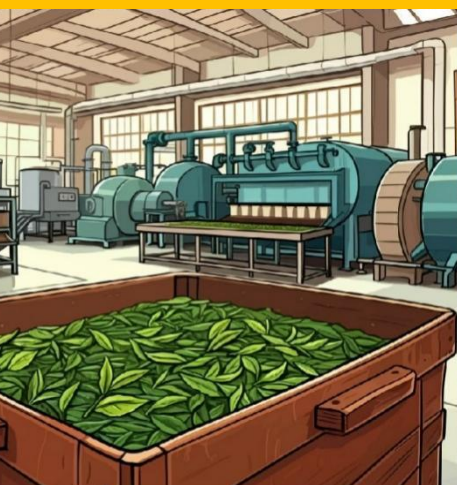




RQF LEVEL 5



FOPTP 503

FOOD PROCESSING

Tea Leaves Processing

TRAINER MANUAL

October, 2024



TEA LEAVES PROCESSING



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ACRONYMS

°C: Degree Celsius

°F: Degree Fahrenheit

ATP: Adenosine Triphosphate

BC: British Columbia

CBT/A: Competence Based Training/ Assessment

CIP: Cleaning in Place

COP: Cleaning Out of Place

CTC: Crush, Tear, Curl

CTC: Cut Tear Curl

FDA: Food and drug Authority

g: grams

HACCP: Hazard Analysis and Critical Control Point

ISO: International Organization for Standardization

KOICA: Korea International Cooperation Agency

NAEB: National Agricultural Export Development Board

OCIR: Office des cultures Industrielles du Rwanda

PPE: Personal protective Equipment

ROI: Return on Investment

rpm: rotation per minute

RTB: Rwanda TVET Board

TQUM Project: TVET Quality Management Project

TVET: Technical and Vocational Education and Training

INTRODUCTION

This trainer's manual includes all the methodologies required to effectively deliver the module titled "**Tea leaves processing.**" Trainees 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 trainer'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 trainer, you will begin by asking questions related to the activities to encourage critical thinking and guide trainees toward real-world applications in the labor market. The manual also outlines essential information such as learning hours, didactic materials, and suggested methodologies.

This manual outlines the procedures and methodologies for guiding trainees through various activities as detailed in their respective trainee manuals. The activities included in this training manual are designed to offer trainees opportunities for both individual and group work. Upon completing all activities, you will assist trainees in conducting a formative assessment known as the end learning outcome assessment. Ensure that trainees review the key reading and the points to remember section.

MODULE CODE AND TITLE: FOPTP 503 TEA LEAVES PROCESSING

Learning Outcome 1: Prepare workplace and tea leaves

Learning Outcome 2: Ferment rolled tea leaves

Learning Outcome 3: Dry fermented and steamed tea leaves

Learning Outcome 4: Store graded tea products

Learning Outcome 1: Prepare Workplace and Tea Leaves



Indicative contents

1.1 Introduction in Tea Leaves Processing

1.2 Selecting Tools and Equipment Used in Tea Leaves Processing

1.3 Selecting Materials Used in Tea Leaves Processing

1.4 Cleaning of Workplace

1.5 Receiving green Tea Leaves

1.6 Steaming of Tea Leaves for Green Tea Making

1.7 Monitoring Withering Conditions of Green Tea Leaves

Key Competencies For Learning Outcome 1: Prepare Workplace And Tea Leaves

Knowledge	Skills	Attitudes
• Explanation of tea leaves. • Identification of tools and equipment used in tea leaves processing. • Identification of materials used during tea leaves processing. • Description of quality characteristics of tea leaves • Description of withering process	• Selecting tools and equipment used in tea leaves processing • Selecting of materials used during tea leaves processing. • Cleaning and arranging of workplace • Receiving green tea leaves • Steaming tea leaves for green tea making • Withering tea leaves for tea making	• Being attentive during selection of materials, tools and equipment used in tea leaves processing. • Being careful during cleaning process • Being honest during receiving tea leaves • Being decision maker during receiving tea leaves • Being careful during arrangement of work place • Being vigilant during withering and steaming condition of green tea leaves



Duration: 20 hrs

Learning outcome 1 objectives:



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

1. Describe clearly tea as a product from tea leaves processing.
2. Identify properly tools and equipment used in tea leaves processing.
3. Select properly tools and equipment used in tea leaves processing.
4. Identify clearly materials used during tea leaves processing.
5. Select properly materials used in tea leaves processing.
6. Clean properly workplace to be used in tea leaves processing
7. Receive correctly green tea leaves to be used in tea leaves processing
8. Describe appropriately quality characteristics of green tea leaves used in tea leaves.
9. Steam correctly tea leaves used during green tea making.
10. Describe properly wither as used in tea leaves processing.
11. Wither effectively tea leaves during tea leaves processing.



Resources

Equipment	Tools	Materials
● Weigh bridge or electronic balance ● Mono Rail ● Fan ● Sifter ● Magnet ● Weigh Feeder ● Conveyors ● Rotor Vane ● CTC rollers, ● Fermentation tank	● Thermometer ● Hygrometer ● Trolley ● Green leaf bag ● Brooms ● Spade ● Sorting bins ● Leaf count table ● Tasting cup ● Tasting bowl ● Tasting spoon ● Kettle	● Green tea leaves ● Cleaning agents ● Water ● Source of energy (Electricity, Gas, Firewood (Eucalyptus), Briquette, Peat) ● Packaging material ● Napkin ● Towel

● High pressure washer ● Fluid bed dryer ● Steam boiler, ● Super 3t fiber extractor ● Grading machine ● Packing machine ● Sealing machine ● Air compressor ● Wood split machine ● Rolling table ● Working table	● Bucket ● Moisture meter ● Fork	
 Advance Preparation: Before delivering this learning outcome, you are recommended to: ● Have tea leaves processing workshop ● Avail fresh tea leaves ● Avail functioning tools and equipment for tea leaves preparation. ● Avail cleaning and packaging material ● Avail manuals/guide, protocol, video and photo related to preparation of workplace and tea leaves.		



Indicative content 1.1: Introduction on tea leaves processing



Duration: 2 hrs



Theoretical Activity 1.1.1: Introduction on tea leaves processing



Notes to the trainer:

- Trainer may use small groups to introduce tea leaves processing
- Trainer may use pictures or videos as didactic materials which show the history of tea leaves processing.



Key steps:

While delivering this activity, pass through the following steps:

Step 1. Introduce the activity and ask trainees to answer the following questions:

- i. What do you understand by the following terms?
 - a) Tea leaves
 - b) Tea leaves processing
- ii. What could be the types of tea products?
- iii. What could be the health benefits of tea?

Step 2. Ask trainees to write the findings on papers, flip chart, blackboard or white board

Step 3. Engage trainees to present their findings

Step 4. Provide the expert view and clarify idea by using didactic material

Step 5. Address any questions or concern

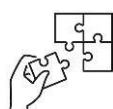
Step 6. Ask trainees to read the key reading 1.1.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.1



Points to Remember

- Tea products are processed from tea leaves of *Camellia sinensis* plant and tea leaves are processed into several of tea products like green tea, black tea, white tea, Oolong tea and herbal tea.
- Tea has more health benefits where tea contains various antioxidants like flavonoids and polyphenols that help combat oxidative stress and may reduce the risk of chronic diseases.



Application of learning 1.1.

Organize field visit with trainees to tea factory where they are processing tea leaves and ask them to observe and document tea products.

Checklist

S/N	Criteria	Indicator	Observations	
			Yes	No
1.	Tea leaves processing is properly documented	1. The background of tea is explained		
		2. Tea products are listed		
		3. The health Benefits of tea are identified		



Indicative content 1.2: Selecting tools and equipment used in tea leaves processing



Duration: 3hrs



Theoretical Activity 1.2.1: Identification of tools and equipment used in tea leaves processing.



Notes to the trainer:

- Trainer may use small groups to identify tools and equipment required during tea leaves processing.
- Trainer may use pictures or videos as didactic materials which show the tools and equipment required during tea leaves processing.



Key steps:

While this activity, pass through the following steps:

Step1.Introduce the activity and ask trainees to answer the following questions:

- What could be the tools and equipment used in cleaning?
- What could be the tools and equipment used in wet processing area during tea leaves processing?
- What could be tools and equipment used in dry processing area during tea leaves processing?
- What could be the use of tools and equipment answered in question (i), (ii), (iii)?

Step2.Ask trainees to write the findings on papers, flip chart, blackboard or white board

Step3.Engages trainees to present their findings

Step4.Provides the expert view and clarify idea by using didactic material

Step5.Address any questions or concerns

Step6.Ask trainees to read the key reading 1.2.1 in trainee manual.



