SFMA SPORTS FIELD MANAGEMENT ASSOCIATION

Potentially Reduce Fertilizer and Irrigation Inputs on Athletic Fields

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Potentially Reduce Fertilizer and Irrigation Inputs on Athletic Fields

A.J. Lindsey, Ph.D.

Urban Turfgrass Management

Environmental Horticulture

University of Florida

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Outline

- Soil Health
- Soil Amendments
- Fertilizer Sources

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Soil Health/Quality

Soil Health/Quality

What is Soil Health or Quality

- Ability of soil to:
  - Function and sustain productivity
  - Enhance and maintain water and air quality
  - Support plant health

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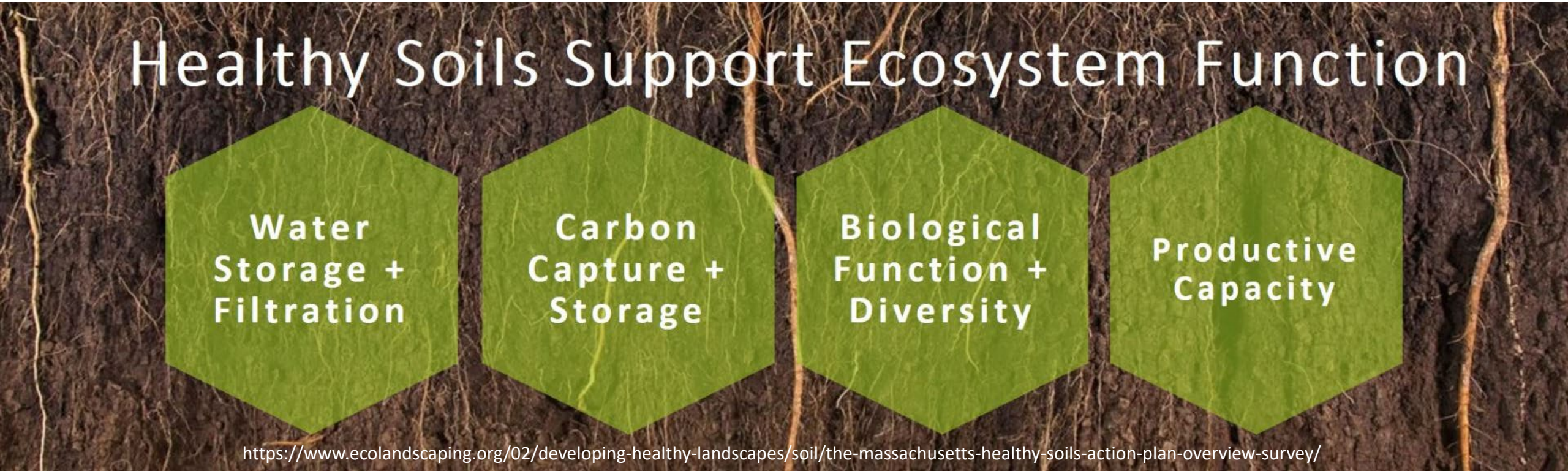
Why is Soil Health Important

- Nutrient cycling & availability
- Water holding capacity
- Soil structure
- Reducing potential pollutants
- Physical stability
- Sustain plant and animal life



https://www.ecolandscaping.org/02/developing-healthy-landscapes/soil/the-massachusetts-healthy-soils-action-plan-overview-survey/

Soil Health

- Physical
  - Soil texture, moisture, porosity, aggregation, compaction
- Chemical
  - Organic matter, pH, cation exchange capacity (CEC), nutrient concentrations
- Biological
  - Microbial biomass, activity, mineralization, respiration, enzymes

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Poor Soil Quality/Health

- Decreased rooting
- Compaction
- **Increased fertilizer and irrigation**

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Soil Health - Sustainability

- Less inputs - Save money
  - Irrigation and fertilizers
- Easier management

Nutrition and Fertilization BMPs

The goal of a proper nutrient management plan should be to apply the minimum necessary nutrients to achieve an acceptable quality and apply these nutrients in a manner that maximizes their plant uptake

Sustainability

- Soil amendments
  - Peat-based materials
  - Biosolids
  - Compost
  - Biochar
  - Humic-based products
- Alternative fertilizers

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Compost

- Tillage
- Quality compost
  - Variation between products
- Application
- Irrigation reductions?
- Nutrient impacts
  - Adjust fertilizer rates

Compost Soil Incorporation

Eban Z. Bean, PhD, PE; ezbean@ufl.edu

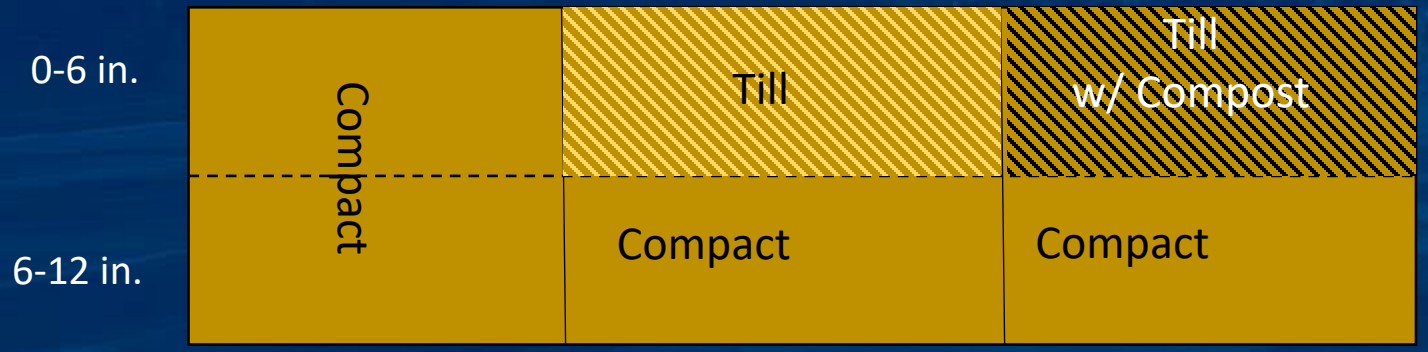
Treatments

- 3 compacted
- 3 tilled (5-6 in.)
- 3 tilled compost (Comand) into soil

4 $yd^3/1000\ ft^2$

(1 in. into 6 in.)

