RQF LEVEL 5

TRADE FOOD PROCESSING

MODULE CODE: FOPFV501

TEACHER'S GUIDE

Module name: DRYING FRUITS AND VEGETABLES

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ACRONYMS

FOP: Food Processing

DVF: Drying fruit and Vegetables

SB: Steam blanching

RQF: Rwanda qualification flame work

FOPFV: Food processing fruit and vegetable

RSB: Rwanda standard board

Introduction

One of the most serious problems facing growers of fruits and vegetables is how to prevent these products from spoiling and thereby becoming unfit for consumption. There are various methods of accomplishing this, such as canning or freezing. However, one of the most suitable methods of preserving most fruits and vegetables is through drying to remove most of the water content.

Food drying is one of the oldest methods of preserving food for later use. It can either be an alternative to canning or freezing, or compliment these methods. Drying foods is simple, safe and easy to learn. With modern food dehydrators, fruit leathers, banana chips and beef jerky can all be dried.

Drying removes the moisture from the food so bacteria, yeast and mold cannot grow and spoil the food. Drying also slows down the action of enzymes (naturally occurring substances which cause foods to ripen), but does not inactivate them.

Because drying removes moisture, the food becomes smaller and lighter in weight. When the food is ready for use, the water is added back, and the food returns to its original shape.

Foods can be dried in the sun, in an oven or in a food dehydrator by using the right combination of warm temperatures, low humidity and air current.

In drying, warm temperatures cause the moisture to evaporate. Low humidity allows moisture to move quickly from the food to the air. Air current speeds up drying by moving the surrounding moist air away from the food.

Module Code and Title: FOPFV501 DRYING FRUITS AND VEGETABLES

LEARNING UNITS

1. **Pre- treat Fruits and Vegetables**
2. **Dry fruits and Vegetables**
3. **Monitor the dryness of fruits and Vegetables**
4. **Pasteurize the product**
5. **Package and store the product**

LEARNING UNIT 1: PRE-TREAT FRUITS AND VEGETABLES

STRUCTURE OF LEARNING UNIT

LEARNING OUTCOMES:

1.1 Handle prepared fruits prepared fruits and vegetables according to atmospheric conditions

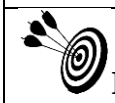
1.2 selection of pre-treated substances according to fruits and vegetables varieties

1.3 usage of pre-treated substances/methods according to shelf life requirement and health effect

1.4 usage of pre-treated substances/methods based on direction for use

Learning outcome 1.1 Handle prepared fruits prepared fruits and vegetables according to atmospheric conditions

 **Duration: 3 hrs**

 Learning Outcome 1.1 Objectives :

By the end of the learning outcome, the trainees will be able to:

1. Handle prepared fruits and vegetables
2. Select pre-treatment substances
3. Describe the Uses pre-treatment substances

 **Resources**

Equipment	**Tools**	**Materials**
Audio-visual equipment - Sun dryer - Solar dryer - Dehydrator - Food mill - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

 **Advance preparation:**

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 1.1: Handle prepared fruits and vegetables

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

A fruit is defined as the sweet and fleshy product of a tree or other plant that contains seeds and can be eaten as food. Or the fleshy or dry ripened ovary of a plant, which encloses the seed or seeds.
A vegetable is the edible portion of a plant. Vegetable are usually group according to the proportion of plant that is eaten such a leaves (lettuce), stem (celery), roots (carrots), tubers (potatoes) bulbs (onion) and flowers (broccoli). a
By handling fruit and vegetables, you wash your hands, kitchen utensils, and food preparation surfaces, including chopping boards and countertops, before and after preparing fruits and vegetables.
Fresh fruits and vegetables need **low temperatures (32 to 55°F) and high relative humidity (80 to 95 percent)** to lower respiration and to slow metabolic and transpiration rates

Handling conditions
Temperature
Air flow
Humidity
Controlling parameters
Oxidation
Enzymatic activity

STEPS TO PREPARE FRUIT AND VEGETABLE FOR DRYING
the basic preparation steps in fruits.
All accepted fresh fruit and vegetables must be thoroughly washed before entering the main processing area.
The outer peel of the fruit can be contaminated with potentially dangerous microorganisms from a variety of sources such as birds, insects, rodents, and grazing animals (in the case of windfalls).
There should be minimal delay between acceptance of the incoming of fruit and vegetables and the time they go through the initial washing phase of the process.
This will reduce the need to store incoming fresh fruit and vegetable before they are washed and help maintain a clean production environment.
Washing must be done with potable water. “Potable water” is water that is fit for human consumption.
This will prevent the incoming fruit and vegetables from being contaminated further, which would be the case if impure water was used in the washing stage.

A rinse with a chlorine solution or passage through a bath of chlorine solution would help reduce the microbial population on the surface of the fruits.

The easiest way to prepare a disinfecting solution of chlorine is by using a bleach solution.

A household bleach container often has instructions on the label for preparing such a solution.

The strengths of chlorine solutions can vary depending on their application and the concentration of the initial bleach solution.

A mixture of 180 mL of bleach and 4 litres of potable water may be sufficient for this application.

This would need to be followed by a thorough rinse with potable water.

Your fingers are the ten most common causes of infection and food contamination

Hand-washing stations using warm potable water and equipped with soap dispensers should be within easy access of workers.

Towels for hand-drying should be clean and changed regularly.

In addition, there should be adequate washroom facilities which should be maintained and cleaned according to a regular schedule.

Workers should never return to their work stations without having properly washed their hands.

Fresh fruits and vegetables need **low temperatures (32 to 55°F) and high relative humidity (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


Theoretical learning Activity

Conduct brainstorming session with the student on different handling steps of fruits and vegetables

Have students in their respective groups discuss different handling conditions and handling parameters


Practical learning Activity

Provide students with pictures of the different fruits and vegetables and ask them to discuss about their quality and conditions to select some of them


Points to Remember (Take home message)

All accepted fresh fruit and vegetables must be thoroughly washed before entering the main processing area.
Hand-washing stations using warm potable water and equipped with soap dispensers should be within easy access of workers
Fresh fruits and vegetables need **low temperatures (32 to 55°F) and high relative humidity (80 to 95 percent)** to lower respiration and to slow metabolic and transpiration rates
Handling conditions of fruit and vegetables
Temperature
Humidity
Air flow


Learning Outcome 1.1 Formative Assessment

Written assessment

Question1. What is a fruit?

Answer:

A fruit is defined as the sweet and fleshy product of a tree or other plant that contains seeds and can be eaten as food. Or the fleshy or dry ripened ovary of a plant, which encloses the seed or seeds.

Question2. Give 3 examples of vegetables you know?

Answer:

Cabbages

Carrots

Amaranths

Is it important to control enzymatic activities? True False

Answer: True

Question3. Workers should never return to their work stations without having properly washe ds True False

Answer: True

Question4. Choose the correct answer

Fresh fruits and vegetables need low temperatures and high relative humidity which equal to

a. (30 to 55°F) to (70 to 95 percent

b. (32 to 55°F) to (80 to 95 percent

c. (32 to 50°F) to (80 to 90 percent

d. (33 to 54°F) to (80 to 95 percent

Answer: b (32 to 55°F) to (80 to 95 percent

Practical Assessment

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of TUZAMURANE cooperative, you assigned **to wash, Peel, core and Slice pineapple.**

The pineapple should have:

-well washed with portable water

-peeled properly with no residue

-and sliced into the thickness of 3-4 cm

Task: Handle prepared fruits(pineapples)

Observation Checklist	**Score**	
	Yes	**No**
Indicator 1: Washing conditions are respected		
Potable is used		
PPE is respected		
Pineapples have no residual dirty		
Indicator 2 : Peeling is done properly		
Tools, materials and equipment for peeling are selected		

Peels are well removed		
Indicator 3 : Slicing is done properly		
Core is are well removed		
thickness of slices is respected		
Observation		

References:

Donald G. Mercer, "Solar Drying in Developing Nations: Possibilities and Pitfalls", Chapter 4, in "Using Food Science and Technology to Improve Nutrition and Promote National Development", G.L. Robertson and J.R. Lupien, editors. Published by The International Union of Food Science and Technology, 2008. ISBN 978-0-9810247- 0-7

Learning outcome 1.2 selection of pre-treated substances according to fruits and vegetables varieties

Duration: 3 hrs

Learning Outcome 1.2 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain the reason for pre-treat fruit and vegetables before drying
2. Select pre-treatment substances
3. Describe different pre-treatment substances

Resources

Equipment	**Tools**	**Materials**
Audio-visual equipment - Sun dryer - Solar dryer - Dehydrator - Food mill - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 1.2: Select pre-treatment substances

 Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

Selection of pre-treated substances according to fruits and vegetables varieties

Five major reasons for treating Food before drying are to :

1. Preserve colour and flavour
2. Minimize nutrient loss
3. Stop decomposition (enzyme action)
4. Ensure more even drying
5. Extend storage life

Selection criteria of pre-treatment substances :
Varieties of fruits and vegetables
Health effects
Shelf life
Food/reagent grade
Direction for use
Pre-treatment process and methods:
Blanching for vegetable
Outdoor
Indoor
Types of pre-treatment substances:
Sulfuring
Sulphite dip (sodium sulphite or sodium meta bisulphite
Ascorbic acid
Fruit juice dip
Honey dip
Syrup blanching
Steam blanching
Pre-treatment Methods for Fruits and Vegetables

Fruits	Vegetables
Ascorbic acid Citric acid dips Salt solution dips Syrup blanching Honey dip Fruit juice dip Sulfiting (Sodium sulphite or sodium meta- bisulphite dip)	Steam blanching Water blanching

 Theoretical learning Activity

Conduct brainstorming session with the student on different handling steps of fruits and vegetables

Have students in their respective groups discuss different pre-treatment substances

 Practical learning Activity

Provide students with pictures of the different pre-treatment substances of fruits and vegetables and ask them to discuss about their quality and conditions to select some of them

 Points to Remember (Take home message)

Select pre-treatment substances
Five major reasons for treating Food before drying are to :
Preserve colour and flavour
Minimize nutrient loss
Stop decomposition (enzyme action)
Ensure more even drying
Extend storage life

Selection criteria of pre-treatment substances :
Varieties of fruits and vegetables
Health effects
Shelf life
Food/reagent grade
Direction for use

 Learning Outcome 1.2 formative Assessment

Written assessment

Question1. Write Five major reasons for treating foods before drying

Answer:

Five major reasons for treating foods before drying are to

Preserve colour and flavour

Minimize nutrient loss

Stop decomposition (enzyme action)

Ensure more even drying

5. Extend storage life

Question2. Enumerate Selection criteria of pre-treatment substances

Answer

Selection criteria of pre-treatment substances

Varieties of fruits and vegetables

Health effects

Shelf life

Food/reagent grade

Direction for use

Question3. Choose the correct answer

The following are Pre-treatment Methods for Fruits only except….

