

Organic Farming in the Tropics and Subtropics

Exemplary Description of 20 Crops

Bananas



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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, mango, pineapple 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 Cultivation of Bananas

1. Introduction

Economically, the most important type of tropical fruit is the banana (*Musa x paradisiaca* L.). Marketing of bananas was begun largely by multinational companies, and has altered in this respect little to this day. These companies often maintain a production chain stretching from their own plantations to ripening stations at the final ports of destination. Certain types of banana, but especially the plantain, form part of the staple diet in many tropical countries.

Bananas grown organically have only appeared in recent years, and are invariably intended for shipment to the European markets.

1.1. Botany

The banana belongs to the Musaceae family and includes the genera *Musa* and *Ensete*. The economically important banana sorts belong to the *Eumusa* section. The name *Musa x paradisiaca* is generally retained for the entire group of fruit and cooking bananas, because many of the varieties are of a hybrid nature.

Edible bananas contain no seeds. Reproduction is carried out via its subterranean rhizome, the shoots of which regularly forms fruitful buds. The banana plant possesses a so-called pseudo-stem, which is created by the leaf sheathes. Inflorescence usually begins around 7-9 months after planting, depending on climatic conditions and type of soil. Parthenokarpy (unfertilised) fruits, standing together in groups (clusters), develop from the female blossoms. Seed formation is still visible in the fruit as blackened bands. The development period of the fruit can last up to ca. 3-4 months, depending on weather conditions. After the bunch has been fully formed, the parent plant dies off.

1.2. Varieties and countries of origin

As a tropical culture, the banana places heavy demands on temperature (opt. 25°C) and rainfall (opt. 1500-4000 mm). Nevertheless, bananas are also grown in subtropical areas such as South Africa, Lebanon, Israel and on the Canary Islands, although additional irrigation is generally necessary in these regions. In practical terms, only cold-resistant dwarf bananas ("Dwarf Cavendish") are suitable for these regions.

Varieties of the Cavendish group currently dominate in commercial plantations, after the taller "Gros Michel" bananas were decimated by the Panama disease. In addition to the extensively grown commercial varieties, a large number of local varieties are found in the tropical regions world-wide. These can be utilised in various ways to accommodate different sites and production systems, and also combined with one another.

Overview of the most important varieties and their characteristics ¹

Varieties	Characteristics and Genome
"Sucrier"	Around 60 varieties, mostly in SEA, resistant against Panama disease, low yield. Genome: AA
"Ney Poovan"	From South India, varieties barely described, highly resistant against Panama and Sigatoka diseases. Genome: AB
"Gros Michel"	Strong growth, fruitful, susceptible to Panama disease. Genome: AB
"Robusta" and "Lacatan"	Not as susceptible to Panama disease and wind break as "Gros Michel". Genome: AB
"Dwarf Cavendish"	Especially suited to unfavourable climatic conditions, resistant against Panama disease, but very susceptible to the Sigatoka disease, widely distributed, especially in Australia, South Africa, Israel and the Canary Islands, distributed world-wide
"Mysore"	Resistant against Panama disease and banana root borer, grown in India, strong growth. Genome: AAB
"Silk",	Grows fairly strong, widely distributed, resistant against Sigatoka disease, but not against Panama disease. Genome: AAB
"Pome"	Strong growth, medium harvest, resistant against Panama and Sigatoka diseases, distributed throughout southern India, Hawaii and E. Australia. Genome: AAB
"Bluggoe"	Strong growth, resistant against Panama and Sigatoka diseases, only a few clusters with large, green fruits, high starch plantain. Genome: ABB
"Pisank awak"	Very strong growth, resistant against Sigatoka disease, different mutations, red flesh, contains seeds after fertilisation, grown in Thailand. Genome: ABB
"Bodles Altafor"	Fruitful, resistant to diseases, but not tested sufficiently yet, cross between "Gros Michel" and "Pisang lilin" (AA\ clone). Genome: AAAA
"I.C.2"	Found in West India, Honduras and the Pacific region, cross between "Gros Michel" and <i>M. acuminata</i> , resistant against Sigatoka disease, less resistant against Panama disease. Genome: AAAA
"Klue teparod"	Only natural tetraploide variety, fruit is matt grey, mushy, stringy, sweet plantain in Thailand and Burma, a robust and disease-resistant variety. Genome: ABBB

¹ LÜDDERS, P. (1989) in: Manual about Agriculture and Nutrition in Developing Countries, Volume 4, Ulmer.

There are many other local varieties, as well as common commercial varieties grown under different local names.

Organically produced bananas have become more widespread in the past few years. Most of the bananas intended for the European market are grown in the Canary Islands, as well as from Ecuador, the Dominican Republic, Costa Rica, Uganda and Israel. Smaller organic projects also exist serving regional markets (e.g. Bolivia).

1.3. Uses and contents

The main form of the common eating banana is as fresh fruit, only a small proportion enter the market in dried form. In Europe and North America, the common eating banana, produced and marketed by a handful of major companies, is most widespread. In contrast to this, smallholders produce mainly for themselves and for regional markets, where the banana represents an important part of the daily diet. Plantains play a large role here, and a wide variety are thereby cultivated.

The following represents nutritional values of the common eating banana²

Nutritional value of bananas per 100g fresh weight of the edible parts:

Contents	Amount
water	75 g
Edible carbohydrates	20 g
Raw fat	0,3 g
Raw fibres	0,3 g
Vitamin A	400 I.E.
Vitamin C	10 mg
Energy	460 kJ
Reduction before eating	33%

Flour is produced from both plantains and eating bananas in many regions, which can then be used in soups, baking or as a drink. The banana can also be used to make vinegar and to brew alcoholic beverages. The staminal flowers can be used as a vegetable, after briefly heating them in salty water (to remove the bitterness). Bananas can also be used as a starch-rich animal feed (pig farming). The fresh leaves are high in protein content, and are preferred for their taste by cattle and chickens. The leaves are also commonly used as packing material and for roofing. Along with the pseudo-stem they offer excellent mulching material.

² REHM, S. und ESPIG, G. (1976): Crops in tropical and subtropical regions, Ulmer Taschenbuch.

2. Aspects of plant cultivation

2.1. Site requirements

The ancestors of our commercial bananas originated from the Malaysian peninsula, New Guinea and South-East Asia. They grow in alluvial and volcanic soils, as well as in river deltas and forest perimeters, where the soil is rich in organic material. They are part of both young and old secondary forest formations, where they are located either at the top or the middle of the forest, according to variety and development stage. This means that they are more or less adaptable to shade, according to variety. In comparison with eating bananas, plantains require more soil fertility. They grow in the upper layers of natural vegetation, therefore requiring more light, and cannot tolerate extended periods of shadow. Commercially used varieties cannot endure stagnant water conditions, and are susceptible to wind break (especially when not grown in agroforestry system).

