

Long-Term Management Effects on Labile Carbon:

A Response to Changing Climate in the Pacific Northwest

Carissa Burns

Stephen Machado PhD

Rajan Ghimire PhD

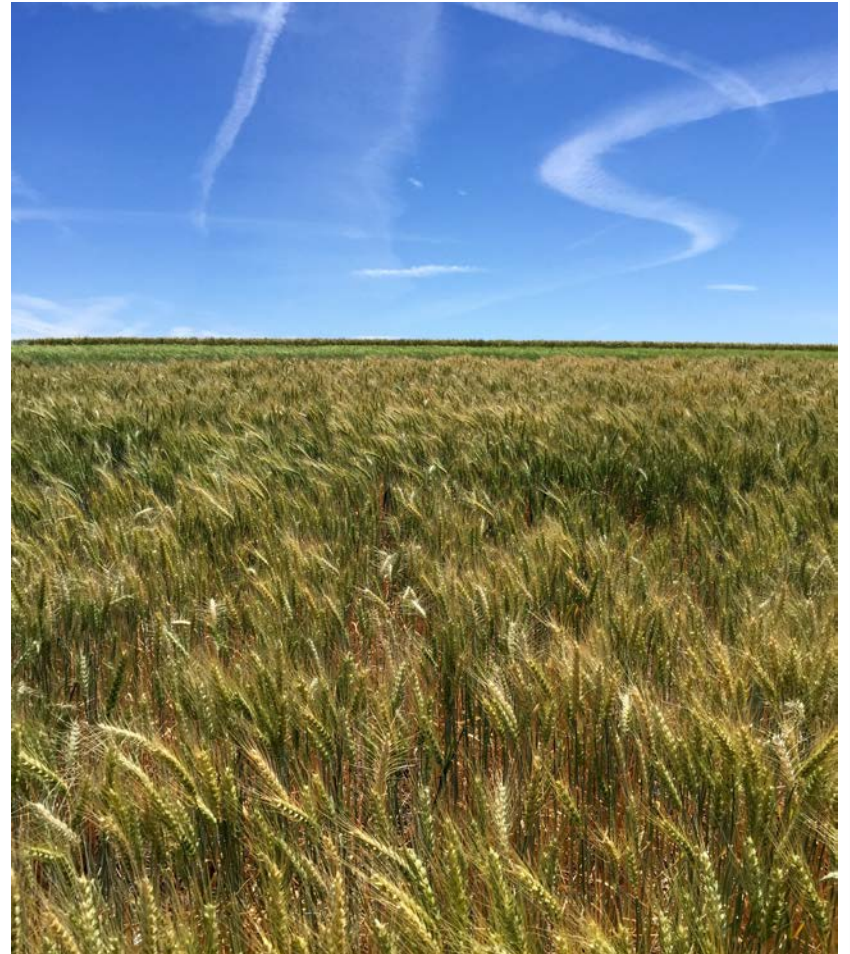
Prakriti Bista PhD

Columbia Basin Agricultural Research Center – OSU

Introduction

PNW Cereal Region

- Columbia Plateau between the Cascade and Rocky Mountains
- < 18 in. of precipitation
- Walla Walla silt loam
 - 18% clay, 17% silt in top 12 in.
- Soft White Wheat



Long-Term Experiments

Among the oldest replicated research trials in the Western United States, which are crucial resources for cereal producers in the region.

Representative of most cropping systems in the PNW cereal region

Takes up to 10-20 years to identify and evaluate changes in soil properties and health

To, “[identify] the effects of crop rotation, variety development, fertilizer use, aerial and surface contamination, and organic amendments on soil productivity and other beneficial soil properties” (*Petrie, 2001*).

Long-Term Experiments

Grass Pasture – **GP** (1931)

1. No experimental variables

Residue Management – **CR** (1931)

