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Elizabeth Maynard

Purdue University - Main Campus, emaynard@purdue.edu

Erin A. Bluhm

Purdue University, ebluhm@purdue.edu

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Pumpkin Variety Performance With and Without Treatment for Powdery Mildew in Northern Indiana, 2017

Elizabeth T. Maynard and Erin A. Bluhm, Purdue University
PO Box 1759, Valparaiso, IN 46384 emaynard@purdue.edu

Introduction

Pumpkins are grown on 5,000 acres in Indiana with an average yield of 6.75 tons per acre. In 2016 the value of Indiana's utilized production was \$9.5 million (USDA NASS, 2017a). Successful pumpkin production requires the use of varieties that yield well and produce pumpkins of the size, shape, color, and quality demanded by the market. Genetic resistance to the fungal disease powdery mildew is present in some varieties. This trial was designed to evaluate performance of pumpkin varieties in northern Indiana with and without treatment for powdery mildew. The trial included fourteen orange jack-o-lantern size pumpkins, one small or 'pie' pumpkin and one specialty yellow pumpkin.

Materials and Methods

A replicated trial was conducted at the Pinney-Purdue Agricultural Center in Wanatah, Indiana. Treatments were arranged in a split plot design with powdery mildew treatment (yes or no) as the main plot, and variety as the sub-plot. Treatments were replicated two times in blocks. For powdery mildew treatment, the experimental unit was 30 ft. by 360 ft. and contained 16 sub-plots, one per variety. Four such units comprised the experiment and were separated by three 15-ft. alleys. Each variety sub-plot had two 30-ft. rows of one variety. The two rows were 7.5 ft. apart. The distance between rows of different varieties was 15 ft., thus each variety was centered in a plot 22.5 ft. wide by 30 ft. long. Along outside edges of the trial, additional pumpkin plots were seeded either as guard rows or for different experiment.

The soil was a Tracy sandy loam. The fall 2016 soil test showed 1.6% organic matter, pH 6.6, 73 ppm phosphorus (P), 147 ppm potassium (K), 160 ppm magnesium (Mg), and 600 ppm calcium (Ca). Nitrogen, 40 lb./A N from urea, was broadcast and incorporated on April 12. An additional 60 lb./A N from urea ammonium nitrate solution was injected on June 20.

Pumpkins were seeded on May 31, 2017, using a modified 2-row John Deere Maximerge 7000 planter. Twelve seeds per 30-ft. row were dropped by hand into the seed tube. Uneven emergence and cutworm feeding resulted in an uneven plant stand. To compensate, on June 16 seedlings started in greenhouse trays on May 31 were transplanted to bring each plot as close as possible to the desired population of 20 plants/plot.

Weeds were controlled with the herbicides Strategy[®] (ethalfluralin+clomazone) broadcast and Curbit[®] (ethalfluralin) between rows only applied on June 1, and by cultivation, hoeing, and hand weeding. Approximately 1/2 inch of overhead irrigation was applied on June 12. Insects were managed with applications of Arctic[®] (permethrin) at 6 to 8 fl. oz./A on June 13 (black cutworms), June 22 (squash vine borer), July 27 and August 25 (squash bug).

Main plots assigned to receive treatment for powdery mildew were treated with Quintec[®] (quinoxifen) at 6 oz./A on July 14 and August 11 and Rally[®] (myclobutanil) at 4 oz./A on July 27 and August 25. All plots were treated with 3 lb./A of Mankocide[®] (copper hydroxide) on July 27 and August 25; 2 pints /A of Bravo Weather Stik[®] (chlorothalonil) and 1.2 pints/A of Previcur Flex[®] (propamocarb) on August 11, and 8 oz./A of Tanos[®] (famoxadone and cymoxanil) on August 25. Treatments applied to all plots were made in order to suppress bacterial fruit spot and downy mildew which were observed in the trial. Downy mildew was present in plots even with treatment and made evaluating powdery mildew difficult at the end of the growing season.

Emergence was determined on June 8 and 12, and the final stand count was taken on June 19, when all plants, whether from the initial seeding or from transplanting, were counted.

Powdery mildew severity was evaluated on August 21-23, Aug. 31-Sept. 1, and Sept. 7-8. The percent of upper and lower leaf surface and petiole covered with powdery mildew was estimated for two young, two middle-aged, and two old leaves per plot. The overall percent of foliage affected by powdery mildew on vines in each plot was estimated. Percent estimates were recorded using the modified Horsfall-Barratt rating scale. The overall vigor of vines in the plot was also rated using a scale of 9 (extremely vigorous) to 1 (very low vigor).

