USDA
United States Department of Agriculture
Natural Resources Conservation Service Maine

High Tunnel System

High Tunnel Systems are steel-framed, polyethylene-covered structures for crops that can extend the growing season by several weeks in Maine. High Tunnels create a protected environment that provides warmer temperatures for heat-loving crops or early- and late-season crops.

The micro-climate produced inside the High Tunnel System tends to produce crops of higher quality and can produce higher yields than field-grown crops. Crops must be planted in the ground in High Tunnels, not in containers. Because High Tunnels require irrigation, your chosen location must have access to a water source that can supply enough clean irrigation water to meet crop needs.

High tunnels are not greenhouses. While both can depend on plastic covering and often use heaters to raise temperatures within the structures, plants in the High Tunnel System grow directly in the soil. Also, unlike a greenhouse, a High Tunnel is considered a temporary structure.

To be eligible for Maine NRCS programmatic assistance, High Tunnel structures and materials must meet certain criteria. Prior to signing a contract with NRCS, the producer should shop for and choose a structure meeting criteria. Financial assistance for High Tunnel Systems is available from NRCS through the Environmental Quality Incentives Program (EQIP) or the Agricultural Management Assistance (AMA) Program.

Design Recommendations

Avoid plywood on southern end of the tunnel if oriented North-South.

Vents on each end peak are strongly recommended.

For increased ventilation and access, construct a minimum 6 ft. x 6 ft. opening with doors on both endwalls. Endwall and entrance height will affect the size of the equipment to be used in the tunnel. Sidewall height will affect what crops can be grown, as well as worker access around crops.

Add more purlins, cross-ties, and/or wind bracing kits in windier areas. Movable tunnels may have fewer ground posts, and therefore may be more susceptible to wind.

In unprotected high-wind areas, consider orienting the high tunnel with end wall facing prevailing wind direction. Consider wind break plantings, but plan mature height and distance from tunnel to prevent shading and allow for snow removal.

In Maine, an East-West orientation provides best light for early and late season production.

For more information on High Tunnels and eligibility,
call us at ***(207) 990-9100***, visit your nearest NRCS field office,
or visit us online at: ***www.me.nrcs.usda.gov***

Required Material and Design Criteria

- Frame is gothic style (peaked, not rounded).
- Maximum tunnel width is 30 ft. Minimum height is 6 ft.
- Bows and ground posts are at least:
  - (i) 1.90” round 14 gauge galvanized steel or stronger for tunnels ≥ 26 ft. wide
  - (ii) 1.66” round 14 gauge galvanized steel or stronger for tunnels < 26 ft. wide
  - (iii) 2.00” square 16 gauge galvanized for all tunnel widths
  - (iv) 1.625” x 2.750” oval 16 gauge for all tunnel widths
- Bows are spaced 4 ft. apart. Exception: Bows may be spaced 6 ft. apart for tunnels constructed with galvanized steel bows and ground posts that are at least:
  - (i) 2.375” round 14 gauge or
  - (ii) 2.0” x 3.56” oval 16 gauge
- 3 purlins for tunnels < 26 ft. wide, 5 purlins for tunnels ≥ 26 ft. wide. This includes one central “ridgepole” purlin. A ridgepole purlin is always required.
- For tunnels ≥ 26 ft. wide, cross-ties with trusses/braces at least every other bow (recommended for all widths).
- Wind bracing diagonals on each end, placed in accordance with manufacturer’s directions.
- Frame is covered with at least 6-mil, 4-year UV resistant polyethylene film, or polycarbonate.
- Roll-up or drop-down sides are installed on both sides. Rope (or equivalent material) is attached from hip-board to baseboard the entire length to protect sides from billowing.
- End walls are framed with wood or metal and covered with UV resistant polyethylene film (at least 6-mil, 4-year), polycarbonate, or wood.
- Baseboards are installed as instructed.
- At least one end wall contains a door for access (end wall vents are also recommeded).
- Bows/posts shall consist of no more than 5 individual segments, including ground posts. Typically this includes 2 ground posts, 2 half bows, and a bow connector. (Splices/sleeves may be used to join posts/bows and are not considered segments).
- All segments of the bow must be through-bolted (carriage bolt and nut) at the connection point.

