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CARIBBEAN OPEN TRADE SUPPORT PROGRAM

WORK REPORT FOR GREEN MOUNTAIN FLOWERS

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Caribbean Open Trade Support Program

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Implemented by Consortium led by
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WORK REPORT
For

Green Mountain Flowers

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Funded by:
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1. BACKGROUND

The Caribbean Open Trade Support (COTS) Program of USAID/Barbados is designed to facilitate the transition of selected Organization of Eastern Caribbean States member states to open trade, and to enable the countries to compete more successfully and be more sustainable in the global economy. To this end, COTS will implement a wide range of activities over a four-year period geared towards:

1. Enabling businesses to compete more effectively in the global economy
2. Enhancing public-private sector interaction and dialogue leading to improved public policy dialogue
3. Assisting government institutions and agencies to remove administrative barriers to the growth of the private sector
4. Increasing the private sector and the media's understanding of the challenges and opportunities of the new trading regimes
5. Increasing the region's resilience to natural disasters
6. Mitigating the impacts of human disturbance on ecosystems and improving the institutional framework for managing protected areas

2. COMPONENT

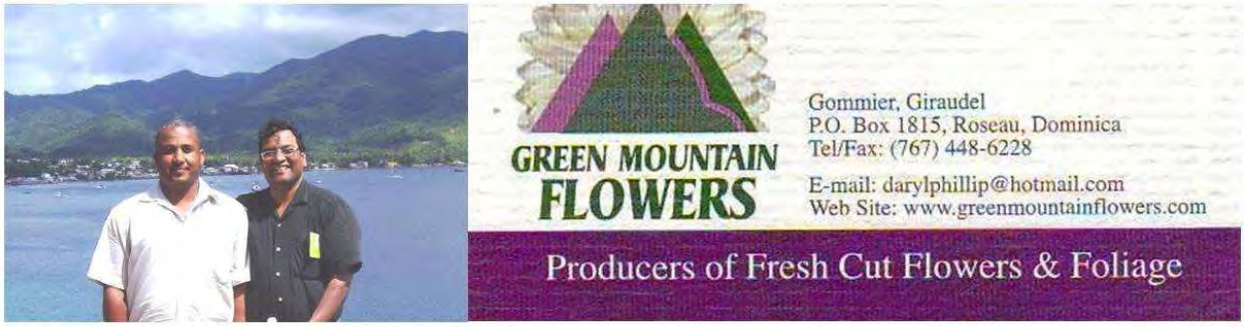
The COTS Program provides business advisory services under its Private Sector Development Component to client firms to increase sales. COTS assist clients to identify and remove constraints inhibiting sales growth through focused and cost effective support. Specific support from the Program is tailored to removing the constraint or "bottleneck" that inhibits a specific business transaction. Services range from business mentoring and networking assistance to providing local, regional or international consultants. These services that are provided will result in:

- Significant sales generation for assisted firms in Dominica is one of the primary objectives.

. Dominica is presently faced with numerous challenges as they seek to develop the main sectors, namely Agriculture and Tourism, which constitutes the building blocks of our national economy. More competitive enterprises in a number of clusters such as tourism, ICT, food and beverage, agro-processing, light manufacturing, entertainment, financial services, and advertising and public relations (PR) Streamlined, more efficient, pro-biodiversity and more environmentally-friendly firms need t be developed. Enhanced private sector knowledge of, and access to, global markets, resulting in increased and sustainable exports. Agriculture seems to be the worst affected and is becoming increasingly difficult to compete at the local, regional and international levels. A primary contributing factor to this problem is the lack of new business involvement in

this sector. In this competitive world environment, there arises an urgent need to inject new ideas and technology into the sector if it is to attain sustainability.

- A Client company, **Green Mountain Flowers**, Gommier-Giraudel, Roseau, in the Commonwealth of Dominica operates a greenhouse nursery producing potted plants and cut flowers for local and export markets.



