



# 2018 New England High Tunnel Survey

In 2018, Extension personnel from the Universities of Massachusetts, Vermont, New Hampshire and Rhode Island documented production practices and took soil and leaf samples from 20 tomato high tunnels in those 4 states, with support from the New England Vegetable and Berry Grower's Association. Soil and tissue samples were analyzed at the University of Maine and Massachusetts labs. Here are some guidelines for optimizing tomato production based on the data collected. NOTE - this project surveyed current practices and conditions in a variety of tunnels; additional research is needed to quantify the impact of different management and fertilization practices.

## Practices that may increase yield:

- **Transplant** earlier, at higher density: April 1<sup>st</sup> – May 1<sup>st</sup> with 3-5ft<sup>2</sup> per leader.
- **Graft** plants for stronger roots, especially if soil conditions are not optimal.
- **Avoid compaction.** Sample 10 locations to 15 cm depth. If over 300 psi found, subsoil or make raised beds.
- **Provide adequate soil moisture.** Install at least 2 drip lines per plant, up to 4 if sandy soil. Mulches may help keep moisture even across the soil surface.
- **Keep up with pruning.** Prune side shoots when small, remove foliage to 1<sup>st</sup> cluster.
- **Track performance.** Measure harvests, even if simply counting boxes. This is key to assessing management changes.
- **Set yield goal.** Based on length of season, variety, etc. Reasonable goals = 3-5 lbs/ft<sup>2</sup> Make fertilizer applications based on goal (see tables on the reverse page)
- **Phosphorus\*** don't over-apply, crops do not remove a lot, tunnel soils are warm.
- **Potassium\*** is removed in large quantities by tomatoes. Make sure adequate K is available, especially as fruits form.
- **Nitrogen\*** is also removed in large quantities, provide sufficient available N for biomass production through the entire growing season. Front-load slow-release amendments and/or apply soluble fertilizer during the season.
- **Monitor available AND reserve soil nutrients** (Table 1). Take leaf samples monthly for additional guidance.
- **Fertilizer application should be based on soil test results**, otherwise you are guessing!
- **Scout and Manage Pests.** Do not let challenging insects (like aphids) or diseases (like powdery mildew) get ahead of you. Set up a regular scouting schedule and send samples to lab for ID as needed. Find scouting guidelines here: [ag.umass.edu/vegetable/outreach-project/new-england-pest-scouting-network](http://ag.umass.edu/vegetable/outreach-project/new-england-pest-scouting-network)

**Table 1. Recommended Ranges for Tissue and Soil High Tunnel Testing**

Analysis	Greenhouse leaf tissue at first full bloom <sup>y</sup>	Standard soil test for High Tunnels <sup>z</sup> (reserve nutrients)	SME test for High Tunnels <sup>z</sup> (available nutrients)
pH	-	6.2-6.8	6.2-6.8
Organic Matter	-	8-12%	8-12%
Soluble Salts	-	n/a	2-4 mmhos/cm
Nitrate – N	2.5-4%	100-200 ppm	100-200 ppm
Ammonium – N	-	<10 ppm	<10 ppm
Phosphorous	0.2-1%	20-40 ppm	1-5 ppm
Potassium	2.5-10%	200-300 ppm	150-275 ppm
Calcium	1-3%	-	>250 ppm
Magnesium	0.3-1%	-	>60 ppm
Sulfur	0.3-0.8%	>25 ppm	>25ppm
Boron	20-40 ppm	0.5-1.2 ppm	0.05 -0.5 ppm
Copper	5-15 ppm	0.8-1.2 ppm	0.01 -0.5 ppm
Iron	40-100ppm	6-10 ppm	0.3 -5.0 ppm
Manganese	30-100ppm	4-8 ppm	0.1 – 3.0 ppm
Sodium	-	<200 ppm	<100 ppm
Zinc	25-40ppm	1-2 ppm	0.3 – 3.0 ppm

<sup>y</sup> Adequate ranges from University of Florida Electronic Data information Source: <https://edis.ifas.ufl.edu/ep081> <sup>z</sup> Optimum and normal ranges based on the UMaine Soil Lab for the long term high tunnel test (standard soil test uses the Modified Morgan extract solution, and the SME test uses a water extract solution): [http://anlab.umesci.maine.edu/soillab\\_files/prices/soiltest12.pdf](http://anlab.umesci.maine.edu/soillab_files/prices/soiltest12.pdf)  
**Note:** The University of Maine reports test results in lbs/A. To convert from ppm to lbs/A multiply by 2. For example, 100ppm = 200lbs/A  
**BONUS! Fertilizer recommendations on the back** →





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## Nitrogen applications should be based on yield potential

N application rate based on yield goal

	Yield goal lb/acre	=Yield lb/ft <sup>2</sup>	=Yield lb/stem = lb/4 ft <sup>2</sup>	Approx. plant height	N need lb/acre @ 90% recovery	N need* lb/1,000 ft <sup>2</sup>
Low yield	40,000	1	4	8'	100	2.3
Medium yield	80,000	2	8	12'	200	4.6
Good yield	120,000	3	12	16'	300	6.9
High yield	160,000	4	16	20'	400	9.2

\* Subtract N credit for each 1% soil organic matter of .25 lb/1,000 ft<sup>2</sup>, up to 1 lb.

