Tomato Variety Trial in High Tunnels of 2013, Kingston, RI

Andy Radin, Department of Plant Science and Entomology and University of Rhode Island Cooperative Extension

**Introduction**

Season extension practice using high tunnels has made possible ever earlier tomato sales in temperate climates, but the potential of these structures is far from being realized. Because Southern New England growers rely on direct marketing to a great extent (Connecticut, Massachusetts, and Rhode Island rank first, second, and third in the nation respectively for direct market sales on a per farm basis, according to the 2007 Census of Agriculture), flavor and appearance should weigh in more heavily for variety selection than storage and shipping qualities. Growers may be more familiar with field varieties that serve the latter purposes but are unaware of varieties that perform especially well under cover for fresh direct marketing. One purpose of this trial is to demonstrate a number of such varieties in several fruit classes in order to provide ideas for a more diverse product line in direct market settings such as farmers’ markets and roadside stands.

**Methods**

**Seedlings** of 13 indeterminate tomato varieties were **started** during the first week of February at Chase Farm, Portsmouth, RI from seed provided by Johnnys Selected Seeds. Varieties were chosen on the basis of their colors and classes in order **to display a range of diversity** (See Table 1 for descriptions). Sixteen plants of each variety were planted in sections of rows, and three additional plants of each (but two varieties) were planted in one row (Figure 1).

**Soil** was heavily **amended** with compost supplied by Earth Care Farm at a rate of approximately 0.5 cu. ft. per square ft., or 2.67 cu. yd. for each 1344 sq. ft. tunnel. (Tunnels had never been amended with compost prior to this season; this is a one-time heavy supplement, and subsequent years will require much less.) Lime was applied at 1 ton per acre. A 7-5-7 granular organic fertilizer was applied to achieve 75 lbs. N per acre in a 12” wide band over each row.

**Transplants** grown up into 3” pots were **set out** in two high tunnels each measuring 72’ X 21’ on April 18, 2013 into bare soil and watered in with a dilute solution (one pint per five gallons) of Organic Gem fish emulsion (3-3-0.3). Soil temperature at the time of transplanting was 60°F. Plants were spaced at 16” within each row, 48 plants per row, in five rows (3 in “south” tunnel (pH 6.5), 2 in “middle” tunnel (pH 5.8)), with five feet between rows. Wire hoops covered with polyester row cover were immediately installed to protect against cold. Early morning temperature on April 21 was 27°F but plants sustained no damage, most likely because of warmed soil. Two drip tapes were also installed on each row.

Beginning immediately, **plants** were **pruned** of sideshoots to a single stem and on May 9, plants were attached to **string trellises** wound around plant hangers suspended from overhead conduit pipes. As plants grew, they were regularly pruned of sideshoots and trained to the string trellis using plastic tomato clips. When plants reached the overhead pipes (beginning in late June), string was unwound from the hangers to **lower the growing points**, and the hangers were moved down the pipe a short distance to accommodate the vine. Lower leaves were first stripped up to the first fruiting cluster on June 7 and this was performed following every lowering in order to keep good airflow around the “ankles” of the plants for disease prevention. Pruning and lowering were continued well into October.

**Plants** were regularly **irrigated** with anywhere from 1” to 2” per week, and several **liquid nutrient amendments** were applied through the system (Table 2) until late September. Approximately five gallons of Organic Gem 3-3-0.3 fish emulsion (Advanced Marine Technologies, OMRI listed) was applied over the entire season. Two seaweed products were used, including approx. two gallons Ocean Organics (OMRI listed) 0-0-1 for supplemental potassium, and two gallons of Stimplex, (Acadian Seaplants, not OMRI listed) for growth promoting substance content. Also, 2 gallons of Full Measure Cal 12.5% Calcium carbonate and EDTA (Tiger Industries Inc., not OMRI listed) for blossom end rot prevention and several solutions of Epsom salt (MgSO4) when deficiency was observed. Small top dressings of bone char for phosphorus and sul-po-mag for potassium were also applied in late May.

In order to allow adequate soil warming, **mulching** of **plants with rye straw** to a depth of approximately 4” was delayed until May 23. A total of 30 rectangular bales were used.

