



Greenhouse Tomatoes

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Introduction

Greenhouse tomato production has increased in recent years, responding to consumer demand for year-round fresh produce and advances in greenhouse vegetable production practices. However, of all the greenhouse crops, tomatoes (*Lycopersicon esculentum*) are the most complicated to grow because they require the most management, the most labor, and the most light. A grower must be committed to meeting the daily demands of production to be successful. Prospective growers need to get as much information as they can about all aspects of greenhouse production before beginning this enterprise.

Marketing

There are multiple retail and wholesale marketing channels for greenhouse vegetable production across the state. Growth of farmers markets, roadside farm markets, community supported agriculture and other direct markets are all possibilities to sell greenhouse tomatoes directly to consumers. Wholesale markets include produce auctions, supermarkets, restaurants, caterers and wholesale distributors for retail and foodservice.

Market Outlook

The production area for all vegetables grown in greenhouses or under protection increased from 71 million square feet in 2009 to 93 million square feet in 2014, according to USDA, with tomatoes taking up about half that area. Consumers continue to demand both taste and value in the produce section, and wholesale greenhouse tomato production has a growing focus on snacking tomatoes (cherry, plum) and other types for which consumers are willing to pay a price premium.



Early season tomato production in greenhouses can capture higher prices, which can be profitable for greenhouse producers.

Excellent light, moderate heating costs, high yields and good prices generally make spring the best time for greenhouse tomato production in Kentucky. For smaller farm greenhouses, fall and winter production generally results in lower returns due to reduced yields and high fuel costs. For this reason, it is difficult to recommend production schedules where tomato harvest would be expected from December through mid-February.

Production Considerations

Production systems

There is no single best system for successfully growing greenhouse tomatoes. Many production systems will work if the grower correctly manages fertilization and watering. With experience, individual growers will be able to determine the best and most economical techniques to use in



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their greenhouses.

A number of different types of growing media can be used for greenhouse tomatoes, including packaged commercial mixes, and various types of hydroponic media. Use only materials that have been sterilized, pasteurized, or manufactured under clean, disease-free conditions. Small growers often use in-ground soil culture in the beginning, but generally switch to perlite or pine bark culture as they learn more about tomato production. A drip irrigation system is used for the distribution of water and nutrients. Tomatoes require 5 square feet of space per plant.

This crop will require attention every day to ensure success. Equipment (such as fans, vents, and irrigation emitters) must be checked daily to be sure they are functioning properly. The application of water and fertilizer, while generally controlled automatically with a time clock, needs to be monitored on a daily basis. Non-grafted greenhouse tomatoes are typically pruned to a single stem, and suckers must be removed regularly. If flower clusters are hand-pollinated, they must be shaken or vibrated each day as soon as the petals open. Bumblebees are often the preferred method of pollination in greenhouse environments.

Actively growing tomatoes must be tied or clipped weekly to a string or twine support. A plant fully loaded with fruit may weigh as much as 10 to 15 pounds. Because some greenhouse structures are not strong enough to support a tomato crop, a separate support system may have to be constructed inside the greenhouse for those structures. Greenhouses designed to support a tomato crop are available from some manufacturers.

Variety selection

There are thousands of tomato cultivars available, but not all are suitable for greenhouse production. It is important, therefore, to select varieties that have been specifically bred for greenhouse conditions or have

proven successful in greenhouse production. Most greenhouse cultivars are specifically bred for low light conditions common in greenhouses and have the ability to set fruit over an eight- to nine-month period of time. Common cultivars include 'Trust,' 'Cobra,' 'Matrix,' and 'Geronimo.'

Cultivars can differ in such horticultural traits as fruit characteristics (e.g. size, color, shape and flavor), earliness (early, mid- and late-season), growth habit (determinate and indeterminate), and disease resistance. Lack of physiological problems and yield uniformity are desirable traits in a greenhouse cultivar. Consideration must also be given to regional preferences and crop marketability.

'Cluster' or 'truss' tomatoes, first marketed in Europe, have become popular in the U.S. They are smaller vine-ripened tomatoes that are sold as a cluster of fruit with the vine still attached. These varieties have not been as popular with Kentucky growers.



Pest management

Environmental conditions that favor tomato growth also favor the rapid build-up and spread of insects and diseases. Potential disease problems include damping-off, root rots, fungal leaf spots and impatiens necrotic spot virus. The most common greenhouse insect pests are thrips, aphids and white flies.

Few pesticides are labeled for greenhouse vegetables; those that are cleared must be applied thoroughly and regularly due to their low toxicity. However, many greenhouse tomatoes are grown with reduced pesticides by manipulating the greenhouse environment, growing resistant cultivars, and using cultural controls as the primary defenses against diseases. Sticky yellow cards are used to monitor insect pest populations.

