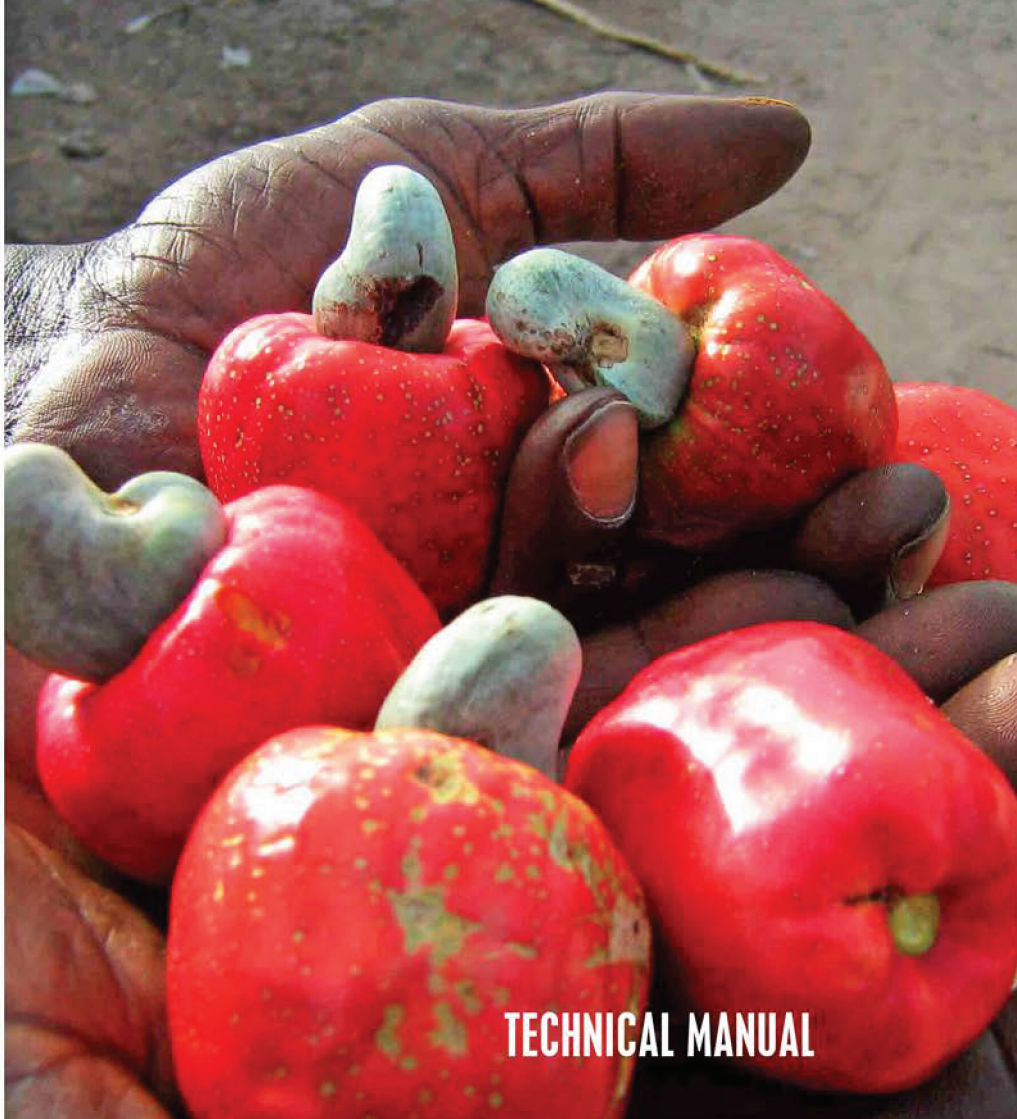
HOW TO ESTIMATE THE QUALITY OF RAW CASHEW NUTS (RCN)?



