Center for Crop Diversification
Martin-Gatton College of Agriculture, Food and Environment
UTIA Institute of Agriculture, The University of Tennessee

Center for Crop Diversification Fact Sheet
CCD-BG-14
ccd.uky.edu

Sample Tomato and Lettuce Budgets and the Economics of Soil Solarization in High Tunnel Production

Margarita Velandia, Zoe Turner, Annette Wszelaki, Rachel Rudolph

This sample budget aims to guide high tunnel (HT) growers and those interested in producing vegetables in high tunnels on the factors to consider when estimating their potential net revenue from growing and marketing vegetables in these covered structures. Additionally, we use this sample budget to help HT vegetable growers understand the potential changes in costs and revenue associated with implementing soil solarization in their HT production systems.

Soil solarization is a management technique that uses passive solar heating of irrigated soil under a transparent plastic tarp to manage soilborne pests, pathogens, and weed seeds (Hanson et al., 2014; Rudolph et al., 2023). Specifically, this technique allows the soil to reach temperatures that are detrimental to soilborne pests, pathogens, and weed seeds. The effectiveness of this technique in managing these organisms depends on the temperature reached inside the HT, which depends on the timing of implementing this technique (Rudolph et al., 2025). Results from field trials conducted by the University of Kentucky and the University of Tennessee in 2024 and 2025 suggest that the best timing for implementing this technique is in the summer months (i.e., July and August). Additionally, results from the University of Kentucky's field trials suggest that the effectiveness of this technique in managing certain soilborne pathogens varies by season, depth, and pathogen biology. These results emphasize the critical role of timing and further support the use of solarization as a component of an integrated soilborne disease management strategy (Gauthier, 2026).

This management technique is attractive to HT growers who have limited options to manage soil issues, such as soilborne diseases and plant parasitic nematodes, especially when growers use organic production practices (Rudolph et al., 2023). A 2024 survey of Kentucky HT vegetable growers found that more than 70% of respondents who have never used soil solarization indicated they were willing to try it. Furthermore, this survey found that 27% of respondents who were not willing to use solarization believed the adoption of this practice would be detrimental to the economic viability of the farm (Velandia et al., 2025). No studies, as far as we know, have evaluated the economics of soil solarization in HTs (Velandia et al., 2025). These survey results suggest that it is important to help HT growers understand the economic factors they should consider before implementing this management technique, which is one of the main purposes of this publication.

This publication is not intended to be a definitive guide to production practices, but rather, to guide the estimation of the physical and financial requirements of comparable farms growing vegetables in HTs, specifically small-scale farms with one or two HTs on their farms, selling vegetables through direct-to-consumer market outlets, and located in states with similar weather conditions to Kentucky and Tennessee. Specific budget assumptions were adopted for this study based on a specific HT example, but these assumptions may not fit every situation, as production costs and revenue vary across farms depending on the following factors:

- Capital, labor
- Crops grown
- Crop yield
- Cultural practices
- Input prices
- Output prices
- Climate and growing season conditions
- Management skills
- Size of the operation

To avoid unwarranted conclusions for any particular operation, readers must closely examine the assumptions made in this study and then adjust the expenses, revenues, or both as appropriate for their operation.

This publication does not aim to describe soil solarization in detail. Therefore, readers are encouraged to consult additional resources, such as Gauthier (2026) and Warren County Agriculture (n.d.), and other resources available through the University of Kentucky Department of Horticulture at https://horticulture.mgcafe.uky.edu/growers/commercial/vegetables.

HT Sample Baseline Budget Details

Although we could focus on the aspects of a HT budget that change when implementing soil solarization, we wanted to create a sample budget that could serve as a guide to individuals thinking about investing in a HT to grow vegetables. One of the challenges related to developing HT budgets, specifically for small-scale operations selling to direct-to-consumer market outlets, is that a representative HT budget may include a wide range of crops throughout the growing season, which can vary by farm depending on grower and consumer preferences.

Since this publication focuses on the economics of soil solarization, we simplified the sample baseline budget by making a few assumptions.

General Assumptions

- **HT size**: The size of the tunnel is 30 x 96 ft (2,880 sq ft).
- **Area in production**: Approximately 84% (2,430 sq ft/2,880 sq ft) of the total HT area is in production. This includes 1.5 ft space between the HT sides and the area in production, and 3 ft space between the HT ends and the area in production. This equals 27 x 90 ft area in production and is equivalent to 2,430 sq ft.
- **Crops grown**: Two crops are grown in the HT: lettuce and tomatoes. Lettuce and tomatoes are chosen because these are high-value crops commonly grown by HT vegetable growers (Velandia et al., 2025).
- **Lettuce growing seasons**: There are three lettuce crops during the growing seasons. The first crop is planted in mid-February and harvested at the end of March or beginning of April (about 45 days after planting). Only lettuce is grown and harvested in the HT for the first crop. The second crop is planted in April and harvested in June. For this second crop, approximately half of the tunnel is used for lettuce production because, in April, tomatoes are planted in the second half of the HT. The last crop is planted in the second week of September and harvested in November. Only lettuce is grown and harvested for this last crop. We assume the lettuce cultivar grown is Harmony, a butterhead type.
- **Tomato growing season**: Red slicer determinate tomatoes are grown in the HT. Tomatoes are planted in April, when planting the second crop of lettuce. Tomatoes are harvested from June through the end of August. Figure 1 shows the growing season and harvest windows of lettuce and tomato.

