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Eastern NY Commercial Horticulture Program

Producing Sweet Potato Slips On-Farm from Certified Rootstocks and Effects of Planting on Plastic Mulches Versus Bare Ground Ridges on Overall Marketable Yield and Quality

2022 Annual Report

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Summary:

Producing local sweet potato slips has proven to be a difficult task, at least for the past two seasons. For the second year, we were unable to produce enough sweet potato slips to have a true idea of the potential amount of slips that could be generated with our slip beds due to another failure with heat mats that are needed to provide the 85-90 degree Fahrenheit soil temperatures required for optimal slip production. This was our second attempt at producing slips with a different heat mat supplier, but results were the same with the mats tripping the electrical breaker, even when we were told they would work on the GFI outlets located in the greenhouse range at the Hudson Valley Farm Hub.

Slip production was very delayed resulting in reduced slip production quantity. However, we were able to produce enough slips to plant our replicated field trial that compared NY grown slips to slips purchased from North Carolina slip producer Jones Farm. We also had enough locally produced slips to plant and evaluate a late planting of NY produced slips in plastic mulch.

The use of plastic mulch to produce sweet potatoes compared to bare ground raised ridges resulted in higher yields for both Covington and Murasaki. Average root size was also larger when sweet potatoes were grown on plastic mulch.

Key Findings:

- Bottom heat to maintain 85-90 degree Fahrenheit sweet potato seed beds are required for optimal slip production.
- AgriTape heat mats that were purchased consistently tripped the GFI breakers in the greenhouse resulting in poor seed bed conditions.
- Plastic vs. bare ground ridges: the use of raised beds mulched with black plastic resulted in an average 30% more roots compared to ridges with the Covington variety, but only an average of 4.4% with the variety Murasaki.
- Plastic also resulted in a greater percentage of roots in the “Large” size category which is the most desirable size range.
- NY Covington produced slips resulted in 30% more roots compared to Jones slips. NY Murasaki produced slips resulted in 22% more roots compared to slips purchased from Jones.
- NY Covington produced the highest number of “Large” roots and the fewest “Jumbo” roots compared to Jones slips. However, NY produced Murasaki produced fewer “Large” roots compared to Jones slips.
- Waiting for seed beds to produce a second round of slips for a later planting (approximately 2-3 weeks after first cutting and planting) does not appear to be beneficial based on total marketable yields for either variety. However, they could be used for replanting slips that may have died after transplanting so it may be worth maintaining beds for a couple weeks after slips are cut for the main planting.

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Background:

Sweet potatoes continue to gain popularity with growers not only in eastern NY, but also across the whole state. Sweet potatoes offer growers that provide winter CSA shares or that participate in winter farmers' markets with an additional offering due to their ability to store for long periods of time without losing quality. Sweet potatoes are not planted from seeds or transplants but by a "slip", which is nothing more than a cutting that is taken from a "mother plant". Nearly all the slips that are purchased by growers in NY are produced in North Carolina, with a few from an organic producer in Pennsylvania. Once slips are cut, the clock starts ticking to get them packaged, shipped and planted by NY growers. Once they are packed, they immediately start to produce heat which then degrades the overall plant quality. On average, it takes 3-5 days to have them shipped from North Carolina - add to that probably another day or two depending on weather, for growers to get them planted. If the weather does not cooperate (too cold or wet etc.), slips may be held for 10 days or more and the higher the breakdown rates.

There is also the issue of slip shipping timing. Even though you can request from the slip supplier the date you would like your slips shipped, very rarely do they actually ship on that date. Over the last several years, growers in eastern NY could have been planting sweet potatoes the third week in May. However, most slips are not ready to be shipped or picked up in North Carolina until the first week in June. If planted in the third week of May, this extra 10 days to 2 weeks or growing could have an impact on not the overall yield, but the overall size of roots harvested in the fall. Producing slips locally would or could allow growers to plant their slips earlier and take advantage of an early spring. They could also spread the workload of planting over several days without losing quality because they could cut their slips as they go and plant instead of having them all arrive at the same time and be planted immediately. The same argument can be made for poor planting conditions – if the weather is not cooperating for planting, slips can be just left in the beds and cut when conditions improve. For growers looking to source slips, having a local slip producer within a couple of hours of driving would be cheaper in the long run and improve the quality of the slips.