Pumpkins were harvested on September 11. Harvested fruit were graded into marketable orange, marketable turning, cull orange, and cull turning. Fruit with more than 50% of the rind orange were considered orange. Fruit that had reached mature size with a tough rind and were less than 50% orange were considered turning. Fruit with soft spots or holes penetrating the rind were considered cull. Bacterial fruit spot was present but fruit with lesions were not culled unless it was severe. Total number and weight in each category were recorded. In addition, individual fruit weights were recorded for jack-o-lantern types in 3 of the powdery mildew treatment main plots. Fruit that could not be moved from the plot due to extreme decay were counted but are not reported here. On September 14, harvested pumpkins were evaluated for color, shape, suture depth, size uniformity, overall quality, and peduncle length and width. Rating scales are described in table footnotes.

For statistical analysis Horsfall-Barratt ratings were converted to percentages (Redman et al., 1974), and area under the disease progress curve (AUDPC) calculated using trapezoid integration (Shaner and Finney, 1977). Fruit number and yield per plot were converted to per plant values based on plant stand determined on June 19.

Analyses of variance were used to test for main effects and interaction of powdery mildew treatments and varieties, followed by mean separation using Fisher's protected least significant difference. Treatments with 0 variance across replications were omitted from ANOVA. If required to stabilize variances data were square-root or log-transformed prior to ANOVA. Pumpkin fruit characteristics are summarized with means and standard errors or graphically.

Results and Discussion

The growing season from May 29 to Sept. 10 was drier and slightly cooler than normal. Indiana Crop and Weather Reports from USDA NASS (2017b) reported 2005 growing degree days (GDD base 50°F), 88 fewer than normal. Rainfall during that period totaled 10.75 inches, 3.18 inches below normal. June and August were dry; July was wetter than normal. In the two weeks leading up to planting on May 31, a total of 1.96 inches of rainfall was recorded which was 0.25 inches more than expected.

Vine Vigor

Vine vigor differed among varieties (Table 1). Kratos was the most vigorous, with a rating of 8.4, but ratings for Cargo PMR, Cracker Jack, Bayhorse Gold, JPN 14-4090, and Zeus were all greater than 7.5 and did not differ significantly from Kratos. Eagle City Gold, Jack Sprat, JPN 62009, Skidoo, Hulk, and Solid Gold were in the middle of range for vigor. JPN 62005R, Owl's Eye and Jack Straw were less vigorous, and Cider Jack was the least vigorous of all varieties. Ratings for vine vigor were made at the same time as disease ratings, but the purpose of the rating was to judge the size and appearance of the vines, independent of any disease. Applying fungicide treatments for powdery mildew did not influence vine vigor (Table 1).

Powdery Mildew Severity

Powdery mildew severity differed among the pumpkin varieties and lines, whether evaluated on the lower or upper surface of the leaf, the petiole, or over the entire plot (Table 1). Differences were greater for the lower leaf surface and the entire plot. Varieties with low levels of disease included JPN 62009, Jack Sprat, JPN 14-4090, Skidoo, and Zeus. JPN 62005R and Cargo PMR had slightly higher levels of disease on the lower leaf surface than those five, but not significantly so. Bayhorse Gold, Solid Gold, Hulk, Owl's Eye had the most disease on lower leaf surfaces, but didn't differ significantly from Eagle City Gold, Jack Straw, Kratos, Cider Jack, or Cracker Jack. Except for Jack Straw, these varieties also had similar levels of disease on the upper leaf surface and over the entire plot.

Across all varieties, fungicide treatments for powdery mildew significantly reduced disease severity (Table 1). There was no significant interaction between powdery mildew treatment and cultivar effects for severity of powdery mildew: fungicide treatments affected disease severity similarly for all varieties. By Sept. 8, powdery mildew coverage on lower leaf surfaces ranged from 38% to 92% for varieties in untreated plots and from 0.2 to 16% in treated plots (data not shown). On upper leaf surfaces, varieties in untreated plots had from 0.6% to 29% coverage by powdery mildew and treated plots had 0 to 4.5% (data not shown). Overall powdery mildew severity ranged from 9 to 81% in untreated plots and from 0 to 20% in treated plots. (data not shown).

Yield, Number of Fruit, and Fruit Size

The average number of plants per plot ranged from 9 for Cider Jack to 20 for Kratos (Table 2). The large variation in stand means that yield differences observed in this trial may not reflect differences that would be seen if varieties were at a uniform stand. Yield components are presented in Table 2. Differences among varieties were highly significant for number and weight of pumpkins per plant, average weight per pumpkin, percent marketable, and percent orange. Differences between plots treated or not treated for powdery mildew were significant for number and weight of fruit per plant. The interaction between cultivar and powdery mildew treatment was significant for number of pumpkins per plant.

