RQF LEVEL 5

TRADE: FOOD PROCESSING

MODULE CODE: FOPCP501

TEACHER'S GUIDE

Module name: PROCESS COFFEE CHERRIES INTO PARCHMENT COFFEE

Table of contents

Acronyms

1.	^{o}F	Degree Fahrenheit
2.	%	Percentage
3.	CIP	Cleaning in place
4.	COP	Cleaning out place
5.	FOPCP	Food processing coffee parchment
6.	Hrs	Hours
7.	IC	Indicative content
8.	IQ	Installation Qualification
9.	KG	Kilogram
10.	LO	Learning Outcome
11.	LU	Learning Unit
12.	OQ	Operation Qualification
13.	PPE	Personal Protective Equipment
14.	PQ	Performance Qualification
15.	SOP	Standard Operating Procedures

Introduction

Coffee production is the industrial process of converting the raw fruit of the coffee plant into the finished coffee. The cherry has the fruit or pulp removed leaving the seed or bean which is then dried. Coffee production is a major source of income, especially for developing countries where coffee is grown. By adding value, processing the coffee locally, coffee farmers and countries can increase the revenue from coffee.

Coffee trees produce berries, called **coffee cherries** that turn bright red when they are ripe and ready to pick. The fruit is found in clusters along the branches of the tree.

The coffee cherry's outer skin is called the *exocarp*. Beneath it is the *mesocarp*, a thin layer of pulp, followed by a slimy layer called the *parenchyma*. The beans themselves are covered in a paper-like envelope named the *endocarp*, more commonly referred to as ***the parchment*.**

Inside the parchment, side-by-side, lie two beans, each covered separately by yet another thin membrane. The biological name for this seed skin is the ***spermoderm***, but it is generally referred to in the coffee trade as the ***silver skin***.

Definitions

The cherry is the name usually given to the fruit of the coffee tree

Parchment Coffee is dried but unhulled coffee beans.

Parchment Coffee: Describes wet-processed coffee shipped with the dried parchment skin still adhering to the bean.

Green coffee beans are the seeds of the coffee shrub, which are disengaged completely from the husk and to a considerable extent from the seed coat (silver skin). The unroasted coffee beans are known as green coffee.

Mucilage: is a thick gluey substance produced by nearly all plants and some Microorganisms.

Harvesting the Cherries / Picking

Whether by hand or by machine, all coffee is harvested in one of **two ways:**

Strip Picked: All of the cherries are stripped off of the branch at one time, either by machine or by hand.

Selectively Picked: Only the ripe cherries are harvested, and they are picked individually by hand. Pickers rotate among the trees every **eight to 10 days**, choosing only the cherries which are at the peak of ripeness.

Clean, washed bags should be used to collect the harvested fruits; never use bags that have contained fertilizer or other chemicals.

Module code and title:

FOPCP501: Process coffee cherries into parchment coffee

Learning Units:

1. Prepare Materials and plant line equipment
2. Receive coffee cherries.
3. Prepare coffee beans

Learning Unit 1: Prepare Materials and plant line equipment

Picture/s reflecting the Learning unit 1

STRUCTURE OF LEARNING UNIT

Learning outcomes:

1.1 Identify plant line equipment and materials

1.2 Cleaning of equipment

1.3 Use equipment

Learning outcome 1.1. Identify plant line equipment and materials

Duration: 6 hrs

Learning out come 1 objectives:

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

1. Identify clearly different types of equipment used in processing coffee cherries to parchment coffee.

2. Explain properly the purpose and function of each type of equipment used in processing coffee cherries.

3. Explain properly the importance of equipment efficiency in coffee processing.

Resources

Equipment	Tools	Materials

Conveyor belts Cherry choppers Grading tanks Disk pulper Sorters Skin separator tank Mucilage remover Driers Washing channel Soaking tanks Fermentation tanks	Timer Moisture meter Spreads Hygrometer Balances	Fiber sacs Polyethane bags P.P.E

Advance preparation:

Prepare workplace and the following materials and equipment should be available

Disk pulper

Mucilage remover

Grading tank

Fermentation tank

Driers

Scales

Moisture meter

Sacs

Indicative content 1: Identify plant line equipment and materials

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

Coffee materials and equipment

Cherry choppers
Disk pulper/pulper remover
Sorters
Flotation tank,
fermentation tank,
washing tank,
grading tank
Mucilage remover
Driers
Skin separator tank
Storage silos

Materials

Basins
sacs
Pollyethane bags
Timer
Balances
P.P.E
Moisture meter
Spreads
Hygrometer
Balances

Name of Tools or equipment	Image	Identification through using.

Cherry chopper(pulping machine)		Fruit pulper with motor is used to extract pulp from fruits, vegetables and other pulpy items. During the operation, the seeds and skin get separated and discharges through a chute
Sorters:		Coffee bean sorter (optical color sorter) really helps to screen Arabica andRobusta coffee beans. By removing all the defected and discolor beans from the raw material you can get fine quality
Mucilage remover		Mucilage remover: they wash out mucilage with the help of water or without water during wet processing.
Drier		Those dries are used to reduce or remove moisture content of coffee cherries

Skin separator tank:	 	Skin separator tank: It was designed to improve the separation of beans and skins after pulping, often interposed between the pulper and fermentation tank.
		Storage silos : Coffee Silo is a large sized, deep containers used to store dreid coffee beans. Perfect Storage Solution for Coffee Beans.

Indicative content 2 : Usage of Equipment

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

Soaking material : soaking tanks used for immersing pulped coffee beans for fermentation. Those are materials used to ferment coffee for the purpose of mucilage removing.
Washing material : Those are materials used to wash away mucilage after fermentation so as to obtain clean coffee beans.
Hulling material : it is used for breaking and removing parchment layer of coffee bean.
Pollisher machine : it is used for removing silver skin layer so as to obtain green coffee bean.

Indicative content 3: Equipment efficience

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

This is the ability of equipment to accomplish the tasks well, or equipment's capacity to work very well. According to the equipment evaluation or checking must be done to ensure that the processing line is complete and their functionality is proper.


Theoretical learning Activity

Conduct brainstorming session with the student on different types of coffee processing equipment

Oral presentation on usage of equipment

Have students in their respective groups discuss different types of coffee processing equipment


Practical learning Activity

Provide students with pictures of the different coffee processing equipment and materials, and ask them to match each item with its respective function.


Points to Remember (Take home message)

Using the cherry chopper is used to Sort the cherries and remove any defective cherries.
The disk pulper is used to remove the skin and pulp from the cherries.
The mucilage remover is used to wash away the mucilage from the beans.
The skin separator tank is used to separate the beans and skin after pulping
Equipment should be efficiency when it is accomplished it task very well.

Learning outcome 1 formative assessment

Written assessment

1. State four (4) equipment or materials used for processing coffee cherries to parchment coffee?

Equipment	**Materials**
Cherry choppers	Sacs
Disk pulper/pulper remover	PPE
Sorters	Detergent
Mucilage remover	Coffee cherries
Driers	Fuels.

2. Table below illustrates different equipment used in parchment coffee processing in column A and their respective function in column B. Read carefully and match both columns by writing a corresponding letter in respective place.

ANSWER	**COLUMNS A**	**COLUMNS B**
1=B	1. Mucilage remover	A. Remove pulp from coffee cherries
2=D	2. Skin separator tank	B. wash out mucilage with the help of water or without water during wet processing
3=E	3. Drier	C. Perfect Storage Solution for Coffee Beans Rost freid Steels offers an ideal design to stock coffee beans
4=C	4. Storage silos	D. It was designed to improve the separation of beans and skins after pulping, often interposed between the pulper and fermentation
5=E	5.Disk pulper	E .used to reduce or remove moisture content of coffee cherrie

3. Select the correct answer by encircle the Letter corresponding

The coffee cherries that are mature to be processed are of:

a. Green color

b. Yellow color

c. Bright red color

4. What do you understand by the term" equipment efficiency"

This is the ability of equipment to accomplish the tasks well, or equipment's capacity to work very well.

