# FEASIBILITY STUDY: REPORT ON THE VISIT TO THE NURSERY PLANTOR FOR GROWING ANTHURIUM IN RWANDA 

## ADAR RWANDA AGRIBUSINESS DEVELOPMENT ASSISTANCE

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# REPORT ON THE VISIT TO <br> THE NURSERY PLANTOR FOR GROWING ANTHURIUM IN RWANDA <br> - <br> FEASIBILITY STUDY 

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## INTRODUCTION

To rebuild the economy of Rwanda after the war much assistance is being provided to the country. USAID is sponsoring several projects and has set up ADAR as a centre for co-ordination of agricultural initiatives. The organisation ADAR helps people to develop viable agricultural enterprises. This study was conducted following a request from Mr. Francois Rusanganwa, owner of the flower production operation "Plantor". Mr. Rusanganwa was interested in producing and exporting Anthurium flowers. Production of Anthurium is the main activity of Plantor, but other ornamental plants are grown there as well.

In March 2002, the World Bank carried out a study on the potential for developing horticultural enterprises in Rwanda. A great deal of general information concerning climate, production possibilities, export and transport is given in the report. Anyone interested in learning more about horticulture in Rwanda is advised to read this report.

The following report is written by a consultant from Bureau IMAC Bleiswijk B.V. Bureau IMAC is specialised in consulting and advising Anthurium growers, especially those in The Netherlands. We also provide advice to growers in other countries, through visits and telecommunications. Because of our expertise we were asked to examine the present situation in Rwanda and to make a feasibility study for exporting Anthurium. This report therefore covers the possibilities for growing and exporting Anthurium, with a focus on Plantor.

During the visit it became clear that much needs to be done before Anthurium exports can become viable. For that reason four options for the development of Plantor are proposed. The first three concern Anthurium production, and the last the general development of the nursery.

- Option 1. Starting with new varieties and new greenhouse for export, $5000 \mathrm{~m}^{2}$.
- Option 2. Starting with new varieties and new greenhouse for local market, $1000 \mathrm{~m}^{2}$.
- Option 3. Continuing present situation with old varieties and old greenhouse for local market.
- Option 4. Suggestions for the production of other plants and flowers.

The three options for Anthurium vary greatly in requirements of investment and expertise, and consequently are associated with different levels of risk as well as and potential for success. The required investments for each option are given below.

The chapters covering the different options start with a brief description of the present situation. For every option the required investments are given, along with recommendations. In many cases reference is made to the book "Cultivation Guide Anthurium". This book is highly recommended for those interested in entering into Anthurium production.

This report was written by Harmen Hummelen from Bureau IMAC-Bleiswijk B.V. after visiting Rwanda in July 2002. In addition to the visits in Rwanda information was gathered in The Netherlands, Uganda and Kenya.

## 1. HISTORY AND PRESENT SITUATION OF THE NURSERY PLANTOR

Plantor is owned by Mister Francois Rusanganwa and is located near Kigali. The nursery grows a broad range of products. In addition to Anthurium, other cut flowers, potted plants, shrubs and trees for landscaping are produced. The cultivated area is approximately 2 hectares. In total there are 8 hectares available but most of it is not flat. A river passes through the premises and this water is freely available. The buildings at the nursery are partly burned and destroyed, however some could be rebuilt and used. At the moment there is no electricity. A mobile phone is used for communication.
A small shop is located at the entrance of the nursery and this shop sells plants to the people who come from Kigali. Flowers are also sold to the shops in Kigali.
Before the war business was done with clients in Belgium. An important product was Dracaena potted plants, with 10 tons being shipped to Belgium every week. Anthurium flowers were also sent to Gent in Belgium. During the war production was low and the buildings were partly destroyed. At the moment the economy is recovering, and therefore the potential for export production of flowers is rising.

## 2. CLIMATE

Anthurium can be grown in most countries, although requirements for protected cultivation vary. During the visit to Rwanda Anthurium plants were seen growing outside in pots at the airport and hotels, indicating outdoor production poses no problem. Below a short summary is given for the optimal growing conditions together with the climatic data for Kigali.

### 2.1. General required growing conditions

The optimal temperature for Anthurium production is between $17^{\circ} \mathrm{C}$ and $32^{\circ} \mathrm{C}$ with an average day temperature around $23-24^{\circ} \mathrm{C}$. Higher temperatures can be tolerated but growth is reduced.
The plant grows best when the relative humidity (RH) is above $50 \%$; a lower level results in reduced size of the flower. A very high humidity can cause damage because the resultant high water potential inside the plant leads to undesirable water exudation from the roots, leaves and flowers.

Anthurium is very sensitive to exposure to high light intensities, with a level 250 Watt or 25.000 lux being the optimum at plant level. For that reason the light is reduced by growing plants under shade cloth. The absolute radiation determines the type of shade cloth that has to be installed over the plants. The light energy in Joules/cm2/day influences the speed of growth and production.

Heavy rainfall is not desired as it can damage the flowers. A lot of rain (in the absence of rain protection) will also leach away the minerals from the flowerbeds. Too much wind can damage the greenhouse and the plants.

### 2.2. Climate data for Kigali

The temperature varies between 15 and $30^{\circ} \mathrm{C}$ with an average around $20.6^{\circ} \mathrm{C}$. Because of the high altitude and proximity to the equator the temperature fluctuation is minimal. The rainfall is well distributed over the year. The amount of sunshine varies only slightly over the year.
The following information comes from the report "Study of the Horticultural Sub-sector in Rwanda". This report also contains the climate data of the other regions in Rwanda.
Location Kigali Lat: 0158 Lon: $03008 \quad$ Alt: 1.490

| Month | Av. Max. ${ }^{\circ} \mathrm{C}$ | Average $^{\circ} \mathrm{C}$ | Av. Min ${ }^{\circ} \mathrm{C}$ | Rainfall (mm) | Hours of sunshine |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 26.305 | 20.576 | 14.850 | 65 | 5.493 |
| 2 | 26.514 | 20.764 | 15.014 | 105 | 5.395 |
| 3 | 26.300 | 20.696 | 15.092 | 110 | 5.202 |
| 4 | 25.594 | 20.512 | 15.413 | 174 | 5.107 |
| 5 | 25.322 | 20.408 | 15.494 | 91 | 5.550 |
| 6 | 25.832 | 20.200 | 14.576 | 21 | 7.032 |
| 7 | 26.439 | 20.422 | 14.406 | 9 | 7.391 |
| 8 | 27.367 | 21.355 | 15.303 | 31 | 6.891 |
| 9 | 27.349 | 21.225 | 15.100 | 72 | 5.922 |
| 10 | 26.671 | 20.942 | 15.210 | 96 | 5.533 |
| 11 | 25.629 | 20.272 | 14.913 | 124 | 5.008 |
| 12 | 25.793 | 20.309 | 14.823 | 88 | 5.285 |
| year | 26.260 | 20.638 | $\mathbf{1 5 . 0 1 7}$ | $\mathbf{9 9 0}$ |  |

## Conclusion and recommendation

The conditions for growing Anthurium in Rwanda are good to very good. The average temperature is a bit low, but this will cause a relatively slow growth rate, which results in flowers of high quality. The maximum temperature is not too high. The minimum temperature can be below $15^{\circ} \mathrm{C}$ so long as the days are warm. The plants and flowers can be damaged by low temperatures but plants will recover. Experience at Plantor has shown that plants have no problems with the low temperatures.

The sunlight is always too strong for Anthurium so a shade cloth is necessary to reduce the light. The intensity of the sun does not vary much over the year so only one type shade is required, although it might be advisable to apply extra shading from June until September in order to improve quality.

The rainfall is constant over the year and is relatively low, hence producing the flowers under plastic is not essential, but could be of value in improving flower quality.

## 3. VARIETIES AND PLANT QUALITY

The quality of Anthurium plants and the type and colour of varieties grown are critical to the production and marketing of the flowers. Good planting material must be purchased from a wellknown breeder. The plants should have a certificate from the plant protection service, which shows that the plants are free of diseases. The choice of flower color depends on the demands of the different markets as well as the preference of the grower.

### 3.1. General requirements

The market demands flowers of first quality. The size required depends on the specific market targeted, with the average size being a breadth of 14 cm . A well-known variety is important because buyers are more inclined to purchase flowers with known characteristics.

### 3.2. Present situation

At the time of the study, Plantor's greenhouse contained a mixture of Anthurium plants with different flower colours. The names of the varieties were not known, and the flowers were harvested as a mixture of colours. The varieties are old, with the result that the size of the flowers and the productivity are far below current standards.

The quality of the plants was variable, with some in a reasonable condition. The maintenance has been minimal over the past years, and because of that production was not very high.
The flowers were being sold to local shops.

Option 1 Starting with new varieties and new greenhouse for export
To be a successful Anthurium producer, one must have first quality flowers which are a good size. The market is only interested in newer, recognized varieties. For export at least $1000-2500 \mathrm{~m}^{2}$ per variety is necessary to have a continuous production of flowers in sufficient quantities to be of interest to importers.

Option 2 Starting with new varieties and new greenhouse for local market
To successfully create a new local, exclusive market, new varieties of Anthurium would have to be grown. The colour and quality of new Anthurium varieties are superior to the older ones presently grown at Plantor, and could, as a result, fetch higher prices. These varieties could also be a starting point for future exports.

## Option 3 Continuing present situation with old varieties and old greenhouse

Growing mixture of Anthurium plants with different flower colours does not pose problems for production, but does require more work after harvesting. It is better to have plants of the same colour grouped together, in that way less time is spent searching for the desired colour. The surface area planted to each colour is known and the production can therefore be more easily estimated.

## Conclusion and recommendation

The newer varieties are superior to those presently being grown at Plantor; therefore planting new varieties is the basis for improving production.

## Plant material

In The Netherlands three companies are developing new Anthurium varieties, namely Anthura, AVO Anthurium and Florist (see Annex 3 for the addresses). The only other Anthurium breeding activities outside of the The Netherlands are in Hawaii. Anthura is the world leader in Anthurium development, and has on offer broadest range of flower colours. The auction statistics show that in 2001 Anthura bred the ten most widely grown Anthurium varieties.
When selecting Anthurium colour, the demand from the market has to be taken in to account. The statistics from the auction are helpful for this. For export production, the main colours are best to start with. For a local production a broader mixture with all colours is most useful. A good mixture should contain at least the following colours: red, white, green and pink. Additional colours are brown and white with a red edge. The selection of the variety to use for each colour category depends on what the breeders can supply.

The following list gives most the major Anthurium varieties found in The Netherlands according to flower colour.
Variety Colour
Tropical red
Midori green
Acropolis white
Cheers pink
Champagne whitish, cream colour
Pistache green, with some red veins
Choco brown
Casino orange
Carnaval white with red edge

## 4. GREENHOUSE REQUIREMENTS

The location and the size of the greenhouse are determined by the area that is available. A square greenhouse is preferred because it has sidewalls. A flat piece of land makes working easier and also the construction can be simpler.

### 4.1. General requirements

The greenhouse should be situated close to a main path or road and close to the packing shed. The other fixed equipment that is needed for cultivation should be placed in a shed close to the greenhouse. The plants are planted in beds which these should be horizontal, and allows for the construction of terraces on hillsides. A good path down the middle is needed to facilitate transport inside the greenhouse. Good water drainage away from the inside of the greenhouse is important to prevent water levels from building up.

### 4.2. Present situation

The Plantor site has approximately 8 hectares of land, some of which is hilly, and the rest reasonably flat. At the moment the Anthurium plants are spread over 4 greenhouses. The surface area of the greenhouses, roughly measured by footsteps, is given below. A diagram of the greenhouse layout can be found in Annex 1.

- Greenhouse 1, plants from bad to reasonable condition.

Length 54 m , width 50 m ; 15 m , path, 35 m ; surface $50 * 50=2500 \mathrm{~m}^{2}$

- Greenhouse 2 , very young plants, plants in bad condition.

Length 17 m , width 55 m ; 30 m , path, 25 m ; surface $17 * 55=850 \mathrm{~m}^{2}$

- Greenhouse 3, behind the bamboo tree, plants in good condition.

Length 33 m , width 40 m , path in the middle; surface $33 * 40=1320 \mathrm{~m}^{2}$

- Greenhouse 4, behind the big trees, small plants which are not in good condition, right side not used.
Length 20 m , width 32 m , path in the middle;


## Total surface with Anthurium plants is approximately

$$
\begin{array}{r}
320 \mathrm{~m}^{2} \\
\text { surface } 20 * 16=\quad \mathbf{5 0 0 0}^{\mathbf{m}}
\end{array}
$$

The paths to the greenhouses are in some cases small. Around the greenhouses are some large trees, for example bamboo.

## Option 1 Starting with new varieties and new greenhouse for export

For export production of Anthurium a reasonable surface area is needed, with the minimum being $5000 \mathrm{~m}^{2}$. Looking at the present situation the best place for this greenhouse will be where at the present Greenhouse 1 is standing together with the open land beside it. The greenhouse could be 50 m long and 100 m wide. One option would be to have paths of 50 m length in the middle and along both sides. Another option would be to have 2 paths on both sides of 25 m length (see Annex 2). The latter situation is better for drainage and makes harvesting easier.

The beds should be made parallel to the road and the slope, i.e. the paths should be at a right angle to the road.

## Option 2 Starting with new varieties and new greenhouse for local market

The location of the greenhouse could be anywhere. An important consideration in selecting the site is whether or not there is adequate space for future expansion of the greenhouse in the event a larger greenhouse is desired. For this to be possible, the greenhouse should be located on open land with an area available to allow for greenhouse extension from one side. Alternatively, Greenhouse 1 could be removed, and a new one constructed which could be extended from the right side in the future. Another possibility would be to improve some of the existing greenhouses.

## Option 3 Continuing present situation with old varieties and old greenhouse

No changes would be implemented in this case.

## Conclusions and recommendations

At the moment Greenhouses 1 and 3 are of a reasonable size. The other greenhouses were simply located where there was space. It is important to plan the location of the greenhouse together with a path leading up to same. In the event the first greenhouse built is not very large, plans need to be made for its expansion.

The connecting paths between the greenhouses and packing shed are important and should be made wide enough to allow for easy transport to the packing shed.

The greenhouse should be built close to the packing shed where the pump and fertilisers are placed to reduce the amount of pipes required.

There are trees growing next to some of the greenhouses which are reducing the amount of sunlight. For a more uniform climate and better use of the light some of the trees need to be removed.

## 5. BUILDINGS AND FENCES

### 5.1. General requirements

A shed is needed to protect both workers and materials from the sun and rain during grading and packing operations, and for the storage of goods.

The materials needed for production have to be stored and kept in good condition. This means that fertilisers and pesticides have to be kept dry and locked up to prevent poisoning of people and animals. Packing material has to be clean and neat for a good presentation and the store room should be clean.

The flowers have to be stored at the appropriate temperature after harvesting and packing in order to avoid loss in quality, thus the shed needs to have adequate holding facilities.

The building should have lockable windows and doors to prevent unwanted people from entering. Similarly the nursery should be fenced for security purposes.

### 5.2. Present situation

At Plantor there is only one small building, which can be locked and where some papers and equipment are stored. The nursery is open to the outside and villagers can enter the nursery. Guards protect the nursery at night to prevent theft of the plants.
There is also a building which was formerly a house, which has a good roof and could be converted into a packing hall. The house is 12 m wide and the first room, which is 6 m long, could be made into the central packing area. Behind this room there are other small rooms. These rooms could be used for administrative purposes and storage of packing material, fertilisers and other materials.

The old swimming pool could be used for water storage.

## Conclusion and recommendation

Around the nursery, or at least around a new greenhouse a good fence would have to be installed to prevent people from entering into the greenhouses. This fence could be constructed from barbed wire, or a wall or thorn bushes could be put in place to keep unwanted people outside.

The house would have to be renovated to be usable. Windows and doors would need to be installed, together with locks.

Electricity would need to be installed so that electrified water pumps could operate, and for provision of light in the evening. A telephone line would also need to be installed.

The old swimming pool would need to be cleaned and made waterproof.

## 6. GREENHOUSE AND INSTALLATIONS

The type of greenhouse and equipment installed depend on the climate, the production system, and level of expertise of the nursery staff. In situations where labour is inexpensive, some of the equipment can be replaced with manual labour.

### 6.1. General requirements

The ambient temperature at Plantor is good for growing Anthurium, so the only protection needed is a shade cloth. The shade cloth reduces the light intensity and prevents scorching of the plants. Too much shade reduces growth speed and plant health. The shade cloth should be 3-4 meters above the ground, and preferably at a higher level so as to allow for greater ventilation. To support the shade cloth a framework of poles is needed. The poles can be made of wood or iron.

To provide the desired amount of light at plant level the type of shade cloth is very important. The optimal amount of light at plant level is around 25.000 lux or 300 Watt, whereas the maximum solar radiation is around 100.000 lux or $900-1000$ Watt. This means that the sunlight has to be reduced by $70 \%$ when the sun strength is maximal. For that reason a shade net with $70 \%$ light reduction is needed.

The light levels vary during the day and with the seasons. To be able to react to the daily changes in light an automatic screen is required, which is very expensive. Since the seasonal changes are known, more shade cloth could be installed for the period of higher light intensity. The first shade cloth which would be permanently installed should reduce the light intensity by $40-50 \%$. A second shade cloth, installed during the summer months, should reduce the light intensity by an additional $20-30 \%$. The same degree of shading could also be created by installing a $50 \%$ shade cloth and using local materials like bamboo leaves on top to increase shading in summer time.

In the future, plastic covered greenhouses (as are found at Highland Flowers) should be constructed to provide the conditions needed for greater quality and quantity of Anthurium production. Plastic would both prevent leaching of fertilizers from the soil, and protect the flowers from damage. The plastic will reduce the light intensity to some extent with further reduction provided by laying a shade cloth on top.

### 6.2. Present situation

In the present situation at Plantor the plants are growing under a shade structure of leaves of bamboo and other plants. The density of the material varies a great deal, and consequently so does the amount of shading provided. The natural material also decomposes and falls down on the plants which results in dirty flowers; the bigger particles can damage the plants and the flowers. The plants and substrate are also subjected to the rain.

## Option 1 Starting with new varieties and new greenhouse for export

To start with a shade cloth of $70 \%$ should be installed on 4 m high poles. The combination of $40 \%$ and $30 \%$ shade cloth is even better to be able to vary the amount of light between summer and winter. In future a plastic greenhouse might be constructed to further improve flower quality. The importance of this depends on the amount of damage caused by rain.

## Option 2 Starting with new varieties and new greenhouse for local market

A shade cloth is also needed to provide a more uniform light distribution and prevent damage caused by decomposing natural materials. The shade cloth system describe in option 1 is best. A shade cloth of $50 \%$ in combination with local shading material would be a good option to start with. In that situation a good system for placing and regularly refreshing the natural material as it decomposes would need to be developed and followed. The existing wooden poles could be used to install the cloth.

Option 3 Continuing present situation with old varieties and old greenhouse
The present set up could be kept with no changes except for the installation of a shade cloth. A shade cloth of $50 \%$ together with local (natural) shade material would provide enough shading. The shade cloth would protect the flowers from most of the falling materials.

## Conclusion and recommendation

A shade cloth is a basic investment, and is absolutely necessary.

## 7. CULTIVATION SYSTEMS AND SUBSTRATES

Anthurium is an epiphytic plant and the roots grow best in a porous substrate with a lot of air spaces and a loose structure. A plant can produce flowers for more than 5 years so the substrate needs to provide stable air spaces and holes. Artificial substrate is advantageous in that it does not break down. Lava stones, which are light with porous structure can also be used. An organic material used as a substrate in other tropic areas coconut husk. At the Plantor nursery bamboo is available so a mixture containing this material could be used as a substrate. The disadvantage of organic material like bamboo is that the material breaks down over time; on the other hand, organic material has a higher water holding capacity. In the north of Rwanda, lava stones can be found. The advantage of using lava stones is that they keep their shape, and the air holes are stable. The disadvantage to lava stone is that water and fertilizers drain quickly out of the substrate.

A good drainage system is also essential because roots rot easily if the substrate is saturated with water, due in part to the lack of oxygen which results. A substrate with larger size particles will drain easily but is poor in retaining fertilizers.

### 7.1. Present situation

At Plantor, Anthuriums are being grown in beds composed primarily of clay soil, to which organic matter (leaves, cow dung) is added.

### 7.2. Required Bed system

Anthurium plants should be grown in beds or pots containing a good substrate. A bed can be 120 cm wide with a layer of $15-20 \mathrm{~cm}$ of substrate. In Cultivation Guide Anthurium (page 123) an example of such a bed is shown. The path between the beds should be 80 cm . In one bed, 4 rows of plants are planted. There needs to be a drainage system in the bed so that water drains either off to the side or to one end of the bed.

It is important that the slope is sufficient to allow the water to flow away easily, and there should absolutely be no lower places were water is left standing. The slope should not be too great or water with flow away directly before it can be absorbed by the substrate. The recommended slope is 1 cm for 25 meters.

## Option 1 Starting with new varieties and new greenhouse for export

In this system beds are constructed on top of the soil. The beds should be 120 cm wide and $15-20 \mathrm{~cm}$ high. The sides are made of bamboo the bed is lined with plastic to protect the plants against possible soil nematodes and other soil diseases. In the middle of the bed space is made for a drain tube, with the drain tube extending to the end of the bed. Pictures of this type of bed can be found in Cultivation Guide Anthurium. In this system the substrate is composed only of lava stones. This necessitate application of water and fertilizers automatically 2 to 6 times each day. A reliable electricity supply and a good pump and sprinkler system are necessary.

## Option 2 Starting with new varieties and new greenhouse for local market

A similar bed system as in option 1 is advised in the event new planting material is purchased.

## Option 3 Continuing present situation with old varieties and old greenhouse

Construct the beds as described above, leaving out the plastic. The water should drain to the sides into the path. This can be achieved by not making the bottom of the bed flat but with a slight slope to the side.

## Required Substrate

Anthurium plants need a good substrate for optimal production. Substrate is one of the most difficult problems to resolve when only local materials are available. The objective is to have an airy substrate that is light and which allows for easy root penetration. For this reason large sized particles are needed. It is also important to remember that the material should last for 5 years.

A suggested substrate is a mixture of lava (from the north of Rwanda lava), clay and bamboo from the Plantor nursery, to which purchase cow dung is added. The clay retains water and fertilisers. The bamboo creates holes for air and retains some water. The lava provides a light structure to the substrate. The cow dung adds nutrients, and contributes to the substrate's water holding capacity. Organic material and clay retain more water which reduces the need for frequent watering

## Option 1 Starting with new varieties and new greenhouse for export

For good growth lava stones are advised. The stones should have a diameter of 0.8-2.0 cm , and should be light in weight.

