



2012 Organic Squash Variety Trial Results

The following tables present the results of organic squash variety trials that took place on research stations and cooperating farms in Washington, Oregon, Wisconsin, and Minnesota in 2012. These trials were part of the USDA-OREI funded project Northern Organic Variety Improvement Collaborative. Trials will continue in 2013.

Detailed descriptions of the trial methods and rating systems are listed after the results tables.



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Table 1: NOVIC 2012 Washington Squash Data

Variety Name	Powdery Mildew (1-5)	Fruit Habit (1-5)	Ave Marketable Fruit Per Plant	Ave Marketable Weight Per Plant (kg)	Notes
Bitterroot Buttercup	4.00 a	5.00 a	1.83 a	2.92 a	External color: Black/green. Internal color: orange. poor germination, immature,
Black Forest	4.17 a	5.00 a	2.05 a	3.55 a	External color: black/green. Internal color: orange. immature, moldy, immature, Lost 1 squash to voles.
Bonbon	4.17 a	4.67 a	2.58 a	6.37 a	External color: green. Internal color: orange. moldy (these plants shaded by Jerusalem Artichokes, moldy,
Burgess Buttercup	4.17 a	4.80 a	2.64 a	5.49 a	External color: black/green. Internal color: orange. plants eaten by Ravens, immature,
Delica	4.33 a	5.00 a	2.36 a	3.96 a	External color: dark green/black. Internal color: orange. eaten by rodents, This variety suffered major vole predation.
Discus Bush Buttercup	4.17 a	1.00 b	3.07 a	6.38 a	External color: blue/grey with peachy orange as matures. Internal color: orange. immature, immature, immature, Many small, immature squash.
Grey Ghost	4.00 a	5.00 a	1.53 a	10.26 a	External color: grey/light blue. Internal color: orange. immature,
Stella Blue	4.20 a	5.00 a	1.25 a	4.68 a	Lost 1 squash to rot.
Sunshine	4.17 a	4.33 a	2.20 a	5.30 a	External color: Bright orange. Internal color: orange. immature, moldy,
Sweet Mama	4.50 a	4.67 a	1.92 a	6.02 a	External color: green with slight orange. Internal color: orange. not enough plants for data, eaten out by rodent, Lost 3 squash to voles.

Letters after the scores represent groups of varieties whose means are not significantly different for that trait. In other words, all the varieties which have a score with an "a" after the number have essentially the same score for that trait. NA indicates that data were not available for that trait for a particular variety. For more information on how traits were measured, please see the protocols at the end of this document.



Table 2: NOVIC 2012 Oregon Squash Data - Part 1

Variety Name	Powdery Mildew (1-5)	Ave Marketable Fruit Per Plant	Ave Marketable Weight Per Plant (kg)	Fruit External Color (1-5)	Fruit Internal Color (1-5)	Fruit Texture (1-5)
Bugle	4.33 a	4.48 a	19.11 a	2.25 bc	2.50 c	3.99 a
Butterfly	3.67 a	3.87 a	25.63 a	2.75 bc	3.00 bc	3.63 a
Early Butternut	3.33 a	2.65 a	17.87 a	2.25 bc	3.00 bc	3.21 a
JWS 6823	4.00 a	4.78 a	21.12 a	3.50 b	3.50 bc	3.76 a
Long Island Cheese	2.67 a	1.93 a	34.82 a	5.00 a	5.00 a	2.40 a
NutterButter	4.00 a	4.25 a	21.60 a	3.50 b	3.25 bc	3.08 a
Pilgrim	2.67 a	3.59 a	21.19 a	3.33 bc	4.00 ab	2.69 a
Tiana	3.67 a	5.25 a	29.52 a	3.50 b	3.88 ab	2.86 a
Waltham	2.67 a	4.37 a	28.25 a	2.00 c	3.00 bc	2.88 a

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Table 3: NOVIC 2012 Oregon Squash Data - Part 2

