High Tunnel Marketing & Economics

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Introduction

High tunnels have the potential to greatly increase the range of crops that can be grown in much of Minnesota. As growers research high tunnel production, they will find that tunnels can increase profitability by:

- Extending the production season or allowing production of crops not winter-hardy enough for field production,
- Increasing the quality and shelf life of the product,
- Minimizing the use of pesticides, and
- Ensuring a continuous flow of produce even when the outside environment is not favorable for field production.

But any new technology should be analyzed from a business perspective to determine if that technology can be a good investment for the owner. Getting started in high tunnel production requires a significant capital investment, and many growers will want to seek credit for this new venture. Lenders will want to know if a high tunnel can be profitable, so devising a business plan that realistically accounts for both the greater expense and the greater potential profit will be necessary.

To determine whether adopting this technology is the best path for a business, consider these questions:

- Does this technology fit with the goals and strategy of my operation?
- Is this technology the best path, or are there alternatives that would be a better investment of my time and energies?
- Can I project the financial impact of this technology? Will it meet my financial goals?
- What are the critical parts of this technology, the things that must be done right for this project to be a success?
- Can I also improve my chances for success by performing a sensitivity analysis that addresses the risks I may encounter: economic, scheduling, market competitive, and regulatory?
- How do I need to modify my management systems to improve success?
- How will I measure success?
- What assumptions am I making about yield and pricing, and is there a way to quantify and verify these assumptions?
- Is there someone who could review my plan and verify strengths and point out weaknesses?
- Do I have a financial advisor who could verify the financial projections?

Marketing: Planning for Profit

Producers must achieve a profit level that compensates them for their efforts and the risk they have assumed in production. People who have survived in the horticulture business will
tell you, if there isn’t a market for something, don’t grow it! All of your assets, including your new high tunnel, are liabilities—until your customer shows up with money and turns them into assets. If the customer does not show up, the assets remain liabilities. An analysis of the suitability of high tunnels for your operation is incomplete unless you have a good understanding of how your efforts will be received in the marketplace.

Marketing is sometimes an afterthought for growers who love the processes of production. But the success of high tunnels as a sustainable part of your business will depend heavily on your success in marketing.

The possibilities for high tunnel profitability are great, but capturing those profits is not a given. Can you evaluate the market and assess the premium people may be willing to pay for the value you bring? How much would your customers pay for fresh, local produce that is:

- **First to market ahead of the regular season, and last at market after killing frosts.** This is the primary advantage of high tunnels.
- **Higher quality.** Because your market is local, you can bring to market a product freshly picked at peak ripeness, and compared to the produce that comes from your fields, high tunnel produce is likely to be even better! Keeping rain off the foliage and fruit, eliminating mud-splash, keeping temperatures warm, preventing damage from wind storms, easily providing water and nutrients as needed by plants: these all lead to bigger harvests of significantly better produce.
- **Not readily available.** In Minnesota, these include tomatoes, peppers, and garlic in the north, and fall-bearing raspberries in much of the state.
- **Certified organic or produced with very little pesticide.** In high tunnels, disease pressure is greatly reduced, and the use of beneficial insects for pest control is easier than in the field.
- **Luxury priced.** Higher prices imply higher quality; lower prices low quality. Some consumers are willing to buy more expensive produce simply because it is more expensive. Know your market!

**Grow what the market values**

The true challenge for fruit and vegetable growers operating on a smaller scale is to find those markets that place high value on their products. Wanting a product and valuing it are different. Customers demonstrate their assessment of value by exchanging money for satisfaction. (When asked directly, people may underestimate or overestimate what they are truly willing to pay.)

It’s important to understand how your customer values the product. One challenge is to select the market channel that best fits with your goals and situation. Price sensitivities and your profit margins will vary by channel.

**Wholesale Channels**

Wholesale channels involve customers who are not the end product consumer, including professional chefs or restaurant owners, wholesale produce brokers, produce managers at local grocery stores, or cooperative organizations. Your product is now part of their product. How does your product impact the value that they deliver to their customers?
What is the value to a restaurateur to have a tomato in a salad that is more then just a piece of pink in a sea of green? What if the tomato actually tasted good? Would this help to create customer loyalty for the restaurateur? The more your product is a key component of your customer’s offering, the greater the value it will be assigned by your customer. Understanding and delivering this kind of value is critical to developing a competitive product, and capturing your share of the value delivered is critical to maintaining a sustainable business operation.