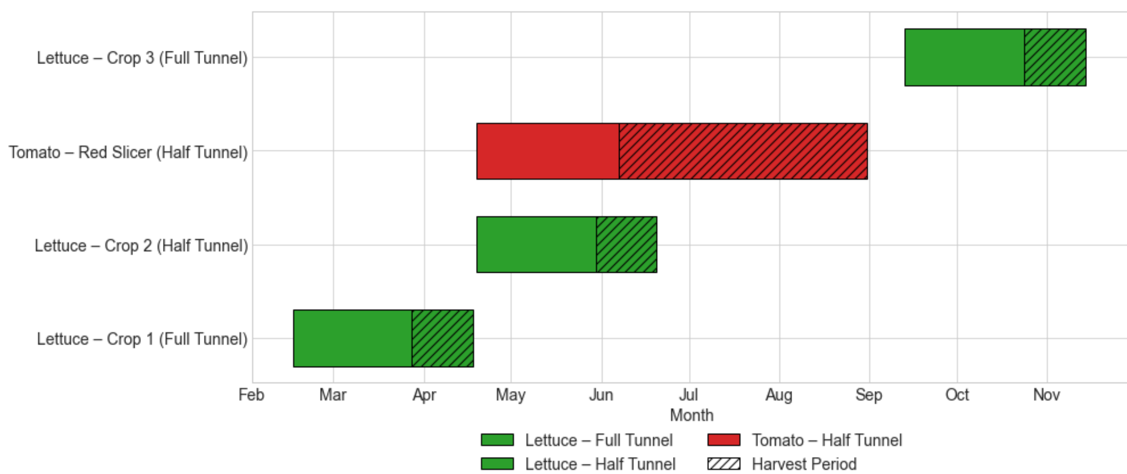

Figure 1. Assumed growing and harvesting windows for three lettuce crops and a tomato crop. Harvest windows are marked with diagonal stripes.

- **Marketing strategies**: Crops grown are sold through farmers markets and restaurants. Specifically, 50% of harvested crops are sold through farmers markets, and the other 50% are sold to restaurants.

Yield, Market Prices, and Gross Revenue

- **Lettuce yield**: For lettuce yield estimates, the average percentage of marketable yields from solarization field trials conducted in 2024 at the University of Tennessee Organic Crop Unit, Knoxville, TN, and the University of Kentucky Horticulture Research Farm, Lexington, KY, is used. Specifically, the average lettuce yield for the plots that were not solarized and were hand weeded. It is a common practice for HT growers to use hand weeding as a strategy to manage weeds. Results from a survey of Kentucky HT growers conducted in 2024 indicated that 95% of survey respondents used hand weeding as a strategy to manage weeds in their HTs (Velandia et al., 2025). Based on field trial information, a 75% marketable yield is estimated. This is consistent with assumptions from other studies evaluating the economics of HT lettuce production (Pedroso-Galinato et al., 2012a). In this publication, we assume 3-row beds with 1-ft spacing between rows, 9-inch in-row spacing between plants, and 2-ft walkways between beds (see Figure 2). Beds are 3 ft wide. This allows 120 lettuce plants per row x 15 rows, considering 84% of the tunnel is used for lettuce production for the first and last crops. This gives us 1,800 lettuce plants (120 per row x 15 rows) per tunnel (April and November crops). Assuming a 75% marketable yield, there are 1,350 heads per tunnel (1,800 heads x 75%) for the first and last crops (Table 1). For the second lettuce crop (June harvest), we assume approximately 50% of the area in production for HT is in lettuce production, and the other 50% is in tomato production. For this second crop, we assume 3 3-row beds, equivalent to 1,080 lettuce plants (120 per row x 3 rows x 3 beds) per tunnel. Assuming a 75% marketable yield, there are 810 lettuce heads (1,080 heads x 75%) for the second lettuce crop.

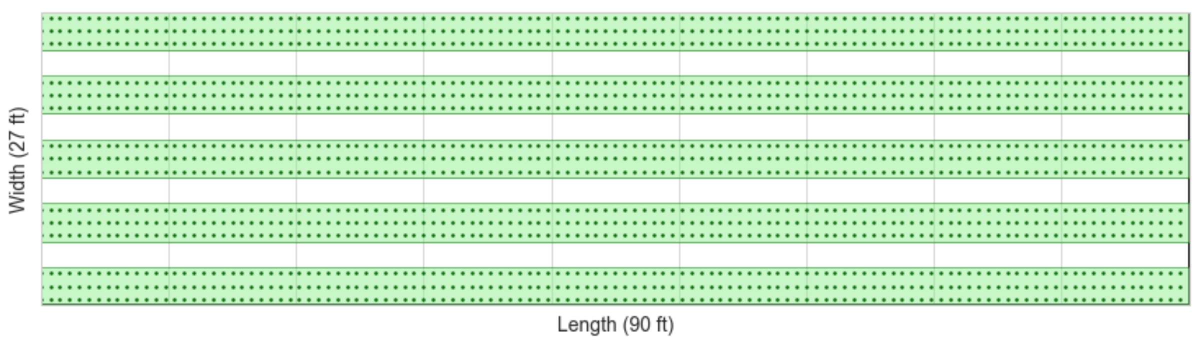

Figure 2. Assumed lettuce production space layout based on row and bed width, and in-row plant spacing, for a 27 x 90 ft area in production.

- **Tomato yield:** For tomato yield estimates, a yield for hybrid determinate red slicer varieties is assumed (e.g., Celebrity Plus, Red Deuce, Mountain Fresh Plus). Since approximately half of the HT is in lettuce and half in tomato production, there is space for three 90 ft-long rows on 4 ft centers and 2 ft in-row plant spacing. This spacing provides a total of 135 tomato plants. Average marketable yield is estimated at 25 lb per plant.

