



NWT CANGROW REPORT

Assessing the Feasibility of Establishing a Commercial Greenhouse in Inuvik, NT

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Executive Summary

This report provides the results of the NWT CanGrow Greenhouse Feasibility study for the Inuvik case study. The feasibility study adapted tools and techniques for designing a commercially viable greenhouse for use in a northern setting. The study focused on addressing the community first – including local preferences, demand and growing conditions – and developing greenhouse design and business model planning around these community factors. The research team used in-depth feasibility analysis to develop recommendations for operating a successful commercial greenhouse in each community.

This report uses the data collected in Inuvik to assess community readiness, make design recommendations, calculate the commercial feasibility of the endeavor, and assess the contributions that a commercial greenhouse can make as a social enterprise. The results reported refer to the first year of the proposed operation and guidance for expanding the operation in future years is provided throughout the report.

The proposed greenhouse would be 2160 sq ft. Hydroponic systems with built-in drip irrigation would be used to grow crops and radiant heating would be used to maintain temperature. A forced air ventilation system is required to circulate air and maintain temperature.

The report finds that a moderate revenue could be generated by a commercial greenhouse in Inuvik. The most significant costs in the first year will be start-up costs. A large capital investment is recommended to establish the greenhouse and install an energy efficient radiant heating system. The proposed greenhouse would have the capacity to extend the growing season, offset imports and generate \$47,648 in profit from sales in the first year.

Recommendations discussed include:

1. Greenhouse Design

The proposed greenhouse is a 30ft by 72ft by 18ft arched greenhouse with 10ft sidewalls, polycarbonate end walls and double door entryway with a polyethylene glazing.

2. Crop Selection

While the greenhouse design allows for plenty of room for expansion, the recommendation is to start with 8 -10 crops: tomatoes, bell peppers, cucumbers, basil, cilantro, thyme, baby spinach, mixed greens, butter lettuce and romaine.

3. Growing Schedule

The greenhouse design and proposed crops would be best served by a growing season that starts in April and ends in October.

4. Markets

In its first year, the greenhouse is designed to grow enough produce to supply local restaurants (The Mackenzie Hotel, The Gallery Café, Alestine's, Andre's) and a weekly Community Supported Agriculture (CSA) box for about ten people. In future years, the CSA membership can be expanded.

5. Heating

Two heating systems have been assessed for feasibility: forced air and radiant heat. If the capital money is available radiant heat is strongly recommended to reduce energy costs.

6. Growing System

Hydroponic vertical growing towers and bato buckets are recommended because soil is not a readily available resource in Inuvik, and shipping enough soil for a greenhouse of this size would be less efficient than growing without soil.

7. Bedding Plants

Bedding plants are a great source of revenue, as they are sold early in the year at a profit, leaving room to start other crops. It should be noted that a spring bedding plant sale would compete with the Inuvik Community Greenhouse's spring bedding plant sale.

8. Raised Beds

Raised beds would be required for in-ground growing in Inuvik. While many local restaurants report a high demand for root vegetables, like potatoes, carrots, and onions, raised beds are not an efficient growing option for a greenhouse that would have to ship soil.

The study concludes that a commercial greenhouse designed according to the proposed model could be feasible in Inuvik, particularly if funding was accessed to assist with start-up costs, especially equipment and capital. There is enough local support and demand for fresh produce, and it is possible to design a greenhouse that will be highly productive without accumulating high annual costs.



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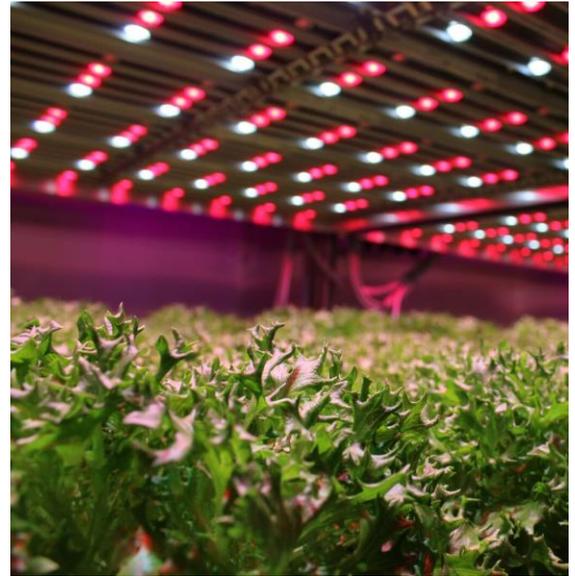
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Introduction

Project Overview

The Aurora Research Institute developed the *NWT CanGrow Greenhouse Feasibility Study* to find out whether it is feasible to operate a commercial greenhouse in the Northwest Territories (NWT). NWT communities are interested in improving food security, increasing access to fresh and healthy produce, encouraging positive dietary choices and creating economic opportunities in local food production. Community growing initiatives have expanded across the north in recent years and a community of growers has emerged to support the budding NWT agricultural shift.



This study was supported by the Canadian Northern Economic Development Agency and the Government of the Northwest Territories Department of Industry Tourism and Investment. Like ARI, both agencies are interested in how commercial greenhouses can improve food security, economic opportunity and quality of life in NWT communities.

The feasibility study adapts tools and techniques for designing a commercially viable greenhouse for use in a northern setting. The study tools are flexible enough to accommodate the differences between communities, which range from southern boreal to the high arctic. The feasibility study is focused on addressing the community first – including local preferences, demand and growing conditions – and developing greenhouse design and business model planning around these community factors. The research team examined two case studies – Inuvik and Normal Wells – and used in-depth feasibility analysis to develop recommendations for operating a successful commercial greenhouse in each community.

In February 2016, Kimberley Sellwood conducted data collection in Inuvik to more accurately understand the local conditions, gather information about community readiness, and seek stakeholder input on the potential for a commercial greenhouse in the community. This report uses the data collected in Inuvik to assess community readiness, make design recommendations, calculate the commercial feasibility of the endeavor, and assess the contributions that a commercial greenhouse can make as a social enterprise.

Reading the report

This report is intended for individuals or organizations in Inuvik who may be involved with or are considering commercial greenhouse growing. This report is divided into four main parts 1) Community Readiness, 2) Design Planning for a Feasible Greenhouse, 3) Accounting for a Feasible Greenhouse, 4) Greenhouses as a Social Enterprise. The information provided in this document outlines the most feasible production schedule based on the feedback about produce needs, as sourced from community members, food retailers, organizations and institutions who are key players in the local food economy. It proposes a greenhouse design that can accommodate the production schedule that the community requires. It provides an overview of the projected costs and revenues that can be expected from the proposed greenhouse. Finally, the report considers the wider benefits that a commercial greenhouse can have within the community, as reported by the local stakeholders.

Part 1: Assessing Community Readiness

The benefits of a local greenhouse are often quite apparent to those who hope to establish greenhouses in NWT communities. The community readiness assessment explores whether there is demand for a greenhouse in the wider community and whether the local markets can support the proposed operation.

Investigating the Market

There appears to be a robust market for fresh produce in Inuvik. Online surveys conducted, in-person and online, with community members demonstrate that many respondents are dissatisfied with the quality of produce available to them now and that they would be willing to support a local business that could provide fresh produce. Interviews with local restaurant owners found that they were unanimously in favour of using local greenhouse produce in their menus. In total, 81 surveys were collected and 7 restaurants were surveyed for their produce needs. Even though produce prices are high in Inuvik, the survey results suggest community members would be willing to pay a bit more for access to fresh locally grown food.

Supplying to local restaurants means consistent, large orders for the greenhouse grower, and it allows the restaurant owners to purchase a portion of their produce needs, in the volumes they require, at its peak of freshness. There was no lack of interest or support from local businesses and territorial institutions in Inuvik, however, for some there were limiting factors – the local daycare, for example, most often purchase fruit crops that the greenhouse would not be able to productively grow. A modest budget already prevents the high school foods program from purchasing very much produce.

Table 1: Selected results from online community readiness survey (Inuvik, NT)

Statement	Agree OR Strongly Agree	Neutral	Disagree OR Strongly Disagree
Very fresh fruits and vegetables are not usually available for me to buy.	70%	15%	15%
I would be willing to pay a little more for very fresh produce.	66%	16%	18%
I will buy fruits and vegetables wherever they are the cheapest, even if the quality is lower.	8%	17%	75%
I think fruits and vegetables should be grown locally.	58%	33%	10%
I would support a local business that sells fresh fruits and vegetables.	95%	4%	1%

Estimating Demand

The surveys and interviews were analyzed to determine which markets are the most viable for immediate development, as well as those that do not seem like they would generate a reasonable revenue stream. The best markets to supply, in the first year of business, are four local restaurants and a weekly vegetable subscription for ten local members, with plans to expand in subsequent years (see Appendix B for the list of businesses and projected volumes.)