TECHNICAL MANUAL

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Co-funded by the European Union

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FOREWORD

The Market Oriented Value Chains for Jobs and Growth in the ECOWAS Region (MOVE) formerly known as the Competitive Cashew Initiative (ComCashew) and now tagged as (MOVE-ComCashew) presents a new and innovative model of broad-based multi¬-stakeholder partnership in development cooperation. MOVE-ComCashew is co-financed by the European Union (EU) under the post-Cotonou Agreement with the Organization of African, Caribbean and Pacific States (OACPS) and by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the Joint Action; Business Support Facility for Agricultural Value Chains, implemented by Agri-Business Facility for Africa and the Market Oriented Value Chains for Jobs and Growth in the ECOWAS region (MOVE).

The goal of MOVE-ComCashew is to create income and employment in its implementing countries with a focus on increasing the value creation of cashew processing, improving the economic/environmental sustainability of the cashew agricultural systems, improving the marketing of cashew regional products, disseminating good practices in promoting cashew, inclusive business models targeting gender inclusion and strengthening public-private cooperation in policymaking. Under the Business Support Facility for Resilient Agricultural Value Chains, MOVE-ComCashew aims to develop and enhance the capacities of actors along the cashew value chain in the African Caribbean and Pacific (ACP) countries and attract finance and investment towards low-emissions and climate-resilient value chains with a focus on "building bankable projects for investment through targeted capacity building". The project provides Matching Grant Funds (MGF) to strengthen the resilience of the Micro, Small, and Medium Enterprises (MSME) and promote policy dialogue and South-South cooperation in the cashew sector.

The world market's success relies on producing a significant volume of excellent quality cashew nuts. For this reason, MOVE-ComCashew focuses some of its activities on helping cashew nut producers meet international quality standards. In collaboration with its partners, MOVE-ComCashew provides advice and training for each step of the production process: farm management, yield increase, harvest & post-harvest handling, cooperative management and compliance with specific market requirements.

MOVE-ComCashew has accumulated valuable experience and knowledge in the production and processing of cashew nuts and its by-products and this resource is shared with the industry, notably processors and potential investors in the cashew processing sector in Africa, the Caribbean and the Pacific.

ACA

ComCashew

Implemented by:

giz Deutsche Ges für Internatio Zusammenart

This technical manual gives the physical criteria used by the market players worldwide to assess the quality of the raw cashew nuts.

The main criteria used are: Out Turn (Kernels Output Ratio), Moisture, Nut Count, and Total Defective Nuts.

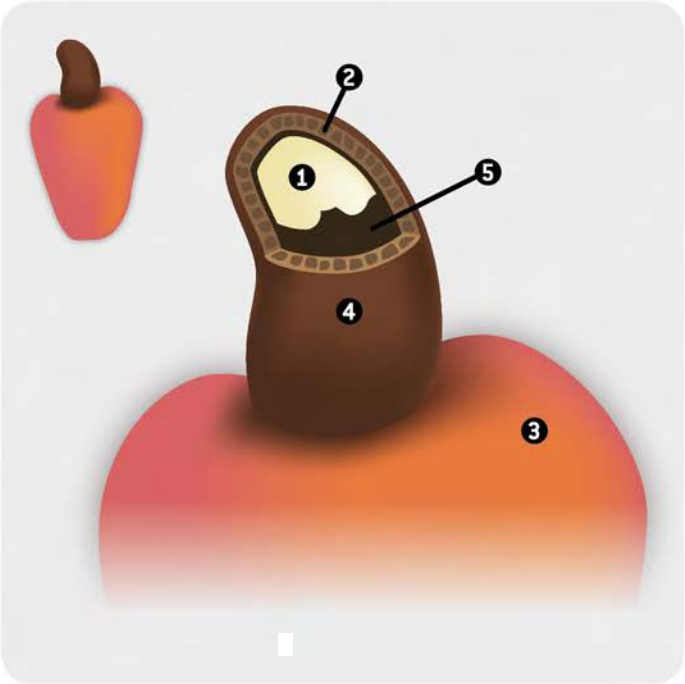
Quality control of Raw Cashew Nut requires skills and strictness; this is one step in the marketing of raw cashew nuts.

This manual aims to make easier the training of quality inspectors specialized in the quality control of raw cashew nuts.

This manual has been designed from field experiences carried on by the following partners:

THIS MANUAL GIVES THE CRITERIA USED TO ASSESS THE QUALITY OF THE RAW CASHEW NUTS (ANACARDE).

