Horticultural Crops Production -Level-IV

Based on March 2019, Version 2 Occupational standards

Module Title: - Supervising seed crop harvesting

LG Code: AGR HCP4 M17 LO (1-4) LG (74-77)

TTLM Code: AGR HCP4TTLM 1220v1

December 2020

GREEN FLOWER FOUNDATION

Table of Contents

LG #74	LO #1- Prepare for harvesting

Instruction sheet

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

- Assessing crop maturity and quality
- Determining and carrying out pre-harvest treatments
- Identifying and complying licenses or permits to moving machinery
- Assessing insurance requirements
- Planning and implementing risk management strategies

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Assess crop maturity and quality
- Determine and carrying out pre-harvest treatments
- Identify and complying licenses or permits to moving machinery
- Assess insurance requirements
- Plan and implementing risk management strategies

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Assessing crop maturity and quality

1.1 Assessing crop maturity

Optimum maturity at harvest is a very important determinant factor to the final quality of the product. It is advantageous to harvest the crop at physiological maturity. However, it is always not possible to take up harvesting at this stage due to scarcity of labor and hence harvesting may be taken up calculating the crop duration. The time of harvesting a crop product has implications in its yield, use, quality and storage. Delaying harvesting or harvesting prematurely often adversely affects product quality. It must be pointed out that premature harvesting is desirable for certain products for certain markets.

Maturity can be described as the attainment of the particular size or stage after which ripening takes place. On the other hand, ripening means the qualitative changes in fruits after maturity of which it become edible. If the crop is left in the field for too long after maturity, it becomes pre- disposed to pest attack and deterioration forms the vagaries of weather. Premature harvesting may mean improper filling of the seed or grain, leading to reduced yield and quality product. If poor quality produce is placed into storage, poor quality produce will come out of storage.

1.2 Practical uses of Maturity Indices

1) State and Federal regulations often include a guide for minimum and maximum maturity that is acceptable for a given commodity

2) Marketing strategies to obtain premium prices for commodities “Supply and demand” delaying or expediting harvesting and shipping of a particular crop at the beginning or end of the season requires a measure of maturity if quality is to be maintained

3) Efficient use of labor – A measure of maturity is important for organizing start and end dates for harvesting to ensure labor and equipment availability and reduce harvesting costs.

Types of Maturity of Fruits and Vegetables A) Harvesting Maturity B) Physiological Maturity C) Commercial or Horticultural Maturity

1.3 Physiological maturity, horticultural maturity, Harvest maturity

Physiological maturity

- ✓ Plant (part) has completed natural growth and development
- ✓ Certain stage of development so that upon harvesting from the plant commodity will continue to develop as if still on plant.

- ✓ Quality has reached minimum acceptable standards.

Horticultural maturity/Commercial maturity

- ✓ Stage of development when a plant possesses the quality prerequisites for use by consumers for a particular purpose
- ✓ Commodity can be horticulturally mature at any stage of development or physiological maturity
- ✓ All plant (parts) are harvested when horticulturally mature but may be physiologically immature or mature

Harvesting Maturity

✓ The harvest maturity of vegetable depends upon the purposes for which it is harvested. For local market and for processing, fully coloured tomato fruits are harvested. However, for a distant market fruit which have started developing colour are harvested.

✓ The post-harvest quality and storage life of fruit appear to be controlled by the maturity. If the fruits are harvested at a proper stage of the maturity the quality of fruit is excellent.

Table 1.1

Vegetable Harvest Guide		
Vegetable	***Size***	***Color***
Beet	2-3 in diameter	red, varies with cultivar
Broccoli	6 to 7 across	blue-green
Cabbage	varies with cultivar	green, red
Carrot	3/4 in diameter	orange
Cauliflower	6 to 8 across	creamy white
Pickling	2-4 long	dark green
Slicing	6-8 long	dark green
Eggplant	varies with cultivar	purple, white, green
Garlic	2-3	white, reddish purple
Kohlrabi	2-3 diameter	green
Lettuce (leaf)	4-6 long	green
Muskmelon Cantaloupe	5-10 in diameter	yellow-tan between netting
Okra	3 long	bright green
Onion	varies with cultivar	white, yellow, red
Parsnip	8-18" long	white or cream
Snow (Sugar)	3 long pods	bright green
Snap	3 long pods	bright green
Garden (Shell)	3 long pods	bright green
Hot	1 to 3 long	red, purple, yellow, green
Sweet	2 to 4 in diameter	green, red, yellow, purple, orange
Potato	varies with cultivar	varies with cultivar
Pumpkin	varies with cultivar	orange
Spring	1/2 to 2 in diameter	red, white, varies
Winter	6-12 long	white, varies
Snap Bean (Green Bean)	4 to 6 long	green, yellow, purple
Spinach	6-8 tall	green
Scallop	3 to 5 in diameter	yellow, green
Zucchini	6 to 12 long	green, yellow
Sweet Corn	5 to 10 , varies with cultivar	yellow, white, bicolor
Sweet Potato	varies with cultivar	Gold or orange
Tomato	varies with cultivar	red, orange, yellow
Turnip	2-3 in diameter	white, reddish purple
Watermelon	varies with cultivar	light to dark green, striped
Winter Squash	varies with cultivar	varies with cultivar

Self-check 1	Written test

Name…… ID…… Date…….

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

Test: Answer the following questions (20 point)

1. List the indicators of crop maturity in readiness for harvesting (5pts)
2. What are the adverse effects of delaying harvesting crops and harvesting them prematurely. (5 points)
3. Explain the differences between physiological, horticultural and harvest maturities? (5 points)
4. What color changes are observed during the maturities of cabbage and carrot? (5 points)

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

You can ask you teacher for the copy of the correct answers

Information Sheet 2- Determining and carrying out pre-harvest treatments

2.1. Determining and carrying out pre-harvest treatments

Food safety recommendations state raw manure applications must be made a minimum of 120 days prior to harvest for any produce where the edible portion is in direct contact with the soil and 90 days prior to harvest if the edible portion is not in direct contact with the soil. Guidelines differ for composted manure applications. Plant based compost is not considered raw manure.

Food safety is also a concern when flooding occurs in a vegetable garden. Remove and destroy produce if the edible portion is in contact with floodwaters.

2.2 Reasons for pre-harvest treatments:-

- To reduce weight of foliage.
- To facilitate mechanized harvesting.
- To facilitate bulk harvesting sorting, grading and packing by machines.
- To improve post-harvest life of produce.
- To delay harvest date.

Pre-harvest treatments, either physical or chemical, may have a favorable or unfavorable impact upon postharvest quality. Examples of physical treatments include:

a. The gathering of cauliflower leaves around the head prior to harvest to prevent yellowing.

b. Twisting of cabbage (90 degrees) before harvest to break some roots and induce wilting - this causes the wrapper leaves to tighten, thereby helping to protect head during postharvest.

c. Wrapping fruit while still on tree, e.g. apples, carambola (star fruit) and bananas may be wrapped with paper or plastic to prevent attack from birds, fruit flies and other pests or to enhance ripening or fruit color.

Despite the increasing in organic products, our understanding of how different organic products affect fruit and vegetable quality is still limited. The effect of three organic pre-

harvest treatments, effective microorganisms (EM), a fermented mixture of effective of effective microorganisms with organic matter and an auxiliary soil products.
Effect of pre harvest treatments on yield and effect and effect of pre-harvest treatments on yield and quality of fruit crops quality.

Pre-harvest treatments with nutrients, growth regulators and pre-harvest cultural practices have profound influence on yield and post-harvest qualities. These pre harvest treatments influence the fruit yield, fruit firmness, biochemical composition, color development, physiological loss in weight, respiratory rate, enzyme biosynthesis, ethylene production and storage potential.
Organic compounds other than nutrients which in small amount promotes, inhibits or modifies the physiological processes in the plants.

Pre-harvest weed problems are appear in some fields, especially in thin fields and areas with abundant rainfall. Any further delays in harvest will likely exacerbate the problem. Broadleaf weeds can sometimes grow rapidly in crop fields toward the end of the growing season. When this happens, the weeds can grow above the crops canopy for instance cereal crops and small grain crops and the other crops. This not only interferes with harvest, it can also result in dockage problems.

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (20 points)

1. What are the importances of pre-harvest treatments? (5pts).
2. What are the mechanisms of undertaking pre- harvest treatments? (5pts).
3. Define physical pre-harvest treatments? (5pts).
4. What are the profound influences of nutrients, growth regulators and pre-harvest cultural practices? (5pts).

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

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

Information Sheet 3- Identifying and complying licenses or permits to moving machinery

In order to undertake agricultural crop harvesting the following permits must be considered:

- ❖ Crop maturity in readiness for harvest
- ❖ Resource availability because harvesting is lab our intensive
- ❖ Equipment availability
- ❖ Favorable weather condition- do not harvest on rainy day
- ❖ Staff requirements

Harvest permits are sold to vehicles that will be utilized to haul agricultural products or to service harvesting equipment. A permit is required for each truck or tractor and each grain hauling trailer.

If you drive a larger vehicle, the maximum authorized mass - i.e. the total weight of the vehicle plus the maximum load it can carry - will determine which driving license entitlement you require, for example:

- 3.5 to 7.5 tonnes requires a category C1 license
- more than 7.5 tonnes requires a category C license

You must be at least 18 years of age to drive a vehicle weighing between 3.5 and 7.5 tonnes, and 21 years of age to drive a vehicle over 7.5 tonnes.

Permit Provisions:

Vehicles Transporting Agricultural Products: Over Axle/Over Gross Weight Tolerance Permit authorizes the operation of vehicles transporting agricultural products with a tolerance of:

- Up to 12 percent above legal axle weight on one single axle or tandem axle, up to10 percent above legal axle weight on all remaining single axle or tandem axle.
- Up to, but not more than 5 percent above the gross vehicular weight.

