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GSDI **hands!**



LEARNING FACILITATING MATERIALS

NATIONAL CERTIFICATE LEVEL 2

TRADE AREA: **CASHEW PRODUCTION**

UNIT 4

**QUALITY ASSURANCE AND MANAGEMENT IN  
CASHEW PRODUCTION**



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## UNIT INTRODUCTION

Welcome to Unit 4 of your learning journey in cashew production. This guide explains the main steps for quality assurance and management in cashew production.

Do you already know how to test the quality of raw cashew nuts and cashew kernels?

The quality of raw cashew nuts is tested by assessing the external physical criteria such as size, shape, colour, moisture level and cleanliness. The quality of the cashew kernels is tested by cutting the raw cashew nuts to assess the physical features of the kernel such as size, shape, colour and defects.



In this unit, you will learn about methods for testing and measuring raw cashew nut and kernel quality. The learning material covers five sub-units:

- 1) Quality standards in cashew production
- 2) Conducting quality tests in cashew production
- 3) Certification processes in cashew production
- 4) Traceability in the agribusiness industry
- 5) Documenting cashew production

Each sub-unit contains theoretical and practical exercises. Each module includes written materials, visuals as well as self-assessments to test your knowledge and skills.

It is important to remember that the excellence and thoroughness of harvest and post-harvest handlings affect the quality of raw cashew nuts and kernels, which in turn affects the country's – in this case Ghana's – reputation as a cashew producing country and processing location.

Good product quality increases the demand for raw cashew nuts and kernels on the world market, which in turn positively affects the price of raw cashew nuts.

Remember! The higher the quality of your product, the higher your selling price.

Even though this learning material provides essential information on quality assurance and management in cashew production for National Certificate Level 2, you should also look out for new information, innovations and technological advances during your practical work that expand your knowledge and skills.

Do you want to become an expert in cashew? This is your chance!

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## ICONS



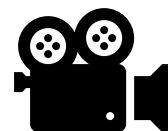
LEARNING  
OBJECTIVES



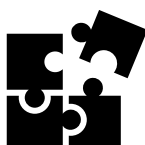
ATTENTION



PRACTICALS  
HANDS ON



WATCH VIDEO



SELF ASSESSMENT



WELL DONE!



TAKE A BREAK!

## ABBREVIATIONS

Here are some commonly used abbreviations.

<b>BRC</b>	British Retail Consortium
<b>g</b>	Gram ( <i>1000 grams = 1kg</i> )
<b>GAP</b>	Good agricultural practices
<b>GMP</b>	Good manufacturing practices
<b>GPS</b>	Global positioning system
<b>HACCP</b>	Hazard analysis and critical control points
<b>ICT</b>	Information and communications technology
<b>ISO</b>	International standards organisation
<b>lb</b>	Pound ( <i>1 lb = 0,45359 kg</i> )
<b>lbs</b>	Pounds ( <i>1 kg = 2,20462 lbs</i> )
<b>kg</b>	Kilogramme ( <i>1kg = 1000 grams</i> )
<b>KOR</b>	Kernel outturn ratio
<b>RCN</b>	Raw cashew nuts
<b>SOP</b>	Standard operating procedures
<b>W</b>	Weight

## 1. DEMONSTRATE KNOWLEDGE OF QUALITY STANDARDS IN CASHEW PRODUCTION

### a) Explain quality standards

Quality standards are documents that provide requirements, specifications, guidelines or characteristics of materials, products, processes, and services.

Agribusinesses use standards as guidelines, definitions, and procedures to:

- satisfy their customers' quality requirements
- ensure that their products and services are safe (e.g. for human consumption or usage)
- comply with national and international regulations
- reduce product rejections or recalls
- meet environmental, social and ethical objectives
- protect products against climatic or other unfavourable conditions
- ensure that internal processes are defined and controlled (e.g. good agricultural practices, good manufacturing processes, standard operating procedures)

Agribusinesses that follow quality management standards often:

- increase their profits
- reduce losses or costs across the business
- improve their competitiveness
- gain market access across the world
- increase consumer confidence and loyalty



Source: GIZ/ComCashew – Employees in cashew processing factory adhering to GMP

## **b) State types of quality standards**

There are many different types of quality standards for various industries.

The quality standards relevant to cashew production are:

- Product standards
- Food safety and hygienic standards
- Environmental and social standards
- Corporate social responsibility standards
- Health and safety standards
- Traceability standards

## **c) Identify quality standards application**

Quality standards are very relevant for the cashew sector and impact the cashew processing industry. International buyers request audits of processing factories or compliance certificates with specific standards before starting business relationships. In order to ensure the continuous compliance with national and international standards in produced and manufactured goods, periodic random inspections are conducted. To stay competitive and increase market share it is vital for African businesses to catch up on food quality and food safety.

Food quality and food safety are also of increasing importance to consumers. Whereas food safety is mostly imposed by legal regulations, food quality is rather linked to specific consumer requirements and preferences. Nevertheless, food quality and safety are very closely connected. Food safety is often seen as a condition for food quality.

## **d) Explain standard operating procedures (SOP)**

A standard operating procedure (SOP) is a set of detailed instructions compiled by an organization / business / factory to help employees carry out complex routine tasks on a daily basis. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations. SOPs ensures a uniform and transparent work processes and workflow.

## **e) Explain good manufacturing practices (GMP) in cashew production**

Good manufacturing practices (GMP) are the practices required in order to adhere to the guidelines recommended by authorizing agencies that control the licensing of manufacturing companies and the sale of certain products. GMP guidelines provide minimum requirements that manufacturers must follow to assure that their products are consistently high in quality – from batch to batch – for their intended use.

The rules that govern each industry may differ significantly. However, the main purpose of GMP is to prevent harm from occurring to the end consumer / user.



## SELF ASSESSMENT

1. Explain quality standards.

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2. Explain standard operating procedures (SOP).

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3. Explain good manufacturing practices (GMP) in cashew production.

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*Congratulations! You have completed the first set of questions.  
Take a break before you move to the next chapter.*



## 2. DEMONSTRATE SKILLS FOR CONDUCTING QUALITY TESTS IN CASHEW PRODUCTION

### a) Explain quality tests in cashew production

A quality test is a way to verify product quality and to detect defects in raw cashew nuts and kernels before purchase and/or processing. Quality tests enable negotiations between farmers and buyers according to the product quality provided.



The better the quality of the product, the better the buying price.

Quality testing involves procedural and administrative activities:

1. Conduct quality tests (procedural)
2. Document and calculate quality outcomes and product price (administrative)



Quality tests also function as feedback loops to farmers and sellers. If the quality of the product is low, the farmer can improve on the application of good agricultural practices (GAP) or rejuvenate the farm with high-quality planting materials to produce better quality products.



Source: GIZ/ComCashew – Conducting Kernel Outturn Ratio (KOR) Test

**b) State types of quality tests applicable to cashew production**

There are four (4) quality tests in cashew production:

**1) Kernel Outturn Ratio (KOR) Test**

Outturn refers to the amount of usable kernels after de-shelling the raw cashew nuts. It is expressed in pounds (lbs), which means the weight of the useful kernels is weighed in pounds for one 80 kg jute bag of raw cashew nuts.



