

Organic Farming in the Tropics and Subtropics

Exemplary Description of 20 Crops

Cashew Nuts



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Franz Augstburger, Jörn Berger, Udo Censkowsky,
Petra Heid, Joachim Milz, Christine Streit.

The cultivation guidelines are available in English, Spanish and German for the following crops:

banana, brazil nut, cashew nut, cocoa, coconut, coffee,
cotton, hibiscus, macadamia, mango, papaya, peanut,
pepper, pineapple, sugar cane, sesame, tea, vanilla.

The cultivation guidelines for Bananas, Mangoes, Pineapples and Pepper were revised in 2001 for the United Nations Conference on Trade and Development (UNCTAD) by Udo Censkowsky and Friederike Höngen.

In 2002 two more guidelines, for rice and date palms, were published in English.

All the authors emphasize, that the cultivation recommendations at hand can just provide general information. They do not substitute technical assistance to the farmers with regard to the location.

All indications, data and results of this cultivation guidelines have been compiled and cross-checked most carefully by the authors. Yet mistakes with regard to the contents cannot be precluded. The indicated legal regulations are based on the state of the year 1999 and are subject to alterations in future. Consequently all information has to be given in exclusion of any obligation or guarantee by Naturland e.V. or the authors. Both Naturland e.V. and authors therefore do not accept any responsibility or liability.

Furthermore the authors kindly call upon for critical remarks, additions and other important information to be forwarded to the address below. The cultivation guidelines will be updated regularly by Naturland e.V.

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Organic Cashew Nut Cultivation

1. Introduction

The cashew tree *Anacardium occidentale* (French.: acajou, anacarde; Spanish.: marañon, caju, acaju) originates from south and central America (from Brazil to Mexico). The cashew apple is a pseudocarp, and, in botanical terms, is the thickened stem of a fruit which the actual fruit, the cashew nut, is attached. In its originating countries, the pear-shaped cashew apple is eaten fresh. The fruit is distributed throughout the tropics in this form. It was the development of a roasting method to extract the oil from the shell which turned the nut itself into the main product.

Cashew nuts consist to 35-45% of seeds and around 55-65% of shells. The shells contain 15-30% oil. A ton of nuts contains around 200 kg seeds and 180 kg oil (cashew nut oil or cashew nut shell liquid "CNSL"). CNSL is used as oil in industry.

Cashew nuts are dried before being sold. The cashew apple can be sold fresh as soon as they have been picked, and then used, e.g. as a culinary ingredient, or further processed into drinks (juice, wine), marmalade or vinegar. In India, rubber is sometimes harvested from the trunk, and used instead of rubber arabicum.

The most important producing countries for organic cashew nuts are Brazil, Madagascar and Sri Lanka. In Mexico and Honduras, organic cashew nut cultivation is still relatively unknown.

2. Aspects of cultivation

2.1. Site requirements

In Brazil, one of the countries where cashew trees come from, three different types grow, which have each become adapted to different eco-systems. They differ from one-another in terms of their crowns, height of growth, and in the colour, shape and taste of their fruits. Each of the types grows into the apex of primary forest trees at their site, and when fully grown, there are no trees which outgrow them.

The type of cashew tree called "Mata Atlantica" originates from the primary forest belt on the Atlantic coast of Brazil. The tree grows to a height of 35-40 m, produces yellow fruits and requires 1500-3000 mm of rainfall. It is hardly ever used commercially.

The type of cashew tree from the Restinga region (Brazil) grows to a height of 15-20 m and requires 1000-2000 mm of rainfall. Commercially, this type is one of the most important cashew nut trees.

The type of cashew tree most resistant to drought originates from the Catinga region (Brazil) and only reaches 7-10 m in height, yet a rainfall of about 400-800 mm is sufficient. This type is also of commercial importance.

On marginal or eroded sites (e.g. dry, steep slopes), the integration of cashew trees into cultivation system can contribute to the regeneration of the soil, and, in addition, also produce a worth-while crop. The yields lie then somewhere in the region of 8-10 kg unshelled nuts per tree, as opposed to over 70 kg grown under optimum conditions.

At these marginal sites, the cashew tree mainly serves to aid control of erosion and as a supply of fuel. At rainfalls exceeding 1500 mm, cashew tree only grow well on well-drained soil. The less rainfall there is, the deeper the soil should be.

Steadily high market prices for cashew nuts have led in recent years to the cultivation of cashew trees on plantations in the Amazon regions – which has caused massive phytosanitary problems, and is still unmanageable today, despite considerable outlays in conventional plant protection measures. When the question arises as to whether a certain crop is capable of being integrated into a cultivation system, its eco-physiological suitability for this particular eco-system should always be considered.

