# OrgFarm

**Sample Only**

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ISMT E-130

**Problem Definition**

As consumers shy away from genetically engineered food, organic farming is gaining popularity in the United States, with some estimates calling for 20% growth over the next three years. In this growing market, Anne Spillman and her brother, Bill, saw an opportunity: Their parents, Angela and Brian, were lifelong organic farmers but wanted to retire to Florida. Anne, a successful businesswoman in Boston, and Bill, a Harvard educated chemist, thought they could turn their parents' small farm into a much larger operation, especially with Bill’s revolutionary compound, a new natural fertilizer. Additionally, Anne and Bill discovered that adding tiny ventilation holes in the plastic bags used to package the lettuce increased air circulation and reduced condensation, resulting in dryer lettuce with a longer shelf-life. The siblings believed that the new technologies could lead to higher production per acre, better tasting crops, and thus increased demand.

Anne recognized that she and Bill would need a dynamic business model that would help them understand the potential of the farm and how specific factors would affect OrgFarm’s sales and profit margins. Thus, prior to agreeing to purchase their parent’s farm, Anne and Bill brought our group, (SMM Inc.), in to help them plan the business strategy and capital expenditures over the next three years and to ensure that they would break even and receive an adequate return on their investment.

Anne and Bill wanted our group to help them decide whether changing the fertilizer and packaging techniques as well as purchasing and maintaining greenhouses would be:

* Profitable over the initial twelve-quarter time horizon.
* Enable OrgFarm to capture greater market share and, thus, sustain an increase in sales.

Finally, Anne and Bill wanted us to help them decide if they should establish greenhouses from the onset and, if so, on how much of their land.

Our group was tasked with developing a sustainable decision support system that projected an estimated Profit Margin, as captured within the Income Statement. Anne and Bill asked our group to focus on the income statement as it provides the opportunity to compare profits from the existing farm with that of two scenarios:

* Scenario 1: Growth
* Scenario 2: Hyper-growth

In addition, they understood that the Income Statement would be the foundation for the other financial statements, (cash flow and balance sheet), if a future project intended to produce complete pro-forma financials.

**The Farming Process**

Before discussing the two scenarios we modeled, a brief description of the current organic farming process is necessary. Much of the process in the current farming business is the same as it was when this nation was originally settled. Of course, technology has made the life of the modern farmer much easier then her predecessor.

For the Spillmans, the growing season consists of six months, April-September. Lettuce has a three month growing cycle, so the OrgFarm is able to plant and harvest twice during the growing season. To prevent over usage of the land, only 75% of the farm is used during a given spring and summer, while the other 25% remains dormant to allow for regeneration of the land’s important minerals.

Planting typically takes 4 days (10 hours per day) on a 1,000-acre farm, with 4 migrant farm workers brought in to help with the process. Harvesting is a 5-day process, again with the help of 4 workers. For the OrgFarm, 3 tractors, 3 precision planters, 3 trailers and 1 plough owned by the farm, aid both processes.

Once harvested, the lettuce is brought to the farm’s barn for inspection. Any heads of lettuce not meeting the Spillmans quality standards are discarded. The OrgFarm contracts with a packaging company, which receives delivery of the lettuce, and ships it to produce distributors once it is packaged. Again, the lettuce is inspected during packaging to guarantee quality of the product. OrgFarm’s yield is defined as the total number of bags of lettuce produced. As Bill’s new fertilizer was estimated to enable more lettuce to be grown and packaged per acre, the young Spillman’s OrgFarm was expected to experience an increase in yield from 900 to 1,100 bags per acre and, thus, an increase in production. However, the Spillmans receive payment from the distributors on a bag sold basis only. Accordingly, if OrgFarm’s lettuce goes bad in the truck, while being transported to the distributor, the Spillman’s will lose sales and revenue. This is where the new packaging technique ameliorates the Spillman’s farm operations. The new packaging technique was projected to reduce packaged lettuce spoilage from 40% to approximately 10%, increasing sales and revenue.

The standard, and for this model’s purposes unchanging, costs of running the OrgFarm are detailed in the base assumptions section of the model. We have assumed that these factors will remain static throughout the twelve-quarter period that is being modeled.

**Scenario Descriptions**

## Base Case: 12Q ‘Old OrgFarm’ Performance Leading Up to the Sale

In order to compare the effect of the new fertilizer, packaging and greenhouses on the profitability of the OrgFarm we must start by understanding the existing farm’s past performance. To do this we modeled OrgFarm’s results based on actual data provided by Anne and Bill’s parents.

