

Flowers

1. Anthuriums
2. Ginger Lily
3. Heliconias
4. Orchids

TECHNOLOGY PACKS



ANTHURIUMS



November 2015

Background

Production decisions concerning how much effort and resources to invest and which farming practices to follow, have consequences and create opportunities for the farm affecting production levels, input costs, time constraints, and the potentially size of the operation. They also may have implications for resource use and environmental quality.

Numerous information exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and climate change that impact on the environment and rural livelihoods. These issues are also closely related to the importance of the role of primary producers in increasing the earnings of all actors along the value chain in supporting the development of a commercially viable and sustainable agricultural industry.

The production of high quality and easily understood information packages is critical as this forms a basis for farmers to obtain financing from lending institutions and to efficiently increase their production through the availability of modern technology. This will also result in a reduction of rural unemployment and will greatly help in alleviating poverty and other associated social ills.

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ANTHURIUMS



November 2015

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Introduction

This Technological Package (Tech Pack) deals with the production and postharvest aspects of *Anthurium andrea*

Also included in the Tech Pack are appendices:

- Template for cost of production
- List of recommended pesticides and application rates
- Good Agricultural Practices data record sheet.

Notwithstanding the identification of any specific pesticide for the control of pests and diseases, this decision is for the discretion of the Ministry of Agriculture Area Extension Officer and the farmer.

However, the mention of any pesticides and other products used in the Tech Pack should strictly comply with local regulations and all instructions provided by the manufacturer. Also, the use of trade names in the Tech Pack is for the purpose of citing examples and is not meant to either endorse or discredit any particular product.

Botanical Description

Anthurium is a genus belonging to the family Araceae, comprising of numerous species.

Varieties

Two general types of anthuriums are cultivated in St. Lucia, endemic type e.g. the Caribbean Red and Pink varieties (Plates 1 & 2) and the imported hybrid types e.g. *Anthurium andreanum* (Plate 3)



Plate 1 Caribbean Red

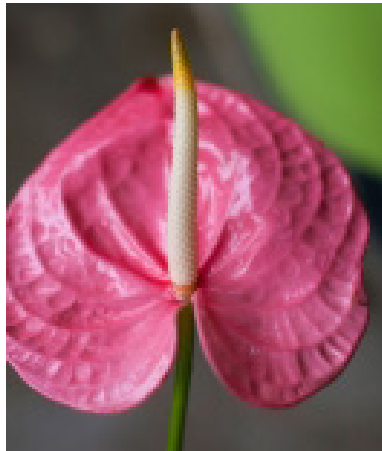


Plate 2 Caribbean pink

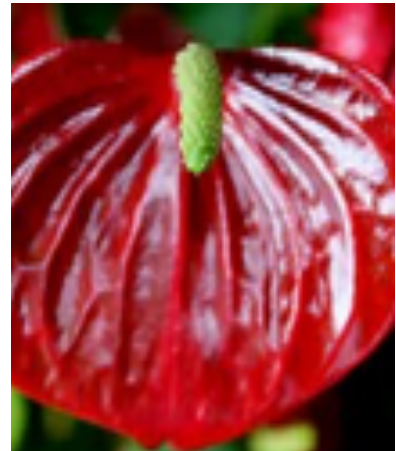


Plate 3 Anthurium hybrid (*Anthurium andreanum*)

Propagation

Anthuriums should be propagated using various methods: top cuttings, seeds and tissue culture.

a. Top cuttings

Cuttings are by far the easiest way to propagate anthurium plants. Allow the plant to grow producing at least four nodes or sets of leaves and roots, before taking a cutting. Once your plant is large enough, cut it in half, so that each portion has at least two nodes. Leave the base of the plant in its original pot and it will generate new growth. Then place the top cutting into a new pot, water it regularly and allow the plant to grow. Other easier

methods of propagation of anthuriums are by stem cuttings, layering and division of offsets or suckers that sprout laterally from the base of the plant (Plate 4).

b. Seeds

Another method to propagate plants is by seeds. It is a more difficult process. The stigma and stamen of these flowers are active at different times, so pollen must be stored in the freezer or use more than one flower at different stages of development. The first step is to gather pollen by using a fine paintbrush to scrape pollen off the stamen and into a clean, dry vial. The vial is then kept in the freezer until stigmas are ready to be pollinated. Once you have a flower with receptive stigmas dust with the stored pollen. Seeds generally take one year to be produced (Plate 5).

c. Tissue Culture

Tissue culture is an expensive method of propagation. It is done exclusively within the confines of a laboratory and requires technical skills for the production of large commercial quantities of tissue culture plantlets (Plate 6), which can be made available to anthurium producers.