For wholesale customers, focus on the total value delivered to their operation. More than just product quality, value can include reliability, trustworthiness, timeliness, and an ability to position oneself as a critical cog in their operation. The position to avoid is to be perceived as just another part of their cost structure—the definition of a vulnerable business relationship is one where your customer views you only as an input cost, which should be reduced as much as possible.

The importance of customer relations cannot be overemphasized. People want quality, but quality without reliability is of little use to the wholesale buyer. If your product is an important part of their offering, they have to know that you can deliver. The last thing a chef wants is to prepare a menu and then not be able to deliver because of the lack of an ingredient. Communication about the status of supply and delivery schedules is part of reliability.

**Retail Channels**
Retail channels involve customers who are the end product consumer. The interface point varies: a roadside or on-farm stand, a pick-your-own operation, a farmers’ market, or a subscription arrangement such as Community Supported Agriculture (CSA).

The risks associated with retail markets can be reduced by a better understanding of your customers, especially their behavior patterns. Market analysis identifies customers in two ways: who they are and what they do. The first is called demographic and might identify where people live, how old they are, and how much money they make. These are good things to know about your customers to help you formulate the best win-win deal between what they want and what you have to offer.

Even more important than the demographic data is the behavioral data. How do they purchase their produce? How important is taste, presentation, location of purchase, philosophy of production? For some people one or more of these is irrelevant. For others these features are very important. The key is to identify those people who value your unique offerings.

If your retail customers value low price over high quality, investing in a high tunnel may be a bad idea!

**Record Keeping**
What is your system for capturing data? It is difficult to establish a win-win business relationship with customers if you don’t know what constitutes a win for you.

Evaluate your financial tracking system. It needs to be simple, accurate, and focused on those numbers that will help you identify your best and most profitable crops, horticulture methods, and market channels. With this information, you can continue to eliminate inefficiencies and choose profitable pathways. Without it, you are left with hunches.
When times are great you may be able to prosper without good systems. But when times become challenging it is much more difficult. What do you think the probabilities are that you will not encounter challenging times?

Reasonably priced computer and barcode systems exist that can reduce tedium, improve accuracy, and give you good management data. It may be that food security issues will generate regulations requiring this level of data. Your customers may demand it before the law does.

Financial Analysis

This is what a lender will want to see, and what you will want for your own peace of mind as you go ahead with a substantial investment.

Establishment Costs
How are the costs associated with the establishment of high tunnels classified? Are there capital costs that will be depreciated? What part of the establishment of the tunnels can be expensed? What are the tax implications? Are there labor related costs? Are there any own or lease issues? Do you have a timeline for establishment and a finance plan that matches?

Table 1 estimates costs of establishing a 26’ x 96’ high tunnel. The cost estimate ranges from about $7,000 to about $11,000. Many tunnels will cost more, if they include heaters or more sophisticated environmental controls. Smaller tunnels could cost somewhat less. Another thing to consider is shipping. Obviously shipping from Ledgewood Farms in New Hampshire is going to be more than from Farmtek in Iowa. But there is no question that the construction of a tunnel is a significant capital project for any farm.
Table 1. High Tunnel Construction Costs (20’ x 96’) excluding site preparation and shipping (2012)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost Range</th>
<th>Site Prep.</th>
<th>Local Labor</th>
<th>Professional Construction</th>
<th>Non-kit Materials</th>
<th>Irrigation</th>
<th>Misc.</th>
<th>Totals</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>There are many sizes available - please visit: <a href="http://www.poly-tex.com/high_tunnels.html">http://www.poly-tex.com/high_tunnels.html</a> for more details</td>
</tr>
<tr>
<td>Site Prep.</td>
<td></td>
<td>Site specific</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gothic Frame Kit</td>
<td></td>
<td>Distributor</td>
<td>Base Kit</td>
<td>Upgrade Options</td>
<td>Shipping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6’ Spacing</td>
<td>4’ spacing</td>
<td>Door</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poly-Tex</td>
<td>$5,467</td>
<td>$6,734</td>
<td>$264</td>
<td>$5,731</td>
<td>$6,998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td>Local Labor</td>
<td>114 man-hours</td>
<td>Where on the learning curve?</td>
<td>$15 per hr.</td>
<td>$1,710</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professional Construction</td>
<td>Per sq. ft. basis</td>
<td>Cost per tunnel 1920 sq. ft.</td>
<td>$300 to $500</td>
<td>$600 to $1,920</td>
<td>$1,920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-kit Materials</td>
<td></td>
<td>Materials obtained locally for: baseboards, hipboards, rope (may want extra screws and metal banding)</td>
<td>$300</td>
<td>$500</td>
<td></td>
<td>$100</td>
<td>$200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td>Includes: set up, headers, drip tape</td>
<td>$200</td>
<td>$400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misc.</td>
<td></td>
<td>Miscellaneous items not anticipated</td>
<td>$100</td>
<td>$200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>Construction cost range based on above estimates</td>
<td>$8,041</td>
<td>$10,018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Table 2. High Tunnel Crop Budget – Tomatoes (2012)

