Switchgrass in Québec

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Project Rationale

- Switchgrass is a promising perennial biomass energy crop native to Eastern North America.
- Increased interest in commercial switchgrass production for biofuels over the last several years has highlighted the need for:
  - locally adapted varieties
  - better understanding of factors influencing the chemical composition of the product
  - research-based strategies for producers in the event of poor first-year establishment

Objective 1

- Commercial switchgrass cultivars grown in Quebec were developed in the United States, and are adapted to more Southerly climates (Summer: South Dakota, Cave-In-Rock: Illinois)
- Genetic improvement in the form of intensive breeding selections by REAP-Canada has produced locally adapted switchgrass varieties developed specifically for use in Quebec/Ontario

Objective 1

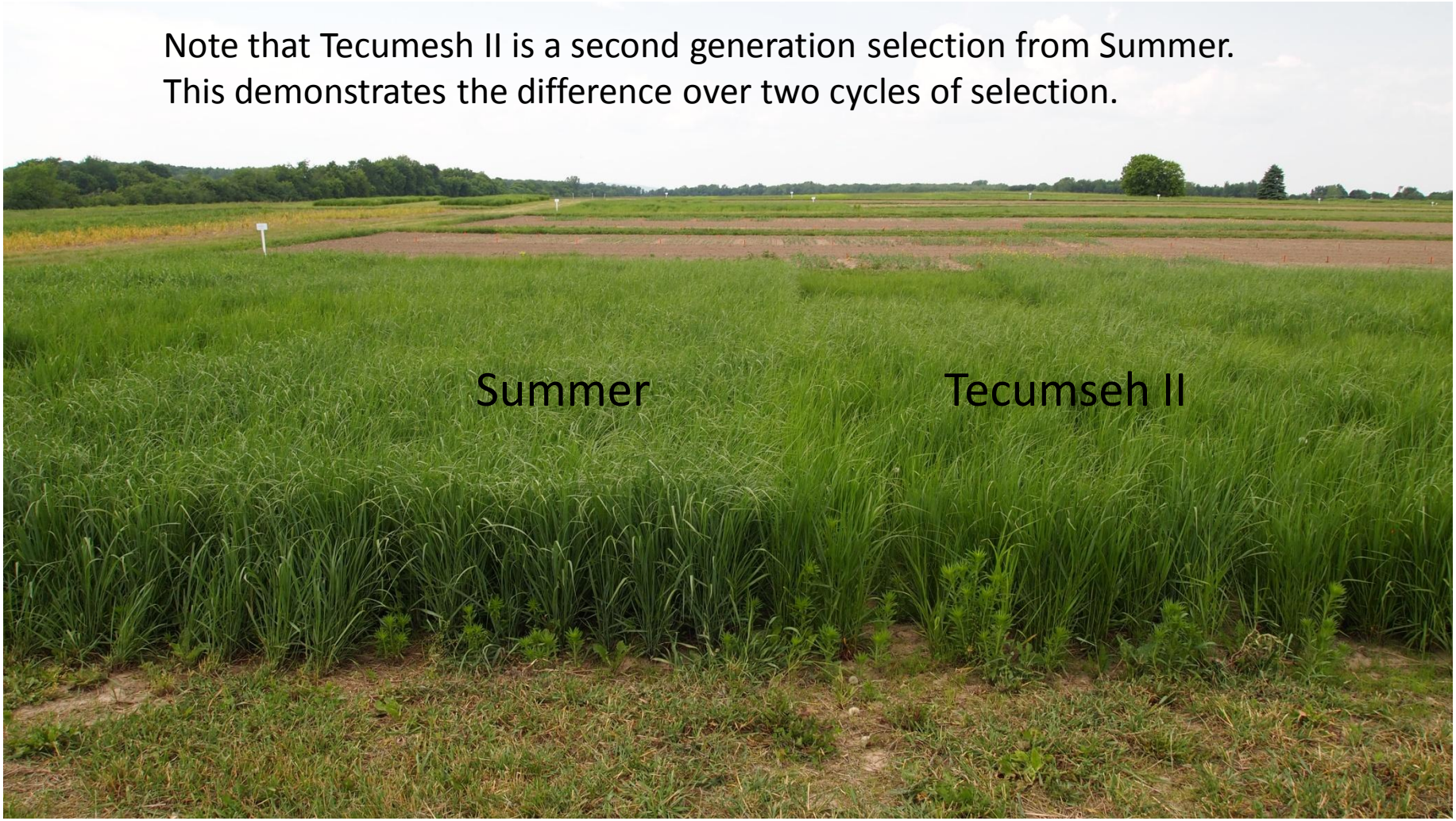
- The goal of objective 1 is to evaluate the performance of 12 new switchgrass cultivars at two sites; McGill's MacDonald campus and Lennoxville, PQ
- Traits examined include height, tiller number by area, yield, progression of phenological stages of maturity, proportion of vegetative and reproductive tillers, % ash, and elemental composition