JPN 14-4090 produced the highest yield (lb.) per plant of orange, orange plus turning, and all fruit, but not significantly higher than Bayhorse Gold for orange fruit, Cargo and Eagle City Gold and Skidoo for orange and turning fruit, or Cargo, Eagle City Gold, and Hulk for all fruit (Table 2). The pie pumpkin Jack Sprat produced the most fruit per plant. For orange fruit, JPN 14-4090 and Bayhorse Gold were second and third behind Jack Sprat in number of fruit per

plant. For orange and turning, and all fruit, the specialty yellow pumpkin Owl's Eye was second behind Jack Sprat for number of fruit per plant.

The percent marketable by weight ranged from 78% for JPN 62009 and Hulk to 97% for Skidoo. Twelve varieties with at least 86% marketable did not differ from Skidoo and included: Owl's Eye, Bayhorse Gold, JPN 14-4090, Jack Straw, Cracker Jack, Kratos, Eagle City Gold, Jack Sprat, Cargo PMR, Cider Jack and Solid Gold. Percent marketable by number showed a similar trend (data not shown).

Varieties differed in earliness. The percent of all fruit by weight that was orange by Sept. 11 ranged from 14% for JPN 62009 to 95% for Jack Sprat. Bayhorse Gold, JPN 14-4090 and Cider Jack had at least 81% orange, not significantly different from Jack Sprat. Eagle City Gold, Skidoo, Solid Gold, Kratos, and JPN 62005R and Jack Straw had between 80% and 67% orange and didn't differ from one another. Later maturing varieties included Cargo PMR, Cracker Jack, Hulk, Owl's Eye, Zeus and JPN 62009. Percent orange fruit by number showed a similar trend (data not shown).

Average fruit weight ranged from 30 lb. for Hulk to 2.7 lb. for Jack Sprat for orange fruit, and 25 lb. to 2.6 lb. if both orange and turning fruit are considered. Hulk was significantly larger than other varieties. Varieties that did not differ significantly in average weight of orange fruit included: Cargo PMR, Solid Gold, and Kratos (25 to 22 lb.); JPN 62005R, Bayhorse Gold and Eagle City Gold (22 to 20 lb.); Zeus, Cider Jack, JPN 14-090 and Cracker Jack (18 to 17 lb.), and Jack Straw and Skidoo (15 to 14 lb.). The yellow pumpkin Owl's Eye averaged 5.9 lb.

The range and distribution of weight for individual marketable fruit from plots treated for powdery mildew are shown in Figure 1 for the jack-o-lantern types. Varieties with at least 50% of fruit in a single 5-lb. size category included Jack Straw, JPN 62009, and Zeus, all with more than half the fruit between 10 and 15 lbs. Varieties with less than 30% of fruit in any 5-lb. size category included Cargo PMR, Hulk, and Solid Gold.

Plots treated for powdery mildew produced about 30% greater yield of orange pumpkins per plant (20.2 lbs. vs. 15.7 lbs.), 22% more orange and turning pumpkins per plant (2.33 vs 1.91 pumpkins), and 22-24% higher number and weight per plant of all marketable plus cull pumpkins. Average pumpkin weight was not affected by powdery mildew treatment; nor was the percent marketable fruit or percent orange fruit.

The differences among varieties for the number of marketable orange and turning pumpkins per plant, or total number of pumpkins per plant were influenced by the powdery mildew treatment, as indicated by significant PM Trt X Variety interaction (Table 2). With treatment for powdery mildew, the following varieties moved up two or more places in rank compared to without treatment for powdery mildew, meaning they performed relatively better with treatment: Jack Straw, Zeus, and, for marketable number only, Eagle City Gold. The following varieties moved down two or more places in rank, meaning they performed relatively worse with powdery mildew treatment: JPN 62009, JPN 14-4090, Cider Jack, Bayhorse Gold, and JPN 62005R.

Fruit Characteristics

Observations on peduncle (stem) length and width, fruit uniformity, and overall fruit appearance are shown in Table 3. Varieties with peduncles judged long for the fruit size were Solid Gold, Jack Sprat, and JPN 62005R (ratings of 6.8), and to a lesser extent Cargo PMR and JPM 62009 (ratings of 6.5). Varieties with peduncles thick for the fruit size were Hulk, JPN 14-4090, and

Skidoo (ratings ≥ 7.0), and to a lesser extent, JPN 62009, Kratos, and Solid Gold (ratings ≥ 6.5). Varieties with high ratings for uniformity included JPN 14-4090, JPN 62009 and Kratos (ratings ≥ 7). Hulk, Solid Gold, and Jack Straw were rated the least uniform. For overall quality, JPN 14-4090, Kratos, and Jack Sprat received the highest ratings, followed by Cargo PMR and Owl's Eye.