1 lb = 0.45359 kg  
 1 kg = 2.2 lbs



Example: An outturn of 49 lbs means that the processors can obtain 22.2 kg (49 lbs) of kernels from an 80 kg bag of raw cashew nuts.

KOR is an important parameter to measure and control raw cashew nut quality. Quality control of raw cashew nuts requires skills and strictness. Figure 1 shows a photo of good quality kernels

- **Good quality kernels (green category)**



Figure 1: Good quality kernels

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

## 2) Defective Nut Rate

The defective raw cashew nut rate measures the quantity of defective nuts of the sample. Figures 2 - 8 show examples of defective nuts.

- **Premature kernels (blue category)**

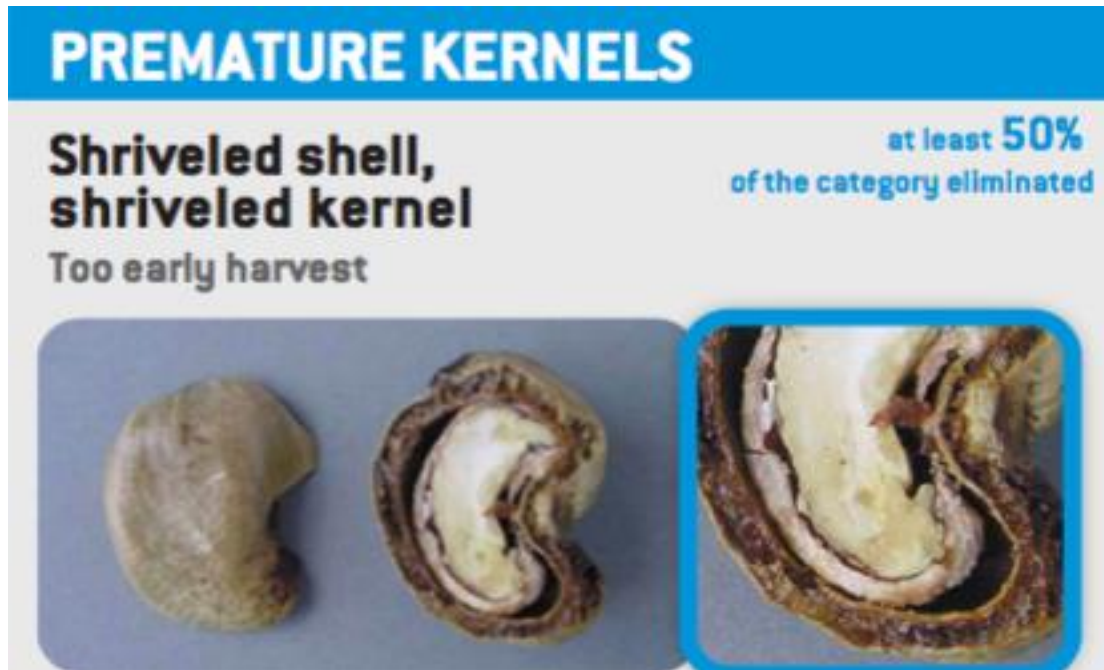


Figure 2: Premature kernels

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

- **Spotted kernels (blue category)**

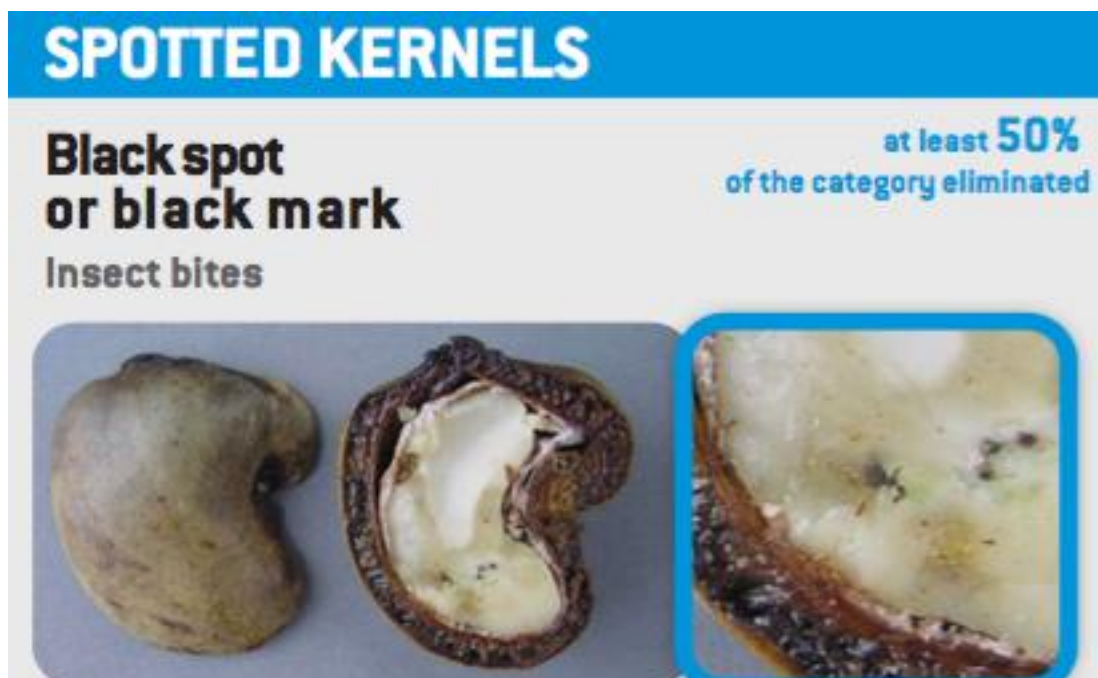


Figure 3: Spotted kernels

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

- Stunted kernels (red category)



Figure 4: Stunted cashew nuts

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

- Empty nuts (red category)



Figure 5: Empty cashew shells

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

- Moth-eaten nuts (red category)