There is also still a looming question about the value of using black plastic mulches compared to bare ground sweet potato production. Many growers use black plastic mulches to produce their sweet potatoes however, there are still a number of growers that do not use mulches and plant their sweet potatoes on bare ground. There is no clear evidence, only personal observations as to which way results in the highest yield and marketable roots. Comparing the two production techniques side by side allowed us to qualify and quantify the differences between the two different systems and help us educate growers as to which way may result in the best production of sweet potatoes.

Photo 1: Bedding bins laid over the top of AgriTape heating mats and foam insulation before filling.

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Methods:

Trial 1 - Slip Production Sweet potato seed stock roots of Covington (orange skin, orange flesh) and Murasaki (reddish purple skin, white flesh) arrived at the Hudson Valley Farm Hub on March 23, 2022 from Jones Farm, located in Baily, North Carolina. On March 30th, AgriTape Heat mats that were placed on top of a sheet of 1" insulating foam board in the designated area of the HVFH greenhouse. The idea of the insulation was to try and keep the heat from the heat mats to move upward and not down through the bottom of the bench. On top of the heat mats and insulation, two shallow 6" high x 2' wide x 8' long wooden bins were placed on top (Photo 1) and 1-2 inches of potting soil was placed on the bottom of the bins. At the same, 2 more bins were placed on the bench without heating mats or insulation and filled with the same potting mix. Covington and Murasaki roots were each placed in one heated and one unheated bin (Table 1, Photos 2 & 3). Bins were topped off with potting mix and watered well. Heat mats were plugged in, set at 85 degrees Fahrenheit, and turned on.

Table 1: Number and weight of sweet potato roots used for bedding.

Variety	Number of Roots	Weight of Roots (pounds)
Covington - heated	254	53.8
Covington - unheated	250	53.6
Murasaki - heated	155	75.0
Murasaki – unheated	141	72.7



Photos 2 & 3: Sweet potato roots laid in the bins and ready to cover.



Photos 4 & 5: Bins with sweet potato slips ready to be cut (left) and cut slips ready to head to the field to be planted(right).

On May 27, 2022 our purchased slips arrived from Jones Farm, Lucama, North Carolina in very good shape. Slips had been picked up in North Carolina by a local grower and delivered to the HVFH, three days after initial cutting by

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employees of Jones Farm. On May 31, 2022, 4 treatments replicated 3 times, were planted in the field at the HVFH (Table 2). Covington and Murasaki slips being grown at the HVFH were cut by hand on May 31st (Photos 4 & 5) and delivered to the field along with the Jones slips and planted by CCE ENYCHP staff into raised beds that were mulched with plastic and drip irrigation tape or raised ridges, typically used by HVFH to plant various crops including sweet potatoes. Field preparation including all tillage, fertility and plot preparation was completed by HVFH staff. The plastic mulched beds were approximately 4-6" tall and 30" wide on 6.5' center spacing with two rows of slips were planted in a double staggered row 12" apart. The bare ground ridges were 12" high, 4" wide on top and on 30" centers, with one row planted on each ridge with 12" between plants. To keep plant numbers consistent, all bare ground plots were 2 ridges x 10' for a total of 20 plants per plot. Mulched beds were also 10' long for a total of 20 plants per plant as well. It was a bright sunny day and the high temperature for this day was 91 degrees Fahrenheit with an average of 81 degrees, followed by a week of sunny weather and average temperatures in the upper 70's. Overhead irrigation was applied the following day to cool the beds and ensure good conditions for plant survival. HVFH staff used straw to mulch between the rows of plastic for weed control. Ridges were cultivated during the season for weed control and all plots were hand weeded as needed. Irrigation was provided by HVFH staff as needed.

Table 2: Sweet potato treatments being applied in 2022 at the Hudson Valley Farm Hub.			
Variety	Slip Source	Planting Treatment	Planting Date
Covington	NY	Plastic mulch	May 31, 2022
Covington	Jones, NC	Bare ground ridge	May 31, 2022
Covington	NY	Plastic mulch	June 14, 2022
Murasaki	NY	Plastic mulch	May 31, 2022
Murasaki	Jones, NC	Bare ground ridge	May 31, 2022
Murasaki	NY	Plastic mulch	June 14, 2022

On June 14, 2022, approximately 14 days after the first cutting of slips was taken, a second cutting of Covington and Murasaki slips from the same mother plants grown in the greenhouse at the HVFH were taken and planted in the field. Plots were only planted in the plastic mulched beds and replicated 3 times. The same planting configuration and plot size was used as the first planting: double staggered row, 12" between plants with plots 10' long for a total of 20 plants.