## Option 2 Starting with new varieties and new greenhouse for local market

Depending on the watering system the substrate can vary from only lava stones to a mixture of lava stones, bamboo and some clay. See the table below, under option 3.

## Option 3 Continuing present situation with old varieties and old greenhouse

In this case a mixture of clay, bamboo, cow dung and lava can be used for the substrate. Suggested mixtures are shown in the table below. The lava and bamboo particles should be 0.5 to 2 cm in diameter.

## Percentage in the mixture

| Mixture | lava | bamboo clay |  | cow dung |
| :---: | ---: | :---: | :---: | :---: |
| 1 | 50 | 30 | 20 | 0 |
| 2 | 30 | 35 | 30 | 5 |
| 3 | 20 | 35 | 40 | 5 |

Clay holds a great deal of water, so with a higher percentage of clay in the mixture, the frequency of water application is reduced. The bamboo and the lava particles create a more porous substrate. The bamboo is broken down over time, so after 3 to 6 years the substrate has to be renewed. With more lava in the substrate water drains out more quickly, necessitating more frequent application of water. One way to determine which of the above mixtures would work best at Plantor is to try each in separate beds in an experimental set up.

## Conclusion and recommendation

With a good bed and drainage system, and water and fertiliser supply, a substrate composed of lava stones alone is preferred. Where only simple watering systems are available, other components need to be added to the substrate, namely clay, bamboo and cow dung. A good drainage system is essential to avoid root rots in places where water tends to collect.

## 8. WATER

It is very important to have a good quality water supply. It is a basic necessity for every living thing. In the water the fertilisers are dissolved and distributed to the plants. Moreover water can be used to lower the temperature and increase the relative humidity. Water should be available throughout the year.

### 8.1. General requirements

A constant water supply is very important, and, if possible, should come from a reservoir to ensure that it will always be available. With pumps the water is taken from a well or river to the reservoir and subsequently from reservoir to the plants.

Watering can be via an automatic system or by hand. Watering by hand is done with a hose. The automatic system uses pipes with sprinklers, which lie in the bed between the plants. The water distribution is more equal over the bed and watering at a greater frequency easier to achieve with an automatic system. Sprinklers are not too sensitive to blockage by dirt which may be in the water and can be replaced very easily.

Another way of applying water is with drip lines. These are tubes with small holes, which deliver small amounts of water. The disadvantages to this system are that the water is concentrated under the drip point, and the tubes are more susceptible to blockage dirt; it is difficult to tell whether or not the drippers are working.

When sprinkler or drip systems are used, the irrigation water should be free from at least visible dirt to avoid blocking of the sprinklers and drippers. If dirt is present in the irrigation water, a filter (such as the sand filter at Highland Flowers) is necessary. The water can be collected in a reservoir where most large dirt particles will sink to the bottom. The water will then be filtered between the reservoir and feeding it into the irrigation system.
Water quality has to be checked with respect to two major factors: biological contamination and water purity.

Biological contamination is concerned with diseases, bacteria and nematodes (regarding the importance of diseases, refer to the disease chapter). Diseases are difficult to detect in a water sample so general information about existence of diseases in the production area is needed.

Water purity, in this case absence of mineral salts, is also important. The most important are the electric conductivity (EC) and pH . The salinity of the water is expressed in the EC , this should be below 0.5 $\mathrm{ms} / \mathrm{cm}$. The pH should be around 6 . The water must be analysed for macro elements and microelements.

Rainwater is best for irrigation, but river water or well water can also be used. Well water often has a higher EC and pH due to calcium and bicarbonate. A combination of well water and rainwater can also be used.

### 8.2. Present situation.

The water used for irrigating plants at Plantor comes from the adjacent river, flowing along a channel to the plant beds. The plants also receive water from rainfall. With the current system, plants are exposed to surface water, and thus water-borne diseases which are present spread to all the plants. Samples of water were taken from the well and river for analysis, and the results are shown in annex 4.

The water quality is good, with low EC and small amounts of calcium and bicarbonate.
Direct water measurements with hand EC and pH meter revealed the following values.
EC pH
$\begin{array}{lll}\text { river } & 0.1 & 7.8\end{array}$
well $0.2 \quad 6.0$

## Option 1 Starting with new varieties and new greenhouse for export

Good water supply could be obtained with a good reservoir and filter system, preferably using well water.

For plants in beds with lava stones, the best irrigation system is an automatic sprinkler on the surface of the bed in between the plants. For this system 2 PVC pipes are placed on each bed, with sprinklers every 60 to 75 cm , depending on the type of sprinkler. Another irrigation system would be to use drip lines, such as those used at Highland Flowers. In this case, 4 drip lines per bed are needed.

## Option 2 Starting with new varieties and new greenhouse for local market

A sprinkler system as described in option 1 would be best for irrigation. Hand watering could be done, but is very time consuming and is less uniform. Filtering the irrigation water would be beneficial, but not absolutely necessary.

## Option 3 Continuing present situation with old varieties and old greenhouse

A sprinkler irrigation system would still be the easiest one to manage. Otherwise, watering by hand from the top with a hose is acceptable, provided water is not simply put into the pathways (as occurs at present), where it does not reach the plants, and makes the paths difficult to work on.

## Conclusion and recommendation

In the future, if new plants are purchased and planted, they should be watered with well water as it is less likely to be contaminated with diseases or chemicals.
When plants are grown in beds, using the new system, water has to be applied from the top. This requires a pump and electricity to distribute the water. The electric pump can be switched on by hand by one of the workers. Pipes and sprinklers are needed for a uniform and regular water distribution.
For the older system, hand watering using a hose with a rose head or spray nozzle can be used. Watering by hand is feasible as long as the substrate contains a lot of clay, which reduces the need for frequent water applications. If the substrate contains less clay it is better to use an automated system.

## 9. FERTILISERS

For good growth and optimal production a plant needs adequate and regular fertilization. The choice of the method of fertilizing depends on the production system employed.

### 9.1. General requirements

It is important to note the difference between compound fertilisers and single fertilisers. Compound fertilisers contain several elements and single fertilisers only one or two. With single fertilisers it is possible to work more precisely.
It is also important to note the difference between methods of applying fertilizer. Fertilizers can be first dissolved in water, and the resulting solution applied to plants, or the fertilizers can be applied directly to the substrate in which plants are growing. For the latter method, the only equipment required is a hose, with the fertilizers being rinsed into the substrate (where they are then taken up by the plants) each time the plants are watered. When using the first method of fertilizer application, the fertilisers are dissolved in a tank with clean water and channelled to the plant beds by pipes, where the solution is applied via sprinklers. To make a standard fertiliser solution, one needs 1 to 2 tanks of 10001 capacity, and a machine which adds the fertilizers in the amounts needed to achieve the desired concentrations; the Dosatron found at Highland Flowers is an example of such a machine.

Instructions on preparation of standard feeding schemes for both solid and water soluble fertilizers can be found in "Cultivation Guide Anthurium", pages 54-55.

### 9.2. Present system

Minimal fertilizers are applied to the Anthurium plants at Plantor at the present. Cow dung is occasionally applied, and plants extract minerals from the clay soil.

## Option 1 Starting with new varieties and new greenhouse for export

For this situation, single fertilisers would be used with two 1000 litre tanks ("A" and "B" tank). In each tank the specific fertilisers are dissolved and with 2 Dosatrons applied into the watering system. This system is similar to that found at Highland Roses.

A fertilization program is proposed, based on the content of the water from the well or the river.; this program can be found in Annex 5.

## Option 2 Starting with new varieties and new greenhouse for local market

Depending on the substrate and irrigation system used, the choice would be either water soluble or solid fertilisers. If the substrate has a higher clay content, use of solid fertilisers is possible.

## Option 3 Continuing present situation with old varieties and old greenhouse

The least expensive method of fertilizer application is to apply solid fertilisers directly to the bed. When the bed is watered, fertilizer moves with the water into the substrate, where it is taken up by the plants (see "Cultivation Guide Anthurium", page 55). The NPK fertiliser 17-17-17, which is available at Agrotec in Kigali., could be used. For a balanced fertilizer regime, other fertilizers also need to be applied. Specifically, the plants need more nitrogen and potassium, along with calcium, magnesium and sulphate. The fertilizer program given in "Cultivation Guide Anthurium" uses another compound fertiliser, along with these other fertilisers. The average amount of solid fertiliser should be around 20 gram $/ \mathrm{m}^{2} /$ week. The amount of microelements which should be applied has not been calculated because it is not known which microelements are in the compound fertiliser.

Recommended fertiliser program with compound fertiliser 17-17-17.

| fertiliser | elements | concentration | gram/m $/$ week |
| :--- | :--- | :--- | :--- |
| compound | $\mathrm{N}-\mathrm{P}-\mathrm{K}$ | $17-17-17$ | 6 |
| potassium nitrate | $\mathrm{KNO}_{3}$ | $38.2 \% \mathrm{~K}, 13 \% \mathrm{~N}$ | 1.5 |
| calcium nitrate | $\mathrm{CaNO}_{3}$ | $19 \% \mathrm{Ca}, 15.5 \% \mathrm{~N}$ | 4.5 |


| magnesium sulphate | $\mathrm{MgSO}_{4}$ | $9.9 \% \mathrm{Mg}, 13 \% \mathrm{~S}$ | 4.5 |
| :--- | :--- | :--- | :--- |
| potassium sulphate | $\mathrm{KSO}_{4}$ | $44.8 \% \mathrm{~K}, 17.0 \% \mathrm{~S}$ | 3 |
| Total per week |  |  | 19.5 |

## Conclusion and recommendation

Compound fertilisers in combination with some single fertilisers could form the basis of a good fertiliser program. Whether this mixture is dissolved in water or applied directly to the beds depends on the watering system. Use of soluble fertilizers, dissolved in the irrigation water, is necessary where a lava substrate is used because fertilisers need to be applied daily in this case, which is not possible with solid fertilizers applied by hand. In this situation, the Dosatron machine is needed to mix the fertilisers in the right concentration into the water.
A good pair of scales or balance is needed to weigh out the fertilizer in order to make up the solution to the correct concentration. A pH and EC meter are also needed to check the solution prior to its application. These meters can be purchased in Kampala or Nairobi; it is advisable that spare parts also be ordered in the event of damage during operation.

## Supply of fertilisers

Fertilisers are available in Kampala (this is where Highland Flowers procures their supplies). In Kigali the only fertiliser available is a compound fertilizer, NPK 17-17-17. The proposed fertiliser program lists the required fertilisers. The percentage of an element can be differ for fertilizers sourced from different suppliers.

Compound fertilisers can contain microelements in undesirable quantities; however, this is not a problem when plants are given abundant water, e.g. using the hand watering system.

## 10. DISEASES

Anthurium is in general not very susceptible to diseases. There are two diseases, which can be very harmful, and they are discussed below. There are, in addition, general plant pests which can also affect Anthurium.

### 10.1. Serious Anthurium diseases

The bacteria Xanthomonas axonopodes pv dieffenbachiae, (common name, bacterial blight) is an extremely harmful disease. This bacterium has large areas of Anthurium production in Mauritius and Reunion. If clean planting material is used, and the disease is not present in the surrounding environment, it usually does not pose a problem. With good hygienic practices, the disease can be prevented. Annex 6 contains a description of the disease, along with photographs.
No bacterial blight was observed on the Anthurium plants during the visit to Rwanda. Other susceptible species, such as Calla Lily, were seen growing in areas around the Anthurium plants. Since these species (in the Aracea family) could transmit bacterial blight to the Anthurium, if infected, they present a potential danger. It is advisable to allow only Anthurium to grow in the greenhouse (excluding all other members of the Aracea, like Calla Lily), and to allow only the workers to enter the greenhouse.
The second serious parasite is a nematode with the Latin name Radopholus similis,. Many nematodes can damage plants but this is the most important one affecting Anthurium. This nematode also lives on banana. If a clean substrate is used, the chance of infection is minimal. Also, it is better to use well water than water from a river, as nematodes are more likely to be found in the latter source. Since the nematodes can in the roots of the Anthurium plant, it is better to buy planting material from a certified breeder. Do not mix new plants in with old ones to avoid cross contamination.

Staff at ISAR stated they were familiar with this nematode, and that they could identify it in contaminated samples. From visual observation, the plants did not appear to be infected with nematodes. It is possible that plants were infected, but the infection masked by other, more serious growing problems.

### 10.2. General parasites

In general insects like thrips, aphids, and caterpillars, along with mites, can cause damage. Pesticides can be used to control these parasites. According to Highland Flowers, no thrips are present in their greenhouses.

Few signs of insect or mite damage were observed during the visit.
Fungal diseases can sometimes infect Anthurium, but in general they do not pose a problem. Under adverse growing conditions, especially when grown under conditions which tend to be too wet, the plants are more predisposed to fungal infection. A good substrate and adequate drainage are very important.

## Conclusion and recommendation

To produce high quality flowers, it is very important to be able to recognise pest problems and to control them properly. It is harmful for the environment and very expensive when pesticides are applied unnecessarily. Control of pests requires that someone capable of identifying symptoms inspect the plants on a regular basis, and determine when, if needed, pesticide applications should be made. Knowledge of the effects of different pesticides on both pests and human beings is also important, along with the ability to properly calculate the amounts to be applied, and how to apply them. It may be necessary to train the person responsible for pest management so that they can properly conduct the pest management program.

A hand lens or magnifying glass is needed to see small. For proper pesticide application, it is necessary to have a high quality sprayer. This can be a backpack sprayer with a manual pressure system.
A secure storeroom is necessary to keep the pesticides in a good condition and to prevent theft. A balance and measuring cup are required for measuring out the correct amounts of pesticides. Some pesticides can be purchased in Kigali at Agrotec, however for larger quantities and special chemicals, procurement would have to be made from Kampala.

## 11. HYGIENE

Precautions must be taken to reduce the risk of disease infection and spread. This is particularly important in the case of bacterial diseases; good hygienic practices can greatly reduce the spreading of the bacteria. No one should be allowed into the greenhouse who is not a member of the staff, employed specifically for greenhouse work. Putting a fence around the premises would reduce the risk of unwanted people entering into the greenhouse. In the future, additional measures need to be taken , such as requiring the workers to have clean clothes, and disinfecting their footwear and hands before entering the greenhouse.
Standard hygiene practices are given on page 92 of "Cultivation Guide Anthurium".

## 12. LABOUR

Labour is an important consideration in Anthurium production. Plant maintenance, flower harvesting, grading and packing are very time consuming and require trained people. In Holland, cost of labour represents $30 \%$ of the total cost of Anthurium production. The management aspects, along with the manual labour, are very important..

### 12.1. Present situation

At the moment there are around 20 people working at the Plantor nursery, as shown in the table below. Only half of these people are directly involved in production activities. The guards are for protection during the night and 3 other people work outside the nursery.

- 7 garden workers, for Anthurium and other plants
- 1 supervisor
- 1 assistant supervisor
- 1 cashier
- 6 guards
- 3 maintaining the garden of the social security department
- 1 gardener outside the nursery

In Rwanda the daily wage for a labourer is $1-1.5$ USD day ( $700 \mathrm{RWF} /$ day). This is $30 \mathrm{USD} /$ month.
The salary of an agronomist who has a Bachelor degree or higher is around 150-200 USD/month.

### 12.2. Required staff

In The Netherlands the normal situation in Anthurium production is that the owner or a nursery manager works together with several workers. In general one worker is needed for every $1500-1700 \mathrm{~m}^{2}$. Thus for a nursery of $5000 \mathrm{~m}^{2}$, the total number of workers should be 3 to 4 , who will be responsible for the management, plant maintenance, harvest and post harvest operations. The situation in The Netherlands is of course not comparable with Rwanda because of a higher level of automatisation, easier marketing and better logistical and supply systems in The Netherlands. It is, however, an indication what is possible. In Cultivation Guide Anthurium (page 114) the amount of time required for plant maintenance, harvesting and packing of flowers is given.

In a small nursery, the owner is responsible for all management issues and, at the same time also works in the nursery. There is sometimes a distinction between the workers who are working in the greenhouse and the workers in the packing shed. At other nurseries the workers are able to do all the work.

The number of people required for a $5000 \mathrm{~m}^{2}$ Anthurium nursery in Rwanda is:
In the greenhouse 3
In the packing hall 3
General management 1
Sales and export 1
Accounting 1
Total
9

The above calculation is only a rough estimate. The staff's experience and work speed influence the number of workers required. The amount of work for the general management, the sales and export and for accounting is impossible to predict because the such activities tend to require more time in Africa. The initial phase, where a large number of arrangements will have to be made, will probably require a considerable amount of time to be completed.
The security guards, who are essential, form part of the general costs and are not directly related to the Anthurium cultivation.

### 12.3. Profile of the workers

## In the greenhouse

For greenhouse operations, a technical manager and workers are needed. The technical manager should be able to understand the plant production cycle, to know when it is time for pruning and harvesting, how to make the substrates and fertiliser solutions, to set up the irrigation program, scout for pests and diseases and to know when and what control measures should be taken. This person should also be able to show the workers how to do the work and work together with them.
The workers should be able to plant and prune plants; harvest flowers and apply water. They should be careful with the plants to be able to transport flowers from the greenhouse to the packing shed without damaging them.

## In the packing hall

The packing and handling manager is responsible for operations in the packing shed. This person has to arrange everything to make the flowers ready for sale. This includes setting up the packing shed, instructing the workers on how to grade and pack the flowers, and subsequent quality control. This person should also take care of ordering the packing materials, and storing them in a clean room. Women are most often employed to do the packing of flowers. Flowers must be handled carefully in order to avoid bruising.

## Export and sales

After packing the flowers have to be sold. The staff handling the marketing need sales skills in order to get the best price and to maintain good contacts with the customers. For export, the person handling the sales needs to be fluent in English in order to communicate with the importers. This person should also have sales experience and if possible understand the European culture and market.
For the local and regional market the salesman should speak the local language and if possible French.

## General management and finance

Good management of the operations requires a great deal of logistical arrangements. To begin with, all materials needed, from those required for greenhouse construction to the packing materials, need to be sourced and ordered.. After setting up the nursery all the supplies have to be ordered in a timely fashion. Selection and management of workers is also very important. The general manager is also responsible for talking with the bank and with the suppliers.

The first and last step in management is a good financial analysis of the expenditures and the returns. The general manager or investors should together with an accountant judge what the flower price should be, and to set up the financial structure for the nursery. This financial person should also know the volumes of flowers and plants sold, and the prices. By knowing the expenditures and the returns, analyses can be conducted to determine if the production is profitable.

### 12.4. Conclusion and recommendation

When starting up the nursery one person will be in charge of several tasks. It is best is to begin with a good technical manager who has at least a Bachelors degree. This person should be familiar with Anthurium production and know what equipment and materials are necessary. This person can train the workers and check the quality of the flowers.

Along with a technical manager, a person with sales and financial experience is needed. This person should be responsible for selling the flowers, and keep track of expenditures and returns. This person has to be able to order materials and make payments.

These two staff members (a good technical manager and a good sales and financial manager) determine to a large extent the success of the project. The technical manager has to ensure a good quality product is produced, and the financial manager has to keep track of the costs and get a good price for the flowers. These people should be knowledgeable, enthusiastic and able to motivate the workers.

The managers need to be helped by workers. The workers can have a lower level of education. Some workers with at least a secondary level of education are needed for the more difficult tasks and to take charge of operations when the manager is absent.

## 13. MARKET

The market is the most important and difficult aspect because markets can change easily and are influenced by many outside factors. In general there are three markets, the local market, a regional market and the export market to Europe.

### 13.1. Present situation, the local market

At the moment Plantor is growing Anthurium only for the local market. The Rwandan market for cut flowers appeared to be sizeable, judging from the number of flower shops in Kigali. According to Francois Rusanganwa the demand for Anthurium flowers is greater than his supply. This indicates that there is a need to increase Anthurium production. Visits to the Kigali flower shops revealed a limited range of flowers available. The main flowers are listed in the table below. The market price is the price in the shops for the consumer; the grower's price is what the nursery Plantor asks for their flowers.

|  | Flower price in RWF |  | Flower in USD Cents |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Market | Grower | Market | Grower |
| Anthurum | $70-100$ | 50 | $15-20$ | 10 |
| Alstroemeria | 50 |  | 10 |  |
| Asters | 50 |  | 10 |  |
| Calla | 50 | 20 | 10 | 4 |
| Carnation |  |  |  |  |
| Delphinium | $100-300$ |  | $20-60$ |  |
| Roses | $100-150$ |  | $20-30$ |  |
| Tuber rose | 50 | 20 | 10 | 4 |

The quality of the flowers in the shops was not high, except for the roses from Highland Flowers. The flowers were bruised and damaged during transport and placed together in one bucket in the shop. Highland Flowers packs its roses in cartons and delivers the flowers with a small company van.

## Conclusion and recommendation

There appears to be a demand for flowers in general in Rwandan markets. Anthurium is well known and is used in bouquets and flower arrangement at present. For that reason it is expected that the market will accept an increase in production and a higher quality of Anthurium. The vase life of the Anthurium flower is relatively long at higher temperatures, which makes it very useful in tropical countries.

The price for Anthurium flowers in Rwanda is not very high. In the Netherlands the price for a rose is lower than the price for an Anthurium, whereas in Rwanda the rose price is higher. The expectation is that a higher quality flower can command a higher price. The price for Delphinium flowers in Rwanda is higher than that for Anthurium; since Delphinium is a large flower, this indicates that there is a market for large, expensive flowers.

For local sales, more customers would be attracted if a large sign were placed at the entrance of Plantor along the road.

For selling Anthurium to the shops, a photo album of the different flowers available should be made. In addition to pictures of the flowers, pictures of flower arrangements and of pot plants could be shown.

### 13.2. Regional market

The regional market is important because the freight costs are lower, as are the quality standards, cin comparison with those for Europe. Selling to regional markets would allow Plantor to gain experience in packing and transport techniques.

In Africa there are only a few Anthurium growers. There is a large grower in Kenya, and some smaller growers in Egypt, Ivory Coast and South Africa. Most growers only produce for their domestic markets.

Mauritius and Reunion grew a great deal of Anthurium in the past, which they exported to Europe, mainly Italy. This production declined considerably as a result of high levels of infection with bacterial disease.

Small amounts of Anthurium could be sold in markets in region surrounding Rwanda; however all cities on the African continent, which can be directly reached by bus or airplane, are a potential market.