Points to Remember

- The rolling table is essential equipment for tea leaves processing for shaping the tea leaves and initiate the oxidation process by rupturing the leaf cells, which releases essential oils and enzymes.
- Ensuring that tea products remains fresh and retains its aroma until it reaches the consumer, packing machines is used to seal the tea in airtight containers or bags.
- To ensure a cleaned tea product, the Super 3T Fiber Extractor is used to separate fibers and stalks from the actual tea leaves.
- Ensuring that moisture evaporates efficiently and uniformly, fans are used to circulate air through the leaves.



Practical Activity 1.2.2. Selecting tools and equipment used in tea leaves processing



Notes to the trainer

- The trainer may demonstrate how to select tools and equipment used in tea leaves processing.
- For the effective delivery; it is recommended to avail tools and equipment to be selected for tea leaves processing.



Key steps:

While delivering this activity, pass through the following steps:

Step1.Introduce the activity and ask trainees to go in tea leaves processing workshop to select and adjust tools and equipment used in tea leaves processing.

Step2.Explain the task and provide clear work instruction (PPE, Time allocated).

Step3.Demonstrate how to select and adjust tools and equipment for tea leaves processing. While demonstrating. While selecting, explain the selection criteria of tools and equipment used in tea leaves processing.

Step4.Ask trainees to select and adjust tools and equipment for tea processing, and monitor the procedures.

Step5.Verify whether tools and equipment for tea leaves processing are properly selected, adjusted and provide feedback where necessary.

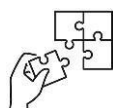
Step6.Ask trainees to read key reading 1.2.2 in trainee manual

Step7.Ask trainees to perform the task provided in application of learning 1.2.



Points to Remember

- Have a thorough understanding of the tea processing steps involved, from withering to rolling, fermentation and drying and ensure that the tools and equipment selected are compatible with the specific processing methods you intend to use.
- Adjusting tools and equipment is a common task in tea leaf processing, but it requires careful handling to prevent damage, ensure accuracy, and maintain safety.



Application of learning 1.2.

With trainees, organize a field visit in tea factory near school where they are processing tea leaves and ask trainees to select tools and equipment to be used in tea leaves processing.

Check list:

S/N	Criteria	Indicators	Observation	
			Yes	No
1.	Tools and equipment used in tea leaves processing are properly selected	1.1. Tools are selected		
		1.2. Equipment are selected		
		1.3. Selection criteria of tools and equipment are respected		
2.	Tools and equipment are correctly adjusted	2.1. Manual guide are selected		
		2.2. Equipment are adjusted		
		2.3. Tools are adjusted		



Indicative content 1.3: Selecting materials used in tea leaves processing



Duration: 3hrs



Theoretical Activity 1.3.1: Identification of materials used during tea leaves processing.



Notes to the trainer:

- Trainer may use small groups to identify materials used during tea leaves processing.
- Trainer may use pictures or videos as didactic materials which show materials used during tea leaves processing.



Key steps:

While this activity, pass through the following steps:

Step 1. Introduce the activity and ask trainees to answer the following questions:

- What could be raw material used to process tea products?
- What could be cleaning agent that can be used during tea leaves processing?
- What could be packaging materials that can be used during packaging of tea products?
- What could be the source of energy used in tea leaves processing?

Step 2. Asks trainees to write the findings on papers, flip chart, blackboard or white board

Step 3. Engages trainees to present their findings

Step 4. Provides the expert view and clarify idea by using didactic material

Step 5. Address any questions or concerns

Step 6. Asks trainees to read the key reading 1.3.1 in trainee manual



Points to Remember

- Careful selection of packaging materials is essential to ensure the integrity of the product and enhance its overall appeal.
- Tea leaves can be oxidized by exposure to oxygen, leading to a loss of freshness and flavour. Therefore, packaging should be oxygen-barrier to minimize this process.
- The primary raw material used in processing tea products is tea leaves.

- Detergents are commonly used for general cleaning of equipment, surfaces, and floors in tea processing facilities whereas disinfectants are used to kill harmful microorganisms and sanitize surfaces that should come into contact with tea leaves or processing equipment.



Practical Activity 1.3.2. Selecting of materials used during tea leaves processing



Notes to the trainer

- The trainer is supposed to demonstrate how to select materials used in tea leaves processing.
- For the effective delivery; it is recommended to avail materials to be selected for being used in tea leaves processing.



Key steps:

While delivering this activity, pass through the following steps:

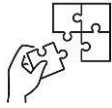
- Step 1:** Introduce the activity and ask trainees to go in tea leaves processing workshop to select materials used in tea leaves processing.
- Step 2:** Explain the task and provide clear work instruction (Task, PPE, Time allocated).
- Step 3:** Demonstrate how to select materials for tea leaves processing. While demonstrating, explain the selection criteria of materials.
- Step 4:** Ask trainees to select materials for tea processing, and monitor the procedures.
- Step 5:** Verify whether materials for tea leaves processing are well selected and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 1.3.2 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 1.3.2



Points to Remember

- Ensure the leaves are freshly plucked, ideally processed within a few hours of harvesting

- Careful selection of packaging materials is essential to ensure the integrity of the product and enhance its overall appeal.
- Cleaning agent must be food-safe and leave no harmful residues on surfaces or equipment.



Application of learning 1.3.

Organize a field visit to the nearest tea factory where they are processing tea leaves and ask trainees to select materials used in tea leaves processing.

Checklist

S/N	Criteria	Indicators	Yes	No
1	Materials used in tea leaves processing are properly selected	1.1 Green tea leaves are selected		
		1. 2 cleaning agents are selected		
		1.3 Packaging materials are selected		
		1.4 Source of energy are selected		



Indicative content 1.4: Cleaning of workplace



Duration: 4 hrs



Practical Activity 1.4.1. Cleaning and arranging the workplace



Notes to the trainer

- The trainer may demonstrate how to clean and arrange of workplace for tea leaves processing.
- For the effective delivery; it is recommended to avail materials, tools and equipment to be used during cleaning workplace.



Key steps:

While delivering this activity, pass through the following steps:

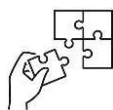
- Step 1:** Introduce the activity and ask trainees to go in tea leaves processing workshop to clean and arrange the workplace for tea leaves processing.
- Step 2:** Explain the task and provide clear work instruction (PPE, Time allocated).
- Step 3:** Demonstrate how to clean and arrange of workplace for tea leaves processing. While demonstrating, explain how to check the effectiveness of cleaning of workplace.
- Step 4:** Ask trainees to clean and arrange of workplace for tea leave processing, and monitor the procedures.
- Step 5:** Verify whether workplace for tea leaves processing are well cleaned and arranged and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 1.4.1 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 1.4.



Points to Remember

- Proper cleaning and arrangement of tools, equipment, and workplaces are essential to maintain hygiene, prevent contamination, and ensure efficient tea leaf processing.

- Clean all tools, equipment, and surfaces regularly, especially after each use or at the end of each production day and check effectiveness of cleanliness by using visual inspection, ATP Test and Riboflavin test.



Application of learning 1.4.

Organized a field visit to the nearest tea factory which process tea leaves and ask trainees to clean and arrange tools and equipment used tea leaves processing.

Check list

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Workplace is efficiency Cleaned	1.1 CIP is applied		
		1. 2 COP is applied		
		1.3 Dry cleaning is applied		
		1.4. Wet cleaning is applied		
		1.5. Visual inspection is done		
		1.6. ATP testing is done		
		1.7. Riboflavin testing is done		
2	Workplace for tea leaves processing is appropriately arranged.	2.1. Tools are arranged		
		2.2. Equipment are arranged		
		2.3. Materials are arranged		



Indicative content 1.5: Receiving green tea leaves



Duration: 4 hrs



Theoretical Activity 1.5.1: Description of quality of tea leaves



Notes to the trainer:

- Trainer may use small groups to describe the quality of tea leaves.
- Trainer may use fresh green tea leaves, pictures or videos as didactic materials which show quality characteristics of tea leaves.



Key steps:

While this activity, pass through the following steps:

Step 1. Introduce the activity and ask trainees to answer the following questions:

- What could be the quality characteristics of tea leaves?
- What could be factors affecting quality/acceptance of green tea leaves?

Step 2. Asks trainees to write the findings on papers, flip chart, blackboard or white board

Step 3. Engages trainees to present their findings

Step 4. Provides the expert view and clarify idea by using didactic material

Step 5. Address any questions or concerns

Step 6. Asks trainees to read the key reading 1.5.1 in trainee manual



Points to Remember

- Maintain a consistent temperature and humidity level during weighing to prevent changes in leaf weight
- Regularly calibrate the weighing scale to ensure accurate measurements.



Practical Activity 1.5.2. Receiving green tea leaves



Notes to the trainer

- The trainer is supposed to demonstrate how to receive green tea leaves for tea leaves processing.
- For the effective delivery; it is recommended to avail green tea leaves, tools and equipment for green tea leaves reception.