Plant stands were recorded on June 14, 2022 for the first planting and June 21, 200 for the late planting. All plots were harvested October 7, 2022 by CCE ENYCHP. Roots were placed in harvest totes and HVFH staff placed roots with their own to be cured and stored. CCE ENYCHP staff began grading roots on December 8, 2022. Grading consisted of weighing individual roots from each plot and determined marketability according to size and quality (decay, misshaped etc.). Once graded and data collected, roots were categorized into 3 marketable size grades: **'Fingerling' = less than ¾ of a pound; 'Large' = ¾ to 1.5 pounds; 'Jumbo' = roots over 1.5 pounds.**

Results and Discussion:

Slip Production: One of the main goals of this project was to determine the time it takes to produce a slip that is suitable for planting and the number of slips that can be produced per square footage of seed bedding. Unfortunately, neither one of these goals has been met in the last two years due to heating mat failures that are essential for producing slips. In reviewing literature and speaking with colleagues in Canada where they are producing a fair number of their own slips for field production, seed beds need to be maintained at soil temperatures of 80-85 degrees Fahrenheit to produce strong, healthy slips. Even though we purchased heating mats that according to the manufacturer would work on the electrical system located at the Hudson Valley Farm Hub, they failed to provide the necessary heat. We were able to produce enough slips for what was required for the field trials albeit just barely and slips that were cut were notably shorter than what should have been available with the appropriate heating requirements.

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Locally produced slips (NY) vs. Southern purchased slips (Jones):

For me, the main goal of this project was to determine if producing local slips that can be cut and planted on the same day or a day later, can improve yield and quality of roots compared to those slips purchased from traditional southern sources. In this trial, NY produced Covington slips resulted in a statistically significant total overall yield of roots, with a 30% increase in total root weight compared to Covington slips being produced in North Carolina, purchased from Jones Farm (Table 3). Fingerling roots yields were statically significant, making up much of the 30% yield difference between locally produced slips and southern sourced slips. There was no statistical difference in Jumbo or Large root yields. However, although not statistically significant, NY slips produced an average of 23% more Large category sized roots compared to Jones roots in this trial. Although the increase in Fingerling yields may not be desirable, the 23% increase in Large roots is desirable. The Large category of roots is important because they range from $\frac{3}{4}$ of a pound to 1.5 pounds in size, which is the typical marketable root size for the industry. In the southern areas where sweet potatoes are traditionally grown, this is the size range they also prefer to obtain their 40-pound boxes that have an average root count of 50 – 60 roots per box. However, they also have an outlet for what we consider Jumbo roots or those weighing more than 1.5 pounds. These roots are sent to processing facilities that are located throughout the growing region. In New York, we do not have those types of facilities, so growers are left with no market for these roots.

The increase in Fingerling yields with NY grows slips would be desirable for those that have a market for that size, but I am also hypothesizing that potentially, some of these Fingerling roots might make a Large if we were able to extend the growing season by being able to plant a week earlier which would be another benefit of producing our own slips as stated earlier. As stated earlier, normally we do not have much ability to dictate when southern purchased slips are ready shipping, nor do we have any control over the environmental conditions when they do arrive. The slip quality can decline quite rapidly if they have to be held too long after receiving them. Producing your own slips or purchasing slips from a nearby producer would not be as impacted by shipping concerns or environment because slips could just be left to grow in the beds till conditions were better.

When it came to Murasaki, it was the opposite compared to Covington. Jones slips produced higher overall yields, but not statistically different compared to NY Murasaki. Again, NY Murasaki produced a statistically significant increase in Fingerling yields, again something that may or may not be important to some growers. However, we know that Murasaki is a longer season variety compared to Covington and being able to plant Murasaki earlier may be able to increase the number of Large roots by allowing more time for those Fingerling roots to grow and make a Large size. This work also demonstrates the difference that might happen between different varieties, and it would be my recommendation that if someone was to produce their own slips, they would need to make sure they work with the varieties they are using for the best results – in some cases, it may still be more feasible to purchase southern produced slips.