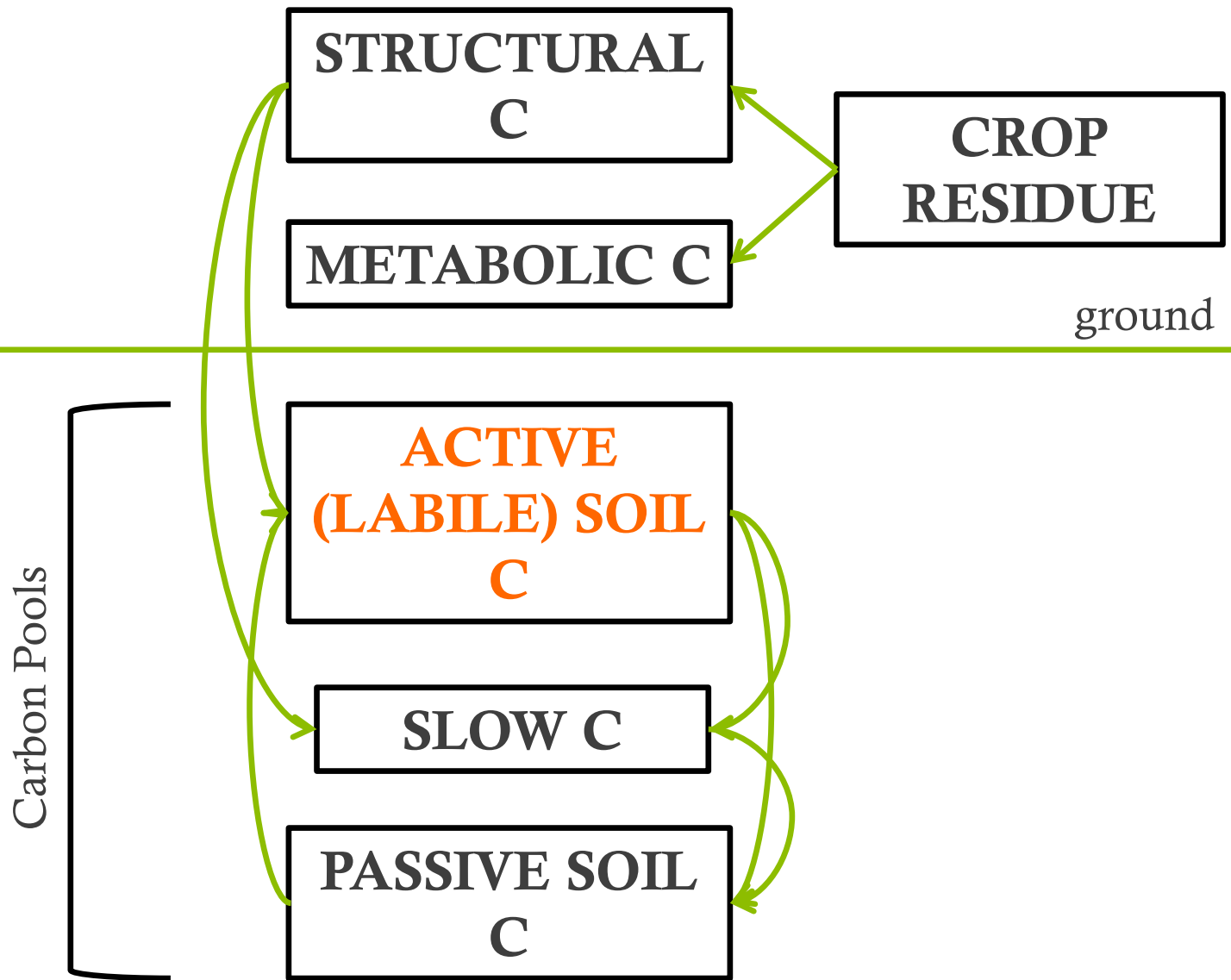
2. Winter Wheat/Fallow with conventional tillage and manure treatment

Tillage-Fertility – **TF** (1940)

3. Winter Wheat/Fallow with conventional tillage and 90kg N application

Wheat/Pea – **WP** (1963)

4. With conventional tillage and 90kg N application
5. With no-till and 90kg N application



(Norton et. al, 2004)

General Focus

Effects of each treatment:

- %H₂O
- pH
- NO₃⁻
- CO₂*

STRUCTURAL
C

METABOLIC
C

ACTIVE SOIL C
(LABILE)

SLOW C

PASSIVE
SOIL C

Experiment

- Soil samples were collected in May and stored at 4°C before we arrived
- Weighed two sets of 28 ($\sim 22 \pm 0.5\text{g}$), samples and placed in 50mL beakers
- Placed each beaker in a 1qt mason jar with 5mL H₂O and sealed lid
- 28 samples plus one blank in 20°C incubation
- 28 samples plus two blanks in 30°C incubation
- Incubation intervals: 24 hrs, 72 hrs, 1 week, 2 weeks, 3 weeks, 4 weeks since beginning of incubation

