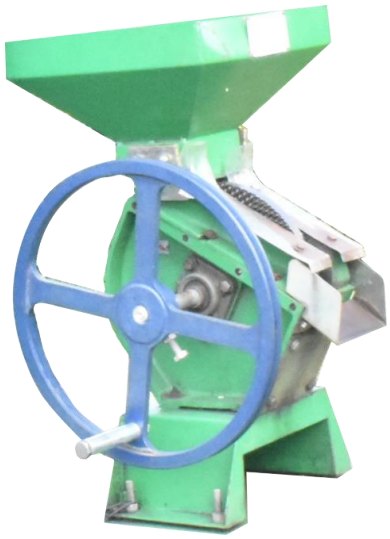
WORKSHOP

Coffee Processing theory:
A preparatory course for Coffee Quality Institute (CQI)
Q Processing Arabica Level 2

Student handbook
2024



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About the CQI QP2 preparation course and the handbook

The Q Processing Level 2: Professional Arabica course, designed by the CQI (Coffee Quality Institute), is aimed at individuals who already have several seasons of experience in a coffee washing station. The course allows you to acquire more in-depth scientific knowledge which will allow participants to better understand and better carry out their Post-Harvest processing work in the field.

"Q Processing Professional is a six-day field-based course where people working normally in coffee washing stations, deepen their theoretical knowledge in general and of the main processing methods, and gain hands-on experience with a quality control system for Post-Harvest Processing. Students will begin to develop the skillsets necessary to achieve different flavour profiles through processing. To be certified, attendees must pass both theoretical and practical tests."

In particular, the course is composed with 10 theoretical modules, coffee processing methods, coffee fruit anatomy, fermentation, drying, storage, quality control, using different tools, in a more rigorous manner. Cupping sessions will allow students to feel the difference between processing methods and also to taste defects in coffee.

As the course is intense with numerous tests, ITC propose to prepare students for 2 days for the next QP2 course and thus increase the rate of success. Attendees should be aware that the CQI Q processing Professional level 2 certificate will give you some respect and professionalism in the coffee value chain.

Disclaimer

The contents of this manual or any other material referenced for purpose developing this manual are the sole responsibility of consultant and can in no way be taken to reflect the views of the ITC nor European Union.

CHAPTER ONE: About the CQI Q Processing Level 2: Professional Arabica Course

General description of the practical course

Q Processing Arabica Level 2 Professional is 6-days course that will give you more scientific knowledge, which will enable you to make better quality-related decisions on your coffee washing station. More specifically, you'll be able to understand various complex aspects of Post-Harvest processing. This course must be taken during the coffee season, as it involves handling fresh cherry coffee. The following modules are taught, in the QP2 course:

- The coffee value chain, actors and operations
- Raw material and characterisation
- Coffee fruit anatomy and the main processing methods
- Pulping
- Fermentation
- Washing and demucilation
- Drying
- Storage, dry-milling,
- Defects identification
- Quality control monitoring
- Issues and future of processing

To obtain a certification such as Q processing professional, the student is required to pass various tests, as you'd expect. As you can imagine, the course is very intensive and the aim of this preparation is to put you in the best possible conditions to succeed in the next QP2 course.

General issues faced by participants in undertaking and completing the course

Here are just a few of the difficulties encountered by many students.

- Learning is a lifelong attitude that must be pursued throughout one's life, in order to be constantly up to date. This is absolutely true when it comes to the coffee industry. Today we have access to the resources of the web and artificial intelligence. The success of the general knowledge exam is partly linked to the knowledge already acquired.
- Many of the answers to the exam questions are in the course, and the instructor often gives hints. This requires attention and good note-taking skills. This is true in many circumstances of our professional or student life. So it's important how to take notes efficiently.
- The CQI system requires each student to register in the database. This is done once for all CQI courses the student will take in the future. Unfortunately, experience shows that if students don't master the registration procedure, a lot of time is wasted, and the schedule can slip.
- Calculation problems can be difficult for some. In our case, there are only arithmetic rules and logic. Preparation will enable you to practice.
- Practical work is done in groups and this is graded. If a student does not have the opportunity to handle the measuring equipment, it will be difficult for him to do so during the test. It is therefore recommended to handle the equipment by yourself.

CHAPTER TWO: The CQI data base system

How to register into the CQI data base

You should know that the CQI (Coffee Quality Institute) manages a database for a lot of information and for different courses for what interests us now. It is absolutely essential to register in the system, if you wish to register for a Q course. This is done in 2 steps:

step 1: register your profile in the system

step 2: register for the course you wish to take

Connect to www.coffeeinstitute.org

CLICK on LOGIN Button (Top Right corner

CLICK on -CREATE AN ACCOUNT-

Fill in

- Your First Name and Surname
- Your Email address
- Your Password

Fill in

The rest of the information

- It is alway
- You have the possibility to update the saved information.

Be careful, saving dates can sometimes be a problem and does not always work on mobile phones. This is why it is advisable to use a computer to obtain a valid date

Note: The trainer will provide a hands-on demonstration (Internet Connection needed)