NOTE: For agricultural and non-agricultural products, the gross weight should never exceed 84,000 pounds.

Examples of agricultural products include, but are not limited to, the items listed below.

- Cottonseed hulls, cottonseed meal, and sugar beet pulp.
- Cotton (not baled).
- Fresh eggs.
- Fresh fruits and vegetables.
- Grain, including rice.
- Hay.
- Live animals, including livestock, poultry and game birds.
- Live horticultural products and live nursery stock, including any tree, shrub, vine, cutting, graft, scion, grass, bulb, or bud that is in a growing state and is grown for, kept for, or is capable of propagation and distribution for sale.
- Manure produced by livestock, poultry, or game birds.
- Nuts.
- Oil seed.
- Peanuts.
- Raw milk.
- Seed for planting.
- Sugar cane.
- Timber.
- Wool and mohair.
- Wood pulp.
- Wood Chips

Vehicle Registration Requirement: Vehicles issued an Over Axle/Over Gross Weight Tolerance Permit must be registered for the maximum permissible weight for the particular vehicle, not to exceed 80,000 pounds. This permit does not increase the registered weight limit, but only allows a tolerance above the maximum registered weight.

Agricultural engines

Agricultural engines are restricted to purpose-built vehicles that:

- are designed and used solely for agriculture, horticulture or forestry work
- are used on public roads only for going to and from a place of work
- if used on a public road, do not carry any load except such as is necessary for its propulsion or for the operation of any machinery built-in or permanently attached to the vehicle

Examples of agricultural machineries that use agricultural engines include:

- combine harvesters, forage harvesters, pea viners, Mowing machines

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions

1. What are the permissions required for moving machineries? (5 pts.)
2. What are the licensing requirements of agricultural vehicles? (5 pts.)
3. Why harvesting during rainy time is not permitted? (5 pts.)

Note: **Satisfactory rating 15 points** **Unsatisfactory – below 15 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 4- Assessing insurance requirements

Crop insurance includes the coverage of crop damaged by fire, hail and transportation. This policy provides insurance for loss or damage to growing crops caused by hail or other perils. This policy is a concept of combining hail coverage. Coverage for damage before and during harvest and while your crop is in the harvester. This also includes crops in small grain stubble.
In areas of the country where hail is a frequent event, farmers often purchase crop-hail policies to protect high-yielding crops. These policies are not part of the Federal Crop Insurance Program; they are sold by private insurers and regulated by state insurance departments. Many farmers purchase crop-hail coverage as a supplement to MPCI **(**Multiple peril crop insurance).

Crop-hail policies often have a low or even no deductible. Because, unlike drought or blight, hail can completely destroy a portion of crops in one area of a farm but leave other crops undamaged, a hail claim may be less than the amount of the deductible on an MPCI policy. Crop insurance is purchased by agricultural producers, and subsidized by the federal government, to protect against the loss of their crops due to natural disasters, such as hail, drought, and floods, or the loss of revenue due to declines in the prices of agricultural commodities.

For Ethiopian farmers dealing with the worsening impacts of climate change, small scale crop insurance can be life saver. But the insurance needs to expand and undergo some tweaks to effectively help them recover from extreme weather. Any decision-making process on crop insurance involves many stages. These stages and certainly the priorities will differ, depending on which type of body is doing the investigation. This may be a government ministry, a farmers' organization, an insurer, a bank or a group of marketing/processing agencies. In any case, some of the more important issues and steps are:

- Demand assessment - ensuring that any initiatives are in response to real risk management needs;
- Identification of the key insured parties; automatic or voluntary cover?
- Determination of key perils - a key factor in insurance design;
- Decision on crops to be covered - another key factor in insurance design;
- Analysis of insurance options, administrative models and loss assessment procedures, together with determination of associated costs;
- Rating - determining the pure premium required, plus administrative and loss adjustment overheads to derive the initial premium level to be charged;

- Identifying possible complementary roles for the government and for the private sector.

Insurance implications can similarly be summarized in a brief list:

- It is sometimes possible for growers to obtain cover against pests and diseases where there is no generally accepted management control.
- in an attempt to reduce the adverse environmental impact of some well-established chemical spray routines for pest and disease control (e.g. certain chlorinated hydrocarbons) alternative, benign regimes have been developed. Insurance may be utilized in the future in order to provide temporary risk assurance to growers using the new routines;
- Frequently damage to fruit and other crop products provides an entry point for disease organisms. Perforation of the skin due to hail damage is a common example. In this case any hail policy needs to be clear as to whether the consequential loss from disease is also covered.

Self-Check – 4	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions

1. List the Crop insurance coverage **(5pts)**
2. List the importances of crop insurance to the farmers **(5pts)**
3. What are the two general categories of crop insurance? **(5pts)**
4. What are decision-making processes on crop insurance? **(5pts)**

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 5- Planning and implementing risk management strategies

A listing of key perils and risks for agriculture across the world would be long. For the present purposes it is useful to focus on developing countries. Further, they can be clustered into a number of groups. One such clustering would produce a list as follows:

- Production risks
- Natural resource risks
- Financial risks
- Marketing and price risks

Production and natural resource risks are relevant to this discussion of crop insurance, and are discussed in greater detail below. Financial and marketing/price risks fall outside the scope of the present publication, except in the case of crop/revenue insurance products, as discussed above.

5.1 Production Risks

This is the main category of insurable risks. Both quantity and quality losses can result. Perils included are:

- Adverse climate conditions: drought, excessive rain, flood, windstorm, frost, hail, sunburn, snow;
- Pest and disease attack;
- Fire.

a. Drought

It is a major concern of many developing countries, and the natural weather event which causes most problems for insurers. The reasons for this are many. Firstly, insurers feel most confidence when an adverse event has a clearly defined time of impact, coupled with a clearly defined geographical area. The classic example is hail, which may do its damage in a matter of a few minutes, or even seconds, and will typically impact an area confined to a few hundred square metres up to a few square kilometers. Hail damage is clearly attributable to the adverse weather event, and is readily verified as such provided that a field inspection is undertaken.

b. Excessive rain

Crops need water, and much of the developing world's arable and horticultural production relies on rainfall. Too much rain at any time can damage a crop, but there are periods of special vulnerability, described below.

The first danger point is excessive rain just after germination and emergence. Entire crops can be washed out of the ground, necessitating re sowing. This is an insurable risk, where the indemnity which would be written into the policy would be the costs of re-sowing, plus a possible additional amount in those cropping situations (common in tropical, rain fed agriculture) where a delay in sowing means that the eventual harvested crop is smaller than would have been the case had the crop been able to take advantage of the whole of the normal growing season.

c. Flood

Flood damage may be due to on-site excessive rainfall, but it can also be caused by excessive precipitation elsewhere, and the subsequent rise of river and lake levels, to cause flooding of crop land. The risk is usually insurable. Exceptions would be crop land which is insufficiently drained or where existing drains are not maintained, and also flood plains exposed to a very high risk of flooding.

d. Windstorm

Crop insurance programmes in the Windward Islands (bananas) and in Mauritius (sugar cane) have already been mentioned. Both were set up to assist in managing the losses from excessive wind - cyclones in Mauritius and hurricanes in the Caribbean. High wind speeds affects nearly all crops - and can cause serious damage in forests.

e. Frost

Although not at all common in developing countries generally, there are some regions where this is an occasional risk, especially to vegetable and fruit crops. This applies especially to Eastern Europe and the Middle East.

f. Hail

Hail holds a special place in the history and also the current practice of crop insurance. It was the first crop peril to be insured by a modern insurance company - the first policies being issued, in Germany, in 1791. It is also the simplest of weather perils to handle from an insurance point of view.

g. Sunburn (sunscald)

Sunscald, under exceptionally adverse conditions, causes damage to fruits such as pip and stone fruit, grapes and nuts. It is associated with the premature loss of foliage from the plant. The risk is insurable, often as an extra-cost option under multi-risk policies.

h. Snow

Snow can damage all types of crops, including fruit trees and it also a peril of note in forests, where excessive weight loading can cause breakage of parts of trees, or even toppling of the whole tree. Developing countries vulnerable include those in Central Asia, Eastern Europe and the Middle East regions. Snow is an insurable peril in many circumstances.

i. Pest and disease attack

Insurance cannot substitute for sound management of the risk of pests, parasites and diseases. Indeed, this is a significant area of modern farm and forest management, with very substantial losses resulting from failures in this area. Moreover the growing importance of international trade in agricultural commodities impacts on the pest and disease issue in developing country farming in several ways:

j. Fire

Crop fire insurance coverage can be very different from policy to policy**.** Because farm insurance policies are so individual to the farms they cover, you can't necessarily rely on what happened to a friend—or even a neighbor across the street—when trying to predict what might happen to you after a crop fire. Some crop insurance policies will cover some types of fire damage, and some farms even have some coverage for crop fires under their umbrella policies. The only way to really know is to look at the coverage you carry.

5.2 Risk Management Strategies

The best way to mitigate the uncertainties faced by production agriculture is to ensure that the operation is being run by an experienced, professional farmer who makes decisions based on profitability. Variables such as weather, water, and disease that most growing operations face can be mitigated by someone who knows what he or she is doing. Before investing in any type of production agriculture, be confident that the grower will manage risk effectively to maximize your returns.

Effective risk management involves anticipating possible difficulties and planning to reduce their consequences, not just reacting to unfavorable events after they occur. The two primary aspects of risk management are: 1) anticipating that an unfavorable event

may occur and acting to reduce the probability of its occurrence and 2) taking actions which will reduce the adverse consequences should the unfavorable event occurs.