Ascorbic acid

Citric acid dips

Salt solution dips

Water blanching

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO

DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of TUZAMURANE Cooperative, you assigned **to select a pretreatment substance for pineapple pre-treatment.**

The pretreatment selected should be:

- appropriate to the pineapple

Task: Select pretreatment substances

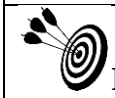
Checklist	**Score**	
	Yes	**No**
Indicator 1: Selection criteria of pre-treatment substances are well considered		
Varieties of fruits are well selected		
Health effects is well considered		
Shelf life is well checked		
Food /reagent grade is well considered		
Direction for use is well followed		
Indicator 2: Pre-treatment process and methods are well understood		
Outdoor pre-treatment is well done		
Indoor pre-treatment is well done		
Indicator 3: Types of pre-treatment substances are well identified		
Sulfuring		
Sulfite dip(sodium sulfite or sodium meta bisulfite		
Ascorbic acid		
Fruit juice dip		
Honey dip		
Observation		

References:

Donald G. Mercer, "Solar Drying in Developing Nations: Possibilities and Pitfalls", Chapter 4, in "Using Food Science and Technology to Improve Nutrition and Promote National Development", G.L. Robertson and J.R. Lupien, editors. Published by The International Union of Food Science and Technology, 2008. ISBN 978-0-9810247- 0-7

Learning outcome 1.3 usage of pre-treated substances/methods according to shelf life requirement and health effect

 **Duration: 4 hrs**

 Learning Outcome 1.3 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain the Methods of using pre-treatment substance
2. Explain the Directions for use of pre-treatment substances
3. Explain the Safety usage cautions

 **Resources**

Equipment	**Tools**	**Materials**
Audio-visual equipment - Sun dryer - Solar dryer - Dehydrator - Food mill - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

 **Advance preparation:**

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 1.3: Use pre-treatment substances

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

Pretreating Fruits
Decomposition from enzyme action during storage is less a problem with fruits than it is with vegetables.
Fruits have higher levels of sugar and acid, which counteract enzyme action.

Although pre-treating fruit is not necessary, you can use:
An ascorbic acid/citric acid dip, a salt solution dip, syrup blanching, a honey dip, or a sulfiting procedure. Certain fruits, such as apricots, pears, peaches, and some varieties of apples, tend to discolor with drying.
Pre-treating those fruits can decrease browning during processing and storage and lower losses of flavour and of vitamins A and C.

N.B: If you use a pre-treatment method that requires soaking fruits in a water solution, you will need to increase drying time because the fruit will absorb some water. Do not allow foods to soak more than 1 hour.
Ascorbic acid (vitamin C): mixed with water is a safe way to prevent fruit browning. However, its protection does not last as long as sulfuring or sulfiting. Ascorbic acid is available in the powdered or tablet form, from drugstores or grocery stores. One teaspoon of powdered ascorbic acid is equal to 3000 mg of ascorbic acid in tablet form. (If you buy 500 mg tablets, this would be six tablets).

Directions for Use: Mix 1 teaspoon of powdered ascorbic acid (or 3000 mg of ascorbic acid tablets, crushed) in 2 cups water. Place the fruit in the solution for 3 to 5 minutes. Remove fruit, drain well and place on dryer trays. After this solution is used twice, add more acid.

2.Ascorbic Acid Mixtures: Ascorbic acid mixtures are a mixture of ascorbic acid and sugar sold for use on fresh fruits and in canning or freezing. It is more expensive and not as effective as using pure ascorbic acid.

Directions for Use :Mix 1 1/2 tablespoons of ascorbic acid mixture with one quart of water. Place the fruit in the mixture and soak 3 to 5 minutes. Drain the fruit well and place on dryer trays. After this solution is used twice, add more ascorbic acid mixture.

3.Fruit Juice Dip - A fruit juice that is high in vitamin C can also be used as a pretreatment, though it is not as effective as pure ascorbic acid. Juices high in vitamin C include orange, lemon, pineapple, grape and cranberry. Each juice adds its own color and flavor to the fruit.

Directions for Use - Place enough juice to cover fruit in a bowl. Add cut fruit. Soak 3 to 5 minutes, remove fruit, drain well and place on dryer trays. This solution may be used twice, before being replaced. (The used juice can be consumed.)

4.Honey Dip - Many store-bought dried fruits have been dipped in a honey solution. A similar dip can be made at home. Honey dipped fruit is much higher in calories.

Directions for Use - Mix 1/2 cup sugar with 1 1/2 cups boiling water. Cool to lukewarm and add 1/2 cup honey. Place fruit in dip and soak 3 to 5 minutes. Remove, drain well and place on dryer trays.

5.Syrup Blanching - Blanching fruit in syrup helps it retain color fairly well during drying and storage. The resulting product is similar to candied fruit. Fruits that can be syrup blanched include apples, apricots, figs, nectarines, peaches, pears, plums and prunes.

Directions for Use - Combine 1 cup sugar, 1 cup light corn syrup and 2 cups water in a saucepot. Bring to a boil. Add 1 pound of prepared fruit and simmer 10 minutes. Remove heat and let fruit stand in hot syrup for 30 minutes. Lift fruit out of syrup, rinse lightly in cold water, drain on paper toweling and place on dryer trays

6.Salt Solution Dip:
Prepare a solution of 2 to 4 tablespoons of salt per gallon of water. Soak fruit for 2 to 5 minutes, and then drain it well

7.Sulfiting.
Sulphur dioxide treatments, either sulfiting or sulfuring, are very effective for retarding oxidation and browning in fruit

Amount of sulphur to add per quart of water:
Sodium bisulphite 1 /2 to 1 teaspoon
Sodium sulphite 1 to 2 teaspoons
Sodium metabisulfite 1 to 3 teaspoons

Pretreating Vegetables
Blanching (heating in boiling water or steam) is the pre-treatment method of choice for vegetables.
Almost all vegetables should be blanched before drying to destroy the enzymes that make vegetables deteriorate.
Blanching keeps vegetables from browning, becoming bitter, or developing off flavours.
Blanching also cleans and softens vegetables and makes them easier to rehydrate later.

Although you can use either **boiling water or steam for blanching**, vegetables lose more nutrients during boiling.

1.Steam Blanching

Steam blanching also helps retain colour and slow oxidation. However, the flavour and texture of the fruit is changed.

Directions - Place several inches of water in a large saucepot with a tight fitting lid.

Heat to boiling.

Place fruit not more than 2 inches deep, in a steamer pan or wire basket over boiling water.

Cover tightly with lid and begin timing immediately. See below for blanching times.

Check for even blanching half way through the blanching time.

Some fruit may need to be stirred. When done, remove excess moisture using paper towels and place on dryer trays

2.Water Blanching**:**

Fill a kettle with enough water to cover the food.

Bring the water to a rolling boil and gradually stir in the food. C

over the kettle tightly and boil.

You can reuse the water when blanching more of the same food, adding more water as necessary.

If the water appears dirty, replace it with clean water.

Determining Blanching Times:

Blanching times vary with altitude (higher altitudes require longer blanching times), the type and texture of the vegetable, the amount of vegetable, and the thickness of the pieces.

Generally, vegetables should feel and taste firm yet tender. They should not be fully cooked, but they should be heated all the way through.

Test the food by cutting through a piece.

If sufficiently blanched, it will appear cooked (translucent) nearly to the centre.

N.B: You should test the food frequently to avoid over- or under blanching.

Under blanching may cause deterioration in storage, poor rehydration, or bad colour.

Over blanching makes vegetables lose colour, flavour, and nutrients and gives them poor texture after rehydration.

After Blanching: Drain vegetables by pouring them directly on the drying trays.

If you plan to reuse the water, place a large pan under the trays.

Wipe the bottom of the drying tray with a clean towel to remove excess water.

Draining the vegetables on one tray and then transferring them to the drying tray results in unnecessary handling.

Immediately transfer the blanched vegetables into the dehydrator so drying can begin while the vegetables are still warm.

 Theoretical learning Activity

Conduct brainstorming session with the student on different system of how fruits vegetables should be pre-treated

Have students in their respective groups discuss how pre-treatment substance should be used

 Practical learning Activity

Provide students the pre-treatment substance of fruits and vegetables and ask them to calculate according to dosage

 Points to Remember (Take home message)

Pre-treating Fruits
Decomposition from enzyme action during storage is less a problem with fruits than it is with vegetables

Pre-treating Vegetables
Blanching (heating in boiling water or steam) is the pre-treatment method of choice for vegetables. Almost all vegetables should be blanched before drying to destroy the enzymes that make vegetables deteriorate
Under blanching may cause deterioration in storage, poor rehydration, or bad colour.
Over blanching makes vegetables lose colour, flavour, and nutrients and gives them poor texture after rehydration

Steam Blanching
Steam blanching also helps retain colour and slow oxidation. However, the flavour and texture of the fruit is changed

 Learning Outcome 1.3 Formative Assessment

Written assessment

Question1. Define fruit pre-treating

Answer:

Pre-treating: it is activities applied on fruit which helps keep light-coloured fruits from darkening during drying and storage

Question2. Explain the effect of Under blanching and Over-blanching on vegetables

Answer:

Under-blanching may cause deterioration in storage, poor rehydration, or bad colour.