Plate 4 Anthurium cuttings



Plate 5 Anthurium seeds on spadix



Plate 6 Commercially produced anthurium tissue culture plantlets in the laboratory

Land Preparation

Anthuriums require special soil-free growing media, which are free draining and well aerated, but retains sufficient moisture and provides support to the plant. Raised-bed culture is recommended for commercial plantations rather than growing them in pots. Thus, flat land is preferred for the

construction of beds. However, with sloping land, terracing is recommended prior to preparing beds. A black or white plastic should be first placed on the ground after the beds are prepared in order to limit problems associated with soil borne pathogens (Plate 7). Anthurium seedlings can also be grown in containers such as plastic pots (Plate 8) or polythene bags.



Plate 7 Covering beds with black plastic

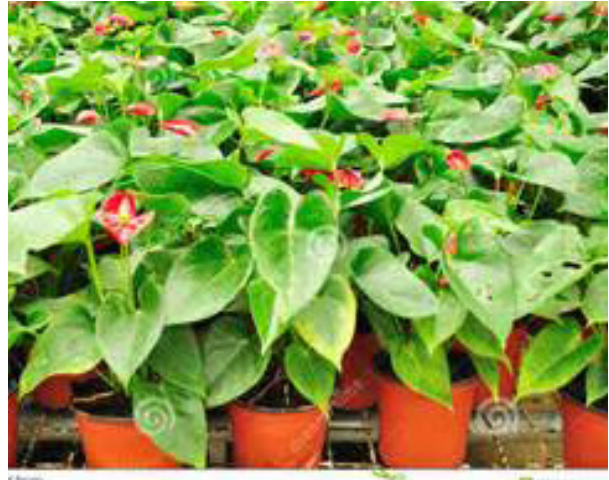


Plate 8 Anthurium seedlings in pots

Growth Medium

The best growing media should be one that drains well with good water retention capability such as coconut husk or coir dust (Plate 9). Plants crave moisture, but won't tolerate standing in water. Inadequate drainage will rot the roots and kill the plant quickly. The roots must be able to "breathe" without remaining soggy for the control of soil pathogens. The selection of the growth media will depend on availability, cost and ease of handling.



Plate 9 Anthuriums grown in coconut coir growth media

Planting and Spacing

Plants should be spaced at 12 inches x 12 inches (30 cm x 30 cm) or 12 inches x 18 inches (30 cm x 45 cm) depending on the size of the plant at maturity. Plants should be pruned down to four leaves per plant. Closer planting would require the continuous maintenance of 3 - 4 leaves/ plant at all times.

Light Requirements

The best conditions to cultivate anthuriums are under 60 - 75% shade. The hybrids should be grown under shade cloth (saran netting) whilst the Caribbean Pink should be grown between shade trees as an understory. Too much shade retards growth and flowering whilst too little results in bleaching of flowers and death of leaves. Caribbean farmers have shown that flower peduncles get longer and spathe size increases at lower light levels, and the number of flowers produced decreases.

Temperature Requirements

The best temperature for growing anthuriums ranges from 70 - 77°F (20 - 25°C) nighttime, and 80 - 86°F (25 - 30°C) daytime.

Water Requirements

Plants require water during all stages of growth with a maintained humid environment of 70 -80% for optimal production. The quantity and frequency of watering depends on the prevailing climatic conditions in the production area, planting medium and degree of shade. During dry periods plants should be irrigated regularly, as needed.

Fertilization

For plants grown on a media such as coconut husk, fertilizers having an N:P:K ratio of 20:20:20 can be sprayed as a foliar application. During flowering, ratios may be changed to 6:14:7 or 20:30:20. Fertilizers with the elements Ca, Mg and other microelements should also be added in liquid form. Slow release fertilizers, for example Bloom Booster and Osmocote can also be used. The pH of the media must be monitored and adjusted with calcium carbonate to maintain the pH at 5.5. Anthuriums should be fertilized sparingly at least once per month. Excessive fertilizer inhibits the production of flowers or reduces the frequency of blooming and produces lush foliage but not flowers.





Weed Control



Weeds can only be controlled through constant manual weeding. Chemical control of weeds is not recommended, as many chemicals are phytotoxic to the anthurium plants. With too low light intensity, algae can sometimes grow on the leaf blade and hamper plant photosynthesis. Increasing light intensity will cause the algae to die.


