



TECHNICAL / OPERATIONAL STUDY

Jamaica - Canada Agricultural Business Venture

CIDA Inc. Project # K062267

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On Behalf of



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I. Acknowledgements

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II. Executive Summary

One must never underestimate nor take for granted that anything is the same in another country. An understanding of carefully researched data will need to be learned in order to operate with a third world country, as compared to a first world. Technology transfer, training, and development will play a key role to make this venture successful into the future years.

In order to have a chance at being successful, every step of the way needs to be identified and improved due to the broken infrastructure that is presently in place.

The areas of interest in Jamaica are Hounslo and Mountainside in the St.Elizabeth Parish, and Brokenhurst, Devon, Broadleaf, and Christiana in the Manchester Parish. These areas have been chosen for their climate, soil, and facilities currently available. The overall climate in Jamaica is very different than that of Canada. Direct sunshine hours are more apparent and two to three hours longer than that in Canada. Rainfall is more intense at times and for longer periods. Winds are more steady, but also more violent when hurricane season hits. The weather also varies from town to town due to the elevations.

The first demonstration project will consist of 15 acres of vegetables grown in the Mountainside and Hounslo areas in St.Elizabeth parish. All products grown on this plot will be for domestic consumption, with the exception of the sweet potatoes and Jamaican pumpkins, which are for consistent export supply. Once knowledge is obtained on what crops are profitable and suitable by the results of pilot project, surrounding growers will have the opportunity to watch, learn, and make the decision if they want to grow with Nightingale Farms Jamaica on a services contract basis.

Yams and other root crops have been produced in the past in the Broadleaf area commencing in November of 2005, and will be expanded to accommodate for growing demand in the international markets. When packaged and distributed to Canada, Bell City Brands will retrieve the product and transport it to their facilities to apply additional value-added qualities.

The final pilot project will be in the Devon and Brokenhurst areas and cover approximately one acre of ground, encompassing a massive high-tunnel, hydroponic growing structure. All crops will

be for domestic consumption. The proposed high-tunnel structure is to cover the entire area, incorporating eight connected multi-bays on the surface. These systems combined will extend the growing season, providing protection from wind, rain and hail, modifying the growing environment, allow spraying and harvesting during wet weather, reducing moisture related diseases, and increase crop yield and quality. This crop will be harvested on a year round basis to fill requirements of the larger hotel chains and grocery stores.

The CPGCA is located in Christiana, Jamaica, and will act as the centre nucleus where all business will filter through. It is a collection of growers working as a team with the proper expert guidance and financing taking the system from seed to the consumer with no middlemen with anything invested or at risk. They will act as a supplier of chemicals, fertilizers and other needed materials. All packing, storage, distribution, and marketing domestically and internationally will also be done out of their main facility. Once in Canada (primary international target market) a local warehouse will retrieve the product and incorporate value-added qualities. From storage, the products will be marketed and distributed amongst both chain and independent grocery stores. Major renovations are needed to comply and exceed international standards in the pack house facility, though these costs do outweigh the initial capital that would have to be raise if construction of a new building was done. The CPGCA will also encompass a grower training center; providing a library of information available for anyone who wants to make the future of the agriculture industry in Jamaica a promising one.

Disease pressures are noticeably higher in Jamaica due to the humidity factor. Since there is minimal known commercial breeding of seeds, North American varieties will have to be used, countering it with a more than ample spraying program that will have to be monitored and maintained.

Transportation throughout the island is adequate; most of the roads are paved, and there are options of air or sea freight for export and importing products and or other materials. Prices are dramatically different, the choice will depend on the time span needed and location drop off point.

Security, larceny, and theft will always be an issue, especially when dealing with a third-world country. Security device monitoring and accountability will be stressed to keep the negative effects to a minimum.

In order to get the best understanding of exactly the conditions that lie ahead, three test crops (cantaloupes, yellow yams, and sweet potatoes) were previously grown, harvested, and marketed

with much success in Ontario, Canada. Through these pilot projects, tremendous data and knowledge was collected.

Past cultural practices of growing in Jamaica will need to be learned, then technology will be implemented where efficiency lacks. Many agriculture projects have tested faulty in the past, research will be done to learn from their prior mistakes. The technical feasibility of this project is one of a high success rate, though many precautions will have to be taken to ensure everything runs smoothly.

III. Methodology

Methods of collecting data during this study include continuous interviews, grower surveys, and grower group meetings. Multiple methods were exhausted at all levels to convey elicited important information relative to the proposed venture. Candidates were asked their opinions on the technical and operational feasibility of this project, given their past involvement within the agriculture field presently in Jamaica.

Thirty minute interview sessions were held with participants; both closed and open-ended questions were asked, promoting high levels of feedback. All answers and comments were recorded and later used as knowledge data within the report.