Breeding lineages

- Sunburst → Bluejacket I → Bluejacket II
  Bluejacket I → Bluejacket Early
- Summer → Tecumesh I → Tecumseh II
- Cave-In-Rock → Cave-In-Rock II
  Cave-In-Rock → Cave-In-Rock Early
- Sandlover: Selection of NU942 from University of Oklahoma
- High Tide II: Selection for wet environments

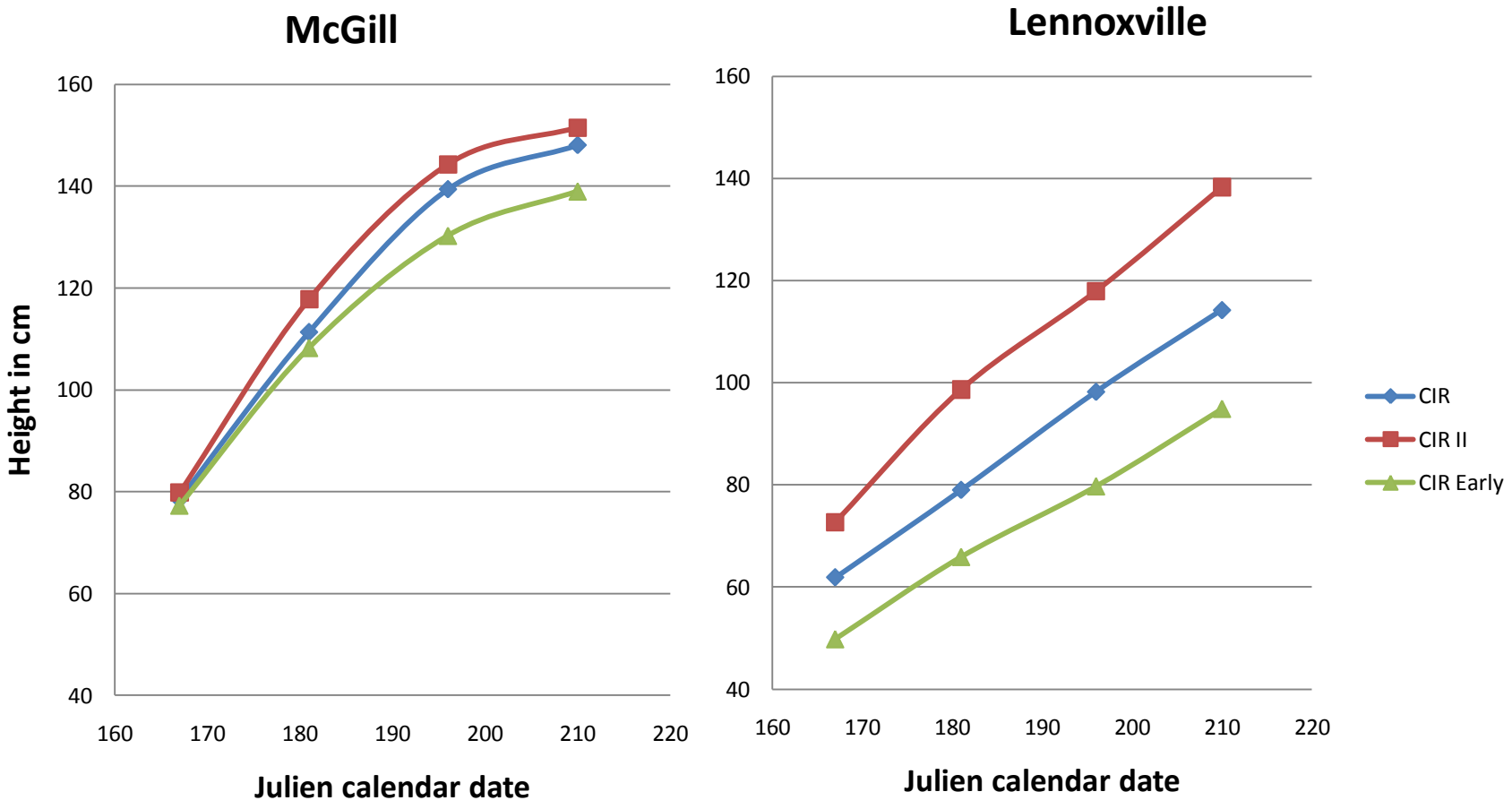