The most common concern among the restaurant owners was the time spent seeking out fresh produce. Three of the four restaurant owners interviewed said they went to the grocery store to purchase fresh foods daily. When they ordered in bulk they often had a higher volume of unusable produce, due to their order being held up by road closures or freezing during transport. All of the restaurant owners interviewed said they would support a local commercial greenhouse and three of the four said they would pay more for fresher, higher quality produce.

Selling Community Supported Agriculture (CSAs) memberships would be a prudent strategy to take advantage of the interest community members have shown in purchasing produce. A CSA is an agreement made between the grower and the customer to purchase a subscription to receive a weekly box of produce at a rate that is set in advance. Full payment is taken at the beginning of the season, when growers need a large injection of funds to float seed and supply purchases, and vegetables are distributed each week. Weekly vegetable subscriptions are not only a consistent source of revenue, but can be expanded in later years as the growing capacity of the greenhouse increases.

Other local markets include the Inuvik Farmer's Market, which has the potential for a lot of foot traffic, but local sellers have noted that traffic is inconsistent, for example, when it's cold out much fewer people show up. The independent grocer in town noted that it would purchase vegetables locally, if the price was competitive with southern suppliers. These could be options for selling excess produce that remains after the core markets have been served. At this time, it is not efficient to rely on these markets for strong sales.

Survey results show that community members are interested in some greenhouse produce, but also some produce that is better grown in-ground growing or raised beds. Greenhouse operations may consider adding beds inside or outside to expand capacity to support other crops.



Table 2: Likelihood of purchasing produce by crop (Inuvik, NT)

Item	Always & often	Seldom & never	Top ten crop?	Top five crop?
Beans	62%	38%		
Beets	43%	57%		
Broccoli	96%	4%	Yes	Yes
Cabbage	57%	43%		
Cauliflower	78%	22%		
Cucumbers	86%	14%		
Carrots	93%	7%	Yes	Yes
Eggplant	22%	78%		
Garlic	82%	18%		
Kale	64%	36%		
Kohlrabi	21%	79%		
Leek	34%	66%		
Lettuce	93%	7%	Yes	
Mixed Greens	95%	5%	Yes	Yes
Onions	94%	6%	Yes	Yes
Peas	80%	20%		
Peppers (bell)	92%	8%	Yes	
Peppers (hot)	55%	45%		
Potatoes	91%	9%	Yes	
Radishes	33%	67%		
Spinach	87%	23%	Yes	
Swiss Chard	30%	60%		
Tomatoes	89%	11%	Yes	
Turnips	54%	46%		
Zucchini	65%	35%		
Strawberries	92%	8%	Yes	Yes
Fresh Herbs	83%	17%		

Based on the results of the customer demand surveys and the reported demand from local restaurants, the proposed crops for the Inuvik greenhouse are: tomatoes, cucumbers, bell peppers, herbs, spinach, mixed greens, green lettuce, and romaine.

Bedding Plants

Seventy-five percent of those surveyed said they were unaware that bedding plants were available for sale in the spring from the Inuvik Community Greenhouse. Fifty percent of those surveyed said they would buy bedding plants if they were available for purchase. This suggests a need for more marketing from the current vendor, but also indicates there is room for growth in future years. A commercial greenhouse could amend their production schedule to sell bedding plants early in the season, before they begin selling produce. There is a lot of opportunity in this market, as a wide selection of vegetable, herb and flower bedding plants are in demand.

Table 3: Bedding plants survey results (Inuvik, NT)

Item	Very Likely & Somewhat likely	Somewhat unlikely & not likely	Never
Annual flowers for pots and planters	57%	35%	8%
Annual flowers for a flower bed	52%	34%	14%
Perennial flowers	57%	31%	12%
Vegetables for a home garden	62%	29%	9%
Vegetables for a home greenhouse	55%	34%	11%
Herbs	77%	17%	94%
Berry bushes	56%	31%	13%
Shrubs for landscaping	28%	56%	16%
Trees for landscaping	28%	54%	18%

Pricing Produce

Despite the already high prices of produce for sale in Inuvik, more than half of the residents surveyed said they would be willing to pay a little bit more for fresh produce and only five percent of those surveyed felt the produce available is fresh (see Table 1). Generally, in the first year of operation, the commercial greenhouse need only to set prices that are close to the prices offered by current vendors in order to be competitive.

Produce in Inuvik is delivered by truck and sold at three grocery vendors: two independent grocery outlets and the chain store, Northern. For this study, Stanton Grocery produce prices were used as a benchmark, since community members report it has a consistently stocked, good selection of fresh produce. High-value or specialty crops, such as herbs and mixed greens are hard to transport up north, as they freeze easily. Therefore they can be sold for a premium, because they will be harvested and delivered within 24hrs; making them of the highest nutrient content and freshest produce available to the community.

Table 4: Local market prices and proposed greenhouse pricing (Inuvik, NT)

Crop type	Unit type	Current market prices	Commercial Greenhouse Prices
Tomatoes	Pound	\$3.67/lb	\$4/lb
Bell Peppers	Pound	\$9.69/lb	\$9/lb
Cucumber, English	Fruit	\$4.29ea	\$4ea
Basil	Gram	\$3.29/28g (1oz)	\$5/28gr (1oz)
Spinach	Pound	\$7.39/284g (10oz)	\$21/1lb (\$8.50/8oz)
Mixed Greens	Pound	\$6.79/142gr (5oz)	\$21/1lb (\$8.50/8oz)
Green Lettuce	Head	\$4.49ea	\$5
Romaine	Head	\$4.99ea	\$5

The response from Inuvik residents, businesses, and institutions was overwhelmingly supportive of a commercial greenhouse. The key to moving forward is to ensure the crops made available by the greenhouse reflect the demand in line with what the surveys and personal interviews indicated the community would most likely purchase. A schedule of demand has been developed based on the information gathered in this section. Appendix D contains planning charts for each market that specify how much of each crop each market will consume each week throughout the growing season. Appendix E shows the weekly demand for each crop from all markets – this is the total demand for each crop that the greenhouse will have to produce each week in order to supply all of the proposed markets.

Using the total number of units required each week to supply all proposed markets, the chart below summarizes the monthly activities (planting or harvesting) for each crop and number of units planted or harvested every week for the entire season. Crops are planted each week throughout the planting season and harvested each week during the harvesting season in order to provide a steady supply that matches the projected demand reported by customers.

Table 5: Summary planting and harvesting schedule

Month	Activity	Crop	# of Units
April	Weekly plantings begin	Baby Spinach	41
		Mixed Greens	41
		Butterhead Lettuce	41
		Romaine	41
		Herbs	50
		Bell Peppers	30
May	Weekly plantings begin	Tomatoes	123
		Cucumbers	57
	Weekly harvesting begins	Baby Spinach	41
		Mixed Greens	41
		Butterhead Lettuce	41
		Romaine	41
		Herbs	50
	Weekly harvesting begins	Bell Peppers	30
		Tomatoes	123
Cucumbers		57	



To achieve these weekly targets the greenhouse must have sufficient area to accommodate starting enough plants, weekly, to accommodate the weekly harvests required for all markets. Appendix F contains the planning charts for space requirements by crop. Table 6 summarizes that growing area required for the proposed greenhouse. This includes area required for seedling trays, pots, and vertical hydroponic systems in each month.

Table 6: Growing Area Chart

Production Months	Total Area for Trays	Total Area for Pots	Total Area for Vertical Systems	Total Area for Beds*	Monthly GA Req
April	50ft ²				50ft ²
May	79ft ²		256ft ²		335ft ²
June	57ft ²	474ft ²	256ft ²		787ft ²
July	57ft ²	474ft ²	320ft ²		851ft ²
August	57ft ²	474ft ²	320ft ²		851ft ²
September	57ft ²	474ft ²	320ft ²		851ft ²
October		474ft ²	320ft ²		851ft ²



Hydroponic systems were chosen for the proposed greenhouse design because they are an intensive growing model that focuses on getting the highest yield out of the smallest space. Bato buckets will be used to grow tomatoes, bell peppers and cucumbers (please see Part 2 for more details.)