### 13.3. Export market

Growers aiming for the export market will always encounter competition with the growers in the targeted country. Buyers will give preference to imported flowers only if there is a difference in the cost and quality of the flowers. The quality of Anthurium flowers produced in The Netherlands good, and even in wintertime, it is not possible to compete with the superior varieties produced in The Netherlands.

Thus the situation for the Anthurium export market cannot be compared with that of roses, where the quality of African roses in winter is superior to that of roses produced in The Netherlands.

The greatest expense when exporting flowers is the transport cost, with the result that it is not possible to export roses to markets where the distances are great. In most cases, export is possible when there is a direct flight, of reasonable distance, between the producing and importing countries. Exporters are also required to provide regular deliveries in order to gain the trust of the importers. For Rwandan producers, European, and perhaps Middle Eastern, markets offer the best potential.

## Europe

The most important markets are in The Netherlands and Belgium (the latter because of the direct flight from Rwanda). In The Netherlands, most Anthurium flowers are sold on the auction, and from there are distributed all over Europe. In other countries, especially in southern Europe, more and more Anthurium is grown locally.
The prices on the auction in The Netherlands are available (see Annex 7). The prices of flowers are highest between November and March, when it is wintertime in Europe and local flower production is lower. In summer time the prices are very low, and even below the cost of production for Dutch growers. The average price over the entire year is 63 Euro cents (2001), with the lowest price around 40 Euro cents in summer and the highest around 90 Euro cents in winter.
Export to other countries in Europe would be difficult for Rwanda because most buyers purchase flowers in The Netherlands. Since a direct/nearly direct flight is necessary to reduce the transport time, London, Brussels and Frankfurt might be possible markets for Rwandan flowers. In Great Britain supermarkets buy directly from growers but they have very strict requirements and demand a very regular supply.

The auction statistics in The Netherlands give no numbers on imports of Anthurium flowers from Africa. Information given by product managers and importers also indicated that import was minimal. Sometimes when there were high peaks in production, some flowers were imported.

## America

The transport costs will be too high because the plane first goes to Europe before crossing the Atlantic. Additionally, Caribbean producers are taking over this market.

## Middle East

In Iran around 3 hectares of Anthurium are grown. The other countries import flowers on a very small scale, mostly a combination of species from one wholesaler. If there is a direct flight to these countries it would be worthwhile trying to export to the Middle Eastern markets.

### 13.4. Conclusion and recommendation

For export it is very important to have regular flights to the destination market, and a good agent in the importing country who can handle and sell the flowers. A good agent is very important in order to check the flower quality and to ensure the market requirements are met.
It might be possible for Plantor to use the same agent as Highland Flowers. In this way it would be possible to start on a small scale with exports and build up a reputation.

Samples of Anthurium flowers can be sent separately from the roses, on the same flight, and the agent can determine if the quality meets the required standards, and if it is possible to sell the flowers.

It is also a good idea to make photographs of the flowers. A photo album of the Anthurium flowers could be produced to show to product managers of the auctions and importers in The Netherlands.

## 14. HARVESTING AND FLOWER HANDLING

Like many flowers, Anthurium flowers are very perishable and are easily damaged. Normally the flowers are packed in a box in a single layer (an example is shown in the book "Cultivation Guide Anthurium"). For export more value per volume is necessary and for that reason the flowers are packed closer together and with more flowers per box. The box that is presently used is shallower than the standard boxes in The Netherlands. A higher number of flowers per box increases the number of damaged flowers.

### 14.1. Option 1: Starting with new varieties and new greenhouse for export

The starting point is to understand the Dutch packing regulations (Annex 8) for Anthurium, in other words to be familiar with these standards. These standards are well known in Europe and include specifications on flower quality and sizes. For exports from Rwanda, the Dutch regulations result in too low a weight to volume ratio, hence it is not recommended to exactly follow these regulations. Instead, it would be necessary to pack more flowers in one box. This can be done by stacking the flowers on top of each other.

The recommended boxes for transport should fit on a standard pallet. The length should be 100 cm and the width 30 or 40 cm . The height of the box should be as low as possible; the standard height is 10 cm but this should be brought down to $6-7.5 \mathrm{~cm}$, depending on the size of the flowers and the variety.
The price of boxes used for transport of roses by Highland Flower is USD 1.60-180. The box required for Anthurium would be a little bit bigger but the price will be nearly the same.

The flower is wrapped in a small plastic bag and the bottom of the stem put in a small plastic bottle. These materials can not be purchased in Rwanda, and would have to sourced from Uganda or Kenya. Examples of bottles and bags are on display at the ADAR office. The price of a plastic bag together with one bottle is around 5 USD cents.

Transport of flowers within the nursery should be done with trolleys and buckets. The maximum number of flowers per bucket should be between 20 and 30 to reduce damage.

## Option 2: Starting with new varieties and new greenhouse for local market

A good flower requires good protection, thus it is advisable to pack flowers in a box. This would also contribute towards developing experience that would be useful for exporting flowers in the future. Boxes are also recommended for regional transport of flowers, as bruising is reduced.

## Option 3 Continuing present situation with old varieties and old greenhouse

For the local market the flower quality needs to be improved. At present, the workers collect the flowers then have to carry them back to the road. Handling of the flowers is very rough: there are not enough buckets to hold the flowers, and there is no packing shed or table for grading and packing the flowers. Most of this work is being conducted outdoors, and there are no packing materials such as plastic bags or boxes available.

The first step would be to purchase the buckets needed for holding the flowers. The buckets can be brought to the house, which would be the packing shed in future. A table for grading and packing would need to be installed in this house.

The flowers should be sorted according to size and colour. For the local market, the flowers could be distributed in buckets. To prevent bruising a carton has to be placed around the entire bucket, and the bucket transported to the city very carefully.

In the future a small van could be purchased and used for distributing the flowers to the flower shops.
By correctly packing the flowers for the local market the workers will learn how to handle the flowers carefully. Packing material would need to be purchased, and the packing shed set up.

### 14.2. Conclusion and recommendation

Regardless of the scenario, the flowers must be handled carefully, and quality checked after packing and before distribution. Packing in a box is the best way, but is perhaps too expensive for the local market. Printing a logo on the box would serve as an extra advertisement.

For export, a box is required, and should be 100 cm long and 30 or 40 cm wide. The width depends on how many flowers can be laid next to each other. For the smaller flowers 3 flowers could be placed next to each other in a 30 cm box, with bigger flowers the 40 cm box is necessary.

The height should not be too low (minimum 7.5 cm ) or the flower spadix will touch the cover and be damaged. For the local market the box can be higher, the number of flowers per box lower, as is the standard in The Netherlands.

The biggest problem is that the buyers are used to the standard Dutch way of packing and do not readily accept anything else. Repackaging the flowers after import is not an option because this is too expensive. The buyers should accept the different type of packing but this might result in their offering a lower price.

The long transport distance increases the chance for damaged flowers and this will be another reason that importers will be more careful when buying these flowers.

## 15. TRANSPORT

To reach the markets in Europe the only possible option is air transport. For this reason several air cargo companies were visited in Rwanda. The main questions were: what volume of space did they have, what are the temperatures during transport and what is the price per kg freight. Temperature is especially important because below $15^{\circ} \mathrm{C}$ the flowers are damaged beyond the point of being marketable. A temperature of around $20^{\circ} \mathrm{C}$ during transport (in the airplane) and at repackaging locations is essential !!

For the local market and for transport to the airport a small van would need to be purchased for taking the flowers directly to the airport and to clients in town.
When the flowers arrive at the destination the importer has to arrange for the transport within the country. The costs are included in the commission or auction costs.

### 15.1. Air freight companies

## SN Brussels Airlines

This company flies every Tuesday and Saturday to Brussels and continues on to Amsterdam; connections on to Frankfurt are also possible. The plane leaves around 19.20 and arrives the next morning at 6.20 in Brussels.

The temperature during transport is no problem according to the SN Brussels Airlines representative. The amount of cargo is 3-6 ton every week. It is necessary to make a reservation some days before the date of the flight.

The price for transport of flowers is as follows:

- to Brussels 1 kg USD 1.75
- to Amsterdam 1 kg USD 2.00 plus 0.05 for fuel and 0.15 for security, for a total of 2.20 USD

At the moment a contract is made with an import company (Vermeulen, Belgium) for transport of 4000 kg of Dracaena stems each week for a price of USD 1.55. This indicates that prices are lower with larger amounts of cargo transported, and a fixed contract.

An airway bill (LTA) which costs USD 15 is also required.
A clearing agent and the storage at the airport also have to be paid when shipping flowers, for a total cost around USD 100.

## Alliance Express, working for Martinair.

This company handles goods for a wide range of companies.
There is one flight each week on Tuesday leaving at 18.30 and arriving in Amsterdam at 6.00 the next morning, i.e. Wednesday. The transport temperature is no problem.
The price for transport is between USD 2.00 and 2.25 for every kg . There is an extra cost for an airway bill of around .05-. 10 USD, however it was not clear if this was the total or per kg charge.
The freight costs to Johannesburg are between USD 1.75 and 1.90.

## DAS Air Cargo

This company flies on Fridays, leaving Kigali at 20.00 and going by way of Nairobi to arrive around midday on Saturday at Amsterdam and 2 hours later in London. A reservation has to be made by Wednesday.

The temperature for transport is no problem.
The price is between USD 1.70 and 2.00 per kg. The handling costs are $10-$ cents $/ \mathrm{kg}$.
During a discussion about the price, the DAS representative said that the price for Highland Roses was USD 20 for a 10 kg box with a size of $100 * 40 * 15 \mathrm{~cm}$ (the rate being USD $2.00 / \mathrm{kg}$ ). The question of whether a lighter box with only $2-4 \mathrm{~kg}$ would have a lower price was not really answered. It was not absolutely clear if they would charge by the kg or the volume. The representative first wanted to see the box and the content, and to weigh the box.

The DAS representative also provided a calculation of the price per pallet. The price is approximately USD 3000 / pallet, the pallet size being $300 * 220 * 170 \mathrm{~cm}=11.2201$.

An export box is $100 * 40 * 7.5=30.000 \mathrm{~cm}^{3}$, is $301.11 .220 / 30=374$ boxes $/$ pallet
374 boxes for a price of USD 3000 yields USD 8 / box.
Calculating on the basis of flowers, with 15-18 flowers per box than the price is between USD 0.53 and 0.44 per flower. Thus there is a large difference in price when calculated on this basis rather than the kg price.

All companies said that the price is the same throughout the year. Reserving the cargo space early will guarantee that the transport is available.

The cargo size should be based on normal standard size. A pallet used for airfreight is on average 300 cm by 220 cm by 160 cm .

The manager of Highland Flowers mentioned that the flights by Martin Air and DAS are sometimes postponed, but that SN Brussels is always on time.

### 15.2. Price per flower

The weight of one flower is approximately 35-40 grams. The packing material, the box, the bottle with water and plastic bag weigh another 30-60 grams. The Dutch box weighs 900 grams. Using a simple calculation, a flower including packing material weighs a total of 100 grams.
Between 15 and 20 flowers can be packed in a box of $100 * 40 * 7.5 \mathrm{~cm}$, and the total weight will be approximately 2 kg . The average transport costs are $2.00 \mathrm{USD} / \mathrm{kg}$. So the transport cost per box is 4 USD. In the table below, the prices per flower are also given, in case the transport price is $10 \%$ higher.

Transport costs per flower, prices in USD:

| box weight |  | transport price/kg | price per box |  | flowers/box |
| :---: | :---: | :---: | :---: | :---: | :---: | price/flower

### 15.3. Airport facilities

At the airport in Kigali there is a big shed where goods can be stored. There is no climate control so temperature in the hall is the same as the outside temperature. There are some containers available where goods could be cooled at a cost of 50 RWF $/ \mathrm{kg} /$ week.
The flowers from Highland Flowers are brought to the airport 1-hour before the departure of the plane. The paperwork is processed before hand, so that the flowers go directly onto the plane. For the roses there is no storage room at the airport.

### 15.4. Conclusion and recommendation

Only with enough flowers per box could the transport cost be reduced. More flowers per box increases the number of damaged flowers. This manner of packing does not conform with the auction regulations so that the flowers would have to be repacked, unless buyers are found who would accept this method of packing.
The condition of flowers on arrival should be checked each time because the transport temperature which is promised is not always maintained. The reliability of cargo companies is also important and contracts have to be made to avoid situations where the flowers are left behind.

## 16. ECONOMICS

This report suggest three different options for Anthurium production, however there are some general recommendations, applicable to each option, as to how to finance a company.
A company has to produce and sell their product and the selling price should be greater than the production costs. Production requires the appropriate conditions as was described in the previous chapters (the materials, labour and management required).

When a good product is made it still has to be transported and sold. Flowers are a living and fragile product, and require a short transport time under appropriate conditions. The transport time also determines which markets can be reached. The different markets have their own characteristics. Understanding the demands of the market is very important because only for the right products is a good price is paid.

The three options mentioned in this report are not strictly separate roads. The three systems can be combined and changed over time. It is possible to start with option 3, this means improving the present situation. It is also possible to start with option 1, this means a complete new set up with modern facilities. The starting point is determined by how much money is available and what risk can be taken. The following chapter will give an overview of the investments, costs and the income and show the feasibility of every option.
In this case it is also important to mention the $4^{\text {th }}$ option. This has nothing to do with Anthurium but with the other activities of the nursery and in this way the nursery would be less dependent on one product. The other activities could create a stronger financial and knowledge base which could support the Anthurium cultivation. The overhead costs are then not only for the Anthurium but also contribute towards the other activities in the nursery.

## Present situation

At the moment there is a very low level of investment and financial input. This is the result of the war and the following years where there was no demand for flowers. Under these circumstances it was also impossible to invest and to produce because the products could not be sold. At the moment the demand is increasing and this means that investments can return a profit.

## 17. INVESTMENTS

The amount of money required for investment depends largely on which option is chosen. For that reason three investment scenarios are presented. The investment can be divided in 3 important parts: planting material, greenhouse with the growing system and general equipment.

The planting material is very expensive and for that reason should be treated very well. This in turn requires a good greenhouse and growing system. The growing environment for the plants should be optimal. Most of the materials would have to be imported and as a result would be very expensive. Some components could be useful if purchased individually, however others are only useful if the whole system is bought. It is also important to purchase spare parts so that they are readily available when repairs need to be made. The general equipment is necessary for Anthurium production, but can also be used for the other plants which are grown in the nursery.

The basic investments depend to some extent on which option is chosen, but are in general necessary for good nursery development. In the first instance electricity should be provided. In that way light is available and also electric pumps can be used. A telephone line is needed for communication with clients and to accept orders from flower shops in town. To be able grade and pack the flowers, a packing shed is needed; one could be set up in the house that is presently empty. Tools need to be purchased for operations such as planting, harvesting, installation and repair of equipment. The transport available at the moment is minimal. To be able to deliver flowers and plants to the city a small van would be of great help.

## Option 1 Starting with new varieties and new greenhouse for export

Producing for export would require the highest investment. A good greenhouse with good shade cloths would be necessary. The beds and the watering system would also need to be improved, as is described above. A good packing shed and packing material would also be needed.

## Option 2 Starting with new varieties and new greenhouse for local market

The biggest investment would be the planting material, which in turn would require a reasonable greenhouse and production system. A shade cloth would be necessary. The watering system would not have to be a pipe with sprinklers but could be done by hand with a hose. In this case the surface planted should not be too large because it would take too much time to water.

## Option 3 Continuing present situation with old varieties and old greenhouse

To improve the production, the plants should be grown in beds with a good mixture of substrate. The plants have to be protected with netting material; this could be combined with the shading material that is used at the moment. Watering could be done by hand with a hose.

## 18. FEASIBILITY STUDY

To be able to make a good decision regarding the investments, both for the present and in the future, an overview is given. The investments are always a point of discussion because in the proposal more or less standard equipment is used and every grower will discuss the necessity and the price of the materials. Some investments can be carried out with cheaper material or at a later date, which would reduce the total costs.

The flower prices and the production costs are also always a point of discussion. The prices of the past are known and from them an average has been taken with a correction for the expected development of prices.
An important point when investing is the amount of money available from a private source, or alternatively, the amount of money that has to be borrowed from the bank. The interest rate in Rwanda is $16 \%$ and that is high. With a larger investment more money has to be borrowed and with a smaller investment it is expected that less money has to be borrowed.
The calculation is made for the first two options, and not the third (production for the local market with the old plants). The second option is calculated three times, the normal situation, with minimal costs and at last with smaller and in that way cheaper plant material. The costs which are calculated are described separately for each option and an explanation provided where necessary. For the less expensive options some material is left out, which is an indication of the relative importance of different materials.

## General points

The use of the land is not calculated in the study, in other words these costs are extra above the costs mentioned.

The costs of repairing of the buildings are given by Mr. Rusanganwa. Prices of products are partly given by Booth Irrigation LTD in Kenya. Other prices are based on prices in The Netherlands and our experience.

The price of Anthurium plants is taken from Anthura, the largest breeder with the best varieties. The plant costs compared to the total costs are relatively high. This emphasizes again the importance of treating the plants well.
There is a distinction between standard varieties and exclusive varieties; in fact, it is possible to start with only standard varieties but for a good mixture of colours exclusive varieties are also necessary.

The plant price and the freight costs increase with plant size. For export the average best plant size is 15 cm . Smaller plants are possible but require a longer time to come into flowering, and raising the plants carries the risks of diseases and poor growth.
The production is calculated with a production of $40 \%$ in the first year, $80 \%$ in the second year, $100 \%$ in the following three years and this goes down to $90 \%$ in the 2 last years. In the case of starting with smaller plants, which are called plugs, the production is $0 \%$ in the first year, $50 \%$ in the second year and then it continues as with the bigger plants.

## Flower price

The flower price in The Netherlands is reasonably stable. Over the last few years, the average price has decreased slightly every year, but this can vary between varieties. The price of the flowers is highest in wintertime from October until March, ranging between 70 and 100 Euro cents. It is possible to export flowers to The Netherlands only during this period. That means that half of the production is sold for this price, with the other flowers being sold on the local market for a low price.
The average Anthurium flower price was 63 Euro cents in 2001.
The flower price on the local market has to be guessed. During the visit in July 2002 the price was 0.10 USD. The quality of the flowers was also very low. With a good quality the price will go up and a price between 0.30 and 0.50 USD is expected. The amount of flowers needed for the market is not known. It is possible that with an overproduction the flower price will drop. This is comparable with the relatively low price for roses resulting from the overproduction by Highland Roses.

## Option 1 Starting with new varieties and new greenhouse for export

The calculated labour requirements are 2 managers and 7 workers. The number of workers is not very high, and it is expected that these 7 workers are enough for the work in the Anthurium. An additional worker is not very expensive, and would not influence the costs a lot.
The price of a fence can vary a great deal, and a price of USD 10 per meter is not high.
The existing road will need some improvement but this can be done with local labour and materials.
The present buildings have to be renovated, and a good packing shed is absolutely necessary.
For the greenhouse construction poles are needed and wood is expensive. The price of shade cloth is taken from Booth Irrigation LTD.

A shade cloth is absolutely the best investment that needs to be made. Calculations are based on a shade cloth of $70 \%$, but it is also possible to use two shade cloths of $30 \%$ and of $40 \%$; this is, however, a little more expensive.

The irrigation system is very important. Good pumps and enough pipes are needed for a good water supply. For fertiliser distribution, two Dosatrons are proposed. It is possible to use just one, but this requires more labour and in case of break down there is no alternative.

The substrate is very important. The lava has to be taken from the mountains and transport is expensive. The price used is not very high.

With respect to tools and machinery, the highest costs are for a van and a generator. The van is needed for transporting flowers to the airport or to town. To lower the costs a cheaper van can be bought or a van can be hired. A generator is required in the event of an electricity failure.

The calculated total investments show that the cost of planting material is more than half of the total costs.

Packing material, transport and auction costs are a big part of the total costs. The transport price of 0.20 USD is the absolute minimum for a normal flower quality. Transport price can also go up to 0.30 0.40 USD.

The auction costs are the handling fees by the importer and the auction. With a direct export the handling cost can go down by about $10 \%$.

The indirect costs also show a post for plant insurance, this is set at $8 \%$. Every $1 \%$ for insurance is $0 . .25$ USD less costs per $\mathrm{m}^{2}$.

The price of the flowers is the average price on the auction in The Netherlands last year.

## Conclusion and recommendation

The calculation shows that it is not profitable to produce for the export market. Even if no interest had to be paid, the costs are too high. Exporting only when the flower price is high in The Netherlands results in only half of the flowers produced being sold at double the price so in total the income is the same. The other half of the year the flowers have to be sold on the local market resulting in very low prices, which is not profitable.

## Option 2 Local market with normal investment

For the local market the calculation is made for $1000 \mathrm{~m}^{2}$. This means that the overhead costs are relatively high. The biggest question will be how many flowers can be sold on the local market so the best strategy is to start small.
For the labour one manager together with three workers can do the work. With less equipment, more people are needed.

A fence is not included but guarding will have to be done more attentively.
The packing shed can be renovated just a little bit in order to become suitable for packing.
The greenhouse construction stays the same. A shade cloth of $50 \%$ is enough, with extra shading provided by local material.

The water system is no longer automatic, and instead watering is done by hand. In this situation only one pump is needed. The water can flow from the river directly into the basin or the water can be pumped into the basin and later on the pump is used for watering the plants. Pipes are needed for conducting the water.

The substrate has to be reasonably good, but cheaper substrate such as bamboo and clay can be used. For transport a less expensive van can be purchased. A generator is not necessary because watering can postponed in the case of an electricity failure.

The indirect costs are a lot lower because there are minimal costs for packing and transport. The costs for fertilisers and chemicals are also lower.

The flower price used in the calculation is that which would yield a profit. Whether or not this price can be achieved in Rwanda is open to question.

## Conclusion and recommendation

The calculation shows that a profit can be realized after two years if the price of the flowers is set at 0.35 USD. The investments will also contribute towards the production of the other plants and in this way also contribute to the profits.

## Option 2 Local market with minimal investments

In this situation the investments are minimal. The price for the planting material is still the same so it is questionable whether it is wise to start in this way.

The labour situation is similar to the previous option.
The improvements to the packing shed are minimal, and the building materials for the greenhouse and water and bed preparation system are all as inexpensive as possible.

No van for transporting the flowers is purchased, and few tools are purchased.
A calculation of the total investment shows that plant price is $75 \%$ of the total.
The direct and indirect costs are brought back to a minimal amount.
The flower price used in the calculation is that which would yield a profit. Whether or not this price can be achieved in Rwanda is open to question.

