

Seasonal High Tunnel Production: Organic Tomato Guide

DEVELOPED BY **The Carolina Farm Stewardship Association**

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CAROLINA FARM STEWARDSHIP ASSOCIATION

The Carolina Farm Stewardship Association (CFSA) is a farmer-driver, membership-based 501(c)(3) non-profit organization that helps people in the Carolinas grow and eat local, organic foods by advocating for fair farm and food policies, building the systems family farms need to thrive, and educating communities about local, organic agriculture.

For more information, please visit www.carolinafarmstewards.org.

Introduction

High tunnels are unheated polyethylene-covered structures that are typically cooled through passive ventilation. High tunnels increase day and night temperatures and protect crops from many environmental factors such as wind and precipitation. Many crops can be profitably grown in high tunnels including various varieties of tomatoes (*Lycopersicon esculentum*). Tomatoes are an integral part of many farms in North and South Carolina. Although field production of tomatoes is common, there are many benefits of growing tomatoes in high tunnels including higher marketable yields, lower disease pressure and season extension. Research has shown that heirloom tomatoes grown in high tunnels in North Carolina can be ready for market three weeks earlier with 55% more marketable fruit compared to field production (O'Connell et al., 2012). However, effectively growing tomatoes in high tunnels can be challenging. This guide provides information on proper high tunnel tomato production to help increase the yields and crop success across the Carolinas.

Variety Selection

There are many varietal characteristics that should be considered when choosing appropriate tomato varieties including customer preference, days to maturity, and disease resistance. Some characteristics can lead to better performance in high tunnels due to the unique microclimate and should also be taken into consideration, specifically:

1. **Determinate vs Indeterminate:** Determinate tomato plants are smaller plants that typically flush 1-3 fruit clusters whereas indeterminate tomato plants continue growing and setting fruit until outside environmental factors, like a heavy frost, limit growth. Both variations perform well in high tunnels but have different harvesting and care requirements. Determinants require less in-season maintenance but only produce a limited amount of fruit. Indeterminate varieties are great for early spring production that will carry through into the summer months. Determinate varieties are optimal for fall production although their application in the spring can ensure a heavy early harvest.
2. **Flavor:** Many hybrid varieties are bred for earliness, disease resistance and/or harvest amounts. The promise of an early abundant crop is tempting but the fruit flavor can suffer to achieve this end goal. If flavor is a top priority, consider heirlooms. Heirloom tomatoes can be difficult to grow profitably due to disease susceptibility, low marketable fruit quantities and limited shelf life. High tunnels offer a protected growing environment that increase effectiveness in growing heirloom tomatoes. Heirlooms come in all shapes, colors and sizes. Many breeders are developing hybrids that mimic heirloom flavor but also add some disease resistance.
3. **Specialty Varieties:** Niche markets for specialty tomatoes can be supported through high tunnel production. French hybrid heirlooms are reminiscent of French heritage tomatoes and grow exceptionally well in tunnels. Heart shaped tomatoes like 'Oxheart' are unique and can suit some niche tomato markets. Finally, high quality cherry tomatoes like 'Indigo Kumquat', 'Sakura' and 'Black Cherry' grow well in tunnels.

Grafted Plants

Although most tomato plants can be grafted, certain varieties, like heirlooms, benefit more from the practice. Grafted tomato production can be used in the field, high tunnel, and greenhouse to increase yields and decrease disease incidence. The use of grafted tomatoes is particularly beneficial in high tunnels due to common soil issues that can arise. Heirloom tomatoes are growing in popularity among chefs, local consumers and large scale buyers making them a profitable crop for high tunnel production; the use of grafted heirloom tomato plants can increase this profitability. Considering this demand, farmers stand to make a profit off the crop through many market venues. Grafting tomatoes onto resistant rootstock varieties can also reduce disease pressure, producing more marketable fruit than non grafted plants (Figure 1).



Figure 1. Un-grafted (left) and grafted (right) Brandywine Tomatoes showing different levels of disease damage.

Scion: A scion is the upper fruiting portion of a grafted plant. Production and yield goals, combined with market needs, should be considered when choosing a scion variety. Consider planting a few different varieties. Some heirlooms that work well for grafting and high tunnel production are: ‘Brandywine’, ‘Cherokee Purple’ and ‘German Johnson’ although others are available.