From the demand targets identified for all markets and the space requirements for each crop, the total growing area for the proposed greenhouse is 2160 square feet. The growing area required for the first year has been doubled to ensure that crop production can be expanded in subsequent years. This will also allow area for workstations, washrooms, a point of sale area, and any other facilities that may be needed within the greenhouse itself.

Part 2: Design Planning for a Feasible

The previous section has established that there is significant support for a commercial greenhouse in the community. Part 2 explores the key design considerations that impact feasibility of commercial greenhouses. The following analysis will provide design recommendations and further planning details to ensure a feasible greenhouse.

Growing Systems

In order to have a feasible commercial greenhouse in Inuvik, the proposed design plan must extend the growing season for as long as possible, while economically managing costs required to provide adequate heat and light to the crops. The objective of the proposed greenhouse design is to grow as late into the year as possible: crop production will begin in April and continue until the end of October.

Table 7: Summary planting and harvest dates by crop

Crop	Plant Date	Harvest Date
Tomatoes	May 1 st	Harvest weekly starting in July
Bell Peppers	April 1 st	
Cucumbers	May 1 st	
Herbs	April 1 st ; plant every subsequent Sunday	Harvest weekly starting in May
Baby Spinach	April 1 st ; plant every subsequent Sunday	
Mixed Greens	April 1 st ; plant every subsequent Sunday	
Butter Lettuce	April 1 st ; plant every subsequent Sunday	
Romaine	April 1 st ; plant every subsequent Sunday	

The proposed design incorporates two growing systems to achieve the most economical production. As mentioned, bato buckets will be used to grow tomatoes, bell peppers and cucumbers. The buckets are filled with a soilless substrate. Nutrients are dripped into the top of the buckets and excess is drained out the bottom as waste water. The remaining crops will be grown in a vertical hydroponic system made up of grow towers (when linked together on a custom rack, this system is called a ZipFarm.) Like the bato buckets, the grow towers pump nutrients through the hydroponic solution. Hydroponic growing is not necessarily organic, as the plants are not being fed a natural-based nutrient solution, however, of those Inuvik residents who took the Customer Demand Survey, only 38% percent expressed interest in organic produce. This production design emphasizes access to healthful, fresh produce rather than organic produce.

The decision to use hydroponic technology recognizes the limitations of growing in the high Arctic: in-ground growing is not possible in Inuvik. The cost to ship soil and soil amendments to Inuvik every year from southern suppliers is not economically efficient, but investing in hydroponic systems that will last 10 – 20 years will ensure future efficiencies: these systems only need annual purchases of liquid nutrients and seeds and will allow the grower to maximize the yield capability of their crops within the smallest possible growing space.

Bedding plants can be an important addition to any commercial greenhouse operation. As mentioned above, the total growing area for the greenhouse is 2160 square feet, but this area is much larger than what's required to grow the first year crops. This means expending resources to heat an unused space. Using that space to grow trays of bedding plants will generate \$7-9 per square foot and ensure that valuable greenhouse space does not go to waste

Another option, if capital funding is available, would be to install separate closed system growing units that can produce crops all year-round.

Glazing and Framing

In addition to the crop type and space requirements discussed above, greenhouse design must consider the local conditions in order to create and maintain an optimal growing environment. The glazing and framing materials were chosen after a thorough consideration of Inuvik's two most serious challenges: high shipping costs and extreme cold climate.

Table 8: Glazing and Framing Recommendations

Item	Description	Transportation	Construction	Temperature
Kit	30' x 72' x 18' arched roof greenhouse kit with 10ft sidewalls, twin wall polycarbonate end walls, double door entryway	Will transport easily in one shipment, reducing transportation costs	Designed for simple design, reducing construction costs	
Glazing	Double inflated 6mm polyethylene glazing	Much lighter than triple or double polycarbonate	Less likely to be damaged during installation, draping process can be done by the grower, avoiding high construction costs	Adequate R-value (1.7), less prone to condensation issues
Framing	Galvanized steel	Fairly light for its strength – less support framework is required – reducing transportation costs	Very sturdy, generally has less support framework, reducing construction costs	Casts minimal shadow

The proposed greenhouse would be a kit consisting of galvanized steel covered with polyethene glazing, except for two polycarbonate end walls. A triple or double wall of polycarbonate glazing offers the best insulating capability, however, it scratches easily and may not transport well. Also, if it is not properly installed, it is prone to serious condensation issues, which can cause fungal disease that wipes out crops quickly. Conversely, an inflated double wall of 6 mm polyethylene film has a similar R-value (insulating property) of 1.7 to a double wall of polycarbonate, but it is much lighter and damage-resistant. Perhaps most importantly, it likely will not be subject to IRC construction rates (\$325 - \$400/sq ft), as the installation process for poly film is a simpler: draping and then securing the poly film over the structure. Rates found for constructing a poly film greenhouse in our southern provinces is \$17-\$19/sq ft.

One disadvantage of poly film is that it starts to become opaque over time, reducing light transmission and requiring replacement every 3-5 years. Still, the labour rate for replacement should be affordable due to the ease with which it can be re-glazed – many growers install the glazing themselves.

Temperature Needs

Heating the greenhouse in Inuvik is not only the largest annual fixed expense, but it is also the key to optimal germination rates and even plant growth. Planning for this cost is critical to a commercial greenhouse's success. Seedlings will be started in the greenhouse in April and plantings will continue into September –Table 8 indicates the start date/month and the optimal temperature by crop, while Table 9 provides the average monthly temperatures in Inuvik.

Table 9: Crop Temperature Planning Chart

Crop Type	Start Date	Optimal Crop Temperature
Tomatoes	May 1st	18-25
Peppers	May 1st	18-25
Cucumbers	May 1st	18-25
Herbs	May, June, & July	18-25
Baby Spinach	April, May, June, July, August, & September	7-21
Mixed Greens	April, May, June, July, August, & September	7-21
Butter Lettuce	April, May, June, July, August, & September	7-21
Romaine	April, May, June, July, August, & September	7-21

Table 8: Average Monthly Temps

Month	Average Monthly Temperature
April	-13
May	0
June	12
July	15
August	11
September	4
October	-2

Table 10 projects the average amount of propane or natural gas (the two most common fuels sources for heating greenhouses) that would be required to keep a greenhouse of the proposed size at a temperature between 20 - 25 degrees Celsius, given the monthly average temperatures in Inuvik.

Table 10: Monthly Fuel Projections Chart

Month	Average Monthly Temperature	Monthly Fuel Projection for Propane	Monthly Fuel Projection for Natural Gas
April	-13	1442L * \$1.45/L = \$2090.90	41.59GJ * \$35.44 = \$1473.94
May	0	1094L * \$1.45/L = \$1586.30	27.36GJ * \$35.44 = \$969.63
June	12	583L * \$1.45/L = \$875.35	14.59GJ * \$35.44 = \$517.06
July	15	439L * \$1.45/L = \$636.55	10.95GJ * \$35.44 = \$388.06
August	11	632L * \$1.45/L = \$916.40	15.81GJ * \$35.44 = \$560.30
September	4	919L * \$1.45/L = \$1332.55	22.99GJ * \$35.44 = \$814.76
October	-8	1442L * \$1.45/L = \$2090.90	36.12GJ * \$35.44 = \$1280.09

According to the cost comparison, natural gas is the less costly option. It is also a cleaner fuel. The greenhouse will only need to be heated full-time in April; in May, September and October heat will only be needed in the evenings and early mornings. From June to August, supplemental heating will not be necessary.

The most common approach for heating commercial greenhouses is to use forced air units and fans to circulate the warm air. A more efficient option is to install a closed looped hydronic radiant heating system.

Table 11: Radiant Heat vs Forced Air

Radiant Heat	
Advantages	Disadvantages
1/3 the fuel cost of forced air	Initial investment is five times more than forced air
Direct contact with soil means Increased nutrient uptake	An additional room (the storage room) would be necessary to house the boiler
Consistent temperatures equals more even crop growth	
Different temperature zones for flexible growing schedules	
Shorter production times	
Forced Air	
Advantages	Disadvantages
Minimal initial investment	It has the highest energy costs out of any system
Situated in the greenhouse, the units are hung from rafters	It is the most inefficient system, and needs additional fans to circulate the air around the greenhouse
	Hot air blown across the plant canopy is not ideal, and there is no additional heat being directed at the soil, where it is needed the most.

