Module 10: Primary Coffee Processing

Objective

To enable learners understand all aspects of primary processing of coffee in order to maintain the quality of harvested cherries throughout the process

Content

i) Cherry harvesting - Selective picking, cleanliness of harvesting containers, protection from the direct sun light and cherry transportation
ii) Cherry sorting - avoiding contamination, what to sort, weighing and what to do with the sorted beans
iii) Pulping and pre-grading - definition, machine cleanliness, when to pulp, pre- grading and water re-circulation
iv) Fermentation and intermediate washing - why ferment, shading fermentation tanks, fermentation period, intermediate washing, grittiness as an indication complete fermentation and maintenance of fermentation tanks
v) Final washing and grading of parchment - Use of paddles, grading by parchment density, parchment soaking
vi) Parchment drying - skin drying, white stage, soft black stage, medium black stage, hard black stage and conditioning
vii) The semi-washed processing method - eco-pulper as a water saving technology and the process
viii) Processing at small and medium estate farms - Use of hand/motorized pulpers, fermentation containers, grading and soaking
ix) Storage of parchment - ventilated bins, avoiding moisture reabsorption, insulation from heat, sorting of defects and storage duration
x) Factory hygiene and maintenance - repairs, painting, cleanliness and general hygiene
xi) Coffee waste management - use of seepage tanks, minimizing water usage, maintenance of seepage tanks, use of pulp
xii) Important considerations in coffee processing - harvesting of roof water, use of final washing water, managing dull weather and avoiding contamination
xiii) Buni drying - what and how to dry, avoiding rewetting, avoiding mixing of different stages and final buni moisture content
xiv) Common errors on pulper settings and their remedies - errors, causes and remedies

Methodology

i) Class lecture/field trainings sessions
ii) Discussions on various practices being carried out currently
iii) Demonstration on sorting, checking completion of fermentation and grading by density and gravity
iv) Group work practical sessions in a coffee factory setup

Teaching aids/materials

i) Trainers' manual/training posters
ii) Laptop/Projector, flip chart/white board and marker pens
iii) A moisture meter
iv) Illustrations of an eco-pulper, hand pulper and a motorized hand pulper
v) Some cherries -red ripe, Under-ripe, over-ripe, small cherries
vi) Some parchment and pulp

10.1 Introduction

Proper coffee processing is important as it sustains bean quality and thus assures better prices to growers. There are two methods of coffee processing namely wet and dry methods. Wet processing is the pre-dominant practice in Kenya. The process involves a series of stages and each must be undertaken in the right manner and with facilities which are in good order. The stages are:

10.2 Cherry harvesting

- Ensure timely and selective picking of bright red cherry. Avoid picking green and under-ripe berries which may cause pulping and fermentation problems
- Use clean harvesting bags, baskets or tins
- Avoid dropping cherry on bare ground during picking
- The harvested cherry should be kept under shade to protect it from direct sun
- Cherry should be transported in clean containers/bags
- Transportation of cherry to the factory should be done on the same day of harvesting
- Its important to note that the Kenyan law does not allow children to pick coffee

Cherry harvesting – pick only the red ripe

10.3 Cherry sorting

- Spread the cherry on a clean material/floor to avoid contamination
- Remove the green, under/over ripe, dry, insect infested/diseased berries, twigs, leaves and any other foreign materials such as stones
- Weigh and record the sorted cherry
- Process the sorted out lower grade cherry (under ripes, over ripes and greens) by the dry method as Buni

Cherry sorting

Sorted out leaves and cherries

10.4 Pulping and pre-grading

- Pulping involves the removal of the outer red skin (pulp) of the cherry
- The pulping machine used should be clean, in good mechanical order and well-adjusted depending on the size of beans
- Control the cherry feed rate to avoid overfeed that may cause too much pulp in the parchment
- Pulping should be done on the same day of cherry harvesting
- Processing water must be clean, free from colour and odours
- During pulping, pre-grade coffee parchment into heavy and light beans
- Re-circulate processing water to enhance subsequent fermentation. Dispose off the re-circulated water every day after pulping
- Flush the pulping system with clean water immediately after pulping

