Republic of the Philippines
DEPARTMENT OF EDUCATION

K to 12 Basic Education Curriculum
Technology and Livelihood Education
Learning Module

AGRICULTURAL CROP PRODUCTION

EXPLORATORY COURSE

Grade 7 and Grade 8

TABLE OF CONTENTS

What Is This Module About?

Welcome to the world of ***Agricultural Crop Production!***

This Module is an exploratory course which leads you to ***Agricultural Crop Production*** National Certificate Level II (NC II)[1]. It covers four common competencies that a Grade 7 / Grade 8 Technology and Livelihood Education (TLE) student like you ought to possess, namely:

1) Use farm tools and equipment;
2) Perform estimation and basic calculation;
3) Interpret plans and drawings; and
4) Apply safety measures in farm operations.

These four common competencies are covered separately in four Lessons. As shown below, each Lesson is directed to the attainment of one or two learning outcomes:

Lesson 1 –Use Farm Tools and Equipment
- LO1. Select and Use Farm Tools
- LO 2. Select and Operate Farm Equipment
- LO 3. Perform Preventive Maintenance

Lesson 2 – Perform Estimation and Basic calculation
- LO 1. Perform Estimation
- LO 2. Perform Basic Workplace Calculations

Lesson 3 – Interpret Plans and Drawings
- LO1. Interpret Farm Plans and Lay-outs
- LO2. Interpret Irrigation Plan and Design

Lesson 4 – Apply Safety Measures in Farm Operations
- LO 1.Apply Appropriate Safety Measures while Working in the Farm
- LO 2 Safe keep / Dispose materials and outfit

Your success in this exploratory course on **Agricultural Crop Production** is shown in your ability to perform the performance standards found in each learning outcome.

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[1]***NATIONAL CERTIFICATE (NC) is*** *a certification issued to individuals who achieved all the required units of competency for a national qualification as defined under the Training Regulations. NCs are aligned to specific levels within the PTQF.* ***(TESDA Board Resolution No. 2004-13, Training Regulations Framework)***

NATIONAL CERTIFICATE LEVEL *refers to the four (4) qualification levels defined in the Philippine TVET Qualifications Framework (*PTQF*) where the worker with:*

a. ***NC I*** *performs a routine and predictable tasks; has little judgment; and, works under supervision;*

b. ***NC II*** *performs prescribe range of functions involving known routines and procedures; has limited choice and complexity of functions, and has little accountability;*

How Do You Use This Module?

This Module has 4 Lessons. Each Lesson has the following parts.

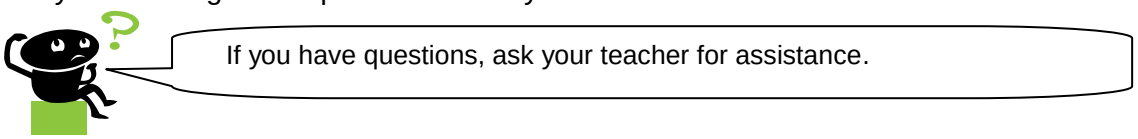
- Learning Outcomes
- Performance Standards
- Materials
- References
- Definition of Terms
- What Do You Already Know?
- What Do You Need to Know?
- How Much Have You Learned?
- How Do You Apply What You Learned?
- How Well Did You Perform?

To get the most from this Module, you need to do the following:

1. Begin by reading and understanding the Learning Outcome/s and Performance Standards. These tell you what you should know and be able to do at the end of this Module.
2. Find out what you already know by taking the Pretest then check your answer against the Answer Key. If you get 99 to 100% of the items correctly, you may proceed to the next Lesson. This means that you need not go through the Lesson because you already know what it is about. If you failed to get 99 to 100% correctly, go through the Lesson again and review especially those items which you failed to get.
3. Do the required Learning Activities. They begin with one or more Information Sheets. An Information Sheet contains important notes or basic information that you need to know.

   After reading the Information Sheet, test yourself on how much you learned by means of the Self-check. Refer to the Answer Key for correction. Do not hesitate to go back to the Information Sheet when you do not get all test items correctly. This will ensure your mastery of basic information.
4. Demonstrate what you learned by doing what the Activity / Operation /Job Sheet directs you to do.
5. You must be able to apply what you have learned in another activity or in real life situation.
6. Accomplish the Scoring Rubrics for you to know how well you performed.

Each Lesson also provides you with references and definition of key terms for your guide. They can be of great help. Use them fully.



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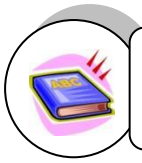
LESSON 1

Use Farm Tools and Equipment

LEARNING OUTCOMES:

At the end of this Lesson you are expected to do the following:

LO 1. select and use farm tools;
LO 2. select and operate farm equipment; and
LO 3. perform preventive maintenance.



Definition of Terms

Equipment - powered tool machine used in farming

Farm implements - accessories pulled by animals or mounted to machineries to make the work easier

Hand tools - objects that are usually light and are used without the help of animals and machines

Preventive maintenance - an activity or operation done to prevent malfunction of tools and equipment and it is done to prolong the useful life of tools and equipment

Repair - to restore to good condition something broken or damaged

LEARNING OUTCOME 1

Select and use farm tools and equipments

PERFORMANCE STANDARDS

- Appropriate farm tools are identified according to use.
- Farm tools are checked for faults.
- Appropriate tools and equipment are safely used according to job requirements and manufacturers' conditions.

Materials/Resources

- Bolo
- Pick-mattock
- Spade
- Rake
- Light hoe
- Hand cultivator
- Pruning shears
- Knife
- Water pails
- Wheel barrow
- Plow
- Rotavator
- Crowbar
- Grab-hoe
- Shovel
- Spading fork
- Hand trowel
- Hand fork
- Axe
- Sprinklers
- Sprayers
- Sickle
- Harrow

What Do You Already Know?

Let us determine how much you already know about use of farm tools and equipment. Take this test.

Pretest LO 1

Read the questions carefully and select the best answer by writing only the letter of your choice on a separate sheet of paper.

1. Which of the following is an example of a digging tool?
   A. Bolo
   B. Crowbar
   C. Grub hoe
   D. Pruning shear
2. Which tool is used for cutting grasses?
   A. Shovel
   B. Bolo
   C. Crowbar
   D. Mattock
3. What tool does NOT belong to the group?
   A. Crowbar
   B. Mattock
   C. Shovel
   D. Pruning shear
4. Farm tools are very important in pre-horticultural operations because they _____
   A. Make work easier
   B. Make work faster
   C. Save time and effort
   D. All of the above
5. A tool with one end of its blade flattened and the other pointed at right angles to its handle is a _____.
   A. mattock
   B. crowbar
   C. bolo
   D. spade
6. Which tool resembles the appearance of spoon and use for transferring soil?
   A. Spade
   B. Shovel
   C. Spading fork
   D. Grub hoe

7. What implement is being pulled by a working animal to till the land?
   A. Harrow
   B. Native plow
   C. Disc plow
   D. Disc harrow
8. An implement mounted to a tractor that is used to pulverize the newly plowed soil is a_____.
   A. trailer
   B. disc harrow
   C. native plow
   D. disc plow
9. An open container with a single wheel at the front and two handles at the back used to transport things
   A. Hand tractor
   B. Tractor
   C. Basket
   D. Wheel barrow
10. Which of the following tools is used to harvest crops?
   A. Knife
   B. Plow
   C. Spade
   D. Basket

What Do You Need To Know?

Read the Information Sheet 1.1 very well then find out how much you can remember and how much you have learned by doing the Self-check 1.1.

Information Sheet 1.1

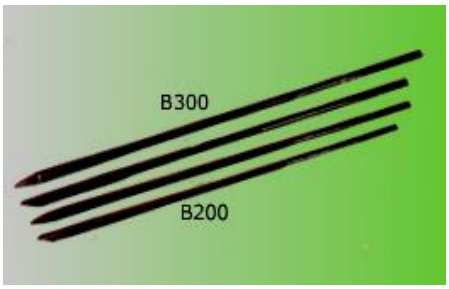
FARM TOOLS IN AGRICULTURAL CROP OPERATION

Farm tools, implements, and equipment play very important role in agricultural crop operations. Their availability makes the work much easier and faster. However, even if one may have the most sophisticated tools and implements, but does not know how to use them, they are useless. In order to do crop production operations successfully, one must have a good working knowledge of the tools, implements and equipment before using them.

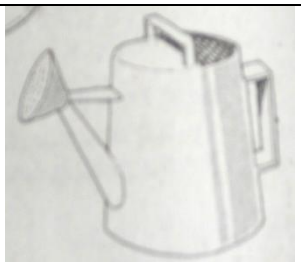
Hand Tools

Hand tools are usually light and are used without the help of animals or machines. They are being used in performing farm activities which involve small areas like school garden and home garden.

Examples:

Bolo is used for cutting tall grasses and weeds and chopping branches of trees.	
Crowbar is used for digging big holes and for digging out big stones and stumps.	
Pick-mattock is used for digging canals, breaking hard topsoil and for digging up stones and tree stumps.	
Grab-hoe is used for breaking hard topsoil and pulverizing soil.	

Spade is used for removing trash or soil, digging canals or ditches and mixing soil media.	
Shovel is used in removing trash, digging loose soil, moving soil from one place to another and for mixing soil media.	
Rake is used for cleaning the ground and leveling the topsoil.	
Spading fork is used for loosening the soil, digging out root crops and turning over the materials in a compost heap.	
Light hoe is used for loosening and leveling soil and digging out furrows for planting	
Hand trowel is used for loosening the soil around the growing plants and putting small amount of manure fertilizer in the soil.	

Hand cultivator is used for cultivating the garden plot by loosening the soil and removing weeds around the plant.	
Hand fork is used for inter row cultivation.	
Pruning shears is for cutting branches of planting materials and unnecessary branches of plants.	
Axe is for cutting bigger size post.	
Knife is for cutting planting materials and for performing other operations in horticulture	
Sprinklers – for watering seedlings and young plants	

Water pails – for hauling water, manure and fertilizers	

Sprayers are for spraying insecticides, foliar fertilizers, fungicides and herbicides

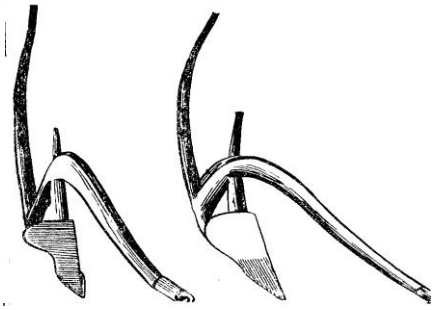

Wheel barrow is used for hauling trash, manures, fertilizers, planting materials and other equipment	
Sickle is a hand-held agricultural tool with a variously curved blade typically used for cutting weeds.	

Farm Implements

These are accessories which are being pulled by working animals or mounted to machineries (hand tractor, tractor) which are usually used in the preparation of land. These are usually made of a special kind of metal.

Examples are:

1. **Plows.** These are farm implements used in horticultural operations either pulled by a working animal or a tractor. The plow is specifically used for tilling large areas, making furrows and inter row cultivation. Plows pulled by working animals are made of either a combination of metal and wood or pure metal. They are used to till areas with a shallower depth than that of the disc plows which are pulled by tractors.



Native plow

Disc plow

2. **Harrow.** The native wooden harrow is made of wood with a metal teeth and pulled by a carabao while the disc harrow is made of metal mounted to a tractor. Harrows are used for tilling and pulverizing the soil.

Native wooden harrow

Disc harrow

3. **Rotavator.** The rotavator is an implement mounted to a tractor used for tilling and pulverizing the soil

DEFECTS OF FARM TOOLS AND REMEDIES

Although there are many different types of farm machinery, they tend to have similar characteristics and parts, such as:

- cutting edges,
- gears,
- chains,
- levers,
- revolving shafts, and
- rotating blades.

The main hazards associated with exposure to these parts are described below.

Shear/Cutting Points

1. Shear points are created when the edges of two objects are moved close enough together to cut a material, as in the case of a pair of shears or an auger.
2. Cutting points are created when a single object moves forcefully or rapidly enough to cut, as in the case of a sickle blade.
3. They are hazards because of their cutting force, and because they often move so rapidly that they may not be visible.
4. Workers should be aware of shear points, and shields or guards should be used to prevent exposure or access.

Pinch Points

1. Pinch points are formed when two objects move together and at least one of them is moving in a circle. For example, the point at which a belt runs onto a pulley is a pinch point. Belt drives, chain drives and gear drives are other examples of pinch points in power transmission devices.
2. Body parts such as fingers, hands and feet can be caught directly in pinch points, or they may be drawn into the pinch points by loose clothing that becomes entangled.
3. Workers should be aware of pinch points, and shields or guards should be used to prevent exposure or access.

Wrap Points

1. Rotating shafts are the most common source of wrap point accidents, although any exposed tool part that rotates can be a wrap point. Clothing or hair can catch on a rotating part.
2. The ends of shafts that protrude beyond bearings are also dangerous. Universal joints, keys and fastening devices can also snag clothing.
3. Entanglement with a wrap point can pull you into the machine, or clothing may become so tightly wrapped that you are crushed or suffocated.
4. Workers operating machinery should be aware of wrap points and wear clothing that will not become entangled in moving components. In addition, where possible, shields or guards should be used to prevent access.

Crush Points

1. Crush points are created when two objects move toward each other or one object moves toward a stationary one. For example,
    - failure to block up tool safely can result in a crushing injury.
2. Crushing injuries most commonly occur to fingers. To prevent a crushing injury, workers should:

- be aware of crush points and avoid potentially dangerous situations;
- arrange the hitch point so that a tool can be backed into position without a worker being in the path;

Pull-In Points

1. Pull-in points usually occur when plant material or other obstacles become stuck in feed rolls or other tool parts, preventing the mechanism from operating

Springs

1. Springs are commonly used to help lift equipment such as shock absorbers, and to keep belts tight and may harbour potentially dangerous stored energy.
2. Springs under compression will expand with great force when released while those that are stretched will contract rapidly when released.
3. A worker should know in which direction a spring will move and how it might affect another tool part when released, and stay out of its path.

FARM TOOL SAFETY

Keeping tools in good working condition is half the formula for being safe. The other half is the ability and awareness of the person using the tools

Safety = Good Working Tools + Able and Aware Worker

Tool failure causes some farm accidents; however, most farm accidents are caused by tired, stressed, rushed, distracted, or incompetent workers.

In addition to the specific safe handling rules for each type of farm tools, there are ten basic guidelines for tools safety:

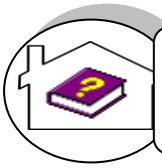
- Read and comply with the operator's safety manual for each piece of farm tool.
- Prepare for safety by wearing appropriate clothing, having enough rest, not drinking alcohol, and ensuring that all workers have been trained and are capable of safely using the farm tool.
- Keep all guards, shields, and access doors in place when the tool is in used
- Be aware of what you are doing and where you are going.
- Adjust tool to fit working conditions.
- Keep children and other people away from the working area.
- Take breaks from work, as necessary.

Self-Check 1.1

_____1.	Sprinkler	A.	used for spraying insecticides, foliar

fertilizers, fungicides and herbicides

_____2.	Knife	B.	used for hauling water, manure and fertilizers
_____3.	Hand Fork	C.	used for watering seedlings
_____4.	Bolo	D.	used for cutting planting materials
_____5.	Rake	E.	used for leveling the top soil
_____6.	Shovel	F.	used for removing trash, digging loose soil, moving soil from one place to another and for mixing soil media
_____7.	Pruning Shear	G.	used for cutting bigger size post
_____8.	Sprayer	H.	used for cutting branches of planting materials and unnecessary branches of plants
_____9.	Pail	I.	used for inter row cultivation
_____10.	Axe	J.	used for cutting tall grasses and weeds and chopping branches of trees



How Do You Apply What You Have Learned?

Show that you learned something by doing this activity

Activity Sheet 1.1

DEMONSTRATING THE USE OF FARM TOOLS

Farm Tools:

- Land preparation tools
- Cultivation tools
- Plant propagation tools
- Harvesting Tools

Instructions:

The trainee will do the following instructions.

1. Make a list of farm tools used in:
   - land preparation
   - cultivation
   - plant propagation
   - harvesting
2. Write the functions of each tools.
3. Compile the listings in one folder and submit to your teacher.

After submission trainee will perform the following instructions:

1. Select and identify the tools in land preparation and demonstrate its use.
2. Select and identify the tools in cultivation and demonstrate its use.
3. Select and identify the tools in plant propagation and demonstrate its use.
4. Select and identify the tools in harvesting and demonstrate its use.

Operation Sheet 1.1

USING THE RAKE

Introduction:

Rake is used in different farm operation. It is used in moving dirt from one place to another, cleaning ditches, etc. Proper use of this tool can help user to make the work easier.

PPE and Tools needed:

- Rake
- Footwear
- Long pants
- Gloves
- Rag
- Plastic bag
- dustpan

Procedure:

Make sure that before you perform this activity, you are wearing appropriate personal protective equipment. Follow these instructions

1. Determine the destination area where the leaves will go after collection, whether it's in a bag or a curb, back into the garden as mulch, or in a backyard compost pile.

2. Decide how much time you can spend raking each day or get help and divide up the task.

3. Get a rake and big plastic sheet around 6 feet (2m) square. A large sheet of burlap or an old drop cloth or other sturdy fabric will also work.

4. Moving your feet, rake leaves straight back and move with the rake as you walk toward the back.

5. Spread the plastic sheet on the ground near the raking area. Pull the leaves over to the plastic sheet with the help of the rake. When it covers the whole sheet, take one corner of the sheet and join it with the corner diagonally across from it. Then do the same with the other diagonal. Carry the leaves to the destination area or dump them into bags.

6. Alternately, use a grass catcher from a push mower or a large dustpan designed for outdoor collection. You'll make more, smaller trips to wherever you're collecting the leaves, but each trip will be lighter to carry.

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

For Activity 1.1

Criteria	Score			
	20	15	10	5
List of tools are completed				
Function of tools are correctly stated				
Appropriate farm tools are identified and selected according to requirements/use				
Farm tool checked for faults and defective tools are reported in accordance with farm procedures				
Appropriate tools are safely used according to job requirements and manufacturers' conditions.				

For Operation 1.1

Criteria	Score			
	20	15	10	5
Determined area for waste disposal is estimated against the volume of dirt/leaves				
Appropriate farm tools are identified and selected according to use				
Appropriate PPE is used				
Tools are checked for faults and defective tools are reported in accordance with farm procedures				
Appropriate tools are safely used				

LEARNING OUTCOME 2

Select and operate farm equipment

PERFORMANCE STANDARDS

- Appropriate farm equipment are identified.
- Instructional manual of farm tools and equipment are carefully read prior to operation.
- Pre-operation check-up is conducted in line with manufacturers' manual.
- Faults in farm equipment are identified and reported in line with farm procedures
- Farm equipment are used according to their function.

What Do You Already Know?

Let us determine how much you already know about farm equipment. Take this test.

Pretest LO 2

ANSWER THE FOLLOWING:

1. What is an equipment? (4 points)
2. Give the specific uses and function of the following equipment:
   A. Hand tractor (3 points)
   B. Four wheel tractor (3 points)
   C. Water pump (3 points)

What Do You Need To Know?

Read the Information Sheet 2.1 very well then find out how much you can remember and how much have you learned by doing the Self-check 2.1.

Information Sheet 2.1

COMMON FARM EQUIPMENT

These are machineries used in crop production especially in vegetable production. They are used in land preparation and in transporting farm inputs and products. These equipment need a highly skilled operator to use.

Hand tractor is used to pull a plow and harrow in preparing a large area of land.

Four wheel tractor is used to pull disc plow and disc harrow in preparing much bigger area of land.

Water pumps are used to draw irrigation water from a source.

Hand Tractor

Four Wheel Tractor

Water Pump

Courtesy of Alcala Rural School

Thresher

Corn Dehusker

Rice harvester

Grass cutter

Rice seeder

Miller

FARM EQUIPMENT PARTS AND FUNCTIONS

Understanding the Various Controls on the Tractor

- **Starting the Tractor**
  - The Kubota and most small farm tractors are started by turning the key to the right one click until the light for the glow plugs comes on and then goes off again.
  - You may then depress the clutch and turn the key all the way to the right until the engine turns over.
  - On cold mornings the choke may be required. This is operated by pulling the choke (located near the key) all the way out. As you turn the engine over, slowly push the choke back in until the engine kicks on.
  - It is very important that the throttle be pushed all the way in the upward (turtle) position before starting the tractor. This gives the tractor an opportunity to warm up in the idle position, which is very important for any diesel engine.

- **Throttle Control**
  - The throttle can be located sticking out of right side of the dash. It is an orange handled lever equipped with a turtle and a rabbit symbol.
  - Pulling down on the lever towards the rabbit increases the amount of fuel fed into the engine and therefore increases RPM's and available power to the tractor.

- **Clutch Pedal**
  - This pedal is found on the left side of your foot controls. It is a single pedal.

- **Forward and Reverse Pedal**
  - This "rocker" pedal makes the tractor go forwards and backwards and can be found on the right side of your foot controls. It sits on the floor of the tractor.

- **Brake Pedals**
  - These pedals sit above the "rocker" pedal and can be operated as one pedal or split to brake the individual rear wheels

Understanding the various parts of a small farm tractor and their functions

• **PTO (power take off)**
  - A PTO is used for powering a tiller, auger, or any other implement that is actively driven by the tractors engine.
  - The PTO can be located in the back of the tractor.
  - Hooking up the PTO drive shaft to the PTO and running the engine so the tachometer reads 540 RPM's use the PTO.
  - To engage the PTO the clutch must be depressed. Once the clutch is depressed you may shift the PTO lever forward and then slowly release the clutch pedal to begin spinning the PTO. The lever can be found next to your right hip on the tractor.
  - It is important when engaging the PTO not to "shock load." A "shock load" happens when the clutch is popped and the engine is revved to a running RPM level. "Shock loading" the PTO stresses the metal on the tractor and the implement being driven. To avoid this, run the tractor's engine with the lowest RPM's possible when taking your foot off the clutch and engaging the implement.

• **Three-Point Hitch Hydraulic**
  - The hydraulic unit and three-point hitch system is designed to raise and lower the implement positioned on the rear of the tractor.
  - The hydraulic is used to determine the operating depth of both active (PTO driven) and passive implements. This will determine the depth of tillage, subsoil ripping, plowing, etc of any given implement in use.
  - The lever that controls the three-point hitch can be found on the right side of the tractor driver's body around the height of the knee.
  - If the lever is pushed towards the ground at maximum depth the implement will be forced down as far as it may go by the hydraulics of the tractor.

• **Front Bucket Loader**
  - The front bucket loader is used for scooping large loads and moving heavy objects or masses of earth around the farm.
  - The front bucket loader is hydraulically operated using the ball lever located on
  - the right hand side of the tractor directly across from the tractor driver's shoulder.
  - There are two different ranges of motion available to you when using the front loader.
  - The arm of the bucket may be raised or lowered and the bucket may be tilted forward and backward.
  - The controls are "reversed" in that to make the arm of the bucket come up, you pull down on the ball lever. To lower the arm, you push up on the ball lever.
  - To dump the bucket, you move the ball lever to your right. To tilt the bucket back, you move the ball lever to your left.
  - These are the four main movements of the ball lever. Each movement is accomplished by moving the lever in the primary directions (north, south, east and west).
  - There are four other movements that incorporate both ranges of motion simultaneously. In other words, they move the arm and the bucket at the same time. These movements can be found by engaging the ball lever at

the secondary directions (i.e., southwest, northeast, etc). These movements require more skill and experience and will make your movements more fluid.

FARM EQUIPMENT SAFETY PRINCIPLES

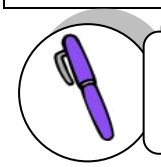
- Always wear your seatbelt! Most tractors are equipped with a roll over protection device that
- is built to protect you if the tractor rolls. A seatbelt will save you from getting crushed!
- Never stand near a spinning PTO! The PTO and connected drive shaft spins with incredible
- force. Keep clothing and body parts away from the spinning shaft, or risk dismemberment and death!
- Do not rest arms or hands in the joints of any hydraulic part! Or risk dismemberment.
- Never put your hands inside or around active implements when the tractor is running!
- Turn off tractor if any jamming or other obstructions occur when using PTO driven implements.
- Do not operate tractor on a dangerous slope! Be aware of rollover dangers.
- Always move very slowly when moving heavy loads in the bucket! Driving with a heavy
- load greatly changes the balance and stability of the tractor. Heavy loads encourage tipping and rolling.