Observations on fruit color, shape, and suture depth, are summarized in Figure 2. Representative fruit from plots not treated for powdery mildew are shown in Figure 3.

Comparison of Varieties by Fruit Size

Among the seven varieties with fruit averaging more than 20 lb., Hulk was noteworthy for being the largest, having thick stems and a decidedly oblong shape, but it was late to mature, had a lower percent marketable fruit, and showed poor resistance to powdery mildew. Cargo PMR and the experimental JPN 62005R had the best resistance to powdery mildew in this size group. Cargo was relatively late to mature but total yields were high, and the dark orange fruit had longer stems and better overall quality than average for the trial. JPN 62005R had round, medium orange fruit with yield and maturity in the middle of the pack. Kratos, Bayhorse Gold, Eagle City Gold, and Solid Gold were between Hulk and Cargo PMR in terms of powdery mildew resistance. Kratos was notable for very vigorous vines and a high percentage of marketable fruit. Bayhorse Gold also had a high percentage of marketable fruit, and was earlier than most others in this size range. Eagle City Gold was second in marketable yield for this size group, producing light to medium orange pumpkins with shallow sutures. Solid Gold produced bright, light to medium orange pumpkins with relatively long stems; it was on the lower end for yield in this size group.

Among four varieties with fruit averaging 16 to 18 lb., Zeus and JPN 14-4090 had the best resistance to powdery mildew. Zeus had vigorous vines, but was very late to mature and produced the lowest yield in this size class. JPN 14-4090 had vigorous vines, produced high yield, a high percentage of marketable fruit, and was much earlier than Zeus. Cracker Jack appeared intermediate between Zeus and Cider Jack in terms of powdery mildew resistance. It had a high percentage of marketable fruit but was later in maturity than Cider Jack. Cider Jack had the least vigorous vines; maturity was similar to JPN-4090, and yield was in the middle for this size group.

Among the three varieties with fruit averaging 12 to 15 lb., JPN 62009 and Skidoo had better resistance to powdery mildew than Jack Straw. JPN 62009 had slightly smaller fruit and was much later in maturity than the other two, and marketable yield and percent marketable were also lower. Skidoo had more vigorous vines than Jack Straw and appeared slightly earlier in maturity, but marketable orange plus turning and total yields were similar.

The specialty pumpkin Owl's Eye did not have good resistance to powdery mildew, but produced attractive, squat, 6-7 lb. fruit that started out cream-colored and then turned yellow. The cream-colored fruit is attractive, and the late maturity reported here may not be a problem if the fruit can be marketed before it turns yellow.

Jack Sprat, the only pie pumpkin trialed, had very good resistance to powdery mildew, vigorous vines, early maturity, and produced 2-3 lb. fruit with shallow sutures.

Summary

Fungicide treatments for powdery mildew significantly reduced the severity of the disease. Disease severity differed among varieties, with several showing good levels of resistance.

Number and pounds of pumpkins per plant ranged from 20% to 30% higher with fungicide treatment for powdery mildew than without; statistical significance of the effect depended on the category of fruit considered.

The results presented here provide yield and descriptive information for pumpkin varieties and experimental lines. Combined with results from trials in other locations and years, this information should help producers choose varieties most suitable for their operations.

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Table 1. Vine vigor ratings and powdery mildew severity on upper and lower leaf surfaces, petioles, and for entire plot for 16 pumpkin varieties, and effect of fungicide applications for powdery mildew on vine vigor and disease severity, northern Indiana, 2017.^z

Effect	Vine Vigor ^x	AUDPC ^y				
		Lower Surface	Upper Surface	Petiole	Entire Plot	
<i>Variety</i>						
Bayhorse Gold	7.8 AB ^w	309 A	47 ABCDE	14 ± 13	168 ABCD	
Cargo PMR	8.2	84 BCD	20 DEF	0 ± 0	52 DEF	
Cider Jack	3.7 E	197 ABC	58 ABCDE	120 ± 62	281 AB	
Cracker Jack	7.8 AB	167 ABC	56 ABCD	33 ± 22	155 ABCD	
Eagle City Gold	7.3 BC	228 AB	116 AB	108 ± 63	256 ABC	
Hulk	7.0 BC	265 A	80 ABC	346 ± 177	397 A	
Jack Sprat	7.3 BC	31 D	7 F	1 ± 0	20 EF	
Jack Straw	5.6	218 ABC	33 BCDE	161 ± 125	116 BCD	
JPN 14-4090	7.9 AB	41 D	27 CDE	0 ± 0	77 CD	
JPN 62005R	6.5 CD	70 CD	32 CDE	0 ± 0	63 DE	
JPN 62009	7.3 BC	34 D	18 EF	3 ± 3	16 F	
Kratos	8.4 A	193 ABC	44 ABCDE	108 ± 77	165 ABCD	
Owl's Eye	5.8 D	282 A	74 ABC	480 ± 265	256	
Skidoo	7.3	48 D	24 DE	1 ± 1	49 DEF	
Solid Gold	7.0	276 A	125 A	351 ± 235	316 AB	
Zeus	7.5 ABC	53 D	16	4 ± 3	51	
<i>Powdery Mildew Treatment</i>						
No	6.7	662	146	205 ± 157	384	
Yes	7.3	20	10	9 ± 11	28	
<i>Significance (P>F)</i>						
PM Trt	0.3353	0.0301	0.0437	–	0.0041	
Variety	0.0001	0.0001	0.0013	–	0.0001	
PM Trt X Variety	0.3500	0.1500	0.6500	–	0.7000	

