

# 12. Effects of Organic Amendments on Soil Health Indicators in an Indigenous Farm in the Northern Peace River Region of Canada†

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## Highlights

Indigenous knowledge is cumulative, holistic, dynamic and inclusive of all variants of knowledge, including, but not limited to science, cosmology, spirituality, language, politics and law. It is relationship-oriented, place-based, intergenerational and validated by lived experience and time.

*Closed loop farming guarantees carbon returns to a local system*

- Increased soil carbon sequestration;
- Increased biodiversity;
- Increased nutrient availability; and
- Reduce pest and disease issues

## Introduction

The historical, cultural and socio-economic context of Indigenous agriculture is different from the context of conventional agriculture. Some indigenous farmers practice closed loop organic farm by recycling nutrients within their system. The belief on “everything is connected” is the key concept that “soil and soul” are connected thus should be honored to sustain the life in continuum.

Maintaining soil health and fertility development is the key for sustainability of agriculture and food security. Indigenous communities have been practicing farming based on traditional skill and knowledge since time immemorial. With an aim to allow Indigenous communities to integrate western science into their Indigenous knowledge, a study on evaluating the soil health and quality was carried out on the Fourth Sister Farm at Progress, British Columbia, Canada. Effects of five different type of farmyard manure (FYM) namely: Bovine, Swine, Equine, Poultry and Vermi-compost on soil health indicators were tested in a two-year pilot project from 2021-2023. First year crop was Fava bean, and second year crop was Oats.

Expected outcomes was also a greater understanding of Indigenous community research priorities related to Indigenous agriculture, which can support the co-creation of larger strategic research collaborations.

## Material and Methods

- Followed a decolonial approach to research from consultation, co-development, and execution by the Indigenous farmer (plot size, seed & seeding, traditional/manual, phenology, resulting in food & seed).
- Soil samples were collected before seeding of crops for baseline data on soil health and nutrients.
- Five FYM treatments and one controlled were replicated four times following complete random block design.
- First year crop was Fava bean (*Vicia faba*) and second year crop was Oat (*Avena sativa*).
- Rhizosphere sampling was carried out during the peak growing season (mid-July/August).
- Final soil sampling was collected immediately after the harvesting in September in each year.
- Soils were tested for key soil health parameters – soil organic carbon (SOC), Total nitrogen (TN), Aggregate stability, microbial biomass, bacterial/fungal diversity and biomass in the rhizosphere.

## Results

- Soil health parameters did not differ by FYM type by the end of two growing seasons ( $P > 0.05$ )
- Bacterial relative abundance was not impacted by manure application type
- Fungal richness only responds with vermi-compost in year one.
- Aggregates were more stable in vermi-compost treated soils
- Richness may have increased between years, but sample analysis methods may be confounding the results.

