

Project: PEI Potato Bio-fumigation Project - Interim Report
Crop Year: 2020
Date: December 1st, 2020
Report by: Steve Watts, Genesis Crop Systems

Introduction

Genesis Crop Systems Inc (GCS) was engaged by the PEI Potato Board to implement a three year project comparing the effects of Caliente Rojo Mustard with arugula (CaIM) with Brown Mustard (BM) - Centennial variety, Annual Ryegrass (RG) and Sorghum Sudangrass hybrid (SS – two sites only) on the following parameters;

- soil health metrics as per the PEI Agriculture Soil Health Initiative
- soil chemistry metrics via the PEI Soils Lab
- presence of two of the Potato Early Dying (PED) Complex causal agents – *Pratylenchus penetrans* (RLN) and *Verticillium dahliae* (Vd)
- yield, quality and economic value of the subsequent year potato crop

Methodology

GCS arranged for three PEI commercial potato farm operations to collaborate in trial activities. These included Island Holdings – *New Annan*, MacLennan Properties – *West Cape* and Wallace Properties – *Elmsdale*.

Each farm supplied a field of approximately 30 acres in size for trial activities. The original plan was to have the fields seeded out with the CaIM, BM and RG crops in early to mid-May, with SS to be planted late June early July. Late delivery of CaIM seed prevented this from happening, so fields were seeded out in early to mid-June, approximately four weeks later than planned. A fertilizer blend was created to deliver approximately 100-125 lbs of nitrogen and 20-25 lbs of sulfur, as recommended by the CaIM seed vendor. These rates are to ensure rapid growth with lots of vegetation (fig 1) and high levels of glucosinalates, the compounds responsible for the bio-fumigation component of the CaIM application.



Fig 1: Well established crop of Caliente Mustard. Note the purple foliage of Caliente Rojo mustard mixed with Arugula to attract root lesion nematodes to the rooting zone. *PEI PED 2020*

Shortly after seeding, GCS and PEI Potato Board staff collected soil samples from GPS referenced locations in each treatment at each site. Samples were divided up and submitted for the S3 Soil Chemical Analysis and the SH1 Soil Health Analysis at the PEI Analytical Laboratories, and nematode testing at the PEI Potato Quality Institute, and *V. dahliae* testing at the ACS Lab in Fredericton, NB.



Fig 2: Crop stage at early pod development; ready for flail mowing & incorporation. PEI PED 2020

Crop growth was monitored weekly and the CalM and BM crops were flail mowed just at time of immature pod development (fig 2), incorporated and packed in order to attain sufficient soil sealing so that the mustard gasses could present to the soil environment – figs 3,4.



Fig 3: Flail mowing Caliente Rojo mustard at WP site. PEI PED 2020



Fig 4: Incorporating and packing Caliente Rojo mustard immediately after mowing. PEI PED 2020

Fields were left to fallow for at least a two-week period following the bio-fumigation and then reseeded with SS in early August. Although most areas were dry at this time, the SS established relatively well and provided good growth right through to freeze up – fig 5.



Fig 5: Reseeded Sudan Sorghum August 18 PEI PED 2020

Results:

Soil chemistry, health and RLN/Vd data are summarized in table 1. Raw data is provided in appendices 1-3. This data was collected to serve as “baseline” data to compare with samples before potatoes are planted in 2021.

Generally, characteristics of the fields under investigation are reflective of many fields commonly used for commercial potato production in PEI. Note that lime and/or commercial/organic fertilizers will be added to each field to support 2021 potato production.

The series of testing reported above will be repeated in spring 2021 prior to planting. Various aspects of potato crop performance will be monitored during the growing period. Replicated strip samples will be collected from each treatment at each site to identify potential impacts on crop yield, quality and economic value.

The protocol discussed above will be repeated at a new series of sites in 2021, allowing for two full years of potato production measurements.

Table 1: Summary of pre-fumigation soil health measurements at three PEI bio-fumigation sites

	Organic	Active	Soil	Aggregate	Bio N	Soil	RLN	VW
Site	Matter	Carbon	Respiration	Stability	Availability	pH	dry soil	cells/g soil
IH CalM	H	L+	L+	M	H	5.4	1719	18331
IH BM	L+	L	L	L+	L+	5.5	3293	6271
IH RG	L+	L	L	M	L+	5.7	3100	13393
MP CalM	L+	L	L	L+	L	6.4	3615	12228
MP RG	L+	L	L	L+	L	6.5	4877	8500
MP BM	L+	L	L	L+	L	6.6	2302	7230
MP SS	L+	L	L	L+	L	6.5	2039	7695
WP CalM	L+	L	L+	L+	L+	5.5	0	5910
WP RG	L+	L	L	M	L+	5.5	565	2005
WP BM	L+	L	M	L+	L	5.7	284	5391
WP SS	L+	L	L	L+	M	5.9	286	6450

PED causal factors RLN and Vd varied between fields and within fields. Causes of this in field variation are unknown at present but likely occur in many PEI potato fields. Site to site variation can most likely be attributed to past cropping practices including rotation crops, frequency of potatoes, variety of potatoes and other unknown factors.

The levels of root lesion nematodes in all three fields in the spring of 2020 was lower than anticipated, particularly in the WP field. Levels of *V. dahliae* are considerably higher are consistent with levels that have caused yield loss due to Verticillium wilt in other trial in other PEI Potato Board trials. Vd levels were particularly high in the IH trial field. Most of the treatment areas of the field are considered low for organic matter, with the exception of the Caliente Rojo mustard treatment area of the IH field. This will need to be considered when interpreting data after potatoes in 2021.

Acknowledgements:

We would like to thank the participating growers for their active role in these trials: MacLennan Properties, Wallace Properties, and Island Holdings. Thanks also to J & J Smallman Farms for their assistance in flail-mowing at two of the trial fields this summer.

Thank you to High Performance Seeds of Moses Lake, WA for provision of Caliente Rojo mustard seed for the trial and for providing agronomic support in preparation for the trial.