓ Powered ladders and scissor lifts.

Plant training equipment may include trellising and specialized training systems.

Self-Check 7	**Written Test**

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

1. List all tools, equipments and machinery used during thinning activities? 10 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-8	Operating crop regulation tools, equipment and machinery

While using different tools, equipments and machineries, there may be faulty items and structural damage that may result in OHS hazards.

Before using, these tools, equipments and machineries, checking that they function properly and safe to use important.

This must be done by responsible who have technical skill and knowledge concerning the tools, equipments and machineries.

Safety check is especially important to minimize damage incidence and infection of plant on which crop regulation activities are undertaken.

Tools, equipment and machinery are calibrated and adjusted according to manufacturer's guidelines and enterprise work procedures.

Self-Check 8	**Written Test**

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

1. Describe the importance of safety check. 4 pts
2. Discuss the advantages of calibrating and adjusting of tools, equipments and machinery before thinning activities? 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-9	Recording and reporting signs of diseases and pests

Types of Diseases

There are two types of diseases these are;

- Parasitic versus
- Non-parasitic Diseases

Parasitic diseases are caused by certain types of fungi, bacteria, and viruses that invade plants and multiply within their tissues.

Non-parasitic (non-infectious) diseases are caused by unfavorable growing conditions or other non parasitic factors such as:

- Excesses, deficiencies or imbalances of soil nutrients
- Excessive soil acidity or alkalinity
- Temperature extremes
- Poor drainage or drought
- Mechanical, fertilizer or pesticide injury
- Air pollutants like ozone and sulfur dioxide.

Fungal Diseases

Fungi are actually tiny parasitic plants without roots, leaves or chlorophyll which feed on living or decaying organic matter. They reproduce and spread by means of microscopic seeds called spores. Some fungi, such as those that help break down crop residues into humus, are beneficial. Fungi can penetrate directly into seed, leaf or rock tissue or can enter through wounds or natural openings. General types of fungal diseases are leaf spots leading to possible defoliation; rotting of seeds, stems, stalks, roots, grain heads, pods, and ears; and storage molds and wilts.

Bacterial Diseases

Bacteria are microscopic single cell organisms that multiply by cell divisor. Like the fungi, some bacteria are beneficial and perform essential functions like converting unavailable organic forms of soil nutrients to available inorganic (mineral) forms.

Others invade plants and cause diseases that produce leaf spots, wilts, galls, and fruit and stem rots. For several reasons, bacterial diseases are generally much less prevalent than fungal diseases.

Viral Diseases

Viruses are microscopic particles consisting of a core of nucleic acid (genetic material) surrounded by a protein coat. Viruses can multiply by diverting living host cells into the production of more virus particles and can also mutate to produce different strains. They are largely spread by sucking insects such as aphids, leafhoppers, and trips. The relationship between these insect vectors (insect that transmit disease) and the viruses is sometimes very specific. For example, peanut rosette virus is transmitted by only one species of Aphid. Weeds are susceptible to certain viruses and serve as alternate hosts for viral diseases which are transmitted by sucking insects to crops. Viruses usually do not kill plants, but can greatly reduce yields and quality.

How to Identify Plant Diseases

Some plant diseases can be identified readily by nonprofessional's right in the field. In other cases, however, accurate diagnosis requires a good deal of field experience or even the expertise Pest Control:

Controlling Major Disease of Field Crops

Controlling includes all the measures taken to reduce the damage caused by disease causing agents below that causes economic threshold level. There are two primary methods of managing a plant disease:

1. Preventing the disease from developing, and

2. Suppressing the disease after it has occurred.

A) **Cultural Control**

Use of healthy seed from known source: A rapidly growing agribusiness in many communities is the production and sale of disease-free planting material and certified seed. Crop seeds such as maize and wheat should be treated to prevent the spread of fungal and bacterial diseases.

Proper Crop Rotation: Crop rotation will rarely eliminate a pathogen, but it may break the pathogen's life cycle. The use of non-host plant will greatly reduce the survival of plant pathogens 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.

Removal of Crop Residue: Many pathogens live in residue. Removal of crop residue is an excellent means of disrupting the over-wintering and survival of plant pathogens

Correcting Potassium Deficiency in the Soil: potassium induces disease resistance in plants, therefore it is always advisable to give balanced fertilizers. If only N is given then it leads to luxuriant crop growth which favors disease infestation

Maintaining Planting Time & Optimum Plant Population

The plant may avoid being inflected under certain environmental conditions by modification the planting time. Plant population affects the light, temperature and soil moisture near the soil surface. Disease development will be repressed under an adverse environment in optimum plant population. For example, planting winter wheat when soil temperature is too high may result in increased damage from root-rotting fungi.

Balanced application of fertilizers: Excessive nitrogen keeps plant in a succulent condition, which often make more susceptible to disease. Potassium deficiency also makes plants more susceptible to disease. The skillful formation and application of fertilizer are critical to vigorous plant growth.

B) Mechanical Control

Proper Tillage Practice: Removing of crop residues and cleaning the land with tillage is a good farming practice. Placing planting material and seeds at the proper depth in an undamaged condition is critical. Planting too deep will delay germination and emergence, giving disease organisms a better chance to infect the plant.

Removing & Burning Disease Plants (Phytosanitation): Diseased plants are sources of the pathogen that spread to healthy plants. Removing & burning disease plants may prevent pathogen from spreading to the healthy plants.

Host Plant Resistant: Use of resistant varieties: Resistant varieties are some cultivars that have the ability to avoid a disease attack, or tolerate the presence of diseases to a greater degree than other cultivars. Resistant varieties limit the development of plant diseases. It is effective, economic and environmentally friendly method of plant disease management.

C) Chemical Control: Use of properly, approved wide-spectrum pesticides can effectively control some pathogens. Most of the chemicals used in the control of pathogens are classified as fungicides. A small number of bactericides and nematicides are available.

Sulfur and copper were among the first chemicals used to control plant diseases by helping from a barrier against disease organisms. Such chemical compounds which help to protect the plant are applied to its surface before the pathogen arrives.

Systemic-type chemicals enter the host plant and help provide protection from plant diseases from within the plant. They can be used to treat diseases which are already present within the plant.

Fungicide	Diseases can be controlled
Zineb	Rust of wheat, barley; downy mildew; anthracnose
Thiram	Dressing seed: smut of wheat, barley, maize Spraying: downy mildew
Chlorothalonil	Northern blight of maize; rust, black rot of peanut; late blight, downy mildew of potato
Carbendazim	Smut, head blight of cereals; wilt, anthracnose of cotton; wilt, root rot of peanut; potato black rot; sheath blight of cereals
Baviston	Powdery mildew of cereals, vegetables, tobacco

Table 2. Important fungicides and their function

Controlling Major Insect Pests of Field Crops

Controlling Methods of Insect Pests of Field Crops: Indiscriminate use of broad-spectrum chemical agents is considered unwise, as it destroy both beneficial and harmful insects. A combination of chemical, mechanical, cultural and biological techniques is being recommended to minimize adverse affects on the environment while conserving natural control agents. Integrated pest management has been defined as the selection of management practices that promote favorable economic, ecological, and sociological outcomes.