Over-blanching makes vegetables lose colour, flavour, and nutrients and gives them poor texture after rehydration

Question3. Choose true or false

A) Steam blanching involves in the use of cold water during blanching?
B) **Blanching** is the pre-treatment method of choice for vegetables.
C) Steam blanching also helps retain colour and slow oxidation
D) Sulphur dioxide treatments, either sulfiting or sulfuring, are **very effective for retarding oxidation and browning in fruit**

Answer:

A) False
B) True
C) True
D) True

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of TUZAMURANE Cooperative, you assigned to **apply pretreatment substances.**

-Use of pretreatment substance according to the ratio within 5 minutes

Task: Apply pre-treatment substances

Checklist	**Score**	
	Yes	**No**
<u>Indicator 1: Methods of using pre-treatment substances are well understood</u>		
<u>Indicator 2:</u> Directions for use pre-treatment substances are well followed		
Ratio		
Time		
<u>Indicator 3:</u> Safety usage cautions are well respected		
Observation		

References:

Donald G. Mercer and Robert Myhara, "Improving the Operation of a Commercial Mango Dryer", Chapter 6, in "Using Food Science and Technology to Improve Nutrition and Promote National Development", G.L. Robertson and J.R. Lupien, editors. Published by The International Union of Food Science and Technology, 2008. ISBN978-0-9810247- 0-7

LEARNING UNIT 2: DRY FRUITS AND VEGETABLES

STRUCTURE OF LEARNING UNIT

LEARNING OUTCOMES:

2.1 Prepare/select dryers

2.2 Apply drying methods

2.3 Use dried fruits and vegetables

Learning Outcome 2.1: Prepare/select dryers

Duration: 3 hrs

Learning Outcome 2.1 Objectives :

By the end of the learning outcome, the trainees will be able to:

1. To differentiate the types of dryers
2. To explain the conditions of dryer
3. To describe the Harmful dryer materials to avoid
4. To know the Harmful effects of non-complaint dryer material

Resources

Equipment	Tools	Materials
Audio-visual equipment A scenario - Chart on dehydrator - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 2.1: Select dryers

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

Selecting fruits and vegetables for drying

Fruits:

If you're new to drying, start with the fruits you like best.

Think also about how you will use your dried fruits.

Most fruits are easy to dry.

High-quality fruits make the best dried products.

Choose firm, fully ripe fruit that is heavy for its size.

Handle fruits gently and process them immediately because fruit ready for drying is very fragile.

Use overripe or bruised fruits in other ways (for example, as fruit leathers)

Vegetables:

Vegetables for drying should be **fresh, tender, and just mature.**

Avoid immature vegetables because their colour and flavour tend to be weak or poor.
Also avoid excessively mature vegetables, which are inclined to be tough, woody, or fibrous.
For the best quality and nutrition, dry vegetables as soon as possible after harvest.

Preparing Foods for Drying

Fruits:

- ✓ Gently wash all fruits in cold water just before drying to remove dirt, bacteria, and insects.
- ✓ Thoroughly wash fruits that have skins you will not peel off, such as cherries and prunes.
- ✓ Do not soak fruit because extended soaking can cause nutrient loss and waterlog the fruit, which increases drying times.
- ✓ Remove fruit stems and peels.
- ✓ Peels may be left on some fruits, such as apples and peaches, but they may become bitter or discolor during drying.
- ✓ Core or pit the fruit and cut it into uniform halves, quarters, or slices.
- ✓ Trim away diseased or soft spots.

Vegetables:

- ✓ Wash vegetables in cold water just before drying.
- ✓ If vegetables are covered with soil, wash them under clean running water to prevent the dirt from resettling on the food.
- ✓ Do not allow vegetables to soak in water. Most vegetables should be peeled and trimmed then cut, sliced, or shredded into uniform pieces.
- ✓ Although peeling some vegetables such as young zucchini and well-washed carrots is optional, unpeeled vegetables tend to be tougher when dried.
- ✓ Remove fibrous or woody portions and damaged areas.
- ✓ You can prepare pieces with a food slicer or food processor.

Select dryers

- ✓ Dryers cleanness
- ✓ Cleaning materials
- ✓ Cleaning methods

Dryers types

- ✓ Oven
- ✓ Dehydrator
- ✓ Solar dryer

Conditions of dryers

- ✓ Stainless steel
- ✓ Teflon coated fiberglass or plastic

Harmful dryer materials to avoid

- ✓ Hardware cloth
- ✓ Copper
- ✓ Aluminium screener

- **Harmful effects of non-complaint dryer materials:**

✓ Oxidation
✓ Vitamin destruction
✓ Discoloration
✓ Corrosion
✓ Off flavour in the food


Theoretical learning Activity

Conduct brainstorming session with the student on different system of how to select fruits vegetables for drying

Have students in their respective groups discuss about types and conditions for dryers


Practical learning Activity

Provide students with pictures of the different types pf dryers for fruits and vegetables and ask them to discuss about their quality and conditions to select some of them


Points to Remember (Take home message)

- **Selecting Foods for Drying**

Fruits:
If you're new to drying, start with the fruits you like best. Think also about how you will use your dried fruits.

- **Choose firm, fully ripe fruit that is heavy for its size**. Handle fruits gently and process them immediately because fruit ready for drying is very fragile.
- **Use overripe or bruised fruits in other ways (for example, as fruit leathers)**

Vegetables:
Vegetables for drying should be **fresh, tender, and just mature.** Avoid immature vegetables because their colour and flavour tend to be weak or poor.
Also avoid excessively mature vegetables, which are inclined to be tough, woody, or fibrous


Learning Outcome 2.1 Formative Assessment

Written assessment

Question1. What are criteria to choose fruit to dry

Answer

Choose firm, fully ripe fruit that is heavy for its size. Handle fruits gently and process them immediately because fruit ready for drying is very fragile

Question2. Complete the following statement

Vegetables for drying should be**.....**

Answer

Vegetables for drying should be **fresh, tender, and just mature**

Question3. Choose true or false

a) Avoid immature vegetables because their colour and flavour tend to be weak or poor.

b) Dryers types are Oven, Dehydrator, Trays

c) Also avoid excessively mature vegetables, which are inclined to be tough, woody, or fibrous

d) Conditions of dryers are Stainless steel only

Answers

TRUE B) **TRUE** C) **TRUE** D) **FALSE**

Question4. List the harmful effects of non-complaint dryer materials:

Answer

The harmful effect of non-complaint dryer materials

Oxidation

Vitamin destruction

Discoloration

Corrosion

Off flavour in the food

Question5. write the Harmful dryer materials to avoid

Answer

The Harmful dryer materials to avoid are:

Hardware cloth

Copper

Aluminium screener

Question6. why we have to avoid excessively mature vegetables?

Answer

Because mature vegetables are inclined to be tough, woody, or fibrous

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY F RESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of TUZAMURANE Cooperative, you are assigned **to select dryers for pineapples drying.**

-The appropriate types of dryers are well selected

-Dryer conditions are checked

Task: Select dryers for pineapple drying

Checklist	**Score**	
	Yes	**No**
<u>Indicator 1 :</u> Cleanness of dryer is well checked		
<u>Indicator 2 :</u> Types of dryers are well identified		
Oven		
Dehydrator		
Trays		
Drying rack		
Solar dryer		

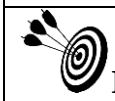
<u>Indicator 3 :</u> Dryers Conditions are well checked		
Stainless steel		
Teflon coated		
Fiberglass plastic		
<u>Indicator 4 :</u> Harmful dryer materials are avoided		
Hardware cloth		
Aluminum screener		
Copper		
<u>Indicator 5 :</u> Effects of non-complaint dryer materials are well outlined		
Oxidation		
Vitamin destruction		
Discoloration		
Corrosion		
Off flavor in the food		
Observation		

References:

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the University of Idaho Cooperative Extension System, the Oregon State University Extension Service, Washington State University Extension, and the U.S. Department of Agriculture cooperating Published June 1995. Revised April 2000. Reprinted August 2003.

Learning Outcome 2.2: Select drying methods

 **Duration: 4 hrs**

 Learning Outcome 2.2 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Differentiate the drying methods
2. Allocate Varieties of fruits and vegetables to each type of methods
3. highlight the advantages and disadvantages of drying methods
4. determine the factors affecting fruits and vegetables while drying

 **Resources**

Equipment	**Tools**	**Materials**
Audio-visual equipment A scenario - Chart on dehydrator - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

 **Advance preparation:**

. Select all equipment, tools and materials for each drying method

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 2.2: Select drying methods

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

2.2: Select drying methods

Drying methods:
Sun drying
Solar drying
Oven drying
Dehydrator drying
Drying Methods
Drying Foods Outdoors:
1. **Sun Drying**
The high sugar and acid content of fruits make them safe to dry in the sun.
Vegetables and meats are not recommended for sun drying.
Vegetables are low in sugar and acid.
This increases the risks for food spoilage.
Meats are high in protein making them ideal for microbial growth when heat and humidity cannot be controlled.
To dry in the sun, hot, dry, breezy days are best.
A minimum temperature of 86°F is needed with higher temperatures being better.
It takes several days to dry foods out-of-doors. Because the weather is uncontrollable, sun drying can be risky.
High humidity is a problem.
Humidity below 60% is best for sun drying.
Often these ideal conditions are not available when fruit ripens.