How to Update your profile

CLICK on **LOG IN TO YOUR ACCOUNT-**

CLICK on **PROFILE** **(On Top)**

CLICK on **Edit My Profile**

CLICK on **Update-**

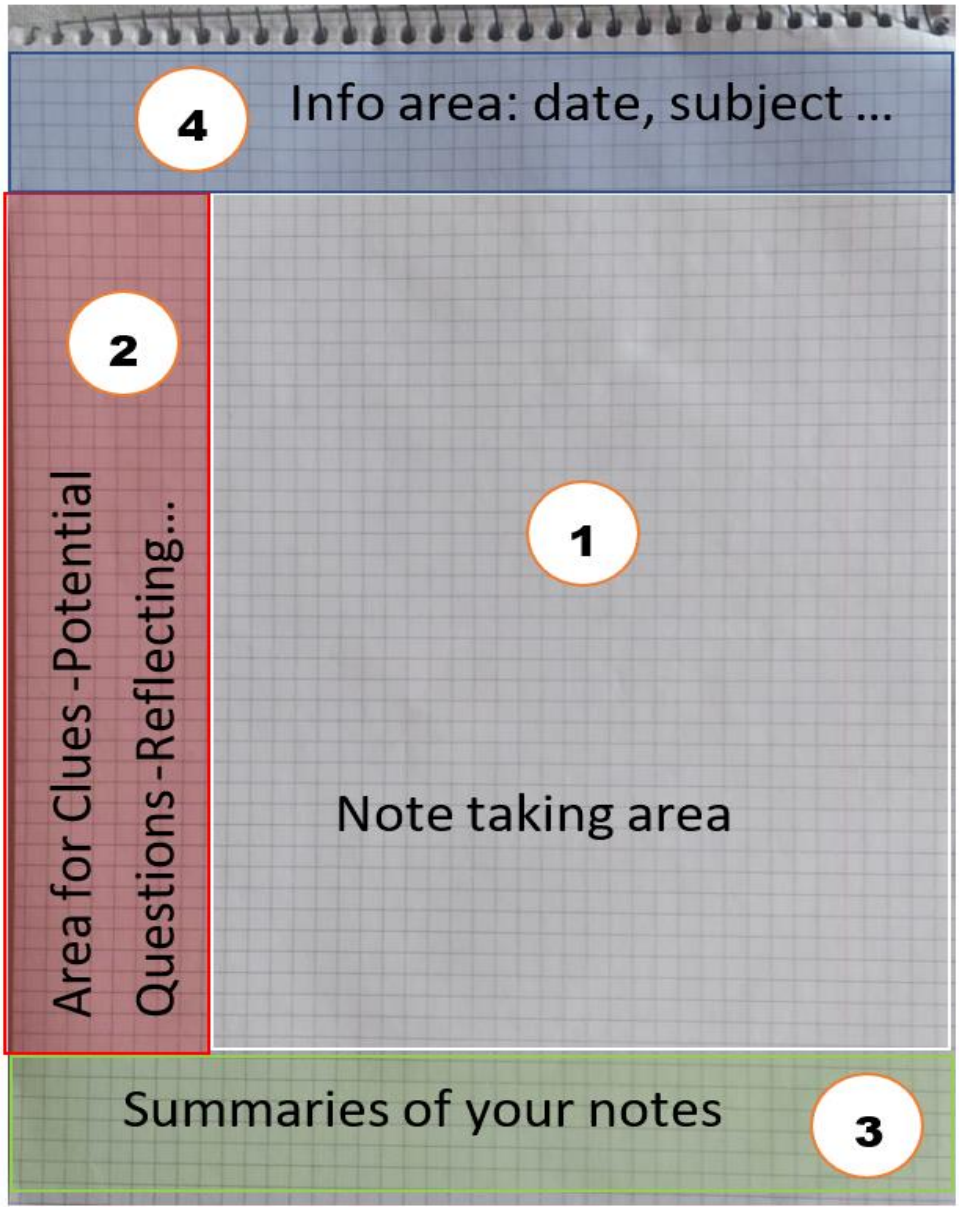
You can Reset your Password

CHAPTER THREE: The Cornell Note-Taking Method

Taking into consideration that we have noticed that very often students are focused on writing in their notebook and tend to report as much as possible of what the instructor says. The consequence is that students do not capture the important parts of the course and especially miss the recommendations given for the tests. To remedy this, we suggest trying a proven method, the Cornell method created by Walter Pauk, a professor at Cornell university, in the 1950s. In fact, we believe that the person who will be taking notes, using the method, will organize the notebook better, according to the diagram below which will activate also the visual memory.

Here is a link to watch a video: https://www.youtube.com/watch?v=SDfdEMTrbSk

The page is divided into 4 areas



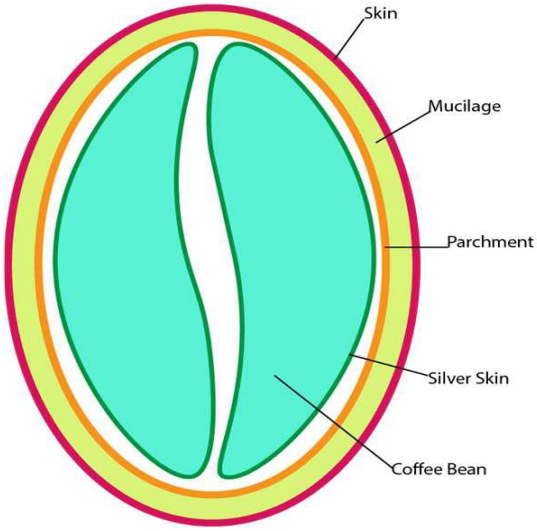
It is highly recommended to review your notes on the same day and try to answer the questions you have noted in the "Cues" column to test if you have understood. For example, in Q courses, the instructor provides guidance on topics that might come up on the exam during presentations. This is when you have to be attentive and note carefully and point in the "cues column".

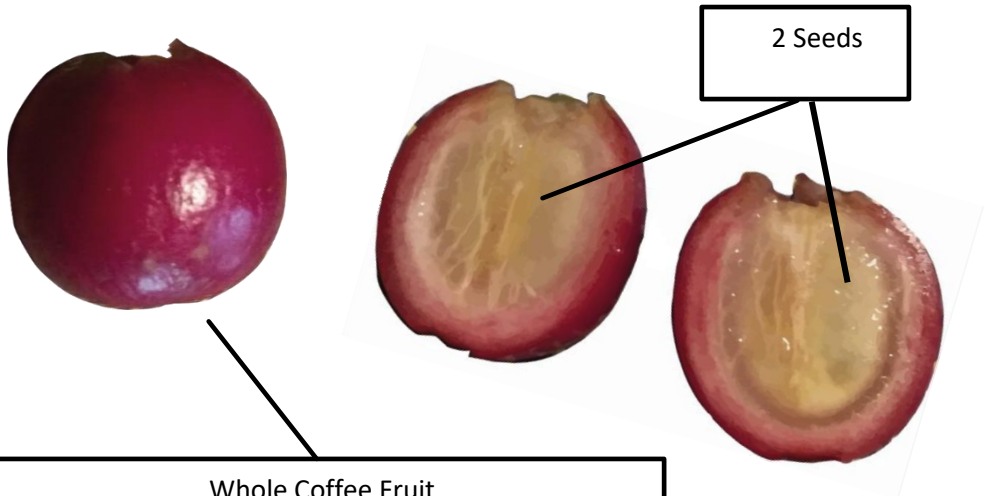
CHAPTER FOUR: Coffee Fruit Anatomy

Why should we be interested in the anatomy of the coffee fruit? We are interested at first to most inside part which is the green coffee bean, the part which is exported and roasted.

To reach and isolate the seed, it will be necessary to remove, by using different processing methods, the layers which are above this seed, and this is where a good knowledge of anatomy is necessary. It is also important to have some knowledge about the elements that composed those parts of the fruit, because its helps to understand the fermentation process.