5. Answer by writing true to the statement which is correct or false to the statement which is incorrect statement to this tools, equipment and materials used in coffee processing.

Before starting using equipment, verification should not be done which consists on checking whether the equipment is working properly. FALSE

All equipment and tools used in parchment coffee processing are brought and arranged according to the way they were before processing. TRUE

soaking tanks used for immersing pulped coffee beans for fermentation. Those are materials used to ferment coffee for the purpose of mucilage removing. TRUE

7. Which of the following is a material used for washing away mucilage from coffee beans?

a. Basins

b. Pollyethane bags

c. Timer

d. Hygrometer

 **Please mix different assessment tools for triangulation and relevancy of assessment**

Practical assessment.

As trainee who has qualified in coffee processing, you are hired by ISHEMA coffee washing station for helping casual labours to perform coffee cherries into parchment.

You are asked to receive and identify by labelling different materials and equipment that have been supplied.

Observation checklist

Checklist	**Score**	
	YES	**NO**
Indicator: Equipment are received and identified		
Cherry choppers		
Disk pulper/pulper remover		
Sorters		
Mucilage remover		
Driers		
Skin separator tank		
Separator		
Storage silos		

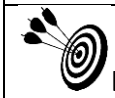
Indicator: Materials are received and identified		
Basins		
sacs		
Pollyethane bags		
Timer		
Balances		
P.P.E		
Moisture meter		
Spreads		
Hygrometer		
Balances		

References:

1. Anon. (1983) "Coffee: Marketing and Processing: UNCTAD Reports". Planters' Chronicle, 78(4) : 123-124. 02.
2. Anon. (1982) "Quality Control of Coffee". Indian Coffee, 56 (1-2) : 3-24. 03.
3. Anon. (1981) "Recirculation of Water Combined with Land Treatment as a Solution to the Problem of River Pollution from Coffee Factories." Kenya Coffee, 46(549) : 363-368.

Learning outcome 1. 2 Cleaning of equipment

 **Duration: 6 hrs**

 Learning outcome 1 objectives :

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

1. Differentiate properly different cleaning techniques used in coffee processing.

2. Describe properly standard operating procedures(SOPs) for cleaning the equipment in coffee processing.

4. discuss properly the usage of different materials and equipment used in coffee processing.

5. Identify clearly the hygienic precautions for cleaning the equipment in coffee processing.

 **Resources**

Equipment	Tools	Materials

Conveyor belts Cherry hoppers Grading tanks Disk pulper Sorters Skin separator tank Mucilage remover Driers	Washing channel tanks Soaking tanks Fermentation tanks Timer Moisture meter Spreads Hygrometer Balances	Detergent Water P.P.E Cleaning clothes Brushes

Advance preparation:

The following should be available

Cleaning products: detergents and disinfectants

Cleaning tools**:** brushes, squeegees

Adequate potable water

Indicative content 1: Different cleaning techniques

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

COP (Cleaning Out place) : This method provides the cleaning with the displacement moving the equipment in the installation Area.
CIP (Clean In Place) : The methods involve the cleaning the equipment in the installation area. In other words, cleaning in place is a method of cleaning the interior surface of pipes, vessels, process equipment, filters and associated fittings without dismantling.

Indicative content 2: Standard operating procedures (SOPs) for cleaning

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

User manual : the efficiency of use manual for cleaning accomplished by training of the cleaning operators, ensuring the exact methods of cleaning manually, SOPs validating the methods from different operators and verifying the procedure with interval of time.
The manual for cleaning depends on

Concentration of detergent used
Temperature of washing liquid

Indicative content 3: Hygienic precautions

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

PPE : It is important for every worker to wear Personal Protective Equipment in order to avoid work accident.

Well maintained and clean personal protective clothing prevent a food handling person from contaminating food. Each food handling person should be provided with a minimum two pairs of work uniforms which include:

Respiratory for example, disposable, cartridge, airline, half or full face

Eyes protective equipment– for example, spectacles/goggles, shields, visors

Hearing protective clothing – for example, ear muffs and plugs

Hand protective equipment– for example, gloves and barrier creams

Foot – for example, shoes/boots

Head protective clothing, hats

Skin protective equipment – for example, hats, sunburn cream, long sleeved clothes

Other personal protective equipment: This may include PPE for specific tasks such disposable clothing for working with chemicals, radiation hazards, welding, painting. Examples include: lead aprons for x-ray protection; sleeve protectors, aprons, coveralls when using chemicals; leather jackets, trousers and spats for welding; thermal and cold protective clothing for work near furnaces and cool rooms

Those personal protective clothing should be worn to ensure the safety of the food. Gum boots with slip- resistant sale should be worn to protect against slipping.

Personal clothing should be:

Clean and in good repair personal protective clothing

Washable, easy to clean or single use personal protective clothing

Personal protective clothing covers all outer clothing which poses threat to cross contamination and all body parts like hair, beard, nose, mouth, etc…. susceptible to cause contamination. PPE should be kept separately from personal clothing

After used cover machine : It is advised to cover machine after using it because this will protect machine from contamination

Cleaning before and after used : This is the rule of all processing units, to clean every equipment before work and after work to eliminate hazards

Theoretical learning Activity

Trainees are asked to brainstorm about the use of equipment in the group.

Trainees are asked to discuss about proper adjustment of equipment in the group.

Practical learning Activity

Trainees practical prepare and asked to perform SOPs document by basing on coffee processing line.

Points to Remember (Take home message)

To differentiate COP and CIP as cleaning technique. SOP as a document which describe how the processing operations of coffee cherries into parchment coffee bean should be conducted. Importance of hygienic precaution as both to prevent contamination and to prevent accident to the handler.

Learning outcome 1 formative assessment

Written assessment

1. Answer by true or false

a) CIP: Clean In Place: This method provides the cleaning with the displacement moving the equipment in the installation Area. FALSE

b) COP: Cleaning Out place: The methods involve the cleaning the equipment in the installation area. FALSE

2. State two (2) important of wearing personal protective equipment?

It is important for every worker to wear Personal Protective Equipment in order to avoid work accident

Well maintained and clean personal protective clothing prevent a food handling person from contaminating food.

3) the following are the characteristics of personnel protective equipment used in Parchment coffee processing?

Good personal clothing should be:

Clean and in good repair personal protective clothing

Gum boots with slip- resistant sale should be worn to protect against slipping.

Washable, easy to clean or single use personal protective clothing

Should be easily to break and costly high for affordable.

 **Please mix different assessment tools for triangulation and relevancy of assessment**

Practical assessment

In your respective groups, you are asked to clean equipment and materials before being used in processing of coffee cherries into parchment coffee.

