HORTICULTURAL
MU Guide
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Watering and Fertilizing Tomatoes in a High Tunnel

Proper watering and fertilization are essential for successful production of tomatoes within a high tunnel. High tunnels exclude natural rainfall, so timely irrigation is important. In addition, growers must consider the special needs of high tunnel soil to ensure appropriate levels of nutrients are available to the plants.

A high tunnel is a low-cost, solar-heated greenhouse that can extend the growing season of vegetables such as tomatoes.

Drip irrigation. Drip irrigation is the most efficient method of delivering water and nutrients to high tunnel tomatoes. Through a small, ¾-inch-diameter, collapsible tube, water is slowly applied to the plant without wetting the foliage. Drip tape, usually 8 to 10 mil thick, is buried 1 to 2 inches deep. Dripper or emitter spacing is typically 4 to 12 inches. Tomatoes require a single drip line per row, offset about 2 inches from the plant. Flow rates of drip tapes vary. Most growers choose a medium-flow tape, which delivers ½ gallon per minute (gpm) per 100 feet. High-flow tape, which delivers 0.8 to 1.0 gpm, is useful for preventing clogging and reducing irrigation time (Table 1).

Another distinct advantage of drip irrigation is the ability to inject water-soluble nutrients through the irrigation system, a technique that is called fertigation. This technique allows nutrients and water to be applied as the crop grows, rather than all the nutrients being applied at once, either at planting or before (Figure 1). Fertigation saves both water and fertilizer.

Table 1. Irrigation hours per week required to apply 68 ounces of water per tomato plant per day based on varying plant populations and drip tube flow rates.

Drip tube flow rate		Tomato plants per high tunnel		
Gph/100 ft[1]	Gpm/100 ft[2]	300	400	500
8	0.13	21	28	35
10	0.17	17	22	28
12	0.20	14	19	23
16	0.27	11	14	18
18	0.30	9	12	16
20	0.33	8	11	14
24	0.40	7	9	12
30	0.50	6	8	9
36	0.60	5	6	8
40	0.67	4	6	7
42	0.70	4	5	7
48	0.80	3.5	5	6
60	1.00	2.8	4	5

[1]Gallons of water per hour per 100 ft. run of drip tape.
[2]Gallons of water per minute per 100 ft. run of drip tape.

Watering. Because tomato fruits are more than 90 percent water, yield and quality suffer when plants are under drought stress. Tomatoes that are not adequately watered develop fewer flowers per truss, produce less fruit and often contract blossom end rot.

The critical growth periods for adequate watering of tomatoes are during flowering, fruit set and fruit development. Flowers appear on tomatoes beginning about four weeks after transplanting. Determinate tomato varieties have a concentrated period of flowering, whereas indeterminate tomatoes flower continuously through the growing season. Tomatoes begin developing fruit about six weeks after transplanting, and adequate watering is needed for the fruit to develop and attain proper size. As the fruit continues to grow, an average of 2 to 2.5 quarts of water per plant per day will be needed (Figure 1). This equates to a bit over 1,000 gallons of water per week for a high tunnel containing 300 tomato plants.

Credits

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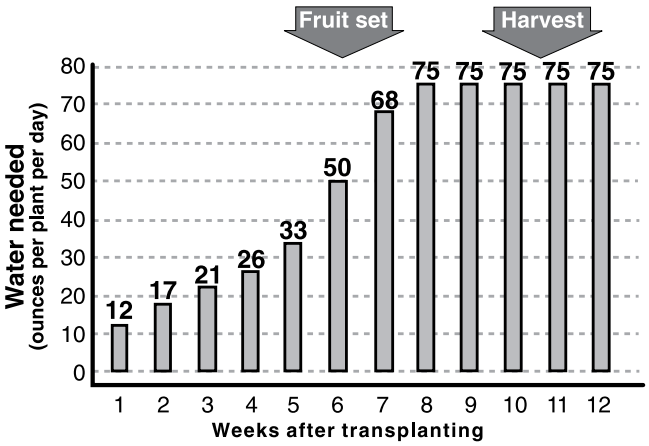

Figure 1. Water requirements of high tunnel tomatoes.

