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YIELD AND HANDLE QUALITY OF TWENTY-ONE CARVING PUMPKIN VARIETIES

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ABSTRACT

We evaluated 21 varieties of 15-25 lb orange, smooth-faced pumpkins at 3 Pennsylvania locations in 2016-17 to provide farmers with recommendations for selecting carving pumpkins. Based on yield, no variety was consistently different than the standard 'Gladiator' with weight ranging from 13-27 lbs. Handle (peduncle) quality was assessed on a 5-point scale, with 5 being highest. Based on handle quality, all varieties except 'Camaro' (2.6), 'Spartan' (2.3), and 'Challenger' (2.3) are recommended as they were lower than 'Gladiator' (3.3). Based on these results, farmers have many high yielding options for carving pumpkin cultivars and may consider growing a combination of varieties with different ornamental qualities to accommodate consumer preference.

INTRODUCTION

Pumpkins are a unique vegetable crop in that they are grown not only for consumption, but also for their ornamental characteristics. All U.S. states produce some pumpkins for commercial markets but in 2012, about half were grown in just six states and about 80 percent were grown in just 16 states (U.S. Department of Agriculture [USDA], 2017). Illinois is the largest producer, harvesting two to four times as many pumpkin acres as any of the other top states. It should be noted that most of these pumpkins are grown for the processing market for use in products including baby food and puree. In Pennsylvania, 6,871 acres were devoted to pumpkins on 1,305 farms in 2017, ranking second and first in the nation, respectively (USDA, 2017) with the majority destined for the ornamental market as carved pumpkins.

About 70% of Americans planned to celebrate Halloween in 2018 (Statista, 2019) with 45% planning to carve a jack-o-lantern (National Retail Federation [NRF], 2018), slightly down from 46% in 2017 (NRF, 2017). Carving pumpkins are available in many sizes with most in the range of 10 lb to 50 lb. They are typically rounded in shape with variations resulting in some being oblong. There can be differences in the degree of ribbing on the fruit with a preference to various shades of orange although yellow, white, and pink are available. Customers wanting a quality carving pumpkin are advised to pay attention to handle (peduncle) quality (Boeckmann, 2018).

Farmers growing carving pumpkins have numerous varieties to select from on traits such as fruit quality, yield, and disease resistance. It is not uncommon for a variety to perform well in one region or state and poorly in another. This can make selection time-consuming and leave farmers unsure about how new varieties will perform on their farms. In a participant survey at the 2019 Mid-Atlantic Fruit and Vegetable Convention, 70% of respondents (n=139) stated that variety trials were important to very important for their success (Butzler et al., unpublished data). Seventy-two percent also stated that it was important to very important that variety trials be conducted in areas like theirs.

We evaluated 21 varieties of 15-25 lb orange, smooth-faced pumpkins in 2016-17 at three locations, using varying production practices, to provide farmers with recommendations for selecting carving pumpkins. Top rated varieties can be considered widely adaptable to the Mid-Atlantic region as they exhibited consistent yields and quality regardless of site, year, and production methods.

METHODS

Twenty-one pumpkin varieties (Table 1) were grown in conventional systems in 2016-17 in southwestern Pennsylvania at Yarnick's Farm in Indiana (lat. 40°39'30.9"N, long 79°16'05.4"W), in central Pennsylvania at the Russell E. Larson Research and Education Center in Pennsylvania Furnace (lat. 40°42'45.04"N, long 77° 57'12.44"W), and in southeastern Pennsylvania at the Southeast Agricultural Research and Extension Center in Manheim (lat. 40° 07'05.11"N, long 76° 25'45.69"W). Locations were selected to represent major production areas across the state representing different soil types and climatic conditions (Table 2).

Table 1. Varieties, seed sources, maturity date of cultivars evaluated at three locations in Pennsylvania in 2016-17.

Variety	Source	Maturity[1]
Early King[2]	Abbot & Cobb, Feasterville, PA	90
Ares	Harris Moran Seed Co., Davis, CA	115
Gladiator		115
Kratos		100
Magic Lantern		110
Magic Wand		115
Rhea		105
Zeus		110
Camaro	Hollar Seeds, Rocky Ford, CO	110
Challenger		100
Hannibal	Hybrid Seed Co., Feastervillle, PA	105
Cargo	Johnny's Selected Seeds, Winslow, ME	100
Orange Rave	Rupp Seeds Inc., Wauseon, OH	105
Solid Gold		100
Bayhorse Gold		100
Eagle City Gold		100
Gold Challenge		105
Earlipak	Sakata Seed America, Morgan Hill, CA	95
Honky Tonk		105
Mr. Wrinkles		100
Spartan		100

[1]Based on seed catalogs, days from planting to harvest

[2]All seed were FarMore treated.