## Conclusion and recommendation

The calculation shows that profit is made after 2 years if the price of the flowers is set at 0.30 USD. The profit is similar with that of the previous calculations because the advantage of the lower costs is offset by the lower flower price.

In this calculation the planting material is $75 \%$ of the total cost, with the result that a flower price of 0.30 USD would be required to realize a profit.

## Option 2 Local market with normal investments but with small plants (plugs)

If there is not enough money available, smaller plants (plugs) could be purchased in place of the larger form for planting material. Because of lower cost of the planting material, the investment is lower and so is the interest. Plants do not come into productivity until one year later, and because of their smaller size, the production costs for the first year will be lower.
Small plants are more susceptible for diseases and there will likely be some losses. The expected number of plants that will be lost will be between 20 and $50 \%$; this is not included in the calculation.

## Conclusion and recommendation

Production of flowers does not start until the second year of plant growth. In the following years a higher profit, compared to the other options, can be realized due to the lower costs of interest, depreciation and insurance.

## Conclusion

According to the calculations, it would not be possible to make a profit from production of Anthurium for export. Production for the local market could be profitable if the flower price increased to approximately 0.35 USD per flower. Thus it would be possible to start with minimum investments, but the question is whether flower quality will be good enough to warrant this price. The cost of the planting material is so high that it would be wiser to invest more to reduce the risk of failure due to poor growing conditions. Starting with small plants (plugs) to lower the investment costs is not advised because this would mean a delay of one year before profits can be made, and there is a large risk that a high percentage of the small plants would not survive.

## 19. RISKS

The greatest risk is to be dependent on factors which are difficult to predict and can not be controlled. Factors which can not be controlled are the political situation in Rwanda as well as in the countries importing the products. Local restrictions were not investigated and should be judged by the investors themselves. Import restrictions by countries to which the flowers are sent to cannot always be foreseen.

The general economic situation in Rwanda as well as the rest of the world are difficult to predict, and can influence the currency rate and the flower prices. Changes in the price of oil also impact on profitability. With a change in oil prices, the transport costs are affected which, in the case of export production, can strongly influence the market price. Many petroleum based products (e.g. fertilizer) would also be affected by changes in the price of oil

## Option 1 Starting with new varieties and new greenhouse for export

Most of the exported flowers would be sent to Europe. The market in Europe demands flowers of very high quality and a regular supply. If these conditions are not met, Plantor's reputation would suffer, and the price paid for their flowers would be lower.

Another large variable is the transport to Europe. Transport conditions have to be optimal to maintain flower quality, and hence guarantee higher prices. The transport also needs to be regular and reliable. The largest unknown factor concerning transport is the price of oil, which determines the freight costs. The freight cost is a large part of the total costs in export flower production, so this will have a large influence on the profitability.

## Option 2 Starting with new varieties and new greenhouse for local market

The biggest risk in this situation is over-production. If too many flowers are brought to the market the price will drop, perhaps beyond the cost of production.

## Option 3 Continuing present situation with old varieties and old greenhouse

The old varieties are perhaps too old to satisfy the market demands. Consumers might opt to purchase other types of flowers if only offered the old Anthurium varieties.

## Conclusion and recommendation

The first recommendation is to not be totally dependent on exporting Anthurium because the international situation and oil price can not be controlled. Instead, profits from sales on the local market would provide $20-40 \%$ of Plantor's income (from Anthurium or other plants). If exporting is not possible, the nursery could survive on local sales.

## 20. INFORMATION MANAGEMENT

The first step towards producing a good product is knowledge. Books will provide some knowledge but it is also important to gain information from visiting other growers, and talking to breeders and suppliers.
The book "Guide for Anthurium Cultivation" will answer most questions on the technical aspects of Anthurium production (see the Annex for the order form).

In Africa not many people are growing Anthurium so visiting other growers is not easy. There is one grower in Kenya who might be open to accepting visitors. A good opportunity would be to visit organisations in The Netherlands. For instance, one could visit the breeders of Anthurium (there are three breeders: Anthura, AVO and Florist). The breeders' addresses can be found in Annex 3. The breeders would be able to show visitors their greenhouses, where one can see their cultivation systems. The breeders could even provide names of Anthurium growers who could be visited.

Most flowers are sold at the auction, which is an important organisation to visit, in order to understand techniques of packing flowers, and flower quality. There are two large auctions in the Netherlands, VBA and FloraHolland. For anyone exporting flowers to The Netherlands, it is important to know the contact people at the auctions.

Around the auction there are also many wholesalers and importers of flowers; names could be provided by people from the auction, so that one could contact them directly. Some of the companies are listed in Annex 3.

There is also information available from Africa. Kenya and Uganda have large flower industries, stimulated in part by the countrys' governments. There is an extension service, which provides a lot of information, perhaps not about Anthurium but certainly about many other flowers and supplies. These countries also have suppliers for all the necessary materials. In many cases the Dutch companies have offices in Kenya. The Hortec brochure gives the addresses of many companies and organisations.

In Rwanda itself there is not a great deal of horticultural knowledge, but some does exist. ISAR can assist with many things, as can the university. Also, other growers like Mr. Ndimukaga from Gysenyi and the managers from Highland Flowers can provide a lot of information about growing and/or exporting flowers.

During visits all kind of information and samples should be gathered. The main items are: flower boxes, flower bags, small bottles, shade cloth, irrigation pipes and sprinkler installations.

To understand the systems better and to be able to communicate this information to workers, it is important to take photographs. Photographs of the greenhouse systems, packing techniques, flower quality, etc. could all be of use.

The final step is to invite consultants to visit the nursery or ask questions by phone, fax or e-mail. Visiting the nursery and discussing the growing conditions is the best way to learn more. For advice concerning Anthurium it is advised to contact Bureau IMAC Bleiswijk B.V. For other flower crops and more general advice, consultants from Kenya and Uganda could be contacted.

## Option 4 Other possibilities for the nursery Plantor

This chapter is supplementary, and the advice based only on the consultant's general knowledge of plant production and nursery set up. The recommendations given are useful but have to be worked out by specialists in the particular field.

## Climate

The climate is very good for growing many types of plants with minimal investments.

## Varieties and plant quality

At Plantor, many plant species are grown. Many more types of plants are available in the country, at other nurseries and at ISAR. In addition, seeds and planting material could be purchased in Uganda and Kenya.

For cut flowers from seed the following plants are recommended: delphinium, snapdragon (Antirrhinum major), Limonium, Trachelium and many other plants which are produced in Kenya and Uganda. The fastest varieties are ready in 8-12 weeks, which provides a very fast return on investment. The flower shops asked for carnations and gerbera, and mother plants for these species could be purchased in Uganda.

## Greenhouse and installation

Construction of some greenhouses with a shade cloth will improve the quality of the plants and make it easier to grown young plants.

A good watering system with electric pumps and a hose are also a basic investment for better plants.

## Greenhouse composition

In the future, plantings should follow a good plan with square fields and paths. One field or bed should contain only 1 plant species or variety.

## Water and substrate

There is enough water available throughout the year, which makes it possible to grow plants the year round.

The soil is very rich and many plants grow well on clay. Other plants need more sand in the soil or more humus. Special fields can be made with better mixtures of substrate.

A good compost heap would also be very useful.

## Fertilisers and pesticides

The use of some fertilisers or cow dung will improve plant growth a great deal, and is highly recommended.

The use of pesticides can improve crop quality and would be especially beneficial with young plants to reduce loss of expensive planting material.

## Labour

There are already experienced workers in place. It would be good to engage a qualified agronomist as well. As more varieties are grown, the labour's knowledge base will increase. It might be possible to attract production specialists, along with financial and sales specialists.

## Harvesting and plant handling

The handling of the plants is at present too rough. The staff should be provided with training so that they understand how flowers have to be handled.

## Transport

For internal transport some small trucks should be purchased in order to deliver the plants and flowers to the city on a daily basis.

## Market

There is a local market with many flower shops. A good quality with a year round production of flowers will make selling a lot easier.

## Information management

Rwanda is a small country but has some institutes with enough knowledge to improve the current flower production systems. The neighbouring countries Uganda and Kenya have a lot of specific expertise about growing many plants and flowers. Visiting these countries and inviting consultants from these countries would stimulate the workers and improve the production.

## Economics

With a relatively small investment summer flowers can be grown from seed. The investment is low and the flowers can be sold 3-8 months after sowing. This will give a turnover of money, which is faster than is possible with vegetatively propagated plants which require more time before producing flowers. With a wider range of products, risk of failure is reduced as income is derived from a number of different products.

## Other directions for the nursery Plantor

At present three of the workers at Plantor are engaged for planting and maintaining gardens in Kigali, primarily for government buildings, banks and embassies. An interesting prospect would be for Plantor to also produce plants for and maintain public gardens.
Pot plants and flower arrangements for banks, embassies and hotels will stimulate the production at the nursery level.

## General future perspective

The nursery Plantor has a history of producing plants and is still doing so at present. There are skilled people who know how to grow plants. This in combination with an increasing demand for flowers opens possibilities for expanding the nursery. Flowers other than Anthurium could be grown and sold to the local shops. In this way Plantor could become a major supplier of a broad range of flowers the year round.

In the near future other nurseries are likely to start growing more flowers and only nurseries with a broad range of products and the newest varieties will get the highest prices.

If the roads between Rwanda and Uganda are improved, flowers may well be imported from Uganda and it will be very difficult for Rwandan flower growers to compete with the larger and betterequipped Ugandan nurseries.

The nursery Plantor has to prove in the future that it can grow a wide range of plants and cut flowers for the local market. In so doing it is more likely to attract the interest of investors.

## 21. THE WAY FORWARD AND TIME SCHEDULE

Plantor is at present is too old fashioned, and the staff not sufficiently skilled to take the big step of producing for the export market. Even if a very well qualified manager is employed, it will take at least a year to get over all the start-up problems. The staff have too much to learn at one time, and since they will be asked to work in a different way, this can lead to a lot of frustration on the part of the manager and the workers. This in turn can result in the manager quitting or the worker's refusal to cooperate. Anthurium planting material is expensive so it would be better to first gain experience with other types of plants, for which the starting material is less expensive.

The best approach would be to start producing for the local market. By starting with a wide range of flowers on a small scale, a lot of experience could be gained, the company would be in operation and a local market is created. With a good, functioning company, the next step would be to import new Anthurium varieties. The Anthurium flowers produced should first be targeted for the local market. In the event the prices for Anthurium in Europe are high, some boxes can be sent to Europe and in so doing, experience with export is gathered. If the export is profitable, the surface area planted to Anthurium could be increased.

The following scheme outlines the recommended actions to be taken, and the goals to work towards:

- Final months of 2002:
- Start with improving the greenhouses for the Anthurium
- Buy shade cloth
- Make beds with good substrate
- Start improving the watering system
- Start planting other types of flowers from seed (or in the case of carnation, from mother plants) using plant and seed material purchased in Uganda
- Send people to ISAR and Gysenyi to buy new plant varieties
- First months of 2003:
- Preparing the packing shed for grading and packing flowers
- Find out where to all kinds of building material, fertilisers and packing material
- Train workers on improved flower handling
- Half way through 2003:
- Anthurium plants are growing well
- Production of other flowers from seed should be going well
- Handling of flowers has improved
- The local shops are provided with a better quality of Anthurium flowers and several other types of flowers.
- Prepare a new greenhouse for $1000 \mathrm{~m}^{2}$ of new Anthurium plants.
- Order the plants in June and plant in September.
- End of 2003:
- Anthurium production has improved, with plants growing well in a good greenhouse with a good watering system
- Experience has been gained on use of good substrates and shading, and this is applied in the production of new Anthurium plants
- A wide range of flowers is being produced.
- Following evaluation of all flower varieties, decisions are made regarding which other flowers are needed.
- Half way through 2004:
- Try to export some Anthurium flowers to regional markets.
- End of 2004:
- Try to export some Anthurium flowers to the European market.
- Early 2005:
- Evaluate the success of trial exports to the regional and European market and decide if a larger surface should be planted to Anthurium
- Half way through 2005:
- Prepare the greenhouse for the second $1000 \mathrm{~m}^{2}$ of new Anthurium plants.
- Order the plants ( for September planting)

The above time frame is very short and it is quite possible that it will take twice as much time to complete the above scenario. If the suggestions which were made during the visit in July and in the draft report have already been followed, it would be possible to achieve the above program in the short time span given.

## 22. FINAL CONCLUSION AND RECOMMENDATIONS

The nursery Plantor has a good basis from which to start. At the moment, it would be too large a step to start production for the export market. Whether this step to export can be done in future is uncertain and will depend mainly on the transport costs. An important recommendation is for Plantor to put good technical and financial management in place, in fact it is critical to do so. At present there is very little management, and the owner (Mr. Rusanganwa) does not have enough time to properly manage the nursery.

The best step to take for the moment is too increase the production of Anthurium for the local market by investing in a better greenhouse and watering system. New Anthurium varieties will give an extra boost to flower quality and price. Starting with $1000 \mathrm{~m}^{2}$ will provide good insight as to how to produce Anthurium in a modern system. The investment required for this scenario is not too high. If the flower price is sufficiently high, a profit can be made within two years.

Together with improving the Anthurium production; other flower crops and ornamental plants should be grown. The starting for these plants is in most cases less expensive than that of Anthurium. The cultivation of other crops will add to the nursery's experience in and knowledge of plant production. By producing all kind of flowers the flower shops can be supplied with a broad range of products. In this way the nursery Plantor could become the main producer of broad range of flowers with the best quality.

By increasing the production it would be possible to employ technical specialists and managers. The specialists will improve the flower quality. The managers will learn how to arrange everything and handle problems. Together they will learn how to produce and sell flowers and this can be the basis from which to take the step to export. Export can start on a small scale and thus reduce the risk of losing a lot of money.

With a widder range of products and a good local market the financial basis of the nursery will be stronger. The improvements in the coming year and the quality of the flowers produced will be an indication of whether or not there is enough knowledge and commitment to improve the nursery Plantor. Only by showing that they are capable of a high quality of production will Plantor be attract investors.

## ANNEXES

## Annexe 1: Map of the nursery Plantor

Overview of the present situation of the greenhouses and buildings of the nursery Plantor.
Drawing is not according to scale.


## Annex 2. Proposed greenhouse composition and size.

## Drawing is not according to scale.

Situation 1. Two paths and bed length of 25 m .

| drain gutter | bed | path | bed | drain gutter | bed | path | bed | draingutter |
| :--- | :--- | :--- | :--- | :---: | :--- | :--- | :--- | :--- |
| 2 m | 25 m | 4 m | 25 m | 3 m | 25 m | 4 m | 25 m | 2 m |



The 4 parts are 25 m long and 25 wide. Between the 2 parts is a path. There is a drain gutter at the end of the beds. A bed is 1.20 m wide and the path 0.80 m . There are 12 beds.

Situation 2. One middle path and bed lenght of 50 m.


The 2 parts are 50 m long and 25 wide. Between the 2 parts is a path. There is a drain gutter at the end of the beds.. A bed is 1.20 m wide and the path of 0.80 m . There are 12 beds.

## Annex 3. Addresses of breeders, auctions and wholesalers in The

## Netherlands.

## Breeders

## Anthura

Anthuriumweg 14
2665 KV Bleiswijk, The Netherlands
Tel. +31105220444
E mail. Info@anthura.nl

## AVO Anthurium vogels

Stuartlaan 1
2675 BN Honselersdijk, The Netherlands
Tel. +31174292524

## Florist De Kwakel B.V.

Hoofdweg 42
1433 JW Kudelstaart (Aalsmeer), The Netherlands
Tel. +31297328229 www.anthuriumplant.com

## Addresses of auctions

VBA, Flower auction Aalsmeer
Legmeerdijk 313, Postbus 1000, 1430 Aalsmeer, The Netherlands
Tel. + 31297393939
www.aalsmeer.com
Contactperson; Auke Grond + 31297393939

## FloraHolland, Flower auction Naaldwijk

Middelbroekweg 29, Postbus 220, 2670 AE, Naaldwijk, The Netherlands
Tel. + 31174633333
www.bvh.nl

## Wholesalers or Importers

- Dutch Flower Group
agnolia 1, 1424 LA De Kwakel, The Netherlands
Tel. + 31297389389
- East African Flower Company

Noordammerweg 102 b, 1187 ZV Amstelveen, The Netherlands
Tel. + 31206569777
www.tfa.nl

- Gebr. Berk

Legmeerdijk 313 b, 1431 GB Aalsmeer, The Netherlands
Tel. +31297321766
www.gebrberk.nl

- Zurel en Co B.V. Aalsmeer

Legmeerdijk 313, 1431 GB Aalsmeer, The Netherlands
Tel. +31 297333333
Fax. + 31297333518
www. zurel.nl

## Annex 4. Water analyses results, well and river water.



The well is from a rather good quality for growing Anthurium.

| Feeding solution: | $100 \mathrm{~m}^{3}$ |  | Culture: | Anthurium | Used water anal |  | 6 august 2002 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Solution A 100 times concentrated |  |  |  |  | kg. | ltr. |  | River water Rain water |  |  | Feeding solution | Total elements |
| Nitrate of Lime | $\mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2}$ | 19,0 | $\% \mathrm{Ca}$ | 14,4 \% NO3 | 30,0 |  | $\mathrm{mmol} / \mathrm{tr}$. | 100 | 0 | \% |  |  |
| Ammonium Nitrate (liquid) | $\mathrm{NH}_{4} \mathrm{NO}_{3}$ | 9,0 | \% $\mathrm{NO}_{3}$ | $9,0 \% \mathrm{NH}_{4}$ | 12,0 | 9,6 | NO3 | 0,0 | 0,0 |  | 6,6 | 6,6 |
| Nitrate of potash | $\mathrm{KNO}_{3}$ | 38,2 | \% K | $13,0 \% \mathrm{~N}$ | 16,5 |  | NH4 | 0,0 | 0,0 |  | 1,0 | 1,0 |
| Nitrate of Acid $\quad 38,0 \%$ | $\mathrm{HNO}_{3}$ | 6,0 | mol $\mathrm{H}_{3} \mathrm{O}^{+} / \mathrm{kg}$ | $8,4 \% \mathrm{~N}$ | 0,0 | 0,0 | P | 0,0 | 0,0 |  | 1,2 | 1,2 |
| Chelate of Iron $3,0 \%$ | (DTPA) |  |  |  | 3,5 |  | K | 0,0 | 0,0 |  | 4,5 | 4,5 |
| Solution B 100 times concentrated |  |  |  |  |  |  | Ca | 0,2 | 0,0 |  | 1,4 | 1,6 |
| Monopotashposphate | $\mathrm{KH}_{2} \mathrm{PO}_{4}$ | 28,2 | \%K | $22,3 \% \mathrm{P}$ | 17,0 |  | Mg | 0,1 | 0,0 |  | 1,0 | 1,1 |
| Sulphate of potash | $\mathrm{K}_{2} \mathrm{SO}_{4}$ | 44,8 | \%K | $17,0 \% \mathrm{~S}$ | 4,0 |  | S | 0,2 | 0,0 |  | 1,2 | 1,4 |
| Phosphoric acid $59,0 \%$ | $\mathrm{H}_{3} \mathrm{PO}_{4}$ | 6,0 | mol $\mathrm{H}_{3} \mathrm{O}^{+} \mathrm{kg}$ | 18,6 \% P | 0,0 | 0,0 | umol/tr. |  |  |  |  |  |
| Nitrate of potash | $\mathrm{KNO}_{3}$ | 38,2 | \%K | $13,0 \% \mathrm{~N}$ | 12,5 |  | Fe | 23,0 | 0,0 |  | 18,8 | 41,8 |
| Nitrate of Acid $38,0 \%$ | $\mathrm{HNO}_{3}$ | 6,0 | mol $\mathrm{H}_{3} \mathrm{O}^{+} \mathrm{kg}$ | 8,4 \% N | 0,0 | 0,0 | Mn | 2,3 | 0,0 |  | 0,0 | 2,3 |
| Nitrate of magnesium | $\mathrm{Mg}\left(\mathrm{NO}_{3}\right)_{2}$ | 6,1 | \% Mg | $7,0 \% \mathrm{~N}$ | 0,0 |  | Zn | 0,0 | 0,0 |  | 3,5 | 3,5 |
| Magnesium sulphate | $\mathrm{MgSO}_{4}$ | 9,9 | \%Mg | $13,0 \%$ S | 25,0 |  | B | 0,0 | 0,0 |  | 17,8 | 17,8 |
| Manganese sulphate | $\mathrm{MnSO}_{4}$ | 32,5 | \%Mn |  | $0,0 \mathrm{gr}$ |  | Cu | 0,0 | 0,0 |  | 0,7 | 0,7 |
| Zinc sulphate | $\mathrm{ZnSO}_{4}$ |  | $\% \mathrm{Zn}$ |  | $100,0 \mathrm{gr}$ |  | Mo | 0,3 | 0,0 |  | 0,4 | 0,7 |
| Borax | $\mathrm{Na}_{2} \mathrm{~B}_{4} \mathrm{O}_{7}$ | 11,3 | \%B |  | $170,0 \mathrm{gr}$ |  | pH | 0,0 |  |  |  |  |
| Copper sulphate | $\mathrm{CuSO}_{4}$ | 25,5 | \% Cu |  | $18,0 \mathrm{gr}$ |  | EC | 0,10 |  |  |  |  |
| Sodium molybdate | $\mathrm{Na}_{2} \mathrm{MoO}_{4}$ | 39,6 | \% Mo |  | $10,0 \mathrm{gr}$. |  |  |  |  |  |  |  |

Scledules are given on the condition that the user gives up every claim to responsibility Also check the pH of the feedingwater because the $\mathrm{HCO}_{3}$ concentration can change.