Observation checklist

Checklist	Score	
	YES	NO
Indicator 1: Cleaning techniques are well performed		
CIP		
COP		
Indicator 2: cleaning methods are well performed		
Dry method		
Wet method		
Indicator 3: Cleaning product are well selected and used		
Detergents		
Desinfectants		
Indicator: Hygienic precautions are respected		
PPE are well used		
Machine are cleaned		
Machine are covered after cleaning		

References:

1. Anon. (1976) "Emergency in a Coffee Factory : How to Cope with a Peak Crop in a Co-operative Coffee Factory." Kenya Coffee, 41(486) : 303-307. 05.
2. Anon. (1974) "Better Coffee Farming : Coffee Processing" Kenya Coffee, 39(462) : 303-307

Learning outcome 1. 3 Use equipment

Duration: 8 hrs

Learning outcome 1 objectives :

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

1. Describe properly SOPs (standard operating procedures) for each equipment.
2. Develop appropriately equipment adjustment procedures
3. Identify clearly effectiveness of the equipment used in coffee processing.
4. Explain properly the safety precautions of the equipment used in coffee processing.
5. Discuss properly on monitoring plant line equipment sequence in coffee processing.

Resources

Equipment	Tools	Materials
Conveyor belts	Timer	Fiber sacs
Cherry choppers	Moisture meter	Polyethane bags
Grading tanks	Spreads	P.P.E
Disk pulper	Hygrometer	
Sorters	Balances	
Skin separator tank		
Mucilage remover		
Driers		
Washing channel		
Soaking tanks		
Fermentation tanks		

Advance preparation:

Fuel and electrical power must be availability

Indicative content 1. Safety of tools and equipment


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

The safety of tools and equipment is not only the concern of the management, but of the workers who use the equipment as well. Proper maintenance and safety of tools and equipment are important for the following reasons:

Good quality of service: Modern equipment has built-in controls, thermometers and timing and regulating devices. A breakdown of these devices may affect the quality of the food being prepared and caused slowdown in production and service

Sanitation. Mechanical function of equipment encourages the development of disease causing bacteria. Negligence of their cleanliness leads to the growth of food-borne bacteria.

Safety. Most food service accident happens in coffee processing. This is due to lack of knowledge and training of food worker in the use of tools and equipment.

Less cost of production. Expenses will be minimized if tools and equipment are in good condition.

Indicative content 5. Safety measures in the use of tools and equipment.


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

Stores of equipment and materials like, choppers and cutting blades should be a designated places and should be Labeled.

Repair broken tools and equipment immediately.

Check wiring of electrical equipment regularly.

Report equipment that is not functioning properly.

Tie the long hair to the back of the head**,** Wear safety goggles at all times during the experiment, wear other PPE as required by local safety rules and regulations

Store tools and equipment in a clean dry place. Do not keep them when wet.

Chemical safety precautions, safety glasses are to be worn whenever working with acids, bases or any flammable materials.

Let the instructor know immediately about any glass ware breakage or chemical spills that may occur. So that proper clean up procedures can be instituted.

Notice: An action taken in advance to protect against possible danger, failure or injury.

Safe guard followed by safety precautions when using heavy machinery.

SOPs (standard operating procedures) for each equipment develop SOP's for each machine: Before working, it is recommended to carefully read and understand the operation of the tools and equipment from their labels or manuals. Standards for that must be followed even if some small changes can occur purposively without breaking principals.

Indicative content 6. Equipment adjustment procedures

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

Follow instruction of the machine manufacturer, each equipment has an instruction for use before use check their instructions and respect their adjustment order.

Effectiveness of the equipment

Capacity: for each machine the operator should take into account the capacity of this; everyone is recommended to not over load the machine while it is working.

Equipment types: the type of equipment is one key to consider when you are using the equipment, we are recommended to use the equipment for their intended use.

Assembling the equipment: this should be done with high attention and by the qualified worker.

Capacity: It refers to the production **capacity** of workers or **machines**, and is usually expressed by "hours". The Process **Capacity** of workers is called human **capacity**, while that of **machines** is called **machine capacity.**

Machine capacity = operating hours x operating rate x the number of machine

Safety precautions of the equipment

Before starting using equipment, verification should be done which consists on checking whether the equipment is working properly. For any default, correct it or ask supervisor for help. Any damage of equipment or accident should be reported immediately to the supervisor.

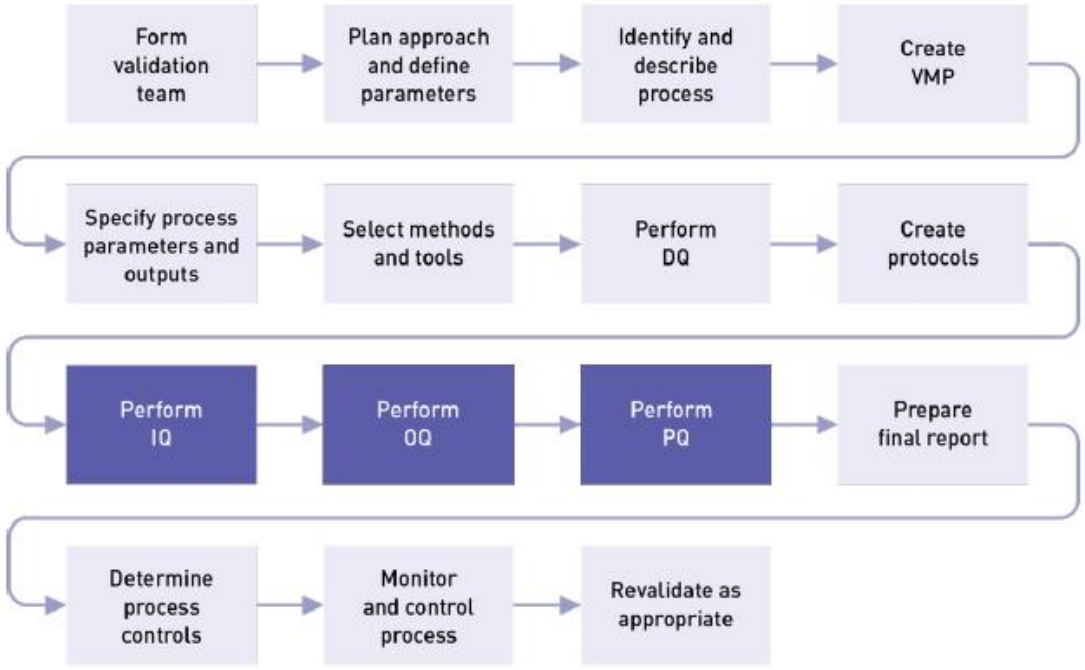
Establishing a preventive maintenance program helps to ensure that all equipment and tools function as intended. Failure to perform maintenance activities during production may increase the risk of microbial contamination. Preventive maintenance includes periodic examination and maintenance of tools and equipment. Saving money is one good reason in performing preventive maintenance.

All equipments and tools are brought and arranged according to the way they were before processing. They have to be handled with care in order to avoid contamination and breakage.

Indicative content 4. Monitoring of plant line equipment sequences

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

Protocol this will help to know where to start and where to end up in any give plant.
Some meaning
Installation Qualification (IQ): Is everything installed correctly?
Operational Qualification (OQ): Is everything operating correctly? Are operating limits understood?
Performance Qualification (PQ): Did it produce the correct result? Is the process stable and capable?
Design Qualification **(DQ)**



Source: Global Harmonization Task Force: Guidance for Industry – Process Validation: General Principles and Practices

Theoretical learning Activity

Trainees are asked to discuss about conducting the session on cleaning of equipment.

Practical learning Activity

Trainees are learning in the workshop and then tool and equipment are provided to them and asked them to perform cleaning and arrange them according to the processing line.

Points to Remember (Take home message)

Reasons for properly maintenance and safety of tools and equipment Measures for safety use of tools and equipment. Effectiveness and safety precaution of the equipment. Monitoring of plant line equipment sequence.

Learning outcome 1 formative assessment

1. Below they are the main reasons for proper maintenance and safety of tools and equipment except:

Good quality of service

Sanitation.

Safety.

Less cost of production.