Bluejacket II

Differences between cultivars



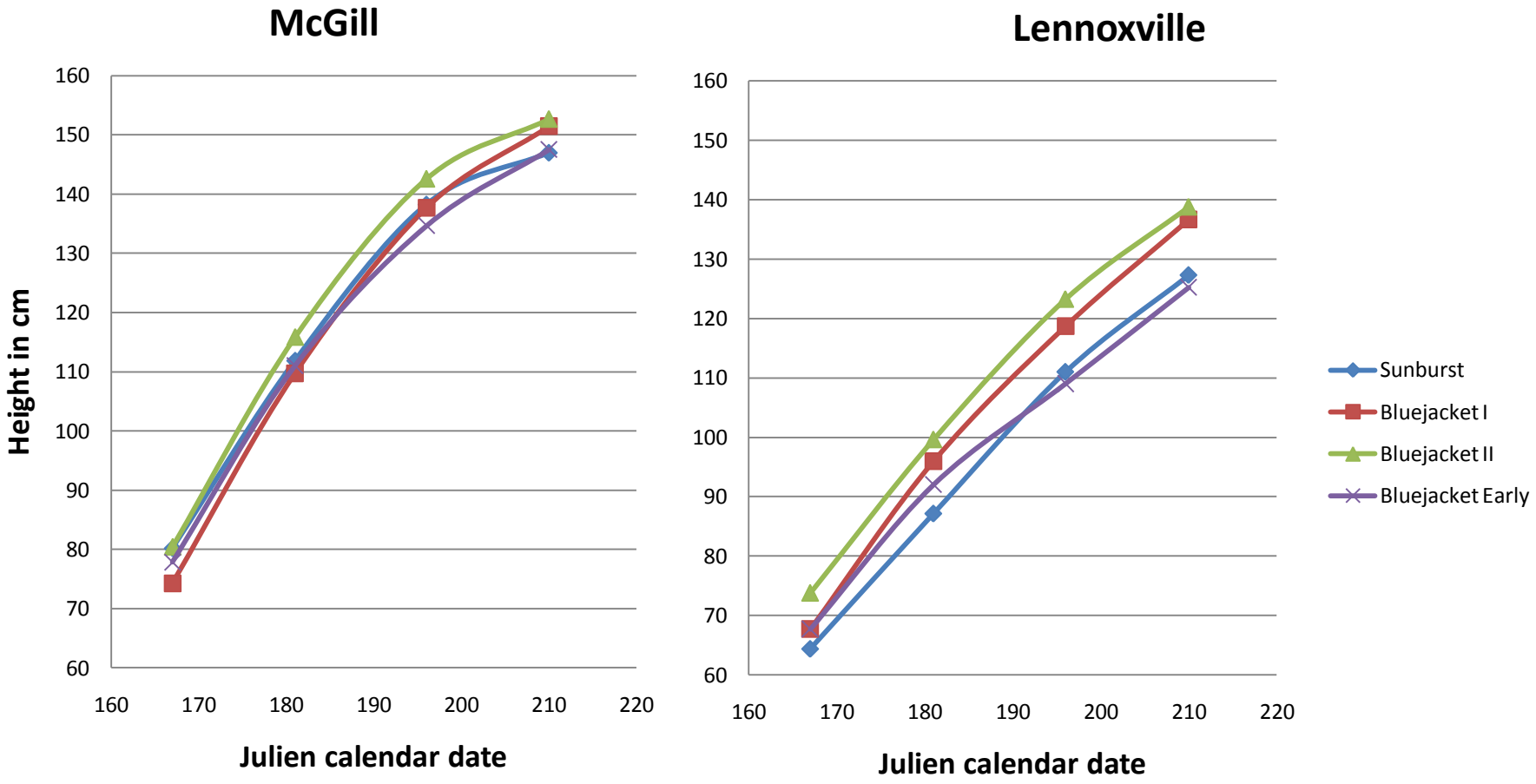
Height of Cave-in-Rock selections

Differences between sites are likely due to reduced density-related inter-plant competition at the Lennoxville site, and climatic and weed pressure differences. Trends remain consistent across sites.



