Cashew

1. General Information

The Cashew Nut is native of North-east Brazil. During the 16th century, the Portuguese introduced it into India and Portuguese colonies in Africa such as Mozambique. From India, cashew trees spread all over South-east Asia. The tree grows in tropical areas with an annual rainfall ranging from 400 to 4,000 mm, and it grows from sea level to an altitude of 1,000 m. Cashew is cultivated primarily in India, Vietnam, Côte d'Ivoire, Guinea-Bissau, Tanzania, Benin, Brazil, and other countries in East and West Central Africa and South East Asia. Plantings have also been established in South Africa and Australia.

Cashew (*Anacardium occidentale* L.) belongs to the Anacardiaceae family, which includes about 60 genera and 400 species, among mango (*Mangifera indica* L.) and pistachio (*Pistacia vera* L.) are also included. Cashew trees are evergreen and can grow rapidly up to 20 m, but usually reach 8-12 m height. *Anacardium occidentale* L. is an andromonoeic species, with male and hermaphrodite flowers on the same plant and in the same panicle.

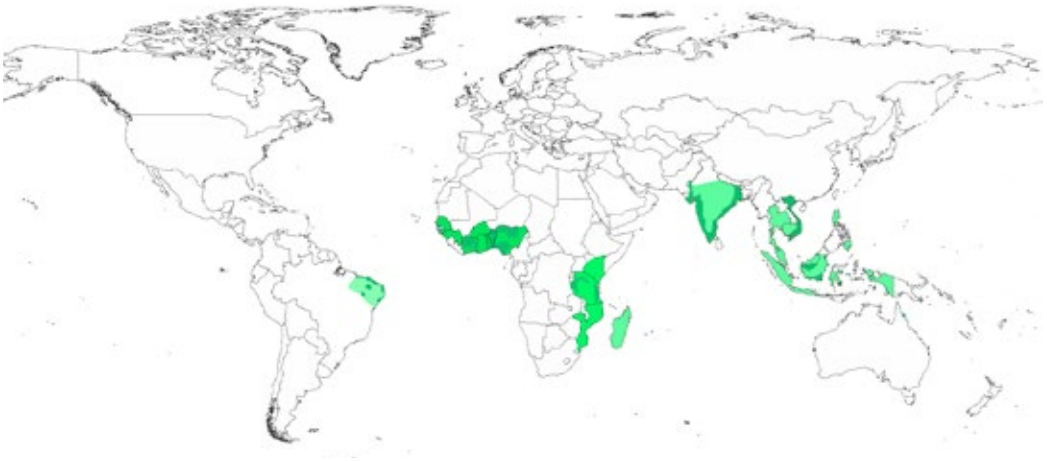
Edible cashew kernels have been used as snack for centuries. They are used as a major ingredient in sweets and cooking, particularly in Asian cuisine. Cashews are also used as an ingredient in chocolate, cookies, and ice cream. Recently, cashew milk has also become popular as a lactose-free milk substitute.

As with other nuts, cashews are healthy and packed with minerals and nutrients such as phosphorous, copper, and magnesium, not commonly found in other foods. Cashews, along with pistachios, have the lowest fat content among nuts. Almost 80% of the fat in cashews is unsaturated, which helps maintain healthy cholesterol levels. They are also rich in tocopherols and phytosterols.

The cashew kernel occurs within a shell, which contains an inedible phenolic oil, also known as cashew nut shell liquid (CNSL) which has wide industrial uses thanks to its polymerizing and friction-reducing properties. The nut hangs under an edible false fruit called the cashew apple, which is very high in Vitamin C. The fruit can be eaten fresh, mixed in fruit salads, or made into juice, which can be distilled to produce alcoholic drink.

Overview of Cashew Production

World production of cashew is stabilized between 470,000 and 580,000 metric tons (kernel basis) per year. India, with 150,000-190,000 metric tons of annual production ranks first, followed by Côte d'Ivoire and Vietnam with 70,000-95,000 metric tons each, and Brazil with 40,000-60,000 metric tons.



