

PROJECT REPORT: POTATO VARIETY EVALUATION FOR STARCH PURPOSES

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Genesis Crop Systems Inc (GCS) was engaged by the PEI Potato Board to implement a potato variety trial to evaluate the potential of 11 potato varieties currently under production in PEI as well as several new, novel varieties currently in development with several potato variety development companies for their potential to provide high yielding production of raw product for the potato starch market.

Several prospective starch companies have visited PEI in recent years and expressed interest in operating such a factory here. Speculation regarding real cost of potato raw product and lack of precise information on anticipated vs real raw product cost may have been one factor in their decision not to locate a facility here.

The major objective of this trial was to evaluate a number of known and new novel potato varieties that would allow for development of a better understanding of the real costs associated with producing potatoes for starch under PEI conditions **or, how many pounds per acre of potato starch can we produce here, and at what cost?**

Methodology:

Land and plot management services were provided by Kyle Murray Farms, Augustine Cove PEI. The site was located in a section of a forage field that would be representative of an industry accepted three year crop rotation sequence.

1.5 -10 oz Elite 2 or Elite 3 seed of the candidate varieties was collected from several Island seed producers in late May and held at GCS until planting.

The cooperating grower prepared the area for planting with primary tillage and row construction that included application of in furrow insecticide, fungicide & base fertilizer with a 6 Row Spudnik potato planter.

On June 1st and 2nd, 2.25 - 3.0 oz. hand-cut seed pieces of each candidate variety were hand planted at the predetermined in row spacing interval for the respective plot in single row 15 ft plots with seed of two red skinned plant varieties placed between each plot. The red potatoes were placed to facilitate ease for subsequent mechanical harvest with a one row plot harvester. Base fertilizer for all plots was 1100 lbs/acre 13-19-13-2Mg-0.2B + 1L Zn per acre placed in 2x2 bands either sides of the seed piece with the planter. A Randomized Complete Block Design was used; most treatments replicated three times. A small number of plots contained additional plant populations for some varieties that had one – two replications. A complete plot plan is presented in Appendix 1 under the plot plan tab.

Additional Nitrogen fertilizer was applied to a number of plots to attain industry acceptable rates for the particular variety on July 14 shortly before full row closure (Fig 1). Ammonium Nitrate was hand applied over the row and directly cultivated in with the cooperating growers hilling equipment.



Figure 1: PEI Potato Starch Trial on July 24, 2015 at Full Row Closure

All in season weed, insect and disease control applications were applied using locally acceptable best management practices (BMPs) for potato production in PEI.

Plots were generally allowed to senesce naturally, but a light dose of Reglone top desiccant was applied to the entire trial October 16.

All plots were harvested with a small plot potato harvester on October 25; 125 days after planting (Fig 2). All material was placed in a secure storage facility for subsequent tuber evaluation.



Figure 2: Plot harvest - 2015 PEI Potato Starch Trial

All plot materials were evaluated for size, yield and tuber count Nov 28 – Dec 1. Tubers were sized into the following categories: 1 oz – 2" dia, 2" – 10 oz, 10 oz – 16 oz and >16 oz. Tuber number and size was recorded for each plot. Ten pound composite subsamples were collected from each nitrogen rate for each variety. The samples were evaluated for tuber specific gravity values. Further, a 2-3 lb subsample of each of these composites was submitted to Central Testing Laboratory, Winnipeg, MB for starch content evaluation.

Tuber samples of several other varieties that could not be included in this trial were added to the material for specific gravity and starch evaluation. Yield data from these additional varieties as compared to Russet Burbank was provided as well to offer relative yield potential from the respective sources.

Results:

All tuber yield data is presented in the tuber yield tab in Appendix 1. None of the data has been subjected to statistical analysis. Any reference made to observed differences in values should be considered as numerical only until statistical review is conducted. Known varieties performed as expected and showed various levels of foliar senescence as harvest season approached (see Fig 3).



Figure 3: Variation in plot senescence; PEI Potato Variety Starch Trial
Photo taken Sept 8, 2015 – 98 days after planting

Large differences in total tuber yields were evident between varieties and between various plant populations within varieties. Most previous PEI variety evaluations have normally placed varieties in one plant population position based on the sponsors' best estimate of where the variety might perform for a specific market and limited nitrogen application to one rate for the entire trial. Data from this trial suggests that large changes in tuber yields (ie. a 90 cwt difference from lowest to highest in Atlantic; 78 cwt in Ranger Russet) may be possible based on meeting the optimum plant population for the candidate variety and end use.

Several of the varieties presently in production in PEI produced total tuber yields greater than 450 cwt per acre. These include Atlantic, Kennebec, Marcie, Ranger Russet, Russet Burbank and Snowden. All three developmental varieties in this trial also produced quite acceptable yields: Chicago - 447, Dionne - 485 and Taurus – 452 cwt/acre, respectively.

Tuber dry matter data from Central Labs appeared quite variable even after a second evaluation. A chart providing specific gravity to tuber dry matter conversion obtained from Eugene MacLure at Agrawest in Souris, PEI was used to convert locally obtained tuber specific gravity values to tuber dry matter, and subsequently, plot starch yields for the trial. Both the CLS (in red) and the locally derived data

(highlighted in yellow) are presented in the data spreadsheet. All subsequent comments are made in reference to the locally derived data. Table 1 shows an overview of the key performance indicators from each variety that was planted at the Augustine Cove site.