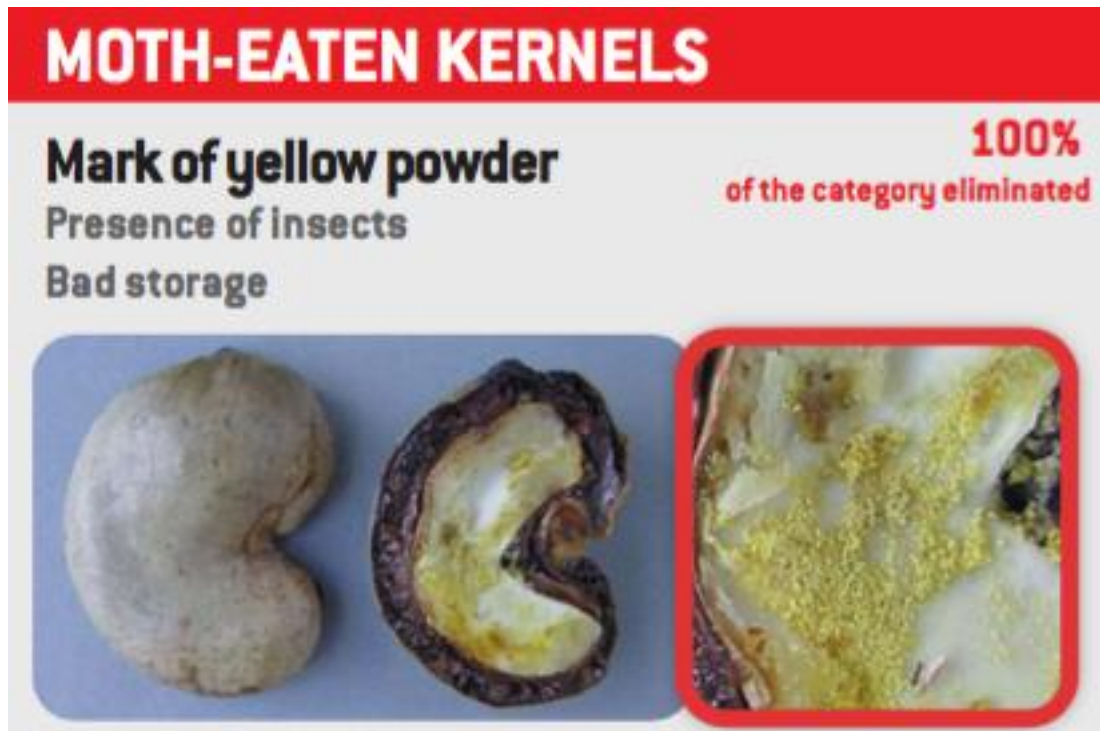


Figure 6: Moth-eaten kernels

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

- Mouldy kernels (red category)

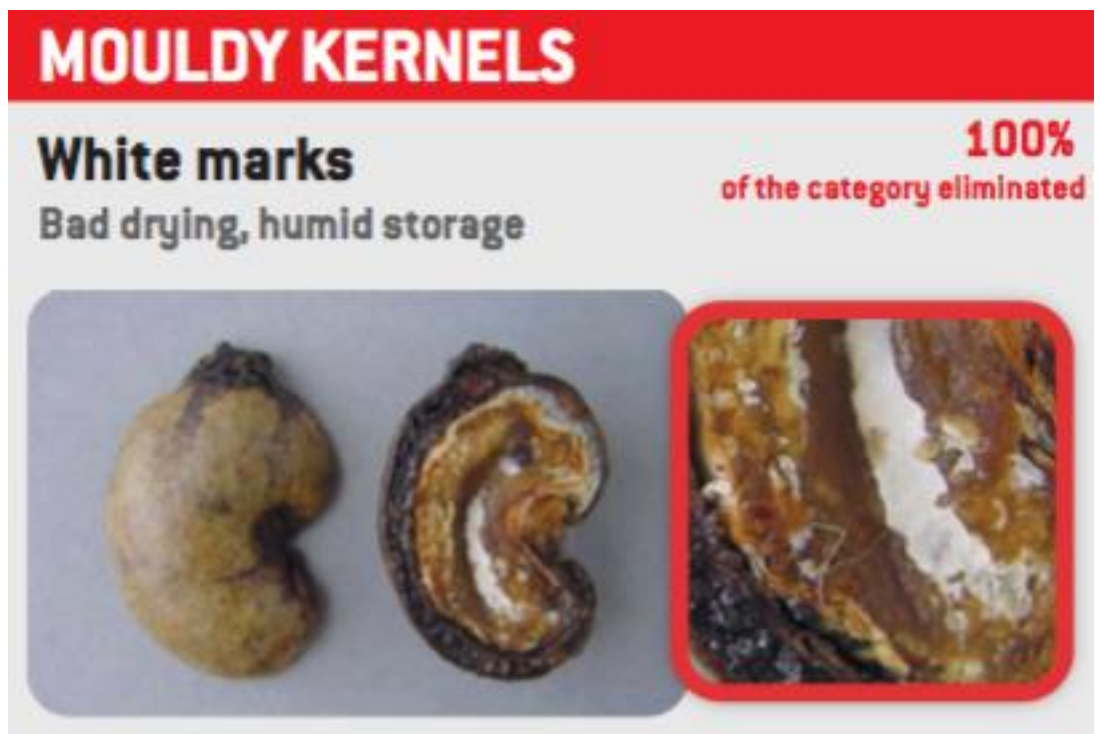


Figure 7: Mouldy kernels

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

- **Brown Kernels (red category)**



Figure 8: Brown kernels

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

To determine the defective nut rate, you need to weigh the kernels and the shells of these two categories:

- Blue (premature and spotted kernels)
- Red (stunted, empty, moth-eaten, mouldy and brown kernels)

The defective nut rate is expressed in percentage. In general, a sample with more than 24 % deficiency is rejected.

It is faster and easier to calculate the defective nut rate than the kernel outturn ratio. This method is used to get an initial idea about the quality of the batch.

### **3) Nut count (number of nuts/kg)**

The nut count refers to the number of raw cashew nuts per kg. It is expressed in raw cashew nuts/kg. The nut count fluctuates between 150 and 240 raw cashew nuts/kg.

The smaller the number, the bigger the raw cashew nuts.

Combined with the outturn ratio, the nut count gives information about the kernel size after deshelling.

The bigger the nuts, the higher the outturn, and the more likely you are to get big kernels after deshelling. Big kernels are more easily sold on the world market and attract premium prices.

#### 4) Moisture content

The moisture rate of raw cashew nuts has to be between 7 – 10 %. Raw cashew nuts with a moisture content of more than 10 % can go mouldy. Raw cashew nuts below a moisture content of 7 % can become dry and lose weight.



Source: GIZ/ComCashew – Drying of raw cashew nuts

#### c) State the quality parameters applicable to cashew production

During the commercial transaction between a farmer and a buyer/trader/processor, several exterior criteria are used to specify the cashew nut quality:

- Colour
- Shape
- Brightness

The most important quality criterion is the kernel inside the shell:

- 1) Kernel Outturn Ratio (KOR) Test
  - Good KOR is considered to range between 49 – 52 lbs of kernels / 80 kg of raw cashew nuts and above
- 2) Defective Nuts Rate
  - Less than 24 % defective nuts
- 3) Nut count (number of nuts/kg)
  - 150 and 240 raw cashew nuts/kg
- 4) Moisture content
  - 7 - 10 %

## d) Conduct quality tests



Practical Exercise: Conduct the KOR Test and follow the step below.

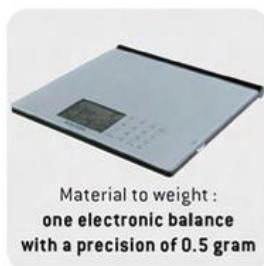
There are seven (7) steps in testing the kernel outturn ratio (KOR):

- 1) Preparing materials used to calculate the outturn
- 2) Sampling or taking of the mother sample
- 3) Weighing the sample
- 4) Calculating the nut count or counting number of nuts that make 1 kg
- 5) Opening the nuts, segregation of the kernels and classification into 3 categories (good, defective and rejects)
- 6) Weighing the three categories of nuts
- 7) Calculating the KOR

### Step 1: Assemble required materials for the KOR Test

The following tools are required to calculate the out-turn:

- Electronic balance with a precision of 0.5 gram
- Catheter bag
- Scissors especially designed for de-shelling (cracking) raw cashew nuts
- Scooper
- Plastic buckets
- Plastic bowls
  - Green – Good quality kernels
  - Blue – Defective (premature and spotted) kernels
  - Red – Rejects (stunted, empty, moth-eaten, mouldy, brown) kernels
- Latex gloves



Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?