Cashew World Growing Areas (Source: INC)

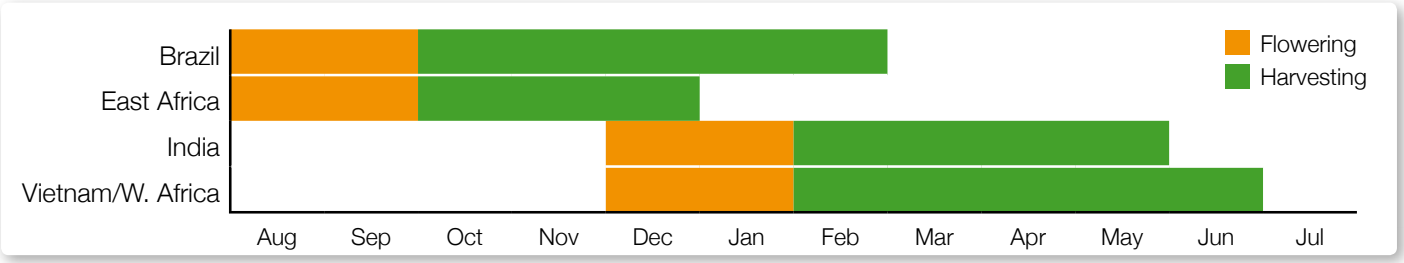
Seasons

Flowering takes place from December to April in the Northern hemisphere, and from June to December in the Southern hemisphere, with a higher concentration from September to November. The cashew has crossed fertilization.

About a week after fertilization, the green nut with a puny apple (false fruit) appears. The nut rapidly grows till it reaches almost 80% of its final size. The fruit starts growing to become wider and apple-shaped after the nut attains its full size. The apple has a thin green skin and as it matures the color turns red or yellow and becomes fragrant.

Meanwhile, the nut's shell becomes hard and turns grey in color and the kernel grows within the nut. Nut and apple fall to the ground when fully mature. The time for fruit maturity varies from 2-3 months depending on the variety, the health of the tree, and the climate conditions during fruit growth.

Harvest takes place during dry weather and nuts are harvested only when the apples are fully ripe. Three to four flowering and fruiting in a 3-4 month horizon makes multiple harvesting necessary. The nut remains firmly attached to the apple and consequently the bulk of the harvest consists of the cashew apples. The nuts are separated from the fruits, sun-dried for 2-3 days, and sent to factories for de-shelling and further processing. The fruits are generally consumed at the farm and at proximate markets.



The chart shows the higher concentration months of flowering, but the flowering season can be longer depending on the tree variety and the zone.

Overall harvesting seasons are similar in the producing countries, depending on the location relative to the equator. Countries north of the equator, including India, Vietnam, and West Africa, start harvesting early in the calendar year until approximately mid-year. Countries south of the equator, including Brazil and East Africa, harvest from September or October to early in the following calendar year.