Hazard

2. Develop any (4) Safety measures in the use of tools and equipment during parchment coffee processing

Wear personnel protective equipment correctly

Stores of equipment and materials like, choppers and cutting blades should be a designated places and should be Labeled.

Repair broken tools and equipment immediately.

Check wiring of electrical equipment regularly.

Report equipment that is not functioning properly.

Store tools and equipment in a clean dry place. Do not keep them when wet.

3. Answer by true or false

Any damage of equipment or accident should be reported immediately to the supervisor. **True**

Failure to perform maintenance activities during production may increase the risk of microbial contamination. **True**

All equipment and tools are brought and arranged according to the way they were before processing. **True**

Please mix different assessment tools for triangulation and relevancy of assessment

Practical assessment

In your respective groups, each member is asked to assemble and adjust disk pulper equipment before being used in processing of coffee cherries into parchment coffee.

Observation checklist

Checklist	Score	
	YES	NO
Indicator: Adjustment of equipment		
SOP is described		
Assembling of equipment is done		
Adjustment procedures is conducted		
Safety precaution of equipment is respected		

Reference:

1. UNCTAD, Secretariat. (1983) Marketing and Processing of Coffee : Areas of International Co-operation. Geneva: UNCTAD. Rept. No. TD/B/C.1/PSC/31. 27.
2. United Nations, Centre on Transnational Corporations. (1981) Transnational Corporations in Food and Beverage Processing. New York: UN.

Learning Unit 2: Receive coffee cherries

Picture/s reflecting the Learning unit 2

STRUCTURE OF LEARNING UNIT

Learning outcomes:
2.1. Select coffee bean quality
2.2 Sort coffee bean from foreign matter

Learning outcome: 2.1. Select coffee bean quality

Duration: 5 hrs

Learning outcome 1 objectives :

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

1. Distinguish properly coffee varieties received at coffee processing plant.
2. Identify properly coffee cherries maturation parameters
3. Differentiate correctly coffee cherries defects based on during coffee sorting.

Resources

Equipment	**Tools**	**Materials**
Cherry hoppers	Plastic sheeting Chairs Basket Bags Scales.	Water P.P.E Coffee cherries

	Sorting table Basin	

Advance preparation:

Cherry hoppers must be clean

Indicative content 1: Select coffee bean quality

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

Coffee varieties

There are three varieties of coffee:

Coffea Arabica is the major cultivated specie in Africa. The coffee beans of this variety are more expensive, the higher the plantations, as the fruits ripen more slowly at greater altitudes, becoming horny and hard and containing only little moisture. They consequently have a strong, full flavor. counts for **60–80%** of the world's coffee production

Coffea robusta: beans have higher water content and generally have a less powerful flavor. Counts for **20–40%** of the world's coffee production.

Robusta and Arabica differ when it comes to taste, growing environments and quality

Coffea liberica /The Liberian coffee shrub.

A lowland coffee, whose beans, though larger than those of Coffea arabica, are less highly regarded because of their sharp flavor

Coffee cherries maturation parameters

Colour: The coffee cherries that are mature to be processed are of bright red color when they are ripe. Green to begin with, the berries ripen over several months, becoming successively yellow, then red, deep red, and finally almost black. The ideal time for harvesting is when the berries are red.

A look into the interior of the coffee cherry shows: the two seeds, the actual coffee beans, are surrounded by whitish yellow, sweet pulp and face each other with their flat sides which have the typical longitudinal groove. The two coffee beans are also surrounded by the seed skin, the so-called silver skin, a thin mucous layer as well as the pale yellow parchment. In this condition the matured coffee cherries can now be processed.

Size: The **coffee cherries** that are mature to be processed should achieve the maximum size. measures about 6/10-inch (1.5 cm) long.

Odor: The fruits, or *cherries*, are rounded and mature in 7 to 9 months; they usually *Coffee aroma* included Flowery, nutty, smoky.

Coffee cherries defects:
The coffee cherries defects can be physical damage or biological deterioration.
Physical: During selection those defected coffee cherries are not selected for processing because they can result in poor quality coffee.
Biological: Storage of cherries in bags or boxes for longer than 24 hours will result in fermentation in the cherry and deteriorated quality due to microorganism's attack.

Theoretical learning Activity

Trainees are asked to discuss about factors to consider in selection of coffee cherries in the groups.

Using the pictures while delivering the session to trainees for Viewing them for more understanding.

Trainees are asked to discuss about coffee cherries defects in groups.

Practical learning Activity

Provide coffee cherries that are grown in different stages to trainees and asked them to conduct the selection those cherries by basing on their maturity stages.

Points to Remember (Take home message)

Select coffee cherries by basing on coffee varieties
Maturation parameters of coffee cherries
Physical and biological damages or defects of coffee cherries.

Learning outcome 1 formative assessment

1. There are different varieties of coffee plant in the world. Enumerate **three (3)** varieties of coffee used in processing of parchment coffee?

Coffea Arabica

Coffea Robusta

Coffea liberica

2. choose the correct answer

Coffee cherries maturation parameters

a) Colour, size and odour

b) Colour, size and density

c) Size, density and shape

3. Explain coffee cherries defects that are considered during selection of coffee berries?

Physical: During selection those defected coffee cherries are not selected for processing because they can result in poor quality coffee. These are dried coffee cherries, disease cherries, immature cherries, un ripen cherries and so on.

Biological: Storage of cherries in bags or boxes for longer than 24 hours will result in fermentation in the cherry and deteriorated quality due to micro- organisms attack. These defects are discoloration of cherries, sour taste and off-odor.

Please mix different assessment tools for triangulation and relevancy of assessment

Practical assessment

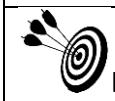
Suppose that you are technician who has hired for receiving coffee cherries by XY coffee washing station and you are asked to select good quality coffee cherries in provided samples of three varieties of coffee cherries.

Observation checklist

Checklist	**Score**	
	YES	**NO**
Indicator 1: Coffee varieties are well selected .		
Arabica		
Robusta		
Liberica		
Indicator 2: Mature cherries are well selected		
Color		
Size		
Odour		
Indicator 3: Coffee cherries defects are well checked		
Physical defects		
Biological defects		

Learning outcome: 2.2 Sort coffee cherries

Duration: 5 hrs



Learning outcome 1 objectives :

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

1. Discuss properly sorting techniques used to prepare coffee cherries in coffee processing.

2. Identify appropriately recording data during coffee reception.

Resources

Equipment	**Tools**	**Materials**
Conveyor belts	Plastic sheeting	Water
Sorters	Chair	P.P.E
Separation tank	Basket	Bushes
Vibration table	Bags	Coffee cherries
Screaner	Scales.	Books and pens
	Sorting table	

Advance preparation:

The following equipment should be available

Adequate water must available

Electrical power must be available

Indicative content 1. Sorting parameters

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

Purpose of sorting:
Even after careful harvesting, a certain number of partially dried, overripe and unripe cherries, as well as some stones and dirt, will be present among the ripe cherries; that is why it is necessary first **to remove all those unwanted materials which can reduce the quality of coffee.**
Sorting parameters
Defects: we consider (Physical damage, size of the cherries)
Maturity levels: unripe, overripe and dried cherries are separated from ripe cherries

Indicative content 2: Sorting techniques

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

Vibration: is the method used to separate good coffee cherry from a wanted one buy using a force or shaking the less weight move first and the good one remain.
Floating: It is a technique of separating the sinks and floating. The pulp and coffee beans are then separated by centrifugal force and a barrel screen system. The ripe cherries can also be separated by flotation.
When the coffee cherries are sorted by **immersion in water/ flotation,** an overripe coffee cherry, undeveloped coffee cherries, sticks and leaves **floa**t in water and good ripe coffee cherries are dense and **sink**. The floaters are pulped separately.
Picking: by using hand the farmer chooses the good coffee cherry which is well ripened, not damaged, good size, and good quality, this is used mostly in harvesting time.
Screening: Screens may also be used to improve the separation between the ripe and unripe, large and small cherries.