^zFungicides applied for powdery mildew included Quintec[®] (quinoxifen) at 6 oz./A on July 14 and August 11 and Rally[®] (myclobutanil) at 4 oz./A on July 27 and August 25.

^yAUDPC=area under disease progress curve calculated by trapezoidal integration from observations Aug. 21-23, Aug. 31-Sept. 1, and Sept. 7-8. ANOVA for upper, lower, and entire plot ratings performed on log-transformed data; back-transformed least square means are presented. ANOVA not performed for petiole data; standard errors of means are presented.

^xVine vigor=average of ratings on three dates above using a 9-point scale: 1=very low vigor; 5=moderate vigor 9=extremely vigorous.

^wMean separation by Fisher's Protected LSD at P=.05. Means without a letter were not included in analysis due to lack of variation across reps.

Table 2. Plant stand, number and weight of pumpkins per plant, and average weight per pumpkin for 16 pumpkin varieties, and effect of fungicide applications for powdery mildew on yield and average weight per pumpkin in northern Indiana, 2017.^z

Effect	Seed Source ^y	Stand plants /plot ^x	Marketable Pumpkins						All Pumpkins				
			lb/fruit ^x	Orange no/plant ^w	lb/plant	lb/fruit ^w	Orange and Turning no/plant	lb/plant	no/plant	lb/plant	Percent by Weight Marketable Orange		
<i>Variety</i>													
Bayhorse Gold	RU	18.0	20.4 D	1.42 BCD	28.9 AB	19.6 CD	1.67 EFG	32.6 BCD	1.78 GH	34.5 BCD	94 A	89 AB	
Cargo PMR	JSS	13.0	25.4 B	0.81 EF	20.4 CDE	22.6 B	1.59 EFG	35.9 AB	1.91 FGH	41.2 AB	88 ABC	56 E	
Cider Jack	HMS	9.0	17.6 E	1.19 DE	20.8 CDE	17.0 E	1.57 EFG	26.5 DEFG	1.90 FGH	30.6 CDE	87 ABC	82 ABC	
Cracker Jack	SK	17.0	16.8 E	0.62 FG	10.4 F	15.0 F	1.81 DEF	27.3 CDEFG	1.99 EFGH	29.4 DE	93 A	40 F	
Eagle City Gold	RU	17.5	20.3 D	1.35 CD	27.5 B	19.3 D	1.81 DEF	34.9 AB	2.06 DEFG	39.2 AB	89 ABC	80 BCD	
Hulk	SK	14.0	30.0 A	0.37 GH	10.9 F	25.3 A	1.16 G	29.5 BCDEF	1.58 GH	37.8 ABC	78 C	37 F	
Jack Sprat	SK	14.3	2.7 H	5.69 A	15.3 EF	2.6 K	6.01 A	15.9 H	6.97 A	18.1 F	89 ABC	95 A	
Jack Straw	HMS	15.5	14.5 F	1.35 CD	19.7 DE	13.0 H	2.26 CD	29.4 BCDEF	2.45 CDEF	31.6 CDE	93 A	68 DE	
JPN 14-4090	JSS	12.0	17.3 E	1.96 B	33.7 A	17.1 E	2.33 CD	39.7 A	2.56 CD	42.6 A	93 A	83 ABC	
JPN 62005R	JSS	13.8	22.5 CD	0.86 EF	19.4 DE	21.2 BC	1.33 FG	28.0 CDEFG	1.69 GH	35.1 BCD	79 C	73 CD	
JPN 62009	JSS	11.3	12.4	0.16 H	2.0 G	11.3 I	1.96 CDE	22.1 GH	2.64 C	28.2 DE	78 C	14 G	
Kratos	HM	20.0	22.8 BCD	1.02 DE	23.5 BCD	21.8 B	1.43 EFG	31.4 BCDE	1.62 GH	34.3 BCD	91 AB	74 CD	
Owl's Eye	HMS	12.5	5.9 G	0.66 FG	4.2 G	6.8 J	3.71 B	25.5 EFG	3.93 B	26.6 E	96 A	16 G	
Skidoo	RU	15.3	14.3 F	1.82 BC	26.0 BC	13.8 GH	2.43 C	33.4 ABC	2.51 CDE	34.4 BCD	97 A	79 BCD	
Solid Gold	RU	17.5	23.6 BC	0.86 EF	20.5 CDE	21.9 B	1.21 G	26.8 CDEFG	1.42 H	30.6 CDE	86 ABC	77 BCD	
Zeus	HM	15.5	17.8	0.22 H	4.0 G	14.5 FG	1.59 EFG	23.0 FG	2.07 DEFG	29.1 DE	81 BC	16 G	
<i>Powdery Mildew Treatment</i>													
No		15.2	17.5	1.10	15.7	16.0	1.91	25.8	2.20	29.2	88	59	
Yes		14.3	18.0	1.44	20.2	16.9	2.33	32.0	2.68	36.2	88	62	
<i>Significance (P>F)</i>													
PM Trt			0.3121	0.0521	0.0380	0.2884	0.0064	0.0926	0.0173	0.0476	0.8649	0.1618	
Variety			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0153	0.0001	
PM Trt X Variety			0.6120	0.1821	0.3386	0.3034	0.0245	0.1989	0.0034	0.1416	0.7972	0.6663	