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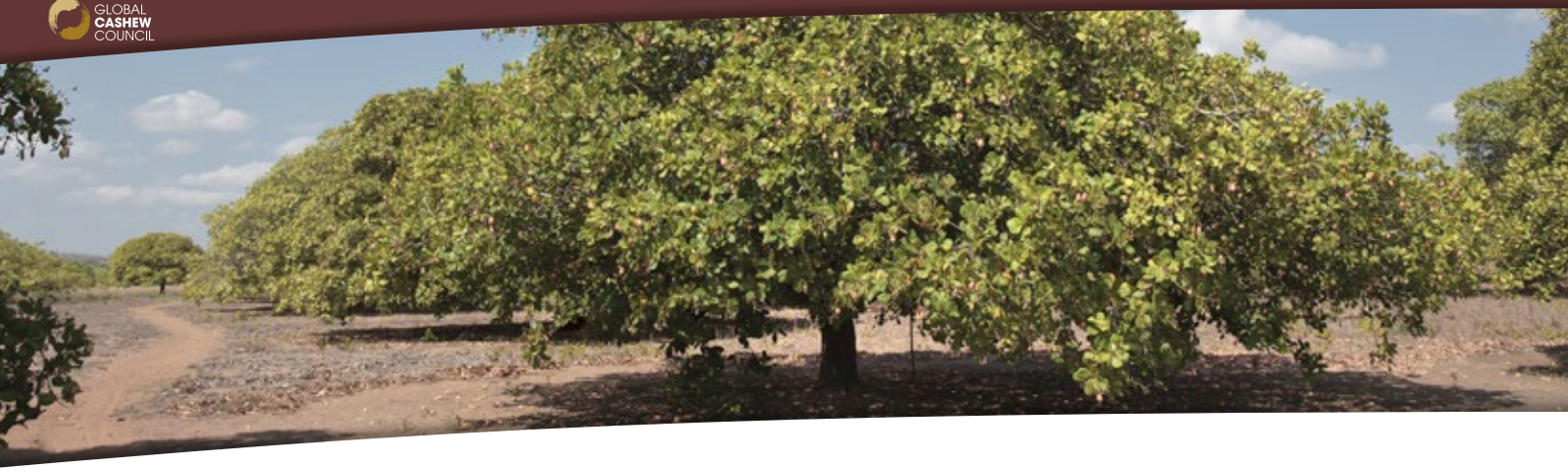
2. Tree Products

The cashew tree produces a soft, shiny, and juicy fruit, known as cashew apple which bears a single-seeded nut in its bottom covered with a hard grey shell. This nut is the most valued product and is commonly consumed as snack or used in confectionery and cooking. Cashew nuts are rich in unsaturated fatty acids, palmitoleic, vaccenic, linolenic, and gadoleic acids, and especially oleic and linoleic acids. The nuts are also a good source of protein, carbohydrates, and dietary fiber.

The cashew apple's juice is mainly used to make drinks, both natural and fermented. Furthermore, the fruit pulp can be made into jelly, syrup, candied fruit, and preserves. The cashew apple juice is rich in vitamin C, antioxidants, minerals, and sugars.

The liquid enclosed in the shell of the nut (cashew nut shell liquid, CNSL) is commonly used for industrial purposes. The liquid is nocuous, contains cardol and anacardic acid, and has polymerizing and friction-reducing properties. It is used in many industrial processes in developing lubricants, varnishes, cements, drugs, antioxidants, and fungicides, among other uses.

Cashews are mostly consumed as snacks raw, roasted, salted, or flavored. Cashews are also used as an ingredient in Indian sweets, savories, and cooking. The manufacturing industries are increasing the use of cashews as ingredients in new recipes.



Used as Snack

Uses in Bakery and Confectionery

Industry	Used as
Ice cream	Cashew pieces and diced whole cashews are used as toppings in ice creams.
Bakery (cakes)	Cashew pieces are used as toppings in cakes, like dried fruit cakes.
Bakery (biscuits)	Cashew pieces and flavor are used in cookies.
Confectionary	Cashew pieces are used as ingredient in chocolates. Whole cashew coated with chocolate, pepper cashews, chili cashews, etc.
Sweets	Topping and base (powder) for sweets.

Other Uses

Industry	Used as
Restaurant	Cashew powder is used to get consistency (thickness) in curries.
Health drink	Cashew as one of the ingredients in health drinks.
Ready to cook/eat	Many companies are using cashew pieces as ingredients in their ready to eat breakfast items, Rava Idli, Upma, oats, and to cook sweets like Payasam. Cashew pieces as salad topping.

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3. Forms

GLOBAL CASHEW COUNCIL

The following forms and specifications are included in the United Nations Economic Commission for Europe (UNECE) Standard DDP-17 concerning the marketing and commercial quality control of cashew kernels, edition 2013.

1. Whole Kernels:

Specifications:

Size code or count	Maximum number of kernels per pound	Maximum number of kernels per kilogram
150	150	325
180	180	395
210	210	465
240	240	530
320	320	706
450	450	990
500	500	1100

Applications:

- Natural, roasted, or flavored snacks.
- Ingredients for confectionery and bakery.

