WINTER SQUASH

Cucurbita moschata & pepo

Final Crop Analysis

Estimated Harvest goals:

Market	Crop/Variety	Weeks Needed	Lbs. Requested each week	Total Pounds Requested per Market
CSA	Waltham Butternut Acorn Honey Bear Spaghetti Squash	27-Sep 4-Oct 11-Oct 25-Oct 1-Nov 8-Nov 15-Nov	5 5 5 5 5 5 5	6,125
Farmer's Market	Waltham Butternut Acorn Honey Bear Spaghetti Squash	20-Sep 27-Sept 4-Oct 11-Oct 1-Nov 8-Nov 15-Nov	15 10 15 10 15 20 20	100
Big Y	Amherst North Hampton Greenfield South Hadley	27-Sep to 15-Nov 10 27-Sep 11-Oct 25-Oct 8-Nov 10	100 80 150 150 150 100 50	800 800 550 500
Earthfoods Greenos	Waltham Butternut Acorn Honey Bear Spaghetti Squash	EF 13-Sep 27-Sep 11-Oct 25-Oct 8-Nov 15-Nov G 13-Sep 27-Sep 11-Oct 25-Oct 8-Nov	50 50 50 50 50 75 25 25 25 25 25	EF 325 G 125

Cultivars/varieties and seeds:

Seed Source	Suggested Variety	Cost	Pelleted or coated seed? Y/N	Organic ? Y/N	Notes
Johnny's	Acorn Honeybear	$10.24/oz	N	N	
Johnny's	Waltham Butternut	$46.44/lb	N	Y	
Johnny's	Spaghetti	$5.68/oz	N	N	

Reasons for selecting these cultivars:
I was interested in winter squash which is resistant to powdery mildew.
Butternut is a staple crop and last year the butternut variety was popular for the CSA. Big Y and Earthfoods are also interested in it. Acorn Squash - Honey bear is a single serving fruit when sliced in half and will provide CSA members a unique option. Spaghetti Squash - It was successful in Big Y sales and works great for the CSA. This larger version is more productive and has a higher demand compared to the angel hair variety.

Did the variety description meet your expectations? Why or why not?
The variety which I picked lived up to healthy looking plants and abundant fruit. However, we ended up using some Waltham Butternut seeds purchased from the Hadley Garden Center. This direct seeded squash became unhealthy and infected with powdery mildew. Additionally, the fruit was infected with black rot, fusarium fruit rot, and bacterial soft rot. It did not store well. More on this later.

Would you recommend these varieties again?
Despite these challenges, I recommend all three varieties. Be mindful of the type of seeds which you use. Do not grow cucurbits in South Deerfield A.

Make suggestions for two other varieties you think would be interesting to try in 2020. List your reasons.
Delicata JS- Stands out and looks different. Stripes and green streaks.
North Georgia Candy Roaster- Looks crazy, can store up to 5 months after harvest. Its tubular shaped and can appear an orange tinge with green stripes. This rare variety could spice up the CSA and provide a unique flare for Farmers Markets. Johnny claims that it tastes amazing. There are many recipes online.

How and when the crop was seeded/transplanted

Greenhouse seeding

Variety	Seed date	Tray size	Number of trays	Notes on germination
Butternut	5/8	48	21	
Spaghetti	5/8	48	16	
Honey Bear	5/15	48	5	

Field Planting Info

Planting #	Plant date	Number of row feet planted	Rows per bed	Planting method	Notes on survival in field
Butternut	5/29	1800	1	Plastic and water wheel transplanter	Mildew, squash bugs
Spaghetti	5/29	1200	1	Plastic and water wheel transplanter	
Honey Bear	5/29	600	1	Plastic and water wheel transplanter	

Farmer Notes: *Original numbers were wrong, we did not have enough transplants. Two beds of Waltham Butternut were purchased at Hadley Garden Center. Seed was direct seeded into ground and became infected. This direct seeded squash became unhealthy and infected with powdery mildew. Additionally, the fruit was infected with black rot, fusarium fruit rot, and bacterial soft rot. Also, our original seeding numbers were incorrectly planned. We did not have enough transplant and this is why more were purchased at Hadley Garden center.*

Planting Information:

Expected yield/ft: This was the expected harvest yield for Waltham Butternut: Weight range is 4-5lbs, 4-5 fruit per plant, 16-25 lbs/plant. 1 plant per 8". However, we ended up harvesting nothing ☹.
2 - 3.12 lbs per foot of row.
Acorn honey bear: 1-1.25lbs, 3-4 fruit per plant, 3-5 lbs plant. Compact vine length, 1 plant per 4". .75 lbs - 1.25 lbs per foot of row.
Spaghetti: 3-4 lbs, 4-5 avg fruit per plant, 12-20 fruit per plant. 1 plant per 8".
foot of row. 1.5 lbs - 2.5 lbs per foot of row.
Direct seed or transplant: TP and DS
In-Row Spacing: 12

Between Row Spacing: 5 ft

Number of Rows Per Bed: 1

Bed Feet planted: 3600ft

Row Feet Planted: 3600 ft

Number of succession plantings: 1

Field Planted in: SD A

Broadcast Fertility: 4/16/19 Composted Chicken Manure 5-4-3 1000 lbs/A

Additional Fertility:

Cultural practices:
Black plastic was laid in early May. The squash transplants were planted with the water wheel transplanter. Two people dropped transplants into moist holes created from dibbles. This occurred on May 27th. We ran out of transplants, additional Butternut seed was purchased from the Hadley Garden Center. We did not use reemay over the few beds and this may have proved to weaken the plants disease resistant. The squash was later covered in reemay to protect from the cold nights of Spring and early pest damage from insects such as the striped cucumber beetle. Prior to applying reemay, we were diligent to hoe in between the rows and hand weed all unwanted weeds in the poked holes around the squash plants before covering with reemay. At one point, Ellis, Rhianna, Al and myself crawled into the reemay to check on the status of the transplants and weed some more. This may have been a waste of time but it was a toasty, warm and humid adventure. I still remembered taking the reemay off for the first time and seeing a huge amount of weed growth. I imagine that we would have lost the some squash (even earlier in the season) if we hadn't been weeded so meticulously prior to using reemay. After removing the reemay, the next step was to weekly monitor the weeds in between rows and keep the holes clean for the squash to continue to develop. We used scuffle hoes and occasionally the I and J toolbar would be driven through attached to the Green Bean to cultivate between the beds. Spaghetti squash was harvested with big hand pruners, rubbed with a cloth and placed into waxed bushel boxes. The acorn squash was harvested with pruners. We used a tractor carrying a large bin to quickly harvest the squash. However, numerous Honeybear was sticky and mushy. We had to compost a fair amount. Consider storing the squash with less pressure in a cool dry area, space in the barn? Butternut was harvested with pruners and left to cure in the field. However, it did not store well due to many diseases explained below.

Notes on Pesticide Application:
The squash was sprayed twice to protect against the striped cucumber beetle. The first was on May 27th, the same day as transplanting at a rate of "15 cups an acre" (Pesticide Application Records 2019). Sorrund/Kaolin Clay was applied. Later on June 26th, Pyganic was applied to the squash to help reduce the effects of striped cucumber beetles.

Notes on Irrigation:
The squash was irrigated through drip tape which was laid down at the same time as black plastic. It was turned on more often in the middle of the summer when we had stretches of long hot weeks. Drip tape was not left on overnight. Field A did not get particularly dry and the squash did not suffer extreme heat damage.

Diseases observed:
Powdery mildew- PM is a white powdery growth on the surface of leaves and stems. Fruit size is stunted and the fungi known as *Erysiphe cichoracearum* attacks in a wide range of temp 50-90 degrees and humid conditions. It strongly affects late planted squash.
Black rot- The spaghetti squash had a common case. This type of rot is caused by the same fungus which causes gummy stem blight.
Fusarium fruit rot- This pathogen can survive in the soil for 2-3 years and can be carried on or in the seed. I suspect that the Butternut from Hadley Garden center may have been infected. Butternut had an odd pimple like symptoms which oozed a sap often times appearing like a foam. The diagnostic lab report from UMass extension guessed that the rot was a symptom of

some type of wounding of the fruit which allowed both the fusarium and bacteria to penetrate the skin.
Bacterial soft rot- This bacteria is spread from cultivation and insects. Healthy tissue is invaded through wounds created from squash bugs and other damages. Bacteria can also be splashed up from rain water or irrigation. Infection often occurs after a heavy wet week. UMass extension does not have any effective treatments for control of bacterial soft rot. One should remove as much infected plant material as possible. We ended up ripping up two beds of squash to prevent further spreading back in August when the squash was looking poor. Plants should be given enough remove to grow, drip irrigation is more effective than overhead at limiting the spread of disease.

Potential Disease Threats: What should farmers of the future expect to see?
Please refrain from planting any cucurbits in block A for three years. The diseases which infected the squash will remain in the soil and can infect other types of cucurbits such as pumpkins, cucumbers, summer squash, and zukes.

Insect Pests observed:
Striped Cucumber Beetle
SCB effect different types of cucurbits and we found them flying around the haygrove near cucumbers as well as in block A near the winter squash. The pests are ¼ inch long, have a black underside and 3 black and yellow stripes on their wings. These stripes are straight and this helps distinguish them from the potato beetle. Larvae are ⅜ inch long and look like tiny white worms. After overwintering, the adults emerge when temperatures exceed 55 degrees. They feed on the pollen of plants and move towards the winter squash plants to mate. Often they will emerge from wooded areas and create a concentrated perimeter around the crops. The eggs are laid at the base of the plants in soil and hatch after 1 week. Larvae grow for 2-4 weeks and summer adults will feed on flowers, foliage, and fruit. These beetles feed on cotyledons and vector (transmit) pathogens which can cause bacterial wilt. Their poop clogs the plant vascular tissue.
Squash Bug
Mushy fruit, difficult harvest, spreading of disease. Squash bugs ran rampant during the Butternut harvest. There were so many of them all over the place. Although a small quantity can just live around the squash in harmony, I think the masses may have hurt growth and spread disease. We did not take any real actions as it occurred late in the summer and we were busy with harvests and other projects at the ALC.