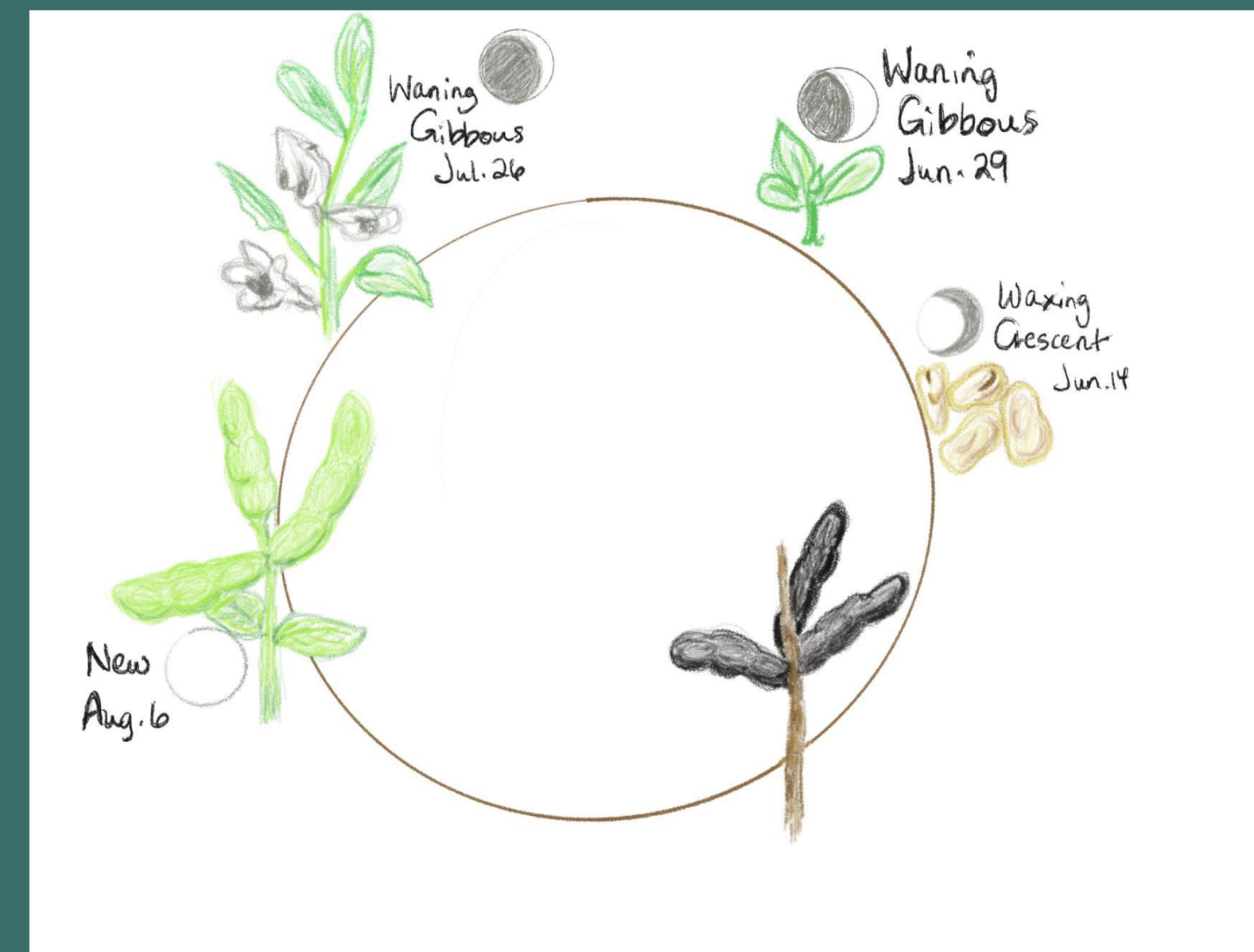


Fig 1. Phenological changes and moon phases during the growing season (Art by Tiffany traverse)