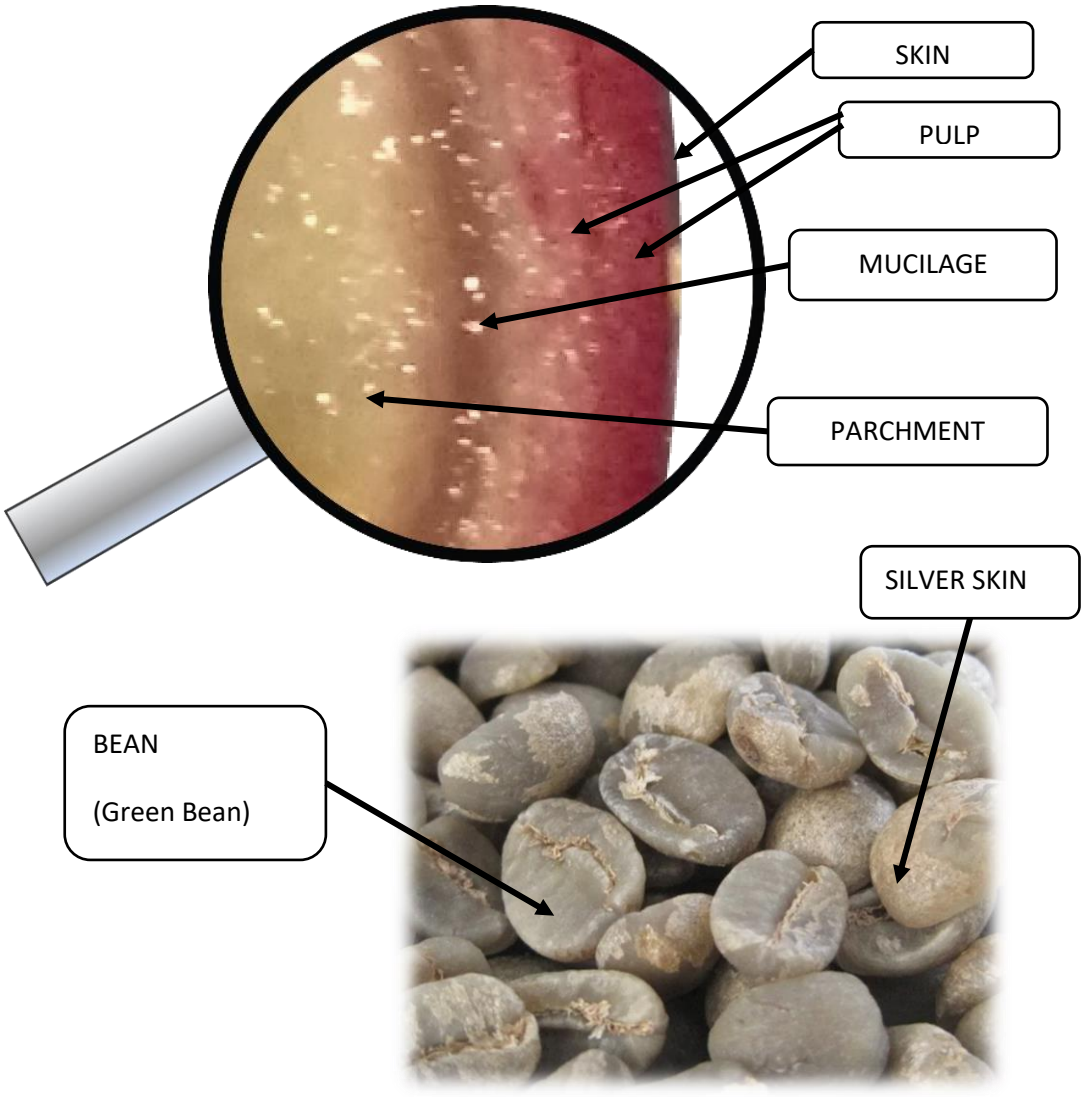
To explain the different coffee processing methods, the Coffee Quality Institute (CQI) proposes the idea of classifying these methods according to the part of the fruit that will be removed.





Whole Coffee Fruit

- The Coffee Fruit is a **Drupe**
- **Indehisent** (Does not free the seeds)
- Ripening stops once harvested


SKIN
PULP
MUCILAGE
PARCHMENT
SILVER SKIN
BEAN
(Green Bean)

Technical vs Botanical names

	TECHNICAL	BOTANICAL	
1	Skin	Exocarp / Epicarp	Pericarp
2	Pulp	Mesocarp (outer)	
3	Mucilage	Mesocarp (inner)	
4	Parchment / Hull	Endocarp	
5	Sylerskin / Chaff	Spermoderm	Seed
6	Bean	Endosperm	
7	Embryo	Embryo	

Notes

CHAPTER FIVE: The 3 most used processing methods

Processing and fruit anatomy

Let's now connect the anatomy of the coffee fruit and make a classification of the main processing methods. Note that other classification systems exist. For the course, we will retain three main methods, the natural method, the honey method and the washed/Fully-washed method. Depending on the processing method chosen, what parts of the fruit will be removed?

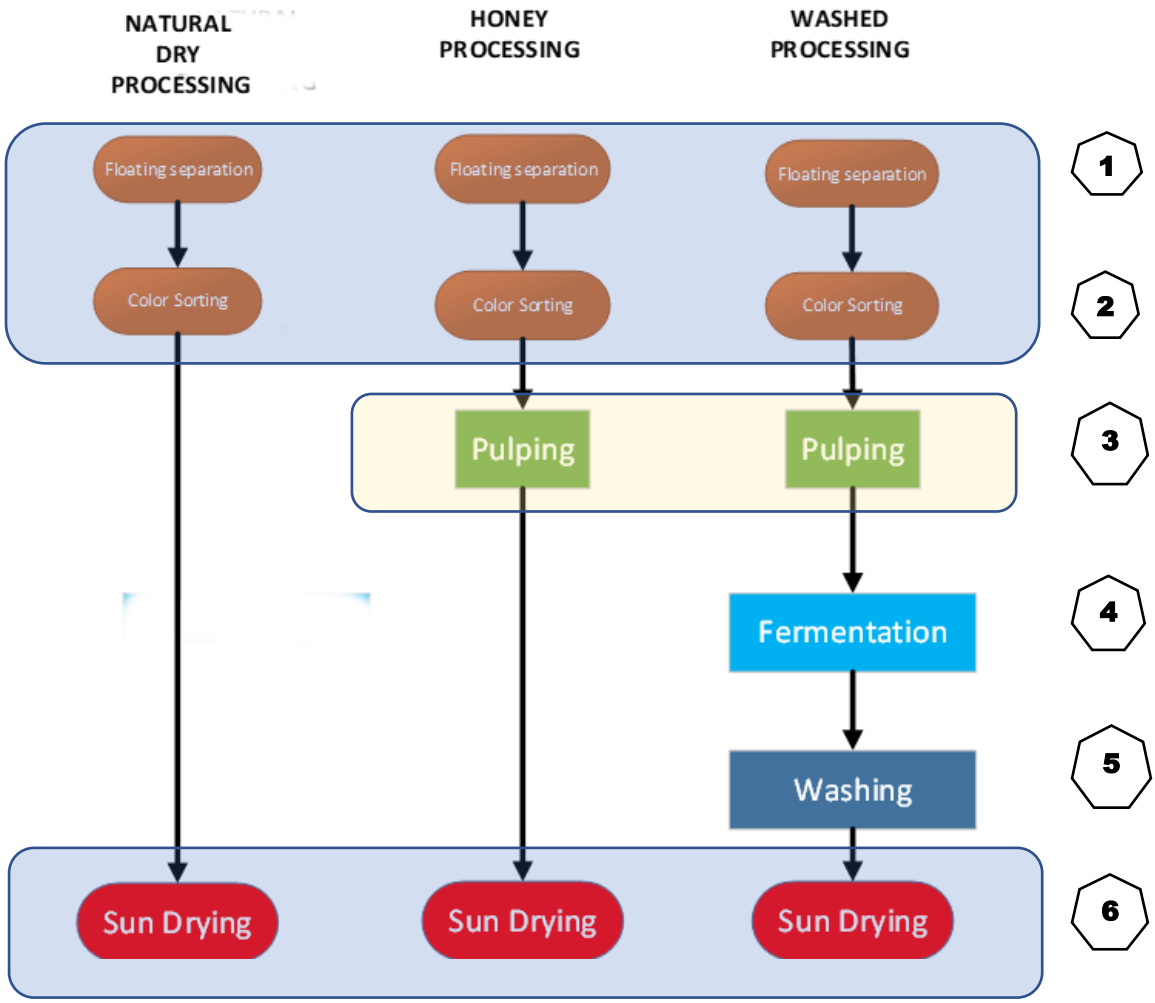
The table below shows the relationship between the anatomy of the coffee fruit and the 3 processing methods. The green tick means that a processing action is taken.