A) Cultural Control

Modification of Planting/sowing and Harvesting Dates: Modification of ideal planting date may avoid excessive reduction of crop yield. For example, Management of Hessian fly population is aided by destroying volunteer wheat during the summer and sowing wheat after fly-free date. This technique may reduce the opportunities for Hessian fly females to lay eggs. Some insects can be kept under control by harvesting the crop early.

Planting Resistant Varieties: Planting resistant varieties may reduce pest populations. Wheat varieties should be resistant to Hessian fly and sorghum varieties resistant to green bugs.

Deep Plowing: A number of insects that infest the wheat crop can be prevented from emerging by plowing under the wheat stubble after harvest.

Deep Plowing/Tillage: Timely tillage practices throughout the growing season may help destroy insect cocoons and eggs by exposing them to the sun or bury them so deeply that the insects cannot emerge.

Crop Rotation: Rotating crops have been proved to be an effective control measure for those insects with specialized feeding habits.

B) Mechanical Control

Hand picking and killing: is one of the earliest methods of pest control and is still regarded as a profitable method for the removal of large sized insects and their larvae from plants.

Trapping: trapping of insects by either using light trap or pheromone traps which attract insects.

Hindrance: Coating the fruit with bag**:** Fruit covered with a bag may avoid being damaged by insects.

Digging groove: Some insects such as armyworm cannot pass the groove.

Temperature, Moisture Adjustment

Sunlight: Many insects die above 50 ^{o}C and cannot live in dry environment.

Boiled water: Treated with boiled water for 25-30 seconds, the insects in the seed will die.

Low temperature: Many insects stop reproducing under the temperature of 3-10 ^{o}C.

Radiation and Laser Treatment: Most insects cannot live or reproduce under the radiation and laser.

C) Chemical Control: A registered insecticide is one that has been approved, following extensive scientific research to prove its reliability, ability to selectively kill insects, and safety to humans when used at recommended rates on the appropriate crop and under proper conditions.

A stomach poison is one that attacks the internal organs of the insect after the material has been swallowed.

Contact insecticides kill when the material comes into contact with the insect and is absorbed through the external parts of the insect's body. The insecticide is sprayed where the insects can come into contact with the poison.

Fumigant insecticides enter the insect's body through the breathing tubes of its skin as a gas. They can be used to kill many kinds of insects and nematodes that attack the root system of growing plants.

A relatively new group of insect poisons are classified as systemic insecticides. A systemic insecticide is absorbed by the plant or animal, and the insect is killed when it feeds on the plant or animal.

D) Integrated pest management: despite the 5 million tones of pesticides being applied every year, pests around the globe still destroy about 35% of all potential crops before harvest, strongly indicating that the use of pesticides has been only marginally successful at improving agricultural productivity. The hazards associated with pesticide use are well known, of which contamination of the environment is most pronounced. So it gives rise to the concept of biological control based on integrated pest management (IPM) system where biological control agents are seen as essential and of first priority in building IPM systems. The methods and components of IPM include cultural, mechanical/physical, biological and use of environmentally friendly chemicals.

IPM approaches are based on the following assumptions:

- ✓ For pest control do not depend on any single pest control measures but integrate two or more measures like cultural, mechanical, biological and environmentally friendly chemicals.
- ✓ Chemicals should be last options and used when it is necessary
- ✓ The control measures should be economical
- ✓ The control measures should be environmentally friendly

Self-Check 9	Written Test

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

1. Define parasitic diseases. 4 pts
2. Define non parasitic diseases. 4 pts
3. Describe the different method of controlling major disease of field crops. 8 pts
4. What is cultural method of diseases control? 4pts
5. What is Integrated Pest Management (IPM)? 6 pts

Note: Satisfactory rating – 25 points and above Unsatisfactory - below 25 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Operation sheet 3	Carry out field crop maintenance operations

Procedures to carrying out field crop maintenance operations are:-

1. Identify site of crop maintenance and field crops to undertake maintenance operation
2. Select and prepare tools, materials and equipments used for field crop maintenance according to types of selected crops
3. Identify and asses OHS hazards and risks of site preparation
4. Select and use personal protective equipments properly
5. Undertake field crop maintenance operations accordingly
6. Complete field crop establishment operations

Crop production

Level II

Learning Guide #40

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO6-LG-40

TTLM Code: AGR CRP2TTLM 0919v1

LO 6: **Carry out maintenance operations**

Instruction Sheet	Learning Guide #40

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

- Providing assistance with the crop weed control program.
- Providing assistance with the crop pest and disease control program.
- Providing assistance with the crop nutrition program.
- Providing assistance with paddock maintenance duties.
- Providing assistance with irrigation duties

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 –

- Assistance is provided with the crop weed control Program.
- Assistance is provided with the crop pest and disease Control program.
- Assistance is provided with the crop nutrition program.
- Assistance is provided with paddock maintenance duties.
- Assistance is provided with irrigation duties where appropriate.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -83, 85, 93, 94 and 100** respectively.

Information Sheet-1	Providing assistance with the crop weed control program.

A weed is generally defined as any plant that is out of place. The chances of a farmer losing his entire crop to weeds is relatively remote, nevertheless, weeds cause a great deal of damage each year. Weeds prevent plants from growing well they take out of the soil the mineral salts that the crops need. But weeds are not always bad for farmers same examples

- Some weeds can be used as additional forage for livestock.
- Other weeds can be returned to the soil to increase OM.
- Allowing weeds to grow in some paddy dikes provides shelter to many beneficial insects where they stay throughout the dry season and help keep pest populations down once planting begins.

How Weeds Reproduce and Spread: Annuals vs. Perennials

Annual weeds live only a year or so and reproduce by seed: they are the most common weeds in may fields. In the tropics, annuals may live more than a year if rainfall is sufficient. Most annuals produce tremendous amounts of seed, some of which may not germinate for years. When you stir the soil with a hoe, harrow, or cultivator to kill weeds, you destroy one crop of them but encourage another by moving more weed seeds closer to the surface where they can sprout.

You can help lower a field's population of annual weeds by controlling them before they produce seed. Permanent eradication of annual weeds isn't possible because most fields contain millions of weed seeds waiting to germinate, and the supply is continually replenished by more seeds brought in by wind, water, animals, animal manure, and by contaminated crop seeds.

Perennial weeds live more than 2 years. Most produce seed but many also propagate by means of creeping above-ground stems (solons) and creeping underground stems (rhizomes). Johnson grass, Bermuda grass, quack grass, and nut sedge are some of the more aggressive perennial weeds. Hoeing or mechanical cultivation may actually aid in spreading them around the field. Most herbicides will kill only the top growth, and there is enough food in the underground parts to continue propagation.