Surveys were distributed to individual growers in multiple areas to gain knowledge of the cultural practices currently performed in agriculture. Advantages and disadvantages of their strategies were noted, enabling a clear view of where the opportunities lie within the sector.

Ten grower group meetings were held in Mountainside, Hounslo, and Christiana at the CPGCA (Christiana Potato Growers Cooperative Association). The current growers of Jamaica expressed their views on the progression of the agriculture sector in the past, and their ideas on how to forward it into the future. Different strategies were discussed; systems to incorporate the past growers into the future of this industry through training in growing techniques, harvesting, and overall technology transfer.

IV. Geographic Location and Assessment of Proposed Sites

i) Jamaica

Jamaica is an island with an area of 11,244 square kilometers (4,411 square miles). The island is surrounded by the warm waters of the Caribbean Sea, located in the tropics, approximately midway between the southern tip of Florida and the Panama Canal.

Appendix:

Map of the Country of Jamaica

Map of the Island Parishes of Jamaica

Among the most important climatic influences are the Northeast Trade Winds, the range of mountains that runs east-southeast to west-southwest along the centre of the island, the warm waters of the Caribbean Sea, and weather systems such as upper and low-level low-pressure centers, troughs, and cold fronts. The cold fronts are usually weak after migrating from the North

American continent, but still are evident from mid-October to mid-April. The tropical weather systems, including tropical waves, depressions, storms, and hurricanes, occur from April to December. The official hurricane season is from June to November.

Appendix:

Worst Hurricane Systems to Affect Jamaica within the Last 50 Years
Tropical Cyclones Making Landfall or Hitting Jamaica; 1871-1988

Of the weather parameters, rainfall is the most variable. Island wide, during the period 1951 to 1980, annual rainfall ranged from a maximum of 2593 millimeters (102.09 inches) in 1963 to a minimum of 1324 millimeters (52.13 inches) in 1976; an average of 1940 millimeters (76.38 inches) annually. Some mountainous areas in the island's northeast receive more than 5080 millimeters (200 inches) annually, while coastal areas to the southeast and south-centre receive less than 889 millimeters (35 inches) annually. Yearly, most areas of the island have two distinct wet seasons, May to June and September to November, which occur regularly as yearly cycles.

The driest period is usually from December to March. Most of the rainfall during this period is associated with cold fronts migrating from North America. Whether during the dry or rainy season, however, other rain-producing systems are influenced by the sea breeze and orographic effects, producing short-duration showers, mainly during mid-afternoon.

Appendix:

Island-Wide Rainfall Distribution (mm); Monthly Averages
Long-Term Mean Parish Rainfall (mm); 1951-1980
Rainfall Distribution (mm) by Parishes; 1951-1980
Precipitation Outlook for the Caribbean (March-April-May 2006)

Temperatures in coastal areas are comfortably warm, becoming cooler in the hilly and mountainous regions in the centre of the island, but more so in the Blue Mountain range with a peak of 2256 meters (7,402 feet). The island's temperatures remain fairly constant throughout the year under the moderating influence of the warm waters of the Caribbean Sea. In coastal areas, daily temperatures average 26.2 degrees Celsius, with an average maximum of 30.3°C and an average minimum of 22.0°C. Inland, temperature values are lower, depending on elevation, but, regardless of elevation, the warmest months are June to August and the coolest December to February. The diurnal range of temperature is much greater than the annual range and exceeds 11.0°C in mountainous areas of the interior. Night-time values range from 18.9 to 25.6°C in coastal areas. At elevations above 610 meters (2000 feet), minimum temperatures of 10°C have been reported occasionally when active cold fronts reach the island.

For most of the year, the daily wind pattern is dominated by the Northeast Trades. By day on the North Coast, the sea breeze combines with the Trades to give an east-northeasterly wind at an average speed of 15 knots (17 miles per hour), and along the South Coast, an east-southeasterly wind with an average speed of 18 knots (21 miles per hour). In the period December to March, however, the Trades are lowest and the local wind regime is a combination of trades, sea breeze, and a northerly or northwesterly component associated with cold fronts and high-pressure areas from the United States. By night, the trades combine with land breezes which blow offshore down the slopes of the hills near the coasts. As a result, on the North Coast, nighttime winds generally have a southerly component with a mean speed of 5 knots (6 miles per hour) and on the South Coast, a northerly component with a mean speed of 7 knots (8 miles per hour). By day, from June to July, mean onshore winds often reach a maximum of up to 23 knots (26 miles per hour) along the North Coast and 26 knots (30 miles per hour) along the South Coast during mid-afternoon. However, winds are generally lighter inland and towards the west. Calms, therefore, attain their highest frequency in the western extremity of the island and in the two intervening periods between the full development of the land and sea breezes.