Key steps:

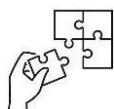
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in tea leaves processing workshop to receive green tea leaves for tea leaves processing.
- Step 2:** Explain the task and provide clear work instruction (PPE, Time allocated).
- Step 3:** Demonstrate how to receive green tea leaves for tea leaves processing. While demonstrating, explain leave count as used in tea leaves processing.
- Step 4:** Ask trainees to receive green tea leaves for tea leave processing, and monitor the procedures.
- Step 5:** Verify whether green tea leaves for tea leaves processing are well received and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 1.5.2 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 1.5



Points to Remember

- Leaf count refers to the process of counting the number of leaves per shoot and two leaves and buds is preferred while plucking (harvesting) tea.
- Select samples randomly to avoid bias and ensure a representative representation of the entire batch.



Application of learning 1.5.

Ask trainees to go in tea leaves processing workshop and to receive green tea leaves.

Checklist:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Green tea leaves are well received	1.1 Green leaves are weighed		
		1.2 Sampling techniques are applied		
		1.3 Leaf count results are interpreted		



Indicative content 1.6: Steaming of tea leaves for green tea making



Duration: 2 hrs



Practical Activity 1.6.1. Steaming tea leaves for green tea making



Notes to the trainer

- The trainer is supposed to demonstrate how to steam tea leaves for green tea making.
- For the effective delivery; it is recommended to avail green leaves to be steamed and steam generator machine to be used during steam generation.



Key steps:

While delivering this activity, pass through the following steps:

Step1: Introduce the activity and ask trainees to go in tea leaves processing workshop to steam tea leaves for green tea making.

Step2: Explain the task and provide clear work instruction (PPE, Time allocated).

Step3: Demonstrate how to steam tea leaves for green tea making. While demonstrating, explain steam generation process.

Step4: Ask trainees to steam tea leaves for green tea making, and monitor the procedures.

Step5: Verify whether green tea leaves for green tea making are well steamed and provide feedback where necessary.

Step6: Ask trainees to read key reading 1.6.1 in trainee manual

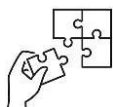
Step7: Ask trainees to perform the task provided in application of learning 1.6



Points to Remember

- Pressure vessels, such as boilers and steam generators, should be regularly inspected and maintained to ensure they are in safe operating condition.
- Ensure that isolation valves are in place to allow for safe maintenance or shutdown of steam systems and wear appropriate personal protective equipment, including gloves, eye protection, and heat-resistant clothing, to prevent burns or injuries.

- If the temperature is too low below 82-93°C, the enzymes in the tea leaves may not be fully inactivated. This can lead to continued oxidation, resulting in a darker colour, a more bitter taste, and a loss of fresh flavour.
- If the temperature is too high above 82-93°C, the tea leaves may become over-oxidized. This can cause the leaves to brown, develop a bitter taste, and lose their delicate aroma and avoid excessive steaming, as it can lead to browning, bitterness, and nutrient loss



Application of learning 1.6.

Ask trainees to go in tea leaves processing workshop and to steam tea leaves for green tea making.

Checklist:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Tea leaves for green tea making are properly Steamed	1.1 Methods of drying are selected		
		1.2 Level of boiler water is checked		
		1.3 Steam is generated		
		1.4 Steam is supplied		
		1.5 steamed green tea leaves are cooled		



Indicative content 1.7: Monitoring withering conditions of green tea leaves



Duration: 2 hrs



Theoretical Activity 1.7.1: Description of withering process



Notes to the trainer:

- Trainer may use small groups to describe withering process of tea leaves.
- Trainer may use pictures or videos as didactic materials which show tea leaves during withering process.



Key steps:

While this activity, pass through the following steps:

Step 1. Introduce the activity and ask trainees to answer the following questions:

- What do you understand by withering process of tea leaves?
- What could be purpose of withering green tea leaves?
- What could be different between physical withering and chemical withering of green tea leaves?
- What are withering conditions for tea leaves?
- What could be chemical and physical change during withering?

Step 2. Asks trainees to write the findings on papers, flip chart, blackboard or white board

Step 3. Engages trainees to present their findings

Step 4. Provides the expert view and clarify idea by using didactic material

Step 5. Address any questions or concerns

Step 6. Asks trainees to read the key reading 1.7.1 in trainee manual



Points to Remember

- Maintain a temperature between 20-25°C because higher temperatures can accelerate the withering process, but excessive heat can damage the leaves and lead to a loss of aroma and flavour.
- Adhere to recommended concentrations to prevent excessive chemical residue on the tea leaves



Practical Activity 1.7.2. Withering green tea leaves



Notes to the trainer

- The trainer is supposed to demonstrate how to wither green tea leaves.
- For the effective delivery; it is recommended to avail steam generator machine to be used during steam generation.



Key steps:

While delivering this activity, pass through the following steps:

Step1: Introduce the activity and ask trainees to go in tea leaves processing workshop to wither green tea leaves.

Step2: Explain the task and provide clear work instruction (PPE, Time allocated).

Step3: Demonstrate how to wither green tea leaves. While demonstrating, explain hard wither and soft wither as used tea leaves processing.

Step4: Ask trainees to wither green tea leaves, and monitor the procedures.

Step5: Verify whether green tea leaves are well withered and provide feedback where necessary.

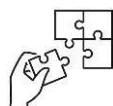
Step6: Ask trainees to read key reading 1.7.2 in trainee manual

Step7: Ask trainees to perform the task provided in application of learning 1.7.2



Points to Remember

- Keep the humidity levels relatively low to prevent mold and mildew growth. High humidity can also cause the leaves to become sticky and clump together.
- Avoid excessive manipulation of the leaves, as this can bruise them and affect their quality.



Application of learning 1.7.

Ask trainees to go in tea leaves processing workshop and to wither green tea leaves for tea leaves processing

Checklist:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Withering conditions are properly monitored	1.1 Green leaves are cooled		
		1.2 Temperature is controlled		
		1.3 Relative humidity is controlled		
		1.4 Moisture content is analyzed		
		1.5 Time is respected		



Learning outcome 1 end assessment

Written assessment

1. Read careful the following statements related to tea leaves processing and choose by encircling the letter corresponding to the correct answer.

i. What is the primary purpose of tea leaves processing?

- a) To package tea leaves
- b) To preserve and enhance the flavor of tea leaves
- c) To grow tea leaves faster
- d) To sell tea in the market

Answer:

What is the primary purpose of tea leaves processing?

- a) To package tea leaves
- ☒ b) To preserve and enhance the flavor of tea leaves
- c) To grow tea leaves faster
- d) To sell tea in the market

ii. Which type of tea undergoes full oxidation during processing?

- a) Green Tea
- b) Oolong Tea
- c) Black Tea
- d) White Tea

Answer:

Which type of tea undergoes full oxidation during processing?

- a. Green Tea
- b. Oolong Tea
- ☒ c. Black Tea
- d. White Tea

iii. Which of the following equipment is used in the withering process of tea?

- a) Rolling machine
- b) Withering trough
- c) Dryer
- d) Fermentation chamber

Answer:

Which of the following equipment is used in the withering process of tea?

- a) Rolling machine
- ☒ b) Withering trough
- c) Dryer
- d) Fermentation chamber

iv. What is the primary tool used to roll tea leaves?

- a) Sieve
- b) Heater
- c) Rolling machine
- d) Shaker

Answer:

What is the primary tool used to roll tea leaves?

- a) Sieve
- b) Heater
- ☒ c) Rolling machine
- d) Shaker

v. What type of tea leaves are commonly used for processing green tea?

- a) Withered tea leaves
- b) Fresh green tea leaves
- c) Fermented tea leaves
- d) Rolled tea leaves

Answer:

What type of tea leaves are commonly used for processing green tea?

- a) Withered tea leaves
- b) Fresh green tea leaves
- c) Fermented tea leaves
- ☒ d) Rolled tea leaves

vi. Which of the following is NOT a material used in tea leaves processing?

- a) Fresh tea leaves
- b) Stems and twigs
- c) Heat-treated water
- d) Fermentation enzymes

Answer: d

Which of the following is NOT a material used in tea leaves processing?

- a) Fresh tea leaves
 - b) Stems and twigs
 - c) Heat-treated water
 - ☒ d) Fermentation enzymes
- vii. What is the first step after receiving green tea leaves for processing?
- a) Rolling the tea leaves
 - b) Cleaning the leaves
 - c) Inspecting for quality and freshness
 - d) Storing the tea leaves

Answer:

What is the first step after receiving green tea leaves for processing?