Just before sod (Empire zoysia) laid



Plant Available Water

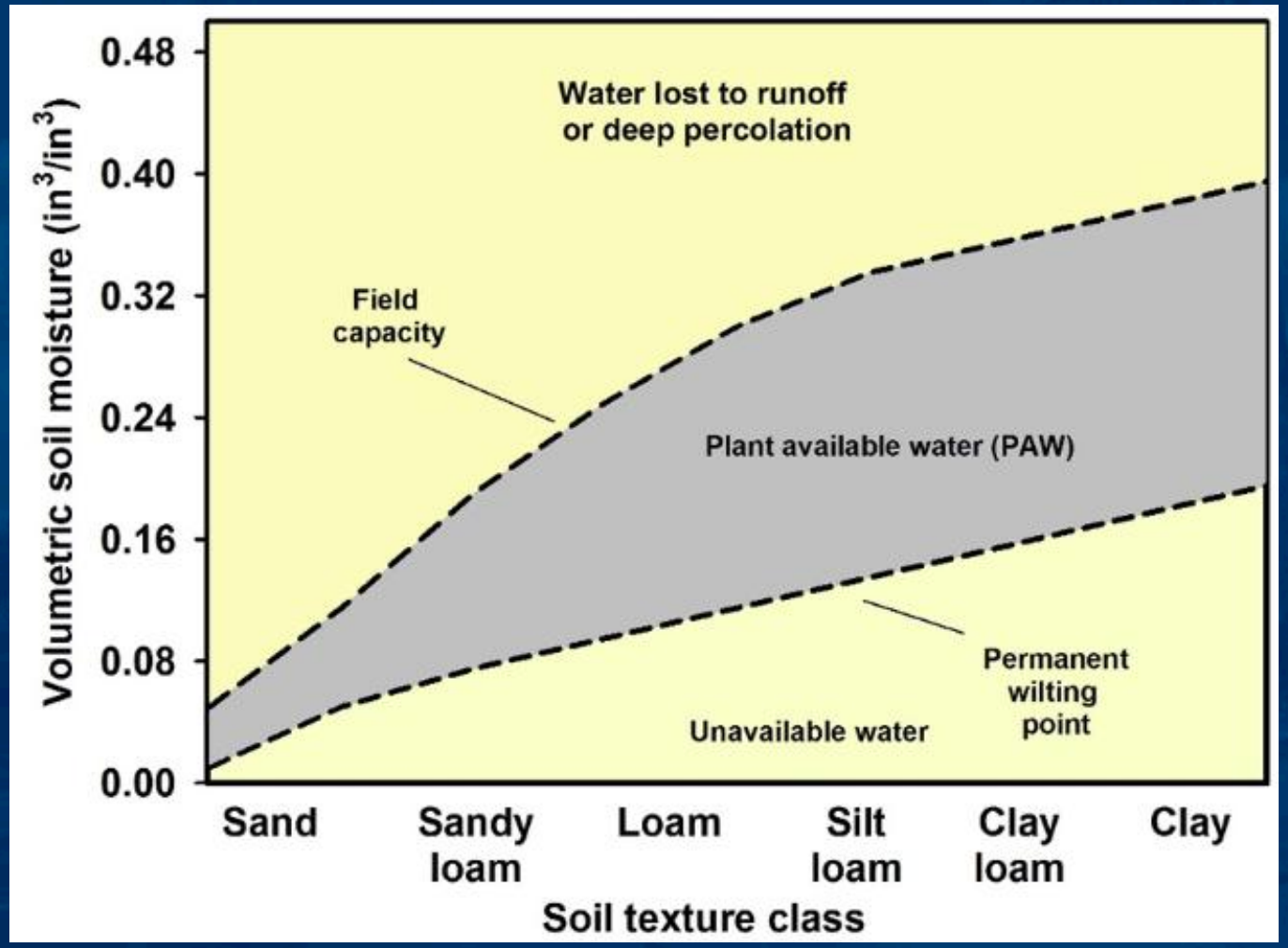
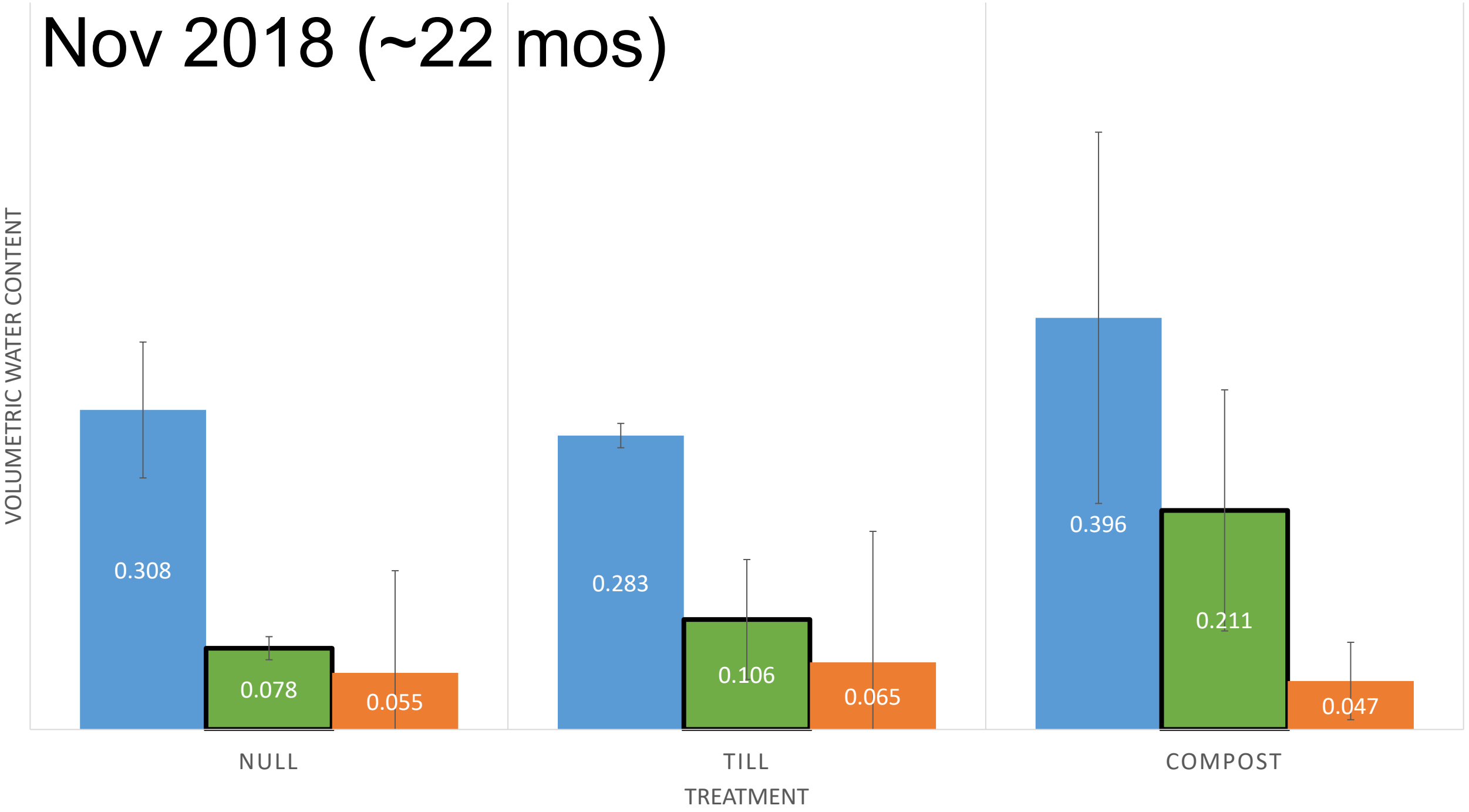


Figure 2. General relationship between plant available water, soil field capacity, permanent wilting point, unavailable water, and soil texture class. Credit UF/IFAS.

Nov 2018 (~22 mos)