Appendix:

Summary of Wind Conditions in Proposed Areas

Variations of sunshine from month to month in any area are usually small, approximately one hour. Differences, however, are much greater between coastal and inland stations.

Maximum day-length occurs in June when 13.2 hours of sunshine are possible and the minimum day-length occurs in December with 11.0 hours. However, the mean sunshine in mountainous areas is less than 6 hours per day, while in coastal areas it is near 8 hours per day. The shorter duration in the hilly areas is caused mainly by the persistence of clouds.

Afternoon showers are the major cause of most daily variations in relative humidity. Highest values recorded during the cooler morning hours near dawn, followed by a decrease until the early afternoon when temperatures are highest. Although relative humidity in coastal areas average 84 percent at 7 a.m., temperatures at this time are in the mid 20's (°C), therefore, little or no discomfort results. At 1 p.m. the average relative humidity on the coasts is 71 percent while values in the plains will average about 77 percent, reflecting the effects of afternoon showers in the nearby hills.

ii) St. Elizabeth Parish, Jamaica- Mountainside and Hounslo Area

St. Elizabeth is Jamaica's second-largest parish covering a total area of 1212.4 sq km (largest is Saint Ann, covering a total of 1212.6 sq. km), and is located in the southwest of the island. Its capital, Black River, is located at the mouth of the eponymous stream, the longest on the island. Directly located to the east is Manchester, the west is Westmoreland, and to the south, St. James and Trelawny.

The parish had an estimated population of 148,000 in 2001, 4000 of which live in the capital of the town. The distinct feature of this parish is that numerous ethnic groups can be found there; St Elizabeth probably has the greatest racial mixture in Jamaica.

There are three mountain ranges on the northern and north eastern parts of the parish: the Nassau Mountains in the north-east, the Lacovia Mountains to the west of the Nassau Mountains, and the Santa Cruz Mountains which, running south, divide the wide plain to end in a precipitous drop of 1600 feet at Lovers' Leap. The central and southern sections form an extensive plain divided by the Santa Cruz Mountains. A large part of the lowlands is covered by morass, but it still provide grazing land for horses and mules.

The main river running through the parish is the Black River; measuring 53.4 kilometres (33 miles), making it the longest river in Jamaica. The river has its source in the mountains of Manchester where it rises and flows west as the border between Manchester and Trelawny, then goes underground. It reappears briefly in several surrounding towns, but reemerges near Balaclava and tumbles down gorges to the plain known as the Savannah, through the Great Morass and to the sea at Black River, the capital of the parish.

There are many limestone formations in the parish, resulting in the formation of 44 caves. Mineral deposits include bauxite, antimony, white limestone, clay, peat, and silica sand which is used to manufacture glass.

The parish has been a major producer of bauxite since the 1960s. Port Kaiser, near a town called Alligator Pond, has a leading deep-water pier for bauxite export. A huge \$125 million alumina plant has been constructed at Nain.

The parish also produces a large quantity of Jamaica's sugar; there are two sugar factories in the parish. Fishing is a major industry in the parish, as is tomato canning; a plant is at Bull Savannah. The parish also cultivates crops such as cassava, peas, tobacco, coffee, and much more. As a result of the fertile soil that provide for grazing fields, pastoralism is possible. Livestock include goats, sheep, hogs, cattle, and horses.

Since the 1990s, the parish has become a significant tourist destination, with most visitors going to the Treasure Beach area. The Appleton rum distillery, near Balaclava in the north of the parish, is also a tourist destination. Ecological tourism along the Black and YS rivers, and in the Great Morass has been developed in recent years.

The rainy season is from August to November; October has the highest amount of precipitation, with a total monthly average of 219mm (approximately six inches). The dry season ranges from December to July; February having the lowest monthly average, approximately one inch (34mm). The maximum rainfall in one day, on average, is approximately 101mm (three inches).

One possible constraint that can be seen in previous years in this area is excess rain. This is the main weather element that can destroy proposed crops; sometimes with heavy down-pours and lasting for days, ultimately bring forth multiple pests and diseases.

SOURCE: http://en.wikipedia.org/wiki/St.Elizabeth,_Jamaica

Appendix:

St.Elizabeth Rainfall Distribution (mm); Monthly Averages

iii) Manchester, Jamaica – Devon and Broadleaf Areas

The parish of Manchester is located in west-central Jamaica, in the county of Middlesex. Its capital, Mandeville, is a major business centre. The population of Manchester is approximately 190,000 people; Mandeville recording a population of over 30,485.