2. Pieces:

Specifications:

Designation/Size code	Minimum size
Large Pieces	Not passing through a sieve of aperture 4.75 mm.
Small Pieces	Not passing through a sieve of aperture 2.80 mm.
Very Small Pieces	Not passing through a sieve of aperture 2.36 mm.

Applications:

- Ingredient for confectionery and bakery.
- Ingredient for cereals.
- Sweets.

Large Pieces

Small Pieces

3. Diced/Baby Bits:

Specifications:

Designation/Size code	Minimum size
“Baby Bits” or “Granules”	Not passing through a sieve of aperture 1.70 mm.

Applications:

- Ingredient for cereals.
- Toppings for ice cream.
- Filling for bakery and confectionery.

Diced/Baby Bits

4. Flour/Meal:

Applications:

- Cashew paste or butter.
- Indian curry, bakery, and confectionery.

Flour/Meal

5. Milk

Sources:
· INC.
· UNECE STANDARD DDP-17 concerning the marketing and commercial quality control of cashew kernels, Edition 2013.

Cashew

4. Processing

GLOBAL CASHEW COUNCIL

Immediately after harvest, raw cashew nuts are processed, which is fundamental to maintain their quality and properties. Farmers separate the drupe from the cashew apple to put them sun-drying. These raw products are traded and then processed to obtain the cashew nut kernel.

Product packaging is fundamental to maintain its quality, especially to avoid product damage, deterioration, or contamination. Appropriate packaging ensures a better quality and higher product value.

Further packaging, maintaining controlled optimal storage conditions is essential to maintain the product properties.

RECOMMENDATIONS FOR PROCESSING, PACKAGING, AND STORAGE

PROCESSING

Processing Cashew Fruit (Drupes) into Kernels

Generally the processing of raw cashew nuts into edible cashew kernels takes the following steps (traditional method, Figure 1): (i) roasting; (ii) shelling; (iii) drying; (iv) peeling; (v) grading; (vi) quality controls/fumigation; and (vii) packaging.

All these steps have to be conducted with care to obtain good quality and good grade kernels.

In order to ensure the quality requirements and avoid contamination of the cashew nuts, preparation takes place under clean, hygienic, and ideal conditions. The following aspects are cleaned regularly: equipment (tubs, knives, etc.), working and drying surfaces (racks, mats, etc.), personnel clothes, and preparing and storage rooms.

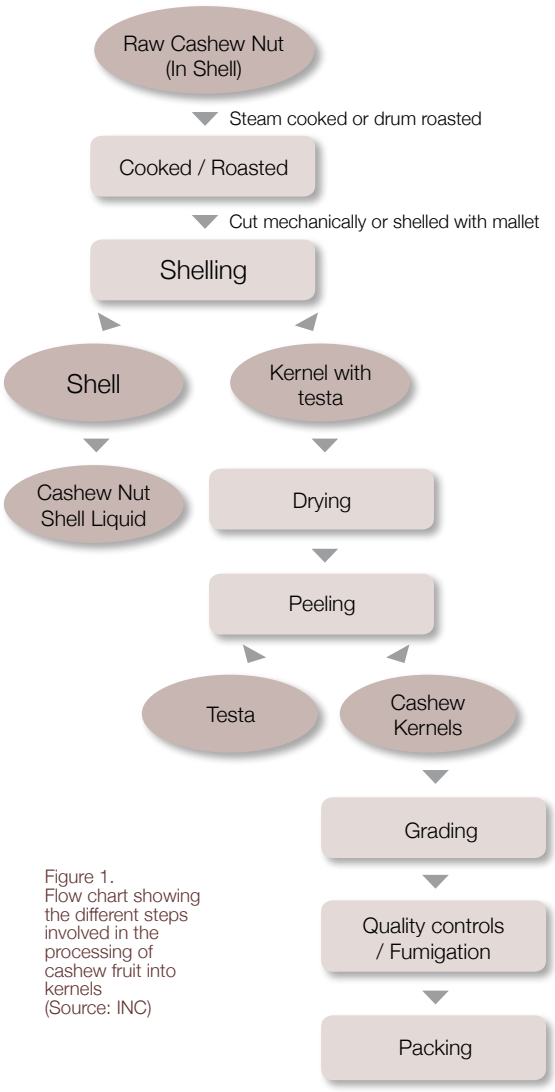
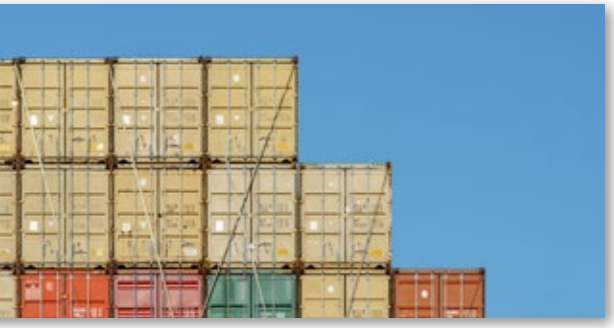


