Evaluating Mini-Butternut Cultivars in the Upper Midwest

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Butternut squash *(Cucurbita moschata)* is a common winter squash variety grown on vegetable farms and enjoyed by consumers in Iowa. Standard butternut squash cultivars produce fruits that weigh three to five lbs. In recent years vegetable breeders have developed butternut squash cultivars that are smaller and have reduced weights. The most popular of these mini-butternut cultivars, Honeynut, is a cross between butternut and buttercup squash *(C. moschata x C. maxima)*. Honeynut is reported to produce sweeter, more flavorful fruits with thin skins while maintaining the butternut shape, and has spurred interest among consumers and growers. Given the success of Honeynut, breeders have developed new mini-butternut cultivars to meet consumer demand. Mini-butternuts produce fruits weighing between 0.5 and 1.5 lbs. while growing under the same conditions as classic butternut squash varieties. The size of the fruits is appealing to vegetable growers selling through community supplemented agriculture (CSA) or packing boxes. Mini-butternuts are gaining market value, although there are reports about decreased shelf life. Storage longevity of these types is about three months, in contrast to the six months of a standard, full-size butternut squash variety.

The objective of this study was to evaluate five mini-butternut squash cultivars on yield, sweetness, and storability in Upper Midwest growing conditions.

Materials and Methods

Mini-butternut cultivars were selected from organic sources, with estimated fruit weights between 0.5 and 2 lbs. The five organic cultivars evaluated in this study include: Honeynut (High Mowing Organic Seeds), Brulee (High Mowing Organic Seeds), Butterscotch (Harris Seeds), Butterbaby (Johnny's Selected Seeds), and Tiana (High Mowing Organic Seeds). Although described as a small butternut, Tiana produced large fruits and should not be considered a mini-butternut.

The squash was seeded at the Department of Horticulture greenhouses June 3, in 50-cell trays with Purple Cow Organics Seed Starter Mix. The study was conducted on certified organic land at the ISU Horticulture Research Station. Squash was transplanted by hand June 21, 2021. Sustane® Natural Fertilizer (4-6-4), Inc. was applied to provide 100 lbs. of nitrogen per acre.

The study consisted of four replicated plots, with each plot 25 ft. wide and 30 ft. long. Each cultivar was grown in one row per plot. Cultivars were randomized within an individual plot to establish a randomized complete block design. Row spacing (center to center) was 4.5 ft. Before transplanting, four-foot-wide black woven ground cover was laid between rows and secured in place with ground staples for weed control. Plant spacing was 2 ft. within rows, for a total of 13 plants per row. With four replications, the total number of squash plants grown for each cultivar was 52.

The crop was irrigated with drip irrigation and hand weeded as needed. Plants were monitored for pest and disease incidence in accordance with organic crop management guidelines. Striped cucumber beetles were identified as a pest. To manage beetle populations and reduce damage to squash plants, PyGanic® EC 1.4 and Surround® WP were sprayed at recommended rates on June 30, July 7, July 12, and July 16.

Crop was harvested September 24. Fruits were categorized as marketable or non-marketable. The number and weight of marketable fruits for each cultivar/replication was recorded. Length of four marketable fruits from each cultivar/replication was measured from base of fruit to below stem. This later was averaged for an average height of marketable fruit for each cultivar. Non-marketable fruits were categorized into insect damage, unripe, presence of rot, or deformed fruit. The number and weight of fruits in each non-marketable category was recorded.

After harvest, squash was cured for seven days at a temperature of 80˚F. After curing, the squash was placed in a storage cooler at 54˚F for continued evaluation. At the time of writing this report, the storability portion of this experiment is ongoing and results are unavailable past one month in storage.

Three marketable squash samples per cultivar/replication were collected for brix analysis on two occasions: at harvest and after curing. Additional samples (one marketable fruit per cultivar/replication) were collected for brix analysis after four weeks of storage. For brix analysis, one 1-in. cube was cut from the interior of the neck of each squash. Samples were placed in marked plastic bags and frozen. Before analysis, samples were thawed at room temperature for 24 hours. Fluid from each cube sample was extracted with a garlic press for one composite sample per cultivar/replication. The liquid was analyzed with a refractometer for total soluble solid content (degrees Brix), an indication of sugar content. Three readings were taken per composite sample and later averaged for one value per cultivar/replication.

Table 1. Squash yield per plot at the ISU Horticulture Research Station from the 2021 growing season.

