

PEACE REGION LIVING LABS



The Peace Region Living Lab project is a region-wide collaboration led by the Peace Region Forage Seed Association (PRFSA). Seven other producer groups and an Indigenous Partner, Fourth Sister Farm, have joined the PRSFA to bring together a project that will serve agricultural producers and land stewards of the region. Enhancing agroecosystem services in the Peace River Region is the focus of the Peace Region Living Lab (PRL), with the goal of adoption of practices that improve productivity, profitability and environmental resiliency.



Throughout the year we had a lot of spotlight tours and learning clusters. From 2022 up to 2026 that we will be running the Peace Region Living Lab program, we will be hosting a Spotlight tour for each of our Primary Producers and a learning cluster each year. In 2023, we hosted two Producer Spotlight Tours with learning clusters. The goal of PRL Tours is to showcase our producers who are implementing Best Management Practices in the Peace Region. Gives them a chance to share their experiences and bring in experts to ask questions.

Many producers joined us for learning clusters as we collected samples in their BMP and check fields. We called t When producers joined us, we would show them what we were doing and what information we were collecting from each sample.



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SO... WHAT IS PRL ABOUT?

The Peace Region Living Lab is a strategy from Agriculture and Agri-food Canada to promote the use of best management practices in agriculture in various agricultural field zones across the country. The idea is to create a data compilation of parameters observed in growers field and use this data to compare and assess the impact of sustainable versus conventional agricultural practices.

Parameters are measured in either a field conventionally managed or a field following best management practices such as cover cropping, intercropping, pasture, etc. These parameters are comprised of four properties related to soil described as follows: (1) Infiltration: The rate of water flowing through the soil column is measured by using (a) a mini-disk infiltrometer, where a small transparent column, with a semipermeable end is placed on top of the soil and allowed to discharge its water content (60ml) onto the soil ground. Volume of water discharged every 30 seconds. A maximum of five minutes (10 water volumes) is recorded should there still be water inside the column after that time period; or (b) a single ring system, where a ring as wide as 15cm is hammered into the ground to a depth of 5cm. The ring is covered with a plastic film and 0.5L of water are poured into the film inside the ring. The film is removed and the time water takes to percolate through the soil inside this ring is taken. (2) Compaction which is measured through a penetrometer. In this way, pressure in pounds per squared inch are taken at depths of 10, 20, and 30 cm in a single place. (3) Temperature and soil moisture, taken using a soil thermometer and a soil moisture metre and (4) a visual assessment where a shovel of soil is dug out. Soil exhumed is observed for physical features and whiffed to capture scent or foul odour.

Moreover, other parameters are taken, both in conventional and non-conventional fields. (1) Insect monitoring, which is taken by digging a small hole in the soil and set a plastic pit trap in it, collecting them a week after. Sweep nets are also used. The

operator walks 50 steps along a transect at the edge of the field and into the field and waves the sweep net inwards along the transect. Insects are stored away in alcohol and shipped to the AAFC Beaverlodge research station for identification purposes. (2) Disease monitoring, ten random plants are collected at each inflection point of a zig zag pattern. Each plant is assessed for signs of pathology (plant diseases) or arthropod herbivory (insect feeding). Plants are collected, pressed for preservation, and sent to Dawson Creek in British Columbia for identification. (3) Forage and crop residue are

collected as well. Forage is collected before a scheduled cutting by the grower to assess forage yield and its nutrient content. Crop residue and grain is also collected in fields where a cash crop was grown to assess grain yield and observe potential signs of pests or pathology in leftover stubble.



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As part of the living labs project, NPARA monitors these parameters over ten fields in total, as mentioned before five of them are conventional and the other five follow BMP practices. This is different from 2022, the living labs pioneering year, where we had a total of twelve fields but two of them were removed due to the grower selling its land properties. The table below shows the different crops grown at each of these fields and a chronology of when these parameters were recorded during the growing season of 2023.



Agricultural practice and 2023 chronology of parameters taken in conventional and best management practice (BMP) fields belonging to five growers, part of the North Peace.