The beginning factors for the model are a price of $2.00 per bag, a jagged, slowly growing sell-through rate, a yield of 900 bags per acre, a spoilage rate of 40%, a packaging cost of $.45 per bag and a cost of fertilizer of $1.00 per acre. Labor productivity is 1.10 and land usage is the standard 75% in the Spring/Summer season and 0% in the off-season. The Old OrgFarm’s factors and results are depicted in the tables below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Base Case | Y1Q1 | **Y1Q2** | **Y1Q3** | **Y1Q4** | **Y2Q1** | **Y2Q2** | **Y2Q3** | **Y2Q4** | **Y3Q1** | **Y3Q2** | **Y3Q3** | **Y3Q4** |
| Price | $ 0 | $ 2.00 | $ 2.00 | $ 0 | $ 0 | $ 2.00 | $ 2.00 | $ 0 | $ 0 | $ 2.00 | $ 2.00 | $ 0 |
| Land Usage | 0% | 75% | 75% | 0% | 0% | 75% | 75% | 0% | 0% | 75% | 75% | 0% |
| Sell Through | 0% | 70% | 73% | 0% | 0% | 71% | 74% | 0% | 0% | 73% | 75% | 0% |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Base Case Results | **Year 1** | **Year 2** | **Year 3** | **3-Year Total** |
| Year End Net Income | $ 217,014 | $ 227,544 | $ 244,054 | $ 688,613 |
| Year End Growth Rate | N/A | 4.9% | 7.3% | N/A |

While a copy of this scenario is not part of the deliverables included in our contract with the Spillman’s, we will refer to the results of the base case. The Spillmans have the option to recreate the results with the model we provide.

We needed to start with the numbers attained by the elderly Spillman’s original organic farm for both scenarios. As Anne and Bill were certain that if they implemented Bill’s new fertilizer it would be coupled with the new packaging technique, we needed our model to determine:

* How profitable would be the young Spillman’s investment.
* How greenhouses would affect profitability.

## Scenario 1: Growth with New Fertilizer and Packaging

Anne and Bill Spillman were confident that they would break even and see a quick return on their parent’s low-ball asking price, of $ 750,000, for OrgFarm—especially with the technology upgrades they were planning to implement as the new fertilizer and packaging technique did not entail a huge increase in costs. Nevertheless, before making any investments, the young Spillman’s wanted to see a model that would put to rest any of their residual worries and ensure all their bases were covered.

During last year’s season, Bill tested the effectiveness of his new fertilizer on OrgFarm’s strain of lettuce. Accordingly, Bill had an idea of the new fertilizer’s impact on their farming yields. The new fertilizer increased yields to between 1,100-1,400 bags of lettuce. Likewise, the new packaging technique proved to decrease spoilage to between 5-10% of total crops. In Scenario 1, we wanted to assume the worst case scenario as to calm any and all of the Spillman’s fears, thus we chose to use the low end of the ranges determined. Once the season has started, Anne may update these factors in our model, which dynamically adjusts the projections depending on the actual occurrences.

Our group also assumed that the better tasting and longer lasting crops produced by the new fertilizer and packaging technology would allow for an increase in price. The elder Spillman’s were able to charge $2.00 per bag of lettuce in the open market. In our first scenario, we assumed that the new and improved lettuce would support a $2.50 price per bag. A 20% price increase could be considered aggressive, but market research showed that the lettuce consumer was willing to pay more for lettuce that tasted better and lasted longer on the shelves and in their refrigerators.

An additional enhancement to sales in Scenario 1 is an initially sharper and faster growing sell-through rate. The sell-through rate, (amount produced that is actually sold), is a proxy for the demand of the lettuce. The greatest growth rate in sales occurs in the first two quarters that the Spillman’s introduce the new lettuce. The sell-through rate Y1Q2 is only 1% above the elderly Spillman’s sell-through rate Y3Q3 as OrgFarm generally loses market share over the winter months but, with the new lettuce, they managed to quickly make up the lost market share that year. The sell-through rate in Y1Q3 of Scenario 1 truly reflects the impact of the new fertilizer and packaging technique on OrgFarm’s sales. In Y2Q2 and Y3Q3, OrgFarm loses market share over the winter months, as it is harder to hold onto a greater percentage of market share than less, as in the early days of the business. Nevertheless, in Scenario 1 we assume a quickly increasing sell-through rate as the lettuce-consuming public begins to learn more about and place additional value on our product. The table below depicts the inputs for Scenario 1.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario1 | **Y1Q1** | **Y1Q2** | **Y1Q3** | **Y1Q4** | **Y2Q1** | **Y2Q2** | **Y2Q3** | **Y2Q4** | **Y3Q1** | **Y3Q2** | **Y3Q3** | **Y3Q4** |
| Price | $ 0 | $ 2.50 | $ 2.50 | $ 0 | $ 0 | $ 2.50 | $ 2.50 | $ 0 | $ 0 | $ 2.50 | $ 2.50 | $ 0 |
| Land Usage | 0% | 75% | 75% | 0% | 0% | 75% | 75% | 0% | 0% | 75% | 75% | 0% |
| Sell Through | 0% | 76% | 82% | 0% | 0% | 80% | 89% | 0% | 0% | 87% | 95% | 0% |

In parallel with the changed yields and spoilage, our team had to incorporate the increase in production costs associated with the new technologies. Preliminary cost data for the new fertilizer showed an increase of 50% per acre compared to the standard lettuce fertilizer ($1.00 to $1.50). Although this appears to be a large increase in costs, fertilizer cost has a minimal impact on our total cost base. In addition, no additional cost was incurred with the new packaging technique as it cost the same price to produce and purchase.