TRACTOR SPECIFICATIONS

Brand - Ford
Model - TW-20

3 pt Hitch Hitch Catogory: III • Rear Lift @ 24": 5,700 lbs **Battery** • Number: 1 • Volts: 12 **Capacity** • Coolant: 22 Qts • Fuel Capacity: 33 gal • Hydraulic Fluid: 18.25 gal **Dates** • Production End: 1983 (Year) • Production Start: 1979 (Year) **Dimensions** • 4WD turn circle: 45.3 feet • Ground Clearance: 25.2 inches • Height: 112.7 inches	**Engine** • Air Cleaner: dry with precleaner • Aspiration: turbocharged • Bore/Stroke: 4.40x4.40 inches • Compression: 15.6:1 • Cooling: liquid • Cylinders: 6 • Displacement: 401 ci • Firing Order: 1-5-3-6-2-4 • Fuel: diesel • Manufacturer: Ford • Oil Capacity: 20 qts • Rated RPMs: 2200 • Torque: 416 lb-ft **Engine Power** • Drawbar (rated): 121.5 hp • Horsepower (Rated): 144.5 HP • Horsepower(Gross): 157.1 HP	**Hydraulics** • Pressure: 2500 • Steering Pump Flow: 4.2 gpm • Valve Flow: 16 gpm **Mechanical** • Brakes: differential hydraulic wet discs • Chassis: 4x2 2WD • Steering: hydrostatic power **Power Take-Off** • Rear PTO: independent • Rear speed: 540/1000 **Tires** • Ag front: 11.00-16 (2WD) • Ag rear: 18.4-38 **Transmission** • Capacity: 79 qts • Forward Gears: 16

• Length: 175.6 inches • Weight: 12,250 lbs • Wheelbase: 109.7 inches • Width: 104.32 inches	• PTO (rated): 135 hp **General** • Amps: 72 • Manufacturer: Ford • Original Price: $40,648	• Forward Gears: 8 • Reverse Gears: 2 • Reverse Gears: 4 • Type: Dual Power

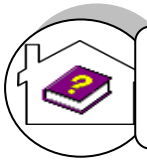


How Much Have You Learned?

Self-Check 2.1

Answer the following:

1. Define equipment. (4 points)
2. Give the specific uses and function of the following equipment:
   A. Hand tractor (3 points)
   B. Four wheel tractor (3 points)
   C. Water pump (3 points)



How Do You Apply What You Learned?

Show that you learned something by doing this activity

Operation Sheet 2.1

OPERATING THE FARM EQUIPMENT

Introduction:

Given the available farm equipment, the trainee will be able to operate this equipment following the given instructions and the trainee will be observed and assessed by the trainer using the performance standard reflected in the scoring rubrics.

Equipment:

Any of the following equipment or farm equipment suggested by the trainer is acceptable in performing this operation.

- Hand Tractor
- Four Wheel Tractor
- Water Pump

Instructions:

1. Read the operation manual of the selected equipment carefully.

2. Identify the parts and operation controls and explain its functions in the presence of the expert/trainer.
3. Conduct inspection using the pre-operation check up manual.
4. Make the inspection report and indicate the action to be taken.
5. Correct and remedy the equipment trouble as instructed by the expert/trainer.
6. Ask permission from the authorized personnel to operate the equipment.

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

While performing the activity it is important that you to assess your performance following the criteria below:

Criteria	Score			
	20	15	10	5
Instructional manual of farm equipment are carefully read prior to operation.				
Appropriate farm equipment and operation controls are identified and functions are explained.				
Pre-operation check-up is conducted in line with manufacturers' manual				
Faults in farm equipment and facilities are identified and reported in line with farm procedures				
Farm equipment are safely operated according to its function				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

How Do You Extend Your Learning?

Assignment Sheet 2.1

SCRAPBOOK ON FARM EQUIPMENT

After learning what are the different farm equipment, you will be compiling pictures of farm equipment and its instructional manual.

1. Collect pictures of various farm equipment and instructional manual. You may clip pictures from the internet.
2. For the pictures taken from online sites, copy the URL and paste below the pictures.
3. Cut the pictures and paste it on a short bond paper
4. Search the uses or functions of this equipment and write it below or beside the pictures.
5. If the instructional manuals are available paste it on another bond paper.
6. Compile the sheets into 1 folder.
7. Submit it to your teacher.

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

While performing the activity it is important that you to assess your performance following the criteria below:

Criteria	Score			
	20	15	10	5
Completeness				
Well organized				
Neatness				
Updated				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

LEARNING OUTCOME 3

Perform preventive maintenance

PERFORMANCE STANDARDS

- Tools and equipment are cleaned immediately.
- Routine check-up and maintenance are performed.
- Farm tools and equipment are regularly sharpened and oiled from time to time.

What Do You Already Know?

Let us determine how much you already know about preventive maintenance. Take this test.

Pretest LO 3

TRUE OR FALSE: Read and analyze each statement below .Write True if the statement is correct; False if the statement is incorrect on the space provided for.

_____1. It is not advisable to use the stone in a stabilized way.
_____2.Tools that are worn out should be separated and be fixed immediately to avoid accident.
_____3.When sharpening, try to maintain the original factory bevel or angle.
_____4.Always push the file across the blade in a motion away from your body.
_____5Clean accumulated rust and dirt off all metal surfaces with paint.
_____6.Move the file diagonally, so that its cutting teeth are biting into the metal on the tool.
_____7.Use medium-grit sandpaper to remove rust on larger tools such as shovels, spades, and hoes.
_____8.When sharpening with a file, use oil.
_____9. Oil helps tool to work as intended and will also prevent the formation of rust.
_____10.For pruners, use a whetstone because it produces a very sharp cutting edge.

What Do You Need To Know?

Read the Information Sheet 3.1 very well then find out how much you can remember and how much you learned by doing the Self-check 3.1.

Information Sheet 3.1

PRE-OPERATIVE CHECK UP OF FARM TOOLS, IMPLEMENTS AND EQUIPMENT

Imagine that the long, hot summer vacation has finally come to an end and it's the beginning of the school year and you are ready to start working your vegetable gardens. But before that let us check first our tools, implements and equipment you are going to use.

Garbed with your working clothes and personal protective equipment (PPE). Proceed to the shop to retrieve your tools so that you can start clearing away the last remnants of summer and begin breaking the soil for a new year. Imagine your frustration as you start pulling out all of your tools to see that they are covered with rust and dirt that has hardened and crusty globs of oil that have collected dust last vacation. It seems that you are going to spend more time cleaning and repairing tools on this nice day than you will actually use them.

How to Clean Your Garden Tools:

Let's start with the basics. Your shovel, spade, hoe, or even the blades on a hedge trimmer will be a lot easier to use if you take a few minutes to knock some of the rust off the blade. Not only will this extend the life of the tool, but also it will cut through the soil better, and thus require less effort to use, if it has a nice sharp blade. It is a good idea to keep a large whetstone in your shop. A whetstone is an ideal tool to use to keep all of the cutting edges of your garden tools honed. It will work well on your shovel, as well as many other common garden tools.

The best way to use the stone is to find a way to stabilize the tool that you want to work on. A bench vise is ideal. You will be able to clamp the tool into place at an angle, so you can work on it. Clamping the garden tool into place with a vise frees up both of your hands to use the whetstone and gives you more control over what you are doing.

Apply a little bit of lubricating oil to the end of the tool and carefully begin to work the stone over the blade. Maintain a 30-degree angle between the stone and the blade to form the ideal cutting edge for your tool. Not only will the edge become sharper, but you will also be removing any pitting and rust that has formed at the edge of your tool's blade.

In instances where the moving parts of your garden tools (such as with of any new pruners, shears, and loppers) have frozen in place, like springs and pivot joints, you should disassemble them first carefully break free any rust or dirt that may keep the tool from functioning properly. Clean accumulated rust and dirt off all metal surfaces with a wire brush. Remove stubborn rust from small tools with fine steel wool. Using an old toothbrush with some lightweight lubricating oil is a great way to work fresh oil into the joints of most garden tools. Not only will this fresh oil helps your tool to work as it was intended, but it will also prevent the formation of rust. Use medium-grit sandpaper to remove rust on larger tools such as shovels, spades, and hoes.

Once your tools are cleaned, they're ready to be sharpened. When sharpening, try to maintain the original factory bevel or angle. For pruners, use a whetstone because it produces a very sharp cutting edge. Depending on the type of whetstone, apply a few drops of oil or water to the stone. With the beveled side of the blade against the stone, rub the sharp edge of the blade toward the stone in a curved motion, as if you were trying to shave off a thin slice from the stone.

When working with a file, stabilize the blades in a vise or against a solid surface such as a work bench to avoid injury and ensure an even stroke. Always push the file across the blade in a motion away from your body. Move the file diagonally, so that its cutting teeth are biting into the metal on the tool. When sharpening with a file, do not use oil; metal filings will accumulate and clog the file's serrations.

Farm implements like ordinary plow and wooden harrow should be checked thoroughly before use. Loosened bolts and nuts should be tightened firmly. Disc plow and harrow should also be lubricated on their moving parts like bearings. Tractors should be tuned-up very well by skilled operator. Check on their oil, lubricant, fuel and cooling system.

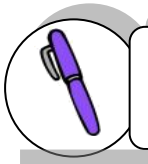
Tools that are worn out should be separated and be fixed immediately to avoid accident

Upkeep of Equipment

- Keep a detailed service record. Scheduled service intervals are usually found in the owner's manual, but many tractors do not get enough use to reach the hour requirements for oil changes, etc., so these services may be done on an annual basis instead.
- When lubricating grease fittings, it is best practice to lubricate in both the loaded and unloaded positions, as the grease will only press into the unloaded space in either position. Greasing in both positions will better provide a complete lubrication.
- The battery in this tractor has little protection so it should be checked often

- Always allow tractors, especially diesel engine tractors, to warm up when cranked after a long period of non-use. Never over rev the engine when it is first started. Hydraulic lifters, hydraulic pumps, and oil pumps may drain down while the tractor is not in use, and damage can occur to these components.
- Check lug nuts. The lug nuts on the large back wheels are prone to work loose if not torqued properly.
- The rear wheel has a tapered hub, so reversing the wheel brings the tire in toward the tractor's center

Learn to reverse the wheels if you use the tractor for field operations that require different wheel width settings. Some equipment, such as bottom plows or mowers, work better with a narrow wheel width, where for planting and cultivating crops you may need the wheels set out to the widest width.



How Much Have You Learned?

Self-Check 3.1

TRUE OR FALSE: Read and analyze each statement below. Write True if the statement is correct; False if the statement is incorrect on the space provided for.

_____1.The best way to use the stone is to find a way to stabilize the tool that you want to work on.
_____2.Tools that are worn out should be separated and be fixed immediately to avoid accident.
_____3. When sharpening, try to maintain the original factory bevel or angle.
_____4. Always push the file across the blade in a motion away from your body.
_____5. Clean accumulated rust and dirt off all metal surfaces with a wire brush.
_____6. Move the file diagonally, so that its cutting teeth are biting into the metal on the tool.
_____7. Use medium-grit sandpaper to remove rust on larger tools such as shovels, spades, and hoes.
_____8. When sharpening with a file, do not use oil; metal filings will accumulate and clog the file's serrations.
_____9.Oil will help tools to work as intended and will prevent the formation of rust .
____10.For pruners, use a whetstone because it produces a very sharp cutting edge.

Refer to the Answer Key. What is your score?

How Do You Apply What You Have Learned?

Show that you learned something by doing this activity

Activity Sheet 3.1

CREATING FORMS FOR MONITORING THE PREVENTIVE MAINTENANCE

Materials needed:

- Ballpen
- Bond paper
- Farm tools and equipment

Instructions

After learning about the preventive maintenance of different farm equipment, you will making an inventory reflecting the conditions of all the tools and equipment.

1. Make a list of all the tools and equipment
2. Create a maintenance checklist of all the tools and equipment reflecting its regular and periodic cleaning
3. Create an inspection checklist reflecting its condition
4. Create an inspection summary checklist stating the conditions and the action to be done
5. Compile the sheets in one folder and submit to your teacher.

Operation Sheet 3.1

Sharpening of Tools

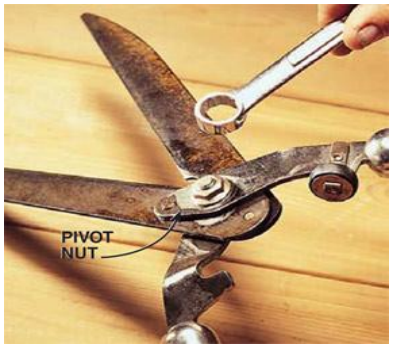
Materials, Tools and Equipment:

Materials:		
○ Oil	-	
○ Rag	-	1 pc
○ Sand Paper 300	-	1 pc
Tools		
○ Hedge shear	-	1 set
○ Metal clamp	-	1 set
○ File	-	1 pc
○ Wrench		

Introduction:

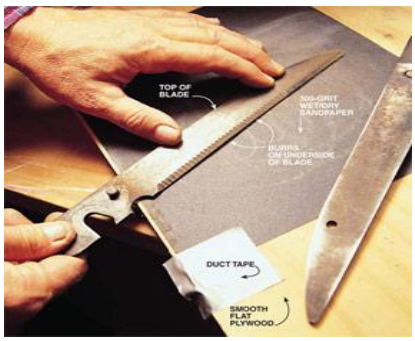
Hoes, forks, shears, and spades become blunt and need to be sharpened. Use a file or sharpening steel. Sharpen the upper surface. Then rub over with an oily rag.

Procedure:



Step 1: Tighten the pivot nut. Before sharpening, check the pivot nut. It could be loose, making the blades drift apart while cutting and tearing the twig instead of cutting it clean. The nut should be snug with no play in the pivot. With the nut tightened, check the tool; if it cuts cleanly, it doesn't need sharpening. If it still cuts poorly, look down each blade to make sure it's not bent. If a blade is slightly bent, loosen the pivot nut and separate the blades. To straighten the blade, put it in a vise, slip on some thick leather gloves and tweak it until it's straight.

Step 2: File the edge to expose clean metal Clamp the blade firmly in a vise. Examine the factory edge. Hold the file with both hands and mimic the direction of the bevel like a golfer taking a practice putt. Now move the file in one broad stroke away from you along the entire cutting angle. To reiterate, move the file in one direction, away from you. Don't use small, jerky strokes or you'll lose the factory edge. As you work, you can see the clean metal path left by the file. Adjust your angle as needed to file the entire edge evenly. Repeat this motion several times until you expose clean metal over the whole edge. Usually it'll take only about 10 strokes. Do the same with the other blade.



Step 3: Sand the back side of the blade Place a sheet of 300-grit wet/dry sandpaper on a smooth, flat piece of plywood. You'll be able to feel the burrs (be careful—they're sharp) on the back side of each blade caused by the filing action. To remove them, lightly sand the back side of the blade. Keep the blade flat and move it in a circular motion. After making several circles, pick up the blade and gently feel the edge. When the burrs left by the file disappear, assemble the blades and lightly oil the moving parts with 3-In-One oil.

Step 4. Perform house keeping

How Well Did You Perform?

For Activity 3.1

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

Criteria	Score			
	20	15	10	5
Completeness				
Well organized				
Neatness				
Updated				

For Operation 3.1

Criteria	Score			
	20	15	10	5
The blade is properly sharpened				
The nut is properly removed and returned				
The step by-step procedures are correctly followed				
The safety precautions are properly observed.				
Housekeeping is performed accordingly				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!

REFERENCES

LO1

- Asuncion,Ramon G,et.al, Agricultural Arts
- Phipps, McColly, Scranton, & Cook, Mechanics Textbook
- Tony Biggs, Growing Vegetables
- Jef Van Haunte-Lyds Quileste, Growing Rich, Tasty Veggies in Harmony with Nature
- http://www.antiquefarmtools.info
- http://www.cdc.gov/niosh/pdfs/01-111b
- http://www.ebc.com.au

LO2

- http://library.thinkquest.org/TQ0312380/machine.htm
- http://www.agmachine.com/xmmd43d.htm

LO 3

- http://library.thinkquest.org/TQ0312380/machine.htm
- http://www.agmachine.com/xmmd43d.htm

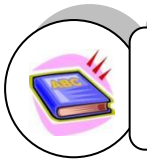
LESSON 2

Perform Estimation and Basic Calculation

LEARNING OUTCOMES:

At the end of this Lesson you are expected to do the following:

LO 1. perform estimation; and
LO 2. perform basic workplace calculations.



Definition of Terms

Area- refers to the size of the surface

Fertilizer- any material added to the soil to support nutrient

Germination- the development of the seed into a young plant

Graph- a drawing in which the relationship between two (or more) items of information (e.g. Time and plant growth) is shown in a symbolic way

Gross Income/Sales- the equivalent value of the product sold

Interest- the corresponding value that will be added to the principal as payment for using money of the lender

Labor- refers to the work performed by farm workers in exchange for salary

Net Income- the value remains after all the expenses have been deducted from the gross income or sales

Principal –refers to the amount you owed

Volume- the content of a body or object

Acronyms

MAD(Man Animal Day) refers to the number of day/s the work will be completed by 1 person and 1 animal.

MD-(Manday) refers to the number of day/s the work will be completed by 1 person

LEARNING OUTCOME 1

Perform estimation

PERFORMANCE STANDARDS

- Job requirements are identified from written or oral communication.
- Quantities of materials and resources required to complete a work task are estimated.
- Time needed to complete a work activity is estimated.
- Accurate estimate for completion are made.
- Estimate of materials and resources are reported to appropriate persons

Materials

- Calculator
- Pencil
- Graphing paper
- References

What Do You Already Know?

Pretest LO 1

Let us determine how much you already know about estimation. Take this test.

Label the following pictures


1. _____

2. _____


3. _____


3. _____


4._____


6. _____


7. _____


8._____


9._____


10._____

What Do You Need To Know?

Examine the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing the Self-check 1.1.

Information Sheet 1.1

FARM INPUTS

SEEDS

FERTILIZER

INSECTICIDES

FARM LABOR

LABOR REQUIREMENT FOR LAND PREPARATION

Plowing using tractor

Clearing of the land using hoe

Plowing using animal

Harrowing using hand tractor

LABOR REQUIREMENT IN PLANTING

PULLING OF SEEDLINGS

TRANSPLANTING OF SEEDLINGS

LABOR REQUIREMENT FOR PLANT CARE

FERTILIZER APPLICATION

PEST CONTROL

IRRIGATION

WEEDING

HARVESTING

THRESHING RICE

DRYING RICE

THRESHING CORN

DRYING CORN

STORING

Estimating Farm Inputs and Labor Requirements

Estimated irrigation expenses from planting up to last harvest *

Irrigation expenses is the product of price of water per volume, the number of volumes per day and total number of days to be irrigated from planting to last harvest. This is expressed as

$$\text{Irrigation Expenses} = \frac{\text{Price of Water}}{\text{Volume}} \times \frac{\text{No. of volumes}}{\text{Day}} \times \text{Total no. of days}$$

Estimated worker hired to perform irrigation from planting to last harvest.*

$$\text{Estimated workers} = \frac{\text{Worker}}{\text{Square area}} \times \text{Total irrigated area}$$

Estimated number of days for spraying insecticides* (per worker)

$$\text{Estimated no. of days} = \frac{\text{No. of days}}{\text{Square area}} \times \text{Total land area}$$

Estimated workers needed for spraying insecticides* (in one day)

$$\text{Estimated workers} = \frac{\text{No. of worker}}{\text{Square area}} \times \text{Total land area}$$

Estimated cost of insecticide use for spraying*

$$\text{Estimated cost} \quad \frac{\text{Price}}{\text{Insecticides}} \times \frac{\text{No. of insecticides}}{\text{Square area}} \times \text{Total land area}$$

Workers' salary during insecticide spraying*

$$\text{Worker' salary} = \frac{\text{Salary}}{\text{Day}} \times \text{Total no. of days}$$

Estimated number of weeding operation*

Estimated number of workers needed in weeding*

$$\text{Estimated workers} = \frac{\text{No. of worker}}{\text{Square area}} \times \text{Total land area}$$

Workers salary during weeding

$$\text{Workers salary} = \frac{\text{Salary}}{\text{Worker}} \times \text{Total no. workers}$$

Estimated number of workers employ during harvesting

$$\text{Workers employed} = \frac{\text{No. of worker}}{\text{Square area}} \times \text{Total land harvesting area}$$

Example:

Given the gathered data

Total land area	50 ,000 sq meter
Amount of fertilizer	20/kilo

Number of days consumed in planting the area	2 day
Number of workers planted the area	5 workers
Amount of salary paid in planting the area	300/day
Number of workers who fertilized the area from planting up to the date of this survey.	2 workers
Quantity of fertilizer used from planting up to the date where survey was made	200 kilos
Amount of salary paid in applying fertilizer from planting to the date of this survey	300/day
Quantity of fertilizer to be used after the survey until final harvesting*	500 kilos
Number of workers required to perform fertilization after the survey until final harvesting*	2 workers
Amount of salary paid in applying fertilizer from planting to the date of this survey	300/day

Computation:

a) Total amount of salary paid in planting the area

Total amount of salary = (no. of days)(no. of workers)(amount of salary
Total amount of salary paid in planting the area = (2)(5)(300) = 3,000.00

b) Total amount of fertilizer consumed from planting up to the date of the survey

Total amount of fertilizer = (amount of fertilizer per kilo)(no. of kilos)
Total amount of fertilizer =(20)(200) = 4,000.00

c) Total amount of salary paid in fertilizing the area from planting up to the date of the survey

Total amount of salary = (no. of days)(no. of workers)(amount of salary)
Total amount of salary paid in fertilizing the area = (2)(2)(300) = 1,200.00

d) **Total amount of fertilizer consumed after the survey until final harvesting**

Total amount of fertilizer = (amount of fertilizer per kilo)(no. of kilos)
Total amount of fertilizer =(20)(400) = 8,000.00

e) Total amount of salary paid in fertilizing the area after the survey until final harvesting

Total amount of salary = (no. of days)(no. of workers)(amount of salary
Total amount of salary paid in fertilizing the area = (4)(2)(300) = 2,400.00

Total cost of all the expenses is the sum of the following:

Total amount of salary paid in planting the area	3,000.00
Total amount of fertilizer consumed from planting up to the date of the survey	4,000.00
Total amount of salary paid in fertilizing the area from planting up to the date of the survey	1,200.00
Total amount of fertilizer consumed after the survey until final harvesting	8,000.00
Total amount of salary paid in fertilizing the area after the survey until final harvesting	2,400.00
Total cost of all the expenses	**18,600.00**

How Much Have You Learned?

Self-Check 1.1

Direction: Enumerate answers to the following:
Give at least (3) examples of farm inputs
1.
2.
3.
Enumerate (7) farm activities that requires labor force
1. 5.
2. 6.
3. 7.

How Do You Apply What You Have

Show that you learned something by doing this activity

Activity Sheet 1.1

ESTIMATING FARM INPUTS AND LABOR REQUIREMENTS

SPECIFIC INSTRUCTION:

1. Visit a vegetable farm near to your school or home
2. Get the following data
   a. Area
   b. Crop
   c. Age of crop
   d. Quantity of planting materials (in kgs)
   e. Number of workers prepared the land
   f. Number of days consumed in preparing the area
   g. Amount of salary given to each worker during land preparation
   h. Number of worker planted the area
   i. Number of days consumed in planting the area
   j. Amount of salary paid in planting the area
   k. Number of worker fertilized the area from planting up to the date of this survey.
   l. Quantity of fertilizer used from planting up to the date where survey was made
   m. Amount of salary paid in applying fertilizer from planting to the date of this survey
   n. Quantity of fertilizer to be used after the survey until harvesting
   o. Number of workers required to perform fertilization after the survey until final harvesting
   p. Amount of salary needed for fertilizer application after this survey until harvesting
   q. Estimated irrigation expenses from planting up to harvesting
   r. Estimated worker hired to perform irrigation from planting to harvesting.

s. Estimated days for spraying insecticides
t. Estimated workers needed for spraying insecticides
u. Estimated cost of insecticide used in spraying
v. Workers salary during spraying of insecticides
w. Estimated number of weeding operation
x. Estimated worker needed in weeding
y. Workers salary during weeding
z. Estimated worker employ during harvesting

3. Present your data in tabular form

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

Criteria	Score			
	20	15	10	5
Required measuring tool is used in measuring the area.				
The data gathered is consistent				
The respondent answers the question carefully				
The safety precautions are properly observed.				
Data are presented in a tabular form				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

LEARNING OUTCOME 2

Perform basic workplace calculations

PERFORMANCE STANDARDS

- Calculations to be made are identified according to job requirements.
- Correct method of calculation is determined.
- Systems and units of measurement to be followed are ascertained.
- Calculations needed to complete work task are performed using the four fundamental operations.
- Appropriate operations are used to comply with the instruction.
- Result obtained is reviewed and thoroughly checked.

Materials

- Mathematics Books
- Ruler
- Calculators
- Relevant tools and equipment for basic calculations

What Do You Already Know?

Let us determine how much you already know about basic workplace calculations. Take this test.

Pretest LO 2

Answer the following:

Convert the following:

1. 1m=____cm
2. 400cm=_____m
3. 5km=_____m
4. 1km=_____cm
5. 2000 m=___km

Find the area (hectare) of the following.

