University of Kentucky
College of Agriculture,
Food and Environment
Cooperative Extension Service

Center for Crop Diversification Crop Profile
CCD-CP-111

Organic Tomatoes

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Introduction

Tomatoes (*Lycopersicon esculentum*) are among the most popular fresh market vegetables grown commercially in Kentucky. Rising consumer demand for organic products and sustained interest in local and regional foods make organic tomatoes an excellent prospect for local fresh market sales.

Organic tomatoes are produced using pest management and fertilization methods that do not include synthetic compounds. Growers producing and selling tomatoes with an organic label must be certified by a USDA-approved state agency (e.g., the Kentucky Department of Agriculture) or private agency, plus follow production standards regulated by the National Organic Program (NOP).

Marketing

Tomatoes are grown in Kentucky primarily for fresh market sales. Planting for very early or for late fall markets often brings the most profit because prices tend to be higher either before or after others have tomatoes in the market. Fresh market options for organic tomatoes include roadside stands, farmers markets, local grocery stores, community supported agriculture (CSA) subscriptions, produce wholesalers, and produce auctions. Restaurants and health food stores may also be interested in locally produced organic products.

Offering educational materials for consumers at farmers markets about how the organic tomatoes were grown may be an effective way to attract new customers. New producers should consider low-volume retail sales opportunities initially (such as farmers markets or roadside stands); large-scale production usually requires knowledge of wholesale marketing channels, which can handle larger volumes of produce.

Market Outlook

Organically grown tomatoes are popular among consumers seeking organic vegetables for health or ideological reasons, as well as consumers seeking unique varieties and flavors. Most fresh market organic field tomato acreage is found in California. Field tomato acreage in Kentucky ranged between 15 and 30 acres in 2019. Certified organic greenhouse tomato production has helped grow the organic tomato category, even while field area remained fairly steady or slightly decreased nationally.

Organically grown tomatoes can command premium prices, especially when offered for early and late-season availability. Certified organic tomatoes may

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command wholesale price premiums 10 to 50 percent greater than conventionally grown tomatoes; however, these premiums may vary considerably between market areas. Producers should develop a detailed marketing plan for certified organic produce and understand differences in pricing between organic and conventional produce in their region. Daily wholesale price reports for terminal markets around the country can be accessed on the Fruit and Vegetable Marketing News page of the USDA Agricultural Marketing Service website. Some archived price information and reports about organic produce prices are also available at the USDA Economic Research Service.

Higher prices for certified organic produce are often critical for profitable organic production. Producers may choose to offer point-of-purchase information to new organic consumers about the costs of organic certification and potentially greater labor costs that may be incurred with organic tomato production. Some consumer education resources for producers may be available through farm and food groups, such as the Organic Trade Association.

Production Considerations

Site selection and preparation

Only land that has been free of prohibited substances (e.g., substances not on the OMRI list, that are not NOP-compliant or have not been approved by the grower's certification agency) for three years can be certified for organic production. Selecting a site that is well suited to the crop is especially important in organic production. Healthy, fast-growing plants can better tolerate or outgrow pest problems.

Choose a site for tomato production with well-drained soil that warms up quickly in the spring. Tomatoes are quite cold-sensitive, so low-lying fields that are subject to late frosts should be avoided. Tomatoes are also quite sensitive to certain herbicides, so locate tomato fields where plants will not be damaged by herbicide drift from neighboring conventional fields. Fields should be rotated out of tomatoes and related solanaceous crops (e.g. tobacco, peppers, and potatoes) for a period of at least three years to avoid pest problems common to this plant family. Tomatoes do well when transplanted to a field where fescue sod was plowed under the previous fall.

Healthy soil is the key to successful organic production. It is important to collect a soil sample annually in order to know what, if any, additional soil amendments are required. Soil fertility can be enhanced by adding raw or composted animal manure, green manure (cover crops turned under prior to planting), and approved natural fertilizers. There are no restrictions regarding the source of animal manure; that is, it can come from conventional farming operations. However, the NOP does regulate the timing of the application of raw manure to minimize the risk of pathogens being transferred to the harvested portion of the crop. Raw manure must be applied 120 days or more before harvest of the crop. In addition, compost and composted manure must meet specific processing requirements. The University of Kentucky and other private labs offer manure testing. Acquiring an accurate test of the manure growers plan to apply will allow for more accurate application of soil amendments.