Rootstock: The rootstock is lower portion of a grafted plant which mainly consists of the root system. When choosing a rootstock you must match it’s attributes to your production goals and scion variety. The United States Department of Agriculture (USDA) published a Description of Commercial Tomato Rootstocks that provides the attributes of commercially available rootstocks. Many seed companies will assist in making the best rootstock choice. Keep in mind that the temperature inside the high tunnel can be high in the summer so it is important choose heat tolerant varieties like ‘DRO141TX’ for summer production. Other common rootstock varieties include ‘Maxifort’ and ‘Estimino’. There are a few certified organic options available,

however, if you are looking for specific attributes not available organically, get approval from your certifier before planting. Cost to grow or purchase grafted transplants are greater as compared to un-grafted however, sales from increased marketable harvests can offset these costs.

Assess the Microclimate

All high tunnels are different. With this in mind, assess the conditions in the tunnel and understand how management practices impact the microclimate. Installing temperature monitors will enable monitoring of low nighttime temperatures and high daytime temperatures. This will impact planting dates, projected yields, and use of row covers. Hi/Low temperature monitors are readily available and prices range from \$25 to several hundred dollars. Tracking temperatures over a few years can give a good idea of a tunnel’s capability to maintain optimal temperatures.

Planting Dates

Tomatoes will need at least ten hours of daylight and cannot withstand freezing temperatures for much more than 30 minutes without sustaining fatal damage. Considering frost dates and daylight, an estimated spring planting date for hardiness zone 7 would be March 20 and zone 8: March 1 (Table 1). If your tunnel is in full direct morning sunlight, it will warm up quickly and decrease the amount of time below freezing. The later a tunnel receives morning sun, or decreased amount of morning sun due to shading, the longer it will stay below freezing and therefore later transplant dates are required. The use of row cover also impacts planting dates. Utilizing covers will create an opportunity for earlier plantings.

Table 1. General High Tunnel Planting Dates for Tomatoes in Hardiness Zone 7 and 8.

Season	Hardiness Zone 7	Hardiness Zone 8
Spring: Plant after	March 20	March 1
Spring: Plant before	April 15	April 1
Fall: Plant after	July 15	August 1
Fall: Plant before	August 15	September 1

Create a Production Plan

Once varieties and planting dates have been determined, a production plan should be created to include a timeline, estimated time input, general maintenance schedule, irrigation plan, nutrient management plan, anticipated first harvest date, and projected harvest amounts. A pest management plan should be developed to mitigate high pest and disease pressure. Production plans can simply be notes on a calendar, or they can be an in-depth spreadsheet. Choose the style that best fits production needs.

Seed Date

When growing transplants, determining a seeding date is important. The seed date will depend on greenhouse conditions. Greenhouses managed at an optimal temperature range of 75-80°F will produce transplants more quickly as compared to structures that experience temperatures outside of this range. The

amount and quality of daylight can also impact seedling development. In some areas, daylight can be a limiting factor in transplant production for early spring crops. Under optimal conditions seedlings need approximately four weeks from seeding date to transplant date to reach a suitable size. If optimum growing conditions are not attainable, plan on a five week transplant production period, or longer, to account for inconsistencies in the growing environment. For example, if you are targeting a transplanting date of March 15, seed transplant trays on February 8.

Carefully calculate how many seeds to start. The number of tomatoes per bed will be based on in-row and between row plant spacing, discussed below. To determine how many seeds to start, multiply the number of plants per row by the number of rows per bed by the number of beds. Increase the total number of plants needed by 20% to account for germination issues and transplant loss. If grafting, increase total number of seeds started by 50% to account for germination issues and loss of plants during the grafting process.

Grafting

Although grafting may not impact transplanting dates and other post-plant practices, seeding dates are affected. Tomato plants loose about a week of growth due to the healing process. Also, rootstocks and scions may have varying growth rates. Take this into account when deciding on seeding dates for both the scion and the rootstock.