- **Lettuce and tomato prices:** Information from the Tennessee and Kentucky farmers markets' price reports available at https://ccd.uky.edu/pricereports is used to estimate tomato and lettuce prices. Common prices for lettuce and tomatoes observed across different Kentucky and Tennessee farmers markets in 2025 are used. Specifically, $3.50 per lb for tomatoes and $3.00 per lettuce head. We assume a 20% discount price for products sold to restaurants. For example, in Table 1, we show that the price for tomatoes sold through farmers markets is $3.5 while the price for tomatoes sold through restaurants is $2.80 ($3.5 x (1-20%)). In Table 1, we add the total revenue for each lettuce crop and for tomatoes sold through farmers markets and restaurants to estimate the total gross revenue. Total revenue for each crop sold through each market outlet is estimated as the price per unit ($/unit) multiplied by marketable yield. Total marketable yield is divided by two for each crop in each row of Table 1 to reflect that 50% of the crop production is sold through farmers markets and the other 50% is sold through restaurants. For example, the total marketable yield for the first crop of lettuce is 1,350 heads, 675 heads are sold through farmers markets, and 675 are sold through restaurants.

Table 1. Estimated gross revenue – HT lettuce and tomatoes.

GROSS REVENUE	UNIT	YIELD	$/UNIT	TOTAL
Tomatoes - Farmers Markets	lb	1,688	$ 3.50	$ 5,908.00
Tomatoes - Restaurants	lb	1,688	$ 2.80	$ 4,726.40
Lettuce (first crop) - Farmers Markets	head	675	$ 3.00	$ 2,025.00
Lettuce (first crop) - Restaurants	head	675	$ 2.40	$ 1,620.00
Lettuce (second crop) - Farmers Markets	head	405	$ 3.00	$ 1,215.00
Lettuce (second crop) - Restaurants	head	405	$ 2.40	$ 972.00
Lettuce (third crop) - Farmers Markets	head	675	$ 3.00	$ 2,025.00
Lettuce (third crop) - Restaurants	head	675	$ 2.40	$ 1,620.00
Total Gross Revenue				**$ 20,111.40**

Variable Costs

- **Lettuce seeds:** Based on the spacing and yield described above, 5,616 seeds are used for the entire year (assuming one seed = lettuce transplant, and an 80% germination rate). We obtain this number by calculating the total number of lettuce plants for the entire season (4,680) by 1.2. Based on prices from various input suppliers for a 1,000 seed pack, we assume a cost of $0.01 per seed ($10/1,000 seeds). This results in an estimated seed cost of $56.16 ($0.01 × 5,616 seeds) (Table 2).
- **Tomato seeds:** As stated above, there are 135 hybrid determinate red slicer tomato plants grown in the HT from April through August. To hedge for less than perfect germination and the potential of needing to replace a few plants once transplanted, 200 seeds are sown in four 50-cell trays. Based on the average cost of various hybrid determinate red slicer tomato varieties for a 250-seed

pack, a cost of $0.15 per seed is assumed. Cost will vary by tomato variety. We estimated a seed cost of $30 ($0.15 x 200 seeds) (Table 2).

Table 2. Annual variable costs except labor and marketing costs.

	UNIT	QUANTITY	$/UNIT	TOTAL
Seed Cost				
Lettuce seed	seeds	5,616	$ 0.01	$ 56.16
Tomato seed	seeds	200	$ 0.15	$ 30.00
Potting Soil	45 qt bag	8	$ 46.90	$ 375.20
Seed trays lettuce	72 cell tray	78	$ 1.03	$ 80.34
Seed trays tomatoes	50 cell tray	4	$ 1.18	$ 4.72
Fertilizer Cost				
Calcium Nitrate	lb	65	$ 0.61	$ 39.65
Wood Stakes (tomatoes)	stake	69	$ 1.10	$ 75.90
Twine/String	box (3 lb 6,300 ft)	1	$ 7.50	$ 7.50
Plastic mulch (tomatoes)	sq ft	1,080	$ 0.01	$ 10.80
Irrigation supplies				
Drip tape	3,000 ft roll	1	$ 93.00	$ 93.00
Lay Flat	linear ft 1-1/2" roll	25	$ 0.50	$ 12.50
Shade Cloth	1 32 ' x 100 '		$425.00	$ 425.00
Soil Test	test	1	$ 15.00	$ 15.00
Total Variable Cost				**$ 1,225.77**

- **Seed trays:** It is assumed 78 72-cell seed trays are used to grow lettuce and four 50-cell seed trays are used to grow tomato transplants. The cost per 72-cell tray is $1.03, and $1.18 per 50-cell tray. These prices are based on a cost of $103 per 100 72-cell trays and $118 per 100 50-cell trays. The total estimated cost for seed trays is $85.06 (Table 2).
- **Potting soil**: It is assumed that a compost-based potting mix is used to grow lettuce and tomato transplants. Approximately eight 45-qt bags are needed to fill 78 72-cell trays and four 50-cell trays. The cost per 45-qt bag is estimated at $46.90. Therefore, the potting soil cost is estimated at $375.20.
- **Fertilizer:** Following the University of Kentucky 2026-28 Vegetable Production Guide for Commercial Growers' recommendations for HT lettuce production (Gauthier et al., 2025), we assume 50 lb of nitrogen (N) is broadcast applied per acre, before planting lettuce. This is equivalent to 1.5 lb per 1,350 sq ft (the beds' area, 15 ft (5 3-ft wide beds) x 90 ft = 1,350 sq ft). After planting, an additional 50 lb of N is applied per acre (i.e., 1.5 lb per 1,350 sq ft). Total N applied is 3 lb per 1,350 sq ft. This is equivalent to approximately 20 lb of calcium nitrate per first and last crop of lettuce, or a total of 40 lbs. For the second crop, which will account for about 50% of the area in production, approximately 10 lb of calcium nitrate are required. We assume the total calcium nitrate applied across the three lettuce crops is 50 lbs.

