

# Heating and Cooling Alternatives for High Tunnel Tomato Production

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## Cooling

Summer cooling is usually done through roll-up or drop-down sides and endwall doors. Cost is about \$10/linear foot. Roof vents have been installed in some tunnels but are expensive at about \$40/linear foot. Ken-Bar, Inc., Reading MA makes small manual and automatic vents that can be inserted into the roof to reduce the temperature about 5°F if installed on a 20' spacing. If crops are to be grown during the summer, shade cloth could be placed over the tunnel to reduce the inside air temperature. It is available from 5 to 95% shade. Cost is about \$0.20 to \$0.40/sq ft. A summer crop of tomatoes usually requires about 50% shade. Fan ventilation could be installed at about ½ volume air change/minute for early spring operation. When it warms up then roll-up sides are opened. Motorized equipment requires an electric service.

## Heating

For early season crops such as tomatoes, cucumbers and peppers, a root-zone heating system should be installed. This system utilizes a propane gas hot water heater, circulating pump, 1/2" or 3/4" diameter tubing or pipe and a remote bulb thermostat to maintain a 70 to 75°F soil temperature in the root zone. Electricity will be needed to operate the pump and controls.

The least expensive pipe is polyethylene which is available in 100' and 400' rolls. Select a pipe made of virgin plastic rather than one having reconstituted resins. It should have a pressure rating of at least 100 psi.

Commercially available systems are available that use EPDM rubber tubing either as single tubes or as two or four tubes attached to a web. Diameters of 3/8" or 1/2" have greater heat transfer and eliminate some problems from chemical coating and sedimentation blocking. Cross-linked polyethylene (PEX) tubing in 5/8" or 3/4" diameter can also be used.

The size of the water heater or boiler depends on the amount of area to be heated and the cropping system used. For tomatoes grown in rows in the soil or in bags with a single line of pipe under each row, you can estimate that it takes 10 Btu/linear foot of row length. Add about 10% to this total for heat loss from the supply pipes. The soil around the pipes needs to be kept moist to get good heat transfer.

A tank-type, domestic hot water heater (30,000 to 40,000 Btu/hr) fired by natural gas or propane will provide the root zone heat for a tomato growing area up to 6,000 sq ft. Multiple water heaters can be connected together with a manifold to get higher outputs.

In the simplest system using a water heater, the thermostat on the tank is set at the desired root zone water temperature (usually 100 deg F). Return water from the loops goes back to the tank to be reheated. Activation of the circulating pump is done with a remote bulb thermostat inserted

in the soil or growing bag. An electronic thermostat is a good choice as the differential between on and off is only a degree or two. Mechanical thermostats have a greater differential.

Air heat may be needed on cold nights. A non-vented heater may be ok for a night or two but tomatoes are very sensitive to sulfur dioxide and ethylene gas from combustion of fossil fuels. This will show up as white spots on the leaves or misshapen leaves. A better choice for heat is a vented heater, either a unit heater or a furnace.

### **Irrigation**

Irrigation water is needed for the plants. If zoned properly, several high tunnels may be supplied by a 1" or 1-1/4" poly pipe line. Where the tunnels are located a distance from water, a trailer mounted tank could be used for the water supply. For crops grown in rows or containers, a drip system will reduce the amount of water needed.

Although high tunnels can't provide the same environment as a greenhouse, they can offer a grower the opportunity to have additional growing space during the spring and fall for crops that are not highly temperature sensitive. They do require more attention and maintenance.

### **References:**

**Production of Vegetables, Strawberries and Cut Flowers Using Plasticulture** – NRAES-133 – 146 pgs. Available from [www.palspublishing.cals.cornell.edu](http://www.palspublishing.cals.cornell.edu).

**Greenhouse Engineering** – NRAES-33 – 212 pgs. Available from [www.palspublishing.cals.cornell.edu](http://www.palspublishing.cals.cornell.edu).

The following information sheets are available from the author at [jbartok@rcn.com](mailto:jbartok@rcn.com)

Plastics on Tunnels for Different Seasons

Bottom Heat for Tomatoes

Design and Layout of a Small Commercial Greenhouse Operation

A Few Pointers for Better Irrigation