WHICH PARTS OF THE FRUIT OF THE CASHEW TREE ARE USABLE?



❶**The kernel :** it is mainly consumed roasted and salted. Crushed kernels are used in the food industry (chocolate factory, pastry factory, biscuit factory). The pressing of the kernels gives oil used to produce cosmetics or in food preparations.

❷**The balm :** also called Cashew Nut Shell Liquid (CNSL); it has several uses in the industry. Extracted from the shell, this liquid is mostly composed of anacardic acids; it is used, after purification, in the chemical products manufacturing. This liquid is dangerous; it can not be handled with bare-hands. Its handling requires use of oil, gloves, etc ...

❸**The apple :** it is juicy, lightly flavoured, sour and with a lot of vitamin C. This apple is edible. Juice can be extracted from the apple to produce alcohol, vinegar and syrup.

❹**The shell :** the empty shell is used as a fuel to drive the nuts processing (cooking or drying).

❺**The peel or testa :** sometimes, they are used either like the shells or to complement livestock food; they also can be used to make dyeing.

WHO ASSESSES THE RAW CASHEW NUTS QUALITY ?

During the raw cashew nuts marketing, quality control occurs at several levels :

• Farmers

Farmers ensure the quality of the cashew nuts they sell in order to get the right price by the buyers.

• Local buyers

They assess the quality of the cashew nuts they buy in order to avoid the return of bad batches from their clients (local processors, exporters)

• Exporters

Most of the raw cashew nuts produced in Africa are, then, exported to Asian countries (India, Vietnam). In big exportation harbours (such as Abidjan, Tema, Lomé), the exporters always check the quality of the cashew nuts batches coming from the productive areas.

• Local shelling factories

Quality control is carried out when the cashew nuts arrive in the shelling factories. If the processing occurs after a long time, the cashew nuts quality can decrease. That's why this is important to check the cashew nuts quality just before their processing; then you can anticipate the productivity after the shelling.

Therefore, the quality control occurs throughout the supply chain.

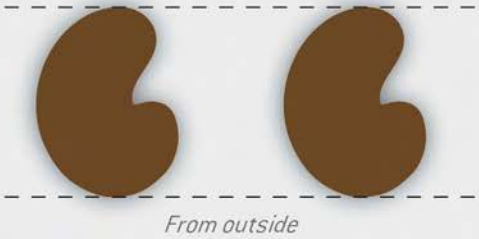
Quality is assessed throughout the cashew nuts marketing.

WHY IS THE QUALITY CONTROL OF THE RAW CASHEW NUTS NECESSARY?

During a commercial transaction between a farmer and a tracker for instance, several criteria can be used to specify the cashew nuts quality: colour, shape, brightness, exterior aspect.

But the most important is the quality of **the kernel inside the shell**.

Cashew nuts buyers are actually processing factories, who need good cashew nuts, to get good kernels to be dispatched.



From outside

From inside

CRITERIA USED TO ASSESS THE QUALITY OF THE RAW CASHEW NUTS

1. **The OUT TURN or KOR** (Kernel Output Ratio)
2. **The DEFECTIVE NUTS RATE**
3. **The NUT COUNT** (numbers of nuts/kg)
4. **The MOISTURE**

1 OUT TURN

In general Out-turn means the amount of usable kernels after de-shelling the nuts. It is expressed in lbs quality, which just means the weight of **useful kernels** weighed in pounds in one 80 kg jute bag of RCN. Out-Turn can also be called KOR (Kernel Output Ratio) or kernels output.

Example : *an Out-turn of 49 lbs/bag of 80 kg means that we can have 49 lbs (22.2 kg) of kernels usable by the manufacturer if we shell 80 kg nuts.*

To package the cashew nuts, we use gunny bags of 80kg; they are the bag usually used to store cocoa. We assess the kernels quality in these 80 kg-bags. Then the kernels are sold in pound. That's why the Out-Turn means kernels weighed in lbs in 80 kg-bags.