Risk management strategies are developed to provide some protection in situations in which the consequences of a decision are not known when the decision is made. Risk management strategies consist of a variety of responses which may reduce the probability of an unfavorable event occurring and/or reduce the adverse consequences if the event occurs. However, in gaining protection from a possible loss, part of the potential gain is generally given up. In other words, most responses to risk have a cost associated with them, even if it is not explicit. Generally, farmers would like to avoid major losses, but would also like to be in a position to benefit from favorable events. The trick is to effectively manage risk without unduly sacrificing gains.

Self-Check – 5	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. What are the types of risks that are going to be insured by insurance agencies (5 pts.?)
2. How does a perennial crop can be insured? (5 pts.)
3. What are the exceptions that cannot be included in flood insurance? (5 pts.)

Note: **Satisfactory rating 15 points** **Unsatisfactory - below 15 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Operation sheet 1	Identifying the maturity status of horticultural crops for harvesting

Basically, identifying is the maturity status of a given crop is very crucial point to undertake crop harvesting. The way of identifying crop maturity depends on different morphological changes and crop maturity parameter that indicates proper maturity stage of a given crop to be marketed or stored. Therefore, to determine the maturity of a given horticultural crop, follow the following steps one by one.

1. Select the type of horticultural crop to be identified (fruit, vegetables, flower, tubers…etc)
2. Prepare materials and tools (like knives, sizing rings, color charts, refractometeres, pentameters…etc) available to test the maturity of a given crop depending on type of crop you have selected.
3. Carefully observe the maturity indices or parameters (like size, weight, length, shape, color, ripeness, texture, skin condition, ease of removal and moisture content, flavor…etc) and the type of maturity (physiological or harvest) depending on the type of crop you have selected.
4. Test the maturity of the crop by either using tools or equipment or through careful observation depending on the type of crop you have selected.
5. Interpret and analyze the results by comparison with specification charts and enterprise/industry maturity standards.
6. Finally, report to your supervisor or other concerned body what you have identified and faced when operating the tasks.

LAP Test	Practical Demonstration

Name_____ Date_____

Time started_____ Time finished_____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2** hour. The project is expected from each student to do it.

Task 1: Identifying the maturity status of horticultural crops for harvesting

LG #75	LO #2- Determine harvest strategy

Instruction sheet

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

- Estimating and calculating optimum time to harvest
- Assessing resource requirements
- Confirming and arranging labor and equipment
- Identifying and arranging fire prevention and control

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Estimate and calculate optimum time to harvest
- Assess resource requirements
- Confirm and arrange labor and equipment
- Identify and arrange fire prevention and control

Learning Instructions:

1. Read the specific objectives of this Learning Guide.

2. Follow the instructions described below.

3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

4. Accomplish the “Self-checks” which are placed following all information sheets.

5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Estimating and calculating optimum time to harvest

1.1 Estimating harvesting time

Crops that are immature lose water rapidly and don't store well, in addition to not tasting their best. Crops that are over-matured can be tough and starchy, like beans and corn, or too soft and easily damaged, like plums. Both immature and mature crops are subject to decay. Harvesting during the coolest part of the day is important because high temperatures lead to deterioration in highly perishable crops. The term "field heat" refers to the heat stored in crops from being out in the sun. In harvest and post-harvest handling you want to manage for reducing/taking out the field heat in your crops

Harvesting vegetables at the right stage of maturity ensures the best taste and quality. Many vegetables should be picked throughout the summer to maintain plant productivity. The time, frequency and method of harvesting vary depending on spices. Vegetables such as standard sweet corn have a very small harvest period. Others, such as many of the root crops, can remain in the garden for several weeks with little effect on their state. Some vegetables, like summer squash, have to be harvested almost daily. Other plants, such as tomatoes can be harvested on a weekly basis. Use the table below to determine the optimal time to pick and enjoy your favorite vegetables.

The shelf life of a produce is highly correlated to the physiological/ horticultural maturity at harvesting

• Therefore, understanding the unique characteristics of different produce at physiological maturity is vital in ensuring that only mature produce is harvested

• This greatly reduces the post-harvest losses associated with produce harvested prematurely

• Below are the harvesting indices for different produce

1.2 Vegetable Harvest Guide

- ✓ **Color of the skin & seeds** (e.g. Tomato, Chili, and Passion Fruits)

- ✓ **Size of leaves & fruits** (e.g. Kale, Banana, and Pineapple)
- ✓ **The sound when thumped** (e.g. Watermelon, Melon, and Cabbage)
- ✓ **Shape of produce** e.g. mature bananas are more rounded

Table.2.1 Days to maturity

Optimal time of harvesting vegetable	
Vegetable	***Days to Maturity***
Beet	50-70
Broccoli	50-65*
Cabbage	60-90*
Carrot	60-80
Cauliflower	55-80*
Pickling	55-65
Slicing	55-65
Eggplant	75-90*
Garlic	90**
Kohlrabi	55-70
Lettuce (leaf)	45-60
Muskmelon Cantaloupe	75-100
Okra	50-65
Onion	100-120 90-100**
Parsnip	110-130
Snow (Sugar)	55-85
Snap	55-85
Garden (Shell)	55-85
Hot	60-90*
Sweet	70-90*
Potato	90-120
Pumpkin	85-120
Spring	25-40
Winter	45-70
Snap Bean (Green Bean)	50-70
Spinach	45-60
Summer squash	

Scallop	50-60
Zucchini	50-60
Sweet Corn	70-105
Sweet Potato	100-125
Tomato	70-90*
Turnip	45-70
Watermelon	80-100
Winter Squash	85-120

Harvesting is the separation of the crop from the site of immediate growth. It is considered as the last step in crop production but the first step in post-production system. Therefore it is very important to perform the harvesting operation on time and with great care as it influences the subsequent processing and preservation of the crop.

Harvesting operation under taken when the crop is physiologically enough matured. This physiological maturity can be determined either by visual observation at field or by taking sample. In general, timely harvesting of the crop has advantages of:

- Reducing crop loss due to birds, insects, rodents, and wild animals damage
- Decreasing field insect pest infestation problem
- Making free the field for timely preparation for the next crop

Crop maturity indicators (by visual observation)

The time of harvesting is determined by the degree of maturity. With a cereals and pulses ,a distinction should be made between maturity of stalks(straw),ears or seed pods and seeds for all that it affects successive operation , particularly storage and preservation.

1.3 Harvesting Guides of some fruits

There are few more satisfying activities on the permaculture plot than eating ripe fruit directly from the plant. Plucking an apple from the bough of a tree and crunching into it, standing there in the open air; or easing a pear from its stalk to take back to the kitchen and slice over your breakfast cereal; or getting your fingers stained with the juice of ripe strawberries or raspberries as you harvest the sweet bombs of flavour – these are some of the intensely pleasurable experiences that come with cultivating fruit on your site. To fully appreciate them – and to ensure they are at their tastiest and most nutritious – it is important to know when to do fruits harvesting. This avoids picking unripe fruit that is harder to use in the kitchen, or allowing fruit to go overripe and so end up in the compost pile. Here is a guide about the visual and textural clues to look for so you know when various fruits are ripe for the picking.

a. Watermelon

Watermelons have a curly tendril that protrudes from the stem of each fruit-bearing branch. This tendril drying up and turning brown is a signal the fruit is ready for harvest. The other signs that you should harvest the fruit are that the underside that is in contact with the ground will turn yellow or cream in colour, the skin loses its shine and becomes difficult to penetrate with your fingernail, and if you give the melon a tap it will have a resonant sound.

b. Pear

Pears are actually one of the fruits that it is preferable to harvest a few days before optimum ripeness, allowing them to reach perfection in a bowl indoors and giving you a longer timeframe in which to eat them (if the pear ripens fully on the tree, it will start to spoil within just a day or two of picking). Pears are ready for harvest when the green colour starts to lighten and go yellow. The flesh should still be hard, but if you twist the fruit it should come easily away from the stem.

c. Apple

With so many different varieties of apple, it can be tricky to know when your particular variety is ready to harvest. Juvenile apples tend to be green, so if you are cultivating a yellow or red variety, you will see the green change to these mature colours. But, of course, some apples remain green even when mature.

d. Blueberries

Blueberry is ripe when the fruit is uniformly blue-purple in colour; if you can still see a ring of red around the point where the stem meets the fruit, leave on the plant. If the berry is ripe I should come away in your hand with almost no pressure.

e. Peach

Peaches should be left on the tree until they are fully ripe. This will ensure the best flavour and texture, as once picked the fruit starts to deteriorate rather than continuing to ripen in a bowl. When growing peaches have green skin; when these change colour completely, the fruit is mature.

f. Cherries

Cherries keep growing until they are fully mature, so they are ready to be picked when they are plump and almost straining at the skin. You want to ensure that the cherries are at peak ripeness before harvesting, as they do not continue ripening once picked. Sweet cherries will be quite firm to the touch, while sour varieties have a bit more give.

g. Strawberries

Pick strawberries that have turned at least three-quarters red. The rest of the fruit will develop this color after picking if kept in a cool place over the next day or two. Do not harvest fruit that is half, or less, red, as these will not be able to ripen after picking.

Self-Check – 1	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions

1. What is the effect of pre mature harvesting on quality? (5 pts.)
2. What is meant by shelf life of horticultural products? (5 pts.)
3. What are the color changes of garlic and carrot when they mature? (5 pts.)
4. List the advantages of timely harvesting of the crop? (5 pts.)

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

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

Information Sheet 2- Assessing resource requirements

Resource requirements for crop harvest are assessed giving consideration to the size of the crop which mean the area coverage of the crop to be harvested and estimated timing of harvest to complete area coverage. The resources required will be stated in terms of personnel (these might be temporary, permanent, or contracted workers), machinery and equipment, consumables, and leasing arrangements.