## Annex 5. Feeding schemes for the Anthurium plants.

| WATER ANALYSES (River) |  | 6 augus 2002 |  |  |  |  |  |  |  |  |  |  | Name Date |  | Rwanda, nursery Plantor 24/10/02 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | ositive ions | mol/itre) |  |  |  | Negative i | (mmolli |  |  |  | Micro eleme | (mic | (l) litr ) |  |  |
| Object | pH water | EC $\mathrm{mS} / \mathrm{cm}$ | $\begin{array}{\|c\|} \hline \text { NH4 } \\ \text { ammonium } \end{array}$ | K potassium | Na sodium | Ca calcium | Mg magnesium | NO3 nitrate | Cl chlorine | SO4 <br> sulphate | H2PO4 phosphorus | HCO3 bicarbonate | $\begin{gathered} \mathrm{Fe} \\ \text { iron } \end{gathered}$ | $\begin{array}{\|c\|} \hline \mathrm{Mn} \\ \text { manganese } \\ \hline \end{array}$ | $\begin{gathered} \mathrm{Zn} \\ \text { zinc } \\ \hline \end{gathered}$ | $\begin{gathered} \mathrm{B} \\ \text { boron } \end{gathered}$ | Cu <br> copper | Mo molybdenum |
| River water | 0,0 | 0,1 | 0,0 | 0,0 | 0,4 | 0,2 | 0,1 | 0,0 | 0,3 | 0,2 | 0,0 | 0,3 | 23,0 | 2,3 | 0,0 | 0,0 | 0,0 | 0,3 |
| Marking level | good | good | good | good | good | good | good | good | good | good | good | acceprable | good | good | good | good | good | good |

The well is from a rather good quality for growing Anthurium.
Feeding solution: $\quad 100 \mathrm{~m}^{3} \quad$ Culture: $\quad$ Anthurium $\quad$ Used water analyses of: $\quad 6$ august 2002

| Solution A 100 times concentrated |  |  |  | kg. | lts. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Nitrate of Lime | $\mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2}$ | 19,0 \% Ca | 14,4 \% NO3 | 30,0 |  |
| Ammonium Nitrate (liquid) | $\mathrm{NH}_{4} \mathrm{NO}_{3}$ | $9,0 \% \mathrm{NO}_{3}$ | 9,0 \% $\mathrm{NH}_{4}$ | 12,0 | 9,6 |
| Nitrate of potash | $\mathrm{KNO}_{3}$ | 38,2 \% K | $13,0 \% \mathrm{~N}$ | 16,5 |  |
| Nitrate of Acid $\quad 38,0 \%$ | $\mathrm{HNO}_{3}$ | $6,0 \mathrm{~mol} \mathrm{H}_{3} \mathrm{O}^{\prime} / \mathrm{kg}$ | $8,4 \% \mathrm{~N}$ | 0,0 | 0,0 |
| Chelate of tron 3,0\% | (DTPA) |  |  | 3,5 |  |



| Monopotashposphate | $\mathrm{KH}_{2} \mathrm{PO}_{4}$ | 28,2 \% K | $22,3 \% \mathrm{P}$ | 17,0 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Sulphate of potash | $\mathrm{K}_{2} \mathrm{SO}_{4}$ | 44,8 \% K | 17,0 \% S | 4,0 |  |
| Phosphoric acid $59,0 \%$ | $\mathrm{H}_{3} \mathrm{PO}_{4}$ | $6,0 \mathrm{~mol} \mathrm{H}_{3} \mathrm{O}^{+} \mathrm{kg}$ | 18,6 \% P | 0,0 | 0,0 |
| Nitrate of potash | $\mathrm{KNO}_{3}$ | 38,2 \% K | $13,0 \% \mathrm{~N}$ | 12,5 |  |
| Nitrate of Acid 38,0 \% | $\mathrm{HNO}_{3}$ | $6,0 \mathrm{~mol} \mathrm{H}_{3} 0^{+} \mathrm{kg}$ | $8,4 \% \mathrm{~N}$ | 0,0 | 0,0 |
| Nitrate of magnesium | $\mathrm{Mg}\left(\mathrm{NO}_{3}\right)_{2}$ | $6,1 \% \mathrm{Mg}$ | $7,0 \% \mathrm{~N}$ | 0,0 |  |
| Magnesium sulphate | $\mathrm{MgSO}_{4}$ | $9,9 \% \mathrm{Mg}$ | $13,0 \% \mathrm{~S}$ | 25,0 |  |
| Manganese sulphate | $\mathrm{MnSO}_{4}$ | $32,5 \% \mathrm{Mn}$ |  | $0,0 \mathrm{gr}$. |  |
| Zinc sulphate | $\mathrm{ZnSO}_{4}$ | $22,7 \% \mathrm{Zn}$ |  | $100,0 \mathrm{gr}$ |  |
| Borax | $\mathrm{Na}_{2} \mathrm{~B}_{4} \mathrm{O}_{7}$ | 11,3 \% B |  | $170,0 \mathrm{gr}$ |  |
| Copper sulphate | $\mathrm{CuSO}_{4}$ | 25,5\% Cu |  | $18,0 \mathrm{gr}$ |  |
| Sodium molybdate | $\mathrm{Na}_{2} \mathrm{MoO}_{4}$ | 39,6 \% Mo |  | $10,0 \mathrm{gr}$. |  |

Also check the pH of the feedingwater because the $\mathrm{HCO}_{3}$ concentration can change.
Schedules are given on the cond
Bureau IMAC Bleiswijk B.V.

## Annex 6 : Xanthomonas information, including hygiene measures.

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K.v.K. Haaglanden no. 29039601

Rábobank no. 10.76.46.064
S.W.I.F.T. code Rabo NL 2 U

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IMAC

## Xanthomonas campestris pv dieffenbachiae and Anthurium

The bacteria Xanthomonas campestris pv dieffenbachiae can cause an extremely dangerous disease in Anthurium. It can force its way into the Anthurium plant either through wounds in the leaves or stalks or through the plant's natural openings, such as stomas and hydathodes (guttation openings). In the 1980s this bacterial infection virtually destroyed the Anthurium production in Hawaii. The same happened to Anthurium growers on the island of Tahiti at the end of the 1980s. By strict phytosanitation, many operations on these islands later succeeded in growing Anthurium without Xanthomonas.

## Infections

The bacteria can cause two types of infections. The first type starts in the leaves. The second type begins in the stalk and can spread rapidly through the entire plant via the vascular bundle system. The leaf infection usually starts at the leaf edges and underneath the leaves where most stomas are located. During the early stages watery stains appear underneath the leaves. In a later stage, brown spots occur on the leaf edges, surrounded by a band of yellow leaf tissue. Unless removed in the very early stages, the bacteria can spread through the entire plant via the vascular bundle system. The systematic or vascular-bundle infection becomes visible through yellowing of the leaves. One can identify infections during the early stages by the dull colour of the new leaves. The clogging of the vascular bundles by bacteria causes the dull colour and the yellowing of the leaf, preventing the flow of water and nutrients to the leaves. In a brief period this type of Xanthomonas can result in the stalks of the flowers and leaves falling from the stems. The growing point quickly rots and shows slime formation. Sometimes, the vascular-bundle infection resembles a leaf infection, when the sap flows carry the bacteria to the leaves. In such cases, watery spots appear around the main nerves in the centre of the leaves. It is not possible to save plants that have systematic infections.

## Ideal Conditions

Especially warm and wet conditions assure a rapid multiplication of the disease. The bacteria multiplies by division, resulting in large numbers in a very short time. If, in addition, water gets onto the plants directly and there is leaf damage, the bacteria can easily penetrate the plant. If the plants are given moisture, the bacteria can easily move to healthy plants via the water. People working with the plants can easily spread the bacteria. Plants that show signs of stress, for whatever reason, appear to be more susceptible to attacks from Xanthomonas.

## Measures

To prevent bacteria entering your operations, you can take the following PREVENTIVE MEASURES:

1. Pot only non-infected plant material (from tissue culture). The process of striking cuttings or topping can easily spread the disease, for example.
2. Make sure that visitors in your nursery wear laboratory coats and that shoes can be disinfected. You can use trays filled with a quarternairy ammonium compound (use a $2 \%$ concentration), formaldehyde ( $10 \%$ ) or chlorine-based disinfectants (1-2\%) to disinfect the shoes. Refill the trays daily and change the mats regularly. The mats can be covered with a piece of cloth that is regularly cleaned. In this way, you do not have to keep

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replacing the mats. When the disinfectant comes into contact with large quantities of organic material, the effect of the disinfectant is nil. Before allowing visitors to enter your nursery, they should wash their hands with a disinfectant. Alcohol-based lotions or a quarternairy ammonium compound are effective for disinfecting hands.
3. Do not place any plants from the Araceae family such as Aglaonema, Philodendron, Caladium, Dieffenbachia or Spathiphyllum near Anthurium.
4. Never bring any Anthurium plants from other production farms into your nursery.
5. Disposal of plant material should take place in sealed containers. Plant residue can easily cause infection.
6. It is important that you and your staff recognize the symptoms of bacterial infection.
7. Constantly check to see whether there are any gaps in your operations that could break the chain of phytosanitation.

If the bacterial infection has been ascertained in your operations, you can take the following CURATIVE MEASURES to control the disease in your nursery:

1. All previously mentioned measures remain extremely important.
2. One should always work from clean to contaminated plots.
3. To prevent spreading among plants via the wounds made by leaf and flower cutting, the knives should be disinfected each time they are used. You can use alcohol ( $85 \%$ ) or a quarternairy ammonium compound ( $2 \%$ ). Best is to use at least 2 knives, so that when using one knife, the other can be put in the disinfectant. One can also buy decontamination knives with built-in reservoirs that automatically disinfect the knife blade after each use.
4. Infected plants should be removed from the bedding and be placed in sealed plastic bags. Plants in the immediate vicinity and the substrate should also be removed.
5. The bacteria is easily spread by moisture. Measures promoting atmospheric humidity to wet the plants may no longer be used.
6. The plants must be kept as dry as possible using proper air conditioning. Plant guttation must be prevented wherever possible.
7. Fertilization must be adapted to keep the production of glutamine in the plant at a minimum. Glutamine is a major source of food for bacteria. It is released from plants via guttation. Plants produce less glutamine if the levels of ammonium and nitrate nitrogen are kept as low as possible. Ammonium nitrate can be left out of the feeding schedule. Desirable levels of potassium must be maintained.
8. Plants that grow poorly are especially susceptible to bacteria. You should therefore avoid extreme climatic conditions and high temperatures. The ideal temperature for the spread of bacteria is $30^{\circ} \mathrm{C}$, while Anthurium can easily show signs of stress at such temperatures.
9. It is not possible to combat the bacteria. Its presence can be inhibited with antibiotics (Phytostrep), agents containing copper (the bacteria quickly acquires resistance and the agents are often phytotoxic) and the fungicide Aliette (a.i. $80 \%$ fosethyl-aluminium).
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Tel. (31) 105219094 BTW no. NL 8020.54.316.B.01

