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High Tunnel Summer Squash and Zucchini Cultivar Trial, 2018

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Squash and zucchini (*Cucurbita pepo* L.) are popular summer vegetable crops that are generally considered easy to produce. However, they often succumb to various disease and insect pressure. Part of this disease pressure is from powdery mildew which can be influenced by rain that leaves moisture on leaf tissue. Although high tunnels are known for their usefulness during spring and fall for the shift in temperatures, they are also used to control moisture on plants which can increase disease pressure. Using a high tunnel to produce squash in the summer may help reduce management costs and labor due to lower disease pressure. However, not all cultivars are suited for the high temperatures experienced in high tunnels compared to open field production. Additionally, certain cultivars may be appropriate for smaller, direct-to-consumer markets, but may not produce fruit uniform enough for larger markets, such as wholesale. The objectives of this trial were to evaluate cultivars not previously evaluated in Kentucky and assess appropriate cultivars for high tunnel production.

Materials and Methods

Four cultivars of yellow summer squash and three cultivars of zucchini squash were transplanted in a high tunnel (30 x 96 ft) on 8 June 2018 at the University of Kentucky Horticultural Research Farm in Lexington. The summer squash included the cultivars 'Gold Star', 'Slick Pik', 'Tempest', and 'Zephyr'. The three zucchini cultivars were 'Costata Romanesco', 'Dunja', and 'Spineless Perfection' (Table 1). The trial was arranged as a randomized complete block design with five replications of the seven cultivars. The crop was transplanted on raised beds of Maury silt loam covered with black woven weed barrier mat on 5 ft centers. There was 18-inch spacing between each plant and seven plants in each treatment plot. The buffer space between each treatment plot within the same row was 2.5 ft.

Fertilizer was incorporated prior to shaping the beds at 50 lb of N per acre (33.06 lb of Nature Safe® 10N-0P-8K). Drip irrigation tape was installed at the same time the raised beds were formed and the weed mat was laid. Plant irrigation was maintained as needed based on soil moisture. Plants were maintained conventionally, including an application of imidacloprid insecticide (Admire® Pro; Bayer CropScience) through the drip irrigation line five days after transplanting to manage cucumber beetle pressure. Periodic aboveground fungicide applications were also used to control for powdery mildew. Applications included copper fungicide (Nordox 75 WG; Nordox) on 11 July and penthiopyrad fungicide (Fontelis®; DuPont™). We applied calcium nitrate weekly through the drip irrigation tape at a 7 lb/acre rate.

Fruit was harvested three times per week for four weeks beginning 27 June and ending 23 July for a total of 12 harvests. We determined fruit to be mature enough for harvest if it was at least 6 inches long. Marketable and unmarketable fruit were sorted based on USDA grading recommendations (USDA, 2016). Both marketable and unmarketable fruit were counted and weighed immediately after harvest. Data were subjected to an analysis of variance (ANOVA) test using Statistical Analysis System (SAS) statistical software (Version 9.4; SAS Institute Inc.).

Tukey was used to separate means when ANOVA tests were significant. Alpha was set at 0.05 for all data.

Results and Discussion

The 2018 summer growing season experienced more precipitation than normal. From the planting date to the last harvest, it rained 8.7 inches (Kentucky Mesonet, 2018). This was 20% more precipitation than in the same time period in 2017 and 50% more than in 2016 (Kentucky Mesonet, 2016, 2017). Because it was being grown under the high tunnel, the precipitation during this time appeared to have a minimal effect on the squash/zucchini crop. However, Choanephora fruit rot was still one of the more common diseases on unmarketable fruit. Leaf wetness is considered a contributing factor to Choanephora fruit rot (Seebold et al., 2009).

'Slick Pik' summer squash and 'Dunja' zucchini produced the highest marketable total yield for the entire season (Table 2). 'Slick Pik' and 'Dunja' also had the highest mean yield per plot, but were only significantly more than 'Gold Star'. 'Gold Star' produced the smallest fruit by weight, but was not significantly smaller than any of the yellow squash cultivars, only the three zucchini cultivars (Table 2). 'Costata Romanesco' had the heaviest fruit, but the lowest total yield. This cultivar produced large, dense fruit, but not a large quantity. It had low total yield, second only to 'Gold Star'. 'Tempest' had the third highest total marketable yield, but also had a high number of culled fruit (Table 2). Choanephora fruit rot was observed on 'Tempest' fruit and those fruit were culled. Viral symptoms were also observed on 'Tempest' fruit. 'Zephyr' was similar to 'Tempest' with a high culled fruit weight and number; marketable yield was also similar.

