Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

2020-21 – Semi-Annual

Activity title:
Activity 14 - Enhancement of Canadian Potato Industry through Smart Agriculture

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Activity Objectives (as per approved workplan):
The overall objective is to develop and evaluate precision agriculture (PA) practices suitable for applications in potato production areas of Canada including delineation of management zones (MZs) and variable rate application (VRA) of fertilizer, pesticides, irrigation, plant density as compared to uniform rate application on the basis of tuber yield and quality, nutrient leaching and economic benefits in the provinces of Québec and Prince-Edward Island.

Research Progress to Date:

Activity 14A Precision Agriculture in Québec:

A 10 ha field under commercial potato production (cultivar Russet Burbank) was selected in order to evaluate his potential for the nitrogen (N) fertilization experiment under PA approach. The aim was to identify areas with homogeneous characteristics (MZs), to minimize intra-zone variability and maximize inter-zone variability. Delineation of MZ was based on the elevation. Three MZs was judged optimal. Soil was sampled at 30 georeferenced sampling points (SP) to determine soil chemical parameters (pH, macro- and micronutrients extracted with Mehlich-III solution, total C and total N) (Fig. 1a). Experimental design was implemented in the field (Fig. 1b). Four treatments consisted of N rates varied from 170 to 270 kg N/ha were applied in three applications. Two times during the growing season, soil samples and many plant parameters [i.e., vegetation indices via drone images, petiole nitrate concentration] were measured at 72 georeferenced SP located in all the 16 strip treatments (Fig. 1b). On September 24, 2020, total and marketable yield (1-row X 3-m X 2 X 72= 144 yield evaluations) as well as residual soil nitrate were measured on the 72 sampling points. All laboratory analyses and statistical analysis will be completed later this winter.

Activity 14B Precision Agriculture in PEI:

Four commercial potato fields were selected across PEI to develop soil electrical conductivity (EC) based management zones (MZs). The geo-referenced surveys of topography and soil electrical conductivity were conducted in each field during May 2020. MZs were delineated for site-specific nutrient management. Three fields were used for VRA of fertilizer based on prescription maps using CAVAgri fertilizer spreader. One field was used to conduct VR planting using EC-topography based prescription map. The MZs were divided into four sections i.e., control, low -, medium- , and high productivity, as indicated by the SWAT mapping. Control sections in each field were treated as grower standard practice and compared with the VR sections, proposed by SWAT mapping. Three soil samplings were performed in each field during the growing season. Zone samplings were carried out in each zone within selected sites to reduce the number of samples, analysis cost, and improve efficiency. The soil samples were analyzed for macro and micronutrients from PEI Analytical Laboratory. The soil texture was also analyzed in each field/zone once during the growing year. The soil moisture, DualEM, NDVI, slope and soil temperature data were recorded using various sensors to examine the efficacy and spatial variations within the MZs. The

data sensors were collected four times during the growing season. The SP in each zone were georeferenced with an RTK-GPS. Tuber yield was collected in each zone using 3-m strips at selected random points within each field (6/zone) to evaluate the performance of the MZs in terms of productivity. Geo-references yield data were also collected using yield-monitoring systems in each field to overly on top of the MZs to evaluate the efficiency of the MZs in detail. The collected data is being processed using statistical, geo-statistical and GIS tools. Detailed results will be presented in the final report. The Fig. 2 below is presented as an example of the VR nutrient done during this growing season.

