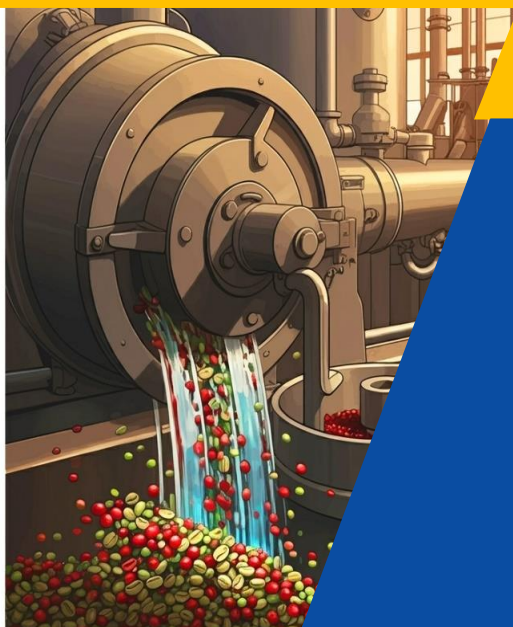




RQF LEVEL 5



FOPCP503

FOOD PROCESSING

Coffee Cherries Processing

TRAINEE'S MANUAL

October, 2024



COFFEE CHERRIES PROCESSING

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Original published version: October 2024

ACKNOWLEDGEMENTS

The publisher would like to thank the following for their assistance in the elaboration of this training manual:

Rwanda TVET Board (RTB) extends its appreciation to all parties who contributed to the development of the trainer's and trainee's manuals for the TVET Certificate V in Food Processing, specifically for the module "**FOPCP503: Coffee Cherries Processing.**"

We extend our gratitude to KOICA Rwanda for its contribution to the development of these training manuals and for its ongoing support of the TVET system in Rwanda

We extend our gratitude to the TQUM Project for its financial and technical support in the development of these training manuals.

We would also like to acknowledge the valuable contributions of all TVET trainers and industry practitioners in the development of this training manual.

The management of Rwanda TVET Board extends its appreciation to both its staff and the staff of the TQUM Project for their efforts in coordinating these activities.

This training manual was developed:

Under Rwanda TVET Board (RTB) guiding policies and directives



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ACRONYMS

°C: Degree Celcius

°F: Degree Fahrenheit

AGR: Agriculture

CBC: Competence Based Curriculum

CCP: Critical Control Point

FOP: Food Processing

PPE: Personal Protective Equipment

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

SOP: Standard Operating Procedure

TQUM Project: TVET Quality Management Project

TVET: Technical and Vocational Education and Training

Hrs: Hours

pH: Potential of Hydrogen

%: Percentage

ml: milter

mm: millimeter

QR: Quick Response Code

INTRODUCTION

This trainee's manual includes all the knowledge and skills required in food processing specifically for the module of **"Coffee Cherries Processing "**. Students enrolled in this module will engage in practical activities designed to develop and enhance their competencies. The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainee's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainee, you will start by addressing questions related to the activities, which are designed to foster critical thinking and guide you towards practical applications in the labor market. The manual also provides essential information, including learning hours, required materials, and key tasks to complete throughout the learning process.

All activities included in this training manual are designed to facilitate both individual and group work. After completing the activities, you will conduct a formative assessment, referred to as the end learning outcome assessment. Ensure that you thoroughly review the key readings and the 'Points to Remember' section.

MODULE CODE AND TITLE: FOPCP503 COFFEE CHERRIES PROCESSING

Learning Outcome 1: Receive coffee cherries

Learning Outcome 2: Process coffee cherries into parchment coffee

Learning Outcome 3: Process parchment coffee into green coffee

Learning Outcome 4: Grind roasted coffee

Learning Outcome 1: Receive Coffee Cherries



Indicative contents

1.1 Introduction to coffee processing.

1.2 Selecting of tools and equipment used in coffee processing.

1.3 Arranging the workplace.

1.4. Checking quality of coffee cherries

Key Competencies for Learning Outcome 1: Receive Coffee Cherries

Knowledge	Skills	Attitudes
• Explanation of key terms used in coffee cherries processing • Identification of coffee benefits. • Description of coffee processing methods • Description of tools and equipment used in coffee cherries processing • Description of cleaning products • Description of quality characteristics of coffee cherries.	• Selecting and adjusting tools and equipment used in coffee cherries processing • Cleaning the workplace • Checking cleanliness of the workplace • Arranging the workplace • Selecting coffee cherries • Sorting coffee cherries • Floating coffee cherries	• Being responsible while selecting tools and equipment • Being carefully while adjusting tools and equipment • Being attentive when using cleaning products • Being carefully while checking quality of coffee cherries



Duration: 10 hrs.

Learning outcome 1 objectives:



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

1. Explain correctly the key terms and processing methods as used in coffee cherries processing.
2. Identify effectively the health and economic benefits of coffee for human
3. Describe appropriately tools and equipment used in coffee cherries processing according to their uses
4. Explain correctly coffee cherries selection criteria based on reception parameters
5. Select and adjust properly tools and equipment used in coffee cherries processing according to their functionality
6. Prepare properly the workplace according to the safety measures and processing line
7. Sort correctly coffee cherries according to sorting parameters
8. Check correctly the quality of coffee cherries according to the quality parameters



Resources

Equipment	Tools	Materials
• Washing tanks • Floating tanks • Fermentation tanks • Conveyor belts • Grading channel • Pulping machine • Colour sorters • Mucilage remover • Coffee dryer • Personal protective equipment	• Basins • Timer • Analytical balances • Moisture meter • Hygrometer • Thermometer • Brushes • Buckets • Mopes • Kettles • Bowls • Hot water glass • Coffee testing spoons	• Packaging material • Coffee cherries • Serviettes • Water • Cupping form • Black plastic net • Plastic sheeting • Ropes • Cupping form

• Sorting tables • Weighing balances • Coffee hulling machine • Cyclone • Fan • Destoner • Grading machine • Coffee roaster • Coffee grinder • Water sprayers • Cupping table • Packaging machine • Sealing machine • Labelling machine	• Plastic cups • Color checker • Magnets • Coffee cupping tray.	
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Indicative content 1.1: Introduction to coffee processing.



Duration: 2 hrs.



Theoretical Activity 1.1.1: Introduction to coffee cherries processing.



Tasks:

1: You are requested to answer the following questions related to the introduction to coffee cherries processing:

- i. What do you understand by the following terms?
 - a) Coffee cherries
 - b) Parchment coffee
 - c) Green coffee
 - d) Roasting profile
 - e) Cupping
 - f) Coffee fermentation
- ii. What do you understand by different method of coffee cherries processing?
- iii. What could be the benefits of coffee?

2: Provide the answers to asked questions by writing them on paper, flip chart, blackboards, or whiteboards.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.1.1



Key readings 1.1.1. Introduction to coffee cherries processing

- **Definition of key terms**
 - ✓ **Coffee cherries:** is the name usually given to the fruit of the coffee tree. Or The fruit of any plant of the genus coffee being cherry like in shape, color, and size and containing two seeds enclosed by pulp and an outer skin
 - ✓ **Parchment coffee:** is dried but unhulled coffee beans. Describes wet-processed coffee shipped with the dried parchment skin still adhering to the bean.
 - ✓ **Green coffee:** refers to coffee beans that haven't been roasted. They are the raw, unprocessed form of the coffee beans before it undergoes the roasting process.

- ✓ **Coffee fermentation:** Is a crucial step in the coffee processing journey. It's a controlled biological process where microorganisms break down sugar in the coffee cherry, creating flavours' and aromas.
- ✓ **Roasting profile:** A roast profile is a set of parameters that define how coffee beans have been roasted or how you want to roast them. The two most important roasting parameters are total roast time and coffee roasting temperature.
- ✓ **Cupping:** Is a sensory evaluation method used to assess the quality, flavor and aroma of coffee. It involves a systematic testing process that allows experts to evaluate various attributes of a coffee sample.

- **Benefit of coffee**
- ✓ **Health benefit of coffee**
 - ✚ Coffee may help to lose weight: it contains Mg and K which help the human body use insulin to regulate blood sugar that cause over eight when they stored at in excess into human and also it contains caffeine which break down body fat and used as fuel for human body functioning.
 - ✚ Coffee can reduce risk of type 2 diabetes
 - ✚ Coffee may protect against liver disease, including cirrhosis.
 - ✚ Coffee contains anti-oxidant which help in preventing tissue damage.
 - ✚ Drinking Coffee reduce the risk of heart attacks and strokes.
 - ✚ It helps in control the chance of Parkinson's disease that cause disorder in central nervous system that causes problem in movement.
- ✓ **Negative effect of drinking coffee on human health:**
 - ✚ It causes high blood pressure when it consumed daily and in excess.
 - ✚ It causes rapid heart beating when it consumed in excess.
 - ✚ It causes disorder in digestive system and in excretory system due to its help in increasing of the amount of acid in stomach that can cause stomach to be up-set.
 - ✚ It is causes sleep disorder, nausea and vomiting.
 - ✚ It can cause disorder in fetal grow and even death to placenta of pregnant human.
- ✓ **Economic and social impacts of coffee.**
 - ✚ Employment Opportunities:
 - Direct Employment: The coffee industry provides direct employment to millions of people worldwide, including farmers, processors, roasters, and retail workers.
 - Indirect Employment: The coffee industry also supports a wide range of indirect jobs, such as transportation, logistics, marketing, and finance.
 - ✚ Economic Growth:
 - Export Revenue: Coffee is a major export commodity for many countries, generating significant foreign exchange earnings.

- **Local Economies:** The coffee industry contributes to the growth of local economies, providing income and employment opportunities for farmers, businesses, and communities.
- **Tax Revenue:** Coffee production and consumption generate tax revenue for governments, which can be used to fund public services and infrastructure.
- ✚ **Poverty Reduction:**
 - **Income Generation:** Coffee cultivation can provide a reliable source of income for farmers, helping to lift them out of poverty.
 - **Community Development:** The coffee industry can stimulate community development by investing in infrastructure, education, and healthcare.
- ✚ **Cultural Significance:**
 - **Social Hubs:** Coffee shops and cafes serve as social hubs, fostering community and cultural exchange.
 - **Cultural Identity:** Coffee consumption is often associated with specific cultures and traditions, contributing to a sense of identity and belonging.
- ✚ **Innovation and Entrepreneurship:**
 - **New Products:** The coffee industry is constantly evolving, with new products, brewing methods, and marketing strategies being developed.
 - **Entrepreneurship:** The coffee industry offers opportunities for entrepreneurs to start their own businesses, such as coffee shops, roasteries, or online retailers.
- ✚ **Trade and Globalization**
 - **Global Trade:** Coffee is a globally traded commodity, fostering trade relationships between countries.
 - **International Markets:** Coffee producers have access to international markets, expanding their customer base and increasing revenue.
 - **Coffee processing methods**

- **Coffee processing methods**

- ✓ **Wet processing method**

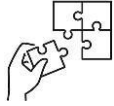
Wet processing (also known as washed process) is a common method that involves removing the fruit outer red skin and pulp from the coffee cherry before drying the beans. Finally beans are fermented to remove the mucilage. After fermentation, they are washed and dried.

- ✓ **Semi-dry / Honey processing method**

Semi-dry processing, also known as honey processing, is a method that combines elements of both the dry and wet processes. It involves pulping the coffee cherry (removing the fruit outer red skin) but leaving some of the mucilage intact. The beans are then dried in the sun.

✓ **Dry processing method**

Dry processing (also known as natural processing) is one of the oldest methods of coffee processing. It involves drying the entire coffee cherry (fruit, pulp, and seed) in the sun



Application of learning 1.1.

You are requested to go in your school's coffee processing workshop to identify coffee cherries, parchment coffee, and green coffee beans respecting the product characteristics.



Indicative content 1.2: Selecting tools and equipment used in coffee processing



Duration: 2 hrs.



Theoretical Activity 1.2.1: Description of tools and equipment used in coffee cherries processing



Tasks:

- 1: You are requested to answer the following questions related to description of tools and equipment used in coffee cherries processing
 - i. What are the tools and equipment which may be used in coffee cherries processing?
 - ii. Based on list of tools and equipment provided, what can be the use of each tool and equipment?
 - iii. What could be the safety precautions of tools and equipment used in coffee cherries processing?
- 2: Provide the answers to asked questions by writing them on paper, flip chart, blackboards, or whiteboards.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the key readings 1.2.1



Key readings 1.2.1.: Description of tools and equipment used in coffee cherries processing

SN	Tools and equipment	Picture	Use of tools and equipment
1	Balance		It used for weighing the coffee cherries and parchment coffee

2.	Cherry Sorters		Is a machine used to sort coffee cherries by removing unwanted materials and removing unripe and overripe coffee cherries.
3.	Soaking tank		Is a tank used to soak coffee cherry before pulping in order to facilitate the pulping process.
4.	Coffee cherries washing machine		Is a machine used to wash coffee cherries before processing

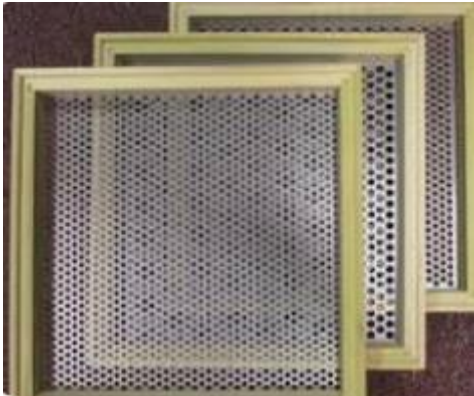
5.	Pulper	 	Is used for pulping coffee cherry in order to remove coffee pulp (red skin) from coffee beans.
6	Fermentation tank		Is used during fermentation process in order to remove the mucilage layer from coffee beans.
7	Mucilage remover		Is a machine used to remove mucilage from coffee beans. wash out mucilage with the help of water or without water during wet processing
8	Washing and grading tank		Is used for washing coffee beans after fermentation

			in order to remove mucilage residues and for grading coffee beans based on their quality by floating them in water.
9	Dryer		Is a machine used to dry coffee beans.
10	Basin		Is a tool used for collecting coffee beans from grading tank to drying bed.
11	Timer		Is used for regulating time

1 2	Drying bed		Is used for drying coffee beans
1 3	Conveyor belts		A belt conveyor system is powered types of convey systems with one or two rotating pulley (like drum) that transports coffee beans.
1 4	Hygrometer		It is an instrument used for measuring the relative humidity
1 5	Storage bins		It used for storage of parchment coffee.

			
1 6	Hulling machine		This machine is used to remove parchment layer from coffee beans.
1 7	Fan		Device used for winnowing coffee beans by separating green coffee beans and chaff or other unwanted materials.
1 8	Densimetric table		Densimetric tables are designed to separate coffee beans

			based on density and are typically used for grading
1 9	Smout peeler polisher		There are used for polishing coffee beans
2 0	Destoner		It used for removing stones in dried coffee beans
2 1	Aspiration channel		The aspiration channel is used in green coffee beans cleaning applications

			for separating specifically lighter particles from granular products. The aspiration air flowing remove specifically lighter particles such as straw, dust, or hull fragments
2 2	Screen		Device used to separate smaller dried coffee beans from larger ones.
2 3	Grading machine		Is a machine used to grade green coffee beans into desired grade according to size or speciality.

2 4	Beans colour sorter		It is used for sorting dried coffee beans defects by using colour sensor and It is used for sorting green coffee beans by removing no green beans like yellow beans, black beans
2 5	Roaster		It is used for roasting green coffee beans
2 6	Cyclone		A cyclone separator is used to separate particulates, such as chaff, from roaster exhaust.

2 7	Cupping table		It is used for the evaluation of coffee but also used as quality control to ensure a coffee roast is tasting as great as it can be.
2 8	Cupping spoon		It is essential for proper taste assessment of coffee, designed to scoop and transfer coffee accurately to the mouth.
2 9	Grinder		It is a machine used for grinding roasted coffee beans in order to get coffee powder
3 0	Thermomete r		It is used for measuring the

			temperature during roasting
3 1	Pallets		It used to support packed ground coffee in storage room.
3 2	Packaging machines		It used to pack the coffee powder in packaging materials
3 3	Vacuum sealer		It is used for sealing the packaging materials after packing

			
3 4	Labelling machine		It is used to apply labels to packaging materials.

Functionality and adjustment

Equipment adjustment procedures

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

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.
- All equipment 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.



Practical Activity 1.2.2: Selection and adjustment of tools and equipment used in coffee cherries processing

Task:

- 1: You are requested to go in the coffee cherries processing workshop to select the right tools and equipment to be used in coffee cherries processing.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, select and adjust tools and equipment used in coffee cherries processing.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 1.2.2
- 6: Perform the task provided in application of learning 1.2



Key readings 1.2.2 Selection and adjustment of tools and equipment used in coffee cherries processing

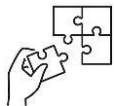
- Selection criteria for tools and equipment used in coffee processing
- ✓ **Efficiency**
 - + **Processing Speed:** Tools should optimize throughput to minimize time from cherry to finished product.
 - + **Energy Consumption:** Look for equipment that balances performance with energy efficiency.
- ✓ **Quality of Output**
 - + **Consistency:** Equipment should produce uniform parchment coffee and ground coffee to ensure quality.
 - + **Flavor Preservation:** Tools should minimize damage to the beans, preserving their flavor and aroma.
- ✓ **Scalability**
 - + **Adaptability:** Equipment should be suitable for different scales of production, from small to large operations.
 - + **Modularity:** Ability to add or upgrade components as production needs grow.
- ✓ **Ease of Use**
 - + **User-Friendly Design:** Tools should be intuitive, requiring minimal training for operators.
 - + **Maintenance:** Consider how easy it is to clean and maintain equipment.

- ✓ **Durability**
 - ✚ **Material Quality:** Equipment should be made from high-quality materials that withstand the rigors of coffee processing.
 - ✚ **Warranty and Support:** Look for tools backed by strong warranties and reliable customer support.
- ✓ **Cost-Effectiveness**
 - ✚ **Initial Investment:** Evaluate upfront costs against expected performance and longevity.
 - ✚ **Operating Costs:** Consider maintenance, energy, and labor costs over the equipment's lifespan.
- ✓ **Technological Features**
 - ✚ **Automation:** Tools with automation features can reduce labor and increase precision.
 - ✚ **Monitoring Systems:** Equipment with sensors or data tracking can help optimize processing.
- ✓ **Safety Standards**
 - ✚ **Compliance:** Ensure that equipment meets local safety regulations and industry standards.
 - ✚ **User Safety:** Design should include features that protect operators during use.
- ✓ **Environmental Impact**
 - ✚ **Sustainability:** Consider equipment that minimizes waste and uses resources efficiently.
 - ✚ **Recyclability:** Tools should be made from materials that can be recycled at the end of their life cycle.



Points to Remember

- Common equipment used in coffee cherries processing include pulper, fermentation tank, washing channel, hulling machine, roaster, and grinder.
- Common tools used in coffee cherries processing include moisture meter, hygrometer, and thermometer.



Application of learning 1.2.

You are requested to go in your school's coffee processing workshop to select and adjust tools and equipment for coffee cherries processing into parchment coffee and ground coffee.



Indicative content 1.3: Arranging the workplace



Duration: 2 hrs.



Theoretical Activity 1.3.1: Description of cleaning products



Tasks:

- 1: You are requested to answer the following questions related to description of cleaning products.
 - i. What do you think could be the cleaning products to use in coffee cherries processing workplace?
 - ii. What could be the direction of use and safety precautions of using cleaning agent in coffee cherries processing workplace cleaning?
- 2: Provide the answers to asked questions by writing them on paper, flip chart, blackboards, or whiteboards.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the key readings 1.3.1



Key readings 1.3.1.: Description of cleaning products

- **Description of cleaning agent**

- ✓ **Types of cleaning agent**

- ✚ **Water**

Water is referred as universal solvent, and this is the prime agent in cleaning process. However, though an excellent solvent, water alone is not an effective cleaner.