2.2. Seeds and seedlings

Proliferation can be performed with seeds, whereby small fruits with a high specific weight germinate better than larger fruits. Vegetative proliferation (branch, grafting, budding) should be practised if twigs are available from healthy trees. The ideal time to begin grafting is during the rainy season. Rootstocks that have been planted out in the field should be grafted after around 2 months.

Proliferation through seeds: Seeds for the seedlings has to come from selected parent trees, because otherwise, cashew seeds can produce very heterogene cultivations. This can be balanced out as much as possible by reverting to vegetative proliferation (grafting of seedlings) whereby a very uniform crop can be achieved.

The selection criteria for good parent trees include:

Healthy trees, chosen during the vegetation period,

The weight of the nut, that should be 5 g or more, and

The percentage of the shell (from the total nut weight) should not exceed 25%.

Proliferation through direct sowing makes especial sense when the cashew nuts are not the main harvest product. The best time to sow is at the start of the rainy season. The seeds are soaked in water for 2 days. Caution! The water will now contain highly caustic Cashew Nut Shell Liquid (CNSL), and should be disposed of at a place where it will be safely decomposed, e.g. in a biological sewage plant or on a compost heap.

A mixture of compost and top soil is placed in the planting hole. Three seeds should be planted per hole in a 10 cm triangle, and then covered with top soil. After a year,

the two weaker seedlings are then removed. If the rainy season is short, then the plants need to be irrigated in order to survive. In such cases, it may be advisable to resort to labour-intensive cultivation in a tree nursery. The seeds that have been soaked in water are now sown in polyethylene growing bags around two months before the rainy season begins. The seeds will germinate after ca. 10-15 days. They should be watered twice a day. The seedlings can then be transplanted into the field 8-12 weeks after sowing, once they have reached a height of ca. 20 cm.

If the cashew production is concentrated mainly on the production of nuts, then a uniform crop should be aspired to through vegetative proliferation. The ca. 30-60 days old seedlings are grafted in a tree nursery. Even larger trees can be grafted.

Proliferation with twigs: Twigs used for grafting should also come from selected parent trees. The twigs should be lignified, 3-5 months old and ca. 10 cm long, they should also be round and straight, and have no flower buds. A week before the twigs are cut off the tree, the leaves are removed along a length of 20 cm, so that fresh buds will form. The twigs must be grafted on the day they are cut down. The best time for grafting is during the rainy period, by medium humidity. The twigs are either grafted on sideways, in a split in the tip, or in a diagonal cut into the tip. Usually, the rootstocks and twigs are cut in such a way that their cambium touch when they are joined. This requires a lot of experience. For this reason, grafting should always take place under supervision.

2.3. Planting method

The cashew tree grows as part of an agroforestry system. The distance between the plants is therefore dependent on the ecological conditions, the specific cultivation system as well as the type and variety of cashew. A crop of about 100 trees/ha generally provides the trees with enough room to develop, and also allows for cultivating other crops in the understorey. The cashew tree fructifies at the edge of the crown. For this reason, the trees should not touch one-another, as this would inhibit the development of the fruit. A planting distance of 10 x 10 m is recommended, which translates into a crop of 100 trees/ha.

2.4. Diversification strategies

When planning a system of cultivation, the availing site conditions need to be considered and suitable types and varieties selected. In organic farming systems the plantation should be complemented with a wide variety of other trees and bushes, because diversified agroforestry systems are especially suited to the cultivation of cashews. If at all possible, local varieties should be chosen and used.

Due to the wide variety of ecological sites for cashew trees, only general recommendations can be offered for diversification possibilities. It is possible to develop a multitude of combination possibilities for each and every site, which include local tree and bush species for agroforestry systems.

Crops such as e.g. hibiscus, peanut, dry rice, sesame, beans and soya beans, as well as various vegetable crops can also be planted. A crop of *Ricinus* (*Ricinus communis*) is also possible, whereby this plant can be integrated as a green fertiliser. Pineapple can be included among the crops mentioned above, as a secondary plant among the bottom crops.

Mangoes as fruit trees are suitable partners in a cashew garden. It should be noted that both grow to roughly the same height and also have widely-spreading crowns, therefore, they need to be planted at a sufficient distance from one-another. Crops that could be planted as middle crops include *Annonaceae ssp.* (*Annona squamosa* L.), as well as guavas (*Psidium guajava* L.), that thrive in the shade of cashew nut trees.