2.1 Harvesting tools

Some fruits need to be clipped or cut from the parent plant. Clippers or knives should be kept well sharpened. Peduncles, woody stems or spurs should be trimmed as close as possible to prevent fruit from damaging neighboring fruits during transport.

Pruning shears are often used for harvesting fruits, some vegetables, and cut flowers. A variety of styles is available as hand held or pole models, including shears that cut and hold onto the stem of the cut product. This feature allows the picker to harvest without a catching bag and without dropping fruits.

Straight bladed hand shears for fruits and flowers:

Using a cutting tool attached to a long pole can aid picking of crops such as mangoes and avocados when the fruit is difficult to reach. Cutting edges should be kept sharpened and the catching bag should be relatively small The angle of the cutting edge and the shape of the catching bag can affect the quality of the fruit harvested, so it is important to check performance carefully before using any new tools.

Picking poles and catching sacks can be made by hand or purchased from horticultural supply companies. The collection bags illustrated below were hand woven from strong cord or sewn from canvas. The hoop used as the basket rim and cutting edges can be fashioned from sheet metal, steel tubing or recycled scrap metal.

Fruit trees are sometimes quite tall and letting fruit fall to the ground when it is cut from the tree will cause severe bruising. If two pickers work together, one can clip or cut the fruit from the tree, and the other can use a sack to break its fall. The catcher supports the bag with his hands and one foot, catches the falling fruit, then lowers the far end of the bag to allow the fruit to roll safely to the ground.

Unlike most nut crops, pistachio nuts should not be knocked to the ground during harvest because of their open shells and relatively high moisture content. The harvesting practice illustrated below can be used with pistachios and olives with good results.

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. What are the resources required for harvesting purposes (5 pts)
2. How can we manage tall fruits during harvesting? (5 pts)
3. What is the purpose of picking poles in fruit harvesting? (5 pts)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**
You can ask you teacher for the copy of the correct answers.

Information Sheet 3- Confirming and arranging labor and equipment

3.1 Arranging labor use

Commercial hand harvesting of fruit, nut, and vegetable crops is hard, tedious, and time-consuming work. Hand harvesting 12 million acres annually would require at least 840 million Lh/year (1.05 million workers for 20 weeks/year), and would easily exceed the labor force of workers willing to do seasonal crop harvesting. Fortunately, several of the crops are now already harvested mechanically, and some are harvested using labor-aid machines or devices that make the work easier.

Hand harvest is still the only practical method for many high value products that are either sensitive to bruising or that must be selectively picked. The mechanization of harvesting has proceeded in stages, thus, we may speak of completely mechanized, semi-mechanized, and non-mechanized harvest. In hand harvest, crops picking may use different ways, such as cutting, digging, clipping, pulling or shaking. Those to be done are according the kinds of horticultural crop to be harvested. One advantage of hand harvesting is the ability to pick more small fruit which are often lost during mechanical harvest. The harvest labor requirement of fruit crops is quite high, frequently being more than 50% of the cost of production. The amount of labor required to hand harvest a given field will depend on yield, number of times harvested, and the amount of production.

One advantage of hand harvesting is the ability to pick more small fruit which are often lost during mechanical harvest. The harvest labor requirement of fruit crops is quite high, frequently being more than 50% of the cost of production. The amount of labor required to hand harvest an acre will depend on yield, number of times harvested, and the amount of vine growth. As an example, in prolific fields, an individual can pick 300 pounds (up to 6 bushels) of pickling cucumbers each hour. Approximately 24 hours of labor per acre will be needed for each harvest. Hand labor has not been replaced in the harvest of tomatoes and-until a plant breeding program develops a variety whose fruit will ripen all at one time, so it can be shaken free of the plant-growers will use hand labor. I n the last harvest of pear-shaped tomatoes, the plants usually are cut by hand at the ground level and the fruit shaken from the plants, The acceptable fruit is picked u p and put in lug boxes. If all or most of the fruit is to meet the state grade, each individual fruit has to be handled. A field with plants that have a high yield potential is an excellent enticement to labor since no one wants to pick from low-yielding plants.

Figure 3.1 Hand harvesting of cucumbers

Growers should secure picking labor well before harvest. Having sufficient labor is critical to the success of a farm operation. More stringent labor rules have been adopted and enforced in recent years. As labor costs continue to escalate, harvesting aids and mechanical harvesters have attracted more interest. Harvesting aids are often farmer-built or rebuilt from tobacco equipment and are designed to eliminate stoop labor by allowing pickers to work in a more comfortable sitting position. The efficiency of harvesting aids varies widely, but growers usually find recruiting and supervising labor easier when these machines are used. These machines could substantially reduce per-unit harvesting costs of pickling cucumbers, but growers might have to sacrifice some quality because fewer small-sized cucumbers are harvested than with hand-harvested fruit.

3.2 Arranging equipment for harvesting

Equipment required to carry out harvesting operations may include: contracted resources, field bins and boxes, grading gauge, knives, platforms, scales, trolleys, trucks, trailers and tractors, waste containers, picking tools, ladder, bags, etc. When hand harvest, the fruits should be carefully picked and avoided any mechanical injuries from the hand harvesting process. If the product has wounds, it is easily attacked by microbe, and the respiration of fruits will be promoted, and the storage capacity and marketing value will be reduced.

The materials, tools and equipments needed for harvesting vegetables may include:

- Containers: bags, sacks, cardboards, baskets, plastic sheets, trays, etc.
- Cutting or clipping tools: shears, cutlass, knifes, sickles, machetes, etc.
- Digging tools: spades, forks, towels, hoe, etc.
- Treatment chemicals

❖ **Harvesting containers-** Picking baskets, bags and buckets come in many size and shapes. Several examples are illustrated below.

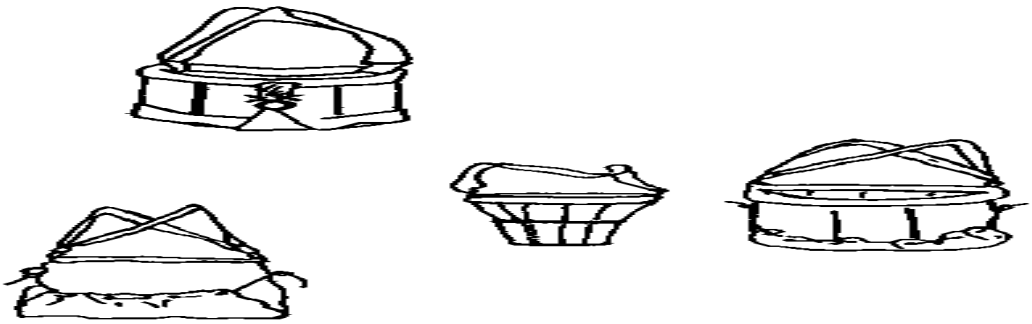

Figure 3.2 harvesting containers

Plastic crates are relatively expensive but are durable, reusable and easy to clean.

❖ **Harvesting tools-** Some fruits need to be clipped or cut from the parent plant. Clippers or knives should be kept well sharpened. Pruning shears are often used for harvesting fruits, some vegetables, and cut flowers. A variety of styles is available as hand held or pole models, including shears that cut and hold onto the stem of the cut product. This feature allows the picker to harvest without a catching bag and without dropping fruits.

Straight bladed hand shears for fruits and flowers:

Pole mounted cut and hold picking shears:

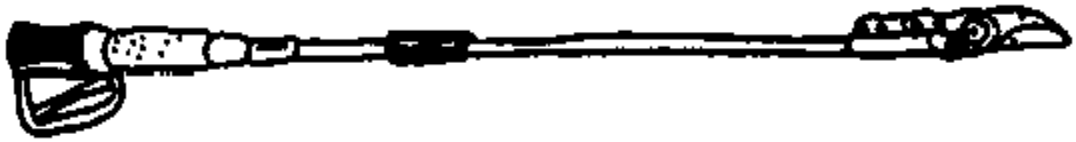

Figure 3.3 Clippers for fruit and flower harvesting

Using a cutting tool attached to a long pole can aid picking of crops such as mangoes and avocados when the fruit is difficult to reach. Cutting edges should be kept sharpened and the catching bag should be relatively small. The angle of the cutting edge and the shape of the catching bag can affect the quality of the fruit harvested, so it is important to check performance carefully before using any new tools.

Using a picking pole:

Figure 3.4 picking pole

Hand woven collection bag

Picking poles and catching sacks can be made by hand or purchased. The collection bags illustrated below were woven from strong cord. The hoop used as the basket rim and cutting edges can be made from sheet metal or steel.

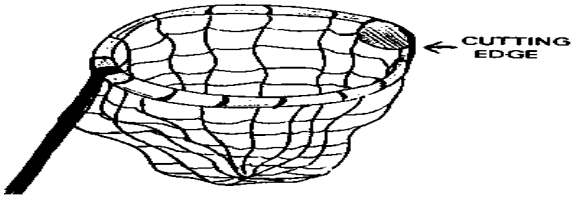

Figure 3.5 Collection bag

Fruit trees are sometimes quite tall and letting fruit fall to the ground when it is cut from the tree will cause severe bruising. If two pickers work together, one can clip or cut the fruit from the tree, and the other can use a sack to break its fall. The catcher supports the bag with his hands and one foot, catches the falling fruit, then lowers the far end of the bag to allow the fruit to roll safely to the ground as illustrated below. Some nuts should not be knocked to the ground during harvest because of their open shells and relatively high moisture content.

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. Why growers should pick labor before harvest (5 pts.)
2. What is the advantage of hand harvesting? (5 pts.)
3. Why harvesting aids and mechanical harvesters have attracted more interest now days (5 pts.)?