Potential Insects:
Squash bugs- often mistaken for stink bugs. These guys can grow to over a ½ inch long. Young squash bugs look like aphids and often move robotically. These bugs will overwinter in dead leaves and vines. It is best to move squash far away from block A, in an attempt to end their life cycle. Squash bugs can inject a toxin into the plant and drink sap. This stab causes a yellow spot and can cause leaves to wilt, inhibiting the flow of nutrients. Squash bugs can therefore encourage the spread of bacterial wilt.

Do you think the production practices needed for this crop was worth the yield that we received?
I think Winter Squash is a great crop for the farm and in recent years has resulted in large amounts of revenue. It is easy to manage and grows well. Although our crew suffered a tough L in the production of Honeybear and Waltham Butternut, it should be grown again. Consider growing over at the ALC or in SD B/C and manage well with pesticide application, row cover, and frequent cultivation. Squash is a staple of the Student Farm, please bring us redemption!

Harvest & Storage

When was the crop ready for harvest? How did you know?
Spaghetti Squash was ready for harvest in mid August. It appeared as a white to yellow color and was quite firm. Acorn squash and Butternut was ready in September. They were firm and no longer had a glossy texture. Acorn is ready when it reaches a dark green color and the Butternut when it is tan. Acorn should be around the size of a softball. The butternut should be around 12" long.
How was it harvested? Butternut was cut off the vine using large pruners and some hand pruners. Butternut was placed in rows on the black plastic to cure for one week. Acorn squash harvest was really fun. We worked in groups and cut all ripe squash off the vine. Then a tractor was driven in the harvest row with a large white bin. Two people tossed the acorn squash to catchers who dropped the squash lightly into the bin. Spaghetti squash was harvested with large pruners and then cleaned off with a rag. It was placed directly into wax bushel boxes.

How was it washed at the wash station?
Winter Squash was not washed, it was cleaned off with cloth and rags.

List different post-harvest practices for each market (if any) Spaghetti Squash was put into wax bushel boxes for wholesale to the Springfield Big Y. Acorn was brought to CSA in lock top bins. Butternut never made it to any official type of market.

List different shipping practices for each market (if any) Wax Bushel boxes for Spaghetti Squash to the Big Y wholesale in Springfield. We used lock tops to bring acorn to the first CSA pickup.

What different or improved harvest, storage and shipping recommendations can you make?
It would be smart to store the acorn and butternut with less weight (do not stack) or in a cleaner bin. The acorn began to rot in the bay across from the SD cooler. There was too much pressure from excessive squash. The Butternut had a huge set of problems regarding pests and disease, however it also was stored in a similar method as acorn squash. Consider storing in a stable temperature, giving the squash as much space from each other as possible.

Storage and post-harvest handling

Curing: Butternut was cured for a week. Right after harvest, we laid them on top of the black plastic in rows. Cure for 7-10 days.

Washing before storage: Cleaned off with cloths

Storage Requirements: 50 degrees, darkness. Relative humidity of 50–70%.

How should this crop be processed for long term storage: Same as above

Where your crop was stored this fall 2019?
Inside by the bay in South Deerfield.

How well did this crop fair in storage and how did it enter storage? See above

Were there any problems in storage? See CA-3. Butternut had an odd pimple like symptoms which oozed a sap often times appearing like a foam. The diagnostic lab report from UMass extension guessed that the rot was a symptom of some type of wounding of the fruit which allowed both the fusarium and bacteria to penetrate the skin.

Farmer Notes: *Store in a single layer, not stacked on other squash.*

Actual Yields and Sales: CSA

Date	Week #	Unit lbs., bunches, bags	Amount Per share	Total brought to CSA	Notes
9/13	1	Lock Top	1	All	Acorn Squash

Other Markets – report total amount sold to each market over the season

Market	Price/unit	Total Units sold	Total amount of sales
Big Y Warehouse	**$1.50**	**738lbs**	**$1,107**
Big Y Amherst	**$1.50**	**56 lbs**	**$84.00**

Both of these above sales are Spaghetti Squash.
Total Gross Income Received From Your Crop: $1,191

Review and Recommendations

What was different between what was done and what was planned?
This is pretty self-explanatory. We did not have enough squash to offer to CSA or other markets. The Butternut was unsuccessful, and the spaghetti was sold in summer to the Big Y Warehouse in Springfield.

What worked really well and should be continued?
Large shipments of squash should be brought to the warehouse in Springfield if the CSA season has yet to begin.

What changes would you recommend for next year?
None
Should we grow this crop again? Why or why not?
Yes, winter squash has proven successful in many years prior to this one. We had an unfortunate run, but I recommend that you try your hand at growing winter squash.

Farmer Notes: *I recommend staying for the summer in order to grasp a full understanding of the speed and timing that it takes to harvest large amounts of produce. This will better serve you in the fall while attempting to manage classes, harvests, friends, and other responsibilities. Like any college class, sleep is really important as early morning harvests will usually lead to long class days. Try and find a schedule in the fall which complements the Friday farmers market as well as Tuesday/Thursday Harvests.*