- ✚ **Detergent**

Detergent may be made from a base of either pure soap or organic chemicals. Detergents are of two types:

- **Soapy detergent:** Is made from animal or vegetable fat and may be used as solid block for washing materials and tools
- **Synthetic detergent:** Is made from organic chemicals derived from petroleum. They are used for cleaning floors. They are in form of a powder, liquid, gel or crystal.

- ✚ **Acid cleaners**

Acids used as cleaning agents may vary from mild acid e.g. acetic acid or strong concentrated hydrochloric acid. Acids should be used in solutions followed by thorough rinsing. All, except under citric and acetic acid should be used under supervision with extreme caution and with the protection of rubber gloves. Strong acids are poisonous and corrosive.

E.g. Citric acid and acetic acid used for metal cleaning

Dilute hydrochloric acid used in removing lime scale from sanitary ware

Oxalic acid for removing water stains from hard floors and sanitary ware

Alkaline cleaners

Alkaline are particularly good for removing grease

Example: -Sodium carbonate: is used to remove light grease

-Sodium hydroxide: is used to remove grease from grills and blocked drains

Sanitizers

Chemicals sanitizers; chlorine, iodophors, quaternary ammonium compounds used to destroy or inhibit the growth of microorganisms

Disinfectants

Those are chemicals that destroy pathogenic bacteria

Examples: peroxyacetic acid and sodium hypochlorite

✓ **Safety precautions of cleaning agents**

- Read product and equipment labels and usage instructions before starting to clean
- Wear recommend PPE
- Worker must know which cleaning chemicals must be diluted and how correctly dilution is.
- Thoroughly reviewing and training workers on the use, storage for cleaning chemicals
- Handling in a sanitary manner in order to protect its shelf-life
- Providing workers with a place to wash up after using cleaning chemicals
- Operating ventilation systems as needed to allow sufficient air flow and to prevent build-up of hazardous
- Warning workers not to mix cleaning products that contain bleach and ammonium



Practical Activity 1.3.2: Arranging the work place



Task:

1: You are requested to go in the coffee cherries processing workshop to clean and arrange the work place

2: Apply safety precautions.

3: Referring to the procedures provided on step 3, clean and arrange the work place

4: Present your work to the trainer and whole class. Ask for clarification where necessary

5: Read key reading 1.3.2

6: Perform the task provided in application of learning 1.3



Key readings 1.3.2. Arranging the workplace

- **Purpose of workplace arrangement**

Workplace arrangement in the coffee processing industry serves several critical purposes:

- **Efficiency and Productivity:**

- ✚ **Optimized equipment placement:** Strategic positioning of machinery and equipment reduces unnecessary movement and time wastage.

- ✚ **Improved accessibility:** Easy access to tools, materials, and storage areas enhances efficiency and productivity.

- ✓ **Safety and Health:**

- ✚ **Hazard prevention:** Proper arrangement of equipment and workspaces helps prevent accidents and injuries, such as slips and falls.

- ✚ **Compliance with safety regulations:** Adhering to workplace safety standards ensures a safe and healthy environment for employees.

- ✓ **Quality Control:**

- ✚ **Minimized contamination:** Careful arrangement of processing areas helps prevent cross-contamination between different batches of coffee.

- ✚ **Controlled environment:** Proper layout and ventilation can maintain optimal temperature and humidity levels for coffee processing.

- ✚ **Effective quality checks:** Strategically located inspection points facilitate thorough quality control throughout the process.

- ✓ **Maintenance and Cleaning:**

- ✚ **Easy access for maintenance:** Well-organized layouts allow for efficient maintenance and repair of equipment.

- ✚ **Simplified cleaning:** Proper spacing between equipment and work areas

facilitates thorough cleaning and sanitation.

✓ **Employee Morale and Satisfaction:**

✚ **Pleasant working environment:** A well-designed workplace can improve employee morale and job satisfaction.

✚ **Increased motivation:** A comfortable and safe environment can motivate employees to perform at their best.

• **Application of cleaning methods**

There are two methods of cleaning:

✓ **Dry cleaning:** Dry cleaning: it is a process that uses liquids other than water to clean or cleaning without water. Dry cleaning still involves liquids or non-water solvents that are “wet.” It is used for tough stains and time saving.

✓ **Wet cleaning:** Wet cleaning: It is a process of cleaning that uses water as liquid.

• **Checking cleanliness of workplace**

There are many ways to check the cleanliness of a workplace, including:

✓ **Visual inspection (Best verification method):** This involves looking for visible dirt, dust, and debris. It is important to look carefully in all areas of the workplace, including floors, walls and equipment.

✓ **Swab testing:** This involves using a swab to collect samples from surfaces. The samples can then be tested for bacteria, molds, and other contaminants.

✚ **Procedure of swab test**

- i. Take swab stick
- ii. Scooping the cleaned surface
- iii. Swab stick is submerged into dilution fluid
- iv. Streaking on appropriate agar
- v. Incubate at appropriate temperature
- vi. Counting colonies

• **Arrangement of workplace**

Coffee processing workplace is arranged according to **processing line**. Here below are coffee cherries processing steps:

1.Reception of coffee cherries: Coffee cherries are selected according to Coffee varieties, Coffee cherries maturation parameters and Coffee cherries defects (physical and biological)

2. Weighing and recording coffee cherries: 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.

3. Sorting coffee cherries or cherries separation: It is necessary sort coffee cherries in order to remove all unwanted materials which can reduce the quality of coffee, including a certain number of partially dried, overripe and unripe cherries, as well as some stones and dirt. This is performed by those techniques: Floating, Picking, Screening, Vibration

4. Pulping: The outer skin (exocarp) and pulp (mesocarp) of the coffee cherry are removed, usually using a mechanical pulper.

5. Fermentation: Is done to remove the mucilage layer on pulped coffee beans, to reduce sweetness from coffee beans and to enhance the coffee aromatic and flavor quality. This can be either dry or wet fermentation.

6. Washing: When the fermentation is complete, the coffee is thoroughly washed with clean water in tanks or in special washing machines to remove mucilage residues

7. Drying: The beans are dried to a moisture content of around 10-13%. This can be done using the sun, a drying machine, or a combination of both.

8. Hulling: The parchment layer is removed from the beans using a hulling machine.

9. Polishing: The beans are polished to remove any remaining bits of parchment and silver skin

10. Grading and Sorting: The beans are graded based on size, density, and quality. They may also be sorted by defect.

11. Roasting: The green coffee beans are heated to high temperatures, which develops their flavor, aroma, and color. The roasting process can be adjusted to achieve different flavor profiles.

12. Cooling: After roasting, the beans are cooled to prevent them from burning.

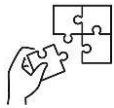
13. Grinding: The roasted beans are ground to the desired coarseness, depending on the intended brewing method.

14. Packaging and storing: Coffee powder is packed for preserving its freshness, aroma, and flavor. Then stored in a cool, dark environment away from direct sunlight and heat sources.



Points to Remember

- Before arranging the workplace for coffee cherries processing, bear in mind the flow chart of coffee cherries processing into parchment and ground coffee.
- When diluting cleaning products, it is highly recommended to respect the dosage
- While preparing cleaning products, never mix bleach and ammonia as this can produce highly toxic chloramine gas, which can cause serious health problems.
- Cleaning methods are wet and dry cleaning
- Cleaning effectiveness should be well checked in order to avoid contamination of the product.



Application of learning 1.3.

You are requested to go in your school's coffee processing workshop to clean and arrange the workplace.



Indicative content 1.4: Checking quality of coffee cherries



Duration: 2 hrs.



Theoretical Activity 1.4.1: Description of coffee cherries reception activities



Tasks:

1: You are requested to answer the following questions related to description of coffee cherries reception activities

- i. What do you understand by manual sorting of coffee cherries?
- ii. What do you understand by weighing and recording of coffee cherries after reception?

2: Provide the answers to asked questions by writing them on paper, flip chart, blackboards, or whiteboards.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.4.1



Key readings 1.4.1.: Description of coffee cherries reception activities

- **Coffee cherries receiving activities**
- ✓ **Manual sorting of coffee cherries**

Manual sorting of coffee cherries is a traditional and often still preferred method in many coffee-producing regions, particularly in smaller-scale operations. It involves carefully examining each cherry by hand to identify and remove defective or low-quality beans.



Sorting Process

- The harvested coffee cherries are typically spread out on a flat surface or sorting table.
- Sorters carefully examine each cherry, looking for signs of defects such as:
 - ◆ **Underripeness:** Unripe cherries often have a green or pale color.
 - ◆ **Overripeness:** Overripe cherries may be soft, mushy, or have split skins.

- ◆ **Damage:** Cherries with bruises, punctures, or other physical damage are also removed.

- Defective cherries are handpicked from the good ones and discarded or used for other purposes.

Challenges and Benefits

While manual sorting is effective, it is also labor-intensive and time-consuming. It requires skilled workers with a keen eye for detail. However, the benefits in terms of quality control and preserving traditional methods make it a valuable practice in many coffee-producing regions.

✓ Weighing and recording coffee cherries

At reception, the coffee cherries are weighed and recorded.

📊 Recording Information of Coffee Cherries at Reception

When coffee cherries are brought to a reception area, it's essential to accurately record relevant information to ensure proper tracking, quality control, and payment. Here are some key details to consider:

Basic Information

- **Farmer's Name:** The name of the farmer delivering the cherries.
- **Farm Name:** The name of the farm where the cherries were grown.
- **Quantity:** The total weight or volume of the cherries delivered.
- **Delivery Date:** The date of delivery.

Quality-Related Information

- **Variety:** The specific coffee variety (e.g., Arabica, Robusta, Bourbon).
- **Ripeness:** An assessment of the ripeness of the cherries.
- **Defects:** Any noticeable defects or imperfections in the cherries.

Financial Information

- **Price:** The agreed-upon price per unit of weight or volume.
- **Total Payment:** The total amount due to the farmer.

Additional Notes

- **Sample:** A small sample of the cherries may be taken for quality testing.
- **Certification:** If the coffee is certified (e.g., organic, fair trade), the certification details should be recorded.
- **Special Instructions:** Any specific instructions or requirements from the farmer or the reception facility.

Recording Methods:

- **Paper Forms:** Traditional paper forms can be used to manually record the information.
- **Digital Forms:** Electronic forms or databases can streamline the process and reduce errors.
- **Mobile Apps:** Specialized mobile apps can be used for data collection and analysis in the field.

By accurately recording this information, coffee reception facilities can ensure transparency, traceability, and fair payment to farmers. This data can also be used for quality control, market analysis, and improving production practices.



Practical Activity 1.4.2: Selecting coffee cherries



Task:

- 1: You are requested to go in the coffee cherries processing workshop to select the coffee cherries to be processed.
- 2: Apply safety precautions.
- 3: Referring to the criteria provided on step 3, select the best coffee cherries required for coffee processing.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 1.4.2
- 6: Perform the task provided in application of learning 1.4



Key readings 1.4.2. Selecting coffee cherries

- **Selection criteria of coffee cherries**

Once the cherries are harvested, they are first selected in order to choose the best one to be processed. This selection is based on:

- ✓ **Coffee varieties**

There are three varieties of coffee:

-  Coffea arabica
-  Coffea robusta
-  Coffea liberica

In Africa, **Coffea Arabica** is the major cultivated specie. 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.

Coffea robusta beans have a higher water content and generally have a less powerful flavor and **Coffea liberica** beans are less highly regarded because of their sharp flavor.

No	Difference	Arabica coffee	Robusta coffee
1	Quality of drink	Higher	Lesser
2	Flavor	Full Strong power of flavor	Less power of flavor
3	Tree height(m)	Small	Tall
4	Leaves	Small in size	Larger in size
5	Shape of berries	Oval shape	Round shape
6	Root system	Tap root	Shallow root
7	Disease resistance	Low	High
8	Pest resistance	Low	High

9	Taste	Bitter	Sweet
10	Caffeine	Low	High
11	Yield	Low	High

✓ **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, garnet 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.

✚ **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 is like Flowery.

In this condition the matured coffee cherries can now be processed.

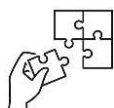
✓ **Coffee cherries defects**

The coffee cherries defects can be **physical** damage (due to poor transportation or harvesting method) or **biological** deterioration (picked by insects). During selection those defected coffee cherries are not selected for processing because they can result in poor quality coffee. Storage of cherries in bags or boxes for longer than 24 hours will result in fermentation in the cherry and deteriorated quality.



Points to Remember

- Coffee cherries Selection criteria are: Coffee varieties, Coffee cherries maturation parameters and coffee cherries defects.
- The coffee cherries that are mature to be processed are of bright red color.
- Biologically defected beans cause quality deterioration of coffee mainly flavour that why they are all removed during sorting.



Application of learning 1.4.

You are requested to go in your school's coffee processing workshop to select coffee cherries, weighing them, record coffee cherries information and then perform manual sorting respecting sorting parameters.



Indicative content 1.5: Floating coffee cherries



Duration: 2 hrs



Practical Activity 1.5.1: Floating coffee cherries



Task:

- 1: You are requested to go in the coffee cherries processing workshop to float coffee cherries to be processed.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, select the right tools and equipment used in coffee cherries processing.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 1.5.1
- 6: Perform the task provided in application of learning 1.5



Key readings 1.5.1. Floating coffee cherries

✓ Purpose of coffee cherries floating

The primary purpose of floating coffee cherries is to separate defective or low-quality beans from high-quality ones during the coffee processing process.

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** : (Physical damage and biological deterioration are removed)

✚ **Maturity levels**: unripe, overripe and dried cherries are separated from ripe cherries

✓ Floating procedure

Coffee cherries are placed in a water tank, Defective or low-quality cherries, which are often less dense due to factors like underripeness, overripeness, or damage, will **float** to the surface. and good ripe coffee cherries are dense and **sink**.

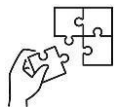
These floating cherries are removed, leaving behind the denser, higher-quality beans.

This process helps ensure that only the best coffee beans make it to the next stage of processing, resulting in a superior final product.



Points to Remember

- Floating of coffee cherries should be well done in order to remove all unwanted materials and process the good cherries
- Sorting parameters are: Maturity levels and defects



Application of learning 1.5.

You are requested to go in your school's coffee processing workshop to sort coffee cherries by floatation respecting sorting parameters.



Learning outcome 1 end assessment

Theoretical assessment

1. Answer by **True** when the statement is correct or **False** when the statement is incorrect.
 - i. Coffee cherries are the fruit of the coffee tree and contain two seeds enclosed by pulp and an outer skin.
 - ii. Parchment coffee refers to fully hulled coffee beans that are ready for roasting.
 - iii. Green coffee refers to coffee beans that have been roasted and are ready for brewing.
 - iv. Coffee fermentation is a step that helps develop flavors and aromas in coffee by breaking down sugars in the coffee cherry.
 - v. A roast profile includes parameters such as total roast time and brewing temperature.
 - vi. Cupping is a method used to evaluate the sensory attributes of coffee.
 - vii. Drinking coffee can lead to higher blood pressure if consumed excessively.
 - viii. The coffee industry does not significantly impact local economies or employment opportunities.
2. From the table below, match the following tools and equipment with their functions by writing the letter with the corresponding digit in the provided space.

Answer	function	Tool/equipment
1.....	1) It is an instrument used for measuring the relative humidity	A. Moisture meter
2.....	2) It is a machine used for grinding roasted coffee beans in order to get coffee powder	B. Smout peeler polisher
3.....	3) It is used for measuring moisture content of coffee beans during drying	C. Hygrometer
4.....	4) There are used for polishing coffee Beans	D. Roaster

5.....	5) Is used during fermentation process in order to remove the mucilage layer from coffee beans	E. Grinder
6.....	6) It is used for roasting green coffee beans.	F. Fermentation tank

3. Fill in the blank space with the following words related to cleaning products used in processing coffee cherries into parchment coffee and ground coffee (**acidic cleaner, water, alkaline cleaner, neutral cleaner, and degreaser**).

- is a fundamental cleaning agent used for rinsing equipment and surfaces. It helps remove food particles, grease, and other contaminants.
 - contain strong bases like sodium hydroxide or potassium hydroxide. Bleach (pH 12) and ammonia (pH 11) are common alkaline cleaning agents.
 - have a dissolving action on grease and similar dirt. The solvent-containing degreaser may have an alkaline washing agent added to a solvent to promote further degreasing.
 - agents are mainly used for removal of inorganic deposits like scaling. The active ingredients are normally strong mineral acids and chelants.
 -agents are pH-neutral and based on non-ionic surfactants that disperse different types of dirt.
4. The following steps are for coffee cherries processing into parchment and ground coffee, rearrange them in a logical sequence.

- Reception of coffee cherries, Fermentation, Sorting coffee cherries or cherries separation, Polishing, Pulping, Washing, Packaging and storing, Cooling, Hulling, Roasting, Grading and Sorting and Grinding

4. Read the statements below and circle the correct answer

- The following are purposes of floating coffee cherries expect
 - Ensuring proper fermentation of coffee cherries
 - Sorting of coffee cherries by their density
 - Removing broken coffee cherries
- To perform floating of coffee cherriesis the most suitable.
 - Hot water
 - Warm water
 - Cold water
 - Reused water

Practical assessment

Your school have a food processing unit that process coffee cherries into parchment and ground coffee. The coffee produced is used for breakfast of teaching staff. Recently, there have been complaints from teaching staff over the past two consecutive months regarding the flavour and tastes of the served coffee that might be due to poor sorting of coffee cherries or contamination during process. You are requested to go in school coffee processing workshop to perform the following tasks:

Task:

- 1.** Select tools and equipment
- 2.** Arrange the work place
- 3.** Select coffee cherries.

All necessary materials, tools and equipment are available in the workshop. The task should be completed in 4 hours

END



Reference

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- Vincent, J. C. (1987). Green coffee processing. In *Coffee: Volume 2: Technology* (pp. 1-33). Dordrecht: Springer Netherlands.
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Learning Outcome 2: Process Coffee Cherries into Parchment Coffee



Indicative contents

2.1 Pulping of coffee cherries

2.2 Fermenting the parchment coffee

2.3 Checking quality of parchment coffee

2.4 Drying of parchment coffee

Key Competencies for Learning Outcome 2: Process coffee cherries into parchment coffee

Knowledge	Skills	Attitudes
• Description of coffee pulping • Description of coffee beans fermentation • Description of washing process • Explanation of coffee fermentation methods • Identification of factors that affect coffee fermentation • Description of parchment coffee grades • Explanation of coffee drying methods	• Pulping of coffee cherries • Fermenting coffee beans • Washing fermented coffee beans • Grading coffee beans • Sorting coffee beans • Drying coffee beans • Checking quality of parchment coffee	• Being carefully while pulping coffee cherries • Being responsible while washing fermented coffee beans • Being carefully while grading coffee beans. • Being attentive when drying coffee beans • Being attentive when checking quality of parchment coffee



Duration: 15 hrs.

Learning outcome 2 objectives:



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

1. Pulp properly coffee cherries according to coffee beans quality
2. Describe appropriately coffee beans fermentation process as performed during coffee cherries processing.
3. Ferment appropriately coffee beans according to fermentation conditions.
4. Wash properly fermented coffee beans based on quality requirement
5. Grade appropriately coffee beans according to quality requirement
6. Dry properly coffee beans according the quality requirement
7. Check correctly the quality of parchment coffee based on quality parameters.



