High Tunnel Tomato Production

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Introduction

This years' high tunnel tomato work is a continuation of last year's variety evaluation research (for a copy of the 2006 progress report see, http://www.public.iastate.edu/~taber/Extension/Progress%20Rpt%2006/High%20Tunnel%20final%20report.pdf. We evaluated 10 varieties in both high tunnel and outdoor field plantings in 2006, and for 2007 selected the top three performing varieties across three maturity classes: early = Sunstart (67 day), 2nd early = Mountain Fresh (72 day), and main season = Florida 91 (80 day). Our objective was to evaluate a sequential planting scheme using high tunnels and outdoor field plantings to maintain a continuous market supply.

Materials and Methods

The project was established at the Armstrong Research Farm (southwestern Iowa – a well-drained silt loam soil) and the Horticulture Research Station (central Iowa – a well-drained loam soil). The previous crop at both the Armstrong Farm and the Horticulture Station in the high tunnel was tomatoes. Previous crop at the outdoor site on the Armstrong Farm was corn, and at the Horticulture Station tomatoes. Both sites were fertilized according to soil test recommendations. The cultural system consisted of SRM-olive plastic mulch (wavelength selective) and trickle irrigation. Transplants were set 18-inches in-row and rows 4.5 ft on center for high tunnel production and 6-ft on center for field production. All plants were staked, tied, and pruned to the first flower cluster. Irrigation scheduling was via tensiometers. Pest management practices for field production included necessary herbicide, insecticide, and fungicide applications for top production. High tunnel production included only an organic insecticide (Thuricide) application for tomato hornworm control. There were three replications of each variety at each site in the high tunnel and two replications for the May and June field plantings.

Transplant dates were: Armstrong Farm high tunnel on April 18, and field transplant dates of May 12 and June 8; Horticulture Station high tunnel on April 16, and field transplant dates of May 11 and June 8. Mountain Spring, a 72-day maturity, was included in the outdoor plantings for a fourth variety.

Yield data consisted of a weekly harvest at the Horticulture station and twice a week at the Armstrong farm with fruit sorted into marketable and culls. Culls included very small fruit and fruits with rots, radial and concentric cracks, and ripening disorders. The marketable category was graded into four sizes: extra large (> 2 7/8 inch), large (2 7/8 to 2 ½ inch), medium (2 ½ to 2 ¼ inch), and small (< 2 ¼ inch).

Results and Discussion

Sunstart variety was the first to begin production, June 28, from the high tunnel planting at both sites (Figure 1). Early yield was generally higher at Armstrong and the cullage was less compared with the Horticulture Station. Low night temperatures at the Horticulture Station, and to a lesser extent at the Armstrong Farm, caused severe cat-facing on the Sunstart fruit accounting for its high percentage of culls (Table 1). Mountain Fresh and Florida 91 production began a week earlier at the Horticulture Station, compared at Armstrong, and production remained reasonably steady, while at Armstrong the yields peaked at the second harvest, July 26. April daily

temperatures were much colder than normal at both sites in 2007, as compared with 2006. Armstrong Farm April 2007 average temperature of 47.8°F was 2.7 degrees below normal while 2006 was 4.8 degrees above normal. Horticulture Station April temperature of 48.5°F was 4 degrees below normal compared with 3.1 degrees above normal in 2006. However, May and June 2007 monthly temperatures were above normal at both sites.

As in 2006, there was a stark contrast between the two sites for total high tunnel season yield. Although both sites were planted at similar times and the harvest season identical, Armstrong had higher total and marketable yields, with Mountain Fresh and Florida 91, 22% more compared with the Horticulture Station (Table 1). A large part of the difference was in percentage of culls with the Horticulture Station almost twice Armstrong's. The lower soil K fertility led to much more non-uniform color (blotchy ripening) development at the Horticulture Station. These total yields (162 lb/10 plants) for an 8-week harvest period are 28% less than 2006 (224 lb/10 plants) values for a similar harvest period.

Field plantings were established with the same three varieties in mid-May, with the addition of Mountain Spring, once the danger of frost passed. The field location was adjacent to the high tunnel at both sites. First harvest occurred for all varieties on July 26 at Horticulture Station. The corresponding date at Armstrong was July 31. However, Sunstart produced substantial fruit a week earlier, July 23 (Figure 2). Armstrong production peaked the week of August 17. At the Horticulture Station, weekly yields steadily declined to August 17. Tomatoes at the Horticulture Station were planted on the same site as in 2006. Therefore, *Septoria* and bacterial disease severity continued to increase in spite of a weekly fungicide program. This underscores the necessity of the cultural practice to rotate every 3 to 4 years between crops.