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Table 3: Total Yield, Yield by Size Category and Average Root Size for slips Planted May 31, 2022

Sweet Potato Slip Source	Plastic/ridge	Total number roots	Total root Weight (lbs)	# Fingerling	Weight Fingerling (lbs)	# Large	Weight Large (lbs)	# Jumbo	Weight Jumbo (lbs)	Average Size Fingerling (lbs)	Average Size Large (lbs)	Average Size Jumbo (lbs)
JONES Covington	Plastic	36,784	26,035.8	21,538	7,242.4	11,374	11,915.6	3,872	6,877.8	0.34	1.05	1.78
NY Covington	Plastic	48,400	32,715.8	30,976	12,603.2	14,762	15,063.7	2,662	5,049.0	0.41	1.02	1.90
JONES Covington	Ridge	35,960	12,218.3	33,930	10,284.8	2,030	1,933.5	0	0.0	0.30	0.95	0.00
NY Covington	Ridge	56,260	13,562.9	55,970	13,297.2	290	265.7	0	0.0	0.24	0.92	0.00
JONES Murasaki	Plastic	63,404	41,371.9	42,108	14,850.0	16,698	17,461.8	4,598	9,060.1	0.35	1.05	1.97
NY Murasaki	Plastic	69,212	35,245.6	53,966	19,519.4	14,762	14,842.5	484	883.8	0.36	1.01	1.83
JONES Murasaki	Ridge	60,320	31,385.8	49,300	18,227.8	8,990	9,335.6	2,030	3,822.4	0.37	1.04	1.88
NY Murasaki	Ridge	91,640	28,943.1	87,870	25,422.9	3,770	3,520.2	0	0.0	0.29	0.93	0.00

Fingerling roots = roots that were appropriately shaped and weighed between 0.30 - 0.75 pounds

Large roots = roots that were appropriately shaped and weighed between 0.75 - 1.50 pounds

Jumbo roots = roots that were appropriately shaped and weighed greater than 1.5 pounds

NY Covington and NY Murasaki were slips grown at the HVFH and cut on May 31, 2022.

Jones Covington and Jones Murasaki were slips purchased from Jones Family, Baily, North Carolina and planted May 31, 2022.

Trial 2- Plastic Mulch vs. Bare Ground Ridges:

As noted earlier, there has been no clear work in our region to determine if using plastic mulches has any benefits in producing sweet potatoes compared to bare ground. In my travels I've had growers tell me that they didn't feel there was any difference and have just continued with bare ground. For this trial, we saw a significant difference in overall yields of both Covington and Murasaki varieties. There was an increase in Fingerling, Large and Jumbo roots (Table 3). Yields of Covington in plastic mulch were 57% higher compared to bare ground with most of that an increase in Large roots. Murasaki had a significant increase in overall yields of 22%, the majority of that in the Jumbo root category compared to bare ground.

Table 4: Total Yield, Yield by Size Category and Average Root Size for Second Slip Cutting Planted June 14, 2022.

Sweet Potato Slip Source	Plastic/ridge	Total number roots	Total root Weight (lbs)	# Fingerling	Weight Fingerling (lbs)	# Large	Weight Large (lbs)	# Jumbo	Weight Jumbo (lbs)	Average Size Fingerling (lbs)	Average Size Large (lbs)	Average Size Jumbo (lbs)
NY LATE Covington	Plastic	16,214	6,074.5	14,762	4,517.0	1,452	1,557.5	0	0.0	0.31	1.07	0.00
NY LATE Murasaki	Plastic	27,588	13,216.2	22,506	7,451.4	4,356	4,392.2	726	1,372.6	0.33	1.01	1.89

Fingerling roots = roots that were appropriately shaped and weighed between 0.30 - 0.75 pounds

Large roots = roots that were appropriately shaped and weighed between 0.75 - 1.50 pounds

Jumbo roots = roots that were appropriately shaped and weighed greater than 1.5 pounds

NY Late Covington and NY Late Murasaki were slips grown at the HVFH and cut on June 14, 2022.

Conclusions:

Though more work needs to be done, especially in proving the concept of producing locally grown slips, this work has demonstrated that yield and quality wise, it would be worth producing your own slips, especially Covington planted in raised beds with black plastic mulch. More work needs to be completed on the cost of producing those slips and the associated costs that go along with growing them on plastic mulch. This would include the cost of the plastic, labor of laying the plastic, planting costs, laying of mulches between the rows compared to cultivating, a common practice in organic production or the use of herbicides between the rows with conventional growers. There are also the increased costs of labor for plastic retrieval and disposal fees. However, there may be a reduction in labor for weeding, better efficacy of water/irrigation and the increased yields by growing on plastic should exceed the costs of these additional inputs.

