# PEI POTATO YIELD VARIABILTY STUDY
# PHASE II - FINAL REPORT

**Genesis Crop Systems Inc**

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## Overview

**Genesis Crop Systems Inc was engaged by the PEI Potato Board to conduct a two year study continuing investigation of potential causes of reduced yields in PEI potato fields. This project served as a Phase II extension of a previous study initiated by the Potato Board in 2013.**

**Two commercial processing growers (MacLennan Properties and Island Holdings) served as project collaborators.**

**Yield data collection varied between years as described below. In 2016, similar to Phase I activities, field yield zones were identified using harvester mounted yield monitors.**

**Computer generated yield maps (Fig 1) were used to identify sampling points representing high and low yielding zones within the field. Following determination of overall average tuber yield in the two fields, 15 sample points each of high and low yielding areas were identified and assigned reference points A-O.**

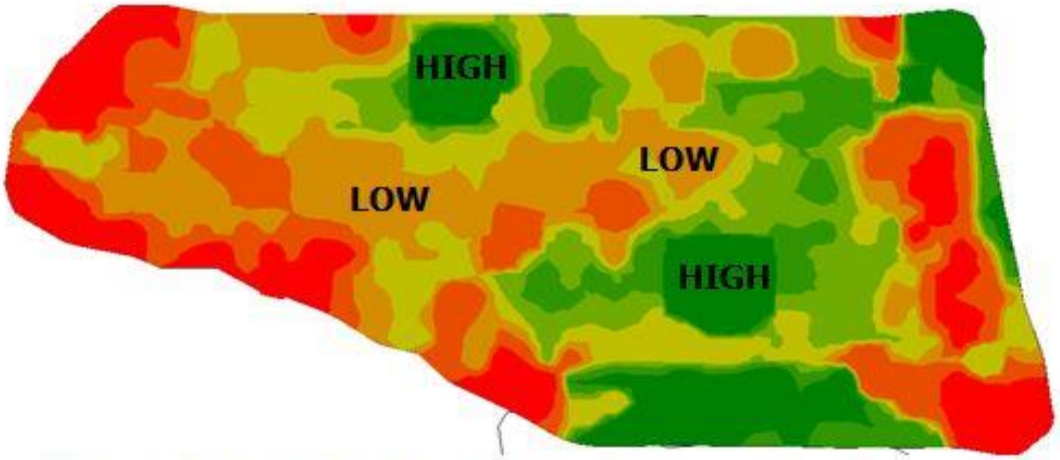


**Figure 1: Example of a potato yield map used for identifying high and low sample point location – PEI Potato Yield Variability Study 2016-2017**

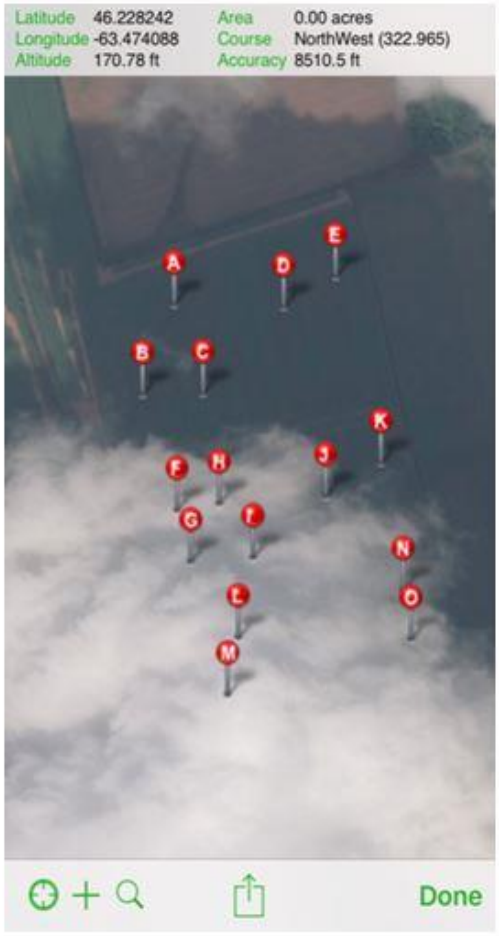


**Figure 2: Sample point location – PEI Potato Yield Variability Study 2016-2017**

**The high and low yielding points represented areas with yield values 50-100 cwt/acre higher or lower than the calculated average value for the field.**