Variety Name	Fruit Sweetness (1-5)	Fruit Flavor (1-5)	Overall Quality Rating (1-5)	Notes
Bugle	2.68 a	3.59 a	3.18 ab	unripe, split, unripe
Butterfly	3.02 a	3.74 a	3.72 a	unripe, cracked, unripe,
Early Butternut	3.08 a	2.93 a	3.21 ab	unripe, split, off-types, cracked, split
JWS 6823	2.58 a	3.22 a	3.10 ab	unripe, split
Long Island Cheese	1.78 a	2.50 a	1.83 c	unripe, unripe, unripe(?) - light color,
NutterButter	2.86 a	3.56 a	3.28 ab	unripe,
Pilgrim	2.94 a	3.14 a	3.10 ab	unripe/eaten, unripe, unripe, weird shape,
Tiana	2.56 a	2.81 a	2.67 abc	unripe, unripe, unripe,
Waltham	2.97 a	2.88 a	2.52 bc	unripe/eaten, cracked, split, split, unripe

Letters after the scores represent groups of varieties whose means are not significantly different for that trait. In other words, all the varieties which have a score with an "a" after the number have essentially the same score for that trait. NA indicates that data were not available for that trait for a particular variety. For more information on how traits were measured, please see the protocols at the end of this document.



Table 4: NOVIC 2012 Wisconsin Squash Data - Part 1

Variety Name	Powdery Mildew (1-5)	Ave Marketable Fruit Per Plant	Ave Marketable Weight Per Plant (kg)	Fruit External Color (1-5)	Fruit Internal Color (1-5)	Fruit Texture (1-5)
Bugle	3.33 ab	2.38 a	2.06 a	2.00 c	2.00 e	2.33 cd
Butterfly	2.00 b	1.31 a	1.84 a	3.33 abc	2.00 e	3.00 bcd
Early Butternut	3.50 ab	1.21 a	1.84 a	3.00 bc	2.50 de	3.50 abc
Honeynut	2.25 ab	2.35 a	1.40 a	5.00 a	5.00 a	2.50 bcd
JWS 6823	4.67 a	1.51 a	1.93 a	2.67 bc	4.00 b	4.33 a
Long Island Cheese	3.33 ab	0.96 a	3.35 a	4.00 ab	2.00 e	1.00 e
Metro	3.67 ab	1.65 a	2.41 a	2.33 bc	3.00 cd	2.00 de
Nutterbutter	2.00 b	2.67 a	3.02 a	3.00 bc	3.00 cd	3.67 ab
Pilgrim	2.33 ab	1.48 a	2.26 a	2.33 bc	3.67 bc	3.67 ab
Tiana	2.67 ab	2.06 a	2.94 a	2.00 c	4.00 b	3.00 bcd
Waltham	2.33 ab	2.31 a	3.60 a	2.67 bc	2.67 de	3.00 bcd

Letters after the scores represent groups of varieties whose means are not significantly different for that trait. In other words, all the varieties which have a score with an "a" after the number have essentially the same score for that trait. NA indicates that data were not available for that trait for a particular variety. For more information on how traits were measured, please see the protocols at the end of this document.



Table 5: NOVIC 2012 Wisconsin Squash Data - Part 2

Variety Name	Fruit Sweetness (1-5)	Fruit Flavor (1-5)	Overall Quality Rating (1-5)	Notes
Bugle	3.00 b	2.00 d	2.67 cd	insects, lots of splitting, insects, splitting, some rot, insects, splitting, rot, underripe, white/scaly mold, splitting
Butterfly	3.33 ab	2.67 cd	2.67 cd	insect, rot, underripe, insects, split, insects, splitting, rot, scabby, not ripe, white/scaly mold
Early Butternut	4.50 a	3.00 c	3.00 bcd	insect damage, mishapen, minor rot, not mature, insects, underripe, split, pest damage, mold
Honeynut	3.50 ab	5.00 a	5.00 a	many insects, rot, many underripe, insects, underripte, insects, rot underripe, midew, insects, rot, underripe, pest damage/mushy
JWS 6823	4.67 a	3.33 bc	4.00 ab	insect, rot, splitting, immature, insects, few split, virus, insects, splitting, rot, scab, white scaly mildew, brown spots
Long Island Cheese	4.67 a	3.00 c	2.00 d	insects, underripe, rot, insects, rot, underripe, insects, underripe, white spots
Metro	3.00 b	3.00 c	2.67 cd	insects, rot, insects, rot, insects, rot, white scaly mildew
Nutterbutter	3.67 ab	4.00 b	4.00 ab	insects, few rot and split, insects, insects, splitting
Pilgrim	4.00 ab	3.33 bc	3.67 bc	rot insect, mishapen, underripe, insects, underripe, insects, rot, mold, holes
Tiana	3.67 ab	4.00 b	3.67 bc	insects, rot, underripe, insects, underripe, insects, rot, underripe, white/scaly mold
Waltham	3.00 b	3.00 c	2.67 cd	underripe, insect damage, minor rot, insects, insects, mushy top. Brown spots, white scaly mildew

Letters after the scores represent groups of varieties whose means are not significantly different for that trait. In other words, all the varieties which have a score with an "a" after the number have essentially the same score for that trait. NA indicates that data were not available for that trait for a particular variety. For more information on how traits were measured, please see the protocols at the end of this document.