- ☒ a) Rolling the tea leaves
 - b) Cleaning the leaves
 - c) Inspecting for quality and freshness
 - d) Storing the tea leaves
- viii. Which of the following is NOT part of the inspection when receiving green tea leaves?

- a) Checking leaf freshness
- b) Measuring leaf size
- c) Assessing the color of leaves
- d) Shredding leaves for processing

Answer:

Which of the following is NOT part of the inspection when receiving green tea leaves?

- a) Checking leaf freshness
- ☒ b) Measuring leaf size
- c) Assessing the color of leaves
- d) Shredding leaves for processing

ix. What is the purpose of withering green tea leaves?

- a) To start oxidation
- b) To reduce moisture content
- c) To dry the tea leaves completely
- d) To roll the tea leaves

Answer:

What is the purpose of withering green tea leaves?

- a) To start oxidation
- ☒ b) To reduce moisture content

- c) To dry the tea leaves completely
- d) To roll the tea leaves

x. Withering of green tea leaves primarily reduces:

- a) Flavor
- b) Oxidation
- c) Moisture content
- d) Leaf color

Answer:

Withering of green tea leaves primarily reduces:

- a) Flavor
- b) Oxidation
- ☒ c) Moisture content
- d) Leaf color

xi. What is the primary purpose of steaming green tea leaves?

- a) To remove moisture
- b) To stop oxidation
- c) To add flavor
- d) To ferment the tea leaves

Answer:

What is the primary purpose of steaming green tea leaves?

- a) To remove moisture
- ☒ b) To stop oxidation
- c) To add flavor
- d) To ferment the tea leaves

xii. Which of the following processes follows steaming in green tea production?

- a) Rolling
- b) Withering
- c) Drying
- d) Fermentation

Answer:

Which of the following processes follows steaming in green tea production?

- a) Rolling
- b) Withering
- c) Drying
- ☒ d) Fermentation

2. Read carefully the following statement bellow related to tea leaves processing and answer by True if the statement is correct or False if is not correct.

1. Tea leaves processing involves a single step to ensure flavour development.
Answer: False
2. Withering is an essential step for both green tea and black tea processing.
Answer: True
3. A rolling machine is used to prevent oxidation in green tea processing.
Answer: False
4. Cleaning the workplace is essential for ensuring the safety and hygiene of tea leaves during processing.
Answer: True
5. Cleaning is only done before processing begins, not during or after.
Answer: False
6. Steaming tea leaves helps to preserve the fresh green colour and prevent oxidation.
Answer: True
7. Steaming is a process used in green tea production.
Answer: True

3. Read carefully the table below and answer the question by matching the description in column B and their terms in column C and write letter in space provided in column (A)corresponding to the correct answer.

Column A(Answer)	Column C(Description)	Column B(Terms)
1)	1. Keeps the tea leaves fresh and prevents browning.	A. Withering
2)	2. The process of reducing moisture from fresh tea leaves.	B. Fermentation
3)	3. Shaping and breaking down tea leaves after withering.	C. Steaming
4)	4. process of converting liquid water into water vapor	D. squeezing
5)	5. Quick application of steam to halt enzymatic activity.	E. Prevents Oxidation
		F. Rolling
		G. Steam generation

Answer:

Column A(Answer)	Column C(Description)	Column B(Terms)
1) E	6. Keeps the tea leaves fresh and prevents browning.	H. Withering
2) A	7. The process of reducing moisture from fresh tea leaves.	I. Fermentation
3) F	8. Shaping and breaking down tea leaves after withering.	J. Steaming
4) G	9. process of converting liquid water into water vapor	K. squeezing
5) C	10. Quick application of steam to halt enzymatic activity.	L. Prevents Oxidation
		M. Rolling
		N. Steam generation

4. Read carefully the following statements related to tea leaves processing and fill in the gaps by choosing in the following terms in blanket: **(moisture, green tea leaves, oxidation, clean, quality, contamination, cooled, reduction, water, withering, steaming)**

- The primary material used in tea leaves processing is
Answer: Green tea leaves
- Tea processing requires clean, uncontaminated materials to avoid affecting the.....of the final tea product.
Answer: Quality
- Proper cleaning of the workplace prevents.....of tea leaves.
Answer: Contamination
- Tools and equipment must be cleaned withbefore tea leaves processing begins.
Answer: Water
- Steaming tea leaves is done to stop..... in green tea production.
Answer: oxidation
- After steaming, tea leaves are.....to prepare for the rolling process.
Answer: Cooled
- Withering helps to reduce thecontent of the tea leaves to make them more pliable for rolling.
Answer: moisture

Practical assessment

AB Tea cooperative is a company that produces black tea and green tea. It wishes to hire a technician who is skilled in workplace and tea leaves preparation which will be used for producing black tea and green tea. The manager of the company asks you to prepare workplace and tea leaves which will be used for producing black tea and green .

Checklist

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Tools and equipment are correctly selected and adjusted	1.1 Tools are selected		
		1.2 Equipment are selected		
		1.3 Tools are adjusted		
		1. 3 Equipment are adjusted		
2	Materials are properly selected	2.1 Cleaning products are selected		
		2.2 source of energy to use is selected		
		2.3 Packaging materials are selected		
3	Workplace is properly cleaned and arranged	3.1 Work area is cleaned		
		3.2 Cleanliness is checked		
		3.3 Tools are arranged		
		3.4 Equipment are arranged		
4	Green tea leaves are correctly received	4.1 green tea leaves are weighed		
		4.2 Sampling of green tea leaves is done		
		4.3 Leaf are counted		
5	Withering conditions are properly monitored	5.1 tea leaves are steamed		
		5.2 withering method is done		
		5.3 withering conditions are monitored		



Further information to the trainer

Deb, S., & Jolvis Pou, K. R. (2016). A review of withering in the processing of black tea. *Journal of Bio Systems Engineering*, 41(4), 365-372.

Hossain, M. A., Ahmed, T., Hossain, M. S., Dey, P., Ahmed, S., & Hossain, M. M. (2022). Optimization of the factors affecting BT-2 black tea fermentation by observing their combined effects on the quality parameters of made tea using Response Surface Methodology (RSM). *Heliyon*, 8 (2), 08948

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Lin XiangYang, L. X., Zhang LiJing, Z. L., Lei, H. W., Zhang Hong, Z. H., Cheng, Y. L., Zhu RongBi, Z. R., & Ruan, R. (2010). Effect of drying technologies on quality of green tea. *International Agricultural Engineering Journal*.

Naheed, Z., Barech, A. R., Sajid, M., Khan, N. A., & Hussain, R. (2007). Effect of rolling, fermentation and drying on the quality of black tea. *Sarhad Journal of Agriculture*, 23 (3), 577.

Learning Outcome 2: Ferment Rolled Tea Leaves



Indicative contents

2.1 Sifting withered tea leaves

2.2 Rolling withered and green tea leaves

2.3 Fermenting tea leaves

Key Competencies for Learning Outcome 2: Ferment Rolled Tea Leaves

Knowledge	Skills	Attitudes
● Description of sifting techniques ● Description method of fermentation ● Description of factors influencing fermentation process ● Differentiation of chemical and physical changes during fermentation	● Sifting withered tea leaves ● Rolling withered and green tea leaves ● Fermenting tea leaves	● Being carefully during sifting ● Being attentive during rolling withering and green tea leaves ● Being attentive during fermentation of tea leaves



Duration: 15 hrs

Learning outcome 2 objectives:



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

1. Describe properly sifting techniques of tea leaves in tea leaves processing.
2. Sift correctly withered and steamed tea leaves in tea leaves processing
3. Roll effectively withered and green tea leaves in tea leaves processing
4. Differentiate correctly chemical and physical changes used during fermentation
5. Describe correctly the methods of fermentation in tea leaves processing
6. Describe properly the factors influencing fermentation process in tea leaves processing
7. Ferment properly withered tea leaves in tea leaves processing



Resources

Equipment	Tools	Materials
● Fan, ● Sifter ● Magnet ● Weigh feeder ● Conveyors ● Rotor van ● CTC roller ● Fermentation unit ● High pressure washer ● Trolley ● PPE ● Circular saw	● Thermometer ● Hygrometer ● Basket ● Brooms ● Spade	● Green/tea leaves ● Cleaning agents ● Water

• Rolling table • Rotary drum		
 Advance Preparation: Before delivering this learning outcome, you are recommended to: • Have tea leaves workshop • Avail withered tea leaves • Avail fermentation unit for withered tea leaves fermentation • Have manuals/guide, protocol, video and photo related to fermentation withered tea leaves.		



Indicative content 2.1: Sifting withered tea leaves



Duration: 5hrs



Practical Activity 2.1.1. Sifting withered tea leaves

Notes to the trainer

- The trainer is supposed to demonstrate how to sift the withered tea leaves.
- For the effective delivery; it is recommended to avail sifting equipment for sifting process.