2.2. Seeds and seedlings

Bananas are reproduced vegetative. In accordance with availability, required amounts and transport possibilities, the following are suitable:

- Whole rhizomes
- Rhizome pieces
- Shoots with inflorescence in the pseudo-stem
- Shoots lacking inflorescence in the pseudo-stem.

Using whole rhizomes is laborious. It requires a large amount of starting material and generates high transport costs. Rhizome pieces and shoots lacking inflorescence in the pseudo-stem are less expensive.

It is very important that the shoots are undamaged, and originate from nematode-free plantations. Prior to planting, the roots and any damaged spots should be removed with a sharp knife.

2.3. Methods of planting

The distances between plants is determined by the variety, soil conditions and the type of planting system. Slow growing plants, such as the Dwarf Cavendish, can be planted in a density of 2500 plants/ha. The more robust Giant Cavendish, Robusta or other strongly developing varieties are set at 600-1200 plants/ha. Experiences culled in the different regions have led to a variety of recommendations regarding size and depth of hole required, which should be heeded. It is recommended to cover the planted rhizome with mulching.

The most suitable planting period is towards the end of the dry season, or at the beginning of the rainy season, and is also dependent upon any accompanying

crops. Several seeds from different local shrubs and trees should be dropped into each plant hole. Cuttings from varieties which reproduce vegetative can also be used (*Morus albus*, *Malvaviscus arboreus*, *Gliricidia sepium*, etc.).

In regions of intensive banana production, it is important to ensure that no undesirable pesticide-drift from conventional neighbouring plantations occurs. This is especially the case when aero spraying takes place. Under these circumstances, it is necessary to plant high, growing hedges of sufficient depth.

2.4. Diversification Strategies

On conventional plantations, bananas are grown over large areas as part of a monoculture. A wide variety of combination possibilities is available for organic cultivation, especially in connection with permanent crops and agroforestry systems.

The following recommendations pertain to the common eating banana. Due to their high demands on soil (comp. 2.1.), an intensive accompanying vegetation is required. With sufficient foresight and planning, this can later be used to replace the bananas. Due to the fact that specific plantation systems with the suitable variety of plant need to be established for each region, site, and even for individual plots, it is only possible to provide an overview of the basic guidelines here.

In principle, bananas can be combined with practically any type of cultivated or wild plant which has similar eco-physiological requirements. Young banana plants are excellent "wet nurses" for other crops and forest plants, which can be planted very close to the bananas.

Three examples:

1.

1. year	2. year	3. year	5. - 10. year	from 11. year
Maize				
Papaya	Papaya			
Banana	Banana	Banana	Banana	
Cocoa	Cocoa	Cocoa	Cocoa	Cocoa
Forest trees	Forest trees	Forest trees	Forest trees	Forest trees

2.

1. year	2. year	3. year	5. - 10. year	from 11. year
Hibiscus				
Banana	Banana	Banana	Banana	
Coffee	Coffee	Coffee	Coffee	Coffee
Forest trees	Forest trees	Forest trees	Forest trees	Forest trees

3.

1. year	2. year	3. year	5. year	6. - 10. year	from 11. year
Maize/Manioc					
Pineapple	Pineapple	Pineapple	Pineapple		
Banana	Banana	Banana	Bananas	Bananas	
Forest trees	Forest trees	Forest trees	Forest trees	Forest trees	Forest trees

If no other crops are to be integrated into the system, then it is sufficient to combine the bananas with forest trees and native fruit trees.

If other crops are to be introduced onto an existing monoculture plantation, then especially the fruit carrying pseudo-stems will need to be thinned out.

Depending upon which plantation system is used, the planting times for the different crops need to be co-ordinated, to ensure each receives its optimum location. Each crop can thereby be planted as if in a one-crop system. The types of maintenance employed are most important in this approach. Native species with varying heights, as well as trees that can withstand frequent cutting – such as *Inga ssp.*, *Erythrina ssp.* Etc, depending on the site – which have been tested in standard agroforestry systems, should be used as forest trees. A wide variety of species and high density of plants should be striven for. The high plant density can be useful for example in suppressing the growth of other vegetation (like grasses etc.). It also provides sufficient mulching material, which needs to be continually cut and added to the soil. Satisfactory banana production can only be achieved with a large amount of organic material produced on the plantation itself (compare 2.5.).

2.5. Nutrients and organic fertilisation management

2.5.1. Nutrient requirements

On conventional plantations in prime locations, bananas are planted over many years as monocultures. This results in a continual loss of organic material, and to a general degeneration of the soil, which then needs to be compensated for with a high input of mineral fertilisers.

The following "nutrient depletion" results for each 1000 kg bananas³ (in kg):

N [kg]	P [kg]	K [kg]	Ca [kg]	Mg [kg]
2	0,3	5	0,4	0,5

³ JAKOB, A., u. UEXKÜLL, H.V. (1963): Fertilizer Use. Nutrition and Manuring of Tropical Crops. 3. Aufl. Verlagsgesellschaft für Ackerbau, Hannover.

Understandably, the amounts of nutrients recommended vary quite strongly, depending on which literature one consults. The following refer to individual plant parts:

Required amounts of nutrients (in kg/ha) for a harvest of 1000 kg/ha of bananas (adjusted acc. to⁴):

Plant part	N [kg]	P [kg]	K [kg]	Ca [kg]
Pseudo-stem	0,96	0,16	2,5	0,56
Leaves	6,38	0,6	10,5	3,43
bunch	2,13	0,26	4,53	0,1
Total	9,46	1,03	17,6	4,2

2.5.2. Organic fertilisation strategies

These values for nutrient depletion and fertilisation are given from a viewpoint of conventional plantation systems. They are not capable of solving the problems of decreasing yield and soil fertility. The majority of banana varieties cultivated for export purposes require a high soil quality. In natural forest ecosystems, they appear towards the beginning of the new growth, and must be replaced by other species about every 10-15 years. If this is not carried out on the plantation, then sooner or later a crisis will occur, which can only be solved in the short term by applying fertilisers and pesticides.

Regular application of organic material gained from cutting work helps to maintain a layer of humus and activity in the soil. This includes adding dead leaves and pseudo-stems grown on the plantation as mulching material. It is important that the material is spread evenly throughout the entire plantation. Organic manure should only be seen as an additional fertiliser, and not as the main source of nutrients for the bananas. These measures will suffice to maintain the fertility of the soil on sites suited to growing bananas, despite continual harvests.