## Fertilizers options to meet N target application rate (lb./1,000 ft<sup>2</sup>)

Target N application lb/1,000 ft <sup>2</sup>	Soybean meal 7% N 75% avail.	5-4-3 organic 75% avail.	feather meal 10% N 75% avail	soluble fertilizer 20% N	soluble fertilizer 16% N	soluble fertilizer 12% N
2	38	53	27	10	13	17
4	76	107	54	20	25	34
6	114	160	81	30	38	50
8	152	213	108	40	50	67

If using soluble N fertilizer it is important to spread applications over the growing season to provide for consistent growth. Slower-release organic fertilizers may be front-loaded if well mixed into the soil, throughout the rooting zone, to allow for N recovery throughout the season. However, on light textured soils and/or high N application rates it is advisable to apply 1/3 to 1/2 of the total N after fruiting begins, either by using soluble materials or by spreading fertilizer by hand under mulch/drip lines.

## P<sub>2</sub>O<sub>5</sub> application rate based on modified Morgan's soil test

Yield goal	Low <20 lb./acre = <10 ppm		Medium 20-40 lb./acre = 10-20 ppm		High/optimum 40-80 lb./acre = 20-40 ppm		Excessive > 80 lb./acre = > 40 ppm	
	lbs/acre	lbs/1000 ft <sup>2</sup>	lbs/acre	lbs/1000 ft <sup>2</sup>	lbs/acre	lbs/1000 ft <sup>2</sup>	lbs/acre	lbs/1000 ft <sup>2</sup>
Low yield	180	4.1	120	2.8	60	1.4	0	0
Med yield	240	5.5	160	3.7	80	1.8	0	0
Good yield	300	6.9	200	4.6	100	2.3	0	0
High yield	360	8.3	240	5.5	120	2.8	0	0

If concurrent SME test shows less than 1 ppm P prior to transplanting, apply some soluble P<sub>2</sub>O<sub>5</sub> as a starter fertilizer, in the range of 1 lb P<sub>2</sub>O<sub>5</sub> /1,000 ft<sup>2</sup>.

## Some fertilizer options to meet P target application rate (lb./1,000 ft<sup>2</sup>)

Target P <sub>2</sub> O <sub>5</sub> application lb./1,000 ft <sup>2</sup>	Bone char 16% available	5-4-3 organic	Rock phosphate 3% available	soluble fertilizer 20% P <sub>2</sub> O <sub>5</sub>	soluble fertilizer 10% P <sub>2</sub> O <sub>5</sub>	soluble fertilizer 5% P <sub>2</sub> O <sub>5</sub>
1 lb	6.3	25	33	5	2.5	20
2 lb	12.5	50	66	10	5	40
3 lb	18.8	75	99	15	7.5	60
4 lb	25	100	132	20	10	80
5 lb	31.3	125	165	25	12.5	100

## K<sub>2</sub>O application rate based on Modified Morgan's soil test

Yield goal	Low <400 lb./A = <200 ppm K		Medium 400-800 lb./A = 200-400 ppm K		High/optimum 800-1200 lb./A = 400-600 ppm K		Excessive > 1200 lb./A = > 600 ppm K	
	lbs/acre	lbs/1000 ft <sup>2</sup>	lbs/acre	lbs/1000 ft <sup>2</sup>	lbs/acre	lbs/1000 ft <sup>2</sup>	lbs/acre	lbs/1000 ft <sup>2</sup>
Low yield	300	6.9	200	4.6	100	2.2	0	0
Med yield	450	10.3	300	6.9	150	3.4	0	0
Good yield	600	13.8	400	9.2	200	4.6	0	0
High yield	750	17.2	600	13.8	300	6.9	0	0

To provide 1 lb K<sub>2</sub>O: apply 2 lb potassium sulfate, or 4.5 lb sul-po-mag, or 5 lb 20% soluble K<sub>2</sub>O etc. If concurrent SME test shows less than 100 ppm K prior to transplanting, apply an additional 100 lb/acre soluble K<sub>2</sub>O as a starter fertilizer (2.3 lb/1,000 ft<sup>2</sup>). On light-texture soils (sandy loams) K application should be split: pre-plant and sidedressing. On heavier soils (with more silt, clay) all K may be front-loaded. If Mg < 60 ppm in SME, use sul-po-mag, if >60 ppm use potassium sulfate as a K source.

## Questions? Contact Us.

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