Key steps:

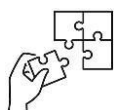
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in the tea leaves processing workshop to sift withered tea leaves.
- Step 2:** Explain the task and provide clear work instruction (PPE, Time allocated).
- Step 3:** Demonstrate how to sift withered tea leaves. While demonstrating, explain techniques of sifting tea leaves.
- Step 4:** Ask trainees to sift withered tea leaves and monitor the procedures.
- Step 5:** Verify whether withered tea leaves are well sifted and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 2.1.1 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 2.1.1



Points to Remember

- After the withering process, gently collect the withered tea leaves to avoid breaking or damaging them
- Choose the correct mesh size based on the type of tea and the desired leaf size. Larger mesh for whole leaves, finer mesh for broken or finer grades.
- Ensure that the withered tea leaves are not too moist or too dry. Too much moisture can cause leaves to clump, making sifting difficult, while overly dry leaves may crumble easily.



Application of learning 2.1.

Organize trainees field visit to a factory where they are processing tea leaves and ask them to sift withered tea leaves.

Checklist/ Solution for application

S/N	Criteria			
		Indicator	Yes	No
1	Withered tea leaves are properly sifted	1.1.Sifting Technique is selected		
		1.2. Sifter is prepared		
		1.3.Tea leaves are separated		
		1.4. Impurities are removed		



Indicative content 2.2: Rolling withered and green tea leaves



Duration: 5 hrs



Practical Activity 2.2.1. Rolling withered and green tea leaves



Notes to the trainer

- The trainer is supposed to demonstrate how to roll the withered and green tea leaves.
- For the effective delivery; it is recommended to avail tea roller machine to be used during rolling process.



Key steps:

While delivering this activity, pass through the following steps:

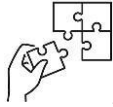
- Step 1:** Introduce the activity and ask trainees to go in tea leaves processing workshop to roll withered and green tea leaves.
- Step 2:** Explain the task and provide clear work instruction (PPE, Time allocated).
- Step 3:** Demonstrate how roll withered and green tea leaves. While demonstrating, explain how to monitor parameters affecting rolling of tea leaves.
- Step 4:** Ask trainees to roll withered and green tea leaves and monitor the procedures.
- Step 5:** Verify whether withered and green tea leaves are well rolled and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 2.2.1 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 2.2



Points to Remember

- Rolling green tea aims to preserve the tea's fresh, vegetal qualities rather than induce oxidation and hand-rolling is often used for premium green teas, ensuring a more uniform and aesthetically pleasing shape.

- Rolling duration and intensity impact the oxidation level, influencing the flavor profile (light, medium, or heavily oxidized) and over-rolling can damage the leaves, leading to an overly bitter flavor due to excessive cell rupture.



Application of learning 2.2.

Organize field visit with trainees to tea factory where they are processing tea leaves and ask them to roll withered and green tea leaves.

Checklist

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Withered/green tea leaves are properly rolled	1.1. Temperature is controlled		
		1.2. Feeding rate is regulated		
		1.3. Rotor vane Blades angle is set		
		1.4. Cooling is performed		



Indicative content 2.3: Fermenting tea leaves



Duration: 5hrs



Theoretical Activity 2.3.1: Description of fermentation methods of rolled tea leaves



Notes to the trainer:

- Trainer may use small groups to describe fermentation process of tea leaves.
- Trainer may use pictures or videos as didactic materials which show fermented tea leaves with different fermentation method.



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- What do you understand by fermentation process of tea leaves?
 - What could be purpose of fermentation process tea leaves?
 - What could be different between convention fermentation and modern fermentation?
 - What could be chemical and physical change during fermentation of rolled tea leaves
- Step 2:** Ask trainees to write the findings on papers, flip chart, blackboard or white board
- Step 3:** Engage trainees to present their findings
- Step 4:** Provide the expert view and clarify idea by using didactic material
- Step 5:** Address any questions or concerns
- Step 6:** Asks trainees to read the key reading 2.3.1 in trainee manual



Points to Remember

- Maintain the ideal temperature, typically between 24°C and 30°C (75°F to 86°F), depending on the type of tea. Higher temperatures speed up oxidation but can lead to over-fermentation and bitter flavors, while lower temperatures may slow the process down too much.



Practical Activity 2.3.2. Fermenting tea leaves



Notes to the trainer

- The trainer is supposed to demonstrate how tea leaves are fermented.
- For the effective delivery; it is recommended to avail tools and equipment to be used in fermentation process of tea leaves.



Key steps:

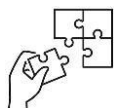
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in tea leaves processing workshop to ferment tea leave.
- Step 2:** Explain the task and provide clear work instruction (Task, PPE, Time allocated).
- Step 3:** Demonstrate how to ferment tea leaves. While demonstrating, Describe the factors influencing fermentation process of tea leaves.
- Step 4:** Ask trainees to ferment tea leave and monitor the procedures.
- Step 5:** Verify whether tea leaves are well fermented and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 2.3.3 in trainees manual
- Step 7:** Ask trainees to perform the task provided in application of learning 2.3.3



Points to Remember

- Keep the humidity level around 90-95% to allow the leaves to oxidize uniformly. Low humidity can cause uneven fermentation, while excessive humidity might promote mold or spoilage.
- Timing is critical. Black tea typically requires 1-4 hours of fermentation, while oolong tea requires less time depending on the desired oxidation level.



Application of learning 2.3.

Organize field visit with trainees to tea factory where they are processing tea leaves and ask them to ferment tea leaves.

Checklist

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Fermentation process of withered tea leaves is properly monitored	1.1. Methods of fermentation are selected		
		1.2. Temperature is controlled		
		1.3. Relative humidity is monitored		
		1.4. Fermentation time is respected		
		1.5. Volume of air is regulated		



Learning Outcome 2 end assessment

Written assessment

1. Read carefully the following statements, choose and write letter corresponding to the right answer.

i. What is the main purpose of fermentation in tea processing?

- a) To dry the tea leaves
- b) To oxidize the leaves and develop flavor
- c) To clean the leaves
- d) To make the leaves soft

Answer: b

ii. Which type of tea undergoes a rolling process primarily to shape the leaves without inducing oxidation?

- a) Black tea
- b) Green tea
- c) Oolong tea
- d) White tea

Answer: b

iii. What happens to the color of tea leaves during fermentation?

- a) They turn green
- b) They remain unchanged
- c) They turn reddish-brown
- d) They turn white

Answer: c

iv. How is the fermentation process stopped?

- a) By applying heat
- b) By adding water
- c) By freezing the leaves
- d) By exposing the leaves to sunlight

Answer: a

v. What is the main purpose of rolling withered tea leaves?

- a) To dry the leaves completely
- b) To initiate the oxidation process
- c) To retain moisture in the leaves
- d) To stop fermentation

Answer: b

2. In The table below,match the following terms used during fermentation process of tea leaves in **Column B** with their corresponding description in **Column C** by writing the letter corresponding to the correct answer in the provided space in **Column A**.

Column A	Column B	Column C
1	A. Oxidation	1. No oxidation, shaping only
2	B. Temperature	2. The gas needed for fermentation
3	C. Yellow tea	3. The process where tea leaves change color
4	D. Humidity	4. A critical factor to control fermentation
5	E. Reddish-brown	5. Undergoes oxidation
6	F. Green Tea	6. The color change during fermentation
	G. Black tea	
	H. Air flow	

Answer:

Column A	Column B	Column C
1 F	A. Oxidation	1. No oxidation, shaping only
2 H	B. Temperature	2. The gas needed for fermentation
3 A	C. Yellow tea	3. The process where tea leaves change color
4 B	D. Humidity	4. A critical factor to control fermentation
5 G	E. Reddish-brown	5. Undergoes oxidation
6 E	F. Green Tea	6. The color change during fermentation
	G. Black tea	
	H. Air flow	

3. Fill in gaps by choosing the appropriate word from the highlighted ones reflecting on fermentation of tea leaves: **oxidation, two, Temperature, four, humidity reddish-brown, heat, five, oils**

- i. The fermentation process of tea leaves is also known as _____.

Answer: oxidation

- ii. During fermentation, tea leaves change from green to _____ in color.

Answer: reddish-brown

- iii. _____ and _____ are two key environmental factors that must be controlled during the fermentation process.

Answer: Temperature, humidity

- iv. Rolling withered leaves also helps to release essential _____ that contribute to the tea's aroma and flavor.

Answer: oils

- v. The fermentation process is stopped by applying _____, which halts the oxidation process.

Answer: Heat

4. The following statements are related to rolling and fermentation of tea leaves. Read them carefully and answer by **True** if the statement is correct or **False** if it is wrong.