**The GPS coordinates representing these locations were subsequently entered into an Agriplot$^{tm}$ application on an Apple iPhone 4$^{tm}$ to locate sample points in the field (Fig 2).**

**In November, following harvest of the potato crop, the following actions were performed at each sample point:**

- **Eight soil core samples were collected at 8" depth within a 30 ft radius of the sample point. Core samples were mixed in a plastic pail, divided in three sub samples and submitted to the PEI Soils Lab for the S3 soil analysis, the PEI Potato Quality Institute for Root Lesion Nematode – RLN (*Pratylenchus penetrans*) & Verticillium *spp*. identification and to the AAFC Research Station in Fredericton NB for additional testing via a project team led by Dr. Bernie Zebarth. Dr Zebarth and his colleagues performed measurements on a number of indices of soil health including parameters such as soil aggregate stability, particulate organic matter carbon (POM C) nitrogen (POM N), various N fractions, etc.**
- **Eight soil compaction measurements were collected similar to above using a Field Scout SC900 penetrometer. Measurements in psi @ 12" depth were recorded and mean values calculated providing average soil resistance values for the target depth at each site.**

Figure 3: Tools used for collection of soil samples and compaction testing – PEI Potato Yield Variability Study 2016-1017

**The project involved collection and evaluation from 60 unique sample sites in 2016 (2 cooperators x 1 fields/cooperator x 15 sample sites/field).**

**Sampling protocol changed for 2017 activities. A series of 10 ft hand harvested samples were collected from various GPS referenced points at each of the two sites. Following commercial harvest, soil samples and compaction measurements were collected as described above at a subsample of each of the above referenced points.**

**Following tuber sample evaluation for yield and quality, all soil sample and compaction data information was sorted and categorized as either high or low yielding zones for subsequent discussion purposes. Note that the numbers of samples identified and discussed from 2017 data may not be balanced and that there**

**were only eight samples from each low and high yielding area from each site submitted to PQI for RLN and *Verticillium* analyses.**

**All data was subjected to statistical analysis using the Excel simple t-test function set at 90% confidence level.**

## Results

**All raw data including a glossary of terms is presented in the accompanying Appendix 1. Impact of the various parameter values varied from field to field and from year to year. Table 1 summarizes all parameters considered to have an impact on yield at the p=90% level.**

## 2016

**2016 fields are identified as 1650/1651 and 1660/1661**

### *2016-1650/1651*

**Parameters having a higher value in the higher yielding areas of this field include % Organic Matter, ppm Iron, POM-C, POM-C/POM-N, POM C/SOC, Total N, POX-C, Organic C and Labile-N.**

**Parameters having a lower value in the higher yielding areas of this field include of ppm Boron, K2O, ppm Magnesium and ppm Sodium.**

**Although not significant, numerical values in the higher yielding areas in 1650/1651 were 20% less for RLN and 8% less for soil resistance. Note that the RLN values were well above locally established economic threshold (ET) levels established for Russet Burbank potatoes in Prence Edward Island. Both *Verticillium dahliae* (VD) values and *V. albo-atrum* (VAA) values were similar.**