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

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

Information Sheet 4- Identifying and arranging fire prevention and control

In conditions of very low relative humidity and high temperatures, the machinery used for harvesting and gathering cereal crops can cause forest fires, which sometimes lead to serious harm to persons and their safety, to the loss of the crop and of the machinery, to a threat to farm buildings and it may ultimately also affect forest land.

The risk of fire caused by sparks when harvesting cereal crops rises in conditions of low relative humidity (below 50 % there begin to be fires, while a peak in fires occurs with a humidity of below 30 %).

Statistically, the fire curve shifts in terms of time with regard to the relative humidity curve due to the effect of increased fire risk caused by radiation, with a fire peak between 1 pm and 2 pm, and ignitions concentrated between 1 pm and 5 pm; consequently, it is advisable to take the utmost precaution during the times of maximum sunlight.

- Avoid the over-heating of machines or their bearings, as well as the build-up of static electricity with earth dischargers.
- Take extreme care in the maintenance of machines, i.e. clean the exhaust manifold and other points on the machine where the chaff and straw collect every day. Similarly, check the exhaust pipe gas outlet to ensure that the spark arresters are working properly. Provide extinguishers if speedy action for fire in the machinery is required, and water carriers for use on fire in cereal and straw.
- Whenever possible, ensure that there is an observer monitoring the whole of the harvested field in order to detect possible ignitions (the lorry driver or grain tractor driver or any other assistant).
- Ensure discontinuity between the areas already harvested, those not harvested and the forest land. For this reason it is very important that, whenever possible, you leave a strip of field around these areas with the disc ploughs after harvesting.
- On days in a heat wave with relative humidity of below 30%, it is advisable to reduce or, better still, stop activity between 1 pm and 5 pm.
- Schedule the harvest with the concerned body that is defense group (example, ADF)so that the primary action material that the ADF may provide and its volunteers are coordinated and working together at times that the machines are working.
- When harvesting on uneven ground, it is advisable to raise the cutter a little, when turning the harvester between 1 pm and 5 pm (official time) to prevent friction against the ground and any stones. It is also advisable to cover the bottom of the skid with nylon or other non-metallic plates.
- Carry a mobile phone and alert immediately of any incident, and in the event of a fire.

Self-Check – 4	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. Why overheating of machines should be avoided? (5pts)
2. What is the importance of raising the cutter a little when harvesting on an uneven ground? (5pts)
3. Why carrying a mobile is good in case of fire emergency? (5pts)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask you teacher for the copy of the correct answers

LG #76	LO #3- Coordinate the harvest strategy

Instruction sheet

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

- Implementing effective communication strategies
- Implementing and adjusting harvesting operations
- Coordinating equipment operation
- Identifying and controlling existing and potential hazards

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, **upon completion of this learning guide, you will be able to**:

- Implement effective communication strategies
- Implement and adjust harvesting operations
- Coordinate equipment operation
- Identify and control existing and potential hazards

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Implementing effective communication strategies

Harvest is a busy and often hectic time for farmers and agricultural workers because crops ripen on their own time schedule. More workers, more equipment, and a compressed time schedule for harvest increases the potential for accidents and injuries. Employers and workers can increase safety by inspecting the worksite, training employees, and maintaining equipment before harvest work begins.

Implementing effective communication strategies to ensure personnel safety and smooth flow of operations plays a great role in:-

- Solving different problems associated with harvesting operation
- Creating safe working environment
- Minimizing OHS hazards and using the corresponding care
- Facilitating the workers etc…

When your objectives involve communicating with others (when do they not?), the most pertinent environmental conditions consist of the **ideas** that your publics have about you and your objectives. It is sometimes said that **"perception is reality."** More to the point: Your publics' perception is your reality.

Before starting harvesting operation, communicating ideas and information to work team members, supervisors and other concerned bodies is the most important part of harvesting work. Communicating and sharing of ideas and information to work team members and supervisors regarding the horticultural harvesting operation is important to:-

- ✓ Reduce work load among workers
- ✓ Reduce work place hazards and risks
- ✓ Successfully complete the harvesting operation
- ✓ Have quality and quantity harvested product
- ✓ Reduce disagreement and biasness among workers
- ✓ Operate the harvesting activities based on crop type, part of the plant harvested, time of harvest, skill level and enterprise work procedures.
- ✓ Solve different problems that may occur during harvesting operation.

One of the best ways to ensure farmer participation is by creating partnerships with telecommunications companies in order to make interactions with farmers through phone and SMS inexpensive for the farmers and organizations. An example of ways to do this is through utilizing something like a beep system where calls aren't ever actually

answered so charges aren't accrued, however some companies will provide certain services at low or no cost.

The rapid advancements in technology are making it easier and easier to reach more farmers, but the large number of technologies out there can also become overwhelming. By tailoring messages and programs to specific groups to ensure they aren't receiving unnecessary information will make tech adoption and agricultural improvements more sustainable in the long run. The best way to do this is by continued engagement with your target group, redefining what your goals are for different segments of your target group, and keeping the costs down for farmers.

Self-Check – 1	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. Explain the importances of communication in harvesting? (5 pts.)
2. What is the role of technology in easing communication? (5 pts.)
3. What issues are communicated during harvesting? (5 pts.)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of the correct answer

Information Sheet 2- Implementing and adjusting harvesting operations

During harvesting operation, a high standard of field hygiene should be maintained. It should be done carefully at proper time without damaging the fruits.
During harvesting operation, a high standard of field hygiene should be maintained. It should be done carefully at proper time without damaging the fruits. The harvesting operation includes.

i) Identification and judging the maturity of fruits.
ii) Selection of mature fruits.
iii) Detaching or separating of the fruits from tree, and
iv) Collection of matured fruits.
There are many different ways in which fruits and vegetables are harvested. The harvesting method depends on the crop, how it is grown and the resources available. For example, if it is a crop where there is machinery available to do or to help with the harvesting, those methods can only be utilized if the grower or harvesting company can afford to use that machinery to get the crops harvested. Below, the common harvesting methods of fruits and vegetables, and included examples based on the footage I have been able to gather at different harvests.

Harvesting Methods

In general, these are the three different harvesting methods that take place when harvesting fruits and vegetables:

Hand Harvesting

Harvesting with Hand Tools

Harvesting with Machinery

However, it is important to note that it is hard to categorize the different types of harvesting because there can be some overlap.

1. Hand Harvesting

Hand harvesting is just that: produce is harvested by hand, without the use of any tools. When hand harvesting, it is typically done using a picking cart or some sort of container. A common example of a hand harvest with a picking cart is a strawberry harvest. While, an example of a hand harvest using containers is the hand harvesting carrot

operation you have seen previously on the blog. (There are two different types of carrot harvest that can be done: hand harvest for the fresh market or machine harvest for carrots that go on to be processed in to baby carrots or something of that sort.)

Figure 2.1 Hand Harvesting

2. Harvesting with Hand Tools

This harvesting method is typically carried out when harvesting tree fruit, where some sort of clipper (usually specialized for the type of produce being harvested) is used to remove the fruit from the tree, and then the fruit is placed into harvesting containers. Once the harvesting containers are full, the harvested product is transferred to larger bins in the field, of which those are then transported to the facility. Some examples include the harvesting of fresh figs, peaches, and Cuties. Although this is very common in the harvesting of tree fruit, it does also occur for other produce items, such as onion (the non-machine harvesting operation), garlic and row crops.

Figure 2.2 harvesting by hand tool

3. Harvesting with Machinery

There are a lot of different harvesting types that land under this category. There are operations that perform hand harvesting and harvesting with hand tools that also use harvesting machinery (e.g., harvesting rig) to aid in the overall harvesting and packing process. But, there are also harvesting operations that use the harvesting rigs to perform further "semi-processing activities" or postharvest washing. Then, there are also harvesting mowing machines and combines. All of these harvesting types serve a specific purpose, based on the type of produce being harvested, and considering the amount of investment that goes into the machinery, it needs to make sense.

a) Harvesting Using a Harvesting Rig – Commonly, the produce items are either hand harvested or harvested using tools and then passed on to the workers working on the harvesting rigs, where the product can be packed; washed and packed; trimmed, washed and packed; etc. The harvesting rigs serve as an aid in the packing process and then once the product is packed, or prepared for the processor, it is transported (typically via a conveyor belt) over to an adjacent trailer that is responsible for transporting the product out of the field. Some examples of this include the harvesting of cauliflower, cantaloupe, and romaine hearts (this is an example of semi-processing activities in the field).

Figure 2.3 use of harvesting rigs

b) Harvesting Using a Mower – The mower harvests have been perfected to rely heavily on the mowers and not so much on actual workers. There is the mower, with a few workers on it or at least one driving it and then an adjacent trailer to capture the harvested product. Some examples include the harvesting of spring mix and basil. Another form of a mower that you have seen is as part of the 3-step almond harvesting process (which also includes a sweeping and shaking machine).

Figure 2.4 Harvesting using harvesting mowers

c) Harvesting Using a Combine – Combines are used to harvest grain crops. They pass through the fields and mow down the grain crops and remove the desired portion into the machine and spit the rest out the back. An example of this is a corn combine that is used to harvest corn that is harvested to be used in processed products (e.g., corn chips, corn tortillas, etc.).

Figure 2.5 Combine harvesting

Key points to be considered during harvesting are:

- Whenever possible, ensure that there is an observer monitoring the whole of the harvested field in order to detect possible ignitions (the lorry driver or grain tractor driver or any other assistant).
- Ensure discontinuity between the areas already harvested, those not harvested and the forest land. For this reason it is very important that, whenever possible, you leave a strip of field around these areas with the disc ploughs after harvesting.
- On days in a heat wave with relative humidity of below 30%, it is advisable to reduce or, better still, stop activity between 1 pm and 5 pm.

