

Case Study: Star Light Gardens

Almost half an acre of intensive production in five high tunnels (17,500 square feet) complements an acre of field grown salad crops and other vegetables at Star Light Gardens, located one half hour south of Hartford, Connecticut. Mixed baby greens, mesclun, and tomatoes as well as arugula, basil, and pea tendrils are currently David and Ty Zemelsky's main tunnel crops. Close to year round sales of freshly harvested produce from this micro-farm provide the couple with their livelihood. Each had another career before they made a quick transition to farming in the late 1990s.

David always had a passion for gardening. In the years before he and Ty started their own farm, David deepened his horticultural know-how by lending a hand to an aging friend and long-time organic farmer. At the time, he did not imagine that pursuing his avocation would enable him to quit his day job.

Listening to his friend's tales of winter growing pioneer Eliot Coleman prompted the Zemelskys to make a 500 mile round trip pilgrimage to Coleman's Four Season Farm on Maine's Penobscot peninsula in October 1999. Ty said, "We didn't even know what questions to ask." They bought Coleman's *Winter Harvest Manual* and Ty, who describes herself at the "instigator," decided that there was no reason they couldn't start their own business using this model.

With their children grown, the Zemelskys had been exploring ways to be self-employed together. They were about 50 years old and fit enough to be running marathons. They wanted to find "good honest work" that was compatible with their values and provided a reasonable livelihood. A home-based enterprise

was attractive to Ty who, as a visual artist, found working alone in her studio to be too isolating.

To build their first high tunnels, they took out a home equity loan. By Thanksgiving of that year, their son (a landscaper) had prepared the site and they had erected their first two high tunnels. They remember the date—April 9, 2000—of their very first greens harvest, from seeds sown in February. When June rolled around, with a small field planted outside and restaurants buying their produce, David left his school psychologist job for good.

Within two years, David and Ty had put up a total of four 30' x 96' high tunnels on a North-South axis. Next, they hired the local greenhouse fabricator to construct a 30' x 144' structure on an East-West axis, making it their warmest and brightest tunnel. All are gothic style.

Their first two high tunnels are skinned with double layers of plastic inflated with a small blower fan. Initially none of the tunnels had heat. After a few years, they decided to install a forced air oil furnace in one of these original tunnels to facilitate early tomato production. Ducts transport hot air to an adjacent tunnel. They have no inclination, however, to put heat in their other three tunnels.

The Zemelskys chose high tunnel design options that maximize passive ventilation. They set 30" roll up sides about 2' above ground level to protect young plants from cold blasts of air. Directly below the roll-up is the high tunnel baseboard. Plastic film covering the tunnel below the baseboard is buried in a trough in the ground. On each high tunnel, both gable ends have large doors that fully open. Under cold winter conditions, these passive venting systems are not

feasible. David and Ty say they would have opted for ridge vents if they were more affordable.

In their first four tunnels, the Zemelskys experimented with two types of fans. Above the doors, each of these tunnels has a louvered vent on one gable end and a big exhaust fan mounted at the other. A thermostat triggers the louvers to open and let fresh air in. This automatically turns on the fan. They set the thermostat at 80°F for winter greens.

Horizontal airflow (HAF) fans are the second type they had installed. This conventional greenhouse ventilation system is comprised of four window fans hung from the trusses, with one pair blowing air up one side and the other pair blowing it down the other side. Their purpose is to keep air circulating inside, particularly on cloudy winter days when the tunnels are closed. After the Zemelskys stopped growing fall and winter lettuce (their mildew-prone crop), they eagerly stopped running these fans and significantly cut their high electrical consumption.

