

2022 Bell Pepper Cultivar Trial

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A bell pepper cultivar trial was planted at the Southwest Michigan Research and Extension Center (42.081985, -86.354087, Benton Harbor, Michigan). Enza Zaden (EZ), HM Clause (HM), PanAmerican (PA), Seminis (SE), and Sakata (SK) seed companies donated bell pepper cultivars for plastic-mulch bedded and trellised hand harvest. Overall trial quality was excellent, however environmental conditions increased the numbers of choppers during the 2nd and 3rd pickings. In the future, we will not pick small fruit because there is no market for them.

Materials and Methods

On 7 April, 15 bell pepper cultivars were seeded into 72-cell trays and raised for 43 days in a greenhouse and 6 days in a shadehouse.

On 29 April lime and fertilizers were preplant incorporated to achieve 40 lb. N, 0 lb. P₂O₅, 20 lb. K₂O, 1 lb. B, 25 lb. S, and 2000 lb. lime per acre (119 lb. 21-0-0-21S, 32 lb. 46-0-0, 28 lb. 0-0-60, 6.5 lb. 0-0-0-15B) in a field size of 0.4 acre. The soil type was a well-drained Oakville fine sand. On 11-12 May, black plastic mulch and drip tape was laid with 6 ft between beds. No fumigation was used.

On 26 May, peppers were planted in a completely randomized design with four replications, two rows per bed, 14 inches apart between rows and 18 inches between holes in-row resulting in 16 plants per bed and a final plant population of 9,680 plants per acre. Two plants of a distinctly different variety were planted on either end of each plot to reduce picking errors between plots.

On 2 June, the fertigation schedule started delivering 5 lb. N and 5 lb. K₂O per week (30 lb. 18-0-0-5Ca-1.5Mg, 9 lb. 0-0-60) for 15 weeks. No herbicides were applied. The field was hand-hoed, and diseases were managed with a weekly rotation of standard fungicides. Hornworms and two-spotted spider mites were treated on 29 July, and 2 September, respectively.

Four reps of all cultivars were harvested and measured four times on 4 Aug (70 dap), 17 Aug (83 dap), 25 Aug (91 dap), and 7 Sep (104 dap). We harvested all 16 plants from each dual row plot when the fruits began reaching advanced sizes. Hard-ripe fruit were removed from the plants and sorted and counted by the following sizes for No. 1 quality fruit: Small (< 130 g), Medium (130 – 159 g), Large (160 – 189 g), Extra Large (190 – 229 g), Jumbo (> 230 g). In addition, No. 2 quality fruit (choppers) and culls were counted and weighed. Yield data was analyzed with a both parametric ANOVA and non-parametric Kruskal-Wallis procedures followed by a Least Significant Difference (LSD) calculation.

Fruit per plant, 1-1/9 bushels per acre of each size class, and combined total 1-1/9 bushel per acre yield calculations do not include culls. We determined 1-1/9 bushels per acre with the following equation.

$$\frac{1\frac{1}{9} bu}{24 lb} * \frac{1 lb}{435.6 g} * \frac{weight (g)}{plot} * \frac{1 plot}{0.001652893 ac} = \frac{1\frac{1}{9} bu}{ac}$$

Results and Discussion

The season was characterized by warmth and dryness, though the peppers harvested 91 days after planting exhibited the stubby growth characteristic of cool temperatures at bud-formation (Table 1). The established transplant stand was near 100%, and plants grew well.

Total clean yield (jumbo + xlarge + large + medium + small + choppers) averaged 955.8 1-1/9 bushels per acre (Table 2). The top five cultivars with the highest combined clean yields of the most profitable size classes (xlarge, jumbo, large) were SE Redfish, SK Mercer, SE Tarpon, PA Remarkabell, and EZ Regulator. The total yield of PA Kickstart and PA 11033 was driven by high proportions of smalls and choppers relative to other more profitable sizes. However, the overall means across all cultivars for each size class were nearly equal, at around 107 1-1/9 bushels per acre for each size class. The five lowest yielders in total 1-1/9 bushels per acre were PA Trailblazer, SK Nitro S10, EZ 9, HM Captain, and PA 11135.

