KALE

Brassica oleracea

Final Crop Analysis

Estimated Harvest goals:

Market	Crop/Variety	Weeks Needed	Lbs. Requested each week	Total Pounds Requested per Market
CSA	Darkibor Toscano Amara KX1	10	2, 2.5, 2, 2.5, 2, 2.5, 2, 2.5, 2, 2.5	3937.5
Farmer's Market	Darkibor Toscano Amara KX1	10	30	300
Big Y	Darkibor Toscano Amara KX1	A, NH, SH: 10 weeks Greenfield: 9/13 30lb 9/27 30lb 10/11 20lb 10/25 10lb 11/8 10lb	Amherst 30 NoHo 25 SH 20	A 300 NoHo 250 SH 200 G: 100
Dining Commons	Darkibor Toscano Amara KX1	10	50	500
Student Business	Darkibor Toscano Amara KX1	Earthfoods 10 Catering 10	**10**	**900**

Harvest Total: 6,487.5 lbs

Cultivars/varieties and seeds:

Seed Source	Suggested Variety	Cost	Pelleted or coated seed? Y/N	Organic? Y/N	Notes
Turtletree	Ruffles	1,000 seeds, $6.35	N	Y	
Johnny's	Toscano	$12.10/oz	N	Y	
Johnny's	KX1	$7.50/oz	N	Y	

Reasons for selecting these cultivars:
Mix of KX1 and Toscano will add a colorful and unique addition to our CSA.
Lacinato- Toscano known as dinosaur kale, is tolerant of hot and cold weather and is recommended for baby leaf. This was requested by Earth Foods and is very easy to sell to the Dining Commons. Ruffles can be sold bunched to Big Y wholesale. It is dark green, curly, and attractive for the CSA. Despite my original plan, the final selected varieties for Kale were Ruffles, Toscano, and KX1. We chose three varieties instead of four. Ruffles, our curly and abundant kale, was chosen because it could sold to all of our markets. We chose KX1 and Toscano in order to explore varieties that do not take as long to grow as well as types which could be brought in order to diversify the CSA.

Did the variety description meet your expectations? Why or why not?
Yes we have an abundance of Kale. It is going to every market! It is going to sustain us for many weeks to come.

Would you recommend these varieties again?
Yes, I would recommend ruffles. The crew can decide what other kinds of unique kale to grow. I do not recommend growing KX1. It was an experiment for us and we never ended up harvesting much for the CSA. No KX1 was sent to other markets. I think growing a Dinosaur kale variety is important like Toscano.

Make suggestions for two other varieties you think would be interesting to try in 2020. List your reasons.
Redbor – similar to ruffles and Winterbor. Solid yield in late season. It is purple!
Red Russian – This would add some diversity to Farmers Market and may be received well by customers who want to cook and make salads. 2020 should look into DC cooks and if they would prefer this variety.

How and when the crop was seeded/transplanted:

Greenhouse seeding

Variety	Seed date	Tray size	Number of trays	Notes on germination
Ruffles	5/30	128	22	
Toscano	5/30	128	6	
KX1	5/30	128	3	
Ruffles	6/21	128	22	
Toscano	7/3	128	6	
KX1	7/3	128	3	

Field Planting Info

Planting #	Plant date	Number of row feet planted	Rows per bed	Planting method	Notes on survival in field
Ruffles #1	7/1	1925	2	Tractor furrow and hand plant	
Toscano #1	7/1	550	2	Tractor furrow and hand plant	Early insect damage but recovered after spray
KX1 #1	7/1	275	2	Tractor furrow and hand plant	Early insect damage but recovered after spray
Ruffles #2	7/15	1925	2	Tractor furrow and hand plant	
Toscano #2	7/15	550	2	Tractor furrow and hand plant	
KX1 #2	7/15	275	2	Tractor furrow and hand plant	

Farmer Notes: Kale is thriving and bountiful. We have an enormous amount! I think it will serve us well late into the season.

Planting Information:

Expected yield/ft: 1 pound per foot of row
Direct seed or transplant: TP
In-Row Spacing: 12”

Between Row Spacing: 2.5 ft

Number of Rows per Bed: 2

Bed Feet planted: 2750ft

Row Feet Planted: 5500 ft

Number of succession plantings: 2 July 7th and July 17th!

