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High Tunnel Tomato, Pepper, and Bean Observations

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Abstract
Previous vegetable trials (2006 through 2008) concentrated on tomato and bell pepper variety adaption to early planning (mid-April) in a high tunnel structure. That work indicated growers should use an early, determinate tomato variety as opposed to an indeterminate greenhouse type to gain earlier production in the marketplace. The production of colored bell peppers, from traditional field varieties, was successful but did not allow double cropping because of the maturation time length before fall freeze; and, thus, was not profitable. The use of a greenhouse bell variety with a long harvest period may provide more opportunity for income particularly when using a vertical training system.

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Introduction

Previous vegetable trials (2006 through 2008) concentrated on tomato and bell pepper variety adaption to early planning (mid-April) in a high tunnel structure. That work indicated growers should use an early, determinate tomato variety as opposed to an indeterminate greenhouse type to gain earlier production in the marketplace. The production of colored bell peppers, from traditional field varieties, was successful but did not allow double cropping because of the maturation time length before fall freeze; and, thus, was not profitable. The use of a greenhouse bell variety with a long harvest period may provide more opportunity for income particularly when using a vertical training system. For reports of previous work see: www.public.iastate.edu/~taber/Extension/Progress%20Rpts.htm

Our objectives were to compare: 1) a large tomato transplant produced in a 4-in. plastic pot to a 72-cell tray transplant for early production; 2) colored bell pepper production from Aristotle transplants versus Triple-4 transplants, a greenhouse variety, and 3) French type pole bean production Fortex compared with commercial snap bean production Strike (a concentrated set type).

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 peppers and tomatoes. The cultural system consisted of plastic mulch (wavelength selective) and trickle irrigation for all three crops, except the Strike snap beans, which were seeded in bare ground. Tensiometers were used for all crops to schedule irrigation events.

Beans. For the pole bean Fortex, the cultural system consisted of SRM-red plastic mulch (wavelength selective) with seeds seeded in a single row with an in-row spacing of 3 in. Cattle fence was used as training panels set about 6½ ft in height. The commercial snap bean Strike was direct seeded in twin rows (18-in. apart) and plants thinned to 2-in. in-row once emerged. Harvest began when pods reached sieve size No. 4 and conducted every 48 hours for Fortex and every 2 to 4 days for Strike.

Pepper. For the commercial field variety, Aristotle, 72-cell transplants were set in twin rows 16 in. apart and in-row spacing of 18 in. on plastic (SRM-olive wavelength selective) mulch bed. The greenhouse variety Triple-4 was set in a single row on the plastic mulch bed at the same time with an in-row spacing of 18 in. Cattle panels were attached to 6-ft steel posts for training. After the crown bud developed, the two strongest side shoots remained and others were removed. Harvest began when a strong, red color developed on at least 25–30% of the fruit surface. At the Horticulture Station, fruit color ranged from 25 to 100% of the fruit surface.

Tomato. The early Sunstart variety was grown in either 4-in. plastic pots or 72-cell trays. Fifteen plants of each were set in a single plastic row at an in-row spacing of 18-in. Both

were pruned to the first flower cluster and the Florida stake and weave training system used with 4-ft wooden stakes. Yield data consisted of harvesting every 10 to 14 days with the first harvest on June 11, 2009.

Results and Discussion

Beans. Harvest commenced at similar dates for both locations: 70-day maturity for Fortex (same as in the 2008 planting) and 65 days for Strike (Table 1). The concentrated set of Strike resulted in a higher yield per row length, compared with the pole bean Fortex at the Armstrong Farm, but not at the Horticulture Station. The reduced yield for Fortex at Armstrong was the result of heavy insect mite pressure shortening the harvest period. Also, there was a herbicide drift from nearby agronomic fields that was evident on the foliage. Sixty-five percent of the yield occurred on June 24 and 29. At the Horticulture Station, Fortex continued to produce approximately 10 to 12 lb/100 feet every 2 days until August 18, except for the week of July 15 to 22 when production dropped about 60%. However, in 2008 at both the Armstrong Farm and the Horticulture Station, Fortex production did not remain constant but peaked the week of July 9 to 16. In-row plant spacing was 8-in. for that year.