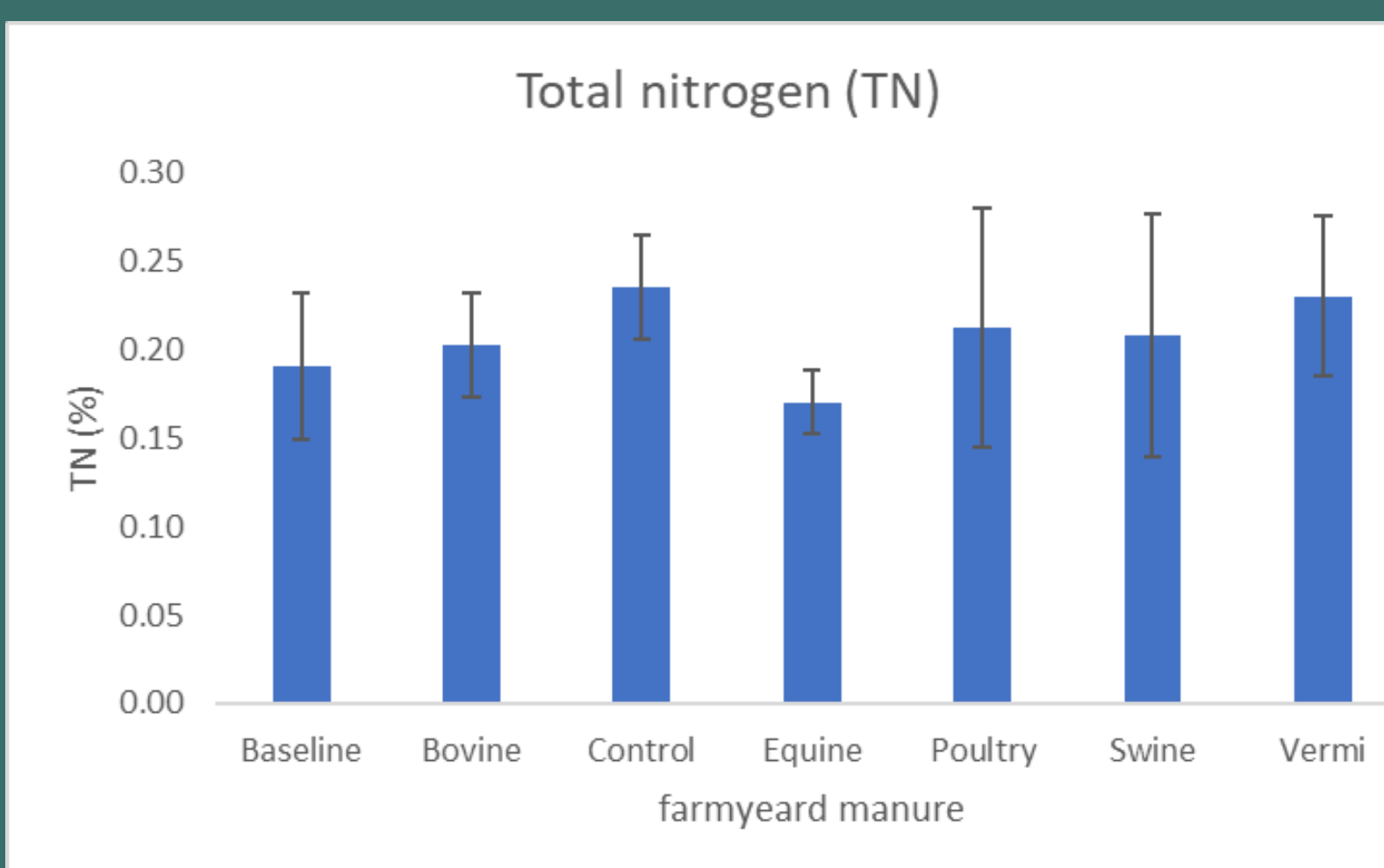
