

Organic Farming in the Tropics and Subtropics

Exemplary Description of 20 Crops

Hibiscus



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Naturland would like mention the following authors and thank them for their contributions:

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

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

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

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

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

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

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

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

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Organic Hibiscus Cultivation

(other names: Florida cranberry, Malva, Roselle)

1. Introduction

1.1. Botany

Hibiscus spp. belongs to the superorder Malvaceae. They originate either in Angola and/or Sudan, although definitely in East Africa. Many different varieties exist, whereby *H. sabdariffa var. sabdariffa* are cultivated to be consumed as vegetables and tea, whereas other hibiscus varieties are planted for the fibres they produce.

Hibiscus sabdariffa grows in bush-form, with branches that point upwards, and smaller twigs; the plant is annual or biennial and is classed as a pioneer plant. Depending on the cultivation conditions at the site, and the time of sowing, the plants can reach heights between 1 m and 3 m. They are generally self-fertilising, meaning that own selections (dark colour, little hair) can be created.

1.2. Varieties and countries of origin

The main producers of hibiscus blossoms are Egypt, Sudan, Mexico, Thailand and China. Organic hibiscus cultivation is also currently practised in Egypt, Tanzania, Mexico and Bolivia.

1.3. Uses and contents

Consumable parts include the dried calyxes and corollas, which are then harvested. They are traded as either whole or cut dried calyxes, and described as hibiscus blossoms. Main varieties, along with *Hibiscus sabdariffa*, are *H. cannabinus* (Kenaf) which is cultivated for its fibres, as well as *H. esculentus* (okra, ladyfinger) which is used as a vegetable.

Its acid content of 15-30 % (among others citric, malic acid, tartaric acid, hibiscin) lend hibiscus tea (also sold as malvern tea) its pleasantly tart taste. The wine-red colour is due to an anthocyanin content of around 1.5%.

	calyxes	seeds	leaves
Protein [g]	2.0	28.9	3.5
carbohydrates [g]	10.2	25.5	8.7
Fat [g]	0.1	21.4	0.3
Vitamin A I.E.	-	-	1000
Thiamine [mg]	0.05	0.1	0.2
Riboflavin [mg]	0.07	0.15	0.4
Niacin [mg]	0.06	1.5	1.4
Vitamin C [mg]	17	-	2.3
Calcium [mg]	150	350	240
iron [mg]	3.0	-	5.0

The fleshy calyxes are eaten raw as fruit, boiled or dried as a tea, whereby the foodstuffs take on a deep red colouring. The seeds are ground up to provide a nutritious foodstuff. Young plants and leaves are eaten as leaf vegetables. Hibiscus leaves are highly suited as fodder, and are favoured by ruminants.

2. Aspects of plant cultivation

2.1. Site requirements

Hibiscus prefer warmer climates, the optimum temperature being 25°C, and a rainfall of 400-500 mm spread over the 4-5 month vegetation period.

Due to its critical photoperiod of around 12 hours, cultivation of hibiscus is limited to the regions below 25° geographical longitude. Reproduction requires a dark period of at least 11.5 hours, flower formation is during the daytime lengths of 12.5-13.5 hours, during which, upwards growth is also terminated.

The following table provides data concerning the plant's development in relationship to hours of daylight (average values).¹

Treatment (day-light hours)	Height when blossoming began (in cm)	Stem circumference when blossoming began (in cm)	Days until blossoming began	Days until fructification (creation of first visible fruit cusps)
8	93,8	2,984	87,5	92
10	71,36	2,125	69,25	75
12	210,7	4,1	126	131
14	240,78	4,6	141	150
16	235,0	5,28	154	162
Control*	236,7	5,0	122	127

*Daylight lengths of 13 hours 20 mins. continually rising until blossoming began to 13 hours 31 mins. and reduction once blossoming had commenced to 12 hours 5 mins.

¹ Nature, Vol 170 (Sept 1953)

The table clearly shows that an increase in the hours of daylight mainly encourages vegetative growth, whilst simultaneously, the time until fructification is significantly delayed.