Owner-Manager Mr. Daryl Philip & Consultant Dr. Thomas Varghese

I reviewed the current product list at GMF is very interesting and with a dynamic taste that are intended to support the demand of the local consumption and tourism. Among the products there are three groups of plants that are imported from Florida and in line with the trend in US market. They are **Interior low light requiring foliage, Exterior high light requiring landscape plants and Plants for cut flowers and foliage for vase and other decorative arrangements.** The Client needs to increase production to satisfy increased demand but is limited in its **knowledge of water utilization, distribution and production systems**. The Client needed the assistance of an agricultural greenhouse technician to design a system to respond to its water distribution and production needs.

Current Samples of Products grown at Green Mountain Flowers

A Sample of Cut Flowers processed for exports to other at GMF

3. OBJECTIVE AND TASKS

This assignment seeks to assist the Client to meet increased demand for its products with the design and installation of an effective water distribution system and implementation of efficient production systems. Also recommendations (See item 7) were discussed and listed below for further expansion, increased volume and effective sales and marketing.

Specifically the tasks to achieve this objective will be to:

- **Review the Client's current water storage and distribution systems**

Currently used water utilization system at GMF greenhouses

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Make recommendations for the design and installation of a more effective and efficient water storage and distribution system in harmony with the Client's needs.

Designed a System:

1. Sketch the windbreak area and include the following steps 1 to 4.
2. Select the drip emitter.

Using a Pressure compensating Emitter for Even Uniformity

The heart of a drip irrigation system is the drip emitter. It is designed to discharge water at a slow, preset flow rate. This method allows the water to be precisely applied at the base of each potted plant, only where it is needed.

The pressure compensating drip emitter is a device that is inserted into the 1/2" or 3/4" polyethylene drip tubing (lateral) at specified intervals or near each tree (one or two per tree depending on the soil and the size of the tree). The drippers consist of a cylinder with a labyrinthine water passage and a diaphragm. The diaphragm inside the dripper continuously

adjusts to varying water pressure, ensuring a constant flow rate. It also allows particles to pass through the dripper without harming it, providing reliable performance and a long life.

Calculating Water Requirement
To calculate water requirement we need the information below:

1. Location of the water supply, the size of the water supply, and the distance from the water supply to the control valve, and from the control valve to the first row.
2. Number of rows and plant spacing
3. How many pots in each row.
4. Total flow rate

Layout example
We need the location of the water supply, the size of the water supply, and distance from the first row.
Example: ***1 3/4" faucet about 3' from the first potted plant***
How many rows and the pot's spacing?
Example: ***Two rows with the plants spaced 1' apart***
Number of plants per each row?
Example: ***50 plants per each row***
Select dripper flow rates.
Example: ***1 GPH PC dripper***

With this information determine total flow rate, and select the size of the drip laterals based on the chart below *Example:* ***Total Flow Rate: 2 rows x 90 plants = 180 plants x 2 1-GPH drippers = 30 GPH. Total flow rates require: 30 gallons per hour (about 0.6 gallons per minute). To determine the length of the lateral, multiply the number of plants x plant spacing. 90 plants per row x 3" spacing = 90" length of each lateral.***
From the information above we know the following:
Total flow rate: 30 GPH. From chart A, we select 3/4" as the main line
Flow rate per each lateral: 1 GPH (gallon per hour). From chart A we select 1/2" for the two laterals.
Lateral length: 900. From chart B, we verified the maximum length base on a 10" spacing.
With this information we selected the main line pipe sizes (from the water outlet to the laterals), and the two lateral sizes

Chart A: *The charts below show the maximum flow rate that various pipe sizes can handle; pick the smallest size that will carry the required amount of water.*

Example Pipe Size	Maximum Flow in Gallons per hour
1/2 in .700 OD	220
3/4 in .940 OD 480	480

1 in	780
1 1/4 in	1380
1 1/2 in	1920

Chart B: *Distance to run 1/2" or 3/4" drip line with 1 GPH PC dripper per tree*

Pipe Size	**Maximum Lateral Length**				
	6' spacing	**8' spacing**	**10' spacing**	**12' spacing**	**16' spacing**
1/2 in.	1000 ft.	1300 ft.	1500 ft.	1700 ft.	2000 ft.
3/4 in.	1900 ft.	2300 ft.	2600 ft.	2900 ft.	3500 ft.