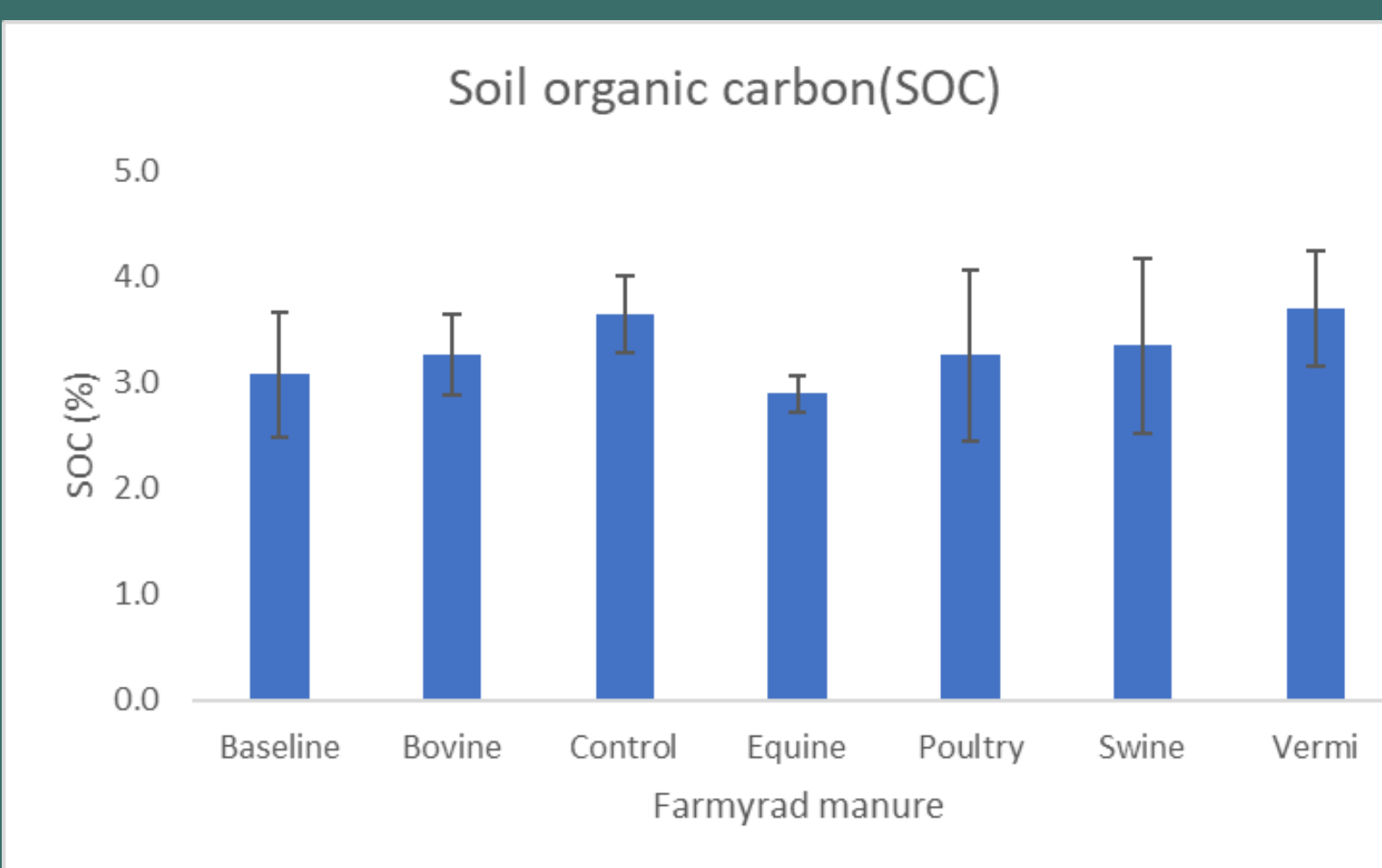