Processing Method		NATURAL	HONEY	WASHED
Fruit's Part Removed	Skin	✗	✓	✓
		Nothing Romoved	1 Part Removed	2 Parts Removed
	Mucilage	✗	✗	✓
1 - Depulping	Use of a Depulper machine	✗	✓	✓
2 - Mecanical Muciage Removing	Use of a Mucilage Remover	✗	✗	✓
3 - Fermentation	Different Methods of Fermentation	✗	✗	✓
4 - Washing	Different systems of Washing	✗	✗	✓
5 - Predrying	Under shade	✗	✗	✓
6 - Drying	Solar or Mecanical	✓	✓	✓
7 - Storage before dry milling	Moiture control	✓	✓	✓

Note that at the drying stage (6) and storage stage (7), the protocols are identical or very similar for all processing methods.

Processing diagram

A large part of the QP2 course is devoted to practical manipulations with fresh coffee. You will therefore have the opportunity to practice in the field.



Historically, the natural processing method was first used before the advent of mechanical means of processing with the aim of reducing processing time. This required methods to remove the skin, liquefy the mucilage and wash it off the beans. Then the washed method was born. But it was noticed that the coffee flavours changed, with more acidity, less body and a reduced aroma intensity. After that, people sought to obtain a product which had characteristics between those of natural and those of washed, while having a reasonable drying time. The honey method then appeared.

Basic Processing Steps

Steps 1 and 2: Sorting (Common to all methods)

Coffee selection, starting with picking, is the starting point for producing specialty coffee. Step 1 is dedicated to floating the cherries. For this, we will use water which will be used at the same time to wash the fruits, to lower the temperature to slow down the action of bacteria and finally to carry out a density separation. In step 2 we will finish with a colorimetric sorting of the cherries which have not been separated by their density.

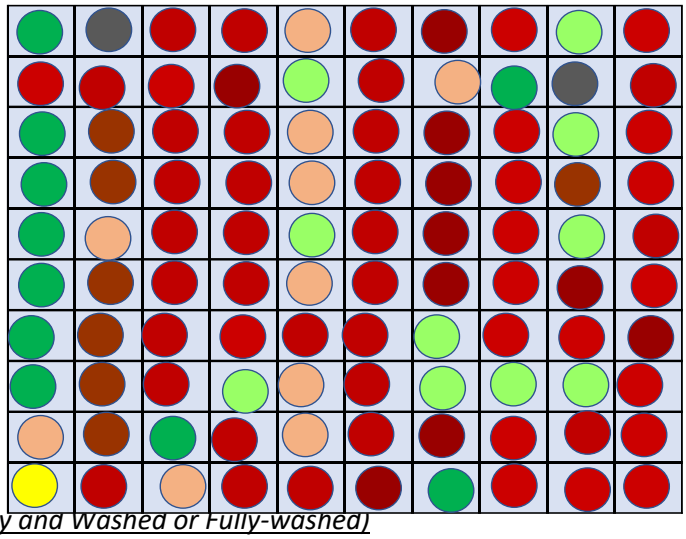
It is important to understand how the raw material (coffee cherry) can be characterized, particularly the ripening stage of the fruit.

- What is a ripening series?
- What is a target?
- How do you use a ripening board?

All these questions are part of exercises and tests of the QP2 course

Ripening series

Ripening Board (100 coffee cherries taken at random)



Step 3: Pulping (Honey and Washed or Fully-washed)

Pulping requires the use of a machine. However, if necessary, you can make do with a mortar, or use your feet and hands. There is almost always a solution to a problem.

We will further describe the different types of machines commonly used around the world.

In recent years, we have seen the emergence of eco-pulpers machines, that is to say machines that pulp coffee, using a smaller amount of water. This is advantageous for the protection of our environment and useful in regions where water is rare.

There are machines that mechanically remove the mucilage, partially or almost completely. They are mucilage removers. This makes it possible to reduce the fermentation time and also to use less water

for washing. However, since the mucilage is the part of the fruit that contains the most sugar, there will be an impact on the fermentation process.

Step 4: Fermentation (Washed and other more recent methods)

The fermentation is a complex process with a series of biochemical reactions depending on the type of microorganism involved, the type of sugars or carbohydrate being fermented, and the conditions of the fermentation process, such as temperature, pH level, and oxygen level. The microorganisms used in fermentation can be **natural or wild** or can be specifically selected, **artificial**. However, the QP2 course will be limited to the most classic fermentation methods.

- What is fermentation (as a unit operation)?
- What are the controllable variables that will allow us to act on fermentation?

QP2 practicum includes :
- Washed with fermentation under water
- Washed with piled-up dry fermentation
- Washed with spread-out dry fermentation
- (Inoculation with yeast)

Step 5: Washing (grading) (Washed or Fully-washed)

Washing parchment coffee after fermentation is very important. The purpose of washing is to completely remove the mucilage from the coffee seeds, so that there is no risk of fermentation resuming. This operation is done using clear water. In our area, a masonry wash channel is used and the coffee will be stirred by hand. There are also machines to do the job.

One of the advantages of the washing channel is that it is used for density separator. It means that parchment coffee beans are separated , according to their density. This process is also called the grading, high qualities are separate from the lowest qualities.

- When can we stop the fermentation?
- How can we monitor the fermentation process?

Step 6 : Drying (Common to all methods)

Drying coffee is a crucial phase to take care of, particularly because it will condition the storage of coffee in warehouses and during transport to the final destination. In the coffee industry, either solar or mechanical drying is used. In the case of solar drying, several types of surface can be used, raised beds, concrete (patio), tarpaulins. In our regions, drying tables are preferably used. In fact, this reduces the risk of contamination, access to the coffee for animals and we have good ventilation.

- What are the main precautions to take during drying?

Coffee beans parchment should not exceed 40°C (washed processing and honey).

Natural coffee beans should not exceed 45°C.

It is important to stir the coffee constantly during the first days of drying so that it is uniform and to avoid the appearance of unwanted mold. Natural coffees should be mixed at least 12 times a day. Pre-drying under shade can be used in both cases of solar and mechanical drying.

Drying will be stopped when the humidity will be between 10% and 12%.

External atmospheric conditions determine the quality and drying time. This is why it is important to monitor the evolution of the outside temperature and the relative humidity of the air.

Step 7: Storage (Common to all methods)

Storage is the final step of a wet mill processing and a very important one. Coffee can lose all its quality if stored incorrectly done. The purpose of storage is to preserve the quality of the dry row material (parchment or natural) until it is transported to the dry mill. The dry coffee is packed in bags (jute or polypropene). After dry milling, le green coffee will be again store all along the way to the roasters. Ambient conditions, temperature and relative humidity play an important role in quality preservation. Green coffee is traditionally ships in jute bags. But for high quality coffee it is recommended to bag green coffee into barrier packaging, GrainPro, Ecotact, two most popular.. Usual rage for relative humidity is 50 to 70% and a moderate temperature. Above 80% RH, the risk of fungi growth increase significantly. And of course pests control is very important.