The conversion lbs/kg is a conversion between the metric system and the English system:
1 lb = 0.45359 kg (or also 11.33 kg = 25 lbs)
1kg=2.2 lbs

The Out-Turn is an important parameter for the user to control the nuts quality. The nuts prices are determined according to the nuts quality; thus these users will be able to avoid the underestimation of their products by shady buyers. Indeed they will know how to fix the right price. The value of the Out-Turn can also make them able to improve the technical route.

2 THE DEFECTIVE NUT RATE

The defective cashew nuts rate gives the quantity of defective nuts of the sample : **premature kernels, spotted kernels** (**blue** category) + **Stunted kernels, Void nuts, Moth-eaten kernels, Mouldy kernels, Brown kernels** (**red** category).
To determine this rate, we weight **the kernels and the shells** of these two categories. It is expressed in percentage. In general, a sample with more than 24 % of defective nuts is rejected.
This is faster and easier to calculate the defective rate than the Out-Turn; therefore it is used to have a first insight of the batch quality.

3 THE NUT COUNT

This is the number of nuts per kilogram; it is expressed in nuts/kg. In practice, it fluctuates between 150 and 240 noix/kg. The smaller is the number, the bigger are the nuts.

Combined with the Out-Turn, the Nut Count gives information about the kernels size that we might get after the shelling.

Indeed the bigger are the nuts and the higher is the Out-Turn, the more likely we are to get big kernels. Big kernels are especially easily sold on the world market.

❹ THE MOISTURE RATE

This is an important element concerning the nuts storage. It is expressed in percentage. It has to be under control from the harvest to the shelling. This is better to keep this rate under 10% after the drying. Over 10 %, nuts are likely to go mouldy; however if the rate is too low (under 6%) kernels become dry and loose weight. There is a shortfall for the seller. Moreover Kernels too dry are too flimsy during the processing.
Therefore the moisture rate has to be between 7 and 10 %.

The Out-Turn makes farmers able to correct some weaknesses of the technical route, but it is also very important for the nuts marketing. Indeed marketing is an important step for all the players of the cashew chain because this is when the quality is defined. The nuts price are set according to the value of the Out-Turn of the product. Thus, the player who knows the Out-turn is able to negotiate prices. Buyers (often from Asia) are specialists in this area, therefore local farmers and buyers have to know the Out-Turn to avoid the underestimation of their products.

Here are the steps to assess properly the quality of the cashew nuts batch.

HOW TO MEASURE THE ASSESSMENT CRITERIA?

STEPS OF THE QUALITY CONTROL

MATERIALS NEEDED TO CALCULATE THE OUT-TURN 1

Material to weight :
one electronic balance with a precision of 0.5 gram

Material to take nuts from the bag :
catheter bag

Material to open the nuts :
one pair of scissors especially designed for shelling raw cashew nuts

Material to separate the kernel from the shell :
One scooper (could be adapted from a screw driver or made by local crafts men)

Plastic buckets :
for the samples
(one bucket/one sample)

4 plastic bowls to store kernels and nuts during the analysis. The use of bowls of different colours (green yellow, red, blue) would make easier the sorting out of the kernels

A pair of latex gloves
to protect hands

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:

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? 2

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

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.