Grower identification/ field site	Agricultural practice	Crop/Forage sown	Soil measurements	Insect/Disease Monitoring in 2023		Forage inventory	Crop residue Collection
D1	BMP	Canola/ pea intercrop	May 18	June 22-29	July 31 August 8	N/A	Not harvested
	Conventional (Check)	Pasture and wheat	May 17	June 22 July 6	July 31 August 14	July 31	N/A
D2	BMP	Annual and perennial cover crops	May 31	June 21-28	August 1-8	N/A	N/A
	Conventional (Check)	Perennial forage	May 31	June 21-28	August 1-8	June 21	N/A
D4	BMP	Annual cover crop for swath grazing	May 17	June 21-28	August 4-11	August 23	N/A
	Conventional (Check)	Canola	May 17	June 21-28	August 4-11	N/A	September 22
D5	BMP	Alfalfa (hay)	May 31	June 20-27	August 1-8	July 6 September 22	N/A
	Conventional (Check)	Barley as greenfeed	May 31	June 20-27	August 1-8	August 22 September 22	N/A
D6	BMP	Canola	May 31	June 20-27	August 1-8	N/A	September 22
	Conventional (Check)	Canola	May 31	June 20-27	August 1-8	N/A	October 3

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INFILTRATION (SINGLE RING)

P-values obtained from analysis of time in minutes taken from single ring infiltration. Data was compiled from years 2022 and 2023

Effect	P-value
Year	0.2404
Grower identification/ field site	0.0023
Agricultural practice	0.6790
Field site*Agricultural practices	0.5984

Mean minutes taken from single ring infiltrometer readings

Grower identification/ field site	minutes (Standard error)		
D1	4.14	(6.19)	A
D2	4.32	(6.18)	A
D3	3.57	(6.38)	AB
D4	6.61	(6.18)	A
D5	4.05	(6.18)	A
D6	1.37	(6.18)	B

Single ring infiltration showed that D6 fields both conventional and BMP adopted have less infiltration than the others. D3 fields may be similar to D6 but D6 fields are having infiltration and likely compaction problems to a greater extent than the others.

INFILTRATION (MINI DISK)

Minidisk infiltration had to be analyzed separately for each year because measurements were taken differently. While in 2022 only the volume after 30 minutes was recorded, in 2023, as mentioned previously, volume was recorded every 30 seconds to a maximum of 5 minutes (if there still was water present inside the glass column). In 2022, there was no impact in water volume flowing through the soil surface in any grower field under any agricultural practice. In 2023 however, field site, agricultural practice and an interaction of both effects impacted water volume flowing across the soil surface. As such more water volume flowed through the soil column in D4 and D5 fields compared to D1 fields. It is possible that previous practices conducted in this fields may have influenced water percolation. Moreover conventional fields had less water infiltration in comparison to fields where BMP practices were adopted. This states that roots, crop rotation, pasture and other practices do contribute to greater water infiltration through the soil system than conventional practices. An interaction between field site X agricultural practice showed that most of the BMP fields had more water infiltration than those fields following conventional agricultural management. Discrepancies can be seen however as values from the D4 conventional field reported more infiltration than its BMP counterpart. Moreover water infiltration in D2 and D5 fields is the same despite the agricultural practice used.

P-values from analysis of water infiltration taken from a minidisk infiltrometer in 2022

Effect	P-value
Grower identification/ field site	0.1749
Agricultural practice	0.9534
Field site X Agricultural practices	0.0575

P-values from analysis of water infiltration taken from a minidisk infiltrometer in 2023

Effect	P-value
Grower identification/ field site	0.0323
Agricultural practice	0.0001
Field site X Agricultural practices	<0.0001

Mean values of water volume taken from a minidisk infiltrometer in various fields that adopted BMP and conventional practices in 2023

Agricultural practice	Grower identification /field site	Water infiltration		
		mL		
BMP	D1	42.07	1.7	ABC
	D2	40.74	1.6	ABCD
	D4	37.94	1.8	CDE
	D5	43.76	1.6	AB
	D6	43.64	1.5	AB
Check	D1	31.50	2.0	F
	D2	36.98	1.7	DE
	D4	44.73	1.5	A
	D5	39.40	1.7	BCDE
	D6	34.94	1.6	EF