Strike yield at either location was about three times that of field production with 70% of total harvested yield occurring in the first six days. But earliness was not advanced more than 7 to 10 days compared with traditional field planted beans. This may be somewhat related to the cold growing conditions of 2009. Even with a higher price for early harvest, the use of Strike in a high tunnel is not cost effective. On the other hand, a high quality French type pole bean, such as Fortex that cannot be successfully grown in a field setting, could produce a continuous supply throughout the growing season. If a market was available, a 30 × 96 ft high tunnel could produce 60 to 72 lb every other day, requiring 10 man hours/harvest at our spacing arrangement. More research needs to be done on training systems.

Peppers. Both varieties produced heavily for about four weeks, commencing July 20 at each location, 97-day maturity (Table 2). The highest production occurred the first week of August with numbers twice that of the previous or following weeks. Aristotle production stopped by the end of August. Although Triple-4 continued production throughout September, but not at Armstrong, fruit numbers were very light approximately 18/100 ft of row. Unmarketable fruit at the Armstrong Farm was largely the result of rots and misshaped fruit. Marketable production was very similar at both locations with the greenhouse Triple-4 providing no advantage over the field commercial variety Aristotle.

Tomatoes. Production from the large transplant (4-in. pot) began about 2 weeks before the 72-cell tray size (Table 3). Further, the Armstrong location commenced harvest 12 days ahead of the more northern location in central Iowa. Harvest frequency at both locations was once per week and peak harvest occurred from July 22 to August 10.

Table 1. **Pole bean and bush, snap bean comparison in a high tunnel at two sites, Armstrong Farm (southwest Iowa) and Horticulture Station (central Iowa). Data from a single observation.**

				Yield, lb/100 feet	
Variety	Seeded	1st harvest	Harvest period	Marketable	Unmarketable
			Armstrong		
Fortex	April 15	June 24	26 days	109	8.2
Strike	April 15	June 19	17 days	169	2.9
			Hort Station		
Fortex	April 15	June 22	56 days	304	Na
Strike	April 15	June 18	13 days	144	Na
Strike (2nd)*	July 6	August 28	7 days	82	Na

*Strike was double cropped at the Horticulture Station site, but not Armstrong. First planting plants removed and the variety re-seeded in same location. The short, 7-day harvest period is not a reflection of total yield, but a discontinuance of harvest due to lack of labor. Thus, second planting harvest was on target for yield comparable with the first planting.

Table 2. **High tunnel colored, bell pepper production from two varieties grown at two sites, Armstrong Farm (southwest Iowa) and Horticulture Station (central Iowa). Transplanted to high tunnels at both sites on April 15, 2009. Data from a single observation.**

			Yield, fruit number/100 feet		Fruit size
Variety*	1st harvest	Harvest period	Marketable	Unmarketable	oz. each
			Armstrong		
Aristotle	July 23	69 days	561	268	10.6
Triple-4	July 23	69 days	359	220	8.9
			Hort Station		
Aristotle	July 20	42 days	570	Na	10.3
Triple-4	July 20	52 days	389	Na	9.0

*Variety: Aristotle, a commercial field grown type set in twin rows on plastic. Triple-4, a greenhouse type set in a single row on plastic and trained to a fence.

Table 3. **Tomato transplant size comparison grown in a high tunnel at two sites, Armstrong Farm (southwest Iowa) and Horticulture Station (central Iowa). Transplants set on April 15, 2009 at both sites. Data from a single observation.**

			Yield, lb/100 feet		Fruit size
Transplant size*	1st harvest	Harvest period	Marketable	Unmarketable	oz. each
			Armstrong		
4-in. pot	June 11	111 days	1333	610	8.1
72-cell tray	June 30	92 days	1298	500	7.8
			Hort Station		
4-in. pot	June 23	56 days	987	Na	6.6
72-cell tray	July 7	42 days	734	Na	10.0

*Sunstart, an early, commercial field grown type set in a single row on plastic with plants 18-in. row and trained using the Florida stake and weave system. Unmarketable fruit at the Armstrong location was largely the result of worm damage with smaller amount of blotchy ripening.