Pests and Diseases


The major pests and diseases affecting anthuriums, symptoms and control/management are indicated in Table 1.

Table 1 Causal agents, symptoms and control of pests and diseases of anthuriums

Pest & Diseases	Symptoms	Control/ Management
 <p>Plate 10 Aphids</p>	<p>Symptoms of anthuriums infested by aphids include yellowing, distortion of leaves and poor growth.</p>	<p>For the control of these pests apply “insecticidal soaps” or insecticides. The best method of insect control is to monitor anthurium plants and treat before there is insect infestation.</p>
 <p>Plate 11 Scales</p>	<p>Symptoms of anthuriums infested by scale insects of stems and leaves.</p>	<p>Apply strong insecticides.</p>
 <p>Plate 12 Spider Mites</p>	<p>Initial damage appears as yellow or grey stippled patterns. Severe damage includes plant yellowing, necrosis, and defoliation; overall appearance may be “bronzed”. Also presence of webbing.</p>	<p>Inspect plants frequently to determine when and where to apply insecticides.</p> <p>Apply insecticides (contact or systemic) before severe damage occurs; thorough leaf coverage (underside of leaves) is necessary.</p>
 <p>Plate 13 Mealy Bugs</p>	<p>White cottony spots, sometimes accompanied by black sooty mold. White fuzzy nests at leaf bases and other junctions.</p>	<p>Use of biological control methods if available (Lady bird beetle).</p> <p>Alternatively apply fatty based insecticides. Systemic chemical control can also be used.</p>

Pest & Diseases	Symptoms	Control/ Management
 <p data-bbox="201 554 334 575">Plate 14 Thrips</p>	<p data-bbox="613 302 1016 506">Damage to anthuriums appear as white streaks or scarring on the front and back of the spathe, deformed spathes, and with age, bronzing of injured tissue.</p> <p data-bbox="613 558 1016 762">In severe cases, anthurium spathes fail to open, foliage may be deformed with bronzing and streaking, and reduced plant growth may occur.</p>	<p data-bbox="1036 302 1412 590">Remove infested flowers and foliage from the field or shade house to eliminate existing sources of thrips. Control weeds, grass and old stock plants that may serve as hosts to anthurium thrips.</p> <p data-bbox="1036 642 1412 972">Because thrips prefer young, growing plant tissue, good spray coverage with insecticides directed at the base of plants where spathe development occurs is essential to contact any exposed thrips.</p>
 <p data-bbox="201 1323 594 1400">Plate 15 Anthracnose caused by a fungus <i>Colletotrichum gloeosporioides</i></p>	<p data-bbox="613 1029 1016 1400">Symptoms start as tiny brownish spots on the flower spadix. During high humidity these spots enlarge, appear water-soaked and turn necrotic. Sometimes the entire spadix will turn black as lesions coalesce. Leaves and spathes are rarely infected.</p>	<p data-bbox="1036 1029 1412 1274">There are several anthurium varieties grown in the St. Lucia that are resistant to Anthracnose disease. Use fungicides to control Anthracnose if present.</p>

Pest & Diseases	Symptoms	Control/ Management
 <p>Plate 16 Bacterial Blight caused by a bacterium <i>Xanthomonas campestris</i> pv. <i>dieffenbachiae</i>.</p>	<p>The first sign of infection is the appearance of irregular water-soaked spots on areas on the underside of leaves and spathes and faint chlorosis when viewed from the upper side. As infection proceeds, the spots become brown or black at the centre and bright yellow at the edges. A characteristic symptom of advanced systemic infection is discoloration of the vascular system.</p>	<p>Preventative measures that can be used to manage bacterial blight disease at economically feasible levels include:</p> <ul style="list-style-type: none"> - Using of clean planting material - Installing footbaths with disinfectant at entrances to greenhouses - Adjusting plant density on beds to facilitate good aeration - Working from clean to diseased fields to minimize pathogen movement - Discarding and burning of infected plants - Disinfecting tools and clothing regularly, changing tools on different plots, avoid exchange of material between greenhouses - Ensuring good drainage of the growing substrate - Using drip irrigation or micro-sprinklers - Avoid the presence of visitors not attached to the farm - Removing all debris and old media and let beds lie fallow for 2 months - Produce disease-free planting material from bud- or tissue-cultured plants away from production fields - Ensure that the plants' nutritional needs are met to improve their vigour. <p>Where the disease has been already established, sanitation practices should be performed. These include:</p> <ul style="list-style-type: none"> • Adhering to all the preventative measures • Keeping plants as dry as possible • Removing diseased leaves early and burning them • Avoiding extreme climatic conditions particularly high temperatures • Adapting a fertilization regime to keep the production of glutamine in plants at a low level, as glutamine is a major food source for the bacteria. Leaving out ammonium nitrate and maintaining desirable levels of potassium can achieve this.