Bordered by St. Elizabeth in the west, Clarendon in the east, and by Trelawny in the north, Manchester covers an area of 830 sq km, making it Jamaica's sixth largest parish. It has three mountain ranges — the May Day Mountains, and the Don Figuerero Mountains, and the Carpenters Mountains which boasts the highest point above sea level at 2770 feet.

Over 90 percent of the parish's surface is limestone, therefore an abundance of cockpits, sinkholes, caves, and underground passages are found throughout. The Oxford Cave in upper Manchester is the largest of 20 known caves in the parish. Manchester also has large bauxite deposits.

The parish offers a variety of climate, vegetation, and scenery. The capital, Mandeville, is situated at an elevation of 626 metres (2,061 ft), and noted for its natural beauty and salubrious climate. Temperatures range from a low of 12.7°C in December and January, to a high of 31°C in July and August. There are very few rivers in the parish, and the existing ones are rather small; Alligator Hole River, Alligator Pond River, Hector's River, Two Rivers, and Swift River. Hector's River runs along the border of Manchester and Trelawny, then sinks at Troy where it flows underground for approximately six kilometres and rises below Oxford Cave as One Eye River. Despite this, water supply is generally scarce; the southern districts often suffer drought..

There is no large-scale cultivation of crops as the area is generally mountainous. Crops such as sugar cane require large tracts of flat land. Bananas, coffee and pimento, annatto, and ginger are grown, and also noted for its citrus; oranges, ortaniques and grapefruit, all of which are exported.

SOURCE: http://en.wikipedia.org/wiki/Manchester,_Jamaica

Climate ranges are the same as the St.Elizabeth parish, the rainy season running from August to November with October exceeding all months at an average of 219mm (approximately six inches). The dry season runs from December to July, February has the lowest monthly average at 34mm (one inch). The maximum average rainfall per day is approximately three inches (101mm).

Appendix:

Manchester Rainfall Distribution (mm); Monthly

Physiography of the St.Elizabeth – Manchester Area

Manchester, Jamaica – Christiana Area

Christiana is located 28 kilometers (14 miles) north of Mandeville atop the central mountains, and is considered the second largest town of the parish of Manchester. The Christiana Land Authority assists agricultural development in the region.

At an elevation of 3000 feet above sea level and midway between the north and south coasts, Christiana is a center for transportation and commerce in the area. The cooler and drier climate provides excellent conditions for the growing of Irish potatoes, sweet potatoes, yams, ginger, leftman coco, tomatoes, sweet peppers, and an abundance of root and vegetable crops.

The Christiana area is also home to the Blue Hole, Christiana Bottom, and the Gourie Forest Reserve. The Blue Hole is a swimming hole and waterfall located 3.2km and 800 feet down from the center of Christiana.

Christiana also supports several banks, grocery stores, hardware stores, farm stores, churches, schools and public services.

V. Proposed Projects

A) Project #1: St.Elizabeth Parish; Mountainside and Hounslo Areas

A1: Background

The first test project will consist of 15 acres of vegetables grown in the Mountainside and Hounslo areas in St.Elizabeth parish. All products grown on this plot will be for domestic consumption, with the exception of the sweet potatoes and Jamaican pumpkins, which are for consistent export supply. Once knowledge is obtained on what crops are profitable and suitable by the results of pilot project, surrounding growers will have the opportunity to watch, learn, and make the decision if they want to grow with Nightingale Farms Jamaica on a services contract basis.

A2: Proposed Crops Produced

- *Jamaican Pumpkins*
- *Sweet Corn*
- *Cantaloupes*
- *Honey Dew*
- *Cucumbers*
- *Tomatoes*
- *Strawberries*
- *Sweet Green Peppers*
- *Red and Yellow Peppers*
- *Scotch Bonnet Peppers*
- *Sweet Potatoes*
- *Zucchini*
- *Broccoli*
- *Cauliflower*
- *Romaine Lettuce*

A3: Current Soil Conditions

The first two samples were taken from the St.Thomas area. The test soil presents large challenges for growing vegetables. It has very high clay content, higher than any 'Haldimand Norfolk' clays in Southern Ontario. The heavy clay soils will not provide a suitable soil structure for general crop production. The soil aeration will be very poor, compaction will be high, and root development will be restricted. The high pH levels combined with excessive calcium will further reduce availability of the already deficient soil phosphorous. Considering an experimental error of +/- 3 ppm, some of this soil is virtually void of phosphorous. Corrective measures would require supplemental phosphorous applications in excess of 240lbs/Ac P₂O₆ per yr for several yrs, with soil levels improving at a rate of only 8ppm per year.

The sample taken from the Hounslo, St.Elizabeth area provides a better overall nutrient balance. Higher organic matter levels provide higher overall nutrient levels and moisture balance. Existing phosphorous and potassium levels can easily be managed using commercial fertilizers if available for application. The existing magnesium and calcium levels, although lower than the samples from St.Thomas, are more than adequate for most vegetable crops grown in this area. The soil test results show this to be more of a sandy loam, a favourable soil type for vegetable production in Ontario.