2.6. Biological methods of plant protection

2.6.1. Diseases

The most important diseases in conventional banana plantations are:

- Panama disease (*Fusarium oxisporum* f. sp. *Cubense*)
- Black and yellow Sigatoka disease (*Mycosphaerella musicola*, (*Mycospheerella fijiensis*)
- Root rot (*Poria* sp., *Pytium* sp., *Armillaria mellea*, *Rhizoctonia solani*)
- Bacterial rot (*Pseudomonas solanacearum*)
- Rhizome rot (*Erwinia carotovora*)

⁴ BOUFFIL, in Franke, G. (1984): Nutzpflanzen der Tropen und Subtropen, Hirzel Verlag Leipzig.

- Virus diseases (Mosaic virus, banana bunchy top virus, infectious chlorosis etc.)

The above mentioned diseases occur mainly in conventional plantation systems, and are combated by using resistant varieties (Cavendish instead of Gros Michel), or in conventional farms by spraying with mineral oil and fungicide by aeroplane. In organic plantation systems these phytosanitary problems must be prevented by cultivation methods and also the use of resistant plants (compare 2.7.).

2.6.2. Pests

The most important pests also occur mainly on monoculture plantations, these are:

- Root nematodes
- Banana root borer (*Cosmopolites sordidus*)

The exclusive use of healthy seeds, and application of appropriate measures, offer the most effective preventative and thus alternative methods of controlling insects and nematodes (comp. 2.7.). The application of waste from extensive shrimp farms in Ecuador (shrimp shells) has shown good results against nematodes beside being a good organic fertilizer.

In conventional plantations, the bunches are often protected by covering them with polyethylene sacks. When protective bags are used in organic systems, the following must be heeded: That the insides are pesticide-free (quite normal on conventional plantations), and that the plastic coverings are bio-degradable.

2.7. Monitoring and Maintenance

2.7.1. Crop Establishment

Around 4-6 months after the bananas and additional crops have been planted, a primary selective weed regulation should be performed. The actual time depends largely on the type of additional crops (annual crops, annual or biannual under seeds), and also from the preliminary condition of the plot. Strong growths of Gramineae and Cyperaceae will occur in soils already degraded. These should be pulled up, and exchanged for seeds of the *Canavalis ensiformis*, *Crotalaria ssp.* or other similar under seeds from non-creeping plants. Foliage regulation consists in the main of cutting back the blossoms and removing grasses, as mentioned above, which are both then left on the surface as mulching material.

Surplus shoots need to be regularly cut away from the planted bananas. Three shoots should be left, which can then grow until they are ripe. Thereafter, only one shoot is left remaining, so that after one year three times the density has been achieved, which is then maintained.

The accompanying vegetation (bushes and trees which can be cut) is cut back, and the resulting material chopped up and spread around the surface as mulching material. This should be carried out once or twice a year, according to growth. This cutting regulation results in a continual supply of organic material in varying consistency, and also increases the amount of available light, thus stimulating new growth.

Trees which cast no foliage (e.g.. *Inga ssp*, *Glyricidia sepium*, *Leucaena leucocephala*), should be cut back at the banana plant's height once a year, so that around 15% of their leaves remain. Depending on which variety of bananas have been planted, more or less shade can then be controlled. The tall varieties such as Red, Green Red (manzano, manzano rojo) and Giant Cavendish belong to those that can cope with a lot of shade, whereas Dwarf Cavendish requires less.

2.7.2. Crop production

After around one to two years, usually no weeding activities are necessary, and pruning remains as the main work. In addition to regularly removing the shoots, the inactive leaves should also be cut away (these usually hang bent downwards). In the course of time, the plantation will tend to "wander", in that the original gaps between the plants change. This means that it may be necessary to remove plants that now stand too close to one another. Depending on the initial situation at the site and the type of plantation, the production of bananas is lessened by the gradual coverage of accompanying vegetation. If the plantation has been established with additional economically interesting crops, then these can continue to be harvested. If there is no relevant alternative to the banana production, then the plantation can be cleared, and newly planted. In the latter case, the farmer now has soil with an improved fertility.

2.8. Harvesting and post- harvest treatment

2.8.1. Harvesting

Harvesting the banana bunches is usually spread evenly throughout the whole year. A slowing down in production, or even cessation, only generally occurs at sites which experience either a noticeable drop in temperature during the winter months, or distinctive dry periods.

Whilst still green, the fruits have a distinctly edged appearance, which gradually becomes almost round as they ripen. The fruits of a bunch do not ripen at the same pace. If some fruits have begun to turn yellow on the plant, then it is already too late to transport them any great distance, as they quickly become too soft and burst. The bananas must therefore be harvested while still green. The optimal cutting stage is established by the diameter of individual fruits. To simplify the harvest, the bushes are marked with different coloured bands as the fruits appear. The workers will then only cut bananas of a particular colour, which are now ripe enough. Terms which characterise the thickness of the fruit, such as "three-quarters", "light full three-quarters", "full three quarters" and "full", are also used. The duration of a proposed transport determines in which stage a fruit destined for export is judged to be ripe.

In order to achieve a uniform ripeness during shipping, the maturity stage of an entire bunch should be as consistent as possible. Harvests are therefore usually carried out at one to two week intervals.

The bunches are harvested by cutting them away from the plant just above where the fruit begins. The tall varieties must also be freed of their pseudo-stems, which are bent back and cut off, in order that the bunches become visible. Thereby, it is very important that the bunches do not fall, or are otherwise bumped during shipping, as this causes them to blacken and rot.

It is advisable to leave behind a ca. 2 m high stub (depending on the variety) of the pseudo-stem, because nutrients and water are still transported to the remaining shoots for several weeks, and thereby encouraged in their development. The cut away part of the pseudo-stem is lain with the cut side facing downwards directly next to the neighbouring trees. This type of mulching prevents a damaging anaerobe oxidation by butyric acid bacteria inside the stalk, and encourages an intensive stimulation of the soil flora. The remains of the stalk are then cut off at the base during the next bout of maintenance work, and also lain on the ground. The large surface of the banana leaves should be trimmed away along the petiole and chopped up, in order that the secondary vegetation be allowed to develop.

2.8.2. Preparation, transport and storage

On large plantations, the harvested clusters are transported to distant packaging sites by fastening them down with ropes, or hanging them from the lorries to avoid bruising. Once there, the clusters are prepared by cutting away any badly formed fruits at their tops and base. Any leaking milk which drops onto the fruit will cause it to blacken during ripening and sale will be impossible. This can be avoided when the individual, separated bunches are washed in cold water, where they can be drained.

Conventionally, the fruit is washed with disinfectant (Na-Bisulfite, Na-Hypochlorite) and/or treated in a fungicide bath.