Ingredients of the Zemelskys' salad mix changes with the seasons and every year they experiment with new varieties. Their hardier, sturdier winter mix contains about eight different kinds of cold-hardy brassicas (including 'Siberian' and 'Dino' kale), and various Asian greens such as Tatsoi and Mizuna. Claytonia—which thrives in cold, low light conditions—is a winter favorite. Arugula accounts for as much as 30% of their sales. Pea tendrils are another important cool weather crop. Some of their seed comes from High Mowing, a small Vermont seed house that only sells open-pollinated, organic seeds. Wild Garden Seed in Philomath, Oregon is the source for chervil and mixed mustards they like called, 'Morton's

Mild Mustard Mix.’ Johnny’s Selected Seeds is another source.

Timing is very important for winter production since the growth rate of crops decreases to almost a standstill in the weeks leading up to winter solstice. To work around this cycle, the Zemelskys have learned to sow greens from early September through October 7 for winter harvest in their location. They start slower growing crops like spinach, chard, and beet greens earliest. For spring harvest, they have planted late into November and in February. With the exception of tomatoes, all of their high tunnel crops are direct seeded.

Intensive production and double or triple cropping requires ample nutrient availability. Before fall planting, David applies an inch of a purchased certified organic leaf-based compost. In the spring, he adds more compost as well as some organic fertilizer into the tomato transplant holes. The Zemelskys also make their own compost by windrowing leaves from local landscapers. Since these composts are low in nitrogen, David supplements them with a purchased fertilizer product from North Country Organics and alfalfa meal for extra nitrogen content. They test the soil periodically as required by their organic certification agency.

David used to roto-till the soil but he has discontinued that practice because he feels it damages soil structure and brings up weed seeds. Instead, he uses shallow tillage to prepare the planting beds. He is experimenting with a small power harrow, a tool that does not invert the soil. Alternatively, he uses hand tools for soil preparation: a saddle hoe to remove debris and old plants, a wheel hoe with a cultivator attachment, and a broad fork. Before planting, he rakes the seedbed and firms up the top layer of soil with a mesh roller.

Over the years, the Zemelskys have found weeds to be quite challenging. Weeds slow harvest and compete with the crops. Certain tenacious cool season weeds, like chickweed, have been very difficult to overcome. Stale seed bedding followed by flaming is proving to be the best prevention for weed proliferation. After preparing the seedbed, David irrigates and, when the weeds emerge, he cooks them with a propane backpack flamer. David is learning to leave two weeks between getting the beds ready and planting the crop to allow time for this technique.

After using a four-row pinpoint seeder for several years, David graduated to a newer six-row model that has built-in rollers. He said the six-row seeder is an improved model that is more forgiving than the four-row one. He recommends a plastic cover over the seed trays for keeping soil from kicking into each bin, and Johnny’s incorporated that suggestion. He said, “At first it didn’t seed well, but the company got the kinks out of it, for the most part.”

With any of the pinpoint seeders, monitoring the operation of the seeder is critical in David’s experience. He makes sure the shaft is turning and the belt has not jumped onto a different pulley as this determines how much seed is sown.

To achieve the intensive production he aims for, David prefers to grow his greens in blocks rather than rows. Rows allow for cultivation with a hoe, whereas blocks do not. He explained that seeding in blocks requires successful implementation of stale seed bedding to reduce the weed seed bank. If an area is too weedy, he can still use his six-row pinpoint seeder, filling only two of the six hoppers in order to skip two rows for every row he seeds.

Like others with a similar mix of crops, the Zemelskys use two

different watering methods. For their summer crops like tomatoes and peppers, drip irrigation helps conserve their extremely limited water supply. With the aid of electronic timers, they irrigate three times a day—in the middle of the night and early morning hours—in order to load up the soil with water before it gets too hot.

With their greens seeded in blocks rather than rows, drip irrigation is not feasible. David is slowly converting his overhead irrigation to a product called “Ein Doers” that is sold by various dealers. Four rows cover a 30’ wide tunnel. He also uses a conventional rotating sprinkler, mounted on a tripod, and another conventional sprinkler that goes back and forth.