- i. Fermentation in tea production involves microbial activity

Answer: False

- ii. Rolling of green tea leaves is mainly done to release essential oils and stop fermentation

Answer: False

- iii. Rolling withered tea leaves initiates the oxidation process, which is crucial for developing flavours in black tea.

Answer: True

- iv. Rolling the tea leaves before fermentation helps initiate the oxidation process. **Answer: False**

Practical assessment

AB Tea cooperative is a company that produces black tea and green tea. It wishes to hire a technician who is skilled in fermenting tea leaves which will be used for producing black tea. The manager of the company requests you to ferment rolled tea Leaves which will be used for producing black tea and orthodox tea.

Checklist:

S/N	Criteria	Indicator	Observation	
			Yes	No
1	Withered tea leaves are properly sifted	1.1. Sifting Technique is selected		
		1.2. Sifter is prepared		
		1.3. Tea leaves are separated		

	according to product quality requirements.	1.4. Impurities are removed		
2	Withered/green tea leaves are properly rolled	2.1. Temperature is controlled		
		2.2. Feeding rate is regulated		
		2.3. Rotor vane Blades angle is set		
		2.4. Cooling is performed		
3	Fermentation process of withered tea leaves is properly monitored	3.1. Methods of fermentation are selected		
		3.2. Temperature is controlled		
		3.3. Relative humidity is monitored		



Further information to the trainer

Deb, S., & Jolvis Pou, K. R. (2016). A review of withering in the processing of black tea. *Journal of Bio Systems Engineering*, 41(4), 365-372.

Naheed, Z., Barech, A. R., Sajid, M., Khan, N. A., & Hussain, R. (2007). Effect of rolling, fermentation and drying on the quality of black tea. *Sarhad Journal of Agriculture*, 23 (3), 577.

Hossain, M. A., Ahmed, T., Hossain, M. S., Dey, P., Ahmed, S., & Hossain, M. M. (2022). Optimization of the factors affecting BT-2 black tea fermentation by observing their combined effects on the quality parameters of made tea using Response Surface Methodology (RSM). *Heliyon*, 8 (2), 08948.

Kumar, K. R., Dashora, K., Kumar, S., Dharmaraja, S., Sanyal, S., Aditya, K., & Kumar, R. (2023). A review of drying technology in tea sector of industrial, non-conventional. <https://www.sciencedirect.com/journal/applied-thermal-engineering>

Learning Outcome 3: Dry fermented and steamed tea leaves



Indicative contents

3.1 Regulation of steam

3.2 Controlling drying parameters

3.3 Checking tea quality

Key Competencies for Learning Outcome 3: Dry fermented and steamed tea leaves.

Knowledge	Skills	Attitudes
• Description of factors to consider when regulating steam • Description of drying methods • Description of physical and chemical change during drying • Description of drying fault in tea leaves processing	• Regulating steam • Drying fermented and green tea leaves • Testing moisture content	• Being vigilant when regulating steam • Being careful while drying fermented and green leaves • Being attentive when testing moisture content



Duration: 15 hrs

Learning Outcome 3 objectives:



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

1. Describe correctly methods of drying fermented and green leaves
2. Describe effectively factor to consider when regulating steam to dry green tea leaves

3. Regulate properly the steam while drying fermented and steamed tea leaves
4. Dry effectively green tea leaves and dhool in tea leaves processing
5. Describe correctly physical and chemical changes occurs during drying
6. Describe properly drying faults present during drying in tea leaves processing
7. Test effectively the moisture content of dried tea in tea leaves processing



Resources

Equipment	Tools	Materials
● Electronic balance/scale, ● Sifter, ● Magnet, ● Conveyors, ● Fluid Bed Dryer, ● Steam boiler, ● Air compressor, ● Moisture meter, ● PPE.	● Thermometer, ● cleaning tools ● hygrometers	● Source of energy, ● fermented tea leaves (dhools), ● green tea leaves



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Have a well fermented tea(dhool) for black and orthodox tea and well steamed tea for green tea
- Avail tutorial video, protocols and flowchart related to drying of fermented and steamed tea leaves
- Avail tools and equipment and ensure that they are in good working condition
- Avail materials used in drying tea leaves



Indicative content 3.1: Regulation of steam



Duration: 5 hrs



Practical Activity 3.1.1. Regulating steam to dry fermented and steamed tea leaves



Notes to the trainer

- The trainer may facilitate this activity by demonstrating how to regulate steam
- For effective deliver it is recommended to avail tools, equipment, and source of energy that should be used to regulate steam
- Videos related to regulation of steam are required



Key steps:

While delivering this activity, pass through the following steps:

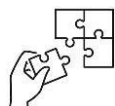
- Step 1:** Introduce the activity and ask trainees to go to tea leaves processing workshop to regulate steam
- Step 2:** Explain the task and provide clear work instructions (PPE, Time allocated)
- Step 3:** Demonstrate how to regulate steam . While demonstrating, Describe the factors to consider when regulating steam
- Step 4:** Ask trainees to regulate steam and monitor the activity
- Step 5:** Verify whether steam is correctly regulated and provide feedback where necessary
- Step 6:** Ask trainees to read key reading 3.1.1. in trainee manual
- Step 7:** Ask trainees to perform application of learning 3.1 in trainee manual



Points to Remember

- The key factors influencing steaming process include temperature, pressure, and humidity levels.
- When using steam boiler check if boiler is filled with water, and check the van if are in good working condition

- Always check the tea leaves condition to avoid that leaves can be over dried or under dried
- The primary goal of drying green leaves is to halt enzymatic activity quickly, preventing oxidation, green tea leaves undergo a specific drying process to preserve their natural color and flavor.
- Sun drying of fermented and green leaves has negative impact as it is linked with unstable weather conditions.
- Steam drying and oven drying methods is mostly used in the tea leaves processing industry as it easy to control inlet temperature that will dry leaves.



Application of learning 3.1. Regulation of steam

Organize field visit with trainees to tea factory where they are processing tea leaves and ask them to regulate steam from boiler.

Solution:

S/N	Criteria	Indicators	Observations	
			Yes	No
1	Steam is properly regulated	1.1. Source of energy is identified		
		1.2. Water is heated		
		1.3. Temperature is controlled		
		1.4. Steam is generated		



Indicative content 3.2: Controlling drying parameter



Duration: 5 hrs



Theoretical Activity 3.2.1: Description of physical and chemical changes during drying



Notes to the trainer:

- Trainer may use small group to describe physical and chemical changes during drying
- For effective delivery it recommended to used didactic materials such as pictures and images related to description of physical changes during drying and avail dried fermented and steamed tea leaves



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. What could be the physical and chemical changes occurred during drying fermented and steamed tea leaves?
- Step 2:** Ask trainees to write the answers on paper, flip charts, or blackboards.
- Step 3:** Facilitate trainees to present provided answers
- Step 4:** Provide the expert view and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns
- Step 6:** Ask trainees to read key reading 3.2.1 in the trainee manual



Points to Remember

- As tea leaves dry, their color changes from vibrant green to a more muted shade. This change is primarily due to the breakdown of chlorophyll, which gives fresh leaves their green color. The degradation of chlorophyll occurs as temperatures rise during drying.
- One significant chemical change that occurs during drying is the inactivation of enzymes present in fresh tea leaves, particularly polyphenol oxidase (PPO). This enzyme is responsible for oxidation reactions that can lead to browning and flavor changes if not controlled. By applying heat during drying, these enzymes are denatured, preventing unwanted oxidation and preserving the green color and fresh flavor profile.



Practical Activity 3.2.2. Drying fermented and steamed tea leaves



Notes to the trainer

- The trainer may facilitate this activity by demonstrating how to dry fermented and steamed tea leaves
- For effective deliver it is recommended to avail tools and equipment for drying fermented and steamed tea leaves.



Key steps:

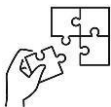
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go to tea leaves processing workshop to dry fermented and steamed tea leaves
- Step 2:** Explain the task and provide clear work instructions (PPE, Time allocated)
- Step 3:** Demonstrate how to dry fermented and steamed tea leaves. while demonstrating, explain drying methods of fermented and green tea leaves
- Step 4:** Ask trainees to dry fermented and steamed tea leaves and monitor the activity
- Step 5:** Verify whether fermented and steamed tea leaves properly dried and provide feedback where necessary
- Step 6:** Ask trainees to read key reading 3.2.2. in trainee manual
- Step 7:** Ask trainees to perform application of learning 3.2.



Points to Remember

- The drying period of fermented and green tea leaves take around 20-25min, the dried tea leaves have moisture range of 2.9-3.5%.



Application of learning 3.2.