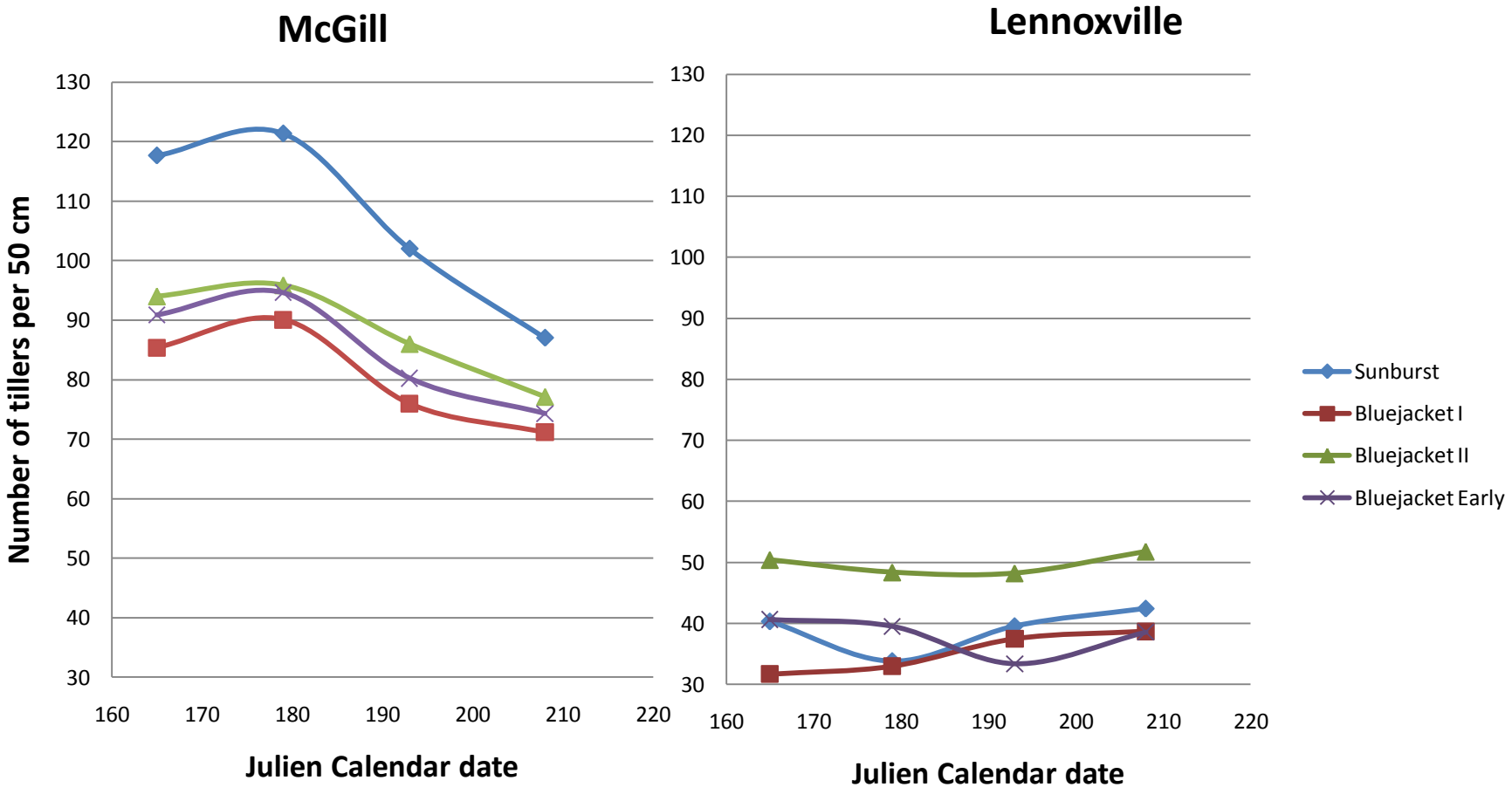
Height of Sunburst selections

As in the Cave-In-Rock selections, the second round of selection produced the highest averages. Trends remain constant across locations.



Average tiller # of Sunburst selections

Due to lower density at the Lennoxville site, tiller mortality due to inter-plant competition was not a factor. At the McGill site we see a reduction of tiller number through the breeding process. Lower tiller numbers are desirable to reduce wasted plant energy in producing many tillers which die before the end of the season.



Objective 2: Renovation Strategies

- The goal of this experiment is to evaluate strategies that producers can use in the event of poor first-year establishment, a common problem in switchgrass
- Treatments evaluated include the application of herbicides, nitrogen fertilizer, and reseeding of the affected plot
- All combinations of treatments are evaluated

Reseeding with a direct seeder

The seeder passing over the poorly established area

Furrows left by the passage of the seeder

Objective 2

- Evaluation of renovation treatments is still underway
- Preliminary results suggest that reseeding may not be an effective renovation strategy under the tested conditions

Objective 3: Correlation Between Soil and Biomass Characteristics

- Elemental composition of biomass is important for quality of combustion
- In particular, reducing the amount of ash, K, and Cl in biomass feedstock is important for improving combustion quality

Objective 3

- In this experiment the relationship between soil characteristics and the influence on yield and quality of biomass is assessed