Identifying Weeds

Where weeds are being controlled by hoeing or mechanical cultivation, their specific identification is usually not important.

However, where chemical weed control is used, you and the farmer should have a good idea of which specific weeds are present, because most herbicides do not give broad spectrum control.

Broadleaf vs. Grassy Weeds

Broadleaf weeds have wide (broad or oval shaped) leaves with veins that form a feather-like pattern. Grassy weeds are true grasses and have long, narrow leaves with veins that run up and down in a parallel pattern. A few weeds like nutsedge (nutgrass) belong to neither category but are sedges, all of which have triangular stems. Some chemical herbicides are more effective on broadleaf weeds, while others give better control of grassy types

Requirements of weed control

Depending upon the climatic zone, weed control is one of the most labour-intensive operations, especially if it is carried out with the hand hoe. The importance of weed control also depends on the competitive forces of the respective crop as well as the amount of time required to build a canopy. The more rapidly the

Plants grow; the more effective is the shading of the soil as a weed control measure. According to rank, crops having a small spacing possess a relatively greater competitive force. Maize and wheat are very sensitive crops due to their slow initial development.

For permanent cropping and high weed invasion it is necessary to apply weed control measures already prior to seeding, since with mechanical hoeing devices only an average

Success rate of 50 % can be achieved. Moreover, the weed-control effect of the implements is poor in row crops. The number of work operations fluctuates depending upon the crops and the growth of the weeds. The later the weeding takes place, the greater the root penetration of the weeds demanding deeper working of the fields. The subsequent work operations depend on the type of crop, the climate and weeds; here superficial work operations are recommended in order to prevent damage to the root system of the crops.

The major goal of weed control is to reduce the competition with cultivated crops. The elimination of weeds from a field is impossible. Often when one pesky species is controlled, another arises to fill its niche.

Practical control is achieved through one or a combination of methods, which might include reduction of germination, reducing the growth rate, or killing the weed during its growth.

It is almost always possible to improve weed control on the small farm. Better weed control will almost always improve yields. Yet, you should be aware that weeds can be tolerated in some situations. It may be uneconomical to control them, especially if they are few in number, not very competitive, or only present as the crop is maturing.

Controlling Weeds by Recommended Method:-

Controlling Methods

- ® Mechanical/physical method
- ® Cultural method
- ® Biological method
- ® Chemical method

Mechanical/Physical weed control: - The common physical methods are as following.

- ❖ Hand pulling
- ❖ Hoeing.
- ❖ Machine Tillage
- ❖ Mowing
- ❖ Fire
- ❖ Mulching

Cultural methods of weed control: - The cultural methods of weed control are as follows:

- ➢ Land preparation
- ➢ Time of Sowing
- ➢ Crop Rotation
- ➢ Plant population
- ➢ Intercropping
- ➢ Crop Varieties

Biological weed control: -

Several bio agents such as

- ✓ Insect
- ✓ Herbivorous fish
- ✓ Other animals
- ✓ Disease organisms and
- ✓ Even competitive plants have been identified for effective weed control

Chemical weed control: - The chemicals used to control the weeds are known as “Herbicide”.

The Herbicides can be classified based on

1. Time of application
2. Selectivity
3. Site of herbicide action

Application of Herbicides based on time

- Pre plant incorporation
- Pre emergency herbicide
- Post emergency herbicide

Based on Selectivity

- Selective Herbicide
- Non- Selective Herbicide

Based upon site of Herbicide action:

1. **Contact Herbicides (Non systemic**.
2. **Systemic Herbicides (Trans located** e.g. 2; 4-D kills broad leaved and spares the grassy weeds or crops.

Integrated Weed Management:- This method is also referred to as system approach to control weeds. In this approach more than one method is followed simultaneously for controlling weeds under a given situation. Its main advantage is that it provides, grater, more rapid and long lasting control of weeds compared with any other technique used in isolation. The components of IWM are cultural, physical, biological and chemical methods.

Self-Check 1	Written Test

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

1. What is weed? 3 pts
2. Identify different categories of weed. 4 pts
3. List different method of weed control? 6 pts
4. What is integrated weed management (IWM)? 3pts

Note: Satisfactory rating – 14 points and above Unsatisfactory - below 14 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-2	Providing assistance with the crop pest and disease control program.

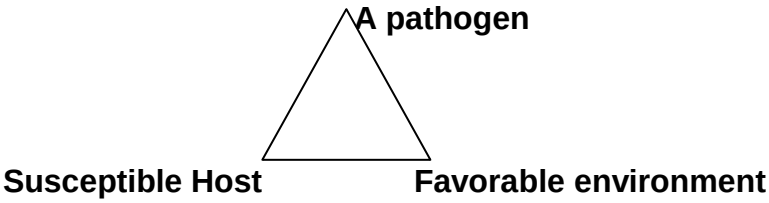
Identifying Pests of Field Crops

Pest:-Any animal or plant which harms or causes damage to man, his animals, crops or possessions, or even Just causes him annoyance may be termed as “Pest”

Insects: -are **small animals**. Their body is divided into three section **head, thorax and abdomen**. Most adult insects **have 3 pair of legs** and **one or two pair of functional wings**.

Diseases: - Plant diseases can be defined as harmful alteration of the normal physiological process of the plant.

Disease Triangle: - Interaction of the three elements is necessary for plant disease to develop **(1) A susceptible host (2) A pathogen (disease causing agent) (3) a favorable environment** for disease development.



Causal agents of Plant diseases

1. Caused by Fungi
2. Caused by Bacteria
3. Caused by Viruses
4. Caused by Nematodes

Controlling Major insect-pests of Field crops

Indiscriminate use of chemicals to control the insects is not beneficial as it also destroys some beneficial insects besides harming the environmental health. Major control methods of insects pests are described below:-

Cultural Control Method

- Deep summer ploughing
- Tillage
- Crop Rotation.
- Modification of sowing time.
- Time of harvesting
- Trap Crops
- Balanced fertilizer application
- Use of resistant Varieties
- Optimum Plant population
- Clean seed material

Mechanical Control Methods

a) Hand picking and skilling.
b) Banding on fruit trees
c) Trapping

Chemical Control of insects: - The chemical control of insects is use of insecticide. The results of chemical control are more predictable than for other methods.

Self-Check 2	**Written Test**

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

1. What are causal agents of diseases? 4 pts
2. Describe disease triangle. 4 pts
3. List different method of diseases control? 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Providing assistance with the crop nutrition program.

Nutrition is crucial to sustained production. Highly weathered being inherently low in nutrient reserves, must have a regular and supplemental nutrient supply to facilitate intensive cultivation for increased food production. Intensive land use and high yields on soils of low inherent fertility can be achieved only by raising the nutrient levels through the use of inorganic fertilizers, organic amendments, and nutrient recycling. Nutrient enhancement for these soils is indispensable. Although crop production can be increased by increasing fertilizer use, many small land holders and resource-poor farmers cannot afford the expense.