Indicative content 3. Recording system

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

At reception, the coffee cherries are weighed and recorded. There is a report recording of each farmer's delivery, the date, and the weight of cherry they have delivered.

Theoretical learning Activity

Trainees are asked to discuss and brainstorm about sorting, weighing and data that are recorded during receiving coffee cherries.

Group discussions about weighing techniques and recording system

Practical learning Activity

Trainees are provided the coffee cherries among their groups and are asked practical to perform weighing and keeping their records.

Points to Remember (Take home message)

Parameters to consider in sorting of coffee cherries Sorting techniques Information to record during receive coffee cherries.

Learning outcome 1 formative assessment

Written assessment

1. At reception, the coffee cherries are sorted out before pulping. Explain the purpose of sorting process during parchment coffee processing?

The coffee cherries are sorted out before pulping. This helps to eliminate the immature, diseased, pest damaged and dry cherries as well as the leaves, twigs and other foreign materials present.

2. Explain techniques used for sorting coffee berries?

Vibration: is the method used to separate good coffee cherry from a wanted one buy using a force or shaking the less weight move first and the good one remain.

Floating: It is a technique of separating the sinks and floating. The pulp and coffee beans are then separated by centrifugal force and a barrel screen system. The ripe cherries can also be separated by flotation. When the coffee cherries are sorted by **immersion in water/ flotation,** an overripe coffee cherry, undeveloped coffee cherries, sticks and leaves **floa**t in water and good ripe coffee cherries are dense and **sink**. The floaters are pulped separately.

Picking: by using hand the farmer chooses the good coffee cherry which is well ripened, not damaged, good size, and good quality, this is used mostly in harvesting time.

3. At reception, the coffee cherries are weighed and recorded. One of these information is not recorded during reception of coffee cherries.

a) Name of farmer's delivery,
b) the date, and
c) the weight of coffee cherries they have delivered
d) Batch number
e) Price

 **Please mix different assessment tools for triangulation and relevancy of assessment**

Practical assessment

You as a technician who has knowledge in performing sorting techniques of coffee cherries, you are asked to record data of received coffee cherries and to sort them.

Observation checklist

Checklist	**Score**	
	YES	**NO**
Indicator: recording techniques are well described		
Batch		
Origin		
Weight		
Indicator 2: one in the following sorting techniques is well done		
Vibration		
Flotation		
Screening		
Hand picking		

Learning Unit 3: – Prepare coffee beans

Picture/s reflecting the Learning unit 3






STRUCTURE OF LEARNING UNIT

Learning outcomes:

LO 3.1 – Coffee Cherries Processing Techniques

LO 3.2 – Pulping coffee beans

LO 3.3 – Fermentation of coffee beans

LO 3.4. Wash coffee beans

LO.3.5. Grade Coffee Beans

LO. 3.6: Dry coffee Beans

Learning outcome: 3.1. Coffee Cherries Processing Methods

Duration: 5 hrs

Learning outcome 1 objectives :

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

1. Explain clearly coffee cherries processing techniques in coffee processing.

2. Identify clearly purpose of pulping coffee cherries in coffee processing.

3. Discuss appropriately steeping process and its conditions in coffee processing.

Resources

Equipment	Tools	Materials
N/A	N/A	N/A

Advance preparation:

Well prepared Hand out

Indicative content 1 : Processing method

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

Specialty coffee is processed using various methods from origin to origin. By "processed" we mean, the pit (bean) of the cherry is extracted from the pulp, dried and prepared for exportation and artisan roasting.

Wet process: In the wet process, the fruit covering the seeds/beans is removed before they are dried. Coffee processed by the wet method is called wet processed or washed coffee. The wet method requires the use of specific equipment and substantial quantities of water. The skin of the cherry and some of the pulp is removed by pressing the fruit by machine in water through a screen. The bean will still have a significant amount of the pulp clinging to it that needs to be removed. This is done either by the classic ferment-and-wash method or a newer procedure variously called machine-assisted wet processing, aqua pulping or mechanical demucilaging.

In the ferment-and-wash method of wet processing, the remainder of the pulp is removed by breaking down the cellulose by fermenting the beans with microbes and then washing them with large amounts of water. Fermentation can be done with extra water or, in "Dry Fermentation", in the fruit's own juices only. The fermentation process has to be carefully monitored to ensure that the coffee doesn't acquire undesirable, sour flavors. For most coffees, mucilage removal through fermentation takes between **8 and 36 hours**, depending on t**he temperature**, **thickness of the mucilage layer,** and **concentration of the enzymes.** The end of the fermentation is assessed by feel, as the parchment surrounding the beans loses its slimy texture and acquires a rougher "pebbly" feel. When the fermentation is complete, the coffee is thoroughly washed with clean water in tanks or in special washing machines

Dry process: Dry process, also known as unwashed or natural coffee, is the oldest method of processing coffee. The entire cherry after harvest is first cleaned and then placed in the sun to dry on tables or in thin layers on patios. The ripe cherries can also be separated by flotation in washing channels close to the drying areas. The coffee cherries are spread out in the sun, either on large concrete or brick patios or on matting raised to waist height on trestles. As the cherries dry, they are raked or turned by hand to ensure even drying and prevent mildew.

It may take up to 4 weeks before the cherries are dried to the optimum moisture content, depending on the weather conditions.

On larger plantations, machine-drying is sometimes used to speed up the process after the coffee has been pre-dried in the sun for a few days. The drying operation is the most important stage of the process, since it affects the final quality of the green coffee. A coffee that has been over dried will become brittle and produce too many broken beans during hulling (broken beans are considered defective beans).

Coffee that has not been dried sufficiently will be too moist and prone to rapid deterioration caused by the attack of fungi and bacteria. The dried cherries are stored in bulk in special silos until they are sent to the mill where hulling, sorting, grading and bagging take place. All the outer layers of the dried cherry are removed in one step by the hulling machine.

The dry method is used for about 90% of the Arabica coffee produced in Brazil, most of the coffees produced in Ethiopia, Haiti and Paraguay, as well as for some Arabicas produced in India and Ecuador. Almost all Robustas are processed by this method. It is not practical in very rainy regions, where the humidity of the atmosphere is too high or where it rains frequently during harvesting.

Semi-dry: Semi-dry is a hybrid process used in Indonesia and Brazil. The process is also called "wet-hulled", "semi-washed", "pulped natural" or, in Indonesia, "Giling Basah". Literally translated from Indonesian, Giling Basah means "wet grinding". This process is said to reduce acidity and increase body. In this process, farmers remove the outer skin from the cherries mechanically, using locally built pulping machines. The coffee beans, still coated with mucilage, are then stored for up to a day.