Cultivar	Marketable		Insect Damage	Rot Presence	Deformed	Unripe
	No.	Weight kg	No.	No.	No.	No.
Brulee	35.4 b	16.1 b[z]	15.3	35.0 a	0.0 b	14.5
Butterbaby	35.7 b	18.1 b	9.3	26.3 ab	0.3 b	15.8
Butterscotch	22.9 c	14.0 b	8.0	23.0 bc	0.5 ab	7.3
Honeynut	48.8 a	23.7 ab	19.5	12.5 cd	0 b	15.5
Tiana	24.7 c	35.5 a	10.8	10.3 d	1.3 a	11.3
P-value	0.0183	0.0232	0.0533	0.0032	0.0295	0.2684

[z] Means within a column with the same letters are not statistically different (P<0.05)

Results

Squash marketable yield. Statistically significant differences for number and weight of marketable fruits between the cultivars were found (Table 1). Honeynut produced significantly more fruits than other cultivars, an average of 48 fruits per row. Brulee and Butterbaby produced a statistically similar number of fruits per row. Butterscotch produced the fewest number of fruits per row at 22.

Tiana produced a significantly larger weight of marketable fruit, 23.7 kg per row. Because Tiana is not considered a mini-butternut and produces much larger fruits than the other cultivars, this result is expected. Marketable weights of Brulee, Butterbaby, and Butterscotch were statistically similar.

Non-marketable squash. No statistical difference was found between the cultivars for number of fruits with insect damage. Brulee had significantly more rotten fruit than other cultivars, 35 fruits per row, and a significantly higher weight of nonmarketable fruit than Butterscotch, Honeynut, and Tiana. Honeynut and Tiana had significantly fewer rotten fruits, 10.3 and 12.5 fruits per row, respectively.

Tiana produced significantly more deformed squash than other cultivars. The most common deformity seen was the stalk of the squash plant growing attached to the skin of the fruit.

No statistical difference was found for the number of unripe fruits between the cultivars.

Average Fruit size. Average fruit length was non-significant (P<0.05) among cultivars (Table 2). Average fruit length and weight of Tiana was 199.4 mm and 1.34 kg, respectively. Because Tiana is not considered a mini-butternut and produces fruits comparable to full-sized butternut cultivars, this result is expected. Average fruit weight of all other cultivars was statistically similar.

After curing, all cultivars had statistically similar sugar content, except Tiana, with significantly lower degrees brix from the other cultivars, 8.5˚Bx. All cultivars experienced increased sugar concentrations during the curing process.

After four weeks in storage, all cultivars had statistically similar sugar concentrations, except Tiana, with significantly lower degrees brix than the other cultivars, 9.6˚Bx. All cultivars experienced increased sugar concentrations from samples taken directly after curing and at the time of harvest.

Discussion

Although differences between the mini-butternut squash cultivars were found in yield, non-marketable fruit, and brix content, all cultivars are suited for production in the Upper Midwest.

Closer to the harvest, bacterial leaf spot was identified in the field. Brulee appears to be the most susceptible to this pathogen, having significantly more damage than the other cultivars. Even with higher pathogen load, Brulee produced similar number of more marketable fruit as Butterbaby. This may indicate that, in the absence of bacterial leaf spot, Brulee has the potential to produce higher number of marketable fruits.

Butterscotch produced the smallest yield of marketable squash, but did not suffer from a significant amount of insect damage or rot, indicating general low productivity.

All mini-butternut squash cultivars produced fruit with high sugar concentrations, ranging from 13.5 to 12.1˚Bx, after harvest, curing, and four weeks in storage. Honeynut is known to have fruits with higher sugar content. The other mini-butternut squash cultivars Brulee, Butterscoth, and Butterbaby, also are able to produce fruits with comparable or increased sweetness as Honeynut.

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Table 2. Average marketable fruit size of mini-butternut squash cultivars.

Cultivar	Length (mm)	Weight (kg)
Brulee	127.6	0.44 b[z]
Butterbaby	128.3	0.49 b
Butterscotch	158.4	0.64 b
Honeynut	122.4	0.51 b
Tiana	199.4	1.34 a
P-value	0.0843	0.0240

[z] Means within a column with the same letters are not statistically different (P<0.05)

Total soluble solid. Brulee, Butterbaby, Butterscotch, and Honeynut had statistically similar brix values (Table 3). Tiana had the lowest degrees brix at time of harvest, 7.3˚Bx.

Table 3. Sugar concentration (Bx˚) of mini-butternut squash cultivars.

Cultivar	At harvest	After curing	In storage
Brulee	9.6 a[z]	11.5 a	12.1 a
Butterbaby	10.0 a	11.5 a	13.2 a
Butterscotch	10.7 a	11.4 a	13.5 a
Honeynut	10.8 a	10.7 a	12.8 a
Tiana	7.3 b	8.5 b	9.6 b
P-value	0.0313	0.0018	0.0076

[z] Means within a column with the same letters are not statistically different (P<0.05)