## Step 2: Collect the “Mother Sample”

Nuts are taken from the stock of different places:

- directly at the farmer’s place
- in local or bigger shops
- in cargos at the harbour
- in warehouses at the harbour

Quality can be checked on any nut stocks.

## STEPS OF THE QUALITY CONTROL

### SAMPLING : TO TAKE THE « MOTHER SAMPLE » **2**

Nuts are taken from the stocks of different places: directly at the farmer’s place, or in local shops, or in big shops, or in cargos, or in warehouses at the harbour. Quality can be checked on any nuts stocks.

**First a sample has to be taken. Sampling is an important step in calculating the Out-Turn, it has to be done carefully by following a specific process.**

*Examples of nuts batches:*



Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?



First a sample has to be taken. Sampling is an important step in calculating the outturn; it has to be done carefully by following a specific process.

- For large volumes (30 - 40 tons), take samples from one in every 10 bags
- For small volumes (15 - 20 tons), take samples from one in every 5 bags
- For 20 bags of raw cashew nuts, take samples from every bag

The quantity of nuts taken from the entire batch is spread out on a flat surface area. This is the “mother sample”. With the help of a “quarter method”, samples are taken from the mother sample and used for the analysis.

The 3-step quarter method:

1. Mix the mother sample carefully to get a homogenous pile
2. Divide the mother sample in 4 batches “quarters”
3. Compose samples for analysis



Here a truck is unloaded at the Abidjan harbour. During the unloading of the truck, nuts are taken from bags by a sampler with a catheter bag. This sampling is generally done in one every ten bags for big batches (30-40 tons) or in one every 5 bags for small batches (15-20 tons). For the buyer, it is useful to take a sample in each bag for a better accuracy and to prevent suppliers from hiding bad-quality bags in the middle of the batch.



HOW TO TAKE  
A MOTHER-SAMPLE?



The quantity of nuts taken in the entire batch is scraped up on a flat area. This quantity is the “mother-sample”. Then a sample has to be taken for its analyse. The “quarter method” has to be followed to take the sample.



*Mother-sample*

This is a 3-steps method: mixture of the “mother-sample”, composition of the “quarters”, and composition of the samples to analyse.

Here the sampler mixes the mother-sample; this has to be done carefully in order to get a homogeneous pile.



*Mixing of the mother-sample*

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

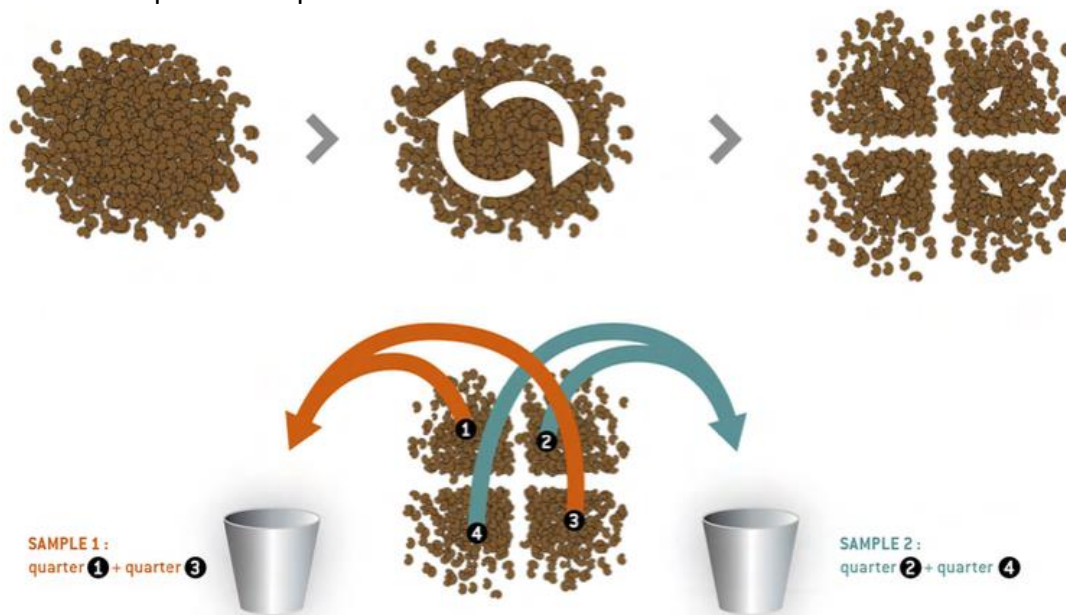
## Take note of the required steps to compose the quarters for the KOR Analysis

Divide the mother sample into 4 more or less equal parts. Each part is called “quarter”. There are 4 quarters: two to two opposite.

- The first quarter is opposite to the third quarter
- The second quarter is opposite to the fourth quarter

Each sample has to come from two opposite quarters. Therefore, take small amounts of nuts from the opposite quarters and mix them in a bucket.

- Sample 1: mix quarter 1 and 3
- Sample 2: mix quarter 2 and 4



Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

## HOW TO COMPOSE QUARTERS?

2

The mother-sample is divided into 4 parts more or less equal. Each part is called “quarter”. We have 4 quarters: two to two opposite.

Therefore :

- the first quarter is opposite to the third quarter
- the second quarter is opposite to the fourth quarter.

Each sample has to come from two opposite quarters. For this, we take small amounts more or less equal of nuts in the opposite quarters; we mix them in a bucket.

Thus we get :

- sample 1 from the first quarter and the third quarter
- sample 2 from the second quarter and the fourth quarter.

See next page for details



Composition of quarters



Composition of samples to analyse

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

### Step 3: Weigh the sample to obtain 1 kg for the KOR Analysis

Each sample, composed as described before, is weighed to get about 1 kg of raw cashew nuts.

**Write down the weight of the sample:**

$W_1 =$

The weight can fluctuate between 998g and 1002g.

## STEPS OF THE QUALITY CONTROL

WEIGHING  
THE SAMPLE

3

Each sample, composed like describe before, is weighed to get about 1kg of nuts. Let  $W_1$  be the weight of a sample. .

**! WRITE THE RESULT !**  
 $(W_1 = \dots)$

It can fluctuate between 998g and 1002g.

**It can be useful to keep a witness-sample of about 1kg to check in case somebody contests the results.**



*Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?*

### Step 4: Count the total number of nuts that make 1kg / Calculate the Nut Count

After weighing the sample, calculate how many nuts are in the sample



Example: For 193 nuts, make 19 piles of 10 nuts and 1 pile of 3 nuts

**Write down the results:**

**N=**

During this step, you also check for foreign matter in the batch (e.g. leaves, stones, dry apples, branches)

## STEPS OF THE QUALITY CONTROL

CALCULATION OF THE NUT COUNT (NC)

**4**

After the weighing of the sample, we calculate how many nuts are in the sample.

During this step, we also check if foreign matters are in the batch (leaves, stones, dry apples, branches).