Following this waiting period, the mucilage is washed off and the parchment coffee is partially dried in the sun before sale at 10% to 12% moisture content. The tricky part during the semi-washed process method are bacteria which are always around. Fermentation can start immediately as honey dried coffee beans have a remaining “sugar” layer which is vulnerable to any sort of mold and offers feeding ground for

bacteria. Drying carefully and under supervision is crucial to the success of this processing method. The beans need to constantly move during the drying process to prevent mold and fungal infections. The processor needs to rack the green coffee beans 2-3 times per hour to ensure a safe drying process.
Once the beans have reached a sufficient moisture level, again, the beans are dry milled to remove the “parchment” layers and are sent off to roasters and wholesalers globally.
Specialty coffee is processed using various methods from origin to origin. By "processed" we mean, the pit (bean) of the cherry is extracted from the pulp, dried and prepared for exportation and artisan roasting. The method is called wet process because water is the primary means to both moving the coffee through the process and to making the extraction of the seed possible.
Since processing method affects taste, understanding these things is important if we are to fully understand why certain coffees taste the way they do.
3. After being separated, the coffee will go into a de-pulper. The pulp is the red part of the cherry. This is removed and kept for compost/fertilizer. It shows the depulper spinning in the picture on the left, and dumping the refuse into a pile on the left. If the pulp does not come off in this step, then it is not completely ripe and is hand sorted out and used in the lesser quality coffee. Yes, that's right...hand sorted out. All the coffee in the world .

Indicative content 2: Steeping process and conditions

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

Pulping: it is a process of removing the skins on the coffee cherries. It is necessary to continuously monitor the pressure so that about 3% of ripe cherries are not pulped and are removed with the green cherries. This margin of error ensures that no green cherries are mistakenly pulped. The pulp and coffee beans are then separated by centrifugal force and a barrel screen system.
Separation of pulps from coffee bean: Coffee is pulped with and separated with coffee beans
Separation by density: Pulped coffee beans are soaked in water and lighter float while other sink.

Theoretical learning Activity

Trainees are asked to discuss about coffee cherries pulping in the groups.

Trainees are asked to brainstorming about steeping process and its related conditions.

Practical learning Activity

Trainees will be putted into the practical work group in workshop and given any equal quantity of coffee cherries and asked them to perform pulping of coffee cherries and also to separate the pulped coffee by basing on the density as both the task they have to achieve.

Points to Remember (Take home message)

To differentiate dry, wet and semi-dry as processing method of coffee cherries. Steeping process and conditions.

Learning out come 1 formative assessment

Written assessment

1. The following are the steps involving in processing of coffee cherries into parchment coffee by using dry method except:

a) Sorting

b) pulping

c) drying

2. Answer by true or false

a) In wet method, the coffee cherries are dried before being pulped. **False**

b) Sorting, pulping and drying are conducted in semi-dry method of coffee processing. **True**

b) Fermentation breaks down the mucilage so that it can be readily separated from the parchment

Please mix different assessment tools for triangulation and relevancy of assessment

Practical assessment

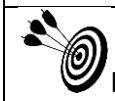
Kageyo washing station has received the visitors from NAEB in the time where steeping process is to be carried out. Production manager request you as internee to perform steeping process as demonstration to visitors.

Observation Checklist

Checklist	Score	
	YES	**NO**
Indicator 1: Steeping process is well performed		
Pulped coffee is Soaked well		
All floated cherries and pulps are removed		
Separation by density is respected		

Learning outcome: 3.2 Pulping coffee beans

Duration: 3 hrs



Learning out come 1 objectives :

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

1. Discuss appropriately fermentation conditions of pulped coffee cherries.

2. Discuss properly fermentation process of pulped coffee cherries.

Resources

Equipment	Tools	Materials
Disk pulper	Basin	Water Coffee cherries

Advance preparation:

Fuels or electrical power should be available.

Indicative content 1: Pulping coffee beans

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

The first step in wet processing is to remove the outer skin of the cherry and the pulpy flesh beneath it and should be carried out as soon as possible after harvesting, certainly within 24 hours and no more than 48 hours.
First, the freshly harvested cherries are passed through a pulping machine to separate the skin and pulp from the bean. The skin of the cherry and some of the pulp is removed by pressing the fruit by machine in water through a screen.
Then the beans are separated by weight as they pass through water channels. The lighter beans float to the top, while the heavier ripe beans sink to the bottom. They are passed through a series of rotating drums which separate them by size.
The bean will still have a significant amount of the pulp clinging to it that needs to be removed. This is done either by the classic ferment-and-wash method or a newer procedure variously called machine-assisted wet processing, aqua pulping or mechanical demucilaging.

Indicative content 2: Mucilage properties

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

The mucilage is made up of **pectin** materials including **protopectin** (33%), reducing sugars including **glucose and fructose** (30%), non-reducing sugars such as **sucrose** (20%), and **cellulose and ash** (17%). The protopectin is not water soluble and will hydrolyze to pectinic acid in fermentation tanks. Hydrolysis of protopectin and degradation of pectin by enzymes is the process that occurs to remove the mucilage during fermentation.

Theoretical learning Activity

Trainees are asked to present by oral on coffee cherries pulping

Using the images and video which showing the trainees the activities of pulping of coffee cherries during delivering the session.

Trainees are asked to discuss about steeping process and its conditions in the group.

Trainees are also to brainstorm about the mucilage components.

Practical learning Activity

After coffee cherries is being pulped by the trainees, they will put them on fermentation tank for the purpose of fermenting them as the one way of removing mucilage adhering to coffee parchments.

Points to Remember (Take home message)

Pulping as the act of separating and removing the outer skin of the cherry and the pulpy flesh beneath it. Component of mucilage

Learning outcome 1 formative assessment

Written assessment

1. What will be happen when the coffee cherries are processed after 24 hours after harvesting?

The mucilaginous coating protecting the beans decomposes before pulping, the bean can be mechanically damaged in the pulping process. Without mucilage, the beans will not slip through the pulper grooves and may be nicked, scratched, or chipped by the rough surface of the pulper drum. Beans with mucilage stuck behind ones that are not slippery can also be damaged.

Also, heat generated by fermentation of the pulp causes the bean to respire and ferment, resulting in weight loss and discoloured, sour beans. The sour characteristic of fermented beans is one of the worst defects.

2. Why should mucilage be removed from coffee beans?

Mucilage should be removed from coffee beans because:

It is sticky, inhibits drying, attracts dust, makes handling difficult and is a good media for spoilage microorganisms to thrive on.

3. Answer by true or false

The following processes occur during removal of mucilage during fermentation process:

a) Hydrolysis of protopectin **True**
b) degradation of pectin by enzymes **True**
c) oxidation of coffee beans **False**

Please mix different assessment tools for triangulation and relevancy of assessment

Practical assessment

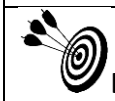
DUCOFI is a cooperative which grow coffee on large scale and selling coffee cherries to coffee washing station, recently this cooperative would buy three-disc coffee pulping machine for the purpose of selling the parchment for increasing its income, but this cooperative face with problem of insufficient information on working principle of pulping machine, as qualified technician in coffee processing you are asked to train 15 cooperative members on how pulping process is performed.

Through training, farmers will be trained by basing on the following highlighted point.

First, the freshly harvested cherries are passed through a pulping machine to **separate the skin** and **pulp from the bean**. The skin of the cherry and some of the pulp is removed by **pressing the fruit by machine in water** through **a screen**.

Learning outcome: 3.3 Fermentation of coffee beans

Duration: 7 hrs



Learning outcome 1 objectives :

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

1. Explain properly purpose of fermentation of coffee beans in coffee processing.
2. Describe correctly fermentation conditions (Factors) that decrease the time of fermentation.
3. Explain properly fermentation process of the pulped coffee cherries in coffee processing.

Resources

Equipment	Tools	Materials
Mucilage remover Fermentation tank	Fermentation tank or container. Hygrometer Thermometer pH meter and refractometer	Ferment Water Pectic enzymes Chemical alkali

Advance preparation:

Fermentation tank should be prepared before using it.