Arable fruits can also be planted between the rows, especially in young cashew gardens. Intensity, species and crop rotation are dependent on the specific site conditions and the market access for each crop. In West Africa, good results have been gained from using peanuts and soya beans as bottom crops. Grains and arable fodder crops are also possibilities. The bottom crops need to be integrated within a crop rotation system.

Under no circumstances should the system lack palm trees. The wide variety of different regional species on the planet makes it slightly difficult to offer any recommendations here. Even when no commercially viable varieties are available within the region, palm trees are generally excellent suppliers of building materials and fuel.

2.5. Supplying nutrients and organic fertilisation management

Cashew trees place no special demand on soil fertility. When, as is usual in organic cultivation systems, cashew trees are cultivated with bottom crops in agroforestry systems, then the resulting organic material provided from pruning and green manure plants is sufficient. Additional organic fertiliser is then usually not necessary. Conventional examinations have resulted in the following nutrient-depletion values for trees with a yield of 24 kg Nuts per Tree: 2.85 kg N, 0.75 kg P₂O₅ and 1.27 kg K₂O¹

¹ OHLER, J.G. in Rehm (1989): Handbuch der Landwirtschaft and Ernährung in den Entwicklungsländern Band 4

2.6. Biological methods of plant protection

2.6.1. Diseases

Fungus diseases only usually occur on unsuitable sites:

High humidity and poor air circulation can encourage an infestation of **powdery mildew** (*Oidium anacardii*). The fungi infects the leaves and buds of cashew trees.

An infestation of **anthracnose** in wet regions can lead to the loss of an entire crop. The first thing is to introduce methods of thinning out the plantation (improving the ventilation). Sulphur preparations can be used in an emergency, although this ought to be discussed with experts in organic farming first.

Sudden deaths can be caused by the fungi *Valsa eugeniae*. The fungi produces an effect as if the tree had recently been burnt, with black leaves and trunk. The fungi cannot spread very rapidly, though. The diseased or dead tree must be removed and burnt. As a rule, this measure suffices in keeping the fungi under control.

2.6.2. Pests

In a balanced, organic farming system, the cashew tree is a very hardy crop.

It is usually weakened trees that are infested by the **cashew bug** (*Helopeltis anacardii*), the main pest for cashew trees. They harm the young shoots, thereby reducing the harvest because the cashew trees fructify on the young shoots. In the tree nursery, the shade should not be too intense, because this will encourage an infestation by cashew bugs. Cotton should therefore be avoided as a bottom crop, because it attracts cashew bugs. An extreme case can be treated with neem-preparations².

2.7. Crop cultivation and maintenance

Young cashew trees should be trimmed in the first 3-4 years, so that they develop enough fruiting lateral. Afterwards, no further trimming is necessary. Yet when branches reach down to the ground, or older trees are too widely spread, then a regeneration cutting should be performed. Dead branches should be regularly removed. Tree grids with a diameter of 2-4 m should be covered with mulching material before harvest work commences to ease this.

² According to the European Regulation for Organic Agriculture (EEC) 2092/91 the application of Neem preparations is restricted and only allowed for the production of seed and seedlings. This regulation is discussed controversial. An up-date information is available from your certification body.

2.8. Harvesting and post harvest treatment

2.8.1. Harvest

If the cashew tree apple is to be used, the ripened fruits need to be harvested twice a week. The fruits are taken to the processing site, where the nuts are separated from the rest of the fruit. If the apples are not to be used, then picking up the fallen nuts once per week is sufficient. The apple parts are then cut away from the nuts and left out on the site.

2.8.2. Post harvest treatment

The processing method to use depends on the amount of nuts harvested:

If fewer than 10 tons of raw nuts have been harvested, then no special equipment is needed to roast them, and the nuts can be shelled by hand.

Between 10-50 tons, the nuts can be processed with simple tools (locally manufactured equipment). The nuts can either be dry-roasted, or in a bath of CNSL.

Above 50 tons of raw nuts per year, it is worth investing in a fully-automatic shelling machine, which can also be manufactured locally. A prototype was recently developed in Mozambique.

3. Product specifications

Seeds are sorted into 8 different categories in order to be offered on the international market, in number per pound (454 g) (comp. table p. 9).

W 180 are the largest seeds, with 180-200 seeds per pound

W 500 are the smallest seeds, with 450-500 seeds per pound

The seeds need to be white to light ivory-coloured, free of pieces of shell, unharmed and without any dark flecks. Other colours or breakages will reduce the quality and thus the price. For larger amounts to be exported, advice should be sought of the "Commonwealth Technology Research Institute (CTRI) in Mysore, India". India is the largest exporter of cashew nuts world-wide, and therefore is very experienced in questions of quality.

