

COMMERCIAL ANTHURIUM PRODUCTION

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The anthurium (*Anthurium andraeanum*; Araceae), has been grown by home gardeners in the Caribbean for many years but is becoming increasingly important both as an import substitution and export crop. The plant is a perennial and the flowers have a relatively long shelf-life.

THE ANTHURIUM BLOOM

The anthurium bloom is really a modified leaf or spathe with hundreds of small flowers borne on a pencil-like spadix arising from the base of the spathe.

CULTIVARS

The most common type grown is the local or Caribbean Pink which is frequently used by local florists but there are a number of other cultivars which are more suited to the export market.

Plants should grow vigorously and be prolific producers of suckers and flowers. Internodes should be short and spathes should be heart-shaped with symmetrical overlapping or fused lobes. Spadices should be gently reclining and shorter than spathes.

Dutch Cultivars

These generally require cooler conditions than other types but have been grown successfully in the Caribbean. Examples are:

- Anneke 141* - Pink flower - rapid growth, high production.
- Cuba* - Large white flower, high production.



Claudia 108 - Large red flower, moderate branching.

Lydia 420 - Pink splash, rapid growth, high production.

Hawaiian Cultivars

Ozaki - Light red, broad, heart-shaped spathe with reddish purple erect spadix; high yield of flowers and suckers; requires more shade than other varieties; susceptible to anthracnose.

Kaumana - Dark red, small to medium spathe with reclining

white spadix; high yielding, quick growing with many suckers; highly susceptible to anthracnose.

Kansako - Medium-sized red spathe with overlapping lobes; high yielding with long stems which hold flowers high, protecting them from bruising by foliage.

Nitta - Broad, orange, heart-shaped spathe with overlapping lobes, and white reclining spadix; vigorous, high yielding with many suckers; tendency to produce flowers parallel to the stem.

DeWeese - Small, white open heart-shaped spathe with yellow reclining spadix; fairly high flower yield and large number of suckers.

Marian Seefurth - Broad, rose-pink heart-shaped spathe with unusually large overlapping lobes and greenish-yellow spadix which droops when young and becomes erect when mature; exceptionally high yielding and suckers freely; highly resistant to anthracnose.

Obake types - These are extremely variable in size and shape and usually exhibit some chlorophyll in the spathe. They are becoming increasingly popular. Varieties include Anuenu, Chameleon and Mauna Kea.

Other Cultivars

Novelty Types - These include the tulip types which have an upright and cupped spathe e.g. *Calypso* which is dark pink and *Trinidad* which is off-white with a maroon flush.

PROPAGATION

Commercial propagation for the cutflower market is usually vegetative. Mature plants produce aerial shoots or "suckers" which will flower 3-6 months after planting. Seedlings are also available from commercial nurseries. More recently, the tissue culture technique has been used to rapidly propagate plantlets from promising specimens and these *in vitro* plantlets have become available to commercial growers. The CARDI tissue culture laboratory has been successful in the micro-propagation of the Caribbean Pink and orange tulip types. The plants obtained from culture must be potted and "hardened" under mist before being planted in their final positions.

SEED PRODUCTION

Plant nursery operators will probably be more interested in this method of propagation than commercial flower producers. Hand pollination can produce a number of interesting hybrids but the practice is time-consuming since the period from pollination to first flowering of the resulting plant may be as long as 2 years. Parent plants should be productive, with good flower size and colour.

Pollination is done by grasping the spadix with the thumb and two fingers of one hand and sliding the fingers firmly up the spadix to remove the pollen grains. The sticky pollen is then transferred to the spadix of a receptor plant. After a few weeks seeds will be produced on the spadix. At this time

the pollinated flower should be bagged in cheese cloth to protect it from damage by insects and other predators.