'Slick Pik' is advertised as an early producing cultivar. The first week of harvesting, it did have the highest mean weight of marketable fruit, although not significantly different from the other cultivars (Table 3). It produced 23% more than the next highest producer, 'Zephyr'. 'Slick Pik' also had consistent production through the harvest window. The average marketable harvest did not vary more than 23% from the lowest producing week (Week 2) to the highest producing week (Week 4; Table 3). The second week of harvest was the only time period in which the mean marketable weights were significantly different from one another. 'Dunja' and 'Spineless Perfection' produced significantly more marketable fruit than 'Gold Star' and Zephyr' (Table 3).

'Dunja' and 'Slick Pik' performed consistently well and would be appropriate for larger-scale commercial high tunnel production in Kentucky. These two cultivars also produced uniform fruit throughout the season, making them more appropriate for wholesale markets compared to the other cultivars in the trial. However, both cultivars produce fruit that is considered standard, which may not attract customers in direct-to-consumer markets. 'Tempest' and 'Zephyr' produced moderate marketable yield compared to the other cultivars and produced fruit that is more unique in appearance and may attract more customers at farmers' markets. 'Tempest' and 'Zephyr' may not be suitable for wholesale markets as these two cultivars did not produce uniform fruit throughout the harvest season.

Acknowledgments

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Table 1. Cultivar characteristics of summer squash and zucchini

Cultivar[1]	**Squash type**	**Days to maturity**[2]	**Description**
Gold Star F1	Yellow crookneck	50	Uniform fruit, nice shape; not many culled fruit
Slick Pik YS 26 F1	Yellow straight neck	48	Spineless; early producing, high yielding
Tempest F1 OG	Yellow crookneck	54	Nice color with subtle ribbing and striping; good yield
Zephyr F1	Yellow straight neck	54	Slender yellow fruit with green blossom end; virus appearance later in season; high number of culls
Costata Romanesco	Heirloom zucchini	52	Medium green with flecks and stripes; large blossom scar; lower yield due to high number of culls
Dunja F1 OG	Dark green zucchini	47	Large disease resistance package; uniform, straight fruit; high yielding
Spineless Perfection F1	Medium-green zucchini	45	Straight fruit, spineless plants; large disease resistance package

[1]All seeds were purchased from Johnny's Selected Seeds.
[2]Refers to average number of days from seeding to harvest.

Table 2. Total yield and weights of summer squash and zucchini grown in a high tunnel in central Kentucky, 2018.

Cultivar	Total marketable yield (lb)[1]	Mean marketable yield/plot/harvest date (lb)[2]		Mean marketable fruit wt (lb)[4]		Total culled fruit (lb)	Mean culled fruit/plot/harvest date (lb)	
Gold Star	112.33	1.87	b[3]	0.35	c	6.51	0.11	b
Slick Pik	183.96	3.07	a	0.42	bc	13.78	0.23	b
Tempest	167.60	2.79	ab	0.47	abc	38.81	0.68	a
Zephyr	154.48	2.58	ab	0.45	bc	42.67	0.71	a
Costata Romanesco	123.00	2.05	ab	0.69	a	4.31	0.07	b
Dunja	181.93	3.03	a	0.60	ab	3.05	0.05	b
Spineless Perfection	141.20	2.35	ab	0.59	ab	5.86	0.10	b

[1]Total marketable yield represents the yield from all treatment plots across all harvest dates harvested from five 18 ft^2 plots.
[2]All plots consisted of 7 plants at the beginning of the trial.
[3]Values within the same column followed by the same letter(s) are not significantly different at $P \leq 0.05$.
[4]Calculated by dividing the marketable fruit weight by the number of marketable fruit.

Table 3. Mean marketable yield per plot by week, beginning 27 June and ending 23 July, of summer squash and zucchini grown in a high tunnel in central Kentucky, 2018.

Cultivar	Week 1[1] mean harvest (lb)	Week 2 mean harvest (lb)		Week 3 mean harvest (lb)	Week 4 mean harvest (lb)
Gold Star	5.08	5.23	bc[2]	5.68	6.48
Slick Pik	8.67	8.38	abc	8.81	10.93
Tempest	5.37	9.70	ab	9.23	9.22
Zephyr	6.70	9.10	abc	9.52	5.57
Costata Romanesco	3.95	4.73	c	8.25	7.67
Dunja	5.82	12.24	a	10.41	7.91
Spineless Perfection	4.31	10.12	a	7.36	6.45

[1]Each week represents three harvests that occurred over the course of 7 days.
[2]Values within the same column followed by the same letter(s) are not significantly different at $P \leq 0.05$.