Figure 1.
Flow chart showing the different steps involved in the processing of cashew fruit into kernels
(Source: INC)

INC international Nut&DriedFruit



PACKAGING

Bulk Packaging

Cashew kernels must be packed in such a way so as to protect the produce properly. The materials used inside the package must be clean and of a quality such as to avoid causing any external or internal damage to the produce. Cashew kernels must be packed in hermitically sealed containers. The use of materials, particularly of paper or stamps bearing trade specifications, is allowed, provided the printing or labelling has been done with non-toxic ink or glue.

Transport Packaging

Transport packaging should be strong enough to protect the contents against damage by outside pressure.

The packaging is dimensioned to allow contents to be held firmly, but not too tight. The dimensions should be compatible with standard pallet and container dimensions.

STORAGE

Raw Cashew Nuts Inshell

After harvesting, cashew nuts are immediately placed out in the sun to dry and are continuously mixed until the nuts in their shells get to around 8 to 10% rest moisture. Cashews inshell and kernel are stored in dry (<65% relative humidity), dark, cool (<10 ºC/50 ºF), and well-ventilated conditions.

Cashew Kernels

Cashew moisture should be maintained at 5% or less, exposure to strong odors avoided, and storage conditions should protect them from insects and pests.

When the organic product is stored together with conventional cashew nuts in a single warehouse the following methods are used:

- Training and informing warehouse personnel.
- Explicit signs in the warehouse (silos, pallets, tanks, etc.).
- Color differentiation (e.g. green for the organic product).
- Incoming/dispatched goods separately documented (warehouse logbook).

It is prohibited to carry out chemical storage measures (e.g. gassing with methyl bromide) in mixed storage spaces. Wherever possible, storing both organic and conventional products together in the same warehouse should be avoided.

In fact, methyl bromide should never be used to fumigate cashews, as it causes a chemical reaction in the nuts that results in a terrible sour milk-like off-flavor. It would be useful to include a cautionary statement in the storage section warning against fumigation of cashew drupes or kernels with methyl bromide, under any circumstances.