We assume 50 lb of N per acre is applied before planting tomatoes. This is equivalent to approximately 0.6 lb of N for the beds' area (6 ft (3, 2 ft-wide beds) x 90 ft = 540 sq ft). Using calcium nitrate and broadcast applying is equivalent to approximately 3.8 lb of calcium nitrate. Two weeks after transplanting, weekly fertilization would begin using soluble fertilizer applied through the drip irrigation lines (fertigation) at 7.5 lb of N/week/acre or approximately 48 lb of calcium nitrate per week per acre, or 0.6 lb per 540 sq ft/week. This application continues through late August, for approximately 18 weeks. At the rate mentioned above, that is a total of 10.8 lb of calcium nitrate during the season (0.6 lb of calcium nitrate/week x 18 weeks = 10.8 lb). Total calcium nitrate applied for the tomato crop is 14.6 lb (rounded to 15 lb). The price per lb for calcium nitrate is estimated at $0.61 (Table 2).
The total cost of calcium nitrate is estimated at $39.65 ($0.61 x 65 lb).

- **Plastic mulch:** For tomato production, 1 mil, 4-ft wide white-on-black plastic mulch is used. This type of mulch reflects light, keeping soil temperatures lower. We assume the use of this mulch in the summer months when growing tomatoes to prevent excessive soil heating (Torres Quesada, 2024). We assume the cost of a 4 x 4,000 ft or 16,000 sq ft of a 1 mil, white-on-black roll is $165.96. That will be equivalent to $0.01 per sq ft. To cover three 90 ft long rows, we need 1,080 sq ft of plastic mulch, for a total cost of $10.80 ($0.01 x 1,080 sq ft) (Table 2).
- **Drip tape:** It is assumed that one drip tape line is needed per row of lettuce and tomato. The maximum number of rows at one time for the first and last crop of lettuce is 15 rows (5 beds of 3 rows each). This is the guideline we use to estimate the drip tape needed per season. That is equivalent to 1,350 linear ft of drip tape for the first and last lettuce crops (90 ft x 15 = 1,350 linear ft). It is assumed that a 3,000 ft roll is more than enough to cover the HT production area for a total cost of $93 (Table 2).
- **Other irrigation supplies:** We assume a cost of $148 per 300 ft 1-1/2" of lay flat, which is equivalent to approximately $0.50 per linear ft. We assume only about 25 linear ft are used for the area in production, for a total cost of $12.50 (Table 2).
- **Shade cloth:** We assume a 32 x 100 ft 30% shade cloth is used to reduce heat stress on lettuce and tomato production from mid-June through August (see Figure 3). The cost of a 30% shade cloth with these dimensions is $425 (Table 2).

Figure 3. Shade cloth installed over the soil solarization field trials conducted in 2024 at the University of Tennessee Organic Crop Unit, Knoxville, TN.

- **Soil test:** Soil test fees in the sample budget are from The University of Tennessee Extension's Soil, Plant, and Pest Center Fee Schedule. This cost is estimated at $15 per test per season (Table 2).
- **Stakes and strings for tomatoes:** Stakes are usually placed every other plant. Given an estimated 45 tomato plants per 90-foot row, approximately 23 stakes are required per row x 3 rows, for a total of 69 stakes for the high tunnel area in tomato production. The price per stake is estimated at $1.10. The total cost of the stakes is estimated at $75.90. A box of string is assumed to be more than enough to cover three 90-foot rows of tomatoes and costs $7.50 (Table 2).
- **Interest on Variable Cost** - Operating interest is assumed to be charged on half of all variable expenses, excluding marketing and labor costs. We assume an 8% interest rate.
- **Labor:** We use labor hour estimates for tomato and lettuce HT production from Washington State University's 2011 lettuce and tomato HT budgets as guidelines to estimate labor costs (Pedroso-Galinato et al., 2012a, 2012b). For labor hours associated with HT temperature management, we assume 15 hours, which is the estimated number of hours for HT lettuce production according to the Washington State University HT lettuce budgets (Pedroso-Galinato et al., 2012a). We adjusted Washington State University labor-hour estimates for planting and harvesting based on plant density or harvested pounds. For example, for lettuce, these budgets assume 5 hours are associated with planting 2,300 lettuce plants. We adjusted this estimate based on our estimated 4,680 lettuce plants planted for the entire growing season (4,680 plants x 5 hours / 2,300 plants = 10.2 hours). For labor hours associated with tomato harvesting, we use the Washington State University assumption of 80 lb per hour (Pedroso-Galinato et al., 2012b) to estimate the labor hours required to harvest 3,375 lb of tomatoes. All estimated labor hours are rounded to the nearest half hour (0.5 hour). The estimated wage rate is the 2025 Adverse Effect Wage rate for Tennessee and Kentucky ($15.87 per hour). We add 11% for workers' compensation and insurance, for an estimated wage rate of $17.62 per hour (Table 3). Although not shown in Table 3, we also add 50 hours of operator and unpaid family labor associated with other production and farm management activities, based on estimates from the University of Kentucky small-scale vegetable budgets

(University of Kentucky – Center for Crop Diversification, 2025). The hourly wage rate for operator labor is estimated at $42.30 based on the 2024 median paid for agricultural managers according to the US Department of Labor (Bureau of Labor Statistics - US Department of Labor, 2025).

Table 3. Annual production labor costs.