10.5 Fermentation and intermediate washing

10.5.1 Fermentation

- This is done to break down the mucilage into simple non sticky substances which are easily washed off from the coffee beans
- Mucilage attracts dust, taints coffee, inhibits drying and is a media of mould growth, all of which affect bean quality. Its removal is therefore important for drying
- Place the different grades of parchment in separate fermentation tanks. The tanks should be shaded to protect the parchment from direct sunlight and rainfall
- Fermentation is complete when parchment feels gritty and is no longer slippery upon pressing between fingers. To test, put some fermented parchment in a bowl, add enough water, wash and check for grittiness.
- Drain all the water and leave the parchment to ferment for about 16 hours and monitor closely till fermentation is complete. Warm weather conditions and re- circulation of pulping water quickens the process.
- The depth of parchment in fermentation tanks should not exceed 1 metre
- Always ensure that the fermentation tanks are free from cracks and are well painted with appropriate paints (eg epoxy/epilex paints) or non-acid corrosive/clay tiles which are acid resistant and compliant with health standards

Well painted fermentation tanks

Parchment fermentation

10.5.2 Intermediate washing

- This is normally done approximately 16 hours after pulping
- Wash the parchment in the fermentation tanks to remove the degraded mucilage and drain the water to allow fermentation to continue if necessary
- The fermentation procedure should be 'dry', followed by intermediate washing (after about 16 hours or so), then 4 to 6 hours of further dry fermentation if necessary, until the gritty feel is achieved

10.6 Final washing and grading of parchment

- Once fermentation is complete, fill the tank with clean water, stir vigorously with paddles, drain off the water and repeat several times to assist in detaching the mucilage from the parchment
- Wash the parchment thoroughly on well painted concrete channels using clean water and rubber paddles/squeezers
- Push the parchment against a stream of water to clean and grade it into parchment 1, 2, 3 and lights (PL)
- Take Parchment 3 and lights to the skin drying tables
- Put parchment 1 and 2 under water in separate soak tanks overnight. Thereafter, wash and take the parchment to the skin drying tables
- If the drying tables are inadequate, one may soak for longer periods, changing the water daily but usually not more than 7 days

10.7 Parchment drying

10.7.1 Skin drying of parchment (55 – 45% MC)

This is the removal of surface water and that between the parchment hull and the bean. It should be executed within the shortest time possible (2-3 hrs in a normal day). Parchment should not be left on the skin drying tables overnight

- Maintain a parchment layer of approximately 1 inch for even drying
- Frequently stir the parchment to enhance water removal and prevent parchment cracking
- Mechanical drying can be done if facilities allow.
- Sort out defective beans since they are easily distinguishable during this stage
- Transfer the parchment to the final drying beds when the skin of the parchment is free of surface moisture as well as beneath the hull
- Maintain drying tables in clean condition and absolutely flat for even drying
- Clear all leftover beans on the beds before placing new wet parchment

10.7.2 White stage (45-30% M.C)

- The beans are white when the parchment skin is removed
- Place the parchment on drying beds lined with sisaltex, hessian cloth, tilder/shade net maintaining a parchment depth of about 2.5 cm (1 inch)
- Practice slow and cool drying to avoid cracking
- Spread the parchment in a thin layer and stir regularly during the morning hours and in the evening
- Ideally, in the hot part of the day, a raised shade cover should be put in place to allow free air movement. Else, pile coffee into a ridge of about 4-5 inches deep along the centre of the table and stir regularly

- Finalise the sorting out of the damaged and defective beans
- In the evening and during rainy weather, cover the parchment with both hessian cloth and nylex
- Avoid dropping parchment on bare ground or on the grass. Any parchment collected should be put in the parchment light category

Parchment drying

Mettalic drying tables

10.7.3 Soft black stage (30 -20% M.C)

- At this stage the beans are soft and translucent
- The parchment depth can be increased to about 5cm
- Expose the parchment to sunlight for about 50 hours of actual sunshine
- Sun light is essential in the formation of the final bluish-green colour of the bean at this stage. Mechanical drying is not recommended

10.7.4 Medium black stage (20 -16% M.C)

- The beans are fairly dark and hard
- In case of congestion, temporary storage in ventilated bins is permitted
- Parchment can be dried rapidly without loss of quality and mechanical driers can be used

10.7.5 Hard black stage (16 -11% M.C)

- Fully hard beans and dark in colour
- Can be dried rapidly without loss of quality

10.7.6 Conditioning (11-10.5% M.C)

- This is normally done in ventilated stores or bins to even out moisture level
- The parchment is ready for storage when it has a moisture content of 11 to 10.5%. Use a well calibrated moisture meter to measure the moisture content in order to avoid over or under-drying

