

Seasonal High Tunnel Production: Organic Cucumber Guide

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Introduction to High Tunnels

High tunnels are unheated polyethylene-covered structures that are typically cooled through passive ventilation. They increase day and night temperatures and protect crops from environmental stressors such as wind and precipitation. Various crops, including cucumbers, can be profitably grown in high tunnels. Cucumbers are a warm-season vegetable and a staple crop on many North and South Carolina farms. Due to their sensitivity to cold, they cannot be grown outdoors during winter in this region. Cucumbers are usually trellised in high tunnels to maximize vertical space, improve airflow, and reduce disease pressure. They produce fruit continuously throughout the season. While field production is common, growing cucumbers in high tunnels offers advantages such as higher marketable yields, reduced disease incidence, and season extension. However, success in high tunnel production requires careful management. This guide provides information on proper high tunnel cucumber production and trellising techniques to help growers in the Carolinas improve yields and crop performance.

Variety Selection

When selecting cucumber varieties for high tunnel production, several characteristics should be considered, including customer preferences, days to maturity, plant vigor, yield, fruit size and color, pollination needs, and disease resistance. The unique microclimate of a high tunnel makes certain traits particularly valuable:

- *Parthenocarpic*: These self-pollinating varieties do not require insects for fruit set—an important trait in high tunnels, where pollinator access may be limited, especially in early spring.
- *Gynoecious*: These varieties produce only female flowers (fruit), directing more energy toward fruit production.
- *Disease Resistance*: While high tunnels help regulate moisture levels and can reduce the risk of certain diseases, particularly those driven by rain and humidity, diseases caused by windborne or soilborne pathogens can still pose significant threats, especially without proper sanitation, crop rotation, or soil management practices.
- *Specialty Varieties*: High tunnels are well-suited for producing niche cucumber types. Consider exploring specialty cucumbers with unique shapes, sizes, colors, or textures to appeal to premium or local markets.

Temperature Management

Temperature in high tunnels is managed through solar radiation and passive ventilation. High tunnels capture heat during the day through solar radiation. 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 reducing the 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 than outside air temperatures, helping many plants, like cucumbers, which can only survive short periods below freezing.

Cucumbers thrive between 70°F 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 before sunset only on days when nighttime outside air temperature is forecasted below 50°F. During spring, when outside nighttime 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 nighttime.

One benefit of a high tunnel microclimate is the elimination of natural moisture. When plants and leaves are kept dry, disease risk is reduced. However, improper venting can increase humidity, increase leaf wetness, and, therefore, cause 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. At the same time, 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.

Row Cover

Row covers are essential for protecting cucumbers from frost and freezing temperatures, especially during early spring and late fall. They can be used nightly or as needed. Medium-weight covers work well in tunnels, offering light frost protection without limiting airflow. Row cover should be suspended just above plants when freezing temperatures are forecasted. PVC, metal, or conduit hoops can support covers over beds. When not in use, covers need to be kept clean and dry. Mulching tunnel walkways will help reduce row covers from becoming dirty and damp.

Low tunnels, mini-tunnels made with hoops and plastic sheeting or row covers, can raise air and soil temperatures within a high tunnel, further extending the growing season by protecting plants from freezing temperatures. Some research shows that row covers can increase the air temperature under the low tunnels by 2–4 degrees compared to the ambient high tunnel air temperature.



Bed Preparation

Cucumbers prefer deep beds and well-drained soil, which can be achieved by making raised beds to increase drainage and rooting capacity. Till the soil before attempting to shape beds to improve soil tilth. If using cover crops, terminate and incorporate the cover crop several weeks before 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. The standard bed width is 30", and length will depend on the size of the high tunnel and the required space for irrigation header pipe. With 30" beds, cucumbers are typically planted in one of two ways: a single row per bed with 12-inch in-row spacing or two staggered rows per bed with 24-inch in-row spacing. Some growers with optimized fertility, irrigation, pruning, and sanitation may plant two rows per bed with a tighter 12-inch in-row spacing.