The seeds first appear as greenish-yellow, pea-like structures which eventually turn brown after about 6 months. These brown capsules must be broken to release the seeds which are covered in a soft, jelly-like substance which is easily removed. Seeds should be promptly planted uncovered but firmly pressed in a mixture of manure, charcoal dust and sand in a shallow box. Germination may take place from 2 weeks to 3 months after sowing.

GROWING MEDIUM

Plants grow best on a well-aerated organic medium with good water-retention and drainage and a pH of 4.5-5.0. Media of (a) 2 parts soil: 2 parts coconut fibre bast: 1 part manure (b) 1:1 chopped coconut husks and coir dust or (c) bagasse have been used successfully.

GROWING CONDITIONS

Light Anthuriums require shade, the degree depending on cultivar, plant age and climate. Light requirement is usually 60-80 per cent of full sunlight. Insufficient shade results in bleaching of flowers and death of leaves; too much shade retards growth and flowering. Shade may be achieved by growing under trees such as Citrus, Cassia and Gliricidia or under shade cloth covered structures.



Temperature and Relative Humidity Anthuriums thrive when night temperature is never lower than 15°C (60°F) and day temperature is 21-35°C (70-86°F). Relative humidity should be 70-80 per cent.

Water Anthuriums require an average of 50m³ per 1000m² (2 ac in) water per week which is equivalent to 8 L (2 gal) per plant in two applications. This should be adjusted when rainfall occurs. Relative humidity should be maintained at 70-80 per cent.

Wind Plants should be protected from constant wind.

SPACING

Planting distance varies with the vigour of the cultivar but the trend is towards close planting e.g. 30cm x 30cm or 62,500 plants per ha. With this close spacing rigid leaf pruning is necessary to allow air circulation and prevent spread of disease. Pruning to a minimum of four leaves can be done without any adverse effect on flower production and quality. Plants should not be placed more than 5 cm (2 in) deep as deep planting may result in rotting of stems and roots.



FERTILIZER

Triple superphosphate at 250 kg per ha (25 kg per 1000m²) should be mixed with the growing medium prior to planting. This is equivalent to about 4 g per plant. Starting 1 month after planting, complete fertilizers such as 12:12:17+2 should be applied monthly at the rate of 20-25 kg per ha (2-2.5 kg per 1000m²) or 50g per 100 plants. Experience in Jamaica indicates that a chemical blend 12:2:17+2 has a favourable effect on flower size and quality. It is important to irrigate after application of dry fertilizers to avoid scorching the roots.

Organic fertilizers such as chicken manure may be applied at planting at the rate of about 2,500 kg per ha (250 kg per 1000m²) or 40g per plant. Foliar fertilizer may be applied monthly at manufacturers' recommended rates.

MULCHING

Coconut husks, bagasse or coconut fibre bast is used to mulch plants after planting and approximately twice per year thereafter.

PEST AND DISEASE CONTROL

The observation of national plant quarantine regulations is the first step to be taken in maintaining pest and disease-free plants.

Growers desirous of importing planting material must apply for import permits from the necessary authority - usually the local Ministry of Agriculture. The permit will specify the conditions of importation. Importation from some countries may not be allowed; in other cases only *in vitro* plantlets may be allowed entry.

Pest control chemicals must be used carefully and efficiently to avoid damage to blooms. Compatibility of chemicals must be checked before mixing so that phytotoxicity will be avoided. Under some conditions anthurium plants have been reportedly damaged by diazinon, dimethoate (Rogor[®], Perfekthion[®]), malathion and dicofol (Kelthane[®]). Some sulphur-containing fungicides will react strongly with chemicals like dimethoate causing blemishes on leaves and flowers. It is advisable to spray only during the early morning or late evening since the anthurium plant is particularly sensitive to phytotoxicity during the period 10 a.m. to 3 p.m.



