2015 Evaluation of Determinate Tomato Varieties for High Tunnel Production in Kansas

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High tunnel (hoop house) production of vegetables has become very common in Kansas as they protect the crop from wind and storm damage in addition to providing season extension. We conducted a variety trial of determinate hybrid tomatoes grown in a high tunnel to determine which cultivar is best suited for hoop house cultivation in the Great Plains. Ten commercially available varieties were tested and yields ranged from 26 to 33 lbs of total fruit per plant. The three varieties with the highest marketable yield were 'Primo Red', 'BHN 589', and 'Red Deuce'. 'Red Deuce' had the largest marketable fruit size this season as well as in 2014. 'Primo Red' had the highest percent marketability by fruit number and weight this season as well as in 2014.

Introduction

Fresh-market tomatoes are a valuable crop for vegetable growers in Kansas, and are often grown in high tunnels. They provide a valuable commodity that can be sold through farmers' markets and CSA's as well as wholesale markets and restaurant sales. In four season high tunnels, indeterminates are often used in addition to determinate varieties and heirlooms. However, in three season high tunnels, a vertical trellis system typically cannot be supported by the tunnel frame and planting dates are only slightly earlier than traditional field plantings. This offers a unique situation where determinates and/or semi-determinates grown in raised-bed plasticulture under stake-and-weave management are more practical than indeterminates and/or heirloom varieties. The goal of our study was to investigate the performance of ten determinate hybrid varieties for fresh-market production in high tunnels.

Materials and Methods

The trial was conducted at the Olathe Horticulture Research and Extension Center located approximately 30 miles southwest of Kansas City. Transplants were grown in soilless potting media using 50-cell propagation trays. Seeds were sown on March 9, 2015 and transplanted to 50-cell trays on March 18th. Transplants were set on April 16th in one bay of a multi-bay high tunnel (96' x 200' Haygrove Multibay High Tunnel) in the inner two (of four) rows. The high tunnel trial had five plants per plot and in-row spacing was 18", which is typical of commercial pepper production. Preplant crop nutrients were provided by calcium nitrate and potassium nitrate using equal portions of nitrogen at 75 lbs nitrogen/acre total. Plastic mulch and drip irrigation were employed and the stake-and-weave method was utilized to trellis the plants vertically. Fertigation was carried out at a rate of 10 lbs nitrogen/acre per application on 19 May, 26 June and 18 July. Potassium nitrate was used for the first and third fertigation events and calcium nitrate was used for the second fertigation. Magnesium was also applied through fertigation at 10 lb magnesium/acre on the second application. Harvesting was carried out from June 22 through October 7. During the last harvest, all fruit larger than 5 cm were picked. Fruit were graded for marketability and fruit number and weight were recorded. Average fruit size and percent marketability were determined and are presented below. All data were analyzed using ANOVA (PlotIt, Scientific Programming Enterprises, Haslett, MI), and a mean separation test was carried out by using an F-protected least significant difference (LSD) test. A separate analysis was carried out for each individual observation and the results of the LSD test are shown where statistically significant treatment effects occurred.

Results and Discussion

Table 1. Marketable and total per plant fruit yield of tomato varieties grown in a three season high tunnel in Olathe, Kansas.

	Marketable		Total	
Variety	**Number**	**Wt (lbs)**	**Number**	**Wt (lbs)**
Primo Red	51.1 cd	25.0 c	75.0 abc	33.4 D
BHN 589	54.4 d	23.2 bc	86.9 c	33.1 Cd
Red Deuce	35.1 a	19.3 ab	67.4 a	31.1 Bcd
Fletcher	46.0 abcd	18.5 ab	72.8 ab	26.6 Ab
Tribute	41.7 abc	18.2 a	73.1 ab	28.3 Abc
Biltmore	38.6 ab	18.0 a	69.1 ab	28.8 Abcd
Mountain Majesty	37.3 ab	17.5 a	73.1 ab	30.4 Abcd
Tasti Lee	47.3 bcd	17.0 a	79.8 bc	26.0 A
BHN 1021	43.0 abc	16.4 a	78.7 abc	26.5 Ab
Scarlet Red	39.4 ab	16.3 a	71.8 ab	26.8 Ab
LSD $_{(0.05)}$	10.95	4.92	11.95	4.94

Table 2. Mean tomato fruit size (lbs) and marketability of tomato varieties grown in a three season high tunnel in Olathe, Kansas.

	Average Fruit Size (lbs)		Percent Marketability	
Variety	**Marketable**	**Total**	**Number**	**Weight**
Red Deuce	0.55 f	0.46 f	69.7% bc	74.8% Bc
Primo Red	0.50 ef	0.45 ef	85.1% c	87.7% D
Mountain Majesty	0.47 de	0.41 cde	59.3% ab	62.7% Ab
Biltmore	0.46 cde	0.41 cde	66.1% ab	71.0% Ab
Tribute	0.43 bcd	0.39 cd	74.5% bc	77.8% Bc
BHN 589	0.43 bcd	0.38 bcd	75.8% ab	80.8% Cd
Scarlet Red	0.41 abcd	0.38 bcd	68.2% ab	72.4% Bc
Fletcher	0.40 abc	0.37 abc	71.4% bc	75.2% Bcd
BHN 1021	0.38 ab	0.33 ab	66.0% bc	70.6% Ab
Tasti Lee	0.35 a	0.33 a	70.8% bc	76.0% Bc
LSD $_{(0.05)}$	0.06	0.05	0.10	0.09

'Primo Red' had the highest per plant total and marketable yield, but marketable yield was statistically similar to 'BHN 589' (P<0.05). 'BHN 589' had statistically similar yield to 'Red Deuce', 'Fletcher', and 'Primo Red'. A similar trial was conducted in 2013 and 2014, and 'Primo Red', 'Red Deuce' and 'BHN 589' had the highest marketable and total yield all three years. 'Primo Red' was a new entry into the annual variety trials conducted at our location in 2014 and performed well in both years. In 2015, 'Primo Red' had the highest marketable yield per plant and was second to 'Red Deuce' in 2014. Similar to 2014, 'Primo Red' had the highest fruit marketability percentage and was 85.1% (by number) and 87.7% (by weight). In 2014, 'Primo Red' fruit marketability percentage was 86.9% (by number) and 91.7% (by weight) respectively. The major portion (>80%) of the fruit quality problems seen in this trial were the result of blossom end rot (BER). Although the

cull fruit were not graded specifically for this issue, the results seen in this study were most likely the result of a lower incidence of BER.

'Primo Red' was a consistent producer throughout the season with an average fruit size of 0.50 lbs/fruit. There were two harvest peaks; one on July 16 averaging at 0.72lbs/fruit and August 31 at 0.61 lbs/fruit (data not shown). Another variety that is known for its high Lycopene levels, 'Tasti Lee', was also a season consistent producer with smaller fruit between 0.30 and 0.42 lbs/fruit. and had a mid-season flush with an increase in fruit size jumping to .70 lbs/fruit on Aug 13. Several varieties showed good potential for early-season production, which can be advantageous for marketing high-value fruit. In particular, 'Primo Red', 'Fletcher', and 'BHN 589' showed the highest yields during the early weeks of July (data not shown). 'Primo Red', 'Red Deuce', and 'Scarlet Red' had the highest yields at peak harvest. 'BHN 589'and 'Mountain Majesty' also showed very strong production in the early part of September, which may be useful for growers looking to cater to late markets

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