1. 600m x 600m
2. 100mx1000m
3. 200mx300m
4. 300mx400m
5. 500mx600m

Compute the following:

1. 6% of 100 plants were replaced
2. 15% of 28 hectares are harvested
3. 80% of 90 farmers are present
4. 50% of P200 increase in farmers salary
5. 5% of 100 kg seeds are dormant

What Do You Need To Know?

Read the Information Sheet 2.1 very well then find out how much have you can remember and how much you learned by doing the Self-check 2.1.

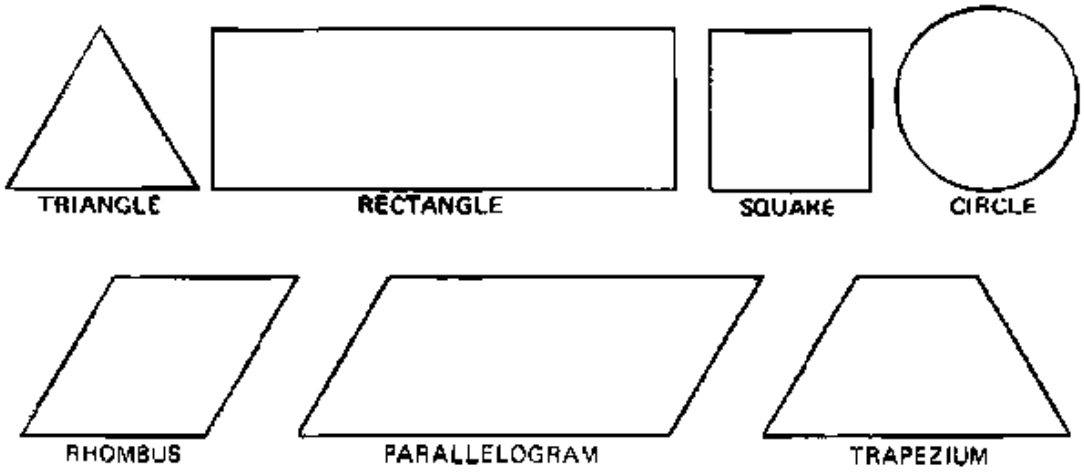
Information Sheet 2.1

PERFORM CALCULATION

It is important to be able to measure and calculate surface areas. It might be necessary to calculate, for example, the surface area of the cross-section of a canal or the surface area of a farm.

This section will discuss the calculation of some of the most common surface areas: triangle, square, rectangle, rhombus, parallelogram, trapezium and circle.

The most common surface areas illustrated:

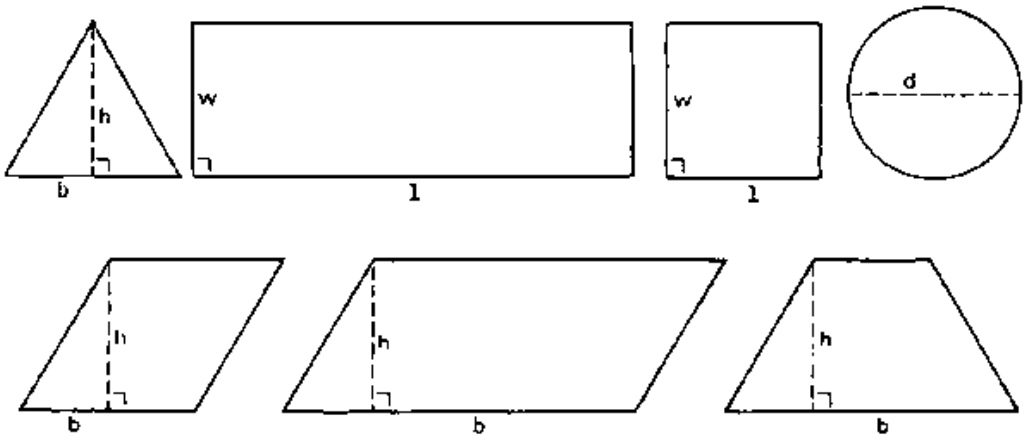


The height (h) of a triangle, a rhombus, a parallelogram or a trapezium, is the distance from a top corner to the opposite side called base (b). The height is always perpendicular to the base; in other words, the height makes a "right angle" with the base. An example of a right angle is the corner of this page.

In the case of a square or a rectangle, the expression length (1) is commonly used instead of base and width (w) instead of height. In the case of a circle the expression diameter (d) is used.

The height (h), base (b), width (w), length (1) and diameter (d) of the most common

surface areas



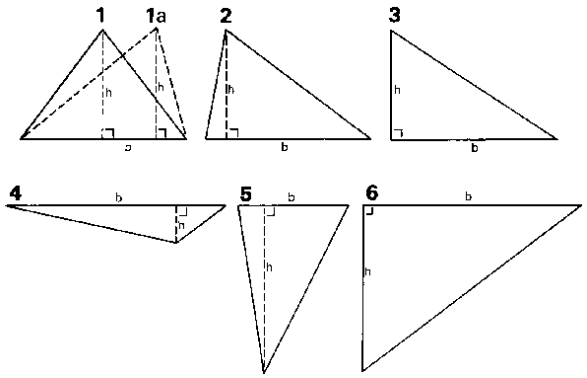
TRIANGLES

The surface area or surface (A) of a triangle is calculated by the formula:

A (triangle) = 0.5 x base x height = 0.5 x b x h ..... (1)

Triangles can have many shapes but the same formula is used for all of them.

Some examples of triangles



EXAMPLE

Calculate the surface area of the triangles no. 1, no. 1a and no. 2

Given		Answer	
Triangles no. 1 and no. 1a:	base = 3 cm height = 2 cm	Formula:	A = 0.5 x base x height = 0.5 x 3 cm x 2 cm = 3 cm^2
Triangle no. 2:	base =3 cm height = 2 cm		A = 0.5 x 3 cm x 2 cm = 3 cm^2

It can be seen that triangles no. 1, no. 1a and no. 2 have the same surface; the shapes of the triangles are different, but the base and the height are in all three cases the same, so the surface is the same.

The surface of these triangles is expressed in square centimeters (written as cm^2). Surface areas can also be expressed in square decimeters (dm^2), square meters (m^2), etc...

PROBLEM:

Calculate the surface areas of the triangles nos. 3, 4, 5 and 6.

Given:		Answer	
Triangle no. 3:	base =3 cm height = 2 cm	Formula:	A = 0.5 x base x height = 0.5 x 3 cm x 2 cm = 3 cm^2
Triangle no. 4:	base = 4 cm height = 1 cm		A = 0.5 x 4 cm x 1 cm = 2 cm^2
Triangle no. 5:	base = 2 cm height = 3 cm		A = 0.5 x 2 cm x 3 cm = 3 cm^2
Triangle no. 6:	base = 4 cm height = 3 cm		A = 0.5 x 4 cm x 3 cm = 6 cm^2

SQUARES AND RECTANGLES

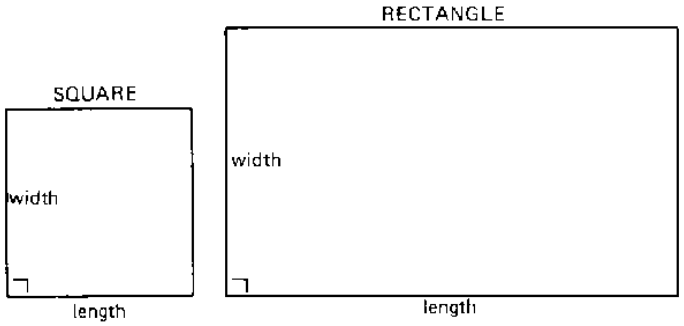
The surface area or surface (A) of a square or a rectangle is calculated by the formula:

A (square or rectangle) = length x width = l x w ..... (2)

In a square the lengths of all four sides are equal and all four angles are right angles.

In a rectangle, the lengths of the opposite sides are equal and all four angles are right angles.

A square and a rectangle



Note that in a square the length and width are equal and that in a rectangle the length and width are not equal.

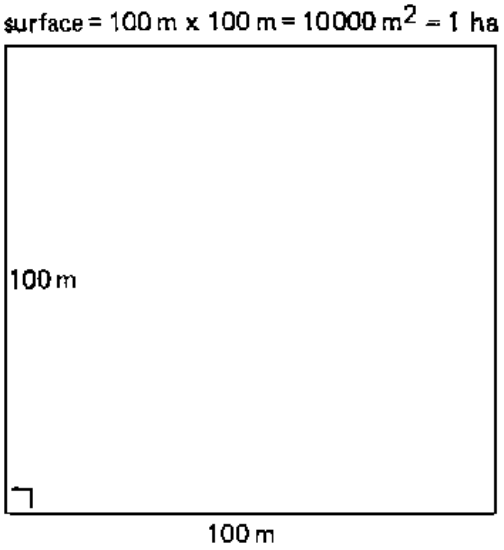
PROBLEM

Calculate the surface areas of the rectangle and of the square.

Given		Answer	
Square:	length = 2 cm width = 2 cm	Formula:	A = length x width = 2 cm x 2 cm = 4 cm^2
Rectangle:	length = 5 cm width = 3 cm	Formula:	A = length x width = 5 cm x 3 cm = 15 cm^2

In calculating irrigation areas , you will often come across the expression hectare (ha), which is a surface area unit. By definition, 1 hectare equals 10 000 m^2. For example, a field with a length of 100 m and a width of 100 m^2 has a surface area of 100 m x 100 m = 10 000 m^2 = 1 ha.

Fig. 4. One hectare equals 10 000 m^2



RHOMBUSES AND PARALLELOGRAMS

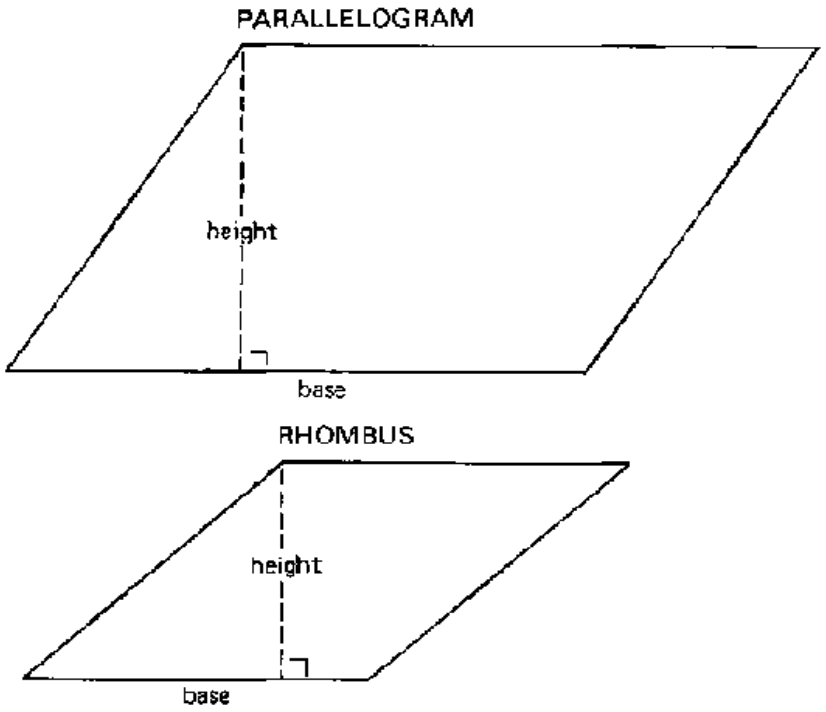
The surface area or surface (A) of a rhombus or a parallelogram is calculated by the formula:

A (rhombus or parallelogram) = base x height = b x h ..... (3)

In a rhombus the lengths of all four sides are equal; none of the angles are right angles; opposite sides run parallel.

In a parallelogram the lengths of the opposite sides are equal; none of the angles are right angles; opposite sides run parallel.

A rhombus and a parallelogram



QUESTION

Calculate the surface areas of the rhombus and the parallelogram.

Given		Answer	
Rhombus:	base = 3 cm height = 2 cm	Formula:	A = base x height = 3 cm x 2 cm = 6 cm^2
Parallelogram:	base = 3.5 cm height = 3 cm	Formula:	A = base x height = 3.5 cm x 3 cm = 10.5 cm^2

1.1.4 TRAPEZIUMS

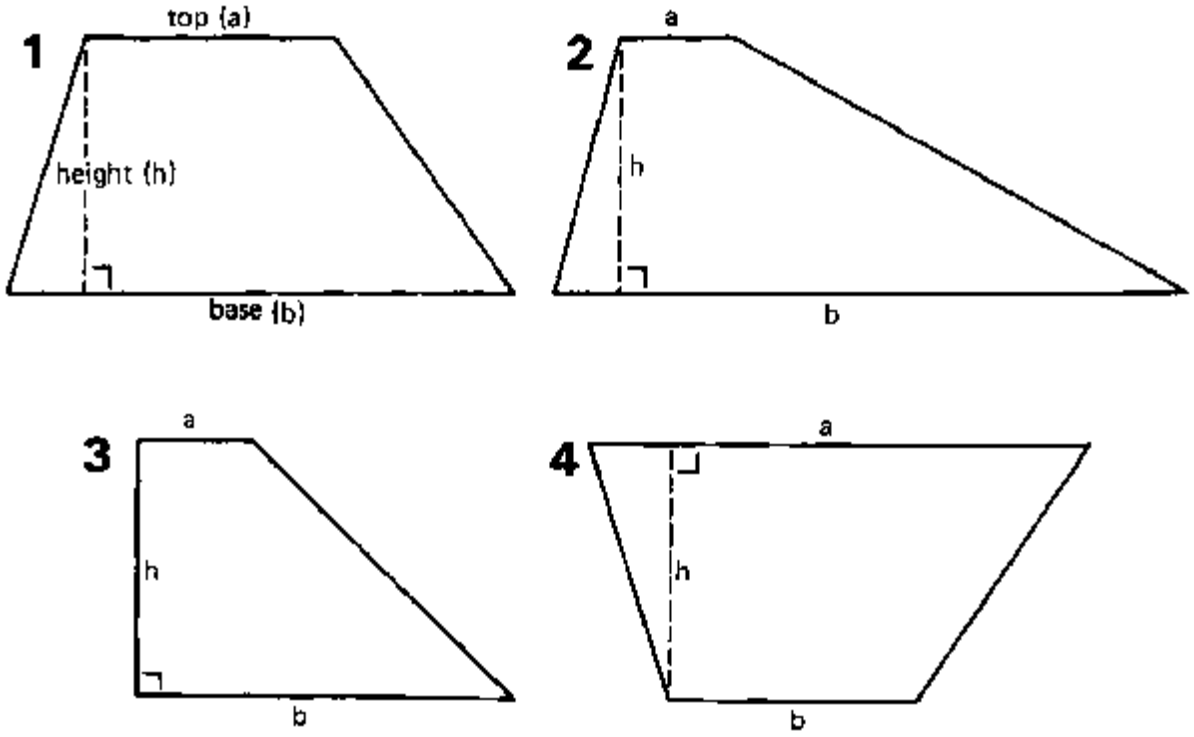
The surface area or surface (A) of a trapezium is calculated by the formula:

A (trapezium) = 0.5 (base + top) x height =0.5 (b + a) x h ..... (4)

The top (a) is the side opposite and parallel to the base (b). In a trapezium only the base and the top run parallel.

Some examples are shown below:

Some examples of trapeziums



EXAMPLE

Calculate the surface area of trapezium no. 1.

Given		Answer	
Trapezium no. 1:	base = 4 cm	Formula:	A =0.5 x (base x top) x height
	top = 2 cm		= 0.5 x (4 cm + 2 cm) x 2 cm
	height = 2 cm		= 0.5 x 6 cm x 2 cm = 6 cm^2

QUESTION

Calculate the surface areas trapeziums nos. 2, 3 and 4.

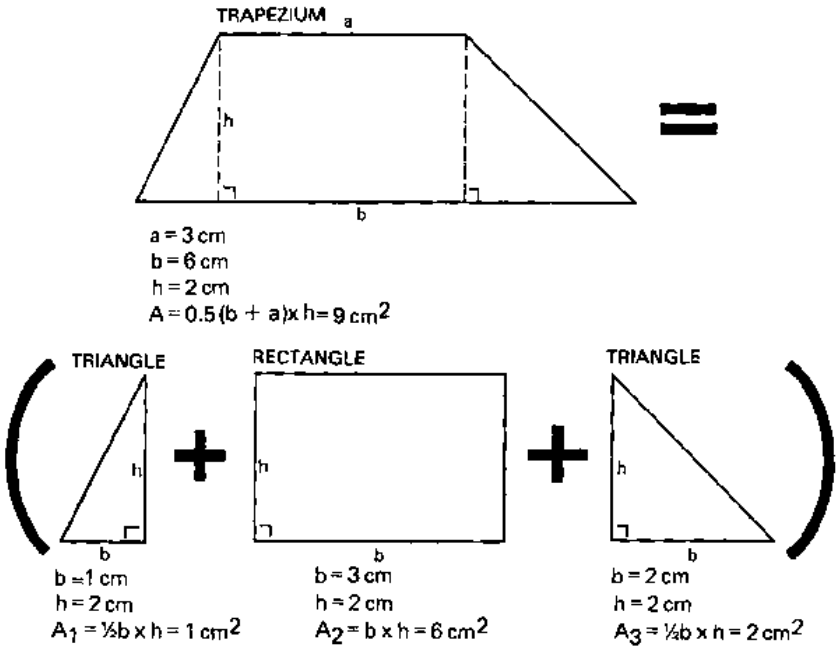
Given		Answer	
Trapezium no. 2:	base = 5 cm top = 1 cm height = 2 cm	Formula:	A = 0.5 x (base + top) x height = 0.5 x (5 cm + 1 cm) x 2 cm = 0.5 x 6 cm x 2 cm = 6 cm^2
Trapezium no. 3:	base = 3 cm top = 1 cm height = 1 cm		A = 0.5 x (3 cm + 1 cm) x 2 cm = 0.5 x 4 cm x 2 cm = 4 cm^2
Trapezium no. 4:	base = 2 cm top = 4 cm height = 2 cm		A = 0.5 x (2 cm + 4 cm) x 2 cm = 0.5 x 6 cm x 2 cm = 6 cm^2

Note that the surface areas of the trapeziums 1 and 4 are equal. Number 4 is the same as number 1 but upside down.

Another method to calculate the surface area of a trapezium is to divide the trapezium into a rectangle and two triangles, to measure their sides and to determine separately the surface areas of the rectangle and the two triangles.

Splitting a trapezium into one rectangle and two triangles.

Note that $A = A_1 + A_2 + A_3 = 1 + 6 + 2 = 9\ cm^2$



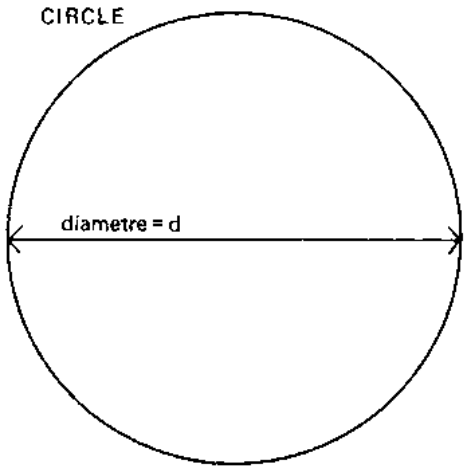
1.1.5 CIRCLES

The surface area or surface (A) of a circle is calculated by the formula:

$$A\ (circle) = 1/4\ (¶ \times d \times d) = 1/4\ (¶ \times d^2) = 1/4\ (3.14 \times d^2) \ldots\ldots (5)$$

whereby d is the diameter of the circle and ¶ (a Greek letter, pronounced Pi) a constant (¶ = 3.14). A diameter (d) is a straight line which divides the circle in two equal parts.

A circle



EXAMPLE

Given	Answer	
Circle: d = 4.5 cm	Formula:	A = 1/4 (¶ x d²)
		= 1/4 (3.14 x d x d)
		= 1/4 (3.14 x 4.5 cm x 4.5 cm)
		= 15.9 cm^2

QUESTION

Calculate the surface area of a circle with a diameter of 3 m.

Given	Answer	
Circle: d = 3 m	Formula:	A = 1/4 (¶ x d²) = 1/4 (3.14 x d x d)
		= 1/4 (3.14 x 3 m x 3 m) = 7.07 m^2

METRIC CONVERSIONS

Units of length

The basic unit of length in the metric system is the meter (m). One meter can be

divided into 10 decimeters (dm), 100 centimeters (cm) or 1000 millimeters (mm); 100 m equals to 1 hectometer (hm); while 1000 m is 1 kilometer (km).

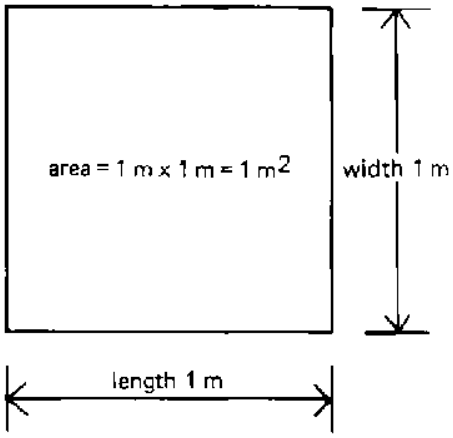
1 m = 10 dm = 100 cm = 1000 mm
0.1 m = 1 dm = 10 cm = 100 mm
0.01 m = 0.1 dm = 1 cm = 10 mm
0.001 m = 0.01 dm = 0.1 cm = 1 mm

1 km = 10 hm = 1000 m
0.1 km = 1 hm = 100 m
0.01 km = 0.1 hm = 10 m
0.001 km = 0.01 hm = 1 m

Units of surface

The basic unit of area in the metric system is the square meter (m), which is obtained by multiplying a length of 1 meter by a width of 1 meter.

A square meter



1 m^2 = 100 dm^2 = 10 000 cm^2 = 1 000 000 mm^2
0.01 m^2 = 1 dm^2 = 100 cm^2 = 10 000 mm^2
0.0001 m^2 = 0.01 dm^2 = 1 cm^2 = 100 mm^2
0.000001 m^2 = 0.0001 dm^2 = 0.01 cm^2 = 1 mm^2

1 km^2 = 100 ha^2 = 1 000 000 m^2
0.01 km^2 = 1 ha^2 = 10 000 m^2
0.000001 km^2 = 0.0001 ha^2 = 1 m^2

NOTE:

1 ha =100 m x 100 m = 10 000 m^2

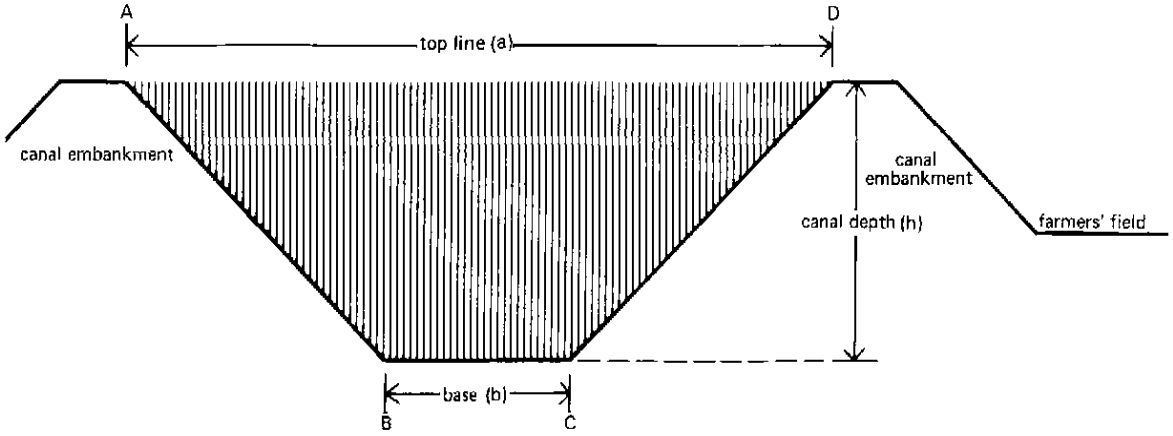
SURFACE AREAS OF CANAL CROSS-SECTIONS AND FARMS

This Section explains how to apply the surface area formulas to two common practical problems that will often be met in the field.

DETERMINATION OF THE SURFACE AREAS OF CANAL CROSS-SECTIONS

The most common shape of a canal cross-section is a trapezium or, more truly, an "up-side-down" trapezium.