Appendix:

Pictures of Growing Area
Pictures of Pilot Project
Seed Varieties and Pricing
Seeding and Planting Schedule Template
Soil Description
Equipment and Supplies Needed
Drip Irrigation Information
Cost of Production
Potential Revenue

B) Project #2: Manchester Parish; Broadleaf Area

B1: Background

Yellow yams will be exclusively grown in Broadleaf, spanning over approximately four acres of land. This project has previously commenced as of November 2005, but would like to expand operations to grow a continuous supply for export into the international markets. When packed and distributed to Canada, Bell City Brands will retrieve the product and use their facilities to apply additional value-added qualities.

B2: Proposed Crops Produced

➤ ***Yellow Yams: 4 acres***

Primarily distributed throughout the ethnic markets, the yellow yam is uniquely Jamaican and highly rated for its use in a number of Jamaican recipes. Yams are approximately 15-30cm (6"-12") long and 10-20cm (4"-8") in diameter. The skin is smooth and dark brown and the flesh is firm when cooked and pale yellow in colour. As a complex carbohydrate and a natural food, its nutritional value is exceptional. This product is available all year, with the greatest supplies available from October to June. For export, the product is packaged in 20.5kg (45lb) boxes in coconut coir (fiber) or sawdust. The packing material protects the tubers during shipment and maintains freshness. In the store, yams last up to three to four weeks.

Appendix:

Commercial Growing of Yams in Jamaica

Soil Description

Cost of Production

Potential Revenue

C) Project #3: Manchester, Devon and Brokenhurst Areas**C1: Background**

This pilot project will cover approximately one acre of ground, and encompass a massive high-tunnel structure. All crops will be for domestic consumption. The proposed high-tunnel structure is to cover an area of one acre, incorporating eight connected multi-bays on the surface. The sections are 28' wide by 200' long; the height of the hoops provides tractor access and improved ventilation which reduces heat and humidity. The site does not need to be on level ground, sloping is adequate and aids natural ventilation. The tunnels have the option of relocating due to the design of the actual structure. The poly that is attached to the top of the structure is secured by hoop clips; ropes are laced over the top of the poly and tightened with special rope clamps. The tunnels are vented manually by pushing the edges of the poly up the hoops with a venting tool. The rope tension holds the poly in the open position. The hoops themselves are constructed of one piece to maximize strength. Properly installed tunnels vented to 'Stage 3' have withstood up to the 70mph wind gusts. Poly should be removed for hurricane force winds. In most installations, the run-off drops to a shallow furrow in each leg row and erosion is controlled with ground cloth, straw, black poly, crushed stone or simply sowing grass or oats.

Extending the season, providing protection from wind, rain and hail, modifying the growing environment, allowing spraying and harvesting during wet weather, reducing moisture related diseases, providing a structure to support shade or bird net, increasing crop yield and quality. This crop will be harvested on a year round basis to fill requirements of the larger hotel chains and grocery stores.

The climate in Jamaica is one of the best for covered produce growing systems. The Devon area is close in proximity to Christiana; the location of the CPGCA center and other small greenhouse projects, creating a gathering place for growers, researchers, and politicians.

The proposed high tunnel system is a quarter to one third of the cost per square foot compared to what is currently available in Jamaica. The structure can withstand gusts up to 70 kilometers per hour damage free if maintained properly. They become 'hurricane proof' by rolling back the poly on the roof of the system, due to the unique roping system used and quick labour management techniques.

A covered system keeps the crops dry, preventing the high pressures of diseases that are common to uncovered growing systems. Yields and quality of produce are greatly enhanced also. This system generates more regularity during harvest, ultimately bringing complete satisfaction to the end user – the customer.

C2: Reasons for Hydroponics vs. Bare-ground and Plastic Growing Techniques

There are many reasons to produce vegetables under hydroponics' technologies verses bare ground and plastic growing techniques which include the following:

1. The soil is full of uncertainty; in the past, the soil was either used for bauxite or some other use that has deemed it useless since. There is also a high rate of nematodes in the soil which is only treated properly with a CP-fumigant, currently unavailable for usage in Jamaica;
2. Excess rainfall at any given time will interrupt harvesting. This will also have a negative effect on marketing and selling of products, demeaning the consistency standard;
3. High tunnels offer less disease pressure due to keeping the crop dry throughout the rainy season;
4. Due to Jamaica's tropical climate, growing techniques are different than those in North America that we are naturally accustomed to (this applies to the entire Caribbean);
5. Yield increases are substantial using a hydroponic system versus a regular soil media, far outweighing the initial costs.