Mulch

Mulch helps regulate soil temperature, retain moisture, and suppress weeds. Plastic mulch, which is widely used and comes in different colors, can impact soil temperature. Black plastic mulch warms the soil in spring, while white mulch can keep the soil cooler in summer. Reflective mulches may reduce pest pressure, and clear plastic mulches can be used to solarize high tunnel soil while not in production to minimize weed pressure and mitigate soil-borne disease. Organic, natural mulches can be used, but there are concerns with persistent herbicide residues, weed seeds, and pests.

Soil Test

Soil testing is essential in high tunnel production. It helps determine nutrient availability and long-term soil health. Due to the enclosed environment, salts can build up over time from irrigation and fertilizer inputs. Testing before planting allows you to adjust your fertility plan and track trends such as salt accumulation over the years.

Fertility

Cucumbers have specific nutrient needs. Use your soil test results to determine available nutrients, and base your fertilizer plan on the crop's total nutrient requirements. According to the [Southeast Vegetable Crop Handbook](#), cucumbers grown in high tunnels need:

- pH: 6.0–6.5
- Nitrogen: 120–150 lbs. per acre
- Phosphorus: 100 lbs. per acre
- Potassium: 100 lbs. per acre

Subtract available nutrients (from your test) from these totals to determine how much to apply. Typically, around 80% of your nitrogen and potassium should be applied pre-plant, with the remaining balance being sidedressed or fertigated throughout the growing season. Cucumbers need additional nutrients when they are beginning to vine, at flowering, and when setting fruit. All other nutrients can be applied at the rate recommended by a soil test. It is recommended to take a tissue sample early in the season to assist in determining the need for additional fertility. Over-fertilization can lead to salt buildup, especially in high tunnels, so it is essential to avoid over-fertilizing crops.

Compost and other high-organic matter amendments can be added before transplanting. Increasing organic matter will improve soil moisture retention and nutrient content and, in most cases, increase soil health. However, fertilizers, compost, and other organic matter inputs can negatively impact soil health. Excessive manure applications can cause high phosphorus levels. Also, any contaminants brought in through compost can be challenging to mitigate once inside a protected structure like a high tunnel. Only source compost and other amendments from reputable retailers.



Trellising Methods

Trellising provides structural support for cucumber plants, helping to prevent damage to stems, leaves, and fruit. It also reduces plant and fruit contact with the soil, lowers disease risk, minimizes shading within the tunnel, and allows for increased plant density per bed. When combined with pruning, trellising improves air circulation and light penetration, which helps limit disease and pest pressure while promoting healthy plant growth.

By training plants to grow vertically rather than sprawl on the ground, farmers can better use the tunnel's vertical space. This approach increases planting density and can lead to higher overall yields and profits, an especially important consideration when significant investments have been made in tunnel infrastructure. Trellising also improves fruit quality by keeping cucumbers off the ground, resulting in straighter, cleaner, and larger fruit with fewer blemishes.

Trellis Types

Two common trellising systems are the Tomahook drop-line and Hortonova netting. Both systems suspend from an overhead wire (6-8 feet above ground) attached to the high tunnel end walls using eye bolts and 6" turnbuckles with hooks. A 12-gauge high-tensile, 1/4 inch cable, 7x19 304 galvanized wire, or aircraft cable is recommended for a 100-foot house.

The **Tomahook drop-line** consists of a top guide wire that runs the length of the tunnel and supports the trellis from above and a spool of polyethylene string. The spool or hook attaches to the guide wire and is wound to easily be unspooled to let out more line and lower the plants as they grow. This is called the "Lower & Lean" technique. The Tomahooks include 40 feet of string and are reusable—simply discard the old line at the end of the season to reduce disease risk, then unspool a fresh length for continued use. Tomato clips can be used to start or continually hold the plants on the trellis line. These clips pinch the string around the cucumber stem to hold it onto the line. Some growers forego the clips after the plants are on the trellis and instead spin the growing point of the plant around the stem, following the same direction each time. This allows the cucumber to use its tendrils and friction to hold the plants. We had limited success with this, as efficient pruning and harvesting are necessary to limit plant slippage.