While grass cover crops (e.g., rye) will increase organic matter, nitrogen-fixing legumes (e.g., hairy vetch) have the additional benefit of providing nitrogen to the soil, which can then be taken up by plants. Tomatoes require significant levels of phosphorus, potassium, and calcium in balanced proportions. Supplemental organic nutrient sources include bloodmeal, fishmeal, cottonseed meal, soybean meal, as well as manure, which usually contains high phosphorus and potassium. It is important to note that these nutrient sources are not fast-acting, therefore applying them early in the season for slow release throughout the production season is important. Organically approved water-soluble fertigation options are limited, but include fish emulsion. For details on fertigation in organic vegetable production, visit https://eorganic.org/node/4937. For a more complete discussion of organic fertility, see https://eorganic.org/node/1471.

Variety selection and transplant production

Variety selection is a critical decision for any commercial crop, but it is especially important in organic production. With fewer pest management options available, it is vital to identify selections with resistance and/or tolerance to as many prevailing diseases and insects as possible.

Tomato variety selection is further complicated by the myriad of horticultural characteristics available. Fruit may differ in size (cherry-size to 1 pound or more in weight), color (pink, yellow, orange, red, red-black,

striped), shape (pear, oval, blocky, globe), flavor, acid content, and intended use (canning, paste, salad, slicing, drying). Tomatoes may be open-pollinated or hybrids. Growth habit is classified as either determinate (bush with a limited production season) or indeterminate (vining with a longer production season). Indeterminate varieties require more harvests than determinate varieties. Varieties may also differ in earliness (early, mid-, and late-season). Other factors that can influence variety selection for local markets are consumer demand and regional preferences, which can include heirloom cultivars. Adaptability to local conditions and suitability to intended production practices must also be considered.

Organic production requires the use of certified organic seed and organic transplant production methods. Individual organic certifiers may permit the use of untreated conventional seed if suitable organic seed is unavailable; however, growers must be able to document their effort to obtain certified organic seed from at least three different sources. Neither seed nor transplants can be treated with any prohibited substances, such as unapproved fungicides.

Stocky, container-grown transplants are most desirable for transplanting, as they will result in earlier yields than bare-root plants. The higher prices generally commanded by early tomatoes usually more than offsets the higher cost of good quality container-grown plants. Many growers produce transplants in 72- or 128-cell trays, although some grow transplants for their earliest crops in larger cells. Tomatoes will tend to get "leggy" if produced in smaller cell trays where plants are tightly spaced.

Planting and crop management

Open field, unprotected, tomato transplanting is done after the last killing frost for a spring crop and in July for a fall crop. The earliest and latest safe planting dates for tomatoes vary according to the region of Kentucky. Most growers use approximately 4,200 to 5,000 plants per acre.

The use of mulch will help preserve soil moisture, moderate soil temperatures, and prevent weed germination near plants. In addition, mulches can reduce the incidence of soil borne diseases that occur when soil is splashed on fruit and foliage, as well as reduce fruit contact with the soil. Mulching materials can include natural materials (e.g., straw or wood chips or paper mulch) or allowable synthetic materials (e.g., newspaper). If a natural mulch is used, such as straw or wood chips, it is important to apply it in a thick layer; otherwise, weeds will come through the mulch and can be more difficult to control than if the ground was left bare. Be sure to know the source of your mulch and what was applied to it, if anything, before applying it to the tomato crop.

Plastic mulch is permitted in organic production if it is removed at the end of the harvest season. University of Kentucky on-farm demonstrations have shown that the highest profits can be obtained with raised beds covered with black plastic mulch and drip irrigation. Black plastic may also enhance earliness by warming soils in the spring. The moisture levels under the plastic must be carefully monitored with tensiometers so that moisture remains relatively constant during the growing season. Allowing soils to dry and then rapidly applying large volumes of water can result in fruit cracking; fluctuations in soil moisture can also lead to blossom end rot.

The use of organic mulch has the additional advantage of improving the soil by adding organic matter back into the soil as it decays. Organic mulches also tend to keep soils cooler in the heat of summer. However, organic mulch will also keep soils cooler in the spring, which could delay early season growth.