Eligibility & Assistance

Eligible applicants include individuals, legal entities, Indian Tribes, or joint operations engaged in agricultural production. In addition, organic producers who grow agricultural commodities on eligible land and have natural resource concerns which may be addressed by a High Tunnel System may participate.

To meet land eligibility requirements, land on which the High Tunnel is to be placed must currently be in cultivation or capable of being planted to a crop, like vegetables, berries or flowers.

Considerations Before Purchasing a High Tunnel System

Additional Labor

- Do you have extra labor help to manage a high tunnel? Pruning, trellising, weeding, etc., can add significant hours of labor during the regular growing season. And an extended growing season means a longer labor season (less time off).

Location

- A High Tunnel should be located conveniently for daily management and with access to a water source.
- Do you have a pressurized, viable water source within reach? Irrigation is required (desert environment inside a tunnel).
- During the summer months, expect to use 250 or more gallons per day for a 30 x 70 structure growing tomatoes.
- Drip irrigation is best for most crops (prevents fungal diseases), but overhead sprinklers may be more appropriate for small crops such as greens.
- Electricity (if needed). Do you need electricity to run inflation fan (if two layers of plastic), ventilation fans, or other desired utilities?

Winter management to prevent collapse

- *Ice and snow can bring a structure down quickly.* Owner is responsible to maintain the structure regardless of weather. Terms of the contract are that, in the event of a collapse, owner must replace structure (without NRCS funding) during the four-year lifespan.
- Snow slides off structure and piles up. Do you have adequate room to plow snow away from sides and an adequate space to pile it or push it offsite? A minimum of 10-20 feet is needed around and between High Tunnel Systems.
- Sometimes snow may NOT slide off structure, and will need to be carefully removed during certain storms.
- Ice storms can add significant weight. Ice removal will be needed, and may involve the use of a heat source during the storm to prevent ice buildup.

Soil/Nutrient management

- What method will you use to supply nutrients to your crop(s)? Crops under black plastic with drip irrigation may require a fertigation system.
- Soils will need organic matter additions periodically, usually in the form of compost.
- Due to the “desert” nature of the High Tunnel, salt will build up in the soil and will need periodic flushing via flooding or removal of the plastic to allow precipitation to flush salts. Plastic removal for a significant period of time may entail sacrifice of a crop or an extended season. The University of Maine soils lab provides testing for High Tunnel nutrients and salt.

Crop management

- Will you be growing summer or winter crops? Heat-loving plants are not compatible in the same tunnel as those needing cooler temps or less sun.
- Winter crops (greens) are planted in early September when tomatoes are still producing. This may present a space conflict.
- Growing the same crops (i.e. tomatoes) in the High Tunnel year after year may lead to disease issues. What will be your strategy to avoid this?

Kit/Design: Critical!

- You are responsible to purchase a structure with all of the components as listed in NRCS-Maine selection criteria.
- Do not accept manufacturer blanket claims that their product meets NRCS criteria. This is misleading, and can result in you not receiving NRCS payment. If you purchase a structure that does not meet criteria and/or is not built to manufacturer recommendations, you will not receive payment.
- You may need to purchase additional components even for “approved” models in order to meet criteria.

Installation

- High Tunnels are not easy to install. Who will you hire to install your structure? Or, if you plan to install it yourself, who will assist you?
- After site prep is done, construction of the structure may take an average of two weeks or longer.
- Posts must be pounded into the ground at perfect four-foot intervals, to the correct depth, AND be vertically plumb. *Got rocky ground???*
- You may need a lift to work on the roof components.
- Plastic must be applied on a wind-free day, with at least several laborers and a means to bring the plastic to the peak.
- End walls must be solidly framed and closed in, in accordance with specifications.
- You will need to budget for new plastic every four years, and will need sufficient labor assistance to apply the new cover (on a windless day).

Talk to NRCS experts and High Tunnel distributors to ensure you are getting a structure that will suit your needs and hold up to Maine winters!