Broadcast Fertility: 6/17/19 Composted Chicken Manure 5-4-3 1000 lbs/acre

Potassium Sulfate 500 lbs/Acre.

Additional Fertility: 9/5/2019 Blood Meal 100 lbs/acre

Cultural practices:
Kale was planted in a simple method. A tractor with a furrow attachment was driven through ALC-7 to create a furrow. Farmers followed in teams of droppers and planters. These method was used frequently over the summer and works well. We did not cover the Kale but brassicas in ALC 7 were sprayed on 7/26 with PyGanic (9oz per ½ acre) to combat flea beetles. Later again, they were spread with the organic fertilizers Dipel DF(rate of 1/2lb per ½ acre) and Entrust (30oz/ ½ acre) on July 30th. We decided to skip black plastic and drip irrigation in these beds and instead focus more on rotational weed management. We used scuffle hoes in and around these rows of kale. Harvest included bunching and loose kale and is quite easy.

Notes on Irrigation:
We used drip tape in the ALC and used it in frequently come late August. There was no black plastic at the ALC. In the first week after planting, the ALC was extremely dry. We had to water by hand with watering cans and also used the water wheel transplanter to splash the kale and other crops in ALC 7. Later on in the season, the ALC was not dry and Kale rebounded from the initial lack of water.

Diseases observed:
Beetle damage prior to spraying. Lots of munching going on when the transplants were young. I was worried that the kale was not going to develop fully because of this however, the ruffles variety appears robust and successful.

Potential Disease Threats: What should farmers of the future expect to see?
Alternaria Leaf Spot. Small black spots which can turn to brown. These lesions will be of different shapes and crack in the center. Leaves will fall off and it can spread to the stem.

Downy Mildew. DM appears as small yellow spots on the upper surface of leaves. Spots spread and can become brown. The Fungus *Pseudoperonospora cubensis* survives in a wetter environment.

Black Rot. Symptoms include V shaped lesions on the edge of leaves, black leaf stems, and brown spots. It thrives in warm and humid climates. Pests and water will spread this disease so it is important to keep our plants clean and sanitary. Controlling weeds will also prevent bacteria build up.

Insect Pests observed:

Flea Beetle: Random loose holes in the leaves of the plants. Slower growth and loss of plants if the leaves are not able to recover. Spray PyGanic.
Diamondback Moths: We had loads of these.
These pests are discovered by their wing tips which point up and are decorated with some small diamond like shapes. Moths overwinter in warm climates. They fly in and lay eggs on plant. They have the ability to migrate far distances. Adults work at dusk and through the night. New adults come up on plants in the morning and will mate on their first day. Females lay eggs for 10 days and can produce as many as 250. The eggs are flat ovals, laid in clusters in the cavities of leaves. They hatch 4 to 8 days later. The larva are distinguishable by pron legs at their tail ending in a V shape. They munch on the underside of the leaf. Trap crops such as white mustard and rape can be implemented to attract the moths. Overtime, these moths acquired a strong pesticide

resistance. Rain and water can kill young larva. We should use cover crops and build a trap with female pheromones.
Imported cabbageworm: see Ellis' IPM chapter.

Potential Insects:
Aphids
Aphids have plumb bodies and thin legs. Their backs contain chronicles which are small backward tubes that face up. These pests suck plant juice sugar with a sharp piercing mouth. It is absorbed into the blood and a substance known as honeydew is released. This causes curling of leaves and sooty mold. Winded females lay eggs in the woods for several cycles by asexual reproduction. They finally move on to plants and lay wingless females. After males visit the plants, eggs will overwinter and hatch in the spring. We can use lady bugs and wasp parasites to help control aphids.
Flea Beetles
Small, 1/16 to ⅛ inch. Black, brown, bronze, gray, some have stripes. Their back legs are black and powerful, allowing them to jump far if scared. Their life cycle is similar to that of aphids. They feed on the roots of new seedlings. Transplants have a much higher tolerance to flea beetles. The beetles dig shallow pits and holes in the leaves which disrupts the photosynthesis process. We need to proactively monitor in the spring. The threshold count for a plant is 5. *Microctonus vittatae* is a wasp which kills the beetles.

Do you think the production practices needed for this crop was worth the yield that we received?
Yes, Kale continues to produce very well. It will need to be sprayed well cultivated but should thrive well at the ALC or SD.