Canal cross section



The area (A B C D), hatched on the above drawing, is called the canal cross-section and has a trapezium shape. Thus, the formula to calculate its surface is similar to the formula used to calculate the surface area of a trapezium:

Surface area of the canal cross-section = 0.5 (base + top line) x canal depth = 0.5 (b + a) x h ..... (6)

whereby:

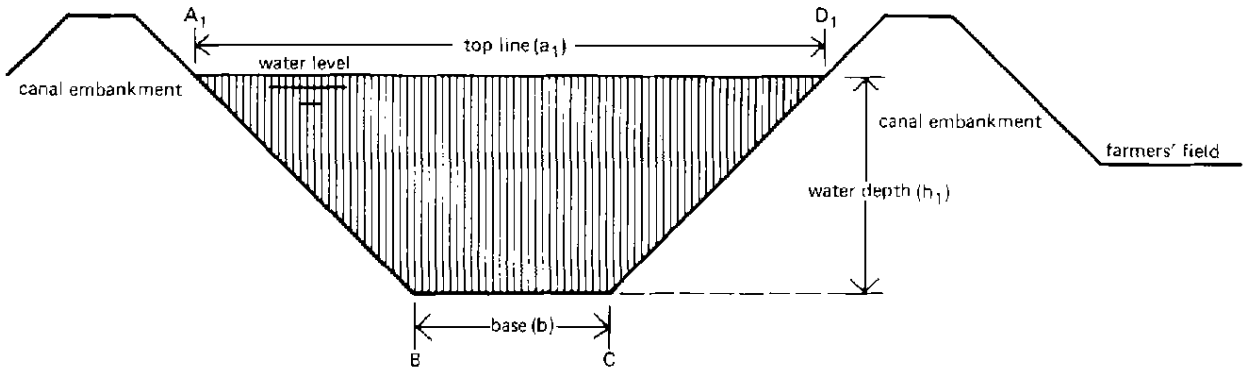
base (b) = bottom width of the canal

top line (a) = top width of the canal

canal depth (h) = height of the canal (from the bottom of the canal to the top of the embankment)

Suppose that the canal contains water, as shown in Figure below.

Wetted cross-section of a canal



The area (A B C D), hatched on the above drawing, is called the wetted canal cross-section or wetted cross-section. It also has a trapezium shape and the formula to calculate its surface area is:

Surface area of the wetted canal cross-section = 0.5 (base + top line) x water depth = 0.5 (b + a_1) x h_1 ..... (7)

whereby:

base (b) = bottom width of the canal

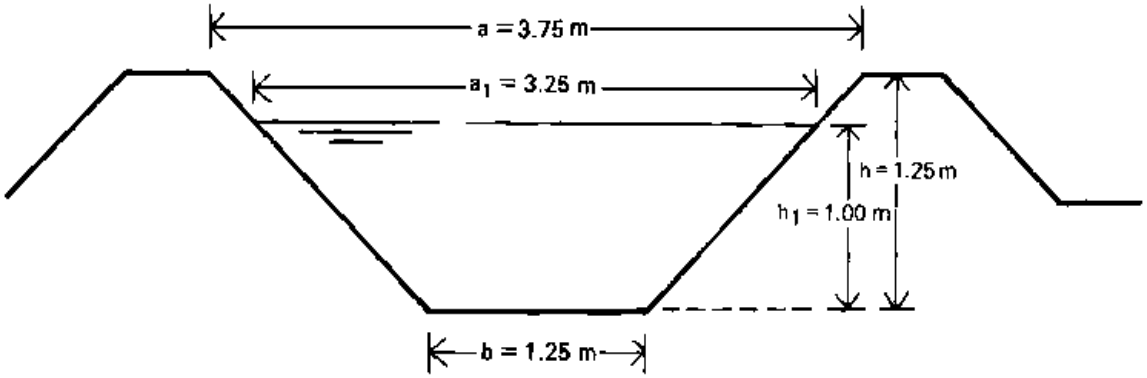
top line (a_1) = top width of the water level

water depth (h_1) = the height or depth of the water in the canal (from the bottom of the canal to the water level).

EXAMPLE

Calculate the surface area of the cross-section and the wetted cross-section, of the canal shown in next figure.

Dimensions of the cross-section



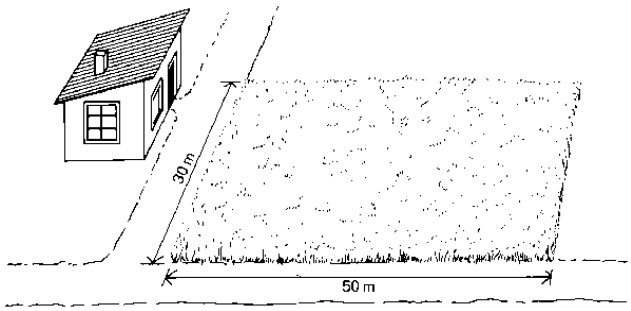
Given	Answer
Canal cross-section:	
base (b) =1.25 m	Formula: A = 0.5 x (b + a) x h
top line (a) =3.75 m	= 0.5 x (1.25 m + 3.75 m) x 1.25 m
canal depth (h) = 1.25 m	= 3.125 m^2
Canal wetted cross-section:	
base (b) = 1.25 m	Formula: A = 0.5 x (b + a_1) x h
top line (a_1) = 3.25 m	= 0.5 x (1.25 m + 3.25 m) x 1.00 m
water depth (h_1) =1.00 m	= 2.25 m^2

DETERMINATION OF THE SURFACE AREA OF A FARM

It may be necessary to determine the surface area of a farmer's field. For example, when calculating how much irrigation water should be given to a certain field, the size of the field must be known.

When the shape of the field is regular and has, for example, a rectangular shape, it should not be too difficult to calculate the surface area once the length of the field (that is the base of its regular shape) and the width of the field have been measured.

Field of regular shape



EXAMPLE

Given	Answer
Length of the field =50 m	Formula: A = length x width (formula 2)
Width of the field = 30 m	= 50 m x 30 m = 1500 m^2

QUESTION

What is the area of the same field, expressed in hectares?

ANSWER

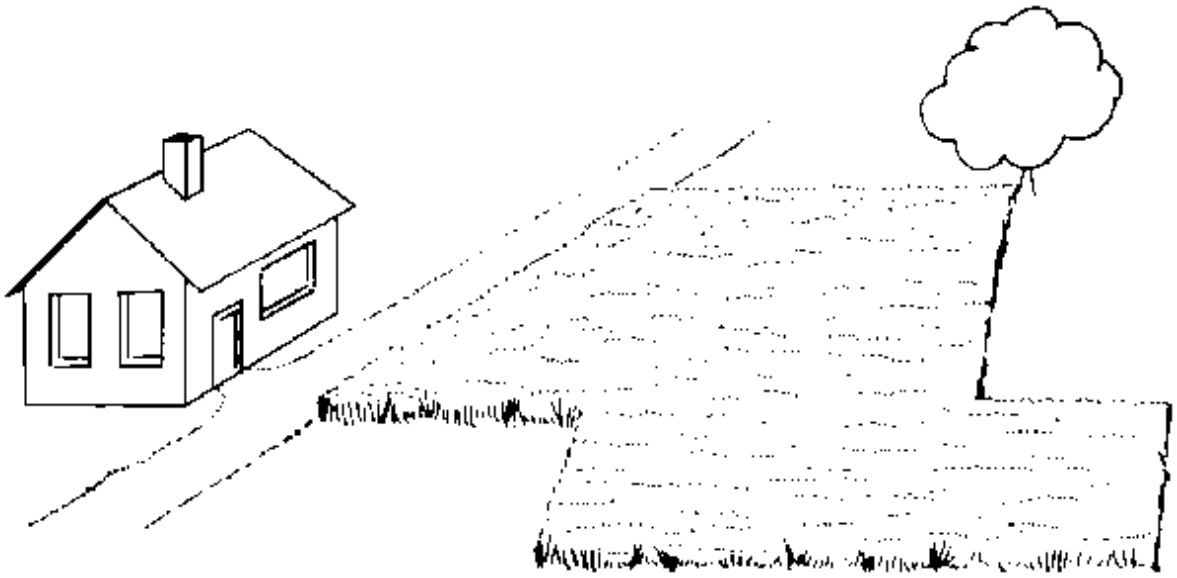
A hectare is equal to 10 000 m. Thus, the formula to calculate a surface area in hectares is:

$$\text{Surface area in hectares (ha)} = \frac{\text{surface area in square metres } (m^2)}{10\,000} \quad \text{..... (8)}$$

In this case: area of the field in $\text{ha} = \frac{1500\,m^2}{10\,000} = 0.15\,\text{ha}$

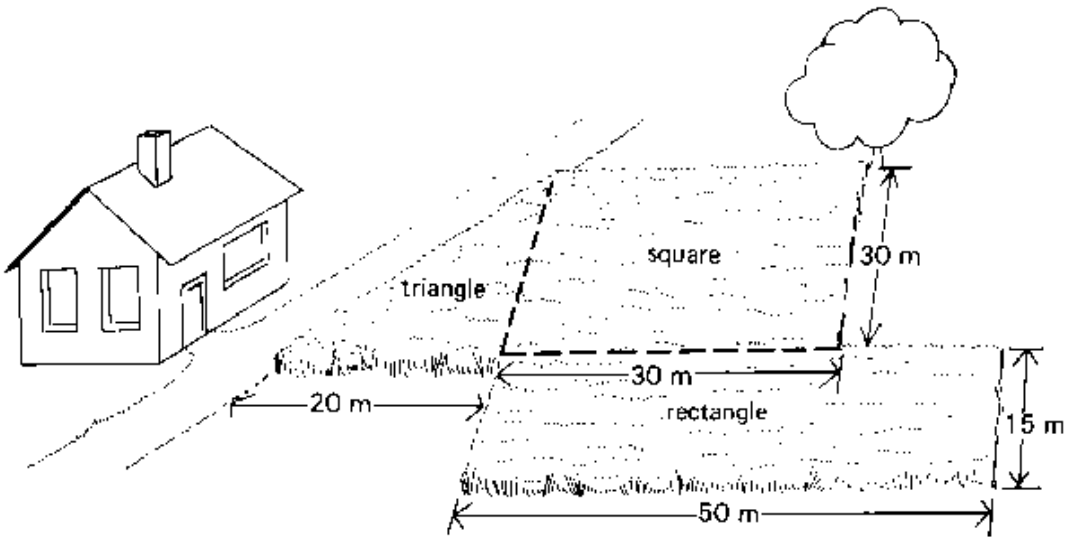
More often, however, the field shape is not regular, as shown in Figure below.

Field of irregular shape



In this case, the field should be divided in several regular areas (square, rectangle, triangle, etc.).

Division of irregular field into regular areas



Surface area of the square: A_s = length x width = 30 m x 30 m = 900 m^2
Surface area of the rectangle: A_r = length x width = 50 m x 15 m = 750 m^2
Surface area of the triangle: A_t = 0.5 x base x height = 0.5 x 20 m x 30 m = 300 m^2
Total surface area of the field: $A = A_s + A_r + A_t$ = 900 m^2 + 750 m^2 + 300 m^2 = 1950 m^2

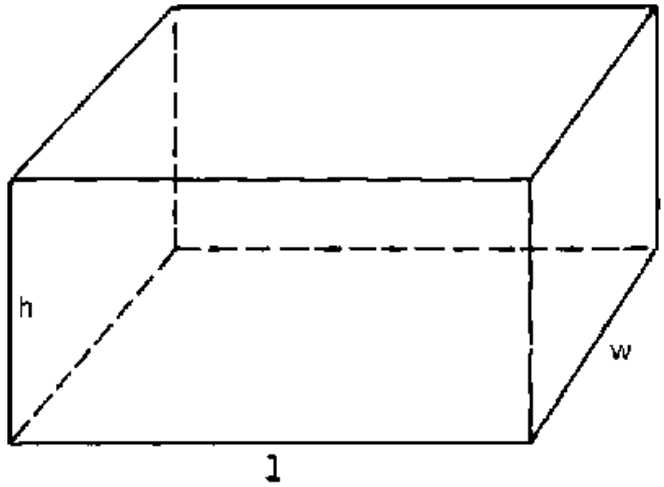
INTRODUCTION TO VOLUME

A volume (V) is the content of a body or object. Take for example a block. A block has a certain length (l), width (w) and height (h). With these three data, the volume of the

block can be calculated using the formula:

V (block) = length x width x height = l x w x h ..... (9)

A block



EXAMPLE

Calculate the volume of the above block.

Given	Answer
length = 4 cm	Formula: V = length x width x height
width = 3 cm	= 4 cm x 3 cm x 2 cm
height = 2 cm	= 24 cm^3

The volume of this block is expressed in cubic centimeters (written as cm). Volumes can also be expressed in cubic decimeters (dm^3), cubic meters (m^3), etc.

QUESTION

Calculate the volume in m^3 of a block with a length of 4 m, a width of 50 cm and a height of 200 mm.

Given	Answer
All data must be converted in meters (m)	
length = 4 m	Formula: V = length x width x height
width = 50 cm = 0.50 m	= 4 m x 0.50 m x 0.20 m
height = 200 mm = 0.20 m	= 0.40 m^3

QUESTION

Calculate the volume of the same block, this time in cubic centimeters (cm^3)

Given

All data must be converted in centimeters (cm)

length = 4 m = 400 cm
width = 50 cm
height = 200 mm = 20 cm

Answer

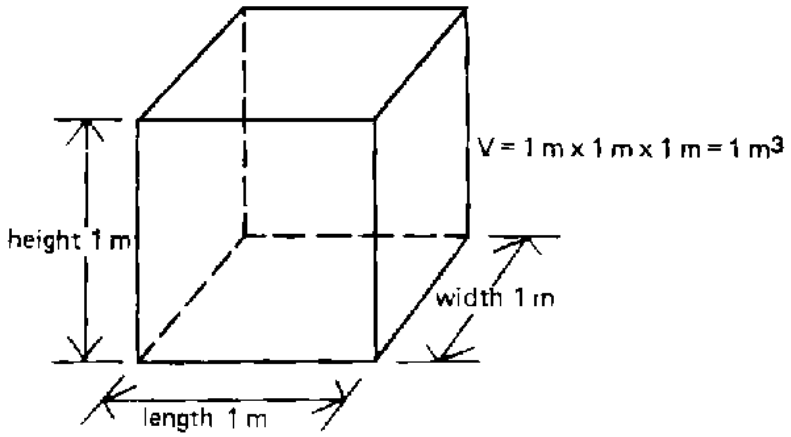
Formula: V = length x width x height
= 400 cm x 50 cm x 20 cm
= 400 000 cm^3

Of course, the result is the same: 0.4 m^3 = 400 000 cm^3

UNITS OF VOLUME

The basic unit of volume in the metric system is the cubic meter (m^3) which is obtained by multiplying a length of 1 meter, by a width of 1 meter and a height of 1 meter.

One cubic meter



1 m^3 = 1.000 dm^3 = 1 000 000 cm^3 = 1 000 000 000 mm^3
0.001 m^3 = 1 dm^3 = 1 000 cm^3 = 1 000 000 mm^3
0.000001 m^3 = 0.001 dm^3 = 1 cm^3 = 1 000 mm^3
0.000000001 m^3 = 0.000001 dm^3 = 0.001 cm^3 = 1 mm^3

NOTE

1 dm^3 = 1 liter

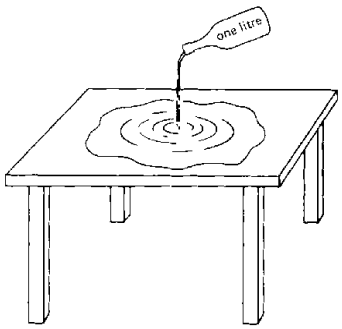
and

1 m^3 = 1000 liters

VOLUME OF WATER ON A FIELD

Suppose a one-liter bottle is filled with water. The volume of the water is 1 liter or 1 dm^3. When the bottle of water is emptied on a table, the water will spread out over the table and form a thin water layer. The amount of water on the table is the same as the amount of water that was in the bottle.

The volume of water remains the same; only the shape of the "water body" changes.



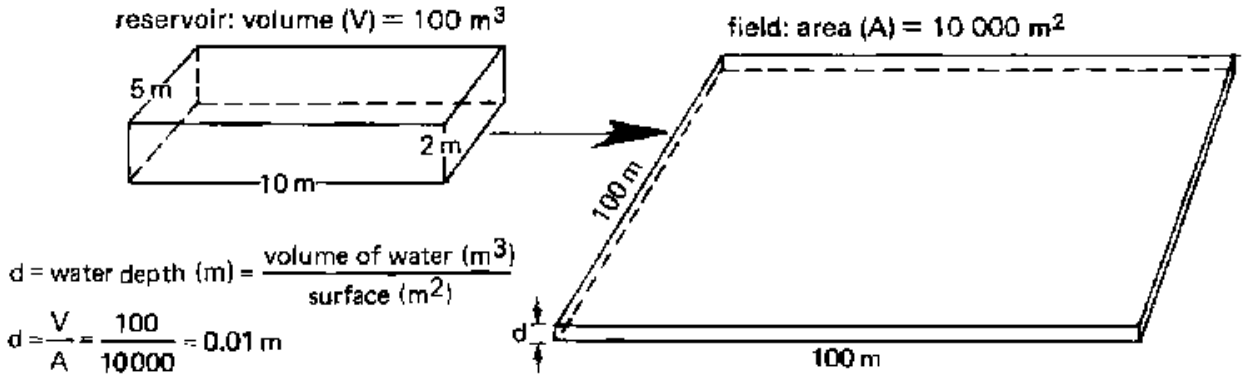
One liter of water spread over a table

A similar process happens if you spread irrigation water from a storage reservoir over a farmer's field.

QUESTION

Suppose there is a reservoir, filled with water, with a length of 5 m, a width of 10 m and a depth of 2 m. All the water from the reservoir is spread over a field of 1 hectare. Calculate the water depth (which is the thickness of the water layer) on the field.

A volume of 100 m^3 of water spread over an area of one hectare



The formula to use is:

$$\text{Water depth } (d) = \frac{\text{Volume of water } (V)}{\text{Surface of the field } (A)} \quad \text{..... (10)}$$

As the first step, the volume of water must be calculated. It is the volume of the filled reservoir, calculated with formula (9):

Volume (V) = length x width x height = 5 m x 10 m x 2 m = 100 m^3

As the second step, the thickness of the water layer is calculated using formula (10):

Given

Surface of the field = 10 000 m^2
Volume of water = 100 m^3

Answer

Formula: $d = \frac{\text{Volume of water } (m^3)}{\text{Surface of the field } (m^2)}$

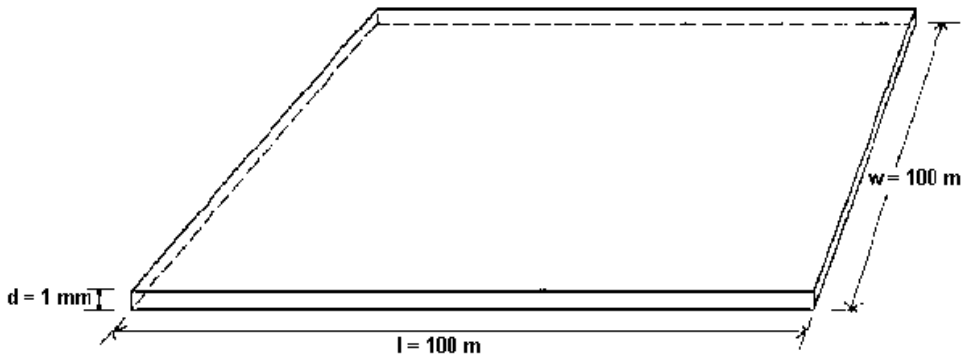
$d = \frac{100\ (m^3)}{10\,000\ (m^2)}$

d = 0.01 m
d = 10 mm

QUESTION

A water layer 1 mm thick is spread over a field of 1 ha. Calculate the volume of the water (in m^3).

One millimeter water depth on a field of one hectare



The formula to use is:

Volume of water (V) = Surface of the field (A) x Water depth (d) ..... (11)

Given

Surface of the field = 10 000 m^2
Water depth = 1 mm =1/1 000 = 0.001 m

Answer

Formula: = surface of the field (m^2) x water depth (m)
Volume (m^3) V = 10 000 m^2 x 0.001 m

$V = 10\ m^3$ or 10 000 liters

INTRODUCTION TO FLOW-RATE

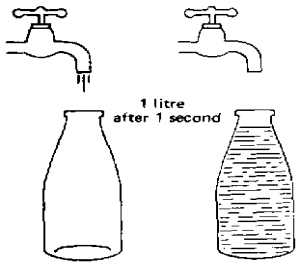
DEFINITION

The flow-rate of a river, or of a canal, is the volume of water discharged through this river, or this canal, during a given period of time. Related to irrigation, the volume of water is usually expressed in liters (l) or cubic meters (m^3) and the time in seconds (s) or hours (h). The flow-rate is also called discharge-rate.

CALCULATION AND UNITS

The water running out of a tap fills a one liter bottle in one second. Thus the flow rate (Q) is one liter per second (1 l/s).

A flow-rate of one liter per second



PROBLEM

The water supplied by a pump fills a drum of 200 liters in 20 seconds. What is the flow rate of this pump?

The formula used is:

$$Q = \text{Flow-rate}\,(l/s) = \frac{\text{Volume of water (litres)}}{\text{Time (seconds)}} \quad \text{.....} \quad (12a)$$

Given	Answer
Volume of water: 200 l Time: 20 s	Formula: $Q = \frac{\text{Volume of water}}{\text{Time}} = \frac{200\,l}{20\,s} = 10\,l/s$

The unit "liter per second" is commonly used for small flows, e.g. a tap or a small ditch. For larger flows, e.g. a river or a main canal, the unit "cubic metre per second" (m^3/s) is more conveniently used.

PROBLEM

A river discharges 100 m^3 of water to the sea every 2 seconds. What is the flow-rate of this river expressed in m^3/s?

The formula used is:

$$Q = \text{Flow-rate}\,(m^3/s) = \frac{\text{Volume of water}\,(m^3)}{\text{Time (seconds)}} \quad \text{..... (12b)}$$

Given

Volume of water: 100 m^3
Time: 2 s

Answer

Formula: $Q = \frac{\text{Volume of water}}{\text{Time}} = \frac{100\,m^3}{2\,s} = 50\,m^3/s$

The discharge rate of a pump is often expressed in m^3 per hour (m^3/h) or in liters per minute (l/min).

$$Q = \text{Flow-rate}\,(l/min) = \frac{\text{Volume of water (litres)}}{\text{Time (minutes)}} \quad \text{..... (12c)}$$

$$Q = \text{Flow-rate}\,(m^3/h) = \frac{\text{Volume of water}\,(m^3)}{\text{Time (hours)}} \quad \text{..... (12d)}$$

NOTE: Formula 12a, 12b, 12c and 12d are the same; only the units change

INTRODUCTION TO PERCENTAGE

In relation to agriculture, the words percentage will be met regularly. For instance "60 percent of the total area is irrigated during the dry season". In this Section the meaning of the word "percentage" will be discussed.

PERCENTAGE

The word "percentage" means literally "per hundred"; in other words one percent is the one hundredth part of the total. You can either write percent, or %, or 1/100, or 0.01.

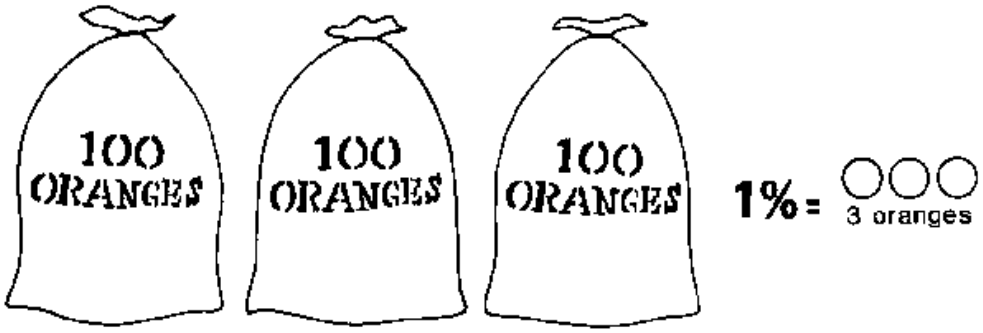
Some examples are:

5 percent = 5% =5/100 = 0.05
20 percent = 20% = 20/100= 0.20
25 percent = 25% = 25/100 = 0.25
50 percent = 50% = 50/100 =0.50
100 percent = 100% = 100/100 = 1
150 percent = 150% = 150/100 = 1.5

QUESTION

How many oranges are 1% of a total of 300 oranges?

Three oranges are 1% of 300 oranges



ANSWER

1% of 300 oranges = 1/100 x 300 = 3 oranges

QUESTIONS	**ANSWERS**
6% of 100 cows	6/100 x 100 = 6 cows
15% of 28 hectares	15/100 x 28 = 4.2 ha
80% of 90 irrigation projects	80/100 x 90 = 72 projects
150% of a monthly salary of P100	150/100 x 100 = 1.5 x 100 = P150
0.5% of 194.5 liters	0.5/100 x 194.5 = 0.005 x 194.5 = 0.9725 liters

INTRODUCTION TO GRAPHS

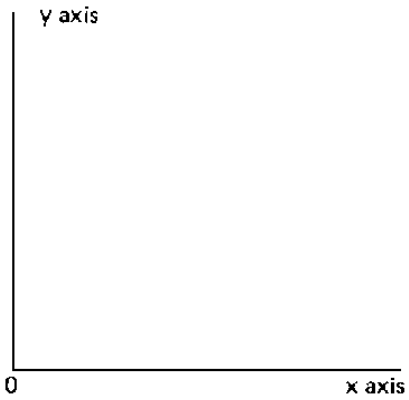
A graph is a drawing in which the relationship between two (or more) items of information (e.g. time and plant growth) is shown in a symbolic way.