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Second Cutting and Late Planting on NY Grown Slips

Planting time is crucial in sweet potato production, especially here in northern US where our season is shorter compared to southern sweet potato growing regions. To make local slip production possible in eastern NY, I felt that it was important to determine if we could take a second cutting from the slips that we are producing approximately 2 weeks later (June 14, 2022). For this trial, we were able to take a second cutting two weeks after the initial cutting and plant them into plastic mulch treatments. However, a June 14th planting, at least in 2022, was too late to produce what I would consider a marketable harvest, apart from Murasaki, which had much higher yields compared to Covington. Covington failed to produce what I would consider an economical yield or Large roots whereas Murasaki produced 3 times the number of Large roots and also produced Jumbo roots which Covington failed to do. However, the number of Fingerlings for both varieties was unacceptable unless the grower has a market for that size category. However, with that said, if we were able to plant our first planting a week earlier, that would allow us to plant a second planting the first week in June, which for many growers is standard planting time, which might result in a longer growing season for this second planting, increasing the number of Large roots, especially for Covington. However, at this time I would not recommend a second cutting until more research and data can be collected.

Table 4: Total Yield, Yield by Size Category and Average Root Size for Second Slip Cutting Planted June 14, 2022.

Sweet Potato Slip Source	Plastic/ridge	Total number roots	Total root Weight (lbs)	# Fingerling	Weight Fingerling (lbs)	# Large	Weight Large (lbs)	# Jumbo	Weight Jumbo (lbs)	Average Size Fingerling (lbs)	Average Size Large (lbs)	Average Size Jumbo (lbs)
NY LATE Covington	Plastic	16,214	6,074.5	14,762	4,517.0	1,452	1,557.5	0	0.0	0.31	1.07	0.00
NY LATE Murasaki	Plastic	27,588	13,216.2	22,506	7,451.4	4,356	4,392.2	726	1,372.6	0.33	1.01	1.89



Treatment: NY Late Planted Murasaki



Treatment: NY Late Planted Covington

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Final Thoughts

Until we can have a successful season where we are able to provide the right conditions for producing our own slips, ie: finding either the right heating mats that can be used on GFI outlets or building a different system utilizing a hot water tubing system, it is difficult to determine what the slip production levels can be. However, as indicated by this research, the use of locally produced slips does have the potential to produce higher yields compared to southern grown purchased slips. The flexibility that producing one's own slips provides is also very important and can influence what happens in the field in terms of planting and possibly the implementation of a second planting that could be also valuable. It is quite evident from this research that the use of plastic mulches does increase the overall yield of sweet potatoes, but more importantly, the yield of Large roots which is the category of that holds the highest value in the market place.



Treatment: Jones Covington, Ridge



Treatment: NY Covington, Ridge



Treatment: Jones Murasaki, Ridge



Treatment: NY Murasaki, Ridge

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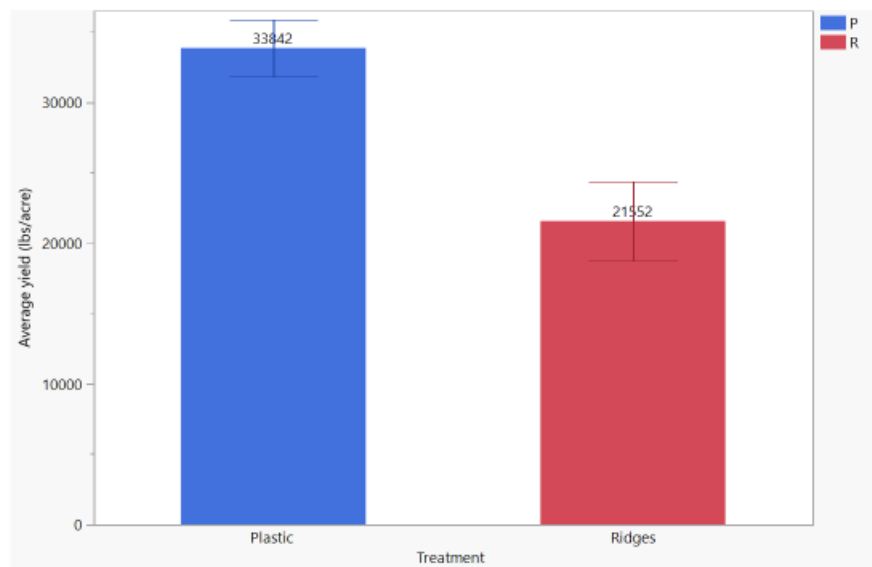