Indicative content 1: Purpose of fermentation of coffee beans

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

Fermentation is when sugars and starches are broken down and become acids or alcohol.
The role of fermentation is:
To remove the mucilage layer on pulped coffee beans.
To reduce sweetness from coffee beans
To enhances the coffee aromatic and flavour quality.
In the ferment-and-wash method of wet processing, the remainder of the pulp is removed by breaking down the cellulose by fermenting the beans with microbes and then washing them with large amounts of water. Fermentation can be done with extra water or, in "Dry Fermentation", in the fruit's own juices only.
The fermentation process has to be carefully monitored to ensure that the coffee doesn't acquire undesirable, sour flavors. For most coffees, mucilage removal through fermentation takes between 12 and 24 hours, depending on the temperature, thickness of the mucilage layer, and concentration of the enzymes. The end of the fermentation is assessed by feel, as the parchment surrounding the beans loses its slimy texture and acquires a rougher "pebbly" feel. When the fermentation is complete, the coffee is thoroughly washed with clean water in tanks or in special washing machines.
In machine-assisted wet processing, fermentation is not used to separate the bean from the remainder of the pulp; rather, this is done through mechanical scrubbing. This process can cut down on water use and pollution since ferment and wash water stinks. In addition, removing mucilage by machine is easier and more predictable than removing it by fermenting and washing. However, by eliminating the fermentation step and prematurely separating fruit and bean, mechanical demucilaging can remove an important tool that mill operators have of influencing coffee flavor.
Any wet processing of coffee produces coffee waste water which can be a pollutant. Ecologically sensitive farms reprocess the wastewater along with the shell and mucilage as compost to be used in soil fertilization programs. The amount of water used in processing can vary, but most often is used in a 1 to 1 ratio.
After separation of the skin and pulp from the beans, the beans are transported to large, water filled fermentation tanks and then covering with polythene or plastic sheet to maintain temperature. They will remain soaked in these tanks for anywhere from **12** to **24 hours to remove the slick layer of mucilage** (called the **parenchyma)** that is still attached to the

parchment. While resting in the tanks, naturally occurring enzymes (pectinase **or pectase**) will cause this layer to dissolve.
There are two fermentation techniques applied by farmers, i.e.: dry and wet fermentation.
Dry fermentation is done by storing wet parchment in a plastic bag for around 12-14 hours.
Wet fermentation is done by soaking parchment in plastic pails for around 12-14 hours and then are stored in plastic bags. Most farmers apply dry fermentation.
Wet fermentation is known to produce a better taste, compared to that of dry fermentation.
The coffee fermentation time depends on a number of factors including thickness of the mucilage layer, amount of coffee fermenting, concentration of the enzymes, the water temperature and humidity.

Indicative content 2: Fermentation conditions (Factor)


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

Water quantity: the quantity of water used in fermentation play important role, when water is adequate quantity, fermentation will be quick but when water is low quantity fermentation will slow down.
Time: This factor is also important, should be long time or short time depending on other factors such as thickness of mucilage layer, water temperature etc.
The coffee fermentation **time** depends on a number of **factors** including **thickness of the mucilage layer, amount of coffee fermenting, concentration of the enzymes, the water temperature and humidity.**
Ferment: The quantity of coffee to be fermented will influence fermentation process, when the quantity is too high fermentation will slow down but when the quantity is low the fermentation will be quick.

Indicative content 3 : Monitoring of fermentation process


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

The fermentation process has to be carefully monitored to ensure that the coffee doesn't acquire undesirable, sour flavours. Over fermentation can cause change in colour, flavour, taste and when there is under fermentation the remained mucilage on coffee beans is

attacked by microorganisms which cause deterioration and also cause change in taste by giving sweet taste.
In monitoring of Fermentation these thinks should be noted:
Soaking level: The level of water should reach or caver all coffee
Bubble forming: those bubbles shows the reaction happen during fermentation, when they start to be more the fermentation should be stopped
Stopping fermentation: when the fermentation is complete the process should be stopped by washing away the mucilage.

 **Theoretical learning Activity**

Trainees are asked to brainstorm about main reasons of fermenting the pulped coffee cherries and techniques used for conducting pulped coffee fermentation.

Trainees are also brainstorm about the factor to consider for decreasing fermentation time and the factors that affecting fermentation

Trainees are asked to discuss about the points to monitor during fermentation process.

 **Practical learning Activity**

Trainees in their respective group, they will be asked for performing fermentation process of the pulped coffee cherries and to monitor all necessary conditions that influence greatly on fermentation process to be accurately until it will be achievable.

 **Points to Remember (Take home message)**

Main reason for fermentation of coffee beans
Factors affecting the rate of fermentations
Point to monitor during fermentation process

 **Learning outcome 1 formative assessment**

Written assessment

1. Give the role of fermentation of coffee beans.

The role of fermentation

-To remove the mucilage layer on pulped coffee beans.

-It reduce sweetness from coffee beans

-It enhances the coffee aromatic and flavor quality.

2. After pulping coffee cherries, the coffee beans undergo fermentation process. These below are the factors that affect fermentation time except:

a) Thickness of the mucilage layer
b) Amount of coffee fermenting
c) concentration of the enzymes
d) The water temperature and humidity.
e) Climate change

3. Differentiate two types of fermentation techniques as used in fermentation of coffee beans

Dry fermentation: fermentation is done in the fruit's own juices only

Wet fermentation: Fermentation is done with extra water.

4. Explain how fermentation is done.

The beans with mucilage are put in fermentation tanks.

Fermentation can be done with extra water or, "Dry Fermentation", in the fruit's own juices only.

Covering with polythene or plastic sheet to maintain temperature.

They will remain soaked in these tanks for **12** to **24 hours to remove the slick layer of mucilage.**

While resting in the tanks, naturally occurring enzymes (**pectinase or pectinase**) and microbes will cause this layer to dissolve.

Fermentation may be hastened by adding enzyme preparation

The end of the fermentation is assessed by feel, as the parchment surrounding the beans loses its slimy texture and acquires a rougher "pebbly" feel.

 **Please mix different assessment tools for triangulation and relevancy of assessment**

Practical assessment

Coffee washing station located at RUSIZI District is faced with the problem of over fermentation and under fermentation in the same fermentation tank. You as trainee you are asked to monitor fermentation as the pulped coffee as to overcome this situation.

Checklist	**Score**	
	YES	**NO**
Indicator 1: Fermentation conditions are respected		
Time is well respected		
Ferment well measured		

Water quantity is well respected		
Indicator 2: Fermentation monitoring process are checked		
Soaking level is well checked		
Bubble forming is checked		
Fermentation is well stopped		

Learning outcome: 3. 4. Wash coffee beans

Duration: 2 hrs

Learning outcome 1 objectives :

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

1. Discuss properly the main reasons of washing the fermented coffee in coffee processing.

2. Describe correctly washing frequencies of fermented coffee in coffee processing.

3. Identify clearly the effect caused by incomplete washing of fermented coffee in coffee processing.

Resources

Equipment	Tools	Materials
Washing channel	Stirrer Spreader	Ferment Water

Advance preparation:

Washing channel should be well prepared before doing washing.

Indicative content 1: Washing of coffee beans

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

When the fermentation is complete, the coffee is thoroughly washed with clean water in tanks or in special washing machines to remove mucilage residues. Repeat this process until the

water becomes clear. This normally takes approximately three washes. The wet parchment coffee at this stage consists of approximately 57% moisture. Final washing of the coffee requires a lot of water. Lack of enough water results in incomplete washing and the coffee will start the drying process when it has some residues of the mucilage. This renders the coffee susceptible to attack by microorganisms and formation of **mycotoxins**, thus lowering the quality.

Theoretical learning Activity

Trainees are discussing in groups about the main reasons of washing the fermented coffee.