Sucker removal (pruning) should be done to reduce vegetative growth and encourage fruit development. For details about pruning, see Pages 92 and 94 of UK's Vegetable Production Guide for Commercial Growers (ID-36) at http://www2.ca.uky.edu/agcomm/pubs/ID/ID36/ID36.pdf. It is important to strike a good balance between fruit and foliage as excessive pruning can reduce yield and fruit quality. The amount of pruning is often determined by the type of tomato plant being grown; indeterminate tomato types require more pruning than determinate types. Tomato plants should be supported and trained using cages, stakes, or a trellis system. While

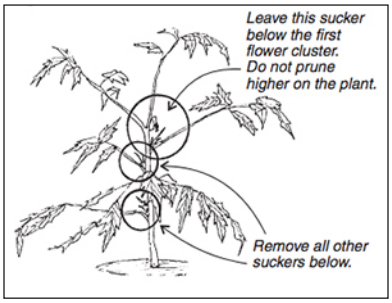

Illustration from UK's Vegetable Production Guide for Commercial Growers (ID-36), Page 94.

support systems require additional material and labor, the benefits generally outweigh the costs in organic production. Support systems result in improved fruit quality, less postharvest fruit decay, and increased yields when compared to unsupported plants (sprawl culture). Support systems, along with pruning, result in improved air circulation through the plants, thus fewer foliar disease problems. Additionally, supported plants are easier to harvest. The support system should be in place two to three weeks after transplanting. Stakes or posts can be made of metal or wood; however, wooden stakes cannot be treated with arsenate or other prohibited materials.

Organic crops must be protected from potential contamination by adjoining conventional farms, as well as from non-organic fields in split operations. The drift and run-off of prohibited substances can compromise the farm's organic certification status. Preventative strategies include the use of buffer zones and barriers, altering drainage patterns, posting "no spray" signs, and cooperating with neighboring conventional farmers. Growers with split operations must take steps to prevent the commingling of their two systems, especially during harvest and storage.

Disease and pest management

Organic tomato production can be very challenging in Kentucky due to the number of diseases and pests that can reduce harvest quality and yields. Pest management in organic systems emphasizes prevention through good production and cultural methods. The goal is not necessarily the complete elimination of pest problems, but rather to manage insects and diseases to keep crop damage within acceptable economic levels. Effective and economically efficient pest management in organic farming requires multiple strategies and an integrated systems approach. Following good cultural practices, such as maximizing air circulation (e.g., with plant spacing, pruning, and trellising), rotating crops, maintaining well-balanced fertility, managing soil moisture, and practicing good sanitation practices, can go a long way in preventing problems that would reduce yields. Frequent scouting is essential to keeping ahead of potential problems; monitoring diseases and pests requires accurate identification.

Tomatoes are subject to a large number of diseases, including anthracnose, bacterial canker, bacterial spot, early blight, Fusarium wilt, Septoria leaf spot, southern blight, and Verticillium wilt. Late blight can be a problem during cooler growing seasons. Growing varieties with multiple resistances to locally prevalent diseases is essential to effective disease management in organic systems. There are some organically approved fungicides available (such as copper and sulfur products). Copper is the best option for organic growers and must be applied according to the label. It should be applied every seven to 10 days or every 10 to 14 days, depending on the product. Excessive copper can be damaging to certain beneficial soil organisms, and sulfur will injure plant foliage at high temperatures. Copper fungicides work best when used preventively. Preventing diseases is essential, as once a disease is present in a field, especially in organic production, it is beyond stopping its spread. A list of approved products can be found on the Organic Materials Review Institute (OMRI) website.

Potential pests include aphids, cutworms, flea beetles, fruitworms, mites, stinkbugs, and root knot nematodes. Trap crops, approved insecticides (such as insecticidal soap and Bt), and beneficial insects can help organic growers manage insect pests.

Weed management begins with careful site selection; thus, sites with perennial noxious weeds that have historically been difficult to control should be avoided. The planned crop rotation program, as well as site preparation, should be directed at making sure existing weeds are under control prior to planting.

Maintaining a "weed free" planting is most critical during the first four to six weeks after transplanting. Once plants have reached a height of 12 to 15 inches they are better able to compete with weedy vegetation. However, if left unchecked, weeds compete with plants for water and nutrients, harbor insect and disease pests, and reduce air circulation. Weeds should not be allowed to go to seed. Plastic or organic mulches can be used to suppress weed development within rows, while mowing, shallow tillage, and living mulches are techniques for managing weeds between rows.

Harvest and storage

Products grown organically but harvested during the three-year organic transition period cannot be marketed as organic. Only those crops that have met NOP production and certification standards, including the three-year minimum transition period, can be market-

ed and sold as certified organic or organic. Harvesting operations and storage areas must comply with NOP standards. Growers with split operations must either use separate equipment and facilities for these operations, or a cleaning protocol must be followed before use in the organic end of the enterprise. Packaging materials must be protected against potential contamination from prohibited substances. NOP standards require that packaging materials are free of prohibited substances and must not contaminate the organic product. For more information, see §205.272 of the Code of Federal Regulations.

