



## Cultivation Insights

### *CULTURAL PRACTICES FOR PROTECTED CULTURE TOMATOES*

- » Tomatoes in protected culture can be grown in systems producing one or two crops per year.
- » Temperature, humidity, water, and nutrition are managed to maintain the desired balance of vegetative growth and fruit production.
- » Regular stem, leaf, and fruit pruning are used to maintain productive, healthy vines.



Figure 1. Support strings are unwound from spools suspended from a support wire above the canopy.

#### ***CROPPING SYSTEMS***

In northern areas protected-culture tomatoes are typically grown in a one crop per year system with eleven months of crop growth and one month for greenhouse cleaning and preparation. In regions with high summer temperatures, a two crop per year system is used to avoid production during the hottest periods.<sup>1</sup> In the one-crop system, tomatoes typically are seeded in November/December and transplanted in January with harvest starting in March and proceeding through November. With the two-crop system, the spring crop is typically started in late-December or January with harvest from mid-March through July. The fall crop is typically planted in mid-August with harvest from late-October through the November/December.<sup>2,3</sup> The timing for both of these systems can vary somewhat from region to region. Other timing options are also used, including the intercropping of plants of different ages to obtain continuous production year-round. Crops grown during the winter months often require the use of artificial light.

#### ***BALANCED GROWTH***

During the production period, it is important to maintain a balance between vegetative growth (growth of leaves and stems) and generative growth (flower and fruit production).

Early in the cropping cycle, plant growth is primarily vegetative. As the season progresses, plant growth becomes more generative, but a balance of vegetative and generative growth needs to be maintained for sustained fruit production. There are some exceptions, such as when crops are transplanted and grow into the winter. The low-light conditions tend to make these plants more vegetative. A balance is obtained through leaf pruning and the management of temperature, humidity, water, and nutrients. Overly vegetative plants have large amounts of leaf area, which leads to delayed flowering, small fruit, poor fruit quality, and delayed harvest. Overly generative plants have a high fruit load, smaller leaves, and weak growing point. This also results in delayed and poor fruit set and lower fruit production.<sup>2</sup>

On producing plants, stems should be about 0.4 inches (1 cm) thick 6 inches (15 cm) below the growing tip. However, this varies with the tomato type (beefsteak vs. cherry). Thicker stems indicate too much vegetative growth, while thinner stems indicate carbohydrate starvation resulting from overly generative growth.<sup>1</sup> One way to manage plants that are becoming too vegetative is to remove the uppermost leaves. One leaf is removed from each plant each week until the desired balance is achieved.



Figure 2. Plastic clips are used to attach tomato vines to support strings.

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Vegetative growth is promoted by low light levels, lower temperatures, high humidity, and adequate water. Generative growth is promoted by increased light, higher temperatures, reduced humidity, and less water. Altering the rates and proportions of nutrients are also used to adjust the balance of growth, as are the frequency and duration of irrigation. Shorter and more frequent irrigation periods promote vegetative growth while longer and less frequent periods promote generative growth. Starting irrigation earlier in the day and ending later in the day promotes vegetative growth while starting irrigation later and ending earlier in the day promotes more generative growth.<sup>1</sup>

## PLANT SPACING

In protected culture systems, tomato plants are often arranged in single rows, typically with five to six feet (1.5 to 1.8 m) between row centers. In-row spacing varies, depending on the desired head-density (number of growing tips), which relates to length of cropping season, tomato variety, and time of the year.<sup>1,2,3</sup> Desired head densities for summer production of beefsteak tomatoes are usually 1.25 to 1.6 heads/5 ft<sup>2</sup> (2.75 to 3.6 heads/m<sup>2</sup>), and 2.0 to 2.5 heads / 5ft<sup>2</sup> (4.2 to 5.5 heads/m<sup>2</sup>) for grape tomatoes.



Figure 3. Vines are leaned and lowered as they grow. Lower leaves are removed to allow for good air-flow and better access to the fruit for harvest.

## PRUNING AND TRAINING

Most protected culture tomatoes are grown using a high-wire trellising system. A support wire is suspended over the tomato plants (Figure 1). Tomato stems are trained up a string attached to the support wire, and plastic clips are used to secure the stems to the string (Figure 2).<sup>1</sup> When the tip of the vine nears the support wire, the string, often on a spool, (Figure 1) is let out to lean and lower the vines, and the spool or point of attachment is slid down the support wire. The lower leaves are removed to improve air-flow, better light penetration, speed up ripening, to make the plant more generative, to help improve fruit size, and provide ease of access for harvesting. One to four leaves are removed weekly to maintain the desired leaf to fruit ratio.<sup>2</sup> The lean and lower process continues throughout the season as the growing points near the support wire (Figure 3).



Figure 4. Flowers are trimmed from flower/fruit trusses to promote even fruit maturation and uniform fruit size. Supports can be used to prevent kinking and snapping of the fruit trusses.

Vines are typically pruned to a single stem per plant and all side shoots (suckers) removed at least once per week. Some operations use a two-stem or V-stem system in which a second stem is allowed to develop and trained up a separate string attached to a second support wire. Sometimes a third head is allowed to develop to achieve the desired head density in the summertime.

Flower trusses are pruned to promote uniform fruit development and to prevent the formation of too many fruit per truss, which results in smaller fruit. For the production of large (beefsteak) fruit, trusses are trimmed to three to four fruit per truss (Figure 4).

Cluster tomatoes are harvested as a group of fruit remaining attached to the inflorescence. Large cluster tomatoes have about four to six fruit per truss, while cherry tomatoes can have eight to twelve fruit per truss. The trusses can get heavy as the fruit mature, and supports may be required to prevent the trusses from kinking or snapping. Kinking and snapping are more likely to occur on plants growing in low light situations.<sup>1</sup>

As the end of the season approaches, the growing point is removed five to eight weeks before the desired termination date. One week after removing the growing point, all remaining flowers and suckers are removed. For the spring crop in a two-crop system, terminating in late June or July, it is important to leave enough leaves on the plant to shade the fruit and prevent sunscald.<sup>1,2</sup>

Sources:

<sup>1</sup> Langenhoven, P. 2018. Hydroponic tomato production in soilless culture. Indiana Horticultural Congress, February 13, 2018.

<sup>2</sup> Ontario Ministry of Agriculture, Food and Rural Affairs. 2010. Growing greenhouse vegetables in Ontario. Publication 836.

<sup>3</sup> Snyder, R. 2010. Greenhouse tomato handbook. Mississippi State University Extension Service. P1828.

**For additional agronomic information, please contact your local seed representative.**

**Performance may vary**, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about greenhouse tomato production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop.

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