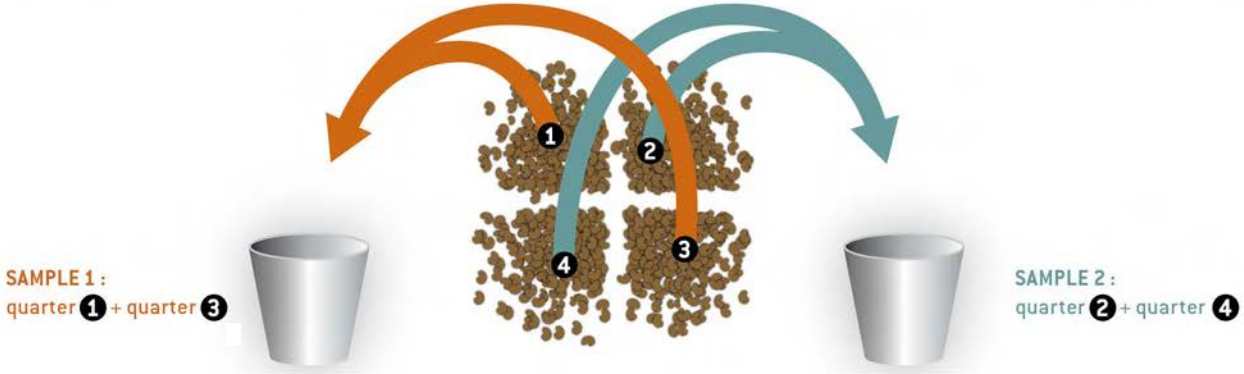
See next page for details

Composition of quarters

Composition of samples to analyse

HOW TO COMPOSE QUARTERS? 2

2



SAMPLE 1 :
quarter 1 + quarter 3

SAMPLE 2 :
quarter 2 + quarter 4

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 = ...)

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.

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 = ...)

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.

5

GOOD KERNELS

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

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)**

STUNTED CASHEW NUTS

THEY ARE SMALL NUTS WITH UNDERDEVELOPED KERNELS BECAUSE OF A LACK OF WATER OR BECAUSE OF AN ABORTION ON THE TREE. THUS **100% OF THESE KERNELS ARE REJECTED.**

MOULDY KERNELS

THESE KERNELS HAVE WHITE MARKS DUE TO A BAD DRYING OR A HUMID STORAGE. THUS **100% OF THESE KERNELS ARE REJECTED.**

BROWN KERNELS

THESE KERNELS HAVE STAYED TOO LONG ON THE GROUND; THEY HAVE AN OILY, YELLOWISH APPEARANCE. THUS **100% OF THESE KERNELS ARE REJECTED.**

MOTH-EATEN KERNELS

THESE KERNELS HAVE BEEN EATEN BY INSECTS; THIS RESULTS IN A YELLOW POWDER INSIDE THE KERNEL. THUS **100% OF THESE KERNELS ARE REJECTED.**

EMPTY CASHEW NUTS

THESE KERNELS HAVE WHITE MARKS DUE TO A BAD DRYING OR A HUMID STORAGE. THUS **100% OF THESE KERNELS ARE REJECTED.**

STEPS OF THE QUALITY CONTROL

WEIGHING **6**

This stage has two steps :

The weighing of **defective kernels** ; ❷ 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 = ...)

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 = ...)

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 = ...)

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 = ...)

STEPS OF THE QUALITY CONTROL

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 :

$$(W_3+W_5)/W_1 \text{ X } 100$$

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_1 : the total weight of kernels+peels of 50% rejected nuts
- W_1 : the total weight of kernels+peels of the good kernels

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

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 :

Out-Turn = % of useful kernels /100 X 80 X 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

STEPS OF
THE QUALITY CONTROL

CHECK LIST 8

- MATERIAL USED TO CALCULATE THE OUT-TURN
- SAMPLING-TAKING OF THE “MOTHER-SAMPLE”
- WEIGHING OF THE SAMPLE
- CALCULATION OF THE NUT COUNT
- OPENING OF THE NUTS, CONTROL OF THE KERNELS, AND CLASSIFICATION INTO 3 CATEGORIES
- WEIGHING
- CALCULATIONS

CALCULATION OF THE TOTAL DEFECTIVE RATE

Not considered

195
Weight in g
+
33
Weight in g
= % 2 = 114

+

116
Weight in g
=
All useless kernels : 230 %
% 1 0 =
% of all useless kernels : 23 %

CALCULATION OF THE OUT-TURN

Weight in g
264
+

15
Weight in g
% 2 = 7,5
+
24
Weight in g
% 2 = 12
=

All useful kernels 283,5
Not considered
× 0 . 1 7 6
=
OUT TURN 49,9

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

TOTAL DEFECTIVE RATE

Not considered

Weight in g

+

Weight in g

= % 2 =

+

Weight in g

=

All useless kernels : %

% 1 0 =

% of all useless kernels : %

OUT-TURN

Weight in g

+

Weight in g

% 2 =

+

Weight in g

% 2 =

=

All useful kernels

Not considered

× 0 . 1 7 6

=

OUT TURN

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