

2014 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 19.5 to 23.3 lbs of total fruit per plant. The three varieties with the highest marketable yield were 'Red Deuce', 'Primo Red', and 'Biltmore'. 'Red Deuce' had the largest marketable fruit size and 'Primo Red' had the highest percent marketability by fruit number and weight.

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 6 March 2014 and transplanted to 50-cell trays on 18 March. Transplants were set on 22 April 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 trials had five plants per plot and in-row spacing was 18", typical of commercial determinate production. Preplant crop nutrients were provided by calcium nitrate and potassium nitrate using equal portions of nitrogen at 75 lbs nitrogen/acre total. Fertigation was carried out at a rate of 10 lbs nitrogen/acre per application on 15 and 23 July, and 7 August. Calcium nitrate was used for the first and third fertigation events and potassium nitrate was used for the second fertigation. Plastic mulch and drip irrigation were employed and the stake-and-weave method was utilized to trellis the plants vertically. Harvesting was carried out from 24 June until 19 September.

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.

Variety	Marketable		Total	
	Number	Wt (lbs)	Number	Wt (lbs)
Red Deuce	40.3 abcd	21.0 c	56.6 bcd	25.8 d
Primo Red	42.7 cde	20.5 c	49.3 a	22.3 abc
Biltmore	41.4 bcde	18.6 bc	62.9 d	24.5 cd
Scarlet Red	43.0 cde	18.0 abc	55.1 abc	21.3 ab
BHN 1021	49.8 f	18.0 abc	73.6 e	23.3 bcd
BHN 589	46.8 ef	16.9 ab	74.4 e	23.2 bcd
Volante	36.5 ab	16.7 ab	50.3 abc	20.6 ab
Tasti Lee	44.4 def	16.1 ab	60.2 cd	19.5 a
Florida 91	38.5 abc	16.0 ab	58.6 cd	21.5 abc
Mountain Fresh	35.4 a	14.9 a	58.9 cd	20.4 ab
LSD _(0.05)	5.6	3.5	7.3	3.1

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

Variety	Average Fruit Size (lbs)		Percent Marketability	
	Marketable	Total	Number	Weight
Red Deuce	0.53 e	0.47 d	71.8 bc	81.0 bcd
Primo Red	0.48 de	0.45 d	86.9 e	91.7 f
Biltmore	0.45 cd	0.39 bc	65.9 ab	75.6 ab
Scarlet Red	0.42 bc	0.39 bc	78.2 cd	84.8 de
BHN 1021	0.36 ab	0.32 a	67.6 ab	77.2 abc
BHN 589	0.36 a	0.31 a	63.0 a	72.6 a
Volante	0.46 cd	0.41 cd	72.7 bc	80.9 bcd
Tasti Lee	0.36 ab	0.32 a	73.7 bc	82.7 cd
Florida 91	0.41 abc	0.37 abc	65.5 ab	73.8 a
Mountain Fresh	0.42 cd	0.35 ab	60.3 a	73.3 a
LSD _(0.05)	0.06	0.06	8.3	6.7

'Red Deuce' had the highest per plant total and marketable yield, but marketable yield was statistically similar to 'Primo Red', 'Biltmore', 'Scarlet Red', and 'BHN 1021' ($P < 0.05$). 'Red Deuce' had statistically similar yield to 'BHN 1021' and 'BHN 589'. A similar trial was conducted in 2013, and 'Red Deuce' had the highest marketable and total yield. 'Primo Red' was a new entry into the annual variety trials conducted at our location and also performed very well. It was second to 'Red Deuce' in marketable fruit production as well as total and marketable fruit size. Interestingly, the proportion of marketable fruit produced by 'Primo Red' was dramatically increased over the other entries and was 91.7% for marketability by weight as compared to the other varieties, which ranged from 72.6% to 84.8%. The major portion (>60%) 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.

Several varieties showed good potential for early-season production, which can be advantageous for marketing high-value fruit. In particular, 'Primo Red', 'Volante', and 'BHN 589' showed the highest yields during the early weeks of July (data not shown). 'Mountain Fresh', 'Red Deuce', and 'Biltmore' had the highest yields at peak harvest. 'Biltmore' also showed very strong production in the early part of September, which may be useful for growers looking to cater to late markets. 'BHN 589' is one of the more common semi-determinate varieties grown in high tunnels. In this trial, 'BHN 589' produced more consistently from week-to-week than any of the others. In fact, it had the highest yields early in the season but had the lowest yield at peak harvest (data not shown).

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