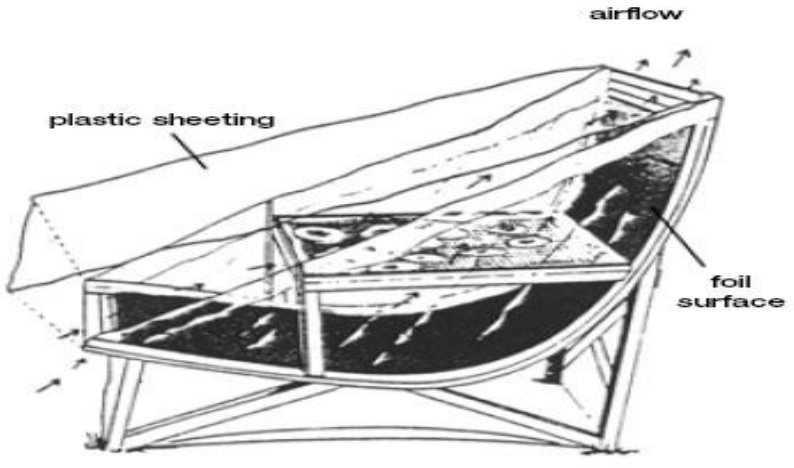
Outdoor Drying Rack

.

Sun Drying Process
To get started, pre-process your fruit produce.

Fruits with seeds should be split into two and the seeds should be removed. Light coloured fruits such as apples, pears and apricot should be soaked in lemon juice, in order to protect them from discoloration.
Ideally, the fruits should be cut into similar-sized pieces in order to ensure that all of them are evenly dried.
Use good drying racks to spread out the fruit in the tray. The racks can be made of bamboo wood or stainless steel.
Place your drying racks in an area that receives bright sunshine and a cool breeze. Preferably stack the drying racks away from dust and traffic.
Normally, it takes three to seven days for sun drying most fruits. The best practice is to let them sit out through the day and bring them back in the night.
Once the food is sundried, it is important to pasteurize and condition them before storage to make sure the produce is insect-free.
Here's how:
a**) Conditioning**: Take the dry fruits and pack them in a sealed container for seven to ten days. If condensation develops in the jar, then the fruit requires more drying before storage.
b) **Pasteurisation**: To pasteurise in a freezer, simply store the cut and dried fruits in plastic bags in a freezer at zero degree Celsius for 48 hours. In case you want to use an oven instead, repeat the process by putting the sun dried produce on a tray and setting it at about 70 degrees Celsius for 30 minutes.
Sun drying is an easy process, if practiced with caution and care. There is no end to the amount of creativity and imagination that can be applied to sun dried produce during cooking. The flavour that is derived from sun dried fruits is truly incomparable to any other

2. **Solar Drying system**
Recent efforts to improve on sun drying have led to solar drying.
Solar drying also uses the sun as the heat source.
A foil surface inside the dehydrator helps to increase the temperature.
Ventilation speeds up the drying time. Shorter drying times reduce the risks of food spoilage or mold growth.



Homemade Solar Dryer

Drying Food Indoor :
Most foods can be dried indoors using **modern dehydrators, convection ovens or conventional ovens**. Microwave ovens are recommended only for drying herbs, because there is no way to create airflow in them.

Food Dehydrators
A food dehydrator is **an electronic box with a fan (or fans) designed to preserve fresh fruit, vegetables, herbs, meat and fish by removing their moisture.**
A food dehydrator has an electric element for heat and a fan and vents for air circulation. Dehydrators are efficiently designed to dry foods quickly at 140 °F.
Dehydrator Features (characteristics) to Look for:
Double wall construction of metal or high-grade plastic.
Wood is not recommended, because it is a fire hazard and is difficult to clean.
Enclosed heating elements.
Counter-top design.
An enclosed thermostat from 85 to 160 °F and a dial for regulating temperature.
A fan or blower.
Types of Dehydrators:
There are two basic designs for dehydrators:
In horizontal air flow units, the heating element and fan are located on the side,
whereas the vertical air flow dehydrators have the heating element and fan located at the base.
The major advantages of horizontal flow are: it reduces flavour mixture so several different foods can be dried at one time; all trays receive equal heat penetration; and juices or liquids do not drip down into the heating element

2. **Oven Drying**
By combining the factors of heat, low humidity and air flow, an oven can be used as a dehydrator.
An oven is ideal for occasional drying of meat jerkies, fruit leathers, and banana chips or for preserving excess produce like celery or mushrooms.
Because the oven is needed for every day cooking, it may not be satisfactory for preserving abundant garden produce.
Oven drying is slower than dehydrators because it does not have a built-in fan for the air movement. (However, some convection ovens do have a fan).
It takes about two times longer to dry food in an oven than it does in a dehydrator.
Thus, the oven is not as efficient as a dehydrator and uses more energy.

How to use your oven?
First, check the dial and see if it can register as low as 140°F.
If your oven does not go this low, then your food will cook instead of dry.

Use a thermometer to check the temperature at the "warm" setting.
For air circulation, leave the oven door propped open two to six inches.
Circulation can be improved by placing a fan outside the oven near the door.
Because the door is left open, the temperature will vary.
An oven thermometer placed near the food gives an accurate reading.
Adjust the temperature dial to achieve the needed 140°F.
Drying trays should be narrow enough to clear the sides of the oven and should be 3 to 4 inches shorter than the oven from front to back.

How do your dry vegetables and fruit in the oven?

You can dehydrate your fruit and vegetables in your oven by turning your oven onto its lowest setting.
You just need to slice your fruit and vegetables very thinly, put them on a sheet of parchment paper on a baking tray and bake for 6 - 8 hours.
Advantages and disadvantages of drying methods
Dehydrators
Produce the best quality product as compared to other methods of drying.
Most food dehydrators have an electric element for heat and a fan and vents for air circulation.
Efficient dehydrators are designed to dry foods uniformly and to retain food quality.
More foods can be dried at the same time
More energy efficient.
Faster drying.
Consistent good result

Disadvantages:

Takes up some counter space
Some models can be really expensive
Fans are noisy during dehydration
Oven drying
Advantages:
Multi-functional has other uses so it does not take up a lot of counter space for most of the year
No need to spend on extra equipment
Disadvantages:
Takes longer for food to dry
Require frequent checking and fiddling during the drying process
Consumes more energy
More difficult to maintain temperature and keep good air circulation
Higher risk of burning or under-drying food

3.solar dryers

Advantages

Drying is faster because inside the dryer it is warmer than outside.
Less risk of spoilage because of the speed of drying.
The product is protected against flies, pests, rain and dust.
It is labour saving.
The quality of the product is better in terms of nutrients, hygiene and colour.

4.Sun drying
Advantages:
No energy is required
Free
No added cost for equipment
Disadvantages:
Slow drying process
Time taking
Molding of food may occur due to slow drying
Cannot be carried out in dust, rainy weather
Nearly impossible to control temperature and humidity to ensure consistent drying conditions
The unpredictable result, some may dry well, some may not dry uniformly

Factors affecting fruits and vegetables while drying:
Initial moisture content of the raw material.
Composition of raw material.
Initial load of the food kept in drier.
Size, shape and arrangement of stacking of the raw material.
Temperature,
relative humidity and
velocity of air used for drying.

 Theoretical learning Activity

Conduct brainstorming session with the student on different drying methods of drying fruits and vegetables

Gather students in their respective groups about the different drying methods

 Practical learning Activity

Provide students different pictures dryers and ask them to choose

The best methods for quick drying

 Points to Remember (Take home message)

Drying methods:
Sun drying
Solar drying
Oven drying

Dehydrator drying
Each drying method has advantages and disadvantages.
Factors affecting fruits and vegetables while drying
Initial moisture content of the raw material.
Composition of raw material.
Initial load of the food kept in drier.
Size, shape and arrangement of stacking of the raw material.
Temperature,
relative humidity and
velocity of air used for drying


Learning Outcome 2.2 Formative Assessment

Written assessment

Question1. Enumerate Drying methods:

answer

Sun drying

Solar drying

Oven drying

Dehydrators

Question2. State the factors affecting fruits and vegetable drying

Factors affecting fruits and vegetables while drying :

Initial moisture content of the raw material.

Composition of raw material.

Initial load of the food kept in drier.

Size, shape and arrangement of stacking of the raw material.

Temperature,

relative humidity and

velocity of air used for drying

Question3. Choose true or false

solar dryers are faster because inside the dryer it is warmer than outside

Initial moisture content of the raw material it cannot affect drying time

Dehydrator is Slow drying process

Dehydrator Produce the best quality product as compared to other methods of drying

Answer

TRUE B) FALSE C) FALSE D) TRUE

Question4: Discuss about the disadvantages of dehydrator

Answer:

Disadvantages:

Takes up some counter space

Some models can be really expensive

Fans are noisy during dehydration

Question5. Explain the two types of Dehydrators

Answer:

There are two basic designs for dehydrators:

In horizontal air flow dehydrators, the heating element and fan are located on the side,

whereas the vertical air flow dehydrators have the heating element and fan located at the base

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to select drying methods for pineapple.

