

# Season Extension of Tomatoes Using High Tunnel Technology in Eastern Kentucky

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## Introduction

Economically, the best times of year for Kentucky tomato growers to sell vine-ripened tomatoes are in the early spring or fall due to the lack of available local field-grown tomatoes. Cool, rainy weather and frosts prevent Kentucky growers from consistently having a high quality early spring or late fall tomato. By using a high tunnel, or a simplified greenhouse, they could greatly reduce the risks associated with freezing temperatures and other weather-related factors that reduce fruit quality. Most Kentucky high tunnel growers transplant the spring crop in March, almost two months ahead of most field production in the area, and finish harvesting the fall crop in late November or early December, one to two months later than field-grown fall tomatoes. Low light intensity during December through February and the high cost of heating prohibit greenhouse production during that time.

Six fresh market, red-fruited tomato cultivars were evaluated in the spring of 2007 to determine their suitability for high tunnel production.

## Methods

The varieties chosen were Polbig, Polfast, Polset, Tormenta, Townsville, and Amelia (Table 1). The tomatoes were seeded in a greenhouse on 23 February. They were transplanted on 13 April into black plastic mulch with trickle irrigation. Rows were 45 feet long and 5.5 feet apart. The in-row spacing was 18 inches. Based on soil test results (Table 2) the planting site received the equivalent of 60 lbs./A of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O. The tomatoes then received weekly applications of nitrogen in the form of ammonium nitrate, potassium nitrate, or calcium nitrate until a total of 120 lbs./A N were applied. The temperature and humidity inside and outside the high tunnel were monitored with Spec Data loggers during the growing season. The high tunnel was 48 feet long, 26 feet wide, and 12 feet high. In the high tunnel, an inexpensive home heater and a greenhouse fan were added to moderate the cool spring temperatures and provide protection if nighttime lows threatened the crop.

There were 14 to 16 harvests beginning on 6 June and continuing until 8 August. The tomatoes were harvested at the breaker stage. Data collected included: grade; weight; and count for jumbos (>3.5 inches), extra large (3-0-3.5 inches), large (2.5-3.0 inches), No. 2, small (2.0-2.5 inches), and cull tomatoes. The reasons for culling included: catfacing, concentric or radial cracks, disease, scars, blossom-end rot, fruit size, and uneven ripening. Only one application of fungicide and two applications of insecticide were used on the crop. Some spider mite problems did develop late in the season.

## Results

The early spring (February and March) was very warm but set record lows for several nights during 9 -12 April. The daily temperatures for the high tunnel and nearby garden during April

are shown in Figures 1 and 2. While the daytime high temperatures inside the high tunnel were much higher than the outside highs, the nighttime lows were not much different. On 14 April the inside low was 47°F and the outside low was 42°F. On 17 April the outside low was 30°F and the inside was 33°F. Thus, the high tunnel did not provide much protection from low temperatures at night.

The first tomato harvest was approximately 54 days after transplanting but early yields were low (Table 3). During the first 30 days of harvest only 56 % of Polfasts' total yield and 30 % of Amelias' total yield were picked. During the first 10 days following transplanting outside temperatures were low and the high tunnel was kept closed. Perhaps there was not adequate wind movement to set fruit on the first two flower clusters. It was noticed that growers who had bumble bees in their high tunnels had good initial fruit set, while those who relied on wind pollination did not have as many fruit in the first two clusters.

Amelia produced significantly more jumbo and extra large tomatoes than the other five cultivars (Table 4). Amelia also had significantly larger fruit size. Customers tended to leave the smaller fruited cultivars when large fruited ones were available. There was no significant difference in pounds of No. 2 or cull tomatoes among the six cultivars. Polbig, Townsville, and Amelia produced significantly more fruit per plant than the other three cultivars.

**Table 1.** 2007 Robinson Station Spring High Tunnel Tomato Cultivars.

| Cultivar   | Days to Maturity | Comments <sup>1</sup>  |
|------------|------------------|--|
| Amelia     | 75               | Determinate; large 8 1/2 oz. red fruit with resistance to FW 1 & 2, VW, TSWV                                     |
| Polbig     | 57-60            | Determinate; round 4 oz. red fruit, resistance to FW, VW   |
| Polset     | 62               | Determinate; flat-round 5 oz. red fruit; resistance to VW, FW 1 & 2. High yielder                                |
| Tormenta   | 73               | Semi determinate; roma type 3 oz. red fruit; resistance to TMV, VW, FW 1,2.                                      |
| Townsville | 65               | Determinate; globe shaped meaty, 6 oz. red fruit; resistance to VW, Fusarium 1 & 2.                              |
| Polfast    | 54-56            | Small determinate plants; 5 oz. oblate dark red fruit; good set at cold temps; resistance to VW, Fusarium 1 & 2. |

<sup>1</sup>FW=Fusarium Wilt, VW=Verticillium Wilt, TSWV=Tomato Spotted Wilt Virus