Fig 2. Soil Organic Carbon - SOC (a) and total nitrogen - TN (b) after 2 growing seasons

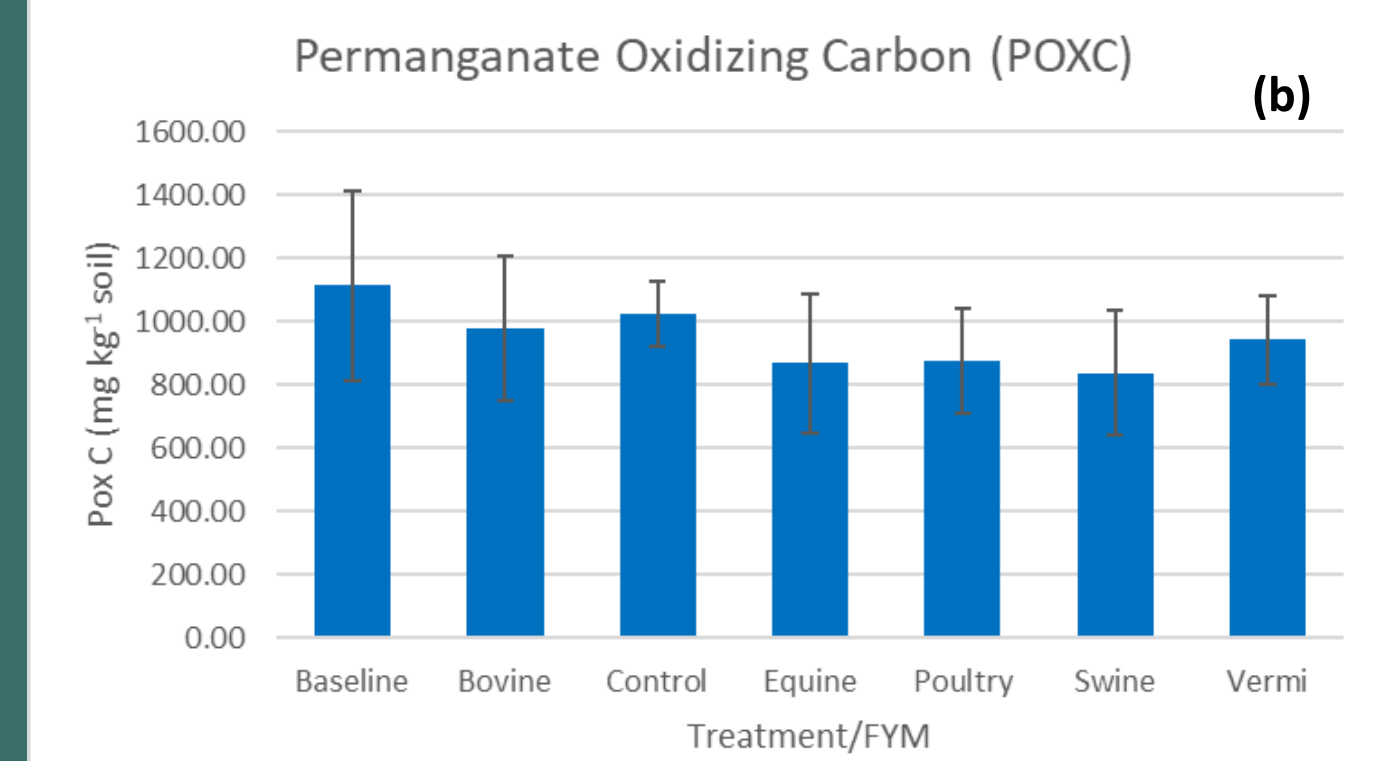
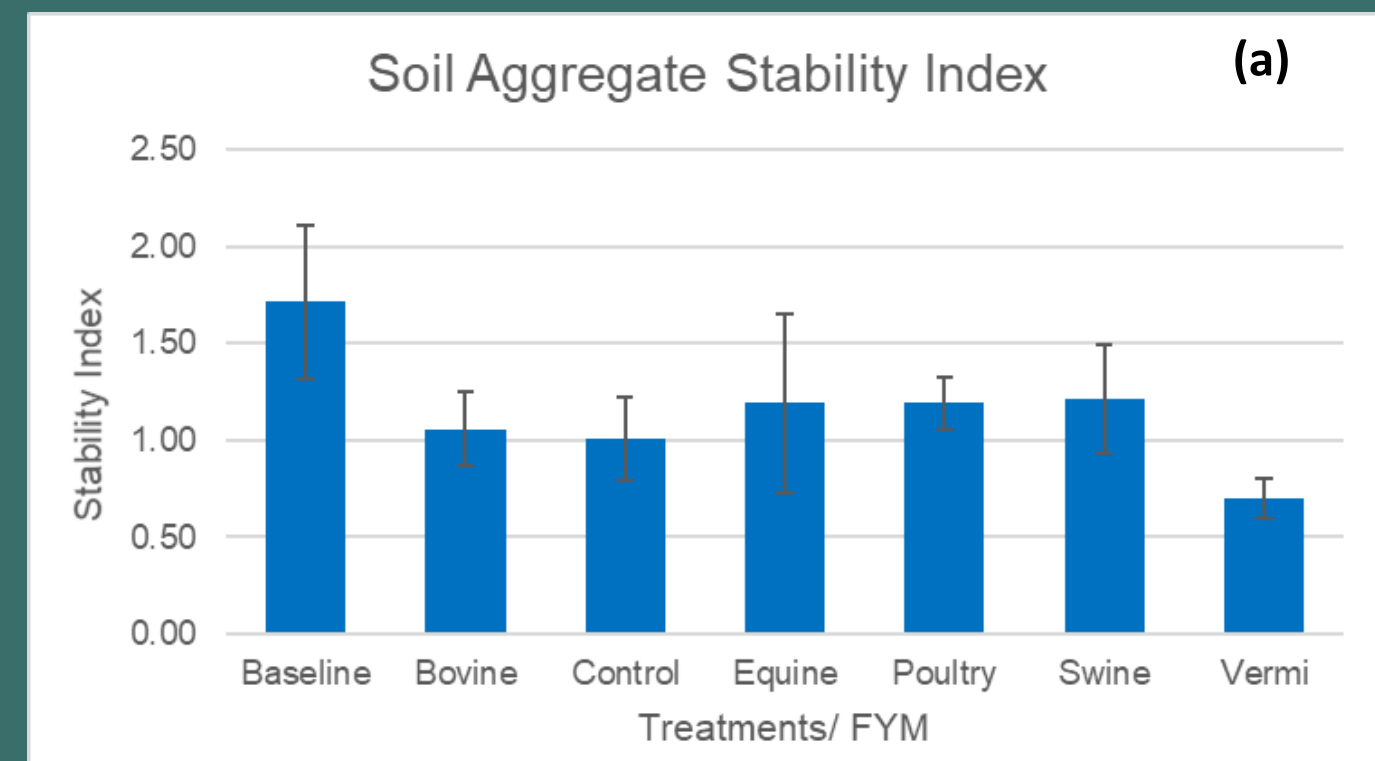
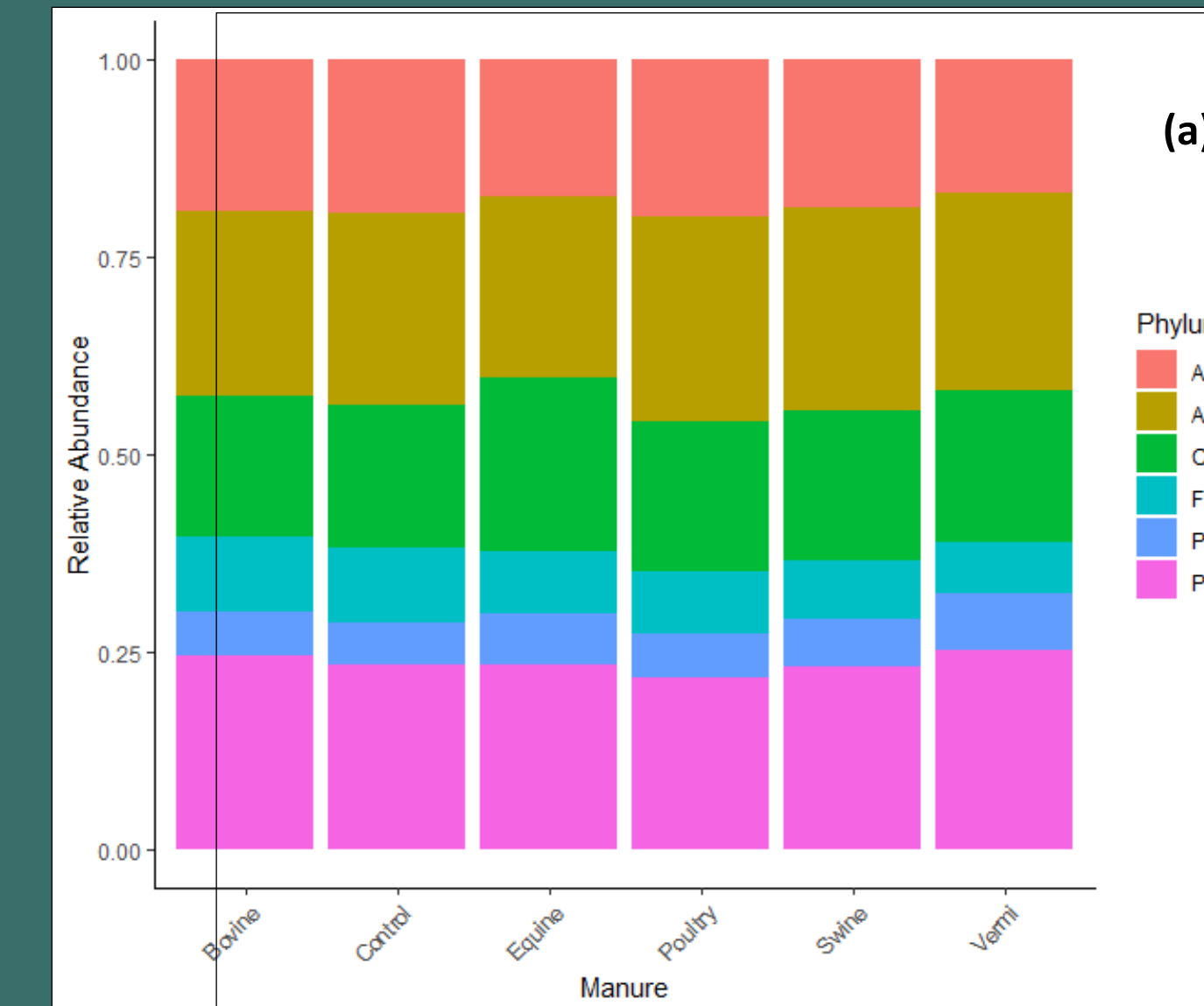