Experiment



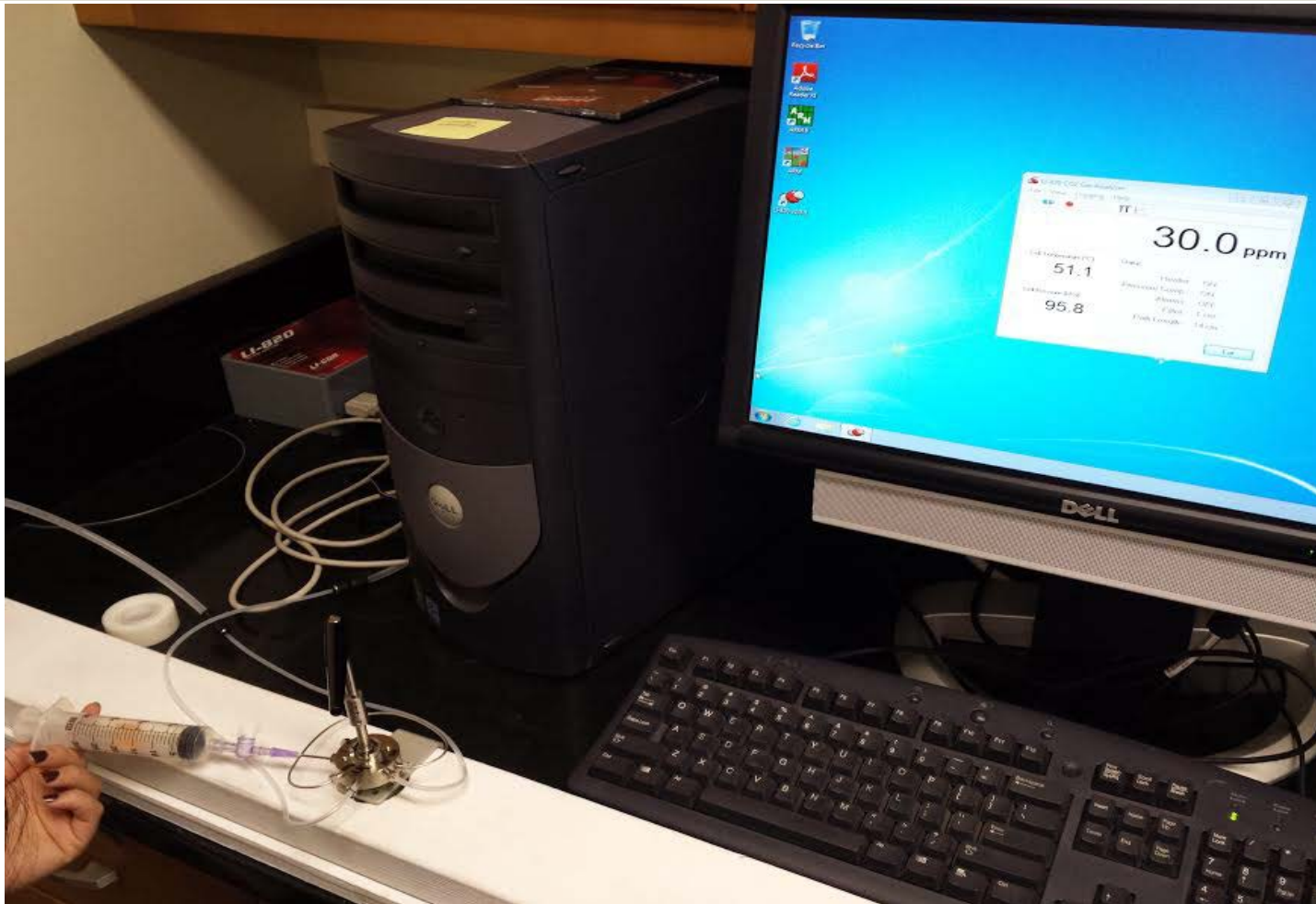
Experiment

- Used needle tip to extract 30 mL CO₂ from each mason jar into individual syringes
- After collection, opened jars and used a vacuum to remove incubated air, re-sealed jars, and placed back into their respected incubation environment
- Injected 7mL of CO₂ into Licor (Li-820) machine from syringe and recorded the measured CO₂ (ppm); repeated this step two more times for a total of three readings per syringe

