Peace Region Living Lab (PRLL)

The Peace Region Living Lab (PRLL) is a collaborative initiative focused on improving the long-term sustainability of farming systems in the Peace Region. The project brings together local producers, researchers, and industry partners to test and evaluate beneficial management practices (BMPs) under real farm conditions. Producers implement BMPs on their own land, while the PRLL team monitors changes in soil, crops, and overall field performance.

The 2025 growing season marked the fourth year of this ongoing project. As in previous years, PRLL continued collecting co-benefit data from core producer sites to better understand how BMPs perform across different farming systems and under varying weather conditions.

Soil Health Assessment Methods

Several practical, field-based soil health assessments were used to evaluate BMP performance:

Soil Infiltration Test – Measures how quickly water enters the soil. Higher infiltration rates generally indicate improved soil structure and reduced compaction, while lower rates may reflect restricted drainage or compacted layers that limit root growth.

Mini Disk Test – Assesses water movement through the soil under conditions that better represent natural rainfall, helping to evaluate soil porosity and water movement.

Visual Soil Assessment (VSA) – A rapid, qualitative assessment of soil structure, surface condition, rooting, and biological activity used to identify issues such as compaction, erosion, and low organic matter.

These field assessments were supported by laboratory soil testing, including nutrient and chemical analyses, to provide a more complete understanding of soil health and to support management decision-making.

2025 Growing Season Conditions

The 2025 growing season in the northern Peace Region, including the Fort Vermilion area, was characterized by prolonged dry conditions. Spring and early summer rainfall was well below normal, with limited precipitation during key crop growth stages. In July, Mackenzie County declared an agricultural disaster due to persistent moisture shortages, which negatively affected annual crops, hay production, and pasture performance across the region.

Although some rainfall occurred later in the season, moisture stress earlier in the year likely had lasting effects on crop development and soil moisture reserves. These conditions provided a valuable opportunity to evaluate BMP performance under moisture-limited conditions.

Producer Activities and BMPs

Four PRLL core producers continued to evaluate a range of BMPs aligned with their individual farm

Objectives

C1 producer implemented sub-soiling to address soil compaction, building on previous observations of improved soil conditions and long-term productivity.
C2 producer continued evaluating intercropping systems to better understand how crops with different rooting patterns interact and share resources.
C3 an organic producer adopted a robotic seeding and weeding system in hemp to improve weed control and field efficiency.
C4 another organic producer assessed a perennial forage system, comparing one-cut and two-cut management to evaluate biomass production and plant recovery following grazing and haying.

Infiltration Results

2025 Results

	Infiltration rates (inches/hour)		
	C1	**C2**	**C3**
Treatment	2025	2025	2025
BMP	8.6	6.82	10.02
CHECK	13.19	4.78	11.23

Infiltration rates (inches/hour)	
	C4
Treatment	2025
BMP1	6.78
BMP2	20.56
CHECK	7.02

Results indicate that BMP performance was more variable compared to 2024, with some sites showing continued benefits and others showing reduced infiltration relative to the check.

At the sub-soiling site (Site C1), infiltration under the BMP was 8.60 inches per hour, compared to 13.19 inches per hour in the check. Unlike 2024, the check exceeded the BMP, suggesting that seasonal conditions or soil moisture distribution may have influenced short-term infiltration dynamics.
At the intercropping site (Site C2), infiltration under the BMP was 6.82 inches per hour, compared to 4.78 inches per hour in the check. This indicates continued improvement in water entry under the intercropping system.
At the minimum tillage and cover cropping site (Site C3), infiltration reached 10.02 inches per hour under the BMP and 11.23 inches per hour in the check. While both treatments maintained relatively strong infiltration, the BMP did not exceed the check in 2025.
At the pasture rejuvenation site (Site C4), infiltration under the annual–perennial system (BMP1) was 6.78 inches per hour, slightly below the check value of 7.02 inches per hour. In contrast, the perennial pasture rejuvenation system (BMP2) reached 20.56 inches per hour, substantially exceeding both BMP1 and the check, indicating strong improvement in soil water movement under this treatment in 2025

2024 Results

	Infiltration rates (inches/hour)		
	C1	**C2**	**C3**
Treatment	2024	2024	2024
BMP	5.99	9.44	15.03
CHECK	4.55	25.78	6.86

Infiltration rates (inches/hour)	
	C4
Treatment	2024
BMP1	19.38
BMP2	4.59
CHECK	16.9

In 2024, infiltration rates were generally lower than in 2023, reflecting drier overall conditions; however, BMPs continued to demonstrate improved infiltration relative to checks.