	UNIT	QUANTITY	$/UNIT	TOTAL
Temperature management HT	hours	15.0	$ 17.62	$ 264.30
Irrigation and fertigation management	hours	16.0	$ 17.62	$ 281.92
Planting (lettuce)	hours	10.5	$ 17.62	$ 185.01
Planting (tomato)	hours	2.5	$ 17.62	$ 44.05
Fertilizer (lettuce)	hours	0.5	$ 17.62	$ 8.81
Fertilizer (tomato)	hours	5.0	$ 17.62	$ 88.10
Trellis set up (tomato)	hours	1.5	$ 17.62	$ 26.43
Twine and pruning (tomato)	hours	6.0	$ 17.62	$ 105.72
Plastic and Stake removal (tomato)	hours	2.5	$ 17.62	$ 44.05
Harvesting (lettuce picking)	hours	37.0	$ 17.62	$ 651.94
Harvesting (tomato picking)	hours	42.5	$ 17.62	$ 748.85
Total Labor				**$ 2,449.18**

- **Marketing costs**
  Farmers Market Fees – There are costs associated with using farmers markets as a market outlet to sell vegetables (e.g., annual membership and booth fees). We use the average annual participation fees and booth fees from various farmers markets randomly selected in Tennessee at $30 and $840 ($35/day x 24 days), respectively (Table 4).
  Hired Labor – Farmers markets in Tennessee last three hours on average, although there are some that can last up to five hours; therefore, four hours of labor are calculated per market day. Additionally, approximately three hours are estimated for preparing produce for market, driving to market, booth setup and take-down, for a total of seven hours per market day. Assuming a grower offers produce throughout the growing season (May 1 to November 1) and attends farmers markets each week of the season, that gives us a total of 168 hours (24 days x 7 hours). We add 48 hours for delivering vegetables to restaurants (2 hours per week x 24 weeks). Thus, hired labor for marketing lettuce and tomatoes through farmers markets and restaurants totals 216 hours (Table 4).

Table 4. Marketing costs.

	UNIT	QUANTITY	$/UNIT	TOTAL
Farmers markets annual fee	year	1	$ 30.00	$ 30.00
Booth fee	day	24	$ 35.00	$ 840.00
Hired labor	hour	216	$ 17.62	$ 3,805.92
Gas/Fuel	gal	192	$ 2.90	$ 556.80
Total Marketing Cost				**$ 5,232.72**

Gas (Driving to market and to deliver to restaurants) – The cost of gas is estimated based on the assumption that the farm is 30 miles away from the farmers market. Gas prices are estimated using the U.S. Energy Information Administration Weekly Retail Gasoline, Regular price Midwest (PADD2) average, which includes Tennessee, from August 18, 2025 ($2.90/gal). Assuming a vehicle with a gas mileage of 15 miles per gallon, we estimate 4 gallons are required to cover 60 miles (round trip). If growers attend all 24 days of the season, a total of 96 gallons is required to cover 1,440 miles. We add 1,440 miles to account for restaurant deliveries, assuming restaurants are also about 30 miles away from the farm. This adds 96 gallons, for a total of 192 gallons of gas per season (Table 4).

Other – There may be additional costs associated with marketing, such as business cards, bags, signage, tents, tables, and other marketing materials that are not included in the sample budget but should be considered when selling produce at farmers markets.

Ownership Costs

A grower owns or controls assets that are used to produce income; in this case, that would include land, high tunnel, machinery, irrigation equipment, and other items. It is assumed that the high tunnel has an 8-year lifespan and the plastic covering has a 4-year lifespan (Chase & Naeve, 2012). We use the straight-line depreciation method (Kay et al., 2020) to estimate these costs. Annual depreciation using this method is estimated as,

$$Annual\ depreciaiton = \frac{cost - salvage\ value}{useful\ life}.$$

For the high tunnel, we assume that the salvage value or monetary cost of the high tunnel and its plastic cover at the end of their useful lives is zero. The annual depreciation for the high tunnel is estimated as ($16,547 - $0) / 8 = $2,068.38. The depreciation cost for the plastic cover is estimated as ($545 - $0) / 4 = $131.13.

We do not include land rental and depreciation on machinery and equipment (tiller, plastic mulch layer, tractor, etc.) in the sample budget because the costs are minimal. Depreciation associated with machinery and equipment could be minimal for a small-scale grower. Some small-scale growers may use a BCS walk-behind tractor with attachments (e.g., tiller, bed shaper, plastic mulch layer). The cost of these walk-behind tractors could range from $9,000 to $11,000, depending on the model and any added attachments. The annual ownership cost (i.e., depreciation) could be relatively low, given that these tractors could last a couple of decades, depending on yearly use and maintenance. Based on a conversation with a small-scale high tunnel grower in East Tennessee, it is not uncommon for growers using no-till practices to use basic tools to minimize soil disturbance in high tunnels, such as a Tilther. The cost of a Tilther is about $600. This tool is used to mix and blend the top two inches of soil into a finely groomed and leveled tilth ready for planting. Depending on use and maintenance, this tool could last a couple of decades. A small-scale grower could use a manual mulch layer to lay plastic mulch. The cost of this tool is about $1,200, and depending on use and maintenance, it could also be used for a couple of decades.

Returns over Total Costs

Based on the assumptions described above, annual total costs are estimated at $13,271.20, and annual return over total costs is estimated at $6,840.20 (Table 5).

Table 5. Estimated gross revenue, costs, and return over total costs of HT lettuce and tomato production for one season (baseline budget).