Treatment: Jones Murasaki, Plastic



Treatment: NY Murasaki, Plastic

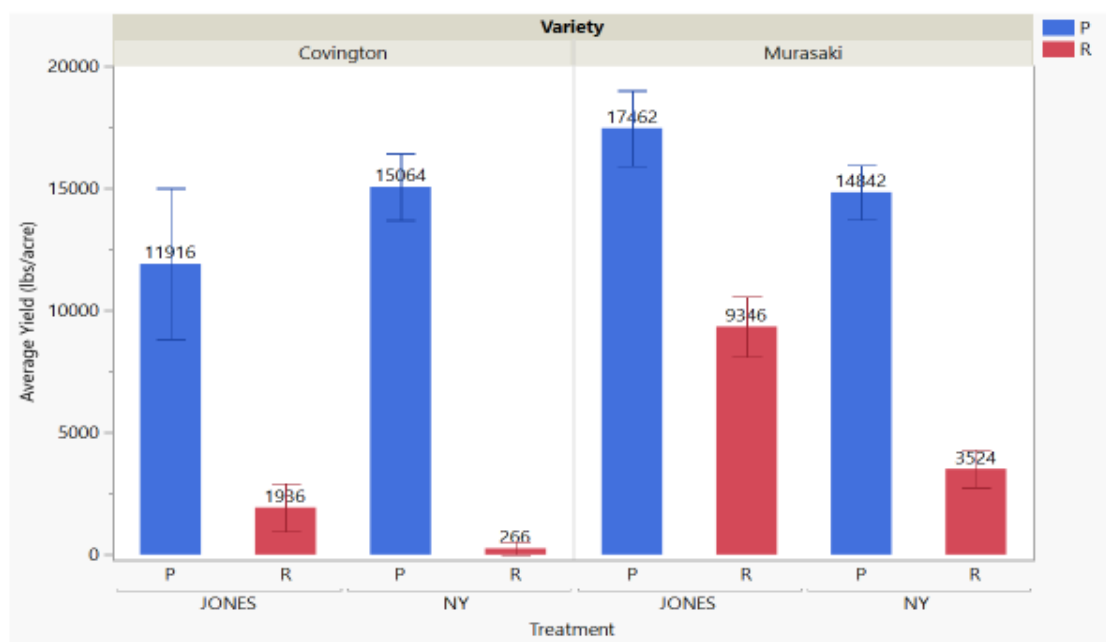
Average Sweet Potato Yield by Plastic or Bare Ground Ridges



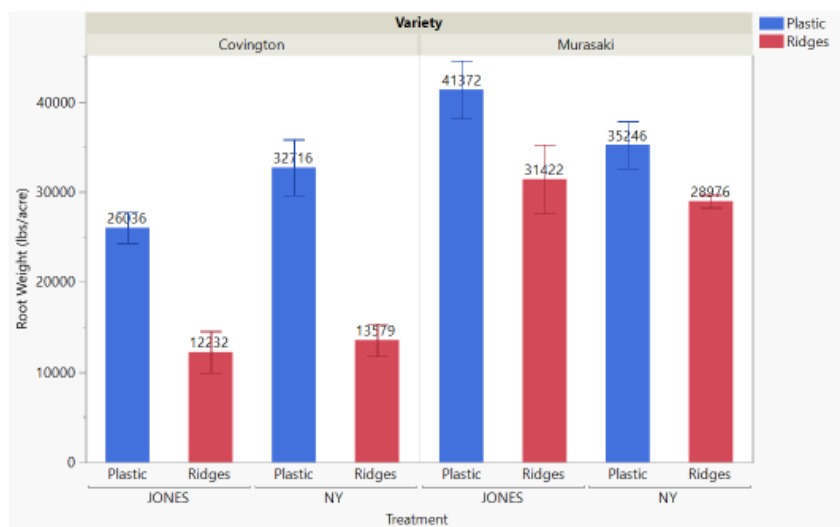
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Average Yield of Large Sweet Potatoes Grown on Plastic or Bare Ground Ridges, Slip Source and Variety



Average Sweet Potato Yield by Variety, Slip Source, and Production System



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Average Sweet Potato Yield by Size Class

