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Kimberly L. Oxley
*Kansas State University*, koxley@ksu.edu

Cary L. Rivard
*Kansas State University*

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**Kimberly L. Oxley and Cary L. Rivard, Kansas State University**
**Department of Horticulture and Natural Resources, Manhattan, KS koxley@ksu.edu**

## Introduction

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. In addition to protection, determinate tomato crop requirements (planting date, soil temperature, crop height, etc.), high tunnels provide an excellent system for bell pepper production. Therefore, this method protects the crop, lengthens the growing season, and increases profitability for the grower as a result (Carey et at, 2009).

Bell peppers in Kansas are a valuable crop that is sold through farmers markets, CSA's, on-farm, wholesale and to restaurant. Results from a grower survey conducted in 2014 by the Kansas Rural center showed peppers were ranked fourth in popularity as one of the most common crops grown in high tunnels (Phelps, 2014). Similarly, peppers also ranked as the fifth most popular crop grown in high tunnels in the central United States (Knewton et at, 2010).

The goal of this study was to investigate the performance of ten hybrid bell pepper (green to red) varieties for fresh-market production in high tunnels. Ten commercially available varieties were tested and total yields ranged from 10.9 to 16.9 lb of fruit per plant. The three varieties with the highest marketable fruit number and weight per plant were 'Galileo,' 'Declaration,' and 'Archimedes.'

## 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 20 February 2017 and transplanted to 50-cell trays on 11 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. Each plot had five plants, and in-row spacing was 18", which is typical of commercial pepper production. Plastic mulch and drip irrigation were employed, and the stake-and-weave method was utilized as needed to trellis the plants vertically. Granular fertilizer was applied on 25 March at a rate of 50 lb N/acre. Weekly tissue samples were used to identify when fertigation was needed throughout the season. Fertigation was carried out at a rate of 10 lb nitrogen/acre and 5 lb/potassium/acre on 4 August. Harvesting occurred from 3 June through 9 October. During the last harvest, all fruit larger than 5 cm were picked. The fruit were graded for marketability, and fruit number and weight were recorded. Average fruit size and percent marketability were determined 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

In our trial, ‘Declaration’ yielded the highest marketable fruit number at 38.5 per plant and was not significantly different from ‘Galileo’, ‘Archimedes’, ‘Vanguard’, ‘Red Knight’, ‘Karisma’, or ‘Intruder.’ ‘Archimedes’, ‘Intruder’, and ‘Declaration’ had the highest percent marketability (by number) at 86.3%, 85.4%, and 84.9% respectively. ‘Declaration’ and ‘Galileo’ had similar marketable fruit sizes at approximately 0.38 lb. These varieties were not significantly different from ‘Vanguard,' ‘Karisma’ or ‘Archimedes’ in regards to average marketable fruit size.

‘Declaration’ resulted in the highest marketable weight at 14.9 lb per plant and was not significantly different from ‘Galileo’, Archimedes’, ‘Vanguard’, or ‘Karisma.’ ‘Currier’, ‘Archimedes’, ‘Intruder’ had the highest percent marketability (by weight) at 90.2%, 88.4%, and 88.1% respectively. Since 2013, ‘Karisma', ‘Declaration', and ‘Archimedes’ have consistently produced high marketable fruit number and weight per plant (data not shown), although ‘Karisma’ did not perform as well in 2017.

Our observations showed three flushes this season (data not shown) during harvests conducted on 20 July, 23 August, and 11 September. During the early peak harvest on 20 July, ‘Vanguard,' ‘Galileo,' and ‘Vanguard’ produced the highest total fruit number. On 23 August, ‘Intruder,' ‘Red Knight’ and ‘Declaration’ produced the highest total fruit number. The harvest that occurred on 11 September was the largest and ‘Archimedes,' ‘Declaration’ and ‘Alliance’ provided the highest total fruit number. The timing of market demand may determine which variety would be ideal for particular growers. If a grower is targeting an earlier season customer base, then ‘Vanguard’ and ‘Galileo’ may work best. However, if market demand is later in the season, then ‘Declaration’ and ‘Archimedes’ may be better-suited. A good mix would be ideal for growers who wants to have a consistent season-long supply.

‘Karisma’ has been trialed every year since 2013. In this trial, ‘Karisma’ was more consistent week-to-week throughout the duration of the season than any of the other varieties tested. It had a high early yield flush, but produced consistently for the remainder of the season with fewer fluctuations in marketable yield than other varieties (data not shown).

A large portion (>80%) of the fruit quality problems seen in this trial were the result of blossom end rot (BER). Though the culled fruit was not specifically graded for this issue, the effects observed in this study were most likely the result of a lower incidence of BER.

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

| Variety | Marketable | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|
| | Number | | Wt (lbs) | | Number | | Wt (lbs) | |
| Declaration | 38.5 | c | 14.9 | e | 45.3 | c | 16.9 | e |
| Galileo | 38.3 | c | 14.4 | de | 45.4 | c | 16.7 | e |
| Archimedes | 37.9 | c | 13.3 | cde | 44.0 | bc | 15.0 | cde |
| Vanguard | 34.6 | bc | 13.1 | cde | 43.7 | bc | 15.7 | de |
| Red Knight | 34.0 | bc | 11.7 | abcd | 41.0 | abc | 13.7 | abcd |
| Karisma | 32.8 | abc | 12.2 | bcde | 38.8 | abc | 14.2 | bcde |
| Intruder | 32.2 | abc | 11.4 | abc | 37.3 | ab | 12.8 | abc |
| Alliance | 30.3 | ab | 10.7 | abc | 37.0 | ab | 12.5 | abc |
| Currier | 28.2 | ab | 9.9 | ab | 33.4 | a | 10.9 | a |
| Bayonet | 26.2 | a | 9.2 | a | 36.6 | ab | 11.9 | ab |
| $LSD_{(0.05)}$ | *7.0355* | | *2.8252* | | *7.7760* | | *2.9305* | |

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

| Variety | Average Fruit Size (lbs) | | | | Percent Marketability | | | |
|---|---|---|---|---|---|---|---|---|
| | Marketable | | Total | | Number | | Weight | |
| Declaration | 0.38 | b | 0.37 | c | 84.9 | b | 87.8 | bc |
| Galileo | 0.38 | ab | 0.37 | c | 84.2 | b | 85.7 | bc |
| Vanguard | 0.37 | ab | 0.36 | abc | 79.0 | ab | 82.5 | ab |
| Karisma | 0.37 | ab | 0.36 | bc | 84.5 | b | 85.6 | bc |
| Archimedes | 0.35 | ab | 0.34 | abc | 86.3 | b | 88.4 | bc |
| Intruder | 0.35 | a | 0.34 | abc | 85.4 | b | 88.1 | bc |
| Alliance | 0.35 | a | 0.34 | abc | 81.6 | b | 84.4 | bc |
| Currier | 0.35 | a | 0.32 | a | 84.4 | b | 90.2 | c |
| Bayonet | 0.35 | a | 0.33 | ab | 71.8 | a | 75.6 | a |
| Red Knight | 0.34 | a | 0.34 | abc | 82.9 | b | 85.2 | bc |
| $LSD_{(0.05)}$ | *0.0336* | | *0.0390* | | *9.4747* | | *7.7531* | |

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## Seed Sources

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Seedway – SW/SDW
Johnny's Selected Seeds - JS

## Contact Info

Kimberly Oxley
Research Associate
Kansas State University
35230 W 135th St
Olathe, KS 66061
koxley@ksu.edu
913-856-2335 x121