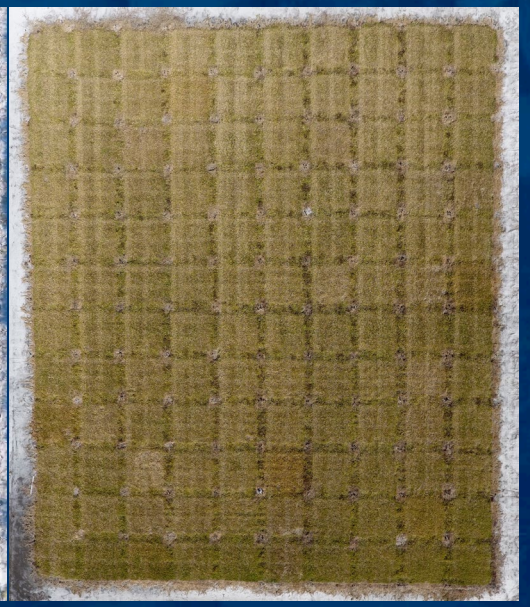


Plot Study Aerial Images: 2019-20

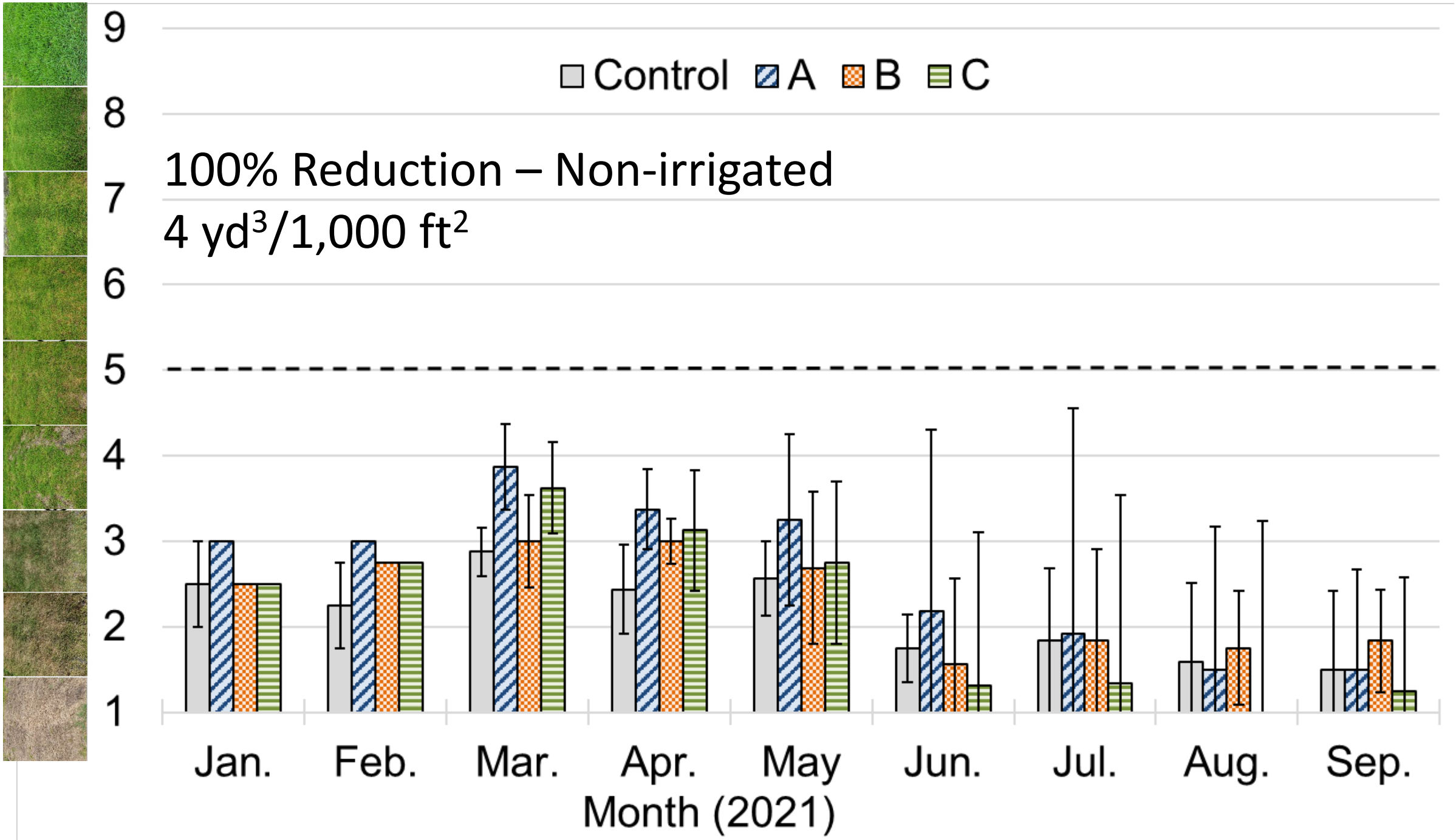
Aug. 2019

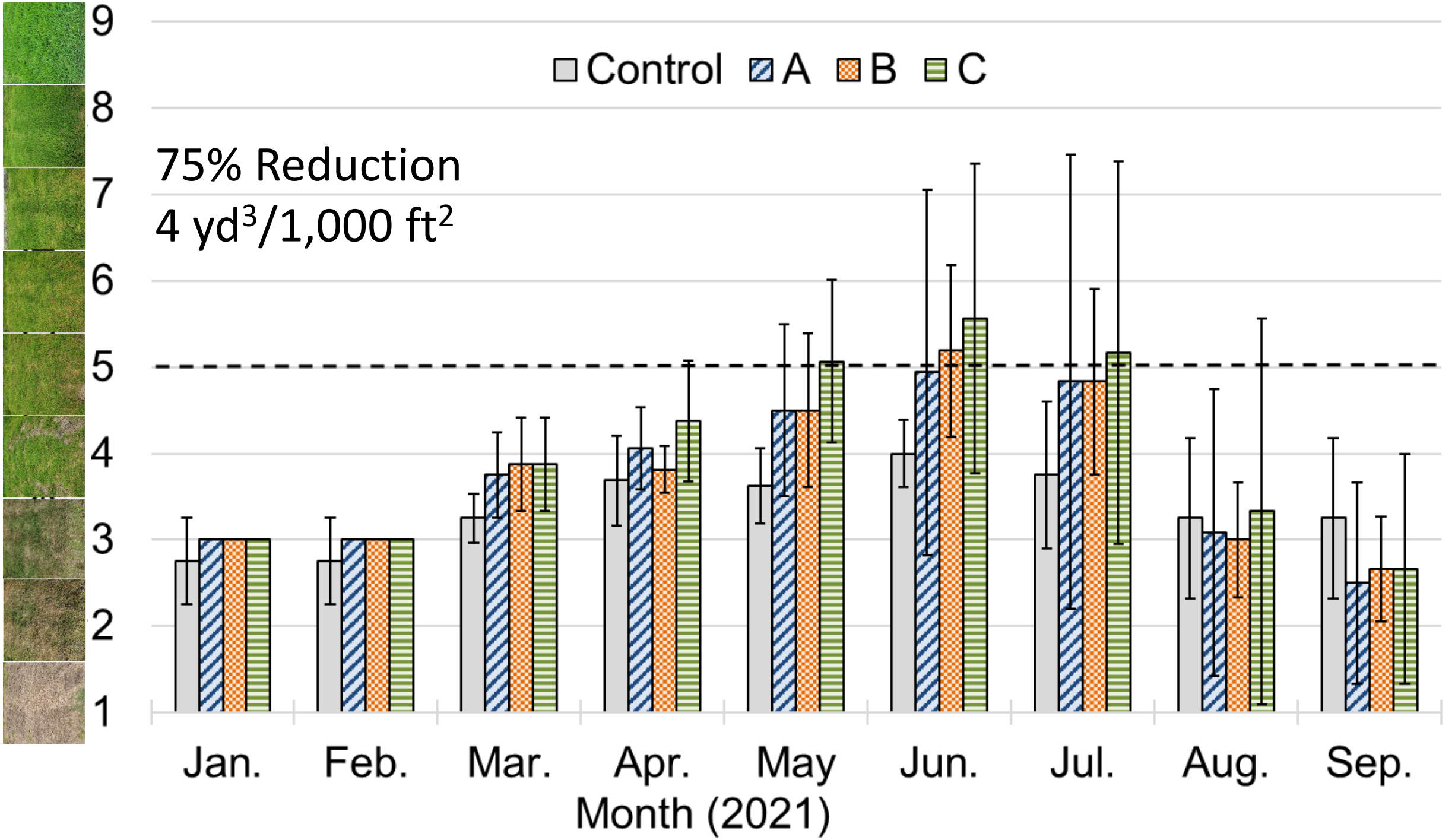
Jun. 2020

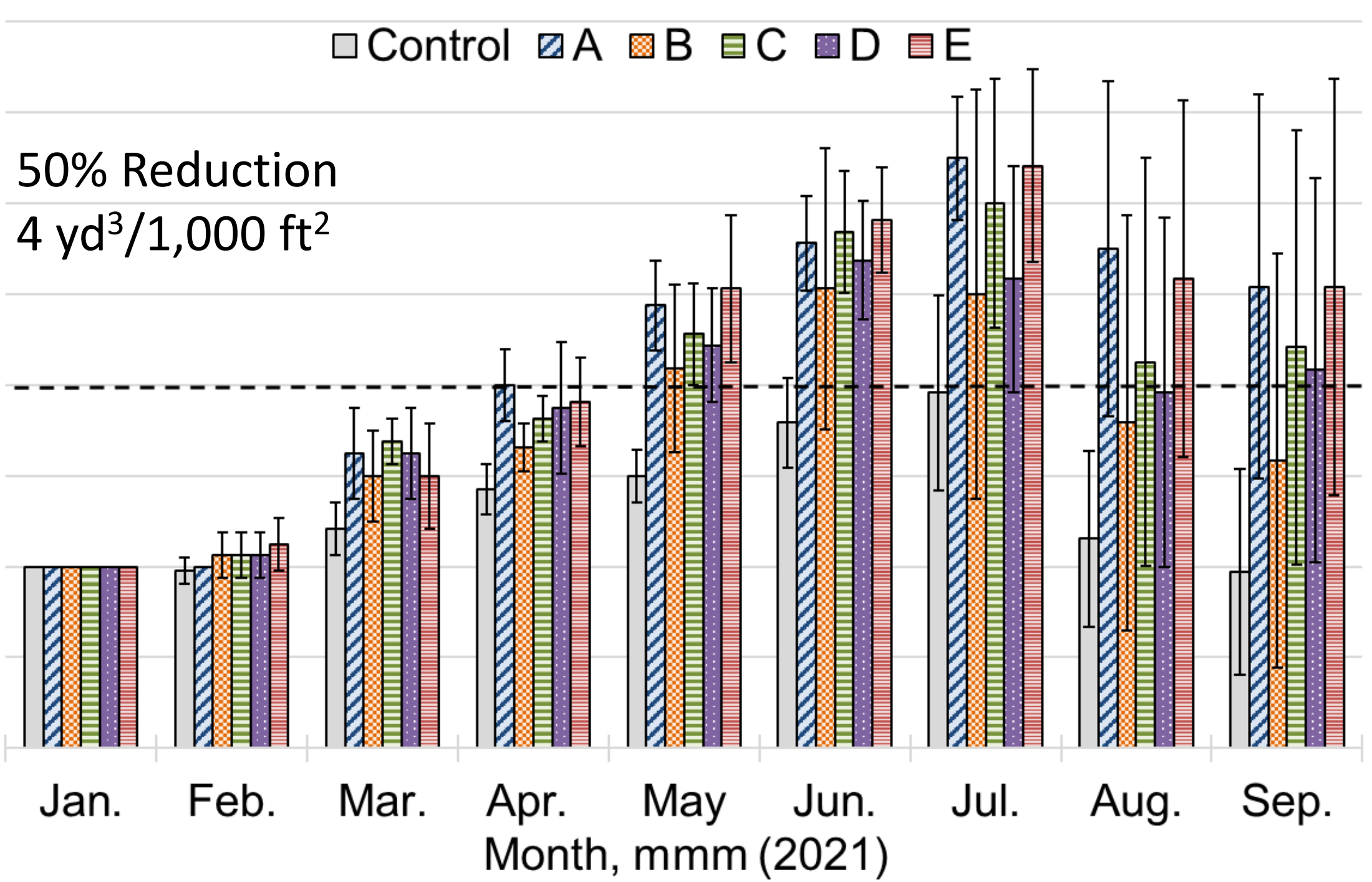
Sep. 2020

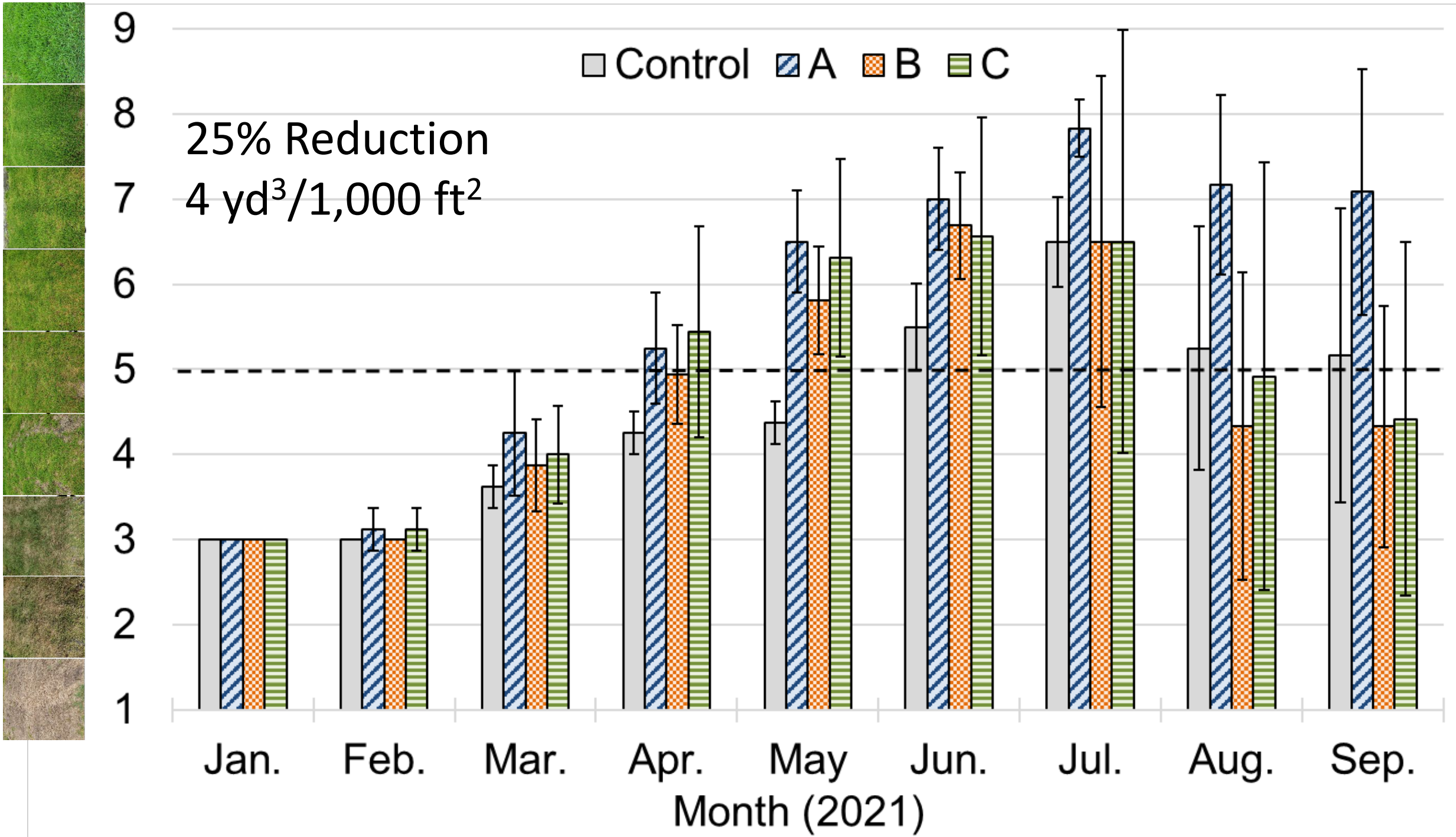


Dec. 2020


Control
A
B
C
100% Reduction – Non-irrigated
4 yd³/1,000 ft²
9
8
7
6
5
4
3
2
1
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Month (2021)


Control
A
B
C
75% Reduction
4 yd³/1,000 ft²
9
8
7
6
5
4
3
2
1
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Month (2021)


Control
A
B
C
D
E
50% Reduction
4 yd³/1,000 ft²
9
8
7
6
5
4
3
2
1
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Month, mmm (2021)


Control
A
B
C
25% Reduction
4 yd³/1,000 ft²
9
8
7
6
5
4
3
2
1
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Month (2021)