Mountain Fresh maintained high production at both sites, although Mountain Spring was equivalent to Mountain Fresh at Armstrong where there was lack of disease pressure. Sunstart and Mountain Spring are known to be susceptible to *Septoria* infection compared with the other varieties grown in this trial.

A second field planting was established on June 8 at both sites to maintain continuous production into the fall. But, because of severe disease pressure, the June planting at the Horticulture Station was eliminated. Data was collected from the first two harvests at Armstrong to determine the timing of initial production.

To maintain uniform fruit production, an early variety, or variety combination, could be planted in a high tunnel followed by a mid-May and early June planting of a second early variety plus a main season variety to stagger peak production times (Figure 3). In 2006, if Sunstart and Mountain Fresh were used in the high tunnel followed a mid-May planting of Sunstart + Mountain Fresh + Florida 91, and early June of Mountain Fresh + Florida 91, the weekly production would be 75 to 100 lb/week per 70 plants (Figure 4). Thus, if you had a market for 30 to 40 boxes (25 lb box) of tomatoes per week you would need 100 plants of each variety planted according to the sequence listed above, i.e. high tunnel would have 100 plants each of Sunstart and Mountain Fresh. This same scheme in 2007 produced similar results except for the August 9 to August 17 time period. The delayed production start by Mountain Fresh resulted in low yields on August 9, and the Mountain Fresh and Florida 91 varieties were of similar maturity for the May planting causing the overlap of production on August 17.

Table 1. Total season yield (lb/10 plants) of tomatoes planted in high tunnels. Total = 8 weeks of harvest. Harvest began June 28 and ended August 17 at both sites, 2007.

	-------- Armstrong Farm ---------			----------Hort Station ---------		
Variety	Marketable	Total	Cull, %	Marketable	Total	Cull, %
Sunstart	144	185	22.2	70	144	51.4
Mountain Fresh	162	180	10.0	116	151	23.2
Florida 91	162	186	13.0	114	149	23.5