Experiment

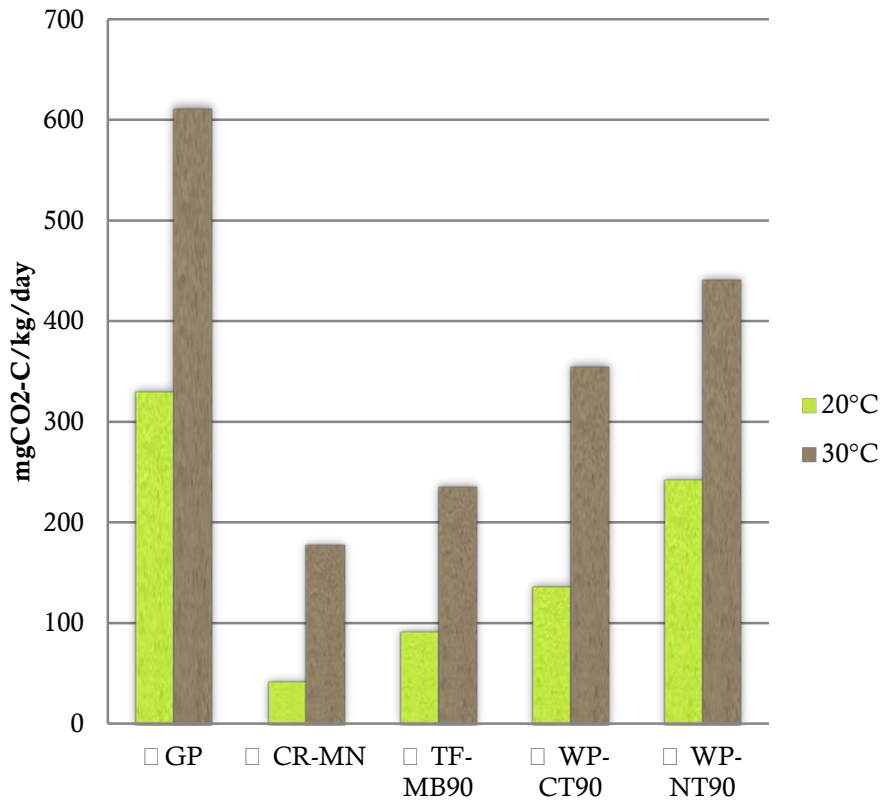


Experiment

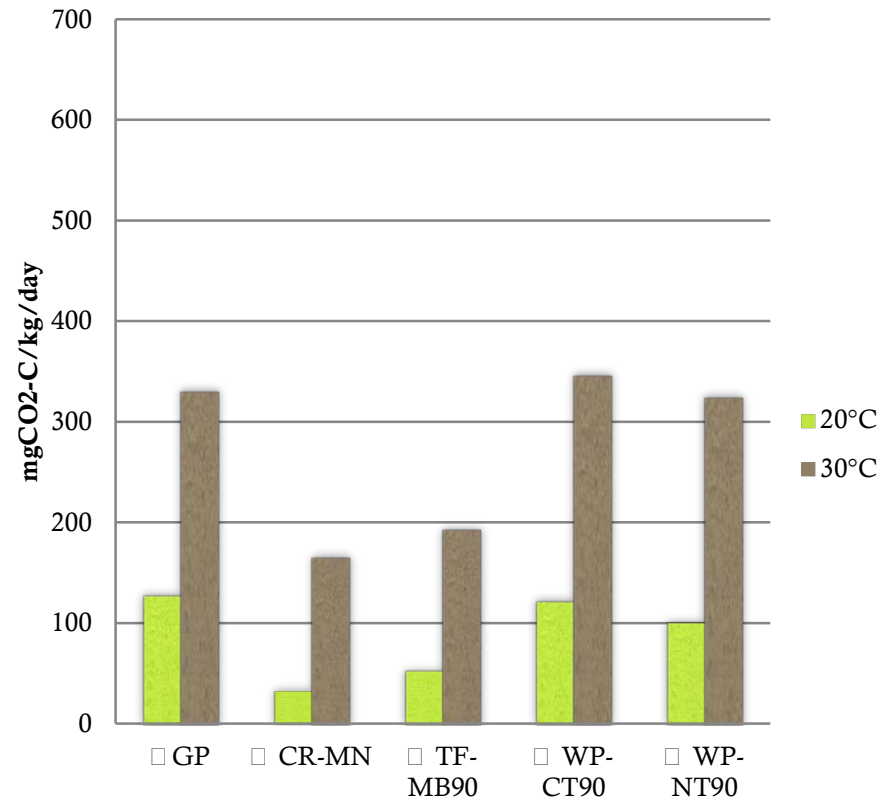


What We Found

Mineralized Carbon (0-10 cm)