Tomato **leaf tissue was sampled** on June 12 and July 8. The first expanded compound leaf (typically the fifth leaf down from the terminal) from each alternating plant was harvested from each variety for a total of 8 leaves per sample per variety. These were oven dried, ground and sent to the University of Connecticut Soil and Plant Analysis Laboratory for analysis.

**Tomato harvest** began on June 18 and continued until a hard freeze on October 25 killed all plants and froze all green fruit. Fruit was harvested twice weekly until late September when ripening slowed, when it was harvested once per week. All fruit was considered marketable until the second week of July, when lower quality fruit was separated from top quality. Any fruits which lacked structural integrity were not harvested. Harvest yield records were maintained throughout the production season.

On two occasions during the season (May and October), **vine lengths were measured** from all varieties and compared in order to **assess plant vigor**.

**Results**

A diverse range of tomatoes were grown using a space efficient and productive trellising and management system. The objective was to display a number of interesting varieties and a trellising and fertility management system for growers to observe. Characteristics of the tomato varieties are shown in Table 3.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 1: Tomato variety descriptions, arranged by fruit size according to catalog rating** | | | | |
| **Tomato Variety** | **Fruit Type** | **Size (oz.)** | **Fruit Notes** | **Vine Vigor** |
| **Rebelski F1** | Medium to large slicer | 7 to 8 | Large, lobed, extra firm | Vigorous |
| **Pink Beauty F1** | Medium slicer | 6 to 8 | Pink like Brandywine, firm | Moderate |
| **Clermon F1** | Greenhouse "Truss" type | 5 | Prune back to 5 per cluster | Moderate to vigorous |
| **Pozzano F1** | San Marzano type | 4 to 6 | Red, long, firm | Vigorous |
| **Granadero F1 (OG)** | salsa/sauce/drying | 4 to 5 | Red, broad, firm | Moderate to vigorous |
| **Golden Rave F1** | salsa/sauce/drying | 2 | Small yellow, med firm | Vigorous |
| **Indigo Rose** | Cocktail | 1 to 2 | Ripens to purple/orange/red | moderate |
| **Juliet F1** | salsa/sauce/drying | 1.5 to 2 | Mini red firm | Vigorous |
| **Suzanne F1** | Cherry | 1/2 | Red, firm | Vigorous |
| **Sakura F1 (OG)** | Cherry | 1/2 | Red, firm | Vigorous |
| **Black Cherry (OG)** | Cherry | 1/2 to 3/4 | Purple/black, med firm | Vigorous |
| **Golden Sweet F1** | Grape | 1/2 to 3/4 | Deep yellow, firm | Moderate to vigorous |
| **Red Pearl (OG)** | Grape | 1/2 to 3/4 | Red, extra firm | Vigorous |