Pest & Diseases	Symptoms	Control/ Management
 <p data-bbox="203 682 584 756">Plate 17 Bacterial Leaf Spot caused by a bacterium <i>Xanthomonas campestris</i> pv. <i>dieffenbachiae</i>.</p>	<p data-bbox="613 304 1016 1228">Two main types of symptoms caused by the bacterium. The first type is the foliar or leaf symptoms that occur when infection begins in the leaf or spathe. The second type is the systemic or vascular symptoms that occur when the bacterium becomes established in the stem and spreads to other parts of the plant. They usually begin as a slight yellowing with water-soaked spots that later become necrotic. As the disease progresses, more leaf tissue is killed and the large, irregular, brown area is surrounded by a bright yellow border. The systemic or vascular infections stage usually appears first as a general yellowing of entire leaf blades of older leaves.</p>	<p data-bbox="1036 304 1414 672">There is no cure for plants infected with bacterial leaf spot. Apply copper-based fungicides weekly at first sign of disease to prevent its spread. This organic fungicide will not kill leaf spot, but prevents the fungus spores from germinating.</p>

As a requirement for adopting Good Agricultural Practice (GAP) related to the use of pesticides, farmers are required to maintain up to date records on all pesticides applied to the crop. These records should include trade names, application rates and dates of application.

Harvesting/Maturity

Anthuriums are ready for harvest when fully open with the spathe completely unfurled, the stems/peduncle are firm, erect and turgid, and the spadices are rough (or degree of colour change of the spadix), before cutting. In immature flowers the spadix is smooth.

Harvest once per week during the early morning or late evening when temperatures are cooler (Plate 18). Cut flowers at the leaf axil with a sharp knife or secateurs that have been sterilized in 70% alcohol to avoid contamination. Submerge the cut ends of the stems immediately in buckets, half filled with water and place in the shade before taking to the packing shed.



Plate 18 Harvesting anthuriums

Post Harvest Care

There are no formal grade standards for anthuriums. Top quality implies long stems, uniformity of colour and size, proper maturity, glossiness of the spathe, and freedom from any damage or disease. To increase the vase life of anthuriums a pretreatment can be applied. Vase life problems are associated with bacterial contamination of the cut stem bases.

Either: pulse the re-cut stems for 10 - 20 minutes in 1000 ppm silver nitrate. (Rinse the stems with fresh water after the treatment).

Or: dip the whole flower in an emulsion of Carnauba wax. After dipping, place the flower stems in water while the wax dries.

After harvesting ensure that anthuriums are not damaged during handling. All flowers should be kept cool after harvest and placed in clean water at least 4 inches (10 cm) deep at all times, a biocide (e.g. 50 ppm hypochlorite) should be added.

For the local market, anthuriums are usually sold packed in clusters or individually. For export, to regional and international markets, anthuriums are packaged in 48 inch x 12 inch x 6 inch; 120 cm x 33 cm x 12 cm (length x width x height) cardboard boxes. The anthuriums should be packaged to prevent abrasion by placing moist shredded paper at the bottom of the boxes and in-between the flowers. They are then covered with plastic to seal in the moisture. Each box is closed and taped with clear tape and is stored in a cool environment. Ensure that flowers are not damaged during transportation for export.

Yields

Yields vary depending on the management practices adopted. Highest yields are obtained when anthuriums are cultivated under optimum conditions required for plant growth such as proper growth media, adequate light, temperature, water and fertilizer regimes.

Storage

Anthuriums can be stored at room temperature for 1 - 2 weeks. For longer storage, anthuriums should be stored at 55 - 70°F (12.5 - 20°C). At lower temperatures they are very sensitive to chilling injury.

Avoid storing or placing blooms near ethylene producing sources such as injured plants, ripening fruits and vehicle exhaust, as the ethylene gas released will age blooms prematurely.