A combination of inorganic and organic fertilizers is a useful strategy to minimize dependence on synthetic fertilizers, and enhance soil structure and physical characteristics. The rate of application of inorganic fertilizers can also be reduced by minimizing losses and increasing the recycling of nutrients. Losses by volatilization, leaching and erosion can be controlled through conservation tillage, timely application by split doses, fertilizer placement, and slow-release formulations.

Determining fertilizer needs

The amount of nutrients that different crops must absorb from the soil to produce a given yield is fairly well known. Yet proper fertilization is not a simple matter of adding this amount for several reasons:

The farmer needs to know what share of the nutrients is already in the soil in available form.

A plant's ability to recover nutrients, whether from fertilizer or natural soil sources, depends on the type of crop, the particular soil's capacity to tie up different nutrients, weather conditions (sunlight, rainfall, and temperature), and leaching losses, physical soil factors like drainage and compaction, and insect and disease problems.

Methods of determining fertilizer needs

Soil testing

Plant tissue testing

Fertilizer trials

Spotting visual "hunger signs"

Making an educated guess

Soil Testing

Soil testing by a reliable laboratory is the most accurate and convenient method for determining fertilizer rates.

Plant Tissue Tests: - Tissue tests are best used to supplement soil test data, since the results can be tricky to interpret by non-professionals.the crop can be tissue-tested while growing in the field for N-P-K levels in the sap.

Deficiencies of one nutrient such as N can stunt plant size and cause P and K to the plant sap, giving falsely high readings

Fertilizer Trials

Severe nutrient deficiencies usually produce characteristic changes in plant appearance, particularly in color. Spotting these "hunger signs" can be useful in determining fertilizer needs.

Making an Educated Guess

If no soil test results are available for a farmer's field, a reasonable estimate of N-P-K needs can be made based on at least four or more of the following criteria:

- Available soil test results from nearby farms with the same soil type and a similar liming and fertilizer history.
- Data from fertilizer trials on the same soil type.
- An extension pamphlet on the crop with fertilizer recommendations for the area soils.
- The particular crop's relative nutrient needs .
- A thorough examination of the soil for depth, drainage, texture, filth, slope, and other factors that may limit yields or fertilizer response, including soil pH .
- Yield history and past management of the farm regarding fertilizer and liming.
- The farmer's management ability, available capital, and willingness to use complementary.

Fertilizer types and how to use them

Chemical fertilizers supply only nutrients and exert no beneficial effects on soil physical condition. Organic fertilizers do both. However, compost and manure are very Low-strength fertilizers; 100kg of 10-5-10 chemical fertilizer contains about the same amount of NP-K as 2000 kg of average farm manure.

The organic fertilizers need to be applied at very high rates (about 20,000-40,000 kg/ha per year) to make up for their low nutrient content and to supply enough humus to measurably improve soil physical Condition.

Guidelines for applying organic fertilizer

- ✓ To avoid “burning" the crop seeds and seedlings, fresh manure should be applied at least a couple of weeks in advance; rotted manure is unlikely to cause
- ✓ Organic fertilizer containing large amounts of straw may actually cause a temporary N deficiency unless some fertilizer N is added.
- ✓ If quantities are limited, farmers are better off using moderate rates over a larger area rather than a high rate on a small area.
- ✓ Manure also can be applied in strips or slots centered over the row if farmers are willing to make the extra effort involved. This is a good way to use scarce amounts. Fresh manure may burn crop if not mixed well with the soil.

Basic guidelines for applying chemical fertilizers

Nitrogen

When fertilizing maize, sorghum, and millet, one-third to one-half of the total N should be applied at planting time. This first application will usually be in the form of an N-P or N-P-K fertilizer. The remaining N should be applied in one to two side dressings (fertilizer applications made along the row while the crop is growing) later on in the growing season when the plants' N usage have increased.

A straight N fertilizer like urea (4546 percent N), ammonium sulfate (2021 percent N) or ammonium nitrate (33-34 percent N) is recommended for side dressings. When one side dressing is to be made, it is usually best applied when the crops are about knee-high (25-35 days after plant emergence in warm areas). On very sandy soils or under high rainfall, two side dressings may be needed and are best applied at the knee-high and flowering stages.

Phosphorus

Phosphorus is virtually immobile in the soil. This means that fertilizers containing P should be placed at least 7.5-10 cm deep to assure good root uptake. The roots of most

Crops are not very active close to the soil surface (unless some form of mulching is used) since the soil dries out so readily. For these reasons, all the P fertilizer should be applied at planting time:

- o Young seedlings need a high concentration of P in their tissues for good early growth and root development.
- o Phosphorus does not leach, so there is no need to make additional side dressings.

- To be effective as a side dressing, P would also need to be placed deep (except on a heavily mulched soil), and this might damage the roots.

NOTE: Many farmers waste money by side dressing with N-P, N-P-K or P fertilizers after already applying P at planting. Others do not apply P until the crop is several weeks old In either case, crop yields suffer.

Potassium

Potassium ranks midway between N and P in terms of leaching losses. As with P, all the K can usually be applied at planting time, often as part of an N-P-K fertilizer. Where leaching losses are likely to be high (very sandy soils or very high rainfall), split applications of K are sometimes recommended.

Unlike N and P, about two thirds of the K that plants extracts from the soil ends up in the leaves and stalks rather than in the grain. Returning crop residues to the soil is a good Way of recycling K. Burning them will not destroy the K, but will result in the loss of their N, sulfur, and organic matter.

Applying fertilizers

Apply by hand.

You can apply the fertilizer by throwing it broadcast.

It falls all over the place.

It is better to apply fertilizer along the plant rows.

With a stick make a line in the earth a few centimeters away from the row of plants.

Put the fertilizer in this line and cover it with earth.

Or else, put the fertilizer at the foot of the plants just before you earth them up

In tree plantations such as palms, coffee, cocoa, put the fertilizer in a circle 1 or 2 metres from the tree trunk. The feeding roots of the tree are at a distance of 1 or 2 metres from the trunk. Spread fertilizer round the trunk at a distance of 1-2 m.

Apply with a machine.

This machine is called a fertilizer distributor.

With some mechanical seed drills you can sow and spread fertilizer at the same time.

Fertilizer application methods

- Broadcasting
- Localized placement (band, hole, half circle)
- Special placement considerations for furrow irrigated soils.
- Application through the irrigation water (fertigation)
- Foliar applications

Broadcasting

Broadcasting refers to spreading the fertilizer evenly over the soil surface with or without working it into the soil

Advantages of Broadcasting

- It gives a more even distribution of nutrients throughout the root zone allowing more roots to come in contact with the fertilizer. It's usually the best method for obtaining maximum yields.
- There's less danger of fertilizer "burn" since the fertilizer is more diluted.
- It may give better distribution of labor by allowing the initial NPK application to be done before planting.