Thrips damage on Anthurium plant

Major anthurium diseases

Common name	Causal organism	Symptoms	Recommended control methods
Root Rot	<i>Pythium</i> sp. or <i>Phytophthora</i> spp.	Rotted roots, fewer smaller leaves and flowers	Improve drainage and aeration Drench with Banrot® at 3.7–7.5g/10 L water or Captan® at 22g/10 L water or Thiram® 11–22g/10 L water
Corticium fungus	<i>Corticium</i> sp.	White mycelial growth on surface of leaf sheath base of plant.	Apply Kocide® 606 at manufacturer's recommended rate.
Anthrachnose (young plants are particularly susceptible)	<i>Colletotrichum gloeosporioides</i>	Circular to triangular black spots on petiole blade, spathe and spadix	Alternate sprays of benomyl (Benlate®) at 11g/10 L water with Dithane® M45 at 22g/10 L and Maneb® at 22g/10 L water. Use tolerant varieties e.g. Marian Seefurth. Pre-plant dip of above chemicals. Prune plants if too dense and burn refuse.
Bacterial blight (particularly destructive to young plants - favoured by warm, wet weather).	<i>Xanthomonas campestris</i> var. <i>dieffenbachiae</i>	Deformed flowers with water-soaked areas from top downwards. Rotting of spadix from tip. Water-soaked spots on leaves which turn black eventually.	Drench with Ridomil®, Dithane® M45 or Aliette® at manufacturers' recommended rates. Pre-plant dip with above chemicals.
Mosaic	Uncertain - may be a virus	Deformed mottled leaves. Blooms distorted and unsaleable.	Reduce plant density. Rogue infected plants if severe, or plant parts if infection is localized. None available. Remove affected plants since suckers will be similarly affected.

Major anthurium pests

Pest	Symptoms	Recommended control
Army worm, Aphids, Thrips	Holes in young developing leaves. Brown scars on spadix	Use Dipel® or pyrethroids like Sherpa®, or Orthene® at 5g/10 L of water or Temik® at 570g/10m ² of bed or Diazinon® at 26 ml/10 L water.
Snails and slugs	Brown scars on spadix	Metaldehyde bait applied to the surface of the growing medium.
Mealy bugs, Scale insects	Loss in plant vigour. Growth of sooty mould fungus on leaves and flowers.	Malathion® at 100m/10L water or Diazinon® at 26ml/10 L water.
Grasshoppers	Holes in leaves and spathes	
White flies	Loss of plant vigour and decreased flower production	Diazinon® at 26 ml/10 L (not for Barbados). Safer Soap® could be tested in small areas where control is not achieved with Diazinon®.
Bees	Damage to flowers	None
Mites	Stunting, speckling, bronzing and curling of leaves.	Kelthane® at 63 ml/10 L water.
Nematodes	High populations may cause yellowing and falling of leaves.	Apply carbofuran (Furadan®) to soil at 3.4kg/1000m ² .
Mole crickets	Plants cut at soil level. Wilting and death of young plants.	Mesurolo® pellets, Diazinon® 63ml/10 L water.

Miscellaneous disorders of anthurium

Disorder	Symptoms	Recommended control
Decline (occurs in older plantings and areas of poor drainage)	Reduced plant and flower size as well as flower number	Raise beds to improve drainage. Replenish growth medium. Control nematodes
Aborted spadix (occurs mainly in younger plants up to 4th bloom)	Spadix reduced or aborted	None usually necessary. Believed to be caused by a deficiency of calcium induced by high soil acidity. As root system expands, symptoms no longer appear
Slime moulds and other saprophytes	Unightly plants and blooms	None usually necessary
Post-harvest chilling injury	Flower discolouration: Purple spots on blooms	May be reversible if exposure time short. Control storage temperature

Recent research in Hawaii indicates that growers would be well advised to implement an Integrated Pest Management approach i.e. to use pesticides judiciously and to consider the cost/benefit and benefit/risk of pesticides.

REPLANTING

Replanting or thinning of plants is necessary every 4-5 years to avoid reduction in blooming rate. Earlier thinning may be necessary if large side shoots are used as planting material.