Organize trip in tea leaves processing factory near the school and ask trainees to dry green tea leaves for green and black tea making

Solution:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Drying parameter are correctly monitored	1.1. Inlet temperature is monitored		
		1.2. Outlet temperature is monitored		
		1.3. Temperature is controlled		
		1.4. Moisture content is analysed		
2	Changes during drying are correctly identified	1.1. Physical changes are identified		
		1.2. Chemical changes are identified		



Indicative content 3.3: Checking tea quality



Duration: 5hrs



Theoretical Activity 3.3.1: Description of drying fault in tea leaves processing



Notes to the trainer:

- Trainer may use small groups to describe drying fault in tea leaves processing
- For effective delivery it recommended to use pictures, tutorial video describing drying fault as didactive materials for drying tea leaves and avail dried tea leaves with drying fault



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. What could be drying faults that likely to occur during drying of tea leaves?
- Step 2:** Ask trainees to write the answers on paper, flip charts, or blackboards.
- Step 3:** Facilitate trainees to present provided answers
- Step 4:** Provide the expert view and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns
- Step 6:** Ask trainees to read key reading 3.3.1 in the trainee manual



Points to Remember

- Drying fault involves case hardening, high firing and under firing



Practical Activity 3.3.2. Testing of moisture content of dried tea leaves



Notes to the trainer

- The trainer may demonstrate how to test moisture content of dried tea leaves
- For effective delivery it is recommended to avail equipment and tools used to test moisture content of dried tea leaves if they are in good working condition and avail dried tea leaves



Key steps:

While delivering this activity, pass through the following steps:

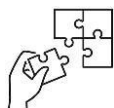
- Step 1:** Introduce the activity and ask trainees to go to tea leaves processing workshop to test moisture content of dried tea leaves
- Step 2:** Explain the task and provide clear work instructions (PPE, Time allocated)
- Step 3:** Demonstrate how to test moisture content of dried tea leaves and explain procedure for testing moisture content
- Step 4:** Ask trainees to test moisture content of dried tea leaves and monitor the activity
- Step 5:** Verify whether moisture content of dried tea leaves properly tested and provide feedback where necessary
- Step 6:** Ask trainees to read key reading 3.3.2. in trainee manual
- Step 7:** Ask trainees to perform application of learning 3.3



Points to Remember

- Calculate the moisture content (m.c) using the following formula

$$m.c = \frac{(m_{total} - m_{tea})}{m_{total}} \times 100$$



Application of learning 3.3.

Request trainees to go in tea leaves processing workshop to check quality of dried tea

Checklist

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Drying fault are properly identified	1.1 Case hardening is identified		
		1.2. High firing is identified		
		1.3. Under firing is identified		
2	Moisture content is effectively tested	2.1. Dried tea leaves are measured		
		2.2. Moisture meter is used		
		2.3. Records are kept		



Learning Outcome 3 end assessment

Written assessment

1. Read carefully the following statement relating to steam regulation and answer by True if it is correct or false if it is incorrect

a. In tea leaves processing one of the purpose of regulating steam is to activate enzymes

Answer: False

b. The advantage of steam drying over traditional drying methods is quality preservation, efficiency and reduction of contamination

Answer: True

c. The drying temperature that allow effective moisture removal is between 200 and 220°F

Answer: True

d. Key factors influencing steaming process include temperature, pressure and humidity levels

Answer: true

3. Following are chemical change and physical change during drying tea. group chemical changes together and physical changes together in the provided table:

Chemical changes	Physical changes

- a. Enzyme Inactivation
- b. Size Reduction
- c. Polyphenol Concentration
- d. Color Change
- e. Loss of Nutrients
- f. Texture Alteration

- g. Volatile Compound Development
- h. Size Reduction

Answer:

Chemical changes	Physical changes
Enzyme Inactivation	Size Reduction
Loss of Nutrients	Color Change
Texture Alteration	Texture Alteration
Volatile Compound Development	

3. Read carefully the following statements and choose by encircling the letter corresponding with the right answer.

a. Following are advantage of steam drying except:

- i. Quantity preservation
- ii. Efficiency
- iii. Reduce contamination

Answer: i.

b. Physical changes during drying are following except:

- i. Moisture Loss
- ii. Odor Change
- iii. Texture Alteration
- iv. Size Reduction

Answer: ii.

c. Following are drying fault except:

- i. Case hardening
- ii. High firing
- iii. Low firing

Answer: iii.

4. Re-arrange the following steps of steam regulation to show a logic sequencenby writing all the name of step

- i. Monitoring humidity levels
- ii. Steam generation
- iii. Adjusting Airflow
- iv. Setting optimal temperature
- v. Finalizing Drying Process
- vi. Preparation of drying equipment
- vii. Cooling Down Phase

- viii. Regular Checks on Tea Leaves
- ix. Uniform distribution of steam
- x. Documentation and Feedback Loop.

Answer:

- i. Preparation of drying equipment
- ii. Setting optimal temperature
- iii. Steam generation
- iv. Uniform distribution of steam
- v. Monitoring humidity levels
- vi. Adjusting Airflow
- vii. Regular Checks on Tea Leaves
- viii. Finalizing Drying Process
- ix. Cooling Down Phase
- x. Documentation and Feedback Loop.

Practical assessment

AMIA tea leaves processing plant is located in Nyabihu District, they process black tea, orthodox tea and green tea, they have got command of supplying their product in umushyikirano conference. Production manager of AMIA tea leaves processing plant request you to dry fermented tea and steamed tea leaves.

S/N	Assessment criteria (Based on performance criteria)	Indicator	Observation	
			Yes	No
1	Steam is properly regulated	1.1 Source of energy is identified		
		1.2 Water is heated		
		1.3 Temperature is controlled		
		1.4 Steam is generated		
2	Drying parameter are correctly monitored	2.1 Inlet temperature is monitored		
		2.2 Outlet temperature is monitored		
		2.3 Temperature is controlled		
		2.4 Moisture content is analysed		
3	Changes during drying are correctly identified	3.1 Physical changes are identified		
		3.2 Chemical changes are identified		



Further information to the trainer

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Learning Outcome 4: Store Graded Tea Products



Indicative contents

4.1 Grading dried tea products

4.2 Packaging graded tea products

4.3. Storing packaged tea products

Key Competencies for Learning Outcome 4: Store graded tea products

Knowledge	Skills	Attitudes
● Identification of grading parameters ● Description of steps involved in grading process ● Description of types of tea grades	● Cupping sorted tea ● Packaging graded tea ● Storing packaged tea products	● Paying attention when cupping tea ● Being accurate when packaging tea



Duration: 20 hrs

Learning outcome 4 objectives:



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

1. Identify correctly grading parameters according to products specification
2. Cup properly sorted tea products
3. Describe correctly steps involved in grading process
4. Describe correctly types of tea grades according to product specification
5. Package effectively graded tea according to packaging requirement
6. Store correctly packaged tea according to storage requirement



Resources

Equipment	Tools	Materials
• Electronic balance/scale, • Magnet, • Conveyors, • Super 3T Fiber extractor, • Pre-sorter, • Grading machine, • Packing machine, • Sealing machine, • Air compressor, • moisture meter, • PPE, • working table.	• Hygrometer, • Bucket, • Brooms, • Sorting bins, • tasting cup, • tasting bowl, • tasting spoon, • kettle, • palettes.	• Green tea, • black tea, • orthodox tea, • cleaning agents, • Water, • Source of energy, • Packaging material, • Napkin, • Towel, • cleaning tools.



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail tools, materials and equipment used in grading tea products
- Avail classroom and workshop
- Prepare protocols, manuals, image, pictures related to grading of tea products



Indicative content 4.1: Grading of dried tea products



Duration: 8 hrs



Theoretical Activity 4.1.1.: Identification of grading parameters of dried tea products



Notes to the trainer:

- Trainer may use small groups to identify the grading parameters of dried tea products
- For effective delivery it recommended to use didactic material such as pictures, dried tea related to grading parameters of dried tea products



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
- i. What could be grading tea parameters in tea processing?
 - ii. Why do we need to grade dried tea products?
- Step 2:** Ask trainees to write the answers on paper, flip charts, or blackboards.
- Step 3:** Facilitate trainees to present provided answers and choose the correct answers.
- Step 4:** Provide the expert view and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns
- Step 6:** Ask trainees to read key reading 4.1.1 in the trainee manual



Points to Remember

Tea is graded based on size ,density,surface characteristics of particles



Theoretical Activity 4.1.2.: Description of steps involved in grading process



Notes to the trainer:

- Trainer may use small groups to describe the steps involved in grading process

- For effective delivery it is recommended to avail pictures and video as didactic materials related to steps involved in grading process



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
 - i. What do you understand by grading process?
 - ii. What could be steps involved in grading process?
- Step 2:** Ask trainees to write the answers on paper, flip charts, or blackboards.
- Step 3:** Facilitate trainees to present provided answers and choose the correct answers.
- Step 4:** Provide the expert view and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns
- Step 6:** Ask trainees to read key reading 4.1.2 in the trainee manual