After sowing, the late plantings are protected with a medium-weight, spun polyester row cover to assist the crop in germination. This microclimate warms the soil 2 to 3°F. Sometimes their plantings under the row cover experience some dieback. When the seedlings reach a certain size, the row cover is suspended over wire hoops pressed into the ground. The hoops prevent the row cover from chafing the fragile leaves and freezing onto the plants. This structure also keeps condensation off the plants.

The Zemelskys begin their high tunnel greens harvest in November and December. For the first few years, they harvested throughout the winter without a break. They have since stopped selling greens in January. By winter solstice, short day length and low light have considerably reduced plant growth, so they take a needed break while they wait for more re-growth to occur. By early February, with the sun higher in the sky and the light intensifying, they resume harvesting and also reseed some beds as necessary to ensure a strong March and April harvest.

Harvesting salad mixes constitutes a major portion of their labor. The dense, good quality crops at Star Light Gardens can be cut with more speed and the Zemelskys can cut almost 30 pounds per hour, compared to 20 pounds an hour in a more average stand. Ty used to be the main cutter but an old back injury was aggravated by all the bending. Now David does most of the harvesting, with the aid of a harvest cutter and a net bag in a laundry basket.

For the greens harvest, they cut with good, small, light-weight kitchen knives into nylon nets (from a fishing supply company) placed in laundry baskets. They wash the greens in the net bags and then run the bag through the spin cycle of a standard washing machine. They mix the greens to their standards or for special orders in a home-made mixer. If a batch of salad mix grows too big, they sell it as braising mix.

A couple of winters ago, the Zemelskys ceased trying to grow lettuce in the winter. David says that lettuces are too susceptible to powdery mildew under low light and high humidity conditions to be worth the trouble of growing in winter. They also grow too slowly after their August planting, requiring a full week longer than Brassicas, and are not nearly as cold hardy. Since Ty and David market their produce as local and seasonal, their customers readily accepted their explanation, without “batting an eye.” Always experimenting, they may try seeding lettuce in February for the spring harvest.

In 2006, a visit to Bryan O’Hara’s low tunnels in eastern Connecticut sparked a fundamental change in Star Light Gardens’ cropping philosophy. (*See section on Low Tunnels, page 38.*) In mid- and late September that year, David planted lettuce outside in low tunnels. He says his goal is to have enough field-grown lettuce to supply

their markets through Thanksgiving, and then start harvesting in the high tunnels. The system appears to be working, though he will need to tinker with crop timing in both of these growing environments.

Pea tendrils are a money-making crop that the Zemelskys grow wherever they can fit it in, such as around the colder edges of their high tunnels and between the rows of tomato plants until they fill out. While pea plants cannot handle freezing the way hardy Brassicas and Claytonia can, they do well in cool fall and late winter conditions.

A pound of ‘Dwarf Grey Sugar Pea’ seed costs \$1.30 and yields about five pounds of tendrils on 5" high pea plants. The Zemelskys plant 10 to 15 pounds of seed per week. David and Ty sell the pea tendrils alone for \$13 a pound. Occasionally they add them to salad mix for more weight. David says, “Pea tendril pesto has regular basil pesto beat, and so much earlier!”

They have also added micro-greens to their marketing mix. They have found that these greens have already helped their bottom line.

Depending upon how early their field dries out, they transition to harvesting field-grown greens sometime in April or early May. The transition between high tunnel and field production can be a challenge. They have attempted to overwinter field greens in low tunnels, but the results have not been consistent.

Initially the Zemelskys only produced salad greens in the tunnels, leaving them vacant in the summer. In their fourth year, they added tomatoes and basil. Tomato transplants go into the high tunnels from March until early April and the tomato harvest lasts from June through early October. They must quickly pull out the tomato plants in time to reseed the tunnels to fall greens.