HARVEST

Anthuriums are usually harvested once a week at three-quarters maturity to achieve maximum shelf-life for the cut flowers. Maturity is determined by the firmness of the peduncle and the colour change of the spadix. As the flowers on the spadix mature, a colour change is seen from the base to the tip of the spadix over a period of 3-4 weeks. Harvesting is best done after 4 p.m.



YIELD

Blooms are produced throughout the year as long as good growing conditions are maintained. Average production is

6-8 flowers per plant per year, but some Dutch varieties may produce up to 12 blooms per plant.

GRADING OF BLOOMS

Damaged flowers must be culled. The undamaged flowers are graded according to size.



International standards are based on Hawaii's standards (see below), but the market requirements depend on the importing country.

Grade	Hawaii State Department of Agriculture standards for anthurium
Average of length plus width of spathe	
Miniature	Under 7.5 cm (3 in)
Small	Over 7.5-10 cm (3-4 in)
Medium	Over 10-12.5 cm (4-5 in)
Large	Over 12.5-15 cm (5-6 in)
Extra Large	Over 15 cm (6 in)

In Trinidad the following six flower sizes are used locally:

Grade	Average of length plus width of spathe	Stalk length
Pee Wee	Under 5.0 cm (2 in)	41 cm (16 in)
Miniature	Under 7.5 cm (3 in)	48 cm (22 in)
Small	9-10 cm (3.5-4.0 in)	56 cm (22 in)
Medium	Over 10-12 cm (4.0-4.7 in)	66 cm (26 in)
Large	Over 12 cm (4.7 in)	79 cm (31 in)
Extra large	Over 15 cm (6 in)	81 cm (32 in)

In Jamaica, the following grades have been established:

Grade	Average of length plus width of spathe
Miniature	5-7.56 cm (2-3 in)
Small	Over 7.5-10 cm (3-4 in)
Medium	Over 10-12.5 cm (4-5 in)
Large	Over 12.5-15 cm (5-6 in)
Extra Large	Over 15 cm (6 in)
Premium	Superior large blooms with 45.7cm (18 in) straight stems, flat spathe and inclined spadix.

In Jamaica a spadix colour change with 2/3 white is allowed. Blooms are required to be free of pests and diseases, with good colour.

PACKING

For export, blooms are usually packed in cardboard cartons. Carton size will depend on the requirements of the individual importer but examples are given below:

Grade	Carton dimension		
	length (mm)	width (mm)	height (mm)
Small	964	137	65
Medium	964	190	65
Large	964	295	65

Each flower should be wrapped individually in a damp paper sleeve to protect against damage during transport. Shredded paper without print should be used for cushioning the blooms. Cartons should be lined with damp paper which should fold over the flowers. Sometimes, a strip of foam and a small piece of wood are fitted across the width of the box, mid-way along the stem length to keep the stems in place during transport.

Boxes must be properly stapled and not too moist. They must never be left in the sun.

Blooms may be transported to local outlets in buckets of clean water. It is recommended that flowers be tied in

bunches of one dozen, and a sleeve placed on each bunch to protect it from mechanical damage.

STORAGE

Blooms should be stored at temperatures between 13 and 17°C (55-36°F). They often remain in excellent condition in water for 3-4 weeks at 13°C. Storage at 7°C (45°F) and below will cause chilling injury resulting in darkening of blooms.

The use of preservatives such as silver nitrate and silver thiosulphate solutions may extend the vase life of some cultivars four times over that of flowers kept in water.

DOCUMENTATION FOR EXPORT

Apart from the usual documents needed for shipping cargo, a phytosanitary certificate issued by the Ministry of Agriculture is required for anthurium flowers being exported.

MARKETS FOR ANTHURIUMS

Europe, USA, Japan, West Germany, Italy and Canada are among the potential markets for anthuriums. Reds and pinks are usually preferred by the USA and orange by Japan.

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