Table 6: NOVIC 2012 New York Squash Data

Variety Name	Powdery Mildew (1-5)	Fruit Habit (1-5)	Ave Marketable Fruit Per Plant	Ave Marketable Weight Per Plant (kg)	Notes
Bugle	5.00 a	5.00 a	2.30 a	2.47 a	immature, split, immature, split
Early Butternut	4.50 a	4.50 a	1.58 a	2.27 a	immature, split, immature, cracks
Honeynut	5.00 a	4.50 a	3.73 a	2.07 a	immature, immature
Long Island Cheese	4.50 a	4.50 a	0.95 a	4.30 a	Rot immature
Metro	4.75 a	4.50 a	3.54 a	3.80 a	immature, split, gsb, immature
Nutterbutter	5.00 a	5.00 a	2.61 a	2.84 a	immature, split, immature
Pilgrim	4.00 a	4.50 a	2.77 a	3.77 a	split, immature, mishapen
Seminole	5.00 a	4.50 a	1.52 a	1.93 a	immature, immature
Waltham	5.00 a	5.00 a	3.38 a	4.04 a	immature, immature

Letters after the scores represent groups of varieties whose means are not significantly different for that trait. In other words, all the varieties which have a score with an "a" after the number have essentially the same score for that trait. NA indicates that data were not available for that trait for a particular variety. For more information on how traits were measured, please see the protocols at the end of this document.

Winter Squash Trials- (version 05-03-2011)

From the trials we seek to determine which butternut squash varieties excel in organic systems based on trait preferences of organic growers and consumers. By having regional trials across the Northern US we will get a greater understanding of the regional adaptation versus broad adaptation of a cross-section of organically produced butternuts that will serve to guide winter squash production and improvement in this tier. We also wish to evaluate the post-harvest quality and longevity of butternut squash and thus help with breeding occurring to improve market extension

Trials will be completed at all four mother sites and participating daughter sites. Each region will have a replicated trial (3 replicates) on their research farm (mother site) and additional single replicates will occur on three local certified organic farms (daughter sites).

Variety Selection

Trial Cultigen selection will be based on:

- Breeding Material-germplasm ready for evaluation from the project breeders (CU and OSU)
- Organic Seed-varieties currently commercially available as organic seed
- Check Regional-varieties currently commercially available and identified by regional growers as commonly grown varieties
- Check Control-varieties currently commercially available that will be held constant across all locations all years
- New Releases- recently released varieties recommended for organic producers by seed companies who serve organic farmers
- Storage Ability- varieties that are known for their storage ability

From these criteria a minimum of nine cultigens will be selected including least 5 commercially available varieties. At least five of the varieties will be trialed in all four regions including the breeding germplasm. Four cultigens may vary by region according to regional grower's interests and regionally identified check varieties. If breeding material is not initially available it will be included as it becomes available in subsequent years of the trials. At least one variety will be a variety that is known to store very well but may be much different than the other standard butternuts.

Growers are welcome to add additional varieties to their on-farm replicates to make the trial even more helpful to their specific farm. Even anecdotal single rep information can be useful for determining varieties to include in future trials.

Trial Specifications:

Growers and Researchers are asked to consult the OSA publication "On-farm Variety Trials: A guide for organic vegetable, herb and flower producers" (Colley and Myers, 2007) to aid in having a successful trial.

Planting Specifications

The following specifications should be followed as closely as possible but it is understood that each farm is different and some modifications may need to be done to fit the methods used on each farm. If a site deviates from the below specifications this should be noted to assist with subsequent analysis. This would include making clear notes if any of the sites use methods to prevent insect and disease pressure like *using organic sprays and row covers*.