Resources

Equipment	Tools	Materials
• Washing tanks • Fermentation tanks • Conveyor belts • Grading channel • Pulping machine • Mucilage remover • Coffee dryer • Personal protective equipment • Sorting tables • Weighing Balances	• Basins • Timer • Moisture meter • Hygrometer • Thermometer • Brushes • Buckets • Mopes • Squeegees.	• Sacks • Ropes • Coffee cherries • Black plastic net • Plastic sheeting

• Water sprayers.		
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Indicative content 2.1: Pulping of coffee cherries



Duration: 3 hrs.



Practical Activity 2.1.1: Coffee cherries pulping



Task:

- 1: You are requested to go in the coffee cherries processing workshop to pulp coffee cherries.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, pulp coffee cherries.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 2.1.1
- 6: Perform the task provided in application of learning 2.1



Key readings 2.1.1. Coffee cherries pulping

✓ Purpose of pulping

+ Removing the Outer Fruit Layer

- **Coffee cherries** have a tough outer skin and a fleshy pulp that needs to be removed to access the parchment coffee. Pulping separates the beans from these layers, making them easier to process.
- This step ensures that the fruit doesn't stay attached to the parchments, which could lead to unwanted fermentation or spoilage if not removed in time.

+ Facilitating the Fermentation Process

- By removing the bulk of the pulp, pulping prepares the beans for the **fermentation process**, where the remaining mucilage is broken down. Fermentation is necessary to remove the sticky mucilage that coats the parchment coffee after pulping.
- Without pulping, the fruit would need to break down naturally, which can be unpredictable and lead to uneven fermentation or poor-quality coffee.

+ Preventing Unwanted Fermentation

- If the coffee cherries are not pulped in a timely manner, the fruit can start to ferment on the beans, which can result in **unpleasant flavors**. Controlled pulping followed by proper fermentation ensures the coffee parchments are processed cleanly and consistently.
- It also reduces the risk of mold, bacteria, or unwanted fermentation by removing the fruit layer.

Improving Bean Quality and Consistency

- Pulping allows producers to **sort and separate beans** by quality. After pulping, beans can be sorted based on density, size, or floatation (where defective or unripe beans float in water), leading to better consistency in the final product.
- High-quality, dense beans typically sink during pulping, while lighter, less dense beans float and can be separated.

Optimizing the Drying Process

- After pulping, the coffee beans dry more quickly and evenly since the outer fruit is no longer present. If the fruit pulp were left intact, it would take significantly longer for the beans to dry, and the drying process would be less predictable.
- Faster drying reduces the risk of spoilage and mold, ensuring the beans maintain their quality during processing.

Preparing for Different Coffee Processing Methods

- **Washed Process:** Pulping is the first step in the washed (wet) process, where the beans are fermented and washed to remove the mucilage before drying.
- **Honey Process (Semi-washed):** In the honey process, pulping removes the skin but leaves some mucilage on the beans, which then dry with this sticky layer intact, contributing to the flavor profile.
- **Natural Process:** In some cases, (especially in the natural process), pulping may not be used, but when it is, it helps speed up processing and improve the consistency of drying.

Pulping procedure

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 oriented to fermentation tank and the skin pass on the other side separately from beans.

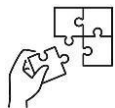
Then the parchment coffee are separated by weight as they pass through water channels. The lighter beans float to the top, while the heavier ripe beans sink to the bottom. They are passed through a series of rotating drums which separate them by size.

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.



Points to Remember

- While pulping don't forget to add water in order to avoid crushing of coffee beans.



Application of learning 2.1.

You are requested to go in your school's coffee processing workshop to pulp coffee cherries respecting pulping procedures and conditions.



Indicative content 2.2: Fermenting the parchment coffee



Duration: 4 hrs.



Theoretical Activity 2.2.1: Description of parchment coffee fermentation



Tasks:

1. You are requested to answer the following questions related to description of coffee cherries reception activities
 - i. What could be the purpose of fermenting parchment coffee?
 - ii. What could be the factors that affect parchment coffee fermentation?
- 2: Provide the answers to asked questions by writing them on paper, flip chart, blackboards, or whiteboards.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the key readings 2.2.1



Key readings 2.2.1.: Description of parchment coffee fermentation

- **Purpose of parchment coffee fermentation**

- ✓ **Mucilage Breakdown**

- ✚ **Mucilage** is a sticky, sugary layer surrounding the parchment coffee. Fermentation is necessary to break down this layer, which would otherwise interfere with drying and negatively affect the coffee's flavor.

- ✚ During fermentation, naturally occurring enzymes and microorganisms (yeasts and bacteria) break down the sugars and other compounds in the mucilage.

- ✓ **Clean Bean Preparation**

- ✚ Fermentation ensures that the mucilage is properly broken down and can be easily washed off. Without this process, the beans would remain sticky and difficult to clean.

- ✚ Clean beans dry more evenly and predictably, reducing the risk of mold or spoilage during the drying phase.

- ✓ **Flavor Development**

- ✚ Fermentation affects the chemical composition of the coffee beans, which influences the flavor profile of the final coffee.
- ✚ It can help highlight certain flavors like acidity, brightness, and clarity, contributing to a cleaner taste compared to other processing methods like the natural or honey process.
- ✚ If fermentation is controlled well, it enhances the complexity of the coffee's flavors by developing fruity, floral, and acidic notes while avoiding any off-flavors from over-fermentation.

✓ **Consistency in Coffee Quality**

- ✚ The fermentation process helps ensure that the beans have a uniform flavor, particularly when done in water-filled tanks where beans are kept at a consistent temperature and humidity level.
- ✚ This results in a more predictable and consistent cup profile, which is highly desirable for specialty coffee producers and consumers.

✓ **Control Over Flavor Profiles**

- ✚ By adjusting the duration and conditions of fermentation (e.g., time, temperature, or water content), coffee producers can fine-tune the flavor profile of the beans. Longer fermentation can introduce more intense flavors, while shorter fermentation keeps flavors mild and clean.



Practical Activity 2.2.2: Fermenting coffee beans



Task:

- 1: You are requested to go in the coffee cherries processing workshop to ferment parchment coffee.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, ferment parchment.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 2.2.2
- 6: Perform the task provided in application of learning 2.2



Key readings 2.2.2 Fermenting parchment coffee

Parchment coffee fermentation refers to the process where the mucilage (the sticky layer around the coffee bean) is broken down after the outer fruit layer has been removed. This step is crucial in the **washed** or **wet processing method**, where coffee is pulped but still retains its parchment layer. There are three primary methods of fermenting parchment coffee:

✓ Fermentation methods

Each of these methods is used to break down the mucilage before washing and drying the coffee beans. Below are the details for each method:

✓ Wet Fermentation Method

In this method, the parchment coffee is submerged in water during the fermentation process.

Process:

- ✚ After the cherries are pulped to remove the outer skin, the parchment coffee, still coated in mucilage, are placed in **fermentation tanks filled with water**.
- ✚ The coffee ferments in water for **12 to 48 hours**, depending on the climate, altitude, and desired flavor outcome.
- ✚ **Enzymes** and naturally occurring microorganisms (yeasts, bacteria) in the water break down the mucilage.
- ✚ The coffee is monitored closely to prevent over-fermentation, which can lead to sour or unpleasant flavors.
- ✚ Once fermentation is complete, the beans are **washed** in fresh water to remove the loosened mucilage.

Advantages:

- ✚ The **water** helps maintain a controlled temperature, preventing the coffee from overheating during fermentation.
- ✚ **Cleaner, brighter flavors** are typically associated with this method, as it allows better control over the fermentation process.

Disadvantages:

- ✚ Wet fermentation requires large amounts of **clean water**, which may not be

readily available in all coffee-growing regions.

- ✚ The wastewater produced needs to be properly treated to avoid environmental issues.

✓ **Dry Fermentation Method**

In dry fermentation, the beans are fermented without being submerged in water.

Process:

- ✚ After pulping, the beans with their mucilage still intact are placed in **dry fermentation tanks** or **concrete pits**, without any added water.
- ✚ The beans are left to ferment in these **open-air environments** for the same time frame (12-48 hours).
- ✚ Fermentation still occurs naturally, driven by the **enzymes and microorganisms** present in the beans and the surrounding environment.
- ✚ After the mucilage has broken down, the beans are washed to remove the residue.

Advantages:

- ✚ This method conserves water, making it more **environmentally friendly** and cost-effective, especially in regions where water is scarce.
- ✚ Coffee fermented using the dry method may develop **richer and deeper flavors**, with more complexity compared to wet fermentation.

Disadvantages:

- ✚ Because the fermentation process occurs without water, **temperature control** can be more difficult, and the coffee parchment may ferment unevenly if not carefully monitored.
- ✚ There's a higher risk of **over-fermentation** or spoilage if conditions aren't optimal, which can negatively affect flavor.

✓ **Semi-Dry Methods**

The semi-dry methods combine elements of both wet and dry processes, and the most common variation of this method is known as the **Honey Process** or **Pulped Natural Process**. Coffee cherries are pulped, but not fully washed, leaving some of the mucilage intact for drying.

Process:

- ✚ After pulping, the beans are **partially washed**, leaving a portion of the mucilage still attached to the beans.
- ✚ The parchment are then dried with the mucilage still clinging to them, either in the sun on drying beds or mechanically.
- ✚ There is no traditional fermentation step where the mucilage is broken down by microorganisms.
- ✚ Instead, the mucilage naturally dries and is later removed during the hulling process.

Advantages:

- ✚ **Less water** is used compared to the full washed process, making it a more sustainable option in regions where water conservation is important.
- ✚ The final flavor of the coffee is often **sweet, syrupy, and more complex**, thanks to the residual sugars in the mucilage.

Disadvantages:

- ✚ The drying process needs to be **carefully managed** to prevent mold or uneven drying, especially since the beans still have some mucilage.
- ✚ **Inconsistent results** may occur if cherries are not dried properly or evenly.

✓ Factors affecting parchment coffee fermentation

✚ Temperature

➤ Impact on Fermentation:

Temperature is one of the most significant factors affecting the rate of fermentation. Higher temperatures speed up microbial activity and enzymatic breakdown of the mucilage, while lower temperatures slow down the process.

➤ Optimal Range:

The ideal temperature for coffee fermentation is typically between **15°C and 25°C (59°F to 77°F)**.

✚ High Temperatures (Above 25°C):

Can cause **over-fermentation**, leading to undesirable flavors such as sourness or off-flavors due to uncontrolled microbial growth.

Rapid fermentation at high temperatures may reduce the control over the flavor profile.

Low Temperatures (Below 15°C):

Slows down fermentation, resulting in **longer fermentation times**. If too prolonged, it may cause fermentation inconsistencies and mold growth, leading to defects in the coffee.

Effect on Flavor:

Higher temperatures tend to produce a **more intense, fruity, and sometimes sour profile**, while lower temperatures can result in **cleaner, brighter flavors** with more acidity.

pH Level

- **Impact on Fermentation:** The **pH level** of the fermentation environment directly influences microbial activity. Fermentation typically starts with a neutral or slightly acidic pH (around 6-7), but as fermentation progresses, the pH decreases as organic acids are produced by microbes.
- **Optimal pH:** A pH range of **4.5 to 6** is considered suitable for fermentation.
- **Low pH (Below 4.5):** A low pH can inhibit or kill some beneficial microbes, **slowing down fermentation** or leading to the dominance of undesirable microbes, which can produce off-flavors.
- **High pH (Above 6):** A higher pH may indicate **incomplete fermentation** and the presence of unprocessed mucilage, resulting in **inconsistent flavors**.
- **Monitoring pH:** Careful monitoring of pH levels helps in controlling the progression of fermentation and maintaining a balance that favors desirable microbial activity. A drop in pH signals that fermentation is proceeding properly.

Oxygen Level

- **Impact on Fermentation:**
 - The availability of oxygen plays a role in the type of microbial activity that takes place during fermentation.
 - In coffee fermentation, both **aerobic (oxygen-dependent)** and **anaerobic (without oxygen)** fermentation can occur, influencing the flavor outcomes differently.
- **Aerobic Conditions:**
 - When oxygen is present, **aerobic bacteria and yeasts** dominate, breaking down sugars and mucilage at a steady rate. Aerobic fermentation often results in **brighter and cleaner flavors**.
 - **Dry fermentation** is an example where aerobic conditions dominate.
- **Anaerobic Conditions:**
 - In oxygen-limited environments, **anaerobic microbes** such as lactic acid bacteria take over. Anaerobic fermentation often leads to **complex, fruity, and**

sometimes wine-like flavors.

- Anaerobic processes are intentionally applied in some fermentation methods to develop specific flavor profiles.

➤ **Balancing Oxygen:**

- Too much oxygen can lead to **oxidation** and rapid microbial growth, which may result in uncontrolled fermentation and off-flavors. In contrast, too little oxygen can limit microbial diversity, slowing down the breakdown of mucilage.

🌈 **Microbial Activity**

- **Role of Microorganisms:** Microbial activity is the driving force behind fermentation. Bacteria, yeasts, and fungi naturally present in the environment or introduced during processing break down the sugars in the mucilage.

➤ **Key Microorganisms:**

- **Yeasts:** Convert sugars in the mucilage into alcohols and acids, contributing to flavor development.
- **Lactic Acid Bacteria:** Thrive in anaerobic conditions and produce lactic acid, which adds to the acidity and complexity of the coffee.
- **Acetic Acid Bacteria:** In aerobic conditions, these bacteria convert alcohols into acetic acid, which can enhance brightness but may lead to overly sour flavors if uncontrolled.

- **Microbial Diversity:** The diversity and balance of microbial species affect the fermentation outcome. A healthy microbial community enhances complexity in flavor, whereas an imbalance can result in undesirable fermentation byproducts, such as excessive acidity or bitterness.

- **Environmental Influence:** Microbial activity is highly influenced by **local environmental conditions**, such as altitude, humidity, and proximity to other fermenting products. Each farm's microbial ecosystem can impart unique characteristics to the coffee.

✓ **Combined Effect on Coffee Flavor and Quality:**

- 🌈 **Temperature, pH, Oxygen, and Microbial Activity** interact synergistically during parchment coffee fermentation.

- 🌈 If all factors are well-controlled, the fermentation process results in a **clean, well-balanced cup profile**, enhancing desirable flavors like brightness, sweetness, and complexity.

- 🌈 Improper management of these factors can lead to **off-flavors**, such as sourness, bitterness, or unwanted fermentation byproducts like alcohol and vinegar-like notes.



Practical Activity 2.2.3: Wash fermented coffee beans

Task:

- 1: You are requested to go in the coffee cherries processing workshop to wash coffee parchments.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, wash parchments coffee.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 2.2.3
- 6: Perform the task provided in application of learning 2.2



Key readings 2.2.3: Wash fermented parchments coffee

- **Washing parchment coffee**

When the fermentation is complete, the parchment 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.

- ✓ **Coffee washing procedures:**

- ✚ **Draining:** After the desired fermentation time (12-48 hours), the parchment coffee and remaining mucilage are drained from the fermentation tanks. This typically involves removing any excess water and preparing the coffee for washing.

- ✚ **Initial Rinsing**

- The beans, still coated in some remnants of mucilage, are rinsed with clean water. This can be done by agitating the beans in large water channels or with specialized mechanical washers.
- **Water Channels:** In traditional setups, the parchment coffee are released into long water channels where the movement of water helps to rinse away the broken-down mucilage.

- **Washing Machines:** In more modern operations, mechanical washing machines are used. These machines use water pressure or rotating brushes to wash off the remaining mucilage.

Agitation and Scrubbing

Whether by hand in water channels or using mechanical equipment, parchment are agitated or scrubbed to fully remove the sticky mucilage layer that may still cling to them after fermentation.

This ensures the beans are clean and prepared for drying, which helps prevent any residual organic material from affecting the quality or shelf life of the coffee.

Repeated Washing (If Necessary)

- Some processes may involve multiple rinsing cycles to ensure the parchment coffee are thoroughly cleaned.
- **Fresh Water:** In each cycle, clean, fresh water is typically used to avoid recontamination of parchment coffee and to ensure the washing process is effective.

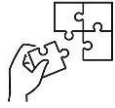
 **Separation of Defective Beans:** During washing, defective or lightweight beans (those that may float) can be removed. Healthy, dense beans usually sink, and these are collected for drying.

 **Draining Excess Water:** Once the washing is complete, excess water is drained from the beans. This can be done by placing them in sieves, containers with perforations, or simply allowing them to sit briefly in a container where the water can run off.



Points to Remember

- Avoid over fermentation and under fermentation of parchment coffee because all can affect the quality of coffee beans.
- Fermentation methods are: Wet fermentation method, dry Fermentation method and semi-dry method
- Fermentation water should be used once
- Washing is done by using enough clean water and the process is repeated until obtaining clear water.



Application of learning 2.2.

You are requested to go in your school's coffee processing workshop to ferment and wash parchment coffee respecting coffee fermentation and washing conditions.



Indicative content 2.3: Checking quality of parchment coffee



Duration: 4 hrs



Practical Activity 2.3.1: Grading parchment coffee.



Task:

- 1: You are requested to go in the coffee cherries processing workshop to grade parchment coffee.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, grade parchment coffee.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 2.3.1
- 6: Perform the task provided in application of learning 2.3



Key readings 2.3.1 Grading parchment coffee.

- **Grading wet parchment coffee**
- ✓ **Purpose of grading**

Grading wet parchment coffee is a crucial step in the coffee processing chain that helps to determine the quality and value of the beans. It serves several key purposes:

- ✚ **Quality Control:** Grading helps to ensure that only the highest quality coffee beans are selected for further processing.
- ✚ **Price Differentiation:** Different grades of coffee command different prices in the market. Grading allows for proper valuation based on quality.

- ✓ **Description of parchment coffee grades**

After washing, parchment coffee are passed in grading tank where grading is done based on **density/weight** and quality. The grading process is done by floating coffee beans in water.

Grading procedure

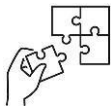
- i. Prepare a large, shallow grading tank filled with enough clean water.
- ii. Immersing or gently add the beans to the grading tank.

- iii. Floating the beans by agitating them in order to help separation into different grades. The beans will begin to float based on their density. Higher-density beans will sink to the bottom, while lower-density beans will float to the surface.
 - iv. The beans are oriented into their respective grading tank
 -  **Grade 1 or A:** These are the highest quality parchment coffee. They have a high density and are free of defects. Grade 1/A beans often have a superior flavor profile and command premium prices.
 -  **Grade 2 or B:** These parchment coffees are of moderate quality and density. They may contain a small amount of defects. Grade 2/B parchment coffee are still considered good quality but may not have the same level of flavor complexity as Grade 1/ A parchment coffee.
 -  **Grade 3 or C:** These are the lowest quality parchment coffee. They have a low density and may contain a significant amount of defects, including pulp and other impurities. Grade 3/C parchment coffee are typically used for lower-grade coffee products or for blending with higher-quality beans.
- ✓ **Factors Affecting Density:**
-  **Maturity:** Ripe cherries tend to have higher density.
 -  **Processing Methods:** Careful handling and processing can preserve bean integrity and density.
 -  **Defects:** Beans with defects, such as cracks or damage, may have lower density.



Points to Remember

- While grading parchment coffee be carefully to avoid mixing different grades
- There are 3 grades of parchment coffee: Grade A with good quality, Grade B with moderate quality and grade C with low quality.



Application of learning 2.3

You are requested to go in your school's coffee processing workshop to grade parchment coffee respecting parchment coffee grades



Indicative content 2.4: Drying of parchment coffee



Duration: 4hrs



Practical Activity 2.4.1: Drying parchment coffee



Task:

- 1: You are requested to go in the coffee cherries processing workshop to dry parchment coffee.
- 2: Apply safety precautions.
- 3: Referring to the methods provided on step 3, dry coffee beans.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 2.4.1
- 6: Perform the task provided in application of learning 2.4



Key readings 2.4.1: Drying parchment coffee

- **Purpose of parchment coffee drying**

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 parchment coffee 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)

- **Parchment coffee drying methods**

- ✓ **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 parchment coffee 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 parchment coffee 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 **35°C** and gradually raise it to **60°C**.