Compost Topdressing

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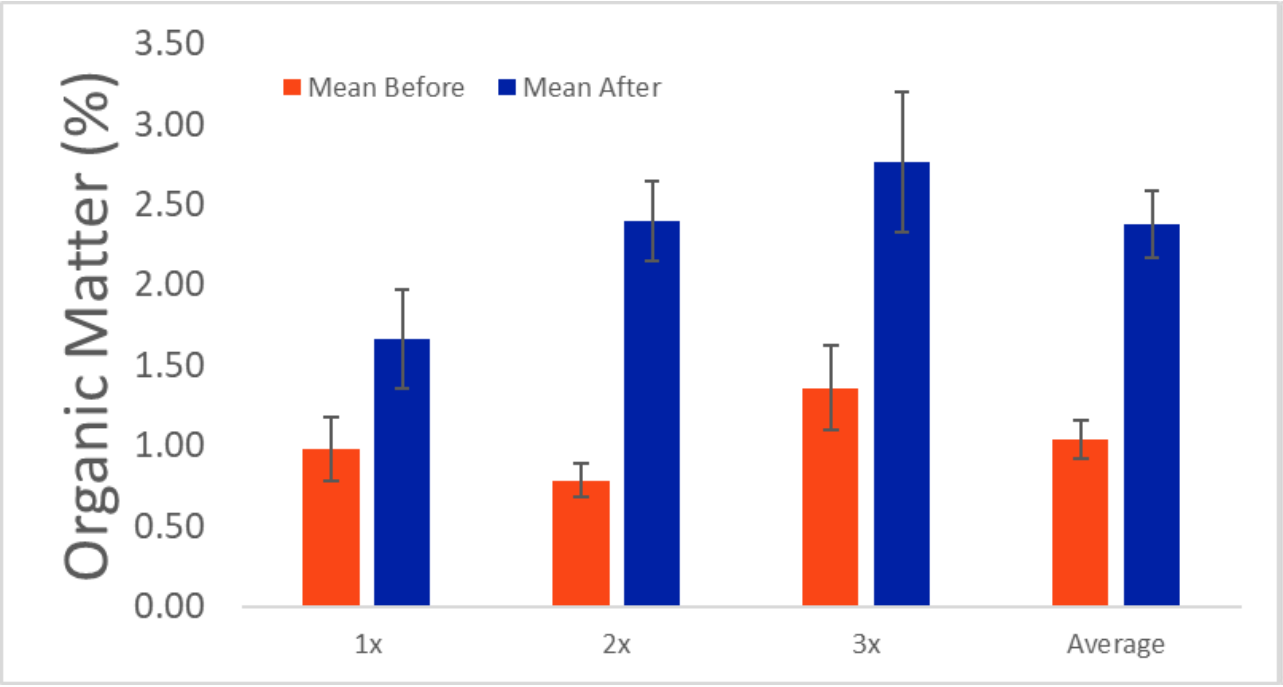
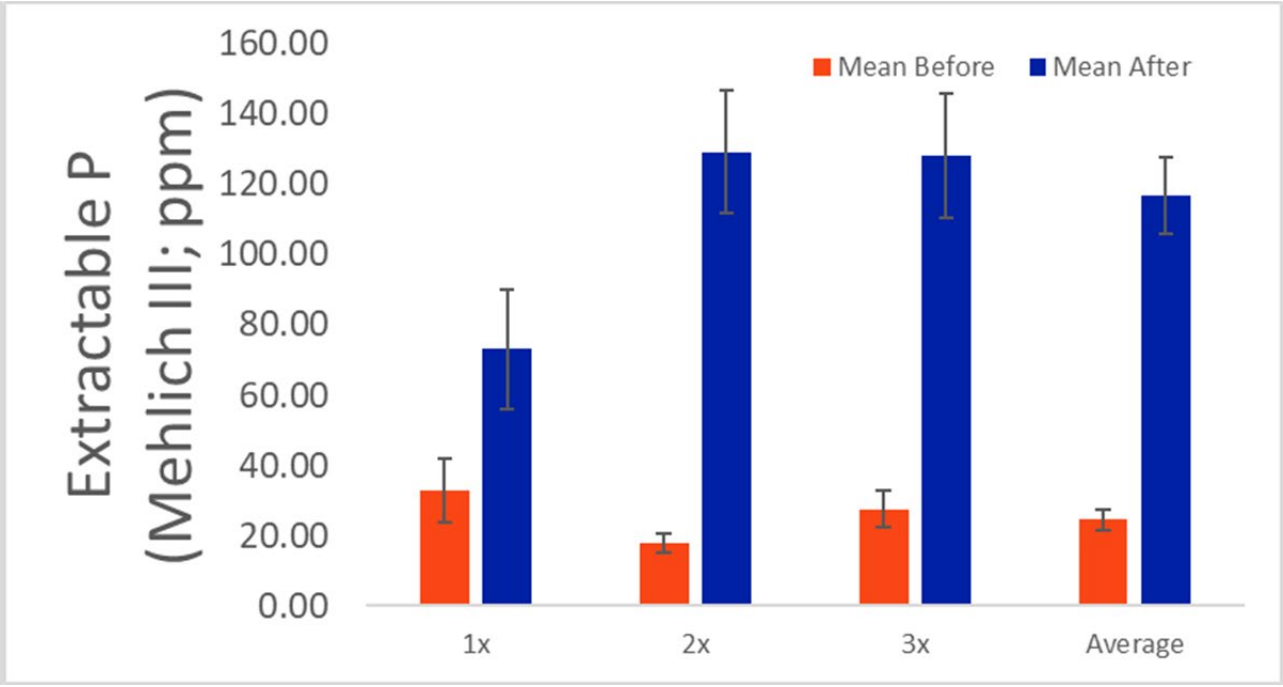
Topdressing Effects on Soil Fertility





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Compost Topdressing

Biochar

Benefits

- Water retention
  - Drought tolerance
- Nutrient retention
- Reduce N leaching

Concerns/Limitations

- Decrease water infiltration

Questions

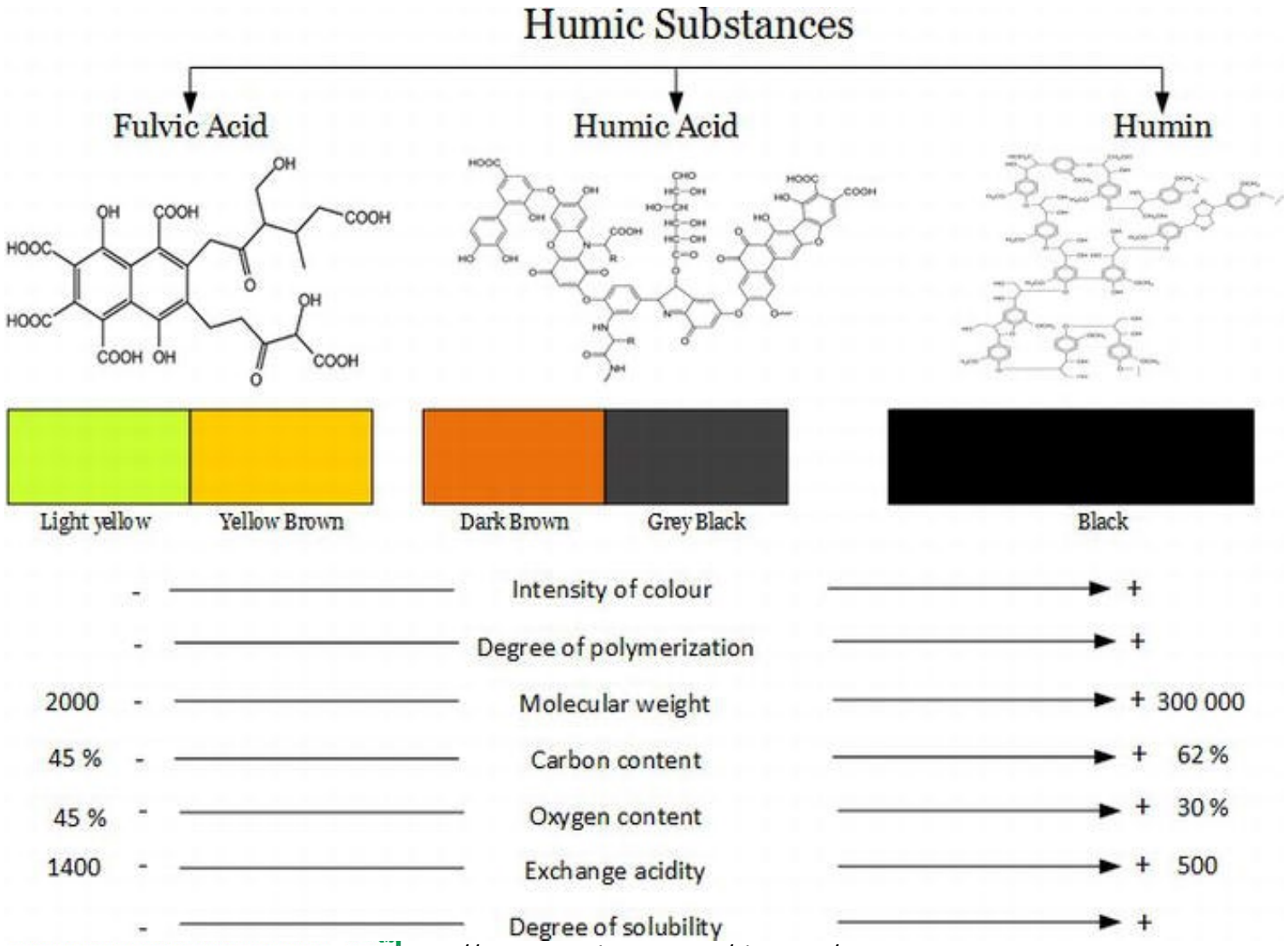
- Irrigation reduction
- Fertilizer and herbicide effectiveness
- Soil Health
- Biological properties