The use of fungicides is out of the question on organic plantations. Either alum salt (potassium alum) or extracts from lemons or orange pips (kernels) can be used to disinfect. So called crown rot (*Colletotrichum musae*) can be prevented by wetting the cut with vinegar.

The cleansing water that collects at preparation sites contains many organic compounds, and must therefore be biologically treated before allowing it to flow into a drainage ditch. Organic material that collects during preparation (e.g. unusable, damaged fruits) should be composted and returned to the soil.

The ratio of harvested to exportable fruits is between 1 : 1 and 1 : 1.7 , whereby the latter is more usual.

The individual bunches are packaged in cartons of 12 kg or 20 kg (Costa Rica), which are lined with polyethylene foil. Cooling equipment must then be used to delay the ripening process during shipping. Optimum temperatures are dependant on the

variety, and vary between 12-15°C. At too low temperatures, frost damage can occur, such as lack of ripening, production of tannins, discolouring of the skins, inhibition of starch transformation as well as an increased production of ascorbic acid. An additional delay in the ripening process can be achieved by increasing the CO₂ content and reducing the O₂ content of the storage room atmosphere during shipping.

2.8.3. Controlled ripening

Special warehouses must be available at the destination port (ripening plant), in order to subject the fruits to a controlled ripening process. This takes place at about 20°C and at an atmospheric concentration of 0,1% ethylene. The use of ethylene to accelerate the ripening process, as well as the use of kalinite to delay the ripening of bananas is allowed in the EEC-regulation for organic agriculture (EEC) 2092/91.

3. Product specifications and quality standards

3.1. Processing

3.1.1. Handling

The banana is the most commonly cultivated tropical fruit. It is used in many areas, in the form of plantains, horse bananas, common eating bananas and fibrous bananas. They can be turned into dried products, such as flour, starch, powder, flakes, chips, and dried fruit, as well as pulp, concentrate, juice and dried fruit or wine, spirits and liquor. A whole range of eating banana varieties in particular are exported fresh.

It is recommended to harvest bananas for the export market whilst they are still green. After harvesting, the 30-45 kg heavy clusters are washed, whereby thyme extract can be added to the water to aid disinfecting. After drying, the bundles ("bunches") are separated, sorted, classified, packed in standard cartons of 12 kg or 18 kg and placed into cold storage.

- ◆ The EU quality standards for Bananas are shown in the Annex.

3.1.2. Packaging and storage

Packaging

The regulations concerning carton labelling were dealt with in section VI of the 'EU quality standards for bananas'.

Storage

Unripe, originally bananas can be shipped within 10-14 days by boat at 14-15°C and 90-95% relative humidity. The final ripening process takes place in special banana ripening plants, at temperatures from 14.5-18 °C and lasts 4-8 days.

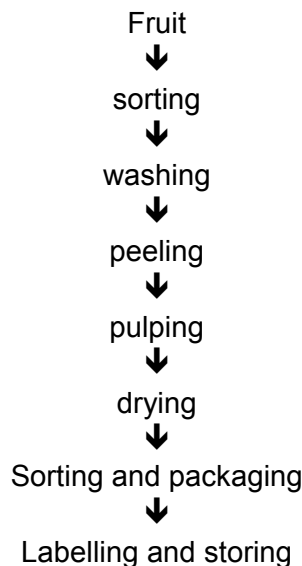
Bananas cannot be stored for long. They can be stored for up to 10 days at 13-15°C and 90% relative humidity, just prior to being ripe enough to eat.

3.2. Dried bananas

3.2.1. Processing

Drying is the oldest method of making food storable for longer periods. It is based on the fact that micro-organisms tend to cease growing below a certain level of water content. During drying, it is important to extract the water from the fruit as carefully as possible. The most important features are a good circulation of air and not too high temperatures

The preparation stages from fresh to dried fruit are outlined and then described more fully below:



Sorting

After harvesting, the fruits are sorted as only fresh, unripe and not fermented fruits can be used for drying.

Washing and peeling

Bananas must be washed very carefully, in order not to damage them. Afterwards, inedible parts such as leaves, seeds, pips, heartwood and skins are removed.

Pulping and drying the fruits

The fruits are now cut into same-sized pieces, and laid out to dry in the air and sun in thin layers on racks, in solar dryers (drying tunnels) or drying ovens (artificial drying at 70°C).

Sorting and packaging

Before they are packed, the fruits are inspected and sorted again, to rid them of discoloured, skin remnants and seeds etc..

Labelling and storage

The packaged fruits can now be labelled and stored prior to being shipped. During and after drying, the dried fruits are not permitted to be treated with methyl bromide, ethylene oxide, sulphur oxides or with ionising radiation.

3.2.2. Quality requirements

The following is a list of quality characteristics with minimum and maximum values for dried fruits, 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, aromatic, fresh, not mouldy
Cleanliness	Free from foreign particles, such as insects, sand, small stones etc.
Water content	max. 18 %
aw-value	0.55 to 0.65 (at 20 °C)
Residues	
Pesticides	Not measurable
Sulphur oxide	Not measurable
Bromide and ethylene oxide	Not measurable
Micro-organisms	
Total number of parts	max. 10,000/g
Yeasts	max. 10/g
Mould fungus	max. 10/g
Staphylococcus aureus	max. 10/g
Coliforms	max. 1/g
Escherichia coli	Not measurable in 0.01 g
Enterococci	Not measurable in 1 g
Salmonella	Not measurable in 20 g
Mycotoxins	
Staphylococcus enterotoxin	Not measurable
Aflatoxin B1	max. 2 µg/kg
Total aflatoxins B1, B2, G1, G2	max. 4 µg/kg
Patulin	max. 50 µg/kg
Heavy metals	
Lead (Pb)	max. 1.25 mg/kg
Cadmium (Cd)	max. 0.125 mg/kg
Mercury (Hg)	max. 0.10 mg/kg

In order that the quality requirements are upheld, and no contamination of the fruits 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 garments.

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 in the open, then fences must be erected to guard the racks against birds and nearby animals.

3.2.3. Packaging and storage

Details given on packaging

The label on the jar must display the following:

- ◆ Packaging types and material

In order to be exported to Europe, the dried fruits can be packed in consumer packs, or wholesaler packs (bulk) in bags made of foils, impermeable to steam (e.g. polyethylene or polypropylene). Before sealing, a gas (e.g. nitrogen) may be added (nitrogen flushing).

- ◆ Details given on packaging

If the dried fruits are packed directly for consumers, then the following details must be included on the outside of the packets:

- ◆ Product name ('trade name')

The name of the product, e.g. organically grown dried banana slices ⁵

Manufacturer

- ◆ Name and address of the manufacturer, importer, exporter or trader within the country of origin, and which country.