	Value ($)
Gross Revenue	**$20,111.40**
Variable costs	
Labor	$ 4,564.18
Marketing	$ 5,232.72
All other variable costs	$ 1,274.80
Ownership costs	**$ 2,199.50**
Total Costs	**$13,271.20**
Return Over Total Costs	**$ 6,840.20**

Economics of Soil Solarization

The costs associated with implementing soil solarization include a 6-mil clear greenhouse plastic to cover the entire HT. For the sample budget presented in this publication, we assume a 32 x 100 ft clear greenhouse plastic is used. The cost of plastic is estimated at $314. Additionally, we assume a total of seven man-hours are required to prepare the top six inches of soil, lay and secure plastic, and remove it once solarization is complete. Four man-hours are associated with tilling, removing large weed debris, and raking smooth to ensure contact between plastic and soil, and labor associated with irrigating the soil before implementing soil solarization. Three man-hours are associated with laying and securing the plastic and removing it once solarization is complete. We also assume the use of sod staples to pin down the plastic. Assuming we put sod staples every 2.5 ft, we will need approximately 94 sod staples (i.e., 90 ft / 2.5 ft = 36 sod staples x 2 sides + 27 ft / 2.5 ft =11 sod staples x 2 sides). Assuming an average cost per 1,000 box of 6” sod staples of $48, that will give us a cost per staple of about $0.05, and a total cost of sod staples to implement soil solarization in a 30 x 96 ft HT of about $4.70. Table 6 shows that the total cost of implementing solarization in a 30 x 96 ft HT is about $442. Figure 4 shows before-and-after pictures of soil solarization on an East Tennessee farm HT.

Table 6. Solarization costs.

	UNIT	QUANTITY	$/UNIT	TOTAL
Clear, 6 mil, UV treated, polyethylene	30 x 100 ft	1	$314.00	$ 314.00
Sod staples to secure plastic	sod staple	94	$ 0.05	$ 4.70
Labor - tilling and irrigating	hours	4	$ 17.62	$ 70.48
Labor - solarization	hours	3	$ 17.62	$ 52.86
Total Solarization Cost				**$ 442.04**

Figure 4. (Left) August 7, 2025, East Tennessee farm high tunnel ready for laying clear plastic to implement soil solarization; (Right) August 7, 2025, East Tennessee farm high tunnel after laying and securing plastic to implement soil solarization.

As stated in the introduction, the effectiveness of solarization in managing weeds, soilborne pests, and pathogens depends on temperature and timing. Because July and August are the best months to implement soil solarization, based on the assumption we made in our sample budgets, there are revenue implications of implementing this practice. First, suppose soil solarization is implemented anytime between the last week of July and the last week of August. In that case, part of the tomato yield must be let go since harvesting will need to stop between the last week of July and the last week of August. If soil solarization is not implemented, the harvest of tomatoes can continue until the last week of August. For growers who grow vegetable crops in HTs year-round, that is the most important implication of implementing soil solarization. We could consider the potential revenue loss associated with implementing soil solarization as the opportunity cost of implementing this practice. For those growers who usually stop producing in the summer months (e.g., July or August), the opportunity cost of implementing this practice is zero. It is important to note that we assume approximately 90% of the total tomato yield is harvested between June and the second week of August. We assume tomato yield declines in the last two weeks of August because tomato plants reach the end of their productive life cycle, and therefore, we assume that only 10% of the tomato yield is harvested during the last two weeks of August (Lessmann et al., 2025).

There are potential benefits associated with solarization that could compensate for the revenue loss associated with letting go of part of the tomato yield in the year when soil solarization is implemented. If there are soilborne disease issues in the HT, after implementing soil solarization, the yield losses associated with these issues could be reduced or eliminated. For example, according to Rudolph et al. (2025), in the presence of *Sclerotinia* spp. diseases in HTs, when solarization is implemented between two and four weeks during the summer months in Kentucky, the *Sclerotinia* spp. viability and percent germination could be zero percent. For the hypothetical HT budget we described above, the benefits of soil solarization are experienced only for the last lettuce crop, planted in the second week of September. *Sclerotinia* spp. can also affect tomatoes (Rudolph et al., 2025), but in this case, we assume decreased marketable yield only for lettuce due to *Sclerotinia* spp. It is important to note that *Sclerotinia* spp. is only one of the issues that soil solarization can address in HTs. It can be effective against other soilborne diseases, plant-parasitic nematodes, and certain weeds.

We assume the temperature between July and August is high enough to decrease *Sclerotinia* spp. viability and germination to zero percent. As expected, the earlier soil solarization is implemented, the more tomato yield the grower is letting go, and therefore, the higher the reduction in revenue from tomato production. For all these scenarios, we are adjusting tomato harvesting labor hours to reflect the reduced labor costs associated with stopping tomato harvesting as early as the last week of July. This adjustment is proportional to yield loss. For example, if 42.5 hours are needed to harvest 3,375 lb of tomatoes for the entire season, assuming 80 lb harvested/hour, then, when implementing soil solarization in the third week of August, approximately 38 hours are needed to harvest 3,038 lb. This means that an 11% reduction in yield is equivalent to approximately an 11% reduction in harvesting labor. We assume the marketable lettuce yield in the presence of *Sclerotinia* spp. is 61%. This assumption is based on the lowest marketable yield observed for Harmony lettuce in the presence of Sclerotinia spp. in HTs, according to Rudolph et al. (2024). Lettuce harvesting labor hours are reduced compared to the baseline scenario when we assume a 75% marketable yield. We present three lettuce marketable yield improvement scenarios after soil solarization is implemented, including marketable yield for the last lettuce crop (planted in September), after solarization goes from 61% to 75%, 80%, and 85%. The highest marketable yield assumption is based on the highest marketable yield obtained by Rudolph et al. (2025) for HT Harmony lettuce trials. In all these scenarios, we focus only on the economics of soil solarization during the year soil solarization is implemented. Although the benefits of soil solarization could be experienced the year after it is implemented, no studies have evaluated how long they last. A summary of all scenarios evaluated is presented in Table 7.

Table 7. Summary of scenarios evaluated based on solarization implementation timing and lettuce third crop marketable yield assumptions before and after implementation.