Humic Products

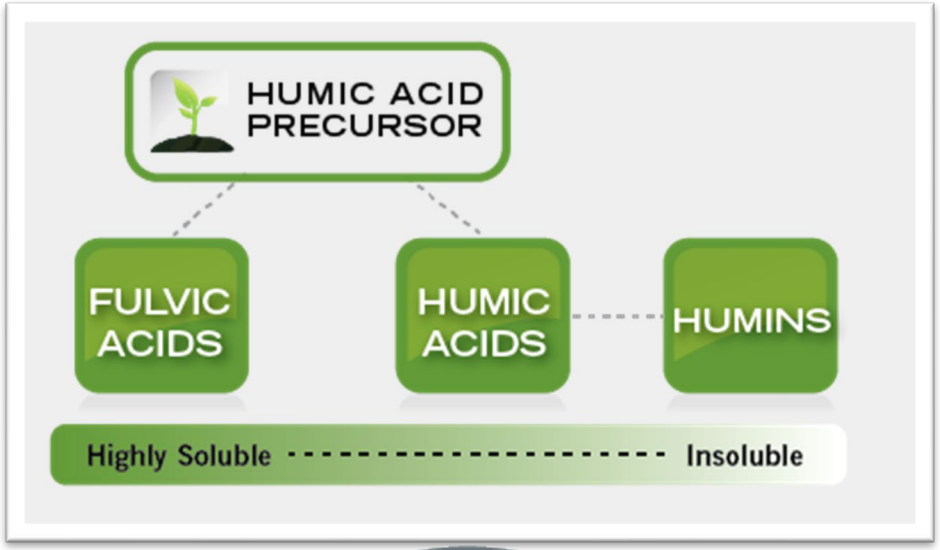
Benefits on turfgrass

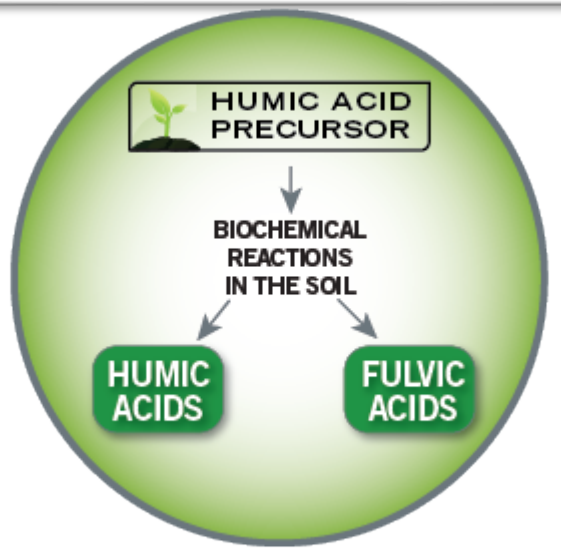
- Rooting
- Quality
- Stress tolerance
- Soil health?
- Increase fertilizer effectiveness?

Humic Product Issues

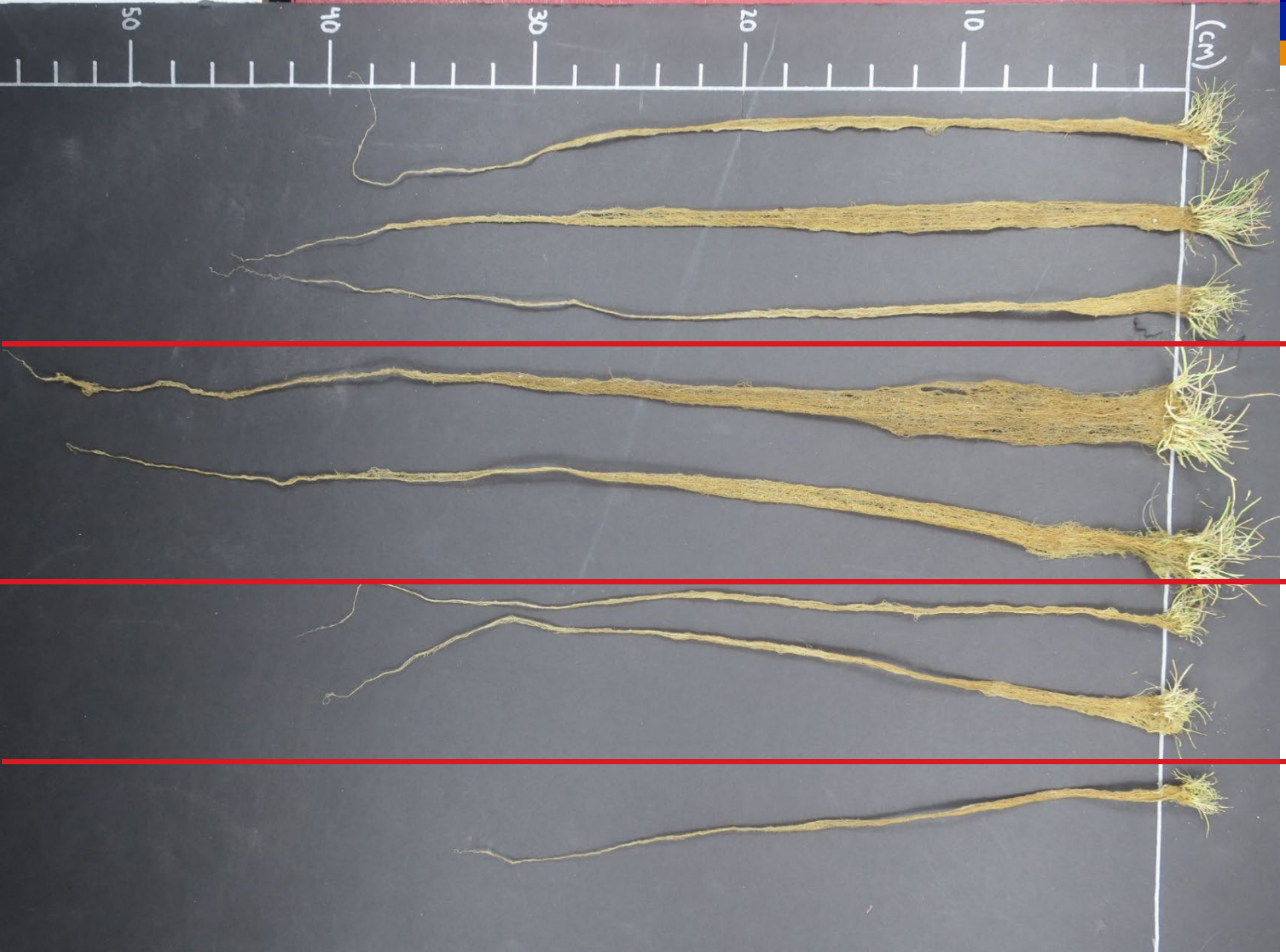


https://www.intechopen.com/chapters/77091





https://andersonshumates.com/our-technology/



Syn. + Humic (H)