## Scenario 2: Hyper-Growth with New Fertilizer, Packaging and Greenhouses

As the construction of greenhouses would entail a more significant capital investment than buying the farm and implementing the new fertilizer and packaging, the Spillman’s wanted our group to break out the acquisition of a greenhouse from their original plan, as represented in Scenario 1. Thus, in Scenario 2, we incorporated the same base assumption and technological improvements as in Scenario 1 and added the additional capital expenditure of greenhouses.

The additional piece of information that was well known in the farming industry and that we incorporated into Scenario 2 was that with a greenhouse, the farm was able to satisfy and retain their most important and high-end customers throughout the winter months and even continue to grow their market share. This was a significant advantage over not having a greenhouse, which resulted in losing market share over the winter months.

Scenario 2 determined that the Spillmans should construct greenhouses on all 1,000 acres of their land. Naturally, this allows for harvesting during all quarters. However, farming in the greenhouse must follow standard land usage rules, so the farm is only using 750 acres of land in the greenhouse or 75% of the total farm size. In quarters when typically there would be no production (Q1 & Q4), OrgFarm is now capable of planting and harvesting on 75% of their land, producing an additional 825,000 bags of lettuce per quarter during the off-season.

Due to capital restrictions, the Spillmans must lease the greenhouse, if they decide to pursue this option. Accordingly, our model incorporates a lease payment and an increase in depreciation expense in Scenario 2. The lease is based on a 5% interest rate, (compounded quarterly), over a 10 year period. We also assume that the greenhouse would have a 10-year useful life. The initial cost of the greenhouse is $300,000.

With the greenhouses the Spillmans are now selling superior lettuce during the winter months, giving them an advantage over other organic lettuce producers. The second scenario assumes that the Spillmans will be able to increase the price of a bag of lettuce in these quarters to $3.00. This price increase is supported by the scarcity of organic lettuce producers in the winter months.

Finally, in regards to the sell-through rate, it mimics the initial rapid growth in Y1Q2 and Y1Q3 of Scenario 1 but, of course, experiences this increase in sell-through rate from the onset, in Y1Q1 and Y1Q2 as OrgFarm is harvesting and producing lettuce all year round. In addition, the Spillman’s are able to build up their market share at a much faster rate as they are not losing it and having to rebuild their customer base every year. Due to the fantastic lettuce and ability to maintain and build market share every quarter, OrgFarm attains a very high and efficient sell-through rate very quickly in Scenario 2. The following table depicts the inputs for Scenario 2.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario2 | **Y1Q1** | **Y1Q2** | **Y1Q3** | **Y1Q4** | **Y2Q1** | **Y2Q2** | **Y2Q3** | **Y2Q4** | **Y3Q1** | **Y3Q2** | **Y3Q3** | **Y3Q4** |
| Price | $ 3.00 | $ 2.50 | $ 2.50 | $ 3.00 | $ 3.00 | $ 2.50 | $ 2.50 | $ 3.00 | $ 3.00 | $ 2.50 | $ 2.50 | $ 3.00 |
| Land Usage | 75% | 75% | 75% | 75% | 75% | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Sell Through | 76% | 82% | 90% | 92% | 93% | 96% | 98% | 98% | 98% | 98.5% | 99% | 99% |

### Conclusions

Our model and two scenarios supported two main conclusions. First, our model demonstrated that Anne and Bill should buy the farm from their parents and implement Bill’s new fertilizer and the new packaging technique immediately. Even on the lower end of the production and spoilage improvements, Anne and Bill would still have a profitable and growing business and break even by Y1Q2. The increased production, due to the more effective fertilizer, and the increased sell through rate, due to both higher demand for the superior tasting lettuce and the ability to sell to markets outside of Massachusetts—primarily in New York city, which represents a huge market for organic lettuce—resulted in significantly higher sales and, ultimately, a net income increase of 81% in the first year. The table below breaks out the results in Scenario 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Scenario 1 – Fertilizer & Packaging** | **Year 1** | **Year 2** | **Year 3** | **3-Year Total** |
| Year End Net Income | $ 1,282,250 | $ 1,414,972 | $ 1,572,540 | $ 4,269,763 |
| Year End Growth Rate | 81% | 10.4% | 11.1% | N/A |