C3: Proposed Crops Produced

- ***Cucumbers: 1 bay***

- **Tomatoes: 3 bays**
- **Sweet Green Peppers: 1 ½ bays**
- **Red and Yellow Peppers: 1 bay**
- **Strawberries: 1 ½ bay**

Appendix:

Pictures of CPGCA's Current Greenhouse Project in Christiana
Pictures of Nightingale Farms Canada – High Tunnel Crops
Pictures of Devon Area Demonstration – High Tunnel Strawberries
Hydroponics Growing Systems Pictures
Hydroponics Growing Information
Hydroponics Quote
High Tunnel Structure Information
High Tunnel Structure Quote
Proposed Structure Layout
Coco Peat Bag Recommendations and Prices
Seed Varieties and Pricing
Soil Description
Equipment and Supplies Needed
Cost of Production
Potential Revenue

D) Project #4: Growers' Alliance

D1: Background

This part of the project will commence after the first year of growing the first test projects are successful. Once growers in the area are able to see the advantages of changing their growing techniques to encompass the newest technology, they will be more likely to embrace a relationship

between themselves and Nightingale Farms Jamaica. This relationship will create a win-win situation for all parties, developing 'supplier power' when dealing with the large buyers.

Appendix:

Pictures of St.Elizabeth Growers

Pictures of Growers' Association Meetings

Sample Growers' Association Application

List of St.Bess Growers

Expert Management Team Pictures: Planning Efforts and Background

Technology Transfer from Nightingale Farms Canada

VI. Disease Pressures and Pests

Downey Mildew (Pseudoperonospora cubensis)

The disease attacks members of the cucumber family (cucurbitaceae) only. The disease is normally spread with spores traveling in air current, creating the potential for spread from one field to the next. In order for infection to occur moisture is required through rainfall, dew, or high humidity. Temperatures in the range of 5' to 30'C will allow infection to occur. During the periods of hot, dry weather, disease activity is reduced. It is believed that during these periods spores will develop to provide a future source of infection.

Control of this disease would require:

1. Use of downy mildew resistant varieties;
2. Plant spacing to promote air movement to reduce moisture;
3. Avoidance of overhead irrigation;
4. And timely fungicide applications with corresponding coverage. During warm, moist conditions, fungicides may need to be applied every three to five days in order to maintain protection. Fungicides types should be rotated to provide systemic as well as contact activity.

Kirk Patterson, CCA (Ont)
Marketing and Agronomy Manager
Scotland Agromart Ltd.

Appendix:

Disease Pressures and Pests in Jamaica
Pictures of Diseased Crops: St.Elizabeth
Current Disease Information

VII. CPGCA: Christiana Potato Growers Cooperative Association

i) Background

The CPGCA was legally established in 1959, one of the few, if not only farmers cooperative in Jamaica that has manages to stand the test of time and maintain the respect of its members since inception. Their mission is “to provide consistently high quality products and excellent services to shareholders and customers, and to focus on the growth ad productivity of the cooperative to the benefit of shareholders, customers, and the wider community.”

With a relatively elaborate storage and input distribution infrastructure, the CPGCA has been strong in the past in providing marketing, input supply, and extension services to its members. While the CPGCA has provided services for a long list of agricultural enterprises over the years, it is more popularly known, mainly because of its name, for its support to the local seed potato industry commonly referred to as Irish potato. The cooperative has also undertaken a number of

projects to enhance the competitiveness of Jamaican agriculture and to work towards more equity for the small farmers generally, and for our members in particular through a vertically integrated approach to development of the small farming community.

The use of cold storage is available to help maximize profits by timing deliveries to markets. Their massive cold storage facility is located in Colleyville, just north of the main office in Christiana. The building is divided into eight 160 tonne bays and four 800 tonne bays.

In support of our own greenhouse vegetable production as well as other producers in the area the smaller 160 ton bays are being used to store fresh produce before transport to market. They also have proper packing and transport crates available to protect the produce prior to sale. In addition to leasing cold storage space, the larger bays are available for lease for conversion into production facilities such as food processing, textiles or most any use.

CPGCA also has operated a successful Farm Store at its Christiana Main Street location since 1968. For over 37 years, the farm store has provided the local rural farmer with affordable farm products at the lowest possible cost. Because they are able to purchase and store feed, fertilizer, and other farm inputs in large quantities, the individual farmer is able to reap the benefits of this high volume and low price structure directly.

Today, the farm store provides the full spectrum of farming inputs including feeds, fertilizers, pest control tools, chemicals, hardware and most important of all, sound advice.