- ❖ Whichever method of drying is used, the parchment on the coffee bean will dry to a pale straw colour (pale yellowish beige colour), and be brittle to touch.

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) 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.

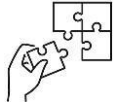
- **Checking parchment coffee quality**

- ✓ During quality check it is necessary to measure coffee bean moisture content because the coffee that is too high or too low in moisture will not maintain high cupping quality.
- ✓ Color: Parchment coffee beans at 12% moisture are rich green with a slight translucence. Wet coffee or coffee that has been rewetted and re-dried is more opaque and whiter. There is little change in color until moisture drops well below 12% but the beans will tend to become distorted.



Points to Remember

- Moisture content of parchment coffee is 12%
- Drying can be done by using dryer or sun drying.
- While drying coffee beans don't forget to stir in order to dry evenly.



Application of learning 2.4.

You are requested to go in your school's coffee processing workshop to dry parchment coffee respecting coffee drying conditions.



Learning outcome 2 end assessment

Theoretical assessment

1. Read the following statements and answer by **True** if the statement is correct and **False** if the statement is incorrect.

- i. Pulping is an important step in coffee processing that separates the parchment coffee from the fruit pulp and skin.
- ii. The pulping machine removes the beans from the cherries without using water.
- iii. Lighter coffee beans float to the top during the separation process in the water channels.
- iv. All the pulp must be completely removed from the beans before fermentation.
- v. The classic method of removing pulp is known as machine-assisted wet processing.
- vi. After fermentation, coffee is washed to remove mucilage residues.
- vii. The washing process typically requires only one wash to remove all residues.
- viii. Wet parchment coffee at this stage contains about 57% moisture.
- ix. Insufficient water during the final washing can lead to the coffee starting to dry with mucilage residues still present.
- x. Proper washing of coffee increases the risk of microbial attack and mycotoxin formation.

2. From the table below, match the following grades of coffee beans with their descriptions by writing the letter with the corresponding digit in the provided space.

Grade	Description	Answer
Grade 1	A. Coffee beans of lowest density and quality, composed with defect and some pulp	Grade 1.....
Grade 2	B. Coffee beans of high density and of highest quality	Grade 2.....
Grade 3	C. coffee beans of moderate density and quality, mixed with small amount of defect	Grade 3.....

3. Circle the letter corresponding to the correct answer

i. What is the optimal moisture content for coffee beans after drying?

- a) 5-6%
- b) 11-12%
- c) 15-20%
- d) 20-25%

ii. How long should sun drying typically take?

- a) 2-4 days
- b) 5-7 days
- c) 8-10 days
- d) 11-14 days

iii. What is the out-turn of clean dry coffee from ripe cherry?

- a) 10-15%
- b) 15-20%
- c) 20-25%
- d) 25-30%

iv. Why should coffee beans not be dried directly on soil?

- a) It makes them too wet
- b) It leads to earthy flavors
- c) It takes too long to dry
- d) It can cause them to crack

v. What is a major problem when rewetting coffee during drying?

- a) It causes the beans to split
- b) It leads to mold development
- c) It enhances flavor
- d) It increases drying time

vi. What is the initial temperature recommended for artificial drying?

- a) 24°C
- b) 30°C
- c) 35°C
- d) 40°C

vii. What color should parchment coffee beans have after proper drying?

- a) Dark brown
- b) Pale yellowish beige
- c) Bright green
- d) Deep red

viii. What happens if coffee is over dried?

- a) It becomes too moist
- b) It produces too many broken beans
- c) It enhances flavor
- d) It becomes more aromatic

ix. What should be checked during quality control of parchment coffee?

- a) Bean size
- b) Color of the packaging
- c) Moisture content
- d) Aroma

x. What effect does insufficient drying have on coffee beans?

- a) Improves flavor
- b) Causes them to turn dark
- c) Makes them more aromatic
- d) Leads to bland flavor and deterioration

Practical assessment

Your school have a food processing unit that process coffee cherries into parchment and ground coffee. The coffee produced is used for breakfast of teaching staff. Recently, there have been complaints from teaching staff over the past two consecutive months regarding the flavour and tastes of the served coffee that might be due to poor sorting of coffee cherries or contamination during process.

You are requested to go in coffee processing workshop to perform the following tasks:

1. Pulp coffee cherries
2. Ferment coffee beans
3. Wash fermented coffee beans
4. Grade coffee beans
5. Dry coffee beans

The task should be completed in 20 hours. All necessary materials, tools and equipment are available in the workshop.

END



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Learning Outcome 3: Process Parchment Coffee into Green Coffee



Indicative contents

3.1. De-hulling parchment coffee

3.2. Sorting green coffee

3.3. Grading green coffee

Key Competencies for Learning Outcome 3: Process parchment coffee into green coffee.

Knowledge	Skills	Attitudes
• Description of de-hulling process for coffee beans. • Identification of sorting criteria for green coffee • Explanation of sorting method • Identification of coffee grades	• De-hulling parchment coffee • Sorting green coffee • Grading green coffee	• Being careful while de-hulling parchment coffee • Being attentive while sorting green coffee • Being vigilant while grading green coffee



Duration: 15 hrs.

Learning outcome 2 objectives:



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

1. Describe appropriately dehulling process for parchment coffee.
2. De-hull properly parchment coffee according to dehulling methods.
3. Identify appropriately sorting criteria for green coffee beans based on product requirements.
4. Explain correctly sorting methods as performed during coffee cherries processing
5. Sort properly green coffee according to sorting criteria.
6. Grade properly green coffee according to grading methods.



Resources

Equipment	Tools	Materials
• Conveyor belts • Colour sorters • Sorting tables • Weighing balances • Coffee hulling machine • Fan • Grading machine.	• Basins • Moisture meter • Hygrometer • Thermometer • Brushes • Buckets	• Sacks • Parchment coffee • Plastic sheeting.



Indicative content 3.1: Dehulling parchment coffee



Duration: 5hrs



Practical Activity 3.1.1: Dehulling parchment coffee



Task:

- 1: You are requested to go in the coffee processing workshop to de-hull parchment coffee.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, de-hull parchment coffee.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 3.1.1
- 6: Perform the task provided in application of learning 3.1



Key readings 3.1.1. Parchment coffee de-hulling

- **Purpose of coffee de-hulling**

Hulling is the process of removing the **parchment layer**, also known as the **endocarp**, from the coffee bean. This layer is a tough, papery skin that surrounds the coffee bean and protects it during drying. Hulling typically occurs after the coffee beans have been dried.

Polishing is an optional step performed after hulling that removes any remaining silver skin, a thin, membranous layer clinging to the green coffee bean. While not essential for all coffees, it can impact the final appearance and brewing characteristics.

- ✓ **Coffee hulling aims at:**

- ✚ Improving Bean Quality: Removing the hull exposes the green beans, which can then be inspected for defects, ensuring only high-quality beans are selected for further processing

- ✚ Preparation for Roasting: De-hulling ensures that only the green coffee beans (without the outer parchment) are sent for roasting, allowing for an even roast.
- ✚ Enhancing Flavor: The removal of the parchment layer helps ensure that the coffee beans develop their full flavor potential during roasting, without interference from unwanted materials
- ✚ Preventing Contamination: De-hulling removes any remaining debris, dust, or contaminants that may cling to the parchment layer, leading to a cleaner final product.

✓ **Coffee polishing:**

Coffee polishing is an optional process in which any silver skin that remains on the beans after hulling is removed in a polishing machine

Coffee polishing aims at:

- ✚ Improving the appearance of green coffee beans
- ✚ Eliminating a by-product of roasting called chaff.

It is described by some to be detrimental to the taste. By raising the temperature of the bean through friction which changes the chemical makeup of the bean.

✓ **Hulling and polishing process and techniques**

The thin parchment around the coffee is removed either by hand, in a pestle and mortar or in a huller. Hulling may or may not remove a final layer closest to the beans, called the silver skin. If removal of silver skin is required, it may require separate equipment following hulling, called polishers.

The mechanism used by the huller machine is simple, with the coffee being fed through the hulling cylinder and filtered through the perforated screen using cross beaters. This helps to reduce the friction between beans and to restrict the generation of dust, thus resulting in minimum loss of product due to breakage.

✚ **Hulling methods**

The two basic types of coffee hulling consist of wet and dry hulling. Each process is the same, but also can be very different.

- **Wet hulling:** The parchment layer of the coffee, which is also known as the endocarp, is removed when the coffee is wet.
- **Dry hulling:** This is a process that entails removing the husk once it is dried.

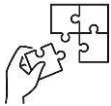
✚ **Husk separation methods**

- **Sieving:** Sieving is a centuries-old method of separating coarse particles from finer particles as they pass through a fine screen.
- **Aspiration:** After hulling and polishing, the remaining residues or chaff are removed by using some machine-like Fan for winnowing, Aspiration channel by flowing air into green coffee in order to remove specifically lighter particles such as straw, dust, or hull fragments. Aspiration is thus one of method used for husk separation.



Points to Remember

- Hulling help removing the parchment layer from coffee beans.
- Polishing removes silver skin and improve appearance of green coffee beans.



Application of learning 3.1.

You are requested to go in your school's coffee processing workshop to de-hull parchment coffee respecting parchment coffee de-hulling conditions.



Indicative content 3.2: Sorting green coffee



Duration: 5hrs



Theoretical Activity 3.2.1: Description of sorting criteria for green coffee



Tasks:

- 1: Answer the following question related to the description of sorting criteria for green coffee.
 - i. What do you understand by green coffee sorting?
 - ii. What may be the purpose of green coffee sorting?
 - iii. What are the criteria may be based on during green coffee sorting?
- 2: Provide the answers to the asked questions by writing on papers, flip chart.
- 3: Present the findings.
- 4: For more clarification read the key readings 3.2.1



Key readings 3.2.1.: Description of sorting criteria for green coffee

✓ Purpose of green coffee sorting

✚ Ensuring Quality Consistency

- Sorting helps to maintain consistent quality across batches by removing defective beans such as chipped, broken, or immature beans that could negatively affect the flavor during roasting.
- Beans of similar size and density roast more uniformly, producing a consistent flavor profile.

✚ Removing Defects

- Sorting removes beans with defects such as black beans, insect-damaged beans, or beans affected by mold, which can cause off-flavors, bitterness, or undesirable cup qualities.
- Defective beans can also impact the physical appearance of roasted coffee, which is important for specialty coffee markets.

✚ Optimizing Roasting

- Uniformity in size and density ensures that beans roast evenly, reducing the risk of under-roasted or over-roasted beans. Beans of varying sizes roast at different rates, leading to inconsistencies in flavor development.

✚ Enhancing Flavor Profile

- By sorting out defective beans and ensuring only premium, uniform beans are selected, green coffee sorting helps to bring out the full flavor potential of the coffee.

- Defective beans can introduce undesirable flavors such as sourness, bitterness, or mustiness, so removing those results in a cleaner, more refined cup.

Improving Market Value

- Coffee sorted for quality commands a higher price in the market, particularly in the specialty coffee industry. Consistently high-quality beans attract better pricing and can be marketed as premium coffee.
- Well-sorted beans with minimal defects have a better appearance and are more appealing to consumers.

Preparing for Export

- For coffee exporters, sorting is essential to meet the quality standards of importing countries. High-grade coffee requires precise sorting to ensure that it adheres to international quality standards.
- Proper sorting reduces the risk of shipments being rejected or downgraded due to quality concerns.
- Increasing Shelf Life
- Defective beans, especially those damaged by pests or fermentation, can degrade quickly, affecting the freshness and longevity of the coffee. By removing these beans, the overall shelf life of the coffee is improved

✓ **Sorting criteria**

Colour defects

- **Black beans:** Any bean which is at least half-black on the outside or inside is called a black bean. This is considered to be the main defect of green coffee, and is used as a standard in inspection tests. Recently, however, stinker, beans have become more common in batches of certain origins, depreciating their value considerably. Black beans make the beverage taste bitter, disagreeable, and render it generally undrinkable. The reason for this defect is attributed to prolonged fermentation of cherries picked from the ground, which then undergo a poor drying process with intermittent periods of wetting. The presence of black beans is rare in wet processing, except where the cherry has been harvested from the ground, or if there are still some beans left from previous operations in the fermentation tanks and poorly cleaned washing channels.
- **Greyish or dark grey beans:** There are several reasons for this colour: harvesting before the beans are ripe, initial fermentation of cherries in the heap, poor drying or repeated spells of wetting if stored under poor conditions, etc. Beans of this colour are classified as undesirable.
- **Foxy beans:** These have red colouring which is essentially due to artificial drying which has been overdone. Reasons for this include high drying temperature, drying period extended over a long time, or the beans not having been sufficiently mixed. It may affect the tissues to varying depths. If the colouring is very superficial, it could be the result of excess fermentation coupled with loose pulp. In some cases it has been attributed to the

adherence of a thin film of reddish soil from the drying area during hulling, if the soil has high clay content.

- **Coated or murram**-coloured beans: this colouring is imparted to the bean by the presence, either wholly or partially, of the skin. It is a defect of minor importance, except for extremely high quality Arabicas.
- **White, opalescent**, and glassy beans: these are generally beans that have been insufficiently dried or have reabsorbed some moisture, within which internal enzyme reactions often appear. These beans are less dense than a healthy bean of the same volume. Glassy beans are the result of artificial drying using too high a temperature at the beginning, resulting in a rapid release of water vapour. They are considered undesirable.
- **Blotchy and spotted** beans: Blotchy beans have spots of various colours due to incomplete or irregular drying. Spots appear on the beans due to the effect of oxidising agents, which are present on the surface tissues following injuries. These develop particularly during the preparation of beans, often during hulling, but certain lesions are induced by pest or disease infections. Poor fermentation or the use of water with high iron content (formation of black precipitates with the tannin from beans) for wet processing can also give rise to spots. The presence of whitish spots reveals poor drying or the initiation of germination resulting in enzymatic reactions.
- **Defects in the aroma and taste**

Stinkers: When these beans are cut, they release a putrid, nauseating odour, which is also rather volatile and this odour will have disappeared after a few hours. As the appearance of these beans is no different or only slightly different from that of healthy beans, it is very difficult to distinguish them. Unfortunately, their bad odour becomes apparent during roasting and the presence of a single stinker in a cylinder is enough to contaminate its entire contents. The taste comes through in the beverage and produces undrinkable coffee. It has now been established that stinkers are caused either by excessively long fermentation or the use of unclean water. If it is a matter of only a few beans in batch, the reason may be that the fermentation tanks or washing channels have been poorly cleaned and all the beans from the preceding operation were not removed.

- **Rancid or acid beans:** These beans have a rather dark brown colour and give off a disagreeable odour when cut. They are the result of poorly managed, excessively long fermentation and their defects are discernible in the beverage.
- **Musty beans:** These beans are either partially or totally covered with mould. They give off a characteristic odour, which does not disappear after roasting and is transmitted to the beverage. The presence of a few musty beans in a batch is enough to contaminate the total contents. It is usually the result of

incomplete drying, or the re-absorption of moisture in the storage areas or during transport (wet bags)

- **Rio flavoured coffee:** A slightly medicinal aroma is characteristic of certain coffees from the regions of Rio and Victoria in Brazil, due to the metabolic activity of bacteria in the soil, which produce an iodised substance which is absorbed by and transported within the coffee tree by the sap (fluid). However, it is not always regarded as a defect, as this very specific flavour is appreciated by some consumers, mainly in regions of Northern France.

Other abnormalities

- **Broken beans:** The beans become broken due to inadequate adjustment of the pulping equipment or hullers, or an excessively rapid rotation of the cylinders during pulping. Breakages most frequently occur during hulling when the coffee is too dry. Broken beans adversely affect the appearance of the batch, but more importantly they roast faster than whole beans, and tend to become charred (burned). Their presence therefore has a negative effect on the quality of the beverage.
- **Crushed beans:** These are rather flat beans, the median furrow (grooves) of which has been laid open. Unlike broken beans, crushed beans are the result of processing insufficiently dried coffee.
- **Pitted beans:** The surfaces of beans which have been infested by insects are more or less riddled (damaged) with small, round holes such as those produced by the berry borer. Cutting them open reveals the pores bored by the insect.
- **Elephant beans:** These are large, deformed beans, consisting of several embryos enveloping the endosperm. Within a batch, they upset the uniformity of the bean size and are also a problem during roasting.
- **Foreign matter:** Impurities such as twigs, leaf debris and wood fragments are very rarely found in well-prepared coffees. Mostly encountered is:
 - Soil and dust (transported by the wind during drying);
 - Small stones (drying on packed earth);
 - Pulp (poorly executed pulping) or parchment debris (incorrect adjustment of the huller's fan)
 - Beans are still in parchment (faulty huller operation) or dry cherries are presented (great variation in the size of the cherry, huller poorly adjusted).
 - The presence of soil and other related debris is revealed by handling the beans and observing the marks that they leave on the skin. It is easy to eliminate these impurities by passing the beans through a winnowing machine.

Pulp debris (skins) depreciates the value of the coffee, especially Arabica. The skins resemble large, dark brown fragments and give the beverage a bad taste.

Parchment debris is mostly small and very fragmented and eliminated by use of a winnowing machine.

Presence of whole parchment coffee beans or whole dry cherries is considered as a major defect because they give the green coffee a disagreeable appearance and are harmful to the roasting process.



Practical Activity 3.2.2: Green coffee sorting



Task:

- 1: You are requested to go in the coffee processing workshop to sort green coffee.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, sort green coffee.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 3.2.2
- 6: Perform the task provided in application of learning 3.2



Key readings 3.2.2: Green coffee sorting

- **Sorting methods**

Green coffee sorting involves various methods that focus on selecting beans based on size, density, color, and other factors to ensure the best possible quality before roasting. The sorting process can be done manually or using machines, depending on the scale of the operation. Below are the primary methods used for sorting green coffee:

- ✓ **Hand Sorting (Manual Sorting)**

-  **Method:** Workers visually inspect green coffee beans and manually remove any defective beans, such as those with discoloration, breakage, or insect damage.

-  **Use:** Often used in small-scale, high-quality, or specialty coffee operations where precision is paramount.

Advantages:

- Can detect subtle defects and ensure high precision.
- Effective for identifying and removing beans with visual defects.

Disadvantages:

- Labor-intensive and time-consuming.
- May be less efficient for large-scale operations.

✓ **Mechanical sorting**

Mechanical sorting of green coffee involves the use of machines to sort beans based on physical characteristics like size, density, and color. This method is efficient and widely used in large-scale coffee production to ensure quality and consistency. Below are the key methods and types of mechanical sorting used for green coffee beans:

 **Size Sorting (Screening):** Coffee beans are passed through a series of mechanical sieves or screens with progressively smaller holes to sort them by size. The size of the holes is measured in increments of 1/64 of an inch, known as the "screen size."

➤ **Process:**

- Beans enter the machine and are vibrated through different-sized screens.
- Larger beans remain on the top screens, while smaller beans pass through.

➤ **Machines Used:** Rotating or vibrating mechanical screeners.

➤ **Purpose:** Ensures that beans of a similar size are grouped together for more uniform roasting. Larger beans generally roast slower, while smaller beans roast faster.

Example: A common screen size for high-quality Arabica coffee is between 16 to 20 (16/64 to 20/64 of an inch).

 **Density Sorting (Gravity Separation):** Beans are sorted by density using gravity tables, where heavier beans are separated from lighter ones. Dense beans tend to be higher in quality and flavor potential.