Bed Preparation

Tomatoes prefer deep beds and well-drained soil, which can be achieved by making raised beds that will increase drainage and rooting capacity. Till soils before attempting to shape beds to increase soil tilth. If using cover crops, terminate and incorporate the cover crop several weeks prior to shaping beds to allow for decomposition. Form beds to a depth of at least 3 inches and up to 12 inches. Install drip irrigation and mulch. For information on high tunnel irrigation see our [High Tunnel Micro-Irrigation Guide](#).

Bed width and length will depend on the tunnel size and trellising. Typical bed width is 30" and length will depend on the size of the high tunnel and required space for irrigation header pipe. With 30" beds, tomatoes can be planted two rows per bed at 24" staggered spacing OR one row per bed at 18-24" spacing. Roller hook/line trellising can accommodate two rows of tomatoes per bed while Florida weave typically accommodates only one row per bed.

Mulch

Mulch can be used to regulate soil temperature, reduce weeds, and reduce water evaporation from the soil surface. Plastic mulch is a popular choice among many farmers and comes in different colors, which impacts soil temperature (Table 2). Black plastic mulch can be used in early spring production to increase soil temperatures. White plastic mulch will decrease soil temperatures for summer and fall tomato production. Reflective mulches can be used to reduce pest pressure. Clear plastic mulches can be used to solarize high tunnel soil while not in production to reduce weed pressure and mitigate soil born disease.

Table 2. Plastic mulch effects on soil temperature.¹

Mulch Type	Soil Temperature Increase (+) or Decrease (-) (°F)
Black	+5
Clear	+8-14
IRT (Infrared Transmissible)	+5-10
White	- 2

¹Jett, L.W., Production of Tomatoes within a High Tunnel.

When using plastic mulch, drip tape should be laid on top of bed with the emitters facing up. Contact between the plastic mulch and soil surface should be maximized to achieve desired soil temperature affects. Alternative and organic mulches are also available. Compost, straw and paper can be used instead of plastic to regulate soil temperature and moisture. Use caution when purchasing natural mulching products to ensure no harmful contaminants are being introduced into the tunnel. Weed pressure may still be high when using non-solid mulches.

Soil Test

Soil testing in high tunnels is essential in order to determine nutrient availability and soil health. Due to the enclosed nature of high tunnels, soil health can suffer. Collect a sample and receive results prior to the transplant date. Also use soil sample results to track nutrients and other soil health factors over several years. Salt accumulation is a common issue in high tunnel production due to irrigation/fertilizer residue and lack of rainfall. Diagnostic testing will give values for salt content which can be easily tracked.

Fertility

Each vegetable crop has unique nutrient needs and tomatoes are no exception. Use fertilizer recommendations provided on soil test results or use nutrient amounts to develop a fertilizer plan. Tomatoes grown under plastic require a pH of 6-6.5, 130-210 lbs. /acre Nitrogen, 200 lbs. /acre Phosphorus, and 420 lbs. /acre Potassium (Kemble, et. al., 2016 and The Southeast Vegetable Handbook, 2017). Use soil test results from a lab to determine available nutrients before developing fertilizer plans with required nutrient amounts; available nutrients must be subtracted from total required. Direct specific questions about testing methods, results and fertilizer recommendations to the testing laboratory. Other necessary nutrients for tomatoes are Calcium and Boron. For more information on the nutrient requirements of tomatoes and other crops visit the [SE 2017 Vegetable Handbook](#). Tomatoes require varying levels of nutrients throughout their life cycle. For example, tomatoes require high levels of potassium during flower set, however, the need for potassium decreases during fruit growth. Therefore, to ensure healthy plants, make sure the tomatoes have appropriate nutrients at the appropriate times in the life cycle. One potential issue in high tunnels is excessive nutrient loads and high salt content that comes with over fertilization, therefore, be sure to avoid over fertilization of crops.

Compost and other high organic matter amendments can be added prior to transplanting. Increasing organic matter will increase soil moisture retention, increase nutrient content and in most cases increase the health of the soil. However, similar to fertilizers, compost and other organic matter inputs can have negative

impacts on soil health. High phosphorus levels can be experienced with excessive manure applications. Also, any contaminants brought in through compost can be difficult to mitigate once inside a protected structure like a high tunnel. Only source compost and other amendments from reputable retailers.