The **Lower and Lean Method** can be utilized when using the drop-line, single leader trellis method. Once plants are growing and have been pruned and trellised as described above, the apical meristem, or top growth of the plant, will reach the top of the guide wire and have nowhere else to go. This is where the Tomahooks come in handy; by spinning the hooks or unspooling an additional length of twine, the plants can be lowered, typically 6-12 inches. The stems that are now making contact with the ground should have been fully pruned before this, and there are wire frames that can be used to keep them from making contact with the ground if desired. Once lowered, all plants on the trellis should be slid down towards one end of the tunnel by simply sliding the Tomahook along the guide wire. The last plant on the trellis may need the Tomahook moved to the guidewire of the bed next to it to make room for this movement. This process is repeated each week throughout the growing season. Through this action, you can grow vines to great lengths, disregarding the limits of the trellis height.



Hortonova netting is a plastic, fence-like material with a 4" x 4" square pattern. It is hung from a central, overhead guide wire and supported with T-posts placed every 15 feet. A V or W truss system in your tunnel is useful for effectively installing a secure top wire. Tomato clips may be needed to get the plants onto the net. At this point, the growing point can be woven through the netting to hold the plants.



Transplant to Harvest

Transplanting

Before transplanting, all seedlings should be hardened off. Hardening off allows transplants to acclimate to a new environment before planting 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. Trays can be left in the high tunnel overnight if conditions are optimal.

Irrigate to increase soil moisture before and after planting. Planting into moist soil will reduce stress on transplants. Measure and mark plant spacing on beds to ensure consistent planting distances and the efficiency of drip irrigation. If using plastic or other solid mulches, pre-punch holes at appropriate spacing before planting.

Soil temperatures should reach or exceed 60 degrees F before transplants can be placed in the high tunnel. When transplanting, the transplant soil line should be placed evenly with the 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.

Pruning

Pruning is a critical and time-consuming maintenance practice in trellised cucumber production. Pruning plants increases tunnel ventilation, decreases disease, and encourages healthy plant growth. Pruning practices vary depending on variety, trellising method, and production goals.

Cucumbers planted using a single-strand, drop-line, Tomahook trellis need to be pruned consistently throughout the growing season to one leader. This requires removing all side branches or suckers and leaving only the fruit in the axils and the leaves unpruned. Lower leaves and petioles must also be removed as the season progresses, leaving only a single bare stem.

Cucumbers planted using Hortonova netting need to be pruned in an umbrella pattern. They are pruned until the sixth node is reached. Nodes are the places along the stem where a branch or point of growth arises. Once the sixth node is reached, pruning stops and the suckers and runners climb and spread up throughout the trellis, creating an umbrella effect. Leaves that contact the mulch or soil should be removed throughout the growing season. Removing bottom leaves reduces contamination risk via soil-foliage contact. To remove suckers or branches, sanitized pruners were used to make clean cuts through the branch at the point where it meets the stem. Remove all pruned plant material and compost or destroy it, as this is a good source of pest and disease infestation.



Irrigation

Irrigation amounts fluctuate depending on environmental stressors, drainage, and plant growth. On average, cucumbers require one inch of water per week. This amount decreases during the early stages of plant development and increases during fruit set/growth. High tunnels help regulate soil moisture through shading and the exclusion of rainfall, making irrigation schedules more consistent than 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 cucumber plants. Monitor plants and soil to adjust water amounts as needed. For example, plants wilting midday require increased water and/or more frequent watering. To avoid disease and other issues, irrigate cucumbers consistently and uniformly. For more information, download the [High Tunnel Micro-irrigation Guide](#).

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 are 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; early detection is necessary to control outbreaks effectively. When pruning, note any diseased plants and their location within the tunnel. Remove all diseased foliage or the 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. Local extension agents can also help identify disease and other cucumber production issues. 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](#), and in South Carolina, growers can submit samples to Clemson's [Plant and Pest Diagnostic Clinic](#).

Gummy Stem Blight,
fungal disease caused
by *Didymella bryoniae*.



Gummy Stem Blight,
fungal disease caused
by *Didymella bryoniae*.



Bloomy white mold of
Powdery Mildew.