*For each sample the nuts are brought together in small piles of ten nuts : this will avoid mistake during the counting.*



*Thanks to the nuts piles, this is easy to know how many nuts are in the sample by counting the number of 10-nuts piles and the extra nuts.*

**Example :** for 193 nuts, we will count 19 piles of 10 nuts + 3 nuts

**! WRITE THE RESULT !**  
**(N = ....)**

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

## Step 5: Cut the raw cashew nuts and conduct the quality analysis

Each nut (shell and kernel) of each sample is cut through – lengthwise – with the help of a specially designed scissors, into two halves.



Make sure that the two halves of each nut are kept together and that the kernels stay with the shells.

## STEPS OF THE QUALITY CONTROL

### OPENING OF THE NUTS, CONTROL OF THE KERNELS AND CLASSIFICATION IN THREE CATEGORIES

# 5



Each nut (shell and kernel) of each sample is cut through with the help of a specially designed scissors; thus we get two halves with or without flaws. The split nuts are classified according to their characteristics.

**Make sure that the two halves of each nut are kept together and that the kernels stay with the shells.**



Notice the position of the nut in the scissors, cut slightly the nut lengthwise, dry the scissors after each cutting.

**Use gloves; the test has to be done in good light.**

By observing these split nuts, we can observe the kernels and classify them into three categories :

- Wholesome kernels (100% accepted)  
**SEE TAB, GREEN COLOUR**
- 50% rejected kernels  
**SEE TAB, BLUE COLOUR**
- 100% rejected kernels  
**SEE TAB, RED COLOUR**

These controlled kernels are put in the bowls according to their category.

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

The nuts are then classified according to their characteristics:

- **Green – Good quality kernels**
  - 100 % accepted kernels
- **Blue – Defective (premature and spotted) kernels**
  - 50 % rejected kernels
- **Red – Rejects (stunted, empty, moth-eaten, mouldy, brown) kernels**
  - 100 % rejected kernels

The first and most important category of nuts is the good kernels. They are accepted 100 %.



### GOOD KERNELS

WHOLESALE KERNELS DON'T HAVE ANY FLAW, THUS ALL OF THEM ARE USABLE. THESE KERNELS ARE **100% ACCEPTED**.

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

The second category is the defective nuts. They are not fully acceptable for human consumption. They have a 50 % acceptancy rate.



### SPOTTED KERNELS

THESE KERNELS HAVE HAD INSECT BITES BEFORE THE DEVELOPMENT OF THE SHELL. THUS THESE KERNELS BEAR AT LEAST ONE BLACK SPOT OR ONE BLACK MARK. PARTS THAT DON'T HAVE ANY SPOT OR MARK CAN BE CONSUMED. THEREFORE **50 % OF THESE KERNELS ARE ACCEPTED (OR REJECTED)**.



### PREMATURE KERNELS

THESE KERNELS ARE SHRIVELED, NOT WELL DEVELOPED BECAUSE OF A TOO EARLY HARVEST (SOMETIMES BY PICKING).

THEREFORE **50 % OF THESE KERNELS ARE ACCEPTED (OR REJECTED)**

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

The third and last category is rotten, oily, mouldy, stunted, brown, moth-eaten nuts and empty shells. They are 100 % rejected because they are unfit for human consumption.



Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

### Step 6: Weigh the three different categories of nuts

## STEPS OF THE QUALITY CONTROL

## WEIGHING 6

This stage has two steps :

The weighing of **defective kernels** ; ② The weighing of **usable kernels** (kernels 100% or 50% accepted)



Good kernels are removed from the shells with the help of the scooper (or the needle) preferably without removing the peel (or testa). We get on one side kernels (with peel), and on the other side shells.

These good kernels are the "100% accepted kernels".

They are put into the **green** bowl.

These good kernels are weighed with their peel. Let  $W_1$  be the total weight of the good kernels.

**! WRITE THE RESULT !**  
 $(W_2 = \dots)$



Weight the kernels+shells of the categories (premature and spotted). Let  $W_3$  be the total weight of the nuts (kernels+shells) 50% accepted.

$W_3 =$  weight of the spotted kernels + weight of the premature kernels (kernels + shells)

**! WRITE THE RESULT !**  
 $(W_3 = \dots)$

Then, the kernels (premature and spotted) are removed from their shells. All these kernels are "the 50% accepted (or rejected) kernels". They are put into the **blue** bowl.

The kernels (premature and spotted) are weighed. Let  $W_4$  be the total weight of the 50% rejected kernels.

**! WRITE THE RESULT !**  
 $(W_4 = \dots)$



In the same way, each other category of defective kernels (mouldy, brown, moth-eaten, empty, and stunted) is weighed with the shells. Let  $W_5$  be the total weight of the nuts (kernels+shells) 100% rejected.

**! WRITE THE RESULT !**  
 $(W_5 = \dots)$

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?



### Green Category

Remove the good kernels from the shell with the help of the scooper.

You will get:

- Half kernel with testa
- Half shell

The good kernels are accepted 100 %. Place them in the green bowl and weigh.

**Write down the weight of good kernels with the testa without the shell.**

$W_2 =$

### Blue Category

**Write down the weight of the spotted and premature kernels with shells**

$W_3 =$

Afterwards, remove the spotted and premature kernels from their shells. The spotted and premature kernels are accepted 50 %. Place them in the blue bowl and weigh.

**Write down the weight of the spotted and premature kernels without shells.**

$W_4 =$

### Red Category

The defective kernels are 100 % rejected. Place them in the red bowl and weigh.

**Write down the weight of the defective, stunted, empty, moth-eaten, mouldy, brown kernels with shells**

$W_5 =$

## e) Determine parameters for cashew production



Practical Exercise: Conduct the KOR calculations to determine the quality parameters of a raw cashew nut batch.

Step 7: Calculation of KOR. This is the final step of the KOR analysis.

## STEPS OF THE QUALITY CONTROL

## CALCULATIONS

### Calculation of the Nut Count

This is the number of nuts per kilogram. It is calculated by dividing the number of nuts in the sample by the weight of this sample; we obtain the value of the grain. The grain gives information about the average size of the kernels. The bigger is the grain value, the more there are nuts in one kilo and so the smaller are the nuts.

With :

- $W_1$  : the weight of the sample
- $N$  : the number of nuts counted in one sample [see tab 4]

$$\text{Nut Count} = N / W_1$$

### Calculation of the total defective rate

To calculate the defective rate, you have to use the followings formula with the data from the weighing [see tab 6].

With :

- $W_1$  : the total weight of the nuts sample
- $W_5$  : the weight of the 100% rejected nuts
- $W_3$  : the weight of the 50% rejected nuts

The defective rate is :

$$(W_3 + W_5) / W_1 \times 100$$

### Calculation of the kernels productivity and of the Out-Turn

To calculate the kernels productivity, you have to use the followings formula with the data from the weighing. [see tab 6].

With :

- $W_1$  : the total weight of the nuts sample
- $W_2$  : the total weight of kernels+peels of 50% rejected nuts
- $W_4$  : the total weight of kernels+peels of the good kernels

$$\% \text{ of useful kernels} = (W_2 + W_4 / 2) / W_1 \times 100$$

For the processors, all reasoning connected to the purchase and the processing of cashew nuts are conducted on the base of a 80 kg-nuts bag and of a weight of kernels expressed in pounds (lb).