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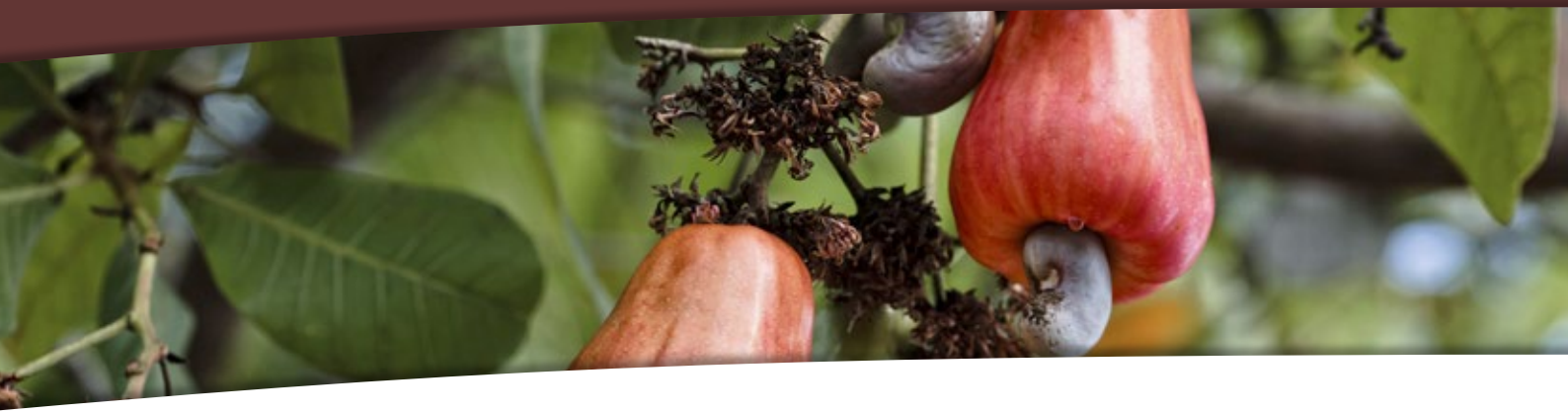
5. Quality Requirements

GLOBAL CASHEW COUNCIL

To ensure the safety of cashews, international growers and processors are setting a wide range of good practices. Cashews are produced with consideration for quality control and food safety international standards. Careful practices have been established to control the chemical, microbiological, pesticide, and contaminant content.



QUALITY ASSURANCE

The following programs are endorsed by the industry:

- Good Agricultural Practices (GAPs), which provide growers guidelines and principles to apply for on-farm production and post-production processes, to provide safety and healthy cashews, minimizing potential hazards, such as pathogens, contaminants, and pest management materials.
- Good Manufacturing Practices (GMPs), which define procedures to be used in the processing, packaging, storing, and transport stages by handlers to ensure the quality of the product. GMPs are used by handlers to treat cashews under the best sanitary conditions.
- Hazard Analysis Critical Control Point (HACCP), which provides a systematic preventive approach to food safety that identifies, assesses, and controls the risk of biological, chemical, and physical hazards in production processes.

CHEMICAL AND MICROBIOLOGICAL PARAMETERS

Approximate Quality Characteristics:

Chemical	
Moisture	Max 5%
Free Fatty Acids	< 0.7%
Peroxide Value	< 1 meq/kg
Microbiological	
Total Plate Count	< 10.000 cfu/g
Yeast and Mould	< 500 cfu/g
Enterobacteria	< 10 cfu/g
Coliforms	< 10 cfu/g
E. coli	Not measurable
Salmonella	Negative in 25 g
Staphylococcus aureus	< 100 cfu/g
Streptococcus	< 100 cfu/g

Source: Naturland e.V.

INC international Nut&DriedFruit

PESTICIDES

Pesticides are responsibly used by growers to reduce potential damage by pests and other organisms, and thus provide safe and high-quality cashews.

2015 Codex Alimentarius Maximum Residue Levels for Tree Nuts:

Pesticide	Value		
2,4-D	MRL (mg/kg)	0.2	
Bifenazate	MRL (undef)	0.2	
Boscalid	MRL (mg/kg)	0.05	(*)
Carbaryl	MRL (mg/kg)	1	
Carbendazim	MRL (mg/kg)	0.1	(*)
Clofentezine	MRL (mg/kg)	0.5	
Fenvalerate	MRL (mg/kg)	0.2	
Glufosinate-Ammonium	MRL (mg/kg)	0.1	
Hydrogen Phosphide	MRL (undef)	0.01	
Methoxyfenozide	MRL (undef)	0.1	
Paraquat	MRL (undef)	0.05	
Phosmet	MRL (undef)	0.2	
Pyrethrins	MRL (mg/kg)	0.5	(*)
Sulfuryl Fluoride	MRL (undef)	3	
Thiacloprid	MRL (mg/kg)	0.02	
Trifloxystrobin	MRL (undef)	0.02	(*)

*At or about the limit of determination.