Disadvantages of Broadcasting

- It maximizes the tie-up of fertilizer P: Broadcasting requires from 3-10 times more P to produce the same yield increase.
- Although broadcasting may produce higher yields if enough extra P is applied to make up for increased tie-up, it's doubtful whether limited-resource farmers should be aiming for maximum yields. Most of them face several yield-limiting factors ranging from marginal land to insufficient capital.
- It also promotes more K tie-up than the LP method on soils where this is a problem (i.e. those high in 2:1 temperate-type clays such as iolite
- It feeds the weeds as well as the crop.
- It's difficult to spread fertilizer evenly by hand.
- Any fertilizer containing P needs to be worked well into the topsoil when broadcast Not all farmers have the time, labor, or equipment to do this.
- It's not well suited to crops with less extensive root systems) unless they're spaced very close together.

Localized placement methods: Band, Hole, Half-Circle

The "LP" methods are usually the best ones for limited-resource farmers whose capital, management, and level of other limiting factors point toward using low to moderate rates of chemical fertilizers:

Advantages of the LP Method

- Low to moderate rates of fertilizer (especially P) are more efficiently used than if broadcast. This provides the maximum return per dollar spent, something small farmers should usually be aiming for.
- It minimizes the tie-up of P (and also of K in the less common case where this is a problem).
- It provides early growth stimulation, especially in cooler soils where plants have trouble taking up enough P. This doesn't always lead to higher yields but helps the crop compete with weeds.
- It doesn't feed the weeds as much.
- It's especially good for crops with less extensive root systems like potatoes, onions, lettuce, and cabbage.

Disadvantages of the LP Method

- It's difficult to produce maximum yields with the LP method alone on low fertility soils. But, maximum yields aren't likely to be the best strategy for most small farmers, anyway, as already mentioned.
- It can be more laborious and time-consuming than the BC method; however, working broadcast fertilizer into the soil may require equal or greater labor.

a. band

Banding refers to placing the fertilizer in a continuous narrow strip running parallel to the crop row and fairly close to it. Of the 3 LP methods, banding is the best suited for closely-sown row crops like spinach, lettuce, turnips, and drill-planted (one seed per hole) maize the banding guidelines below apply to at-planting applications of N, P, and K. Side dressing N on growing crops will be covered farther on.

b. hole method

This method consists of placing the fertilizer in a hole near the seed, plant, or plant group. It's likely to be the least effective of the 3 LP methods, because it confines the fertilizer to a very small area, making it available to fewer roots

c. half circle method

This consists of applying the fertilizer in a semi-circle around the plant, seed, or seed group

SOME SPECIAL ADVICE FOR FURROW-IRRIGATED SOILS

When using LP methods on furrow-irrigated soils, make sure that the farmer places the fertilizer below the level that the irrigation water will reach in the furrow.

This places the fertilizer below the "high water mark" and enables mobile nutrients like nitrate N and sulfate to move sideways and downward towards the roots. If placed above the high water line, upward capillary water movement will carry these mobile nutrients to the soil surface where they can't be used. (Upward capillary water movement is the same process that enables kerosene to "climb" up the wick in a lamp.)

Mixing fertilizers with water (Fertigation)

There are 3 ways of applying fertilizers by mixing them with water:

- Making up a starter solution by dissolving an NP or NPK fertilizer with water.
- Mixing an N fertilizer like urea or ammonium nitrate with water and watering it over plants such as those in a nursery seedbed.
- Soluble forms of NPK fertilizer can be applied through drip-irrigation systems. Research has shown that P applied in this way will move downward to the roots. This is because drip irrigation is essentially an "LP" method of applying water and fertilizer. A typical drip system will concentrate water and fertilizer on 20% or less of the soil surface.

Where sprinkler irrigation is used, soluble N fertilizers like those above can be injected into the pipeline This can be wasteful where water application is uneven, however. (To avoid the possibility of fertilizer burn, be sure to irrigate with plain water for a few minutes afterwards Soluble N sources can also be dissolved in furrow-irrigation water, but this is too wasteful a method.

Foliar fertilizer applications

Foliar applications are best suited for applying micronutrients. Since very small levels are needed to treat a deficiency, they can be easily applied in one or two applications without causing "burning". This method is especially well suited to i _ and manganese, since it bypasses soil tie-up of these nutrients. ".

Soluble powders or liquids containing NPK nay be sold in your area for mixing with water and spraying on crops.

Some soluble granular fertilizers like urea can be used for this purpose too. Although sellers of foliar NPK fertilizers often claim very profitable yield increases, here are some facts to consider:

Self-Check 3	**Written Test**

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

1. What is fertilizer? 4 pts
2. Discuss methods of determining fertilizer needs. 4 pts
3. What is fertigation? 6 pts
4. Describe different method of fertilizer application. 5 pts
5. List the disadvantage of broadcasting fertilizer application method. 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Providing assistance with paddock maintenance duties.

Maintaining clean work environment is the responsibility of everyone. These tasks may include:

- disabling unused tools, equipment and machinery and storing neatly out of the way of crop regulation activities;
- safely storing materials on site;
- Using signage and safety barriers during crop regulation and removing them after activities are completed.
- Swiftly and efficiently removing and processing debris and waste from the work area.

Self-Check 4	**Written Test**

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

1. Explain working area maintenance? 10 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-5	Providing assistance with irrigation duties

Irrigation

The artificial supply of water to support plant growth and production in the absence of adequate supply of water through rainfall is known as irrigation.

Importance of irrigation

Plants need adequate supply of water for their normal growth and production. Where there is a shortage of water, particularly during critical growth stages like flowering and fruiting, there can be drastic reduction in yield, hence the necessity of irrigation to make up this deficiency of water.

System of irrigation: there are four systems of irrigation. These are:-

Surface irrigation

In surface irrigation systems, water moves over and across the land by simple gravity flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into flooding, basin method, furrow method and ring method.

This system is simple and cheap, and is widely used by societies in less developed parts of the world as well as in the U.S. The problem is, about one-half of the water used ends up not getting to the crops. The system is used when there is:

- ample water supply
- on medium to fine texture soils
- on uniform sloping land with slopes ranging from 0-1%

Here are some things that farmers are doing to be more efficient:

1. Leveling of fields
2. Surge flooding
3. Capture and reuse of runoff

1. **Leveling of fields**: Flood irrigation uses gravity to transport water, and, since water flows downhill, it will miss a part of the field that is on a hill, even a small hill. Farmers are using leveling equipment, some of which is guided by a laser beam, to scrape a field flat before planting. That allows water to flow evenly throughout the fields. (Actually, this method of leveling a field is also used to build flat tennis courts).
2. **Surge flooding**: Traditional flooding involved just releasing water onto a field. In using surge flooding, water is released at prearranged intervals, which reduces unwanted runoff.
3. **Capture and reuse of runoff**: A large amount of flood-irrigation water is wasted because it runs off the edges and back of the fields. Farmers can capture the runoff in ponds and pump it back up to the front of the field where it is reused for the next cycle of irrigation.