|  |  |  |
| --- | --- | --- |
| **Table 2: Fertigation and other supplemental amendments applied (until August)** | | |
| **Date** | **Material(s)** | **Quantity** |
| May 17 | Ocean Organics 0-0-1 | 1 quart |
| May 22 | Stimplex from Acadian Seaplants | 1 pint |
| May 28 | O.O. 0-0-1 | 1 quart |
| May 29 | Epsom Salt | 3 TBSP foliar |
| May 29 | Sul-Po-Mag dry granular | 1 TBSP per plant sidedress |
| May 29 | Bone char | 1 Tsp per plant sidedress |
| May 30 | Calcium | 1 quart |
| May 30 | Fish emulsion Organic Gem 3-3-0.3 | 2 quarts |
| June 12 | Fish emulsion | 4 quarts |
| June 17 | Calcium | 1 quart |
| June 19 | Epsom salt + Stimplex | 10 TBSP + 1 quart |
| June 25 | Fish emulsion + O.O. 0-0-1 | 6 quart + 1 quart |
| June 27 | Calcium | 1 quart |
| July 8 | Epsom salt + Stimplex | 10 TBSP + 1 quart |
| July 17 | O.O. 0-0-1 + 12.5% calcium | 1 quart + 1 quart |
| July 24 | Stimplex + O.O. 0-0-1 + fish emulsion | 1 quart + 1 quart + 1 quart |
| August 4 | O.O. 0-0-1 + Stimplex | 0.5 quart + 0.5 quart |
| August 6 | Calcium + Fish Emulsion | 1 quart + 1 quarts |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 3: Yield and other variety data (arranged by fruit weight) for all trial varieties in high tunnels, Kingston, RI** | | | | | | | | |
| **Variety** | **1st pick date** | **Actual days to 1st pick** | **Catalog days to 1st pick** | **Net Wt. (lbs.)** | **Total Pints** | **lbs per plant** | **Pints per plant** | **Frt. Wt. (oz)** |
| **Rebelski** | 1-Jul | 76 | 75 | 407 |  | 21.4 |  | 10.7 |
| **Pink Beauty** | 1-Jul | 76 | 74 | 331 |  | 17.4 |  | 8.9 |
| **Clermon** | 3-Jul | 78 | 70 | 420 |  | 23.3 |  | 6.0 |
| **Pozzano** | 1-Jul | 76 | 72 | 364 |  | 20.2 |  | 4.9 |
| **Granadero** | 1-Jul | 76 | 75 | 437 |  | 23.0 |  | 4.5 |
| **Golden Rave** | 1-Jul | 76 | 67 | 324 |  | 17.0 |  | 2.5 |
| **Indigo Rose** | 5-Jul | 80 | 75 | 84 |  | 5.6 |  | 2.2 |
| **Juliet** | 25-Jun | 70 | 60 | 321 | 354 | 16.9 | 18.6 | 1.1 |
| **Suzanne** | 18-Jun | 63 | 60 | 260 | 289 | 16.3 | 18.1 | 0.7 |
| **Sakura** | 12-Jun | 57 | 55 | 296 | 327 | 15.6 | 17.2 | 0.7 |
| **Black Cherry** | 27-Jun | 72 | 64 | 174 | 195 | 9.2 | 10.2 | 0.6 |
| **Golden Sweet** | 18-Jun | 63 | 60 | 144 | 159 | 7.6 | 8.4 | 0.5 |
| **Red Pearl** | 18-Jun | 63 | 58 | 144 | 158 | 7.6 | 8.3 | 0.3 |
|  |  |  | **Total:** | 3707 | 1482 |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 4: Tissue macronutrient levels for all trial varieties in high tunnels, Kingston, RI, June-July 2013** | | | | | | | | | | |
| Macronutrient | N % d.w. | | P % d.w. | | K % d.w. | | Ca % d.w. | | Mg % d.w. | |
| Sample date | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 |
| **Ref. range** | **2.80 - 4.20** | | **0.31-0.46** | | **3.52-5.08** | | **1.60-3.21** | | **0.36-0.49** | |
| **Rebelski** | 3.4 | 3.58 | 0.42 | 0.42 | 2.52 | 2.41 | 0.94 | 1.18 | 0.37 | 0.42 |