Utilizing the Devon farm property and resources throughout Jamaica, CPGCA provides local rural farmers with the tools and expertise to improve their farming methods and increase their yield. Presently, demonstration plots for different crops and types of sweet potato are available for viewing and discussion at the Devon farm property along with demonstrations of greenhouse farming, drip irrigation, pest control and farm input management.

Eventual development of the CPGCA extension/outreach program will include an office and training center at the Devon farm property with a farming trainer. Classes will be provided in the areas of marketing, business, farming methods, crop selection and management, farm input management, pest control as well as field audits of member farms.

The CPGCA believes that development of this extension/outreach plan is crucial for the modernization of agriculture in Jamaica and the transfer of effective farming skills to the local farmer.

ii) CPGCA Goods and Services Offered

The main functions of the CPGCA throughout this new agriculture venture will include the following:

1. Marketing

- Receives produce
- Storage, grade, and distribute
- Sales to fresh market (domestic), processing market (domestic), and export markets (Canada, USA, and UK)
- Import produce that is not available in Jamaica to keep consistent supply for hotels and supermarkets

2. Organization of Growers

- Make contract arrangements with the serious growers
- Supply some input costs
- Supply expertise transfer and new technology through training center and on-site training
- Hold spray and fertilizer learning programs
- Teach growers business plans
- Liaison between growers and banks
- Build infrastructure
- Make a library of crop information available to growers
- Long-term research and training

3. Supply Company

- Fertilizers, chemicals, plastic, and drip supplies
- Greenhouse structures – high tunnels

- Hydroponic growing systems
- Equipment rental
- Work with the growers on a long-term basis
- Bring in chemicals in bulk, then repackage

4. Training and Development Center

- Technology transfer center

The CPGCA will be the centre nucleus where all business will filter through. It is a collection of growers working as a team with the proper expertise guidance and financing taking the system from seed to the consumer with no middlemen that has nothing invested or anything to risk.

iii) Speculations of Pack House

The CPGCA pack house facility was carefully observed revealing the following data:

➤ **Shell & Structure**

Some of the inside walls of the CPGCA pack house are currently lined with washable zinc; the floors are made from smooth cement. The dividing and outside walls are made from concrete block, insulated between the blocks to shelter the facility from the weather conditions.

➤ **Coolers**

Compressors, fans, and condensers are found in four of the modified 36' wide, 18' deep, and 24' high cooler storage facilities. Each room has a ten horsepower compressor, currently in good running order. The rooms are capable of holding 40-45°F with forced fed ventilation loaded with 28 skids of produce per cooler. The rate of draw down temperature would vary depending on volume and field heat. The inside walls and floors are washable in order to comply with food safety standards. Another four rooms 36'x18'x24' are available but with composed of just fans, compressors and condensers need to be added to allow proper storage.

➤ **Hydro**

A 440 volt, three phase hydro system is available. There is currently a 220 volt single phase system in place, including 100 amp breakers at each cooler. Presently, there is enough electricity available to run all six coolers of 800 tonnes of produce. The more volume of hydro

used, the more of a decrease in rates is applicable. If work is done between 10:00pm to 6:00am, the rate costs are four to eight times less.

➤ **Water**

Water is supplied by the National Water Commission. The average cost is JMD\$1.50 per gallon. The current supply is ample, but there is room for upgrades.

➤ **Disposal & Sewage of Water**

Wash water from grading can be collected on land that is currently owned by the CPGCA.

➤ **Freighting & Distribution**

One of four of the ministry's (2005, 5 tonne refrigerated vans) refrigerated trucks is available for transporting product to customers, possibly two.

➤ **Containers**

5,000 plastic containers for harvesting are available for usage for growers.

Appendix:

Pictures of CPGCA's Current Facilities

Pictures of Yam Production

Current and Proposed Floor Plan

Facilities Renovations and Costs

Packing House Equipment Needed, Pricing, and Quotes

Possible Construction Drawing of New Building

Irrigation Supplies

Greenhouse Supplies

FDA Regulations for Food Facilities

CPGCA Cost of Production

iv) CPGCA Conclusion

The majority of the supplies needed to renovate the CPGCA pack house are available on the island. Qualified manpower may be problematic; the construction needs to be done in a timely fashion. This could be overcome by bringing in qualified help from Canada for a two to three month period. By utilizing a pre-existing building, a substantial saving in capital is gained, and a quicker start-up time is achieved.