Advantages

The advantages of the system are:

- low investment
- no wetting of the foliage (favourable for preventing foliage diseases and when using saline water.

Disadvantages

The disadvantages are:

- high labour demand
- low application efficiency if not carefully executed (run off, percolation, inadequate distribution). With short furrows the efficiency is better than with long furrows.
- obstacle for mechanization, especially so if short furrows are used
- risk of spread of diseases (Brown rot) and risk of water lodging if fields are not properly drained and leveled

Sub-surface irrigation

In this system, water is led into underground perforated pipes. Water slowly reaches the root regions by the upward capillary movement.

Drip or trickle Irrigation: For irrigating fruits and vegetables this method is much more efficient than flood irrigation. Water is sent through plastic pipes (with holes in them) that are either laid along the rows of crops or even buried along their root lines finally out through mechanical devices called emitters. Evaporation is cut way down, and up to one-fourth of the water used is saved, as compared to flood irrigation. Water is delivered at or near the root zone of plants, drop by drop.

This method can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized. In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivery of fertilizer. The process is known as fertigation.

Drip irrigation is used where there is:

- water scarcity
- a very low water holding capacity of soils
- a very high or low infiltration rate and drainage of excess irrigation water is difficult
- water salinity

The water use efficiency is high. The investment costs are high.

Advantages:

- high efficiency of water use and water savings of up to more than 50%
- requires little land leveling
- savings on labour costs for irrigation and fertilizer application
- more efficient use of fertilizers
- lower humidity in the crop with as a consequence a lower incidence of Phytophthora and Alternaria
- foliar applied products for disease control are not wash off by irrigation water
- less problems with surplus water contributes to less (bacterial) rots
- less crop damage by handling irrigation equipment and by persons that enter the field
- saline water may be used
- simultaneous application of water and fertilizer
- higher yield, better quality and uniformity of crop production

Disadvantages:

- high investment costs
- drip – lines have to be renewed regluarly
- requires a good soil tillage in order to prevent that water , due to large soil aggregates drains to the sub-soil too quickly
- relatively clean water and an efficient filter system is required
- the system is vulnerable for rodents, rats
- ridging and re-ridging requires much attention
- salt leaching problems may cause soil becoming saline

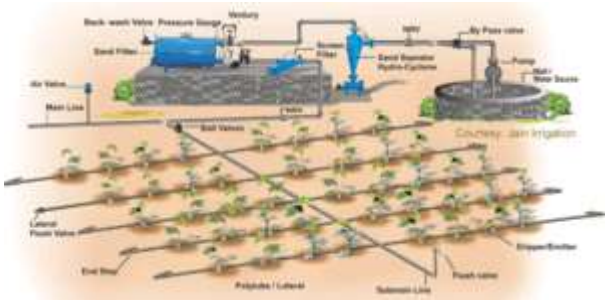


Fig1. Drip irrigation layout

Spray Irrigation: Spray irrigation is a more modern way of irrigating, but it also requires machinery. This system is similar to the way you might water your lawn at home - stand there with a hose and spray the water out in all directions. Large scale spray irrigation systems are in use on large farms today. These systems have a long tube fixed at one end to the water source, such as a well. Water flows through the tube and is shot out by a system of spray-guns.

This an ideal system for hilly and undulating regions where other systems cannot be used.

Common types of spray-irrigation system are:-

Center-pivot systems : The center-pivot systems have a number of metal frames (on rolling wheels) that hold the water tube out into the fields. And there can be a very big water gun at the end of the tube. Electric motors move each frame in a big circle around the field (the tube is fixed at the water source at the center of the circle), squirting water. If you've been in an airplane you can easily locate center-pivot irrigation systems on the ground. You can't miss them -- just look for green circles of irrigated land below.

Fig. 2 sprinkler irrigation

Sprinkler system: In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns.

A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a solid-set irrigation system

Sprinkler irrigation is used where there is:

- water scarcity
- soils with low water holding capacity and high infiltration rate
- irregular topography and soils too shallow to be levelled

Advantages:

- relatively high water use efficiency
- requires little or no land leveling
- applicable on level to rolling land
- applicable on soils with medium to high infiltration rates
- easy to operate and handle

Disadvantages:

- high investment costs
- high operation costs
- moderate to high energy requirements
- wind may influence uniformity of water distribution
- leaf wetting may promote development of late blight

Fig. 3 Sprinkler irrigation

Better spray irrigation: By use of traditional spray irrigation, water basically is just shot through the air onto fields. A lot of the water sprayed evaporates or blows away before it hits the ground. Another method, where water is gently sprayed from a hanging pipe uses water more efficiently. This method increases irrigation efficiency from about 60 percent (traditional spray irrigation) to over 90 percent. Plus, less electricity is needed**.**

Self-Check 5	**Written Test**

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

1. What is irrigation? 4 pts
2. Discuss different method irrigation? 5 pts
3. Describe sprinkler irrigation method. 5 pts
4. Explain the advantages and disadvantages of surface irrigation. 6 pts

Note: Satisfactory rating – 16 points and above Unsatisfactory - below 16 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Crop production

Level II

Learning Guide #41

Unit of Competence: - Assist Field Crop establishment and Maintenance

Module Title: - Assisting Field Crop establishment and Maintenance

LG Code: AGR CRP2 M09 0919LO7-LG-41

TTLM Code: AGR CRP2TTLM 0919v1

LO7. Complete establishment and maintenance operations

Instruction Sheet	Learning Guide # 41

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

- Using correct manual handling techniques
- Cleaning, maintaining, sterilising and storing tools and equipments
- Maintaining a clean and safe work area
- Disposing all containers, leftover fluids, waste and debris
- Completing and reporting all required workplace records

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 –

- Correct manual handling techniques are used when lifting or moving heavy loads.
- Tools and equipment are cleaned, maintained, sterilized and stored according to the manufacturer's specifications, enterprise procedures and regulations.
- A clean and safe work area is maintained throughout and on completion of work.
- All containers, leftover fluids, waste and debris are disposed of safely and appropriately in accordance with enterprise requirements.
- All required workplace records are completed accurately and promptly, and reported to the supervisor in accordance with enterprise requirements.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
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 4 and Self check 5" **in page -105, 108, 109,113 and 114** respectively.
5. Do the "LAP test" **in page – 115** (if you are ready).

Information Sheet-1	Using correct manual handling techniques

At the time of performing different activities, proper handling, moving and lifting of heavy load is important to minimize health risks

Proper methods of lifting and handling protect against injury. Proper lifting makes work easier. You need to "think" about what you are going to do before bending to pick up an object. Over time, safe lifting technique should become a habit.