Thus the productivity Ra becomes the Out-Turn with the following conversion :

$$\text{Out-Turn} = \% \text{ of useful kernels} / 100 \times 80 \times 1 / 0,45359$$

### EXPLANATION

- The productivity in % is converted in a value expressed in weight/weight (for that, we divide % of useful kernels by 100)
  - To reason with 80kg-nuts bag, we multiply by 80
  - To get a value in pounds, we divide by the value of one pound in kg (1lb=0.45359 kg)
- In practice, the values of the Out-Turn fluctuate between 40 and 50 lbs per 80 kg of nuts. When the Out-turn is high, the batch has a good quality.

**GOOD QUALITY = GOOD PRICE**

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

## Calculation of the Nut Count

This is the number of nuts per kilogram. It is calculated by dividing the number of nuts in the sample by the weight of the sample to obtain the value of the grain.



The grain gives information about the average size of the kernel. The bigger the grain value, the more nuts there are in one kilo, the smaller are the nuts and the lower is the quality.

To calculate the nut count, you have to use the following formula:

- $W_1$  – total weight of the nut sample
- $N$  – number of nuts counted in one sample

$$\text{Nut count} = N / W_1$$

### Calculation of the total defective rate

To calculate the defective rate, you have to use the following formula with the date of weighing:

- $W_1$  – total weight of the nut sample
- $W_3$  – total weight of the 50 % rejected nuts
- $W_5$  – total weight of the 100 % rejected nuts

$$\text{Defective rate} = (W_3 + W_5) / W_1 \times 100$$

The image displays two screenshots of a digital scale interface used for calculating the total defective rate of cashew nuts. The left screenshot shows a sample of 195g. It identifies 33g of unusable kernels, which is 23% of the total sample. The remaining 114g are usable kernels. The right screenshot shows the same interface but with empty input fields for the defective rate calculation, illustrating the formula's application.

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

### Calculation of the kernel's productivity and of the outturn

To calculate the kernels productivity, you have to use the following formula with the date of weighing:

- $W_1$  – total weight of the nut sample
- $W_2$  – total weight of good kernels and testa
- $W_4$  – total weight of kernels and testa of the 50 % rejected kernels

$$\% \text{ of useful kernels} = (W_2 + W_4 / 2) / W_1 \times 100$$

## Kernel Outturn Ratio (KOR)

- The productivity in % is converted in a value expressed in weight / weight (for that, you divide % of useful kernels by 100)
- To reason with 80 kg nuts bag, multiply by 80
- To get the value in pounds, divide by the value of one pound in kg (1 lb = 0,45359 kg)

$$\text{Outturn} = \% \text{ of useful kernels} / 100 \times 80 \times 1 / 0,45359$$

### CALCULATION OF THE OUT-TURN

All useful kernels **283,5**

OUT TURN **49,9**

OUTTURN  $\left(\frac{\text{lbs}}{80\text{kg}}\right) = \text{All useful kernels (g)} \times \frac{80 \text{ (kg)}}{454 \text{ (g/lbs)}}$

### OUT-TURN

All useful kernels

OUT TURN

OUTTURN  $\left(\frac{\text{lbs}}{80\text{kg}}\right) = \text{All useful kernels (g)} \times \frac{80 \text{ (kg)}}{454 \text{ (g/lbs)}}$

Source: GIZ/ComCashew – Technical Manual: How to estimate the quality of raw cashew nuts?

In practice the value of the Kernel Outturn fluctuates between 49 – 52 lbs per 80 kg of nuts.

When the Kernel Outturn is high, the batch has a good quality.



Remember! The Ghana Standard for raw cashew nuts and kernels (GS 220) provides guidelines on cashew quality. This standard is based on the Codes Alimentarius for stakeholders working in the cashew sector in Ghana. Consult the GS 220 for more details.



## SELF ASSESSMENT

1. Explain quality tests in cashew production.

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2. State types of quality tests applicable to cashew production.

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3. State the quality parameters applicable to cashew production.

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*Well done! You are doing great on your path to success.*



### 3. DEMONSTRATE KNOWLEDGE OF CERTIFICATION PROCESSES IN CASHEW PRODUCTION

#### a) Explain certification in cashew production

Certification in cashew production covers:

- cultivation practices
- social, ethical and ecological responsibility
- product quality characteristics

A certificate is a written document provided by a national or international certification body that assures the conformity of cultivation practices, social, ethical and ecological responsibility and product quality characteristics with standard requirements in cashew production.

In some cases, products are certified with specific labels that indicate compliance with a certain standard, such as organic cultivation or Fairtrade.

While the certificate is important in the communication and negotiation process between producers and buyers or processors, the label communicates compliance with certain standards to the end consumer.

#### b) State the importance of certification

Certification in cashew production is important to:

- ensure quality production
- ensure a sustainable supply
- offer fair and premium prices to farmers for higher quality products
- increase transparency in cultivation practices
- ensure environmental protection
- ensure social protection

#### c) State the types of certification processes

There are different types of certification processes that are relevant for different agribusinesses:

- Certification of cashew farms (e.g. organic or Fairtrade)
- Certification of cashew processing (e.g. HACCP, ISO 22000, BRC, organic or Fairtrade)
- National product certification (e.g. compliance with product requirement for domestic product marketing)
- International product certification (e.g. compliance with product requirement for international product marketing)

d) State the different certification bodies relevant to cashew production

The following training and certification bodies are relevant to cashew production in Ghana:

Country	Organisation	Address	Remarks
Ghana	Meridian Agricultural Services	<a href="mailto:Aaron.ampofa1@gmail.com">Aaron.ampofa1@gmail.com</a> +233500209573 +233244561416	Organic, Fairtrade Training, Auditing, Internal control
Ghana	SGS-Ghana Ltd	<a href="http://www.sgs-ghana.com/en/Agriculture-Food/Food/Transportation-Logistics-and-Trade/Food-Certification/Organic-Certification.aspx">http://www.sgs-ghana.com/en/Agriculture-Food/Food/Transportation-Logistics-and-Trade/Food-Certification/Organic-Certification.aspx</a> <a href="mailto:EvelynIngrid_Keelson@sgs.com">EvelynIngrid_Keelson@sgs.com</a> +233 302 77 39 94 +233 302 77 39 95	Organic Training, Auditing, Setting up of internal control systems
Ghana	Ecocert	<a href="http://www.ecocert-imo.ch/logicio/pmws/indexDOM.php?client_id=imo&amp;page_id=gh">http://www.ecocert-imo.ch/logicio/pmws/indexDOM.php?client_id=imo&amp;page_id=gh</a> +233-242821996 +233-508058353 <a href="mailto:stephen.acheampong@ecocert.com">stephen.acheampong@ecocert.com</a>	Organic certification
Ghana	Union	<a href="https://certifications.controlunion.com/en/contact-us/find-an-office?activity=Certifications">https://certifications.controlunion.com/en/contact-us/find-an-office?activity=Certifications</a> +233 249705054 <a href="mailto:ghana@controlunion.com">ghana@controlunion.com</a>	Organic certification



Source: GLZ/ComCashew – Organic certified raw cashew nuts

e) **State the certification requirements for cashew production**

The certification requirements vary slightly in different regions and countries:

- **Bio certificate of the European Union**
  - Products not produced by and with genetically modified organisms
  - Products not produced with the use of synthetic pesticides
  - Products which are not produced with the help of easily soluble mineral fertilisers
  - The import of raw materials and products from third countries is regulated and strictly controlled on a batch basis:
    - Crop rotations (two-, three- and four-field farming) must be varied.