The dried pineapple should have:

-Slice thickness of 2-3mm

-Moisture content of 20%

-The drying methods are practiced

Task: select drying methods

Checklist	**Score**	
	Yes	**No**
Indicator 1: Drying methods are well understood		
Sun drying is well practiced		
Solar drying is well practiced		
Oven drying is well practiced		
Dehydrator drying is well practiced		
Indicator 2: Varieties of fruits are well dried		
Dryness is well monitored		
Moisture content is well checked		
Indicator 3: Advantages and disadvantages of each methods are well understood		
Indicator 4: Factors affecting fruit and vegetables dryness are well understood		
Indicator 5: Required Moisture content is achieved		
Condition process is considered		
Accuracy measurement		
Indicator 6 : Require dryness is achieved		
Appearance is considered		
Taste is considered		
Reconstitution is achieved		
Indicator 7: Dryness is well achieved		
Vision inspection is done		
Conditioning is done		
Moisture content id checked		
Indicator 8: Dryness parameters are well checked		
Pliability is checked		
Hardness is checked		

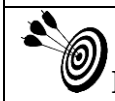
Brittleness is checked		
Taste is achieved		
Observation		

References:

Edited by Judy A. Harrison, Ph.D., and Elizabeth L. Andress, Ph.D., Extension Foods Specialists. The University of Georgia and Ft. Valley State University, the U.S. Department of Agriculture and counties of the state cooperating. Issued in furtherance of Cooperative Extension work, Acts of May 18 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S. Department of Agriculture cooperating

Learning Outcome 2.3: Use dried fruits and vegetables

 **Duration: 3 hrs**

 Learning Outcome 2.3 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain importance of using dried fruits and vegetables
2. Differentiate the ways of using dried fruits and vegetable
3. Discuss the reconstitution process of dried fruits and vegetables

Resources

Equipment	Tools	Materials
Audio-visual equipment A scenario - Chart on dehydrator - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Prepare potable water for reconstitution

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 2.3: Uses of dried fruits and vegetables

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

2.3: Use dried fruits and vegetables
Importance of using dried fruits and vegetables
The purpose of drying fruits and vegetables is:
To prolong storage,
Reduce the need for packaging and
Decrease the weight during transportation.
Ways to use dried fruits and vegetable :

Dried fruits can be **eaten** as it is or **reconstituted**
Dried vegetables must be **reconstituted**
Once reconstituted, dried fruits or vegetables are **treated as fresh**.
Fruit leathers and meat jerky are **eaten** as it is.

How do you use dried fruits and vegetables?

Dried vegetables are easy to store and can be utilized in a variety of dishes, including **soups, stews and casseroles**. You can rehydrate your dehydrated foods by soaking them in either boiling or room temperature water. Drying temperature for vegetables should be slightly lower than those for fruits

Reconstitute process of dried fruits and vegetables:

Factors affecting reconstitution process:

Amount of water to add
Minimum soaking time

Reconstitute process:

To reconstitute dried fruits or vegetables, add water to the fruit or vegetable and soak until the desired volume is restored.

N.B. Do not over-soak the food. Over-soaking produces loss of flavour and a mushy, water-logged texture.

For soups and stews, add the dehydrated vegetables, without rehydrating them. They will rehydrate as the soup or stew cooks. Also, leafy vegetables and tomatoes do not need soaking. Add enough water to cover and simmer until tender.

CAUTION! If soaking takes more than 2 hours, refrigerate the product for the remainder of the time.


Theoretical learning Activity

Conduct brainstorming session with the student on the uses of dried fruits and vegetables

Have students in their respective groups discuss about reconstitution process of dried fruit and vegetables


Practical learning Activity

Provide students dried fruits and vegetables and ask them to reconstitute them according to the standard measures


Points to Remember (Take home message)

How do you use dried fruits and vegetables?

Dried vegetables are easy to store and can be utilized in a variety of dishes, including **soups, stews and casseroles**

Reconstitute process:

To reconstitute dried fruits or vegetables, add water to the fruit or vegetable and soak until the desired volume is restored.

Factors affecting reconstitution process:

Amount of water to add

Minimum soaking time

Learning out come 2.3 formative Assessment

Written assessment

Question1. Define term Reconstitute process

Answer:

Reconstitute process: is to reconstitute dried fruits or vegetables, add water to the fruit or vegetable and soak until the desired volume is restored.

Question2. Write the factors affecting reconstitution process

Answer:

Factors affecting reconstitution process:

Amount of water to add

Minimum soaking time

Question3. Choose true or false

Amount of water to add is one in factors affecting reconstitution process

Over-soaking produces loss of flavour and a mushy, water-logged texture.

If soaking takes more than 2 hours, refrigerate the product for the remainder of the time.

Drying temperature for vegetables should be slightly lower than those for fruits

You can rehydrate your dehydrated foods by soaking them in either boiling or room temperature water

Answer

True 2. True 3. True 4. True 5. True

Question4. Write the purpose of drying fruits and vegetables

Answer:

The purpose of drying fruits and vegetables is:

To prolong storage,

Reduce the need for packaging and

Decrease the weight during transportation.

Question5. Describe the ways to use dried fruits and vegetable:

Dried fruits can be **eaten** as is or **reconstituted**

Dried vegetables must be **reconstituted**

Once reconstituted, dried fruits or vegetables are **treated as fresh**.

Fruit leathers and meat jerky are **eaten** as is.

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to **use the dried pineapples.**

The dried pineapple should have:

-Slice thickness of 2-3mm

-Reconstituted

Task: **Use Dried pineapples**

Checklist	**Score**	
	Yes	**No**
<u>Indicator 1:</u> Importance of using dried fruits and vegetables is well understand		
<u>Indicator 2:</u> Ways to use dried fruits and vegetable are well applied		
Fruits are eaten as is		
Fruits are eaten as reconstituted		
Indicator 3: Reconstitute process of dried fruits and vegetables		
Amount of water to add		
Minimum soaking time		
<u>Indicator 4:</u> Reconstitute process of dried fruits is well done		
Amount of water to add is well calculated		
Minimum soaking time is well calculated		
Observation		

References:

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LEARNING UNIT 3: MONITOR THE DRYNESS OF FRUITS AND VEGETABLES

STRUCTURE OF LEARNING UNIT

LEARNING OUTCOMES:

3.1 Conditioner dried fruits and vegetables

3.2 Determine dryness

2.3 Check the moisture content

Learning Outcome 3.1: Conditioner dried fruits and vegetables

Duration: 3 hrs

Learning Outcome 3.1 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain the importance of conditioning dried fruits and vegetables
2. explain Conditioning process

Resources

Equipment	Tools	Materials
Audio-visual equipment A scenario - Chart on dehydrator - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 3.1: Conditioning dried fruits and vegetables

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc.)

Importance of conditioning dried fruits and vegetables:

Conditioning is a process used:

To equalize the moisture and

To reduce the risk of mold growth

Conditioning process:

To condition the fruit, take the dried fruit that has cooled and pack it loosely in plastic or glass jars. Seal the containers and let them stand for seven to ten days.

Addition:

Conditioning Fruits When dried fruit is taken from the dehydrator or oven, the remaining moisture may not be distributed equally among the pieces because of their size or their location in the dehydrator.

Conditioning is a process used to equalize the moisture and reduce the risk of mold growth.

To condition the fruit, take the dried fruit that has cooled and pack it loosely in plastic or glass jars.

Seal the containers and let them stand for seven to ten days. The excess moisture in some pieces will be absorbed by the drier pieces.

Shake the jars daily to separate the pieces and check the moisture condensation. If condensation develops in the jar, return the fruit to the dehydrator for more drying.

After conditioning, package and store the fruit.

Theoretical learning Activity

Conduct brainstorming session with the student on different types of conditioning process

Have students in their respective groups discuss with them how conditioning process should be done

Practical learning Activity

Provide students with plastics and glass jars with dried fruits and ask them to condition dried fruits and check the moisture content after seen days.

 Points to Remember (Take home message)

Importance of conditioning dried fruits and vegetables:
Conditioning is a process used:
To equalize the moisture and
To reduce the risk of mold growth
Conditioning process:
To condition the fruit, take the dried fruit that has cooled and pack it loosely in plastic or glass jars. Seal the containers and let them stand for seven to ten then check the moisture content change.

 Learning outcome 3.1 Formative Assessment

Written assessment

Question1: write the importance of conditioning of dried fruit and vegetable

Answer

Importance of conditioning dried fruits and vegetables are:

To equalize the moisture and

To reduce the risk of mold growth

Question2: Explain the dried fruits conditioning process

Answer:

Dried fruit Conditioning process:

To condition the fruit, take the dried fruit that has cooled and pack it loosely in plastic or glass jars. Seal the containers and let them stand for seven to ten days and check the moisture content change

Question3: Answer by true(T) or False(F)

Conditioning is a process used to equalize the moisture and reduce the risk of mould growth

Answer

True

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned **to condition the dried pineapples.**

The dried pieces of pineapple should have equal moisture:

Task: Condition the dried pineapples

Checklist	**Score**	
	Yes	**No**
Indicator: Importance of conditioning dried fruits and vegetables are well understood		

Moisture is well equalizes among dried pieces		
Mold growth is well reduced		
Indicator: Conditioning process is well monitored		
Observation		

References:

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Learning outcome 3.2 Determine Dryness

Duration: 3 hrs		
Learning Outcome 3.2 objectives : By the end of the learning outcome, the trainees will be able to: 1. Explain the dryness determination procedures 2. Explain dryness determination parameters 3. Judge the dryness tests		
Resources		
Equipment	**Tools**	**Materials**

A scenario –Containers -Video	- Computer Internet Projector Thermometer	Books Fork lift Flipchart

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 3.2: Determine dryness

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

Determining Dryness of vegetables Conditions to consider for Dryness determination
Required time
Moisture content check (20% mc for fruits ,10% mc for vegetables)
Determining Dryness of Fruits
Since dried fruits are generally eaten without being rehydrated, they should not be dehydrated to the point of brittleness. Most fruits should have about **20 percent** moisture content when dried.

To test for dryness, cut several cooled pieces in half. There should be no visible moisture and you should not be able to squeeze any moisture from the fruit. Some fruits may remain **pliable**, but are not sticky or tacky. If a piece is folded in half, it should not stick to itself. Berries should be dried until they rattle when shaken.