^zFungicides applied for powdery mildew included Quintec[®] (quinoxifen) at 6 oz./A on July 14 and August 11 and Rally[®] (myclobutanol) at 4 oz./A on July 27 and August 25. Means followed by the same letter do not differ significantly at $P=0.05$ based on Fisher's Protected LSD. Means without a letter were not included in analysis due to lack of variation across reps.

^ySeed source: HM=HM Clause; HMS=High Mowing Seed; JSS=Johnny's Selected Seeds; RU=Rupp Seeds; SK=Sakata Seeds.

^xPlots 22.5 ft. wide with two 30-ft. rows 7.5 ft. apart; 675 sq.ft. per plot; 64.53 plots per acre.

^wANOVA and mean separation performed on natural-log-transformed data for lb/fruit and square-root transformed data for orange no/plant to stabilize variances; untransformed means are presented.

Table 3. Fruit characteristics of pumpkins grown in northern Indiana, 2017.^z

Variety	Peduncle ^y		Size Uniformity ^y	Overall ^y
	Length	Width		
Bayhorse Gold	6.0 ±0.4	5.8 ±0.3	5.0 ±0.7	6.0 ±0.4
Cargo PMR	6.5 ±0.3	5.5 ±0.3	5.3 ±0.5	6.8 ±0.3
Cider Jack	4.3 ±0.3	6.3 ±0.3	5.5 ±0.9	5.8 ±0.5
Cracker Jack	5.8 ±0.3	5.5 ±0.3	5.8 ±1.0	6.5 ±0.3
Eagle City Gold	5.8 ±0.5	5.3 ±0.3	5.0 ±0.7	5.8 ±0.3
Hulk	5.5 ±0.3	7.5 ±0.3	4.3 ±0.6	5.3 ±0.5
Jack Sprat	6.8 ±0.3	5.0 ±0.0	6.0 ±0.9	7.0 ±0.4
Jack Straw	4.5 ±0.5	5.8 ±0.5	4.5 ±0.6	5.0 ±0.0
JPN 14-4090	6.0 ±0.0	7.3 ±0.3	8.0 ±0.0	7.5 ±0.3
JPN 62005R	6.8 ±0.3	5.8 ±0.3	5.8 ±0.9	5.8 ±0.6
JPN 62009	6.5 ±0.5	6.8 ±0.3	7.0 ±0.0	5.0 ±0.6
Kratos	5.3 ±0.3	6.8 ±0.3	7.0 ±0.4	7.3 ±0.3
Owl's Eye	6.0 ±0.0	5.5 ±0.3	6.8 ±0.3	6.8 ±0.5
Skidoo	5.3 ±0.6	7.0 ±0.0	6.5 ±1.2	6.0 ±0.6
Solid Gold	6.8 ±0.3	6.5 ±0.3	4.5 ±0.3	5.3 ±0.5
Zeus	5.8 ±0.5	6.3 ±0.3	5.8 ±0.3	5.5 ±0.3
<i>Grand Mean</i>	<i>5.8</i>	<i>6.1</i>	<i>5.8</i>	<i>6.1</i>

^zMean of four plots ± standard error.