Notes

CHAPTER SIX: The measuring devices used (with demonstration)

Refractometer

The refractometer is a common instrument used to measure the sugar content of a solution. The sugar content is measured in Brix degree (°Bx). are calibrated using the brix scale, where one degree brix is equal to 1% sucrose by mass. Like all measuring devices, the refractometer must be properly calibrated to indicate a correct measurement.

Optical type

Digital type

The refractometer is widely used in food processing. It is used to measure the concentration of solids (salt, sugar, other solids) in an item such as fruit, jam, juice, etc.

The refractometer is used to measure the amount of sugar content that is found mainly in the coffee pulp. Drops of juice are extracted from the bean and put on the glass of the refractometer. The maximum sugar concentration will correspond to the optimal fruit ripeness of the fruit. A sweet substrate is an excellent food for microorganisms, which cause fermentation. We will use it in our case, to evaluate the sugar content of the coffee fruit, and therefore its degree of ripening, while also looking at the colour of the fruit and its texture

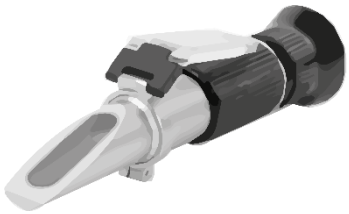
Calibration

To calibrate the **portable optical refractometer** what you'll need (provided with the instrument):

- A screwdriver
- A solution applicator and cleaning cloth
- Distilled water

How to calibrate the Refractometer

Step 1: Open the cover plate and place 2 or 3 drops of distilled water onto the prism ,



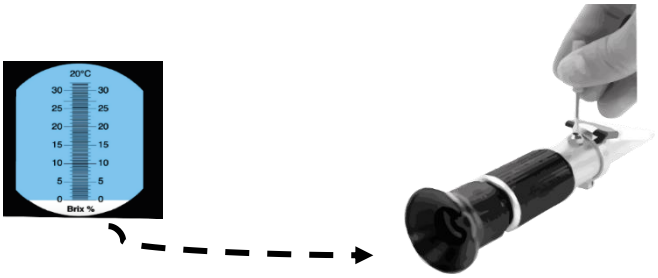
Step 2: Cover the plate and press lightly to ensure the water spreads evenly across the whole surface area,

Step 3: Hold the refractometer towards a light source and look into the eyepiece,

Step 2

Step 3

Step 4: If the boundary line between the upper blue field and the lower white field is not located on the **<u>0 degree line</u>**, adjust the calibration screw until both lines meet



Step 5: Wipe the water from the prism and clean with a dry cloth

How to use the Refractometer

1-Clean

2- Put drops of mucilage on the prism

3-Read

Measurement Steps

- Open the plastic cover and make sure the glass prism is clean and not scratched.
- Place few drops of mucilage on glass measuring surface using plastic pressing the coffee cherry.
- Replace cover. If trapped air exists, gently press down on cover.
- Look through the eyepiece while holding the refractometer up to a natural light or incandescent light source. Adjust the focus by twisting the eyepiece.
- Read where the shadow boundary or contrast line (difference between blue and white areas) crosses the scale. Read the % Brix value.
- Clean between each reading with distilled water, which should be at 20°C

For the demonstration, we can use sugar water or fruit juice, water, cotton and maybe a fruit.

PH meter

PH meter is an instrument used to measure acidity or alkalinity of a solution. pH is the unit of measure that describes the degree of acidity or alkalinity. The unit is pH measured on a scale of 0 to 14. Number 7 is the neutral position, reference of distilled water.


This instrument should be used to monitor the progress of coffee fermentation. There are several models of devices and first of all, you must read the user manual provided by the manufacturer. The important points are generally:

- How to calibrate the device (reference solutions are provided)
- Device storage conditions
- How to change batteries
- How to dip the device into the solution to be measured
- How to clean the device

In addition to the PH, the device also indicates the temperature of the environment and this is important when we want to take measurements under the same conditions.

pH meter use

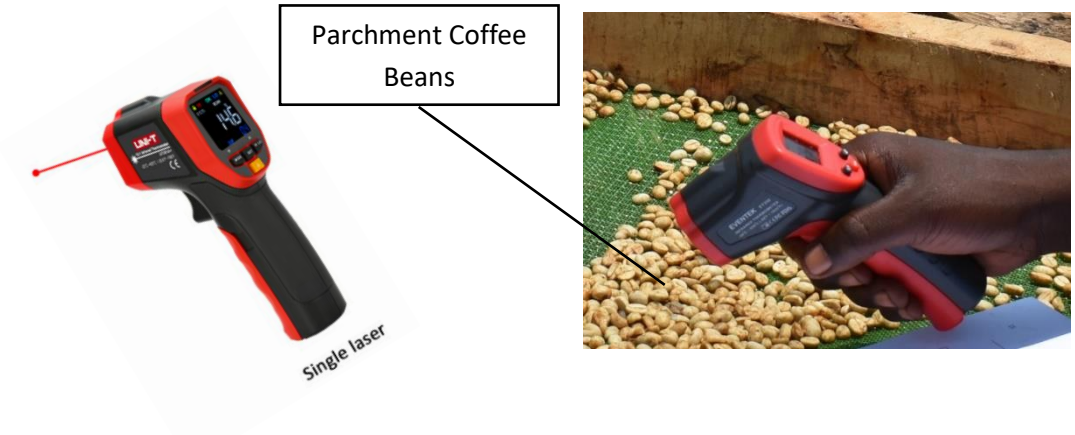
The procedure for making a pH-temperature reading is:

- Rinse the electrode tip in clean water
- Depress the dispenser button on the top of the electrode until a click is heard (releases reference electrolyte at tip of electrode)
- Wait until the readings become steady (``READY'' indicator shows, and meter beeps once)
- record results (including temperature)
- if readings become erratic, dispense more electrolyte
- For coffee the recommendation is to stop the fermentation and wash the coffee before the pH drops to 4.0 or below. It is preferred to stop the fermentation at pH 4.5-4.6.

In coffee, the pH meter is used to monitor fermentation and therefore the activity of micro-organisms which will digest glucose and then generate energy and chemical compounds. The environment will become more and more acidic and this must be monitored.

Infra-Red Thermometer

An infrared (IR) thermometer is an instrument that can rapidly measure the temperature of surfaces of objects from a distance without any contact. ***This equipment is used to measure the temperature of the coffee bean temperature.***

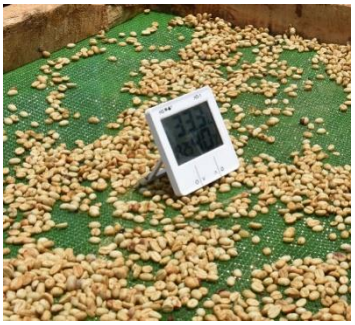


Using the Infra-Red g.. .. is very easy to use. The correct distance for coffee is approximately 30 to 50 cm. We point the spot, which is a red light, on a coffee bean on the drying table, and we read the temperature. You will have to aim for at least 3 different points and this is the average that you will record.

In coffee, the refractometer is used to monitor the temperature of the bean, during drying process. Indeed, the maximum temperatures for parchment and natural coffee must not be exceeded, at the risk of destroying the embryo and therefore the quality.