The appropriate sowing time needs to be evaluated according to site conditions. If sowing is carried out very early, that is, at a time when the daylight hours are rapidly lengthening, then strong vegetative growth will occur, the vegetation period will extend, and the calyxes will later be very light in weight. If sowing is performed at a later date, the plant's vegetative development is lessened, and it will begin to blossom at a shorter height.

Hibiscus sabdariffa prefers heavy soils. Stagnant water must be avoided.

In Africa, hibiscus is sown as an annual crop. Yet experiences in Bolivia that biennial cultivation is possible, if the foliage is cut back.

2.2. Seeds

In market terms, the most important parts of the plant are the deep red dried calyxes, so that drinks made from these will take on a characteristic colouring. This characteristic should therefore be noted during sorting. Some varieties are very hairy, which is a hindrance during the harvest – this should therefore be considered when choosing seeds. It is recommended to select your own seeds on site (less hairs, deep red colour, acid content).

The weight per thousand seeds is around 29 g, the ability of germination after one year is still over 90 %. Depending on the seed density, the amount of seeds needed for 1 hectare is around 2000 g. The seeds do not require any pre-treatment.

2.3. Sowing methods

2.3.1. Direct sowing

Hibiscus can be directly sown without any problem, whereby 3-5 seeds are sown per hole. Germination begins after 2-3 days. The distances between plants depends largely on their amount of growth, which in turn depends upon the variety, the time of sowing, the soil and the climatic conditions. If there is sufficient rainfall, and the soil fertility is high enough, then 1 x 1 m is appropriate. Sowing closer together can lead to overshadowing as well as fungi infestation of the plants and calyxes. Yet during the first stages of development, it might make sense to sow closer together, so that the soil is protected by the plant covering (and therefore weeds suppressed). It will then be necessary, though, to thin out the crop.

2.3.2. Seed beds

Pre-planting the seeds in seed beds is possible, and especially recommended if few seeds are available. This propagation technique is recommended if the hibiscus is

to be combined with other crops, that have already emerged, or which generally develop quicker than the hibiscus. Hibiscus plants are relatively unaffected by transplanting and can even withstand short drought periods. The transplantations should be carried out before the plants are more than 20 cm tall, otherwise yields may drop – even if the plants survive. Proliferation via cuttings is also possible.

2.4. Diversification strategies

Hibiscus is a pioneer crop that cannot tolerate shade, which should be taken into account when planning the plantation.

Depending on the soil conditions, distances between the plants as well as availability of water, a plantation can be fully grown after only 2-3 months. Yet because the vegetation period is concluded after 4 up to max. 5 months, other crops which have longer vegetation periods can easily be combined with hibiscus plants. After the calyxes have been picked, the hibiscus plants are cut down and remain out on the field. Due to the relatively high percentage of bio-mass produced, hibiscus is an excellent crop for enriching the soil with organic material.

On marginal, dry sites, hibiscus builds a very dense blanket of foliage, and therefore provides the soil with plenty of protection.

Cultivation in agroforestry systems: Hibiscus can be cultivated together with coffee, cocoa, bananas, lemons, pineapples and other varieties of fruit, yet because hibiscus cannot tolerate shade, they should to be planted in agro forestry systems when the other crops have been substantially cut back. After well-established coffee plantations have been regenerated, with a simultaneous cutting back of the foliage, hibiscus can be utilised to fill in the gap before the next coffee harvest.

Cultivation in field crop rotation: Traditionally, hibiscus is generally sown on poorer soils, each year on a different plot. The crop mostly follows a fallow stage, or crops such as rice, maize, sorgo, beans or peanuts. In these cases, sufficient green fertiliser must be provided, as well as the integration of legumina crops within the crop rotation. Hibiscus is not suited to being planted again on the same plot, as this can lead to rapid nematode infestation (comp. 2.6.). Simultaneous cultivation of cotton and Hibiscus in a single crop rotation should be avoided (both are Malvern crops).