Table 2. First and last frost dates for three locations in Pennsylvania.

Location	USDA Hardiness Zone[1]	Average Last Spring Frost	Average First Fall Frost
Southwestern Pennsylvania	6a	June 1-10[2]	October 1-10[3]
Central Pennsylvania	6b	May 1[4]	October 11[4]
Southeastern Pennsylvania	7a	April 11[4]	November 1[4]

[1]USDA, 2012
[2]Plant Maps, 2019b
[3]Plant Maps, 2019a
[4]NWS, 2012

Each site used different production systems. The southwestern site production methods were determined by the farmer cooperator: a raised bed system, six feet apart center-to-center, three feet in-row spacing, and without plastic mulch. When beds were formed, 70 lb/acre nitrogen (N), 15 lb/acre phosphorus (P),

and 54 lb/ potassium (K) were applied in 2016 and 60 lb/acre N, 34 lb/acre P, and 65 lb/acre K in 2017. Seed were planted on June 25, 2016 and June 20, 2017. A single line of drip tape was installed over each bed in 2016 to facilitate germination but was not used in 2017.

Pumpkins were hand harvested on October 8, 2016 and October 10 and 13, 2017 and were categorized as fully orange, turning orange, mature green (full sized and dark green) and unmarketable.

At the central site, a plasticulture system, using a single line of drip tape (T-Tape model 508-12-450; John Deere, Moline, IL) centered on beds and black embossed plastic mulch (Sigma Plastic Groups, Allentown, PA) was used. Beds were shaped, and plastic and drip tape were installed on June 10, 2016 and June 12, 2017. Beds were 8 feet apart center-to-center. In 2016, 50 lb/acre of K was added, and based on soil test results no P was applied. In 2017, no K was applied but 65 lb/acre of P was added. Additionally, 50 lb/acre N was broadcast preplant on May 23, 2016 and June 12, 2017. An additional 25 lb/acre N was fertigated throughout the growing season. Plants were provided with 1-1.5 acre-inches of water each week. Pre-emergent herbicides were applied on June 10, 2016 (S-metolachlor at 1.5 pt/acre and ethalfluralin and clomazone at 4 pt/acre) and June 6, 2017 S-metolachlor at 2 pt/acre and ethalfluralin and clomazone at 5 pt/acre (Medal EC; Syngenta Crop Protection, Wilmington, DE and Strategy; Loveland Products, Loveland, CO). Seed were planted on June 13, 2016 and June 22, 2017 using a plant spacing of 4 ft between plants in a single row.

Pumpkins were cut from vines on September 16 and 20, 2016 and harvested on September 29. In 2017, harvest took place on October 5. Pumpkins were counted and weighed in these categories: fully orange, turning orange or mature green and unmarketable. Immature green fruit were left in the field.

At the southeastern site, glyphosate (Credit 41; Nufarm Americas Inc., Burr Ridge, IL) was applied on May 25, 2016 and 2017 for burn-down of winter rye (*Secale cereal*). Pre-emergent herbicides were applied on May 31, 2016 and 2017 with bensulide (Prefar 4-E; Gowan Company, Yuma, AZ) and clomazone (Strategy; Loveland Products, Loveland, CO). Seed was planted into a no-till system using winter rye residue on June 7, 2016 and June 8, 2017 with 8 ft bed spacing and 4 ft between plants in a single row. Based on soil test recommendations, P and K were not applied. Nitrogen was applied at a rate of 90 lb/acre with 50 lb broadcast preplant and the remainder fertigated throughout the growing season. A single line of drip tape (T-Tape model 508-12-450; John Deere, Moline, IL) was centered on each row. Plants were provided with 1-1.5 acre-inches of water each week.

Pumpkins were harvested on October 14, 2016 and October 11 and 16, 2017. At this site, harvest occurred when all fruit were fully orange (no fruit were turning orange).

Diseases and insect pests were managed locally using recommendations from the Mid-Atlantic Commercial Vegetable Production Guide (Sánchez et al, 2016).

Quality of the handles (peduncles) was visually rated at this site using a 1-5 scale with 5 indicating the highest quality. Quality criteria included color, thickness, uniformity, and strength of attachment.

All treatments were arranged in a randomized complete block design with four replications, six plants per replication, at each site. Data were combined by site and year and analyzed using SAS's mixed procedure. When Variety x Year interactions were observed, data were analyzed separately by site and year. Means were separated at the 5% level using pdiff.