Trellising Methods

Trellising provides tomato plants with support to eliminate damage to stems, leaves, and fruit. Trellising can also decrease shading within the tunnel, increase the number of plants per bed, decrease disease and reduce plant/fruit contact with the soil. Trellising methods will differ based on high tunnel structure components, tomato variety, and time of year. High tunnels with 'V' or 'W' truss systems can support roller hook or line trellising. With this trellising method, a cable is run lengthwise just over the cross brace. Trellising lines can then be attached to the cable and secured into the ground using a landscape staple. Tomato plants are then trellised up the line using tomato clips (Figure 2). This trellising method is best for indeterminate tomatoes; note that this method does not work well with row covers. Therefore, if using this method consider installing the trellising after the threat of frost in spring. With roller hook trellising, a 30' x 96' high tunnel can accommodate approximately 540 plants.



Figure 2. Big beef tomatoes on roller hook trellising at NC A&T University Horticulture Unit.

Florida weave, also known as stake and weave, trellising is also an option for high tunnel tomato production.

With this method, stakes (either T post or wooden stakes) are driven into the ground at a spacing of every 2-4 plants. Tomato twine is then woven around the stakes and plants to keep vegetation upright (Figure 3). This method can be used for determinate or indeterminate tomatoes although indeterminate plants may need to be topped due to 'out growing' the trellis system. Row covers can easily be draped over the stakes making this a great option for fall production. Row covers can also be fitted lower on the trellis system for early spring production. With Florida weave trellising, a 30' x 96' high tunnel can accommodate approximately 360 tomato plants.



Figure 3. Florida weave trellising being used in a high tunnel at Lomax Incubator Farm.

Row Cover

Tomatoes are a warm season crop that can sustain damage and/or death from frost and freezing temperatures; therefore, row covers are essential for early spring and late fall production. Having the row cover on hand can provide some assurance that crops will not suffer severe cold damage. Row cover can be used on a nightly basis or as needed. Row cover comes in various weights from insect netting to heavy weight frost cover. A medium weight cover will help provide light frost protection and works well when used in high tunnels. Low tunnels can also be used within a high tunnel. Low tunnels consist of pipe or metal hoops covered in plastic to increase soil and air temperature surrounding plants to further extend the growing season and protect plants from freezing temperatures. A study conducted in Utah on the utilization

of low tunnels inside high tunnels resulted in a 5.4°F increase in air temperature under the low tunnels from ambient high tunnel air temperature (Hunter et. al., 2012).

Row cover should be suspended just above plants when freezing temperatures are forecasted (Figure 4). PVC, metal or conduit can be hooped over beds and provide support for covers. Florida weave trellising can provide structure for row covers as discussed earlier. When not in use, covers need to be kept clean and dry. Using mulch in tunnel walkways will provide protection to reduce row covers from becoming dirty and damp.



Figure 4. Row cover being used in a high tunnel for early spring tomato production in combination with Florida weave trellising.

Transplant to Harvest

Tomato plants require routine maintenance from time of transplant through plant removal. Carrying out this maintenance is essential to ensure plant health and quality of fruit. Although many aspects of tomato production is similar, specifics around proper plant care depend on variety, trellising and production goals.

Transplanting

Before transplanting all seedlings should be hardened off. Hardening off allows for transplants to become acclimated to a new environment before being planted to reduce transplant stress. To harden off transplants, expose them to high tunnel conditions for approximately 3-7 days while still in trays. Trays can be placed inside the high tunnel during the day and returned to the greenhouse for protection at night if needed. If conditions are optimal, trays can be left in the high tunnel through the night.

Prior to and after planting, irrigate to increase soil moisture. Planting into moist soil will reduce stress on

transplants. Measure and mark plant spacing on beds to ensure consistent planting distances and efficiency of drip irrigation. If using plastic or other solid mulches, pre-punch holes at appropriate spacing prior to planting.