Source: <https://de.wikipedia.org/wiki/Bio-Lebensmittel>

- **Bio certificate of German according to EU regulations for organic certification**



Source: <https://www.oekolandbau.de/bio-siegel/>



- **BIO/Organic certificate of the USA**
  - evaluation of soil and nutrient management
  - adjoining land use
  - buffer zones
  - land use history
  - production capacity of the land
  - seeds and planting stock used
  - crop rotation practices
  - pest control practices
  - harvest
  - labelling
  - shipping
  - evaluation of the record-keeping system and verification of activities through appropriate records
  - reconciliation of the volume of organic products produced or received with the number of organic products shipped, handled and/or sold, also known as trace-back audits or in-out balances
  - Sampling of organic agricultural products for residue testing, if applicable



Source: <https://www.usda.gov/topics/organic>

- **Rainforest Alliance Sustainable Agricultural Standard**
  - Biodiversity conservation
  - Improved livelihoods and human well-being
  - Natural resource conservation
  - Effective planning and farm management systems



Source: <https://www.vjtsp.com/nl/onze+groep/sustainable+products>

- **The Fairtrade Certificate**

- Organisation of farmers in cooperatives
- Promotion of the establishment of farmer organisation
- Regulated working conditions
- Prohibition of exploitative child labour
- Prohibition of discrimination
- Environmentally friendly cultivation
- Protection of natural resources
- Prohibition of dangerous pesticides
- No genetically modified seed
- Promotion of organic farming through the organic surcharge
- Payment of Fairtrade minimum price and Fairtrade premium proof of flow of goods and money
- Transparent trade relations
- Pre-financing



Source: <https://www.siegelklarheit.de/Fairtrade-c79>

**f) Outline the procedure for certification in cashew production**

Cashew producers must follow these steps in meeting certification requirements:

1. The producer adopts specific cultivation practices and fulfils certain social, ethical and ecological responsibilities and adheres to product quality characteristics.
2. The producer applies for the certification, by submitting a filled-in application form.
3. The certifying agent reviews the application to verify compliance with the specific standards.
4. The producer demonstrates conformity with standard requirements to an on-site inspector (the inspector usually has an assessment guide to check the level of conformity with the standard requirements).
5. The certifying agent reviews the application and the report of the inspector to determine if the applicant complies with the standards requirements.
6. The certifying agent issues the certificate.
7. Frequent (unannounced) on-site auditing visits to ensure conformity with standard requirements.
8. Frequent announced (mostly annual) on-site visits to ensure continual conformity to standard.



## SELF ASSESSMENT

1. Explain certification in cashew production.

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2. State the importance of certification.

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3. State the types of certification processes.

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4. Outline the procedure for certification in cashew production.

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*Congratulations! You have completed more than half of this training unit already. Take a deep breath and continue to the last chapter. You are doing great!*

#### 4. DEMONSTRATE KNOWLEDGE IN TRACEABILITY IN THE AGRIBUSINESS INDUSTRY

##### a) Explain traceability in cashew production

Traceability is the ability to track, document and / or locate any quantity and quality of food products from primary production to consumption, through all stages of production, processing, marketing and distribution. Traceability is a risk-management tool that enables retailers to withdraw or recall products that have been identified as unsafe for consumption.

ISO 22005:2007 comprehensively explains the principles and requirements for the design and implementation of a feed and food traceability system.

This standard allows organizations operating at any step of the food chain to:

1. trace the flow of materials (feed, food, their ingredients and packaging)
2. identify necessary documentation and tracking for each stage of production
3. ensure adequate coordination between the different actors involved
4. improve communication among the involved parties, and most importantly
5. improve the appropriate use and reliability of information, effectiveness and productivity of the organization.

##### b) State the importance of traceability

The global agri-food and commodity trade is continuously increasing. Changes in the trading environment have led to larger global production and supplier networks. The structure of food supply chains has become highly fragmented and complex across multiple enterprises, countries and continents.

The large number of players involved, the unpredictability of supply and the perishable nature of food products have heightened the need for quality assurance and safety in relation to food products and production processes. Besides, consumers want to know the origin of products that they buy.

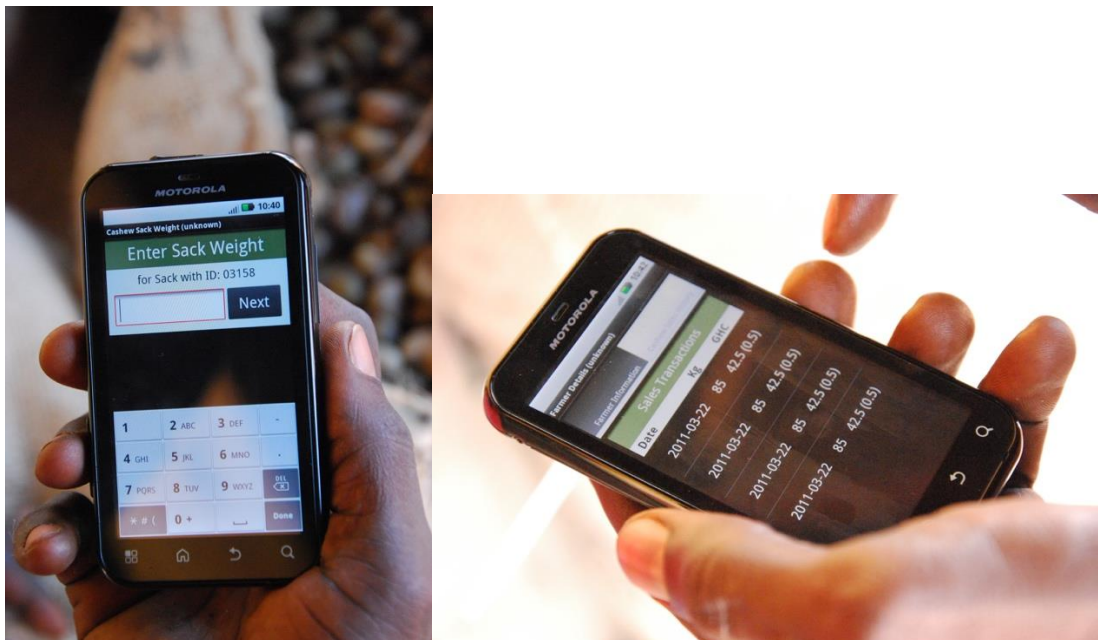
The implementation of effective traceability systems improves compatibility of food safety and quality compliance programs. Information transparency enables agri-food businesses to better manage risks and allows for quick reaction to emergencies, recalls, and withdrawals. Effective traceability systems significantly reduce response times in case of disease outbreaks, by providing more rapid access to relevant and reliable information that helps to determine the source and location of contaminated products. Thus, information (about animal and plant health, country of origin etc.) at any point in the chain from producer to consumer has become crucial.