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Tel. (31) 105219094 BTW no. NL 8020.54.316.B.01
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Fax (31) 105218230 K.v.K. Haaglanden no. 29039601
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Fax (31) 105218230 K.v.K. Haaglanden no. 29039601
www.imac-bleiswijk.nl Rabobank no, 10.76.46.064
www.imac-bleiswijk.nl Rabobank no, 10.76.46.064
info@imac-bleiswijk.nl S.W.I.F.T. code Rabo NL 2U

```
Anthuriumweg 12
2665 KV Bleiswijk
The Netherlands

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Once the bacterial infection has been ascertained in your operations and you start with a new culture you can take the following MEASURES to minimize the chance of RE-INFECTION :
1. When clearing separate the other sections against moist, dust and materials flinging about.
2. Remove all present organic material in the contaminated section (including weeds, old leaves and organic substrates).
3. Replace the actual growing system for new materials. When you do re-use, disinfect the remains as thorough as possible.
4. When the sprinklers are re-used, they have to be flushed well and also the outside has to be disinfected.
5. After clearing everything has to be disinfected, also the greenhouse fixtures and the paths.
6. When possible the greenhouse should stay empty for at least 6 weeks on dry soils before you start a new culture.
7. Disinfection is possible with a quarternairy ammonium compound ( \(2 \%\) ), Virkon ( \(1 \%\) ) or formaldehyde \(5 \%\), (to be sprayed off within 2 days). Sprinklers can also be put one day in acid and one day in an alkaline, followed by thorough flushing. As an acid one can take 1 litre of nitrate acid \(\left(\mathrm{HNO}_{3} ; 38 \%\right)\) on 30 litres of water and as an alkaline 1 kg of potassium hydroxide ( \(\mathrm{KOH} ; 34 \%\) ) on 30 litres of water. The sprinklers have to be free from root and plant rests and from too many algae at all times.
8. Never use drip hoses again; these are hard to disinfect.

\section*{PROPER HYGIENIC MEASURES ARE THE ONLY MEANS FOR CONTROLLING THE PROBLEM}

\section*{Photo captions:}

1 Watery stains underneath an Anthurium leaf and slime formation on the main vein.
2 Oily spots on the topside of the leaf edges.
3 Xanthomonas damage to the Anthurium bud.
4 Slime formation near a cut in the stem.
5 Rotting of the base of the flower/leaf stalk near the growing point with slime formation.
6 Yellowing of the leaf as a result of vascular-bundle infection from Xanthomonas, causing the vascular bundles to clog. The new leaves show a dull colour.
7 Xanthomonas damage on the leaf edge due to leaf infection. The watery stains can be seen next to the brown edge.

\author{
Bureau IMAC Bleiswijk B.V. \\ Ing. André Lont \\ Ir. Josien van Spingelen
}

November 2000

\section*{2IMAC \\ BLEISWIJK BV}

Xanthomonas campestris pv. dieffenbachiae in Anthurium


1


Feasibility Study about Growing Antburium at the Nursery Plantor in Rwanda, Harmen Hummelen/ Consultant, October 2002

\section*{IMAC}

FAX : (31) 10-5218230
Xanthomonas campestris pv. dieffenbachiae in Anthurium


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6


\section*{Annex 7. Anthurium flower prices in The Netherlands.}


Annex 7. Anthurium flower prices in The Netherlands.
Production of Anthurium flowers in The Netherlands. Turnover, quatity and price are an average of all varities together.
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline \multicolumn{3}{|c|}{2001} & \multicolumn{4}{|c|}{2002} \\
\hline Month & Turnover & Quantity & Price in EUR cents & Turnover & Quantity & Price in EUR cents \\
\hline January & 2.644.054 & 3.093 .235 & 85 & 2.933.804 & 3.641 .327 & 81 \\
\hline February & 2.992 .077 & 2.888 .600 & 104 & 3.510 .574 & 3.447.386 & 102 \\
\hline March & 2.541 .583 & 2.921 .018 & 87 & 3.300 .223 & 3.212 .268 & 103 \\
\hline April & 2.606 .033 & 4.373 .886 & 60 & 2.186.997 & 4.784.458 & 46 \\
\hline May & 3.208 .714 & 6.487 .265 & 49 & 3.295 .045 & 7.234.249 & 46 \\
\hline June & 2.468 .080 & 5.880 .976 & 42 & 2.289 .355 & 5.940 .022 & 39 \\
\hline July & 1.951 .568 & 5.463 .712 & 36 & 2.636 .110 & 6.544.622 & 40 \\
\hline August & 2.756 .910 & 5.979 .640 & 46 & 2.938 .853 & 6.087 .850 & 48 \\
\hline September & 3.469 .182 & 5.705 .283 & 61 & & & \\
\hline October & 5.303 .055 & 7.231.204 & 73 & 0 & 0 & 0 \\
\hline November & 3.163 .902 & 4.686 .005 & 68 & & & \\
\hline December & 4.042.776 & 4.626 .500 & 87 & & & \\
\hline Total & 37.147.935 & 59.337.324 & 63 & 23.090 .961 & 40.892.182 & 56 \\
\hline
\end{tabular}
\begin{tabular}{llr} 
Period & & 95 \\
frist quater & 52 & 43 \\
second quater & 40 & 44 \\
third quater & 76 & 0 \\
fourth quater & 49 & 44 \\
& & \\
summer, 2nd and 3th quater & 84 &
\end{tabular}

\section*{Annex 8. Flower packing regulations from the Dutch Auction van Andre in Engels}

\section*{Product specification Anthurium - March 2000}

VBN
In addition to the General Specifications Cut Flowers the requirements mentioned in this product specification are valid for Anthurium.
The product specification Anthurium is valid for all auctions, joint in the VBN (Association of Dutch Flower Auctions) as per March 1, 2000.
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\section*{Description of concepts}

DIAMETER OF FLOWER
The biggest width of a spathe of Anthurium.

\section*{1. Minimal requirements allowing trading \\ Maturity}
- As a minimum requirement for maturity of Anthurium applies that all stems in a lot must have a completely opened spathe.
- As a minimum requirement applies the following relation between flower diameter and stem length.
\begin{tabular}{|c|c|}
\hline diameter of flower (in cm) & minimum stem length (in cm) \\
\hline \(6-7,4\) & 25 \\
\hline \(7,5-8,9\) & 30 \\
\hline \(9-10,9\) & 35 \\
\hline \(11-12,9\) & 40 \\
\hline \(13-15\) & 45 \\
\hline 15 and more & 50 \\
\hline
\end{tabular}

\section*{II. Requirements for quality and sorting}

QUALITY REQUIREMENTS PER LOT
In addition the following is required:
The lot must be free from bracts with blue coloration (because of cold)

Summary 1 in the General Specifications Cut Flowers applies to this requirement.

\section*{SORTING REQUIREMENTS PER LOT}

Anthurium is obliged to be sorted to:
- maturity
- diameter of flower

By sorting to DIAMETER OF FLOWER applies:
- the measured diameter is rounded downwards;
- sorting is done in classes according to table 1 ;
- the sorting per diameter of flower during the trading is mentioned by means of the sorting code. The diameter of the smallest spathe in the lot, rounded downwards, is indicated. In
the sorting code two positions are available, according to the summary.

\section*{SORTING CODE}

For Anthurium it is obliged to mention the sorting to diameter of flower (under 'others').

Table 1: sorting to diameter of flower
\begin{tabular}{|c|c|}
\hline \begin{tabular}{l} 
diameter of flower \\
(in cm)
\end{tabular} & \begin{tabular}{l} 
minimum stem length \\
(in cm )
\end{tabular} \\
\hline \(6-7,4\) & 06 \\
\hline \(7,5-8,9\) & 07 \\
\hline \(9-10,9\) & 09 \\
\hline \(11-12,9\) & 11 \\
\hline \(13-14,9\) & 13 \\
\hline \(15-17,9\) & 15 \\
\hline \(18-20,9\) & 18 \\
\hline \(21-24,9\) & 21 \\
\hline 25 and bigger & 25 \\
\hline
\end{tabular}

\section*{Product specification Anthurium - March 2000}

VBN
In addition to the General Specifications Cut Flowers the requirements mentioned in this product specification are valid for Anthurium.
The product specification Anthurium is valid for all auctions, joint in the VBN (Association of Dutch Flower Auctions) as per March 1, 2000.
No parts of this publication may be reproduced in any form, by print, photocopy, microfilm or any other means without written permission from the publisher (VBN).

\section*{Description of concepts}

DIAMETER OF FLOWER
The biggest width of a spathe of Anthurium.

\section*{1. Minimal requirements allowing trading}

\section*{Maturity}
- As a minimum requirement for maturity of Anthurium applies that all stems in a lot must have a completely opened spathe.
- As a minimum requirement applies the following relation between flower diameter and stem length.
\begin{tabular}{|c|c|}
\hline diameter of flower (in cm) & minimum stem length (in cm) \\
\hline \(6-7,4\) & 25 \\
\hline \(7,5-8,9\) & 30 \\
\hline \(9-10,9\) & 35 \\
\hline \(11-12,9\) & 40 \\
\hline \(13-15\) & 45 \\
\hline 15 and more & 50 \\
\hline
\end{tabular}

\section*{II. Requirements for quality and sorting}

\section*{QUALITY REQUIREMENTS PER LOT}

In addition the following is required:
The lot must be free from bracts with blue coloration (because of cold)

Summary 1 in the General Specifications Cut Flowers applies to this requirement.

\section*{SORTING REQUIREMENTS PER LOT}

Anthurium is obliged to be sorted to:
- maturity
- diameter of flower

By sorting to DIAMETER OF FLOWER applies:
- the measured diameter is rounded downwards;
- sorting is done in classes according to table 1 ;
- the sorting per diameter of flower during the trading is mentioned by means of the sorting code. The diameter of the smallest spathe in the lot, rounded downwards, is indicated. In
the sorting code two positions are available, according to the summary.

\section*{SORTING CODE}

For Anthurium it is obliged to mention the sorting to diameter of flower (under 'others').

Table 1: sorting to diameter of flower
\begin{tabular}{|c|c|}
\hline \begin{tabular}{l} 
diameter of flower \\
(in cm)
\end{tabular} & \begin{tabular}{l} 
minimum stem length \\
(in cm)
\end{tabular} \\
\hline \(6-7,4\) & 06 \\
\hline \(7,5-8,9\) & 07 \\
\hline \(9-10,9\) & 09 \\
\hline \(11-12,9\) & 11 \\
\hline \(13-14,9\) & 13 \\
\hline \(15-17,9\) & 15 \\
\hline \(18-20,9\) & 18 \\
\hline \(21-24,9\) & 21 \\
\hline 25 and bigger & 25 \\
\hline
\end{tabular}

\section*{Annex 9: Documents consulted}

\author{
Annex 9. Documents consulted \\ Study of the Horticulture Sub-sector in Rwanda (Draft) \\ Project number 03.0300 \\ Date March 2001 \\ Requested by the World Bank Group \\ contactperson at the world bank, Mr. Ousmane Baliane \\ Washington USA \\ Submitted by the V.E.K. Adviesgroep B.V. Maasdijk The Netherlands \\ Cultivation Guide Anthurium \\ Global Know-How for growers around the Globe \\ Anthura B.V. Bleiswijk The Netherlands
}

\section*{Annex 10: Order form for cultivation guide(s) Anthurium}

Please send the following cultivation guide(s) to the below mentioned address:
........ copies for the cut flower culture 'Global Know-How for Growers round the Globe' \(\ldots . . .\). copies for the pot plant culture 'In pursuit of excellence'


\section*{SPECIAL OFFER!}

If you order the cultivation guide for the cut flower culture and the cultivation guide for the pot plant culture in one order, we can offer you both cultivation guides for the special price of EUR 175.00 (excluding freight charges).

Price is exclusive of VAT
Payment: \(\quad 0\) Visa
Account number: \(\qquad\)
Card Validation Code*:
Expiry date: ....... /........
0 Mastercard
Account number: \(\qquad\)
Card Validation Code*:
Expiry date: ...... /.........
0 Wire transfer (TT) to Anthura B.V.
Bank: Fortis Bank N.V.
Address: P.O. Box 1045
3000 BA ROTTERDAM, the Netherlands
Account \# NL66MEES0258787635
Swift \# MEES NL 2A
* The CVC code consists of the last 3-figures which are printed on the signature strip, at the back of the Credit Card.
Payment by cheque is not accepted.
We request you kindly to fill in this form and to return it by fax or mail. Thank you for your order.

\section*{Annex 11. Feasibility study Option 1. New varieties and new greenhouse for export, \(5000 \mathrm{~m}^{2}\).}

High investment and modem material
Flower price is based on the average year round price on the Dutch aution.

\begin{tabular}{|c|c|c|c|c|c|}
\hline SITE PREPARATION + FENCING & & COSTS/ & TOTAL & TOTAL & DEPRE- \\
\hline CURRENCY: USD & UNITS & UNITS & UNITS & AMOUNT & CIATION \\
\hline SITE PREPARATION + LEVELLING & sqm & & & 0 & 10,0\% \\
\hline DRAINAGE & sqm & & 8400 & 0 & 0,0\% \\
\hline WATER + ELECTRIC SUPPLY CONNECTIONS & task & 1000 & 1 & 1000
0 & 10,0\% \\
\hline SEWER & meters & 10,00 & 380 & 3800 & 10,0\% \\
\hline FENCING & meters & & & 4800 & 480 \\
\hline TOTAL & & & & & \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline \multicolumn{3}{|l|}{} & \multirow[t]{2}{*}{\[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS } \\
\hline
\end{array}
\]} & \multirow[t]{2}{*}{\begin{tabular}{l}
TOTAL \\
UNITS
\end{tabular}} & \multirow[t]{2}{*}{TOTAL AMOUNT} & \multirow[t]{2}{*}{DEPRECIATION} \\
\hline CURRENCY: & USD & UNITS & & & & \\
\hline \multicolumn{5}{|l|}{\multirow[t]{2}{*}{OUTSIDE ROADS task}} & 0 & 10,0\% \\
\hline & & & & & 0 & 0 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline \multicolumn{6}{|l|}{BUILDINGS + EQUIPMENTS} \\
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline PACKING SHED & \multirow[t]{3}{*}{\[
\begin{aligned}
& \text { sqm } \\
& \text { task } \\
& \text { task }
\end{aligned}
\]} & 125 & 60 & 7500 & 10,0\% \\
\hline PACKING TABLES & & 200 & 5 & 1000 & 10,0\% \\
\hline OFFICE FURNITURE & & 1000 & 1 & 1000 & \% \\
\hline TOTAL & & & & 95 & 950 \\
\hline
\end{tabular}

\footnotetext{

}

GREENHOUSE
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline GREENHOUSE CONSTRUCTION & sqm & 0,50 & 6720 & 3360 & 10,0\% \\
\hline SHADE NET \(70 \%\) & sqm & 1,50 & 6720 & 10080 & 16,7\% \\
\hline PLASTIC RAIN SHIELD & sqm & 0,00 & 5200 & 0 & 33,3\% \\
\hline GUTTER \& CONSTRUCTION & sqm & 0,50 & 5200 & 2600 & 10,0\% \\
\hline FUNDAMENT OF FOUNDATION (concrete) & task & & & 0 & 10,0\% \\
\hline & task & 1,00 & 500 & 500 & 20,0\% \\
\hline TRANSPORT (20 ft) & manmonth & 0,40 & 6720 & 2688 & 20,0\% \\
\hline LOCAL LABOUR for building & manDAY & & & 0 & 20,0\% \\
\hline SUPERVISOR ( excl. ticket+hotel) & & & & 19228 & 2914 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & \begin{tabular}{l}
DEPRE- \\
CIATION
\end{tabular} \\
\hline PUMP CURRENCY. & task & 1000 & 2 & 2000 & 20,0\% \\
\hline SPRINKLER SYSTEM & & 1,50 & 4700 & 7050 & 20,0\% \\
\hline DRAINHOSE ( 50 mm ) & str m & 0,50 & 2350 & 1175 & 20,0\% \\
\hline DRAIN OUTLET ( 110 mm ) & str m & & 226 & 0 & 20,0\% \\
\hline DRAINWATERCOLLECTING TANK WITH PUMP & k & & 1 & 0 & 20,0\% \\
\hline RAINWATER OUTLET & str m & & 226 & 0 & 20,0\% \\
\hline WATERSUPPLYI SUCKING TUBE & meters & 10 & 500 & 5000 & 20,0\% \\
\hline WATER STORAGE SILO & task & 2000 & 1 & 2000 & 20,0\% \\
\hline FILTER SYSTEM & & 500 & 1 & 500 & 20,0\% \\
\hline DOSATRON FOR FEEDING & & 2444 & 2 & 4888 & 20,0\% \\
\hline TRANSPORT (20 ft) & & & 1 & 0 & 20,0\% \\
\hline LOCAL LABOUR & manmonth & & 6 & 0 & 20,0\% \\
\hline SUPERVISOR (excl. ticket+hotel) & manDAY & & & & \\
\hline TOTAL & & & & 22613 & 3113 \\
\hline
\end{tabular}

PLANTMATERIAL

\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline CURRENCY: & USD & THICKNESS & UNITS & \[
\begin{array}{r}
\hline \text { COSTS/ } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL
AMOUNT & DEPRECIATION \\
\hline PLASTIC AND DRAIN & & & str m & 1,00 & 4700 & 4700 & 20,0\% \\
\hline SUBSTRATE LAVA, BED 1.20 M BROAD & & 0,20 m & cb m & 25,00 & 564 & 14100 & 16,7\% \\
\hline TRANSPORT & & & task & & & & \\
\hline
\end{tabular}

TOOLS + MACHINERY
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline & & & costsi & TOTAL & TOTAL & DEPRE- \\
\hline CURRENCY: & USD & & UNITS & UNITS & AMOUNT & CIATION \\
\hline TANK SPRAYER & & task
task & 70 & 1 & - \(\begin{array}{r}10 \\ 0\end{array}\) & 20,0\% \\
\hline HIGH PRESSURE SPRAYER & & task
task & & 1 & 5000 & 25,0\% \\
\hline TRUCKNAN & & task & 5000 & 5200 & 5000 & \(25,0 \%\)
\(20,0 \%\) \\
\hline MIST INSTALLATION & & sq m
task & & 5200 & 5000 & 16,7\% \\
\hline GENERATOR (20 kva) & & task & 5000 & 1 & 500 & 33,3\% \\
\hline COMPUTER & & task & 100 & 5 & 500 & 25,0\% \\
\hline FLOWER TROLLEYS & & & 500 & 1 & 500 & 25,0\% \\
\hline EC + PH MEASURING & & task & 100 & 1 & 100 & 25,0\% \\
\hline LIGHT MEASURING & & task & 100 & 1 & 100 & 25,0\% \\
\hline HUMIDITY MEASURING & & & & 90 & 0 & 10,0\% \\
\hline TOPROOF SPRINKLERS & & & 1000 & \(\bigcirc\) & 1000 & 20,0\% \\
\hline TOOLS & & & & & 12170 & 2578 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline \multicolumn{5}{|l|}{WORKING CAPITAL 6 MONTHS} & \multirow[t]{3}{*}{\[
\begin{array}{|}
\text { TOTAL } \\
\text { AMOUNT }
\end{array}
\]} \\
\hline & & & COSTS/ & TOTAL UNITS & \\
\hline CURRENCY: & USD & UNITS & UNITS & & \\
\hline LABOUR & & task & 1830 & & 1830 \\
\hline STOCK PACKING MATERIAL & & task & 4992 & 1 & 4992 \\
\hline STOCK FERILIZER MATERIAL & & task & 1040 & & 1040 \\
\hline ELECTRO + WATER CONSUMPTION & & task & 260 & & 260 \\
\hline OTHERS & 10\% & task & 812 & & 812 \\
\hline TOTAL & & & & & 8934 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|}
\hline & \multicolumn{2}{|l|}{INVESTMENTS} & \multirow[t]{2}{*}{ANNUAL depeciate} & \multirow[t]{2}{*}{MAINTENANCE} \\
\hline CURRENCY: USD & PER SQ.M & TOTAL & & \\
\hline GROUND & 0,00 & , & & \\
\hline SITE PREPARATION + FENCING & 0,92 & 4800 & 480 & 48 \\
\hline INFRASTRUCTURE & 0,00 & 0 & 0 & 0 \\
\hline BUILDINGS + EQUIPMENTS & 1.83 & 9500 & 950 & 95 \\
\hline GREENHOUSE & 3,70 & 19228 & 2914 & 192 \\
\hline WATERSYSTEM (two PVC pipe) & 4,35 & 22613 & 3113 & 226 \\
\hline BED PREPARATION & 3,62 & 18800 & 3295 & 188 \\
\hline PLANTMATERIAL (depreciation in 7 years) & 21,47 & 111642 & 15630 & \\
\hline TOOLS + MACHINERY & 2,34 & 12170 & 2578 & 122 \\
\hline WORKINGCAPITAL & 1,72 & 8934 & & \\
\hline CONTINGENCY 5\% & 2,00 & 10384 & 2077 & 104 \\
\hline TOTAL & 41,94 & 218072 & 31035 & 975 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|}
\hline EXP & & & & EAR (ultin & & & & & & \\
\hline & & & & 2003 & 2004 & 2005 & 2006 & 2007 & 2008 & 2009 \\
\hline EQUITY & & 20\% & & 43614 & & & & & & \\
\hline LOAN SUM & & 80\% & 174457 & 157012 & 139566 & 122120 & & & & 52337
1,77 \\
\hline INFLATION annual & & 10\% & & 1,00 & 1,10 & 1,21 & 1,33 & 1,46 & 1,61 & \begin{tabular}{l}
1,77 \\
\hline \(90 \%\)
\end{tabular} \\
\hline PRODUCTION LEVEL RATE & & & & 40\% & 80\% & 100\% & 100\% & & & \\
\hline & & & & 2003 & 2004 & 2005 & 2006 & 2007 & 2008 & 2009 \\
\hline DIRECT COSTS & UNITS & UNIT & & & & & & & & \\
\hline & SQM & PRICE & SQM & & & & & & & \\
\hline Fertilizer application & & & 1,00 & 2080 & 4576 & 6292 & 6921 & 7613 & 7956
3978 & \\
\hline Chemicals & & & 0,50 & 1040 & 2288 & 3146 & 3461 & 3807 & 3978 & 4145 \\
\hline Packing material, \(20 \mathrm{fl} / \mathrm{box}\), box USD 1.60 & 3 & 1,6 & 4.80 & 9984 & 21965 & 30202 & 33222 & 36544 & 38188 & 39796 \\
\hline Transport & 60 & 0,2 & 12,00 & 24960 & 54912 & 75504 & 83054 & 91360 & 95471 & \\
\hline Other materials & & & 0,25 & 520 & 1144 & 1573 & 1730 & 1903 & 1989 & 2073 \\
\hline Water & & & 0,00 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\hline Auction costs 15\% of flower price & & & & 11232 & 24710 & 33977 & 37374 & 41112 & 42962 & 44771 \\
\hline & & & & & 0 & 0 & 0 & 0 & 0 & 0 \\
\hline Contingency & & 3\% & 0,56 & 1158 & 2547 & 3501 & 3852 & 4237 & 4427 & 4614 \\
\hline \multicolumn{3}{|l|}{TOTAL DIRECT COSTS} & 19,11 & 50974 & 112142 & 154195 & 169614 & 186576 & 194972 & 203181 \\
\hline & & & & & & & & & & \\
\hline
\end{tabular}


\section*{Annex 12: Feasibility study, Options 2a: New varieties and new greenhouse for local production.}
\begin{tabular}{|c|c|c|c|c|}
\hline \multicolumn{2}{|l|}{DATE} & \multirow[t]{4}{*}{\begin{tabular}{l}
21/oct/02 \\
Nursery Plantor Rwanda Kigali Rwanda
\end{tabular}} & & \\
\hline \multicolumn{2}{|l|}{date} & & & \\
\hline \multicolumn{2}{|l|}{ADDRESS} & & & \\
\hline \multicolumn{2}{|l|}{COUNTRY} & & & \\
\hline \multicolumn{5}{|l|}{TEL} \\
\hline \multicolumn{5}{|l|}{FAX} \\
\hline LENGTH OF SIDE & m & 30 & & \\
\hline WIDTH OF SIDE & m & 50 & & \\
\hline SURFACE OF SIDE & sq m & 1500 & & \\
\hline WIDTH OF SPANS (vakmaat) & m & 4 & & \\
\hline WIDTH OF FRONTS(kapbreedte) & m & 4 & & \\
\hline NUMBER OF SPANS & numb & 6 & & \\
\hline NUMBER OF FRONTS & numb & 10 & & \\
\hline LENGTH OF GREENHOUSE & \(m\) & 40 & & \\
\hline WIDTH GREENHOUSE & m & 24 & & \\
\hline SURFACE OF GREENHOUSE CUTFLOWER & sq m & 960 & & \\
\hline WIDTH MAINPATH & m & 2 & & \\
\hline BEDLENGTH & m & 19 & & \\
\hline NUMBER OF BEDS & numb & 20 & & \\
\hline LENGTH OF SHED & m & 6 & & \\
\hline WDTH OF SHED & m & 10 & & \\
\hline SURFACE OF SHED & sq m & 60 & & \\
\hline CURRENCY OF CALCULATION & & USD & & \\
\hline EXCHANGE RATE: 1.00 USD & EQUALS EURO & 1,00 & & \\
\hline NOMINAL INTEREST RATE LOANS & & 16\% & & \\
\hline INFLATION: & & 10\% & & \\
\hline NOMINAL INTEREST RATE SAVINGS & & 6\% & & \\
\hline REAL INTEREST RATE SAVINGS & & -4,0\% & & \\
\hline MANAGER PER MONTH & USD & 200 & 1 MEN & 200 \\
\hline LABOUR PER MONTH: & USD & 30 & 3 MEN & \\
\hline GROUND PRICE & sq m & 0 & & \\
\hline \multicolumn{5}{|l|}{\multirow[t]{2}{*}{\begin{tabular}{l}
IMPORT DUTY \\
Altough we take all possible precautions, Imac t.v. cannot be held responsible in any form whatsoever for the given advice.
\end{tabular}}} \\
\hline & & & & \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTS } \\
\text { UNITS }
\end{array}
\] & total UNITS & \[
\begin{array}{r}
\text { TOTAL } \\
\text { AMOUNT } \\
\hline
\end{array}
\] & DEPRECIATION \\
\hline SITE PREPARATION + LEVELLING & sqm & & & 0 & 10,0\% \\
\hline DRAINAGE & sqm & & 1500 & 0 & 10,0\% \\
\hline WATER + ELECTRIC SUPPLY CONNECTIONS & task & 250 & 1 & 250 & 10,0\% \\
\hline SEWER & task & & 1 & 0 & 10,0\% \\
\hline FENCING & meters & 0,00 & 160 & 0 & 10,0\% \\
\hline TOTAL & & & & 250 & 25 \\
\hline
\end{tabular}

\begin{tabular}{|c|c|c|c|c|c|c|}
\hline CURRENCY: & USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS }
\end{array}
\] & total UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline PACKING SHED & & sqm & 20 & 60 & 1200 & 10,0\% \\
\hline PACKING TABLES & & task & 100
250 & 1 & 500
250 & 10,0\%
\[
10,0 \%
\] \\
\hline OFFICE FURNITURE & & task & & & 1950 & 195 \\
\hline
\end{tabular}



PLANTMATERIAL
\begin{tabular}{|c|c|c|}
\hline \begin{tabular}{|cc}
\hline & Price per \\
Quantity & Species
\end{tabular} & Size & Amount in Euro \\
\hline Anthurium andreanum: young plants 1000 M2 WITH 10 PLANTS/M2 IS IN TOTALL 10,000 PLANTS & \[
\begin{aligned}
& 25 \mathrm{~cm} \\
& 25 \mathrm{~cm}
\end{aligned}
\] & \[
\begin{array}{r}
14800 \\
4900
\end{array}
\] \\
\hline 10000 pots
ONE PLANT PER POT
10 Plants per sq meter & \begin{tabular}{l}
Value of goods \\
Charges \\
Insurance \\
Freight
\end{tabular} & \[
\begin{array}{r}
19700 \\
150 \\
364 \\
2236 \\
\hline
\end{array}
\] \\
\hline & TOTAL PAYMENT & 22450 \\
\hline
\end{tabular}

Price including royalty
Plantsize: \(\mathbf{2 0 - 2 5} \mathbf{c m}\) tall
Medium : Rockwool-granulate(inert)
Payment : in advance or LC (before delivery takes place)

\begin{tabular}{|c|c|c|c|c|c|}
\hline & task & & & 0 & 20,0\% \\
\hline |HIGH PRESSURE SPRAYER & task & 2000 & 1 & 2000 & 25,0\% \\
\hline TRUCK & & & 960 & 0 & 20,0\% \\
\hline MIST INSTALLATION & sq m
task & 0 & & 0 & 20,0\% \\
\hline GENERATOR (20 kva) & task & & 1 & 0 & 33,3\% \\
\hline COMPUTER & task & 50 & 2 & 100 & 25,0\% \\
\hline FLOWER TROLLEYS & lask & 0 & & 0 & 25,0\% \\
\hline EC + PH MEASURING & task & 0 & 1 & 0 & 25,0\% \\
\hline LIGHT MEASURING & task & & & 0 & 25,0\% \\
\hline HUMIDITY MEASURING & task
sam & & 17 & 0 & 10,0\% \\
\hline TOPROOF SPRINKLERS & & 250 & 17 & 250 & 20,0\% \\
\hline T00LS & & & & 2420 & 589 \\
\hline TOTAL & & & & & \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline \multicolumn{5}{|l|}{WORKING CAPITAL 6 MONTHS} & \multirow[t]{2}{*}{\[
\begin{array}{r}
\text { TOTAL } \\
\text { AMOUNT }
\end{array}
\]} \\
\hline CURRENCY: & USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTS/ } \\
\text { UNITS } \\
\hline
\end{array}
\] & \[
\begin{aligned}
& \hline \text { TOTAL } \\
& \text { UNITS } \\
& \hline
\end{aligned}
\] & \\
\hline LABOUR & & task & 870 & & 870 \\
\hline STOCK PACKING MATERIAL & & task & 96 & & 96 \\
\hline STOCK FERILIZER MATERIAL & & task & 48 & & 48 \\
\hline ELECTRO + WATER CONSUMPTION & & task & 19 & & 19 \\
\hline OTHERS & 10\% & task & 103 & & 103 \\
\hline TOTAL & & & & & 1137 \\
\hline
\end{tabular}




