

RESEARCH REPORT

In search of short season northern sweet potatoes: Variety trials of new sweet potato (*Ipomoea batatas*) crosses

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IN A NUTSHELL

To identify the best performing crosses of sweet potato for organic farming systems in the Ottawa area, Kate, Erin and Lise-Anne compared nine new crosses of sweet potato and one check variety (Covington) in a replicated and randomized trial across three farms.

- They identified three varieties that they think are definitely worth continuing to grow and observe, and another two “runner-up” crosses that are also promising.

MOTIVATION

In the past ten years, sweet potato consumption in Canada has doubled (reference 1). As demand for sweet potatoes grows, Kate Garvie and her mentor Telsing Andrews have been working to create sweet potato varieties that are adapted to the climate and environment of southeastern Ontario. In 2019, Kate grew out 59 genetically unique and diverse sweet potato tubers and evaluated them for their ability to perform well in low input, organic systems in southeastern Ontario and their taste. From the ones that ranked highest, she wanted to see which ones performed best across three farms in the Ottawa region.

DESIGN

Criteria for inclusion in the trial
In February 2020, Kate and her friends taste tested the 59 crosses that she grew in 2019. All testers rated the tubers on sweetness, fibrousness, appearance, and overall

impression, and also noted general comments. Using the 2019 field data and taste test results, Kate chose the top 12 crosses for slipping and then used the top 9 slip producers as the crosses for this trial.

Slip production

In mid-March 2020, Kate grew slips for all three farms using the top 9 crosses (SP1-SP9) as well as a commercially available check variety. The check slips were from Covington sweet potatoes that Kate purchased from Jambican Studio Gardens, who had ordered slips the year before from the United States. Kate aimed to have 10 slips of each cross for all three farms, and a few random slips to use as buffers at the ends of rows.

Kate delivered the slips to the other farms mid-May, so that all farmers could plant them out in late May. All farmers chose to plant under clear plastic with drip tape laid underneath, and on average had 3 plants of each cross per replicate.



Photos 1. Sweet Potatoes growing on clear plastic with three drip lines at BeetBox Cooperative Farm in late June heatwave.

DESIGN

To identify the best performing of the 9 crosses, they set-up a randomized complete block design with 2 replicates on each farm, as shown in **Figure 1**.

At the beginning of September, the farmers raced the frost and dug up each of the replicate rows for observation and data collection. For each cross and replicate, they recorded ease of harvest, skin



Buffer	Buffer
SP8	SP5
SP2	SP7
SP3	SP4
SP9	SP2
SP6	SP10
SP5	SP8
SP4	SP1
SP7	SP3
SP1	SP6
SP10	SP9
Buffer	Buffer

Figure 1. Experimental design for sweet potato variety trial on three farms. Kate, Lise-Anne and Erin each grew two replicate rows and randomly assigned each cross to each row with buffers of 2-3 slips of other varieties at the ends of the rows.

colour, tuber shape, relative tuber size, number of tubers, cracking, and skin smoothness.

Five of the best tubers from each plot were set aside for using as slips for next year and for tasting in the winter. In February 2021, the farmers will taste the sweet potatoes and assess storage quality.

FINDINGS

All farms were able to observe each of the ten crosses throughout the season and recorded similar observations for the 10 crosses. They believe any discrepancies in observations might be due to interpretation of the question or different cultural practices.

They observed that the check variety had smooth tubers with no cracking and a large number of marketable tubers per plant, but farmers rated it lower compared to the trial crosses and one farmer would not grow this variety again (Table 1).

SP2, SP5 and SP9 were varieties that all farmers said that they'd like to grow again. SP9, a red-pink sweet potato with light orange flesh was the only one of those three that had significantly more tubers than the rest (Table 1). SP2 and SP5 did not have a large number of tubers but produced large sized tubers - including one that was 6 lbs! SP3, though it was highly rated in the taste test, was one that no farmer would grow again.

All three of the top crosses are beige or pink with some variant of orange or peach flesh. None of the purple varieties were highly ranked. Whether these preferences are cultural - given that all three farmers grew up eating beige or pink sweet potatoes with orange flesh and not purple - or is because orange sweet potatoes have genetics that are better suited to growing in our northern climate, is not clear from this study.



Photos 2. Kate holding the biggest sweet potato from the trial, which she grew from SP5 at Heartbeet Farm.



Photos 3. SP2 had large tubers with dark eyes.

SP4 and SP8 both had many flowers and produced seeds which can be used for future breeding, however, these two crosses were both purple flesh crosses that were less desirable by the three farmers. Two seed pods were found on SP2, none on SP5 and one on SP9. These might have crossed with the many flowers of the purple varieties and could produce interesting future breeding material.

For the average number of tubers per plant, we performed an analysis of variance (ANOVA) with a 95% confidence level to calculate the least significant difference (LSD) needed to see among crosses in order to call them "statistically different". Using this approach, they needed to observe a difference of 3.4 tubers per plant among crosses.



TAKE HOME MESSAGE

Based on all three farmers' evaluations, **SP2**, **SP5** and **SP9** are crosses that these farmers think are worthy of bulking up and continuing to observe. Based on two farmers' evaluations, **SP6** and **SP7** are also worth continuing.

NEXT STEPS

All three farmers may not have access to land next year and thus need to pause their farming operations. Due to this, they hope that others will take on the work of growing at least the top three varieties (SP2, 5, 9), as sweet potatoes need to be grown each year in order to preserve the genetics.