Necrotic patches with
fungal spores,
pathogen unspecified.

Harvest

Cucumbers should always be harvested before the high tunnel accumulates heat in the morning to maintain postharvest quality. Harvest methods depend on variety and packing requirements. Wholesale markets often have specific product specifications, which should be considered before variety selection to ensure the fruit will meet requirements. Develop an on-farm produce harvesting safety procedure if it is not already in place. Some buyers may require Good Agricultural Practices (GAP) certification. For more information on food safety and GAP certifications, visit [CFSA's food safety resources](#). Always harvest the tunnel working backwards from the best, least diseased plants to the worst, most diseased, and take time to clean and sanitize equipment as you go.

Cucumbers will require multiple harvests during the week. Plan harvests according to fruit maturity, market needs, and input applications. To harvest properly, use clean, sharp pruners to snip the fruit stem closest to the cucumber itself so as not to leave a tail. If applicable, remove decaying blossoms from the end. Some varieties can be easily removed from the plant with a slight twist and pull of the fruit, but if the stem tears into the fruit, the shelf life will be diminished.

Store cucumbers in a cooler or refrigerator until market; an optimal temperature is 40 degrees F. To retain crispness, it is best to keep cucumbers covered or in closed containers. When making choices on packaging, consider market demand, aesthetics, and pricing.



Economics and Potential Profits

In 2024, North Carolina ranked as the third-largest cucumber-producing state in the U.S., valued at \$24 million, accounting for 10% of total national production. The value of fresh market cucumber production in the state was \$9.4 million, while processing cucumbers were valued at \$14.6 million (USDA Ag Census, 2022). While similar data is unavailable for South Carolina, in 2023, cucumbers were grown on 3,337 acres for a total value of \$8.4 million (Clemson, 2023).

Farmers can boost sales by using high tunnels to extend the growing season, allowing them to harvest cucumbers 2 to 4 weeks earlier than field-grown crops. Entering the market early often commands premium prices. Similarly, a late-season cucumber crop made possible through high tunnel production can yield higher profit margins in many regions. While the timing and labor requirements for early, late, and in-season high tunnel cucumber production are generally comparable, the choice of trellising system can significantly affect profitability.

In 2023 and 2024, CFSA conducted research at the Elma C. Lomax Research and Education Farm to evaluate the effectiveness of common trellising techniques currently used for small-scale high tunnel cucumber production to mitigate the impact of downy and powdery mildew. That study included an economic analysis of inputs, labor, and yield data to better inform farmers in the Southeast when making trellising and varietal decisions for cucumber production in high tunnels.

Our research found that cucumbers grown using the Hortanova trellising system yielded a \$6,180 higher net profit compared to those grown with the drop-line system (Table 1) due to slightly lower setup labor costs and a higher volume of marketable fruit. For more information on the research project, visit CFSA's website: [Evaluation of Cucumber High Tunnel Trellising Systems](#).

Table 1. Estimated Economic Analysis for Two Types of Trellising Systems, drop-line and Hortanova, in a 30' by 96' High Tunnel.

ITEM	Drop-Line	Hortanova
Trellising		
Supplies	\$675	\$685
Labor*	\$1,718	\$1,425
Return		
Marketable Fruit	7,325	9,290
Revenue**	\$21,975	\$27,872
Net Profit	\$19,582	\$25,762

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

** Calculated an average rate of \$3.00 per pound for organic cucumbers sold directly to consumers.

Additional Resources

[High Tunnel Micro-Irrigation Guide](#)

[Seasonal High Tunnel Production: Organic Tomato Guide](#)

[Evaluation of Cucumber High Tunnel Trellising Systems](#)

[Trellis Solutions](#)

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

[Growing All Seasons: High Tunnels](#)

References

Clemson University, 2023 FarmGate Reports.

U.S. Department of Agriculture, National Agricultural Statistics Service. 2024: 2024 Vegetable Summary. February 2024.



This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2021-38640-34724 through the Southern Sustainable Agriculture Research and Education program under subaward number 00002884. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s). They should not be construed to represent any official USDA or U.S. Government determination or policy. USDA is an equal opportunity employer and service provider.

