ORGANIC FARMING in the Tropics and Subtropics

Exemplary Description of 20 Crops

WILD COLLECTION OF BRAZIL NUTS

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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.

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.

The cultivation guidelines were published in 2000. Some of them (Bananas, Mangoes, Pineapples and Pepper) were revised for the United Nations Conference on Trade and Development (UNCTAD) by Udo Censkowsky and Friederike Höngen in 2001.

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

All indications, data and results of these cultivation guidelines have been compiled and cross-checked most carefully by the authors. Yet mistakes regarding the content cannot be precluded. The indicated legal regulations are based on the state of the year 1999 and are subject to alterations in the future. Consequently, all information must 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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WILD COLLECTION OF BRAZIL NUTS

1. INTRODUCTION

Brazil nuts (*Bertholletia excelsa*) originate from the warm, humid regions of the Amazon in Venezuela, Columbia, Bolivia, Peru, Guyana and Brazil, where they form an important part of the natives' and settlers' diets. It is a fruit that is traditionally gathered by autochthonous groups of the population of the Amazon region. It is hardly ever cultivated. The largest proportion of the production formerly originated from Brazil and the export of the nut was still organised from there, which accounts for the international trading name "Brazil nut".

Mainly due to the erosion of large tracts of land in Brazil and due to sales problems, caused by a high content of aflatoxins, exports have reduced rapidly over the past few years. Although the felling of *Bertholletia excelsa* is forbidden in Brazil, the ban has had the effect that now only brazil nut trees are left standing on the eroded areas. Those are damaged so much by the subsequent burning and lack of additional vegetation that they die off in a few years anyway. This is the reason that the corpses of solitary brazil nut trees can be seen standing on the grazing meadows of the Brazilian Amazon region.
Now a large portion of the current brazil nut production comes from the Amazon Forest regions of Bolivia and Peru. The reduction in total brazil nut exports is also connected with the fall of the price of rubber as the traditional brazil nut collectors were simultaneously latex collectors because a family could seldom earn enough income by only collecting nuts.
For these reasons, the following offers less of a description of the cultivation of brazil nuts, but more of the collecting and processing methods. The quality of the product is mostly dependent upon these factors.

1.1. Botany

Bertholletia excelsa belongs to the family of lecythidaceae. Trees can reach heights of up to 50 m and thereby stretch above the forest's crown. The main blossoming season stretches from October to December. The up to 1.5 kg heavy fruit capsule needs around 12-15 months to ripen. The 12-36 seeds are contained in a thick wood-like casing, the so-called "coco". Its shape and size are reminiscent of coconut. Just like most wild plants, the brazil nut also alternates to a large degree, i.e., the harvests fluctuate strongly from year to year.

1.2. Social aspects of brazil nut production

Traditionally, collecting brazil nuts is strongly connected with tapping latex. Rubber's quiet phase coincides with the ripe phase of the brazil nuts, which means that the two activities harmonise well. The collecting regions mostly still belong to private companies, who collect the nuts in huge 300,000 ha large forest areas. Collectors are employed with their families for the smallest payment possible. During the harvest, the families live in so-called "Barracas", organised into villages. They lost an important source of income as the international market price for natural latex crumbled. Therefore, during the periods where no harvests take place, the families have to move into city slums. Processing the nuts is usually carried out by women and

children in factories. Due to the existence of a huge pool of potential labour, this work is generally performed under bad social and work conditions for almost no pay.
The dependency of small collectors on large landowners has barely altered over the years. The owners organise the collection paths and assign them to the collectors. The collectors are required to buy their groceries from the "Barraquero" – the owner – who hands them out as a kind of advanced payment. The harvested nuts are brought to a central collecting point, where they are calculated against the advance (in the form of food). It is quite usual for these groceries to be so over-priced as to drive down the collector's payment to such a degree that barely any money is left for the workers.
During the past few years in Bolivia, Brazil and Peru, "free collectors" have begun to organise themselves into cooperatives in order to collect, process and sell the nuts by themselves. The first certified brazil nuts originate from these types of groups (Cooperativa Campesina in Riberalta in Bolivia and the Cooperativa Extractivista Chico Mendez from Xapurí in Brazil).

1.3. Uses and contents

The nuts are sold either as fresh fruits or in their shells (dried); at local markets they are also eaten/sold fresh. The seed contains ca. 56-66% fat, 15% protein and 9% carbohydrates.

Tab. 1: Protein, fat and carbohydrate contents in 100 g of the edible, dried parts [1]

protein [g]	fat [g]	carbohydrates [g]	calories [kcal]
14,0	66,8	7,3	714

Tab. 2: Vitamin contents in mg/100g of the edible part [2]

ß-Carotene	Vit. B1	Vit. B2	Nicotin-acidamid	Vit. C	a-Toco-pherol	y-Toco-pherol
Traces	0,9-1,1	0,04	0,2	-	6,5	11

Tab. 3: Ash content (%) and average mineral contents (mg/100) [3]

Ash	K	P	Ca	Mg	Fe	Mn
1,8-3,9	640	675	175	160	3,4	0,6

The oil from the nuts that can´t be sold is turned into soap, whilst the shells are used to heat the drying kilns. The wood of the Brazil nut tree is very valuable. In Brazil and Bolivia it is forbidden to fell Brazil nut trees.

2. CERTIFIED **WILD COLLECTION**

Due to its long development phase (10-15 years until the first harvest) as well as its blossom and fertilising make-up (obligatory allogamy), brazil nuts are hardly ever cultivated on plantations. They are usually associated with rubber in their natural habitat *(Hevea brasiliensis)*, along with many other species belonging to the upper, middle and lower regions of the amazon forests. Natural fertilisation is dependent upon a variety of rodents who break open the

[1] Chemie in Lebensmitteln, KATALYSE (1981)
[2] dto.
[3] dto.

shells and “free” the seeds. Successful growth is only really possible in clearings, which is one of the main reasons why young brazil nut trees can rarely be seen. The native populations also contribute to the growth and spread of the trees, after they have been forced from their plots of land, in that they deliberately plant seeds so that the trees may grow with the new, naturally occurring forest growth.
An important component to certify the brazil nuts as a product of the ecological wild collection, is using a method of collecting that protects the trees. The collecting activities are not allowed to interfere with the brazil nut population or its natural habitat. This requirement is fulfilled by the traditional brazil nut collecting method. It represents a natural and protecting form of forest production because the natural ecosystem is only marginally disturbed during the process.

2.1. Harvesting and post-harvest treatment

2.1.1. Harvesting

The fruits ripen at the same time as the rainy season begins. The rainwater collects in the base of the fruit stems, where it eventually rots, causing the fruit to drop from the tree. Each collector has their own collecting path – the so-called Estradas – that leads amongst the trees in a particular sector of forest. First the nuts are collected and piled together. This work is not as safe as it sounds – the workers are in constant danger of getting hit by falling nuts and having contact with snakes. Therefore, the nuts that have fallen to the ground are picked up with a kind of wooden fork.
Afterwards, the hard shells are broken open with a hunting knife and the nuts are being removed. The individual seeds are collected into central piles – so-called Payoles – which are usually situated by the side of a path or alongside a riverbank and are then taken to the market. The storage places need to be protected against the weather. Generally, a solid wooden floor, that reaches up to 40cm above the surface of the ground, is constructed. A roof made of palm leaves protects the harvest from rain.
As with all oil nuts, the brazil nut is in danger of being infested with fungus during warm, humid weather. One of the most dangerous fungus poisons, aflatoxin, can be produced in this way. When the nuts fall to the ground with the rotting stem pointing upwards, rainwater can easily infiltrate the nut and can cause fungus rot. Therefore, the collecting paths need to be patrolled quite regularly in order for the nuts to be collected and for the shells to be broken open, before they start to rot.
It is also important that the storage place is dry and well-ventilated. This is facilitated by regularly turning the mound over. In order to be transported, the harvest is then placed into crates for up to 20 kg of nuts. This crate unit (caja) is also used to pay the collectors.

2.1.2. Transport and storage

Up to 10 months can pass from the time the nuts are collected to when they are finally being processed. This goes to show that correct storage and the organisation of a rapid transport system are highly important. Otherwise, an infestation with fungus can hardly be avoided. Great care must also be taken because often the only method of transport is by water.
After the brazil nuts have been transported to the processing centres, they need to be stored for quite a while before finally being processed. Processing is carried out in so-called Beneficiadoras, which have huge storage capacities, and have nuts delivered to them from an area

of hundreds of kilometres. The nuts are piled several metres high upon a wooden floor and need to be regularly turned by hand for ventilation. An alternative storage method would be to place them in round, ventilated metal silos.

3. PRODUCT SPECIFICATIONS

3.1. Damaging substances

In Germany, laws concerning the highest allowable measurements of aflatoxins in foodstuffs exist.
Brazil nuts are one of the foodstuffs that must be examined for a possible aflatoxin infestation. If more than 4 µg (microgram/kg)[1] of aflatoxin B1, B2, G1 and G2 is measured, or the aflatoxin B1 content alone exceeds 2 µg, the nuts can no longer be sold. Within a sample, brazil nuts containing aflatoxin can point to an extremely inhomogeneous distribution, which can give rise to exceptionally differing test results. A problem for the producers is that the fungus responsible for causing aflatoxin can infiltrate the hard outer shell to infest the nut without it being noticeable from the outside. Moreover, there are very few laboratories in the growing regions, that would be capable of monitoring the harvest before it is shipped.
The only way of ensuring that aflatoxin cannot be produced is to strictly adhere to the measures outlined here for collecting, storage and transport, as well as adopting a careful and hygienic method of processing.

3.2. Processing brazil nuts

The nuts are processed in several stages.

1. Steaming
In order to release the nuts from their shells, they are subjected to high pressure steam. This process takes place at 200°C in an autoclave. Fresh seeds take around 55 seconds, whilst older ones may need up to 90 seconds.

2. Cooling down
The nuts are collected in a basket after the steaming process and then quenched in cold water, where they are simultaneously washed and cooled down. The sudden drop in temperature and pressure helps to ease off the shells and afterwards facilitates the breaking process.

3. Breaking
The breaking is usually carried out manually. The nuts are broken open in a separate room by specially constructed nutcrackers. The nuts are extracted from around 35% to 40% of the seeds.

60 kg of seeds, including the shells, which approximately equals the daily workload per person, yields around 25 kg of shelled seeds. This correlates to ca. 20 kg of 1st class, 2 kg of 2nd class

[1] 1 Microgram (µg)/kg = 1 ppb = 0,000 001g = 10^{-6}kg

and 3 kg of 3rd class quality. The nuts are pre-selected during the breaking process and any rotten ones are thrown away.
Modern processing plants are equipped with nut-cracking machines, that heat up the deep-frozen nuts so that the shells burst open, whereas dried nuts are opened in a type of centrifuge. Yet these forms of cracking are extremely energy intensive.

4. Drying
After being cracked open, the nuts are dried. For that, the nuts are placed on trays and then stacked on top of each other in the drying kilns. The entire drying process takes 30 - 40 hours. During that time the moisture content will sink to 3%. For the first 10 hours, the nuts are dried at 40°C. Afterwards the temperature is raised to 60°C. The moisture content needs to be monitored constantly during the last few hours.

5. Cleaning, sorting and packing

Before they are packed, the brazil nuts are released from any foreign matter (stones, shell residues, etc.) and sorted according to the following quality classes.

Quality class	Number of brazil nuts per pound (454 g)
Large	90-110
Medium	110-130
Small	140-160
Midget	160-180
Tiny	180-220

Brazil nuts that have been slightly cut or damaged during the processing are not sorted according to size but are marketed under the term 'chipped'. Brazil nuts that are broken into pieces are usually traded under the term 'Broken'.

Unshelled brazil nuts are traded in the following quality classes:

Quality class	Number (with shell) per pound (454 g)
Extra large	35-40
Large	40-45
Extra medium	50-55
Medium	57-62
Small	more than 70

3.2.1. Quality requirements

The following shows a list of quality characteristics with minimum and maximum values for brazil nuts that are usually required officially or by importers. Different minimum and maximum values can be agreed on 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 mouldy
Cleanliness	Free of foreign matter, i.e. sand, stones, shell parts, insects etc.
Water content	1,5-3,0 %
Peroxide value	max. 1,0 milli-equivalent of peroxide per kg fat
Free fatty acids	max. 0,5 %
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
Entero-bacteria	max. 10/g
Coliforms	max. 10/g
Escherichia coli	Not measurable
Staphylococcus aureus	max. 100/g
Salmonella	Not measurable in 25 g
Mycotoxines	
Aflatoxin B1	max. 2 µg/kg
Total aflatoxins B1, B2, G1, G2	max. 4 µg/kg

For the quality requirements to be upheld, and no contamination of the brazil nuts to occur, 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 fruits. If the fruits are to be dried outside, fences must be erected to guard the racks against birds and nearby animals.

3.2.2. Packaging and storage

Packaging types and material

In order for them to be exported to Europe, the brazil nuts can be packed in consumer packs, or wholesaler packs (bulk) in tins, or in bags made of sealable, foils, impermeable to steam (e.g., polyethylene or polypropylene) of 10 kg or 20 kg each. Before sealing either the tins or bags, a gas (e.g., nitrogen) may be added (nitrogen flushing) or vacuum created (vacuum-packing).

Packaging types

If the brazil nuts are not to be packaged in bulk containers but small units, ready for consumers, the packaging type must fulfil the following functions:

- Protect the brazil nuts against a loss of aroma and the penetration of unwanted smells and tastes from their surroundings (Aroma protection).
- Protect the breakable contents from damage.
- Help the nuts to stay fresh for a reasonable period of time, whereby both moisture loss and gain must be prevented.
- Provide a space where the requisite product information can be printed.

The following materials can be used for the **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 individually packed fruits. Choosing a type of packaging, the following should be heeded:

- Transport packaging made, for example, from 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 ecological source of the product[2] [3]

Storage
The packed brazil nuts should be stored in a dark place at low temperatures (under 18°C) and at a relatively low humidity.
Under optimum conditions, brazil nuts can be stored for ca. 1 year.
If the product is being stored in a single warehouse with both, conventional wild collection and from certified wild collection (mixed warehouse), measures to avoid mixing are needed. 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 product from certified wild collection)
- 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 certified and conventional brazil nuts together in the same warehouse should be avoided.

[2] 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 is applicable to organic products being imported into Europe.
[3] Organic/certified 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 certified collection areas must be recognisably declared as such.

4. CERTIFICATON AND PRODUCT LABELLING OF WILD PRODUCTS

The production of organic agricultural products is defined by production standards, whereas wild harvested products can be certified as organic under the pre-condition that the way of harvesting of those wild products follow specific requirements. Some of the most important requirements are listed below:

a) Clear determination of the collecting area (e.g., maps)
b) No risk of contamination by conventional farming practises (e.g., side contamination by pesticides) and/or other sources of pollution (e.g., industrial plants)
c) Collection of wild products must not endanger the ecosystem as a whole and/or the existence of the collected plant species.
d) Transparent documentation of people involved in the collection of the wild products (e.g., list of all collectors).
In case wild harvested raw materials from certified collection operations are used in organic products (as ingredients and/or as a final product) the origin of the wild raw materials shall be clearly declared (e.g., „brazil nuts from certified organic wild collection“, **but not** „organic brazil nuts“).