Solarization/No solarization	Tomato Marketable Yield	Lettuce (3rd Crop Marketable Yield)
No solarization	100%	61%
Solarization Timing		
July Week 4	63%	75%, 80% or 85%
August Week 1	72%	
August Week 2	81%	
August Week 3	90%	
August Week 4	95%	

Table 8 presents an example of how the baseline budget (Table 5) changes when assuming a 61% marketable yield before solarization is implemented, a solarization cost of $442.04, and a 75% marketable yield for the third lettuce crop after soil solarization is implemented.

Table 8. Estimated gross revenue, costs, and return over total costs of HT lettuce and tomato production for one season: solarization implemented in the fourth week of August, lettuce marketable yield before solarization is 61%, and 75% after solarization.

	Value ($)
Gross Revenue	**$18,485.10**
Variable costs	
Labor	$ 4,449.65
Marketing	$ 5,232.72
All other variable costs	$ 1,274.80
Solarization	$ 442.04
Ownership costs	**$ 2,199.50**
Total Costs	**$13,598.71**
Return Over Total Costs	**$ 4,886.39**

In Table 9, we show how returns over total costs, including the cost of implementing soil solarization, vary with improvements in lettuce marketable yield following soil solarization. It is important to note that the returns over total costs presented in Table 8 are the same as those presented in the last row of the second column in Table 9. This is expected, given that these are the returns for the 75% lettuce marketable yield after soil solarization scenario when implementing soil solarization in the last week of August. Results presented in Table 9 suggest that, for scenarios in which the lettuce marketable yield for the last crop increased from 61% to 75% or 80% after soil solarization, the resulting increase in marketable yield does not compensate for the revenue loss from terminating tomato harvesting earlier to implement soil solarization. In these scenarios, growers are better off not implementing soil solarization, because the return on total cost is highest in the no soil solarization scenario. These results do not account for subsequent years' losses due to *Sclerotinia* spp., which could be avoided if the benefits of soil solarization last at least a couple of months up to a year after implementation. For the scenario where the marketable yield of the last lettuce crop increases from 61% to 85%, returns over total costs are higher when soil solarization is implemented for at least two weeks, starting in the fourth week in August, compared to the no soil solarization scenario. In this case, the growers will be better off implementing solarization because of the improved lettuce marketable yield.

Table 9. Returns over total costs for different solarization timings and improved marketable yield (MY) scenarios after soil solarization.

MY=Marketable Yield	61% MY before solarization, 75% MY after solarization	61% MY before solarization, 80% MY after solarization	61% MY before solarization, 85% MY after solarization
Solarization Timing	**Return Over Total Costs ($/ 30 x 96 HT)**		
No solarization	**$5,192.34**	**$5,192.34**	**$5,192.34**
July Week 4	$1,727.19	$1,952.57	$2,177.95
August Week 1	$2,622.62	$2,848.00	$3,073.38
August Week 2	$3,509.23	$3,734.61	$3,959.99
August Week 3	$4,404.66	$4,630.04	$4,855.42
August Week 4	$4,890.75	$5,116.13	**$5,341.51**

Discussion

The scenarios of soil solarization presented above suggest that although the cost of implementing soil solarization is relatively low, ending the harvesting early of a high-value crop, such as tomatoes, in the year when soil solarization is implemented, could have a substantial impact on the return over total costs for growers growing crops year-round in their HTs. Nonetheless, if marketable yield improvements are substantial after soil solarization is implemented, the opportunity cost of forgoing potential tomato yield will be offset by the increased revenue from lettuce marketable yield improvements. Additionally, since we are just looking at the year when soil solarization is implemented, it is important to mention that marketable yield improvements could be experienced in the year after the implementation of soil solarization, which will result in higher returns over total costs after implementation. Nonetheless, as stated above, there is no information about the time frame over which soil solarization benefits could be experienced. For those growers who stop production in the summer months or who grow low-value crops in the summer months, the benefits of implementing this practice would likely outweigh the cost of implementing it.

Results presented in this publication regarding returns over total costs and the economics of soil solarization will change when the cost and product price assumptions change. Below is a list of limitations and caveats related to the assumptions presented in this publication, which readers should consider when using this publication to develop their own budgets:

- The results presented above are based on a hypothetical scenario in which only lettuce and tomatoes are grown in the HT. Growers are likely to grow a wide variety of crops throughout the growing season, which can vary by farm depending on grower and consumer preferences.
- Tomatoes can be planted earlier than April, but we assume tomatoes would be planted in April because we assume lettuce would be grown in the entire tunnel from mid-February to April.
- Prices at farmers markets vary by location, with prices at farmers markets located in higher-income or metropolitan counties having higher prices than those located in lower-income rural counties for some products (Velandia et al., 2024). Growers should take that into account when setting product prices.
- Growers will likely purchase larger quantities of inputs, such as seeds or fertilizer, in case something goes wrong, and to get discounted prices for large-quantity purchases. Therefore, input costs may be lower than the ones presented in this publication.
- Even though growers buy a whole roll of plastic mulch, in this sample budget, we only estimate the value of the plastic mulch associated with the tomato beds' area, so as not to overestimate the plastic cost.
- Although growers purchase a whole roll of lay-flat for irrigation, in this budget, we estimate only the lay-flat value associated with the area in production to avoid overestimating this cost.
- We did not include specific information on labor associated with HT tillage practices in this publication, as it likely varies by farm, depending on soil characteristics, tillage practices, and other factors.
- In the Washington State University HT lettuce budgets, it is assumed that only lettuce is grown in HT, so we may be underestimating labor hours associated with HT temperature management, given that we are assuming two crops are grown in the HT. Also, labor associated with HT temperature management would vary based on location and temperature.
- Some production practices from the Washington State University budgets do not apply to HT production in the US southeastern states, like Kentucky and Tennessee. For example, these budgets assumed the plastic cover would be removed at the end of the season and reinstalled at the beginning of the next season, because plastic covers in Washington may not be able to support snow loads during the winter months (Pedroso-Galinato et al., 2012a). Plastic removal every season is not a common practice in Kentucky or Tennessee. Therefore, in our sample budgets, we did not include labor costs for removing and reinstalling the HT plastic cover.