**Table 2.** 2007 High Tunnel Soil Test.

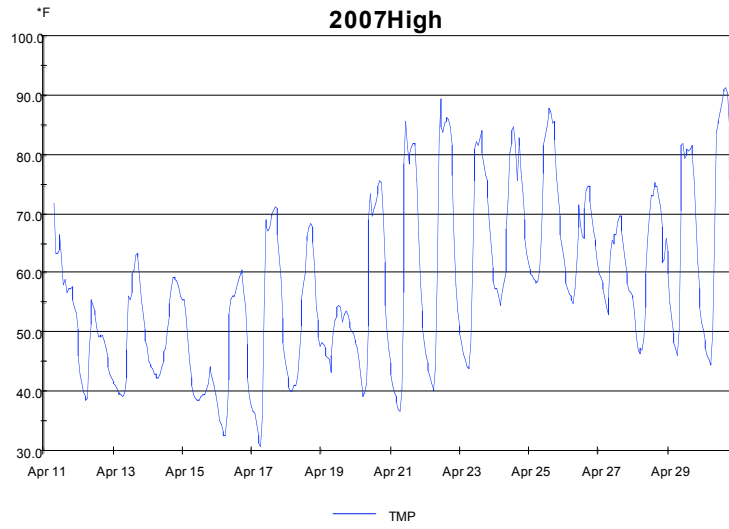
| pH   | Buf-pH | P  | K   | Ca   | Mg  | Zn   |
|------|--------|----|-----|------|-----|------|
| 6.22 | 6.69   | 71 | 347 | 4013 | 166 | 23.1 |

**Table 3.** 2007 Robinson Station Spring High Tunnel Tomato Cultivar Trial (Early Yield).

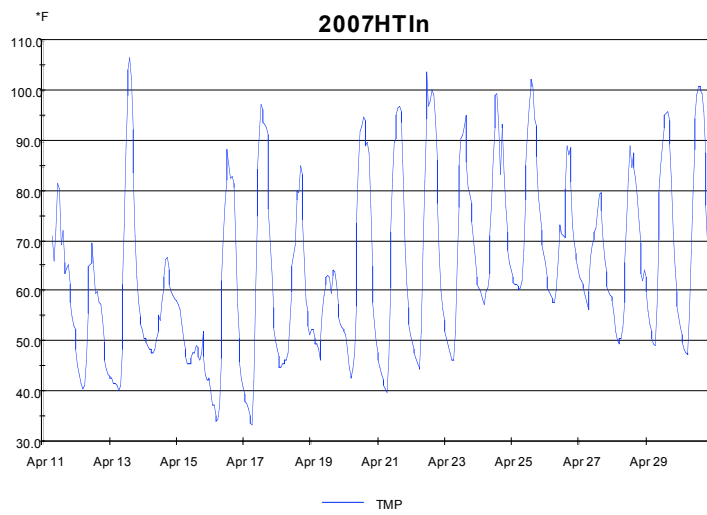
| <b>Cultivar</b> | <b>No. 1 Jumbo + Extra Large (%)</b> | <b>Average Fruit Weight (oz)</b> | <b>No. 2 (lbs.)</b> | <b>Culls (%)</b> | <b>Total Early Marketable Yield/plant (lbs.)</b> |
|-----------------|--------------------------------------|----------------------------------|---------------------|------------------|--|
| Amelia          | 98 A                                 | 10.7 A                           | 0.49 AB             | 3.5 B            | 4.8 A  |
| Polbig          | 75.8 B                               | 7.8 B                            | 0.58 AB             | 10.9 AB          | 5.5 A  |
| Polset          | 44.1 E                               | 5.8 D                            | 0.8 A               | 15.6 A           | 4.8 A  |
| Tormenta        | 0.8 F                                | 4.1 F                            | 0.18 B              | 3.0 B            | 2.6 A  |
| Townsville      | 74.4 C                               | 6.6 C                            | 0.41 AB             | 2.9 B            | 5.8 A  |
| Polfast         | 57.9 D                               | 5.7 E                            | 0.62 AB             | 5.2 AB           | 6.2 A  |

**Table 4.** 2007 Robinson Station Spring High Tunnel Tomato Cultivar Trial (Total Yield).

| <b>Cultivar</b> | <b>No. 1 Jumbo + Extra Large (%)</b> |   | <b>Avg. Fruit wt. (oz.)</b> |   | <b>No. 2 (lbs.)</b> |   | <b>Culls (%)</b> |   | <b>Total weight/plant (lbs.)</b> |    |
|-----------------|--------------------------------------|---|-----------------------------|---|---------------------|---|------------------|---|----------------------------------|----|
| Amelia          | 92                                   | A | 8.3                         | A | 1.6                 | A | 3.4              | A | 15.6                             | AB |
| Polbig          | 74.7                                 | B | 6.8                         | B | 1.5                 | A | 10.3             | A | 18.2                             | A  |
| Townsville      | 65.4                                 | C | 6.3                         | C | 3.5                 | A | 2.0              | A | 20.7                             | A  |
| Polfast         | 57.4                                 | D | 5.9                         | D | 1.2                 | A | 8.8              | A | 11                               | B  |
| Polset          | 40.3                                 | E | 5.6                         | E | 1.7                 | A | 10.1             | A | 11.2                             | B  |
| Tormenta        | 3.8                                  | F | 3.7                         | F | 0.3                 | A | 1.5              | A | 10.9                             | B  |



**Figure 1.** *2007 High Tunnel Outside Temperatures.*



**Figure 2.** *2007 High Tunnel Inside Temperature.*