The Zemelskys make a wire trellis for the tomatoes using the support structure of the high tunnel. They typically use double leaders, pruning each plant to two main stems. The rows run the length of the tunnels, with nine rows fitting their 30' width, though David is considering growing fewer rows. In order to get earlier tomatoes, they may heat one tunnel to 60°F. This year, they began experimenting with grafting tomatoes. They specialize in heirloom varieties for their discerning customers and also grow some indeterminate greenhouse cultivars. Chefs order tomatoes by color.

Star Light Gardens has been very successful in marketing. Restaurants were originally the mainstay of their sales, but after several years of farming, they added farmers’ markets and the Yale University Sustainable Dining Program to their customer base.

Connecticut has few farmers in relation to its population, and organic, fresh, and unique produce is in great demand. The Zemelskys consciously aim to differentiate their produce from generic products, and they trial new varieties every year. They have been able to maintain their wholesale price for salad mix at \$8 per pound. David said, “There is no competing product. What you get from California does not compare with what we have.”

The Zemelskys enjoy a nice relationship with chefs and find it advantageous at their scale not to rely on a distributor or purveyor. They get new accounts by visiting restaurants or when chefs find them through the Northeast Organic Farming Association of Connecticut (NOFACT). “Chefs are movable people,” said David, “We can gain or lose accounts when they change jobs.”

Currently they wholesale to about two dozen restaurants. Their weekly delivery route also includes four

stores (including a family-owned IGA and natural foods stores).

They first tried selling at a farmers' market in 2004, when the founder and manager of a new market in New Haven recruited them. A couple of years later, they joined another farmers' market an hour away, which began when the sponsoring organization of the first market expanded its reach. Farmers' markets have been lucrative and sociable for the Zemelskys, and have also resulted in contacts with chefs and other buyers.

The Zemelskys have also been selling a significant amount of their production to Yale University since 2004 when it began piloting local food in one dining hall. The University is willing to pay 50% more than the going rate to obtain locally grown, preferably organic, food. Yale buys a third to a half of their salad greens during the late fall and early winter.

Enterprise Budget for a Six-Month Brassica Greens Crop in an Unheated 3,000 sq-ft High Tunnel at Starlight Gardens

Fixed Costs

Construction Costs	Materials	Labor
Site preparation, bulldozer		\$1,500
High tunnel construction		\$600
High tunnel frame	\$3,000	
Lumber and hardware	\$400	
Endwall finishing		
Water and electrical service	\$311	\$100
Irrigation	\$150	
Exhaust fan and louvered vent	\$750	
Bed preparation	\$150	
Other (horizontal air flow fans)	\$330	
Subtotals	\$5,091	\$2,200
Total Construction Costs		\$7,291

Fixed Costs

High tunnel construction (divided by 15 years)	\$486
Interest (construction financed at 7% for 15 years)	\$255
Taxes, land, office expenses, fees	\$225
Total Fixed Costs	\$966
Total Fixed Costs (six-month winter season)	\$483

Variable Costs (six-month winter season)

Materials and Machinery	Cost
Seeds	\$46
Fertilizer, lime and compost	\$78
Plastic mulch and row cover	\$75
Heater fuel and electricity	\$25
Beneficials and pesticides	\$10
High tunnel poly cover (1/2 year)	\$110
Delivery costs	\$175
Subtotal	\$519
Labor Costs (\$20/hr)	
Poly cover installation and removal	\$75
Bed preparation and fertilization	\$160
Planting	\$60
Irrigating and managing row cover	\$20
Harvesting	\$750
Washing and packing	\$300
Sales and delivery	\$420
Subtotal	\$1,785
Total Variable Costs	\$2,304

Total Costs	\$2,787
Revenues*	\$6,000
Net Returns	\$3,213

*Revenues are based on a Brassica greens yield of 0.25 lb/sq-ft or a total of 750 lb per cutting in the Zemelsky's 3000 sq-ft high tunnel. The greens were sold at \$8/lb. Arugula, which sells for \$11/lb and is not as cold resistant as some other brassicas, was not included in this accounting.