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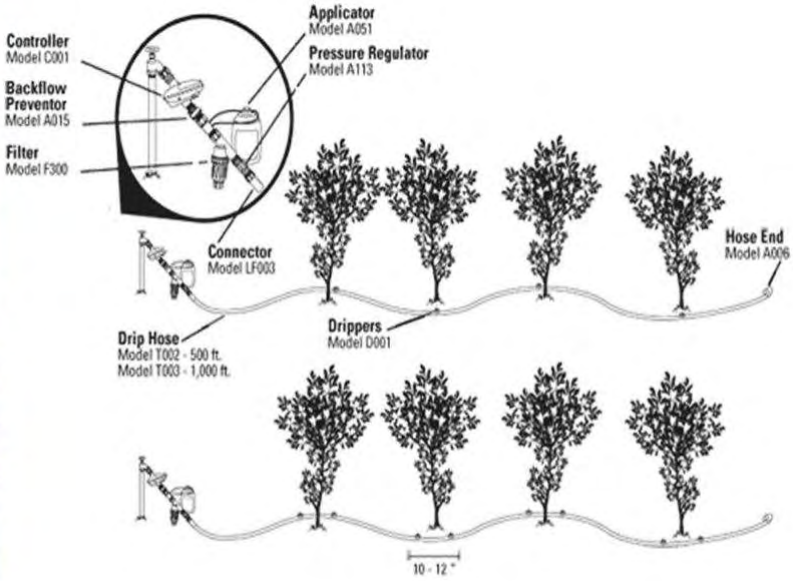

Recommended Low cost Drip Irrigation Design for GMF greenhouses

- After reviewing and discussions and acceptance of the recommendations by the Client, and with materials and labor supplied by the Client, worked with the Client to install the recommended system
- Commissioned and arranged for the handover of the system.
- Made recommendations for more efficient production methods/systems. Besides water utilization, use of growth regulants (PGAs) was discussed to improve the quality of specific plants under the local growing conditions. Possible use of slow release hydrants to prevent excessive loss of water in certain products were discussed and listed.

- Developed a plan for the future development/expansion of the Client's operations. Double Stacking of plants based on the light and space requirements were discussed. This way the number of plants produced per square foot could be doubled in terms of both water and space use. Use of certain netted see through sleeves for finished products was recommended as customers find it difficult to carry plants home from local outlets and displays.
- Trained the Client's staff to operate and maintain the systems

4. OTHER RECOMMENDATIONS & SHARING OF EXPERIENCES IN SHORT TERM:

a. Develop a product list and acquire them based on what the customers are asking for local use.

b. Generate customer interest in new products that are available from trend setting market. Several specifics were discussed with the client.

c. Create inexpensive seasonal & festival buying guides for the local Garden Centers and other outlets.

d. Publish and market GMF through a reasonable website and operate a network to promote GMF in other Caribbean nations.

e. Add value to the finished products by doing them in decorative pots with contemporary tastes and changing festival looks.

5. OTHER THE LONG TERM BUSINESS EXPANSION PROPOSALS FOR GMF:

a. Invest in an additional small greenhouse that can help the client do his own propagation of imported tissue cultured plants to reduce the cost of importing finished plants. This could help the client to become a distributor of starter plants to other clients in CARICOM.

b. Develop and work closely with local academic institutions to train and encourage youth in getting involved with plant propagation through tissue culture biotechnologies and improve the local interest in green and environmental horticulture:

Plant Tissue Culture Technology:

Whoever said that **variety is the spice of life** must have been referring to the horticulture industry. Finding and commercializing new and exciting plant varieties that will surprise and delight customers is essential in this business. That is where plant cloning using tissue culture technologies can help nurseries, growers, and garden centers stay one step ahead of the game. The technology helps in bringing unique or difficult to propagate varieties into production on a commercial scale over a brief time span.

