

2017 Evaluation of Determinate Tomato Varieties for High Tunnel Production in Kansas

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High tunnel (hoop house) production of vegetables has become quite common in Kansas. High tunnels protect crops from harsh environmental conditions such as wind and storm damage. Because of this added protection, as well as the requirements of determinate tomato crops (planting date, soil temperature, crop height, etc.), high tunnels provide an excellent system for tomato production. Therefore, the high tunnel system protects the crop, lengthens the growing season, and increases profitability for the grower (Carey et al, 2009).

We conducted a variety trial of determinate tomatoes in a high tunnel to identify which cultivars are best suited for hoop house production in the Great Plains. Ten commercially available varieties were tested, and yields ranged from 14.5 to 27.6 lb of total fruit per plant. The three varieties with the highest marketable fruit weight were ‘Primo Red’, ‘Red Morning’, and ‘Red Deuce’ respectively. ‘Red Deuce’ had the largest marketable fruit size in this trial at 0.65 lbs., similar to variety trials conducted in 2013 (0.47 lb), 2014 (0.53 lb), 2015 (0.55 lb) and 2016 (0.43 lb).

Introduction

Fresh-market tomatoes in Kansas are a valuable crop that is sold through farmers markets, CSA’s, on-farm, wholesale, and to restaurants. Results from a survey conducted by the Kansas Rural Center in 2014 indicated that tomatoes are the most commonly grown crops in high tunnels in Kansas (Phelps, 2014). Similarly, tomatoes are the most popular crop grown in the central United States (Knewton et al, 2010).

In four-season high tunnels, indeterminates are often used in addition to determinate and heirloom varieties. However, in three season high tunnels, the tunnel frame typically cannot support a vertical trellis system 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 a three-season high tunnel.

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 6 March 2017 and transplanted to 50-cell trays on 16 March. Transplants were set on 2 May in one bay of a multi-bay high tunnel (96’ x 200’ Haygrove Multi-Bay High Tunnel). The trial was planted into four rows with each row consisting of one replication. The high tunnel trial had five plants per plot, and in-row

spacing was 18", which is typical of commercial tomato production. Plastic mulch and drip irrigation were employed, and the stake-and-weave method was utilized to trellis the plants vertically. Granular fertilizer was applied on 25 March at a rate of 50 lb N/acre. Fertigation was carried out at a rate of 10 lb nitrogen/acre and 5 lb/potassium/acre on 4 August. Harvesting occurred from 3 July through 2 October. During the last harvest, all fruit larger than 5 cm were picked. The fruit was graded for marketability, and fruit number and weight were recorded. Average fruit size and percent marketability were calculated and are presented below. The data set was analyzed using an 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 observation, and the results of the LSD test are shown where statistically significant treatment effects occurred.

Results and Discussion

'Primo Red' had the highest marketable yield at 21.0 lb per plant while 'Red Morning' had the highest total yield at 27.7 lb per plant. 'Primo Red,' 'Red Morning' and 'Red Deuce' showed no significant differences ($P < 0.05$) in regards to total yield. 'Red Deuce' had the highest average marketable and total fruit sizes at 0.65 and 0.59 lb respectively. The results were similar to those of previous variety trials (2013 (0.47 and 0.45 lb), 2014 (0.53 and 0.47 lb), 2015 (0.55 and 0.51 lb) and 2016 (0.43 and 0.42 lb). The average marketable and total fruit size of 'Red Deuce' was significantly higher from other the varieties trialed.

While fruit sizes remained constant for some varieties, others decreased throughout the season. 'Primo Red' was a consistent producer throughout the season with an average marketable fruit size of 0.57 lb. 'Red Deuce' produced the largest single harvest average marketable fruit size of any variety on 31 July at 0.77 lb. After this harvest, the average marketable fruit size of 'Red Deuce' consistently decreased. By the last harvest, the average marketable fruit size of 'Red Deuce' had dropped to 0.38 lb per fruit (data not shown).