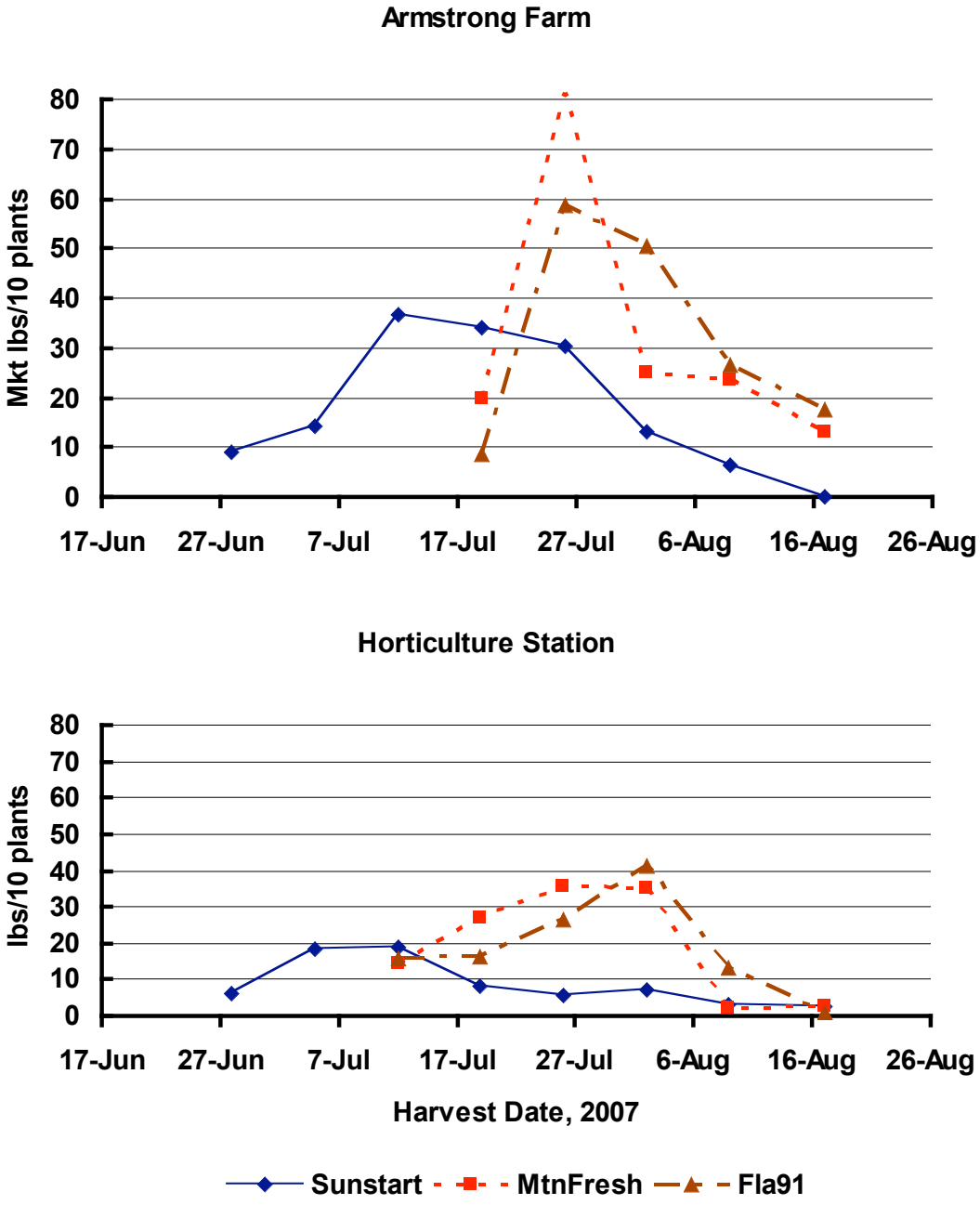


Figure 1. Comparison of weekly production of three tomato varieties grown in a high tunnel at the Armstrong Farm and Horticulture Station, 2007. Yields are expressed as lb marketable fruit/10 plants.