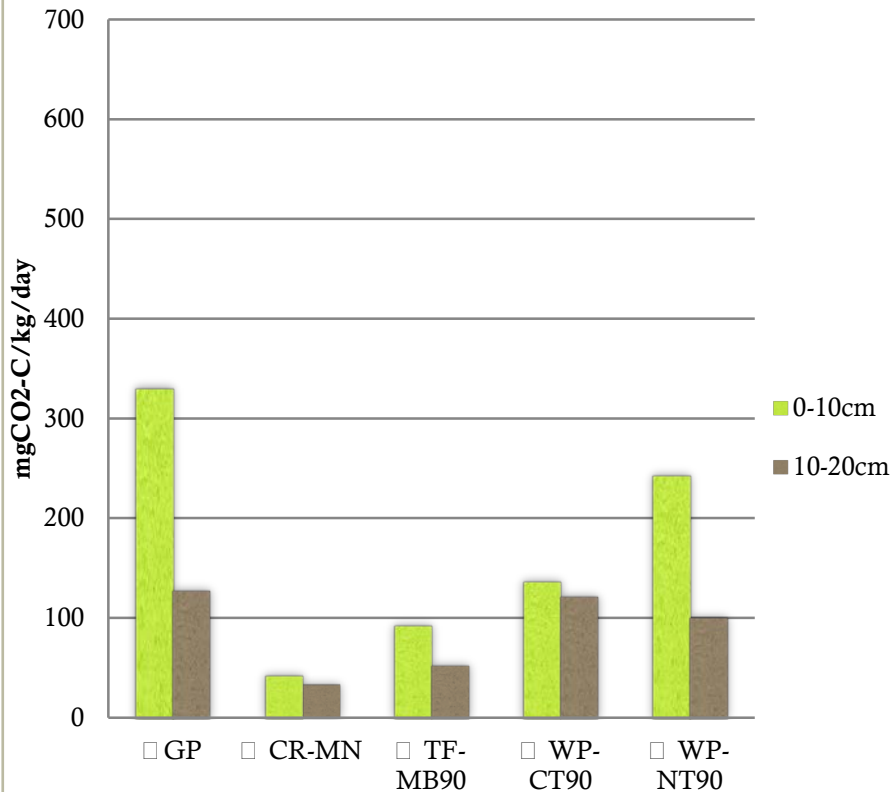
Mineralized Carbon (10-20 cm)



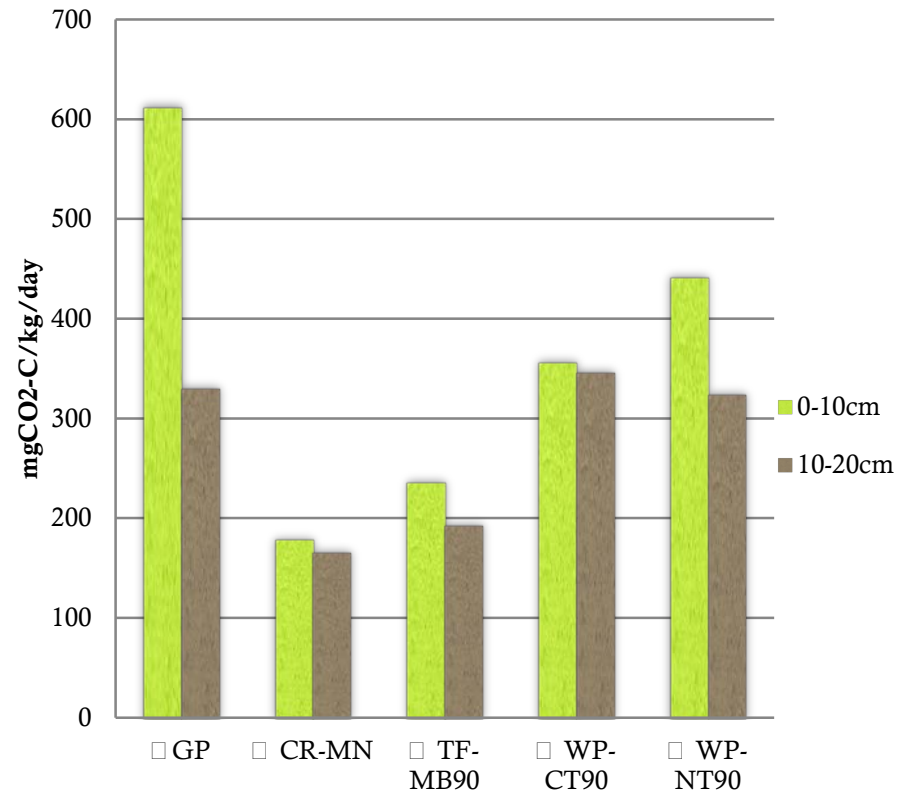
*graphs based off average of three repetitions

What We Found

Mineralized Carbon (20°C)



Mineralized Carbon (30°C)



*graphs based off average of three repetitions

In Summary

Which long-term treatments maintain adequate labile carbon and how do they face up to a warming climate?

Our data shows that:

- Total carbon mineralized is higher at 30°C than at 20°C for all of the five treatments
- Total carbon mineralized is higher at shallower depths (0-10cm) than at deeper depths (10-20cm)
- Total carbon mineralized is higher in less disturbed treatments

What we still don't know:

- What other factors are contributing to the labile carbon pool and how will they react to the warming climate?

What Can We Do?

Potential Stakeholders: Farmers and contributors of the PNW cereal production region, investors, the general public

Extension: a website or blog with published journals or studies paired with public field days including a cost/benefit analysis for potential stakeholders; set up an informational booth at farmer's markets

In the Meantime...