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COMPACTION

P-values from analysis of compaction values in pounds per square inch and depth taken in inches taken in 2022

Effect	Compaction	Depth
Grower identification /field site	<0.0001	<0.0001
Agricultural practice	0.5223	0.7521
Field site* Agricultural practices	<0.0001	<0.0001

Compaction in 2022 was impacted by the field site where compaction was measured and also the agricultural practice in which these fields were managed. These means that the agricultural site was not influential on its own but rather WHERE the agricultural practice is placed had a greater effect. As such, D1 and D5 had less compaction in fields under BMP practices than fields in conventional practices. The opposite was found in D3 and D6 fields. Same compaction between BMP and conventional practices was found in D2 and D4 field sites. As of how deep the penetrometer went into the ground to measure compaction, all field sites showed no difference in depth between agricultural practices except D3. The BMP depth in the D3 site was 34% shallower than that found in the D3 site with adopted conventional practices. What this is showing is that previous agricultural practices matter and cumulative practices such as excessive use of heavy machinery and growing plants with shallow root development may not ensure proper soil porosity. This is worsened by soil texture, where heavy clays in the North Peace region make compaction a more serious problem to endure during precipitation events.

Mean values of compaction readings taken in various field sites subjected to either BMP or conventional agricultural practices.

Grower identification / Field site	lb in-2		in	
D1	591.18	C	3.83	D
D2	701.01	A	5.64	C
D3	443.33	E	17.07	A
D4	535.88	D	5.83	BC
D5	639.64	E	2.83	D
D6	647.10	D	7.50	B
Standard error	14.7		0.7	

Mean values of compaction readings taken various field subjected to BMP and conventional agricultural practices

Agricultural practice	Grower identification / Field site	Compaction		Depth	
		lb in-2		in	
BMP	D1	533.16	EF	4.42	EF
	D2	690.94	AB	6.57	CDE
	D3	516.05	F	13.61	B
	D4	532.20	EF	6.98	CD
	D5	576.72	DE	2.31	F
	D6	688.83	AB	8.31	C
Conventional	D1	649.20	BC	3.24	F
	D2	711.09	A	4.72	DEF
	D3	370.60	G	20.53	A
	D4	539.57	EF	4.68	DEF
	D5	702.57	A	3.35	F
	D6	605.38	CD	6.68	CDE
Standard error		19.5		0.9	

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COMPACTION



P-values obtained from compaction values taken at three different depths in various field sites subjected to either BMP or conventional practices in 2023

Effect	Depth (inches)		
	4	8	12
Grower identification/ field site	<0.0001	<0.00001	<0.0001
Agricultural practice	0.0003	0.0006	<0.0001
Field site X Agricultural practice	<0.0001	0.0029	<0.0001

A different protocol was conducted in 2023. In this protocol, compaction readings were taken at three different depths: 4, 8 and 12 inches. Our results indicate that compaction readings at all designated depths were different from each other at each grower site and whether the site was managed through conventional or sustainable practices. The BMP field in D1 was less compacted than the conventional field of the same site at 4 inches, however there were no differences in compaction between BMP and conventional sites in D1 at 8 and 12 inches. All compaction readings taken in D2 and D6 sites were greater in BMP fields compared to conventional fields at all depths. BMP and conventional fields compaction at D4 on the other hand, were the same despite depth. At D5, compaction at the BMP field was greater than that found at the conventional field at 4, and 8 inches but the same at 12 inches. It is unclear why BMP fields in D2, D5 and D6 would be more compacted than their conventional counterparts. Sod caused by the thick root network that grass produces may have contributed to greater compaction values. Moreover, cattle grazing also could have influenced a reduction in soil pore space and hence an increase in soil bulk density in the upper soil layer.