Hygrometer-Thermometer

An Hydrometer-Thermometer measures the humidity and relative temperature of the ambient air. Indeed, coffee being a hygroscopic product, that is to say one which absorbs humidity, it is important to monitor these parameters during drying and storage of coffee.



Some models are equipped with an external probe which then allows the temperature to be measured in another medium, including liquid.

In coffee, especially during the drying phase, it is very important to monitor the atmospheric conditions (Humidity and temperature), because they have a positive or negative impact on the drying of the coffee.

Moisture meter

There is a wide variety of humidity measuring devices with varying degrees of accuracy.

These devices are generally designed to measure the moisture content (Humidity) of several products in the dry grains category. For coffee, it will be possible to select the type of coffee you want to measure. For example, Arabica, Robusta, Natural, Parchment. In General, the calibration of a moisture meter requires the intervention of a more specialized laboratory.

The pitfall in the QP2 test, for using the moisture meter, is that students forget to check in the menu that it is the product they are measuring. Measuring Coffee dried humidity is crucial if we want the coffee to be stored for a long time in good conditions. A buyer may reject coffee that is not well dried, for example at 12.5%. Improper drying of coffee can also lead to a deterioration in quality.

Notes

CHAPTER SEVEN: The importance of Data processing recording

It is very important to record some important parameters during the entire transformation process. Indeed, the analysis of this data will make it possible to understand the phenomena and above all to identify deviations which will affect quality. Controlling the evolution of parameters will also allow us to produce coffee with consistency.

What are these parameters ?

- Weight
- Temperature
- Humidity (moisture content)
- The odour
- The texture of the product

Thus, we will be able to make a decision and intervene based on the data, mainly drying and fermentation.

The fermentation monitoring form will include, for example, the following information:

- The date
- The initial weight (not always possible)
- The initial time
- The processing method
- The Lot number

  - Date
  - Time
  - Texture
  - Odour
  - pH
  - Temperature
  - Notes

- Date/ time of washing point

We will demonstrate on a whiteboard, emphasizing the mistakes not to make when filling out the data sheet.

The drying monitoring form will include, for example, the following information:

- The date
- The initial weight
- The initial time
- The processing method
- The Lot number

  - Date
  - Time
  - Weight
  - Bean temperature (average 3 measures)
  - Ambient temperature
  - Relative humidity
  - Moisture content
  - Notes

- Date / time of drying end
- Final weight
- Final moisture content

CHAPTER EIGHT: The main pulping machines types

There are 4 types of coffee pulping machine: disc pulper, horizontal drum, vertical drum and mesh pulper.

Disc pulper

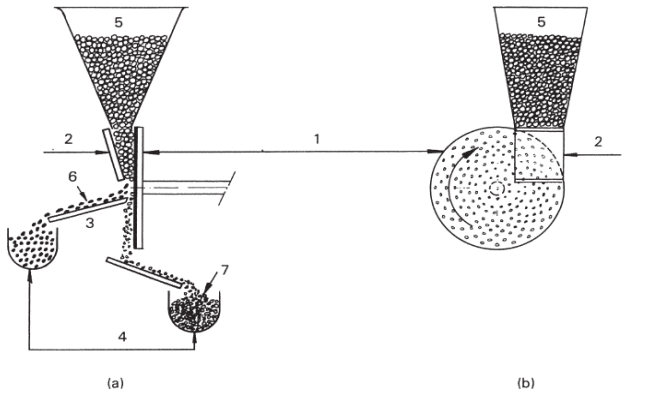


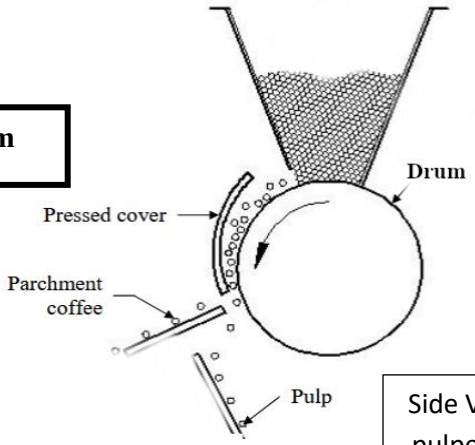
Fig. 7. Diagrammatic details of a disc pulper in (a) side and (b) end sectional view; showing the (1) rotating disc, (2) pulping bar, (3) separating plate, (4) receiving troughs, (5) cherries, (6) beans, (7) pulp.

J-C Vincent 1987

View of part of a McKinnon disc pulper. In the foreground, freshly pulped parchment coffee is squeezed between the disc and the separation plate.

Horizontal drum pulper

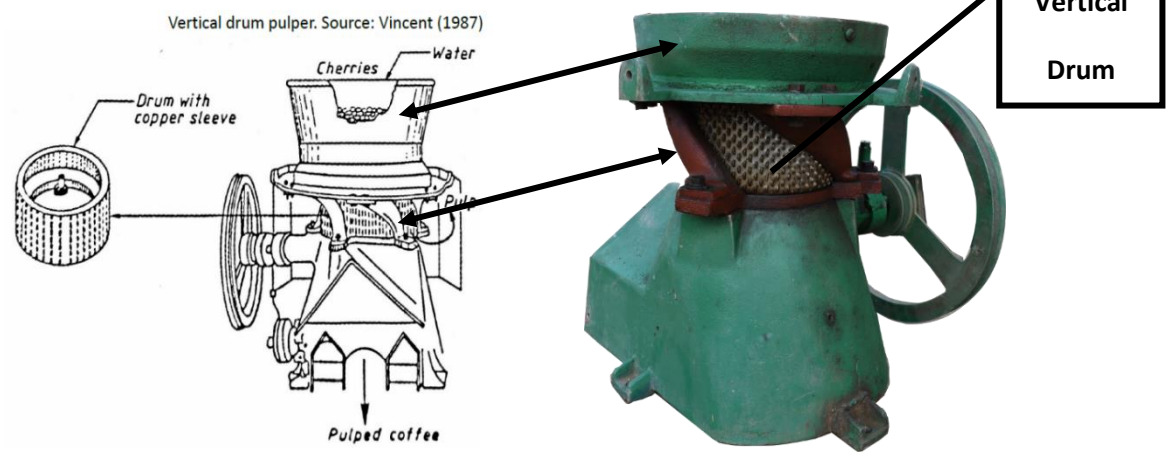
Drum



Side View of the pulper machine

This is a part of a horizontal drum pulper and on the right, the drawing shows how the machine works. It will be explained in detail in the course.