Here's what else is going on in Pendleton

- CO2 Measurements
- Nitrogen Extractions
- pH Measurements
- Moisture Readings
- Wheat Harvest
- Biochar Experiment
 - Soil Sample Analysis
 - Root/Crown Analysis
 - Plant/Soil Grinding



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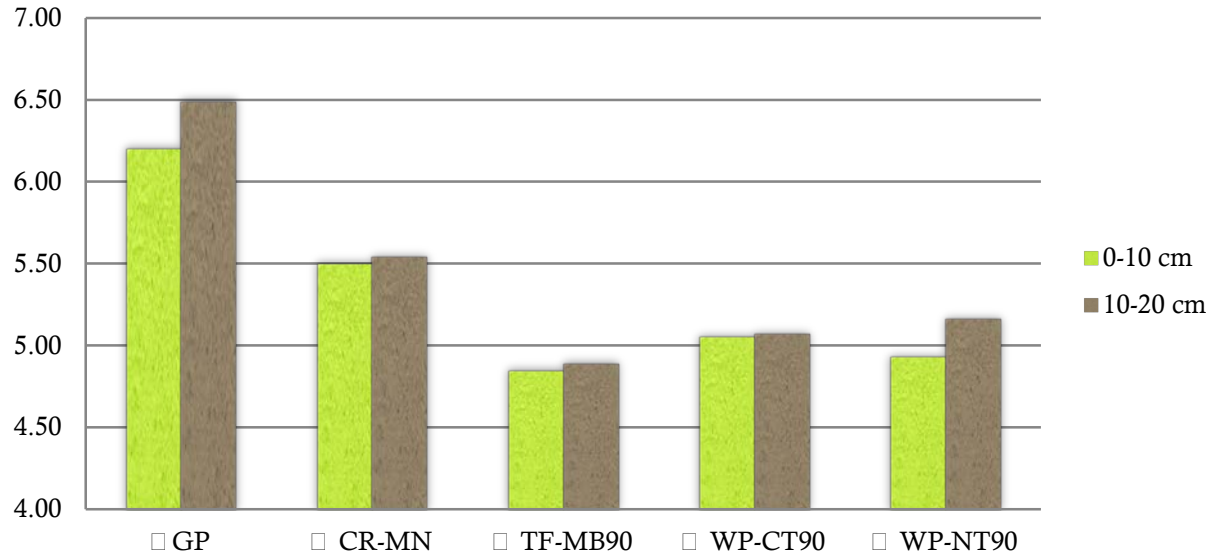
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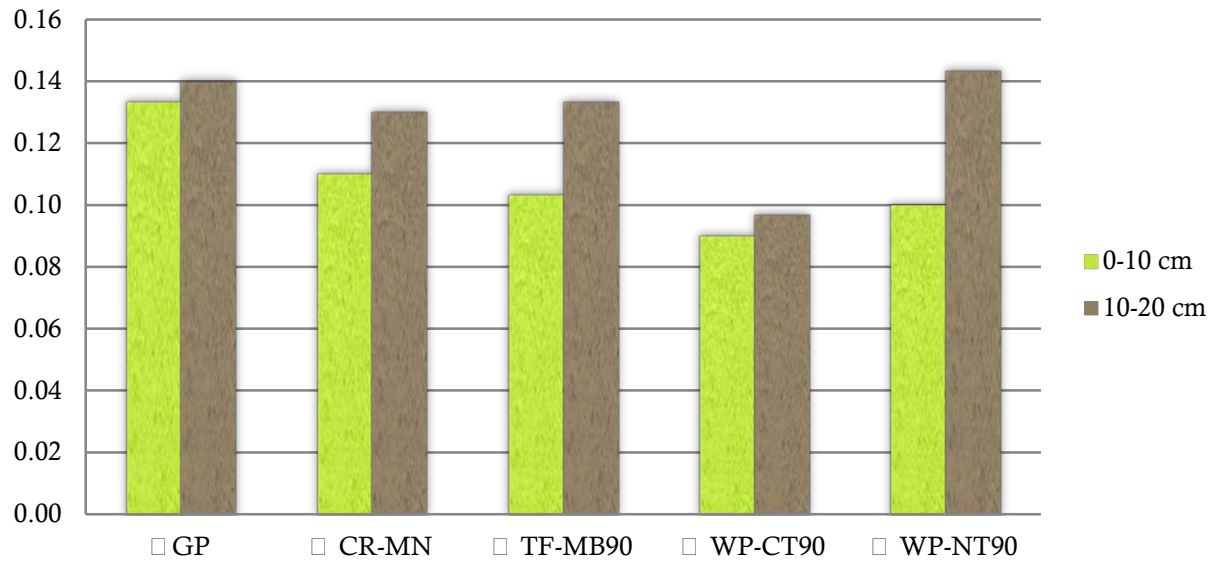


Questions?