It is difficult to export smaller amounts than 5 tons of nuts (equates to 20 tons of raw nuts) per month onto the global market. This must be taken into account when planning an organic production base.

Drying and deep-freezing neutralise the astringent taste of the cashew apple. Yellow apples are generally preferred for their subtler taste. Apples harvested too soon are very bitter. Processing into marmalades, juices, liquors or on cakes is generally done with standard kitchen utensils. Additional information is available from the following organizations:

Institute de la Technologie Alimentaire, Dakar, Senegal

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany

3.1. Cashew nuts

3.1.1. Preparation

The cashew fruits produce cashew apples and cashew nut which can be used as foodstuffs. In addition, a by-product, Cashew Nut Shell Oil, is used in the paint and brake-liner industries. Cashew apples can be eaten raw, or made into jam, refreshing drinks or spirits. The actual fruit, the cashew nut, requires a special kind of procedure in order to break open the hard shell and extract the nut. Cashew nuts are traded in a variety of different quality grades, and are used in the snack, confectionery, chocolate and baking industries.

Drying

After the harvest, cashew nuts need to be immediately placed out in the sun to dry, whilst being continually raked over, until the nuts rattle around in their shells (3% rest moisture). In this form, cashew nuts can be stored for up to 2 years, in ideal storage conditions (dry, dark, cool, well-ventilated). Yet they are usually processed within the same year of harvesting.

Roasting

The mesocarp, which is the outermost, roughly 3 mm thick oily-soft shell of the cashew nut, contains a caustic, poisonous oil called Cashew Nut Shell Liquid = CNSL in glands. For this reason, cashew nuts are usually prepared in one of the following ways.

During the **traditional method** (used for smaller amounts), sun-dried nuts are first dunked briefly in water, and then roasted over a fire in pans with holes in them. It is important that the nuts are constantly stirred to prevent them burning. The shells break open during the heating process, whereby some of the cashew nut shell oil drips out through the holes and onto the fire. Afterwards, the split-open shells are collected in ash or sawdust to soak up the rest of the oil.

Another method (so-called **hot oil bath**) sun-dried nuts are placed in wire baskets and dipped into baths containing hot Cashew nut shell oil (180-200°C) for 90 seconds. The shells become brittle, and some of the CNSL (ca. 25-50%) can flow out into the oil bath. Finally, the baskets are removed to let the oil drip back into the bath.

It is also possible to roast the cashew nuts in a wood-fired **roasting oven**. Thereby, the CNSL is not removed from the shell, and can be used as industrial oil. The nuts need to be roasted for so long until the shells are completely dark brown to black. Otherwise, there is a danger that the shells will be difficult to break open, and that seeds then may become damaged.

Shelling

In order to get at the cashew nuts, the shells are opened either manually with a small hammer on a hard piece of wood, or by machine. Afterwards, the cashew nuts

are briefly dried at 150-200°C down to a moisture content of 5%, in order to remove the inner shell (Testa) more easily.

Cleansing, sorting, packaging

Before they are packaged, foreign particles (small stones, shell rests etc.) are removed, and the cashew nuts sorted according to size, colour and kind of damage. The nuts are traded in the following quality grades. The price on the international market generally refers to the most important quality, the “W 320”, this means 320 undamaged cashew nuts per English pound, or 454 g.

The cashew nuts are not allowed to be treated with methyl bromide, ethylene oxide or ionising rays.

Special classification	Indian/ African grade	Number of kernels per pound (1 lb=454 g)
White wholes - W		
Must be kidney shaped, free from infestations, insect damage, mould, rancidness, testa residues, extraneous material; white, pale ivory, or ash coloured, corrugated kernels are allowed if the kernel shape is not jeopardised: Up to 5% lower category is accepted.	W 180	180-200
	W 210	200-210
	W 240	220-240
	W 280	260-280
	W 320	300-320
	W 400	350-400
	W 450	400-450
	W 500	450-500
Scorched wholes - SW		
Scorched wholes as above, pale or dark ivory, slightly burnt due to scorching;	SW 180 - SW 500	See above
Desert cashew kernels		
Scorched wholes seconds, as above, but scorching, small spots and fading are allowed;		SST
Desert wholes, as above, but fading, scorching, black spots and corrugations are more evident;		DWG
White pieces		
Butts: white kernels broken crosswise and cotyledons attached		B
Splits: white kernels split lengthwise		S
Large white pieces: kernels broken into more than two pieces, not passing through a through a ¼ inch mesh sieve.		LWP
Small white pieces: kernels broken into more than two pieces, not passing through a 1/10 inch mesh sieve.		SWP
Baby bits: broken kernels, not passing through a 1/14 inch mesh sieve.		BB

3.1.2. Quality requirements

The following is a list of quality characteristics with minimum and maximum values for cashew nuts that are usually required officially or by importers. Different minimum and maximum values can be agreed between importers and exporters, providing these do not clash with official regulations.