- ◆ List of contents

A list of ingredients and additions, beginning with the heaviest proportion of total weight at the time of packaging.

- ◆ Weight

Details of the total packed weight in gram

⁵ 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 plantation must be recognisably declared as such.

The numbers describing the weight of the contents must be of the following sizes

Weight of contents	Letter size
Less than 50 g	2 mm
More than 50 g to 200 g	3 mm
More than 200 g to 1000 g	4 mm
More than 1000 g	6 mm

◆ Best before date

The 'Best before ...' details must include day, month and year; e.g.. best before 30.11.2001

◆ Batch number

Function of the product packaging

The product packaging should fulfil the following functions:

Protect it 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.

Transport packaging

Some form of transport packaging is required in order to ship the bulk or singly packed fruits. 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 notice of the organic nature of the product⁶

⁶ When products from organic plantations are being labelled as such, it is necessary to adhere to the requisite government regulations of the importing country. Information concerning this is available from

Storage

The dried fruits should be stored in dark areas at low temperatures and relative humidity.

Under optimum conditions, dried fruits can be stored for up to 1 year.

If the organic product is being stored in a single warehouse together with conventional bananas 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)

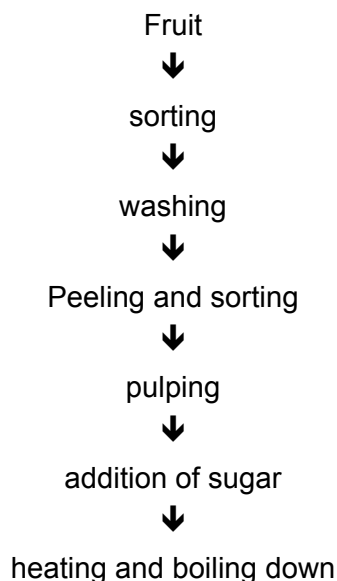
It is prohibited to carry out chemical storage measures (e.g. gassing with methyl bromide) in mixed storage spaces. Wherever possible, storing both organic and conventional products together in the same warehouse should be avoided.

3.3. Banana marmalades

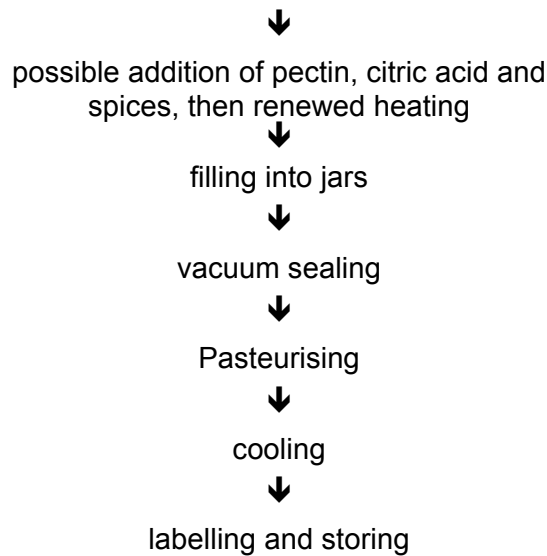
3.3.1. Processing

Jams are basically preparations made of fruit (jams) and various sugars that are made conservable mainly by heat treatment (boil down). The half-set yet spread able consistency of these products is achieved by releasing the pectin found in the fruit pulp during the boiling process, and using this together with further pectin added to form a jelly-like mass.

The preparation stages from fresh fruit to jam are outlined and then described more fully below:



the appropriate certification body. The regulation for organic agriculture (EEC) 2092/91 is applicable to organic products being imported into Europe.



Sorting

After harvesting, the fruits are sorted, because only those that are fresh, ripe and not rotten can be used to make jams. Jams can also be made from previously prepared, frozen fruits and pulp.

Washing

The fruit should be washed very carefully as it can easily be damaged.

Peeling and sorting

This follows the procedure of removing leaves, wooden pieces, pips or seeds and peel. Peeling is often done manually, or with knives, yet sometimes the skin is loosened with steam and then subsequently rubbed away mechanically. Finally, the fruits are sorted again to remove any blackened pieces, bits of peeling seeds etc.

Pulping and adding sugar

The peeled fruits are then pulped, and sugar added. They might also be mixed with water or fruit juice. To make jam, at least 350 g fruit per 1000 g finished product must be used; to make jam extra, at least 450 g fruit per 1000 g finished product must be used. The sugar must be ecologically grown.

Description	Fruit content during manufacture
Jam, extra	450 g fruit per 1000 g product
Jam	350 g fruit per 1000 g product

Heating and boiling

The mixture is now heated to 70-80°C and boiled down, while constantly being stirred, at 65°C until shortly before it reaches the desired consistency.

Adding citric acid, pectin and spices (optional)

If necessary or desired, citric acid, pectin and spices (from certified organic production) can be added, and the mixture again briefly heated to 80°C.

Filling into jars, vacuum-sealing and Pasteurising

The liquid mass is now poured into jars, vacuum-sealed and pasteurised.

Cooling, labelling and storage

After the heating process, the jams are first cooled to 40°C, and then subsequently down to storage temperature, labelled, and finally stored.

3.3.2. Quality requirements

In addition to the previously mentioned quality requirements, such as clearly defined fruit content, the jams also have to conform to the following specifications. These quality requirements, with their minimum and maximum values, are generally issued by the authorities or importers. Yet agreements may be reached between individual manufacturers and importers upon different values, providing they still conform to official requirements.

Quality requirements	Minimum and maximum values
Smell and taste	Variety-specific, aromatic
Cleanliness	Free of foreign substances such as peel, stalks etc.
Contents of jam extra	Min. 450 g per 1000 g product
Contents of jam	min. 350 g per 1000 g product
Soluble dry mass in percent (measured refractometrically)	min. 60 %
Mycotoxins	
Aflatoxin B1	max. 2 µg/kg
Total aflatoxins B1, B2, G1, G2	max. 4 µg/kg
Patulin	max. 50 µg/kg
Residues	
Pesticides	Not measurable
Sulphur oxide	Not measurable
Bromide	Not measurable
Ethylene oxide	Not measurable

In order to conform to the quality requirements, and to prevent the fruit becoming contaminated, all preparations must be carried out under clean, hygienic and acceptable conditions. The following aspects must be heeded:

- Equipment (tubs, knives etc.), as well as working surfaces (tables 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 over garments.
- Water used for cleansing purposes must be free from faeces and other contaminants.
- Animals or animal faeces must not come into contact with the processed fruits.

3.3.3. Packaging and storage

Packaging types and material

In order to be exported to Europe, the jams are usually filled into consumer-size jars with twist-off lids.