Fruit classified as choppers were often mishappen due to plant architecture or environmental effects and the overall mean across all cultivars was 419.5 1-1/9 bushels per acre. Choppers averaged 45% of the total yield across cultivars, and this ranged from 35% (SE Tarpon) up to 62% (EZ 3), indicating the importance for secondary markets for bell peppers (Table 3).

Cull rates averaged 8% and were between 1% (SE Sailfish) and 29% (EZ 9) (Table 3). The culls were largely due to blossom end rot, and sunscald to a much lesser extent. The five cultivars with the lowest cull percentages were SE Sailfish, PA 11033, SK Mercer, PA Kickstart, and PA Remarkabell. The five cultivars with the highest cull percentages were HM Captain, SE Redfish, EZ Regulator, PA 11135, and EZ 9.

The best overall performer was SK Mercer, with the highest total yield, highest yield across the two middle pickings, the second highest number of marketable fruit per plant, and third smallest cull percentage (5%). Trial observers were attracted to PA 11033 for its bright white color and some sensed that it had a different smell. For one commercial bell pepper grower, this different smell was a concern. But, for one consumer the smell was desirable, and “less vegetal”.

Pictures

Pictures were taken after the third harvest on 24 Aug (Figure 2). Each box represents the harvest from 16 plants in one randomly chosen replication.

Acknowledgements

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Table 1. Weather data summarized by weeks between 26 May and 7 September at the Southwest Michigan Research and Extension Center in 2022. Temperatures were averaged by week, and precipitation is total number of inches received for that week. *Week is reported as week of the year (week of the trial).

Week*	Max Air Temp (F)	Min Air Temp (F)	Max Soil Temp (F)	Min Soil Temp (F)	Precipitation (inches)
21(1)	74.13	53.75	73.43	60.70	0.06
22(2)	79.86	56.29	79.29	65.33	0.00
23(3)	72.25	53.87	76.00	63.58	0.96
24(4)	85.79	62.44	86.71	71.61	1.07
25(5)	84.80	61.34	89.39	72.41	0.00
26(6)	82.09	57.20	90.73	71.44	0.00
27(7)	84.50	63.96	87.79	73.20	2.65
28(8)	79.93	60.28	85.60	72.78	0.12
29(9)	85.20	68.90	86.07	75.17	0.36
30(10)	-	-	-	-	-
31(11)	84.77	70.93	84.73	76.07	0.83
32(12)	79.15	65.55	82.65	74.30	0.02
33(13)	-	-	-	-	-
34(14)	81.04	59.42	81.48	71.30	0.00
35(15)	81.43	62.66	82.69	72.19	0.21
Mean	81.1	61.3	83.6	70.8	0.5