The three largest harvests in terms of pounds of marketable fruit occurred on 31 July, 28 August, and 26 September. Though, the 31 July harvest was significantly larger than the other two. 'Primo Red' produced the largest amount of fruit (5.8 lb per plant) on 31 July followed by 'Red Morning' and 'Red Deuce' at 4.2 lb and 3.7 lb per plant respectively (data not shown).

'Tasti Lee' is known for its high lycopene levels and had average marketable and total fruit size of 0.43 and 0.40 lb respectively.

Several varieties showed good potential for early-season production, which can be advantageous for high tunnel growers. During late July (data not shown), 'Primo Red,' 'Red Morning,' and 'Red Deuce' showed higher yields than the other varieties. In late August, 'Skyway,' 'Red Deuce' and 'Red Morning' showed higher yields than the other varieties, which may be useful for growers looking to cater to late markets.

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

Variety	Marketable		Total	
	Number	Wt (lb)	Number	Wt (lb)
Primo Red	37.2 d	21.0 e	57.4 c	27.6 e
Red Morning	34.3 bcd	19.7 de	59.0 c	27.7 e
Red Deuce	26.2 a	17.0 cd	48.9 abc	25.3 de
Scarlet Red	37.3 d	16.1 bc	53.0 bc	20.6 bc
BHN589	35.8 cd	15.0 abc	57.5 c	22.0 cd
Tasti Lee	34.2 bcd	14.6 abc	48.4 abc	18.4 abc
Summerpick	30.8 abcd	14.4 abc	44.3 ab	18.7 abc
Fletcher	34.5 bcd	14.2 abc	46.2 ab	17.2 ab
Skyway	28.2 ab	12.7 ab	42.9 ab	17.5 ab
Richmond	29.7 abc	12.0 a	39.6 a	14.5 a
LSD _(0.05)	6.59	3.49	10.81	4.20

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

Variety	Average Fruit Size (lb)		Percent Marketability	
	Marketable	Total	Number	Weight
Red Deuce	0.65 e	0.59 e	70.7 ab	77.9 bc
Red Morning	0.58 cd	0.53 c	74.7 bc	81.7 cd
Primo Red	0.57 c	0.53 cd	78.8 cd	84.2 cd
Summerpick	0.47 b	0.45 b	77.0 bcd	81.0 bcd
Skyway	0.45 ab	0.42 ab	70.9 ab	75.3 ab
Scarlet Red	0.44 ab	0.41 ab	78.0 cd	82.4 cd
Tasti Lee	0.43 ab	0.40 ab	78.2 cd	83.8 cd
BHN589	0.42 ab	0.39 a	65.7 a	69.6 a
Richmond	0.41 a	0.39 a	81.9 d	86.1 d
Fletcher	0.41 a	0.38 a	79.9 cd	85.2 d
LSD _(0.05)	0.06	0.06	6.86	6.31

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Literature Cited

Phelps, Dan, November 2014. Growing Under Cover: A Guide to Polyunnel Options for Kansas Growers, a Kansas Rural Center publication, Topeka, KS.

Carey, E.E., L. Jett, W.J. Lamont, T.T. Nennich, M.D. Orzolek, and K.A. Williams. 2009. Horticultural crop production in high tunnels in the United States: A snapshot. HortTechnology 19:37–43.

Knewton, S.J.B, Cary, E.E., Kirkham, M.B. 2010. Management Practices of Growers Using High Tunnels in the Central Great Plains of the United States. HortTechnology 20:639-645.

U.S. Department of Agriculture. 2014. Census of Horticultural Specialties. Volume 3 Special Studies Part 3. State Data. Table 14. 2015 December.
agcensus.usda.gov/Publications/Census_of_Horticulture_Specialties

Seed Sources

Harris Moran - HM

Seedway – SW/SDW

Johnny’s Selected Seeds - JS

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