\section*{Annex 13: Feasibility Study, Option 2b. New varieties and new greenhouse for local production, \(1000 \mathrm{~m}^{2}\)}

Investments are as low as possible
Flower prices is the needed price to get profit


Altough we take all possible precautione, imac b.v. cannot be held responsible in any form whatsoever for the given advice.


 TOTAL
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTS } \\
\text { UNITS }
\end{array}
\] & total UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline PUMP CUREE_ & task & 500 & & 500 & 20,0\% \\
\hline SPRINKLER SYSTEM & & 0 & 760 & 0 & 20,0\% \\
\hline SPRINKLER ( \({ }^{\text {drainhose }} \mathbf{( 5 0 \mathrm { mm }}\) ) & str m & 0 & 380 & 0 & 20,0\% \\
\hline DRAIN OUTLET ( 110 mm ) & str m & & 92 & 0 & 20,0\% \\
\hline DRAINWATERCOLLECTING TANK WITH PUMP & task & & 1 & 0 & 20,0\% \\
\hline RAINWATER OUTLET & str m & & 92 & 0 & 20,0\% \\
\hline WATERSUPPLYI SUCKING TUBE & meters & 2 & 200 & 400 & 20,0\% \\
\hline WATER STORAGE SILO & task & 500 & 0 & 0 & 20,0\% \\
\hline FILTER SYSTEM & & & 0 & 0 & 20,0\% \\
\hline DOSATRON FOR FEEDING & & & 1 & 0 & 20,0\% \\
\hline TRANSPORT (20 ft) & manmonth & & 4 & 0 & 20,0\% \\
\hline LOCAL LABOUR & manDAY & & & 0 & 20,0\% \\
\hline SUPERVISOR (excl. ticket+hotel) & & & & 1000 & 200 \\
\hline
\end{tabular}

\section*{PLANTMATERIAL}
\begin{tabular}{|c|c|c|}
\hline \begin{tabular}{|lll}
\hline Quantity & Species & \begin{tabular}{c} 
Price per \\
Pot
\end{tabular} \\
\hline
\end{tabular} & Size & Amount in Euro \\
\hline \begin{tabular}{l}
Anthurium andreanum: young plants 1000 M2 WITH 10 PLANTS/M2 IS IN TOTALL 10,000 PLANTS 8000 STANDARD PRICE \\
2000 EXCLUSIVE PRICE \\
2,45
\end{tabular} & \[
\begin{aligned}
& 25 \mathrm{~cm} \\
& 25 \mathrm{~cm}
\end{aligned}
\] & \[
\begin{array}{r}
14800 \\
4900
\end{array}
\] \\
\hline \begin{tabular}{c}
10000 pots \\
\hline 10 Plants per sq meter
\end{tabular} & \begin{tabular}{l}
Value of goods \\
Charges \\
Insurance \\
Freight
\end{tabular} & \[
\begin{array}{r}
19700 \\
150 \\
364 \\
2236 \\
\hline
\end{array}
\] \\
\hline & TOTAL PAYMENT & 22450 \\
\hline
\end{tabular}

Price including royalty
Plantsize: \(\mathbf{2 0 - 2 5} \mathbf{~ c m}\) tall
Medium : Rockwool-granulate(inert)
Payment : in advance or LC (before delivery takes place)
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline CURRENCY: USD & THICKNESS & UNITS & \[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS } \\
\hline
\end{array}
\] & \[
\begin{aligned}
& \text { TOTAL } \\
& \text { UNITS }
\end{aligned}
\] & TOTAL AMOUNT & DEPRECIATION 20,0\% \\
\hline PLASTIC AND DRAIN SUBSTRATE LAVA plus clay, BED 1.20 M BROAD TRANSPORT & \(0,20 \mathrm{~m}\) & str m cb m task & \[
\begin{array}{r}
0,00 \\
10,00
\end{array}
\] & 760
91 & 0
912
0 & \[
\begin{aligned}
& 20,0 \% \\
& 20,0 \%
\end{aligned}
\] \\
\hline TOTAL & & & & & 912 & 2 \\
\hline
\end{tabular}

TOOLS + MACHINERY

\begin{tabular}{|c|c|c|c|c|c|}
\hline HIGH PREŞSURE SPRAYER & task & 0 & 1 & 0 & 20,0\% \\
\hline TRUCK & task & 0 & 66 & 0 & \\
\hline MIST INSTALLATION & sq m & 0 & 960 & 0 & 20,0\% \\
\hline GENERATOR (20 kva) & task & 0 & 1 & 0 & 20,0\% \\
\hline COMPUTER & task & & 2 & 100 & 25,0\% \\
\hline FLOWER TROLLEYS & task & 50 & 2 & 100 & 25,0\% \\
\hline EC + PH MEASURING & task & 0 & & 0 & 25,0\% \\
\hline LIGHT MEASURING & ask & 0 & & 0 & 25,0\% \\
\hline HUMIDITY MEASURING & task & & 17 & 0 & 25,0\% \\
\hline TOPROOF SPRINKLERS & sqm & & 17 & 0
100 & \(10,0 \%\)
20,0\% \\
\hline TOOLS & & 100 & & 100 & 20,0\% \\
\hline & & & & 270 & 59 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline \multicolumn{5}{|r|}{6 MONTHS} & \\
\hline CURRENCY: & USD & UNITS & \[
\begin{gathered}
\hline \text { COSTSI } \\
\text { UNITS }
\end{gathered}
\] & TOTAL UNITS & \[
\begin{array}{r}
\text { TOTAL } \\
\text { AMOUNT }
\end{array}
\] \\
\hline LABOUR & & task & 870 & & 870 \\
\hline STOCK PACKING MATERIAL & & task & 19 & 1 & 19 \\
\hline STOCK FERILIZER MATERIAL & & task & 19 & 1 & 19 \\
\hline ELECTRO + WATER CONSUMPTION & & task & 10 & 1 & 10 \\
\hline OTHERS & 10\% & task & 92 & & 92 \\
\hline TOTAL & & & & & 1010 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|}
\hline & \multicolumn{2}{|l|}{INVESTMENTS} & \multirow[t]{2}{*}{ANNUAL depeciate} & \multirow[t]{2}{*}{MAINTENANCE} \\
\hline CURRENCY: USD & PER SQ.M & TOTAL & & \\
\hline GROUND & 0,00 & 0 & & \\
\hline SITE PREPARATION + FENCING & 0,10 & 100 & 10 & 1 \\
\hline INFRASTRUCTURE & 0,00 & 0 & 0 & 0 \\
\hline BUILDINGS + EQUIPMENTS & 0,50 & 480 & 48 & 5 \\
\hline GREENHOUSE & 2,00 & 1920 & 299 & 19 \\
\hline WATERSYSTEM (two PVC pipe) & 1,04 & 1000 & 200 & 10 \\
\hline BED PREPARATION & 0,95 & 912 & 182 & 9 \\
\hline PLANTMATERIAL (depreciation in 7 years) & 23,39 & 22450 & 3143 & \\
\hline TOOLS + MACHINERY & 0,28 & 270 & 59 & 3 \\
\hline WORKINGCAPITAL & 1,05 & 1010 & & \\
\hline CONTINGENCY 5\% & 1,47 & 1407 & 281 & 14 \\
\hline & 30,78 & 29549 & 4223 & 61 \\
\hline
\end{tabular}

EXPLOITATION



\section*{Annexe 14: Feasibility study, Option 2c. Similar to option 2b but with a small (cheaper) young plants, \(1000 \mathrm{~m}^{2}\)}

Investment similar as option 2 b , except the lower price of plant material because of buying small plants.

Flower prices is similar as in option 2 a.


SITE PREPARATION + FENCING
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r|}
\hline \text { COSTS } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline SITE PREPARATION + LEVELLING & sqm & & & 0 & 10,0\% \\
\hline DRAINAGE & sqm & & 1500 & 0 & 10,0\% \\
\hline WATER + ELECTRIC SUPPLY CONNECTIONS & task & 250 & & 250 & 10,0\% \\
\hline SEWER & task & & & 0 & 10,0\% \\
\hline FENCING & meters & 0,00 & 160 & 0 & 10,0\% \\
\hline TOTAL & & & & 250 & 25 \\
\hline
\end{tabular}

INFRASTUCTURE
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline CURRENCY: & USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTS } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline OUTSIDE ROADS & & task & & 1 & 0 & 10,0\% \\
\hline TOTAL & & & & & 0 & 0 \\
\hline
\end{tabular}

BUILDINGS + EQUIPMENTS
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline CURRENCY: & USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTSI } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline PACKING SHED & & sqm & 20 & 60 & 1200 & 10,0\% \\
\hline PACKING TABLES & & task & 100 & 5 & 500 & 10,0\% \\
\hline OFFICE FURNITURE & & task & 250 & 1 & 250 & 10,0\% \\
\hline TOTAL & & & & & 1950 & 195 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r|}
\hline \text { COSTS } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline GREENHOUSE CONSTRUCTION & sqm & 0,50 & 1600 & 800 & 10,0\% \\
\hline SHADE NET \(40 \%\), extra shading with local material & sqm & 1,00 & 1600 & 1600 & 16,7\% \\
\hline PLASTIC RAIN SHIELD & sqm & 0,00 & 960 & 0 & 33,3\% \\
\hline GUTTER \& CONSTRUCTION & sqm & 0,10 & 960 & 96 & 10,0\% \\
\hline FUNDAMENT OF FOUNDATION (concrete) & task & & 1 & 0
0 & 10,0\% \\
\hline TRANSPORT (20 ft) & task & 1,00 & 500 & 500 & 20,0\% \\
\hline LOCAL LABOUR for building & manmonth & 0,00 & 1600 & 0 & 20,0\% \\
\hline SUPERVISOR ( excl. ticket+hotel) & manDAY & & & 0 & 20,0\% \\
\hline TOTAL & & & & 2996 & 456 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|c|}
\hline CURRENCY: USD & UNITS & COSTS/ UNITS & TOTAL UNITS & TOTAL AMOUNT & DEPRECIATION \\
\hline PUMP & task & 500 & 1 & 500 & 20,0\% \\
\hline SPRINKLER SYSTEM & & 0 & 760 & 0 & 20,0\% \\
\hline DRAINHOSE ( 50 mm ) & str m & 0,25 & 380 & 95 & 20,0\% \\
\hline DRAIN OUTLET ( 110 mm ) & str m & & 92 & 0 & 20,0\% \\
\hline DRAINWATERCOLLECTING TANK WITH PUMP & task & & 1 & 0 & 20,0\% \\
\hline RAINWATER OUTLET & str m & & 92 & 0 & 20,0\% \\
\hline WATERSUPPLY/ SUCKING TUBE & meters & 5 & 200 & 1000 & 20,0\% \\
\hline WATER STORAGE SILO & task & 500 & 1 & 500 & 20,0\% \\
\hline FILTER SYSTEM & & 500 & 0 & 0 & 20,0\% \\
\hline DOSATRON FOR FEEDING & & 2444 & 0 & 0 & 20,0\% \\
\hline TRANSPORT (20 ft) & & & 1 & 0 & 20,0\% \\
\hline LOCAL LABOUR & manmonth & & 4 & 0 & 20,0\% \\
\hline SUPERVISOR (excl. ticket+hotel) & manDAY & & & 0 & 20,0\% \\
\hline TOTAL & & & & 2095 & 419 \\
\hline
\end{tabular}

\section*{PLANTMATERIAL}
\begin{tabular}{|c|c|c|}
\hline \begin{tabular}{|cc}
\hline & \\
Quantity & Price per \\
& Species
\end{tabular} & Size & Amount in Euro \\
\hline \begin{tabular}{l}
Anthurium andreanum: young plants 1000 M2 WITH 10 PLANTS/M2 IS IN TOTALL 10,000 PLANTS 10000 STANDARD PRICE
\[
1,15
\] \\
0 EXCLUSIVE PRICE \\
1,40
\end{tabular} & \[
\begin{aligned}
& 8-12 \mathrm{~cm} \\
& 8-12 \mathrm{~cm}
\end{aligned}
\] & \[
\begin{array}{r}
11500 \\
0
\end{array}
\] \\
\hline 10000 pots & Value of goods & 11500 \\
\hline \begin{tabular}{l}
ONE PLANT PER POT \\
10 Plants per sq meter
\end{tabular} & Charges Insurance Freight & \[
\begin{array}{r}
150 \\
229 \\
2236 \\
\hline
\end{array}
\] \\
\hline & TOTAL PAYMENT & 14115 \\
\hline \begin{tabular}{l}
Price including royalty \\
Plantsize: 8-12 cm tall \\
Medium : Rockwool-granulate(inert) \\
Payment : in advance or LC (before delivery takes place)
\end{tabular} & & \\
\hline
\end{tabular}


TOOLS + MACHINERY

\begin{tabular}{|c|c|c|c|c|c|}
\hline & & & & 0 & 20,0\% \\
\hline HIGH PRESSURE SPRAYER & task
task & 2000 & 1 & 2000 & 25,0\% \\
\hline TRUCK & & & 60 & 0 & 20,0\% \\
\hline MIST INSTALLATION & sq m & & 1 & 0 & 20,0\% \\
\hline GENERATOR (20 kva) & task & 0 & 1 & 0 & 33,3\% \\
\hline COMPUTER & task & & & 0 & 33,3\% \\
\hline FLOWER TROLLEYS & task & 50 & 2 & 100 & 25,0\% \\
\hline EC + PH MEASURING & task & 0 & 1 & 0 & 25,0\% \\
\hline LIGHT MEASURING & task & 0 & 1 & 0 & 25,0\% \\
\hline HUMIDITY MEASURING & task & & 1 & 0 & 25,0\% \\
\hline TOPROOF SPRINKLERS & sqm & & 17 & 0 & 10,0\% \\
\hline TOOLS & & 250 & & 250 & 20,0\% \\
\hline TOTAL & & & & 2420 & 589 \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|}
\hline \multicolumn{4}{|c|}{6 MONTHS} & \\
\hline CURRENCY: USD & UNITS & \[
\begin{array}{r}
\hline \text { COSTS/ } \\
\text { UNITS }
\end{array}
\] & TOTAL UNITS & \[
\begin{array}{r}
\text { TOTAL } \\
\text { AMOUNT }
\end{array}
\] \\
\hline LABOUR & task & 870 & 1 & 870 \\
\hline STOCK PACKING MATERIAL & task & 0 & 1 & 0 \\
\hline STOCK FERILIZER MATERIAL & task & 0 & 1 & 0 \\
\hline ELECTRO + WATER CONSUMPTION & task & 19 & 1 & 19 \\
\hline OTHERS 10\% & task & 89 & & 89 \\
\hline TOTAL & & & & 978 \\
\hline
\end{tabular}




\section*{Annex 15: Offer Booth Irrigation LTD. The equipment for an Anrhurium greenhouse}


\section*{Annex 16. Reports of trips in Rwanda}

\section*{Visit to ISAR, Institute Scientific Agriculture Rwanda.}

Tuesday July 30. Visit to Butare 2 hours driving south east of Kigali.
This institute works on al kind of agriculture; animals, arable farming and horticulture, it has several stations in the country. We visited the station at Butare.
At this institute soil samples can be analysed and we had taken some soil samples from the nursery to be analysed. Analysing takes two weeks.
There is a horticultural part but as the people say them selves it is only maintained and no research is done. Maintaining means keeping plants of many species alive. It looked good and there were many species. In cut flowers the following were growing; roses, carnation, gerbera, chrysanthemum. For the garden also many plants were available. Also many bushes and trees which are good for the garden but also for the public gardens and along the roads. The plants were grown nice and well maintained. The roses were even propagated and grafted.

The best was that Francois was also supised about all the different plants. He did not know that this was all available so close by. Many plants could be grown in his nursery and sold as pot plants in Kigali. Some of the cut flowers could also be grown and sold in Kigali. The institute has no commercial activity and are only selling some plants to the staff and people in Butare. They said that is was possible for Francois to buy plants. This will be very useful. In future maybe even half-grown plants can be bought and sold very fast in Kigali.
Another advantage is that this institute has skilled labourers and maybe even good qualified agronomists. These people can come over to Kigali and teach the workers of Francois how to grow in the best way. The way of growing and the co-ordination looks very good.

Besides flowers we also saw seedlings from avocado, citrus, papaya and other fruit trees. Francois thought that there was also a market for these plants in Kigali.
Overall it showed that there was a lot available. There were no commercial activities so Francois can step in and he will be the first to have a broad range of products. Also the knowledge at this place can be very useful and the people seem willingly to help.
At the institute we also met people from the laboratories. I asked them about diseases and they said that they knew the nematodes, Radopholus similis and Pratylenchus infestans. They live also on banana and they are able to detect these nematodes in the roots.

\section*{Visit University Bukare}

We visited several people, also the vice-rector Dr. Jean-Bosco Butera. We only met and there was not really any information. They are planning a horticulture course but there are no lecturers at the moment. This is the only university so from this university also the higher qualified people will come and it is good to have a good contact with them. This university may also do some research on the flower business in Uganda and Kenya to see how it works there and whether it can be implemented in Rwanda.

\section*{Wednesday 31 July, visits to banks and other people}

Visit Maurits van der Ven, Advisor to the Managing Director of the Banque Rwandaise de Developpement.
This was an informal visit to talk about the possibilities for horticulture in Rwanda. The bank is involved in the company Highland Flowers and in this way they know exactly how it is going there. The starting problems have been very big and even at the moment it is not easy to keep it going.

\section*{Visit Jean-Pierre Rubulika, Directeur du departement de Financement des Projets of the Banque Rwandaise de Developpement.}

This man was the head of the department for giving loans. He knows the Highland Flower project and warned us for several problems. He mentioned the low density of flowers during transport, the short period of high prices (only in wintertime), and the prices, which can fluctuate a lot.

The interest rate is \(16 \%\). The interest can be lower but this depends on many things.
The local price for roses is 1 dollar for 20 stems, that is 5 cents/stem.

\section*{Bank Kigali}

We had a short visit. The interest is approximately \(17 \%\).

\section*{John Nkera, Managing Director of Highland Flowers, a rose nursery}

This man is the manager of Highland Flowers and Highland Flowers is a modern nursery, which is exporting roses to Europe. The nursery started several years ago. He was lucky to get a technical manager from Uganda who took with him also a lot of other labourers with many years of experience in roses. Besides this also some man with a university degree were employed.
For the greenhouse plastic was bought in Israel, the irrigation material was bought in Uganda from the company Hobra. At the moment also most material like fertilisers and pesticides are bought in Kampala in Uganda. The material comes by truck, in 2 days, or even overnight by bus.

The water that is used comes from the river but is filtered through a sand filter.
For transport a box is used from \(100 * 30 * 30 \mathrm{~cm}\). In this box around 500-600 flowers are packed.
The price of a box is USD 1.80 .
He told us that the transport costs are very high, and it should go down till around USD \(1.50 / \mathrm{kg}\).
The temperature is registrated at the nursery and most of the time the night temperature is in the cooler period between 14 and \(18{ }^{\circ} \mathrm{C}\) but can goes down till \(11^{\circ}\) at some nights.

Also a problem that was mentioned is the postponing of flights by Martin Air and DAS, Sabena is always on time.

The auction VBA has an account manager for east Africa who is visiting east Africa every 3 weeks.

\section*{Nsengimana Evase, Directeur General from the Volcano Export}

This man is exporting fruits to wholesalers in Europe. Fruits that are exported are apple banana (small banana), passion fruit, pineapple and other fruits. At the moment he wants to go for organic producing. He is in contact with a German company, ECOCERT, who has a controller in Madagascar. He buys his fruit from several hundred small farmers.

\section*{Maire, Theoneste Mutsindashyaka, the maire of Kigali}

We talked about the possibilities of Plantor. He was interested how easy it was to reach the export. He knew that Reunion and Mauritius also had a lot of Anthurium and exported to Europe. He wanted a time schedule for when it would be possible. I explained that the way of production is at the moment so low that this first has to be increased, this will take at least half a year. Also to get good qualified people who love plants and have a hart for plants is important.
Maybe somebody from Mauritius or Reunion can be hired to set up the nursery and teach the people to work and also control the standards.

\section*{Visits to flower shops}

We visited 6 flower shops, which were all close together, within 1 km . For me it was a suprise that there are so many flower shops. The most common flowers were Alstroemeria, Delphinium, Tuberosum and roses from Highland flowers. Several of the flowers are coming from Gisengyi, this place we will visit on Thursday.
\begin{tabular}{lll} 
Prices & RWF & dollar cents \\
Alstroemeria & 50 & 10 \\
Rose & \(80-100\) & \(15-20\) \\
Calla & 50 & 10 \\
Anthurium & \(70-100\) & \(15-20\) \\
\begin{tabular}{ll} 
Tuberose & \\
Delphinium & 50
\end{tabular} & 10
\end{tabular}

Prices are for most flowers 50 RWF, the price is the same during the whole year.
The shops look nice and you can see that the people love flowers and that flowers are sold for special occasions. Also a lot of plastic flowers and bouquets.

The quality of the fresh flowers was not so good. Too many flowers in one bucket, a lot of bruises and brown spots caused by wrong handling. The roses from Highland flowers were an exception, they were nice packed, more the European way.

One of the owners asked for carnations. I assume that if more different type of flowers are grown and offered to the market the shops will buy them.

\section*{Thursday 1 July 2002}

Visit to Giisenyi, 3 hours driving by car to the north, Vulcan area.

Frodouard Ndimukaga, Gisenyi, mob 08541088 , Tel 540226.
This man has a nursery in the centre of the city, he is an agronomist. He has many different plants, mainly garden plants but also fruit trees, he knows the names of the plants and he is propagating. He buys the plants or the seeds from Congo, Belgium, Madagascar and probably also other countries. To me he seems to know how he has to grow plants.

From here we went to another place higher into the hills.

Rosa Monde, in the place Mutura. Madam Carr, a Belgium women who is very old and has a plantation. Tel. 08302432 or 540740
This place is high up and it is here very cool. She is growing Alstroemeria, carnation and many other flowers. The Alstroemeria look reasonable, they need some more help to stand upright. The carnations are old plants, new cuttings were made. The total area for flowers is not very big and it is getting old. The flowers are brought to the market in baskets

On the way back we stopped to get lava. First we collected two bags with small lava stones, size \(0.5-1 \mathrm{~cm}\). The man from Gysengyi also uses this kind of soil for his plants. Later on we also stopped at another place and there were big stones, size \(5-15 \mathrm{~cm}\) in diameter. At this place we had to search for the good stones because not all stones were really light.

\section*{Friday 2 august 2002}

\section*{Meeting at ADAR}

People attending; François, Maurice, Anastase Murekezi and Harmen.
We talked about my visit and my ideas. I explained that I will have two main directions in my study, first the possibilities to improve the nursery for the local market, secondly the feasibility study for Anthurium for export to Europe. These are two complete different things but I have my reason for that. At the moment the nursery is just maintained, the staff is not very high qualified and the management is very poor. Also flower handling and marketing for the local market can be improved a lot. My suggestion is to start with producing many different types of flowers for the local market. These flowers should be handled with care and the marketing should be organised in a proper way. By doing all of these skills of the technical people and from the flower-handling people and from the management staffs is improved. This will also create a basic income for the company. The production, the costs and the revenues should be written down to see how it goes, this as a small feasibility study. If the company can organise this in a proper way a next step can be to think about exporting.
For the local market I suggest to start with seed flower, the fastest seed flowers will grow in 8 till 12 weeks from seed to sellable flower. This means a turnover in 3 months. These types of flowers are grown on hundreds of hectares in Kenya, and also exported to Europe. The seeds can be bought in Kenya, probably also in Uganda.
For this seed flowers a plan has to be made. It is very important to be able to sell flowers every week; you should be reliable for the shops in town. So you have to sow every 2 till 4 weeks, just a small amount. By working in this way you will be able to harvest flowers every week. Christmas is a good period for flowers with higher prices so you should start directly.
Flower seeds will be available in Uganda and in Kenya. These countries have a lot of knowledge of all kind of flowers and they will have books about flowers, libraries with information and also an extension service from the government. You have to get access to this information, so go to Kenya and ask for the agricultural department and go to the companies there. Companies are always willingly to sell and in that way also give information.
For a next stage there will also be local consultants in Kenya which are a lot cheaper than from Europe and know the local situation even better and they can help you to improve the nursery and your technical staff.
I will also contact some of the companies, which were on the Hortec exhibition. I will describe your company and make a list with questions and I will ask them to contact you directly.
A question was to describe the profile of the different people, which are needed.

\section*{Visit to Highland Flowers, Mr. Kalisa technical manager}

Tel 08532563
This is a company with 5 hectares of roses. The rose varieties are modern and the roses are sold in The Netherlands on the auction in Bemmel. They have an agent on the auction that takes care of the flowers; the costs for the auction and handling are \(15 \%\).
The man we talked with Mr. Kalisa had worked for 7 years in Uganda and he knows the people there. He may even now people who want to work in Rwanda and have experience in the flower business.

He said that from the total flower costs approximately \(40-60 \%\) is freight costs.

The fertilisers are bought in Uganda; the prices vary between 0.40 and \(0.70 \mathrm{USD} / \mathrm{kg}\). The fertilisers are applied through a Dosatron; this is a very good system to give fertilisers on a controlled way to the plants. The water that is used is filtered to have it cleaned from the main dirt.

The greenhouse was build by somebody from Uganda who builds all the greenhouses in Uganda.

\section*{Greenhouse costs}

The plastic was bought in Israel the costs are USD \(1.60 / \mathrm{m}^{2}\), it was guaranteed for 5 years but now after 3 years it is getting bad.

A part of the greenhouse was build in 1999, this was 3 hectares, the costs were 8.975 .000 RWF , only for the material, wood and nails. In dollars approximately 18.000 , that is per 6000 USD \(/\) ha and 60 USD cents \(/ \mathrm{m}^{2}\).