The system includes rubber tubing that circulates hot liquid – water or glycol are options – to distribute heat. The tubing is laid underneath a concrete floor and through benches that will support seedling trays and bato buckets, to ensure seedlings are receiving enough heat for optimal germination. The benches would be arranged along either side of the greenhouse, with the vertical growing system running through the middle. The in-floor heating, combined with the radiant heating benches, will ensure that the soil is at 21C and the air is at 16C when the outside temperature is around -13 outside. A unit heater is recommended for back-up for when the temperature drops any lower.

An efficient and reliable ventilation system will be critical to the success of the proposed greenhouse. Cooling the space during the summer months, when the sun is overhead 24 hours a day, will ensure plants won't be killed by excess heat. Also, since tomatoes are an important crop for this operation, the space must be well ventilated to prevent fungal diseases triggered by high humidity, to which tomato plants are highly susceptible. Tomato plants also yield less if there is not enough carbon dioxide in the air. A forced air ventilation system would be a simple and efficient solution. An aluminum shutter draws fresh air into one end of the greenhouse, pushing it lengthwise across the structure before being pushed out the other end of the greenhouse by four 20" fans.

Heat within the greenhouse must be managed to accommodate heat-loving and cold hardy crops. To do this, a sheet of poly film can be used at a partition to split cooler crops from those that require more heat and the two environments can be managed separately. At the height of summer, in order to continue growing the cool hardy crops (basil is a heat loving crop and will thrive in the greenhouse) the vertical grow systems need to be situated under a shade cloth. Or, since the system is on rolling rack, the grow towers could be moved outside to the shaded side of the building.

Light Needs

Some greenhouse operations make use of supplemental light to extend the season or to grow year-round. The structure proposed for Inuvik will transmit sufficient sunlight to establish seedlings in the early part of the season. In October, the sun does not rise until 9am and it sets at 8pm. Supplemental light shouldn't be necessary, however, the grower may see a decrease in the final month yields

By June, Inuvik will have 24 hours of sunlight and the use of shade cloths will be essential for the cold hardy crops. Shade cloths should also be hung from both side walls in the evening to give all the crops a break from the sunlight. A typical strategy for shade cloths is to build a rack that the shade cloth is draped over, and the plants can grow underneath the cloth. This is a good option for the plants growing in the vertical system.

Water Needs

The current commercial rate for water in Inuvik is \$7.67/cubic metre. A basic industry accepted standard for water consumption in greenhouses is 7-8 litres per square metre of growing area, per day. The chart below gives the monthly estimates for water consumption for the greenhouse growing season.

Table 12: Water Consumption Estimate Chart – Inuvik, NT

Month	Monthly GA	Estimated consumption
April	80ft2	\$59.98
May	362ft2	\$257.94
June	818ft2	\$605.64
July	882ft2	\$628.48
August	882ft2	\$628.48
September	882ft2	\$628.48
October	794ft2	\$565.82
Total		\$3374.82

Energy Needs

Fuel and electricity rates are the most cost prohibitive aspects of greenhouse production. Wherever possible, it is advisable to invest more money in energy efficient infrastructure up front and reap the benefits of a lower monthly energy consumption. This does require significant capital funding at the outset.

Electrical needs are considered to consume approximately 10 – 15 percent of a growers total energy bill. The proposed greenhouse operates using three main systems: hydronic radiant heating, drip irrigation, and forced air ventilation. Table 13 outlines the electricity used by each system.

Table 13: Energy Use by System

Item	Rate of Use	# of Systems	Cost Per Hour	Projected Annual Energy Costs
Hydronic radiant heating	Fulltime heating in spring and winter	2	\$.91/hr	\$3165.16
Unit Heater	Back up for temperature drops	1	\$5.30/hr	\$212
Drip irrigation	15 minute drip cycle twice a day	2	\$3.90/hr	\$819
Forced air ventilation	In summer one air exchange per minute	1	.91/hr	\$932.40
	In winter 3 per hour			
				Total: \$5128.56

The energy use by these systems accounts for the minimum energy use for the greenhouse operation. If additional systems and appliances are added – for example, a computer system, a cash register, lights, power outlets, etc. – they will need to be factored in to the overall projected energy use.

The design recommendations in this section are closely tied to the local conditions and the needs of the crops that will be grown in the proposed greenhouse. A careful design outline has provided the necessary information to account, in detail, for all costs associated with the construction and operation of the proposed greenhouse operation. The next section will present a snapshot of the expected costs and revenues.



Part 3: Accounting for a Feasible Greenhouse

The previous section outlined the most efficient greenhouse design for the conditions in Inuvik. Part 3 identifies the proposed greenhouse's expected costs and possible revenue sources. The goal is to propose a greenhouse with balanced costs and revenues by limiting costs and maximizing efficiency.

Start-up Costs

The start-up costs for the proposed greenhouse include the purchase of all materials, systems, equipment, supplies and construction costs (including labour). Table 14 outlines, in detail, the start-up costs associated with the proposed greenhouse.

Table 14: Start-up costs

Category	Item	Cost
Greenhouse structure	GrowSpan Series	\$17,104.55
	End Frame Kit	\$3,176
	Clad kit	\$3,153.12
	Rafter kit, posts	\$2,809.86
	Rafter Support	\$1,037.10
	Dbl swinging door	\$859.55
Growing System	Bato Bucket System	\$8,843
	Integrated Panel	\$2,459.45
	Timer	\$65.17
	ZipGrow Commercial Bundle	\$9,450
	ZipGrow Media pulling hook	\$29.99
Radiant Heating System	In-floor & Bench	\$12,725.60
Unit Heater	Optional for colder nights	\$1,150.68
Ventilation	Fan 20"	\$756.48
	Slant wall fan	\$1,081.64
	Aluminum Shutter	\$768.80
Irrigation	Seedling watering system	\$200
Workspace	4'w x 8'L Workbenches	\$7,781.82
Storage, Harvest and Processing	Produce Fridge	\$13,087
	Reusable harvest Containers	\$380
	Reusable harvest Containers	\$399
	Salad Spinner	\$145
	S/S Washbasin work surface	\$1181
Greenhouse Labour	Southern quotes for installation	\$44,200 - \$49,400
ZipGrow System Installation	Upstart Farmers Support Package included	N/A
Radiant Heating Installation	175 man hours (two workers for 9-10 days, 10 hrs/day @ \$75/hr)	\$13,125
Shipping	FarmTek	\$9,956
	ZipGrow Canada	\$400
	Hendrix Restaurant Supplies	\$335.61
	Delta Radiant Heating	\$1,100
Customs		TBD
Total		\$157,761.42 - \$162,961.42

In Inuvik, the Inuvialuit Regional Corporation is responsible for all construction contracts. During data collection, the IRC reported that the construction cost for a greenhouse is \$325-\$400/sq ft. At this rate, the total start-up costs for the proposed greenhouse would range from \$958,561.42 to \$1,153,561.42, and construction costs would account for 85% of the start-up expenses.

After a full analysis, we were not able to achieve a feasible result, from an accounting perspective, if we included the IRC construction rates. Instead, we subbed in rates quoted by southern companies for installation of the proposed greenhouse.

To accommodate IRC construction rates, as is the requirement in Inuvik, this project would need an immense investment to be put almost exclusively to construction costs.

Start-up costs are the largest expense that a greenhouse operation will have to account for. Ideally, much of this cost would be covered by a funding injection, to reduce the financial burden on the grower and improve their chances for success. If capital funding to cover start-up costs cannot be found, the operation may still be feasible, provided the total start-up costs are not exorbitant.

Consumable Item Costs

Once start-up costs are accounted for, consumable item costs must be considered. This includes all direct inputs (planting containers, substrate, seeds, etc) and costs associated with sales (packaging for produce, storage, marketing, etc).

Table 15: *Consumable Item Costs*

Consumable Item Cost	Description	Cost
Containers	Seedling trays	\$42.20
Growing Media (substrate)	Delta 6 Block	\$360.11
	Ziptower FlexiPlugs	\$69.00
Plugs, cuttings, seed	Seed	\$2,000
Tags, Stakes, Trellis, Etc.	Trellis Kit	\$325.50
	Tomato Roller	\$402
	Tomato Clips	\$66.36
Fertilizer		Included in first year hydroponic bundles
Electrode supplies		\$208.43
Chemicals – Pest Control, PGR		Included in first year hydroponic bundles
Total Variable Costs		\$3,196.17

Consumable items are mostly annual expenses that depend on what types of crop and how many units the grower intends to produce. If these costs can be kept modest in the first few years, there is a greater likelihood that the proposed operation will be feasible.