VIII. Products

Domestic Consumption

- ◆ *Tomatoes*

- ◆ *Cucumbers*
- ◆ *Peppers*
- ◆ *Strawberries*
- ◆ *Cantelopes*
- ◆ *Honeydew*
- ◆ *Watermelons*
- ◆ *Sweet potato*
- ◆ *Yams*
- ◆ *Irish potato*
- ◆ *Escallion*
- ◆ *Cauliflower*
- ◆ *Romaine lettuce*
- ◆ *Broccoli*

International Export

- ◆ *Yellow yams*
- ◆ *Sweet potato*
- ◆ *Edeo's*
- ◆ *Coco's*
- ◆ *Dasheen*
- ◆ *Scotch bonnet peppers*
- ◆ *Sorrell*

Appendix:

Pictures of Value-added Qualities Applied to Yellow Yams

Invoice from Yam Test Marketing

Box Printing Sample and Pricing

Labels and Pricing

IX. Transportation and Freight

Transportation and freight are an important consideration in analyzing the feasibility of the technical study due to the reliance that we need to place on the transportation infrastructure of the country.

Gas prices are currently JMD\$56-60 per liter (June 15, 2006), and diesel prices are approximately JMD\$51 per liter.

i) Air

35 airports were listed as 'in use' in Jamaica as of 2005. Out of this total, 11 are reported having paved runways, and the remaining 24 unpaved. There are two major airports for shipping cargo; Kingston (Norman Manley) and Montego Bay (Sangster).

ii) Railway

A total of 272 kilometers of railway is scattered throughout the country. 207 kilometers of this total belongs to the Jamaica Railway Corporation, using it for a common carrier service until 1992 but now are no longer operational. 57 kilometers of the remaining tract is privately owned and used by ALCAN to transport bauxite (2003).

iii) Road

Total roadways encompass 18,700 kilometers; 13,009 paved and 5,610 unpaved (1999). The roads are usually passable to Farmgate from any point at all times, with the exception of areas that are flooded after a heavy rainfall. Most of the paved roads are semi-rough that can be bumpy at times due to the number of pot holes. The inner roads are gravel with pot holes in most areas. The farm roads are narrow, sometimes impossible with larger tractors, trucks, and equipment. If it rains it can be slick due to reddish clay like conditions. Road infrastructure is in place but can be hard on vehicles because of conditions and driver competence for these types of conditions.

The distance CPGCA Pack House is approximately 40 to 60 minutes by truck from the Manchester growing areas (Broadleaf, Devon, St.Elizabeth, and Claridon).

iv) Ship Ports

There are five ports located in Jamaica; Kingston and Montego Bay being the most dominant.

Appendix:

Air and Sea Freight Pictures

X. Security, Theft and Larceny

Larceny in Jamaica is a major problem that a company must take seriously in implementing measures to control; this problem alone can be the deciding factor in the success of the project. The issues need to be dealt with proactively; continuously researching more effective methods and controls that are available. Employee and management staff accountability will be a dominant aspect of many management jobs; incentive programs will be incorporated to keep the negatives to a minimum. Chain-linked fences will be built around the facility encompassing state-of-the-art security technology devices. Supplies and other materials will be stored in a safe place and locked until future usage. A continuous system of monitoring and auditing by stakeholders will be needed on a weekly and monthly basis to protect their investments. Larceny can be controlled as long as motivated, trustworthy people are hired and trained, and adequate capital is incorporated.

Appendix:

Past Security and Larceny Issues

XI. Conclusion

One must never under-estimate nor take for granted that if something of practice works in North America, that it will not necessarily work in the same manner or at all in Jamaica or in other Caribbean Islands. The climate is obviously different; direct sunshine hours are more apparent and two to three hours longer than that in Canada. Rainfall is more intense at times, and for longer periods. Winds are more steady but also more violent when the hurricanes come. Growing produce in different areas of Jamaica bring the increased uncertainty of stable weather patterns due to the elevations. Land is scarcely available; most large acreage is currently used by sugar cane operators. Disease pressures are higher because of the humidity factor and outside plants take longer to dry. Since there is hardly any commercial breeding of seed varieties for the Caribbean, traditional North American varieties will have to be used that are bred for the North American climate, bringing about many reservations. On average, ten percent of the seed will work within reason for acceptable yields, quality, and disease resistance. For this reason alone, a more than ample spraying program for growing has to be implemented and thoroughly maintained. Supplies that we know are in short distance and easily found from our farms in Canada are not nearly as available in Jamaica, therefore a well prepared management staff will be needed for this venture. Key labour and farm workers are not as easy to acquire, but given good pay and training practices, the people will be formed and molded into the best workers they can possibly be. In order to get the best understanding of exactly the conditions that lie ahead, three test crops (cantaloupes, yellow yams, and sweet potatoes) were previously grown, harvested, and marketed with much success in Ontario, Canada. Through these pilot projects, tremendous data and knowledge was collected. Past cultural practices of growing in Jamaica will need to be learned, then technology will be implemented where efficiency lacks. Many agriculture projects have tested faulty in the past, research will be done to learn from their prior mistakes. The technical feasibility

of this project is one of a high success rate, though many precautions will have to be taken to ensure everything runs smoothly.