| **Pink Beauty** | 3.98 | 3.58 | 0.46 | 0.37 | 2.07 | 2.64 | 1.27 | 1.76 | 0.46 | 0.56 |
| **Clermon** | 2.95 | 3.7 | 0.45 | 0.39 | 3.16 | 2.54 | 1.33 | 1.64 | 0.38 | 0.4 |
| **Pozzano** | 4.54 | 3.94 | 0.66 | 0.49 | 2.82 | 2.71 | 0.9 | 1.58 | 0.47 | 0.58 |
| **Granadero** | 4.46 | 4.1 | 0.65 | 0.61 | 2.88 | 2.79 | 1.13 | 1.35 | 0.44 | 0.45 |
| **Golden Rave** | 4.93 | 5.05 | 0.51 | 0.49 | 2.76 | 2.74 | 1.06 | 1.14 | 0.41 | 0.44 |
| **Indigo Rose** | 3.64 | 3.86 | 0.48 | 0.4 | 2.74 | 2.37 | 1.37 | 1.18 | 0.55 | 0.39 |
| **Juliet** | 4.18 | 4.31 | 0.53 | 0.49 | 2.58 | 2.6 | 1.22 | 0.9 | 0.43 | 0.36 |
| **Suzanne** | 3.47 | 3.86 | 0.44 | 0.4 | 2.08 | 2.37 | 0.94 | 1.18 | 0.38 | 0.39 |
| **Sakura** | 4.71 | 4.99 | 0.41 | 0.48 | 2.81 | 2.68 | 1.61 | 1.46 | 0.51 | 0.44 |
| **Black Cherry** | 3.87 | 3.92 | 0.46 | 0.4 | 2.46 | 2.15 | 1.02 | 1.02 | 0.44 | 0.44 |
| **Golden Sweet** | 4.56 | 4.98 | 0.43 | 0.48 | 2.36 | 2.37 | 1.14 | 0.74 | 0.38 | 0.32 |
| **Red Pearl** | 4.75 | 4.38 | 0.48 | 0.47 | 2.03 | 2.54 | 0.96 | 0.77 | 0.32 | 0.33 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 5: Tissue micronutrient levels for all trial varieties in high tunnels, Kingston, RI, June-July 2013** | | | | | | | | | | | | |
| Micronutrient | B (ppm) | | Cu (ppm) | | Fe (ppm) | | Mn (ppm) | | Mo (ppm) | | Zn (ppm) | |
| Sample date | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 | June 12 | July 8 |
| **Ref. range** | **45-76** | | **6** | | **84-112** | | **55-165** | | **2.90-5.80** | | **39** | |
| **Rebelski** | 23 | 20.7 | 24.5 | 23.2 | 108.7 | 157.4 | 26.3 | 26.2 | 0.8 | 0.8 | 34.7 | 37.6 |
| **Pink Beauty** | 23.3 | 33.8 | 19.6 | 18.4 | 104.2 | 124.9 | 24.1 | 27 | 1.4 | 2.1 | 24.9 | 24.3 |
| **Clermon** | 26 | 27.2 | 24.2 | 25.6 | 106.1 | 132.2 | 21 | 23 | 2 | 2.6 | 34.2 | 34.1 |
| **Pozzano** | 18.6 | 28.3 | 17.4 | 24.4 | 102.7 | 155.4 | 19.6 | 19.7 | 1.8 | 1.3 | 34.7 | 41 |
| **Granadero** | 23.5 | 24.8 | 22.2 | 20.1 | 90 | 121.8 | 18.9 | 23 | 1.6 | 2.9 | 34.6 | 37.1 |
| **Golden Rave** | 26.2 | 31.7 | 21.6 | 19.6 | 95.3 | 119.9 | 23 | 29.2 | 1.4 | 2.6 | 36.1 | 25 |
| **Indigo Rose** | 22.3 | 27.4 | 21.9 | 21.9 | 100.3 | 156.9 | 19.6 | 27.1 | 1.4 | 2.7 | 37.5 | 37.6 |
| **Juliet** | 25.5 | 28.3 | 23.8 | 24.4 | 96.9 | 155.4 | 19.7 | 19.7 | 0.9 | 1.3 | 50.5 | 41 |
| **Suzanne** | 24.9 | 26 | 25.2 | 22.7 | 120.9 | 144.9 | 22 | 27.3 | 1.3 | 0.6 | 33 | 40.9 |
| **Sakura** | 24.4 | 34.6 | 18.1 | 18.2 | 80.2 | 183.8 | 25.6 | 29.8 | 0.9 | 1.6 | 34.5 | 20.9 |
| **Black Cherry** | 17.8 | 21 | 15.8 | 16.7 | 66.4 | 113.3 | 18.6 | 25.1 | 0.8 | 1.5 | 27.9 | 33.2 |
| **Golden Sweet** | 23.9 | 26 | 19.4 | 19 | 107.7 | 156.4 | 15.7 | 21.9 | 0.7 | 1 | 41 | 36.9 |
| **Red Pearl** | 24.9 | 21.4 | 20.2 | 25.9 | 102.1 | 160 | 30.5 | 39.6 | 1.8 | 2.4 | 33.9 | 38.6 |