Soil temperatures should reach or exceed 60° before transplants can be placed in the high tunnel. When transplanting, transplant soil line should be placed evenly with natural soil level (or top of raised bed). Gently cover any exposed root ball with tunnel soil to regulate water retention. Place drip irrigation line(s) next to plants. Given the trellising structure may not accommodate small plants, transplants may require additional support after transplanting to reduce injury. Support can be provided through small stakes and landscape tape or clips. If planting grafted plants, be sure to keep the graft union above the soil line to reduce soil contact with the scion, reducing disease risk.

Temperature Management

Managing temperatures inside a high tunnel is achieved through solar radiation and passive ventilation. High tunnels capture heat during the day through solar radiation. As the temperature nears a plant's optimal range, opening the sides, end walls, and vents prevents the temperature from exceeding the optimal range. However, temperatures in high tunnels during the summer typically exceed the optimal range even with proper ventilation. A shade cloth can be installed to help reduce high tunnel temperatures during summer months. One benefit of high tunnel production is the ability to reduce time spent experiencing freezing temperatures. Temperature lows are typically experienced between 4:00 AM and 6:00 AM, shortly before sunrise. Tunnels capture early morning sun and heat up more quickly as compared to outside air temperatures helping many plants, like tomatoes, which can only survive short periods below freezing.

The optimal range for tomato plants is between 70 and 85°F with a base temperature of 50°F. Considering this, tunnels should be vented when outside air temperatures exceed 50°F and/or high tunnel air temperatures exceed 80°F. Close sides, ends and vents roughly one hour prior to sunset only on days when nighttime outside air temperature is forecasted below 50°F. During spring when outside night time air temperatures are above 50°F, the tunnel can be left vented through the night. When nighttime outside temperature is forecasted well below the optimal range for tomatoes, closing the tunnel in the afternoon or early evening can help capture and retain hot air through the night time.

One benefit of a high tunnel microclimate is the elimination of natural moisture. When plants and leaves are kept dry, disease risk is reduced. A study conducted in Knoxville, TN resulted in significantly lower incidences of early blight on organic tomatoes grown in high tunnels compared to field production (Rogers and Wszelaki, 2012). However, improper venting can increase humidity, increasing leaf wetness and therefore increasing disease pressure. Proper ventilation and leaving tunnels vented overnight will decrease leaf wetness and help reduce disease.

Weather can significantly impact the temperature in a high tunnel. For example, full sun can increase temperatures in a tunnel well above the ambient air temperature while cloudy days will leave the tunnel within a few degrees of ambient air temperature. Weather factors to consider while managing high tunnel temperature include air temperature, cloud cover, wind, humidity and hourly night temperatures.

Irrigation

Irrigation amounts fluctuate depending on environmental stresses, drainage and plant growth. On average, tomatoes require one inch of water per week. This amount is decreased during early stages of plant development and increased during fruit set/growth. Fortunately, high tunnels help to regulate soil moisture through shading and the exclusion of rain fall making irrigation schedules more consistent compared to field production. Irrigate the crop once or twice daily to provide consistent water availability and eliminate water loss due to soil drainage. The length of each watering event will depend on plant development, mulching and soil type. Soils should never become completely saturated. Saturated soils experience less air exchange and can cause plant damage. Moist soil should be maintained in the root zone of the tomato plants. Monitor plants and soil to adjust water amounts as needed. For example, plants wilting mid-day will require an increased water amount and/or more frequent watering. In contrast, plants with cracked fruit will require decreased water amounts. Irrigate tomatoes consistently and uniformly to avoid issues like cracking. For more information download the [High Tunnel Micro-irrigation Guide](#).

Pruning

One of the most important and time consuming maintenance practices in tomato production is pruning. Pruning plants increases tunnel ventilation, decreases disease and encourages healthy plant growth. Pruning practices vary depending on variety, trellising method and production goals. For determinate tomatoes, pruning is limited to the lower portion of the plant. As the plant generates more upper leaf area, prune off bottom leaves up to the first flower cluster. Throughout production, remove leaves that are in contact with the mulch or soil. Removing bottom leaves reduces contamination risk via soil-foliage contact. For indeterminate tomatoes, initiate pruning by removing all lower leaves up to the first flower cluster. After tomatoes are harvested from the first flower cluster, prune off all leaves up to the second flower cluster (Figure 5). If using Florida weave trellising for indeterminate plants, topping will be required to reduce damage to plants. When topping plants, cut off the growing point when it grows past the top of the trellis structure. Suckering or re-topping will be required until the plants are terminated.