Examples of crop rotation with hibiscus:	
Tanzania	Hibiscus - Hibiscus – green fallow (with <i>Crotolaria ochrolenca</i>)
Egypt	Hibiscus - sesame - clover - herbs
Mexico	Hibiscus - maize - fallow - fallow

2.5. Nutrients and organic fertilisation management

2.5.1. Nutrients requirements

Literary sources of fertiliser recommendations are based on hibiscus cultivated for their fibres. These are high due to the high levels of bio-mass produced, that is then also removed from the system.

In the case of organic hibiscus cultivation to produce dried calyxes, practically all of the organic material remains within the system, thereby enriching it with bio-mass. Because in the case of hibiscus cultivation, an enrichment of the soil fertility should also occur within the entire system, special fertiliser recommendations are not necessary for the crop. If they are not intended to be planted as a pioneer crop to start off an agro forestry system, care should be taken to ensure that sufficient legumes are integrated within the crop rotation.

2.6. Biological methods of plant protection

2.6.1. Diseases

The most important diseases are types of **stale rot of rape**, more seldomly anthracnose, caused by different fungi varieties.

The most important fungus parasites of the stems, leaves and roots:

Fungi	Disease indications
Phytophthora parasitica	Root rot and stale rot of rape
Phoma sabdariffae	Leaf fleck
Macrophomina phaesolina	Blackleg, stalk base rot and root rot, Shanking
Rhizoctonia solani	root rot, seed rot,
Botrytis cinerea	root rot
Sclerotium rolfsii	Seed and stem rot

Most types of stem or root rot occur during very long periods of heavy rain, or in cases of stagnant water. Too short intervals of hibiscus cultivation in the crop rotation or depleted soils can also be the cause. Direct methods of controlling soil-borne diseases do not exist. Changing the site, or better care of the soil are two ways of alleviating the problem.

If heavy rainfall occurs during the blossoming time, then it is possible that the petals remain attached to the calyxes, instead of falling to the ground. These remain attached, and rot on the plant, which can also affect the calyxes. For this reason, petals that remain on the plants should be removed.

The plants can easily fall over when laden with a lot of heavy fruit, resulting in many of the calyxes rotting on or near the ground. This can be avoided by supporting the plants with sticks.

2.6.2. Pests

Hibiscus is extremely susceptible to **nematode infection**. Other damaging organisms do not generally play an important role. Direct measures to reduce the number of nematodes in the soil are not usually very successful, which means that an infestation must be avoided as well as possible by use of a suitable crop rotation system. Studies in Tanzania have shown that beetles that wander onto the hibiscus plot can cause significant damage. The hibiscus crops can be protected against this by planting an additional strip of Okra (*Hibiscus esculentus*) around the field.

2.7. Crop monitoring and maintenance

2.7.1. Weed management

Measures used to regulate the growth of weeds are largely dependent on the site conditions, as well as the type of cultivation system. The plants develop slowly at the beginning. If the crop is sown directly from seeds, then tilling of tall-growing weeds and grasses may be required once or twice, yet as soon as the crop is fully grown, no further weeding is necessary.

2.8. Harvesting and post harvest treatment

Harvesting commences once the calyxes have reached an optimum size. This point is generally reached shortly before the seed capsules are ready to open, 15-20 days after blossoming. The fruit is separated with the calyx petals manually, either by hand, or with a knife. Afterwards, the seed capsules need to be carefully removed from the calyxes. Round, sharpened metal tubes can be used for this, to cut away the seed capsules at the base, and remove them.

Finally, the water-logged calyx petals are dried out in the sun, which should be performed as quickly as possible. The drying process must be concluded as rapidly as possible, otherwise, there is risk of an infection of mould fungi. Suitable drying areas and methods (e.g. solar dryers) should especially be made available in regions where it can rain during the harvest.

The harvest must be stored in a dry place, protected from light and well-ventilated. Measures to protect against storage pests should be adopted when storing hibiscus. In Tanzania, neem leaves are strewn among the hibiscus.

3. Product specifications

According to the **DAB (German Journal of Medicaments) 1996**, a minimum of 13.5% acid content (calculated as citric acid), as well as a specific colouring (at least 0.350 measured as an absorption at 520 nm, using water as a compensation fluid) are required. The total water content of the fresh fruit, including the calyx petals, should be around 84.5%.