To this end, two lines are drawn at a right angle. The horizontal one is called the x axis and the vertical one is called the y axis.

Where the x axis and the y axis intersect is the "0" (zero) point.

The plotting of the information on the graph is discussed in the following examples.

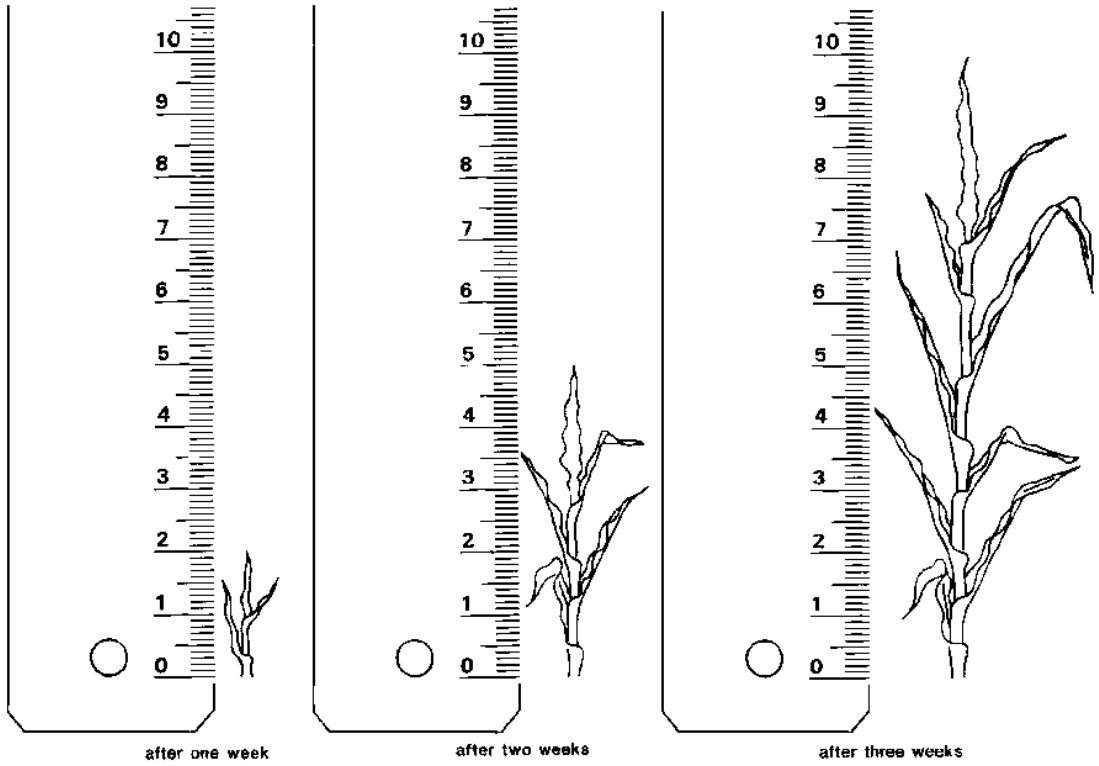
A graph



EXAMPLE 1

Suppose it is necessary to make a graph of the growth rate of a corn plant. Each week the height of the plant is measured. One week after planting the seed, the plant measures 2 cm in height, two weeks after planting it measures 5 cm and 3 weeks after planting the height is 10 cm.

Measuring the growth rate of a corn plant



These results can be plotted on a graph. The time (in weeks) will be indicated on the

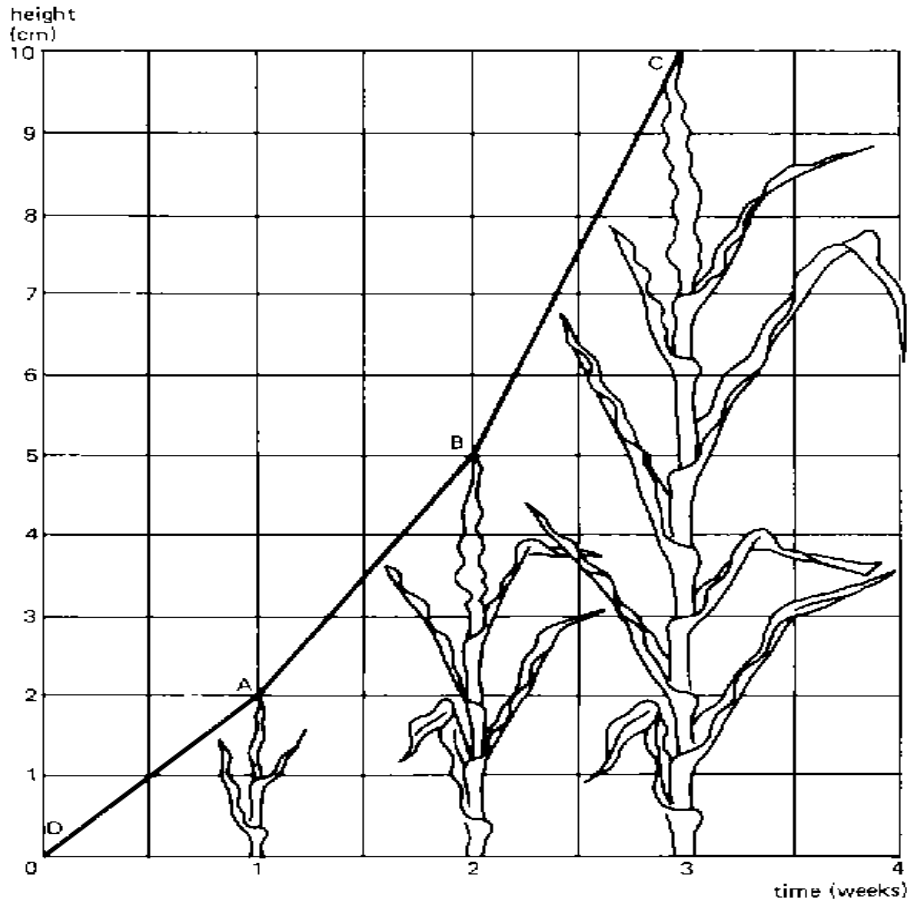
x axis; 2 cm on the axis represents 1 week. The plant height (in centimeters) will be indicated on the y axis; 1 cm on the axis represents 1 cm of plant height.

After 1 week the height is 2 cm; this is indicated on the graph with A; after 2 weeks the height is 5 cm, see B, and after 3 weeks the height is 10 cm, see C.

At planting (Time = 0) the height was zero, see D.

Now connect the crosses with a straight line. The line indicates the growth rate of the plant; this is the height increase over time.

Growth rate of corn plant



It can be seen from the graph that the plant is growing faster and faster (during the first week 2 cm and during the third week 5 cm); the line from B to C is steeper than the line from D to A.

From the graph can be read what the height of the plant was after, say 2 1/2 weeks; see the dotted line. Locate on the horizontal axis 2 1/2 weeks and follow the dotted line upwards until the dotted line crosses the graph. From this crossing follow the dotted line to the left until the vertical axis is reached. Now take the reading: 7.5 cm, which means that the plant had a height of 7.5 cm after 2 1/2 weeks. This height has not been measured in reality, but with the graph the height can be determined anyway.

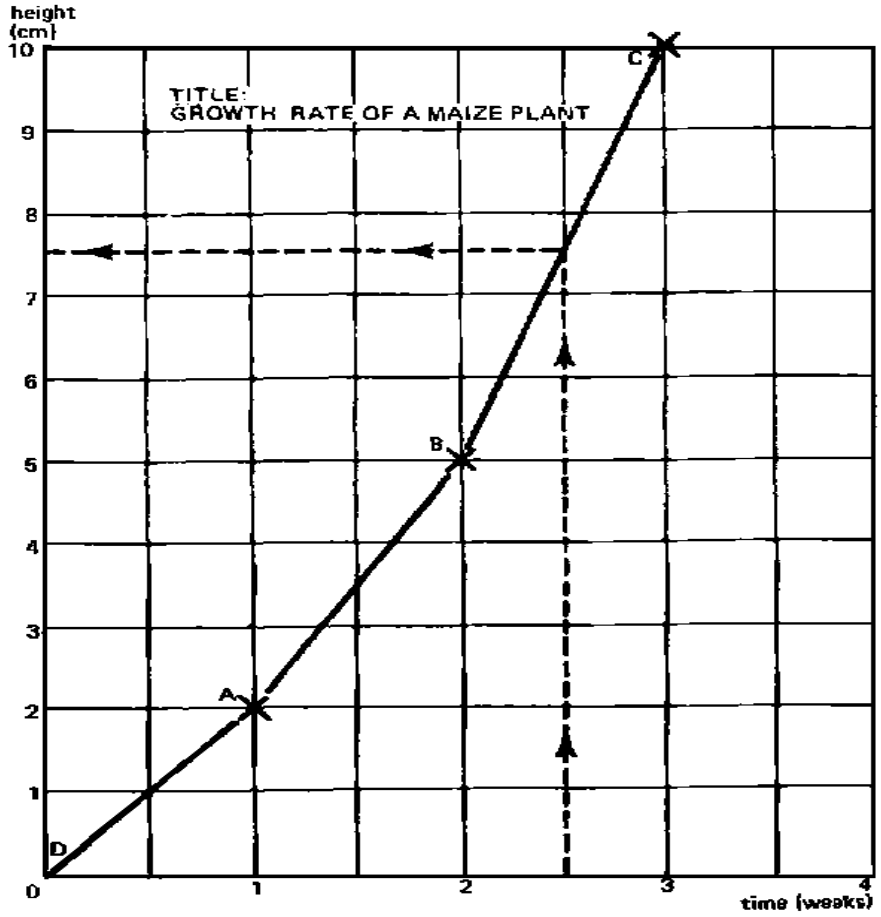
QUESTION

What was the height of the plant after 1 1/2 weeks?

ANSWER

The height of the plant after 1 1/2 weeks was 3.5 cm.

Graph of the growth rate of a corn plant



EXAMPLE 2

Another example to illustrate how a graph should be made is the variation of the temperature over one full day (24 hours). Suppose the outside temperature (always in the shade) is measured, with a thermometer, every two hours, starting at midnight and ending the following midnight.

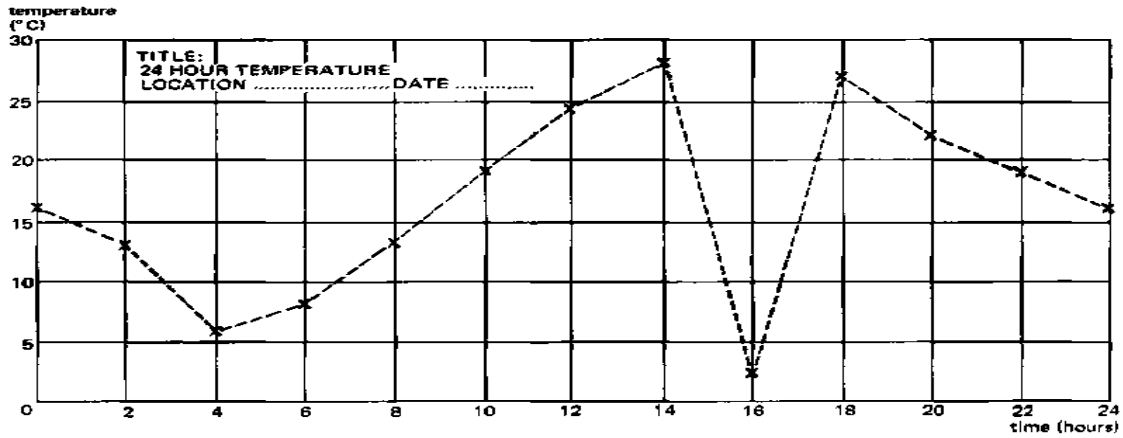
Suppose the following results are found:

Time (hr)	Temperature (°C)
0	16
2	13
4	6
6	8
8	13
10	19
12	24
14	28
16	2
18	27
20	22
22	19
24	16

On the x axis indicate the time in hours, whereby 1 cm on the graph is 2 hours. On the y axis indicate the temperature in degrees Celsius (°C), whereby 1 cm on the graph is 5°C.

Now indicate (with crosses) the values from the table (above) on the graph paper and connect the crosses with straight dotted lines.

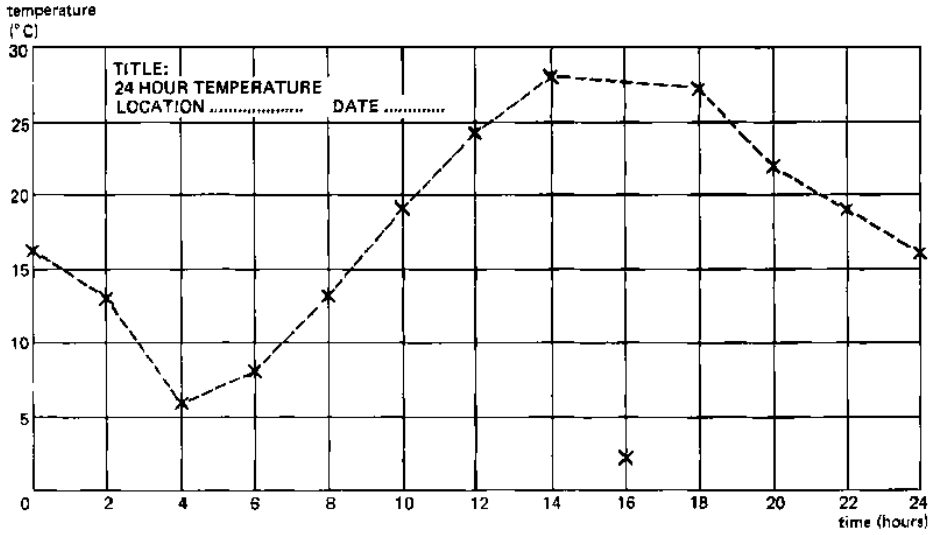
Graph showing temperature over 24 hours; mistake 16 hour reading



At this stage, if you look attentively at the graph, you will note that there is a very abrupt change in its shape around the sixteenth hour. The outside temperature seems to have fallen from 28°C to 2°C in two hours' time! That does not make sense, and the reading of the thermometer at the sixteenth hour must have been wrong. This cross cannot be taken in consideration for the graph and should be rejected. The only dotted line we can accept is the straight one in between the reading at the fourteenth hour and the reading at the

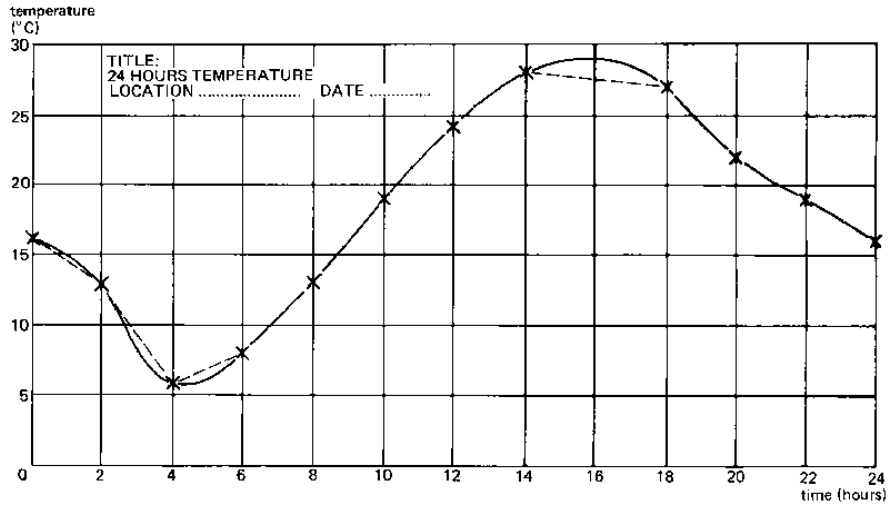
eighteenth hour.

Graph showing temperature over 24 hours; estimated correction of mistake



In reality the temperature will change more gradually than indicated by the dotted line; that is why a smooth curve is made (continuous line). The smooth curve represents the most realistic approximation of the temperature over 24 hours.

Graph showing temperature over 24 hours; smooth curve



From the graph it can be seen that the minimum or lowest temperature was reached around 4 o'clock in the morning and was about 6°C. The highest temperature was reached at 4 o'clock in the afternoon and was approximately 29°C.

QUESTION

What was the temperature at 7, 15 and 23 hours? (Always use the smooth curve to take the readings).

ANSWER

Temperature at 7 hours: 10°C
Temperature at 15 hours: 29°C
Temperature at 23 hours: 17°C

How Much Have You Learned?

Self-Check 2.1

Convert the following:

1. 1m=____cm
2. 400cm=_____m
3. 5km=_____m
4. 1km=_____cm
5. 2000 m=___km

Find the area (hectare) of the following.

1. 600m x 600m
2. 100mx1000m
3. 200mx300m
4. 300mx400m
5. 500mx600m

Compute the following:

1. 6% of 100 plants were replaced
2. 15% of 28 hectares are harvested
3. 80% of 90 farmers are present
4. 50% of P200 increase in farmers salary
5. 5% of 100 kg seeds are dormant

Refer to the Answer Key. What is your score?

How Do You Apply What You Have

Show that you have learned something by doing this activity

Activity Sheet 2.1

PROJECT PROPOSAL

Materials/Tools:

- Mathematics Books
- Ruler
- Calculators
- Relevant tools and equipment for basic calculations

SPECIFIC INSTRUCTIONS:

1. Get a copy of a simple project proposal from any sources (it is suggested that your choice is related to horticulture).
2. Study the different parts and make your own version.
3. Project proposal should include the following:
   - Preparing the operating statement and cash flow.
   - Computing for the total sales, total expenses and net profit or net loss.
   - Computing fertilizer amount of fertilizer
4. Submit your proposal before the end of the quarter or grading period.

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

While performing the activity it is important that you to assess your performance following the criteria below:

Criteria	Score			
	20	15	10	5
Project proposal is simple and easy to understand				
Project proposal is related to your course				
Data are reliable and applicable (prices)				
Sample of project plan is taken from a reliable source				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

Congratulations! You did a great job! Rest and relax a while then move on

REFERENCES

LO1

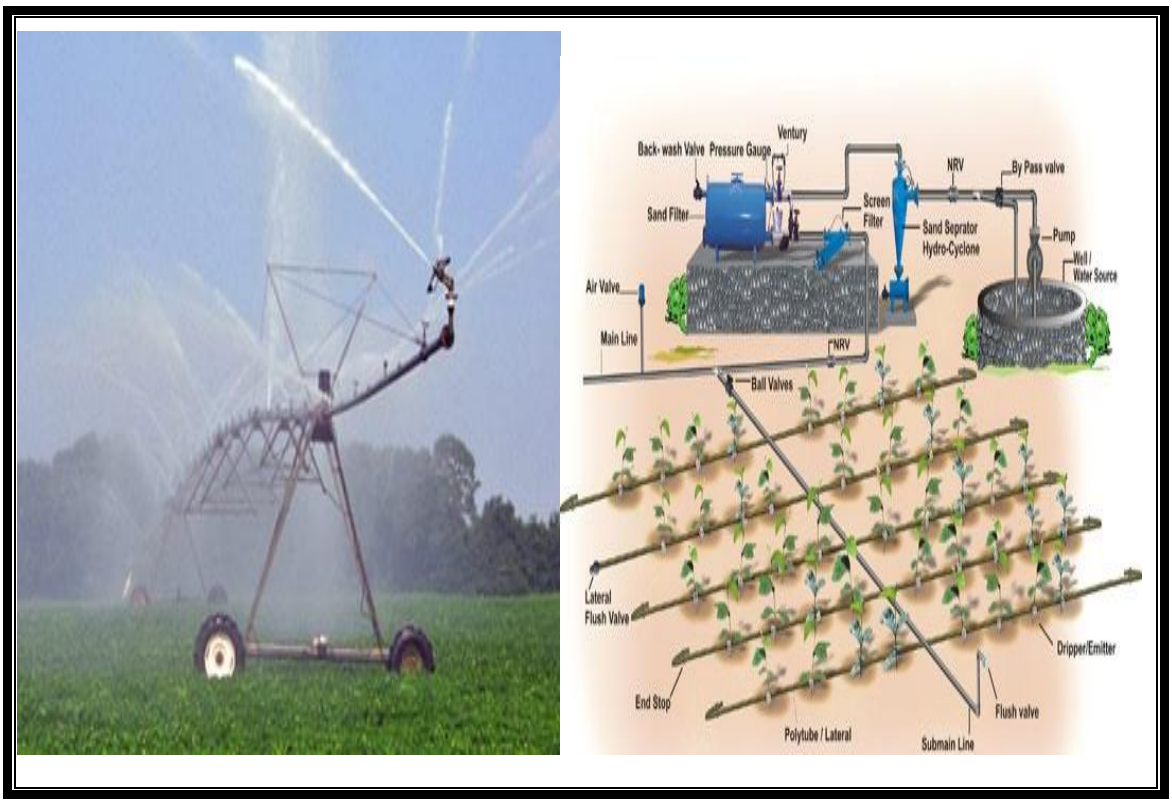
- Jef Van Haunte-Lyds Quileste Van Haunte, Growing Rich,Tasty Veggies
- http://www.antiquefarmtools.info
- http://www.cdc.gov/niosh/pdfs/01-111b
- http://www.ebc.com.au

LO2

- http://www.fao.org/docrep/R4082E/r4082e02.htm#1.1%20introduction%20

LESSON 3

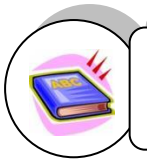
Interpreting Plans and Drawings



LEARNING OUTCOMES:

At the end of this Lesson you are expected to do the following:

LO 1. interpret farm plans and lay-outs; and
LO 2. interpret irrigation plan and design.



Definition of Terms

Lay-outing-locating the position of plant in the field

Intercropping-the planting of other crop within the row of the main crop

Monocropping- the growing of single crop

Irrigation- the application of water to the soil by any other means than rainfall

LEARNING OUTCOME 1

Interpret farm plans and layouts

PERFORMANCE STANDARDS

- Planting system and practices are strictly followed according to approved cultural practices.
- Farm plans and layout are designed according to crop grown.
- Site is staked according to planting plans/system.

Materials

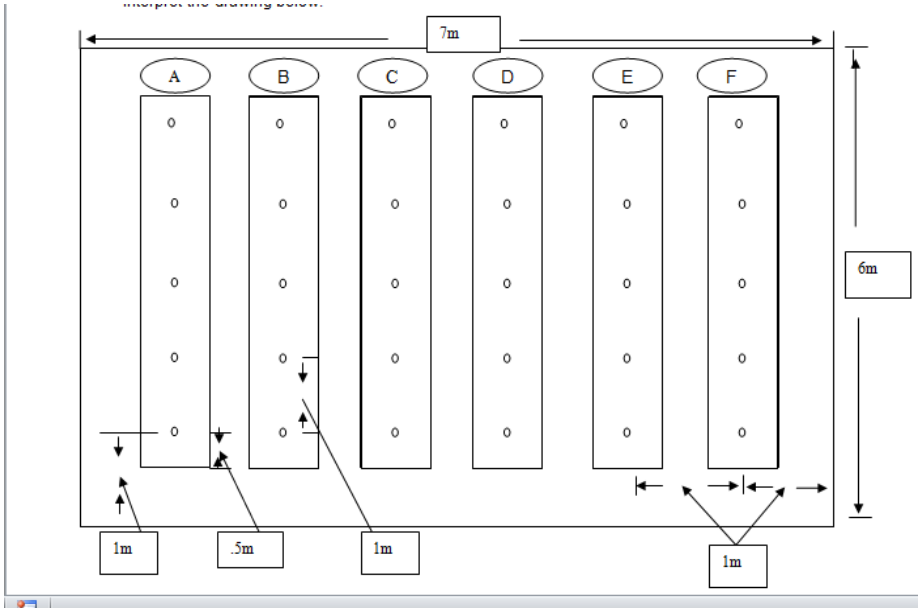
- Calculator
- Pencil
- Graphing paper
- References

What Do You Already Know?

Let us determine how much you already know about interpreting plans and layouts. Take this test.

Pretest LO 1

Interpret the drawing below:



Legend:

- ○ **Plant**

MAKE YOUR INTERPRETATION:

1. What is your area?
2. How many rows are there in the area?
3. How many plants are there in a row?
4. How many plants are there in the area?
5. What is the distance between plants per row?
6. What is the distance of plants between hill?
7. How many plants are there in row A?
8. What is the length of the area?
9. What is the width of the area?
10. How many plants are needed in rows A,B and C?

What Do You Need To Know?

Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing the Self-check 1.1.