APPENDICES



APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: ANTHURIUMS

	Input	Quantity	Units	Unit Cost	Total Cost
1.	Propagation				
	Anthurium plants/seeds				
	Pots				
	Vials				
	Growing media				
	Total cost for propagation				
2.	Land preparation				
	Plastic pots/polythene bags				
	Plastic ground cover				
	Other land preparation costs (e.g. equipment rental)				
	Total cost for land preparation				
3.	Crop maintenance				
	Water/irrigation				
	Fertilizer (specify types used)				
	Pest and disease control (specify chemicals etc. used)				
	Total cost for crop maintenance				
4.	Harvest/storage				
	Cardboard boxes/packing material				
	Carnuaba wax				
	Estimate any utility costs				
	Transport to market				
	Total cost for harvest/storage				
5.	Labour				
	Planting material				
	Land preparation				
	Crop maintenance				
	Harvest/storage				
	Total cost for labour				
6.	Rent/insurance				
7.	Miscellaneous costs				
	Total cost of production				

Notes

1. It is recommended that the above data be completed on an annual basis.
2. The cost of any fixed structures should be considered. For example if a structure is solely used for anthurium production in the year and is expected to last for 10 years, then one tenth of the cost of construction (plus any annual maintenance) should be added at item 7.
3. The revenue obtained from sale of the crop should be compared with the cost of production to determine the profit/loss on the operation.

APPENDIX II: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

INSECTICIDES	APPLICATION RATE
Pronto 35 SC	3 - 5 teaspoons/gallon of water
Target	1 - 2 teaspoons/gallon of water
Pirate	½ - 1 teaspoons/gallon of water
Fastac	1 - 2 teaspoons/gallon of water
Caprid	½ - 1 teaspoon/gallon of water
Diazinon (Basudin)	¾ - 1½ pints/acre
Admiral	¼ teaspoon/gallon of water
Dipel	1½ - 2 teaspoons/gallon of water
Aza-direct	1 - 2 teaspoons/gallon of water
Cure	½ - 1 teaspoon/gallon of water
Danitol	1 - 2 teaspoons/gallon of water
Cypro	½ tablespoon/gallon of water
Dimethoate (Perfection, Rogor 40)	1 pint/acre
Phosvel	1¼ - 2 pints/acre
Orthene	3.2 ounces/acre
Permethrin (Ambush)	½ teaspoon/gallon of water
Padan 50 WSP	2 - 3 teaspoons/gallon of water
Lannate	1 teaspoon/gallon of water
Decis	½ teaspoon/gallon of water
Kelthane 42%	1¼ lb/acre
Orthene 75S	1 lb/acre
Malathion	½ - 1 pint/acre
Sevin	1½ lb/acre
BT (<i>Bacillus thuringiensis</i>)	Label rates
Rotenone	1 - 2 teaspoons/gallon of water
Neem X.	8 - 10 oz/gallon of water
FUNGICIDES	APPLICATION RATE
Bellis	2 teaspoon/gallon of water
Acrobat	2 - 4 teaspoon/gallon of water
Mancozeb (Dithane M45)	1.5 lb/acre
Cabendazim	2 teaspoon/gallon of water
Daconil	1½ - 2 pints/acre
Benomyl (Benlate)	6 oz/acre
Captan	2 - 3 teaspoons/gallon of water
Peltar	3 teaspoons/gallon of water
Manzate DF	2 - 4 teaspoons/gallon of water
Bravo	1½ - 2 pints/acre
Tri-Milttox-Forte	3 teaspoons/gallon of water
Botrilex	5 - 200 lbs/acre
Kocide 101	2 - 4 teaspoons/gallon of water
Cupravit	2½ lb/acre

APPENDIX II: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

WEEDICIDES	APPLICATION RATE
DCPA (Dacthal W-75)	10 lb/acre
Diphenamide	4 - 10 lb/acre
Paraquat (Gramoxone)	1 - 2 pints/acre
Dymid 80W	5 lb/acre
Atrazine 80 (Gesaprim).	1¼ - 1½ lb/acre
Linuron (Lorox)	1 pint/acre
Prometryn (Caparol)	0.8 - 1.6 lb/acre
Sethoxydim (Poast)	1¼ - 3½ lb/acre
Clethodim (Select)	0.094 - 0.25 lb/acre
Prometryn 50WP (Geagard)	2 - 3 lb/acre
Herbicidal Oil (Stoddard Solvent, Kerosene oil)	40 - 80 gallons/acre

APPENDIX III: GOOD AGRICULTURAL PRACTICES DATA RECORD SHEET

Grower name:

* Name of applicator	Date	Brand and product name	Rate	Size of area/no. of plants treated	Total application (amount of the product used)	Notes/target pest	Start/finish time

*The applicator should be trained or, if not, supervised by a trained or certified person. Proof of training required

