



WASHINGTON STATE  
UNIVERSITY  
EXTENSION



## HIGH TUNNELS FOR SEASON EXTENSION IN HIGH VALUE VEGETABLE CROPS

### BY THE NUMBERS

- There are approximately 500 high tunnels in Washington.
- Costs range from \$500 for a 12-by-80-foot temporary structure, to \$7,000 for a kit that makes a sturdy, durable 30-by-100-foot structure.

2014

### ISSUE

Cool summer weather and heavy spring and fall rains limit the growing season in western Washington, and it can be challenging to produce an adequate quantity and quality of high-value, warm-season crops.

Tomato is a warm-season crop that is always in high demand, especially for local markets. Most tomato varieties do not ripen in western Washington, and the crop is frequently threatened by late blight (caused by *Phytophthora infestans*), which thrives in the cool, humid climate of this region.

High tunnels are temporary agricultural field structures with arched or hoop-shaped frames covered with one or more layers of clear plastic. They were first built at the University of Kentucky in the 1950s to protect high-value crops from rain, hail, and low temperatures. These simple structures are solar heated, have no electricity, and have spread in popularity throughout the world, but only recently have been used in western Washington.

### RESPONSE

High tunnels are designed to extend the growing season and intensify production. They create a microclimate, increasing daytime temperatures and protecting the crop from wind, rain, and hail.

Although many crops can be grown successfully in a high tunnel, the limited production space is used to its best advantage for high-value crops. Tomato is the primary crop grown in high tunnels in the United States and worldwide because it is high value and benefits most from high tunnel production.

Drip irrigation is essential in high tunnel production systems. With drip irrigation, a low volume of water is applied daily, which reduces fruit cracking and thereby increases the amount of marketable fruit. To optimize fertilizer efficiency, half the fertilizer is incorporated into the soil prior to planting, and the other half is applied through the drip irrigation system during the growing season. This way, both crop growth and yield are optimized, fertilizer loss is reduced, and water quality is preserved.



## QUOTES

*“We’ve been using the high tunnels for about 20 years, and there is nothing better for season extension. The biggest challenge in Washington for crop production is the weather ... and those tunnels enable us to control the environment so we can grow high-value crops.”*

*“If you get creative, there is a plethora of crops you can grow, and information available about how they can grow in high tunnels and with our environment.”*

*“We’ve paid for the farm twice with crop losses from weather damage. ... We’ve never lost a crop in the high tunnels.”*

*“A grower up here has been growing slips of tropical ginger from Hawaii. ... They grow those in their high tunnel and there’s just a line of [customers] out the door.”*

## IMPACTS

High tunnels make it possible to plant earlier in the spring. They increase the daytime temperature, which increases the rate of plant growth, and they extend crop production into the fall. Both early spring and late fall crop production bring a premium price, so profitability is increased. In the spring and fall, high tunnels also protect the crop from severe weather, including heavy rain, frost, and hail. This not only increases overall yield, but also increases the marketability of high-quality produce.

When maximum daily temperature is increased by approximately 5 °F, as occurs in an open-ended high tunnel, this results in a 40% increase in growing days for tomato crops (50 °F base temperature) throughout the growing season. Temperature increase in a close-ended high tunnel is even greater. Extending the growing season and increasing the temperature increase crop yield. The total marketable yield per square foot for tomato in one growing season is 9 pounds in a high tunnel and 0.70 pounds in the open field.

Research by scientists at WSU Mount Vernon Northwestern Washington Research and Extension Center has shown that late blight is greatly reduced on tomatoes grown in a well-managed high tunnel (well ventilated to reduce air humidity and leaf wetness.) Use of chemical fungicides to control late blight can be reduced or eliminated in a high tunnel, thus crop growth and yield are optimized, pesticide applications are reduced, and environmental quality is preserved.