Fertilization. Many water-soluble fertilizers can be used for tomatoes. However, large quantities of phosphorus and potassium generally should not be applied through the drip irrigation system. Rather, the soil should be tested before the crop is planted, preferably in the fall, and all of the phosphorus and most of the potassium can be applied before planting or between cropping cycles within the high tunnel. The decision to apply additional phosphorus and potassium via drip irrigation should be based on tissue test results.

Nitrogen is used by tomatoes for vine growth. Tomato plants that are low in nitrogen appear stunted and spindly with a yellowish cast to the leaves. Too much nitrogen creates excessive vine growth, twisted foliage, delayed flowering and lower marketable yield. About 40 to 50 percent of the total seasonal nitrogen can be applied at planting, and the balance can be applied through the drip system over the course of the growing season. Many organic sources of nitrogen such as compost, alfalfa meal and soybean meal can be applied and mixed with the soil before planting tomatoes.

For each 1 percent of organic matter in the soil, there can be as much as 20 pounds of residual nitrogen per acre. Thus, if soil organic matter is greater than 3 percent, no preplant nitrogen is necessary. However, if soil organic matter is less than 3 percent and no organic residues have been added to the soil, 1 to 1.5 pounds of actual nitrogen per 1,000 square feet can be applied before transplanting tomatoes in the high tunnel.

Fertigation of nitrogen can be applied based on the volume of water applied by irrigation or based on area. Most tomato roots will be concentrated in a 24- to 30-inch-wide section of the bed or row. Multiplying the root zone width by the length of each row and the total number of rows of tomatoes equals the effective bed width. Additional nitrogen can be applied through the drip irrigation system at a rate of 8 to 10 pounds per acre per week, or 2.9 to 3.7 ounces per 1,000 square feet per week (Table 2). Foliar feeding of nitrogen, phosphorus and potassium is not effective relative to soil application of these major nutrients. Fertilizer nitrogen is available as nitrate or ammonium. Tomatoes respond favorably to nitrate nitrogen. Nitrate nitrogen is readily available to the plant and typically has low salt relative to ammonium fertilizers (ammonium nitrate, urea). Choose nitrogen fertilizers low in salt because salt levels can accumulate in the soil in a high tunnel. Many commercial high tunnel tomato growers choose to fertilize with calcium nitrate and then alternate weekly with a fertilizer high in potassium (4-18-38), particularly during fruit ripening. Calcium reduces the incidence of blossom end rot, and some indicators suggest that potassium might improve fruit quality.

Conduct tissue testing to determine whether the tomato nutrient levels are sufficient. Randomly select 10 to 12 plants per house beginning at flowering or early fruit set. For determinate tomatoes, such as Mountain Fresh Plus, break the fifth or sixth limb from the top of the plant and place the entire limb in a brown paper bag. For indeterminate tomatoes, such as Trust, choose a leaf above a fruit that is about 2 inches in diameter. Dry the sample before sending it to a laboratory for analysis. Compare results with recommended levels of each nutrient (Table 3).

Table 2. Amount of water-soluble fertilizers used to fertigate producing high tunnel tomatoes.

Nitrogen required		Equivalent rate of commercial nitrogen fertilizers (oz/1,000 ft²)			
(lb/acre equivalent)	(oz/ 1,000 ft²)	*15–0–0*	*20–20–20*	*4–18–38*	9–45–15
4	0.7	5	4	18	8
6	2.2	15	11	55	24
8	2.9	19	15	73	32
10	3.7	25	19	93	41

Table 3. Recommended levels of nutrients for high tunnel tomatoes.

Element	Early fruit set	Mid–harvest
Nitrogen (N)	4.0–6.0%	4.5–5.5%
Phosphorus (P)	0.3–0.9%	0.6–0.8%
Potassium (K)	4.0–7.0%	4.0–7.0%
Calcium (Ca)	1.5–3.5%	1.5–5.0%
Magnesium (Mg)	0.4–0.7%	0.4–1.5%
Iron (Fe)	60–300 ppm	60–300 ppm
Zinc (Zn)	30–100 ppm	30–150 ppm
Boron (B)	30–100 ppm	30–100 ppm

For more on production of tomatoes in high tunnels, see MU Extension publication M170, *High Tunnel Tomato Production*.

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