➤ **Process:**

- Beans are spread on a vibrating, inclined table. The table vibrates, and air is blown from below.
- Heavier, denser beans move toward the lower end of the table, while lighter

beans are blown or vibrated toward the top.

- **Machines Used:** Gravity separators or air tables.
- **Purpose:** Ensures that beans of similar density are grouped together, which helps in uniform roasting and ensures higher-quality beans are used for roasting.
- **Advantages:** It effectively removes lighter beans, which are often defective (e.g. hollow or underdeveloped).

 **Color Sorting (Optical Sorting):** Optical or color sorting machines use cameras and sensors to visually inspect beans and sort them based on color and surface characteristics. Beans that are discolored or defective are removed.

- **Process:**
 - Beans pass through the machine on a conveyor belt, and high-speed cameras take rapid images of each bean.
 - Software analyzes the color and defects, and an air jet pushes defective beans out of the flow.

- **Machines Used:** Optical color sorters or digital sorters.
- **Purpose:** Removes beans with visual defects such as black, yellow, or white beans that indicate poor quality, improper fermentation, or drying issues.
- **Advantages:** Highly precise and fast, ideal for sorting large quantities of coffee.

 **Weight Sorting:** Some mechanical systems sort beans by weight to ensure uniformity. This method is often used in combination with other sorting techniques, like size or density sorting.

- **Process:**
 - Beans are passed over weighing sensors or tables that detect differences in bean weight.
 - Heavier, denser beans are separated from lighter beans.

- **Machines Used:** Weight sorters or combination systems.
- **Purpose:** Ensures consistent weight, which can correlate with bean quality and roasting uniformity.

 **Magnetic Sorting:** Magnetic sorting machines are used to remove any metal objects that may have accidentally been mixed with the coffee beans during processing.

- **Process:** Beans pass through a magnetic field where any metal fragments (e.g. nails, screws) are attracted and removed.

- **Machines Used:** Magnetic metal separators.
- **Purpose:** Ensures the safety of the beans by removing metal contaminants, protecting both the beans and the equipment used in further processing stages.

- 🌈 **Air Classification (Pneumatic Sorting):** Uses a stream of air to separate beans based on density or size. Lighter, defective beans are blown away, leaving behind only heavier, high-quality beans.
- **Process:**
 - Beans are fed into a chamber where a controlled stream of air blows through.
 - Lighter beans or foreign matter are lifted and separated from the denser beans.
- **Machines Used:** Pneumatic separators or air classifiers.
- **Purpose:** Efficiently removes lightweight defects, including broken or immature beans.

- 🌈 **Combined Mechanical Sorting Systems:** In large-scale coffee production, mechanical sorting machines often combine multiple sorting criteria (size, density, and color) into a single system to ensure maximum efficiency and quality.
- **Process:**
 - Beans go through multiple stages: screening (size), gravity separation (density), and optical sorting (color).
 - Each stage progressively refines the bean selection, ensuring only high-quality beans remain.
- **Machines Used:** Multi-function sorting machines or integrated coffee processing lines.
- **Purpose:** Reduces manual labor and increases throughput while maintaining a high standard of quality.

- 🌈 **Moisture Sorting:** While not a mechanical sorting method per se, moisture meters are often used in conjunction with mechanical sorting systems to ensure the beans have the proper moisture content for storage and roasting.
- **Process:**
 - Beans are measured using electronic moisture meters.
 - Beans with excessive moisture content (>12%) are removed or dried further.
- **Machines Used:** Moisture meters and sensors.
- **Purpose:** Ensures beans are properly dried before roasting, preventing mold

growth or spoilage.

Advantages of Mechanical Sorting

- **Efficiency:** Mechanical sorting allows for processing large volumes of coffee quickly, making it suitable for industrial-scale operations.
- **Precision:** Advanced systems like optical sorters can detect subtle defects that might be missed during manual sorting.
- **Consistency:** Mechanical systems provide consistent results, ensuring that beans are sorted uniformly based on predetermined criteria.
- **Labor Savings:** Reduces the need for manual labor and human error, allowing for faster, more accurate sorting.

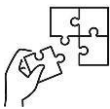
Disadvantages of Mechanical Sorting

- **Cost:** Mechanical sorting equipment can be expensive to purchase, install, and maintain, making it a large investment, especially for smaller operations.
- **Complexity:** Machines require regular calibration and maintenance to ensure proper functioning and precision.
- **Bean Damage:** Some mechanical systems, especially older ones, can cause physical damage to beans during the sorting process, affecting the final quality.



Points to Remember

- Green coffee sorting involves selecting beans based on size, density, color, and other factors to ensure the best possible quality before roasting.
- Sorting of green coffee is done by manual sorting or mechanical sorting method



Application of learning 3.2.

You are requested to go in your school's coffee processing workshop to sort green coffee respecting green coffee sorting parameters.



Indicative content 3.3: Grading green coffee



Duration: 5hrs



Practical Activity 3.3.1: Green coffee grading



Task:

- 1: You are requested to go in the coffee processing workshop to grade green coffee.
- 2: Apply safety precautions.
- 3: Referring to the procedures provided on step 3, grade green coffee.
- 4: Present your work to the trainer and whole class. Ask for clarification where necessary
- 5: Read key reading 3.3.1
- 6: Perform the task provided in application of learning 3.3



Key readings 3.3.1: Green coffee grading

- **Purpose of grading green coffee**

The purpose of **grading green coffee** is to classify and evaluate the quality of coffee beans based on specific criteria such as size, weight, defects, and other factors like origin and flavor potential. Grading is essential for maintaining quality control, ensuring consistency, and setting a standard for pricing in the coffee industry. Below are the key purposes of grading green coffee:

- ✓ **Quality Assurance**

- ✚ Grading ensures that only high-quality beans meet the market's standards. By classifying beans according to their size, defects, and other factors, coffee producers and buyers can ensure the final product meets desired quality levels.
- ✚ It helps in identifying and segregating beans that are free from defects, well-developed, and suitable for roasting.

- ✓ **Consistency**

- ✚ Grading provides uniformity in coffee beans, ensuring that batches are

consistent in size, density, and overall quality. This consistency is crucial for roasters to achieve even roasting, which leads to a balanced and predictable flavor profile in the final cup.

- ✚ It minimizes variations in flavor by ensuring that similar beans are grouped together for roasting.

✓ **Fair Pricing**

- ✚ Coffee is graded to establish a fair price based on its quality. Higher-grade coffee, which has fewer defects and larger, denser beans, commands a higher price in the market. Lower-grade coffee, which contains more defects or smaller beans, is priced lower.
- ✚ Grading ensures transparency in pricing for producers, traders, and buyers, allowing coffee to be priced according to its grade.

✓ **Meeting Export Standards**

- ✚ Many countries have strict grading standards for coffee exports. Grading ensures that green coffee meets these standards, making it suitable for international markets.
- ✚ Export quality grades often adhere to specific industry or country-based guidelines, such as the Specialty Coffee Association (SCA) or national grading systems like those in Ethiopia or Colombia.

✓ **Defect Management**

- ✚ Grading allows the identification and removal of defective beans, which could negatively impact the flavor, appearance, or aroma of the final roasted product. By evaluating the number and types of defects, graders can determine whether a batch of beans is suitable for high-end markets or must be sold at a lower grade.
- ✚ This process also helps in quality control during processing, ensuring that beans with issues such as insect damage, fermentation, or mold are removed before roasting.

✓ **Optimizing Roasting**

- ✚ By sorting beans into grades based on size, density, and moisture content, grading helps roasters achieve more even and consistent roasting. Beans of similar size and density roast more uniformly, resulting in a more balanced flavor profile.
- ✚ Grading allows roasters to choose the best roasting profiles for different grades of coffee, optimizing the flavor potential of each batch.

✓ **Enhancing Marketability**

- ✚ Grading adds credibility to the coffee's value, helping producers and exporters market their coffee to specific buyers. High-grade coffees are often sought after in the specialty coffee market, where buyers are willing to pay a premium for top-quality beans.

- ✚ Having an official grade improves the coffee's reputation, allowing it to be marketed as premium or specialty coffee, attracting consumers who are willing to pay more for quality.

✓ **Facilitating Trade**

- ✚ Coffee grading provides a common language and set of standards between producers, traders, and buyers. Buyers know what to expect based on the grade, which simplifies the negotiation and buying process.
- ✚ Grading systems enable buyers and sellers to communicate about quality without having to sample every batch, streamlining the transaction process.

✓ **Improving Processing and Farming Practices**

- ✚ Grading systems help coffee producers and processors identify areas for improvement in cultivation, harvesting, and processing. If a producer consistently achieves lower grades, they can use this feedback to adjust their practices and aim for higher-quality beans in the future.
- ✚ This feedback loop encourages improvements in agricultural practices, drying methods, and quality control processes.

✓ **Promoting Sustainability**

- ✚ By grading and pricing coffee based on quality, the system rewards producers who invest in sustainable and high-quality farming practices. Premium prices for high-grade coffee can encourage farmers to adopt better practices that improve both the quality of the coffee and the sustainability of their farming methods.

Method of grading

- ✓ **Screen size grading** of green coffee refers to the process of classifying beans based on their physical size using standardized screens or sieves. This system helps ensure uniformity in the size of beans, which is crucial for consistent roasting and quality control. The size of the beans is measured by the diameter of the holes in the screens, which are defined in increments of 1/64 of an inch.

✚ **How Screen Size Grading Works:**

- **Screens** are metal sheets with different hole sizes through which the coffee beans pass. These screens are stacked, with larger-hole screens at the top and progressively smaller ones below.
- The beans are placed on the top screen and shaken or vibrated, allowing beans smaller than the hole size to fall through to the next screen.
- This process continues until the beans settle on a screen that corresponds to their size.

✚ **Screen Size Measurement:**

- The screen size is designated by a number, indicating the diameter of the holes in 1/64 of an inch. For example:

- Screen 18: Holes are 18/64 of an inch (7.14 mm) in diameter.
- Screen 16: Holes are 16/64 of an inch (6.35 mm) in diameter.
- Screen 14: Holes are 14/64 of an inch (5.56 mm) in diameter.

Common Screen Sizes for Green Coffee:

- **Screen 20:** Large beans, usually for premium Arabica coffee.
- **Screen 18:** Also used for high-quality Arabica; typically considered “AA” grade.
- **Screen 16:** Medium-sized beans; widely used for standard commercial Arabica coffee.
- **Screen 14:** Often used for Robusta or smaller Arabica beans.

Different coffee-producing regions may use slightly different standards for screen size, but the principles are the same.

Importance of Screen Size Grading:

- **Uniform Roasting:** Beans of similar size roast at the same rate. Grouping beans by size ensures consistent roasting, leading to uniform flavor development.
- **Quality Control:** Larger beans are often associated with higher quality. Smaller or uneven-sized beans may roast unevenly, leading to defects in flavor.
- **Market Classification:** Some coffee markets and grading systems, like in Kenya or Colombia, use screen size as part of the coffee grading system. Larger beans often command higher prices.
- **Segregating Defective Beans:** Small, broken, or defective beans are often removed during the screen grading process, ensuring only higher-quality beans move forward.

Global Standards and Terminology:

- Different countries and regions have their own grading terminology that relates to screen size:
 - **Colombia:** Uses "Supremo" (screen size 17/18) and "Excelso" (screen size 15/16) classifications.
 - **Kenya:** Grades coffee as "AA" (screen size 18) and "AB" (screen size 15/16).
 - **Brazil:** Common grades are based on screen size, such as "17/18" for larger beans and "14/16" for smaller ones.
- ✓ Defects grading of green coffee is a system used to evaluate and classify

coffee beans based on the presence and severity of physical imperfections or defects. Defects in green coffee beans can significantly impact the quality, flavor, and overall value of the coffee, making defect grading an essential part of the coffee quality assessment process.

Purpose of Defects Grading:

- **Quality Control:** Defects can negatively affect the taste and aroma of the final cup of coffee. Grading based on defects helps ensure that only high-quality beans are processed and sold.
- **Fair Pricing:** Defect grading helps determine the price of coffee. Beans with fewer defects command higher prices, while lower-grade beans with more defects are priced lower.
- **Consistency:** Removing defective beans ensures a more consistent quality in each batch, which is important for maintaining product standards in the coffee industry.

Types of Defects in Green Coffee:

Defects in green coffee beans are typically classified into **two main categories: primary (major) and secondary (minor) defects**. Each defect type is assigned a certain number of defect points, which are used to determine the overall grade of the coffee.

➤ **Primary (Major) Defects:**

These are the most serious defects and have a significant impact on the quality of the coffee. Each primary defect is usually assigned more points because they can severely affect the taste and quality of the coffee.

Examples of primary defects:

- **Black Beans:** Fully black beans, often caused by poor processing, fermentation issues, or disease. These beans have a strong negative effect on flavor.
- **Sour Beans:** Beans that have a sour or fermented taste, often due to improper drying or fermentation.
- **Moldy Beans:** Beans with visible mold, usually due to improper storage or drying, which can affect both the safety and flavor of the coffee.
- **Foreign Matter:** Presence of non-coffee materials like sticks, stones, or shells in the coffee batch.
- **Insect-Damaged Beans:** Beans that have been damaged by insects, leading to

holes or other visible damage.

➤ **Secondary (Minor) Defects:**

These are less severe defects but still affect the overall quality of the coffee. Each minor defect carries fewer points compared to primary defects.

Examples of secondary defects:

- **Broken or Chipped Beans:** Beans that are physically damaged but still retain their internal structure.
- **Immature Beans:** Small, underdeveloped beans that may lead to a grassy or astringent taste when roasted.
- **Shells:** Beans with loose parchment or parts of the bean skin attached.
- **Partial Black Beans:** Beans that are partially black, indicating partial fermentation or disease.
- **Floater Beans:** Beans that float in water due to being hollow or having less density, often due to poor development.

🔲 **Defects Scoring and Grading:**

The overall quality of a batch of green coffee is determined by counting the number and type of defects found in a 300-gram sample. Each defect type is assigned a point value, and the total number of defect points determines the grade of the coffee.

Defect Points System:

- Each **primary defect** is typically assigned 3–5 defect points.
- Each **secondary defect** is assigned 1–2 defect points.

🔲 **Grading Classifications Based on Defects:**

➤ **Specialty Grade:**

- 0–5 total defect points.
- No primary defects are allowed.
- Beans are almost perfect, with very few or no visual defects, resulting in a superior cup profile.

➤ **Premium Grade (High Commercial Grade):**

- 6–8 total defect points.
- Only a small number of minor defects allowed.

- Good quality, often sold as high-end commercial coffee.

➤ **Standard Grade (Commercial Grade):**

- 9–23 total defect points.
- A moderate amount of defects allowed, including some primary defects.
- Common in lower-priced, commercial coffee blends.

➤ **Off-Grade (Low Commercial Grade):**

- 24+ defect points.
- Contains a high number of defects, often including multiple primary defects.
- Typically used in low-quality commercial blends or instant coffee production.

 Common Grading Systems for Defects:

- **Specialty Coffee Association (SCA) Grading:** The SCA uses a 300-gram sample to assess defects and classifies beans into specialty and non-specialty grades based on the number and severity of defects.
- **National Grading Systems:** Many coffee-producing countries, such as Colombia, Kenya, and Ethiopia, have their own grading systems, often based on defect counts, size, and bean quality. These systems may use similar criteria but may have specific rules depending on regional practices.

 Impact of Defects on Flavor:

- **Black Beans:** Can give the coffee a burnt, bitter, or harsh flavor.
 - **Sour Beans:** Impart a sour, vinegar-like, or fermented taste.
 - **Moldy Beans:** Can introduce earthy, musty, or undesirable flavors.
 - **Broken/Chipped Beans:** Affect uniformity during roasting, leading to uneven flavor development.
 - **Immature Beans:** Contribute to grassy or astringent flavors.
- ✓ **Specialty coffee grading** is a systematic process that evaluates coffee beans based on their quality, flavor, aroma, and overall characteristics. The goal of specialty coffee grading is to ensure that only the highest-quality beans are recognized and marketed as "specialty" coffee. Here's a detailed overview of the specialty coffee grading process:

 Definition of Specialty Coffee

Specialty coffee is defined as coffee that scores 80 points or above on a 100-point scale, as evaluated by certified coffee graders, often referred to as Q Graders. Specialty coffee is characterized by its unique flavors, high quality, and distinct origin, making it stand out from commercial-grade coffee.

Grading Criteria

Specialty coffee grading involves assessing several key factors, including:

➤ **Flavor:**

- The primary attribute evaluated in specialty coffee.
- Coffee is assessed for its unique flavors, complexity, balance, and finish.

➤ **Aroma:**

- Evaluators assess both the dry and wet aroma of the coffee.
- The smell of the coffee before and after brewing can indicate quality.

➤ **Acidity:**

- Refers to the bright, tangy flavors that can add liveliness to the coffee.
- Specialty coffees typically have a pleasant acidity that enhances flavor.

➤ **Body:**

- The weight and thickness of the coffee on the palate.
- Specialty coffees can range from light to full-bodied.

➤ **Aftertaste (Finish):**

- The lingering flavors after swallowing the coffee.
- Specialty coffees often have a clean and pleasant aftertaste.

➤ **Balance:**

- The harmony between the coffee's various flavors, acidity, body, and aftertaste.
- A well-balanced coffee presents no dominant flaws and allows all attributes to shine.

➤ **Cleanliness:**

- Refers to the absence of off-flavors or defects.

- Specialty coffee should have a clear and clean profile without undesirable tastes.

➤ **Uniformity:**

- Consistency in size, shape, and roasting characteristics among the beans in a batch.

➤ **Defects:**

- A count of defects is crucial in specialty coffee grading. Coffee with fewer defects is more desirable.
- Specialty coffee typically allows for minimal to no defects, particularly in primary categories.

 Grading Process

➤ **Sample Preparation:**

- A sample of coffee beans (usually 300 grams) is taken from a larger lot.
- The beans are visually inspected for defects and size.

➤ **Roasting:**

- Beans are roasted to a specific profile, typically light to medium, to highlight their unique flavors.
- Roasting is done in small batches, allowing for careful monitoring of the process.

➤ **Brewing:**

- Coffee is brewed using a consistent method, often employing the cupping process.
- Cupping allows evaluators to taste and assess the coffee in a controlled manner.

➤ **Evaluation:**

- A trained panel or certified Q Grader scores the coffee based on the established criteria.
- Each characteristic is rated on a scale, and scores are totaled to determine the final grade.

➤ **Final Scoring:**

- A coffee must score at least 80 points out of 100 to be classified as specialty

coffee.

- Scores of 85 and above are often considered premium specialty coffee, while scores of 90 and above denote exceptional quality.

❖ **Certification**

- ♦ Many organizations, such as the Specialty Coffee Association (SCA) and the Coffee Quality Institute (CQI), offer certification programs for Q Graders and specialty coffee assessors.
- ♦ Grading standards can vary slightly between organizations, but the fundamental principles remain consistent.

Importance of Specialty Coffee Grading

- **Quality Assurance:** Ensures only high-quality beans reach consumers, promoting excellence in the coffee industry.
- **Market Differentiation:** Helps distinguish specialty coffee from commercial-grade coffee, allowing consumers to make informed choices.
- **Consumer Education:** Increases awareness of the factors that contribute to coffee quality and flavor, enhancing the appreciation of specialty coffee.
- **Fair Pricing:** Specialty coffee typically commands higher prices due to its quality, rewarding producers for their efforts in growing and processing high-grade coffee.

Conclusion

Specialty coffee grading is an essential process that evaluates and classifies coffee beans based on specific quality criteria. By focusing on attributes such as flavor, aroma, acidity, and cleanliness, the specialty coffee grading system ensures that consumers receive high-quality products. This system not only enhances the appreciation of coffee but also supports producers in their pursuit of excellence in coffee cultivation and processing.