Fixed Costs

Fixed costs are expenses you pay monthly or annually – the bills. The previous section of this report estimated fuel use for heating the greenhouse, electricity needs and water needs. These needs translate directly into estimated fixed costs. The chart below estimates the fixed costs for the proposed greenhouse during production months – please note, the greenhouse is only in operation for seven of twelve months. Annual costs have been divided amongst the seven months of operation.

Table 16: Fixed Costs

Expense	Monthly Cost	Annual Cost
Greenhouse Property Loan	Unknown	Unknown
Property Taxes	\$163.57	\$1,145
Insurance	\$171.42	\$1,200
Water	\$571.42	\$4,000
Energy	\$732.65	\$5,128.56
Fuel	\$600.38	\$4,202.68
Depreciation	\$871.42	\$6,100.15
Labour	\$500	\$2,068
Total	\$3,610.86	\$25,276.02

Property Taxes/Leases: A mill rate of 17.62 was used to calculate the estimated property tax of \$65,000

Insurance: is a rough estimate for total liability

Water: see Table 12 for a breakdown of water estimates

Energy: estimated total cost for all systems calculated together for the entire season

Fuel – the total cost for natural gas for the season minus 30 percent savings anticipated with radiant heating system.

Depreciation: projected depreciation value of all equipment divided.

Labour: The scale of greenhouse proposed in this report is large enough to need seasonal employees. The range of duties could span the entire season, from planting, to maintenance to harvesting and delivery. An estimate of 25 hours a week at \$20.28/hr was used.

Projected Sales

Sales revenue is the profit the greenhouse operation generates from selling produce, and is calculated annually. Table 17 presents the projected annual revenue from each crop, based on the prices and unit targets set in the community readiness section.

Table 17: Projected Sales Revenue Chart

Crop	Price per Unit	Total Units	Projected Annual Sales
Tomatoes	\$4/lb	1,968 lbs	\$7,872
Peppers	\$9/lb	480 lbs	\$4,320
Cucumbers	\$4ea	912 ea	\$3,648
Herbs	\$5/28gr	1000 bundles	\$5,000
Baby Spinach	\$21/1lb/16oz	404 lbs	\$8,484
Mixed Greens	\$21/1lb/16oz	404 lbs	\$8,484
Butter Lettuce	\$5	984 heads	\$4,920
Romaine	\$5	984 heads	\$4,920
Total projected Sales:			\$47,648

In its first year, the proposed greenhouse can expect to earn \$47,648 in profits from the produce sold. To assess the feasibility of the proposed greenhouse operation, total costs must be compared against total revenues.

Table 18: *Total Costs and Revenues Chart*

Cost Type	Cost Amount	Revenue Source	Revenue Amount
Start-up Costs	\$162,561.42	Projected Sales	\$47,648
Depreciation*	\$6,777.02	Capital Funding	\$150,000
Consumable Item Costs	\$3,196.17	Growing Forward2	
Fixed Cost	\$25,276.02	Northern Foods Development Program	
Sales Cost	\$1,400	Intern Funding	
Total Cost:	\$199,210.63	Total Revenue:	\$197,648

*Depreciation is a cost that is kept in savings each year to account for any systems or items that break or must be replaced. The amount is calculated by the item’s value and its life expectancy.

Provided a grower is able to raise capital funds from federal, territorial, local and/or private funds, the proposed greenhouse can be feasibly established and even achieve modest profits in the first year. If operations are expanded in subsequent years, the grower can expect profits to increase.



Part 4: Commercial Greenhouses as Social Enterprises

Throughout the NWT, there is considerable interest in the wider social benefits that come from growing food locally. Commercial greenhouses can be very successful as a social enterprise that aims equally for commercial success, as well as maximal social benefits for the community.

Local Economy

By expanding the availability of locally produced food, a local greenhouse can displace southern imports, keeping money in the local economy and reducing dependence on outside suppliers.

During the growing season, the greenhouse will need to hire and train local people to assist with planting, caring for crops and harvesting. Through partnerships with local agencies, these jobs can offer an opportunity for local youth, Elders, underemployed individuals or marginalized groups to develop specific agriculture and technology skills.

Healthy Eating Habits

Greenhouse operators have an opportunity to promote their business while also promoting healthy eating. Healthy eating and cooking programs could be developed for both the daycare and high school food program. It was noted during an interview with the instructor of the foods program at the Inuvik high school that there is a limited curriculum for fruits and vegetables because they are too expensive. Hosting field trips at the greenhouse can be an opportunity to introduce children and youth to the basics of growing food. Greenhouse owners may be able to partner with local organizations access agriculture or health funding and coordinate healthy food programming, with excess produce from crops being incorporated into the program budget.

Employees are also a resource for spreading positive eating habits: the influence and knowledge gained through training and work experience could inspire them to choose fresh produce more often and encourage their family and friends to do so as well. When other community members see that fresh produce is turning up on tables and in conversation, they may be interested in trying produce that they had not previously been familiar with. Growers can offer further benefits by offering discounted CSA memberships to employees.

Sustainable Food Systems

By growing local foods, the greenhouse enterprise supports a locally sustainable food system. This is an important goal for northern communities, whose ties to southern food sources can often be precarious, sometimes relying on a single road that can be closed by forest fires, flooding, or weather.

A local greenhouse can also contribute to improving the local food system by teaching planting and growing in the community. This may be an opportunity to partner with other local organizations to access funds for programming that encourages local growing. The benefit is that community members will have a source of food, should they have limited income, or should usual food markets become unavailable in an emergency.

Recommendations

This report aims to provide a plan for a commercial greenhouse in Inuvik a qualified grower could implement. The following are recommendations derived from the feasibility study:

- 1. Greenhouse Design**
The proposed greenhouse is a 30ft by 72ft by 18ft arched greenhouse with 10ft sidewalls, polycarbonate end walls and double door entryway with a polyethylene glazing.
- 2. Crop Selection**
While the greenhouse design allows for plenty of room for expansion, the recommendation is to start with 8 -10 crops: tomatoes, bell peppers, cucumbers, basil, cilantro, thyme, baby spinach, mixed greens, butter lettuce and romaine.
- 3. Growing Schedule**
The greenhouse design and proposed crops would be best served by a growing season that starts in April and ends in October.
- 4. Markets**
In its first year, the greenhouse is designed to grow enough produce to supply local restaurants (The Mackenzie Hotel, The Gallery Café, Alestine's, Andre's) and a weekly Community Supported Agriculture (CSA) box for about ten people. In future years, the CSA membership can be expanded.
- 5. Heating**
Two heating systems have been assessed for feasibility: forced air and radiant heat. If the capital money is available radiant heat is strongly recommended to reduce energy costs.
- 6. Growing System**
Hydroponic vertical growing towers and bato buckets are recommended because soil is not a readily available resource in Inuvik, and shipping enough soil for a greenhouse of this size would be less efficient than growing without soil.
- 7. Bedding Plants**
Bedding plants are a great source of revenue, as they are sold early in the year at a profit, leaving room to start other crops. It should be noted that a spring bedding plant sale would compete with the Inuvik Community Greenhouse's spring bedding plant sale.
- 8. Raised Beds**
Raised beds would be required for in-ground growing in Inuvik. While many local restaurants report a high demand for root vegetables, like potatoes, carrots, and onions, raised beds are not an efficient growing option for a greenhouse that would have to ship soil.