Figure 5. Example of an un-pruned (left) and pruned (right) tomato plant.

With both determinate and indeterminate tomatoes, any diseased or damaged foliage should be removed during the pruning process. This will decrease disease and disease spread within the high tunnel. Prune

close to the main plant stem(s) and avoid leaving stubs from leaf branches on the plant. Consider scouting for insects while pruning. Removing leaves can expose infestations of harmful insects such as aphids (Figure 6). Sanitation of pruning tools is essential to minimize contamination and disease spread. Wipe pruning shears or knives with sanitizer between each plant.



Figure 6. Aphids on tomatoes leaves.

Suckering

Suckering tomato plants helps to control and direct growth. Tomato plants are typically suckered to one or two main stems, or leaders. Each leader is allowed to grow in a vertical direction guided by the trellising structure. Suckers are typically located at the apex between the main stem and a leaf branch although they can exist on other parts of the plant such as flower clusters and leaves. Suckers should be cut or snapped off when under two inches long. If suckers are allowed to grow too large, stem damage can occur during the removal process. Always trim suckers close to the main stem and avoid cutting leaf branches (Figure 7).



Figure 7. A sucker being removed from an heirloom tomato plant.

Scouting for Pest and Disease

Proper scouting techniques can be used to determine insect and disease pressure within a high tunnel. Scouting can occur during pruning events or separately. All harmful and beneficial insects should be noted. Whole tunnel scouting can be time consuming and unnecessary. To effectively scout, isolate a few plants per row or area and thoroughly count all insects and species. If populations near set thresholds, action should be taken. For information on scouting watch [Scouting Vegetable Crops: An Introduction for Farmers](#).

Disease can spread rapidly in high tunnels and early detection is necessary to effectively control outbreaks. When pruning, note any diseased plants and location within tunnel. Remove all diseased foliage or whole plant if necessary. Many disease symptoms can originate and spread due to high humidity and leaf wetness. Vent the high tunnel to avoid increased humidity and help reduce disease.

Identifying the disease can ensure the correct steps are taken to control the outbreak. Clemson University's resource on [Tomato Diseases & Disorders](#) is a good place to start. Local extension agents can also help identify disease and other issues surrounding tomato production. Finally, submitting samples of diseased plants can help identify a disease. In North Carolina growers can submit samples to the [North Carolina Pest and Disease Clinic](#), South Carolina growers can submit samples to the [Clemson's Plant Problem Clinic](#).

Pollination

Tomatoes are pollinated by wind and in some cases insects, like bumble bees. Lack of air movement or low insect populations can impact the pollination of tomato flowers. Typically tomato plants will naturally pollinate in a high tunnel with proper ventilation. However, if ventilation is reduced, hand pollinating can be conducted. Hand pollinating can be completed through shaking plants or simply increasing air circulation around flowers with mechanical toothbrushes, fans or leaf blowers. Note that most tomato plants require temperatures between 60 to 90°F to successfully flower and pollinate. [Tomato pollination and how to increase it in high tunnels](#) is a great resource to learn more about the importance of pollination for tomato production in high tunnels.

Harvest

Tomato plants should always be harvested in the morning, before the high tunnel accumulates heat, in order to maintain postharvest quality. Harvest methods depend on variety and packing requirements. Wholesale markets often have specific product specifications, which should be considered prior to variety selection to ensure the fruit will meet requirements. Develop an on-farm produce harvesting safety procedure if one is not already in place. Be aware that some buyers may require GAP certifications. For more information on food safety plans and GAP certifications visit [CFSA's GAP Consulting](#).

Tomatoes will bruise easily and should be handled as infrequently as possible during the harvesting and postharvest process. Harvesting at an early to mid-breaker stage (Figure 8), while the fruit is still firm, is desirable due to a decreased risk of bruising or damage.



Figure 8. Brandywine tomatoes at the early to mid-breaker stage.