At the sub-soiling site (Site C1), infiltration under the BMP was 5.99 inches per hour, compared to 4.55 inches per hour in the check, indicating sustained structural benefits.

At the intercropping site (Site C2), infiltration under the BMP was 9.44 inches per hour. While variability was observed in the check, the intercropping system continued to demonstrate effective water entry into the soil profile.

At the minimum tillage and cover cropping site (Site C3), infiltration increased substantially, reaching 15.03 inches per hour under the BMP, more than double the check value of 6.86 inches per hour. This highlights cumulative soil structure improvements over time.

At the pasture rejuvenation site (Site C4), infiltration under the annual–perennial system (BMP1) reached 19.38 inches per hour, exceeding the check value of 16.90 inches per hour. The perennial pasture rejuvenation system (BMP2) increased slightly to 4.59 inches per hour but remained lower than both BMP1 and the check.

Interpretation Across Years

While 2024 generally showed stronger and more consistent BMP advantages across sites, 2025 results were more variable.

Some BMP systems, such as intercropping (C2) and perennial pasture rejuvenation (C4 BMP2), continued to demonstrate improved infiltration. However, at other sites (C1 and C3), the check treatment exceeded BMP infiltration in 2025, suggesting that short-term climatic conditions, antecedent moisture, or soil surface characteristics may have influenced measured rates.

These results reinforce the importance of multi-year monitoring to capture both cumulative soil structure improvements and year-to-year variability under Peace Region climatic conditions. Continued evaluation will help determine whether observed differences represent temporary fluctuations or longer-term treatment trends.

Credits

MARA sincerely thanks all participating producers for their collaboration and willingness to test new management approaches. Their engagement is essential to the continued success of the Peace Region Living Lab.

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Demonstration of the efficacy and Cost-Effectiveness of Lime Alternatives for Sustainable Soil Acidity Management in the Peace Region

Introduction

There are over 1 million acres of strongly acidic and 4.5 million acres of moderately acidic soils farmed in Alberta, particularly in central Alberta and the Peace River region (Henry, 2020). Soil acidity can significantly reduce crop yields by limiting nutrient availability and increasing aluminum toxicity, negatively impacting farm profitability. However, the use of agricultural lime—an effective soil amendment—is low due to cost concerns and uncertainties regarding return on investment. This project aims to assess cost-effective alternatives to traditional lime, such as cement kiln dust (CKD), wood ash, and biochar, which are by-products of local industries and readily available in the Peace Region. CKD and wood ash are highly alkaline and react quickly to neutralize soil acidity, while biochar, although slower-acting, improves soil structure, water retention, and microbial activity. By evaluating the effectiveness, and long-term benefits of these materials, this research will provide local producers with data-driven recommendations to improve soil health, enhance crop productivity, and reduce input costs, ultimately contributing to more sustainable farming practices in the region

Material and Methods

This field experiment was conducted in Fort Vermilion, Mackenzie County, using a randomized complete block design with three replicates. Each replicate consisted of four plots, with each plot measuring approximately three-quarters of an acre. Individual plots were 17 m (50 ft) wide and 238 m (750 ft) long, resulting in an area of approximately 0.75 acres per strip and a total treated area of 2.25 acres per treatment. The initial soil pH at the site was 4.6. Within each replicate, four liming treatments were assigned: no application, agricultural lime (AgLime), cement kiln dust, and beet lime (spent lime).