Moisture meter

Conditioning bin

10.8 The semi-washed processing method

- This process combines pulping and mechanical removal of mucilage by friction or attrition in one operation by use of eco-pulpers
- The mucilage is removed immediately after pulping using a demucilager
- Wash off any mucilage mixed with the parchment and soak the parchment under water overnight to improve the quality of the beans
- Grading can be done before the soaking to separate the different parchment grades. Soak P1. P2 can also be soaked if space allows

Eco – pulpers

10.9 Processing at small and medium estate farms

- In small and medium estate farms, drum pulpers, hand and motorized pulpers can be used for pulping
- Fermentation can be done in hard plastic containers. Fill the parchment up to
- ¾ depth to enable intermediate washing and final washing.
- The pulping yields mixed grades of parchment. After the fermentation, grading can be done if the farmer has grading channels. Soak P1 and P2 under water overnight before drying. Else, soak the whole lot

Drum pulper

Hand pulper

Motorised pulper

10.10 Storage of parchment

- Store bulk coffee in well ventilated bins or on wooden floors and stir regularly
- Place coffee bags on wooden pallets 15cm from walls and floors
- The coffee store must be well ventilated and corrugated iron sheet roof adequately insulated to minimize heat transfer
- Avoid storing coffee parchment in the same store with buni
- Avoid pro-longed storage as this leads to quality loss. Over stored parchment becomes "woody" after six months of normal storage in the factory
- In the event that sorting was not adequately done during the skin drying and white stage, it is important to sort the coffee before bagging and final delivery to the mills

N/B : Avoid the use of herbicides as a means of weed control at the wet mills

Storage on wooden pallets

10.11 Important considerations in coffee processing

- Fermentation tanks should be roofed to avoid direct sun
- Clean water can be harvested from the roofs during the rainy season and used for soaking P1 and P2
- Store the water used in final washing for pulping cherry the same day
- In cool, dull weather concentrate on drying the wettest coffee
- Nearly dry coffee (Medium black stage) can be placed in store to give space for wet coffee. Do not forget to take out this coffee when drying conditions improve
- Always wash your hands before handling the coffee
- Do not allow animals in the coffee processing area to avoid off-flavours

10.12 Factory Hygiene and maintenance

- All the factory operators, equipment and materials must be clean. Do not smoke or apply perfumes during processing
- The recommended maintenance procedures e.g. painting, repair of channels and cherry hoppers should be strictly adhered to.
- Wash the pulper immediately after pulping
- Ensure no berries are left out from previous days pulping on the processing lines to avoid formation of stinkers
- Clean the stores at the beginning of the season – remove dirt and old parchment
- Do not store any chemicals or fuels in a coffee store. Coffee beans can absorb odours thus affecting quality negatively

10.13 Coffee waste management

- Channel the waste water to the seepage/soak pits which should be located away from water bodies
- Minimize water usage by re-circulating pulping water and using the final grading water for pulping
- Remove the sludge from the bottom and sides of the seepage pits annually
- Pulp should be separated from waste water and the waste water should not be left to flow to water bodies
- The pulp should be composted and used in farms. Alternatively, the pulp can be used to produce bio-gas


Seepage pits

10.14 Buni drying (dry processing)

- Although wet processing is the most common practice in Kenya, dry processing is done for overripe, under ripe, stripping and in situations where wet processing facilities are not available
- Start drying cherry on a clean and well drained surface after harvesting. e.g. on a concrete surface
- Dry buni on raised surfaces or drying tables and cover with rain proof materials when there is rain to avoid re-wetting. This prevents mould growth
- Avoid mixing freshly picked or sorted out cherry with the drying ones. Each batch of buni should be dried separately to avoid mixed drying
- Ensure buni is properly dried to a moisture content of 12%

Correct Buni drying – on raised surface

Incorrect drying – on the soil

Moulds on Buni

10.15 Common errors on pulper settings and their remedies

Error	Causes	Remedies
Unpulped cherry passing through the pulper / repasser	Knives / Plough too far from the disc Too small beans	Adjust plough closer Proper sorting
Nipping of beans	Knives / plough too close to disc under-ripes, over-ripes	Adjust the plough / knife wider (a used hacksaw blade size), check and replace bearings
Whole cherry lost with pulp	Knife set too far from the disc	Adjust knife setting as above
Excess pulp in pulped coffee	Worn out disc surfaces Too high cherry feed rate into pulper	Re-spray discs Reduce feed rate
Disks rotates backwards	Reversed discs orientation during installation	Change disc orientation
Intermittent ringing sound coming from pulper	Knives set too close to loose disc shaft Cover plates touching disc Hard object trapped between disc and plough disc	Reset Knives correctly Check shaft bearings Correct by adjusting Remove the object