Evaluating Heirloom Winter Squash

2017 Community Day Presentation and Discussion

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All 2017 research was conducted at Care of the Earth Community Farm and funded by a two-year SARE research grant. This work builds upon research previously conducted by Common Wealth Seed Growers in Virginia. We will host two more community days in 2018, one field day that emphasizes on-farm breeding in early June and a final presentation in the fall at which seed stock from our breeding work will be available.

Goals of Project

Year One:

- To conduct a variety trial of 18 open-pollinated (mostly heirloom) *Cucurbita moschata* squash, our breeding seed stock, 1 hybrid butternut squash, and 1 open-pollinated commercial butternut squash under organic conditions and without any row cover, fungicides or pesticides, even those that are organically approved, in order to identify varieties particularly suited to our region and for possible seed stock.

- To identify or develop by traditional breeding methods *Cucurbita moschata* seed stock that is productive, has good flavor, is easily marketable, and stores well. We are looking particularly for a variety or varieties that are heat- and drought-resistant, insect-resistant, and disease-resistant. We have had particular problems in hot, dry seasons like 2016 and with cucumber beetles, squash bugs (*Coreidae*), and downy mildew. Other farmers in the region are also affected by squash vine borers, powdery mildew, and bacterial wilt.

- To conduct breeding trial of F1 cross of San Jose Club Squash and Waltham Butternut, evaluating and selecting for productivity, overall resistance, taste, marketability/appearance, and storage ability. We will continue selecting for butternut shape and size, as long as also correlates with other selection factors.

- To share results as part of community day and identify interested parties that may be able to partner with us in the future.

Year Two:

- To continue to evaluate and to save seed from best performers from 2017 study, selecting for productivity, overall resistance, taste, marketability/appearance, and storage ability.

- To conduct breeding trial of F2 cross of San Jose Club Squash and Waltham Butternut, evaluating and selecting for productivity, overall resistance, taste,

marketability/appearance, and storage ability. We will continue selecting for butternut shape and size, as long as also correlates with other selection factors.

- To conduct breeding trial of F1 cross of Carrizo and VA Select Waltham Butternut, evaluating and selecting for productivity, overall resistance, taste, marketability/ appearance, and storage ability. We will continue selecting for butternut shape and size, as long as also correlates with other selection factors.

- To host a field day to teach about hand-pollination and traditional plant breeding.

- To host a community day to share final results of two-year study as well as seed stock from best performing specimens.

Important Terminology

Open-pollinated seeds are seeds (or seed varieties) that produce the same (or approximately the same) results season after season. Open-pollinated seeds "breed true".

Heirloom seeds are open-pollinated seeds that were grown prior to 1945 (or prior to the emergence of hybrid seeds). Some people further distinguish between heirloom seeds and **heritage seeds**, stating that heirloom seeds are seeds that were grown and saved by a family, community or region while heritage seeds are seeds that were once commercially available.

Hybrid seeds are the cross of two open-pollinated varieties. The cross is not stable and therefore will not breed true in subsequent generations. This is why you must continue to purchase hybrid seeds in order to obtain the same result, and why they are patented. Typically, hybrids offer some advantage (termed hybrid vigor) over both of the two open-pollinated parents. Hybrid seeds are not the same thing as GMO (genetically modified organisms) seeds, which instead contain genetic material from an entirely different species.

Variety trial is a planting experiment which compares several different varieties of the same species. This is often the first step to breeding seed stock, although during the trial, you can discover that what you are looking for already exists.

Breeding trial is a planting experiment in which various plants of a single variety (typically a cross of two open-pollinated varieties) are compared, evaluated, and selected from in order to advance a breeding project. The offspring of the first cross of two open-pollinated varieties is considered an **F1 hybrid**, subsequent generations (or seasons) are labeled **F2, F3, F4** and so on. Once the variety is stable, it can be labeled with a name and is now an open-pollinated variety (as it breeds true and seed can be saved from season to season without variation).

Selection trial is a planting experiment which compares various plants of a single open-pollinated (stable) variety in order to select a strain (not a different variety) that is better suited to whatever conditions or requirements one is selecting for (disease-resistance, taste, storage, etc).

Traditional plant breeding is the process of breeding a hybrid or new open-pollinated variety by pollinating the ovule of one parent variety with the pollen of another parent variety and then observing, comparing, evaluating, and selecting from this initial cross. This process typically takes between 6-10 years. This is the type of breeding humans have been doing since we began farming, 8,000-10,000 years ago. I would not include mutation breeding in traditional plant breeding, although it should be separated from genetic modification.