Seed will be provided by the project and growers are asked to use the seed provided even if they already have seed of the same variety. For squash it is strongly suggested that transplants be started at least 10-14 days before predicted planting date. The use of transplants is recommended because of severe beetle pressure in some regions. Transplant production can be done by the mother site and then transferred to the daughter site or the growers can produce their own transplants with the seed provided. There are 24 seeds (=1 rep) per envelope and it is recommended to start all 24 seeds in the greenhouse to allow for poor germination and any other problems that may happen in the greenhouse. Don't forget to plant enough (twice as much as you need) of the spacer variety that will be provided (see below). Starting twice as many seeds in all cases will make it much more likely that there are enough transplants of each variety. If there are transplant failures of any of the varieties there is an extra packet of seed for each variety to start new transplants. If the replant date is more than 7 days please restart all of the varieties so you won't be planting transplants of different ages.

In-field planting date should be based on when growers in your region usually plant their main crop of butternuts. In the NE squash should be transplanted the first week of June so that squash matures by late September and be harvested before frost/freezing. But it is expected that this will not be the same date for all sites. For any given region with similar weather conditions plant the mother and daughter trials on the same date or as close as possible.

Squash should be planted in single rows spaced 9 feet apart between rows and 2 feet in row. Either bare ground or plastic mulched rows can be used but *please note what system a site is using*. There should be 12 plants of each variety per rep. Plant 2 spacer squash between each variety and at the ends of the rows. This should help prevent in row merging of varieties (that will help at harvest time). On the research farms each rep should be blocked and randomized. All nine varieties should be planted in a block to minimize edge effects and field variability. Varieties should be randomized within in each block. Research farms will have 3 replicates while each farm will have only one each.

Data Collection

Dates should be recorded for anything related to the trials including but not limited to: seeding, transplanting, all data collection, and harvest. Keep a field notebook of all field operations and observations. Pictures taken throughout the season are very useful both

for outreach activities and for a visual memory of what the crop looked like, how bad the weed pressure was, beetle damage, hail damage, fruit load,

A standardized data sheet has been uploaded. Please collect and record your data on this sheet. Use the format outlined on the data sheet and make sure you use the units asked for (even if this mean transforming your units if you don't have measuring devices with the correct units). This will make group data analysis much easier. Before deviating from the data sheet please consult the group. The data sheet includes all the data to collect throughout the entire season (even through storage). Individual data sheets can be printed out for specific data collection events by hiding columns that are not relevant and selecting the area you want to print. This way you won't have ungainly long datasheets when you go to the field

There are separate documents that have pictures to help standardize the rating of striped cucumber beetles, powdery mildew, weed pressure, and plant habit.

For each data collection event below we are describing what should be done at mother sites. In italics is my proposed deviation for the daughter sites. I propose that the minimum number of visits to a daughter site would be three: 1) at planting or close to planting to help with planting or confirm how planting was done and get initial stand counts, 2) in the middle of the season 3 weeks after the farmer has confirmed Powdery Mildew to assess PM and generally how the crop is doing, and 3) at harvest to record weed pressure, final stand counts, and help with harvest.)

All traits will be rated based on a scale of 1 to 5. For each trait, the rating should be based on all plants for each variety for each rep.

Stand Counts- Stand counts should be done at transplanting, before any beetle damage, three weeks after initial beetle discovery, and at harvest. Take notes throughout the season if any plants die throughout the growing season. *(For daughter sites whoever plants the crop should record how many plants go into the field. At harvest, whoever harvests should record the number of plants harvested from. This is data that can easily be collected by the farmer.)*

Striped Cucumber Beetle Damage- It is expected that the main insect problem at all sites will be striped cucumber beetles. Some sites may have spotted cucumber beetles. Cucumber Beetle damage should be assessed for the first six weeks after transplanting of the trial. Record the date that cucumber beetles are first noticed in the field. Three weeks after beetles are first noticed walk the entire trial and rate the foliage of each variety. For each variety use the following ratings. *(For daughter sites please ask the farmer to record when beetles arrive on the crop. Three weeks after beetles arrive all varieties should be rated for beetle damage. This is data that can easily be collected by the farmer.)*

- 5- No visible damage on any of the plants
- 4- Damage on plants but not severe
- 3- Feeding damage affects most leaves
- 2 -Plants are set back for few are dead

1- All plants dead from feeding damage

Weed Pressure- Weed pressure should be evaluated twice: once at fruit set and a second time at harvest. It is assumed every effort will be made to minimize weed pressure. *(For daughter sites midseason weed pressure can be collected if you are already visiting the farm (closed to fruit set is best) but if you are not on the farm this is optional. Rate weed pressure at harvest. This should be done with the farmer just before harvesting)*