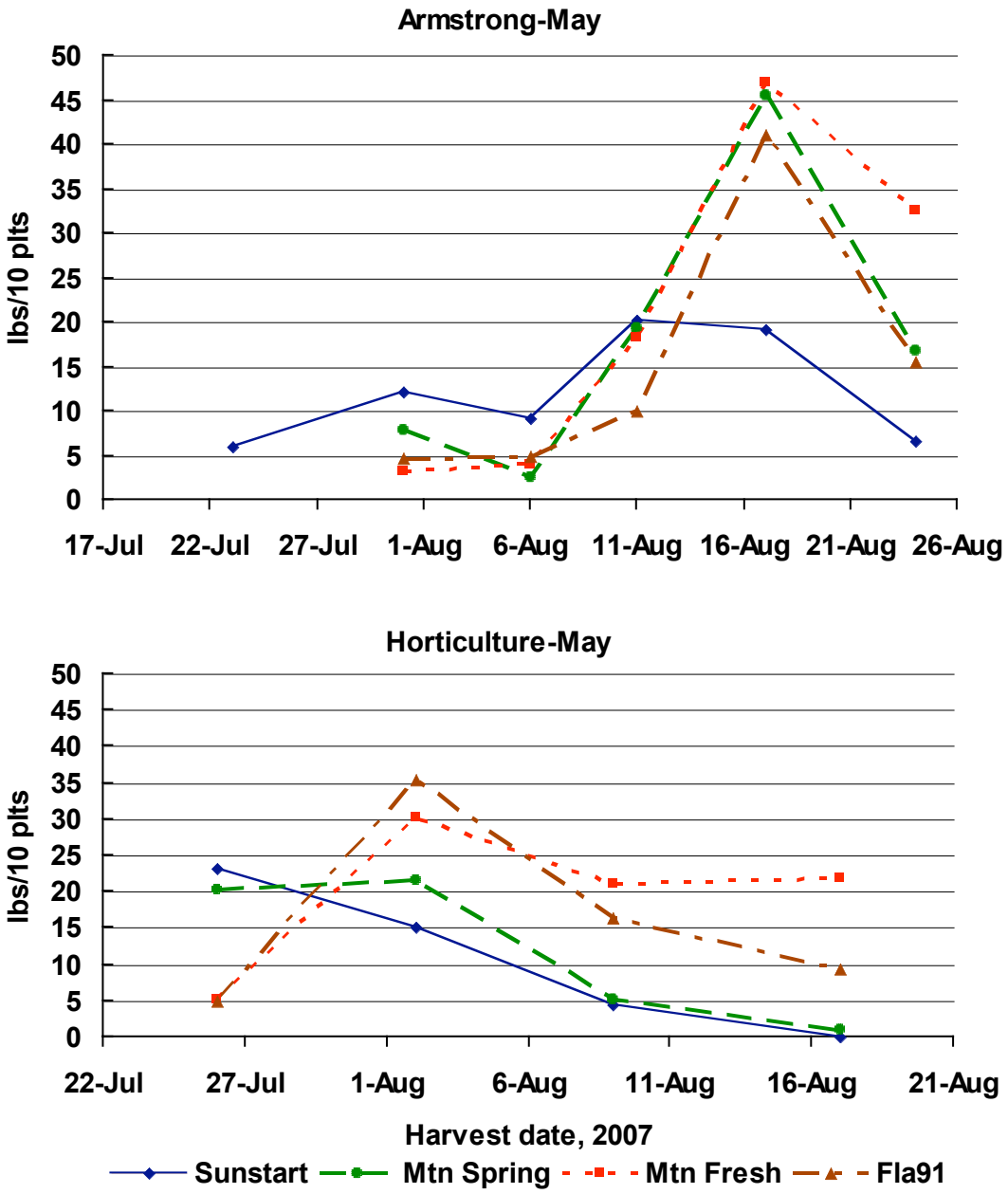
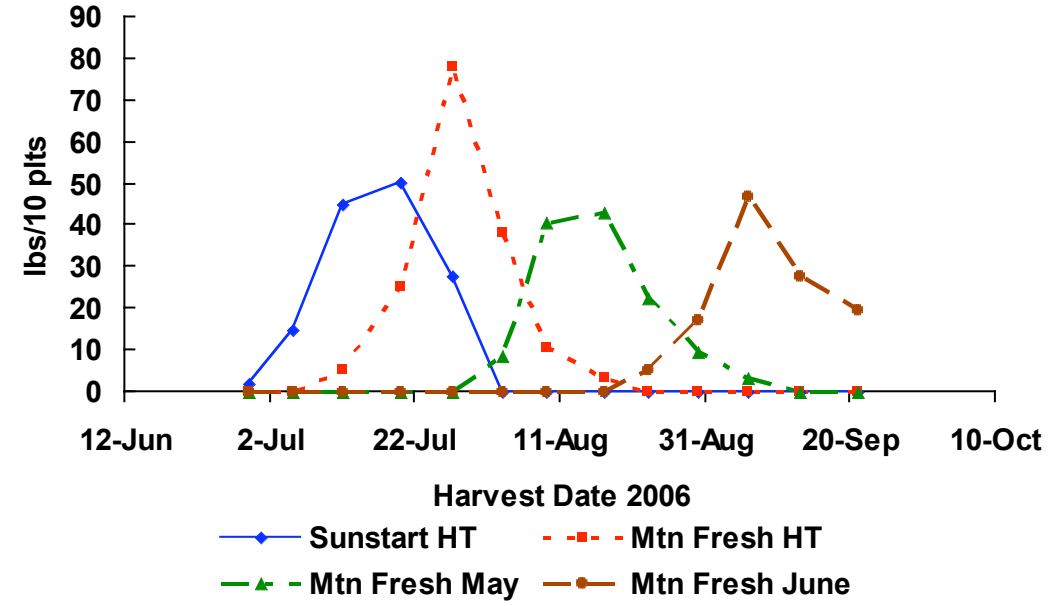


Figure 2. Comparison of weekly production of four tomato varieties grown in outdoor field setting at the Armstrong Farm and Horticulture Station, 2007. Transplants set May 11 at Armstrong Farm and May 12 at the Horticulture Station. Yields are expressed as lb marketable fruit/10 plants.