- Sampling both soil and biomass on switchgrass fields across Southern Quebec and Ontario, we are compiling a dataset of corresponding soil and switchgrass samples

Objective 3

- All soil samples will be analyzed for elemental composition
- All biomass samples will be analyzed for elemental composition, yield, and percentages of lignin, cellulose, hemicellulose
- Using a regression analysis, we will draw correlations between soil quality and the yield and combustion quality of switchgrass

Example of data collection

- Samples from 23 sites were collected in 2011
- In 2012, at least 50 additional sites will be sampled
- GPS coordinates are kept for each site

	GPS coordinates									
Site	Latitude	Longitude	Sample	Whole Sample weight	Bag weight	Sample Weight	DM	DMY (kg)	Quadrat size	DMY (kg/ha)
Valleyfield 1a	45°16.43'	74°09.681'	1	0.86	0.03	0.83	0.95	0.79	1	7885.13
Valleyfield 1a	45°16.43'	74°09.681'	2	0.72	0.03	0.69	0.94	0.65	1	6493.58
Valleyfield 1a	45°16.43'	74°09.681'	3	0.70	0.03	0.67	0.92	0.61	1	6137.30
Valleyfield 1b	45°16.366'	74°09.548'	1	0.37	0.02	0.35	0.96	0.33	1	3320.72
Valleyfield 1b	45°16.366'	74°09.548'	2	0.47	0.02	0.45	0.93	0.42	1	4167.41
Valleyfield 1b	45°16.366'	74°09.548'	3	0.87	0.02	0.85	0.95	0.81	1	8118.05

Project Schedule

- Over winter 2011-2012 laboratory analysis will begin
- A second field season will take place in summer 2012-2013
- Data analysis and compilation of results will be completed in Spring 2013

Thanks to:

- Huguette Martel of MAPAQ and her associates François and Amélie
- Philippe Seguin
- Roger Samson for his technical support
- MAPAQ for their support

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