Acknowledgements

This research was funded by the Southern Sustainable Agriculture Research and Education (SARE) grant LS23-384.

References

Bureau of Labor Statistics, U.S. Department of Labor. (2025). *Occupational Outlook Handbook*, Farmers, Ranchers, and Other Agricultural Managers, at tiny.utk.edu/eAacz (visited *August 28, 2025*).

Chase C., & Naeve L. (2012). Vegetable production budgets for a high tunnel. Iowa State University Extension and Outreach.

Gauthier, N. (2026, January 8). *Solarization in Kentucky high tunnels for specialty crops* [Video]. YouTube. https://www.youtube.com/watch?v=iO1e12HwAbE

Gauthier, N., Leonberger, K, Dixon, E., Smith, H., Lamb, A., Kolawole, O., Rudolph, R., Wright, S., & Bessin, R. (2025). Vegetable Production Guide for Commercial Growers, 2026-28. Available at https://publications.mgcafe.uky.edu/sites/publications.ca.uky.edu/files/ID36-Vegetable-Production-Guide-for-Commercial-Growers-2026-28-Remediated.pdf

Hanson, K., Mahato, T., & Schuch, U.K. (2014). Soil solarization in high tunnels in the semiarid southwestern United States. *HortScience.* 49(9):1165–70. https://doi.org/10.21273/HORTSCI.49.9.1165

Kay, R.D., Edwards, W.M., & Duffy, P.A. (2020). *Farm management*. 9th ed. New York: McGraw-Hill.

Lessmann, P.L., Pettigrew, K., & Rudolph, R. (2025). Comparing open field to high tunnel summer tomato production [Unpublished manuscript]. Department of Horticulture, University of Kentucky.

Pedroso-Galinato, S., Miles, C.A., & Ponnaluru, S.S. (2012a). 2011 Cost of producing head lettuce in high tunnels in Western Washington. FS092E Washington State University Extension.

Pedroso-Galinato, S., Miles, C.A., & Ponnaluru, S.S. (2012b). 2011 Cost estimates of producing high-tunnel tomatoes in Western Washington. FS090E Washington State University Extension.

Rudolph, R.E., Bajek, V., & Munir, M. (2023). Effects of soil solarization and grafting on tomato yield and southern root-knot nematode population densities. *HortScience*. 58(11):1443–1449. https://doi.org/10.21273/HORTSCI17396-23

Rudolph, R.E., Dixon, E., Munir, M., Leonberger, K., Pettigrew, K., Polo, M., Smith, H.S., Bajek, V., Irwin, L., & Gauthier, N.A. (2024). Potential for cultural management of lettuce drop (*Sclerotinia sclerotiorum*) in high tunnels through modification of soil moisture, planting date, and cultivar. *Plant Health Progress*. 25(1):72-77. https://doi.org/10.1094/PHP-07-23-0069-RS

Rudolph, R.E., Dixon, E., Leonberger, K., Munir, M., Pettigrew, K., Polo, M., Smith, H.S., Lamb, A., & Gauthier, N.A. (2025). Effects of high tunnel soil solarization on *Sclerotinia sclerotiorum* in the temperate climate of central Kentucky. *Plant Disease* 109(4):842–50. https://doi.org/10.1094/PDIS-07-24-1550-RE

Torres Quesada, E. (2024). Plastic mulch selection for tomato production in North Carolina. N.C. Cooperative Extension. Available at tiny.utk.edu/PvRAh

University of Kentucky – Center for Crop Diversification. 2025. Budgets. https://ccd.uky.edu/resources/budgets

Velandia, M., Bedwell, M., Lambert, H., Bergerson, B., Sammons, L., Rickman, S., Lamb, E., Powell, L., Rihn, A.L., & Shanto, H.H. (2024). Price trends at Tennessee farmers markets 2018-2023. UT Extension Publication, W1270. https://utia.tennessee.edu/publications/wp-content/uploads/sites/269/2024/10/W1270.pdf

Velandia, M., Rudolph, R.E., Wszelaki, A.L., Turner, Z.A., & Schexnayder, S. (2025). A survey of Kentucky high tunnel vegetable growers: production challenges faced and strategies used to overcome them. *HortTechnology*, *35*(2), pp.177-185.

Warren County Agriculture. (n.d.). *Soil solarization* [Video]. Facebook. https://www.facebook.com/warrencountyag/videos/soil-solarization/749150020988137/

Suggested Citation:

Velandia, M., Rudolph, R., Turner, Z., & Wszelaki, A., (2026). *Sample Tomato and Lettuce Budgets and the Economics of Soil Solarization in High Tunnel Production.* CCD-BG-14. Lexington, KY: Center for Crop Diversification, University of Kentucky, Martin-Gatton College of Agriculture, Food and Environment. Available: https://ccd.uky.edu/resources/budgets

Authors: Margarita Velandia, Professor, Zoe Turner, Undergraduate Research Assistant Department of Agricultural & Resource Economics, University of Tennessee, Annette Wszelaki, Professor Department of Plant Sciences, University of Tennessee, Rachel Rudolph, Extension Professor, Department of Horticulture, University of Kentucky

Reviewed by: Suzette Pedroso Galinato, Associate Professor, Washington State University and Tim Woods, Extension Professor, University of Kentucky