Sweet potatoes are grown from slips such that they are genetically identical to the previous year's crop and, therefore, do not adapt in the same way as cross pollinating crops. For this reason, it would also be interesting to know how environmental conditions and cultural practices affect the appearance (cracking, tuber size) and tuber habit (compact vs dispersed) of the crosses.

Table 1 continued on pages 4-5.



Photos 4. Harvesting sweet potato variety trial plots at Highland Gem Farm.



Photos 6. Some of the 59 unique sweet potato varieties that were evaluated at the taste testing event in February 2020.



Photos 5. Sweet potatoes roasting in the oven for the taste test in February 2020.



Photos 7. The sweet potato taste testing crew.

ACKNOWLEDGEMENTS

We thank Telsing Andrews for starting this process and for her guidance along the way. Lise-Anne and Erin both express gratitude to Kate for continuing to steward this work and for bringing them into the process.

REFERENCES

1. Primomo, V. and D. Pearson, 2020. Sweet Potato Slip Production in Canadian Greenhouses. <https://www.vinelandresearch.com/wp-content/uploads/2020/02/Canadian-sweet-potato-slip-production-manual.pdf>.



Table 1. Findings from the sweet potato trials of 9 crosses and one check. Bolded numbers denote crosses with significantly more tubers per plant compared to non-bolded crosses.

Variety Code	Ease of harvest - Compact (C) Dispersed (D)	Mean # of Tubers per plant	Relative Tuber size - Small Medium Large	Tuber shape Round (R) Roundelongate (RE) Elongate (E)	Cracks (Many Few None)	Skin Smoothness (Smooth Medium Rough)	Flesh	Skin colour	Farmer Overall Rating	Tasting highlights quotes	Taste ratings described	Notes from last year's field data
SP1	C-D (large in middle, smaller dispersed)	12	Small and Large	RE	None	Smooth-Medium (eyes are prominent - white eyes)	Cream	Red - Pink	One farmer would grow this again and gave it their highest rating, but said "Most productive but lumpy" Others said. "very lumpy"	Floury, Dry, Love the Shape	Average sweetness and fibrousness, with low appearance and overall rating	Kate liked this one in the field last year. described as hot pink skin colour with white flesh.
SP2	C	7	Small, Medium, and Large (1 HUGE)	RE	Few	Medium (eyes are prominent)	Light Orange	Beige with dark eyes	All farmers would grow again. One farmer said she loved this one but it's not the most attractive. Nice compact, large tubers	Good colour and texture and flavour, soft and moist, very sweet	Sweet, low fibrousness, good appearance and overall rating (4.4 / 5)	Kate liked this one in the field last year; lots of marketable tubers.
SP3	C-D (some tangling)	12	Small and Medium	RE	None	Smooth	Cream	Red-Dark Pink	No farmers would grow again	This is a great one, so good, mmm!	Medium -high sweetness, low fibrousness, average appearance, with overall rating of 4.25 / 5	
SP4	D	12	Small and Medium (a couple large)	E	Few	Medium (Rusty eyes)	Purple with white rings	Purple	One farmer would grow again but gave it a medium overall ranking (3/5)	Love the colour!, Earthy- Beet-like, Very moist.	Medium sweetness, low fibrousness, appealing, with overall rating of 4/5	Kate liked this variety last year in the field.
SP5	C-D	8	Small and Large (HUGE - 6lbs!)	RE	None	Medium	Peach	Light Red/ Pink / Light Pink/ Yellow/ White	All farmers would grow again. Good productivity and growing habit. Huge tubers, nice colouring but not smooth	Kinda starchy, nice taste, like yucca. not too sweet or bitter.	Medium sweetness, low fibrousness, medium appearance and overall rating (3.75 / 5)	Kate liked this variety last year in the field. Good number of marketable tubers.

Table 1 continued on page 5.



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SP6	C (easy harvest)-D	11	Medium	E - RE	Few	Rough - Smooth	Cream	Red-Dark Pink	Two farmers would grow again. Really nice colouring	Strachy, like a potato, very smooth	Medium sweetness, low fibrousness, medium appearance and overall rating (3.5 / 5)	Good number of round, medium sized marketable tubers last year. Pink-Orange skin with white flesh
SP7	C-D (large in middle, smaller dispersed)	10	Small and Large	RE	Few (Many on one plant)	Medium -Smooth	Cream	Red/ Light Pink/Pale White	Two farmers said they would grow this variety again. Variety in size but compact growing is ideal	So good! Perfect taste/ texture, I love this one!	Just over medium sweetness, low fibrousness, great appearance and overall rating (4.4/ 5)	Kate liked this variety last year in the field.
SP8	C-D	6	Small	E	None	Medium -Smooth (a bit of veining)	Purple w/ white speckles	Purple	One farmer would grow again but others thought it was small and thin.	Beautiful colour, strachy, drier, balsamic flavour	Semi sweet and semi fibrousness, great appearance but medium overall rating	
SP9	C	12	Small and Large	RE	Few, Many	Rough Medium	Light Orange	Pink-Red	All Farmers would grow again. Would give 5 if there wasn't so much cracking. Productive, but Cracking on skin of larger ones made them not marketable	Yum! Love the colour! Moist! Just Great!	Pretty sweet (4) low fibrousness, very appealing appearance	
SP10	C	7	Medium and Large	RE	Few, None	Smooth	Orange	Red,Pink, Orangey Brown	Two farmers would grow again. No huge tubers but very smooth and uniform	n/a	n/a	n/a