PCHCU

Urea + H

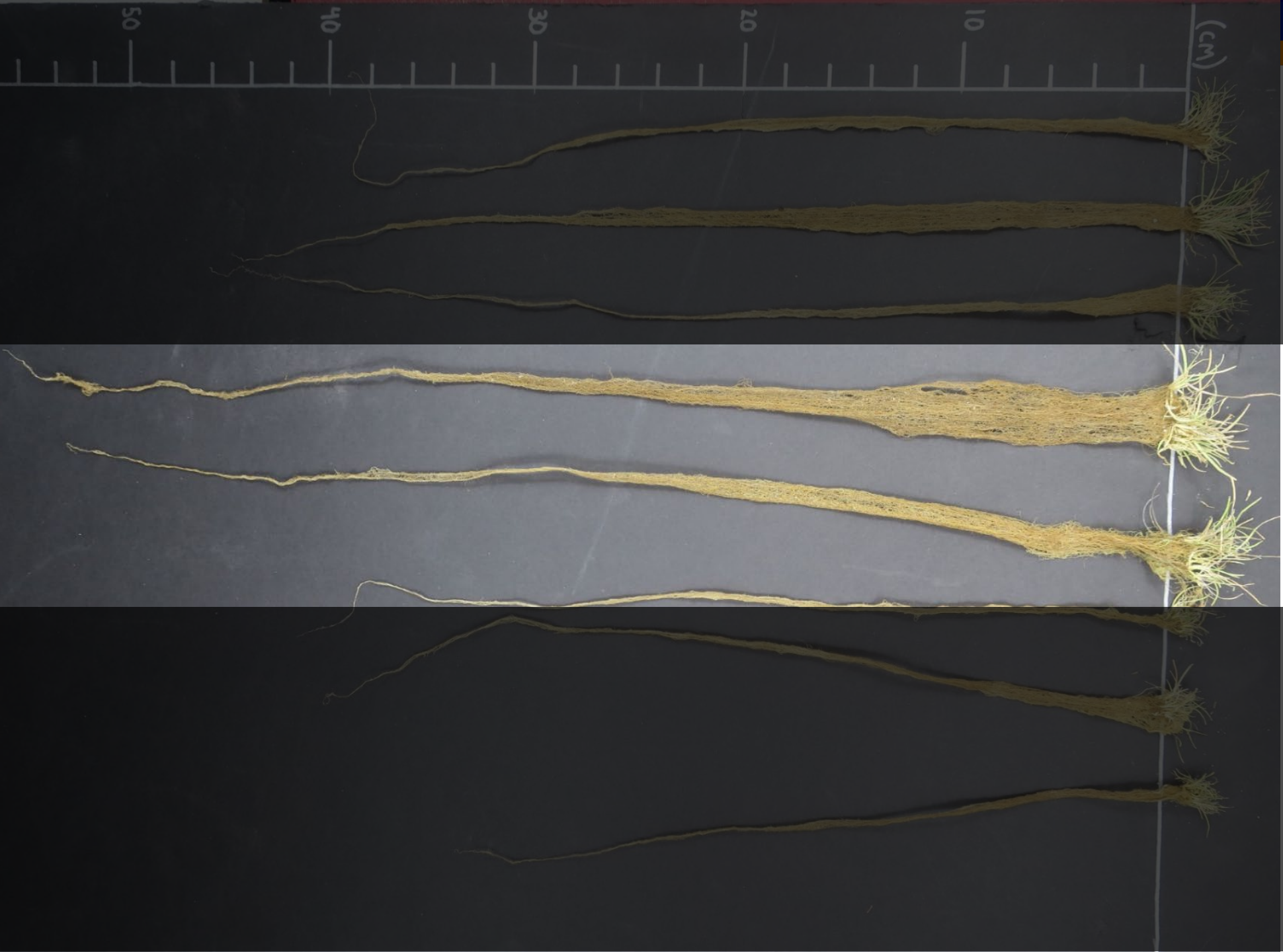
Starter + H

Starter

Uflexx

Urea

Non-treated



Syn. + Humic (H)

PCHCU

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Starter + H

Starter

Uflexx

Urea

Non-treated

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PCHCU

Urea + H

Starter + H

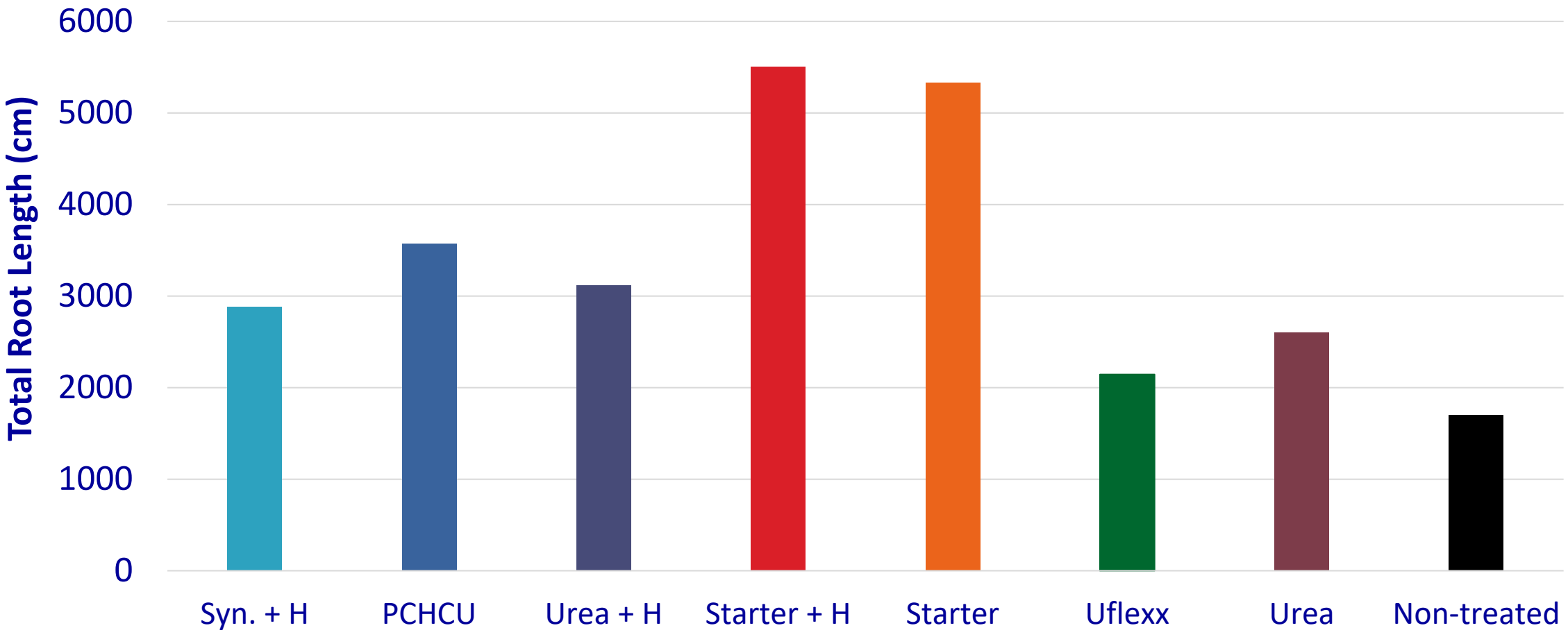
Starter

Uflexx

Urea

Non-treated

Turfgrass Rooting



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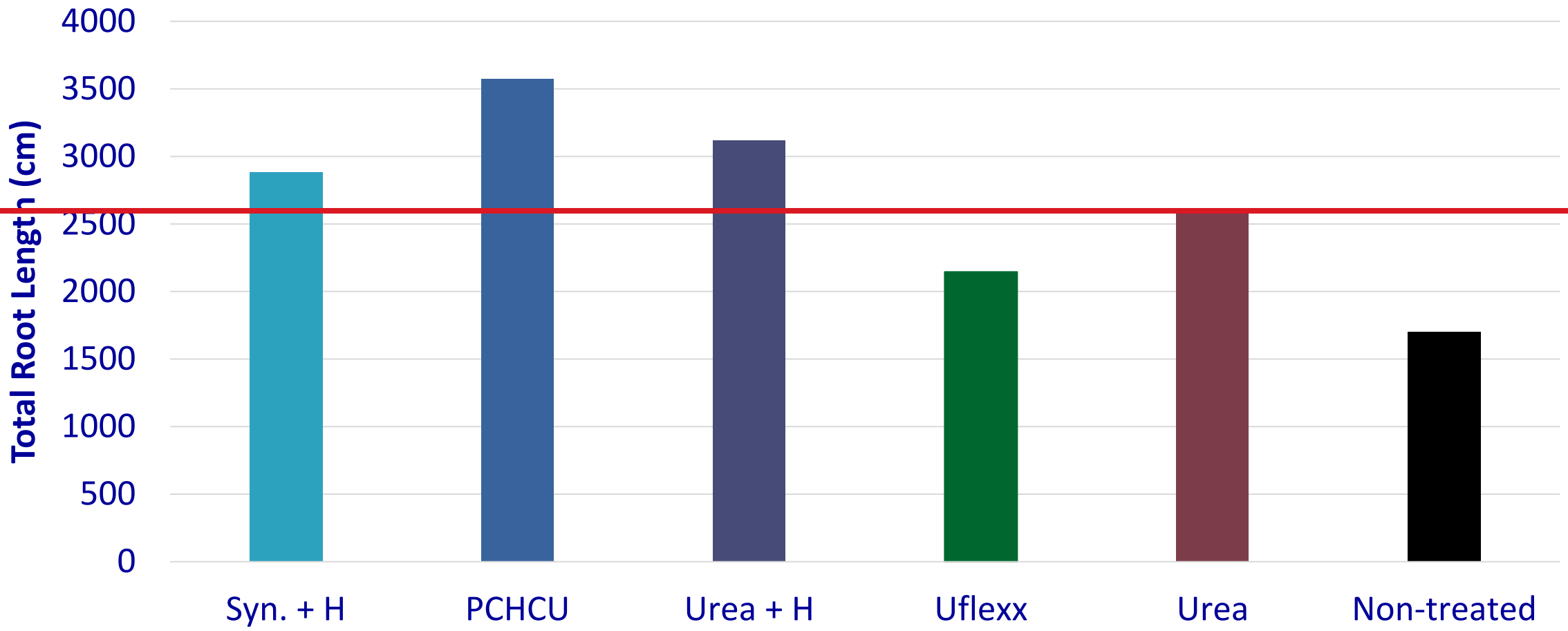
Turfgrass Rooting