- Schedule the harvest with the concerned body that is defense group (example, ADF) so that the primary action material that the ADF may provide and its volunteers are coordinated and working together at times that the machines are working.
- When harvesting on uneven ground, it is advisable to raise the cutter a little, when turning the harvester between 1 pm and 5 pm (official time) to prevent friction against the ground and any stones. It is also advisable to cover the bottom of the skid with nylon or other non-metallic plates.
- Carry a mobile phone and alert immediately of any incident, and in the event of a fire.

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (20 pts.)

1. Explain the different ways of harvesting (5 pts.)
2. What are the points to be considered during harvesting? (5 pts.)
3. What are the three types of harvesting machineries? (5 pts.)
4. Compare and contrast hand harvesting and machine harvesting (5 pts.)

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

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

Information Sheet 3- Coordinating equipment operation

Preparing equipment prior to harvest ensures that it is in good shape for the heavy workload. It should be inspected for proper guarding and all worn parts should be repaired or replaced. Harvesting equipment should not be used unless it is in proper working condition. Agricultural harvesting processes are not evenly distributed over the whole year but are rather subject to very large seasonal fluctuations. External influences such as breakdowns of machine can also interfere with the sensitive structure.
Farm equipment maintenance is not a one season activity. Caring and maintaining of farming machinery is a continuous year-round job. It shouldn't be neglected even during the busiest days within a season.

Failing to perform a series of maintenance and inspections may result into equipment malfunction at a critical time. If equipment fails, it can be devastating to the farming business. Routine inspections or checks and maintenance throughout the year is not time-consuming activity. A routine and quick inspection is enough to catch any awaiting problems that may require immediate fixing. Schedule a comprehensive time-table that will help your preparation prior to harvesting of the yields.

Commercial hand harvesting of fruit, nut, and vegetable crops is hard, tedious, and time-consuming work. The amount of labor needed for harvesting is often well over 50 percent of the total annual labor requirement. Hand harvesting 12 million acres annually would require at least 840 million Lh/year (1.05 million workers for 20 weeks/year), and would easily exceed the labor force of workers willing to do seasonal crop harvesting. Equipment should be made harvest-ready in the off-season, or at least several weeks before use.

- Review operation manuals and follow maintenance guidelines. Cleaning, proper lubrication, replacement of worn parts (belts, chains, springs, hydraulic hoses, etc.), and replacing shields may save valuable time during the short harvest period.
- Remove stumps, stones, or other debris from the field, or clearly mark them to prevent upsets, turnovers, and damage to equipment. Also mark ditches and banks.
- Some banks are undercut. You need to be aware that what appears to be the edge may not be solid, but that there may be an open space below it.
- Plan harvesting so equipment travels downhill on steep slopes to avoid overturns. Space tractor wheels as far apart as possible when operating on slopes.

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. Explain some of the importances of checking the working conditions of machines (5 pts.)
2. List the mechanisms of equipment coordination before harvesting (5 pts.)
3. Why removing stumps, stones, or other debris from the field? (5 pts.)

Note: **Satisfactory rating -15 points** **Unsatisfactory - 15 points**

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

Information Sheet 4- Identifying and controlling existing and potential hazards

Permanent accident procedures must be clearly displayed in accessible, and visible location(s).These instructions are available in the predominant language(s) of the workforce and/or pictograms. The procedures must identify, if appropriate the following; e.g.: farm's map reference or farm address- contact person(s) - location of the nearest means of communication (telephone, radio)- an up-to-date list of relevant phone numbers (police, ambulance, hospital, fire-brigade, access to emergency health care on site or by means of transport, electricity and water supplier); - how and where to contact the local medical services, Hospital and other emergency services. - Location of fire extinguisher; - emergency exits; - emergency cut-offs for electricity, gas and water supplies. - How to report accidents or dangerous incidents.

Are potential hazards clearly identified by warning signs and placed where appropriate?

Permanent and legible signs must indicate potential hazards, e.g. waste pits, fuel tanks, workshops, access doors of the plant protection product / fertilizer / any other chemical storage facilities as well as the treated crop etc. Warning signs must be present.

Is safety advice available/ accessible for substances hazardous to worker health, when required?

Information (e.g. website, telephone no, data sheets, etc.) is accessible, when required, to ensure appropriate action. Preparing equipment prior to harvest ensures that it is in good shape for the heavy workload. It should be inspected for proper guarding and all worn parts should be repaired or replaced. Harvesting equipment should not be used unless it is in proper working condition.

Hazards of falling

to reduce fall hazards, remember to:

- Always keep all platforms free of tools or other objects. Frequently clean the steps and other areas where workers stand to service, mount and dismount, or operate the machine.
- Wear well-fitting, comfortable shoes with non-slip soles. Use grab bars when mounting or dismounting machinery.
- Be sure your position is stable before you perform maintenance.
- Recognize that fatigue, stress, drugs or alcohol, and age may affect stability. Harvest season comes with many stresses.
- Exposure to dangerous situations can increase the mental pressure, and your risk of injury. Follow safe practices around harvest equipment to make the most of your work time during this important season.

Self-Check – 4	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

4. What should be done to reduce fall hazards? (5pts)
5. Why reporting dangerous incidents is important during harvesting? (5pts)
6. What is the consequence of operating mowers at excessive speed? (5pts)

Note: **Satisfactory rating – 15 points** **Unsatisfactory - 15 points**
You can ask you teacher for the copy of the correct answers.

Operation sheet-2	Implementing and adjusting harvesting operation

To undertake harvesting activity of a given horticultural crop, it is important to practice some procedures regarding the task. Therefore, to undertake a proper crop harvesting practices, follow the following procedures carefully.

1. Strictly identify and select the type of horticultural crop to be harvested (fruit, vegetable, flower…) and the plant organ to be harvested (leaf, root, flower, fruit, bunch…)
2. Carefully identify the maturity status of the selected crop depending on the purpose of harvesting and maturity parameters.
3. Prepare all the necessary tools, materials and equipment associated with the harvesting activities (like knives, machetes, rubber bunds, tractor, containers, buckets, baskets…etc) that aids in crop harvesting and reduces crop damages depending on the type of crop selected.
4. Carefully identify all the OHS hazards and use the correct corresponding PPE to reduce the hazard
5. Understand the nature of the crop to be harvested and prepare temporary storage facility depending on the type of crop to be harvested and parts of the plant to be harvested and adjust the time of harvesting depending on the nature of the crop.
6. Establish suitable weather conditions and carefully identify the major factors that affect the harvesting operation.
7. Determine the method of harvesting depending on the type of crop to be harvested and the availability of harvesting materials and the time of the day suitable to harvest the particular crop.
8. Select suitable harvesting method depending on the type of crop to be harvested and the availability of harvesting materials.
9. Communicate with the concerned bodies on the ways of risk management and mitigation.
10. Now start the harvesting operation carefully by giving highest attention for the quality of products by reducing crop damage, wastage, and contamination.
11. Then start the post-harvest activities (like Grading and sorting) depending on the type of crop you have harvested and carefully transport to the storage area.
12. Finally, complete your work by preparing work documents and reports including the risks and hazards that you have faced when performing the harvesting practices.

LAP Test 2	Practical Demonstration

Name_____ Date_____

Time started_____ Time finished_____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2** hour. The project is expected from each student to do it.

Task-1: Implementing and adjusting harvesting operation

LG #77	LO #4- Complete harvest operations

Instruction sheet

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

- Locating storage resources and identifying drying strategies
- Monitoring seed moisture content
- Evaluating harvesting operations and outcomes
- Documenting relevant information

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, **upon completion of this learning guide, you will be able to**:

- Locate storage resources and identify drying strategies
- Monitor seed moisture content
- Evaluate harvesting operations and outcomes
- Document relevant information

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.

- Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

Information Sheet 1- Locating storage resources and identifying drying strategies

1.1 Storage Facilities

Once a crop is harvested, it is almost impossible to improve its quality. Losses of horticultural crops due to improper storage and handling can range from 10 to 40 percent. Proper storage conditions—*temperature and humidity*—are needed to lengthen storage life and maintain quality once the crop has been cooled to the optimum storage temperature.

Crops that require different storage conditions will need three different storage facilities.

- Cold storage (temperatures 32 to 36°F).
- Cool storage (temperatures 40 to 55°F).
- Warmer storage (temperatures 55 to 60°F for sweet potatoes, squash, pumpkins or similar crops).

A recording thermometer can be helpful in determining whether storage facilities are maintaining ideal conditions and are not fluctuating. A maximum/minimum thermometer could be substituted. The thermometer should not be the same as the thermostat controlling the refrigeration equipment. Relative humidity also should be monitored with a hygrometer or a sling psychrometer.

Fresh fruits and vegetables are living tissues, although they are no longer attached to the plant. They breathe, just as humans do, and their composition and physiology continue to change after harvest. They continue to ripen and, finally, they begin to die. Cellular breakdown and death (senescence) are inevitable, but can be slowed with optimal storage conditions. Fresh fruits and vegetables need low temperatures (32 to 55°F) and high relative humidities (80 to 95 percent) to lower respiration and to slow metabolic and transpiration rates. By slowing these processes, water loss is reduced and food value, quality and energy reserves are maintained. The effects of relative humidity and temperature are discussed below.

Relative Humidity

Transpiration rates (water loss from produce) are determined by the moisture content of the air, which is usually expressed as relative humidity. At high relative humidity, produce maintains salable weight, appearance, nutritional quality and flavor, while wilting, softening and juiciness are reduced. Leafy vegetables with high surface-to-volume ratios; injured produce; and immature fruits and vegetables have higher

transpiration rates. External factors affecting transpiration rates are temperature, relative humidity, air velocity and atmospheric pressure. High temperatures, low relative humidity and high air velocity increase transpiration rates.