What is Tissue Culture?
Tissue culture is a process that involves exposing plant tissue to a specific regimen of nutrients, hormones, and lights under sterile, in vitro conditions to produce many new plants, each a clone of the original mother plant, over a very short period of time. Tissue cultured plants are characterized by disease free growth, a more fibrous, healthier root system, a bushier branching habit, and a higher survival rate.

There are three main steps to the tissue culture process:

STAGE I is the initiation phase. It concerns the establishment of plant tissue in vitro by sterilizing the material and initiating it into culture.

STAGE II is the multiplication phase. At this stage, the in vitro plant material is re-divided and placed in a medium with plant growth regulators that induce the proliferation of multiple shoots. This process is repeated many times until the number of plants desired is reached.

STAGE III is the root formation phase. It involves the introduction of hormones to induce rooting and the formation of complete plantlets.

Following these three stages, the plants are then moved from the laboratory to the greenhouses for acclimatization and further development.

When Can Tissue Culture Help With Your Growing Needs of small businesses:
Plant tissue culture technology has proven itself to be an effective and viable option for growers to seriously consider in a variety of different situations.

- **When large-scale propagation of new or superior plant varieties is required for early introduction to market**

Following a decision to release a new variety into the market, the key to success for growers is rapid scale up and production on a commercial level. Tissue culture is often the fastest and most economical means to achieve this goal.

We suggest that growers continually compare the cost of conventional propagation methods to micro propagation, especially when conducted by an established tissue culture company with a proven track record of mass propagation such as Sunshine Horticulture LLC and other off shore labs.

When mass multiplication is needed for varieties which are difficult to regenerate by conventional methods of propagation

It is often the case that new or highly valued plant varieties are also the most difficult to propagate using traditional means. Here again, tissue culture technology can be very helpful to

growers.

The speed of plant multiplication and the quality and uniformity achieved by micro propagation process can be considerably superior to conventional methods.

- **When disease-free plant propagation is important**

One of the inherent requirements of the tissue culture process is that it be conducted in sterile, aseptic conditions. This results in plants that are generally free of bacterial and fungal diseases. This aspect of tissue culture is especially helpful for growers that are propagating plant varieties that have major systemic disease problems.

Tissue Cultured Plants: Quality is the Difference!
The tissue culture process takes place in sterile conditions, and uses hormones that have been shown to have a carryover effect once plants are moved to external conditions. Furthermore, tissue culture leads to the regeneration of whole plants, with their own full root systems and vigorous top growth like young seedlings.

As a result, tissue cultured plants have many visible benefits such as:

- are guaranteed to be disease free
- have a more fibrous, healthier root system free of any root rot problems
- exhibit a denser, bushier branching habit
- are characterized by more vigorous growth after transplanting
- have a higher survival rate
- are ready for re-sale in a shorter time

These benefits of tissue cultured plants result in significant cost savings for growers due to a reduction in growing space and time, and a decrease in the labor required to yield marketable products.

6. DELIVERABLES:

Deliverables included were:

1. A report on observations of the current operations and recommendations for improvement
2. A certificate of acceptance of the installed system from the Client
3. An operations and maintenance manual on the System **(Attached for the client's use)
4. A plan for the long term development/expansion of the operations to include recommendations for more efficient production methodologies

5. A final Report on completion of the assignment to include the tasks undertaken and the deliverables.

7. REPORTING

The Consultant has reported directly to the COTS Business Advisor, Neville Graham and any assignee appointed by Earle Baccus, Team Leader, and Private Sector Development. The COTS Business Advisor was responsible for monitoring the Consultant's performance under this SOW.

8. Consultant LEVEL OF EFFORT

The level of effort made available for this consultancy was 12 days. An illustrative LOE breakdown is included in the table below:

Activity	**LOE** (days)
1. Reviewed the current operations	1
2. Installed the water distribution system	5
3. Developed recommendations for more efficient production methods	1
4. Prepared a long term development plan	2
5. Prepared a manual on operations and maintenance of the water distribution system	2
6. Prepared a final Report	1
Total	**12**

9. ACKNOWLEDGEMENT:

I take this moment to thank USAID-COT program to have given me this opportunity to use and share my experiences with Mr. Daryl Philip of Green Mountain Flowers.