International Regulations for Pesticides:

- Australia: www.apvma.gov.au
- Canada: www.hc-sc.gc.ca
- EU: ec.europa.eu/sanco_pesticides
- Switzerland: www.admin.ch
- USA: www.fas.usda.gov
- International Maximum Residue Limit Database: www.mrldatabase.com

CONTAMINANTS

Although aflatoxins have a low incidence on cashews, they can occur.

International MLs for aflatoxins in ready-to-eat cashews:

Country	Aflatoxin B1 (ppb)	Total Aflatoxins (B1-B2-G1-G2) (ppb)	Source
Australia		15	Australia New Zealand Food Standards Code - Standard 1.4.1.
Brazil		10	Resolução Nº 7, de 18 de fevereiro de 2011. Ministério da Saúde da Brasil
EU	2	4	Commission Regulation (EU) Nº 165/2010
India		10	Food Safety and Standards Authority of India (FSSAI)
USA		20	U.S. Food and Drug Administration Compliance Policy Guides (CPG) Sec. 555.400

Cashew

6. Standards and Grades

GLOBAL CASHEW COUNCIL

Cashew kernels are graded on the basis of their size, shape, and color. Kernels shall have been obtained through roasting, shelling, and peeling cashew nuts (*Anacardium occidentale* L.).

The following requirements are extracted from the UNECE Standard DDP-17 concerning the marketing and commercial quality control of Cashew Kernels, which was created by the Specialized Section on Standardization of Dry and Dried Produce of the United Nations Economic Commission for Europe (UNECE) with the help and recommendations of the International Nut and Dried Fruit Council (INC) and the supervision and approval of the main producing countries.

Quality

Kernels shall be completely free from infestation or living pests, molds, insect damage, rotting, deterioration, mold rancidity, adhering testa, and objectionable extraneous or foreign matter. Scraped and partially shrivelled kernels also permitted provided such scraping/shriveling does not affect the characteristic shape of the kernel.

Classification

Cashew kernels are classified into the following classes: “Extra” Class, Class I, and Class II.

Class	Commercial designation	Description
Extra	“white”	white, pale ivory, pale ash- grey, light yellow.
Class I	“scorched” or “lightly blemished”	light brown, light ivory, light ash-grey, deep ivory, yellow.
Class II	“scorched seconds” or “dessert”	light brown, amber, light blue, deep brown, deep blue, discolored, black spotted, immature, blemished, and stained kernels are permitted.

The defects allowed must not affect the general appearance of the produce as regards quality, keeping quality, and presentation in the package.

Provisions Concerning Sizing

Sizing is compulsory in “Extra class”, but optional for “Class I” and “Class II”. Designation of sizes is as follows:

Whole:

Size code or count	Maximum number of kernels per pound	Maximum number of kernels per kilogram
150	150	325
180	180	395
210	210	465
240	240	530
320	320	706
450	450	990
500	500	1100

Pieces:

Designation/Size code	Minimum size
Large pieces:	not passing through a sieve of aperture 4.75 mm.
Small pieces:	not passing through a sieve of aperture 2.80 mm.
Very Small Pieces:	not passing through a sieve of aperture 2.36 mm.
"Baby bits" or "granules":	not passing through a sieve of aperture 1.70 mm.

INC international Nut&DriedFruit

Quality Tolerances

Tolerances allowed, percentage of defective produce, by number or weight:

Defects allowed		Extra	Class I	Class II
(a)	Tolerance for cashew kernels not satisfying the minimum requirements	6	9	12
	of which no more than:			
	Not sufficiently developed, shrunken, or shrivelled	1	2	not applicable
	Moldy, rancid, decay	0.5	1	1
	Damage by pests	0.5	1	1
	Living pests	0	0	0
	Superficial damage (whole kernels only)	1	2	5
	Adhering testa	3	3	5
(b)	Size Tolerance, if sized for produce not conforming to the size indicated, in total:			
	Wholes (by number)	10	10	10
	Pecies (by weight) (smaller sizes)	10	10	10
(c)	Tolerance for other defects:			
	Broken kernels (butts, splits, and pieces) in wholes	10	10	10
	Pieces in butts/splits	10	10	10
	Kernels of a color of the next lower class	5	5	not applicable
	Foreign matter, loose shell fragments, loose testa fragments, dust (by weight)	0.1	0.1	0.1