Mean compaction values obtained at three different rates in field sites subjected to either BMP or conventional agricultural practices in 2023

Effect			Depth							
			4		8		12			
		Grower identification/ Field site	inches							
		D1	229.28	A		212.56	C		162.96	B
		D2	227.44	A		374.5	B		655.07	A
		D4	157.17	B		207.73	C		245.43	B
		D5	179.94	B		153.03	C		194.02	B
		D6	258.83	A		446.34	A		652.84	A
Standard error			18.4			28.7			45.6	
Agricultural practice										
BMP			234.94	A		314.35	A		470.02	A
Conventional			186.12	B		243.32	B		294.11	B
Standard error			14.5			23.0			36.4	
BMP		D1	192.17	CD		199.12	D		175.07	D
		D2	264.94	B		459.12	AB		932.29	A
		D4	144.94	DE		191.89	D		207.46	D
		D5	245.5	BC		215.84	CD		238.53	CD
		D6	327.17	A		505.78	A		796.73	A
Conventional		D1	266.39	B		226.00	CD		150.84	D
		D2	189.24	CD		289.89	C		377.84	BC
		D4	169.39	DE		223.56	CD		283.40	CD
		D5	114.39	E		90.23	E		149.51	D
		D6	190.50	CD		386.89	B		508.96	B
Standard error			23.5			36.7			57.7	

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NUMBER OF AFFECTED PLANTS BY DISEASE AND/OR ARTHROPOD HERBIVORY

Mean values of plants showing any signs of disease or arthropod herbivory taken from five points at each field site. Twice during the growing season. Field sites were subjected to either BMP or conventional agricultural practices in 2023

Effect			Measurement timing			
			June		August	
	Grower identification/ Field site		number of diseased plants per point at each site			
	D1		4.77	BC	8.69	A
	D2		5.17	B	5.39	B
	D4		4.37	BC	6.49	B
	D5		3.57	C	5.59	B
	D6		7.57	A	5.39	B
Standard error			0.7		0.6	
Agricultural practice						
BMP			-	-	5.27	B
Conventional			-	-	7.35	A
Standard error			-		0.5	
BMP	D1		1.97	E	8.19	AB
	D2		5.37	BC	9.19	A
	D4		5.17	BC	2.19	D
	D5		2.77	DE	8.59	AB
	D6		8.17	A	7.19	BC
Conventional	D1		7.57	A	5.79	C
	D2		4.97	BC	3.39	D
	D4		3.57	CDE	7.79	AB
	D5		4.37	CD	5.39	C
	D6		6.97	AB	5.39	C
Standard error			0.8		0.8	

P-values obtained from number of plants showing any signs of disease or arthropod herbivory obtained from five points at each field site, twice during the growing season. Field sites were subjected to either BMP or conventional agricultural practices in 2023

Effect	Measurement timing	
	June	August
Grower identification/ field site	<0.0001	<0.0001
Agricultural practice	0.0927	<0.0001
Field site X Agricultural practice	<0.0001	<0.0001

As previously explained, a total of ten plants were taken randomly at five spots in the field following a zig zag transect. This was carried out twice (June and August) during the growing season. Analysis was based on how many, out of the ten plants, were showing any signs of disease and/or arthropod herbivory and any other signs of decaying or poor plant health and development. Results showed that disease and herbivory were impacted by the field practice adopted by the grower and where were those fields located. Independently, field site impacted number of affected plants both in June and August but only in August was there an impact from agricultural practice adopted. Less affected plants were observed in D5 compared to D6 in June whereas D1 had more affected plants than the other sites in August. This makes sense as some sites were heavily predated by Brenner grasshoppers.

From the results gathered, agricultural practices affected disease incidence and insect predation later on in the growing season. As such, there was a smaller number of affected plants in fields where sustainable practices were adopted compared to fields with conventional practices. It can be thus argued that BMP may reduce disease incidence in plants and likely also reduce insect herbivory.

However, the interaction effect between grower site and agricultural practice presents incongruent results. In June, the D1 site shows that there were less affected plants in the BMP field compared to the conventional, affected plants in BMP and conventional fields at all other sites were statistically the same. In contrast, only one of the five sites, D4, showed more affected plants in the conventional field compared to the field with adopted BMP and site D6 had still the same statistical difference observed in previous plant counts in June. Many of the BMP fields were likely affected due to grasshopper herbivory, which may heavily damage pastures, grain crops and forage despite the plant diversity present in the field at that time.

PEACE REGION LIVING LABS SAMPLING SITES