Table 1: Key performance indicators of varieties evaluated for starch production. Varieties/treatments producing yields greater than 7500 lbs/acre of starch are in bold.

Variety	Seed Spacing	Yield (cwt/ac)	Specific Gravity	% DM (converted)	% Starch of DM	Starch Yield (lbs/ac)
Atlantic	6	504	1.088	21.91	78.59	8679
Atlantic	9	416	1.088	21.91	78.59	7163
Atlantic	12	414	1.088	21.91	78.59	7129
Atlantic	15	443	1.088	21.91	78.59	7628
Dakota Pearl	9	337	1.076	19.40	72.87	4764
Dakota Pearl	12	315	1.076	19.40	72.87	4453
Kennebec	6	482	1.078	19.90	72.57	6961
Kennebec	9	461	1.078	19.90	72.57	6657
Kennebec	12	435	1.078	19.90	72.57	6282
Kennebec	15	409	1.078	19.90	72.57	5907
Innovator	9	414	1.081	20.50	77.12	6545
Innovator	12	376	1.081	20.50	77.12	5944
Marcie	9	489	1.085	21.30	75.07	7819
Marcie	12	426	1.085	21.30	75.07	6812
Navan	9	480	1.086	21.50	72.73	7506
Navan	12	434	1.086	21.50	72.73	6786
Norvalley	6	444	1.077	19.60	72.96	6349
Norvalley	12	416	1.077	19.60	72.96	5949
Norvalley	15	374	1.077	19.60	72.96	5348
Shepody	6	404	1.081	20.50	70.08	5804
Shepody	9	402	1.081	20.50	70.08	5775
Shepody	12	374	1.081	20.50	70.08	5373
Shepody	15	368	1.081	20.50	70.08	5287
Ranger Russet	6	480	1.096	23.60	66.34	7515
Ranger Russet	12	491	1.096	23.60	66.34	7687
Ranger Russet	15	426	1.096	23.60	66.34	6670
Russet Burbank	6	504	1.089	22.10	70.23	7822
Russet Burbank	9	504	1.089	22.10	70.23	7822
Russet Burbank	12	458	1.089	22.10	70.23	7109
Russet Burbank	15	432	1.089	22.10	70.23	6856
Russet Burbank	18	443	1.089	22.10	70.23	7031
Snowden	9	461	1.093	23.00	69.61	7381
Snowden	12	417	1.093	23.00	69.61	6676
Chicago	12	447	1.090	22.30	68.43	6821
Dionne	12	485	1.079	20.10	73.1	7126
Taurus	12	452	1.085	21.30	70.45	6783

Tuber specific gravity values varied between 1.076 (Dakota Pearl) and 1.096 (Ranger Russet). A number of entries including Atlantic, Chicago, Marcie, Navan, Russet Burbank, Snowden and Taurus provided reasonably good specific gravity values of 1.085 and above. Kennebec and Innovator produced tubers with moderate dry matter levels. Specific gravity for promising varieties may increase if produced using 4R type fertilizer management strategies.

Starch as a percentage of dry matter varied between 78% (Atlantic) and 68% (Ranger Russet). Innovator and Marcie had starch levels >75% while Dionne, Navan, Norvalley, Russet Burbank, Shepody and Taurus had starch levels >70%.

Overall in any particular management protocol, Atlantic produced the highest quantity of starch with 8679 lbs/acre at 6 inch spacing, followed by Russet Burbank at 6 or 9 inch spacing (7822 lbs), Marcie at 9 inch spacing (7819 lbs), Ranger Russet at 12 inch spacing (7687 lbs) and Navan at 9 inch spacing (7506 lbs).

Conclusions:

Results from Year 1 of a Potato Starch Variety Trial for PEI revealed a number of valuable points. There is large variation not only in yields from different varieties, but also within varieties depending on management. Changes in plant populations in a number of varieties produced yield variations of greater than 75 cwt total tuber yield per acre.

Aside from elimination of several varieties that did not produce acceptable yields, subsequent research should include to identification of agronomic methods that would maximize starch production for existing and newer varieties planted in PEI.

Eventually, selection of varieties for this market will rely on several factors including seed cost/availability and overall fertilizer requirements. Interestingly, Russet Burbank planted at 15-18" with 205 lbs N/acre (which would represent the majority of commercial Russet Burbank acres grown for processing at present) did not produce higher yields of tubers greater than 2" than those planted at 6" or 9" with 20 lbs less N/acre, and only slightly better than the yield of those planted at 12" spacing with 185 lbs N/acre.

Subsequent research should also focus on identification of varieties that require less overall fertilizer and crop protection inputs, thus leaving less impact on the environment.

Depending on target price for raw product for potato starch production, several currently popular PEI potato varieties may serve on a temporary basis until higher yielding specialty varieties can be introduced and evaluated.

At the conclusion of this project, 3350 lbs of fresh potatoes were delivered to the Charlottetown Food Bank and Summerside Salvation Army.