CASHEW KERNELS - EXTRA/WHITE

Extra - White - 180

Extra - White - 210

Extra - White - 240

Extra - White - 320

Extra - White - 450

CASHEW KERNELS – CLASS I/SOCORCHED/LIGHTLY BLEMISHED (LB)

Class I - Scorched - LB

Class I - Scorched - LB - 180

Class I - Scorched - LB - 210

Class I - Scorched - LB - 240

Class I - Scorched - LB - 320

Class I - Scorched - LB - 450

CASHEW KERNELS - WHITE PIECES

Butts

Splits

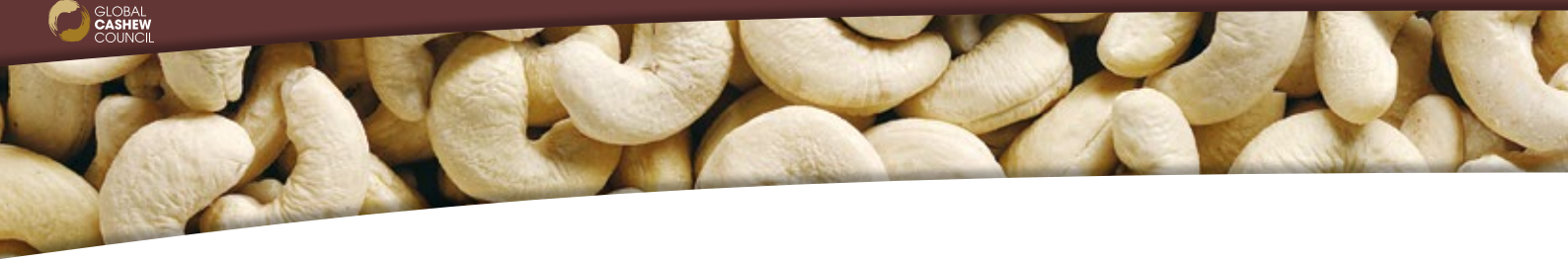
Large Pieces

Small Pieces

Baby Bits or Granules

CASHEW KERNELS CLASS II/SCORCHED SECONDS/DESSERT

Class II - Scorched Seconds - Dessert



CASHEW KERNELS - SCORCHED PIECES

Scorched Butts

Scorched Splits

Scorched Large Pieces

Scorched Small Pieces

CASHEW KERNELS SCORCHED SECOND LARGE PIECES

Scorched Second Large Pieces

Definitions of Defects

A. Defects of Kernels	
Superficial damage:	Damage adversely affecting the appearance of the product, including scraped kernels. Scraped kernels, where characteristic shape is not affected are not considered defective.
Spotted or speckled:	The presence of black or brown spots or specks.
Shrunken or shrivelled:	Kernel which is extremely flat and wrinkled, or kernel with desiccated, dried out or tough portions when the affected portion represents more than one quarter of the kernel.
B. Other Defects from External Causes	
Insect damage:	Containing dead insects, mites, insect fragments, webbing, frass, excreta, or visible damage caused by boring and feeding of insects and animal parasites.
Mould:	Mould filaments either on the inside or the outside of the kernel visible to the naked eye.
Rancidity:	Oxidation or free fatty acid production in the lipids producing a disagreeable flavour.
Decay:	Significant decomposition caused by the action of micro-organisms.
Blemishes:	Spots in aggregate in excess of 3 mm on the kernels from causes other than shelling or blanching.
Foreign Matter:	Any matter or material not usually associated with the product; excludes mineral impurities.
Testa:	Skin adhering to any portion of the kernel.

Source:
· UNECE STANDARD DDP-17 concerning the marketing and commercial quality control of cashew kernels, Edition 2013.