Safe lifting and material handling means keeping your back aligned and balanced when lifting. Most standard loads fewer than **25kg** can be lifted and carried safely by following these steps. You begin by bending from the knees (not the waist), tucking your pelvis and tightening your stomach muscles. You then hug the load close to you, and gradually lift yourself up using the strong muscles in your legs. When carrying the object, be sure not to twist or bend. Then, bend at the knees and slowly slide the load down your body until you can comfortably put the load down

Mechanical Aids

Not all material can (or should) be manually lifted. Carts, bins, hand trucks, dollies, and fork lifts are all mechanical aids that can help transport a load without putting undue strain on your back. Pushcarts and bins can be useful for light, awkward material handling tasks, while hand trucks and forklifts can help move heavier, stackable material. When using mechanical aids for material handling, be sure that the load is secured in place before moving, and be sure to push the device rather than pulling it. When manually moving materials, you should seek help when a load is so bulky it cannot be properly grasped or lifted, when they cannot see around or over it, or when a load cannot be safely handled. Workers also should use appropriate protective equipment as necessary to help reduce accident potential. For loads with sharp or rough edges, wear gloves or other hand and forearm protection. To avoid injuries to the hands and eyes, use gloves and eye protection. When the loads are heavy or bulky, the mover should also wear steel-toed safety shoes or boots to prevent foot injuries if the worker slips or accidentally drops a load.

When mechanically moving materials, avoid overloading the equipment by letting the weight, size, and shape of the material being moved, dictate the type of equipment used for transporting it. All materials handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle those weights All stacked loads must be correctly piled and cross-tiered, where possible. Precautions also should be taken when stacking and storing material. Stored materials must not create a hazard. Storage areas must be kept free from accumulated materials that may cause tripping, fires, or explosions, or that may contribute to the harboring of rats and other pests. When stacking and piling materials, it's important to be aware of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are being stored.

The following are the basics steps of safe lifting and handling.

1. Size up the load and check overall conditions. Don't attempt the lift by yourself if the load appears to be too heavy or awkward. Check that there is enough space for movement, and that the footing is good. "Good housekeeping" ensures that you won't trip or stumble over an obstacle.
2. Make certain that your balance is good. Feet should be shoulder width apart, with one foot beside and the other foot behind the object that is to be lifted.

3. Bend (the knees; don't stop. Keep the back straight, but not vertical. (There is a difference. Tucking in the chin straightens the back.)

4. Grip the load with the palms of your hands and your fingers. The palm grip is much more secure. Tuck in the chin again to make certain your back is straight before starting to lift.

5. Use your body weight to start the load moving, then lift by pushing up with the legs. This makes full use of the strongest set of muscles.

6. Keep the arms and elbows close to the body while lifting.

7. Carry the load close to the body. Don't twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.

8. Watch where you are going!

9. To lower the object, bend the knees. Don't stop. To deposit the load on a bench or shelf, place it on the edge and push it into position. Make sure your hands and feet are clear when placing the load.

Make it a habit to follow the above steps when lifting anything-even a relatively light object.

Self-Check 1	Written Test

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

1. Discuss the importance of correct handling techniques. 5 pts
2. What are correct handling techniques to lift heavy materials? 5 pts

Note: Satisfactory rating – 7 points and above Unsatisfactory - below 7 points

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-2	Cleaning , maintaining , sterilising and storing tools and equipments

Cleaning & Sterilizing tools and equipments

It is absolutely critical to have good sanitation, as dirty equipment does nothing but invite bacteria and unwanted yeast to infect your mead. Some people say you cannot sanitize too much, but, there is a point of diminishing returns. A general rule of thumb is to always clean and dry equipment that is going into long-term storage. Secondly, always clean and sanitize a piece of equipment before you use it. Here is some information that should allow you to make sanitizing decisions.

First of all, there are three important words we all use a lot when talking about getting our equipment scrubbed clean and ready to make mead.

CLEANING refers to the physical removal of visible dirt, residue, lees, fruit remains, etc. - usually done with scrub brushes, squeegees or a clean towel. You must clean your equipment before sanitizing it. It is impossible to sanitize equipment with visible residue on it. This is because molds, wild yeasts and bacteria like living in hidden nooks and crannies, and any sanitizing solution you might use won't penetrate effectively into these areas.

SANITIZING means that you're treating the surface or piece of equipment to reduce, eliminate or prevent the growth of molds, wild yeasts or bacteria to an acceptable level. It is just another way of saying that you're killing microorganisms that can ruin your mead.

STERILIZING: When something is sterilized, it means that it is completely free of bacteria or other microorganisms. Sterilization is mostly carried out hospitals and labs.

CLEANING, MAINTENANCE AND SANITATION

Tools and equipment should be kept in an appropriate state of repair and condition to facilitate cleaning and disinfection.

Cleaning programmers

Cleaning and disinfection programmes should be in place to ensure that anynecessary cleaning and maintenance is carried out effectively and appropriately. Cleaning and disinfection systems should be monitored for effectiveness and should be regularly reviewed and adapted to reflect changing circumstances

How to clean sprayers

In most cases, herbicide and pesticide residues can be removed from sprayers by rinsing them out thoroughly with soap and water. However, the phenoxy herbicides (2,4-D, 24-5-%, MCPA,

Tordon, etc.) cannot be removed with normal cleaning procedures, and contaminated sprayers may cause damage when used to apply pesticides to broadleaf crops. In fact, farmers should preferably use a separate sprayer for applying phenoxy herbicides, but reasonably good cleaning can be achieved as follows:

For backpack (knapsack sprayers: Fill the sprayer with water and add household ammonia at the rate of about 20 cc (ml) per liter of tank capacity. Spray part of the mixture out through the nozzle, and then let the sprayer sit for a day. Spray out the rest of the solution and then rinse with detergent and water. To test the sprayer, refill it with water and spray a few sensitive plants (tomatoes, beans, cotton, etc.). If injury signs are not noticed within a day or two, the sprayer is probably safe to use on broadleaf crops.

Household ammonia or lye may damage the inner pressure cylinder if it is made of brass; in this case, use activated charcoal as below.

For tractor sprayers: Use two pounds of washing soda or soda ash (a 50-50 mix of washing soda and lye) 250 grams per 100 liters in the same way as for backpack sprayers.

Activated charcoal, if available, will do a very quick job in just two to three minutes when used at 1 kg per 100 liters. Rinse out the sprayer with soap and water afterwards.

Symptoms of phenoxy herbicide damage: Only broadleaf plants are affected. In minor cases, the leaves show a slight downward curvature. If injury is severe, leaves and stemsbecome very curved and twisted with considerable leaf distortion.

All washing should be done at a site away from drinking water sources for people or livestock or water bodies that might be polluted by the wash water.

Cleaning procedures and methods

The appropriate cleaning methods and materials will depend on the type of equipment and the nature of the fruit or vegetable. The following procedure should be adopted:
Cleaning procedures should include the removal of debris from equipment surfaces, application of a detergent solution, rinsing with water, and, where appropriate, disinfection. These sprayers will give long service with good care and maintenance.