Fig 3. Soil health indicators: soil aggregate stability index (a) labile carbon (b) and microbial biomass carbon (c) after 2 growing seasons.

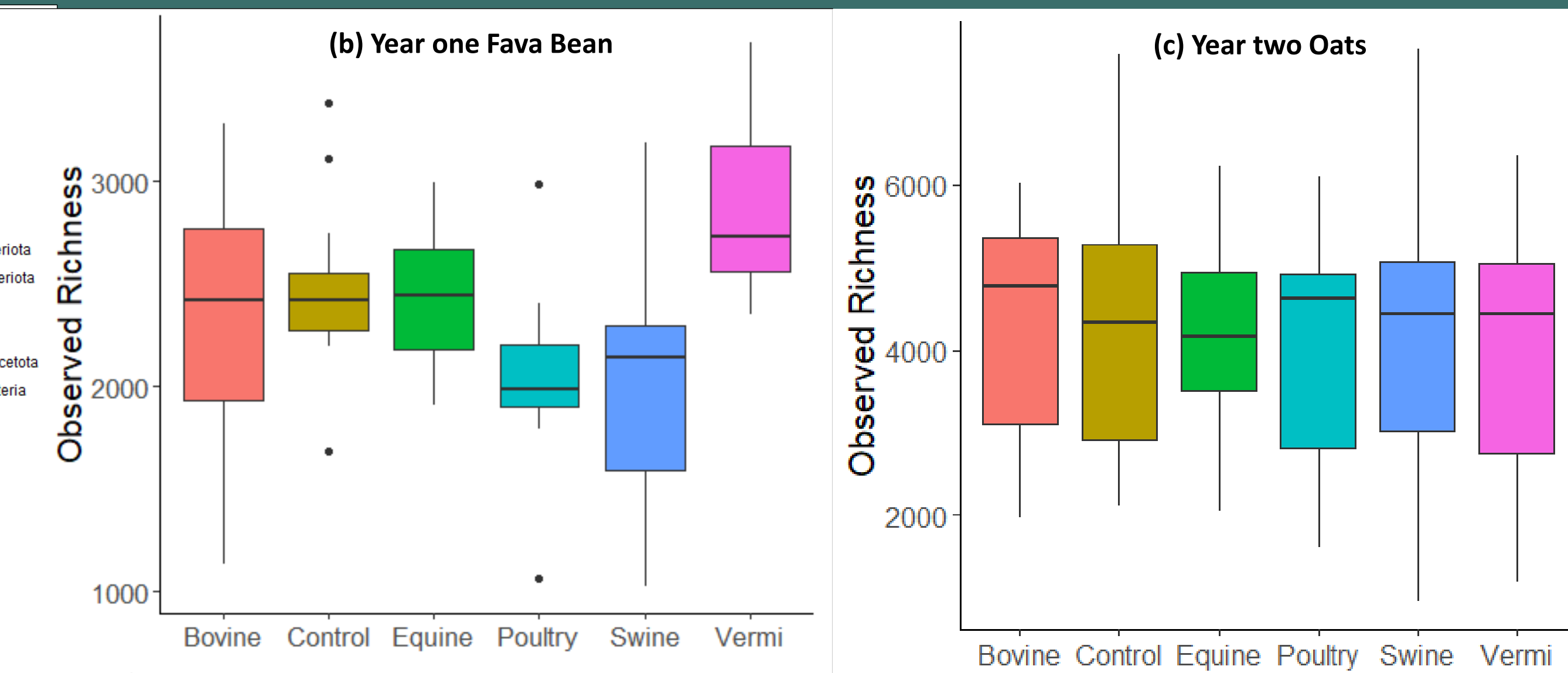


Fig. 4. Relative bacteria abundance (a); Year One Richness (b) and Year Two Richness (c) of fungal diversity in Peace Region soils under different Farmyard manure treatments in summer of 2022 and summer 2023.