After drying, cool fruit 30 to 60 minutes before packaging. Packaging food warm can lead to sweating and moisture build-up. However, excessive delays in packaging could allow moisture to re-enter food. Remember, if you have dried fruit in the sun, it must be pasteurized before it is packaged.
Dryness parameters for Fruits:
Pliable
Leathery
Vegetables should be dried until they are **brittle or "crisp**." Some vegetables would actually shatter if hit with a hammer. At this stage, they should contain about **10%** moisture. Because they are so dry, they do not need conditioning like fruits.
Dryness parameters for Vegetables:
Hard
Brittle

 Theoretical learning Activity

Conduct brainstorming session with the student on how determining the dryness of fruit and vegetables

Have students in their respective groups discuss different dryness parameter of fruit and vegetables

 Practical learning Activity

Provide students with pictures of the different dried fruit and vegetables, and ask them to test the dryness

 Points to Remember (Take home message)

How to test dryiness
To test for dryness, cut several cooled pieces in half.
There should be no visible moisture and you should not be able to squeeze any moisture from the fruit.
Some fruits may remain **pliable**, but are not sticky or tacky. If a piece is folded in half, it should not stick to itself.
Berries should be dried until they rattle when shaken

 Learning outcome 3.2 Formative Assessment

Written assessment

Question1. Discuss how to test the dryness of fruit and vegetable

Answer

To test for dryness, cut several cooled pieces in half. There should be no visible moisture and you should not be able to squeeze any moisture from the fruit. Some fruits may remain **pliable**, but are not sticky or tacky. If a piece is folded in half, it should not stick to itself.

Question2: write the dryness parameter for vegetables

Answer

Dryness parameters for Vegetables:

Hard

Brittle

Question3. list the Conditions to consider for Dryness determination

Answer

Conditions to consider for Dryness determination

Required time

Moisture content check (20% mc for fruits ,10% mc for vegetables)

Question4. Explain the consequences of packaging warm food?

Answer

Packaging food warm can lead to sweating and moisture build-up. However, excessive delays in packaging could allow moisture to re-enter food.

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to determine **the dryness of the dried pineapple.**

The pineapple should have:

A desired moisture content of 20%

-Slice thickness of 2-3mm

Task: Determine the dryness of the dried pineapples

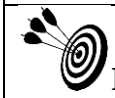
Checklist	**Score**	
	Yes	**No**
Indicator: Procedures for determining dryness are well done		
Required time is respected		
Moisture content check is well done(20% mc for fruits ,10% mc for vegetables)		
Indicator Dryness parameters are well detected		
Pliable		
Leathery		
Indicator: Judging dryness tests are well performed		
Observation		

References:

Edited by Judy A. Harrison, Ph.D., and Elizabeth L. Andress, Ph.D., Extension Foods Specialists. The University of Georgia and Ft. Valley State University, the U.S. Department of Agriculture and counties of the state cooperating. Issued in furtherance of Cooperative Extension work, Acts of May 18 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S. Department of Agriculture cooperating.

Learning outcome 3.3 Check the moisture content

 **Duration: 4 hrs**

 Learning out come 3.3 objectives :

By the end of the learning outcome, the trainees will be able to:

1.Know well the moisture content determination process

2. use tools used to measure moisture content

3. calculate the moisture content

 **Resources**

Equipment	**Tools**	**Materials**
- Containers - Moisture meter – Samples of dried fruit and vegetable	- Scale - internet - laptop	Reference book Flipchart Samples of dried fruit and vegetable

 **Advance preparation:**

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 3.3: Check the moisture content

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

How do you calculate moisture content after drying?
The amount of water is determined by subtracting the dry weight from the initial weight, and the moisture content is then calculated as **the amount of water divided by the dry weight or total weight**, depending on the reporting method.

Moisture content determination process
Tool to measure moisture content
Moisture meter
Formula to calculate the moisture content (%)
Moisture content
The moisture content of a product is a numerical value expressed in percentage. This is determined by the relationship between the weight of the water contained in a given sample of food and the total weight of that sample:
H %= (WWater/ (Wdm+Wwater)) ×100
When: H% the moisture content of the sample (in %);
W, water = weight of the sample's water (in kg);
Wdm weight of the sample's dry matter (in kg).
Therefore, to say that paddy has a 25 percent moisture content means that in a sample of 100 g of raw product there are 25 g of water and 75 g of dry matter.
For example, if 200 kg of peas at 32 percent moisture content are dried to 19 percent moisture content, what is the weight of the dried peas?

Theoretical learning Activity

Conduct brainstorming session with the student on different methods used in moisture determination

Have students in their respective groups discuss about moisture determination process

 Practical learning Activity

Provide students with pictures of the exercise on moisture determination and ask them to calculate the moisture content

 Points to Remember (Take home message)

How do you calculate moisture content after drying? The amount of water is determined by subtracting the dry weight from the initial weight, and the moisture content is then calculated as **the amount of water divided by the dry weight or total weight**, depending on the reporting method.

 Learning Outcome 3.3 Formative Assessment

Written assessment

Question1. what is tools used to measure the moisture?

Answer

Tool to measure moisture content

Moisture meter

Question2. Discuss how the moisture content can be determined

Answer

Moisture content

The moisture content of a product is a numerical value expressed in percentage. This is determined by the relationship between the weight of the water contained in a given sample of food and the total weight of that sample:

H %= (WWater/ (Wdm+Wwater)) ×100

When: H% the moisture content of the sample (in %);

W, water = weight of the sample's water (in kg);

Wdm weight of the sample's dry matter (in kg)

Therefore, to say that paddy has a 25 percent moisture content means that in a sample of 100 g of raw product there are 25 g of water and 75 g of dry matter

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to the moisture content of the dried pineapples.

The pineapple should have:

A desired moisture content of 20%

-Slice thickness of 2-3mm

Task: Check the moisture content

Checklist	**Score**	
	Yes	**No**
Indicator 1: Determination of moisture content is well done		
The moisturemeter is well used to check the dryness		
Indicator 2 : Tool to measure the moisture content is well used		
Moisturemeter is well used		
Formula MC% is well used		
Observation		

References:

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LEARNING UNIT 4: PASTEURISE THE PRODUCT

STRUCTURE OF LEARNING UNIT

Learning outcomes:
4.1 Select pasteurization methods
4.2 Monitor pasteurization process
4.3 Cool the product

Learning Outcome 4.1: Select pasteurization methods

Duration: 2hrs		
Learning Outcome 4.1 objectives : By the end of the learning outcome, the trainees will be able to: 1. Explain the importance of pasteurize dried fruits and vegetables 2. Differentiate Pasteurization methods		
Resources		
Equipment	**Tools**	**Materials**

Audio-visual equipment A scenario - Chart on dehydrator Freezer - Oven Sink - Water - Containers	Shallow pan Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 4.1: Select pasteurization methods

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

Importance of pasteurize dried fruits and vegetables:
Kill all insects and their eggs
Avoid food to be eaten by insects
To inactivate enzymes
Remove undesirable flavours
Improve preservation quality by destroying almost all spoilage organisms.
Sun or solar dried fruits and vine dried beans need treatment to kill any insect and their eggs that might be on the food. Unless destroyed, the insects will eat the dried food.
There are two recommended pasteurization methods:
Freezer Method: Seal the food in freezer-type plastic bags. Place the bags in a freezer set at 0°F or below and leave them at least 48 hours.
Oven Method: Place the food in a single layer on a tray or in a shallow pan. Place in an oven preheated to 160°F for 30 minutes.
After either of these treatments the dried fruit is ready to be conditioned and stored.

 Theoretical learning Activity

Conduct brainstorming session with the student on importance of pasteurization on dried food.

Have students in their respective groups discuss methods of pasteurization

 Practical learning Activity

Provide students with dried fruits and vegetables and ask them to pasteurize them using different methods.

 Points to Remember (Take home message)

Importance of pasteurize dried fruits and vegetables:
Kill all insects and their eggs
Avoid food to be eaten by insects
To inactivate enzymes
Remove undesirable flavours
Improve preservation quality by destroying almost all spoilage organisms.
There are two recommended pasteurization methods:
Freezer Method:
Oven Method

 Learning Outcome 4.1 Formative Assessment

Written assessment

Question1. Answer by true or false

Sun or solar dried fruits and vine dried beans need treatment to kill any insect and their eggs that might be on the food.

If insects are destroyed, they will eat the dried food.

Pasteurization is a method designed to kill spoilage micro-organisms

Freezing is not cold treatment method

Oven is used during freezing of fruit and vegetables

Answer:

True

False

True

False

False

Question2. State any two methods of pasteurizing dried fruits and vegetables

Answer:

Freezer method

Oven method

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to **pasteurize dried pineapples.**

The pineapple should have:

A desired moisture content of 20%

Slice thickness of 2-3mm

Pasteurized with appropriate method

Task: Pasteurize the dried pineapples

Checklist	**Score**	
	Yes	**No**
Indicator: Importance of pasteurize dried fruits and vegetables are well understood		
All insects and their eggs are well killed		
Food is safe from insects attack		
Indicator: Pasteurization methods are well done		
Freezing method is well done		
Oven method is well done		
Observation		

References:

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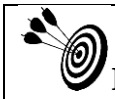
Learning Outcome 4.2: Monitor pasteurization process

Duration: 2 hrs



Learning Outcome 4.2 objectives :

By the end of the learning outcome, the trainees will be able to:

1. explain the Conditions of materials to use while pasteurized by freezing
2. Explain the Conditions of materials to be used while pasteurizing by oven

Resources

Equipment	**Tools**	**Materials**
Audio-visual equipment A scenario – Containers	Laptop Thermometer Projector - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 4.2: Monitor pasteurization process

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

Temperature control is a set of procedures, strategies, measurement, and conditions established to meat and maintain the standards and specifications of a given product and or process regarding temperature
Conditions of materials to use while pasteurized by freezing
Plastic bags
Freezing temperature control
Temp 0 F
Time 2 days

Conditions of materials to be used while pasteurizing by oven
Single layer on tray
Shallow pan
Temperature 160^{o} F
Time 30 minutes
Temperature adjustment
The standard drying time and Temperature for fruits and vegetables need to be adjusted to any method. For freezing method temperature must be adjusted to below zero and in oven method to a Temperature 160^{o} F for their respective time.