After being used, the sprayer should be cleaned and placed upside-down so any moisture will run out. Strainer usually comes with these tools to remove any debris or trash from the spray liquid. When cleaning the sprayer thoroughly, it is best to pump clean water through it. Remember also to take the nozzle apart and clean it very carefully.

Self-Check 2	**Written Test**

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

1. What is cleaning? 4 pts
2. Explain sanitizing? 4 pts
3. Discuss the difference between sanitizing and sterilizing. 6 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-3	Maintaining a clean and safe work area

Maintaining clean work environment is the responsibility of everyone. These tasks may include:

- disabling unused tools, equipment and machinery and storing neatly out of the way of crop regulation activities;
- safely storing materials on site;
- Using signage and safety barriers during crop regulation and removing them after activities are completed.
- Swiftly and efficiently removing and processing debris and waste from the work area.

Self-Check 3	Written Test

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

1. What is the importance of maintaining at end of field crop establishment and maintenance? 4 pts
2. Explain safe work area. 4 pts

Note: Satisfactory rating – 6 points and above **Unsatisfactory - below 6 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-4	Disposing all containers, leftover fluids, waste and debris

Disposing wastes

The processing of products generates a large quantity of waste that can serve as food and shelter for pests. It is therefore very important to plan an effective waste disposal system. This system should always be maintained in good condition so it does not become a source of product contamination.

The following should be considered:

- Waste disposal systems and facilities should be provided. All refuse should be disposed of in containers with lids and stored away from the facility to prevent harborage of pests.
- Refuse containers should be emptied regularly.

Areas for garbage recyclables and compost able waste should be identified and all waste should be stored and disposed of in a manner to minimize contamination.

- Waste should be disposed of on a frequent basis to avoid attracting pests (e.g. flies, rodents).

There are five types of waste chemical

- Empty container
- Excess mixture
- Excess product
- Rinse water from container and application equipment
- Material generate from cleanup of spills and leaks

Disposing of Unwanted Agricultural Pesticides

Disposing of unwanted pesticides is expensive. Minimize the amount of pesticide stored by only purchasing what can be used in a growing season.

There are 3 options to dispose of unwanted pesticides:

1. Return unopened pesticide containers to the Dealer before winter.

2. Use the pesticides according to label directions. For example, apply it to another crop specified on the label.

3. Pay a Hazardous Waste Disposal Company to dispose of the pesticide. Contact a Hazardous Waste Company and obtain a quote for disposing of the Pesticides.

Disposing of Unwanted Spray Mix

Avoid mixing surplus spray by carefully calculating rates, measuring field size, and calibrating your sprayer. Extra pesticide spray mixes can be collected in clean labeled containers and used as water the next time the pesticide is applied or they can be applied to another crop or site listed on the pesticide label. If no such area can be found, spray the mixture over an area on your property where it will cause no damage. Never re-spray the treated field with extra tank mix. Spraying an area twice will double the rate and may result in high residues in the crop or soil.

Disposing of Empty Pesticide Containers

Empty pesticide containers are considered hazardous waste, by law, unless they are drained and rinsed properly. Plastic, metal and glass containers must be rinsed 3 times. The rinse water must be poured into the sprayer and applied with the pesticide. Paper and plastic bags must be rinsed once. Pressurized containers and

Domestic pesticides do not need to be rinsed.

The best way to dispose of empty pesticide containers is to take them to a pesticide container collection site. Containers taken to these sites are recycled into fence posts for agricultural use, highway guardrail posts, or used for energy. Check the list of empty pesticide container collection sites in B.C. to find the nearest one.

If the containers cannot be taken to a collection site you are allowed to dispose of them:

In an approved land fill

Bury it, but only if:

The location is owned or leased by the owner of the container

The location is on flat ground, not on a swale, at least 200m from surface water or wells

The ground is not gravel, sand or other porous material and

It is covered with at least 0.5 m of soil immediately after burial.

Although burying pesticide containers is legal, it is better to take the containers to a landfill.

Do not burn empty pesticide containers. Burning can release toxic fumes.

Safe Disposal of Pesticides

The best way to dispose of small amounts of excess pesticides is to use them - apply the - according to the directions on the label. If you cannot use them, ask your neighbors whether they have a similar pest control problem and can use them.

If all the remaining pesticide cannot be properly used, check with your local solid waste management authority, environmental agency, or health department to find out whether your community has a household hazardous waste collection program or a similar program for getting rid of unwanted, leftover pesticides.

These authorities can also inform you of any local requirements for pesticide waste disposal.

To identify your local solid waste agency, look in the government section of your phone book under categories such as solid waste, public works, or garbage, trash, or refuse collection or you can call 1-800-CLEANUP.

State and local laws regarding pesticide disposal may be stricter than the Federal requirements on the label. Be sure to check with your state or local agencies before disposing of your pesticide containers.

If the container is partly filled, contact your local solid waste agency.

If the container is empty, do not reuse it. Place it in the trash, unless the label specifies a different procedure.

Do not pour leftover pesticides down the sink, into the toilet, or down a sewer or street drain. Pesticides may interfere with the operation of waste water treatment systems or pollute waterways. Many municipal systems are not equipped to remove all pesticide residues. If pesticides reach waterways, they may harm fish, plants, and other living things.

Many pesticides do break down rapidly, but others, such as DDT, Dieldrin and BHC, can remain toxic for as long as 20 years.

Breakdown products of some pesticides (e.g., Malathion and Aldicarb) are more toxic than their parent compounds.

Self-Check 4	Written Test

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

1. Discuss the advantage of removing wastes materials from working site. 4 pts
2. List things that considered as waste materials during field crop establishment and maintenance. 8 pts

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

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Information Sheet-5	Completing and reporting all required workplace records

Record Keeping is an essential part of Agricultural activities.

Management of the farm is the first reason to keep a good set of records.

Record keeping can aid in planning of your activities.

Your records should contain the usage of materials on fields, crops, and other related resources along with fertilizer and restricted use pesticide applications, soil amendments, and resulting crop yields.

The producer can use this recorded information to determine the best amendments for subsequent crop plantings as well as to meet certain governmental reporting requirements. Record Keeping can play a major role in the success of your farm in reducing risks. A successful farm business needs records to monitor the progress of their business and help prepare financial statements. Keeping good records can determine if a farm operation is in a good condition and final evaluation of work results. Based on record kept, work out come is reported for supervisor of the work eventually.

Self-Check 5	**Written Test**

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

1. Discuss the necessity of work place record keeping. 6 pts
2. List things that should be recorded during field crop establishment and maintenance. 6 pts

Note: Satisfactory rating –10 points and above **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 18 hour.

Task 1. Perform site selection and preparation for field crop establishment

Task 2. Undertake field crop establishment

Task 3. Perform field crop maintenance

List of Reference Materials

1- BOOKS

2- WEB ADDRESSES (PUTTING LINKS)

3-