Relative humidity needs to be monitored and controlled in storage. A hygrometer or a sling psychrometer, not the appearance of the produce, should be used to monitor humidity. Control can be achieved by a variety of methods:

1. Operating a humidifier in the storage area.
2. Regulating air movement and ventilation in relation to storage room load.
3. Maintaining refrigeration coil temperature within 2°F of the storage room air temperature.
4. Using moisture barriers in the insulation of the storage room or transport vehicle, and in the lining of the packing containers.
5. Wetting the storage room floor.
6. Using crushed ice to pack produce for shipment.
7. Sprinkling leafy vegetables, cool-season root vegetables, and immature fruits and vegetables with water.

Temperature

Respiration and metabolic rates are directly related to room temperatures within a given range. The higher the rate of respiration, the faster the produce deteriorates. Lower temperatures slow respiration rates and the ripening and senescence processes, which prolongs the storage life of fruits and vegetables. Low temperatures also slow the growth of pathogenic fungi which cause spoilage of fruits and vegetables in storage. Producers should give special care and attention to proper storage conditions for produce with high to extremely high respiration rates—those crops will deteriorate much more quickly.

It is impossible to make a single recommendation for cool storage of all fruits and vegetables. Climate of the area where the crop originated, the plant part, the season of harvest and crop maturity at harvest are important factors in determining the optimum temperature. A general rule for vegetables is that cool-season crops should be stored at cooler temperatures (32 to 35°F), and warm-season crops should be stored at warmer temperatures (45 to 55°F). There are exceptions to this rule, though. Extreme temperature can cause injuries as discussed below

i) Freezing Injury

Temperatures that are too low can be just as damaging as those too high. Freezing will occur in all commodities below 32°F. Whether injury occurs depends on the commodity.

Some can be repeatedly frozen and thawed without damage, while others are ruined by one freezing. Produce that is likely to be injured by one freezing is classified as “most susceptible.” The “moderately susceptible” produce will recover from one or two freezings. Produce which is “least susceptible” can survive several freezings without injury.

Ii) Chilling Injury

Fruits and vegetables that require warmer storage temperatures (40 to 55°F) can be damaged if they are subjected to near freezing temperatures (32°F). Cooler temperatures interfere with normal metabolic processes. Injury symptoms are varied and often do not develop until the produce has been returned to warmer temperatures for several days. Besides physical damage, chilled produce is often more susceptible to disease infection. Table 3 lists susceptible fruits and vegetables, and characteristic symptoms of chilling injury.

Table 1.1 Storage Requirements for Fruits and Vegetables

Commodity	Storage Temperature* (°F)	Relative Humidity (%)	Average Storage Life
Vegetables			
Artichoke, Jerusalem	31–32	90–95	2–5 months
Asparagus	32–36	95–100	2–3 weeks
Bean & pea, dry	32–40	65–70	1 year
Bean, green or snap	40–45	90–95	7–10 days
Bean, lima	37–41	90–95	5–7 days
Beet (topped)	32	90–95	3–5 months
Broccoli	32	90–95	10–14 days
Cabbage, late	32	90–95	3–4 months
Cabbage, Chinese	32	90–95	1–2 months
Carrot	32	90–95	4–5 months
Cauliflower	32	90–95	2–4 weeks
Celeriac	32	90–95	3–4 months
Celery	32	90–95	2–3 months
Corn, sweet	32	90–95	4–8 days
Cucumber	50–55	90–95	10–14 days
Eggplant	45–55	90–95	1 week
Garlic	32	65–70	6–7 months
Leek	32	90–95	1–3 months
Lettuce	32	95	2–3 weeks

Commodity	Storage Temperature* (°F)	Relative Humidity (%)	Average Storage Life
Vegetables			
Melon, muskmelon (Cantaloupe)	32–40	85–90	5–14 days
Melon, honeydew	45–50	85–90	3–4 weeks
Melon, watermelon	40–50	80–85	2–3 weeks
Mushroom	32	90	3–4 days
Okra	45–50	90–95	7–10 days
Onion, dry	32	65–70	1–8 months
Onion, green	32	90–95	3–5 days
Parsley	32	90–95	1–2 months
Parsnip	32	90–95	2–6 months
Pea, green	32	90–95	1–3 weeks
Pepper, dry	32–50	60–70	6 months
Pepper, sweet	45–50	90–95	2–3 weeks
Potato, late	40–45	90	2–9 months
Pumpkin	50–55	70–75	2–3 months
Radish	32	90–95	3–4 weeks
Spinach	32	90–95	10–14 days
Squash, summer	40–50	90	5–14 days
Squash, winter	50–55	50–75	2–6 months
Sweet Potato	55	85–90	4–6 months
Tomato, mature green	55–70	85–90	1–6 weeks
Tomato, colored, firm	46–50	85–90	4–10 days
Fruits			
Apple	30–40	90	3–8 months
Apricot	31–32	90	1–2 weeks
Avocado	50–55	90–95	3–10 days
Blackberry	31–32	90–95	2–3 days
Blueberry	31–32	90–95	2 weeks
Cherry, tart	32	90–95	3–7 days
Cherry, sweet	30–31	90–95	2–3 weeks
Grapefruit	40–50	85–90	4–6 weeks
Grape	31–32	85	2–8 weeks
Orange	32–40	85–90	3–10 weeks
Peach	31–32	90	2–4 weeks
Pear	29–31	90–95	2–4 months
Plum	31–32	90–95	2–4 weeks
Raspberry	31–32	90–95	2–4 days
Strawberry	32	90–95	5-7 days

1.2 Identifying drying strategies

Drying / Dehydration

The terms drying and dehydration means the removal of water.

Drying - is done by using non-conventional energy sources like sun and wind.

Dehydration – means the process of removal of moisture by application of artificial heat under controlled conditions of temperature humidity and air flow.

Various factors that affect the rate of drying of horticulture produce

- Composition of raw material
- Size, shape and arrangement of stacking of produce
- Temperature, humidity and velocity of air
- Pressure (barometric or under vacuum)
- Heat transfer to surface (conductive, convective / irradiative)

Several types of driers and drying methods, each method better suited for a particular situation, are commonly used to remove moisture from a wide variety of food products including fruit and vegetables. Sun drying is followed in certain crops such as prunes, figs, apricots, grapes and dates.

There are three basic types of drying process

- ✓ Sun drying / solar drying
- ✓ Atmospheric drying including batch (Kiln, tower and cabinet driers) and continuous (tunnel, belt, belt-through, fluidized bed, explosion puff, foam mat, spray, drum and microwave).
- ✓ Sub atmospheric dehydration (Vacuum shelf / belt and freeze driers) Common driers type.

Drying techniques / methods

A) Fruit and vegetable natural drying –

- ❖ **Sun or solar drying:** Surplus production and specially grown crops may be preserved by natural drying for use until the next crop can be grown and harvested. These can be cheaply distributed t areas where there are permanent shortages of fruit and vegetables.
- ❖ **Shade drying**: It is done for products which can lose their color and or turn brown if put in direct sunlight. E.g.: Herbs, Green and red sweet peppers, chilies, green beans and okra.

- **Osmotic dehydration:** Here the prepared fresh material is soaked in a heavy or thick liquid sugar solution or strong salt solution and then the material is solar dried.

B) Common driers used for drying / dehydration

- **Air convection driers:** All air convection driers have some root of insulated enclosure, a means of circulating air through the enclosure and a means of heating this air –
- **Kiln drier:** It is the simplest kinds of air convection drier. These are generally used to for large pieces of material. E.g.: apple and Potatoes.
- **Cabinet, tray and Pan driers:** Advanced method, the food is loaded on trays or pans in a thin layer. Hot air is blown across the food trays. It is used for small scale operations.
- **Tunnel and continuous belt driers:** These driers are most commonly used for dehydrating fruit and vegetable. Here also hot air is blown across the trays.
- **Belt through driers:** the belt is usually of metal mesh and heated air is blown up through the mesh. The belt moves continuously keeping the food pieces in through. All products cannot be dried by this method.
- **Air lift driers:** These are generally used to finished dry materials that have been partially dried by other methods.
- Fluidized bed drier: In fluidized bed drying, heated air is blown up through the food particles with just enough force to suspend the particles in a gentle boiling motion. E.g.: grains and peas.
- **Spray driers:** Are used for liquids and low viscosity pastes and purees.

Self-Check – 1	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (20 pts.)

1. What are the three storage conditions for horticultural crops and discuss them? (5 pts.)
2. What are the significance of temperature and relative humidity in the storage of horticultural products? (5 pts.)
3. Discus on some the post-harvest activities like drying, cleaning, grading, sorting and packing operations? (5 pts.)
4. Discuss on the ways of extending the storage of life of a given harvested horticultural product? (5 pts.)

Note: **Satisfactory rating – 15 points** **Unsatisfactory - 15 points**

You can ask your teacher for the copy of the correct answer

Information Sheet 2- Monitoring seed moisture content

Year-long supplies of fresh food have been made possible by improvements in controlled storage conditions, shipping and importing. A fresh weekly food supply at the local supermarket has eliminated the need for the home preservation and food processing of earlier days. Today, we may choose to preserve and process food for reasons besides availability such as the price of food, quality and nutrition. For these reasons, gardeners who find themselves with a surplus of fresh produce at the end of the season may decide to store and preserve. There are five methods of storing vegetables and fruit: drying, canning, curing and salting, freezing and common storage. Which method is chosen depends upon the type of produce, the quality desired and the facilities available for storage. Regardless of the method chosen, some general rules should be followed:

1. Use only fresh produce.
2. Begin the preservation process immediately after harvest.
3. Avoid damaged, cut, bruised and pest or disease infested produce.
4. Use all preserved produce within one year of storage.