Through traceability, information on contaminated products can be communicated to the public, thereby creating awareness and minimizing harm to consumers. Traceability can reduce the amount of recalls by 50 % and up to 95 %. This reduces the amount of product that would have been wasted in the absence of the traceability systems.

Traceability in the cashew industry is a legal requirement for the European market. In the cashew industry, traceability involves the documentation of reliable information about the origin of raw cashew nuts purchased for processing, the processing process and the destination of the finished product. A few traceability systems are available to track cashew nuts and kernel along the value chain: SAP, Sustainable Supply System (3S), FarmForce and SmartFarm.



Source: *GIZ/ComCashew – SAP Traceability App*



Source: *GIZ/ComCashew – SAP Traceability App*



For more information on the traceability system 3S, watch video on *IDH: 3S (Sustainable Supply System)*.

**c) Outline the procedure and tools required for practicing traceability**

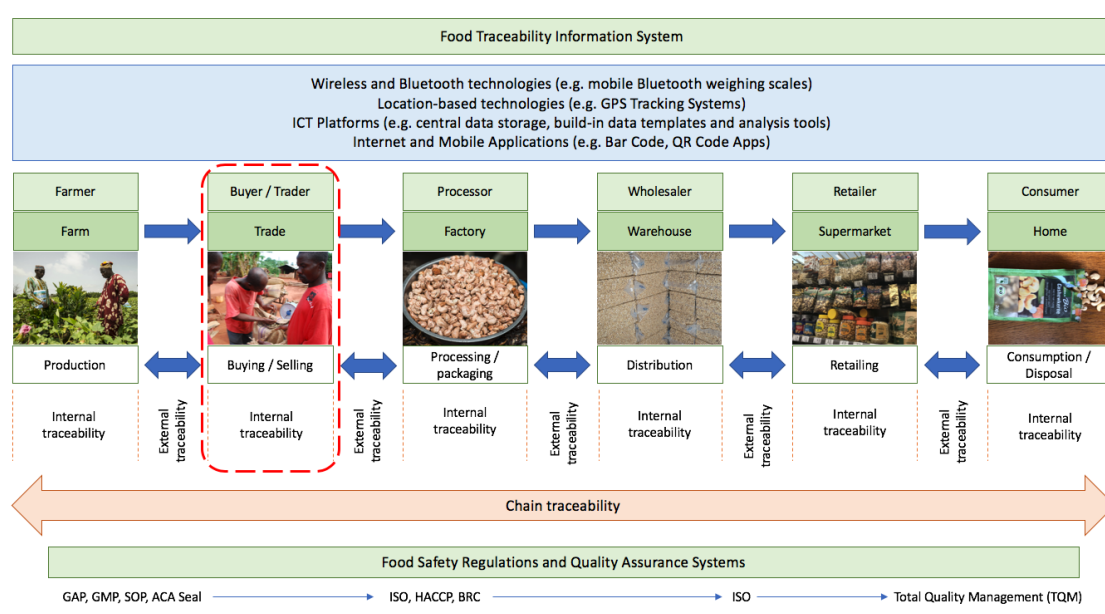
The supply chain image below shows the difference between internal and external traceability:

- Internal traceability refers to the generation of product data within one specific segment of the supply chain
- External traceability is the transfer of product data from one segment to another.

In fragmented supply chains, buyers and traders are relevant players in the supply chain. In highly organized supply chains, business linkages between farmers and processors can exclude the buyers and traders' segment in the supply chain.

There are various technologies that enable traceability such as:

- Mobile Bluetooth weighing scales that generate and transfer data to an app for easy documentation in the procurement process.
- GPS tracking that generates data on farm locations and sizes.
- ICT platforms, which offer the opportunity to work with templates to ensure uniform data collection and analysis.
- Mobile apps that work online and offline facilitate data collection and enable bar code systems through which suppliers receive traceability codes.





#### d) Apply the procedure of traceability in cashew production



Practical Exercise: Go to the farm and document relevant production data in order to ensure traceability of your products. Not all traceability systems are uniform, collect the data that are relevant for the business you are working for.

Document the following data for internal traceability in the production segment of the cashew supply chain:

- Name of the farmer
- Source of origin (e.g. farming community)
- Weight of product (80 kg of raw cashew nuts in each bag)
- Number of product units (X number of 80 kg bags)
- Overall product quantity
- Reference to any product quality control records
  - KOR
  - Nut count
  - Moisture content
  - Defective nuts
- Date of harvest
- Use of chemicals on the product (e.g. pesticides, fungicides)



Source: GIZ/ComCashew – GPS Mapping

e) **Apply the procedure of traceability in the procurement of tree crops**



Practical Exercise: Go to a cashew farming community and procure raw cashew nuts. Document relevant data in order to ensure traceability of the product. Not all traceability systems are uniform. Collect the data that are relevant for the business you are working for.

Document the following data for internal traceability in the trading segment of the cashew supply chain:

- Supplier name
- Source of origin (e.g. farming community)
- Weight of product (80 kg of raw cashew nuts in each bag)
- Number of product units (X number of 80 kg bags)
- Overall product quantity
- Reference to any product quality control records
  - KOR
  - Nut count
  - Moisture content
  - Defective nuts
- Delivery date
- Farmgate price
- Commission for farmer (for higher quality products or as part of loyalty programs)
- Assign any supplier batch codes
- Lot number (if any) assigned to the delivery
- Details of the deliverer and vehicle (as applicable)



## SELF ASSESSMENT

1. Explain traceability in cashew production.

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2. State the importance of traceability in cashew production.

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3. Outline the procedure and tools required for practicing traceability.

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*Bravo! You have completed another unit. Let's tackle the last chapter.*



## 5. DEMONSTRATE SKILLS IN DOCUMENTING CASHEW PRODUCTION

### a) Explain documentation in cashew operations

Documentation in cashew operations is the detailed process of collecting production, processing or business-related data, either on paper or digital form - in a mobile app or in an online data storage system. The compiled documents provide official information or evidence that serve as business records.

### b) State the importance of documentation for quality assurance

Documentation for quality assurance is important to:

- enable payment according to quality
- establish loyalty programs for farmers, by providing bonus payments to farmers who supply better quality raw cashew nuts
- document business operations of farmers to increase their bankability and opportunities to access loans for farm investments and/or expansions
- ensure sustainable supply of high-quality produce

### c) Identify records sheets for quality assurance

Exemplary records sheet for quality assurance and traceability of the product per farmer.

	Name of the farmer							
	Source of origin (e.g. farming community)							
Date	Number bags (80 kg)	Farmgate price	Nut count / KOR	Moisture content	Bonus	Total Value	Receipt No.	Signature

d) **Complete records sheets for quality assurance in cashew production**



Practical Exercise: Go to a cashew farming community and procure raw cashew nuts. Document relevant data in the record sheet. Not all record keeping templates are uniform. Collect the data that are relevant for the business you are working for.



Source: GIZ/ComCashew – Documenting RCN quality



## SELF ASSESSMENT

1. Explain documentation in cashew operations.

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2. State the importance of documentation for quality assurance.

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*Bravo! You have completed this entire unit.*



## REFERENCES

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