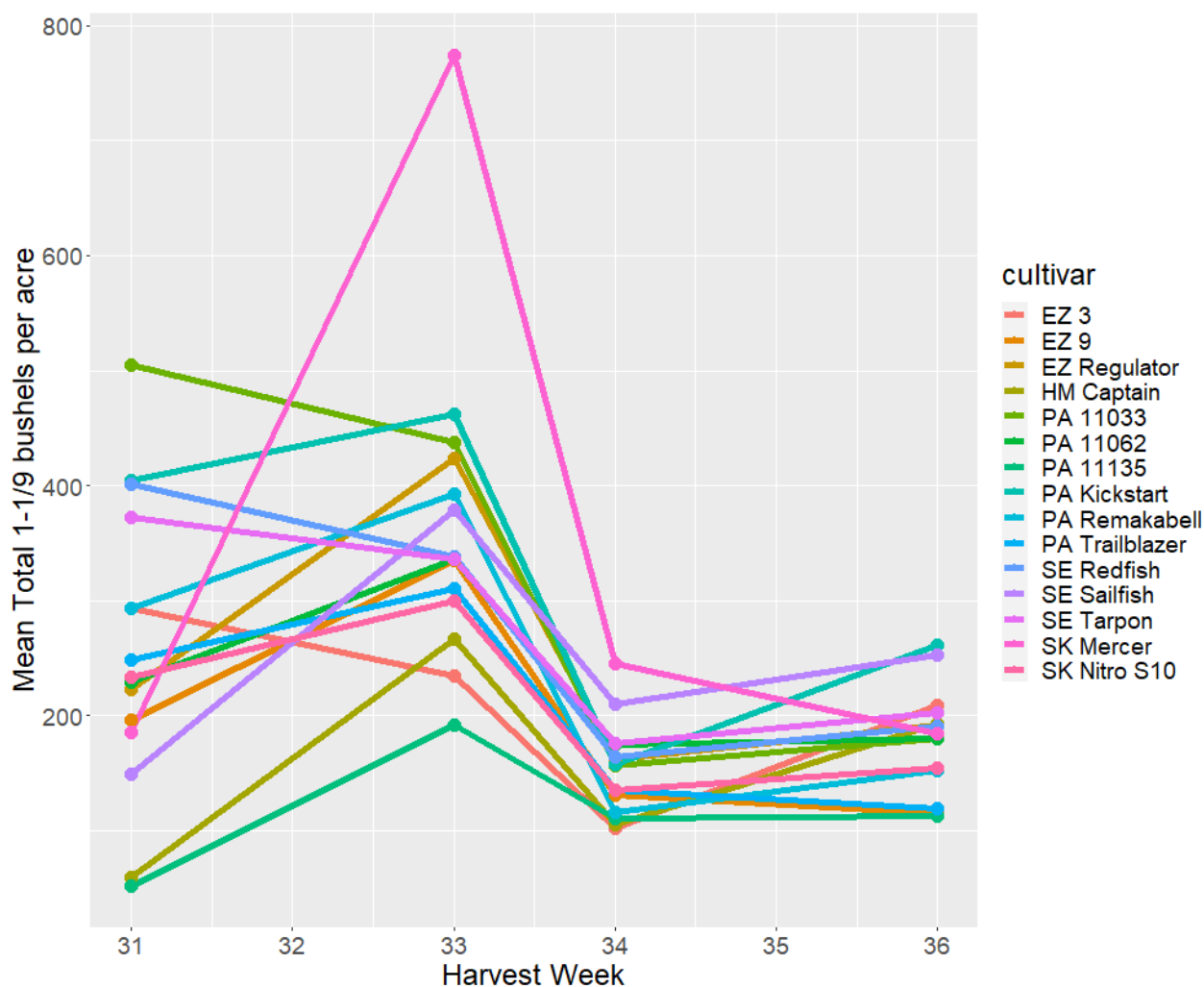


Figure 1. Mean total 1-1/9 bushels per acre of bell peppers across harvest dates. In general, yields peaked on the second picking. Mercer outyielded all other varieties on the second and third picking.

Table 2. Mean yield data of 15 bell pepper cultivars at the Southwest Michigan Research and Extension Center in 2022. Data in this table are arranged in order of largest mean total yield in clean bushels per acre (jumbo + xlarge + large + medium + small + choppers), with a 1-1/9 bushel representing 24 lb. of peppers. Values in bold indicate the cultivar performed statistically like the cultivar with the highest value for that column. Numbers in parentheses are rank-sum values generated through the Kruskal-Wallis procedure used to analyze data that did not meet the assumptions for performing an ANOVA procedure. The Least Significant Difference (LSD) is the critical value that differentiates cultivars statistically. For example, subtracting the Total 1-1/9 bushels per acre LSD of 367.2 from Mercer – 1388.9 – is 1021.7. Any cultivar with a rank-sum less than 1021.7 is deemed significantly different from Mercer. In a column with rank-sums in parentheses, the same process is used with those parenthetical values.