❖ **SCAA: Specialty Coffee Association of America.**

The green coffee classification standard provided by the SCAA is an excellent method to classify coffees. It is superior over some systems in that it better accounts for the relationship between defect and cup quality. However, it leaves out a few of the important defects that can occur in coffee.

To classify a coffee, 300 grams of properly hulled coffee is classified according to the

standards given below. 100 grams of this coffee is sorted using screens 14, 15, 16, 17, and 18. The coffee remaining in each screen is weighed and the percentage is recorded. Since classifying 300 grams of coffee is very time consuming, 100 grams of coffee is typically used. It is recommended that if the coffee is of high quality with few defects to use 300 grams. If the coffee is of a lower quality with many defects 100 grams will often suffice in a correct classification as either Below Standard Grade or Off Grade. The coffees then must be roasted and cupped to evaluate cup characteristics.

- ◆ **Speciality Grade (1):** Not more than 5 full defects in 300 grams of coffee. No primary defects allowed. A maximum of 5% above or below screen size indicated is tolerated. It must possess at least one distinctive attribute in the body, flavour, aroma, or acidity. It must be free of faults and taints. No Quakers are permitted. Moisture content is between 9-13%.
- ◆ **Premium Grade (2):** No more than 8 full defects in 300 grams. Primary defects are permitted. A maximum of 5% above or below screen size indicated is tolerated. It must possess at least one distinctive attribute in the body, flavour, aroma, or acidity. It must be free of faults and may contain only 3 Quakers. Moisture content is between 9-13%.
- ◆ **Exchange Grade (3):** 9-23 full defects in 300 grams. It must have 50% by weight above screen size 15 with no more than 5% of screen size below 14. No cup faults are permitted and a maximum of 5 Quakers are allowed. Moisture content is between 9-13%.
- ◆ **Below Standard Grade (4):** 24-86 defects in 300 grams.
- ◆ **Off Grade (5):** More than 86 defects in 300 grams.

❖ **Brazil/ New York method**

In the Brazilian method 300 grams of coffee is classified. The number of beans equivalent to one full defect is given below. For example, every three shells counts as one full defect. On the other hand one large rock counts as five full defects. If a bean has more than one defect the highest defect is counted. For example an insect damaged black bean counts as one full defect. The table is split up into two since Brazilian legislation allows a maximum of 1% of foreign defects. After counting the number of defects uses the third chart to classify the type and its point rating.

✓ **Grade specification**

Grading is the separation of beans according to **size, shape and density**.

✚ **Shape:** The coffee bean has three dimensions: **length, width, and thickness**. It is usually **oblong, fairly flat, and boat shaped**. A flat bed grader and a drum grader separate the beans according to size.

- ✚ **Density:** Coffee is graded based on size and weight. They are also sorted pneumatically by using an air jet to separate heavy from light beans.
- ✚ **Size:** Beans are sized by being passed through a series of screens with holes that only allow a certain size of beans to pass through.

There are 5 grades determined by bean size:

Grade0: beans held back by screen No. 18 (7mm holes)

Grade I: beans passing through screen No. 18 and held back by screen No. 16 (6.3 mm holes)

Grade II: beans passing through screen No. 16 and held back by screen No. 14 (5.5 mm holes)

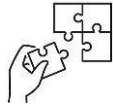
Grade III: beans passing through screen No. 14 and held back by screen No. 12 (4.7 mm holes)

Grade IV: beans passing through screen No. 12 and held back by screen No. 10 (4mm holes)



Points to Remember

- The purpose of grading green coffee is to classify and evaluate the quality of coffee beans based on specific criteria such as size, weight and defects.
- Screen size grading of green coffee refers to the process of classifying beans based on their physical size using standardized screens or sieves.
- Defects grading of green coffee is a system used to evaluate and classify coffee beans based on the presence and severity of physical imperfections or defects.
- Specialty coffee grading is a systematic process that evaluates coffee beans based on their quality, flavor, aroma, and overall characteristics.



Application of learning 3.3.

You are requested to go in your school's coffee processing workshop to grade green coffee respecting green coffee grading parameters.



Learning outcome 3 end assessment

Theoretical assessment

1. Read the statements below and circle the correct answer

i. The primary purpose of coffee de-hulling is?

- a) To add flavor to the coffee beans
- b) To remove the parchment layer (endocarp) from the coffee bean
- c) To polish the coffee beans for better appearance
- d) To roast the coffee beans evenly

ii. What is a key benefit of de-hulling coffee beans before roasting?

- a) It reduces the weight of the beans for packaging
- b) It removes any remaining silver skin from the beans
- c) It ensures even roasting of the green coffee beans
- d) It increases the bean size for better brewing

iii. Which of the following is a potential drawback of coffee polishing?

- a) It makes the beans harder to roast
- b) It can alter the chemical makeup of the beans, affecting taste
- c) It leads to increased moisture in the beans
- d) It causes the beans to lose their color

iv. Which hulling method involves removing the parchment layer while the coffee is still wet?

- a) Dry hulling
- b) Wet hulling
- c) Polishing
- d) Sieving

v. What method is commonly used for husk separation after the hulling and polishing process?

- a) Sieving
- b) Drying
- c) Roasting
- d) Packaging

2. Answer by **True** if the statement is correct and **False** if the statement is incorrect

- i. Sorting green coffee beans helps to maintain consistent quality across batches by removing defective beans.
- ii. Beans of varying sizes and densities roast at the same rate, ensuring uniform flavour development.
- iii. Sorting green coffee beans enhances the flavour profile by removing defective beans that may introduce undesirable flavours.
- iv. Coffee that is well-sorted with minimal defects is less appealing to consumers and commands a lower price in the market.
- v. The presence of black beans in green coffee is usually caused by improper drying and can result in a bitter and undrinkable beverage.

3. Fill in the blank space with the following words (**size, five, one over sixty four**).

- a. The screen size used to measure coffee bean diameter is designated by a number, representing the hole size in increments of of an inch.
- b. Grading helps coffee roasters achieve more even roasting by ensuring beans of similarare grouped together, leading to a balanced flavor profile.
- c. Specialty Grade coffee, according to the Specialty Coffee Association, allows a maximum offull defects in a 300-gram sample and no primary defects.

Practical assessment

Your school have a food processing unit that process coffee cherries into parchment and ground coffee. The coffee produced is used for breakfast of teaching staff. Recently, there have been complaints from teaching staff over the past two consecutive months regarding the flavour and tastes of the served coffee that might be due to poor pulping of coffee cherries, fermentation ,washing, grading and drying of parchment coffee.

You are requested to go in school coffee processing workshop to perform the tasks below:

Task:

- 1. De-hull parchment coffee
- 2. Sort green coffee beans
- 3. Grade green coffee beans

All necessary materials, tools and equipment are available in the workshop. The task should be completed in 4 hours.



References

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Learning Outcome 4: Grind Roasted Coffee



Indicative contents

4.1 Roasting green coffee

4.2 Cooling roasted coffee

4.3 Testing quality of roasted coffee

4.4 Grinding roasted coffee

4.5 Storing Roasted coffee and ground coffee

Key Competencies for Learning Outcome 4: Grind roasted coffee

Knowledge	Skills	Attitudes
• Description of roasting conditions • Description of roasted coffee categories • Identification of changes during roasting • Description of cooling conditions • Description of roasted coffee quality parameters	• Roasting coffee • Cooling roasted coffee • Testing quality of roasted coffee • Grading roasted coffee • Storing roasted coffee	• Being carefully in coffee roasting • Being attentive in cooling • Being attentive in testing • Being carefully in grading • Having accountability in storing roasted coffee



Duration: 20 hrs.

Learning outcome 2 objectives:



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

1. Describe appropriately the roasting conditions as respected during coffee processing.
2. Roast properly coffee beans based on roasting conditions.
3. Describe correctly roasted coffee categories according to the quality of product.
4. Identify successfully the changes during roasting respecting the quality of product.
5. Cool properly roasted coffee according to the cooling conditions.

6. Describe appropriately the cooling conditions based on cooling conditions
7. Describe correctly the quality parameters of roasted coffee according to the quality of product.
8. Test correctly the quality of roasted coffee based on quality parameters of product.
9. Grade correctly roasted coffee according to the quality of product.
10. Store properly the roasted coffee respecting storage conditions.



Resources

Equipment	Tools	Materials
• Weighing balance • Coffee roaster • Coffee grinder • Cupping table • Packaging machine • Sealing machine • Labelling machine	• Basins • Timer • Analytical balances • Moisture meter • Hygrometer • Thermometer • Brushes • Buckets • Kettles • Cupping bowls • Hot water glass • Coffee testing spoons • Plastic cups • Colour checker • Magnets • Coffee cupping trays	• Packaging material • Green coffee • Serviettes • Water • Cupping form



Indicative content 4.1: Roasting green coffee



Duration: 5 hrs



Theoretical Activity 4.1.1: Description of roasting process



Tasks:

- 1: Answer the following question related to the description of roasting conditions, categories of roasted coffee and changes during coffee roasting.
 - i. What do you understand by green coffee roasting?
 - ii. What may be the changes during coffee roasting?
 - iii. What can be the categories of roasted coffee?
- 2: Provide the answers to the asked questions by writing on papers, flip chart.
- 3: Present the findings
- 4: For more clarification read the key readings 4.1.1



Key readings 4.1.1: Description of roasting process

- **Coffee roasting**

Roasting coffee is a crucial step in the coffee production process that transforms green coffee beans into the aromatic, flavourful product that consumers enjoy. The roasting process involves applying heat to the beans, which triggers a series of chemical reactions, enhancing flavor and aroma.

- **Roasting conditions**

- ✓ **Temperature**

- ✚ **Initial Roasting Temperature:** Roasting typically starts at a temperature between **350°F and 400°F (175°C - 200°C)**.

- ✚ **Development of Temperature:** The temperature increases gradually throughout the roast, often reaching up to **450°F (230°C)** or higher for darker roasts.

- ✚ **First Crack:** Occurs at about **400°F (204°C)**; this is when the beans expand and release steam, resulting in a popping sound. This marks the transition from light to medium roast.

- ✚ **Second Crack:** Occurs around **450°F (232°C)** and signifies the onset of darker roasts. It indicates the beans have expanded further and are beginning to break down chemically.

✓ Time

✚ **Roasting Duration:** The length of the roast affects flavor development.

- **Light Roasts:** Typically roasted for **6-8 minutes**; retains more of the original coffee bean's flavors.
- **Medium Roasts:** Usually roasted for **8-12 minutes**; develops more sweetness and complexity.
- **Dark Roasts:** Roasted for **12-15 minutes** or longer; features bold flavors and diminished acidity.

✚ **Cooling Time:** Post-roasting, beans should be cooled quickly to halt the roasting process. This can be done using air cooling, water cooling, or simply spreading them out to cool in ambient air.

✓ Airflow

✚ **Hot Air Roasting:** Involves circulating hot air around the beans, which helps maintain an even temperature and allows for consistent heat transfer.

✚ **Low vs. High Airflow:** Adjusting airflow can affect the roast profile:

- **High Airflow:** Reduces the risk of chaff accumulation and helps achieve a cleaner flavor.
- **Low Airflow:** Retains more heat and can enhance caramelization, contributing to deeper flavors.

✓ Bean Agitation

✚ **Agitation During Roasting:** Continuous movement of the beans ensures even roasting and prevents burning.

✚ **Drum Roasters:** Naturally agitate beans as they tumble.

✚ **Air Roasters:** Utilize air currents to keep the beans in motion.

✓ Description of categories of roasted coffee

Roasted coffee can be categorized based on the degree of roast, flavor profiles, and other characteristics that emerge during the roasting process. The main categories of roasted coffee are typically classified into three primary roast levels: **light**, **medium**, and **dark**. Here's a detailed description of each category:

✚ Light Roast

Characteristics:

- **Color:** Light brown, often with no oil on the surface.
- **Flavor Profile:** Bright, fruity, and acidic; retains the original flavors of the coffee bean. Common tasting notes include citrus, floral, and berry-like flavors.
- **Aroma:** Sweet and fragrant, often showcasing the inherent qualities of the bean origin.
- **Body:** Light, with a crisp texture and clean finish.

Roasting Temperature: Typically roasted to an internal temperature of about **350°F to 400°F (175°C - 204°C)**, just before the first crack.

Medium Roast

Characteristics:

- **Color:** Medium brown, with a slight sheen from the oils beginning to appear on the surface.
- **Flavor Profile:** Balanced flavor with a blend of acidity and sweetness; often characterized by a nutty or chocolaty taste. Tasting notes may include caramel, toffee, and mild fruitiness.
- **Aroma:** Rich and sweet, often with a hint of roasting notes.
- **Body:** Medium body, offering a smooth and round mouthfeel.

Roasting Temperature: Generally roasted to an internal temperature of **410°F to 430°F (210°C - 220°C)**, typically around the first crack and slightly into the second crack.

Dark Roast

Characteristics:

- **Color:** Dark brown to nearly black, with an oily surface that can be glossy.
- **Flavor Profile:** Bold and robust, with pronounced bittersweet flavors. Common tasting notes include chocolate, smoke, caramelized sugar, and even a slight char.
- **Aroma:** Intense and rich, often with smoky or toasty notes.
- **Body:** Full-bodied, with a heavier mouthfeel.

Roasting Temperature: Roasted to an internal temperature of **440°F to 480°F (227°C - 249°C)**, usually around the second crack.

Specialty Roast Categories

Beyond the basic roast levels, specialty coffee can also be categorized into various subcategories based on specific flavor profiles or roasting techniques:

- **City Roast:** A light to medium roast where the coffee retains more of its original flavors, often preferred by those who enjoy nuanced, complex coffee.
- **Full City Roast:** A medium roast with a richer flavor profile that balances acidity and body, showcasing both the bean's origin and the roasting process.
- **French Roast:** A dark roast that is very oily and has a pronounced smoky flavor. It typically features lower acidity and a bold, bittersweet taste.
- **Italian Roast:** Darker than French roast, often roasted past the second crack, resulting in a more pronounced bitterness and depth of flavor, commonly used for espresso.
- **Vienna Roast:** A roast level between medium and dark, characterized by a balance of sweetness and deep, smoky notes, with a slightly oily surface.

❖ Flavor Profiles

The flavor of roasted coffee can also vary based on the origin of the beans and the roasting method used:

- ◆ **Single-Origin:** Coffee sourced from a specific region or farm, highlighting unique flavors characteristic of that area.
- ◆ **Blend:** A combination of beans from different origins, crafted to achieve a desired flavor profile that balances acidity, sweetness, and body.



Practical Activity 4.1.2: Green coffee roasting

Task:

- 1: You are requested to go in the coffee processing workshop to roast green coffee.
- 2: Apply safety precautions.
- 3: Present out the green coffee roasting process.
- 4: Referring to the procedures provided on step 3, roast green coffee.
- 5: Present your work to the trainer and whole class. Ask for clarification where necessary

6: Read key reading 4.1.2

7: Perform the task provided in application of learning 4.1



Key readings 4.1.2 Green coffee roasting

- **Roasting methods**

- ✓ **Manual Roasting**

Description:

Manual roasting involves the hands-on approach of roasting coffee beans, often performed in small batches. This method allows for greater control over the roasting process and is commonly used by home roasters or small-scale artisan roasters.

Methods:

- ✚ **Stovetop Roasting:** Using a pan or pot on a stovetop, the roaster heats the beans while constantly stirring to ensure even roasting. This method can require a keen eye and attention to detail.
- ✚ **Popcorn Popper:** Some home roasters use hot air popcorn poppers to roast coffee beans. The rapid circulation of hot air helps achieve an even roast.
- ✚ **Open Flame Roasting:** This traditional method involves placing beans directly over an open flame, often in a metal drum or pan. This requires skill to control the heat and prevent burning.
- ✚ **DIY Roasters:** Enthusiasts may create their own roasting devices, such as modified ovens or drum roasters, allowing for more experimentation.

Characteristics:

- ✚ **Control:** Manual roasting provides the roaster with immediate control over heat application, duration, and bean agitation.
- ✚ **Flavor Development:** The roaster can experiment with different roast profiles and flavors, allowing for unique outcomes.
- ✚ **Small Batches:** Typically limited to small quantities, making it ideal for individual consumption or small-scale sales.

- ✓ **Mechanical Roasting**

Description:

Mechanical roasting involves using automated machines designed to roast coffee

beans in larger batches. This method is commonly used by commercial roasters and large-scale operations to ensure consistency and efficiency in the roasting process.

Types of Mechanical Roasters:

- ✚ **Drum Roasters:** These machines use a rotating drum to evenly distribute heat and ensure even roasting. The beans are heated from the outside while rotating inside the drum.
- ✚ **Air Roasters:** Utilizing hot air to roast coffee beans, air roasters circulate air around the beans, allowing for quick and even roasting. This method is often associated with a cleaner flavor profile.
- ✚ **Hybrid Roasters:** Combine features of both drum and air roasting, allowing for versatility in roasting styles.

Characteristics:

- ✚ **Efficiency:** Capable of roasting large quantities of coffee beans in a shorter period.
- ✚ **Consistency:** Automated settings and controls allow for precise replication of roast profiles, leading to uniform results across batches.
- ✚ **Heat Distribution:** Mechanical roasters are designed to provide even heat distribution, reducing the likelihood of under- or over-roasting.

✓ **Description of changes during coffee roasting**

During the coffee roasting process, green coffee beans undergo significant physical and chemical changes that transform them into the aromatic, flavorful roasted beans consumers enjoy. Here's a detailed description of these changes:

✓ **Physical Changes**

➤ **Color Change:**

- **Initial State:** Green coffee beans are pale and have a dry appearance.
- **During Roasting:** As roasting progresses, the beans turn from green to yellow and then to various shades of brown. This change is due to the Maillard reaction and caramelization of sugars.

➤ **Expansion:**

- **Size:** Coffee beans expand in size as they heat up, approximately **20-30% larger** by the end of the roasting process.

- **Weight Loss:** The moisture content decreases (from about 10-12% to 1-2%), resulting in a weight loss of approximately **15-20%** due to steam and volatile compounds escaping.

➤ **Surface Texture:**

- **Oil Development:** As roasting progresses, oils begin to surface on the beans, especially in darker roasts. The beans can appear glossy or oily as they reach higher temperatures.
- **Cracks:** The first crack occurs at around **400°F (204°C)**, and the second crack at around **450°F (232°C)**, signaling significant physical changes in the bean structure.

➤ **Shape:**

- The beans become more irregular in shape due to expansion and the impact of heat, losing their original smoothness.

 Chemical Changes

➤ **Maillard Reaction:**

- This complex chemical reaction occurs between amino acids and reducing sugars at elevated temperatures, contributing significantly to flavor and aroma development. It typically starts around **300°F (150°C)** and continues throughout the roasting process, resulting in brown pigments and complex flavors.

➤ **Caramelization:**

- At temperatures above **320°F (160°C)**, sugars in the beans begin to break down and caramelize, contributing sweetness and deeper flavors. This process enhances the complexity of the coffee's taste profile.

➤ **Development of Aromatic Compounds:**

- As roasting occurs, numerous volatile compounds are formed, including aldehydes, esters, and pyrazines, contributing to the characteristic aroma of roasted coffee. These compounds emerge at various stages of roasting, adding to the complexity of flavors.

➤ **Degradation of Chlorogenic Acids:**

- Green coffee contains chlorogenic acids, which break down during roasting, affecting acidity and contributing to the flavor profile. This degradation leads to reduced perceived acidity in darker roasts.
- **Formation of Acids:**
 - Various acids, including citric, acetic, and quinic acids, develop during roasting. The levels of these acids can vary based on roast level, affecting the overall flavor and acidity of the coffee.
- **Formation of Bitter Compounds:**
 - As beans reach darker roast levels, bitter compounds such as caffeine and phenols become more prominent. These compounds contribute to the bittersweet character of darker roasts.