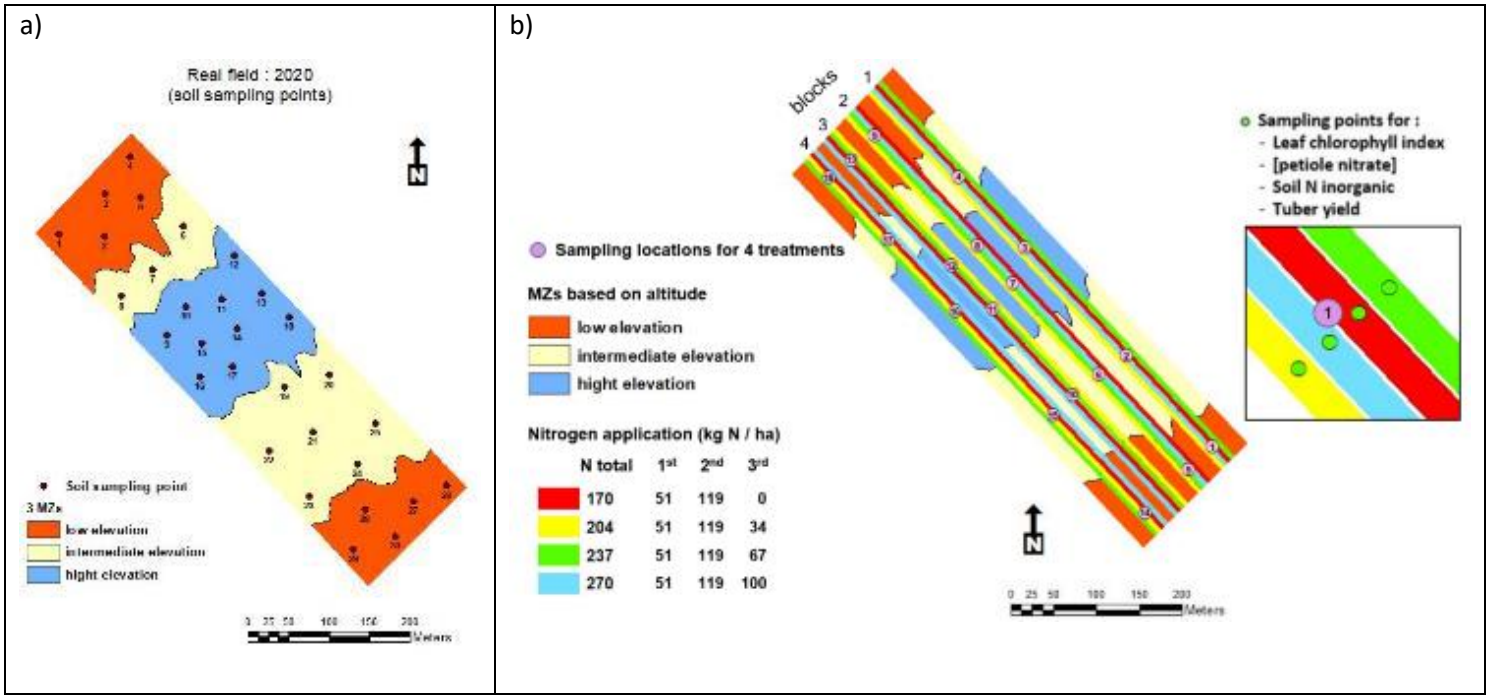

Fig. 1 : (a) MZs delineation and soil sampling points; (b) MZs and the N strip treatment design.

Fig. 2. Management zones for site-specific nutrient management and VR planting in Souris, PEI.

Extension Activities (presentations to growers, articles, poster presentations, etc.):

Cambouris, A.N., H. Ajili, K. Chokmani, I. Perron. In-Season Nitrogen fertilizer Application under Potato Crop in Delineated Soil Management Zones. Invited oral presentation done at the Webinar of the Precise Nitrogen Community hold on 8 October 2020. Virtual International Conference on Precision Agriculture webinar series organized by the International society of the Precision Agriculture. (40 participants)

COVID-19 Related Challenges:

For the Activity 14A, we received authorization to begin the project in June but so far we were able to do everything that was planned in the protocol exception of the chlorophyll meter measurements via the SPAD. Only a few peoples were authorized to go to do field work and our laboratory has been only reopened since the beginning of October. These challenges have slowdown our analysis capacities.

Key Message(s):

- Develop map/sensor-based precision agriculture systems for Québec and Atlantic Provinces Canada's potato industry based on proper characterization and quantification of variability.
- Identify sensor-based options to perform mapping and tailor management practices to reduce labor and sample analysis cost.
- Apply nutrients based on need to evaluate the productivity benefits.
- Evaluate environmental benefits of the variable rate nutrient management.
- Develop user-friendly protocols for farmers/industry use.
- Train HQP and industry personnel in the emerging area of precision agriculture.

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