Details given on packaging

The label on the jar must display the following:

- ◆ Product name ('Trade name')

The name of the product, consisting of: Name of the fruit with or without the description extra – according to fruit content; e.g.: Banana jam extra, organically grown⁷

- ◆ Manufacturer

Name and address of the manufacturer, importer, exporter or product trader, plus country of origin.

- ◆ List of contents

A list of ingredients and additives in the jam, beginning with the heaviest proportion of total weight at the time of packaging

- ◆ Details of the total sugar content

Total sugar content per 100 g product (measured refractometrically at 20 °C) must be represented with the words "Total sugar contentg per 100 g". e.g.: Total sugar content 55 g per 100 g.

- ◆ Details of fruit content

The fruit content per 100 g product must be given with the words "manufactured from....g fruit per 100 g". E.g.: manufactured from 45 g fruit per 100 g.

- ◆ Notice about cooling

The notice about storing the product in a cool place must be given with the words: "After opening, store in a cool place".

- ◆ Weight

Details of the total weight in grams

- ◆ Best before date

The 'Best before ...' details must include day, month and year; e.g.. best before 30.11.2001

⁷ Compare footnote No. 5

- ◆ Batch number

Transport packaging

A form of transport packaging is required to ship the sales packages. In choosing them, the following aspects 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 notice of the organic nature of the product⁸

Storage

The jams should be stored in a dark, cool room at temperatures of max. 15°C. Under optimum conditions, jam may be stored for 1-2 years.

If the organic product is being stored in a single warehouse together with conventional banana jam 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.

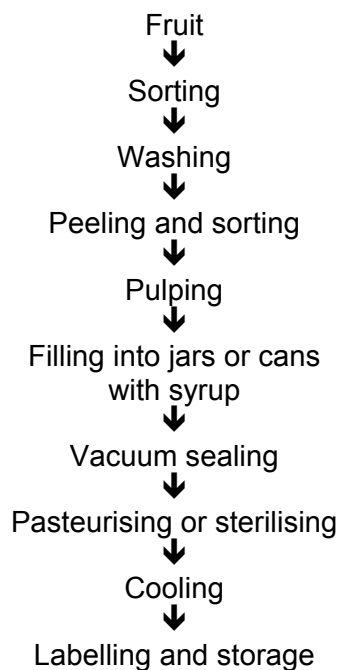
⁸ compare footnote No. 6

3.4. Canned bananas

3.4.1. Processing

Canned foods are products that can be stored over a long period in airtight containers (metal or glass jars). They are preserved mainly by heat treatment, during which the micro-organisms present in the fruit are significantly reduced in number, or their development so restricted, that they are prevented from spoiling the product.

The process involved in turning fresh fruit into canned products is described schematically, and then in more detail below:



Sorting

After harvesting, the fruits are sorted, because only those that are fresh, ripe and not rotten can be used to make jams. Jams can also be made from previously prepared, frozen fruits and pulp.

Washing

The fruit should be washed very carefully as it can easily be damaged.

Peeling and sorting

This follows the procedure of removing leaves, wooden pieces, pips or seeds and peel. Peeling is often done manually, or with knives, yet sometimes the skin is loosened with steam and then subsequently rubbed away mechanically. Finally, the fruits are sorted again to remove any blackened pieces, bits of peeling seeds etc.

Pulping

The peeled fruit can be cut into a variety of shapes, according to type (indicated by the crosses in the table). The shape of the cut fruit must be given on the can (slices, diced, pieces etc.).

Description	Cut shape	Pine-apple	Mango	Papaia	Ba-nana
Whole fruit	Peeled				X
Slices	Slices of fruit cut into approximately the same size	X	X	X	X
Half slices	Uniformly cut, semi-circle shaped slices.	X			
Diced	Fruit cut into dice shapes of roughly the same size.	X	X	X	
Balls	Fruit pulp pieces cut into roughly ball shapes		X		
Pieces	Pieces of fruit cut into irregular shapes	X			
Grated	Irregular thin strips and pieces of fruit	X			
Chunks	Large regularly cut pieces of pineapple	X			
Titbits	Trapeze-shaped segments of pineapple	X			

Filling in jars or cans

The cut pieces are now filled into jars or cans and covered with syrup. Additional information must be given on the can according to the sugar content of the syrup.

Sugar concentration* of the syrup	Description on the can
9-14 %	Very lightly sugared
14-17 %	Lightly sugared
17-20 %	Sugared
over 20 %	Strongly sugared

* The sugar must be organically grown.

If the appropriate fruit juice has been used as syrup then "...in natural juice" must be included on the label, e.g.: Organically grown bananas in natural juice.

Vacuum sealing, pasteurising or sterilising

After the jars or cans have been vacuum sealed, they are either pasteurised (temperatures above 80°C) or sterilised (temperatures above 100°C).

Cooling

After the heating process, the canned fruits are first cooled to 40°C, and then subsequently down to storage temperature.

Labelling and storage

After they have been cooled, the canned fruits are labelled and stored.

3.4.2. Quality requirements

In addition to the previously listed quality requirements, such as clearly defined sugar concentrations of the syrup and shapes specific to certain fruits, the contents should also conform to the following characteristics. These quality requirements, with their minimum and maximum values, are generally issued by the authorities or importers. Yet agreements may be reached between individual manufacturers and importers upon different values, providing they still conform to official requirements.

Quality requirements	Minimum and maximum values
Taste and smell	Variety-specific, aromatic, not mouldy
Cleanliness	Free of foreign substances such as peel, stalks etc.
Mycotoxins	
Aflatoxins B1	max. 2 µg/kg
Total aflatoxines B1, B2, G1, G2	max. 4 µg/kg
Patulin	max. 50 µg/kg
Residue	
Pesticide	Not measurable
Sulphur oxide	Not measurable
Bromide	Not measurable
Ethylene oxide	Not measurable

In order to conform to the quality requirements, and to prevent the fruit becoming contaminated, all preparations must be carried out under clean, hygienic and acceptable conditions. The following aspects must be heeded:

Equipment (tubs, knives etc.), as well as working surfaces (tables 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 garments.

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

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

3.4.3. Packaging and storage

Packaging type and material

In order to be exported to Europe, the fruits can be packed into single or wholesale packages (bulk) made of glass, aluminium or tin cans.

Details given on packaging

The label on the jar must display the following:

- ◆ Product name ('Trade name')

The name of the product, consisting of: Name of the fruit with or without the description extra – according to fruit content; e.g.: Bananas in slices, lightly sugared, organically grown⁹

- ◆ Manufacturer

Name and address of the manufacturer, importer, exporter or product trader, plus country of origin.