Vertical drum pulper

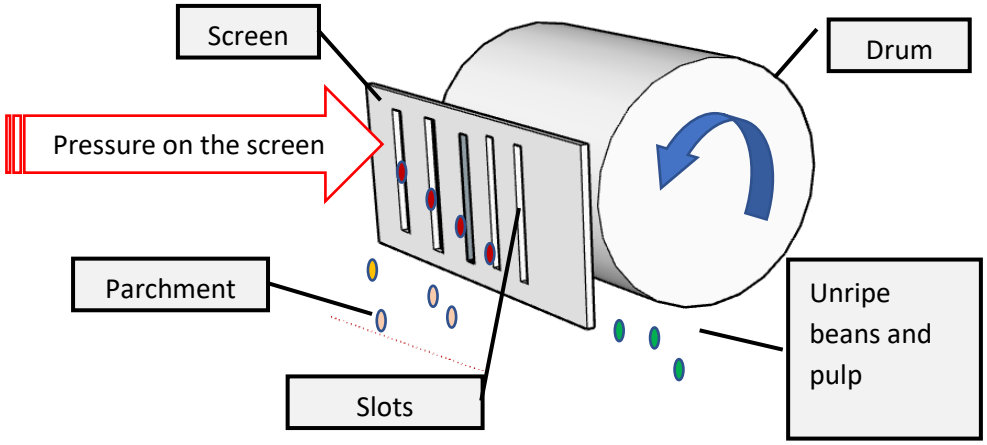


Vertical Drum

J-C Vincent 1987

This is a vertical drum pulper machine. On the left, the drawing shows the different parts. This machine is also called eco-pulper, because it requires a small quantity of water compared to the disc pulper. This is interesting for the environment preservation and useful in some regions where water resources are limited.

Screen pulper



This drawing shows the principle of a screen pulper. This is the latest technology and is not yet widespread in the world. A perforated plate exerts pressure on the coffee, which is conveyed by a rotating drum. The very ripe and soft beans can then pass through the perforations and are pulped. On the other hand, unripe coffee has a harder texture and does not pass through the holes. A separation of ripe and unripe beans can then be made.

Notes

CHAPTER NINE: Useful conversion calculations

As mentioned in Chapter One, this part deserves your attention. Indeed, if you do not master well this chapter, it will be difficult for you to solve calculation problems. Please refer to the appendix at the end of the manual, where an example is presented. The useful part of the table is the one in yellow, but sometime the other parts may one day be useful to you in your professional life.

	Product	*Ratio to green*	*Ratio to cherry*	*Invert Ration to cherry*	*Roasted needed*	*Green needed*	*Cherries available*	*%, loss*
1	**Fresh Cherry**	5,56	1,00	1,00	340,14	333,6	**1000**	1
2	**Dried cherry**	2,25	0,40	2,47	137,65	135	404,68	59,53
3	**Pulped cherry**	3,39	0,61	1,64	207,39	203,4	609,71	39,03
4	**Drained parchment**	2,31	0,42	2,41	141,32	138,6	415,47	58,45
5	**Dry parchment**	1,25	0,22	4,45	76,47	75	224,82	77,52
6	**Green coffee**	1	0,18	5,56	61,18	**60**	179,86	82,01
7	**Roasted coffee**	0,85	0,15	6,54	**52**	51	152,88	84,71

according to CENICAFE, 2008

These figures come from the CENICAFE research centre in Colombia and must be adapted according to the reality of each region.
For day 2 we will do some exercises

Series of exercises (AP1-AP3-AP4)
A series of exercises are proposed, for your preparation for the QP2 exams.

AP1 series are conversion exercises in 3 categories

- Capacity
- Production target
- Performance

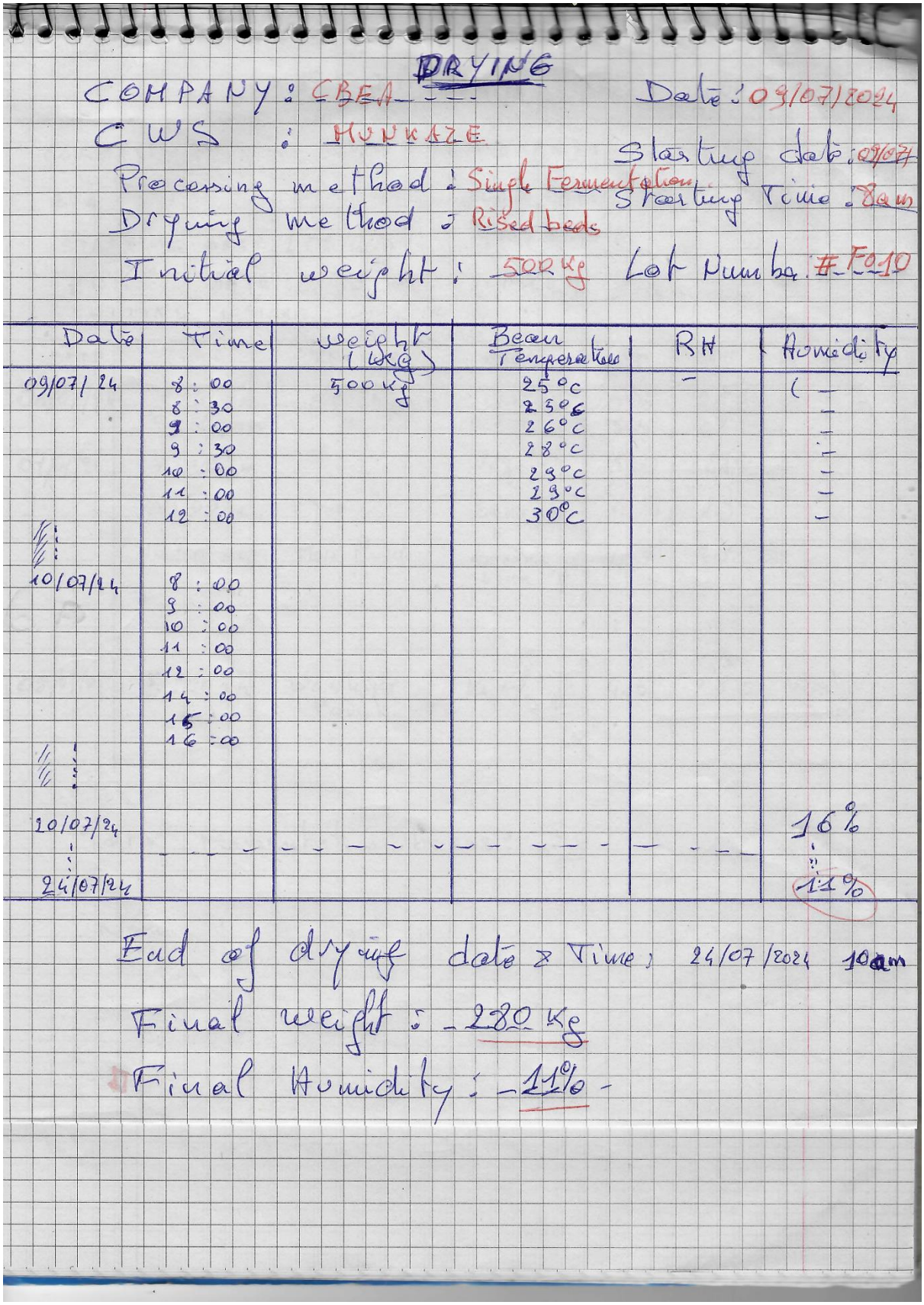
AP3 Interpretation of Pulping Records
AP4 Interpretation of Drying Records

CHAPTER TEN: Simulation of an MCQ (multiple choice questions)

At the end of the workshop, we will simulate a test with 50 multiple choice questions. The time allowed is 60 minutes. Please note that the QP2 final exam consists of 100 multiple choice questions.