^yPeduncle length and width, fruit size uniformity, and overall fruit quality rated on a 1-9 scale, with 2=short/thin/ peduncle, non-uniform, poor quality; 5=average; 8=extra long/extra thick/dark green solid peduncle, very uniform, high quality.

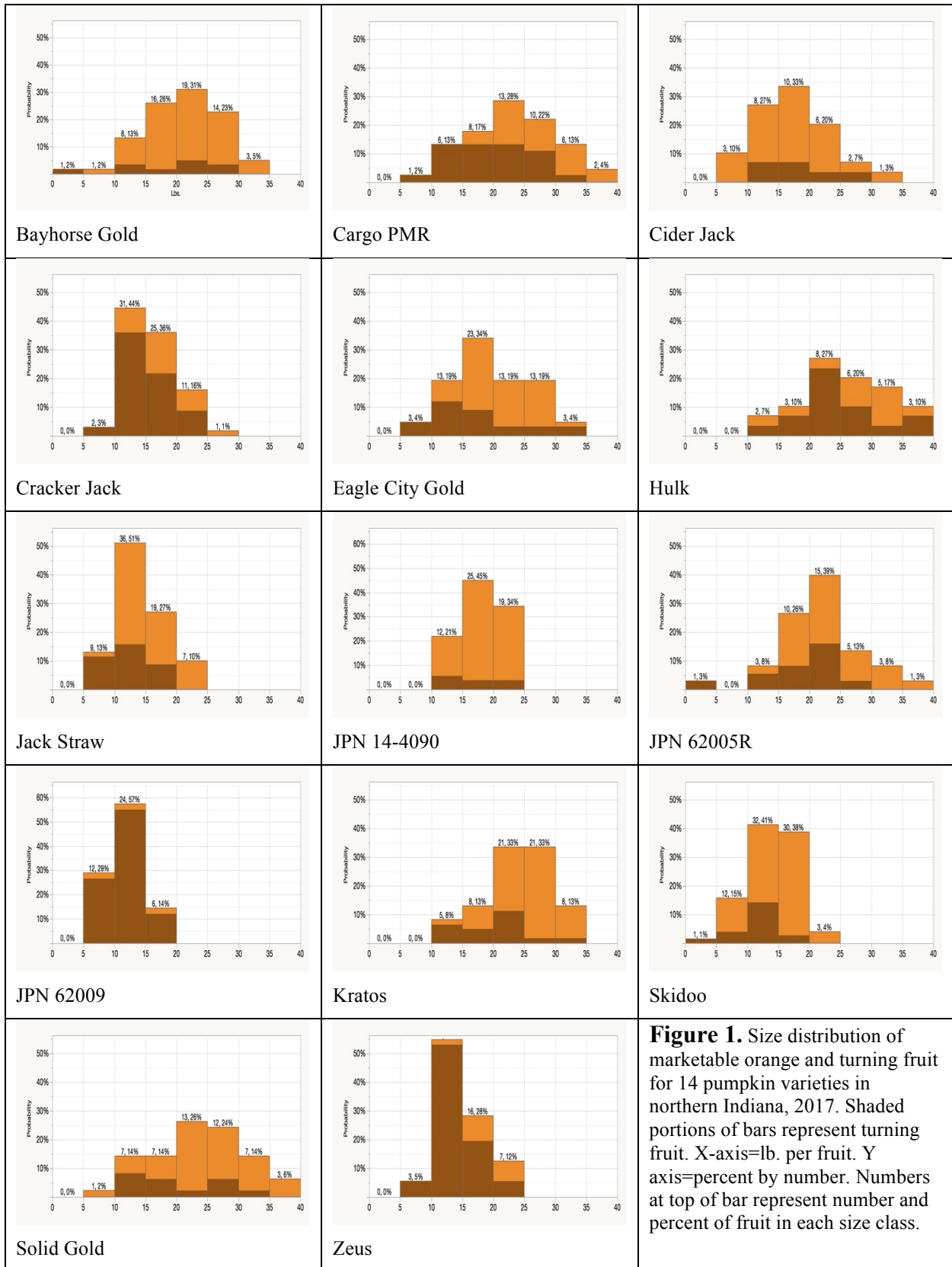
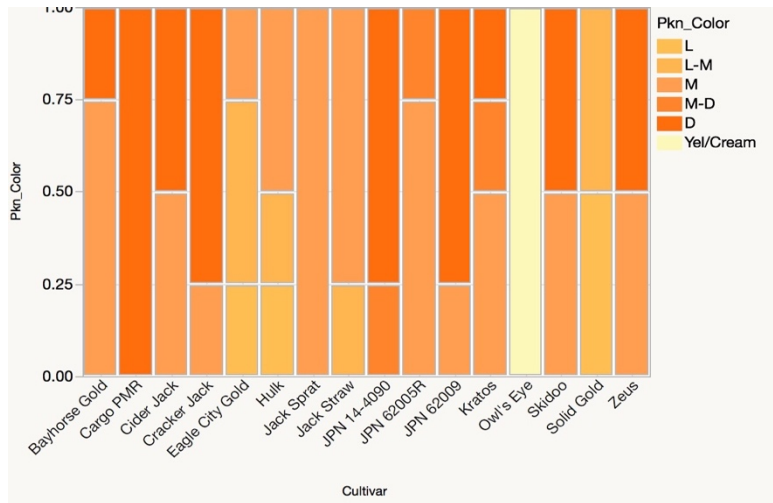
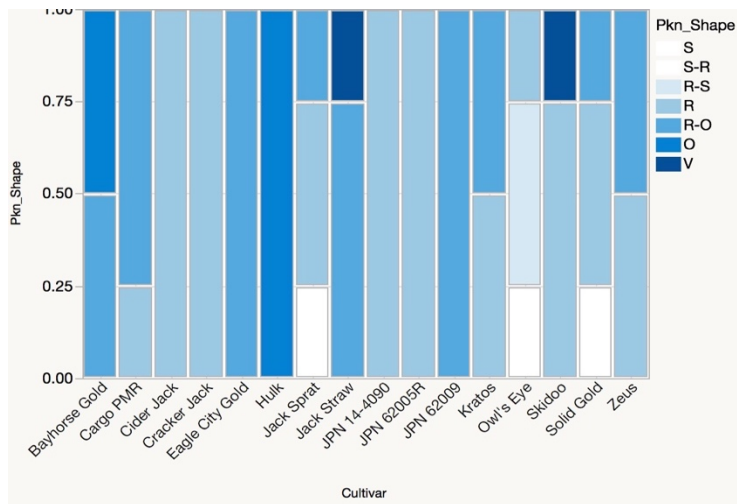