Theoretical learning Activity

Conduct brainstorming session with the student on monitoring pasteurization process

Have students in their respective groups discuss about temperature adjustment.


Practical learning Activity

Provide students oven of the different type and ask them to adjust temperature


Points to Remember (Take home message)

Conditions of materials to use while pasteurized by freezing
Plastic bags
Freezing temperature control
Temp 0 F
Time 2 days

Conditions of materials to be used while pasteurizing by oven
Single layer on tray
Shallow pan
Temperature 160^{o} F
Time 30 minutes
Temperature adjustment by regulating temperature according to the standard related to the product


Learning Outcome 4.2 Formative Assessment

Written assessment

Question1. What is temperature control?

answer

Temperature control is a set of procedures, strategies, measurement, and conditions established to meat and maintain the standards and specifications of a given product and or process regarding temperature.

Question2: list Conditions of materials to use while pasteurized by freezing

Answer

Plastic bags

Question3. Enumerate the Conditions of materials to be used while pasteurizing by oven

Answer

Conditions of materials to be used while pasteurizing by oven

Single layer on tray

Shallow pan

Temperature 160^{o} F

Time 30 minutes

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to monitor **pasteurization method of dried pineapples.**

The pineapple should have:

A desired moisture content of 20%

Slice thickness of 2-3mm

Pasteurized with appropriate method

Task: Monitor Pasteurization method of the dried pineapples

Checklist	**Score**	
	Yes	**No**
Indicator 1: Pasteurization materials are well chosen		
Plastic bags		
Tray		
Shallow pan		
Indicator 2: pasteurization temperature are well controlled		
Freezing temperature is well controlled		
Oven temperature is well controlled		
Indicator 3: pasteurization time is well controlled		
Freezing time is well controlled		
Oven time is well controlled		
Observation		

References:

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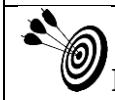
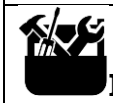
Learning Outcome 4.3: Cool The Product

 **Duration: 1 hrs**

 Learning Outcome 4.3 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain Purpose of cooling
2. Explain the Cooling techniques
3. Explain the appropriate time for cooling

 **Resources**

Equipment	Tools	Materials

Audio-visual equipment A scenario - Chart on dehydrator - Large saucepan	Laptop Thermometer Trays - internet	Reference books, Marker pen, Flip Chalks, Scale
Advance preparation: . All equipment, tools and materials must be available . Organise sitting arrangement . Divide learners into small groups		

Indicative Content 4.3: Cool The Product

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

Cooling is removal of heat, usually resulting in a lower temperature and/or phase change.

Purpose of cooling:
Avoid sweating
Avoid moisture build up
Cooling techniques:
Active cooling: a heat reducing mechanism that is typically implemented in electronic devices and endure building to ensure proper heat transfer and circulation from within
Passive cooling: uses free, renewable source of energy such as the sun and wind to provide cooling, ventilation and lighting needed for household.

Appropriate time for cooling
30 to 60 minutes before packing
types of cooling system
Air cooling system
Liquid cooling system
Forced circulation system
Pressure cooling system

 Theoretical learning Activity

Conduct brainstorming session with the student on different types of cooling system.

Have students in their respective groups discuss different types of cooling methods

 Practical learning Activity

Provide students with the different hot fruits and vegetables and ask them to cool

 Points to Remember (Take home message)

Cooling is removal of heat, usually resulting in a lower temperature and/or phase change.

Purpose of cooling:
Avoid sweating
Avoid moisture build up
Cooling techniques: Active cooling and Passive cooling
Cooling time 30 to 60 minutes before packing
types of cooling system
Air cooling system
Liquid cooling system
Forced circulation system
Pressure cooling system


Learning Outcome 4.3 Formative Assessment

Written assessment

Question 1. What is cooling

Answer : Cooling is removal of heat, usually resulting in a lower temperature and/or phase change.

Question 2. Answer by true or false

Cooling is a process used to dry fruits and vegetables

Cooling time is between 30 to 60 minutes after packing time

Air cooling system is one of the cooling techniques

Passive cooling: uses free, renewable source of energy such as the sun and wind to provide cooling, ventilation and lighting needed for household.

Active cooling: a heat reducing mechanism that is typically implemented in electronic devices and endure building to ensure proper heat transfer and circulation from within

Answer:

False

False

False

True

True

Question 3. State the purpose of cooling.

Answer: Purpose of cooling include:

Avoid sweating

Avoid moisture build up

Question 4. What are the types of cooling system?

Answer:

types of cooling system

Air cooling system

Liquid cooling system

Forced circulation system

Pressure cooling system

Question 5. What are the cooling techniques?

Answer:

Cooling techniques: Active cooling and Passive cooling

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to cool the dried pineapples.

The pineapple should have:

A desired moisture content of 20%

Slice thickness of 2-3mm

Cooled to appropriate degree

Task: Cool the dried pineapples

Checklist	**Score**	
	Yes	**No**
<u>Indicator 1</u>: Cooling purpose is understood		
Moisture build up is avoided		
Sweating is avoided		
<u>Indicator 2:</u> Cooling techniques are well followed		
Active cooling is well controlled		
Passive cooling is well controlled		
<u>Indicator 3:</u> Cooling time is well monitored		

Cooling **time is respected**		
Observation		

References:

Edited by Judy A. Harrison, Ph.D., and Elizabeth L. Andress, Ph.D., Extension Foods Specialists. The University of Georgia and Ft. Valley State University, the U.S. Department of Agriculture and counties of the state cooperating. Issued in furtherance of Cooperative Extension work, Acts of May 18 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S. Department of Agriculture cooperating

LEARNING UNIT 5: PACK AND STORE DRIED FRUIT AND VEGETABLES

STRUCTURE OF LEARNING UNIT

Learning outcomes:

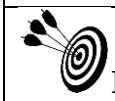
5.1 Select packaging materials

5.2 Label the product

5.3 Store the product

Learning Outcome 5.1: Select packaging materials

 **Duration: 2 hrs**

 Learning Outcome 5.1 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Differentiate types of packaging materials for dried fruits and vegetables
2. Explain the conditions of packaging materials for dried fruits and vegetables
3. Explain deeply safety measure while packaging

 **Resources**

Equipment	**Tools**	**Materials**
Audio-visual equipment Metal cans or freezer Chairs Containers Metal cans or freezer	Gloves Plastic freezer bags - internet	Reference books, Marker pen, Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 5.1: Select packaging materials

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

Packaging is the enclosing of the product to protect it from any damage contamination spoilage, pest attacks and tempering during transport, storage and retail sale.
Good packaging and storage techniques are crucial. Packaging protects your dried food from oxygen, moisture (gain or loss), light, microorganisms, and pests. After you have checked foods and found them to be thoroughly dry and cool, pack them immediately for storage.
5.1: Select packaging materials
Choosing Containers
The ideal container for a dried food is:
• Clean and sanitary
• Nontoxic
• Lightweight
• Easily disposable or recyclable
• Moisture resistant
• Airtight
• Protective against light
• Easily opened and closed
• Impermeable to gases and odors
• Durable
• Low-cost
Types of packaging materials
Glass jars
Metal cans or freezer
Plastic freezer bags

Conditions of packaging materials
Glass jars
Metal cans or freezer: Fruit that has been sulfured or sulfited should not touch metal. Place the fruit in a plastic bag before storing it in a metal can.
Plastic freezer bags': Plastic freezer bags are acceptable, but they are not insect and rodent proof.

Polyethylene
Cellophane bags
Safety measure while packaging:
Clean hands
Wear Gloves
Double-bag the fruits


Theoretical learning Activity

Conduct brainstorming session with the student on different factors to consider while Choosing Containers for packing fruit and vegetables

Have students in their respective groups discuss different types of equipment used to pack fruit and vegetables


Practical learning Activity

Provide students with pictures of the different packaging material and ask them to select packaging material which are suitable for dried fruit and vegetables


Points to Remember (Take home message)

Packaging is the enclosing of the product to protect it from any damage contamination spoilage, pest attacks and tempering during transport, storage and retail sale.

Role of packaging material: Packaging protects your dried food from oxygen, moisture (gain or loss), light, microorganisms, and pests.
Types of packaging materials
Glass jars
Heat sealable bags
Zipper standing pouch
Metal cans or freezer
Plastic freezer bags

Safety measure while packaging:
Wearing Uniforms
Hand washing
Wearing gloves
Use double bags for fruits


Learning Outcome 5.1 Formative Assessment

Written assessment

Question1. What is packaging

Answer: Packaging is the enclosing of the product to protect it from any damage contamination spoilage, pest attacks and tempering during transport, storage and retail sale.

Question2. Answer by true or False

Good packaging help in easy transport

Packaging can play a role in increasing the security risk during the shipment

Packaging can be used in branding and marketing

Good packaging must have a gas, light and aroma barrier properties

Packaging material cannot protect the product against contamination and pest infestation

Answer:

True

False

True

True

False

Question 3. List the types of packaging materials for dried fruits and vegetables

Answer:

Glass jars

Heat sealable bags

Zipper standing pouch

Metal cans or freezer

Plastic freezer bags

Question 4. What are the safety measure that can be taken during packaging?