Points to Remember

- Grading progress involve fiber extraction, sorting by removing cakes and ball, grading by assigning grades



Theoretical Activity 4.1.3.: Description of types of tea grades



Notes to the trainer:

- Trainer may use small groups to describe types of tea grades
- For effective delivery it is recommended to avail graded tea, picture and video as didactic materials describing types of tea grades



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to answer the following questions:
 - i. Identify types of tea grade according to tea products

- Step 2:** Ask trainees to write the answers on paper, flip charts, or blackboards.
- Step 3:** Facilitate trainees to present provided answers and choose the correct answers.
- Step 4:** Provide the expert view and clarify ideas by using didactic materials
- Step 5:** Address any questions or concerns
- Step 6:** Ask trainees to read key reading 4.1.3 in the trainee manual



Points to Remember

- Tea grades are different according to the tea products



Practical Activity 4.1.4. Sensory evaluation of sorted tea



Notes to the trainer

- The trainer may facilitate this activity by demonstrating how to cup sorted tea
- For effective delivery it is recommended to avail tools, equipment and materials for cupping sorted tea



Key steps:

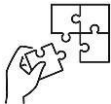
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go to tea leaves processing workshop to cup sorted tea
- Step 2:** Explain the task and provide clear work instructions (PPE, Time allocated)
- Step 3:** Demonstrate how to cup sorted tea and explain the procedures for cupping sorted tea
- Step 4:** Ask trainees to cup sorted tea and monitor the activity
- Step 5:** Verify whether sorted tea is properly cupped and provide feedback where necessary
- Step 6:** Ask trainees to read key reading 4.1.4. in trainee manual
- Step 7:** Ask trainees to perform application of learning 4.1. in trainee manual



Points to Remember

- Cupping standard for tea products involve tea selection and preparation, evaluation criteria
- Tasting process include slurping and spitting



Application of learning 4.1.

Request trainee to go in tea leaves processing workshop and cup sorted tea

Solution:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Cupping is corrected performed	1.1. Tea is prepared		
		1.2. Criteria are evaluated		
		1.3. Record are kept		



Indicative content 4.2: Packaging of graded tea products



Duration: 6 hrs



Practical Activity 4.2.1. Packaging of graded tea products



Notes to the trainer

- The trainer may demonstrate how to package graded tea products
- For effective delivery it is recommended to avail graded tea products, packaging materials, sealer machine and labels



Key steps:

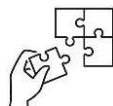
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go to tea leaves processing workshop to package graded tea products
- Step 2:** Explain the task and provide clear work instructions (PPE, Time allocated)
- Step 3:** Demonstrate how to package graded tea products and explain the procedures of packaging graded tea products
- Step 4:** Ask trainees to package graded tea products and monitor the activity
- Step 5:** Verify whether graded tea products are properly packaged and provide feedback where necessary
- Step 6:** Ask trainees to read key reading 4.2.1 in trainee manual
- Step 7:** Ask trainees to perform application of learning 4.2.



Points to Remember

- Packaging of graded tea products involves filling, sealing, labelling



Application of learning 4.2.

Request trainees to go in tea leaves processing workshop and package graded tea products

Checklist:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Graded tea product is correctly packaged	Graded tea product is filled		
		Graded tea product is sealed		
		Graded tea product is labelled		



Indicative content 4.3: Storing of packaged tea products



Duration: 6 hrs



Practical Activity 4.3.1. Storing packaged tea products



Notes to the trainer

- The trainer may demonstrate how to store packaged tea products
- For effective delivery it is recommended to avail packaged graded tea product and storage room.



Key steps:

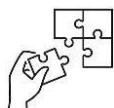
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go to tea leaves processing workshop to store packaged graded tea products
- Step 2:** Explain the task and provide clear work instructions (PPE, Time allocated)
- Step 3:** Demonstrate how to store packed tea leaves. While demonstrating. While storing, explain storage requirement of packaged tea leaves
- Step 4:** Ask trainees to store packaged graded tea products
- Step 5:** Verify whether packaged graded tea products are properly stored and provide feedback where necessary
- Step 6:** Ask trainees to read key reading 4.3.1 in trainee manual
- Step 7:** Ask trainees to perform application of learning 4.3.



Points to Remember

- To manage the stock system of First In First Out (**FIFO**) and Last In First Out (**LIFO**)
- Avoid moisture content and light in store room



Application of learning 4.3.

Organize field visit in tea leaves processing factory, where they process tea leaves and ask trainees to store packaged tea products

Checklist:

S/N	Criteria	Indicators	Observation	
			Yes	No
1	Storage condition are properly respected	1.1. Time is set		
		1.2. Temperature is set		
		1.3. Relative humidity is respected		
		1.4. Stock management system is respected		



Learning Outcome 4 end assessment

Written assessment

1. In the table below, match the following attribute for sensory evaluation in **Column B** with their corresponding parameter to taste in **Column C** by writing the letter corresponding to the right answer in the provided space in **Column A**.

Column A	Column B	Column C
1.....	1) Dry Leaf	A) Thickness, texture
2.....	2) Body/Mouthfeel	B) Intensity, complexity
3.....	3) Liquor Appearance	C) Appearance (uniformity in size, shape and color), Aroma (fresh, stale)
4.....	4) Aftertaste	D) Balance (sweetness, bitterness, astringency, umami), Complexity
5.....	5) Aroma	E) Clarity (clear, not cloudy) Color(golden for black tea, pale green for green tea)
		F) Thickness, texture

Answer:

Column A	Column B	Column C
1...C.....	1) Dry Leaf	A. Thickness, texture
2...A.....	2) Body/Mouthfeel	B. Intensity, complexity
3...E....	3) Liquor Appearance	C. Appearance (uniformity in size, shape and color), Aroma (fresh, stale)
4.....	4) Aftertaste	D. Balance (sweetness, bitterness, astringency, umami), Complexity
5...B.....	5) Aroma	E. Clarity (clear, not cloudy) Color(golden for black tea, pale green for green tea)
		F. Thickness, texture

2. Following statement are related to cupping and storing of tea products answer by true if the statement is correct or false if the statement is not correct

a. Cupping is methods for evaluating tea quality by assessing its appearance, aroma, flavor and texture

Answer: true

b. When preparing tea for cupping, water temperature for green tea is 90-100°C

Answer: false

c. The steeping time for most tea is 3-5 min

Answer: true

d. Filling refers to the step in which processed tea is packaged or placed into container for storage or sale

Answer: true

e. Once tea is filled into packaging material it is sealed to prevent contamination and exposure to air and moisture

Answer: true

3. Arrange in correct order the following steps used during the cupping by writing the all name of step

1. Evaluation Criteria
2. Tea Selection & Preparation
3. Special Considerations
4. Scoring
5. Tasting Process

Answer:

- 1. Tea Selection & Preparation**
- 2. Evaluation Criteria**
- 3. Tasting Process**
- 4. Scoring**
- 5. Special Considerations**

4. Read carefully the following statements, choose and write the letter corresponding with the right answer.

i. during tea selection and preparation for cupping following are preparation conditions involved except

- a. measure 2-3 gr of dry tea
- b. boil water at temperature 90-100
- c. steep tea for 15-10 min

Answer: C

ii. The primary attributes evaluated during tea cupping include:

- a. dry leaf**
- b. liquor

- c. infused leaves
- d. all are correct
- e. a, and b are correct

Answer: d

iii. the storage condition of tea involves:

- a. Humidity
- b. Light protection
- c. Air and oxygen exposure
- d. Temperature
- e. All are correct
- f. A and d are correct

Answer: e

5. Write following term used in stock management in full word

- a. FIFO
- b. LIFO

Answer:

FIFO: First In First Out

LIFO: Last In First Out

Practical assessment

AMIA tea processing plant located in Musanze district process green tea, black tea and orthodox tea, they has process tea that will be exported in Mombassa. Production manager requested you to store graded tea products.

Task

1. Graded dried tea products
2. Package graded tea products
3. Store packaged tea products

Checklist

S/N	Assessment criteria (Based on performance criteria)	Indicator	Observation	
			Yes	No
1	Dried tea products are correctly graded	1.1. Orthodox tea is graded		
		1.2. Green tea is graded		
		1.3. Black tea is graded		
	Cupping is corrected performed	2.1. Tea is prepared		
		2.2. Criteria are evaluated		
		2.3. Record are kept		
2	Graded tea products are effectively packaged	3.1. Filling is performed		
		3.2. Sealing is performed		
		3.3. Labelling is performed		
3	Packaged tea products are correctly store	4.1. Time is controlled		
		4.2. Temperature is monitored		
		4.3. Relative humidity is monitored		
		4.4. Stock management system is respected		



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