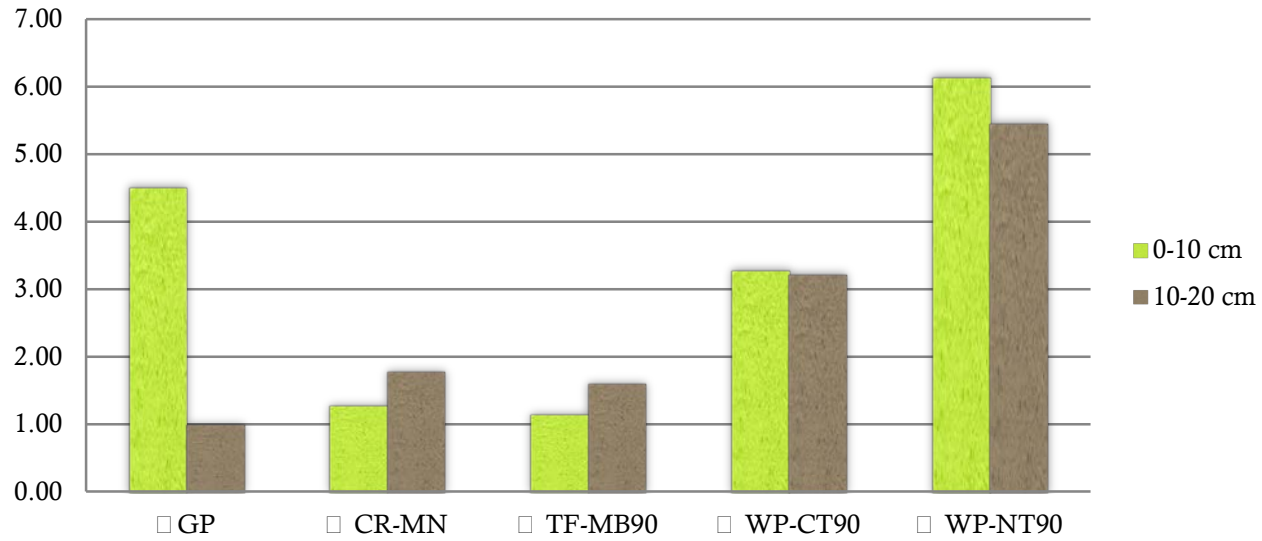
pH Values



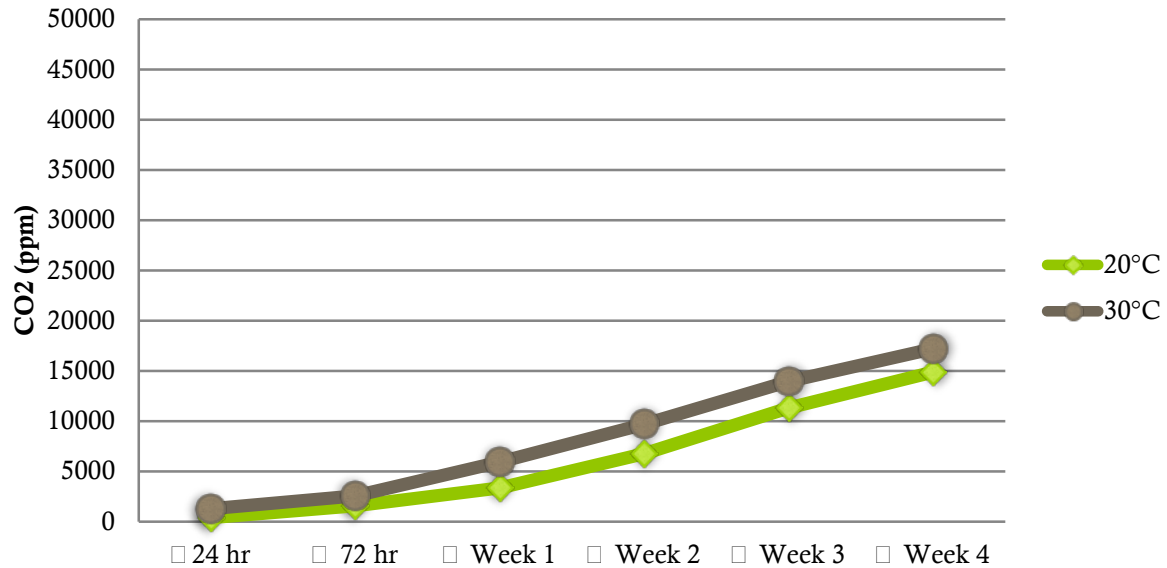
%H₂O



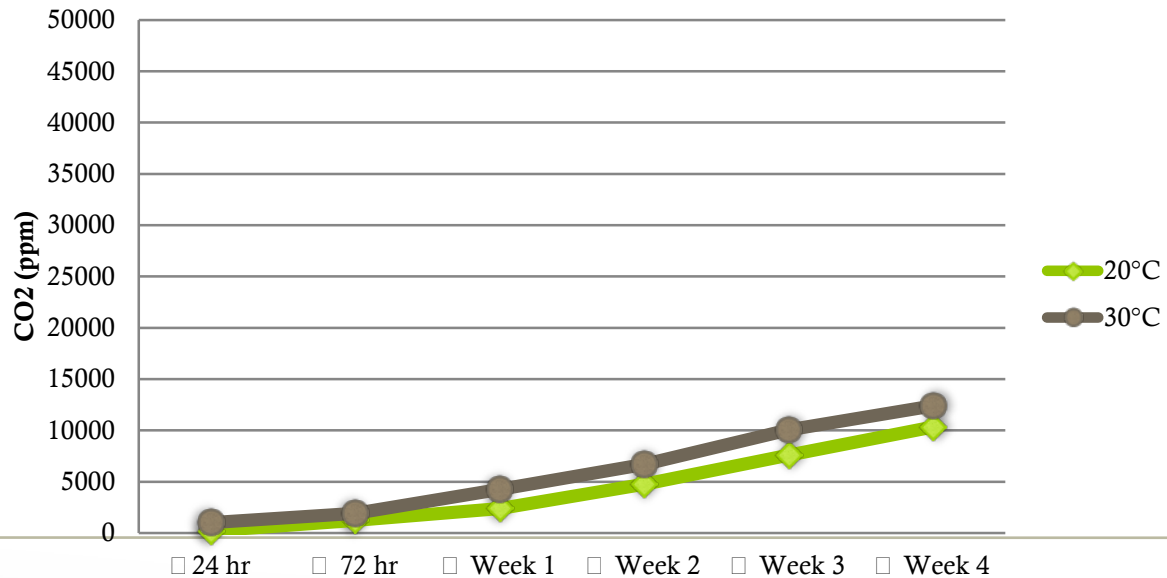
NO₃ (mg/kg)