<u>Harvest & Storage:</u>

When was the crop ready for harvest? How did you know?
Kale was ready once the leaves sized up to about 6 inches and larger. It is dark green and crunchy to taste raw. Kale was ready for harvest during the entire CSA season.

How was it harvested? Kale can take ages to harvest or be super quick. It depends on how many people join in on the fun and how efficient they want to be. Quick harvests of kale included loose leaves being sent to Earthfoods and Hampshire Dining Commons as well as the CSA. It was ripped right off in a down then up movement with both hands, then placed into a bushel box or lock top depending on market. When bunching kale for Big Y, it is important to make similar sized bunches. Even if they are all a little over or under one pound, they should just resemble each other. Bunching kale took longer later in the season as we stripped both successions of the best quality and had to search a little more. They proved to be some aphids and eggs on the underneath side of the leaves.

How was it washed at the wash station? Dunked in the three bay sink. As the season progressed and during some wet harvest, we did not wash any kale!

List different post-harvest practices for each market (if any) Loose leaf was not washed, it was put straight into bushel boxes for dining/student business. Loose leaf for CSA was put directly into lock top boxes. We created one pound bunches for Big Y then either put directly into lock tops or brought back to wash station at barn (in harvest bins) to quickly dunk in three bay sink.

List different shipping practices for each market (if any) Wax bushel boxes for Earthfoods and Hampshire Dining Commons. Lock tops for CSA and Big Y.

What different or improved harvest and shipping recommendations can you make?
If the kale is wet and seems clean, skip the wash and save time. Harvest directly into a shipping bin that applies to the market.

Storage and post-harvest handling:

Curing: None
Washing before storage: None
Storage Requirements: 32 to 40 degrees at 95% relative humidity.
How should this crop be processed for long term storage: Do not wash if storing longer, however, kale was never stored for more than a week. Wash and store if it needs to be removed from the field to excessive heat.
Where your crop was stored this fall 2019? Cooler in barn at ALC.
How well did this crop fair in storage and how did it enter storage? Loose and bunched, will store for a week or so. Harvest as needed.
Were there any problems in storage? Eventually the kale got a little rubbery towards the end of the season in the field.
What different or improved storage recommendations can you make? Harvest kale as needed. Take lots of bodies as sometimes bunching can take a while and it's nice to work in a group. Be really mindful about how many yellow organic bunching bands are left in people's pockets, on wrists, in hair, and on the ground!

Actual Yields and Sales: CSA

Date	Week #	Unit lbs., bunches, bags	Amount Per share	Total brought to CSA	Notes
9/13	1	Pounds	1	160.5	.5 lbs to ½ share
9/20	2	Leafs	10	1160	10 to ½ share
9/27	3	Pounds	1	169	1 lbs to ½ share
10/11	5	Leafs	10	1160	10 to ½ share
1018	6	Leafs	10	1160	10 to ½ share
10/25	7	Bins	Lots	6 bins	Take as you want!
11/1	8	pounds	2	264	1 lbs to ½ share
11/8	9	Pounds	1	197	1 lbs to ½ share
11/15	10	Leafs	Lots	No records	Take all you can!

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

Market	Price/unit	Total Units sold	Total amount of sales
Big Y A	$1.75/lb	303	$530.25
Big Y NH	$1.75/lb	311	$544.25
Big Y SH	$1.75/lb	321	$561.25
Big Y GF	$1.75/lb	197	$344.75
Hamp DC	$1.75/lb	662	$1,158.5

Total Gross Income Received From Your Crop: $3,139

Review and Recommendations:

What was different between what was done and what was planned?
We followed the plan closely.

What worked really well and should be continued?
Kale was sold as a standing order to Hampshire DC and this proven effective. We had ample kale to offer to CSA and plenty left. We consistently offered 15-25 bunches to the Big Y most weeks.

What changes would you recommend for next year?
Consider spending more time sending emails and planning for wholesale markets in the fall. We stopped selling to Greenfield because of forgotten emails and a lack of time. Big Y sales can prove profitable in the fall if the crew takes the time to regularly send emails and plan harvests.

Should we grow this crop again? Why or why not?
Yes, definitely grow kale again. It is productive for most of the season and should last all fall for the CSA. Big Y and the DCs will both purchase kale throughout the fall.