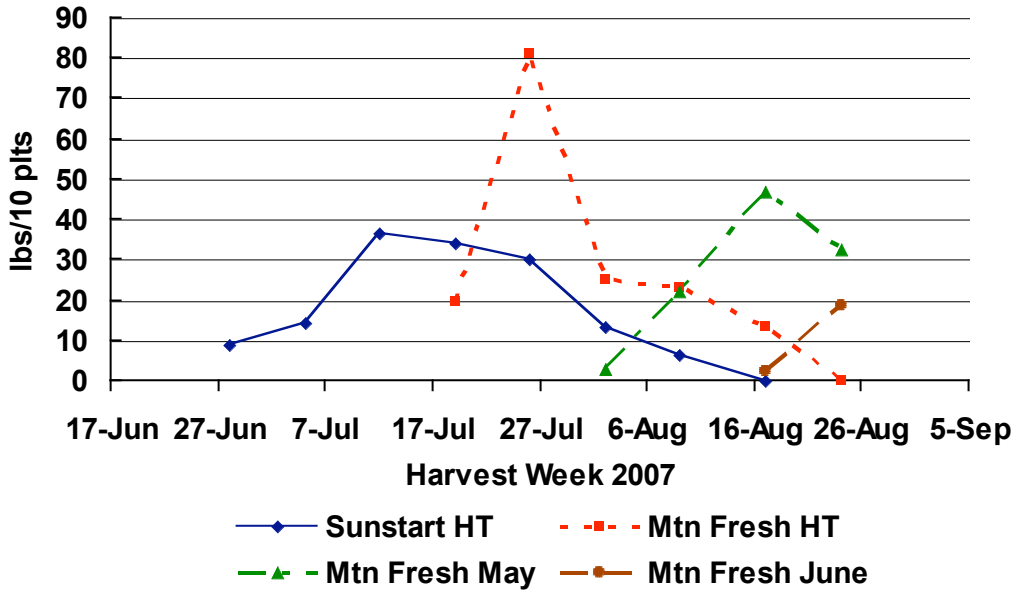


Figure 3. Weekly harvest yields, lb/10 plants, from a planting of Sunstart and Mountain Fresh in a high tunnel and field planting of Mountain Fresh in mid-May and again in early June, Armstrong Farm 2006 and 2007.

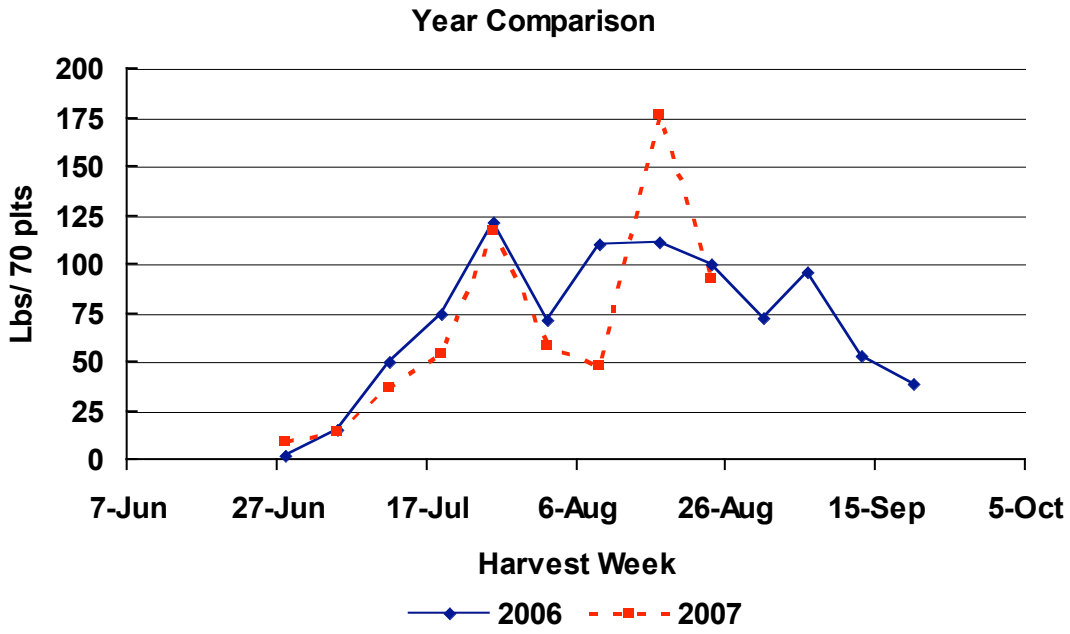


Figure 4. Weekly harvest yields, a total of 70 plants, from a mid-April planting of Sunstart and Mountain Fresh (10 plants each) in a high tunnel; field planting mid-May of Sunstart + Mountain Fresh + Florida 91 (10 plants each); and field planting early-June of Mountain Fresh + Florida 91 (10 plants each), Armstrong Farm. Not all 70 plants were producing the same week.