APPENDICES

Appendix A: Customer Survey Demand Results

Statement	Agree OR Strongly Agree	Neutral	Disagree OR Strongly Disagree
Very fresh fruits and vegetables are not usually available for me to buy.	70%	15%	15%
I would be willing to pay a little more for very fresh produce.	66%	16%	18%
I will buy fruits and vegetables wherever they are the cheapest, even if the quality is lower.	8%	17%	75%
I think fruits and vegetables should be grown locally.	58%	33%	10%
I would support a local business that sells fresh fruits and vegetables.	95%	4%	1%

Item	Always & often	Seldom & never	Top ten crop?	Top five crop?
Beans	62%	38%		
Beets	43%	57%		
Broccoli	96%	4%	Yes	Yes
Cabbage	57%	43%		
Cauliflower	78%	22%		
Cucumbers	86%	14%		
Carrots	93%	7%	Yes	Yes
Eggplant	22%	78%		
Garlic	82%	18%		
Kale	64%	36%		
Kohlrabi	21%	79%		
Leek	34%	66%		
Lettuce	93%	7%	Yes	
Mixed Greens	95%	5%	Yes	Yes
Onions	94%	6%	Yes	Yes
Peas	80%	20%		
Peppers (bell)	92%	8%	Yes	
Peppers (hot)	55%	45%		
Potatoes	91%	9%	Yes	
Radishes	33%	67%		

Spinach	87%	23%	Yes	
Swiss Chard	30%	60%		
Tomatoes	89%	11%	Yes	
Turnips	54%	46%		
Zucchini	65%	35%		
Strawberries	92%	8%	Yes	Yes
Fresh Herbs	83%	17%		

Item	Very Likely & Somewhat likely	Somewhat unlikely & not likely	Never
Annual flowers for pots and planters	57%	35%	8%
Annual flowers for a flower bed	52%	34%	14%
Perennial flowers	57%	31%	12%
Vegetables for a home garden	62%	29%	9%
Vegetables for a home greenhouse	55%	34%	11%
Herbs	77%	17%	94%
Berry bushes	56%	31%	13%
Shrubs for landscaping	28%	56%	16%
Trees for landscaping	28%	54%	18%

Appendix B: Customer reported produce demand

Institution	Produce Type	Weekly Volumes
Mackenzie Hotel Restaurant	Tomatoes	27lbs
	Bell Peppers	6.6lbs
	Cucumbers	15
	Herbs	6 bundles
	Baby Spinach	2.3lbs
	Mixed Greens	2.3lbs
	Butter lettuce	10 heads
	Romaine	10 heads
Gallery Café	Tomatoes	40lbs
	Bell Peppers	5.5lbs
	Cucumbers	13
	Baby Spinach	5lbs
	Mixed Greens	5lbs
	Butter lettuce	10
	Romaine	10
Alestine's	Tomatoes	27lbs
	Bell Peppers	8.3lbs
	Cucumbers	19
	Herbs	10 bundles
	Baby Spinach	5lbs
	Mixed Greens	5lbs
	Butter lettuce	10 heads
	Romaine	10 heads
Andre's	Tomatoes	9lbs
	Bell Peppers	4lbs
	Cucumbers	4
	Herbs	7 bundles
	Baby Spinach	1.7lbs
	Mixed Greens	1.7lbs
	Butter lettuce	1 head
	Romaine	1 head
Weekly CSA	Tomatoes	20lbs
	Bell Peppers	5lbs
	Cucumbers	10
	Herbs	20 bundles
	Baby Spinach	2.5lbs
	Mixed Greens	2.5lbs
	Butter lettuce	10 heads
	Romaine	10 heads

Appendix C: Projected units-per-week demand for each market

Mackenzie Hotel Restaurant								
CROP	Tomatoes	Peppers	Cucumbers	Herbs	Baby Spinach	Mixed Greens	Green Lettuce	Romaine
UNIT	Pound	Pound	Fruit	Bundle	Pound	Pound	Head	Head
May								
1 st Week					2.3	2.3	10	10
2 nd Week					2.3	2.3	10	10
3 rd Week					2.3	2.3	10	10
4 th Week					2.3	2.3	10	10
June								
1 st Week				6	2.3	2.3	10	10
2 nd Week				6	2.3	2.3	10	10
3 rd Week				6	2.3	2.3	10	10
4 th Week				6	2.3	2.3	10	10
July								
1 st Week	27	6.6	12	6	2.3	2.3	10	10
2 nd Week	27	6.6	12	6	2.3	2.3	10	10
3 rd Week	27	6.6	12	6	2.3	2.3	10	10
4 th Week	27	6.6	12	6	2.3	2.3	10	10
Aug								
1 st Week	27	6.6	12	6	2.3	2.3	10	10
2 nd Week	27	6.6	12	6	2.3	2.3	10	10
3 rd Week	27	6.6	12	6	2.3	2.3	10	10
4 th Week	27	6.6	12	6	2.3	2.3	10	10
Sept								
1 st Week	27	6.6	12	6	2.3	2.3	10	10
2 nd Week	27	6.6	12	6	2.3	2.3	10	10
3 rd Week	27	6.6	12	6	2.3	2.3	10	10
4 th Week	27	6.6	12	6	2.3	2.3	10	10
Oct								
1 st Week	27	6.6	12	6	2.3	2.3	10	10
2 nd Week	27	6.6	12	6	2.3	2.3	10	10
3 rd Week	27	6.6	12	6	2.3	2.3	10	10
4 th Week	27	6.6	12	6	2.3	2.3	10	10
TOTAL	432	106	192	72	56	56	240	240

Alestine's Restaurant								
CROP	Tomatoes	Peppers	Cucumbers	Herbs	Baby Spinach	Mixed Greens	Green Lettuce	Romaine
UNIT	Pound	Pound	Fruit	Bundle	Pound	Pound	Head	Head
May								
1 st Week					5	5	10	10
2 nd Week					5	5	10	10
3 rd Week					5	5	10	10
4 th Week					5	5	10	10
June								
1 st Week				10	5	5	10	10
2 nd Week				10	5	5	10	10
3 rd Week				10	5	5	10	10
4 th Week				10	5	5	10	10
July								
1 st Week	27	8.3	19	10	5	5	10	10
2 nd Week	27	8.3	19	10	5	5	10	10
3 rd Week	27	8.3	19	10	5	5	10	10
4 th Week	27	8.3	19	10	5	5	10	10
Aug								
1 st Week	27	8.3	19	10	5	5	10	10
2 nd Week	27	8.3	19	10	5	5	10	10
3 rd Week	27	8.3	19	10	5	5	10	10
4 th Week	27	8.3	19	10	5	5	10	10
Sept								
1 st Week	27	8.3	19	10	5	5	10	10
2 nd Week	27	8.3	19	10	5	5	10	10
3 rd Week	27	8.3	19	10	5	5	10	10
4 th Week	27	8.3	19	10	5	5	10	10
Oct								
1 st Week	27	8.3	19	10	5	5	10	10
2 nd Week	27	8.3	19	10	5	5	10	10
3 rd Week	27	8.3	19	10	5	5	10	10
4 th Week	27	8.3	19	10	5	5	10	10
TOTAL	432	133	304	200	120	120	240	240

The Café Gallery								
CROP	Tomatoes	Peppers	Cucumbers	Herbs	Baby Spinach	Mixed Greens	Green Lettuce	Romaine
UNIT	Pound	Pound	Fruit	Bundle	Pound	Pound	Head	Head
May								
1 st Week					5	5	10	10
2 nd Week					5	5	10	10
3 rd Week					5	5	10	10
4 th Week					5	5	10	10
June								
1 st Week				10	5	5	10	10
2 nd Week				10	5	5	10	10
3 rd Week				10	5	5	10	10
4 th Week				10	5	5	10	10
July								
1 st Week	40	5.5	13	10	5	5	10	10
2 nd Week	40	5.5	13	10	5	5	10	10
3 rd Week	40	5.5	13	10	5	5	10	10
4 th Week	40	5.5	13	10	5	5	10	10
Aug								
1 st Week	40	5.5	13	10	5	5	10	10
2 nd Week	40	5.5	13	10	5	5	10	10
3 rd Week	40	5.5	13	10	5	5	10	10
4 th Week	40	5.5	13	10	5	5	10	10
Sept								
1 st Week	40	5.5	13	10	5	5	10	10
2 nd Week	40	5.5	13	10	5	5	10	10
3 rd Week	40	5.5	13	10	5	5	10	10
4 th Week	40	5.5	13	10	5	5	10	10
Oct								
1 st Week	40	5.5	13	10	5	5	10	10
2 nd Week	40	5.5	13	10	5	5	10	10
3 rd Week	40	5.5	13	10	5	5	10	10
4 th Week	40	5.5	13	10	5	5	10	10
TOTAL	640	88	208	200	120	120	240	240