They brainstorm each other about the washing frequencies of fermented coffee.

They brainstorm each other also about the effect caused by incomplete washing of fermented coffee.

Practical learning Activity

Trainees under workshop, they perform washing activity of the fermented coffee with their hands in their working group until parchment will be clearly visible.

Points to Remember (Take home message)

Importance of washing fermented coffee bean Frequency of washing fermented coffee bean

Learning outcome 1 formative assessment

Written assessment

1.What is the purpose of washing coffee beans?

The purpose of washing coffee beans is to remove mucilage residues.

2.What will be happen when there is incomplete washing of coffee beans.

When there is incomplete washing, the coffee will start the drying process when it has some residues of the mucilage. This renders the coffee susceptible to attack by microorganisms and formation of mycotoxins, thus lowering the quality.

Please mix different assessment tools for triangulation and relevancy of assessment

Practical assessment

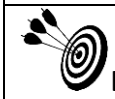
FUNGI washing station is located in Nyaruguru District, this company transforms coffee cherries into parchment coffee. As internee, perform washing process of 30 kg of fermented coffee.

Observation checklist

Checklist	Score	
	YES	**NO**
Indicator: Cleaning process is well done		
Clear water is used		
Washing channel is well cleaned		
Spreader is well used		
Enough water is used		
Three washing frequency is respected		
All mucilage residues are removed		

Learning outcome: 3. 5. Grade Coffee Beans

Duration: 3 hrs



Learning outcome 1 objectives :

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

1. Identify clearly grading categories of coffee parchment in coffee processing.

Resources

Equipment	Tools	Materials
Grading tank	Stirrer	water

Advance preparation:

Grading tank should be cleaning before.

Indicative content 1 : Grading of Coffee Beans

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

After washing, the coffee beans are passed in grading tank where grading is done based on **density.** The grading process is done by floating coffee beans in water and obtain:
Grade 1: coffee beans of high density and of highest quality.
Grade 2: coffee beans of moderate density and quality, mixed with small amount of defect.
Grade 3: coffee beans of lowest density and quality, composed with defect and some pulp.

Theoretical learning Activity

Trainees both brainstorm and discuss about density and defects level to consider during grading the washed coffee beans before drying the within their working groups.

Practical learning Activity

Trainees in their working groups perform the grading activities by basing on density and defect levels of coffee bean.

Points to Remember (Take home message)

Identification three coffee grades by basing on density and the extent level of coffee defects before drying them.

Learning outcome 1 formative assessment

Written assessment

1.Describe 3 grades of coffee beans

Grade 1: coffee beans of high density and of highest quality.

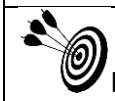
Grade 2: coffee beans of moderate density and quality, mixed with small amount of defect.

Grade 3: coffee beans of lowest density and quality, composed with defect and some pulp.

 **Please mix different assessment tools for triangulation and relevancy of assessment**

Learning outcome: 3. 6. Dry coffee Beans

 **Duration: 10 hrs**

 **Learning outcome 1 objectives :**

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

1. Discuss properly coffee drying methods during coffee processing.

2. Identify clearly the effect of under or over drying of the parchment coffee in coffee processing.

3. Discuss properly condition to consider in storing dried coffee parchment coffee in coffee processing.

4. Illustrate appropriately the consequences of storing parchment coffee with high moisture content.

 **Resources**

Equipment	**Tools**	**Materials**
Drier	Drying table Plastic sheeting Basin and Basket Moisture meter Plastic sheet net	Sacs

 **Advance preparation:**

Drying table should be well fixed

Plastic sheet net and plastic sheeting for covering should be available

Indicative content 1: Drying of Coffee Beans


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

After washing, the wet parchment is moved to pre-drying beds where they are intensively sorted for around six hours.

To reduce the moisture to an optimum **11-12%,** the beans processed by the wet method, pulped and fermented must be dried either in the sun, in a mechanical dryer, or by a combination of the two to properly prepare them for storage.

The out-turn of clean dry coffee from ripe cherry is **15-20%** (5kg of ripe cherries will give 1kg of dry coffee)

1. **Sun drying**

The sun drying is done on extensive flat concrete or brick areas, known as patios, or on tables made of fine-mesh wire netting. Drying coffee directly on soil or dirty surfaces can lead to dirty or earthy flavours in the finished coffee.

The beans should be spread out in a thin layer no more than 3cm thick, stirred 3 times a day and be protected from rainy weather to ensure even drying and prevent mildew. During the process, coffee must be covered with polythene or plastic sheets if rain occurs and every night to stop re-wetting that result in mould development. Avoid very intense sunlight when the coffee is wet as the beans may split.

Rewetting of the coffee or storage of partially dried coffee due to rain is a major problem facing sun-dried coffee. Drying coffee too slowly by spreading it too thick on drying areas is also a major problem. Each of these situations can lead to fermented or fruity flavours in the coffee along with mould-growth producing mouldy or musty flavours.

Sun drying should take from **8 to 10 days**, depending upon **ambient temperature and humidity**.

However, the process must be carefully controlled to achieve satisfactory and economical drying without any damage to quality.

Artificial drying

The use of mechanical dryers is becoming increasingly popular. The beans can be placed in the dryer right after washing.

The temperature and air volume are very important factors to consider. The most important principle in artificial drying is that heat should be introduced at a low temperature at first and gradually increased, particularly if an early model of rotary dryer is used. When possible, sun-dry for a day before using a dryer; otherwise, use a starting temperature of **95°F** and gradually raise it to **140°F.**

Storage

Consequences of storing coffee beans with high moisture content

High respiration rate in the store room

Development of mould

An off flavour of coffee liquor

Change of colour

Theoretical learning Activity

Trainees are asked to brainstorm about coffee parchment drying methods within their working groups.

Trainees are asked to brainstorm and to discuss about the effect of under or over drying of the parchment coffee drying within their working groups.

Trainees are asked to brainstorm about condition to consider in storing dried coffee parchment and to discussing on the consequences of storing parchment coffee with high moisture content within their working groups

Practical learning Activity

Trainees in their working group are asked to perform drying of coffee parchment and to store them.

Points to Remember (Take home message)

Drying conditions

Consequences of storing coffee beans with high moisture content

Learning outcome 1 formative assessment

Written assessment

1.The moisture content of dried coffee beans ready to be stored is:

a. 10%

b.11%

c.13%

d.11-12%

2. How many days does sun dying takes.

Sun drying should take from **8 to 10 days**

3.What is the effect of overdrying and underdrying of coffee beans.

A coffee that has been over dried will become brittle and produce too many broken beans during hulling (broken beans are considered defective beans) and may also result in a bland flavour in the final cup. Coffee that has not been dried sufficiently will be too moist and prone to rapid deterioration caused by the attack of fungi and bacteria.

4. Enumerate the consequences of storing coffee beans with high moisture content.

Consequences of storing coffee beans with high moisture content

High respiration rate in the store room

Development of mould

An off flavour of coffee liquor

Change of colour

Please mix different assessment tools for triangulation and relevancy of assessment

Practical assessment

Maraba washing station is the plant which process coffee cherries into parchment coffee, due to inadequate coffee drying skills of labours, the dried coffee is contaminated by mould which lead to poor quality of produced parchment coffee. As the technician who has skills in drying coffee beans, you are requested to dry 50kg of wet pulped coffee beans as demonstration which will help to this plant labours to improve drying skills.

Checklist	**Score**	
	YES	**NO**
Indicator: drying is well performed		
Drying method is well performed		
Moisture content (11-12%) is well respected.		
Mixing is well done		

References: