

Organic Farming in the Tropics and Subtropics

Exemplary Description of 20 Crops

Coco Palms



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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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Index

1. Introduction	1
2. Aspects of plant cultivation	1
2.1. Site requirements	1
2.2. Seeds	2
2.3. Planting methods	3
2.4. Diversification strategies	3
2.5. Supplying nutrients and organic fertilisation management	4
2.6. Biological methods of plant protection	5
2.7. Crop cultivation and maintenance	6
2.7.1. Crop monitoring	6
2.7.2. Weed management	7
2.8. Harvesting and post harvest treatment	7
2.8.1. Harvesting	7
2.8.2. Post harvest treatment	7
3. Product specifications	8
3.1. Fresh coconuts	8
3.1.1. Preparation	8
3.1.2. Quality requirements	8
3.1.3. Packaging and storage	9
3.2. Copra and dried, grated coconuts	10
3.2.1. Preparation	10
3.2.2. Quality requirements	12
3.2.3. Packaging and storage	13

Organic Cultivation of Coco Palms

1. Introduction

Coco palms *Cocos nucifera* L. (French.: cocotier; Spanish.: cocotero) originate from Melanesia. South east Asia is still an important cultivation region today. The coconut is a monocotyledon plant, and can therefore only proliferate via seeds (comp. 2.2.). It can produce an inflorescence on each leaf axil, which can then have either male or female blossoms. These are formed on the side, so that generally, the coco palm is cross-fertilised by a variety of bee species, other insects and the wind. Coco palms live to an average age of 60 years old.

Every part of the coco palm can be used. The juice from the inflorescence, which can contain up to 15% sugar, goes to make palm-wine. Half-ripened nuts (6-7 months old) are often harvested to be eaten fresh. The coco juice is drunk, and milk squeezed out of the meat (endosperm). Fully ripened nuts (after 11-12 months) provide the so-called copra, which is made from the firm meat of the nut. Copra is high in oil and protein content (65% oil, 25% protein). Coconut oil is produced from drying and pressing the copra. Grated coconut is made from fresh copra. The hard coconut shells are used to fire kilns used to dry the copra, and to make charcoal. When they have been finely grated, coconut shells are used as fillers for objects made of plastic, such as buttons, containers and other objects. Coconut fibres are used in the upholstery industry, to make ropes, as mulching material or as a substitute for peat. The leaves and wood are used as building material and to make household objects (e.g. brooms) and tools.

2. Aspects of plant cultivation

2.1. Site requirements

The saying “the coco palm loves to stand with its feet in the water and its head in the sky”, offers a very characteristic description of the site requirements of coco palms. It needs a continuous supply of water, which can be provided by regular rainfall of about 2000 mm per annum, or from ground water (at a depth of 1-3 m). It cannot tolerate water-logging, though. It grows best at average temperatures of around 26-27°C. Because of its temperature requirements, the coco palm cannot grow above 750 m, even near to the equator. Growth is stimulated by a sufficient supply of chlorine in the soil. The coco can withstand up to 1% salt in the soil.

These conditions are generally to be found in tropical and subtropical coastal regions with little rainfall. Coco palms can also grow on deep, water-logging free, alluvial soil, away from the coast – yet a low chlorine content in the soil could have negative effects. These conditions should be well-heeded when choosing a site.

Depending on the site, coco palms can be suited to cultivation on agroforestry systems. As a plant of the upper storey, with requisite light requirements, the coco palm towers above such crops as citrus plants, cacao and others.

2.2. Seeds

The quality of the seeds is important to the forthcoming yield from the palm. For this reason, the seeds should originate from a healthy, and productive stock plant. Usually, the seedlings are raised in state tree nurseries. If no tree nursery can be found which is capable of working under the restrictions necessary for organic cultivation, then the seedlings will have to be raised on the site.

Two different main groups are cultivated in the commercial sector. The tall plants of the *Typica* group, which generally need to be cross-fertilised, and dwarf types of the *Nana* group, where self-pollination is the norm. Tall varieties should always be chosen for agroforestry systems, because these are the only sorts that can reach up to the upper levels intended for them, and thus fully develop. Dwarf palms grow very slowly, and are easily overshadowed in the system, hindering their full development. In addition, the *Nana* variety reacts more sensitively to drought and some diseases than *Typica* varieties.

Stock plants that are suitable seed providers produce 100 nuts per year, 12-14 syncarpy of differing ages, and up to 180 g copra per nut. The fully-ripened nuts which are intended to provide seeds are harvested after 11-12 months. It should be noted that for the fruit setting at a later date, that the nuts germinate quicker at the lower end, or in the middle, of the syncarpy as at the upper end. The nuts should not be allowed to fall, but should be cut down, and carefully lowered, e.g. by rope. Following the harvest, the produce should be stored for a short break in a covered, well-ventilated place.

Before sowing, the nuts are again sorted; only those nuts containing water are used. The shell is cut away on the germinating side of the nut to facilitate germination, then the nuts are soaked in water for 14 days, before being sown in loose soil which can drain easily. The nuts are laid in the soil lengthways with the upper side still visible. They are sown in nursery beds at a distance of 45 cm. Coconut fibres are used as mulching material between the rows. The planting area is nevertheless left uncovered. The nuts can also be sown in a glasshouse with 95% humidity. On smallholdings, the nuts are often merely set out in shaded areas, lightly dug in, and then covered over with organic material.

2.3. Planting methods

The nuts begin to germinate after 12 weeks in the nursery beds. There, they require no additional fertiliser, as the endosperm provides them with sufficient nutrients. When the seedlings are planted in beds outside the rainy season (and not in glasshouses), then the beds need to be irrigated twice a week with around 5 l water/m². After the 5th month, the strongest seedlings should be selected and labelled for transplanting. Around 20-40 % of the seedlings will be unusable. Suitable seedlings germinate earlier, and have thicker leaf bases. Early leaf-development is a sure sign of a strong plant. The seedlings are transplanted after 9-10 months, by which time they should have developed 4-5 fully-opened leaves. When the seedlings are removed from the nursery beds, their roots are shortened, and then planted again as soon as possible.

The distances between the plants should be between 7.5 x 7.5 m and 6 x 9 m, depending on the cultivation method used and the other crops being grown, or similar distances resulting in an average density of 150-180 trees/ha. The seedlings are planted in a hollow 60-75 cm below the surface which is gradually filled up with the coco palm's growth, while the lateral roots are at a greater depth. This means that the palms are less susceptible to drought periods. This method should not be used when the ground water is relatively high. The young seedlings also need to be protected from bites when animals are being raised.

2.4. Diversification strategies

Organic coconut cultivation does not allow for monocropping. Existing plantations can be improved by sowing at least one bottom crop of plants which offer ground coverage. Legumes can be planted here as green fertilisers. In multi-level agroforestry systems, cacao, bananas, pineapples and many other crops can be used. Spices such as ginger and turmeric also thrive under palms. If animals are kept, fodder crops should be integrated in a crop rotation system underneath the coco palms.

If possible large plants should be used from the nursery beds when setting up agroforestry systems which include coco palms. This applies not only to coco palms, but to all types of palms integrated within agroforestry systems. Coco palms will grow on any sites which are suitable for cacao, bananas, citrus (oranges) or papaya. Plenty of examples of their integration within agro forestry systems can be found in the chapters on cacao and bananas, which are also highly suited to the cultivation of coco palms. On citrus plantations, a slightly lower density should be used (120-150 plants/ha) than for e.g. cacao (150-180 plants/ha).

Three phases can be identified in the development (life cycle of the coco palm) of the crop:

Life cycle	Shade	Mixed crops
1st phase: up to 8th year	A full frond will only have developed after 8 years; during this time, only partial shade is available;	Cultivation of annual crops possible.
2nd phase: from 8-25th year	Comparatively large amount of shade	Cultivation of shade-tolerant varieties.
3rd phase: older than 25 years	Shade reaching to the ground diminishes as trees attain full height	High amounts of sunlight allows cultivation of plants needing lots of light.

A variety of biotopes providing habitats for useful insects and special bees – which both contribute to the fertilising of coco palms – can develop on diversified plantations. Coco palms cultivated in agroforestry systems receive significantly more protection against winds in very windy regions (cyclones).

2.5. Supplying nutrients and organic fertilisation management

The following amounts of nutrient extraction pertain to cultivation on conventional plantations:

Average nutrient extraction of coco palms (kg/ha)¹:

	N[kg]	P [kg]	K [kg]	Ca [kg]	Mg [kg]
Nutrient extraction	67.8	12	83.6	16.6	23.2

If the entire fruit – including fruit shell, husk, endosperm and the leaves – are to be used, then the values for nutrient extraction per hectare cultivated are much higher (232 kg N; 251 kg K; 51 kg Mg; 215 kg Cl).

The level of nutrient extraction on a coco palms/mixed crop system can be balanced by encouraging the decomposition of organic material that is made available, e.g. through mulching material, green fertiliser and tree trimming. A dense crop of legumes such as *Glyricidia sepium*, *Pueraria phaseoloides*, *Calopogonium mucunoides*, *Centrosema pubescens*, *Arachi pintoj*, *Glycine wightii*, *Desmodium ovalifolium* or use of another plants providing ground coverage as bottom crops, and which are regularly supplied with mulching material, will provide a sufficient supply of nitrogen for the plants.

¹ FRANKE, G. (Hrsg.) (1994): Nutzpflanzen the Tropen and Subtropen; Bd. 3: Spezieller Pflanzenbau. UTB Verlag

It is important to take care that all harvest and processing residues, such as coco fibres and press-cakes from the oil-extraction process, are returned to the plantation. This also applies to the potassium-rich ash resulting from burning the coco husks.

If insufficient organic material is produced on the plantation, the deficit can be balanced by regularly adding compost. The compost should be enriched with any wood ashes (or coco husk ashes) that are available.

The compost is spread out in a circle 3-5 m underneath the palms, and preferably covered over with coco shell mulching material. The latter may be especially necessary in systems lacking enough additional vegetation.

A deficiency in potash will result in a large reduction of yield for coco palms. The vast majority of the potassium is thereby contained in the fruit water of the coconuts. On cultivation systems which include cacao, returning the cacao shells to the site will supply sufficient potassium to balance out the extraction. The continual pruning of crops on diversified agroforestry systems provides an important source of nutrients (e.g. of potassium).

When providing a nutrient supply to coco palms, it should be noted that it can take up to 36 months before inflorescence begins. This means that measures to supply nutrients, or to counteract deficits or other morphological disturbances, will take 3 years before they have an effect on production.

Due to their symbiosis with endomycorrhizae fungi (phosphate supply), and their tolerance of soil salts (which are often harmful to the other crops), coco palms, as well as other varieties of palm, have a beneficial effect on the growth of the other crops in an agroforestry system.

2.6. Biological methods of plant protection

In a balanced cultivation system, which includes middle and bottom crops, as well as nitrogen-fixing green manuring plants (legumes), diseases and pests requiring some form of counter-measures will rarely occur – especially when enough birds are present on the plantation. These are often present in multi-level cultivation systems (comp. 2.4.).

Most of the problems concerning disease and pests have the following causes:

- Cultivation in a monoculture, or with too few different varieties.
- Too little distance between species that grow to the same height; failure to trim agroforestry systems.
- Degenerated or poor soil, lack of organic material.
- Unsuitable sites (water-logging, too dry, soil not deep enough for roots).

In most cases, the most effective cure is to alter the entire system of cultivation.

If a system is not yet in a state of ecological equilibrium, **heart rot**, caused by *Phytophthora palmivora*, can occur in all of the producing regions – where it is widely spread. In cases of heavy infestation by *Phytophthora palmivora*, harvest-

losses can be lessened by using Bordeaux mixture, or any other copper-rich spraying preparations², which are permitted in organic farming systems. These measures should only be undertaken in cases of emergency. In less harmful cases, removing any infested plants from the plantation will result in the infection being limited.

Amongst the young trees in tree nurseries, an attack of **termites** may occur. The termites can be effectively combated by pouring a thin layer of sand from the soil over the exposed parts of the buried nuts. Young coco palms are also susceptible to the **rhinoceros beetle** and **coconut caterpillars**. Pheromone traps have been successfully utilised in Sri Lanka against the rhinoceros beetle. In emergency cases, butterfly caterpillars can be regulated with *Bazillus thuringiensis*.

The trunks of young seedlings are often protected against pests by painting them with tar. This is not allowed on organic plantations, and the black covering also causes the plants to heat up unnecessarily. An alternative is to paint the trees with a mixture of sulphur, soil and lime, (1 : 2 : 1) added together with water to make a thick paste. If necessary, the paste may need to be renewed, as rain will wash it off. Considerable damage can be caused in regions with large coco palm monocultures by the **mycoplasma**, a fungi that grows in cuts in the fronds. The disease can be brought under control by removing infested plant parts or whole palms. Coconut red weevil and Rhinoceros beetle only usually damage young palms, yet may also, in exceptional cases, cause damage to mature crops. In acute cases, they can be combated by closing the larvae tunnels, and with pheromone traps.

In coco palm monocultures, rodents, and especially rats, can develop into a serious epidemic which is then difficult to bring under control again. Metal plates affixed to the trunks will effectively stop them from climbing up the trees, though.

2.7. Crop cultivation and maintenance

2.7.1. Crop monitoring

The nuts ripen during the entire year. As a rule, a harvest is carried out every 1-2 months, when the ripened coconuts are harvested directly from the tree – farmers should not wait until the nuts fall from the tree. The nuts are fully ripened when the coconut water can be clearly heard sloshing against the inside when they are shaken. Harvesting too early can unfavourably affect the quality of the copra.

² According to the European Regulation for Organic Agriculture (EEC) 2092/91 the use of copper preparations for plant protection (e.g. Bordeaux Mixture) is allowed for a transitional period which will end at the 31st of March 2002. However, any use of copper preparations until 2002 has to be approved by the certification body. In case copper preparations have to be applied it is recommended to use preparations which contain less copper and therefore to reduce the accumulation of copper in soils (e.g. tribasic copper sulphate, copper hydroxide).

When the coco fibres are to be used to make ropes, the nuts should be harvested before they are fully ripened (about 12 months old nuts), because otherwise the fibres will be brittle. They should be harvested at an age of around 10-11 months. As already mentioned, the tree-coatings may need to be renewed occasionally. (comp. 2.6.)

2.7.2. Weed management

The tilling of weeds should be carried out according to which mixed crop system or agro forestry system is used. Measures need then to be taken when the following occurs:

- Legumes used for ground-coverage, such as e.g. *Pueraria phaseoloides*, *Glycine wightii*, *Arachi Pintoj*, *Desmodium ovalifolium*, *Mimosa invisa*, *Calopogonium muconoides* or *Centrosema pubescens*: these plants rapidly develop a dense layer of foliage, and can also be mulched. The thick layer of mulching material, along with the shade provided by the crop itself (especially by pueraria), is an effective way of controlling weed growth by suppressing it. When planting *Pueraria phaseoloides* and *Glycine wightii*, care should be taken during the rainy months that the young plants are not overgrown by them. For this reason, a monthly check and trim is necessary.
- If forage is being produced, regular grazing (rotational grazing) should be interrupted by a hay pasture. Hay can be used for the dry season; and the crop as well as the weed growth (among others caused by animal movement) can be better controlled. In agroforestry systems, animal husbandry should never be practised within the plantation.
- On young coco palm plantations, it may become necessary to remove climbers and epiphytes from the palms.

2.8. Harvesting and post harvest treatment

2.8.1. Harvesting

In principle, there are three different possibilities:

1. The palms can be scaled, and the coconuts knocked down. The advantage here is that it is easier to tell which nuts are ripe. The palm crown can also simultaneously be trimmed (removing dead leaves).
2. The coconuts are cut down with a knife attached to a long bamboo pole (e.g. in Sri Lanka). This method can be used for palms up to about 8 m in height, and is the most usual method of harvesting.
3. The coconuts are broken off by trained apes (e.g. in Malaysia and Thailand).

An average harvest yields around 40-80 nuts per palm and year.

2.8.2. Post harvest treatment

As a rule, the coconuts are separated from the fibrous husks on the plantation and sold as whole nuts (“balls”). Occasionally, the nuts are halved on the plantation, and dried in the sun. In the majority of cases, though, the coconuts are further processed industrially.

3. Product specifications

3.1. Fresh coconuts

3.1.1. Preparation

To export fresh coconuts, it is recommended to cut off the thick fibrous husk of the coconuts immediately after they are harvested. Inside the husk, the edible copra and a hollow space containing the slightly sweet coconut water, are covered by a thin hard shell. The coconut water solidifies in time into the firm copra meat, and can taste slightly soapy when fully dried. Coconuts intended to be sold fresh should therefore be harvested before they are completely ripe. Then, they still may contain up to 95% coconut water.

Organically produced coconuts are not allowed to be treated with methyl bromide or ethylene oxide, or with ionising rays.

3.1.2. Quality requirements

The following is a list of quality characteristics with minimum and maximum values for fresh coconuts 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
Taste and smell	Variety-specific, fresh, not rancid or stale
Purity	Free of foreign particles, such as sand, stones, insects etc.
Residues	
Pesticide	Not measurable
Bromide	Not measurable
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

A common trading list of conditions for fresh coconuts states:

“Wit no fibrous mesocarp, with a beard (namely, to protect the three germination pores, or ‘eyes’), and with a milk content of ca. 95%”

In order that the quality requirements are upheld, and no contamination of the coconuts 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

In order to be exported to Europe, fresh coconuts are usually transported in bulk quantities of 60-100 pieces in sacks made of coconut fibres, and traded in boxes.

Transport packaging

- 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

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.

Storage

If stored at low temperatures of 0-5°C, in the dark, and at a relative humidity of 90%, fresh coconuts can be kept for up to 2 months.

If the organic product is being stored in a single warehouse together with conventional coconuts mixing of the different qualities must 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.

3.2. Copra and dried, grated coconuts

3.2.1. Preparation

The following is a description of the steps necessary in preparing copra and dried, grated coconuts:

Manufacturing ‘cup copra’

- **Drying**

In order to manufacture so-called ‘cup copra’ the fibrous husks are first removed from the freshly harvested coconut fruits. The coconuts are then split open by a blow with a heavy knife and washed in clean, cold water to rid them of foreign particles and fibres, then briefly pre-dried by lying them out in the sun on racks, mats or in solar dryers – so that the meat becomes easier to separate from the shell. The drying process should begin as soon the coconuts have been opened, as any delays will result in the meat turning reddish-brown. After ca. 2 days (sun-drying), the fruit meat is usually hard enough to be able to be removed from the hard shell. After a further 4-5 days, the drying process should have been completed. Around 530 kg of copra can be gleaned from drying out 1 ton of fresh coconut meat.

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.

- **Cleaning and packaging**

Before it is packed, the copra should be cleansed of foreign particles (stones, sand, fibre residues etc.).

Manufacturing 'ball copra'

- **Drying**

In order to manufacture 'ball copra', ripe coconuts are stored in the shade for ca. 8-12 months. In this way, the coconut water is gradually absorbed, and the coconut meat shrinks and dries, so that it begins to rattle around when shaken.

- **Removing the fibres and shell**

When the meat begins to rattle, the coco fibres and shell may be carefully removed.

- **Cleaning and packaging**

Before it is packed, the copra should be cleansed of foreign particles (stones, sand, fibre residues etc.).

Manufacturing 'dried, grated coconuts'

In order to manufacture dried, grated coconuts, the brown shell around the copra is removed, the meat washed with clean, cold water, then sterilised, grated, dried, and if necessary, sieved into grades.

The grated, dried coconuts are sorted into the following grades according to their grain size:

- **Extra-fine dried coconuts**

These are grated, dried coconuts, of which no less than 90 percent by weight can pass through a sieve with square shaped holes of 0.85 mm, and of which no more than 25 percent by weight can pass through a sieve with holes of 0.50 mm.

- **Fine dried coconuts**

These are grated, dried coconuts, of which no less than 80 percent by weight can pass through a sieve with square shaped holes of 1.40 mm, and of which no more than 20 percent by weight can pass through a sieve with holes of 0.71 mm.

- **Medium dried coconuts**

These are grated, dried coconuts, of which no less than 90 percent by weight can pass through a sieve with square shaped holes of 2.80 mm, and of which no more than 20 percent by weight can pass through a sieve with holes of 1.40 mm.

Un-graded grated, dried coconuts includes all of the specially chopped sorts of strips, e.g. slender or thin flakes, long, thin chips, shreds, long strips, standard strips, etc.

Copra and coconut flakes are not allowed to be treated with methyl bromide or ethylene oxide, or with ionising rays after or during the drying process.

3.2.2. Quality requirements

The following is a list of quality characteristics with minimum and maximum values for copra and grated, dried coconuts 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
Taste and smell	Acc. to variety, fresh, not rancid, not stale
Cleanliness	Free of foreign matter, i.e. sand, stones, fibre parts, insects etc.
Water content (copra)	max. 5-7 %
Water content (grated, dried coconuts)	max. 3 %
Total acid content of the extracted oil, expressed as lauric acid (grated, dried coconuts)	max. 0.3 %
Oil content (grated, dried coconuts)	mind. 55 %
Ash content (grated, dried coconuts)	max. 2.5 %
Residues	
Pesticides	Not measurable
Sulphur oxide	Not measurable
Bromide	Not measurable
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 B ₁	max. 2 µg/kg
Total aflatoxins B ₁ , B ₂ , G ₁ , G ₂	max. 4 µg/kg

In order that the quality requirements are upheld, and no contamination of the copra and grated, dried coconuts 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. If the copra is to be dried outside, nets or a fence should be erected to protect the produce from any animals or birds.

3.2.3. Packaging and storage

Bulk packaging

Copra and grated, dried coconuts 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 copra and grated, dried coconuts 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 product 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)

Transport packaging

Some form of transport packaging is required in order to ship the bulk or produce 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 containers.

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 product⁵

Storage

The packaged copra and grated, dried coconuts, should be stored in the dark, at low temperatures (below 18°C) and relative humidity. Under optimum conditions, the products can be kept for ca. 1 year.

If the organic product is being stored in a single warehouse together with conventional coconuts mixing of the different qualities must 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 eco-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.

⁵ comp. 2,3