Andre's Restaurant								
CROP	Tomatoes	Peppers	Cucumbers	Herbs	Baby Spinach	Mixed Greens	Green Lettuce	Romaine
UNIT	Pound	Pound	Fruit	Bundle	Pound	Pound	Head	Head
May								
1 st Week					2	2	1	1
2 nd Week					2	2	1	1
3 rd Week					2	2	1	1
4 th Week					2	2	1	1
June								
1 st Week				4	2	2	1	1
2 nd Week				4	2	2	1	1
3 rd Week				4	2	2	1	1
4 th Week				4	2	2	1	1
July								
1 st Week	9	4	3	4	2	2	1	1
2 nd Week	9	4	3	4	2	2	1	1
3 rd Week	9	4	3	4	2	2	1	1
4 th Week	9	4	3	4	2	2	1	1
Aug								
1 st Week	9	4	3	4	2	2	1	1
2 nd Week	9	4	3	4	2	2	1	1
3 rd Week	9	4	3	4	2	2	1	1
4 th Week	9	4	3	4	2	2	1	1
Sept								
1 st Week	9	4	3	4	2	2	1	1
2 nd Week	9	4	3	4	2	2	1	1
3 rd Week	9	4	3	4	2	2	1	1
4 th Week	9	4	3	4	2	2	1	1
Oct								
1 st Week	9	4	3	4	2	2	1	1
2 nd Week	9	4	3	4	2	2	1	1
3 rd Week	9	4	3	4	2	2	1	1
4 th Week	9	4	3	4	2	2	1	1
TOTAL	144	64	48	80	48	48	24	24

Saturday CSA Pick-up								
CROP	Tomatoes	Peppers	Cucumbers	Herbs	Baby Spinach	Mixed Greens	Green Lettuce	Romaine
UNIT	Pound	Pound	Fruit	Bundle	Pound	Pound	Head	Head
May								
1 st Week					2.5	2.5	10	10
2 nd Week					2.5	2.5	10	10
3 rd Week					2.5	2.5	10	10
4 th Week					2.5	2.5	10	10
June								
1 st Week					2.5	2.5	10	10
2 nd Week					2.5	2.5	10	10
3 rd Week					2.5	2.5	10	10
4 th Week					2.5	2.5	10	10
July								
1 st Week	20	5	10	20	2.5	2.5	10	10
2 nd Week	20	5	10	20	2.5	2.5	10	10
3 rd Week	20	5	10	20	2.5	2.5	10	10
4 th Week	20	5	10	20	2.5	2.5	10	10
Aug								
1 st Week	20	5	10	20	2.5	2.5	10	10
2 nd Week	20	5	10	20	2.5	2.5	10	10
3 rd Week	20	5	10	20	2.5	2.5	10	10
4 th Week	20	5	10	20	2.5	2.5	10	10
Sept								
1 st Week	20	5	10	20	2.5	2.5	10	10
2 nd Week	20	5	10	20	2.5	2.5	10	10
3 rd Week	20	5	10	20	2.5	2.5	10	10
4 th Week	20	5	10	20	2.5	2.5	10	10
Oct								
1 st Week	20	5	10	20	2.5	2.5	10	10
2 nd Week	20	5	10	20	2.5	2.5	10	10
3 rd Week	20	5	10	20	2.5	2.5	10	10
4 th Week	20	5	10	20	2.5	2.5	10	10
TOTAL	320	80	160	320	60	60	240	240

Appendix D: Projected units-per-week demand for all markets

CROP	Tomatoes	Peppers	Cucumbers	Herbs	Baby Spinach	Mixed Greens	Green Lettuce	Romaine
UNIT TYPE	Pound	Pound	Fruit	Bundle	Pound	Pound	Head	Head
May								
1 st Week					16.8	16.8	41	41
2 nd Week					16.8	16.8	41	41
3 rd Week					16.8	16.8	41	41
4 th Week					16.8	16.8	41	41
June								
1 st Week				50	16.8	16.8	41	41
2 nd Week				50	16.8	16.8	41	41
3 rd Week				50	16.8	16.8	41	41
4 th Week				50	16.8	16.8	41	41
July								
1 st Week	123	30	57	50	16.8	16.8	41	41
2 nd Week	123	30	57	50	16.8	16.8	41	41
3 rd Week	123	30	57	50	16.8	16.8	41	41
4 th Week	123	30	57	50	16.8	16.8	41	41
Aug								
1 st Week	123	30	57	50	16.8	16.8	41	41
2 nd Week	123	30	57	50	16.8	16.8	41	41
3 rd Week	123	30	57	50	16.8	16.8	41	41
4 th Week	123	30	57	50	16.8	16.8	41	41
Sept								
1 st Week	123	30	57	50	16.8	16.8	41	41
2 nd Week	123	30	57	50	16.8	16.8	41	41
3 rd Week	123	30	57	50	16.8	16.8	41	41
4 th Week	123	30	57	50	16.8	16.8	41	41
Oct								
1 st Week	123	30	57	50	16.8	16.8	41	41
2 nd Week	123	30	57	50	16.8	16.8	41	41
3 rd Week	123	30	57	50	16.8	16.8	41	41
4 th Week	123	30	57	50	16.8	16.8	41	41
Total Units	1968	480	912	1000	404	404	984	984

Appendix E: Space requirement by crop

*space requirements are rounded up to non-decimal values

Tomatoes					
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	123	1	2.64lb/ft	47ft	188ft
2 nd Week	123	1	2.64lb/ft	47ft	
3 rd Week	123	1	2.64lb/ft	47ft	
4 th Week	123	1	2.64lb/ft	47ft	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	123	1	2.64lb/ft	47ft	188ft
2 nd Week	123	1	2.64lb/ft	47ft	
3 rd Week	123	1	2.64lb/ft	47ft	
4 th Week	123	1	2.64lb/ft	47ft	
Harvest Date: Sept	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	123	1	2.64lb/ft	47ft	188ft
2 nd Week	123	1	2.64lb/ft	47ft	
3 rd Week	123	1	2.64lb/ft	47ft	
4 th Week	123	1	2.64lb/ft	47ft	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week		1	2.64lb/ft	47ft	188ft
2 nd Week	123	1	2.64lb/ft	47ft	
3 rd Week	123	1	2.64lb/ft	47ft	
4 th Week	123	1	2.64lb/ft	47ft	

Peppers					
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	30	1	.6lb/ft	50ft	200ft
2 nd Week	30	1	.6lb/ft	50ft	
3 rd Week	30	1	.6lb/ft	50ft	
4 th Week	30	1	.6lb/ft	50ft	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	30	1	.6lb/ft	50ft	200ft
2 nd Week	30	1	.6lb/ft	50ft	
3 rd Week	30	1	.6lb/ft	50ft	
4 th Week	30	1	.6lb/ft	50ft	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	30	1	.6lb/ft	50ft	200ft
2 nd Week	30	1	.6lb/ft	50ft	
3 rd Week	30	1	.6lb/ft	50ft	
4 th Week	30	1	.6lb/ft	50ft	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	30	1	.6lb/ft	50ft	200ft
2 nd Week	30	1	.6lb/ft	50ft	
3 rd Week	30	1	.6lb/ft	50ft	
4 th Week	30	1	.6lb/ft	50ft	

Cucumbers					
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	57	1	5 fruit/ft	12ft	48ft
2 nd Week	57	1	5 fruit/ft	12ft	
3 rd Week	57	1	5 fruit/ft	12ft	
4 th Week	57	1	5 fruit/ft	12ft	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	57	1	5 fruit/ft	12ft	48ft
2 nd Week	57	1	5 fruit/ft	12ft	
3 rd Week	57	1	5 fruit/ft	12ft	
4 th Week	57	1	5 fruit/ft	12ft	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	57	1	5 fruit/ft	12ft	48ft
2 nd Week	57	1	5 fruit/ft	12ft	
3 rd Week	57	1	5 fruit/ft	12ft	
4 th Week	57	1	5 fruit/ft	12ft	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	57	1	5 fruit/ft	12ft	48ft
2 nd Week	57	1	5 fruit/ft	12ft	
3 rd Week	57	1	5 fruit/ft	12ft	
4 th Week	57	1	5 fruit/ft	12ft	

Herbs					
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	16 towers/month 16 * 4ft2 = 64ft2
2 nd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
3 rd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
4 th Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	16 towers/month 16 * 4ft2 = 64ft2
2 nd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
3 rd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
4 th Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	16 towers/month 16 * 4ft2 = 64ft2
2 nd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
3 rd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
4 th Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	16 towers/month 16 * 4ft2 = 64ft2
2 nd Week	50	1	2 bundles/ft	25ft/8ft = 4twrs	
	50	1	2 bundles/ft	25ft/8ft = 4twrs	
	50	1	2 bundles/ft	25ft/8ft = 4twrs	

Baby Spinach					
Harvest Date: May	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	

Mixed Greens					
Harvest Date: May	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Jun	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	16.2	1	.5lb/ft	33ft/8ft=5tow	20 towers/month 20 * 4ft2 = 80ft2
2 nd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
3 rd Week	16.2	1	.5lb/ft	33ft/8ft=5tow	
4 th Week	16.2	1	.5lb/ft	33ft/8ft=5tow	