- 5- No weeds visible
- 4- Weeds are visible but don't appear to be effecting crop growth
- 3- Weeds cover the soil but crop is still able to grow
- 2- Weeds cover the soil and crop is clearly affected
- 1- Crop is barely visible because of such severe weed pressure

Powdery Mildew ratings- The date that Powdery mildew arrives will vary considerably from year to year and site to site. The date PM is first noticed should be noted. Do mildew ratings 3 weeks after PM is first noticed. Mildew is rated on a scale of 1-5 with 1 being no mildew and 5 being mildew on all parts of the plants. The breakdown of these ratings is: *(For daughter sites the farmer should record the date that PM is first noticed on the planting. Do mildew rating 3 weeks after PM is first noticed. This is data that can be collected by the farmer but would be best collected by the researcher.)*

- 5- No visible mildew.
- 4- Small mildew colonies on one leaf surface with little or no sporulation.
- 3- Mildew colonies on both leaf surfaces with little sporulation.
- 2- Mildew colonies on leaf surfaces, stems or petioles with less sporulation.
- 1- Mildew colonies on leaf surfaces, stems and petioles with sporulation.

Fruit Habit- Fruit habit can be evaluated near fruit maturity but before plant dieback. This can be evaluated any time after fruit set. *(For daughter sites this can be done midseason when PM is being rated)*

- 5-Highly branched with plants that cover the rows
- 3-Single vine
- 1-Compact bush that leaves bare space between rows

Virus and Downy Mildew- Presence of virus and Downy Mildew is un-likely, so no ratings are necessary. If you suspect viruses or Downy Mildew please contact Michael Mazourek (mm284@cornell.edu) and include a picture. He may arrange to have leaves tested.

Harvest

Squash should be harvested at Maturity. This is normally very close to last frost dates and coincides with foliage die back. In most cases all squash harvest can be done on the same day. Data to collect include: final stand count (number of plants harvested), total number of fruit harvested, total fruit weight, marketable fruit number and marketable fruit weight. Notes should be taken on why some fruit is not marketable. This should include fruit damage due to beetle feeding. Take a picture of the harvest of each variety from each rep to show what the variety looks like.

You should cure (or not cure) squash as you normally do. In the absence of established methods it is recommended that fruits be cured at 80-85°F and 80-85 percent relative humidity for 10 days. Empty greenhouses can be used but be careful to adequately vent. After curing, a subset of fruit (3 per variety per replicate) should be evaluated. Find growers, friends, and students. In an oven (350 degrees) for 30-40 minutes (till soft) cook fruit on either a covered baking dish or a casserole dish with water covering the bottom. Try not to brown or caramelize the squash for that will complicate the taste profile. Cook a half (cut length wise) or just the center 1/3 of a half. Tasting should be based on the center 1/3 of the half. Cooked fruit should be tasted and rated for flavor, color, texture and sweetness. *(For daughter sites- growers should store the squash as they normally do keeping the varieties separate and give us anecdotal information on flavor and storage. We do not need to get formalized tasting and storage data from them like the research farm sites but you should provide growers with the tasting/evaluation sheet.)*

External color- degree of Tan

1-light

3-medium

5-dark

Internal color- degree of orange

1-pale yellow

3-medium orange

5-deep orange

Texture Code

1-stringy (like spaghetti squash)

3- some fibers

5- Fine grain/ smooth

Sweetness Rating

1- no sweetness

3- sweet but not overpowering

5- very sweet (sugary)

Flavor-

1-off-flavors (bad)

3-bland

5-noticably “squashy”

Overall Ranking- This is a comparative ranking, not a rating. 1= worst, 5=best

Storage

A subset of fruit (6 per variety per rep) should be stored in normal storage conditions. In the absence of an established protocol it is recommended to keep the squash at 50°F/50%RH.

Monitor monthly for deterioration over 4 months. Each month evaluate squash by removing (and recording) any squash that is no longer marketable. Note why the squash is no longer marketable (rot, dried out, leaking, etc). After 4 months the initial squash evaluation should be repeated on up to 3 squash of each variety. Some varieties will not make it to the end. Marketable fruit should be tasted and rated for flavor, color, texture and sweetness.