RESULTS

YIELDS

Gladiator was the standard variety to which all other varieties were compared. Mean marketable yield in weight is presented in Table 3 with marketable numbers in Table 4.

Table 3. Marketable yield (lb/6 plants) of 21 pumpkin varieties grown at three locations in Pennsylvania in 2016-17[1]

	Southwestern Pennsylvania		Central Pennsylvania	Southeastern Pennsylvania
Cultivar	**2016**	**2017**	**2016-17**	**2016-17**
Ares	34.2 B	27.1 BCD	289.4 ABC	224.4 ABC
Bayhorse Gold	58.3 AB	57.2 A-D	250.9 CD	202.3 ABC
Camaro	41.1 AB	77.4 AB	332.6 AB	194.0 ABC
Cargo	31.1 B	39.4 A-D	232.9 CDE	201.6 ABC
Challenger	54.1 AB	95.3 A	338.9 A	266.7 A
Eagle City Gold	68.3 AB	47.2 A-D	262.4 BCD	199.5 ABC
Earlipak	23.6 B	15.4 BCD	242.1 CDE	201.7 ABC
Early King	49.7 AB	7.3 CD	344.6 A	245.4 AB
Gladiator	27.5 B	4.0 D	198.5 DE	192.6 ABC
Gold Challenger	33.1 B	28.1 BCD	215.2 DE	150.5 C
Hannibal	51.1 AB	69.9 ABC	207.9 DE	169.7 BC

Honky Tonk	42.7 AB	23.9 BCD	249.2 CDE	189.3 ABC
Kratos	57.6 AB	47.6 A-D	293.9 ABC	260.9 A
Magic Lantern	59.3 AB	11.32 CD	253.0 CD	174.6 BC
Magic Wand	61.5 AB	11.1 CD	233.1 CDE	193.5 ABC
Mrs. Wrinkles	83.1 A	0.0 D	225.0 CDE	189.0 ABC
Orange Rave	71.6 AB	25.3 BCD	261.5 BCD	198.4 ABC
Rhea	61.6 AB	29.6 BCD	255.4 CD	201.7 ABC
Solid Gold	55.7 AB	43.1 A-D	264.5 BCD	211.4 ABC
Spartan	33.4 B	27.0 BCD	255.7 CD	222.1 ABC
Zeus	25.9 B	14.0 BCD	178.6 E	187.9 ABC

[1]Values are the mean of 4 replications; data were analyzed using GLIMMIX. Means were separated at the 5% level using pdiff. Variety x Year interactions for marketable weight were significant at the Southwestern site and data were analyzed separately by year. Variety x Year interactions were not significant for marketable weight at the Central site and Southeastern site; therefore, data for year were combined. Different letters following values in a column indicate significant differences.

Table 4. Marketable yield (no./6 plants) of 21 pumpkin varieties grown at three locations in Pennsylvania in 2016-17[1]

	Southwestern Pennsylvania		**Central Pennsylvania**		**Southeastern Pennsylvania**
Cultivar	**2016**	**2017**	**2016**	**2017**	**2016-2017**
Ares	1.5 BC	1.3 BC	16.3 A-D	11.0 B-E	11.5 A
Bayhorse Gold	2.8 BC	2.8 ABC	13.3 BCD	13.0 A-D	11.9 A
Camaro	1.8 BC	5.3 A	13.3 BCD	16.9 A	10.4 A
Cargo	1.8 BC	1.8 BC	11.8 CD	8.0 E	9.5 A
Challenger	1.5 BC	2.8 ABC	17.0 A-D	10.5 CDE	12.4 A
Eagle City Gold	3.5 AB	2.5 ABC	13.5 BCD	15.3 AB	11.3 A
Earlipak	1.0 C	1.0 BC	13.3 BCD	9.7 CDE	9.4 A
Early King	1.8 BC	0.5 BC	15.0 A-D	13.0 A-D	11.9 A
Gladiator	1.0 C	0.3 C	15 A-D	9.5 DE	11.9 A
Gold Challenger	1.5 BC	2.0 BC	11.5 D	11.0 B-E	8.4 A
Hannibal	2.0 BC	3.3 AB	13 BCD	10.5 CDE	9.3 A
Honky Tonk	2.3 BC	1.5 BC	20.0 A	12.3 A-E	12.5 A
Kratos	1.8 BC	2.5 ABC	17.0 A-D	12.8 A-D	13.8 A
Magic Lantern	2.5 BC	1.0 BC	18 AB	14.5 ABC	12.5 A
Magic Wand	2.5 BC	0.8 BC	18.0 AB	11.5 B-E	12.3 A
Mrs. Wrinkles	5.3 A	0.0 C	12.5 BCD	12.3 A-E	12.3 A
Orange Rave	3.8 AB	1.5 BC	17.5 ABC	12.8 A-D	12.0 A
Rhea	2.0 BC	1.5 BC	17.3 A-D	9.8 DE	10.8 A
Solid Gold	2.3 BC	2.5 ABC	13.0 BCD	10.8 B-E	10.1 A
Spartan	1.5 BC	1.5 BC	14.8 A-D	10.5 CDE	12.8 A