- ◆ List of contents

A list of ingredients and additives in the jam, beginning with the heaviest proportion of total weight at the time of packaging

- ◆ Weight

Total and dry weight of the fruit

The numbers describing the weight of the contents must be of the following sizes

Weight of contents	Letter size
Less than 50 g	2 mm
More than 50 g to 200 g	3 mm
More than 200 g to 1000 g	4 mm
More than 1000 g	6 mm

- ◆ Best before date

The 'Best before ...' details must include day, month and year

- ◆ Batch number

Transport packaging

A form of transport packaging is required to ship the packages. In choosing them, the following aspects 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

⁹ compare footnote No. 5

- ◆ Batch number
- ◆ Destination, with the trader's/importer's address
- ◆ Visible notice of the organic nature of the product¹⁰

Storage

The conserved fruit (especially in jars) should be stored in dark rooms at low temperatures (max. 15°C). Under optimum conditions, conserved fruit can be stored for 1 year (when pasteurised) or 2 years (when sterilised).

If the organic product is being stored in a single warehouse together with conventional bananas 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.

3.5. Banana pulp

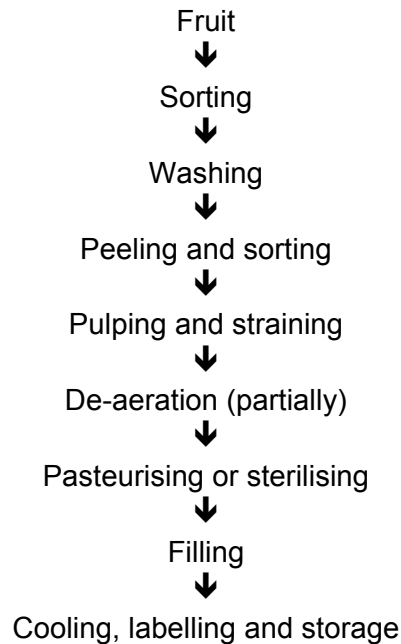
3.5.1. Processing

Canned foods are products that can be stored over a long period in airtight containers (metal or glass jars). They are preserved mainly by heat treatment, during which the micro-organisms present in the fruit are significantly reduced in number, or their development so restricted, that they are prevented from spoiling the product.

The process involved in turning fresh fruit into canned products is described schematically, and then in more detail below:

¹⁰ compare footnote No. 6

Banana pulp processing:



Manufacturing banana pulp

In producing pulp, only fresh, ripe fruit should be used, that has not yet turned mouldy. The skin of fully ripened bananas is entirely yellow, and easy to peel from the fruit. After harvesting, the fruit are first sorted and washed, before being peeled by hand and placed directly in a solution of 4% citric acid and 1% ascorbic acid, to prevent discolouring.

Afterwards, the fruits are placed in a heat exchanger, where they are heated to a temperature of 93° C in order to deactivate any enzymes, and to break down the fruit

pulp. The pulp then passes through a two-stage sieve equipped with a 0.8 mm and a 0.5 mm screen. After de-aeration, the pulp is homogenised at a pressure of 100-300 bar and sterilised for 40-45 seconds at 100° C.

The banana pulp can now be filled into tin cans whilst still hot, whereby the cans are sealed while being steamed, the temperature maintained for 5 min., and then rapidly cooled down. At temperatures of around 15° C, the pulp can be stored for up to 1 year. After pasteurising, the pulp can also be cooled down and filled into polyethylene bags placed in 50-200 kg barrels. It is then rapidly frozen, and can be stored at -18° C for 18 months. Pulp which has been filled under antiseptic conditions (bag-in-box) can be stored for up to 1 year at room temperature.

3.5.2. Quality requirements

These quality requirements, with their minimum and maximum values, are generally issued by the authorities or importers. Yet agreements may be reached between

individual manufacturers and importers upon different values, providing they still conform to official requirements.

Quality requirements	MINIMUM AND MAXIMUM VALUES
Smell and taste	Variety-specific, aromatic
Cleanliness	Free of foreign substances such as peel, stalks etc.
Relative density (20/20) for pineapple juice	min 1.045
Brix value ¹¹ for pineapple juice	min 11.2 %
Relative density (20/20) for Banana pulp	min 1.083
Brix value for Banana pulp	min 20.0 %
Relative density (20/20) for Mango pulp	min 1.057
Brix value for Mango pulp	min 14.0 %
Ethanol	max 3.0 g/kg
Volatile acids, evaluated as acetic acid	max 0.4 g/kg
Lactic acid	max 0.5 g/kg
D-Malic acid	Not measurable
Sulphuric acid	Not measurable
Hydroxymethylfurfural (HMF)	max 20 mg/kg
Heavy metals	
Arsenic (As)	max 0.1 mg/kg
Lead (Pb)	max 0.2 mg/kg
Copper (Cu)	max 5.0 mg/kg
Zinc (Zn)	max 5.0 mg/kg
Iron (Fe)	max 5.0 mg/kg
Tin (Sn)	max 1.0 mg/kg
Mercury (Hg)	max 0.01 mg/kg
Cadmium (Cd)	max 0.02 mg/kg
Residues	
Pesticide	Not measurable
Sulphur oxide	Not measurable
Bromide	Not measurable
Ethylene oxide	Not measurable
Mycotoxins	
Aflatoxin B1	max 2 µg/kg
Total aflatoxins B1, B2, G1, G2	max 4 µg/kg
Patulin	max 50 µg/kg

¹¹ A Brix value is the measure of the concentration of sugars, acids, and other identifying compounds in a juice. Every fruit juice has a slightly different Brix value.

In order to conform to the quality requirements, and to prevent the fruit becoming contaminated, all preparations must be carried out under clean, hygienic and acceptable conditions. The following aspects must be heeded:

- Equipment (tubs, knives etc.), as well as working surfaces (tables 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 over garments.
- Water used for cleansing purposes must be free from faeces and other contaminants.
- Animals or animal faeces must not come into contact with the processed fruits.

3.5.3. Packaging and storage

◆ Packaging type and material

In order to be exported to Europe, the pulp/juices can be packed into single or wholesale packages (bulk) consisting of glass jars, tin cans or polyethylene or polypropylene bags, and also filled antiseptically into 'bag-in-boxes'.

◆ Details given on packaging

The label on the jar must display the following:

◆ Product name ('Trade name')

The name of the product, e.g.: Organic banana pulp¹²

◆ Manufacturer

Name and address of the manufacturer, importer, exporter or product trader, plus country of origin.

◆ List of contents

A list of ingredients and additives, beginning with the heaviest proportion of total weight at the time of packaging, e.g.: bananas, citric acid...