Answer:

Wearing Uniforms

Hand washing

Wearing gloves

Use double bags for fruits

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to select packaging materials for dried pineapples.

- The pineapple should have:

A desired moisture content of 20%

Slice thickness of 2-3mm

Cooled to appropriate degree

Selected packaging should have a desirable characteristics of packing Pineapples

Task: Select appropriate packaging materials for dried pineapples

Checklist	Score	
	Yes	No
Indicator: Types of packaging materials are well identified		
Glass jars		
Metal cans or freezer		
Plastic freezer bags		
Plastic pouch		
Heat sealable bags		
Indicator: Conditions of packaging materials are well identified		
Polyethylene		
Cellophane bags		
Indicator: Safety measures are well respected		
Hands are well cleaned		
Gloves are well used		
Double- bag the fruits		
Observation		

References:

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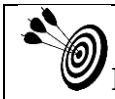
Learning Outcome 5.2: Label the product

 **Duration: 2 hrs**



Learning Outcome 5.2 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain Labelling techniques
2. Explain Label content
3. Explain Labelling requirements

Resources

Equipment	**Tools**	**Materials**
Audio-visual equipment Computer Sealing materials	Laptop Thermometer Labels - internet	Reference books, Products (Dried fruits and vegetables) Flip Chalks, Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 5.2: Label the product

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

Labelling is defined as the process of attaching a descriptive word or phrase to someone or something about a product on its container, packaging, or product itself
Product labelling means displaying information about your product on its packaging.
Label each package with the type of food, pre-treatment step, and date. Labels may be taped on the outside of a package, tied on with string, or inserted into a clear glass or plastic package. With proper labels you will not have to open individual packages each time you want to use a dried food.

Labelling techniques

Applied labelling and Direct labelling
Applied is a type of labelling at which all information is pointed on a paper which is applied on bottle whereas Direct labelling at which all information is printed on the package and later apply on packaging materials.

Labelling requirements

Brand name.
Product name.
Packaging size.
UPC code/barcode.
Company name and address.
Any certifications.
Product story.
Nutritional information

 Theoretical learning Activity

Conduct brainstorming session with the student on different types of information we can found on label.

Have students in their respective groups discuss different technics of labelling

 Practical learning Activity

Provide students with pictures of the different and ask them to read the information written on that label

 Points to Remember (Take home message)

Labelling is defined as the process of attaching a descriptive word or phrase to someone or something about a product on its container, packaging, or product itself
Labelling techniques
Applied labelling and Direct labelling


Learning outcome 5.2 Formative Assessment

Written assessment

Question1. What is labelling?

Answer

Labelling is defined as the process of attaching a descriptive word or phrase to someone or something about a product on its container, packaging, or product itself

Question2. Differentiate two labelling techniques

Answer

Labelling techniques

Applied labelling and Direct labelling

Applied is a type of labelling at which all information is pointed on a paper which is applied on bottle whereas Direct labelling at which all information is printed on the package and later apply on packaging materials.

Question3: Answer by true or False

Bland names are one important requirement to consider while choosing packaging material

Labelling techniques is described as technic used in storage of fruit.

Product labelling means displaying information about your product on its packaging

Answers

FALSE

FALSE

TRUE

Question4. List the information that we found on label?

Labelling information's are the following

Brand name.

Product name.

Packaging size.

UPC code/barcode.

Company name and address.

Any certifications.

Product story.

Nutritional information

Practical assessment

Situation

TUZAMURANE Cooperative located in KIREHE DISTRICT in eastern province operates from GAHARA sector, cultivate organic pineapple on about 90 hectares from plantation A, B and C. Realizing that the farmer's produce was being sold at giveaway price and some pineapples were getting rotten in stores due to lack of ready buyers and postharvest losses The cooperative set up a PINEAPPLE PROCESSING UNIT TO DRY FRESH FPINEAPPLES and export packaged dried fruits commodities to France. The cooperative has a command of 100kgs dried pineapples. As production manager of Tuzamurane cooperative, you assigned to Label the dried pineapples.

The pineapple should have:

A desired moisture content of 20%

Slice thickness of 2-3mm

Cooled to appropriate degree

Label should be applied to packaging materials with all requirements

Task: Label the dried pineapples

Checklist	**Score**	
	Yes	**No**
<u>Indicator 1:</u> Techniques of labeling are well selected		

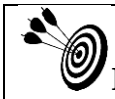
Direct technique is well applied		
Indirect technique is well applied		
<u>Indicator 2</u>: Label contents are well mentioned		
List of ingredients		
Nutritional information		
Batch/Lot number		
Packaging size.		
UPC code/barcode.		
Company name and address.		
Any certifications.		
Product story.		
MFD and EXPD		
Observation		

References:

Edited by Judy A. Harrison, Ph.D., and Elizabeth L. Andress, Ph.D., Extension Foods Specialists. The University of Georgia and Ft. Valley State University, the U.S. Department of Agriculture and counties of the state cooperating. Issued in furtherance of Cooperative Extension work, Acts of May 18 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S. Department of Agriculture cooperating

Learning Outcome 5.3: Store the product

 **Duration: 1 hrs**



Learning out come 5.3 Objectives :

By the end of the learning outcome, the trainees will be able to:

1. Explain Storage conditions
2. Explain Storage safety precautions

Resources

Equipment	**Tools**	**Materials**
Audio-visual equipment A scenario - Chart on dehydrator - Containers	Laptop Thermometer - internet -Scale	Reference books, Marker pen, Flip Chalks, Flip Chart.

Advance preparation:

. All equipment, tools and materials must be available

. Organise sitting arrangement

. Divide learners into small groups

Indicative content 5.3: Store the product

Summary for the trainer related to the indicative content (key notes using bullets such as ticks etc)

The length of time you can store dried food depends on:

The type of food
Factors related to the drying process (pre-treatment and final level of moisture in the dried food)
Packaging of the dried food
The storage area
An ideal storage area conditions for dried food is:
cool,
dark,
and dry.
The cooler the storage area, the longer the shelf life.
Dark areas are ideal because light fades fruit and vegetables and decreases their vitamin A and C contents.
The storage area need not be fancy; a dark, unheated closet or drawer works fine.
Metal containers have the advantage of keeping their contents in darkness. Glass or plastic containers can be covered with a cardboard box, a barrel, or black plastic to keep light out.
Many people store dried foods in the refrigerator or freezer, which keeps quality high.
During storage at room temperature, the most common type of spoilage is mold growth. Molds can grow in foods that are not completely dry and in foods that absorb water when they are packaged or stored in moist conditions.

(Remember: don't consume mouldy foods. Some toxic molds can grow at room temperature.)
Dried food will probably not absorb enough water to allow bacterial or yeast spoilage. One typical change that occurs during storage is "Maillard browning," which involves complex chemical reactions between the food's sugars and proteins.
Other chemical changes that may take place during storage include loss of vitamin C or other nutrients, general discoloration, changes in food structure leading to an inability of the dried food to fully rehydrate, and toughness the rehydrated cooked product. Storage conditions

Storage safety precautions:
Secure
Safe from pests and rodents
Appropriate storage time
Dried food should be stored in a cool, dry, dark place. Most dried fruits can be stored for 1 year at 60°F, 6 months at 80°F. Dried vegetables have about half the shelf-life of fruits. Fruit leathers should keep for up to 1 month at room temperature. To store any dried product longer, place it in the freezer.

 Theoretical learning Activity

Conduct brainstorming session with the student the factors affect the

length of time you can store dried fruits and vegetables

Have students in their respective groups discuss about ideal storage area conditions for dried fruits and vegetable

 Practical learning Activity

Provide students the different dried fruits and vegetables and ask them to store in proper conditions

 Points to Remember (Take home message)

The length of time you can store dried food depends on:

The type of food
Factors related to the drying process (pre-treatment and final level of moisture in the dried food)
Packaging of the dried food
The storage area
An ideal storage area conditions for dried food is:
cool,
dark,
and dry.

Storage safety precautions:
Secure
Safe from pests and rodents
Appropriate storage time

 Learning Outcome 5.3 Formative Assessment

Written assessment

Question 1. What are the factors affecting the length of time you can store dried fruit and vegetables?

Answer:

The length of time you can store dried food depends on:

The type of food

Factors related to the drying process (pre-treatment and final level of moisture in the dried food)

Packaging of the dried food

The storage area

Question 2. What is an ideal storage area conditions for dried food?

Answer:

An ideal storage area conditions for dried food is:

cool,

dark,

and dry.

Question 3. What are the safety storage precautions of dried fruits and vegetables?

Answer:

Storage safety precautions:

Secure

Safe from pests and rodents

Appropriate storage time

Question 4. Answer by true or false

The cooler the storage area, the shorter the shelf life.

Dark areas are ideal because light fades fruit and vegetables and decreases their vitamin A and C contents.

The storage area need not be fancy; a dark, unheated closet or drawer works fine.

Many people store dried foods in the refrigerator or freezer, which keeps quality high.

Molds can grow in foods that are not completely dry and in foods that absorb water when they are packaged or stored in moist conditions.

It is good to consume mouldy foods because some toxic molds cannot grow at room temperature.

One typical change that occurs during storage is “Maillard browning,” which involves complex chemical reactions between the food’s sugars and proteins.

Other chemical changes that may take place during storage include loss of vitamin C or other nutrients, general discoloration, changes in food structure leading to an inability of the dried food to fully rehydrate, and toughness the rehydrated cooked product.

Answer:

False

True

True

True

True

False

True

True

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The product should be store in appropriate storage area.

Task: Store the dried pineapples

Checklist	**Score**	
	Yes	**No**
<u>Indicator:</u> Storage conditions are well respected		

Cool		
Dry		
Dark place		
Indicator: Storage safety precautions are respected		
Secure		
Safe from pests and rodents		
Appropriate storage time		
Observation		

References:

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