Zeus	1.0 C	0.8 BC	13 BCD	11.0 B-E	12.8 A

[1]Values are the mean of 4 replications; data were analyzed using GLIMMIX. Means were separated at the 5% level using pdiff. Variety x Year interactions for marketable number were significant at the Southwestern and Central site and data were analyzed separately by year. Variety x Year interactions were not significant for marketable number at the Southeastern site; therefore, data for year were combined. Different letters following values in a column indicate significant differences

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SOUTHWESTERN SITE

Yields in 2016 were lower at this site compared to other sites. In 2016, planting was delayed due to very dry conditions. Then, dry weather occurring post emergence through the third week of July resulted in slow and uneven germination and growth. In 2017, extended wet weather created favorable conditions for phytophthora blight (caused by *Phytophthora capsici*) which limited yields.

In 2016, 'Mrs. Wrinkles' produced heavier pumpkins compared to 'Gladiator' (Table 3). All other varieties were not different from 'Gladiator'. In 2017, 'Challenger', 'Camaro' and 'Hannibal' produced heavier pumpkins than 'Gladiator'. All other varieties were not different from 'Gladiator'.

In 2016, 'Mrs. Wrinkles', 'Orange Rave' and 'Eagle City Gold' produced more marketable pumpkins than 'Gladiator' (Table 4). All other varieties were not different than 'Gladiator'. In 2017, 'Camaro' and 'Hannibal' produced more marketable pumpkins than 'Gladiator'. All other varieties were not different than 'Gladiator'.

In 2016 and 2017, mean unmarketable number of pumpkins ranged from 0.0/6 plants to 3.8/6 plants from all varieties and was not different from 'Gladiator' or each other in both years (data not shown).

CENTRAL SITE

Over both years, 'Early King', 'Challenger', 'Camaro', 'Kratos', and 'Ares' produced heavier marketable pumpkins than 'Gladiator' (Table 3). All other varieties were not different than 'Gladiator'. Overall mean marketable weight was 243.8 lb/6 plants in 2016 which was significantly lower than 2017, 269.1 lb/6 plants.

In 2016, the mean number of marketable pumpkins for all varieties was not different from 'Gladiator' (Table 4). In 2017, 'Camaro', 'Eagle City Gold', and 'Magic Lantern' produced more marketable pumpkins than 'Gladiator'. All other varieties were not different than 'Gladiator'.

Over both years, the mean number of unmarketable pumpkins ranged from 0.0/6 plants to 0.8/6 plants for all varieties and was not different from 'Gladiator' (data not shown). Mean number of unmarketable pumpkins was not significantly different between 2016 and 2017, 0.2/6 plants in both years.

SOUTHEASTERN SITE

Over both years, the mean number and weight of marketable pumpkins and the mean number of unmarketable pumpkins were not different than 'Gladiator' (Tables 3 and 4). In 2016, the overall mean number of pumpkins was significantly higher, 12.4 pumpkins per 6 plants, compared to 2017, 10.4 pumpkins per 6 plants. In contrast, overall mean marketable weight was significantly higher in 2017, 225.9 lb/6 plants, than in 2016, 181.4 lb/6 plants.

Over both years, the mean number of unmarketable pumpkins ranged from 1.1/6 plants to 3.0/6 plants for all varieties and was not different from 'Gladiator' (data not shown). The mean number of unmarketable pumpkins was significantly lower in 2016, 1.3/6 plants, than in 2017, 2.1/6 plants.

HANDLE QUALITY

Over both years, mean handle quality for 'Gladiator' was 3.3 on the 5-point scale, with 5 being highest (Table 5). 'Ares', 'Rhea' and 'Solid Gold' had higher mean ratings of 4.9, 4.8, and 4.3, respectively. 'Camaro', 'Spartan', and 'Challenger' had lower ratings of 2.6, 2.3, and 2.3, respectively. All other varieties were not different than 'Gladiator'.

Table 5. Mean handle (peduncle) ratings of 21 pumpkin cultivars grown in southeastern Pennsylvania in 2016-17.