Many insect pests, such as white flies, are controlled by predatory insects. One must be careful to properly match predator insect with the pest at hand. For example, there are several species of whiteflies that

have different predator insects — matching the wrong predator and prey will result in poor control. Weed control in and around the greenhouse will also help reduce insect pests and disease problems; however, herbicides must never be applied in greenhouses when crops are present.

Harvest and storage

The stage of maturity at harvest will depend upon the market requirements; however, the longer the fruit can remain on the vine, the better the quality. Tomatoes should be harvested two to three times per week.

Labor requirements

Greenhouse tomato production is a labor-intensive enterprise, requiring approximately 25 person-hours per week (averaged over the season) for a 30-foot by 100-foot house (3,000 square feet). Transplanting and harvesting will require more time per week, while less time is needed from transplanting to the first harvest. Hand pollination alone can require 30 to 40 minutes each day for an experienced worker in a 30-foot by 100-foot greenhouse.

Economic Considerations

Greenhouse tomatoes require a significant start-up cost, as well as demanding labor and management. Initial investments include greenhouse construction, production system costs, and equipment.

The cost of a production-ready greenhouse, excluding land costs, can run approximately \$10 per square foot for construction with a six-mil double plastic covering. Total costs may vary heavily depending on construction materials and greenhouse design. Total operating costs of approximately \$4 to \$6 per square foot can be expected. Total costs for hydroponic production, including all labor, may double costs of non-hydroponic production.

Returns will also vary according to price, production systems and yields. Gross revenues beginning at approximately \$6 per square foot are possible. Returns over operating costs for greenhouse tomato production can range from \$3 to \$17 per square foot, depending on yields, marketing channel and price per pound.

Selected Resources

• The Greenhouse Business in Kentucky – A Review of Crops and How to Begin a Business

(University of Kentucky, 2002)

<http://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/greenhousesinkentucky.pdf>

- Greenhouse Tomato Production Practices (University of Kentucky, 2002) <http://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/greenhousetomatoes.pdf>
- Managing the Greenhouse Environment to Control Plant Diseases, PPFS-GH-1 (University of Kentucky, 2004) <http://plantpathology.ca.uky.edu/files/ppfs-gh-01.pdf>
- Production of Greenhouse Tomatoes in Soil Beds (University of Kentucky, 2002) <http://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/greenhousetomatoesinsoil.pdf>
- Greenhouse and Hydroponic Vegetable Production Resources on the Internet (ATTRA, 2004) <http://attra.ncat.org/attra-pub/ghwebRL.html>
- Greenhouse Tomatoes Frequently Asked Questions webpage (Mississippi State University Extension) <http://extension.msstate.edu/crops/commercial-horticulture/greenhouse-tomatoes>
- Greenhouse Tomato Handbook (Mississippi State University, 2016) <http://extension.msstate.edu/publications/publications/greenhouse-tomato-handbook>
- Greenhouse Tomato Budgets for Mississippi (Mississippi State University, 2017) <http://extension.msstate.edu/sites/default/files/publications/publications/p2766.pdf>
- Greenhouse Tomato Production Manual (Louisiana State University, 2005) http://www.lsuagcenter.com/topics/lawn_garden/commercial_horticulture/vegetables/greenhouse-tomato-production-manual
- Integrated Pest Management for Greenhouse Crops (ATTRA, 1999) <http://attra.ncat.org/attra-pub/gh-ipm.html>
- Greenhouse Vegetable List of References (North Carolina State, 1999) <https://content.ces.ncsu.edu/greenhouse-vegetable-list-of-references>
- Growing Hydroponic Tomatoes (Arizona, 2000) <http://ag.arizona.edu/hydroponictomatoes/index.htm>
- Hydroponic Crop Program: Economic Budgets (Ohio State, 2011) <http://u.osu.edu/greenhouse/hydroponic-crop-program-economic-budgets/>
- Organic Greenhouse Tomato Production (ATTRA, 2002) <http://attra.ncat.org/attra-pub/ghtomato.html>
- Virtual Grower (USDA) <https://www.ars.usda.gov/research/software/download/?softwareid=309>

- Greenhouse Tomato Growers' Glossary <http://extension.msstate.edu/sites/default/files/publications/publications/p2364.pdf>
- Environmental Control for Greenhouse Tomatoes <http://extension.msstate.edu/sites/default/files/publications/publications/p1879.pdf>
- Fertigation: The Basics of Injecting Fertilizer for Field-Grown Tomatoes http://extension.msstate.edu/sites/default/files/publications/publications/p2037_0.pdf
- Starting Vegetable Transplants http://extension.msstate.edu/sites/default/files/publications/publications/p1995_0.pdf
- Greenhouse Tomatoes: Pest Management in Mississippi <http://extension.msstate.edu/sites/default/files/publications/publications/p1861.pdf>

- Greenhouse Tomato Budgets for Mississippi <http://extension.msstate.edu/sites/default/files/publications/publications/p2766.pdf>
- Tomato Troubles: Common Problems with Tomatoes <http://extension.msstate.edu/sites/default/files/publications/publications/p2975.pdf>

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