Tomato fruit is easily damaged and should be handled as carefully as possible in all picking, grading, packing, and hauling operations. Fruit is harvested at the maturity stage preferred by the intended market. Vine-ripe tomatoes must be harvested as often as twice a week, whereas mature-green tomatoes are harvested only three or four times during the season. Pack tomatoes in the type and size container the market requires. Growers should note that many heirloom varieties have thin skins and should be limited to local markets only, as they cannot be transported long distances.

Labor requirements

Organic systems can be more labor intensive than conventional systems. This higher labor requirement is most often attributed to the increased time in weed control and monitoring and managing pests. Conventional tomato production per acre involves approximately 60 hours for production, 600 hours for harvest, and 100 hours for grading and packing. Plasticulture will add eight to 10 hours more labor per acre, mainly for the removal and disposal of the plastic. Organic production could add significantly more production labor hours per acre, with some producers reporting 100 additional hours or more.

Labor times for small-scale organic tomato production, such as that for sale at farmers markets, can also vary according to specific production systems and practices. For tomato production in a 100-foot by 4-foot bed, Iowa State University has estimated about five hours for production and six to seven hours for harvest and postharvest activities.

Economic Considerations

Initial investments include land preparation, the purchase of seed or transplants, and the purchase of stakes or other training system components. Additional start-up costs can include the installation of an irrigation system and black plastic mulch. Organic certification costs will also be incurred in certified organic tomato production.

For small-scale organic tomato production, total production costs (including fixed costs of land and organic certification) are estimated at $280 for a 100-foot x 4-foot bed. Returns will vary based on yield and price. Assuming yields of 400 pounds sold at $2 per pound, this bed could return as much as $520 above total costs. Higher prices per pound can result in substantially higher returns.

Production costs for staked, trickle-irrigated tomatoes are estimated at $2,930 per acre, with harvest and marketing costs for 1,600 10-pound boxes at $8,060 per acre. Total costs, including annual fixed costs, are estimated at approximately $11,980 per acre. These are only representative estimates, as actual costs and returns are highly variable depending on the production situation, price, and yield.

Since returns vary depending on actual yields and market prices, the following per acre returns to land and management estimates are based on three different scenarios. These estimates are the returns above a $3,300 cost attributed for 220 hours of operator labor at $15 per hour. Conservative estimates represent an average cost and return estimate in 2019.

Pessimistic	Conservative	Optimistic
$(1,255)*	$2,855	$7,860

*Parentheses indicate a negative number, i.e. a net loss

Selected Resources

Publications

- Vegetable Production Guide for Commercial Growers, ID-36; includes Organic Manures and Fertilizers: Appendix H (pp. 128-129) (University of Kentucky) http://www2.ca.uky.edu/agcomm/pubs/id/id36/id36.pdf
- Field Production of Organic Tomatoes (eOrganic, 2019) https://eorganic.org/node/2618
- Organic Tomato Production (ATTRA, 2012) https://attra.ncat.org/product/organic-tomato-production/
- Organic Weed Management (eOrganic, 2013) https://eorganic.org/node/2551
- Resource Guide to Organic and Sustainable Vegetable Production (NCAT-ATTRA, 2012) https://attra.ncat.org/product/resource-guide-to-organic-and-sustainable-vegetable-production/
- Training Systems and Pruning in Organic Tomato Production (eOrganic, 2019) https://eorganic.org/node/2620

Organizations/Websites

- Kentucky Department of Agriculture (KDA) Organic Program https://www.kyagr.com/marketing/organic-marketing.html
- Economic Research Service (USDA) http://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/
- Fruit and Vegetable Marketing News-Terminal Market Prices (USDA Agricultural Marketing Service) https://www.marketnews.usda.gov/mnp/fv-home
- National Organic Program (Agricultural Marketing Service-USDA) http://www.ams.usda.gov/nop
- Organic Materials Review Institute (OMRI) http://www.omri.org/
- Organic Trade Association (OTA) http://www.ota.com/

Suggested Citation:

Kaiser, C. and M. Ernst. (2021). *Organic Tomatoes*. CCD-CP-111. Lexington, KY: Center for Crop Diversification, University of Kentucky College of Agriculture, Food and Environment. Available: http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/organictomatoes.pdf

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Photos courtesy of Pixabay.com (Pages 1 and 5); illustration (Page 3) from UK's Vegetable Production Guide for Commercial Growers (ID-36), Page 94.

April 2021