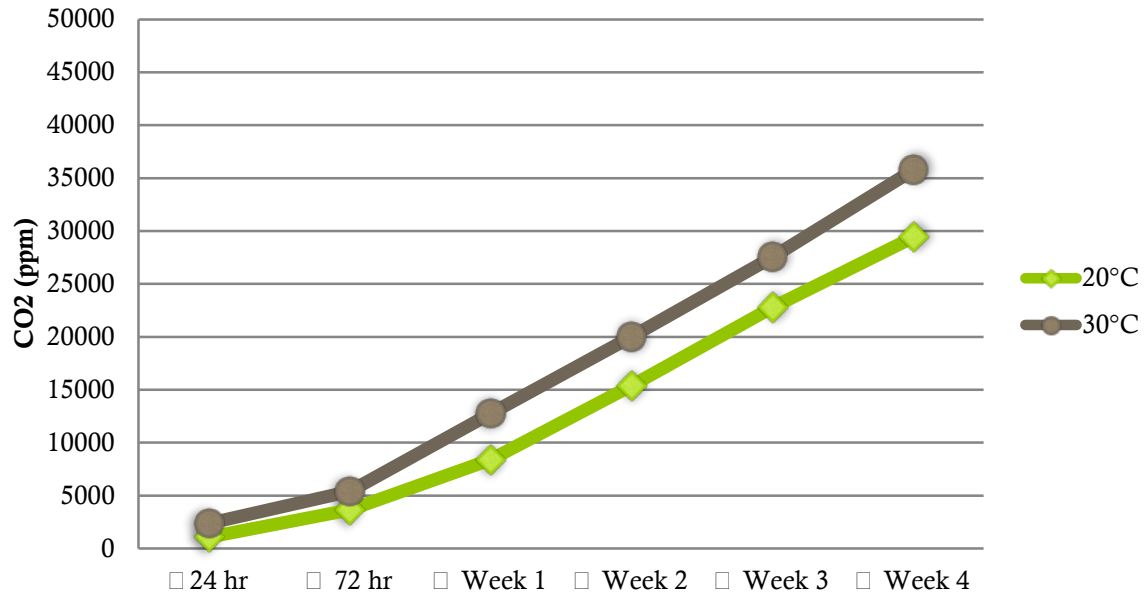
TF-MB90 CO2 Measurement (0-10 cm)



TF-MB90 CO2 Measurement (10-20 cm)



WP-NT90 CO2 Measurement (0-10 cm)



WP-NT90 CO2 Measurement (10-20 cm)