3.1. Dried hibiscus blossoms

3.1.1. Preparation

The fleshy, bright red calyxes of the *Hibiscus sabdariffa L.* can be eaten fresh as fruit, or be processed into refreshing drinks, teas and jellies.

Main exports are the dried hibiscus blossoms known as “Hibiscus tea” (whole or cut up). They are usually sold as herbal teas, or mixed together with rose hip or fruits, and sold as fruit teas in tea bags or as loose leaves.

The following describes how hibiscus blossoms are processed:

Drying

In order to process dried hibiscus blossoms, the calyx and petals of *Hibiscus sabdariffa L.* are harvested at the correct time and dried to a maximum water content of 12%. During the drying process, it is important to extract the water as carefully as possible. The most important factors are a temperature that is not too high, and sufficient ventilation. The calyxes can be laid out in thin layers on racks, and dried by the sun and wind.

Sorting and packaging

After the drying process, the dried hibiscus blossoms are sifted through for stem and other foreign particles, and packaged either whole or cut up.

During the drying process, the hibiscus blossoms are not allowed to be treated with either methyl bromide or ethylene oxide, or with ionisation rays.

3.1.2. Quality requirements

These quality requirements for dried hibiscus blossoms, 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 stale, tart (infusion)
Cleanliness	Free of foreign substances such as sand, stones, stems, insects etc
Dry weight	min. 90.0 %
Water content	max. 12.0 %
Total ash	max. 11.0 %
Hydrochloric acid soluble ash	max. 2.5 %
Residues	
Pesticide	Not measurable
Bromide and ethylene oxide	Not measurable
Micro-organisms	
Aerobe Bacteria	max. 10,000,000/g
Yeasts and mould fungi	max. 10,000/g
Escherichia coli	max. 100/g
Enterobacteriaceae	max. 10,000/g
Salmonella	Not measurable in 20 g
Mycotoxins	
Aflatoxin B1	max. 2 µg/kg
Total aflatoxins B1, B2, G1, G2	max. 4 µg/kg

The 'DAB' from 1996 also demands a minimum of 13.5% acid content (calculated as citric acid), when the dried hibiscus blossoms are to be used medicinally, e.g. to be sold in chemists.

In order to conform to the quality requirements, and to prevent the dried hibiscus blossoms 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 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 processed dried hibiscus blossoms.

3.1.3. Packaging and storage

Packaging types and material

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

Consumer packages

If the dried hibiscus blossoms 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 hibiscus tea 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.
- Provide an easy to open access, that can also be sealed again, so that hibiscus tea remaining in the packaging stays fresh.

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

- Cardboard boxes with or without a transparent cellophane window, polyethylene or polypropylene, or with an internal bag made of polyethylene or polypropylene
- Single-layer plastic bags (polyethylene or polypropylene)

If the hibiscus tea is not be sold loosely, but in tea bags, then the bags should be made of non-glued single or double chamber bags with a string and label attached. The bags are generally sold additionally packed in 20 bag cartons, with a cellophane wrapping.

Transport packaging

Some form of transport packaging is required in order to ship the bulk or singly packed dried hibiscus blossoms. In choosing a type of packaging, the following should be heeded:

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

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

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

Information printed on transport packaging

The transport packaging should display details of the following:

- Name and address of the manufacturer/packer and country of origin
- Description of the product and its quality class
- Year harvested
- Net weight, number
- Batch number
- Destination, with the trader's/importer's address
- Visible indication of the organic origin of the product^{2 3}

Storage

The dried hibiscus blossoms should be stored in dark areas at low temperatures (maximum 15-20°C) and relative humidity (max. 60 %). Under optimum conditions, dried hibiscus blossoms can be stored for around 12-18 months.

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

² When products from organic farms are being declared as such, it is necessary to adhere to the requisite government regulations of the importing country. Information concerning this is available from the appropriate certification body. The regulation (EEC) 2092/91 is applicable to organic products being imported into Europe.

³ Organic 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.