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**Attachment:

Operations and maintenance manual on the drip irrigation System

Operations: Hose and timer:

1. Female swivel hose thread faucet/tap adapter
2. Interior filter
3. Top cover
4. Timer display
5. Programming and operation buttons
6. Male hose thread connection
7. Battery compartment

• Hold the timer with the battery compartment facing you
• Remove the battery compartment cover
• Connect 9V battery to the battery connector
• Insert battery and press on battery cover
• IMPORTANT: when changing the battery, make sure the battery compartment stays dry.
Use 9V alkaline batteries only

Make sure the filter (washer) is in place, then screw the timer to the faucet/tap by attaching the side with the female swivel hose thread connector to the faucet or hose end, then turn it clockwise (hand tighten only).Connect the timer hose male thread side to your system.

The digital timer is programmed with the aid of 4 buttons. Programming step – used to select the appropriate programming mode (e.g. dock setting mode.
Timing Parameter – used to select or change the parameter (e.g. hour, minute, etc.) To implement the change, the selected parameter must be blinking.
Data increment (increase) – raises the value of the selected parameter (e.g. adds an hour)
Data decrement (decrease) – lowers the value of the selected parameter (e.g. deducts an hour).

• Water resistant only. Do not install on PVC pipe.
• If no changes are implemented, the timer display will always revert to the main screen(clock).
• Display digits will stop blinking after 40 seconds. If the last parameter stops blinking before you have completed your programming, press to continue the process.
• To delete a start time advance start hour until" OFF" shows on display (OFF appears after11:00 PM)
• To reset controller, remove battery for 30 min. Install new battery and re-program.

The current time and day of the week must be setas shown to enable the irrigation timer to operate the irrigation system at the required times:

SETTING THE TIME

1. Press until appears, or if appears,
2. The hour digits are blinking. Set the current hour, AM or PM, with the aid of or .
3. Press .The minute digits blinks. Set the current minute with the aid of or.

• For a 24 hour clock display, press concurrently on and buttons. Pressing these buttons again will revert the display back to AM/PM hour display.

SETTING THE DAY OF THE WEEK

1. Press, a blinking drop appears at the top of the display.
2. Set the drop on the current day of the week by pressing on and .Press to repeat the process or to continue.

This section contains an example of a weekly irrigation program. Simply alter data in the example to adapt the program to meet your irrigation requirements.

Let's assume that you want to program the irrigation timer to water for 10 minutes and tostart at 8:00 a.m., 1:30 p.m .and 7:00 p.m. on Tuesday and Friday.

PROGRAM THE RUN TIME: Press until appears opposite "Duration".

Standard Maintenance:

The installed drip hose system is used on the soil surface for foliage and flower crops over a number of years, the drip hose should be lifted periodically so that leaves, soil, and debris do not cover the hose. If the drip hose is not lifted, roots can grow over the hose, anchor it to the ground, and eventually pinch off the flow of water.

Flow of water:

Place a water flow meter between the solenoid valve and each zone and record it's gauge daily. This provides a clear indication of how much water is applied to each zone. Records of water flow can be used to detect deviations from the standard flow of the system, which may be caused by leaks or by clogged lines. The actual amount of water applied recorded on the meter can be compared with the estimated crop water use (crop evapo-transpiration) to help assure efficient water management.

Watch for Leaks:

Leaks can occur unexpectedly as a result of damage by insects, animals, or farming tools. Systematically monitor the lines for physical damage. It is important to fix holes as soon as possible to prevent uneven irrigation.