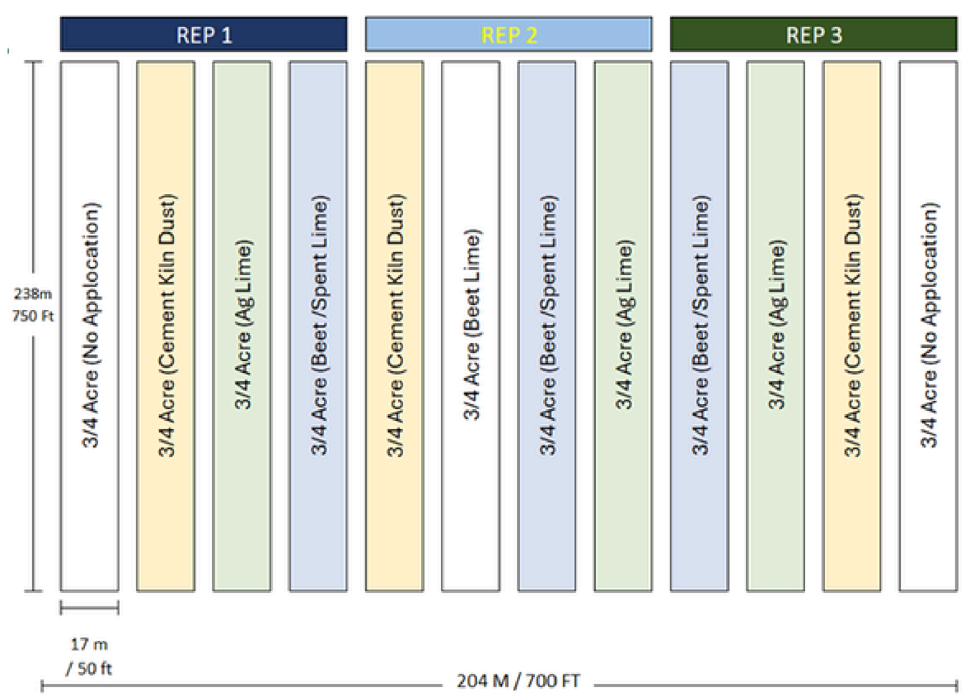

Figure 1. *Layout of the treatments showing randomization, treatments and number of replications*

Based on values reported in the literature, it was estimated that 4 tons acre^{-1} of AgLime would be required to raise soil pH by one unit. Product characteristics—including fineness factor, calcium carbonate equivalent, moisture content, and effective calcium carbonate percentage—were then used to estimate the equivalent amounts of cement kiln dust and beet lime relative to AgLime. These values informed the final application rates to ensure that each product delivered a comparable neutralizing capacity and achieved the targeted increase in soil pH. The treatments were imposed in the autumn of 2025 by surface-applying the respective liming materials to each strip. Changes in soil pH and crop yield will be monitored throughout the 2026 growing season.

Table 1. *Characteristics of the liming products used for the demonstration trial*

Liming Product name	Fineness Factor	Calcium Carbonate Equivalent	Moisture content (%)	%Effective calcium carbonate	Amount required to raise pH from 4.6—5.6
AgLime	—	98.25	—	100	4.0
Cement Kiln Dust	74.56	87.25	16.43	54	7.4
Beet Lime	81.00	97.86	25.00	59	6.8

Preliminary Results

The preliminary cost assessment revealed substantial differences in total expenses among the three liming products evaluated for the 2.25-acre treatment area. Although AgLime required the smallest procurement volume (9 tons), it resulted in the highest overall cost once product, transport, and application expenses were combined. The total cost for AgLime was $7,220, driven primarily by a transport cost of $5,300 from Victoria, British Columbia. This translated into a final cost of $802 per ton, making AgLime the most expensive option on a per-ton basis.

Cement kiln dust required the largest application volume (18 tons) to achieve an equivalent neutralizing effect, but its total cost was $5,725, much lower than AgLime. Transport costs for the cement kiln dust were substantially lower than those of AgLime, as the material was sourced from Norstar in Edmonton. As a result, cement kiln dust had the lowest final cost at $318 per ton, making it the most cost-effective liming material among the three products assessed.

Beet lime required 15 tons for the 2.25-acre treatment area and was sourced from Westlock. The combined product, transport, and application costs totaled $5,295, resulting in a final cost of $353 per ton. Thus, beet lime was more economical than AgLime but slightly more expensive than cement kiln dust.

Overall, the preliminary economic comparison indicates that cement kiln dust is the most cost-effective liming material, followed by beet lime, while AgLime is considerably more expensive, largely due to its high transport cost.

Table 2. *Initial cost analysis for the three products used in the demonstration trial*

Liming Product	Amount required for 2.25 acres (tons)	Product cost / ton (CAD)	Total procurement cost (CAD)	Transport cost (CAD)	Application cost (CAD)	Product cost + Transport cost + Application (CAD)	Cost / acre (CAD)
AgLime	9	155	1395.00	5300.00	525.00	7220.00	3209.00
Cement kiln dust	18	150	2700.00	2500.00	525.00	5725.00	2544.00
Beet Lime	15	118	1770.00	3000.00	525.00	5295.00	2353.00

Looking Forward in 2026:

- 14-day interval soil monitoring to monitor changes in soil pH
- Yield comparison among the treatments
- Tour with producers to discuss season findings