<table>
<thead>
<tr>
<th>Yield (lbs. per plant)</th>
<th>$/Tunnel (20’ x 96’ - 5 rows - 320 pts/tunnel)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Yield (lbs. per tunnel)</td>
<td>2,240</td>
</tr>
</tbody>
</table>

**VARIABLE COSTS**

- **Fertilizer**
  - $40
  - $50
  - $60
  - $70
  - $80

- **Pest Control**
  - $50
  - $50
  - $50
  - $50
  - $50

- **Black Plastic Mulch**
  - $20
  - $20
  - $20
  - $20
  - $20

- **IRRIGATION**
  - **Dripline**
    - $25
  - **Drip Irrigation Operation**
    - $25
  - **Plant Maintenance (Stakes, Twine)**
    - $30
  - **Fuel**
    - $30
  - **Transplant Materials**
    - $48
  - **Packaging - Boxes (@$1.50)**
    - $105
  - **Marketing (3% of ave. revenue)**
    - $50

- **LABOR**
  - **Transplanting**
    - $66
  - **Trellis - Staking, Training**
    - $110
  - **Weeding**
    - $25
  - **Ventilation & Monitoring**
    - $220
  - **Machinery Operation**
    - $35
  - **Harvest**
    - $263
  - **Grading/Packing**
    - $68
  - **Seasonal Cleanup**
    - $55
  - **Land Preparation**
    - $55
  - **Interest Expense**
    - $36

**TOTAL VARIABLE COSTS**

- $1,355
- $1,505
- $1,648
- $1,869
- $2,090

**FIXED COSTS**

- **Land (rent of .2 ac at $150 per acre)**
  - $30
- **Depreciation**
  - $700

**TOTAL FIXED COSTS**

- $730

**TOTAL COSTS**

- $2,085
- $2,235
- $2,378
- $2,599
- $2,820

**BREAKEVEN PRICE**

- 32# box
  - $29.79
  - $22.35
  - $16.99
  - $15.29
  - $14.10
- per pound
  - $0.93
  - $0.70
  - $0.53
  - $0.48
  - $0.44

**Assumptions:**

- Planting rate - 64 plants per 96 ft
- Tunnel dimensions: 96’ by 20’
- 96 ft x 20 x 5 rows = 320 plants per tunnel

<table>
<thead>
<tr>
<th>Yield</th>
<th>Variable Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,240</td>
<td>$1,214</td>
</tr>
<tr>
<td>3,200</td>
<td>$1,349</td>
</tr>
<tr>
<td>4,480</td>
<td>$1,475</td>
</tr>
<tr>
<td>5,440</td>
<td>$1,679</td>
</tr>
<tr>
<td>6,400</td>
<td>$1,882</td>
</tr>
</tbody>
</table>

**Interest expense = 4% loan 9 month term on: variable expenses**

* assigned a land preparation charge in lieu of machinery and equipment expenses
Benefit Analysis
What kind of financial benefits will come from the high tunnel operation?

Benefits from increased revenues
It is critical to define the source of value and the justification for high premiums? Will the value come from products that the market recognizes, but that have a higher value due to timing and quality? Will the value come from features of production, such as organic or reduced use of pesticides? Will the products be new to the market and valued because of their scarcity? Perhaps yields will be higher and the marketing season longer, increasing revenues without increasing price.

Benefits from reduced costs
Will the benefits of this system come from a cost reduction? This could be a reduction in the cost of input materials, such as chemicals used for pest control. It’s likely that growing crops in the high tunnel will cost more than field production in nearly every way, but there could be some savings: watch for them.

Table 3 shows that as both yield and price go up, the potential revenue for a high tunnel crop (in this case, tomato) can be very large.