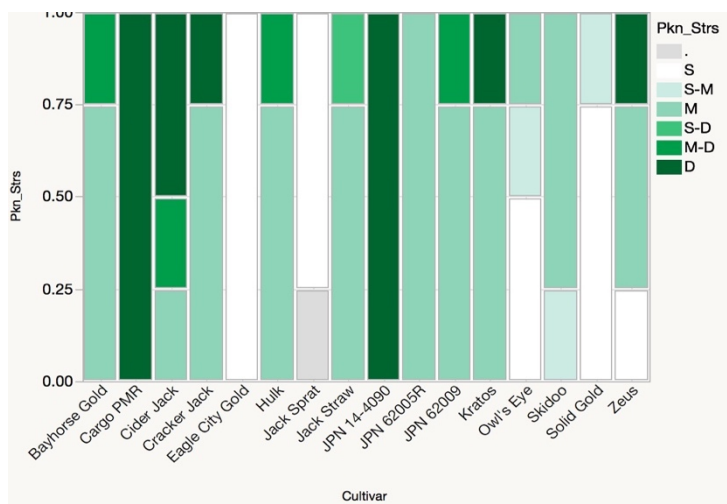
Figure 1. Size distribution of marketable orange and turning fruit for 14 pumpkin varieties in northern Indiana, 2017. Shaded portions of bars represent turning fruit. X-axis=lb. per fruit. Y axis=percent by number. Numbers at top of bar represent number and percent of fruit in each size class.



A. Pumpkin fruit color. Shade of orange: D=dark; M-D=medium-dark; M=medium, L-M=light to medium; L=light. Yel/Cream=yellow or cream.



B. Pumpkin shape. S=squat (wider than tall); R=round (width equals height); O=oblong (taller than wide); V=variable.



C. Suture depth. S=shallow; M=medium; D=deep; .=no data.

Figure 2. Ratings for pumpkin fruit color (A), shape (B), and suture depth (C) for 16 varieties in northern Indiana, 2017. Each replication is represented by one quarter of the bar for each variety. Each quarter-bar segment represents the rating recorded for one plot.



Figure 3. Fruit of pumpkin varieties from 2017 trial in northern Indiana. Top, left to right: JPN 62005R, Cider Jack, Skidoo, Jack Sprat, Bayhorse Gold, JPN 14-4090, Hulk, Cracker Jack. Bottom, left to right: Owl's Eye, Kratos, Jack Straw, Eagle City Gold, Zeus, JPN 62009, Cargo PMR, Solid Gold.