Chlorine Clears Clogged Emitters:

If the rate of water flow progressively declines during the season, the tubes or tape may be slowly plugging, resulting in severe damage to the crop. In addition to maintaining the filtering stations, regular flushing of the drip tube and application of chlorine through the drip tube will help minimize clogs. Once a month, flush the drip lines by opening the far ends of a portion of the tubes at a time and allowing the higher velocity water to rush out the sediment.

Because algae growth and biological activity in the tube or tape are especially high during warmer months, chlorine usually is applied at 2-week intervals during these months.

If drip lines become plugged in spite of maintenance, many cleaning products are available through irrigation systems suppliers. Choose a product appropriate for the specific source of contamination.

Chemigation:

Manage irrigation and fertilization together to optimize efficiency. Chemigation through drip systems efficiently delivers chemicals in the root zone of the receiving plants. Because of the

precision of application, chemigation can be safer and use less material. Several commercial fertilizers and pesticides are labeled for delivery by drip irrigation.

Injection pumps with backflow prevention devices are necessary to deliver the product through the drip lines. These pumps allow for suitable delivery rate control, while backflow prevention protects both equipment and the water supply from contamination.. Other safety equipment may be required as per the supplier for the installed a drip-irrigation system.

Fertilizer:
Soil microorganisms convert nitrogen (N) fertilizers to nitrate. Nitrate is water soluble, available to plants, and subject to leaching loss. Since nitrate loss management was one of the initial reasons for our exploring drip irrigation, it is appropriate that we revisit this topic.

Typically, when irrigation is monitored closely, less nitrogen fertilizer is needed with drip irrigation systems than with furrow irrigation systems because the fertilizer is spoon-fed to the root system and little is lost due to leaching. For example, if a field is converted from furrow irrigation to drip irrigation and the amount of nitrogen fertilizer is not reduced, the crop may become excessively leafy which can inhibit curing and increase harvest costs as well as losses. Leaf tissue analysis performed by a qualified agricultural lab can help determine crop nutrition needs during the season, and tailor the N fertilizer applications to actual crop needs.

Fertilizer can be injected through the drip system. Fertilizer usually is introduced into the irrigation system in front of the filter station so the filters can remove any precipitates that occur in the solution.

Fertilizers containing sulfate, phosphate, calcium, or anhydrous or aqua ammonium can lead to solid chemical precipitation inside the drip lines, which can block emitters. Obtain chemical analysis of your irrigation water and seek competent technical advice before injecting chemical fertilizers into drip systems.

Placement of Tape:
Observe and plan for shoot emergence and growth. The drip tape must be close enough to the surface to support the plant growth if necessary, or a portable sprinkler system should be available. For example, a tape tube 4 to 5 inches deep has successfully grown several plant types in silt loam soil. Tape at 12 inches failed to uniformly grow certain plant types. Proper selections based on experience are the best.

Timing and rates:

The total irrigation water requirements for crops grown with a drip system is greatly reduced compared to a surface flood system because water can be applied much more efficiently with drip irrigation. For example, with furrow irrigation, typically at least 4 acre-feet/acre/year of water is applied to irrigated fields in the non-covered and surrounding areas of the facility. Depending on the year, summer rainfall, and the soil, 14 to 32 acre-inches/acre of water has been needed to raise crop under drip irrigation in the said area.

Applying more water than what plant's need will negate most of drip irrigation's benefits. The soil will be excessively wet, promoting disease, weed growth, and nitrate leaching.

To determine application rates, use measurements of soil water and estimates of crop water use (crop evapotranspiration, or "ETc"). For shallow rooted crops, irrigate only to replace the soil moisture deficit in the top 12 inches of soil. It usually is not necessary to exceed ETc. For measuring soil water, instrumentation for Soil Moisture Monitoring can be used and Irrigation monitoring using soil water tension could also help. Plan proper irrigation scheduling based on the daily needs.

Add chlorine or other chemicals to the drip line periodically to kill bacteria and algae. Acid might also be needed to dissolve calcium carbonates.

Filters must be managed and changed as needed. Even with filtration, however, drip tape must be flushed regularly. The frequency of flushing depends on the amount and kinds of sedimentation in the tape.

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