Company and Cultivar	Total 1-1/9 bu/a	Jumbo 1-1/9 bu/a	XLarge 1-1/9 bu/a	Large 1-1/9 bu/a	Medium 1-1/9 bu/a	Small 1-1/9 bu/a	Chopper 1-1/9 bu/a	Cull 1-1/9 bu/a	Fruit Per Plant
SK Mercer	1388.9	181.3	169.6	156.0	170.5 (47.2)	101.1	610.3	69.4 (32.5)	14.7
PA Kickstart	1284.8	87.1	119.4	163.3	144.1 (41.8)	154.1	616.2	70.5 (29.2)	9.6
PA 11033	1278.1	61.7	133.6	139.8	222.1 (47.5)	246.7	474.1	37.7 (16)	15.6
SE Redfish	1093.8	248.9	177.2	103.6	105.2 (31.3)	71.0	387.8	115.6 (35.7)	8.2
SE Tarpon	1087.3	131.8	125.2	164.1	152.5 (43)	133.7	379.9	90.7 (39.5)	7.6
EZ Regulator	999.8	108.5	118.2	150.6	92.5 (28.2)	77.4	452.4	111.3 (47.2)	9.3
SE Sailfish	990.0	30.4	92.8	87.4	126.3 (37.1)	186.4	466.6	5.9 (3)	8.3
PA Remarkabell	953.7	179.7	123.2	105.1	60.9 (18.5)	71.2	413.6	55.9 (26)	6.4
PA 11062	920.0	66.3	110.3	74.6	143.0 (39.7)	102.0	423.7	55.2 (24.2)	7.4
EZ 3	838.6	163.6	52.6	40.2	29.1 (9)	36.3	516.8	74.5 (35)	5.4
PA Trailblazer	821.4	955.8	105.1	106.8	145.5 (34)	102.6	329.5	72.7 (34.7)	6.7
SK Nitro S10	814.2	55.4	116.7	93.1	106.7 (31.6)	113.1	336.3	68.1 (27.2)	11.5
EZ 9	814.2	47.4	76.6	112.6	73.7 (20)	83.3	307.6	319.7 (58.5)	8.2
HM Captain	775.2	124.8	75.8	109.9	53.2 (15.2)	62.7	355.2	61.6 (28)	7.8
PA 11135	624.0	51.0	55.7	46.2	41.7 (13)	68.6	221.9	54.7 (20.5)	6.3
Mean	955.8	105.1	106.9	105.8	111.2	107.3	419.5	84.2	8.9
CV	34.7	76.0	59.4	67.9	68.1	59.2	34.0	92.5	62.7
Test stat (14,45)	F=3.8	F=5.4	F=1.9	F=1.7	H=29.6	F=7.3	F=3.9	H=30.9	H=21.0
P-value	0.000	0.000	0.083	0.093	0.009	<0.001	<0.001	0.006	0.101
LSD (t.students $\alpha=0.05$)	367.2	79.6	ns	ns	(20.1)	49.2	133.9	(19.6)	ns

Table 3. Percentage of yields for each size class. The order of the cultivars is a continuation of Table 2.

Company and Cultivar	%Jumbo	%XLarge	%Large	%Medium	%Small	%Chopper	%Cull
SK Mercer	13%	12%	11%	12%	7%	44%	5%
PA Kickstart	7%	9%	13%	11%	12%	48%	5%
PA 11033	5%	10%	11%	17%	19%	37%	3%
SE Redfish	23%	16%	9%	10%	6%	35%	10%
SE Tarpon	12%	12%	15%	14%	12%	35%	8%
UA Regulator	11%	12%	15%	9%	8%	45%	10%
SE Sailfish	3%	9%	9%	13%	19%	47%	1%
PA Remarkabell	19%	13%	11%	6%	7%	43%	6%
PA 11062	7%	12%	8%	16%	11%	46%	6%
EZ 3	20%	6%	5%	3%	4%	62%	8%
SK Nitro S10	7%	14%	11%	13%	14%	41%	8%
PA Trailblazer	6%	9%	14%	18%	13%	40%	8%
EZ 9	16%	10%	14%	10%	11%	40%	29%
HM Captain	8%	9%	7%	9%	10%	57%	9%
PA 11135	8%	12%	9%	9%	15%	48%	10%
Mean	11%	11%	11%	11%	11%	45%	8%



Figure 2. Pictures were taken after the third harvest on 30 Aug. Each box represents the harvest from 16 plants in one randomly chosen replication. Top row left to right: (1) SE Redfish, (2) SE Tarpon, (3) SE Sailfish, (4) HM Captain, (5) EZ 9. Middle row left to right: (6) EZ 3, (7) PA Remarkabell, (8) PA Kickstart, (9) PA 11062, (10) PA 11135. Bottom row left to right: (11) PA Trailblazer, (12) PA 11033, (13) SK Mercer, (14) SK Nitro S10, (15) EZ Regulator.