◆ Weight

Total weight

The numbers describing the weight of the contents must be of the following sizes

Weight of contents	Letter size
Less than 50 g	2 mm
More than 50 g to 200 g	3 mm
More than 200 g to 1000 g	4 mm
More than 1000 g	6 mm

◆ Best before date

The 'Best before ...' details must include day, month and year; e.g.. best before 30.11.2001

◆ Batch number

¹² compare footnote No. 5

Transport packaging

A form of transport packaging is required to ship the sales packages. In choosing them, the following aspects 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 notice of the organic nature of the product¹³

Storage

Pasteurised pineapple juice, as well as pasteurised banana, mango and papaya pulp can be stored as follows:

Packaging material/ storage temperature	Pineapple- juice	Banana- pulp	Mango- pulp	Papaya- pulp
Tin cans/glass jars storage temperature below 15°C	1 year	1 year	1 year	9-12 months
Polyethylene bags/ Deep frozen at -18°C	-	18 months	18 months	12 months
Filled antiseptically, bag-in-box/ Room temperature	1 year	1 year	1 year	6-9 months

If the organic product is being stored in a single warehouse together with conventional banana pulp 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)

¹³ compare footnote No. 6

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.

Annex: Quality Requirements

The 'EU quality standard for bananas' clearly defines the quality requirements placed upon trade with fresh bananas. The regulations must be strictly adhered to until the fruit reaches the ripening plants.

The following is an excerpt from the 'EU quality standard for bananas':

I. Definition

The standards apply to bananas of the following listed varieties of the genus *Musa* (AAA) *ssp.*, subgroups Cavendish and Gros Michel, to be transported in a fresh state to consumers. Flour bananas and Fig bananas, as well as bananas intended for industrial processing are not included.

Group	Subgroup	Main variety
AAA	Cavendish	Petite naine (Dwarf Cavendish) Grande naine (Giant Cavendish) Lacatan Poyo (Robusta) Williams Americani Valéry Arvis
	Gros Michel	Gros Michel Highgate

II. Quality characteristics regulations

The standard regulates the quality characteristics that green, unripe bananas must exhibit after packing and processing.

a. Minimum characteristics

Subject to the pertinent regulations and tolerances for each class, the bananas in all quality classes must be configured as follows:

- ◆ green, unripe
 - ◆ whole, firm
 - ◆ clean, practically free of visible foreign matter
 - ◆ practically free of pests and the damage caused by them
- with a unbroken, intact stalk which is not dried out and is free of fungus
- ◆ the fruit must not be misshapen, and not abnormally bent
 - ◆ free of bruising and frost damage
 - ◆ free of strange smells and/or taste

Furthermore, the bunches or clusters must also have:

- ◆ a sufficient, healthy length of normally-coloured coronet, free of fungus

- ◆ a clean cut of the coronet, without evidence of nicks or tearing

The development and ripeness of the fruit must be so that they:

- ◆ can withstand handling and transporting
- ◆ are in a satisfactory condition when they arrive at the port, and will achieve a reasonable state of ripeness after ripening has taken place.

b. Classifications

- ◆ Class extra

Bananas in this class must be of the highest quality. They must possess the characteristics typical of their variety and/or trading type.

The fruits must be unblemished, with the exception of very light surface flaws that cover less than 1 cm² of the fruit's surface, and providing this does not detract from the fruit's general appearance, quality, the time it will keep and the presentation of the bunch or cluster in their packaging.

- ◆ Class I

Bananas in this class must be of good quality. They must possess the characteristics typical of their variety and/or trading type. The following blemishes are permissible, providing they do not detract from the fruit's general appearance, quality, the time it will keep and the presentation of the bunch or cluster in their packaging:

- Slightly misshapen
- Light flaws in the skin caused by friction or by other means, providing the area does not exceed 2 cm² of the total surface area of the fruit.

- ◆ Class II

This class is composed of those bananas that cannot be placed in the upper classes, yet which fulfil the definitions of minimum requirements. The following faults are allowed, providing the bananas retain their essential characteristics in terms of quality, preserve ability and presentation:

- Shape defects,
- Skin flaws, caused by scratches, friction or other means, providing the less than 4 cm² of the total surface is affected.

The flaws are not permitted to affect the fruit's pulp.

III. Size classification regulations

Size classification is performed according to:

- ◆ The length of the fruit in cm measured along the outer curve from the stem to the blossom end.
- ◆ The thickness in mm, measured as the diameter of the middle, cutting across its longitudinal axis.

Size classification of a reference fruit is carried out by measuring the length and thickness

- Of the outer, middle fruit of a bunch
- Of the first fruit of a outer row of a cluster, next to the cut that separated the bunch.

The length must be at least 14 cm and the thickness at least 27 mm.

Deviations to the previous paragraph are allowed in the following regions: Madeira, Azores, Algarve, Crete and Laconia, where bananas measuring less than 14 cm may still be marketed within the union, providing they are classified as class II fruits.

IV. Tolerance regulations

Not dealt with here.

V. Presentation regulations

a. Uniformity

The contents of a carton must be uniform, and may only contain bananas of identical origin, variety and/or trade type, and quality.

The visible part of the carton must be representative of the entire contents.

b. Packaging

The bananas must be packed in a way that ensures they are sufficiently protected. Packing material used inside the carton must be new, clean, and so shaped that it cannot cause any damage to either the inside or outside of the fruit. The usage of materials such as papers and stickers with company details on them is permitted providing the no toxic inks, dyes or glues have been used.

The packaging must be free of all other materials.

c. Presentation

Presentation is in bunches comprising at least 4 fruits.

Clusters with a maximum of two fruits missing are permitted when the stalks have been cleanly cut off, and not torn, leaving the other fruits unharmed.

A maximum of one cluster with three fingers is permitted in each row, providing it conforms to the characteristics of the other fruits in the carton.

VI. Regulations of carton labelling

Each carton must display the following details in unbroken, legible, permanent letters visible from the outside:

a. Identification

Name and address of the packer

b. Type of product

'Bananas', when the contents are not visible

Name of the variety

c. Origin of product

Country of origin, and optionally, national, regional or local description

d. Commercial characteristics

- ◆ Class
- ◆ Net weight
- ◆ Size, depicted as the minimum and (optionally) maximum length

e. Official stamp

(optional)

The following characteristics are not laid down in the 'EU quality standards for bananas', but should nevertheless be adhered to:

Quality characteristics	Minimum and maximum values
Heavy metals	
lead (Pb)	max. 0.50 mg/kg
Cadmium (Cd)	max. 0.05 mg/kg
Mercury (Hg)	max. 0.03 mg/kg
Residues	
Pesticides	not measurable
Sulphur oxide	not measurable
Bromide	not measurable
Ethylene oxide	not measurable