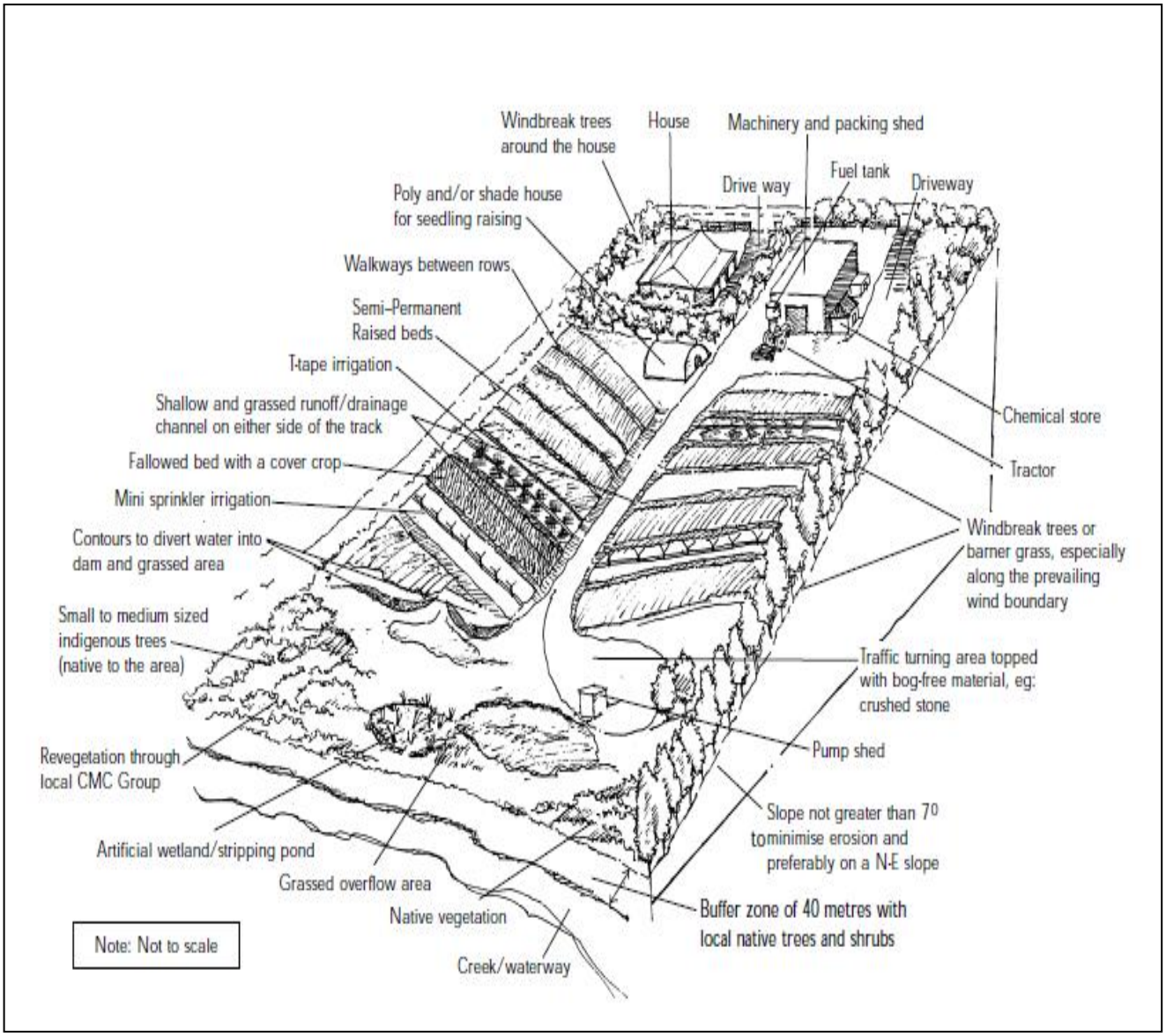
Information Sheet 1.1

INTERPRET FARM PLANS AND LAYOUTS

The 'Farming for the Future' (FFTF) program can help you to plan the best farm layout. It is an initiative of NSW Government agencies focusing on whole farm planning. A whole farm plan considers the farm's physical, financial and human/personal resources for both now and the future.

Site assessment
An on-site assessment of a farm is necessary so that a map can be drawn of the property's topography, boundaries, soils, water resources and so on, and a farm business plan can be formulated.

Government plans
Acquaint yourself with relevant Regional Environmental Plans (REPs), Local Environmental Plans (LEPs), and Development Control Plans (DCPs) and their short and long-term effects on your proposed or existing farm enterprise. This will help reduce unforeseen risks and enhance your farm business. Council's building approval or development consent (DAs) may be needed for siting greenhouses, siting and constructing dams or erecting hail and windbreak netting. Council approval to clear land or a 'no burning of crop debris or waste materials on farm' may apply. Consent will be required if odor or noise is a nuisance likely to be generated from the development.



How Crops are Arranged in Row Planting

Row planting as applied in conventional horizontal farming or gardening is a system of growing crops in linear pattern in at least one direction rather than planting without any distinct arrangement. It is practiced in most crops whether direct seeded, transplanted or grown from vegetative planting materials, both in monocropping and multiple cropping.

Crops are planted in rows or straight lines, either singly or in multiple rows, mainly to enhance maximum yields as well as for convenience. An east-west row orientation is preferred to maximize light absorption, but this is not always possible. In many cases the topography that includes the shape, terrain and slope of the land, as well as the location of existing vegetation, roads, irrigation lines, buildings and physical barriers, dictate the row orientation.

The specific advantages of row planting over *broadcasting or scatter planting* include the following: **(1)** light absorption is maximized and, conversely, the excessive shading effect of other plants is minimized thus favoring more efficient photosynthesis and improved crop yield; **(2)** wind passage along the interrows is enhanced which increases gas exchanges and prevents excessive humidity; **(3)** access through the interrows facilitates cultivation, weeding, and other farm operations including hauling; **(4)** movement within the crop area is convenient and allows close inspection of individual plants; and **(5)** visibility is enhanced.

Row Planting Arrangement

Row-planted crops are either arranged in equidistant **single rows** or in **multiple rows**. Planting in *single rows* is most common in **monocropping** or **sole cropping**, the growing of a single crop.

Different systems of planting arrangement within the row are practiced in both single and multiple row planting, depending on the characteristics and requirement of the crop, particularly its extent of canopy expansion. In the *hill method* of planting crops by direct seeding, the crops are arranged, singly or in group, in uniform distances. But in the *drill method*, the only consideration is a uniform *number of plants per linear meter*.

In row-planted fruit trees and other perennial crops like coconut, oil palm and rubber, the common types of planting or spatial arrangement are the *square*, *rectangular*, *quincunx*, and *triangular or hexagonal*.

Multiple Row Planting Arrangement

Multiple row planting is a system of growing crops in blocks or strips of 2 or more rows. The adjacent blocks are separated by a space which may remain vacant or planted to other crops. This planting arrangement is common in **multiple cropping** in which two or more crops are grown in the same piece of land. It is also employed in monocropping where an alley wide enough to facilitate passage is needed.

Coconut and other perennial crops are often intercropped with multiple rows of annual crops like corn and pineapple. This is a common practice of maximizing the use of vacant interrow spaces when the maincrop has not fully developed thus allowing sufficient light exposure. In some farms, the intercrop consists of multiple rows of such crops as coffee, cacao and banana. In this system, both single row planting (for the maincrop) and multiple row planting (for the intercrop) are combined.

In vegetable production that employs close spacing and where crops should be within easy reach, the common practice is to plant in plots having multiple rows. A space between plots is provided to allow passage.

Spatial Arrangement in Intercropping

Spatial arrangement is the systematic apportioning of the farm area or any growing surface for crop production. In multiple cropping by intercropping, the intercrop can be planted in any of the following ways: **(1)** within the rows of the maincrop, **(2)** between the rows of the maincrop, and **(3)** in replacement series Planting of the intercrop between two adjacent hills within the same row of the main crop allows interrow cultivation but the intercrop has limited exposure to sunlight. This is exemplified by the planting of peanut or mungbean between corn plants within the same row or two coffee plants that are 3 m apart between coconut plants.

Single row planting of the intercrop can also be done between the rows of the maincrop. For example, peanut or mungbean can be dibbled between two adjacent rows of corn. This system of planting arrangement is likewise common in coconut farms where fruit trees like durian, lanzones and mangosteen are grown in single rows between coconut.

In replacement series, one or more rows that are intended for the maincrop are replaced with the intercrop. For example, a 3:2 corn+mungbean intercrop means that for every 4 rows that are intended for sole corn, only 3 rows are planted to corn and one row may be substituted with 2 rows of mungbean. Another practice is in *strip intercropping*, for example the simultaneous growing of 6 rows corn and 12 rows soybean in alternating strips. These particular examples result to multiple row planting arrangement.

Methods of Planting Crops in the Farm

In general, there are two methods of planting crops: direct seeding and transplanting. Direct seeding is either by broadcast, hill or dibble, or by drill method. The hill and the drill methods are alternative options in row planting.

Direct seeding or direct sowing is a method of planting in which seeds are directly planted on the ground in the farm or any growing surface while transplanting makes use of pre-grown plants, seedlings or vegetatively propagated clones. The term transplanting is also used to refer to the practice of replanting an already established plant in one location and moving it elsewhere.

Direct seeding generally applies to large-seeded vegetables as well as in cereals and grain legumes. Transplanting is most common with small-seeded vegetables, vegetatively propagated crops, ornamental crops, fruit trees and many perennial crops. The term direct seeding is also commonly used to refer to the planting of seedpieces or underground vegetative planting materials directly into the soil.

Planting crops by broadcasting or sabog tanim, or scatter planting, commonly applies to small seeds, like rice and mungbean, that are capable of germination and sustained growth without soil cover. There is no control of plant-to-plant spacing. The seeds are simply distributed on a well prepared ground by hand or with a mechanical broadcaster.

With hand broadcasting, a volume of seeds is held by the hand and thrown with a

wide swath. Skill is important to ensure even distribution of seeds per unit ground area based on the desired seeding rate per hectare. For example, a seeding rate of 100 kg per hectare means that the seeds have to be distributed at an average of 0.01 kg or 10 g per sq meter. Assuming that the crop is rice with a weight of 1000 grains of 29 grams, this is equivalent to a seeding rate of about 345 seeds per sq meter.

Excessive seeding per unit area will mean that the prepared seeds will have been completely sown but a portion of the farm is still unplanted, and so additional seeds need to be procured. Conversely, seeding below the average will complete the planting of the entire farm with some seeds still left.

In lowland rice, the seeds are broadcasted on puddled soil or over water and allowed to germinate without covering. The broadcast method of planting crops is also common with mungbean and cowpea grown as green manure. But in upland farming, it is best to pass a tooth harrow or rake after broadcasting to cover the seeds. The soil covering will hide the seeds from seed-harvesting organisms like chicken and birds. It will also ensure that the seeds have full contact with the soil which will maximize germination and improve the chance of the seedlings to fully develop. In pasture establishment, a large herd of livestock can be released after broadcasting to press the seeds into the ground by their hooves. Dibbling is an old method of planting crops practiced by subsistence farmers in hilly lands. My late cousin used to do this on a portion of the farm in Akle, San Ildefonso, Bulacan. That part of the farm, now grown to coconut that is regularly harvested for copra, has a very steep slope with shrubs, stumps of trees, and large limestone. Plowing by carabao was impossible so that the only way to prepare the land was by slash-and-burn or kaingin system.

Slashing and burning are done during summer when the grasses are dry, and corn is planted at the start of the rainy season. With a dibbler or “panghasok” (a pointed, spear-like stem) held by one hand, he strikes the ground to make holes about 2 inches (5 cm) deep and 1-2 steps apart. As the pointed tip of the dibbler is lifted, someone else immediately drops 3-4 seeds of an indigenous, open-pollinated corn into the hole. The hole is not refilled with soil, that part is done naturally by the cascading downward movement of surface soil and fragments of rock. Between harvesting and burning, the area is fallowed.

In both the hill and drill methods of planting crops by direct seeding, there is a desired row-to-row spacing. Hills with a single or multiple number of plants are spaced uniformly within each row so that in the hill method there is always a reference to hill distance and number of plants per hill. A hill is that specific spot on the ground on which a plant or a group of plants is grown. In contrast, there is no uniform spacing between plants in the row in the drill method, but uniformity in number of plants per linear meter is intended.

The hill method of direct seeding is done by dropping seeds in holes made by a dibbler or in furrows that are more or less equidistant. But with mechanized farming, a combine furrower-planter is commonly used.

In planting corn under rainfed conditions at a population density of, for instance, 60,000 plants per hectare at 1 plant per hill in rows 70 cm apart, the farmer walks forward along a furrow and drops a seed every 23.8 cm to the bottom of the furrow. He does not

carry a measuring tool, he just estimates distances on the ground with impressive accuracy borne of long experience. To cover the seeds, he merely sweeps the ridge at either side of the furrow by one foot to push some soil toward the seed and steps thereon to press the soil on top of the seed.

The drill method of planting crops is done, either manually or mechanically, by releasing seeds continuously, as if pouring water from a bottle with a small opening. Manual drilling applies to small seeds like rice, millet, and mungbean and is usually done by hand. It can also be accomplished by placing small, roundish seeds in a bottle with a hole on the cover. The seeds are simply released by tilting and slightly shaking the bottle so that the seeds drop one after the other or in a cascade through the hole and toward the ground.

The seeds are drilled with or without furrows. In rice, drilling in puddled soil in linear direction is a modification of seed broadcasting in which plants are dispersed without plant-to-plant spacing. But in rainfed sorghum, mungbean, and other grain legumes, the seeds are always drilled at the bottom of the furrow, covered with soil by raking or by foot, and stepped on to press the soil.

Just like in the hill method of planting crops, an even distribution of drilled seeds is intended but varies with the seeding rate per hectare and row distance. With a seeding rate of 100 kg per hectare in rows 20 cm apart, the calculated average seeding rate per linear meter in the row is 2 grams. With 1000 grain weight of 29 grams for rice, this is equivalent to a seeding rate of about 70 seeds per linear meter. But if the row distance is widened to 25 cm, the average seeding rate will increase to 2.5 grams or 86-87 seeds per linear meter.

In contrast to direct seeding, transplanting is a method of planting crops in which potted plants or pre-grown seedlings or clones are planted on the ground, other growing surface, or any growing structure. Transplanting is also convenient with a few plants that can be transferred with a ball of soil around the roots. In some vegetables, it is common to prick seedlings from the seedbed and transplant them bareroot to the garden plot. In perennial species like coffee at a time when rainfall has become frequent and light is not intense, uprooted wildlings or bareroot transplants have been directly planted.

How Much Have You Learned?

Self-Check 1.1

Fill-in the blanks

1. An east-west row orientation is preferred to _____.
2. _____is the systematic apportioning of the farm area or any growing surface for crop production.
3. Single row planting of the intercrop can also be done between the rows of the_____.
4. Slashing and burning are done during _____when the grasses are dry, and corn is planted at the start of the rainy season.
5. The _____method of planting crops is also common with mungbean and cowpea grown as green manure.

6-8.The intercrop can be planted in any of the following ways**:** (6)_____**,** (7)_____**,** and (8) _____.

9-10. In general, there are two methods of planting crops: (9)_____and. (10)_____.

How Do You Apply What You Have

Show that you learned something by doing this activity

Activity Sheet 1.1

Layout Garden Plots

MATERIALS NEEDED:

Quantity	Description
2 sheets	Bond paper short
1 pc	Pencil
1 pc	Ruler

INSTRUCTIONS:

1. Put 1 inch border lines on your bond paper
2. Use the following data in making your layout
   Imagine that 1 cm on your drawing is equivalent to 1m
   A. Width= 16 m
   B. Length=19 m
   C. Planting distance
      Between row=1m
      Between hill=.5 m
3. Sketch inside the border lines your plot layout
4. Submit your output to your teacher

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

Criteria	Score			
	20	**15**	**10**	**5**
Accuracy 70%				
Presentation 20%				
Neatness 10 %				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

LEARNING OUTCOME 2

Interpret irrigation plan and design

PERFORMANCE STANDARDS

- Irrigation system plan is interpreted according to established procedures.
- Different designs of irrigation systems are enumerated according to standard procedures.

Materials

- Irrigation plan
- Bond paper
- Pencil
- References

What Do You Already Know?

Let us determine how much you already know about interpreting irrigation plan and design. Take this test.

Pretest LO 2

Enumerate the following:

(2) FUNCTIONS OF FARM IRRIGATION SYSTEMS

1. _____
2. _____

(3) ESSENTIAL FEATURES OF A PLAN

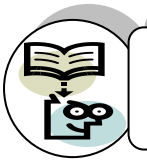
1. _____
2. _____
3. _____

(2) Types of Conventional Sprinkler Systems

1. _____
2. _____

(3) Advantages of drip or trickle irrigation

1. _____
2. _____
3. _____



What Do You Need To Know?

Read the Information Sheet 2.1 very well then find out how much you can remember and how much you learned by doing the Self-check 2.1.

Information Sheet 2.1

IRRIGATION SYSTEM PLAN AND DESIGN

Water required by crops is supplied by nature in the form of precipitation, but when it becomes scarce or its distribution does not coincide with demand peaks, it is then necessary to supply it artificially, by irrigation. Several irrigation methods are available, and the selection of one depends on factors such as water availability, crop, soil characteristics, land topography, and associated cost.

Proper design of an irrigation system requires that the pumping system precisely match to the irrigation distribution system so that the pressure and flow rate required can be efficiently provided by the pumping system. The energy required to pump water is determined by the total dynamic head (water lift, pipe friction, system pressure, etc.), the water flow rate desired and the pumping system's efficiency.

Irrigation water management involves determining when to irrigate, the amount of water to apply at each irrigation event and during each stage of plant, and operating and maintaining the irrigation system. The main management objective is to manage the production system for profit without compromising environment and in agreement with water availability. A major management activity involves irrigation scheduling or determining when and how much water to apply, considering the irrigation method and other field characteristics.

FUNCTIONS OF FARM IRRIGATION SYSTEMS

The primary function of farm irrigation systems is to supply crops with irrigation water in the quantities and at the time it is needed. Specific function includes:

1. Diverting water from the water source.
2. Conveying it to individual fields within the farm.
3. Distributing it within each field.
4. Providing a means for measuring and regulating flows.

Other functions of farm irrigation system include crop and soil cooling, protecting crops from frost damage, delaying fruit and bud development, and controlling wind erosion, providing water for seed germination, application of chemicals, and land application of wastes.

REASONS FOR AN IRRIGATION PLAN

- A project plan enables the designer to lay out the irrigation system in the most cost effective way. The plan is used to generate a material list and to evaluate the anticipated project costs.
- The plan provides step by step information on system installation. Information on crop spacing, sprinklers, pumping requirements, pipeline sizes and lengths should be included on the plan. Pertinent obstructions such as roads, trees, gas, oil, water, telephone or transmission lines must also be indicated.
- Specification, design standards and work schedules as set out on a plan form the basis of any contractual agreements between the installation contractor and the farmer.
- The plan provides a record for future reference. It can be used for overall farm planning and identifies limits of expansion potential.

ESSENTIAL FEATURES OF A PLAN

- **Topographic Data -** the field shape must be accurately drawn showing pertinent obstructions, features and elevation details.

- **Water Source Capacity -** the water supply must be clearly indicated showing location and available capacity.

- **Depending on the water source, a well log or water license must accompany the irrigation plan**. Irrigation reservoirs also require Water Management Branch licensing.

- **Soil and Crop Characteristics -** soil and crop limitations must be accounted for to reduce runoff and deep percolation by mismanagement of the irrigation system.

- **Design Parameters -** soil water holding capacity, maximum application rate and climatic data must be used to select the correct irrigation system design.

- **Design Data -** the nozzle selected, operating pressure, discharge rate and sprinkler spacing must all be shown on the plan. The irrigation interval, set time, application rate and net amount applied must also be calculated.

How Much Have You Learned?

Self-Check 2.1

Directions: Enumerate what is asked in the following statements.

(4) functions of farm irrigation systems

1. _____

2. _____
3. _____
4. _____

(6) essential features of a plan

1. _____
2. _____
3. _____
4 _____
5. _____
6. _____

Read the Information Sheet 2.2 very well then find out how much you can remember and how much you learned by doing the Self-check 2.2.

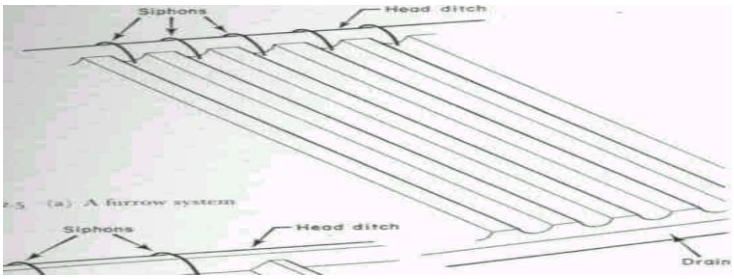
Information Sheet 2.2

DIFFERENT DESIGNS OF IRRIGATION SYSTEMS

1. SURFACE IRRIGATION- water is applied to the field in either the controlled or uncontrolled manner.

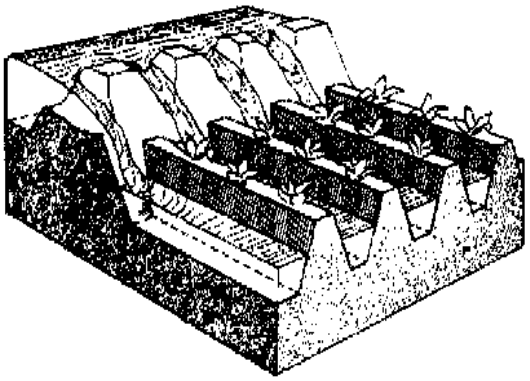
Surface irrigation consist of:

1.1 Furrow system

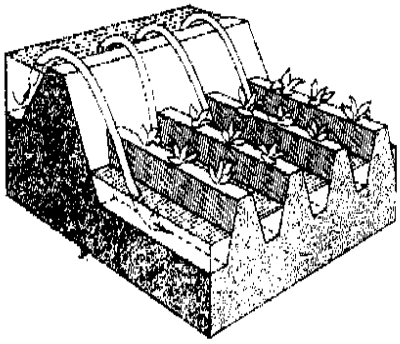


A. FURROW IRRIGATION BY CUTTING THE RIDGE

Fig. 91a. Water flows into the furrows through openings in the bank



B .FURROW IRRIGATION WITH SIPHONS



The Major Design Considerations in Surface Irrigation Include:

1. Storing the readily available moisture in the root zone, if possible;
2. Obtaining as uniform water application as possible;
3. Minimizing soil erosion by applying non-erosive streams;
4. Minimizing runoff at the end of the furrow by using a re-use system or a cut –back stream;
5. Minimizing labor requirements by having good land preparation,
6. Good design and experienced labor and
7. Facilitating use of machinery for land preparation, cultivation, furrowing, harvesting etc.

1.2 Boarder Irrigation System

1. In a border irrigation, controlled surface flooding is practiced whereby the field is divided up into strips by parallel ridges or dikes and each strip is irrigated separately by introducing water upstream and it progressively covers the entire strip.
2. Border irrigation is suited for crops that can withstand flooding for a short time e.g. wheat.
3. It can be used for all crops provided that the system is designated to provide the needed water control for irrigation of crops.
4. It is suited to soils between extremely high and very low infiltration rates.
5. In border irrigation, water is applied slowly.
6. The root zone is applied with water gradually down the field.
7. At a time, the application flow is cut-off to reduce water loses.
8. Ideally, there is no runoff and deep percolation.
9. The problem is that the time to cut off the inflow is difficult to determine.

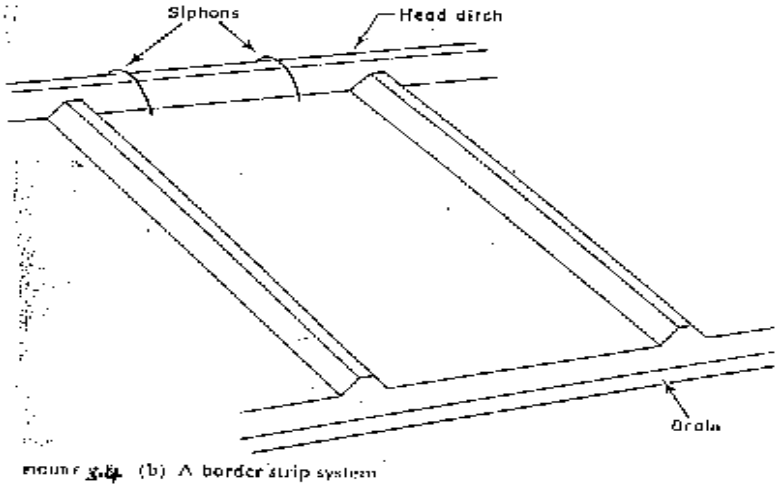
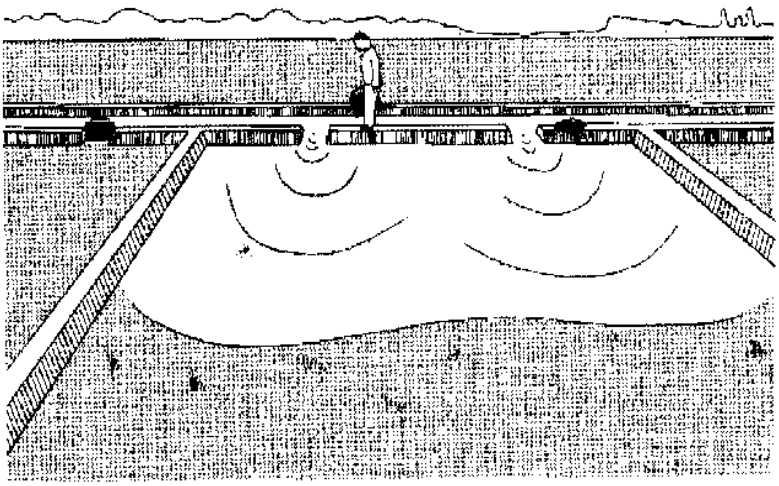


Figure 3.4 (b) A border strip system



Design Parameters of Border Irrigation System

a)Strip width: Cross slopes must be eliminated by leveling.