Quality characteristics	Minimum and maximum values
Appearance	Specific, acc. to quality
Taste and smell	Acc. to variety, fresh, not rancid, not stale
Purity	Free of foreign matter, i.e. sand, stones, shell parts, insects etc.
Water content	Max. 5.0 %
Peroxide value	max. 1.0 milli-equivalent of peroxide per kg fat
Free fatty acids	max. 0.7 %
Residues	
Pesticides	Not measurable
Bromide and ethylene oxide	Not measurable
Heavy metals	
Lead (Pb)	max. 0.50 mg/kg
Cadmium (Cd)	max. 0.05 mg/kg
Mercury (Hg)	max. 0.03 mg/kg
Micro-organisms	
Total number of parts	max. 10.000/g
Yeasts and fungus	max. 500/g
Enterobacteria	max. 10/g
Coliforms	max. 10/g
Escherichia coli	Not measurable
Staphylococcus aureus	max. 100/g
Salmonella	Not measurable in 25 g
Mycotoxins	
Aflatoxin B1	max. 2 µg/kg
Total aflatoxins B1, B2, G1, G2	max. 4 µg/kg

In order that the quality requirements are upheld, and no contamination of the cashew nuts occurs, preparation should take place under clean, hygienic and ideal conditions. The following aspects should be adhered to:

Equipment (tubs, knives etc.), as well as working and drying surfaces (racks, mats etc.) and preparing and storage rooms, should be cleaned regularly.

Personnel should be healthy, and have the possibility to wash themselves, or at least their hands (washrooms, toilets) and wear clean, washable overgarments.

Water used for cleansing purposes must be free from faeces and other contaminants.

Animals or animal faeces must not come into contact with the product.

3.1.3. Packaging and storage

Bulk packaging

Cashew nuts intended for export to Europe are usually packed in bulk in metal cans or in shrink-packaging made out of steam-impermeable, sealable foils (e.g. polyethylene, polypropylene) in units of 10 kg. Before the cans are soldered or the bags sealed, either an inert gas (e.g. nitrogen) can be added, or a vacuum created (vacuum packing, and/or nitrogen flushing).

Consumer packages

If the cashew nuts are not to be packaged in bulk containers in the country of origin, but sealed in consumer packages, then this packaging should fulfil the following functions:

Protect the cashew nuts from loss of aroma and against undesirable smells and tastes from its surroundings (aroma protection).

Offer sufficient conservation properties, especially against loss or gain of moisture.

Protect the contents against damaging.

Provide a surface area for advertising and product information.

The following materials can be used as **product packaging**:

Single-layer plastic bags (polyethylene or polypropylene)

Aluminium tins

Transport packaging

Some form of transport packaging is required in order to ship the bulk or nuts packed for consumers. In choosing a type of packaging, the following should be heeded:

Transport packaging made, for example, out of cardboard, should be strong enough to protect the contents against being damaged by outside pressure.

The packaging should be dimensioned to allow the contents to be held firmly, but not too tightly in place.

The dimensions should be compatible with standard pallet and container dimensions.

Information printed on transport packaging

The transport packaging should display details of the following:

Name and address of the manufacturer/packer and country of origin

Description of the product and its quality class

Year harvested

Net weight, number

Batch number

Destination, with the trader's/importer's address

Visible indication of the organic source of the product³⁴

Storage

The packed cashew nuts should be stored in dark places at low temperatures (under 18°C) and at a relatively low humidity. Under optimum conditions, cashew nuts can be stored for ca. 1 year.

If the organic product is being stored together with conventional cashew nuts in a single warehouse mixing of both has to be avoided. This is best achieved using the following methods:

Training and informing of warehouse personnel

Explicit signs in the warehouse (silos, pallets, tanks etc.)

Colour 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.

³ When products from organic farms are being declared as such, it is necessary to adhere to the requisite government regulations of the importing country. Information concerning this is available from the appropriate certification body. The regulation (EEC) 2092/91 are applicable to organic products being imported into Europe

⁴ Organic products must be protected from contamination by non-compliant substances at each stage in the process, i.e. processing, packaging, shipping. Therefore, products originating from a certified organic farm must be recognisably declared as such.