**Table 1: Summary of effect of various parameters on total yield of potato – PEI Potato Yield Variability Study 2016-1017**

| Field | YR 2016 1650/1651 | | Yr 2016 1660/1661 | | YR 2017 MP | |
|---|---|---|---|---|---|---|
| | Increase Value with | Decrease Value with | Increase Value with | Decrease Value with | Increase Value with | Decrease Value with |
| Parameter | Higher Yield | Higher yield | Higher Yield | Higher yield | Higher Yield | Higher yield |
| % OM | Yes | | | | | |
| Soil Resistance | | | | Yes | | |
| ppm Al | | | Yes | | | |
| ppm B | | Yes | Yes | | | |
| ppm Cu | | | Yes | | | |
| ppm Fe | Yes | | Yes | | | |
| ppm K2O | | Yes | | | | |
| ppm Mg | | Yes | | | | |
| ppm Na | | Yes | | | | |
| ppm P2O5 | | | | | Yes | |
| ppm S | | | Yes | | | |
| ppm Zn | | | | | Yes | |
| Aggregate Stability | | | | | Yes | |
| g/kg soil POM-C | Yes | | | | | |
| POM-C/POM N | Yes | | | | | |
| POM-C/SOC | Yes | | | | | |
| g/kg soil total N | Yes | | | | | |
| POM-N/Total N | | | | Yes | | |
| mg/kg soil POX-C | Yes | | | | | |
| mg/kg soilNH4-N | | | Yes | | | |
| g/kg soil Soil organic C | Yes | | | | | |
| mg/kg soil Labile N | Yes | | Yes | | | |

## *2016-1660/1661*

**Parameters having a higher value in the higher yielding areas of this field include ppm Aluminum, ppm Boron, ppm Copper, ppm Iron, ppm Sulfur, $NH_4$-N, and Labile-N.**

**Parameters having a lower value in the higher yielding areas of this field include levels of ppm Soil Resistance and Total N.**

**Although not significant, numerical values in the higher yielding areas in 1660/1661 were 11% less for RLN and well above local ET levels. *Verticillium dahliae* (VD) values were similar; *V. albo-atrum* (VAA) values were higher.**

## 2017

**2017 fields are identified as 2017 MP and 2017 IH**

***2017-MP***

**Parameters having a higher value in the higher yielding areas of this field include ppm $P_2O_5$, ppm Zinc and Aggregate Stability.**

**No parameters were identified as having significantly lower values in the higher yielding areas at this field.**

**Although not significant, numerical values in the higher yielding areas in 2017-MP were 20% less for RLN and 11% less for soil resistance. Note that the RLN values were below local ET levels. VD were similar while VAA values were higher.**

***2017-IH***

**None of the parameters measured were considered to change significantly in areas of increasing yield in this field.**

**Although not significant, numerical values in the higher yielding areas in 2017-IH were 28% higher for RLN and 8% less for soil resistance. Note that the RLN values were well above local ET levels. VD values were similar while VAA values were higher. Soil pH values were slightly higher in the higher yielding areas of this field.**

## Conclusion

**The topic of factors influencing yield in PEI potatoes is complex. Data collected over a two year period from two commercial Russet Burbank potato fields each year provided mixed results.**

**Factors that would normally be expected to influence yield did now always do so within the confines of the sampling protocol being used. Increased soil organic matter resulted in increased yield at one site of four. There was a trend at all sites for soil resistance values to be lower in the higher yielding areas. Generally, all sites had readings above 150 psi and management practices should be implemented to help reduce these levels. Also and although not significant, an increase in soil pH was the factor measured as closest to improving yield at the 2017-IH site.**

**A number of soil health indices emerged as potential influencers of yield – labile N values were significant at two sites in 2016. Aggregate stability was a factor at one site in 2017. Ability of the soil to "manage" water in a more efficient manner should play a role as PEI tends to have more moisture stress events during recent years.**

**Overall, the biological factors – RLN and Verticillium species were quite high at all sites. Although there were no statistical differences among these parameters at either of the fields in either year, growers are encouraged to identify alternative crop rotation strategies and other management practices that might help in reducing the overall soil "load" of these organisms.**