Downy Mildew (Cucurbit) is a disease caused by fungus-like spores. It arrives in the summer with winds from more southern locations, typically in June on our farm. It creates yellow-brown irregular blotches on the leaves (older first) and eventually total yellowing of the leaves. It thrives in humid weather, and can be catastrophic, resulting in the total loss of a crop (particularly a storage crop like winter squash). It is not the same as powdery mildew.

Variety Information with Photos

JWS 6823 PMR (F1) (<90) - a commercial hybrid butternut squash, bred by Johnny's Seeds for powdery mildew resistance
Nutterbutter (<90)- an open-pollinated butternut variety bred by High Mowing Seeds for early production
VA Select Waltham Butternut (100)- a farmer-selection of the heirloom Waltham Butternut, selected in Virginia since the 1970s
South Anna Butternut (100)- currently an F6 hybrid, it is the result of a cross between Seminole and Waltham Butternut; it is about 90% stable, producing a downy mildew resistant butternut with rich, sweet flavor that stores moderately well. Bred by Edmund Frost at Twin Oaks Farm in Louisa, VA.
Tahitian Butternut/Melon (105)- a large, long-necked, very sweet heirloom butternut squash that keeps well
San Jose Club Squash (115+)- a large, long-necked, flavorful heirloom butternut squash, originally from San Jose, Costa Rica. We obtained seeds for this squash from Baker Creek Seeds (although they no longer offer them) in 2014. It keeps until November.
Carrizo (100)- a large, heirloom butternut-shaped squash from Sonora, Mexico. It was not DM-resistant in Common Wealth Seed Growers initial trial.
Greek Sweet Red (100)- an heirloom butternut squash with a dusty skin appearance. Some DM-resistance.
Seminole (105)- a very old heirloom teardrop-shaped squash from the Seminole Indians (Everglades, FL). It stores incredibly well and has great flavor, but it has very little eating matter/fruit.

Tan Cheese (100)- one of the oldest heirloom cheese pumpkins available; not very productive, good keeper, moderately sweet.
Thai Kang Kob (<90)- a DM-resistant heirloom pumpkin from Thailand, very flavorful; ours did not keep well this season (they may have been harvested too late).
"Ayote"(120)- a Costa Rican pumpkin variety that was given to us at a flea market by a Salvadorean woman. She said it was an heirloom but it has not produced male flowers for us (parthenocarpic or just ill-suited to our climate or latitude?). Ayote just translates to squash or pumpkin. As is typical of many places outside the US, this variety does not appear to have a variety name. It is productive, stores well, and has a great flavor. I wish we could produce seed!
Soler (?)- an op pumpkin from Puerto Rico
Noob Taub (100)- a spotty, bulbous heirloom pumpkin from Laos, some variability in shape, turns tan in storage
Segualca (105)- a large heirloom oblate squash from the Mayo Valley in Sonora, MX
Jamaican Long Neck (110)- a very large heirloom winter squash, shaped like a cushaw but *moschata*
Cuban Neck Pumpkin (?)- a long-neck heirloom squash variety from Cuba, very sweet. DM-resistant in Common Wealth Seed Growers trial, although not for us.
Choctaw (100)- an old heirloom Choctaw winter squash with a very distinct long, rounded teardrop shape
Upper Ground Sweet Potato (100+)- an old Southern Appalachian heirloom squash, round pumpkin to "blob" shape, productive, drought-resistant, great flavor, and store well
Mrs. Amerson's (100)- a flavorful Appalachian heirloom squash, bell shape. Not productive for us in hot seasons but productive this season.
San Jose x Waltham F1 (115+)- a F1 cross of San Jose Club Squash and Waltham Butternut made in 2016. We bred it hoping for a heat, drought, and DM-resistant butternut-like squash with great flavor that keeps until January. There was a lot of shape variability this season, productive, DM-resistant.

Preliminary 2017 Data

Weather: the 2017 season was relatively cool and wet. Squash were **transplanted** the first week of May, and we began harvesting the first week of August, through frost in late October, with the main harvest coming the third week of August. It rained at some point in the day more than half of the days (53) during the 105 growing period. There were only 14 days at 90 degrees or above, most of them coming in mid-to mid-late July. Average high temperature was 84.