Labour costs per \(\mathrm{m}^{2}\) were \(200 \mathrm{RWF} / \mathrm{m}^{2}\); this is 40 USD cents \(/ \mathrm{m}^{2}\).
\begin{tabular}{lll} 
& \(\mathrm{USD} / \mathrm{m}^{2}\) & \\
plastic & 1.60 & \\
wood and nails & 0.60 & this seems to me not very high \\
labour & 0.40 & was a contractor \\
total & \(2.60 / \mathrm{m}^{2}\) &
\end{tabular}

The problems with insects were mainly with spider mites, aphids and caterpillars. Trips are never seen in the greenhouse, also not by crop specialists.
An agronomist costs 100.000 RWR/month, around USD 200/month.
We talked about the outside grown flowers and he told that it is possible to get cuttings from Carnation in Uganda and that they will grow good in Rwanda. Also seed from other flowers can be bought in Uganda. He gave a folder from Kieft seeds in Venhuizen the Netherlands.

Agrotec, a shop for all kind of agricultural material
The only available fertiliser is NPK 17-17-17, the price is RWF \(250 / \mathrm{kg}\), and for a big bag the costs are \(220 / \mathrm{kg}\). The shop also sells seeds of all kind of vegetables and we found even 5 different sachets with flower seeds. Also pesticides and spraying tanks are available.

\section*{List of Annexes}
1. Map of the nursery Plantor.
2. Proposed greenhouse composition and size.
3. Adresses of breeders, auctions and wholesalers in The Netherlands.
4. Water analyses results, well and river water.
5. Feeding schemes for the Anthurium plants.
6. Xanthomonas information, including hygiene measures.
7. Anthurium flower prices in The Netherlands.
8. Flower packing regulations from the Dutch Auction.
9. Documents consulted
10. Order form for cultivation guide(s) Anthurium
11. Feasability study Option 1. New varieties and new greenhouse for export, \(5000 \mathrm{~m}^{2}\).
12. Feasability study Option 2a. New varieties and new greenhouse for local production, \(1000 \mathrm{~m}^{2}\).
13. Feasability study Option 2b. New varieties and new greenhouse for local production, \(1000 \mathrm{~m}^{2}\).
14. Feasability study Option 2c. Similar to option \(2 b\) but with small (cheaper) young plants, \(1000 \mathrm{~m}^{2}\).
15. Offer Booth Irrigation LTD. The equipment for an Anthurium greenhouse.
16. Reports of trips in Rwanda

\section*{Annex 1. Map of the nursery Plantor.}

Overvieuw of the present situation from the greenhouses and buildings of the nursery Plantor. Drawing is not on scale.


Annex 2. Proposed greenhouse composition and size.
Drawing is not on scale.
\(\underline{\text { Situation 1. Two paths and bed lenght of } 25 \mathrm{~m} .}\)
\begin{tabular}{llllclllc} 
drain gutter & bed & path & bed & drain gutter & bed & path & bed & draingutter \\
2 m & 25 m & 4 m & 25 m & 3 m & 25 m & 4 m & 25 m & 2 m
\end{tabular}


The 4 parts are 25 m long and 25 deep. Between 2 parts a path is situated. At the end of the beds a drain gutter is situated. A bed is 1.20 m broad with a path of 0.80 m . in case it is 25 m deep this will be 12 beds.

Situation 2. One middle path and bed lenght of 50 m.
drain gutter
2 m
bed
50 m
path
4 m
\[
\begin{aligned}
& \text { bed } \\
& 50 \mathrm{~m}
\end{aligned}
\]


The 2 parts are 50 m long and 25 deep. Between 2 parts a path is situated. At the end of the beds a drain gutter is situated. A bed is 1.20 m broad with a path of 0.80 m . in case it is 25 m deep this will be 12 beds.

\section*{Annex 3. Adresses of breeders, auctions and wholesalers in The Netherlands.}

\section*{Breeders}

\section*{Anthura}

Anthuriumweg 14
2665 KV Bleiswijk, The Netherlands
Tel. + 31105220444
E mail. Info@anthura.nl
AVO Anthurium vogels
Stuartlaan 1
2675 BN Honselersdijk, The Netherlands
Tel. + 31174292524

Florist De Kwakel B.V.
Hoofdweg 42
1433 JW Kudelstaart (Aalsmeer), The Netherlands
Tel. + 31297328229 www.anthuriumplant.com

\section*{Adresses of auctions}

VBA, Flower auction Aalsmeer
Legmeerdijk 313, Postbus 1000, 1430 Aalsmeer, The Netherlands
Tel. + 31297393939
www.aalsmeer.com
Contactperson; Auke Grond + 31297393939
FloraHolland, Flower auction Naaldwijk
Middelbroekweg 29, Postbus 220, 2670 AE, Naaldwijk, The Netherlands
Tel. + 31174633333
www.bvh.nl

\section*{Wholesalers or Importers}

Dutch Flower Group
Magnolia 1, 1424 LA De Kwakel, The Netherlands
Tel. + 31297389389

\section*{East African Flower Company}

Noordammerweg 102 b, 1187 ZV Amstelveen, The Netherlands
Tel. + 31206569777
www.tfa.nl

Gebr. Berk
Legmeerdijk 313 b, 1431 GB Aalsmeer, The Netherlands
Tel. + 31297321766
www.gebrberk.nl
Zurel en Co B.V. Aalsmeer
Legmeerdijk 313, 1431 GB Aalsmeer, The Netherlands
Tel. +31 297333333
Fax. + 31297333518
www. zurel.nl

Annex 4. Water analyses results, well and river water.

Annex 5. Feeding schemes for the Anthurium plants.

> zijn klaar

Annex 6. Xanthomonas information, including hygiene measures.

\section*{Annex 7. Anthurium flower prices in The Netherlands.}

Production of Anthurium flowers in The Netherlands. Turnover, quatity and price are an average of all varities together.
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline \multirow[b]{2}{*}{Month} & \multicolumn{2}{|l|}{2001} & \multicolumn{4}{|c|}{2002} \\
\hline & Turnover & Quantity & \begin{tabular}{l}
Price \\
in EUR cents
\end{tabular} & Turnover & Quantity & \begin{tabular}{l}
Price \\
in EUR cents
\end{tabular} \\
\hline January & 2.644 .054 & 3.093.235 & 85 & 2.933.804 & 3.641 .327 & 81 \\
\hline February & 2.992.077 & 2.888.600 & 104 & 3.510 .574 & 3.447 .386 & 102 \\
\hline March & 2.541 .583 & 2.921 .018 & 87 & 3.300 .223 & 3.212.268 & 103 \\
\hline April & 2.606 .033 & 4.373 .886 & 60 & 2.186.997 & 4.784.458 & 46 \\
\hline May & 3.208.714 & 6.487 .265 & 49 & 3.295 .045 & 7.234.249 & 46 \\
\hline June & 2.468 .080 & 5.880 .976 & 42 & 2.289.355 & 5.940.022 & 39 \\
\hline July & 1.951 .568 & 5.463 .712 & 36 & 2.636.110 & 6.544.622 & 40 \\
\hline August & 2.756 .910 & 5.979.640 & 46 & 2.938.853 & 6.087.850 & 48 \\
\hline September & 3.469.182 & 5.705.283 & 61 & & & \\
\hline October & 5.303.055 & 7.231 .204 & 73 & 0 & 0 & 0 \\
\hline November & 3.163.902 & 4.686 .005 & 68 & & & \\
\hline December & 4.042.776 & 4.626 .500 & 87 & & & \\
\hline Total & 37.147.935 & 59.337.324 & 63 & 23.090.961 & 40.892 .182 & 56 \\
\hline
\end{tabular}

\section*{Period}
frist quater \(92 \quad 95\)
second quater \(50 \quad 43\)
third quater 48
44
fourth quater 76
0
summer, 2nd and 3th quater 49
44
winter , 1st and 4th quater 84

Annex 8. Flower packing regulations from the Dutch Auction van Andre in Engels

\section*{Annex 9. Documents consulted}

Study of the Horticulture Sub-sector in Rwanda (Draft)
Project number 03.0300
Date March 2001
Requested by the World Bank Group
contactperson at the world bank, Mr. Ousmane Baliane
Washington USA
Submitted by the V.E.K. Adviesgroep B.V. Maasdijk The Netherlands
Cultivation Guide Anthurium
Global Know-How for growers around the Globe
Anthura B.V. Bleiswijk The Netherlands

\section*{Annex 10. Order form for cultivation guide(s) Anthurium}

\section*{Please send the following cultivation guide(s) to the below mentioned address:}
........ copies for the cut flower culture 'Global Know-How for Growers round the Globe'
\(\ldots . . .\). copies for the pot plant culture 'In pursuit of excellence'

Which language do you prefer: Chinese

\section*{cut flower culture 0 Dutch 0 English 0 Spanish 0 pot plant culture 0 Dutch 0 English}

Company name:
Attention:
\(\qquad\)

Address:
\(\qquad\)

State/Zip: \(\qquad\)
City: \(\qquad\)
Country: \(\qquad\)
Telephone number: \(\qquad\)
Fax number: \(\qquad\)
E-mail: \(\qquad\)
Signature: \(\qquad\)

Price: EUR 100.00 per copy
EUR 5.00 for freight charges in the Netherlands for 1-2 books
EUR 15.00 for freight charges in Europe for 1-2 books
EUR 20.00 for freight charges outside Europe for 1-2 books

\section*{SPECIAL OFFER!}

If you order the cultivation guide for the cut flower culture and the cultivation guide for the pot plant culture in one order, we can offer you both cultivation guides for the special price of EUR 175.00 (excluding freight charges).

\section*{Price is exclusive of VAT}

Payment: \(\quad 0\) Visa
Account number:
Card Validation Code*: \(\qquad\)
Expiry date: .......

0 Mastercard
Account number: \(\qquad\)
Card Validation Code*:
Expiry date: \(\qquad\) /........

0 Wire transfer (TT) to Anthura B.V.
Bank: Fortis Bank N.V.
Address: P.O. Box 1045
3000 BA ROTTERDAM, the Netherlands
Account \# NL66MEES0258787635
Swift \# MEES NL 2A
* The CVC code consists of the last 3-figures which are printed on the signature strip, at the back of the Credit Card.
Payment by cheque is not accepted.
We request you kindly to fill in this form and to return it by fax or mail. Thank you for your order.

Annex 11. Feasability study Option 1. New varieties and new greenhouse for export, \(5000 \mathbf{m}^{2}\).

Annex 12. Feasability study Option 2a. New varieties and new greenhouse for local production, \(1000 \mathrm{~m}^{2}\).

Annex 13. Feasability study Option 2b. New varieties and new greenhouse for local production, \(1000 \mathrm{~m}^{2}\).

Annex 14. Feasability study Option 2c. Similar to option 2b but with small (cheaper) young plants, \(1000 \mathrm{~m}^{2}\).

Annex 15. Offer Booth Irrigation LTD. The equipment for an Anthurium greenhouse.

\section*{Annex 16. Reports of trips in Rwanda}

\section*{Visit to ISAR, Institute Scientific Agriculture Rwanda.}

Tuesday July 30. Visit to Butare 2 hours driving south east of Kigali.
This institute works on al kind of agriculture; animals, arable farming and horticulture, it has several stations in the country. We visited the station at Butare.
At this institute soil samples can be analysed and we had taken some soil samples from the nursery to be analysed. Analysing takes two weeks.
There is a horticultural part but as the people say them selves it is only maintained and no research is done. Maintaining means keeping plants of many species alive. It looked good and there were many species. In cut flowers the following were growing; roses, carnation, gerbera, chrysanthemum. For the garden also many plants were available. Also many bushes and trees which are good for the garden but also for the public gardens and along the roads. The plants were grown nice and well maintained. The roses were even propagated and grafted.
The best was that Francois was also supised about all the different plants. He did not know that this was all available so close by. Many plants could be grown in his nursery and sold as pot plants in Kigali. Some of the cut flowers could also be grown and sold in Kigali. The institute has no commercial activity and are only selling some plants to the staff and people in Butare. They said that is was possible for Francois to buy plants. This will be very useful. In future maybe even half-grown plants can be bought and sold very fast in Kigali.
Another advantage is that this institute has skilled labourers and maybe even good qualified agronomists. These people can come over to Kigali and teach the workers of Francois how to grow in the best way. The way of growing and the co-ordination looks very good.
Besides flowers we also saw seedlings from avocado, citrus, papaya and other fruit trees. Francois thought that there was also a market for these plants in Kigali.
Overall it showed that there was a lot available. There were no commercial activities so Francois can step in and he will be the first to have a broad range of products. Also the knowledge at this place can be very useful and the people seem willingly to help.
At the institute we also met people from the laboratories. I asked them about diseases and they said that they knew the nematodes, Radopholus similis and Pratylenchus infestans. They live also on banana and they are able to detect these nematodes in the roots.

\section*{Visit University Bukare}

We visited several people, also the vice-rector Dr. Jean-Bosco Butera. We only met and there was not really any information. They are planning a horticulture course but there are no lecturers at the moment. This is the only university so from this university also the higher qualified people will come and it is good to have a good contact with them. This university may also do some research on the flower business in Uganda and Kenya to see how it works there and whether it can be implemented in Rwanda.

\section*{Wednesday 31 July, visits to banks and other people}

\section*{Visit Maurits van der Ven, Advisor to the Managing Director of the Banque Rwandaise de}

\section*{Developpement.}

This was an informal visit to talk about the possibilities for horticulture in Rwanda. The bank is involved in the company Highland Flowers and in this way they know exactly how it is going there. The starting problems have been very big and even at the moment it is not easy to keep it going.

Visit Jean-Pierre Rubulika, Directeur du departement de Financement des Projets of the Banque Rwandaise de Developpement.

This man was the head of the department for giving loans. He knows the Highland Flower project and warned us for several problems. He mentioned the low density of flowers during transport, the short period of high prices (only in wintertime), and the prices, which can fluctuate a lot.
The interest rate is \(16 \%\). The interest can be lower but this depends on many things.
The local price for roses is 1 dollar for 20 stems, that is 5 cents/stem.

\section*{Bank Kigali}

We had a short visit. The interest is approximately \(17 \%\).
John Nkera, Managing Director of Highland Flowers, a rose nursery
This man is the manager of Highland Flowers and Highland Flowers is a modern nursery, which is exporting roses to Europe. The nursery started several years ago. He was lucky to get a technical manager from Uganda who took with him also a lot of other labourers with many years of experience in roses. Besides this also some man with a university degree were employed.
For the greenhouse plastic was bought in Israel, the irrigation material was bought in Uganda from the company Hobra. At the moment also most material like fertilisers and pesticides are bought in Kampala in Uganda. The material comes by truck, in 2 days, or even overnight by bus.

The water that is used comes from the river but is filtered through a sand filter.
For transport a box is used from \(100 * 30 * 30 \mathrm{~cm}\). In this box around 500-600 flowers are packed.
The price of a box is USD 1.80 .
He told us that the transport costs are very high, and it should go down till around USD 1.50/kg. The temperature is registrated at the nursery and most of the time the night temperature is in the cooler period between 14 and \(18{ }^{\circ} \mathrm{C}\) but can goes down till \(11^{\circ}\) at some nights.
Also a problem that was mentioned is the postponing of flights by Martin Air and DAS, Sabena is always on time.
The auction VBA has an account manager for east Africa who is visiting east Africa every 3 weeks.

\section*{Nsengimana Evase, Directeur General from the Volcano Export}

This man is exporting fruits to wholesalers in Europe. Fruits that are exported are apple banana (small banana), passion fruit, pineapple and other fruits. At the moment he wants to go for organic producing. He is in contact with a German company, ECOCERT, who has a controller in Madagascar. He buys his fruit from several hundred small farmers.

\section*{Maire, Theoneste Mutsindashyaka, the maire of Kigali}

We talked about the possibilities of Plantor. He was interested how easy it was to reach the export. He knew that Reunion and Mauritius also had a lot of Anthurium and exported to Europe. He wanted a time schedule for when it would be possible. I explained that the way of production is at the moment so low that this first has to be increased, this will take at least half a year. Also to get good qualified people who love plants and have a hart for plants is important.
Maybe somebody from Mauritius or Reunion can be hired to set up the nursery and teach the people to work and also control the standards.

\section*{Visits to flower shops}

We visited 6 flower shops, which were all close together, within 1 km . For me it was a suprise that there are so many flower shops. The most common flowers were Alstroemeria, Delphinium, Tuberosum and roses from Highland flowers. Several of the flowers are coming from Gisengyi, this place we will visit on Thursday.
\begin{tabular}{lll} 
Prices & RWF & dollar cents \\
Alstroemeria & 50 & 10 \\
Rose & \(80-100\) & \(15-20\) \\
Calla & 50 & 10
\end{tabular}
\begin{tabular}{lll}
\begin{tabular}{l} 
Anthurium \\
Tuberose \\
Delphinium
\end{tabular} & \(70-100\) & \(15-20\) \\
& 50 & 10
\end{tabular}

Prices are for most flowers 50 RWF , the price is the same during the whole year.
The shops look nice and you can see that the people love flowers and that flowers are sold for special occasions. Also a lot of plastic flowers and bouquets.
The quality of the fresh flowers was not so good. Too many flowers in one bucket, a lot of bruises and brown spots caused by wrong handling. The roses from Highland flowers were an exception, they were nice packed, more the European way.
One of the owners asked for carnations. I assume that if more different type of flowers are grown and offered to the market the shops will buy them.

\section*{Thursday 1 July 2002}

Visit to Gisengyi, 3 hours driving by car to the north, Vulcan area.
Froduard Ndimukaga, Gysengyi, mob 08541088, Tel 540226.
This man has a nursery in the centre of the city, he is an agronomist. He has many different plants, mainly garden plants but also fruit trees, he knows the names of the plants and he is propagating. He buys the plants or the seeds from Congo, Belgium, Madagascar and probably also other countries. To me he seems to know how he has to grow plants.

From here we went to another place higher into the hills.
Rosa Monde, in the place Mutura. Madam Carr, a Belgium women who is very old and has a plantation. Tel. 08302432 or 540740
This place is high up and it is here very cool. She is growing Alstroemeria, carnation and many other flowers. The Alstroemeria look reasonable, they need some more help to stand upright. The carnations are old plants, new cuttings were made. The total area for flowers is not very big and it is getting old. The flowers are brought to the market in baskets

On the way back we stopped to get lava. First we collected two bags with small lava stones, size 0.5-1 cm . The man from Gysengyi also uses this kind of soil for his plants. Later on we also stopped at another place and there were big stones, size \(5-15 \mathrm{~cm}\) in diameter. At this place we had to search for the good stones because not all stones were really light.

\section*{Friday 2 august 2002}

Meeting at ADAR
People attending; Fracois, Maurice, Anastase Murekezi and Harmen.
We talked about my visit and my ideas. I explained that I will have two main directions in my study, first the possibilities to improve the nursery for the local market, secondly the feasibility study for Anthurium for export to Europe. These are two complete different things but I have my reason for that. At the moment the nursery is just maintained, the staff is not very high qualified and the management is very poor. Also flower handling and marketing for the local market can be improved a lot. My suggestion is to start with producing many different types of flowers for the local market. These flowers should be handled with care and the marketing should be organised in a proper way. By doing all of these skills of the technical people and from the flower-handling people and from the management staffs is improved. This will also create a basic income for the company. The production, the costs and the revenues should be written down to see how it goes, this as a small feasibility study. If the company can organise this in a proper way a next step can be to think about exporting. For the local market I suggest to start with seed flower, the fastest seed flowers will grow in 8 till 12 weeks from seed to sellable flower. This means a turnover in 3 months. These types of flowers are
grown on hundreds of hectares in Kenya, and also exported to Europe. The seeds can be bought in Kenya, probably also in Uganda.
For this seed flowers a plan has to be made. It is very important to be able to sell flowers every week; you should be reliable for the shops in town. So you have to sow every 2 till 4 weeks, just a small amount. By working in this way you will be able to harvest flowers every week. Christmas is a good period for flowers with higher prices so you should start directly.
Flower seeds will be available in Uganda and in Kenya. These countries have a lot of knowledge of all kind of flowers and they will have books about flowers, libraries with information and also an extension service from the government. You have to get access to this information, so go to Kenya and ask for the agricultural department and go to the companies there. Companies are always willingly to sell and in that way also give information.
For a next stage there will also be local consultants in Kenya which are a lot cheaper than from Europe and know the local situation even better and they can help you to improve the nursery and your technical staff.
I will also contact some of the companies, which were on the Hortec exhibition. I will describe your company and make a list with questions and I will ask them to contact you directly.
A question was to describe the profile of the different people, which are needed.

\section*{Visit to Highland Flowers, Mr. Kalisa technical manager}

\section*{Tel 08532563}

This is a company with 5 hectares of roses. The rose varieties are modern and the roses are sold in The Netherlands on the auction in Bemmel. They have an agent on the auction that takes care of the flowers; the costs for the auction and handling are \(15 \%\).
The man we talked with Mr. Kalisa had worked for 7 years in Uganda and he knows the people there. He may even now people who want to work in Rwanda and have experience in the flower business.
He said that from the total flower costs approximately \(40-60 \%\) is freight costs.
The fertilisers are bought in Uganda; the prices vary between 0.40 and \(0.70 \mathrm{USD} / \mathrm{kg}\). The fertilisers are applied through a Dosatron; this is a very good system to give fertilisers on a controlled way to the plants. The water that is used is filtered to have it cleaned from the main dirt.
The greenhouse was build by somebody from Uganda who builds all the greenhouses in Uganda.

\section*{Greenhouse costs}

The plastic was bought in Israel the costs are USD \(1.60 / \mathrm{m}^{2}\), it was guaranteed for 5 years but now after 3 years it is getting bad.
A part of the greenhouse was build in 1999, this was 3 hectares, the costs were 8.975.000 RWF, only
for the material, wood and nails. In dollars approximately 18.000 , that is per \(6000 \mathrm{USD} / \mathrm{ha}\) and 60

\section*{USD cents \(/ \mathrm{m}^{2}\).}

Labour costs per \(\mathrm{m}^{2}\) were \(200 \mathrm{RWF} / \mathrm{m}^{2}\); this is 40 USD cents \(/ \mathrm{m}^{2}\).
USD/m \({ }^{2}\)
plastic \(\quad 1.60\)
wood and nails \(\quad 0.60\) this seems to me not very high
labour \(\quad 0.40\)
total \(\quad 2.60 / \mathrm{m}^{2}\)
was a contractor

The problems with insects were mainly with spider mites, aphids and caterpillars. Trips are never seen in the greenhouse, also not by crop specialists.
An agronomist costs 100.000 RWR/month, around USD 200/month.
We talked about the outside grown flowers and he told that it is possible to get cuttings from Carnation in Uganda and that they will grow good in Rwanda. Also seed from other flowers can be bought in Uganda. He gave a folder from Kieft seeds in Venhuizen the Netherlands.

Agrotec, a shop for all kind of agricultural material

The only available fertiliser is NPK 17-17-17, the price is RWF \(250 / \mathrm{kg}\), and for a big bag the costs are \(220 / \mathrm{kg}\). The shop also sells seeds of all kind of vegetables and we found even 5 different sachets with flower seeds. Also pesticides and spraying tanks are available.```


[^0]:    BUREAU IMAC BLEISWIJK BV
    Anthuriumweg 12
    2665 KV Bleiswijk
    The Netherlands