Tomatoes can be harvested with the cap on or off, depending on buyer specifications. The cap consists of the stem structure connecting the fruit to the plant. Although leaving the cap on can increase aesthetic appeal, it can also cause damage during the packing and transit process. To leave caps on and limit damage, pack no more than two layers of tomatoes per container/crate/ box. Place the first layer of tomatoes cap down and the second layer cap up. Store tomatoes in a dark, cool room until market; an optimal temperature is 55°F. Cherry tomatoes and specialty varieties have various packing options and may require the use of clamshells or other small containers. Consider market demand, aesthetics, and pricing when making choices on packaging.

Most tomato varieties will require multiple harvests during the week. Plan harvests according to fruit maturity, market needs and input applications. Please note that most tomato varieties will only ripen when temperatures are between 50-85° F. If a tunnel sustains temperatures outside of this range for several days, harvests may be decreased.

Economics and Potential Profits

In 2016, North Carolina organic tomato sales totaled \$5,200,567 (USDA, 2017) making it one of the highest grossing specialty crops in the state. Many small farms can capitalize on tomato production and sales. Farmers can further increase sales by using high tunnels to achieve season extension. High tunnel tomato production can yield a marketable harvest 2 to 4 weeks early as compared to field production. Capturing this early market can bring premium prices. In many areas a late crop of tomatoes, made possible through season extension in high tunnels, can also lend high profit margins. Timing and labor input for high tunnel tomato production is similar for early, late and in-season production.

Through research conducted at Elma C. Lomax Incubator Farm, high tunnel tomato production was estimated to require an average of 6 hours per week per 180 tomato plants. Less time was spent early in the production season and increased at 8 to 10 weeks after transplanting.

The total amount of time spent throughout the season from March 22 through July 20 was 102.75 hours, excluding transplant production. Assuming a wage of \$15 per hour, total labor cost would be approximately \$1,540.00 (Table 3).

Table 3. Estimated Economic Analysis for Grafted Versus Un-grafted Tomato Production in a 30' by 96' High Tunnel.¹

ITEM	GRAFTED	UN-GRAFTED
Transplant Production		
Labor ²	\$505	\$70
Supplies	\$130	\$45
<i>Subtotal</i>	\$635	\$115
In-Season Production		
Labor	\$1,540	\$1,540
Supplies	\$615	\$615
<i>Subtotal</i>	\$2,155	\$2,155
PRODUCTION TOTAL	\$2,790	\$2,270
Return		
Marketable Fruit	1,880	1,545
Revenue ³	\$4,880	\$4,017
NET PROFIT	\$2,098	\$1,747

¹Based on 180 plants per 270 row feet in a 30' by 96' high tunnel.

²Calculated at a rate of \$15 per hour based on time valued by local farmers.

³Calculated on a rate of \$2.60 per pound based on average 2017 organic tomato prices in the Southeast (USDA Market News, 2017) .

Harvest amounts vary greatly depending on variety. Many hybrid indeterminate varieties can yield well over 20 lbs. of marketable fruit per plant while heirlooms typically yield under 10 lbs. per plant. Certified organic research plots from the above project yielded an average of 8.58 lbs of marketable fruit per heirloom tomato plant. Assuming an average \$2.60/lb. sale price, income from 180 tomato plants would total almost \$4,017.00. Based on labor and cost of supplies, a net income from the 180 tomato plants would be \$1,747.00. Grafted heirloom tomatoes in a high tunnel would lend a net profit of \$2,098.00 from 180 plants.

Conclusion

Although time consuming, tomato production in high tunnels can be profitable. Coordinating other farming obligations around high tunnel schedules can ensure time for proper care of tomatoes and management of the high tunnel. Marketing, not discussed here, plays an influential role in profit margins. When developing

production plans, consider marketing venues and prices to ensure the highest net profit possible. In high tunnels, as with most farming practices, planning is key. Carefully consider the tips and recommendations set forth in this guide while creating production plans for high tunnel tomatoes.

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Additional Resources

[Root Development of Vegetable Crops](#)

[Vegetable Crop Irrigation](#)

[SARE High Tunnel Topic Room](#)

[Natural Resource Conservation Service: High Tunnels](#)

[Johnny's Selected Seed – High Tunnel Tomato Varieties](#)

[Constructing A High Tunnel On Your Farm](#)

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