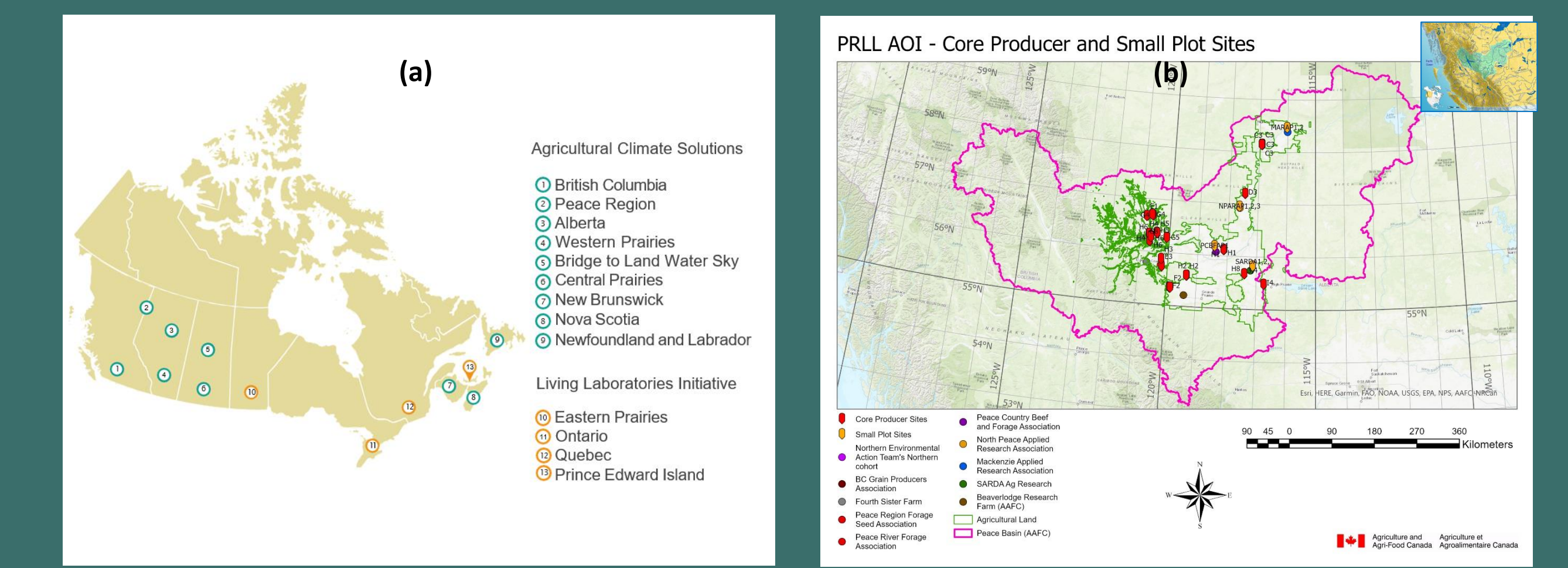


Fig 5. Peace region living lab (2) in the national network of agricultural living labs (a) and PRLL's trial plots in producers farm and partner groups' small plots (b)

## Summary and way forward

- No impact of different FYM treatments on soil health indicators: Aggregate stability, SOC, Mineralizable C, MBC, and root colonization.
- Little impact of manure on fungal community structure after only one season.
- Require more time to see community shifts and change in soil health indicators
- Fourth Sister Farm is collaborating the Peace Region Living Lab
- Agricultural Climate Solutions-Living Lab is a producer-lead innovation project supported by research to store carbon and reduce greenhouse gas emissions
- Peace region Living lab is a AAFC funded five-year project (2022-2027) with the goal to “Enhancing Agroecosystem Services in the Peace River Region” (<https://peacelivinglab.ca/>)

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