<table>
<thead>
<tr>
<th>Yield (lb/plant)</th>
<th>Price per pound ($/lb)</th>
<th>$1.00</th>
<th>$1.50</th>
<th>$2.00</th>
<th>$3.00</th>
<th>$3.50</th>
<th>$4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(lb/tunnel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2240</td>
<td>2.240</td>
<td>3.360</td>
<td>4.480</td>
<td>6.720</td>
<td>7.840</td>
<td>8.960</td>
</tr>
<tr>
<td>10</td>
<td>3200</td>
<td>3.200</td>
<td>4.800</td>
<td>6.400</td>
<td>9.600</td>
<td>11.200</td>
<td>12.800</td>
</tr>
<tr>
<td>20</td>
<td>6400</td>
<td>6.400</td>
<td>9.600</td>
<td>12.800</td>
<td>19.200</td>
<td>22.400</td>
<td>25.600</td>
</tr>
</tbody>
</table>

A grower wanting to take a more conservative view might figure on yield going up moderately and price being only slightly above the price for field-grown tomatoes. To see if a tunnel can be profitable with higher and lower yields and prices, conduct a sensitivity analysis.

Sensitivity Analysis
Whenever attempting to project the financial outcome of a project the answer should never be one number but rather a range of results. This is because there will be uncertainty or potential variation in inputs. In this case we do not know the exact yields or price received for produce. To address this we can specify a range of these input values and then determine the effects of these changes on the output projections. This is called a sensitivity analysis, and it allows us to create a range of profit figures for the enterprise by varying the price and yield input values.

We do have to assign a time value to money. Most businesses like to earn money at a greater rate than what money presently costs them (the cost of capital). This rate could vary from inflation to a higher expectation linked to the bond or equity markets. At this point it is a factor in the spreadsheet. This spread sheet permits one to vary yields and prices and the value of money to arrive at a Net Present Value (NPV) of the high tunnel project. NPV has been described as the cost associated with tying up money in a project, when it could be invested with a financial firm, and earning dividends or interest.
Having identified our anticipated costs for both the establishment and operation of the high tunnel, we can see how various yield and price values impact the potential value of the project. Note that the following scenarios assume a tunnel whose costs are at the low end of the range established for construction of a high tunnel.

### High Tunnel Production System Sensitivity Analysis Profitability Scenarios
(5-year tunnel life expectancy)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Low Price ($1.50) Low Yield (7 lbs./plant)</th>
<th>Medium Price ($2.50) Medium Yield (14 lbs./plant)</th>
<th>High Price ($4.00) High Yield (20 lbs./plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Year</td>
<td>Year</td>
<td>Year</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Average Yield (lbs. per tunnel)</td>
<td>-</td>
<td>2240</td>
<td>2240</td>
</tr>
<tr>
<td>Average Price (per pound)</td>
<td>-</td>
<td>$1.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>Revenues</td>
<td>$3,360</td>
<td>$3,360</td>
<td>$3,360</td>
</tr>
<tr>
<td>Expenses</td>
<td>$2,085</td>
<td>$2,085</td>
<td>$2,085</td>
</tr>
<tr>
<td>Profit/Cash Flow</td>
<td>$1,275</td>
<td>$1,275</td>
<td>$1,275</td>
</tr>
<tr>
<td>PV of Cash Flow @ 4.00 %</td>
<td>($9,500)</td>
<td>$1,226</td>
<td>$1,179</td>
</tr>
<tr>
<td>NPV @ 4.00 %</td>
<td>$5,676</td>
<td>$1,275</td>
<td>$1,275</td>
</tr>
</tbody>
</table>

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The worst-case outcome is Scenario 1, where we have assumed a low yield and low price received. The investment has not been recouped, even after the fifth season. If you thought that these results were the best that you could achieve, you would not start the project.

Scenario 2 assumes an average yield and average price received, the tunnel breaks even in the second growing season, and returns a profit to the grower. If you thought you could achieve these results, you would want to give serious consideration to this project. If you performed a net present value analysis on another potential project, you could compare the two projects to see which might be more profitable. You could also change the rate of the cost of capital from 10% to a value more appropriate to your operation, if you could borrow money for an interest rate less than ten percent.

Scenario 3 is the best case scenario, and assumes that you can produce better than average yields and obtain a significant price premium. In this case the venture would be very profitable.

These are just three of a large number of possible values that could be entered into the spreadsheet. The spreadsheet will be posted on the high tunnel web site, so that you can download the file and change the values as you wish, to reflect actual yields and prices, actual interest rates, and actual cost of construction and crop production.

References


http://www.intrinsiccoach.com/english/home/
http://www.plasticulture.org
http://plasticulture.cas.psu.edu
http://www.ledgewoodfarm.com/
http://www.farmtek.com/farm/supplies/home