Butterhead Lettuce					
Harvest Date: May	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 towers/month
2 nd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 * 4ft2 = 48ft2
3 rd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
4 th Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
Harvest Date: Jun	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 towers/month
2 nd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 * 4ft2 = 48ft2
3 rd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
4 th Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 towers/month
2 nd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 * 4ft2 = 48ft2
3 rd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
4 th Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 towers/month
2 nd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 * 4ft2 = 48ft2
3 rd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
4 th Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 towers/month
2 nd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 * 4ft2 = 48ft2
3 rd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
4 th Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
1 st Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 towers/month
2 nd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	12 * 4ft2 = 48ft2
3 rd Week	41	1	2 heads/ft	20.5ft/8ft=3towers	
4 th Week	41	1	2 heads/ft	20.5ft/8ft=3towers	

Romaine					
Harvest Date: May	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
	41	1	2 heads/ft	20.5ft/7=3towers	12 towers/month
	41	1	2 heads/ft	20.5ft/7=3towers	12 * 4ft2 = 48ft2
	41	1	2 heads/ft	20.5ft/7=3towers	
	41	1	2 heads/ft	20.5ft/7=3towers	
Harvest Date: Jun	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
	41	1	2 heads/ft	20.5ft/7=3towers	12 towers/month
	41	1	2 heads/ft	20.5ft/7=3towers	12 * 4ft2 = 48ft2
	41	1	2 heads/ft	20.5ft/7=3towers	
	41	1	2 heads/ft	20.5ft/7=3towers	
Harvest Date: Jul	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
	41	1	2 heads/ft	20.5ft/7=3towers	12 towers/month
	41	1	2 heads/ft	20.5ft/7=3towers	12 * 4ft2 = 48ft2
	41	1	2 heads/ft	20.5ft/7=3towers	
	41	1	2 heads/ft	20.5ft/7=3towers	
Harvest Date: Aug	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
	41	1	2 heads/ft	20.5ft/7=3towers	12 towers/month
	41	1	2 heads/ft	20.5ft/7=3towers	12 * 4ft2 = 48ft2
	41	1	2 heads/ft	20.5ft/7=3towers	
	41	1	2 heads/ft	20.5ft/7=3towers	
Harvest Date: Sep	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
	41	1	2 heads/ft	20.5ft/7=3towers	12 towers/month
	41	1	2 heads/ft	20.5ft/7=3towers	12 * 4ft2 = 48ft2
	41	1	2 heads/ft	20.5ft/7=3towers	
	41	1	2 heads/ft	20.5ft/7=3towers	
Harvest Date: Oct	Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
	41	1	2 heads/ft	20.5ft/7=3towers	12 towers/month
	41	1	2 heads/ft	20.5ft/7=3towers	12 * 4ft2 = 48ft2
	41	1	2 heads/ft	20.5ft/7=3towers	
	41	1	2 heads/ft	20.5ft/7=3towers	

Appendix F: Space Requirements for Seedling Trays

Crop: Tomato

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
May	226ft	1	1ft	50 cell	5 * 1.6ft2	8ft2

Crop: Peppers

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
May	400ft	1	1.5	50 cell	6 * 1.6ft2	10ft2

Crop: Cucumbers

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
May	96ft	1	1.5	50 cell	2 * 1.6ft2	4ft2

Crop: Herbs

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
May	100ft	1	.5ft	50 cell	4 * 1.6	7ft2
June	100ft	1	.5ft	50 cell	4 * 1.6	7ft2
July	100ft	1	.5ft	50 cell	4 * 1.6	7ft2
August	100ft	1	.5ft	50 cell	4 * 1.6	7ft2
September	100ft	1	.5ft	50 cell	4 * 1.6	7ft2

Crop: Baby Spinach

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
April	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
May	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
June	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
July	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
August	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2

Crop: Mixed Greens

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
April	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
May	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
June	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
July	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2
August	132ft	1	.15ft	72 cell	13 * 1.6ft2	21ft2

Crop: Butterhead Lettuce

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
April	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
May	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
June	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
July	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
August	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
September	100ft	1	.7ft	72 cell	2 * 1.6	4ft2

Crop: Romaine

Planting Month	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/month
April	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
May	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
June	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
July	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
August	100ft	1	.7ft	72 cell	2 * 1.6	4ft2
September	100ft	1	.7ft	72 cell	2 * 1.6	4ft2

Appendix G: Detailed Costs

Category	Item	Cost*	Projected Lifespan in years	Depreciation **
Greenhouse structure	GrowSpan Series	\$17104.55	50	\$34.30
	End Frame Kit	\$1,588 * 2 = \$3176	10-15	\$317.60
	Clad kit	\$1576.56 * 2 = \$3153.12	10-15	\$315.30
	Rafter kit, posts	\$468.31 * 6 = \$2809.86	10 – 15	\$281
	Rafter Support	\$207.42 * 5 = \$1037.10	10 – 15	\$103.70
	DbI swinging door	\$859.55	10 – 15	\$86
Growing System	Dutch Bucket System	\$8843	8	\$1105.38
	Integrated Panel	\$2459.45	5	\$492
	Timer	\$65.17	5	\$13.03
	ZipGrow Commercial Bundle	\$9,450	10-20	\$1181.25
	ZipGrow Media pulling hook	\$29.99	5	\$6
Radiant Heating System	In-floor & Bench	\$12,725.60	20+	\$636.28
Unit Heater	Optional for colder nights	\$1,150.68	15	\$76.71
Ventilation	Fan 20"	\$189.12 * 4 = \$756.48	5	\$151.40
	Slant wall fan	\$1081.64	5	\$216.40
	Aluminum Shutter	\$384.90 * 2 = \$768.80	10 – 15	\$76.90
Irrigation	Seedling watering system	\$200	5	\$40
Workspace	4'w x 8'L Workbenches	\$338.34 * 23 = \$7781.82	10 -15	\$101.47
Storage, Harvest and Processing	Produce Fridge	\$13,087	10 -15	\$1308.70
	Reusable harvest Containers	20 * \$19 = \$380	8	\$47.50
	Reusable harvest Containers	20 * \$19.95 = \$399	8	\$49.87
	Salad Spinner	\$145	8	\$18.13
	S/S Washbasin work surface	\$1181	10 -15	\$118.10
Greenhouse Labour	IRC quoted \$325-\$400 ft2 * 2600ft2 = NOT FEASIBLE	Southern quotes for poly installation is \$17-\$19/sqft	N/A	N/A
ZipGrow Operations Systems Installation	Upstart Farmers Support Package included	N/A	N/A	N/A
Radiant Heat System Installation	175 man hours – 9-10 days with 2 people working 10 hour days	\$75/hr = \$13,125	N/A	N/A
Shipping	FarmTek	\$9,956		
	ZipGrow Canada	\$400		
	Hendrix Restaurant Supplies	\$335.61		
	Delta Radiant Heating	\$1,100		
Customs		Unknown		
Total		\$113,561.42		\$6777.02

*All funds are in Canadian

**Depreciation rate was calculated using the lowest number of years for expected lifespan, ex: the life expectancy of the vertical grow towers is 10 -20 years; for the depreciation calculation 10 years was used.

Sales Costs	Item	Cost
Shipping/Delivery	Gas	\$200/month
Packaging		Fixed Cost, see above
Storage		
Marketing	Use social media	Free
Total Sales Costs		\$1,400 annually

Consumable Item Cost	Item	Cost
Containers	Seedling trays	$\$2.11 * 20 = \42.20
Growing Media (substrate)	Delta 6 Block	$\$5.55 * 46 = \360.11
	Ziptower FlexiPlugs	1500 = \$69.00
Plugs, cuttings, seed	Seed	\$2000
Tags, Stakes, Trellis, Etc.	Trellis Kit	$\$32.55 * 10 = \325.50
	Tomato Roller	$\$1.34 * 300 = \402
	Tomato Clips	$\$22.12 * 3 = \66.36
Fertilizer		Included in first year hydroponic bundles
Electrode supplies		\$208.43
Chemicals – Pest Control, PGR		Included in first year hydroponic bundles
Total Variable Costs		\$3196.17

Special thanks

Special thanks to our funders and partners on this project. Photos courtesy of Villiam Svalo of Vineland Research.



Photo Credit: Northern Farm Training Institute

For more information please contact



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