The moisture content of some fruits and vegetables including apples, pears, strawberries, bananas, and avocados, potatoes, carrots, onions, lettuce, and cabbage, was determined using a microwave oven. The effect of sample weight was studied and the results were compared with those obtained by conventional and vacuum oven drying methods. For 20-g minced samples of fruits and vegetables, these three methods yielded equivalent results, but usage of a microwave oven substantially shortened the drying time required (30 minutes versus 15 hours).

Water is an important constituent of all foods we eat. On a lighter note, moisture in foods can be considered as necessary evil. The palatability freshness and the very appearance of the fruits and vegetables are enhanced by the presence of water. On the other hand, the spoilage and the rate of spoilage are directly proportional to the water content of foods. Fruits and vegetables are often dried to enhance their shelf life. The moisture content of fruits and vegetables are determined for various reasons. Estimating the market value, determining the harvest conditions and shelf life and knowing the progress of drying are some of the few important objectives of determining the fruits and vegetables moisture content.

Currently, oven-drying methods are commonly used for determining the moisture content of foods Water is an important constituent of all foods we eat. On a lighter note, moisture in foods can be considered as necessary evil. The palatability freshness

and the very appearance of the fruits and vegetables are enhanced by the presence of water. On the other hand, the spoilage and the rate of spoilage are directly proportional to the water content of foods. Fruits and vegetables are often dried to enhance their shelf life. The moisture content of fruits and vegetables are determined for various reasons. Estimating the market value, determining the harvest conditions and shelf life and knowing the progress of drying are some of the few important objectives of determining the fruits and vegetables moisture content. Currently, oven-drying methods are commonly used for determining the moisture content of foods

Water is an important constituent of all foods we eat. On a lighter note, moisture in foods can be considered as necessary evil. The palatability freshness and the very appearance of the fruits and vegetables are enhanced by the presence of water. On the other hand, the spoilage and the rate of spoilage are directly proportional to the water content of foods. Fruits and vegetables are often dried to enhance their shelf life. The moisture content of fruits and vegetables are determined for various reasons. Estimating the market value, determining the harvest conditions and shelf life and knowing the progress of drying are some of the few important objectives of determining the fruits and vegetables moisture content. Currently, oven-drying methods are commonly used for determining the moisture content of foods

Most raw tree and vine fruits contain 83-87% water; the water content of ripe guavas is 81%, of ripe olives 72-75%, and of avocado 65%. After commercial drying, fruits contain up to 25% water. Fresh fruit juices and nectars contain 85-93% water; the water content is lowered in concentrated or sweetened products. Sweet potatoes contain less water (69%) than white potatoes (78%). Radishes have the most (93%) and parsnips the least (79%) water among the common root vegetables. Among other vegetables, a still wider range is found. Green lima beans have about 67% and raw cucumbers over 96%

One of the oldest ways to preserve produce is through drying. The basic procedure involves removal of moisture from the produce to a point where decay is not likely. This can be done by using an oven, a dehydrator or the warm heat of the sun. Once finished, the produce should be stored in a dry place in air tight containers. Dried produce does not retain the quality and nutritional value found with fresh produce. The process is also fairly labor intensive and time-consuming.

Fig. 4.1 drying of fruits

As shown in the table, fresh fruit is typically between 75 and 95 percent water, a fact that helps to explain the refreshing character of the food. In general, fruits are acidic, with pH ranging from 2.5 to 4.5.

Self-Check – 2	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions

1. What is the role of monitoring the moisture contents of horticultural crops? (5 pts.)
2. What is a microwave oven? (5 pts.)
3. What is the importance of drying in horticultural crops? (5 pts.)
4. What is the purpose of consuming fresh produce? (5 pts.)

. ***Note:*** **Satisfactory rating – 15 points** **Unsatisfactory - 15 points**

You can ask your teacher for the copy of the correct answer

Information Sheet 3- Evaluating harvesting operations and outcomes

3.1 Evaluating the Harvesting Operations and Outcomes

Harvesting operations and outcomes are evaluated against harvest strategy. This is important because to analysis weather the harvest strategy is good or not and what was the outcomes look like. You can evaluate harvesting operation and outcomes by asking yourself question like:

- Is the harvesting strategy is cost effective?
- Is the harvest strategy save time or not?
- Is the operation is easily is applicable?
- What the effects of operation on personnel safety?

Then, by answering such question you can evaluate harvest operation and outcomes**.**
Formal evaluation of operations will be done by staff of the crops Authority. Self-regulation by logging companies to ensure compliance with the *Code of Practice for horticultural crops Harvesting* and monitoring of performance is recommended.

3.2 Timing of evaluations

- ✓ Crops authority officers will evaluate operations at each inspection.
- ✓ Maximum time between evaluations should be 3 months. Inspection at 1-month intervals is preferable.
- ✓ If the evaluation results in a suspension of operations, a further field evaluation should be carried out to verify that all the work is completed to the required standards, before the suspension is lifted.

3.3 Evaluation procedures

- ❖ All evaluations require ground inspection.
- ❖ The crop authority officer should be accompanied by a representative of the company and other authorities as appropriate.
- ❖ Preliminary evaluations may be undertaken from small format photography/satellite images of logging areas which have been flown since the last inspection. Assessments of operations from photography need to be checked in the field.
- ❖ Areas inspected and evaluated should include a representative sample of: current harvesting operations, areas completed since the last inspection, areas where the company was directed, at the previous inspection, to do further work.
- ❖ During the inspection, all areas of non-compliance with the Code or the harvesting contract are to be explained to the company representative.
- ❖ The company representative is requested to sign the evaluation form as a true record of the inspection

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15 pts.)

1. What are the questions that should be answered during evaluation of harvesting? (5 pts.)
2. At what time evaluation should undertake? (5 pts.)
3. Discuss the roles of evaluation for the final outcome of harvesting? (5 pts.)

Note: **Satisfactory rating - 15points** **Unsatisfactory - below 15 points**

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

Information Sheet 4- Documenting relevant information

Now you have completed implementing harvesting operation. Finally, you have document relevant information you done so far for continual analysis effective planning. Your document may include:-

While the harvest log will be customized to your farm, you may want to incorporate additional recordkeeping requirements here, or maintain them separately. In general, you'll want to maintain at least the following info:

As harvesting is completed all data has been under taken during the process has to be documented for future analysis. The following data has to be documented after completing harvesting operation.

- Harvest date
- Harvest lot number
- Field ID
- Crop/variety
- percentage crop deterioration,
- maturity measurements taken,
- Quantity harvested
- Storage/sale location
- dispatch details and delivery dockets
- total labor required to perform the harvesting operation
- Total cost consumed through the harvesting operation etc…
- Methods of harvesting
- Man power per hectare
- Any treatment used before harvesting
- Problem encountered during harvesting
- Control measure taken
- Estimation of post-harvest yield
- Resource, Equipment, tools and machinery used
- Was the harvest good or fair or poor

Self-Check – 4	Written test

Name…… ID…… Date…….

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

Test: Short Answer Questions (15pts.)

1. What is documentation in horticultural crop harvesting? (5 pts.)
2. What are the documentation parameters? (5 pts.)
3. Discuss the roles of documentation for future work? (5 pts.)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

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

References

TTLM

1. TTLM on Implementing horticultural crops harvesting programs by wondimu Tamirat (August 2012)

2. TTLM on supervising agricultural crop harvesting by Tadiyos Bayisa (August 2012)

3. A Texas Guide to farm vehicles-Texas Department of public safety commercial vehicle enforcement

WEB ADDRESSES

1. https://hortnews.extension.iastate.edu/2004/7-23-2004/vegguide.html
2. https://www.slideshare.net/KarlLouisseObispo/lecture-3-fruits-and-vegetables
3. https://regenerative.com/8-fruits-harvesting-guide/
4. http://extensionpublications.unl.edu/assets/pdf/g1264.pdf
5. https://www.iii.org/article/understanding-crop-insurance

AKNOWLEDGEMENT

We wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

We would like also to express our appreciation to the TVET instructors and respective industry experts of Regional TVET bureau, TVET College/ Institutes, **Green flower foundation** Federal Technical and Vocational Education and Training Agency (FTVET) who made the development of this Teaching, Training and Learning Materials (TTLM) with required standards and quality possible. This Teaching, Training and Learning Materials (TTLM) was developed on December 2020.

The trainers who developed the learning guide

No.	Full name	TVET	Level of education	A/ background	Email	Mobile
1.	Misgana Belay	Nedjo	MSc	Agronomy	Misbel2020@gmail.com	0911983854
2.	Leta Abebe	Waliso PC	BSc	Plant science	Letaabeba361@gmail.com	0922768274
3.	Deribew Gonfa	Fitche PTC	MSc	Plant Science	gonfad24@gmail.com	0912774688
4.	Chimdessa Wakuma	Bako	MSc	Horticulture	wakumachimdessa@gmail.com	0911359086
5.	Alemayehu Tesfaye	Nedjo	MSc	Plant science	alemayehutesfayem@gmail.com	0913214980
6.	Getenesh Belay	Holeta	MSc	Horticulture	Nebzek2@gmail.com	0911449053
7.	Tamirat Tirfesa	Bako	BSc	Plant science	tirfessatamiru@gmail.com	0926811647
8.	Tesfaye Tekola	Assosa	MSc	Agronomy	tttekola@gmail.com	0910550651
9.	Moti Taye	Bako ATVEVT	MSc	Plant science	Tayemoti12@gmail.com	0912801540
10.	Adisu Shamble	Bako ATVET	BSc	Plant science	Adisushambel2011@gmail.com	0920617572
11.	Hailu Dereje	Bishoftu PC	BSc	Plant scicne		
12.	Mamo Abdi	OTVETB	MSc	Environmental and sustainable development	Mamoab57@gmail.com	0917812505