ANNEXES

Drying data recording For example



DRYING

COMPANY : CBEA Date : 09/07/2024

CWS : HUYAZE

Starting date : 09/07

Processing method : Single Fermentation Starting Time : 8am

Drying method : Raised beds

Initial weight : 500 kg Lot Numba : #F010

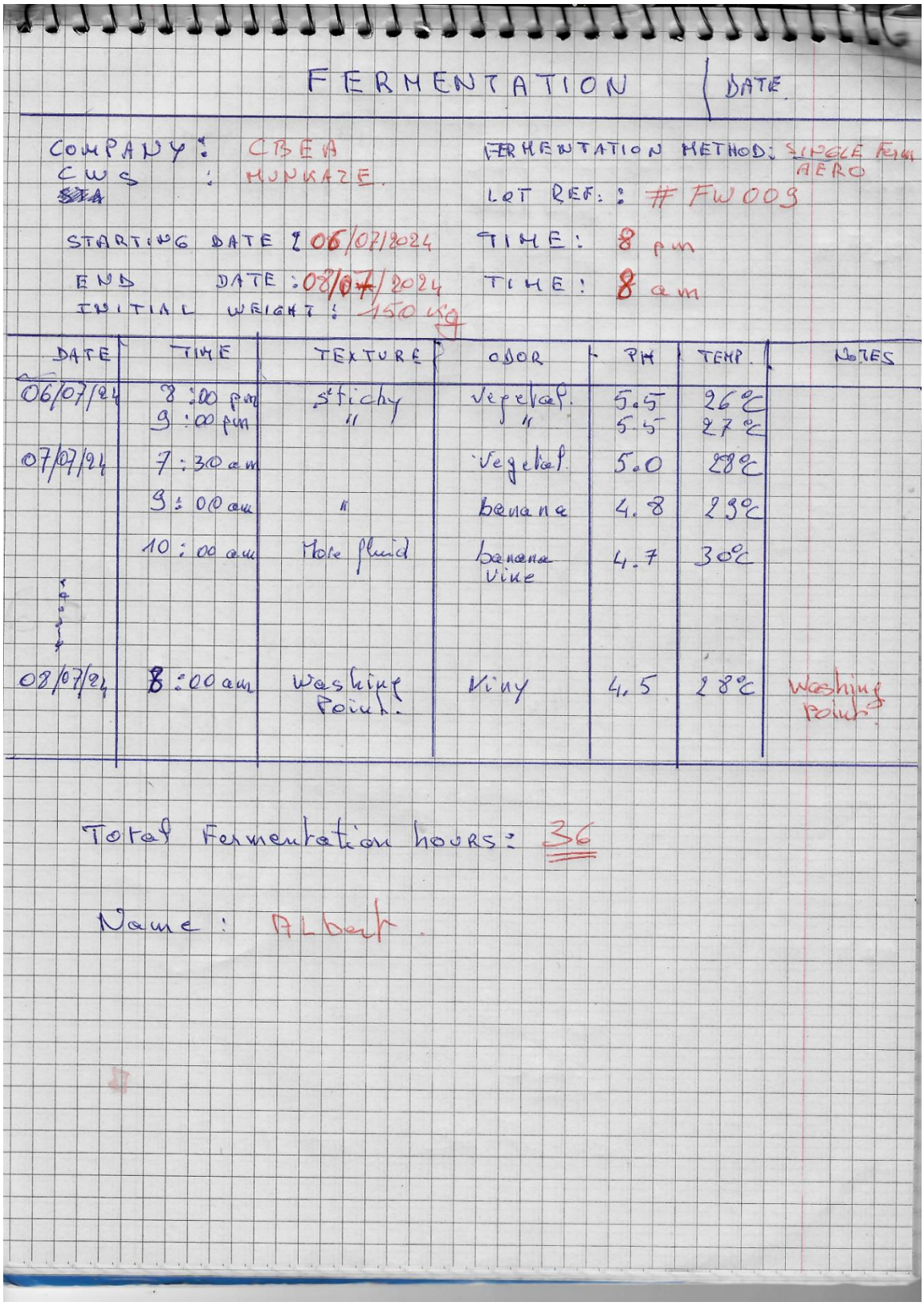
Date	Time	weight (kg)	Bean Temperature	RH	Humidity
09/07/24	8:00	500kg	25°C	–	–
	8:30		25°C		–
	9:00		26°C		–
	9:30		28°C		–
	10:00		29°C		–
	11:00		29°C		–
	12:00		30°C		–
10/07/24	8:00				
	9:00				
	10:00				
	11:00				
	12:00				
	14:00				
	15:00				
	16:00				
20/07/24					16%
24/07/24					11%

End of drying date & Time : 24/07/2024 10am

Final weight : 280 kg

Final Humidity : 11%

Fermentation data recording Form example



FERMENTATION | DATE

COMPANY: CBEA
CWS : MUNKAZE.
FERMENTATION METHOD: SINGLE FERM AERO
LOT REF.: # FW003
STARTING DATE: 06/07/2024 TIME: 8 pm
END DATE: 08/07/2024 TIME: 8 am
INITIAL WEIGHT: 150 kg

DATE	TIME	TEXTURE	ODOR	PH	TEMP.	NOTES
06/07/24	8:00 pm	sticky	vegetal	5.5	26°C	
	9:00 pm	"	"	5.5	27°C	
07/07/24	7:30 am		vegetal	5.0	28°C	
	9:00 am	"	banana	4.8	29°C	
	10:00 am	More fluid	banana vine	4.7	30°C	
08/07/24	8:00 am	Washing Point.	Vinny	4.5	28°C	Washing point.

Total Fermentation hours: 36

Name: Albert

CONVERSION PROBLEMS

a-Capacity problem

- You have 1 horizontal pulping machine and 1 Disc pulping machine with 2 discs, 3 fermentation concrete tanks and 50 drying tables.
- The pulper can pulp 1000 kg of cherry per hour and per disc (working time=15 hours per day).
- You can ferment 1600 kg in 48 hours (dry fermentation) of freshly pulped coffee in each tank.
- Each of raised bed has a capacity of 500 kg of dried parchment coffee and the total drying time is 15 days.

How many kilo of cherries can you receive to the washing station each day?

b-Production Goal problem

You are committed to selling a lot of Fully-washed coffee of 50 bags Specialty Coffee of 60 kilos net of green coffee to a roaster in Japan, Tokyo.

- How much fresh cherry do you need to buy from producers?
- How many days do you need to process all the coffee?

Assumptions:

- The average yield of green coffee milling is 82%, after removing defects and beans below screen 15, after hulling.
- Normally 2% weight of the freshly harvested cherries are removed by floating
- and another 4% of the freshly pulped
- Your coffee washing station has a maximum capacity of 2500 kg of fresh cherry within 48 hours.

c- Performance Problem

Your manager asks you to estimate the total quantity of **green coffee** you have in stock. He wants to have an idea of the quantity he will be able to offer to his buyer. The inventory that you have day gives you the following situation:

- 15000 kg of fresh coffee cherries delivered that day,
- 30 metric tons of fresh coffee bought in the last 15 days and this coffee is not yet dried,
- 25000 Kg of dried cherries in storage.
- 45 metric tons of dry parchment in the warehouse.