Second, our model clearly demonstrated that OrgFarm would be even more profitable if Anne and Bill invested in a greenhouse on 100% of their land from the onset. First, the cost of the greenhouses would be made back in the first quarter of the first year. Second, the greenhouses increased the growth rate by 93% compared to the Old OrgFarm’s performance. Third, the total net income over the consecutive 12 quarters is almost three times greater than the net income in Scenario 1. The reasons for OrgFarm’s great success with the greenhouses and great tasting product is that the greenhouses enable OrgFarm to maintain their high-end customers and continue to build their market share in the winter months, as opposed to losing market share in the winter and having to regain lost market share in the spring as in Scenario 1. The ability to maintain and continue building OrgFarm’s market share results in an exponential increase in sales and market share, in turn resulting in a quick return on their investment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Scenario 2 – Greenhouses** | **Year 1** | **Year 2** | **Year 3** | **3-Year Total** |
| Year End Net Income | $ 3,308,425 | $ 3,907,010 | $ 4,038,322 | $ 11,253,757 |
| Year End Growth Rate | 93% | 18.1% | 3.4% | N/A |

Finally, both scenarios demonstrated that Anne and Bill’s OrgFarm would grow above the industry average of 20%, at 80% to 93% in the first year. Clearly, the Spillmans have established a truly superior business model as compared to the industry. As the Spillman’s attain a very high sell-through rate fairly quickly, purchasing more land and applying their efficient business operations to the new farm would be the way to ensure a high rate of growth and continue expanding their customer base and market share.

### Lessons Learned

Throughout the duration of the project and modeling process we did retain some lessons learned. First, we learned the virtue of patience. Initially, we were so eager to compare and contrast the two scenarios that we started with two workbooks, creating two identical models, one for each scenario. After about 8 hours of time invested and divided between the two models, we realized that it would be more efficient to create only one model with one scenario and then to copy that model, change the inputs and parameters, and create the second model depicting the second scenario.

Second, we learned the virtue of simplicity. Essentially, the only reason why we bothered to stop and reflect upon our modeling process was because we were trying to add so much complexity into the model, along with fancy functions that served little or no purpose at all, that we needed to pause to think about the complexities and debate their worth. Eventually, we were able to significantly reduce the complexity of the factors, which we needed to model, in addition to the functions necessary to adequately represent the model. Ultimately, we discovered array formulas, named ranges, and various named parameters and input streams were perfectly adequate to get the job done well.

Third, we learned the virtue of clarity. Here, we are referring to the use of named references. Our problems were thus:

* Originally we set out the inputs and parameters of the base model and two scenarios on one worksheet, and laid out the basic workings of the model. Our initial error was that we used naming conventions such as Yield0, Yield1, and Yield2, etc., further compounded in formulas such as Yield0 \* Price0 etc. Hindsight showed the best approach would have been to use Yield and Price, etc. for the base model. When the model would be split into the various scenarios, the first case calculations would serve as *the* calculations.
* Our second problem we encountered with named ranges was the late discovery of when to use global names and when to use local names. We did not consider this at the outset, and if we had, it would have saved us some time in the long run. After entering in local names into two separate Revenue and Expense models for hours, then deciding to trash one of the models, simultaneously, we decided that global names would be more efficient and expedient. We quickly recognized the error of our ways when we could no longer remember the originating sheet of the referenced cells. To our dismay, we had to return some of the global names to local names to provide complete transparency to our model. And, thus, we swore a solemn oath to the readings on “Naming” and never chose to ignore the canon again.

Fourth, we learned the virtue of thinking a bit more "outside the box." We encountered problems when we limited our thinking to modeling the two scenarios of growth and hyper-growth. We later realized that the model should be flexible to incorporate other scenarios - i.e., the model should be able to reflect 0% land usage, should the Spillmans, and their staff, decide to take a 3-month long safari in Africa. When we first put together the EqptOwned depreciation schedule, we just considered two possible scenarios for each piece of equipment, i.e., Tractor and Trailer 48 months life under Scenario 1, a 6-month growing cycle, and 36 months life under Scenario 2, a 12-month growing cycle. Later we had to change the depreciation schedule so that our model could take into account the 12-quarter land usage percent, and incorporate this as a driver for depreciation expense. This involved a total rework of the depreciation schedules - we moved from a straight-line depreciation method to a more accurate utilization driven depreciation method.

Finally, we reinforce the practice of starting early with the project proposal and creating accountability for the early efforts with the midpoint status. We were able to enjoy our holidays with a clear conscious and avoided the inevitable two-weeks-until-the-final-project-is-dues ulcers.