Summary of Changes During Roasting

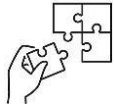
Aspect	Physical Changes	Chemical Changes
Color	Green to yellow to brown	Formation of brown pigments (Maillard reaction)
Size	Beans expand and lose moisture	Weight loss of approximately 15-20%
Surface Texture	Oily appearance, development of cracks	Oil production and breakdown of structures
Shape	Irregular, less smooth	Structural changes due to heat
Flavor Development	Changes in taste profile	Formation of aromatic compounds
Acidity	Decreased perceived acidity in darker roasts	Breakdown of chlorogenic acids
Bitterness	Increased bitterness in darker roasts	Formation of bitter compounds



Points to Remember

- The main categories of roasted coffee are typically classified into three primary roast levels: light, medium, and dark

- Manual roasting involves the hands-on approach of roasting coffee beans, often performed in small batches.
- Mechanical roasting involves using automated machines designed to roast coffee beans in larger batches.
- During the coffee roasting process, green coffee beans undergo significant physical and chemical changes that transform them into the aromatic, flavourful roasted beans.



Application of learning 4.1.

You are requested to go in your school's coffee processing workshop to roast green coffee respecting green coffee roasting parameters and conditions.



Indicative content 4.2: Cooling roasted coffee



Duration: 3 hrs



Theoretical Activity 4.2.1: Description of cooling roasted coffee



Tasks:

- 1: Answer the following question related to the description of cooling roasted coffee.
 - i. What do you understand by cooling roasted coffee?
 - ii. What may be the purpose of cooling roasted coffee?
 - iii. What are the conditions may be based on during cooling roasted coffee?
- 2: Provide the answers to the asked questions by writing on papers, flip chart.
- 3: Present the findings
- 4: For more clarification read the key readings 4.2.1



Key readings 4.2.1. Description of cooling roasted coffee

- **Purpose of cooling roasted coffee**

Cooling roasted coffee is a crucial step in the roasting process, and it serves several important purposes:

- ✓ **Halting the Roasting Process**

- ✚ **Stopping Further Development:** Immediately cooling the coffee beans halts the roasting process to prevent them from continuing to cook due to residual heat. This is essential for achieving the desired roast level and flavor profile.

- ✚ **Preventing Over-Roasting:** If the beans are not cooled quickly, they can become over-roasted, leading to a burnt flavor and loss of the intended characteristics.

- ✓ **Preserving Flavor and Aroma**

- ✚ **Flavor Retention:** Rapid cooling helps lock in the aromatic compounds and flavors developed during roasting. If the beans remain hot for too long, volatile compounds that contribute to the coffee's aroma and flavor can dissipate.

- ✚ **Aromatic Preservation:** The cooling process preserves the delicate balance of flavors that may be altered or lost if cooling is delayed.

✓ **Improving Quality and Consistency**

✚ **Uniformity:** Quick cooling promotes uniformity in flavor and color across all beans, ensuring a consistent product. Uneven cooling can lead to variations in taste and quality.

✚ **Quality Control:** For commercial roasters, effective cooling is vital for maintaining high standards of quality in their coffee offerings.

✓ **Reducing Risk of Defects**

✚ **Minimizing Defects:** If beans cool slowly, they may develop defects such as "quakers" (unroasted or poorly roasted beans) or undesirable flavors. Rapid cooling helps mitigate these issues.

✚ **Avoiding Oiliness:** In darker roasts, rapid cooling prevents excessive oil accumulation on the surface of the beans, which can affect flavor and shelf life.

✓ **Facilitating Packaging and Storage**

✚ **Safe Handling:** Cooling the beans makes them safer to handle, preventing burns to workers or equipment.

✚ **Storage Stability:** Properly cooled beans can be stored more effectively, as residual heat can lead to moisture build up, increasing the risk of mold or spoilage.

✓ **Enhancing Aroma Development**

✚ **Allowing Aroma Release:** During the cooling process, volatile compounds are released, enhancing the aromatic profile of the coffee. This release can contribute to a more aromatic cup of coffee when brewed.

• **Methods of Cooling**

Roasters typically use one of the following methods to cool roasted coffee:

✓ **Air Cooling:** Using fans or air circulation to cool the beans quickly. This is the most common method and allows for rapid temperature reduction.

✓ **Water Quenching:** A less common method where beans are sprayed with water to cool them. However, this can alter the flavor profile and is generally avoided in high-quality roasting practices.

✓ **Description of cooling condition**

- Temperature Conditions

➤ **Cooling Temperature:**

- The goal is to rapidly reduce the temperature of the roasted coffee beans from their roasting temperature (typically around **400°F to 480°F (204°C to 249°C)** for dark roasts) to a safe handling temperature, generally around **70°F to 100°F (21°C to 38°C)**.
- Quick cooling is essential to halt the roasting process effectively and preserve the flavors developed during roasting.

➤ **Cooling Environment:**

- The cooling environment should ideally be well-ventilated, allowing for proper air circulation to facilitate heat dissipation.
- Avoiding excessive humidity is important, as moisture can lead to defects in the beans and negatively impact flavor.

• Time Conditions

➤ **Cooling Time:**

- **Ideal Cooling Duration:** Roasted coffee should be cooled as quickly as possible, typically within **3 to 5 minutes** after the roasting is complete. This timeframe is crucial for preventing further cooking and flavor degradation.
- **Cooling Methods Impacting Time:**
 - **Air Cooling:** This method can achieve rapid cooling, often within the 3 to 5-minute range, depending on airflow and ambient conditions.
 - **Water Quenching:** While effective in rapidly lowering temperature, this method is less commonly used in high-quality roasting due to potential flavor alteration. When used, it can cool beans almost instantaneously.

➤ **Factors Affecting Cooling Time:**

- **Batch Size:** Larger batches may require slightly more time to cool evenly compared to smaller batches.
- **Roast Level:** Darker roasts may retain heat longer, necessitating efficient cooling methods to prevent overdevelopment of flavors.

• Recommended Cooling Practices

- ✓ **Airflow:** Using fans or other airflow devices during the cooling process can significantly enhance cooling efficiency. Strong air circulation can help lower temperatures rapidly while ensuring uniform cooling of all beans.
- ✓ **Cooling Equipment:** Many commercial roasters come equipped with built-in cooling trays or devices designed to optimize airflow and expedite cooling.



Practical Activity 4.2.2: Cooling roasted coffee



Task:

- 1: You are requested to go in the coffee processing workshop to cool roasted coffee.
- 2: Apply safety precautions.
- 3: Present out the roasted coffee cooling process.
- 4: Referring to the procedures provided on step 3, cool roasted coffee.
- 5: Present your work to the trainer and whole class. Ask for clarification where necessary
- 6: Read key reading 4.2.2
- 7: Perform the task provided in application of learning 4.2



Key readings 4.2.2 Cooling roasted coffee

- **Application of cooling methods:**

Cooling methods for roasted coffee, such as **room cooling** and **fan cooling**, play essential roles in ensuring that the coffee beans are cooled efficiently and effectively. Each method has its own characteristics, advantages, and potential drawbacks. Here's a detailed overview of these two cooling methods:

- ✓ **Room Cooling**

- 🌈 **Description:** Room cooling involves allowing roasted coffee beans to cool naturally at ambient temperature without the aid of any specialized cooling equipment. The beans are typically spread out in a shallow layer to maximize

surface area exposure to cooler air.

Process:

- After roasting, the beans are transferred to a cooling tray, colander, or similar vessel, where they are left to cool down in a well-ventilated area.
- The beans may be stirred occasionally to promote even cooling and prevent clustering.

Characteristics:

- **Temperature:** The cooling process relies solely on the temperature of the surrounding environment, which can vary based on room conditions.
- **Time:** Cooling duration can be longer, often taking **10-15 minutes** or more, depending on the ambient temperature and humidity levels.

Advantages:

- **Simplicity:** Requires no additional equipment, making it a low-cost option for small roasters or home enthusiasts.
- **Gentle Cooling:** Reduces the risk of cracking or damaging the beans due to rapid temperature changes.

✓ **Fan Cooling**

 **Description:** Fan cooling employs a fan or air circulation system to rapidly cool roasted coffee beans. This method increases airflow around the beans, promoting quicker heat dissipation and more uniform cooling.

Process:

- After roasting, the beans are placed in a cooling tray or basket that is positioned in front of or beneath a fan.
- The fan circulates air around the beans, allowing for rapid temperature reduction, often within **3-5 minutes**.

Characteristics:

- **Temperature:** Effective at quickly reducing the temperature of the beans from roasting temperatures (around **400°F to 480°F**) to a safe handling temperature (about **70°F to 100°F**).

- **Time:** Significantly reduces cooling time compared to room cooling.

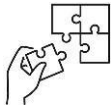
 Advantages:

- **Efficiency:** Rapid cooling helps prevent over-roasting and preserves flavor compounds, ensuring a consistent and high-quality product.
- **Uniformity:** Enhanced airflow promotes even cooling across all beans, reducing the risk of defects and ensuring uniform flavor profiles.
- **Control:** Roasters can better manage cooling conditions, minimizing the risk of temperature-related flavor degradation.



Points to Remember

- Cooling methods for roasted coffee, such as **room cooling** and **fan cooling**, play essential roles in ensuring that the coffee beans are cooled efficiently and effectively.
- While cooling roasted coffee, respect cooling conditions.
- Roasted coffee should be cooled in order to avoid cracking of beans and to facilitate grinding into desired specification.



Application of learning 4.2.

You are requested to go in your school's coffee processing workshop to cool roasted coffee respecting roasted coffee cooling conditions.



Indicative content 4.3: Testing quality of roasted coffee



Duration: 4 hrs



Theoretical Activity 4.3.1: Description of roasted coffee quality parameters.



Tasks:

- 1: Answer the following question related to the description of roasted coffee quality parameters.
 - I. What may be the roasted coffee quality parameters?
- 2: Provide the answers to the asked questions by writing on papers, flip chart.
- 3: Present the findings
- 4: For more clarification read the key readings 4.3.1



Key readings 4.3.1.: Description of roasted coffee quality parameters.

- **Check the quality of roasted coffee**

- ✓ **Brewing steps**

✚ **Water boiling:** The use of water is very important to the quality of the coffee. It is better to use filtered or bottled water as the tap water is not good or has a strong odour or taste, such as chlorine. When brewing coffee with water, it is avoided to use distilled or softened water as the distilled water is water that has been boiled to remove impurities, but also beneficial minerals. It is not a great choice for coffee as the minerals can enhance the flavour.

Water temperature should maintain at water boiling point. Colder water will result in flat, under-extracted coffee, while water that is too hot will also cause a loss of quality in the taste of the coffee.

✚ **Steeping:** a process of creating coffee by adding ground coffee to hot water. It is one way to experience immersion brewing.

Steeped coffee offers complexity in flavours as the coffee grounds remain in the hot water for more extended periods compared to the other coffee preparation methods. For a cup of hot coffee, just under five minutes as appropriate for steeping.

To make the coffee using a French Press, the contact time should be 2-4 minutes while making Espresso coffee has an especially brief brew time: the coffee is in

contact with the water for only 20-30 seconds. It is also possible to create a cold brew while steeping coffee. However, to accomplish this you will need to leave the coffee grounds in the water for around 12-24 hours.

For the best results, coarsely ground coffee should be used. Coarsely ground coffee is preferred to avoid having a cup of coffee that has coffee dust suspended within the liquid. This could lead to coffee dust settling at the bottom of the cup.

Steeping can affect the coffee taste. The coffee with an undesirable taste of the final product is likely either:

✓ **Extraction**

✚ **Strength:** coffee strength is the amount of caffeine contained in a coffee, then the largest single influence is the amount of coffee dosed compared to the amount of water to make a cup of coffee. In this regard the coffee makers the coffee has the most influence, as they will determine the ratio of coffee grinds to water during the brewing process.

The coffee strength can also mean the 'flavour' or how much 'bite' the coffee has.

- **Brew ration:** Coffee-to-Water Ratio: 15gr of ground coffee are dissolved in 225 ml of boiled water.
- **Dark roast coffee:** This produces shiny black beans with an oily on the surface and well-defined bitterness. The darker the roaster, less acidity will found in the coffee beverage as acidity relates to the degree of roast. The lighter the roast, the brighter the cup, the more acidity. A dark roast will have less acidity but more body. A medium bodied cup will have a balance of acidity and body. It has a dark colour and this may give the impression of a stronger tasting coffee; good taste.

✓ **Brewing methods**

✚ **Decoction:** it is extraction of water-soluble substances of coffee by boiling. It refers to brewed coffee that is usually later mixed with milk and sugar. Decoction is act of boiling coffee to extract the coffee flavours.

✚ **Infusion:** Infused coffee is the process of extracting flavours from coffee grounds, similar to steeping tea leaves. The infusion coffee method is a simple process illustrated below. For flavoured coffee, try adding cardamom pods, cinnamon sticks or vanilla beans to the infuser.

 **Espresso:** is a coffee making method of Italian origin, in which a small amount of nearly boiling water is forced under pressure through finely-ground coffee beans.

Espresso coffee can be made with a wide variety of coffee beans and roast levels. It is generally thicker than coffee brewed by other methods, has a higher concentration of suspended and dissolved solids, and has crema on top (foam with a creamy consistency). As a result of the pressurized brewing process, the flavours and chemicals in a typical cup of espresso are very concentrated.



Practical Activity 4.3.2: Cupping of coffee.



Task:

- 1: You are requested to go in the coffee processing workshop to perform cupping of coffee.
- 2: Apply safety precautions.
- 3: Present out the cupping of coffee process.
- 4: Referring to the procedures provided on step 3, perform cupping of coffee.
- 5: Present your work to the trainer and whole class. Ask for clarification where necessary
- 6: Read key reading 4.3.2
- 7: Perform the task provided in application of learning 4.3



Key readings 4.3.2: Cupping of coffee.

- **Cupping (develops and ranks a score sheet)**

- ✚ **Aroma:** Aromatic aspects of ground coffee beans when infused in hot water
 - ✚ **Acidity:** Brightness and or sourness of the coffee. Acidity is often described as "brightness" when favourable or "sour" when unfavourable. At its best, acidity contributes to a coffee's liveliness, sweetness, and fresh-fruit character and is almost immediately experienced and evaluated when the coffee is first slurped into the mouth. Acidity that is overly intense or dominating may be unpleasant, however, and excessive acidity may not be appropriate to the flavour profile of the sample.
 - ✚ **Flavour:** It is defined as taste and aroma, mild-tones of coffee. It is a combined impression of all the gustatory (taste bud) sensations and retro-nasal aromas that go from the mouth to nose.
- ✓ **Coffee flavour profiles consist of:**
- ✚ **Mild:** Coffee with a mild body is not sharp, pungent or strong. Many light roast coffees normally possess a mild flavour profile.
 - ✚ **Bold:** Coffee with a bold body has a strong and noticeable flavour. Coffees from medium to dark roast levels normally possess a bold flavour profile.
 - ✚ **Extra Bold:** Coffee with an extra bold body has flavours that are extremely strong and pronounced. Dark roast coffees normally possess an extra bold flavour profile.
 - ✚ **Sweetness:** Subtle pleasant sweetness in coffee. Sweetness refers to a pleasing fullness of flavour as well as any obvious sweetness and its perception is the result of the presence of certain carbohydrates. The opposite of sweetness in this context is sour, astringency or "green" flavours.
 - ✚ **Body:** Mouth feel or heaviness perceived on the surface of the tongue. The quality of body is based upon the tactile feeling of the liquid in the mouth, especially as perceived between the tongue and roof of the mouth.
 - ✚ **Balance:** Overall rating of coffee, no one parameter should dominate. How all the various aspects of Flavour, Aftertaste, Acidity and Body of the sample work together and complement or contrast to each other is Balance. If the sample is lacking in certain aroma or taste attributes or if some attributes are overpowering, the balance score would be reduced.
 - ✚ **Crema:** is the term for the layer of foam found on the surface of a shot of espresso coffee. Generally golden to dark in colour, this foam is a result of several factors in the brewing of the espresso, from the type of bean to the pressure

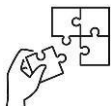
employed by the espresso machine. While the crema does not contribute to the taste of the coffee, it is often considered an indicator of the espresso's quality.

-  **Clean Cup:** Transparency in the cup should be free of off-flavours and defects. It refers to a lack of interfering negative impressions from first ingestion to final aftertaste, a transparency” of cup. In evaluating this attribute, notice the total flavour experience from the time of the initial ingestion to final swallowing or expectoration.
-  **Uniformity:** It refers to consistency of flavour of the different cups of the sample tasted. If the cups taste different, the rating of this aspect would not be as high.
-  **Aftertaste:** Aftertaste is defined as the length of positive flavour (taste and aroma) qualities emanating from the back of the palate and remaining after the coffee is expectorated or swallowed. If the aftertaste were short or unpleasant, a lower score would be given.
-  **Overall:** Overall score of rating any coffee. The “overall” scoring aspect is meant to reflect the holistically integrated rating of the sample as perceived by the individual panellist. A sample with many highly pleasant aspects, but not quite “measuring up” would receive a lower rating.



Points to Remember

- Coffee flavour profiles consist of: Mild, bold, extra bold, sweetness, body, balance, crema, clean cup, uniformity and aftertaste.



Application of learning 4.3.2

You are requested to go in your school’s coffee processing workshop to test the quality of roasted coffee respecting roasted coffee testing procedures and conditions.



Indicative content 4.4: Grinding roasted coffee



Duration: 4 hrs



Practical Activity 4.4.1: Performing roasted coffee grinding.



Task:

- 1: You are requested to go in the coffee processing workshop to grind roasted coffee.
- 2: Apply safety precautions.
- 3: Present out the roasted coffee grinding process.
- 4: Referring to the procedures provided on step 3, grind roasted coffee.
- 5: Present your work to the trainer and whole class. Ask for clarification where necessary
- 6: Read key reading 4.4.1
- 7: Perform the task provided in application of learning 4.4



Key readings 4.4.1: Performing roasted coffee grinding.

- **Roasted coffee grinding method**
- ✓ **Manual grinding:** Manual grinding is performed by the manual grinders which are preferred by a lot of folks who want to get more intimate with the coffee-making experience.

The figure below is the manual coffee grinding machine



There are a few benefits to hand grinders over electric units:

- ✚ **Ground control:** Coffee grind size is imperative to the quality of the brew. It is just known that with a manual grinder, the grinding size is personally controlled.
- ✚ **Price range:** Manual grinders are cheap and effective as can be.

- ✚ **Versatility:** These are ultra-portable, so they can be brought with on a camping trip if you need that fresh coffee when wake up. They can also be brought when travelling and staying in hotels
- ✚ **Reduced Noise:** The grinders go off and it sounds like it is in a plane hangar.
- ✓ **Electrical grinding:** They are responsible for that great-tasting cup of coffee you get each morning on your way to work and save immense amounts of time if you're brewing at home.

The electrical coffee grinding is found on the figure below:



The mains benefits of electrical grinder.

- ✚ **Save time:** It takes an average of seven seconds for an electric grinder to produce a full brew basket of coffee grinds but it can take up to thirty seconds to get a good grind with a manual coffee maker.
- ✚ **Less cleaning:** electric grinder is cleaned out once a month to retain optimal performance, but manual grinders need daily cleaning.
- ✚ **Lasts longer than manual units:** manual units undergo varying amounts of physical stress. An electric grinder could last in a whole decade, but it should be hard-pressed to find a manual unit that will last that long without needing burr replacements every six to twelve months.

