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High Tunnel Pepper Production

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Abstract
The objective of this trial was to identify sweet bell blocky, pepper varieties with good production and fruit quality characteristics suitable for Iowa's variable and often stressful growing season. A combination of high tunnel and field production planting dates were chosen to maintain a continuous growing season supply and to determine profitability of the high tunnel system.

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Introduction

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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 tomatoes at the Horticulture Station. 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 in twin rows, 16-in. apart and in-row spacing of 12 in. on a single plastic row bed. Rows were 4.5 ft on center for high tunnel production and 6-ft on center for field production. Irrigation scheduling was via tensiometers. Pest management practices for field production included necessary herbicide, insecticide, and fungicide applications for top production. A major outbreak of aphids occurred at the Horticulture Station, and to a lesser extent at the Armstrong Farm, in both the high tunnel and outdoor field planting. Insecticidal soap was used to keep the population at low levels. 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: the Armstrong Farm high tunnel on April 18 and field transplant dates of May 12 and June 8; the Horticulture Station high tunnel on April 16 and field transplant dates of May 12 and June 13.

Yield data consisted of harvesting every 10 to 14 days with the first harvest from the high tunnel on June 18 at the Armstrong Farm and June 25 at the Horticulture Station. Corresponding field harvest dates for May and June plantings were July 24 and August 3 for the Armstrong Farm and July 13 and August 17 for the Horticulture Station. Fruit were sorted into marketable and cull (rots, insect damage, severely misshapen, small), and lobe number, fruit size, and fruit length-to-width ratio determined for marketable fruit. The variety characteristics are listed in Table 1.

Results and Discussion

Although there were some week-to-week yield differences among the varieties, overall season production in high tunnels was similar (Table 2). Noticeable differences between the two production sites occurred in yield and fruit shape. The Armstrong Farm plants were more vigorous and continued production for two more weeks resulting in 19.2% more fruit, compared with the Horticulture Station (55.2 versus 46.3 boxes/tunnel). Also, fruit shape was more flattened at the Armstrong Farm. Fruit characteristics such as lobe number and shape did not change throughout the harvest period. The exception was fruit size, which declined from about 8 ounces to 6.2 ounces at the last harvest (Figure 1).

We noticed a profound effect of the spring winds on fruit production at both locations. The plants on the outside tunnel wall were shorter and less vigorous than the inside row (Table 3). The row position effect was more severe at the Horticulture Station where the tunnel runs E-W compared with the Armstrong Farm that has an N-S orientation. This, and probably other factors, led to yield reduction compared with outdoor mid-May plantings. Both Armstrong and Horticulture produced similar yields from the mid-May field planting, 920 and 962 boxes/acre, respectively. Thus, high tunnel production was only 77.8% and 62.5% of field production, respectively. A major factor to consider is the potential for income. Even though production commenced earlier (36 days earlier at Armstrong) from the high tunnel plantings, income prior to field production was not significant (Table 4). Therefore, this work will be repeated to confirm these findings.

Table 1. Bell pepper variety characteristics.

Variety	Days to maturity	Disease resistance[1]	Comments
Alliance	75	BLS 1235,PMV,PVY	Blocky fruit, multiple disease resistance
Aristotle	72	BLS 123, PVY,TMV	Smooth shape, blocky, good green or red color
Paladin	72	Phyt, TMV	Elongated, very large fruit, colored production
Patriot	75	BLS 1235, PVY	Blocky, thick walls, high yielding
Red Knight	63	BLS 123, PVY	Blocky, variable yield, good red production
Revolution	75	Phyt, BLS 1235, CMV	Blocky fruit, multiple disease resistance, vigorous plant

[1]Indicates resistance or tolerance to: BLS = Bacterial leaf spot; PMV = Pepper mottle virus; PVY = Potato virus Y; TMV = Tobacco mosaic virus; Phyt = Phytopthora root rot; CMV = cucumber mosaic virus.

Table 2. **Marketable yield, boxes/tunnel for sweet bell peppers harvested from high tunnels at the Armstrong Farm and Horticulture Station locations, 2007. There was no significant difference among varieties at either location.**

	Armstrong Farm			Horticulture Station		
Variety	Yield[1]	Fruit size, oz.	Fruit ratio[2]	Yield	Fruit size, oz.	Fruit ratio
Alliance	60.5	8.4	0.90	46.2	8.2	0.97
Aristotle	58.2	7.2	1.00	43.6	6.9	0.96
Paladin	50.6	7.4	0.96	49.0	7.0	1.13
Patriot	57.6	7.7	0.91	-[3]	6.3	0.90
Red Knight	50.3	7.5	0.91	48.9	7.8	0.93
Revolution	53.7	8.8	0.88	44.0	8.2	0.96

[1]Yield expressed as boxes/tunnel (1,080 plants) and one box weighs 28 lb. Harvest period at Armstrong was 6 weeks and at Horticulture 4 weeks.
[2]Fruit ratio = length to diameter ratio; 0.95 = very blocky, flattened shape; 1.00 = blocky, length equal to diameter; 1.05 = elongated shape with length greater than diameter.
[3]Represents only one rep, so no yield value presented

Table 3. Seasonal yield of peppers in high tunnel as affected by row location. Values are in lb/100 plants averaged over three varieties. Hort Station = 4 weeks of harvest, Armstrong Farm = 6 weeks of harvest.

Row location	Hort Station	% cull	Armstrong	% cull
Outside	110	13.7	136	30.3
Middle	134	26.3	139	27.7
Inside	188	14.6	165	26.9

Table 4. Early season harvest advantage for high tunnel pepper plantings. Paladin, an early variety, transplants set April 16 and April 18 at the Horticulture Station and Armstrong Farm, respectively. Box equals 28 lb and value placed at $20 each for early season production.

			---------Earlier, compared with mid-May ------		
Location	High tunnel 1st harvest	mid-May 1st harvest	Days	Boxes/tunnel	Gross income
Hort Station	June 25	July 13	18	45	$900
Armstrong Farm	June 18	July 24	36	61	$1,220

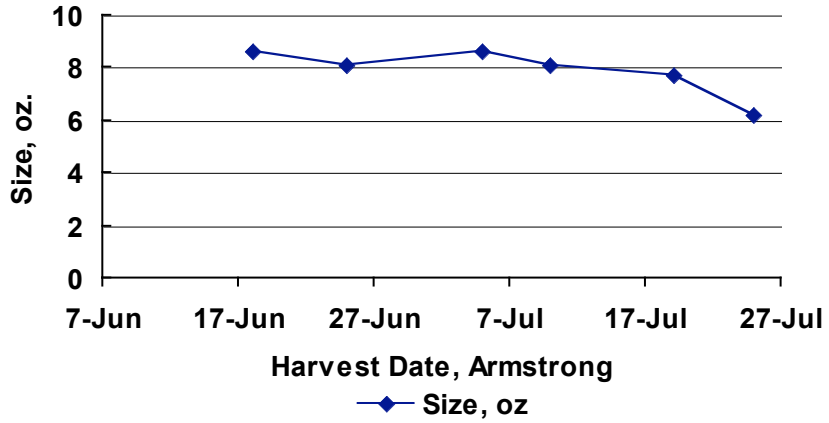

Figure 1. Harvest duration effect on fruit size, ounces each, at Armstrong Farm location, 2007. Values averaged across the six pepper varieties.