Cultivar	Rating[1]
Ares	4.9[2] a
Rhea	4.8 ab
Solid Gold	4.3 b
Gold Challenger	3.5 c
Bayhorse Gold	3.4 cd
Hannibal	3.4 cde
Kratos	3.3 c-f
Cargo	3.3 c-f

Gladiator	3.3 c-f
Magic Wand	3.3 c-f
Eagle City Gold	3.3 c-f
Mrs. Wrinkles	3.2 c-f
Orange Rave	3.0 c-g
Zeus	3.0 c-g
Earlipak	2.9 d-g
Honky Tonk	2.9 d-h
Magic Lantern	2.8 e-i
Early King	2.8 f-i
Camaro	2.6 ghi
Spartan	2.3 hi
Challenger	2.3 i

[1] 1-5 rating scale; 5= best.

[2]Data for 2016 and 2017 were combined.

CONCLUSIONS

Based on yield, no variety was consistently different than the standard 'Gladiator'. Farmers growing carving pumpkins should also consider fruit quality including color, shape, and degree of ribbing when selecting varieties. Fruit description and size based on this evaluation as well as from information listed by seed companies is provided in Table 6. Lawson (2006) and Stanghellini et al. (2003) also indicated that fruit quality characteristics can influence consumer preference. Determining which fruit quality characteristics consumers prefer in carving pumpkins is an area warranting future research. Based on results here, farmers have many options for carving pumpkin varieties without sacrificing yield. Growing a combination of varieties with different fruit quality can help ensure consumer preference is met.

Stem quality is an important indicator of fruit health and contributes to fruit aesthetics (Coolong and Seebold, 2009; Stanghellini et al., 2003). It has been suggested that consumers may prefer long, thick handles compared to short thin ones (Stanghellini et al., 2003). Based on handle quality, all varieties except 'Camaro', 'Spartan', and 'Challenger' are recommended.

Table 6. Fruit description and size of pumpkin cultivars evaluated in three locations in Pennsylvania in 2016-17.

Cultivar	Fruit descriptions	Fruit weight, average (lb)[1]	Fruit weight range (lb)[2]	Listed fruit weight range in catalog (lb)[3]
Ares	Very tall, oblong; fairly deep ribbing; stout, green handle, orange rind	21	16 -26	22 - 28
Bayhorse Gold	Round to slightly oblong, orange fruit; dark green handle	19	13 - 21	15 - 20
Camaro	Orangish-yellow rind; mostly round with dark green handles; slight ribbing	20	14 - 24	20 - 23
Cargo	Dark orange; somewhat round shape; average to deep ribbing; green handle	22	17 - 29	20 - 25
Challenger	Round with orange coloration; slightly ribbed	28	18 - 36	22 - 27
Eagle City Gold	Faint ribbing; round pumpkin starting to trend flat; average handle but green	18	12 - 22	18 - 24
Earlipak	Very round; bright orange; strong, green stem	21	15 - 27	18 - 22
Early King	More tall than round; orange color, slight ribbing; thick handle	23	14 - 28	22 - 28

Gladiator	Dark orange, round fruit; medium ribbing; thick handle	18	13 - 27	20 - 25
Gold Challenger	Dark orange rind; round with medium to deep ribbing; strong green handle	19	14 - 22	20 - 24
Hannibal	Round shape; orange rind; strong green handle; average ribbing	20	16 - 26	18 - 22
Honky Tonk	Dark orange with deep ribbing; very round	16	12 - 20	20 - 25
Kratos	Dark orange pumpkin; round with slight oblong shape; medium ribbing with long, curvy handles	22	15 - 32	20 - 30
Magic Lantern	Orange to dark orange rind; slight ribbing; round	16	11 - 24	16 - 24
Magic Wand	Very round shape, orange rind; medium ribbing; green handle	17	13 - 24	15 - 25
Mr. Wrinkles	Round, dark orange pumpkin; very deep ribbing; strong green handle	17	13 - 22	20 - 30
Orange Rave	Round to slightly oblong; orange color; green stems; medium ribbing	17	14 - 19	15 - 25
Rhea	Round to flat shape with dark orange rind; average ribbing; dark, long handles	22	14 - 31	20 - 30
Solid Gold	Orange coloration with medium ribbing; round shape	21	17 -25	18 - 25
Spartan	Big, round pumpkin with deep orange color; nice handle length and quality	20	15 -27	20 - 25
Zeus	Very round pumpkin with deep orange coloration; ribbed; long, green handles	17	12 - 26	16 - 20

[1]Average fruit weight over 3 sites and two years (2016-17).

[2] Range of fruit weight over 3 sites and two years (2016-17).

[3] Range of fruit weight listed in seed catalogs.

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