- **Specification of coffee powder**

There two main of coffee powder specifications that are coarse and fine



- ✓ **Coarse:** coarse grinds are better for filter methods. Dark roasts, however, always yield more “fines” than lighter roasts.
- ✓ **Fine:** fine coffee powder and **coarse** coffee powder is coffee grind size matters. The length of time the grounds will be in contact with water determines the ideal grade of grinding. Generally, the finer the grind, the more quickly the coffee should be prepared.

In addition, the size of the grind is extremely important to the taste of the coffee: If the coffee tastes bitter, it may be over-extracted, or ground too fine. On the other hand, if the coffee tastes flat, it may be under-extracted, meaning grind is too coarse.

- **Types of grinders**

- ✓ **Blade grinder:** with a blade in the centre of the grinder that looks like a propeller, similar to a blender blade. Blade grinder is inexpensive but produces a very inconsistent particle size. The fineness of the grind is determined by how long the grinder is operating via a built in timer. The longer it grinds the finer the coffee becomes.



- ✓ **Burr grinder:** it is made up of two revolving abrasive surfaces called burrs, in between which the coffee is ground, a few beans at a time. It is a manual coffee grinder. They are **flat** burr grinder and **conical** burr grinder but they do the same thing. The burr grinder is an excellent device.

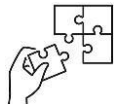


However, Conical Burr Grinders have two cone shaped burrs with ridges that grind/crush the coffee whereas Flat Plate Burr Grinders have two identical and parallel rings that are serrated on the side that faces the other. Both burr grinders have one stationary burr while the motor turns the other. The beans are drawn in between the two burrs and crushed into a uniform size. Both types of grinders are known for their flexibility and quality.



Points to Remember

- Manual grinding is performed by the manual grinders which are preferred by a lot of folks who want to get more intimate with the coffee-making experience.
- Specification of coffee powder are: Fine, medium and coarse



Application of learning 4.4.

You are requested to go in your school's coffee processing workshop to grind roasted coffee into fine, medium and coarse specification.



Indicative content 4.5: Storing Roasted coffee and ground coffee



Duration: 4hrs



Practical Activity 4.5.1: Packaging and storing roasted coffee and ground coffee



Task:

- 1: You are requested to go in the coffee processing workshop to package and store roasted coffee and ground coffee.
- 2: Apply safety precautions.
- 3: Present out the roasted coffee and ground coffee packaging and storing process.
- 4: Referring to the procedures provided on step 3, package and store roasted coffee and ground coffee.
- 5: Present your work to the trainer and whole class. Ask for clarification where necessary
- 6: Read key reading 4.5.1
- 7: Perform the task provided in application of learning 4.5



Key readings 4.5.1 Packaging and storing roasted coffee and ground

- **Selection of packaging materials for roasted coffee and ground coffee**
- ✓ **Key Considerations for Packaging Selection**
 - ✚ **Freshness and Shelf Life**
 - **Barrier Properties:** Packaging must provide a barrier to oxygen, moisture, light, and heat to preserve the coffee's flavor and aroma.
 - **Gas Release:** Roasted coffee emits gases (mainly carbon dioxide) after roasting. Packaging should allow for gas release without allowing air to enter.
 - ✚ **Branding and Marketing**
 - **Visual Appeal:** Packaging should be visually appealing and reflect the brand's identity.
 - **Information Display:** Clear labelling regarding origin, roast date, flavor profile, and

brewing recommendations.

Environmental Impact

- **Sustainability:** Preference for recyclable, biodegradable, or compostable materials to minimize environmental impact.

Convenience and Usability

- **Ease of Use:** Packaging should be easy to open, reseal, and store.
- **Size Variability:** Offering various sizes to cater to different consumer needs (single-serve, bulk, etc.).

✓ **Packaging Materials for Roasted Coffee**

Bag Types

➤ **Foil Bags:**

- **Material:** Multi-layered bags with an inner layer of foil and an outer layer of plastic.
- **Benefits:** Excellent barrier properties against oxygen and moisture; suitable for preserving freshness; can include one-way valves for gas release.

➤ **Kraft Paper Bags:**

- **Material:** Made from natural paper.
- **Benefits:** Environmentally friendly; often used for specialty coffees; can have a lining for added protection but may not provide as strong a barrier as foil.

➤ **Plastic Bags:**

- **Material:** Low-density polyethylene (LDPE) or high-density polyethylene (HDPE).
- **Benefits:** Lightweight and cost-effective; suitable for larger quantities, but may not provide the best barrier properties.

✓ **Other Packaging Options**

Glass Jars:

- **Material:** Clear or tinted glass with a metal or plastic lid.
- **Benefits:** Provides a strong barrier to moisture and oxygen; visually appealing and

reusable, but heavier and more expensive.

Tin Tie Bags:

- **Material:** Paper bags with a metal tie closure.
- **Benefits:** Allows for resealing after opening; good for small quantities but may not provide the same level of protection as foil bags.

✓ **Packaging Materials for Ground Coffee**

Bag Types

➤ **Foil Bags with One-Way Valves:**

- **Material:** Similar to roasted coffee bags, but designed specifically for ground coffee.
- **Benefits:** One-way valves allow gases to escape without letting air in, preserving freshness and preventing bag bursting.

➤ **Plastic Bags with Resealable Closures:**

- **Material:** LDPE or HDPE.
- **Benefits:** Convenient and user-friendly; resealable options help maintain freshness after opening.

➤ **Stand-Up Pouches:**

- **Material:** Multi-layered pouches with foil or plastic.
- **Benefits:** Stable packaging that stands upright on shelves; can include resealable closures and one-way valves.

✓ **Other Packaging Options**

Tetra Pak:

- **Material:** Made of layers of paperboard, plastic, and aluminum.
- **Benefits:** Excellent barrier properties; suitable for ground coffee; lightweight and recyclable.

Metal Tins:

- **Material:** Metal with airtight seals.

- **Benefits:** Strong barrier to light and oxygen; reusable but can be more expensive.

- **Application of packaging methods of roasted coffee and ground coffee.**

- ✓ **Vacuum Sealing**

Vacuum **sealing** involves removing air from the packaging before sealing it, which significantly reduces oxygen levels and extends shelf life.

- ✓ **Applications:**

- **Whole Bean Coffee:** Commonly used for packaging roasted coffee beans to maintain freshness and prevent oxidation.
- **Ground Coffee:** Suitable for ground coffee, especially for smaller packages, to ensure prolonged shelf life.
- **Retail Packaging:** Often used in retail settings to package products for consumers.

- ✚ **Advantages:**

- **Extended Shelf Life:** Reduces oxidation, which can lead to staleness and loss of flavor.
- **Flavor Preservation:** Maintains the coffee's natural oils and volatile compounds, resulting in a more flavorful cup.
- **Reduced Weight and Bulk:** The absence of air allows for compact packaging, making it easier to transport and store.

- ✚ **Considerations:**

- **Cost:** Vacuum sealing equipment and materials can be more expensive than standard packaging methods.
- **Shelf Stability:** Vacuum sealing significantly extends shelf life, it may not be entirely foolproof against prolonged exposure to light or moisture if not stored properly.

- ✓ **Quality Control:** Proper sealing is essential to prevent air leakage and ensure effectiveness.

- ✓ **Modified Atmosphere Packaging (MAP)**

Modified atmosphere packaging involves altering the composition of gases within the packaging to extend shelf life. Typically, oxygen levels are reduced while nitrogen or carbon dioxide is increased.

- ✚ **Applications:**

- **Roasted Coffee:** Often used for freshly roasted coffee beans to maintain quality

during distribution and retail.

- **Ground Coffee:** Ideal for ground coffee products, particularly for those intended for longer storage.
- **Bulk Packaging:** Used for larger quantities of coffee to prevent spoilage during transportation.

Advantages:

- **Enhanced Freshness:** By reducing oxygen levels and increasing inert gases, MAP slows down the oxidation process, preserving flavor and aroma.
- **Prevention of Microbial Growth:** Lower oxygen levels inhibit the growth of spoilage organisms, contributing to longer shelf life.
- **Flexibility:** MAP can be tailored to specific products and requirements by adjusting gas compositions.

Considerations:

- **Initial Investment:** The setup for MAP can be more complex and costly than traditional packaging methods.
- **Shelf Life Variability:** While MAP extends shelf life, factors such as product type and storage conditions can influence effectiveness.
- **Consumer Acceptance:** Some consumers may be wary of the use of modified atmospheres, preferring traditional packaging methods.

✓ **Labelling roasted and ground coffee**

Labelling roasted and ground coffee is a vital component of packaging that serves various purposes, ensuring that consumers receive important information about the product. Here's a comprehensive overview of the purpose of labelling and the key information typically included on coffee labels.

Purpose of Labelling

- **Consumer Information:** Provides essential details about the product, helping consumers make informed choices based on their preferences and needs.
- **Brand Identity:** Establishes brand recognition and differentiation in a competitive market. The design, logo, and overall aesthetics contribute to the brand's image.
- **Regulatory Compliance:** Ensures adherence to food safety and labelling regulations mandated by local and international authorities, including ingredient disclosure and nutritional information.
- **Quality Assurance:** Communicates the quality attributes of the coffee, such as origin, roast level, and certifications (e.g., organic, fair trade), which can influence

purchasing decisions.

- **Usage Instructions:** Provides brewing recommendations and guidelines, helping consumers achieve the best flavor and experience with the coffee.

Labelling Information

- **Product Name:** Clearly states the product type (e.g., "Roasted Coffee," "Ground Coffee") and may include the specific blend or single-origin designation.
- **Brand Name:** The name of the company or brand producing the coffee, often prominently displayed for recognition.
- **Origin Information:** Details about the coffee's geographical source, including the country, region, and possibly the farm or cooperative. This information appeals to consumers interested in specialty or traceable coffees.
- **Roast Level:** Indicates the roast profile (e.g., light, medium, dark) to inform consumers about the flavor characteristics they can expect.
- **Flavor Profile:** Descriptive tasting notes (e.g., fruity, nutty, chocolatey) that give consumers a sense of the coffee's unique flavor attributes.
- **Processing Method:** Information about how the coffee was processed (e.g., washed, natural, honey) can influence flavor and aroma.
- **Net Weight:** The total weight of the coffee in the package (e.g., 12 oz, 340 g) should be clearly indicated.
- **Roast Date:** The date on which the coffee was roasted, helping consumers assess freshness and make informed purchasing decisions.
- **Best By Date:** A suggested date by which the coffee should be consumed for optimal flavor and freshness. This is important for quality assurance.
- **Brewing Instructions:** Recommendations for brewing methods, water-to-coffee ratios, and steeping times to guide consumers in making the best cup of coffee.
- **Certifications:** Logos or statements regarding certifications (e.g., USDA Organic, Rainforest Alliance, Fair Trade) to highlight ethical sourcing and production practices.
- **Nutritional Information** (if applicable): May include caloric content, serving size, and any relevant health information, particularly for flavored coffees or coffee products with added ingredients.
- **Contact Information:** Company name, address, website, and customer service contact for consumer inquiries or feedback.
- **Barcodes and QR Codes:** For inventory tracking and scanning at retail locations; QR codes can lead to additional information about the coffee, such as brewing tips, origin stories, or promotional content.

- **Storage Conditions for Roasted Coffee**

✓ **Airtight Containers**

- ✚ **Use Airtight Storage:** Store roasted coffee in airtight containers to minimize exposure to oxygen, which causes oxidation and staleness.
- ✚ **Preferred Materials:** Glass jars with airtight seals, ceramic containers, or high-quality stainless steel can be effective. Avoid using plastic bags that are not sealed tightly.

✓ **Light Protection**

- ✚ **Opaque Containers:** Choose containers that block light. Ultraviolet (UV) light can degrade the quality of coffee, causing it to lose flavor and aroma.
- ✚ **Dark Storage Area:** Keep the coffee in a dark place, such as a cupboard or pantry, away from direct sunlight.

✓ **Temperature Control**

- ✚ **Cool Environment:** Store roasted coffee at room temperature, ideally around 20°C (68°F). Avoid places with temperature fluctuations, such as near stoves or in cabinets above ovens.
- ✚ **Avoid Heat Sources:** Keep coffee away from heat sources like radiators, microwaves, or direct sunlight to prevent the coffee from getting too warm.

✓ **Moisture Control**

- ✚ **Dry Environment:** Coffee is hygroscopic, meaning it absorbs moisture from the environment. Store it in a dry place to prevent mold growth and spoilage.
- ✚ **Avoid Refrigeration and Freezing:** Storing roasted coffee in the refrigerator is not recommended due to moisture fluctuations. Freezing can be acceptable for long-term storage, but only if done properly (in small, airtight portions).

✓ **Packaging Options**

- ✚ **Vacuum-Sealed Bags:** If purchased in vacuum-sealed packaging with a one-way valve, these bags are great for short-term storage. The valve allows gases to escape while keeping oxygen out.
- ✚ **Post-Roast Bags:** Many specialty coffee brands offer bags designed for short-term storage with one-way valves to allow for gas release without letting air in.

✓ **Shelf Life**

- ✚ **Consume Fresh:** Roasted coffee is best consumed within **2-3 weeks** of roasting for

optimal flavor. After this period, the flavor may begin to diminish, although it can still be drinkable.

- ✚ **Long-Term Storage:** If you need to store coffee for longer than a few weeks, consider using vacuum sealing or freezing methods. However, it's best to use freshly roasted coffee whenever possible for the best flavor.

- **Storage Conditions for Ground Coffee**

- ✓ **Airtight Containers**

- ✚ **Use Airtight Storage:** Store ground coffee in airtight containers to minimize exposure to oxygen. This prevents oxidation, which can lead to stale flavors.

- ✚ **Preferred Materials:** Glass jars with airtight seals, ceramic containers, or high-quality stainless steel are ideal. Avoid using plastic bags that are not sealed tightly.

- ✓ **Light Protection**

- ✚ **Opaque Containers:** Choose containers that block light, as UV rays can degrade the coffee and diminish its flavor. Dark-colored or opaque containers are best.

- ✚ **Dark Storage Area:** Keep ground coffee in a dark place, such as a pantry or cupboard, away from direct sunlight.

- ✓ **Temperature Control**

- ✚ **Cool Environment:** Store ground coffee at room temperature, ideally around 20°C (68°F). Avoid areas with temperature fluctuations, such as near stoves or ovens.

- ✚ **Avoid Heat Sources:** Keep coffee away from heat sources like radiators or microwaves, as heat can cause the coffee to lose its flavor.

- ✓ **Moisture Control**

- ✚ **Dry Environment:** Ground coffee is hygroscopic, meaning it absorbs moisture from the air. Store it in a dry place to prevent mold growth and spoilage.

- ✚ **Avoid Refrigeration and Freezing:** Refrigeration is not recommended as it can lead to moisture build up. Freezing can be done for long-term storage, but it must be done correctly.

- ✓ **Packaging Options**

- ✚ **Vacuum-Sealed Bags:** If purchasing ground coffee in vacuum-sealed packaging, these bags are excellent for short-term storage. They often come with one-way valves to allow gases to escape while keeping oxygen out.

✚ **Resealable Bags:** If using resealable plastic bags, make sure to remove as much air as possible before sealing.

✓ **Shelf Life**

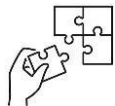
✚ **Consume Fresh:** Ground coffee is best consumed within **1-2 weeks** of opening for optimal flavor. After this period, it can start to lose its freshness and flavor profile.

✚ **Long-Term Storage:** If you need to store ground coffee for more than a couple of weeks, consider vacuum sealing or freezing it in small portions (this helps avoid repeated thawing and refreezing).



Points to Remember

- While selecting roasted coffee and ground coffee packaging materials, consider the key for packaging selection.
- Vacuum sealing involves removing air from the packaging before sealing it, which significantly reduces oxygen levels and extends shelf life.
- Modified atmosphere packaging involves altering the composition of gases within the packaging to extend shelf life.
- When storing roasted coffee and ground coffee, respect the storage conditions for roasted coffee and ground coffee.



Application of learning 4.5.

You are requested to go in your school's coffee processing workshop to package and store properly roasted coffee and ground coffee.



Learning outcome 4 end assessment

Theoretical assessment

1. Read the following statement and circle the correct answer

- i. At what temperature does the second crack typically occur during coffee roasting, indicating the onset of darker roasts?
 - a) 350°F (177°C)
 - b) 400°F (204°C)
 - c) 450°F (232°C)
 - d) 500°F (260°C)
- ii. Which type of roast is characterized by bright, fruity, and acidic flavors, often retaining the original flavors of the coffee bean?
 - a) Medium Roast
 - b) Light Roast
 - c) Dark Roast
 - d) Full City Roast
- iii. Which roast category is described as having a dark brown to nearly black color, with a glossy, oily surface and a bold, bittersweet flavor profile?
 - a) Light Roast
 - b) Medium Roast
 - c) Dark Roast
 - d) Vienna Roast
- iv. Which of the following roasting techniques involves circulating hot air around the beans to maintain even temperature and ensure consistent heat transfer?
 - a) Drum Roasting
 - b) Water Cooling
 - c) Hot Air Roasting
 - d) Espresso Roasting
- v. Which of the following is a commonly used method for cooling roasted coffee beans?
 - a) a. Air cooling with fans
 - b) b. Freezing the beans
 - c) c. Submerging in cold water
 - d) d. Sprinkling with ice
- vi. What is the primary purpose of using airtight containers for storing coffee?
 - a) To prevent exposure to light
 - b) To maintain a consistent temperature
 - c) To minimize exposure to oxygen

d) To enhance flavor through UV light

2. Answer by True if the statement is correct and False if the statement is not correct

- i. Manual roasting methods, such as stovetop roasting or using a popcorn popper, offer less control over the roasting process compared to mechanical methods.
- ii. Mechanical roasting is commonly used for larger-scale coffee production because it offers consistency and efficiency.
- iii. During the coffee roasting process, the beans undergo expansion and lose moisture, resulting in a weight loss of approximately 15-20%.
- iv. The Maillard reaction and caramelization of sugars during roasting only occur in the final stages of the roasting process.
- v. Dark roasts have a lower perceived acidity due to the degradation of chlorogenic acids during the roasting process.
- vi. Rapid cooling of roasted coffee beans helps retain the aromatic compounds and prevents flavor loss.
- vii. Ground coffee should be stored in a cool and dry environment to prevent oxidation and maintain freshness.
- viii. Modified Atmosphere Packaging (MAP) increases oxygen levels inside the packaging to extend shelf life.

3. Fill in the blank space with the following terms and parameters (Burr, 50, Decoction, Espresso, coarse, 15).

- A. The coffee brewing method in which finely-ground coffee is placed under pressure with nearly boiling water to create a concentrated beverage is called ____.
- B. When brewing coffee, the recommended coffee-to-water ratio is ____ grams of ground coffee dissolved in 225 ml of boiled water.
- C. The grind size that is better suited for filter methods and may result in under-extracted, flat-tasting coffee if too coarse is called ____.
- D. The type of coffee grinder that uses two revolving abrasive surfaces to produce a consistent grind is called a ____ grinder.

Practical assessment

Your school have a food processing unit that process coffee cherries into parchment and ground coffee. Recently, there have been complaints from teaching staff over the past two consecutive months regarding the flavour and tastes of the served coffee that might be due to poor roasting, cooling, grinding and storage of ground roasted coffee.

You are requested to go in school coffee processing workshop to perform the tasks below:

Task:

1. Roast green coffee
2. Cool roasted coffee
3. Test quality of roasted coffee
4. Grind roasted coffee
5. Store roasted coffee and ground coffee.

All necessary materials, tools and equipment are available in the workshop. The task should be completed in 4 hours.

END



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October 2024