Since there are no furrows to restrict lateral movement, any cross slope will make water move down one side leading to poor application efficiency and possibly erosion.

-The stream size available should also be considered in choosing a strip width.

-The size should be enough to allow complete lateral spreading throughout the length of the strip.

-The width of the strip for a given water supply is a function of the length

-The strip width should be at least bigger than the size of vehicle tract for construction where applicable.

b) Strip Slope: Longitudinal slopes should be almost same as for the furrow irrigation.

c) Construction of Levees: Levees should be big enough to withstand erosion, and of sufficient height to contain the irrigation stream.

d) Selection of the Advance Stream: The maximum advance stream used should be non-erosive and therefore depends on the protection afforded by the crop cover. Clay soils are less susceptible to erosion but suffer surface panning at high water velocities. Table 3.4 gives the maximum flows recommendable for bare soils.

e) The Length of the Strip: The ideal lengths can be obtained by field tests.

1.3 Basin Irrigation System

Characteristics:

1. In basin irrigation, water is flooded in wider areas. It is ideal for irrigating rice.
2. The area is normally flat.
3. In basin irrigation, a very high stream size is introduced into the basin so that rapid movement of water is obtained.
4. Water does not infiltrate a lot initially.
5. At the end, close the water inlet to avoid water loss in the pond.
6. The opportunity time difference between the upward and the downward ends are reduced.

The size of basin is related to stream size and soil type.

Suggested basin areas for different soil types and rates of water flow

Flow rate		**Soil Type**			
		Sand	**Sandy loam**	**Clay loam**	**Clay**
l/s	**m^3 /hr**	**.....Hectares.....**			
30	108	0.02	0.06	0.12	0.20
60	216	0.04	0.12	0.24	0.40
90	324	0.06	0.18	0.36	0.60
120	432	0.08	0.24	0.48	0.80
150	540	0.10	0.30	0.60	1.00
180	648	0.12	0.36	0.72	1.20
210	756	0.14	0.42	0.84	1.40
240	864	0.16	0.48	0.96	1.60
300	1080	0.20	0.60	1.20	2.00

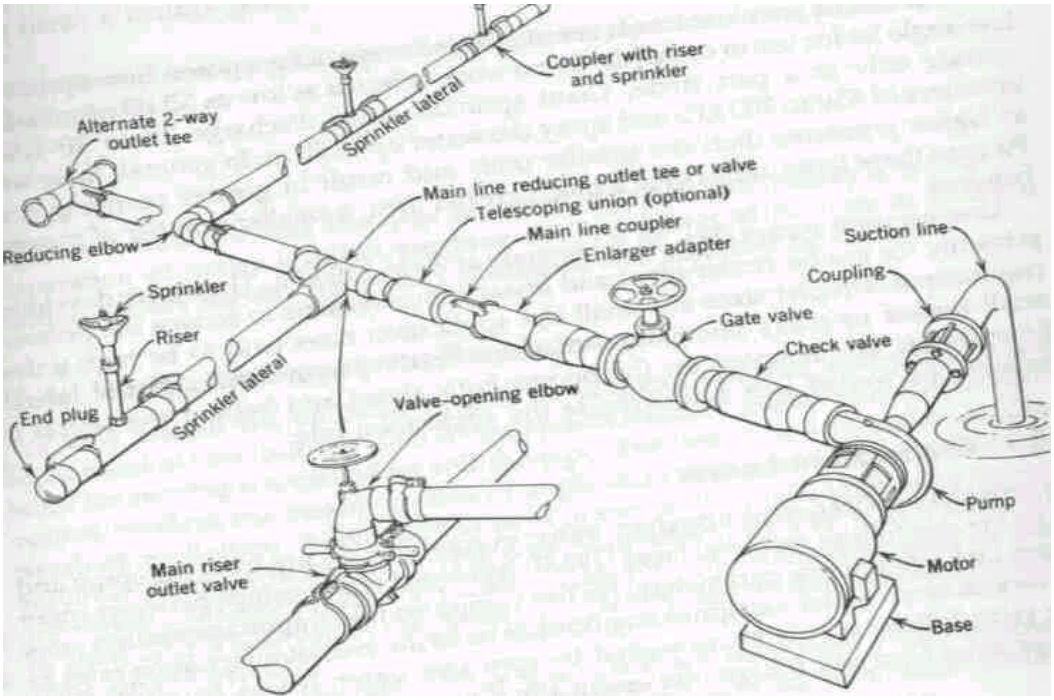
.....

Note: The size of basin for clays is 10 times that of sand as the infiltration rate for clay is low leading to higher irrigation time. The size of basin also increases as the flow rate increases. The table is only a guide and practical values from an area should be relied upon. There is the need for field evaluation.

2. SPRINKLER IRRIGATION

The sprinkler system is ideal in areas where water is scarce.
A Sprinkler system conveys water through pipes and applies it with a minimum amount of losses.
-Water is applied in form of sprays sometimes simulating natural rainfall.
-The difference is that this rainfall can be controlled in duration and intensity.
-If well planned, designed and operated, it can be used in sloping land to reduce erosion where other systems are not possible.

Components of a Sprinkler Irrigation System



Types of Conventional Sprinkler Systems

a) Fully portable system: The laterals, mains, sub-mains and the pumping plant are all portable.

The system is designed to be moved from one field to another or other pumping sites that are in the same field.

b) Semi-portable system: Water source and pumping plant are fixed in locations. Other components can be moved.

The system cannot be moved from field to field or from farm to farm except when more than one fixed pumping plant is used.

c) Fully permanent system: Permanent laterals, mains, sub-mains as well as fixed pumping plant. Sometimes laterals and mainlines may be buried. The sprinkler may

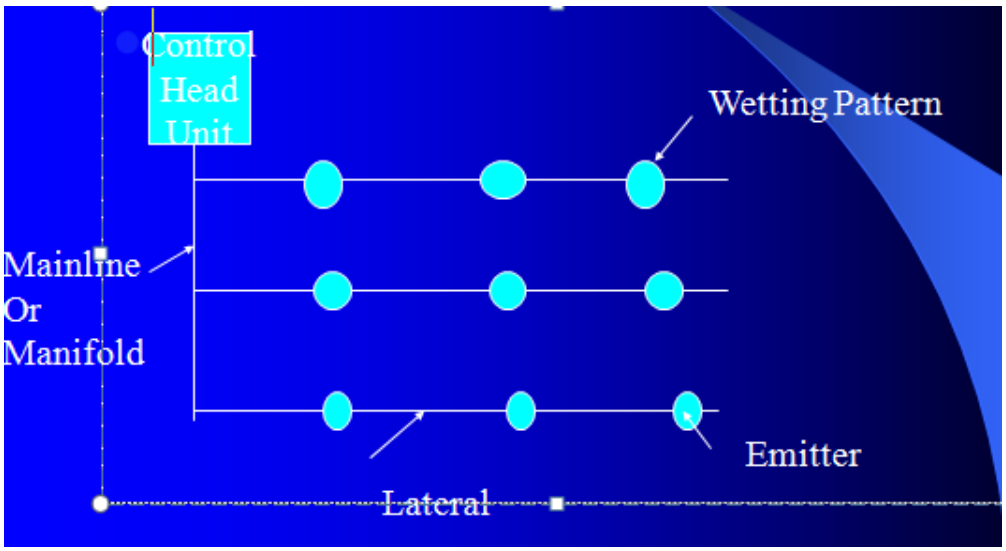
be permanently located or moved along the lateral. It can be used on permanent irrigation fields and for relatively high value crops e.g. Orchards and vineyards. Labor savings throughout the life of the system may later offset high installation cost.

3. **DRIP OR TRICKLE IRRIGATION**

Advantages:

a. Water is applied directly to the crop ie. entire field is not wetted.
b. Water is conserved
c. Weeds are controlled because only the places getting water can grow weeds.
d. There is a low pressure system.
e. There is a slow rate of water application somewhat matching the consumptive use. Application rate can be as low as 1 – 12 l/hr.
f. There is reduced evaporation, only potential transpiration is considered.
g.There is no need for a drainage system.

Components of a Drip Irrigation System



How Much Have You Learned?

Self-Check 2.2

Directions: Enumerate what is asked in the following statements:

(3) Types of Conventional Sprinkler Systems

1. _____
2. _____
3. _____

(7) Advantages of drip or trickle irrigation

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

How Do You Apply What You Have

Show that you have learned something by doing this activity

Activity Sheet 2.1

SKETCH IRRIGATION PLAN

MATERIALS NEEDED:

Quantity	Description
2 sheets	Bond paper short
1 pc	Pencil
1 pc	Ruler

INSTRUCTIONS:

1. After knowing different irrigation designs, select 1 design applicable in your area.
2. Using the materials above sketch the irrigation design applicable in your locality.
3. Explain, why did you considered this design on another sheet of bond paper
4. Submit your output to your teacher after 1 day
5. Your teacher will ask you to present your work in front of your classmates
6. Save your work for the next activity (activity 2.2)

Activity Sheet 2.2

CREATE MINIATURE IRRIGATION CANAL

MATERIALS NEEDED:

Quantity	Description
1 pc	Illustration board
10 bar	Activity clay

INSTRUCTIONS:

1. Your teacher will divide the class into groups (5 members in a group)
2. From your activity sheet 2.1. Select the best work among your group members.
3. Decide which work will serve as your model in creating your miniature irrigation canal.
4. You will be given one hour to finish your group activity.
5. Submit your output when it is already completed.

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

For Activity 2.1

Criteria	Score			
	20	15	10	5
Content 50%				
Applicability 20%				
Presentation 20%				
Neatness 10 %				

For Activity 2.2

Criteria	Score			
	20	15	10	5
Accuracy 50%				
Design 20%				
Presentation 20%				
Neatness 10 %				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

Congratulations! You did a great job! Rest and relax a while then move on to the next lesson. Good luck!

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LO2

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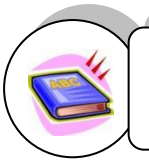
LESSON 4

Apply Safety Measures in Farm Operations

LEARNING OUTCOMES:

At the end of this Lesson you are expected to do the following:

LO 1. apply appropriate safety measures in farm operations; and
LO 2. safekeep/dispose materials and outfit.



Definition of Terms

Cleaning- the act or process of removing dirt from tools, containers and farm facilities.

Disinfection chemicals- refers to the chemical used in cleaning which has the ability to kill microorganisms especially pathogens.

Health-a sound state of the body and mind of the workers that enable him or her to perform the job normally

Occupational safety- the practices related to production and work process

Safety-the physical or environmental conditions of work which comply with the prescribed Occupational Health Safety (OHS) standards and which allow the workers to perform his or her job without or within acceptable exposure to hazards

Sharpening- the process of thinning the edge of the tools like knife, pruning shears, hedge shears, etc.

LEARNING OUTCOME 1

Apply appropriate safety measures while working in the farm

PERFORMANCE STANDARDS

- Safety measures are applied based on work requirement and farm procedures.
- Tools and materials are utilized in accordance with specification and procedures.
- Outfit is worn in accordance with farm requirements.
- Shelf life and or expiration of materials are effectively checked against manufacturer's specifications.
- Hazards in the workplace are identified and reported in line with farm guidelines
- Emergency and accidents are responded to and prevented.

Materials

- PPE
- References

What Do You Already Know?

Let us determine how much you already know about safety measures while working in the farm. Take this test.

Pretest LO 1

MULTIPLE CHOICE: Choose the best answer

1. It is the potential for harm, or adverse effect on an employee's health. Anything which may cause injury or ill health to anyone at or near a workplace
   a. .Chemicals
   b. Exposure
   c. Risk
   d. Hazard

2. It is the likelihood that a hazard will cause injury or ill health to anyone at or near a workplace.
   a. Risk
   b. Exposure
   c. Hazard
   d. .Chemicals
3. This occurs when a person comes into contact with a hazard.
   a. Risk
   b. Exposure
   c.. Hazard
   d. . Chemicals
4. This includes floors, stairs, work platforms, steps, ladders, fire, falling objects, slippery surfaces, manual handling (lifting, pushing, pulling), excessively loud and prolonged noise, vibration, heat and cold, radiation, poor lighting, ventilation, air quality.
   a. Chemicals
   b. Mechanical and/or electrical
   c. Psychosocial environment
   d. Physical
5. It includes electricity, machinery, equipment, pressure vessels, dangerous goods, fork lifts, cranes, hoists
   a. Mechanical and/or electrical
   b. Chemicals
   c. Biological
   d. Psychosocial environment
6. It includes chemical substances such as acids or poisons and those that could lead to fire or explosion, like pesticides, herbicides, cleaning agents, dusts and fumes from various processes such as welding
   a. Chemicals
   b. Psychosocial environment

c. Mechanical and/or electrical
d. Biological

7. It includes bacteria, viruses, mold, mildew, insects, vermin, animals
   a. Biological
   b. Chemicals
   c. Mechanical and/or electrical
   d. Psychosocial environment
8. It includes workplace stressors arising from a variety of sources.
   a. Psychosocial environment
   b. Biological
   c. .Chemicals
   d. Mechanical and/or electrical
9. **I**t is the physical or environmental conditions of work which comply with the prescribed Occupational Health Safety (OHS) standards and which allow the workers to perform his or her job without or within acceptable exposure to hazards.
   a. Safety
   b. Biological
   c. Psychosocial environment
   d. Chemicals
10. **I**t is the practices related to production and work process
    a. Occupational safety
    b. Safety
    c. Psychosocial environment
    d. Biological

What Do You Need To Know?

Read the Information Sheet 1.1 very well then find out how much you can remember and how much you learned by doing the Self-check 1.1.

Information Sheet 1.1

APPLY APPROPRIATE SAFETY MEASURES WHILE WORKING IN FARM

Many hazards are present in the farm. If the farmers are not aware of these hazards these may cause injury to their body or may cause diseases and even death. Farmer should always apply appropriate safety measures while working in the farm. In this lesson the students with the guidance and supervision of their teacher should identify farm works that involve the use of chemicals and hazardous tools and equipment; determine the uses of Personal Protective Equipment (PPE) and determine farm emergency procedures regarding

safety working environment.

HAZARD, RISK AND EXPOSURE IN THE FARM

Agricultural crop production deals with a lot of activities to be done in the different workplace. While performing these activities we expose ourselves to a lot of risk. Workplace hazard is a major cause of accident, injury, or harm to a worker who performs such task. These hazards should be the major concern of all who are involved in a certain job or work.

It is important to distinguish hazard, risk and exposure when undertaking risk management.

- *Hazard* is the potential for harm, or adverse effect on an employee's health. Anything which may cause injury or ill health to anyone at or near a workplace is a hazard.
- *Risk* is the likelihood that a hazard will cause injury or ill health to anyone at or near a workplace. The level of risk increases with the severity of the hazard and the duration and frequency of exposure.
- *Exposure* occurs when a person comes into contact with a hazard.

Types of Hazard

Hazards are classified into five different types. They are:

1. **Physical** - includes floors, stairs, work platforms, steps, ladders, fire, falling objects, slippery surfaces, manual handling (lifting, pushing, pulling), excessively loud and prolonged noise, vibration, heat and cold, radiation, poor lighting, ventilation, air quality
2. **Mechanical and/or electrical** - includes electricity, machinery, equipment, pressure vessels, dangerous goods, fork lifts, cranes, hoists
3. **Chemical** - includes chemical substances such as acids or poisons and those that could lead to fire or explosion, like pesticides, herbicides, cleaning agents, dusts and fumes from various processes such as welding
4. **Biological** - includes bacteria, viruses, mold, mildew, insects, vermin, animals
5. **Psychosocial environment** - includes workplace stressors arising from a variety of sources.

Farm emergency procedures regarding safety working environment

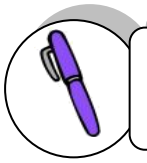
1. Identify the potential emergencies.
   The emergencies that may occur on a crop production farm could include:

   a. Fire
   b. Flood
   c. Typhoon
   d. machinery entrapment
   e. electrical shock
   f. snake or spider bite
   g. chemical exposure
   h. injuries
   i. illness and
   j. accidents
2. Provide emergency facilities appropriate for the sorts of emergencies that might occur on

the farm (e.g. deluge showers, eye washes, firefighting equipment, first aid kits).
3. Make sure that the correct equipment is available to contain and handle any chemical or other dangerous materials spills that might happen.
4. To help minimize the risk of personal injury or property damage in the event of an emergency, people working on and visiting the farm need to know and understand the emergency procedures and their responsibilities.
5. Instruct everyone working on the farm in the emergency response procedures
6. Everyone should know the location of fire alarms, fire extinguishers and first aid kits; how and where to contact emergency services; and where to safely assemble in the event of an emergency.

The following factors may increase risk of injury or illness for farm workers:

1. **Age** – injury rates are highest among children age 15 and under and adults over 65.
2. **Equipment and Machinery** – most farm accidents and fatalities involve machinery. Proper machine guarding and doing equipment maintenance according to manufacturers' recommendations can help prevent accidents.



How Much Have You Learned?

Self-Check 1.1

IDENTIFICATION

1. _____is the potential for harm, or adverse effect on an employee's health.
2. _____ is the likelihood that a hazard will cause injury or ill health to anyone at or near a workplace. The level of risk increases with the severity of the hazard and the duration and frequency of exposure.
3. _____occurs when a person comes into contact with a hazard.
4. _____includes floors, stairs, work platforms, steps, ladders, fire, falling objects, slippery surfaces, manual handling (lifting, pushing, pulling), excessively loud and prolonged noise, vibration, heat and cold, radiation, poor lighting, ventilation, air quality
5. _____ includes electricity, machinery, equipment, pressure vessels, dangerous goods, fork lifts, cranes, hoists
6. _____ includes chemical substances such as acids or poisons and those that could lead to fire or explosion, like pesticides, herbicides, cleaning agents, dusts and fumes from various processes such as welding
7. _____ includes bacteria, viruses, mold, mildew, insects, vermin, animals
8. _____ includes workplace stressors arising from a variety of sources.
9. _____the physical or environmental conditions of work which comply with the prescribed Occupational Health Safety (OHS) standards and which allow the workers to perform his or her job without or within acceptable exposure to hazards.
10. _____the practices related to production and work process

What Do You Need To Know?

Read the Information Sheet 1.2 very well then find out how much you can remember and how much you learned by doing the Self-check 1.2.

Information Sheet 1.2

FARM WORKS THAT INVOLVE USING CHEMICALS AND HAZARDOUS TOOLS AND EQUIPMENT

1. Spraying Chemicals

Many different chemicals are used on a farm including pesticides. These chemicals are used to fertilize and control pests such as insects, weeds, mollusk, etc. Most of these chemicals are applied by spraying

Examples of chemical hazards:

- Spraying in a strong wind and the spray drifting over a dam or the farm house.
- Washing spray equipment and the water running into open drains, collecting in puddles, or running into stockyards or dams.
- Containers or chemicals left lying around. Empty containers lying in a heap.

Some ways you can reduce the risk of hazards from chemicals are:

- Use personal protective equipment such as respirators, waterproof clothes, rubber gloves and waterproof footwear.
- Make sure chemicals are safely stored and cupboards locked.
- Never spray chemicals on days when there is a high wind.
- Know first aid procedures.
- Keep a list of all hazardous substances used on the farm.

Safe use of chemicals

- Consider if a chemical substance is really needed.
- Eliminate a hazardous substance, or if that is not possible, substitute it with less hazardous one.
- Safe work practices or personal protective equipment should be used
- Keep records of farm chemicals.

2. Land Preparation Using Tractor

a. Victims fall off or are thrown from the tractor
b. Run over by either the tractor or an implement being towed, or both.
c. Overturn

Safety Reminders

- Tractors are not passenger vehicles.
- Use seat belts when driving tractors.
- ROPS will protect the operator from serious injuries.

Causes of run over accidents

- Sudden stops
- Driving over holes, stumps and debris, or a sharp turn

How to prevent runover

- Never allow riders on tractors.
- Discuss with family members and farm workers the potential risks of riding tractor.
- It's also helpful to post 'no riders' decals on all tractors to remind others about the policy.
- Use or provide other vehicles that allow passengers, such as trucks or cars, when transportation is needed to fields or remote work sites.

Personal Protective Equipment (PPE)

Personal protective equipment (PPE) can reduce the number and severity of farm work related injuries and illnesses. Personal protective equipment not only helps protect people but also improves productivity and profits. Farmers and ranchers can share in these benefits by using the appropriate protective equipment for themselves, family members and employees when the job and its potential hazards call for it.

	Protect your head with a hard hat when performing construction work, trimming trees, repairing machinery, and doing other jobs with head injury risks. Use a sun safety hat (one with a wide brim and neck protection) to assist in the prevention of skin cancer.

	Protect your vision with appropriate safety eyewear (safety glasses, goggles, face-shields) when applying pesticides, fertilizers, working in the shop, or in heavy dust conditions.
	Protect your hearing with acoustic earmuffs or plugs when operating noisy equipment such as grain dryers, feed grinders, older tractors, chain saws, etc.
	Protect your lungs with the correct respiratory equipment (dust masks, cartridge respirators, gas masks, air pacts) when working in dusty or moldy conditions, spray painting, applying chemicals, working in bins, tanks, silos, and manure storage places.

How Much Have You Learned?

Self-Check 1.2

Fill-in the blanks:

1. _____ can reduce the number and severity of farm work related injuries and illnesses.

2-4 Protect your head with a hard hat when performing 2._____, 3._____,4._____, with head injury risks.

Use a sun safety hat (one with a wide brim and neck protection) to assist in the prevention of 5._____.

6-8 Protect your vision with appropriate safety eyewear (6._____, 7_____, 8._____) when applying pesticides, fertilizers, working in the shop, or in heavy dust conditions

9-10 Protect your hearing with acoustic earmuffs or plugs when operating noisy equipment such as 9._____, 10._____, older tractors, chain saws, etc.

How Do You Apply What You Have

Show that you have learned something by doing this activity

Activity Sheet 1.1

CONDUCT HAZARD REPORT

MATERIALS NEEDED:

Quantity	Description
2 sheets	Bond paper short
1 pc	Pencil/Ballpen

INSTRUCTIONS:

1. Visit farm near your school or home
2. Observe the surroundings
3. List all the possible hazard observed
4. Classify these hazards
5. Identify persons who are at risk with this hazards
6. Suggest all possible solution to reduce or eliminate the risk
7. Report your findings to your teacher

Activity Sheet 1.2

WEAR APPROPRIATE PPE

MATERIALS NEEDED:

Quantity	Description
1 pc	Hard hat
1 pc	Facemask
1 pc	Footwear
1 pc	Goggles
1 pc	Earmuffs
2 sheets	Bond paper
1 pc	1 pencil or ballpen

INSTRUCTIONS:

1. PPE will be prepared by your teacher ahead of this activity
2. The teacher will give specific farm activities, based on this farm activities you will identify and wear the necessary PPE
3. You will demonstrate the farm activities given by your teacher through action or body language.
4. After the specific farm activities. Remove the PPE from your body and write the reasons why you need to wear that particular PPE when performing that task.

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

For Activity 1.1

Criteria	Score			
	20	15	10	5
Potential hazard are properly identified				
Report is properly made				
Suggestions are made to reduce the risk				
Potential victims are properly identified				

For Activity 1.2

Criteria	Score			
	20	15	10	5
Identification and selection of correct PPE				
Reenactment of farm activities				
Written report				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

LEARNING OUTCOME 2

- **Safekeep/dispose tools, materials and outfit**

PERFORMANCE STANDARDS

- Used tools and outfit are cleaned stored in line with farm procedure.
- Unused materials are labeled and stored according to manufacturers recommendation and farm requirements.
- Waste materials are disposed according to manufacturers, government and farm requirements.

Materials/Resources

- Cleaning tools and supplies
- Ppe
- References

What Do You Already Know?

Let us determine how much you already know about cleaning of tools, materials and outfit. Take this test.

Pretest LO 2

Enumerate the following:

(2) Tips in cleaning equipments, tools and garbage cans:

_____

_____

(2) Tips in cleaning areas for handling and storing fresh produce:

_____

_____

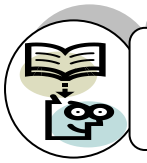
(2) Tips in cleaning hygienic facilities:

_____

_____

(4) Environmental laws

_____
_____
_____
_____



What Do You Need To Know?

Read the Information Sheet 2.1 very well then find out how much you can remember and how much you learned by doing the Self-check 2.1

Information Sheet 2.1

Cleaning, Storing and Waste Management

Protect Tools from the Elements

Blades such as electric hedge trimmer blades, hoe, shovel, and other metal surfaces can be sprayed with lubricant oil. Spray the blades then turn them on to make sure oil works into all areas. All electrical and petrol gardening equipment need to be covered over with a blanket or sheet if kept in the shed. This will prevent dust and dirt getting to them.

General Cleaning Procedures:

The farmer and/or farm workers responsible for cleaning must adhere as much as possible to the following procedures:

- Be properly trained on the cleaning procedures
- Develop a cleaning program and schedule according to the recommended frequency and the cleaning program should be monitored to ensure its effectiveness.
- Cleaning must not take place while fresh vegetables are being harvested, packed, handled and stored.
- Water that is used for cleaning must be safe.
- The cleaning of equipment, tools and containers must take place in a designated area away from field and the storage of agricultural inputs and fresh vegetables.
- When using cleaning and disinfection chemicals, the farmer and/or farm workers must become familiar with the instruction use of these products.
- Strictly adhere to all precautionary statements and mixing instructions.
- Protect equipment, tools, containers and fresh vegetables when working with any chemicals.

Cleaning re-usable containers:

The farmer and/or farm workers responsible for cleaning re-usable containers must adhere as much as possible to the following procedures:

- Remove as much as possible plant debris, soil and residues of any kind, use a brush or appropriate tool when necessary.
- Inspect containers for physical damage which might injure, spoil and contaminate fresh vegetables, if found, repair them.
- Inspect containers for any missed plant debris, soil and residues, if found, re-clean.
- If cleaning and/or disinfection chemicals are used, follow label instructions for mixing.
- Rinse containers with clean water.
- When possible, containers should be placed under the full sun for rapid drying.
- Store re-usable containers properly to avoid contamination.

Cleaning equipment, tools and garbage cans:

The farmer and/or farm workers responsible for cleaning the equipment (e.g. tables, racks, plastic sheet, etc.), tools (e.g. secateurs, knifes, brushes, etc.) and garbage cans must adhere as much as possible to the following procedures:

- Remove as much as possible plant debris, soil and residues of any kind, use a brush or another appropriate tool when necessary.
- Inspect equipment for physical damage which might injure, spoil and contaminate fresh vegetables, if found, repair them.
- Inspect equipment, tools and garbage cans for any missed plant debris, soil and residues, if found, clean again.
- If cleaning and/or disinfection chemicals are used, follow label instructions for mixing.
- As required, apply cleaning materials such as detergent and/or disinfection chemicals, and ensure that no spots are missed.
- Rinse with safe water, if there are parts of the equipment that cannot be rinsed with water, use a clean wet towel and follow the same procedures for cleaning.
- Ensure that small equipment and tools do not touch the ground floor after the cleaning procedures.
- When possible place in the full sun for rapid drying.
- Store equipment and tools properly to avoid contamination.

Cleaning areas for handling and storing fresh produce:

The farmer and/or farm workers responsible for cleaning these areas must adhere as much as possible to the following procedures:

- Unplug any electrical equipment and if possible, cover with plastic electrical motors, electrical boxes, connections, light fixtures, etc. do not use packaging materials for this task.
- Remove trash and any accumulated plant debris from the floors.
- Using low pressure water to:
  Rinse the entire ceiling infrastructure and light fixtures to remove any dust and soil build up.
  Rinse walls, windows and doors from the top downward
  Rinse the entire floor surface to remove any soil build up. Be careful not to splash water onto the equipment.

- If necessary, scrub areas with brush and cleaning materials such as detergent, and ensure that no spots are missed.
- After scrubbing areas with cleaning materials, rinse surface areas as described previously wash out drains; be careful of not splashing water onto equipments.
- If cleaning and/or disinfection chemicals are used, follow label instructions for mixing.

Cleaning hygienic facilities:

The farmer and/or farm workers responsible for cleaning hygienic facilities must adhere as much as possible to the following procedures:

- Pick up trash from the floors and put in trash can.
- By using the proper detergent, clean toilets, sinks and any other fixtures.
- Using low pressure water, rinse the entire floor surface to remove any soil build up.
- If cleaning and/or disinfection chemicals are used, follow label instructions for mixing.
- As required, apply cleaning materials or disinfection chemicals to entire floor surface area, scrub areas with brush if needed, and ensure that no spots are missed.
- Rinse floor and drains.
- Remove excess water and allow drying out at room temperature.
- Ensure that hygienic facilities have enough toilet paper, soap and disposable towel.

Technique in storing chemicals

Chemicals are used on farms for a variety of purposes. The safe management of chemicals requires access to information and responsible action. Manufacturers, suppliers and users of farm chemicals all have an important role to play. Chemical substances present different types of risks to people's health, safety and the environment. For this reason there are different laws controlling them. The purpose of these laws is to ensure that chemicals are used safely and efficiently so that risks to human health, the environment and damage to property are minimized.

Safe Management of chemicals involves:

- correct labeling and packaging;
- provision of material safety data sheets (MSDS);
- safe transport, storage, use and disposal of substances.

Labeling and Packaging of Chemicals

Chemicals must be supplied in packages that are correctly labeled and suitable for the substance. Information provided on the label will depend on the type of substance and the risks associated with it. Items to look for are:

1. Signal words such as 'CAUTION', 'POISON' or 'DANGEROUS POISON', used for scheduled poisons – a signal word alerts users to the possibility of poisoning if the substance is swallowed, inhaled or absorbed through the skin.
2. The Dangerous Goods (ADG) diamond if there is an immediate risk to health or safety e.g. flammable liquids.
3. Risk phrases describing the type of health effects e.g. 'irritating the skin', and safety phrases stating precautions for safe handling, storage, spills, disposal and fire e.g. 'keep away from combustible material'

Ensure that containers remain labeled

Farmers must ensure that the original labels remain on containers of substances. If a substance is poured into a second container such as a spray tank then that container must be labeled with the product name and appropriate risk and safety phrases. These can generally be copied from the parent container. Labeling is not necessary if a substance is used immediately and its container is thoroughly cleaned.

There are good reasons for ensuring that proper containers and appropriate labels are used, including:

- Using food containers to store poisons can result in poisoning due to accidental swallowing.
- Insurance companies may question liability if something goes wrong and an unlabeled container has been the cause of an incident.
- Produce cannot be exported if maximum residue limits are exceeded labels provide advice on permitted use and withholding periods for agricultural and veterinary chemicals.

Material Safety Data Sheets

Material safety data sheets (MSDS) must be produced by the manufacturer or importer of hazardous substance.

The MSDS is not just a piece of paper. It provides important and useful advice about what is in the product, its health effects, safe use and handling, storage, disposal, first aid and emergency operation. Farmers must obtain the MSDS from their supplier and keep them in a register where they are available to people who could be exposed to the hazardous substance.

The register is a collection of the MSDS and other information which can be kept in a folder, filing cabinet or other practical system.

The register can be kept in the house, workplace or the chemical store, so long as it remains accessible to emergency service personnel and any employees who may be exposed to hazardous substances.

Storage and Transport of Chemicals

Safe storage of farm chemicals is needed to protect them from the elements, restrict access to them, prevent contamination of the environment, food or livestock and ensure separation from other incompatible chemicals. Arrangements must be in place to contain any spillage of the chemical.

After considering the potential risk to people's health or to the environment, a farmer might decide that a locked shed with a roof and concrete floor, which is bounded to contain any spills, is the best way to provide safe storage.

Remember, you should never store oxidizing agents with fuels. That is – never store substances labeled yellow diamond with a red diamond.

Safe transport of farm chemicals depends on what the substance is, how much there

is, where it is to be transported and what else is to be transported with it. In general, small quantities (less than 250 liters) can be transported on vehicle provided that the container is properly secured and safe from spillage.

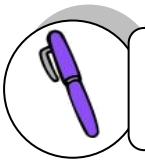
Disposal of Farm Chemicals

Empty farm chemical containers and unwanted chemicals need to be disposed of properly. Prior to disposal of empty containers, wash the container out three times and use the rinse water to dilute further batches of the chemical to working strength.

To wash a container you do not need to fill it each time. If you only have six liters of water, it is more efficient to use three washes of two liters each, than it is to rinse once with the full six liters.

ENVIRONMENTAL LAWS

Presidential Decree (PD) 1152, "the Philippine Environmental Code," which took effect in 1977, provides a basis for an integrated waste management regulation starting from waste source to methods of disposal. PD 1152 has further mandated specific guidelines to manage municipal wastes (solid and liquid), sanitary landfill and incineration, and disposal sites in the Philippines. In 1990, the Philippine Congress enacted the Toxic Substances, Hazardous and Nuclear Wastes Control Act, commonly known as Republic Act (RA) 6969, a law designed to respond to increasing problems associated with toxic chemicals and hazardous and nuclear wastes. RA 6969 mandates control and management of import, manufacture, process, distribution, use, transport, treatment, and disposal of toxic substances and hazardous and nuclear wastes in the country. The Act seeks to protect public health and the environment from unreasonable risks posed by these substances in the Philippines. Apart from the basic policy rules and regulations of RA 6969, hazardous waste management must also comply with the requirements of other specific environmental laws, such as PD 984 (Pollution Control Law), PD 1586 (Environmental Impact Assessment System Law), RA 8749 (Clean Air Act) and RA 9003 (Ecological Solid Waste Management Act) and their implementing rules and regulations.



How Much Have You Learned?

Self-Check 2.1

ENUMERATION: Enumerate following questions.

(2) Tips in cleaning equipments, tools and garbage cans:
(2) Tips in cleaning areas for handling and storing fresh produce:
(2) Tips in cleaning hygienic facilities:
(5) Environmental laws

How Do You Apply What You Have

Show that you learned something by doing this activity

Activity Sheet 2.1

MAKE POSTER ON PROPER WASTE DISPOSAL

MATERIALS NEEDED:

Quantity	Description
1 pc	White cartolina
1 pc	Pencil
1 pc	Ruler
1 set	Crayon

INSTRUCTIONS:

1. Prepare the needed materials
2. You learned on the information sheet 2.1, the proper way of disposing waste and the government laws regarding this. Imagine you are a farmer and you need to dispose your farm waste, what will you do?
3. Answer question in the previous number by drawing or illustration
4 .Submit your work after 1 day to your teacher for evaluation

Activity Sheet 2.2

SLOGAN MAKING CONTEST

MATERIALS NEEDED:

Quantity	Description
2 sheets	Bond paper
1 pc	Pentel pen/ Marker

INSTRUCTIONS:

1Prepare the materials needed
2Think of a slogan on the proper use of tools and equipment.
3.The slogan may be express using local dialect
4You will be given 20 minutes to prepare your slogan
5.Submit your output when it is already complete
6.The teacher will select the best slogan and will receive additional points for this activity

How Well Did You Perform?

Find out by accomplishing the Scoring Rubric honestly and sincerely. Remember it is your learning at stake!

While performing the activity it is important that you to assess your performance following the criteria below:

For Activity 2.1

Criteria	Score			
	20	15	10	5
Content and Message 70%				
Creativity 20%				
Neatness 10 %				

For Activity 2.1

Criteria	Score			
	20	15	10	5
Relevance 60%				
Rhyme 20%				
Presentation 10%				
Neatness 10 %				

Interpretation of Scores:

16 – 20 – Excellent output
11 – 15 – Very good
6 – 10 – Fair output
5 and below – Poor output

Congratulations! You did a great job!

REFERENCES

LO1

- CBLM Horticulture
- http://www.safework.sa.gov.au/contentPages/docs/empFarmChemicals.pdf
- http://www.necasag.org/pdf/Personal_protective_equipment_updated.pdf
- http://www.ashinstitute.org/PDFS/ASHI_BasicFirstAid_SG_Sample.pdf
- http://firstaid.about.com/od/cpr/ss/abcs.htm
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LO2

- http://hostedmedia.reimanpub.com/TFH/Step-By Step/display/FH00MAR_SHARPT_06.JPGhttp://www.thucphamantoanviet.vn/a-aproducers-and-traders/a-egetables-fruits-tea/a-quality-assurance-systems/1200_-_ffv_-_gap_-_sop_for_cleaning_equipments_tools_containers_handling_and_storag

ANSWER KEYS

<table>
<tr><th colspan="2">LESSON 1: USE FARM TOOLS AND EQUIPMENT</th></tr>
<tr><td>ANSWER KEY (PRE-TEST LO1)

1.b
2.b
3.d
4.d
5.a
6.b
7.b
8.b
9.d
10.a</td><td>ANSWER KEY (SELF CHECK #1.1)

1. C
2 .D
3. I
4. J
5. E
6. F
7. H
8. A
9.B
10. G</td></tr>
<tr><td>ANSWER KEY (PRE-TEST LO2)

1.These are machineries used in horticultural operations especially in vegetable production. They are used in land preparation and in transporting farm inputs and products. These equipment need a highly skilled operator to use.
2.A. Hand tractor is used to pull a plow and harrow in preparing a large area of land.
B. Four wheel tractor is used to pull disc plow and disc harrow in preparing much bigger area of land.
C. Water pumps are used to draw irrigation water from a source.</td><td>ANSWER KEY (SELF-CHECK 2.1)

1. These are machineries used in horticultural operations especially in vegetable production. They are used in land preparation and in transporting farm inputs and products. These equipment need a highly skilled operator to use.
2. Answer:
A. Hand tractor is used to pull a plow and harrow in preparing a large area of land.
B. Four wheel tractor is used to pull disc plow and disc harrow in preparing much bigger area of land.
C. Water pumps are used to draw irrigation water from a source.</td></tr>
<tr><td>ANSWER KEY (PRE-TEST LO3)

1. False
2. True
3. True
4. True
5. True
6. True
7. True
8. False
9. True
10. True</td><td>ANSWER KEY (SELF CHECK 3.1)

1. TRUE
2. TRUE
3. TRUE
4. TRUE
5. TRUE
6. TRUE
7. TRUE
8. TRUE
9. TRUE
10 .TRUE</td></tr>
</table>

LESSON 2: PERFORM ESTIMATION AND BASIC CALCULATION	
ANSWER KEY (PRE-TEST LO1) 1. Seeds 2. Fertilizer 3. Weeding 4. Plowing using animal 5. Plowing using tractor 6. Harrowing using hand tractor 7. Pulling of seedlings 8. Drying corn 9. Fertilizer application 10. Transplanting	**ANSWER KEY SELF-CHECK 1.1** 1. Seeds 2. Fertilizer 3. Insecticides or Pesticides 4. Clearing of the land 5. Plowing 6. Harrowing 7. Mulching 8. Irrigation 9. Weeding 10. Harvesting
ANSWER KEY (PRE-TEST LO2) CONVERSION 1. 100 cm 2. 4m 3. 5000 m 4. 100,000cm 5. 2 km AREA 1. 36 ha 2. 10 ha 3. 6 ha 4. 12 ha 5. 30 ha PERCENTAGE 1. 6 plants 2. 4.2ha 3. 72farmers 4. 100pesos 5. 5seeds	**ANSWER KEY SELF-CHECK 2.1** 1. 100 cm 2. 4m 3. 5000 m 4. 100,000cm 5. 2 km AREA 6. 36 ha 7. 10 ha 8. 6 ha 9. 12 ha 10. 30 ha PERCENTAGE 1. 6 plants 2. 4.2ha 3. 72farmers 4. 100pesos 5. 5seeds
LESSON 3: INTERPRET PLANS AND DRAWINGS	
ANSWER KEY (PRE-TEST LO1) 1. 42 sq.m 2. 6 rows 3. 5 plants 4. 30 plants 5. 1 meter 6. 1 meter 7. 5 plants 8. 7 m 9. 6 m 15 plants	**ANSWER KEY (SELF-CHECK 1.1)** 1. Maximize light absorption 2. Spatial arrangement 3. Maincrop 4. Summer 5. Broadcast 6. Within the rows of the maincrop 7. Between the rows of the maincrop 8. In replacement series 9. Direct planting Transplanting

ANSWER KEY (PRE-TEST LO2)	ANSWER KEY (2.1)
FUNCTIONS OF FARM IRRIGATION SYSTEMS 1. Diverting water from the water source. 2. Conveying it to individual fields within the farm. 3. Distributing it within each field. 4. Providing a means for measuring and regulating flows.	**(4)FUNCTIONS OF FARM IRRIGATION SYSTEMS** 1. Diverting water from the water source. 2. Conveying it to individual fields within the farm. 3. Distributing it within each field. 4. Providing a means for measuring and regulating flows.
ESSENTIAL FEATURES OF A PLAN 1. Topographic Data 2. Water Source Capacity 3. Depending on the water source, a well log or water license must accompany the irrigation plan. 4 Soil and Crop Characteristics 5. Design Parameters 6. Design Data	**(6)ESSENTIAL FEATURES OF A PLAN** 1. Topographic Data 2. Water Source Capacity 3. Depending on the water source, a well log or water license must accompany the irrigation plan. 4 Soil and Crop Characteristics 5. Design Parameters 6. Design Data
TYPES OF CONVENTIONAL SPRINKLER SYSTEMS 1. Fully portable system 2. Semi-portable system 3. Fully permanent system	**(3) Types of Conventional Sprinkler Systems** 1. Fully portable system 2. Semi-portable system 3. Fully permanent system
Advantages of drip or trickle irrigation 1. Water is applied directly to the crop ie. entire field is not wetted. 2. Water is conserved 3. Weeds are controlled because only the places getting water can grow weeds. 4. There is a low pressure system. 5. There is a slow rate of water application somewhat matching the consumptive use. Application rate can be as low as 1 - 12 l/hr. 6. There is reduced evaporation, only potential transpiration is considered. 7. There is no need for a drainage system.	**(7) Advantages of drip or trickle irrigation** 1. Water is applied directly to the crop ie. entire field is not wetted. 2. Water is conserved 3. Weeds are controlled because only the places getting water can grow weeds. 4. There is a low pressure system. 5. There is a slow rate of water application somewhat matching the consumptive use. Application rate can be as low as 1 - 12 l/hr. 6. There is reduced evaporation, only potential transpiration is considered. 7. There is no need for a drainage system.
LESSON 4: APPLY SAFETY MEASURES IN FARM OPERATIONS	
ANSWER KEY (PRE-TEST LO1) 1. D 2. A 3. B 4. D 5. A 6. A 7. A 8. A 9. A 10. A	**ANSWER KEY (SELF-CHECK 1.1)** 1. Personal protective equipment (PPE) 2. construction work 3. Trimming trees 4. Repairing machinery 5. Skin cancer 6. Safety glasses 7. Goggles 8. Face-shields 9. Grain dryers 10. Feed grinder

ANSWER KEY (PRE-TEST LO2) & (SELF-CHECK 2.1) *Tips in cleaning equipments, tools and garbage cans:* • Remove as much as possible plant debris, soil and residues of any kind, use a brush or another appropriate tool when necessary. • Inspect equipments for physical damage which might injure, spoil and contaminate fresh vegetables, if found, repair them. • Inspect equipments, tools and garbage cans for any missed plant debris, soil and residues, if found, clean again. • If cleaning and/or disinfection chemicals are used, follow label instructions for mixing. • As required, apply cleaning materials such as detergent and/or disinfection chemicals, and ensure that no spots are missed. • Rinse with safe water, if there are parts of the equipment that cannot be rinsed with water, use a clean wet towel and follow the same procedures for cleaning. • Ensure that small equipments and tools do not touch the ground floor after the cleaning procedures. • When possible place in the full sun for rapid drying. • Store equipment's and tools properly to avoid contamination. *Tips in cleaning areas for handling and storing fresh produce:* • Unplug any electrical equipment's and if possible, cover with plastic electrical motors, electrical boxes, connections, light fixtures, etc. do not use packaging materials for this task. • Remove trash and any accumulated plant debris from the floors. • Using low pressure water for, Rinse the entire ceiling infrastructure and light fixtures to remove any dust and soil build up. Rinse walls, windows and doors from the top downward Rinse the entire floor surface to remove any soil build up, be careful of not splashing water onto equipment's. • If necessary, scrub areas with brush and cleaning materials such as detergent, and ensure that no spots are missed. • After scrubbing areas with cleaning	**ANSWER KEY (PRE-TEST LO2) & (SELF-CHECK 2.1)** *Tips in cleaning equipments, tools and garbage cans:* • Remove as much as possible plant debris, soil and residues of any kind, use a brush or another appropriate tool when necessary. • Inspect equipments for physical damage which might injure, spoil and contaminate fresh vegetables, if found, repair them. • Inspect equipments, tools and garbage cans for any missed plant debris, soil and residues, if found, clean again. • If cleaning and/or disinfection chemicals are used, follow label instructions for mixing. • As required, apply cleaning materials such as detergent and/or disinfection chemicals, and ensure that no spots are missed. • Rinse with safe water, if there are parts of the equipment that cannot be rinsed with water, use a clean wet towel and follow the same procedures for cleaning. • Ensure that small equipments and tools do not touch the ground floor after the cleaning procedures. • When possible place in the full sun for rapid drying. • Store equipment's and tools properly to avoid contamination. *Tips in cleaning areas for handling and storing fresh produce:* • Unplug any electrical equipment's and if possible, cover with plastic electrical motors, electrical boxes, connections, light fixtures, etc. do not use packaging materials for this task. • Remove trash and any accumulated plant debris from the floors. • Using low pressure water for, Rinse the entire ceiling infrastructure and light fixtures to remove any dust and soil build up. Rinse walls, windows and doors from the top downward Rinse the entire floor surface to remove any soil build up, be careful of not splashing water onto equipment's. • If necessary, scrub areas with brush

materials, rinse surface areas as described previously wash out drains; be careful of not splashing water onto equipment's. • If cleaning and/or disinfection chemicals are used, follow label instructions for mixing. *Tips in cleaning hygienic facilities:* • Pick up trash from the floors and remove to trash can. • By using the proper detergent, clean toilets, sinks and any other fixtures. • Using low pressure water, rinse the entire floor surface to remove any soil build up. • If cleaning and/or disinfection chemicals are used, follow label instructions for mixing. • As required, apply cleaning materials or disinfection chemicals to entire floor surface area, scrub areas with brush if needed, and ensure that no spots are missed. • Rinse floor and drains. • Remove excess water and allow drying out at room temperature. • Ensure that hygienic facilities have enough toilet paper, soap and disposable towel. *ENVIRONMENTAL LAWS* • Presidential Decree (PD) 1152, • "the Philippine Environmental Code," which took effect in 1977, provides a basis for an integrated waste management regulation starting from waste source to methods of disposal. • PD 1152 has further mandated specific guidelines to manage municipal wastes (solid and liquid), sanitary landfill and incineration, and disposal sites in the Philippines. • Republic Act (RA) 6969 • PD 984 (Pollution Control Law), • PD 1586 (Environmental Impact Assessment System Law), • RA 8749 (Clean Air Act) and • RA 9003 (Ecological Solid Waste Management Act) and their implementing rules and regulations.	and cleaning materials such as detergent, and ensure that no spots are missed. • After scrubbing areas with cleaning materials, rinse surface areas as described previously wash out drains; be careful of not splashing water onto equipment's. • If cleaning and/or disinfection chemicals are used, follow label instructions for mixing. *Tips in cleaning hygienic facilities:* • Pick up trash from the floors and remove to trash can. • By using the proper detergent, clean toilets, sinks and any other fixtures. • Using low pressure water, rinse the entire floor surface to remove any soil build up. • If cleaning and/or disinfection chemicals are used, follow label instructions for mixing. • As required, apply cleaning materials or disinfection chemicals to entire floor surface area, scrub areas with brush if needed, and ensure that no spots are missed. • Rinse floor and drains. • Remove excess water and allow drying out at room temperature. • Ensure that hygienic facilities have enough toilet paper, soap and disposable towel. *ENVIRONMENTAL LAWS* • Presidential Decree (PD) 1152, • "the Philippine Environmental Code," which took effect in 1977, provides a basis for an integrated waste management regulation starting from waste source to methods of disposal. • PD 1152 has further mandated specific guidelines to manage municipal wastes (solid and liquid), sanitary landfill and incineration, and disposal sites in the Philippines. • Republic Act (RA) 6969 • PD 984 (Pollution Control Law), • PD 1586 (Environmental Impact Assessment System Law), • RA 8749 (Clean Air Act) and • RA 9003 (Ecological Solid Waste Management Act) and their implementing rules and regulations.

Acknowledgement

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