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Soil Health Response

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Soil Microbial Biomass

- Nutrient cycling and availability
- Increased decomposition of organic matter
- Improved soil aggregation/structure
  - Improved water infiltration and holding capacity

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Potential Mineralizable Carbon (PMC)

- Measure CO_2
- Indicator of soil biological activity
- Estimate of soil N availability

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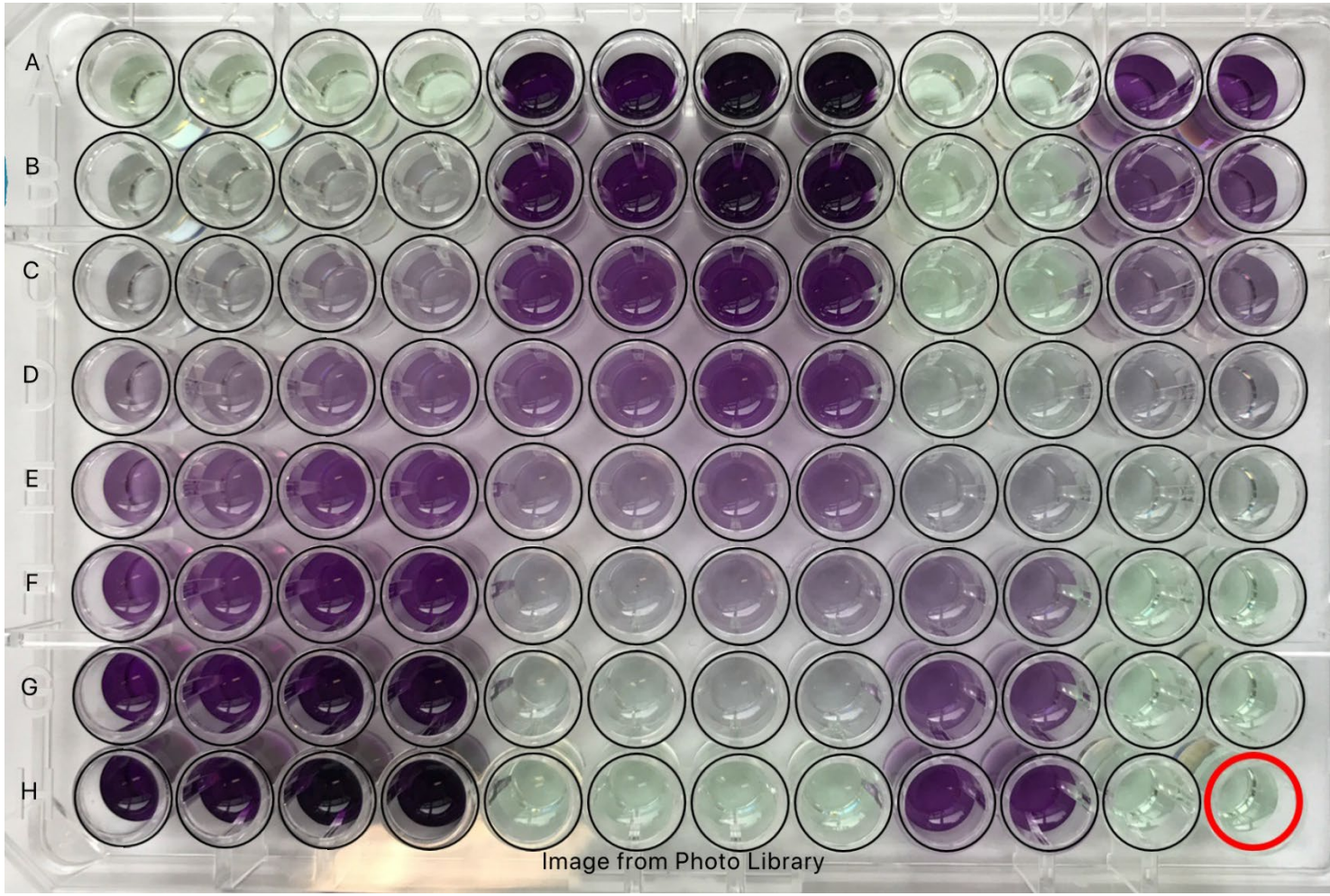
Potential Net N Mineralization (PMN)

- Soil extraction
  - Before and after incubation
- Measure NO_3 & NH_4 concentrations
- Net N mineralization



https://cms.sicasys.com/fileadmin/spotxel-reader/images/imageAnalysisPage.jpg

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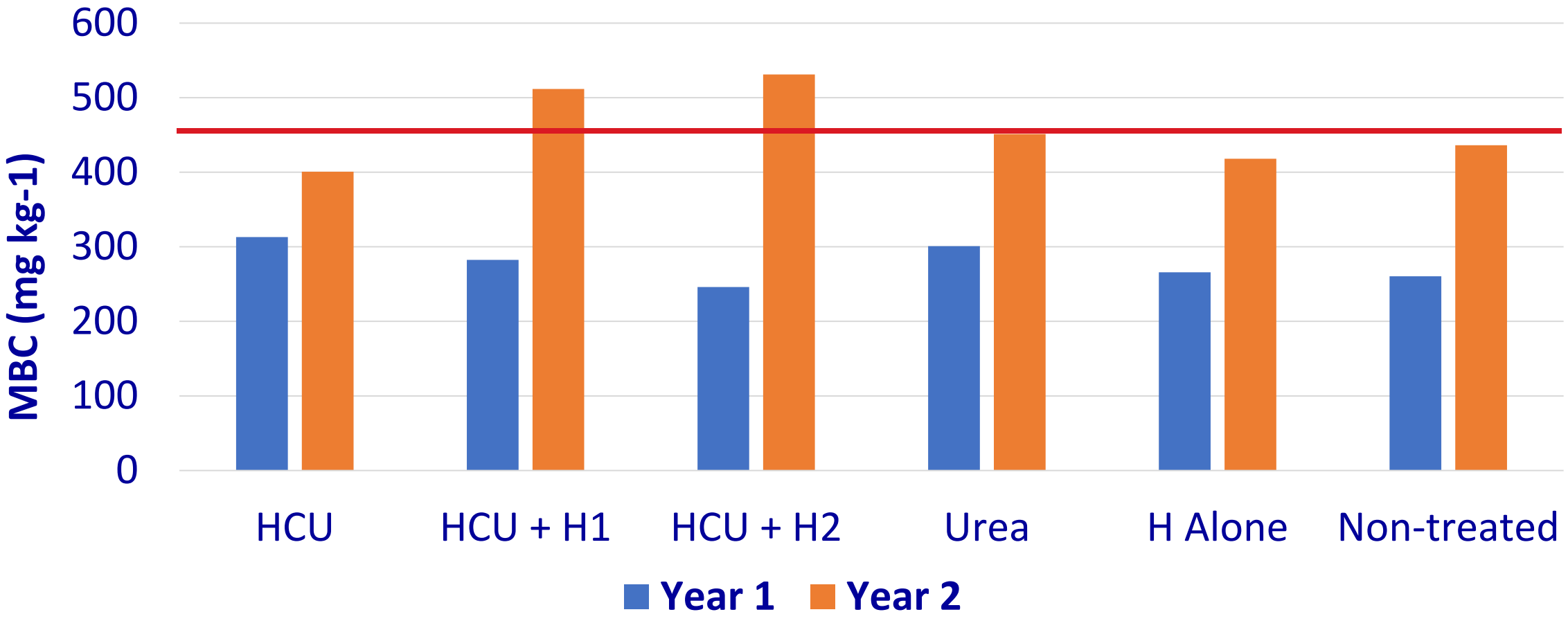
Microbial Biomass – USGA



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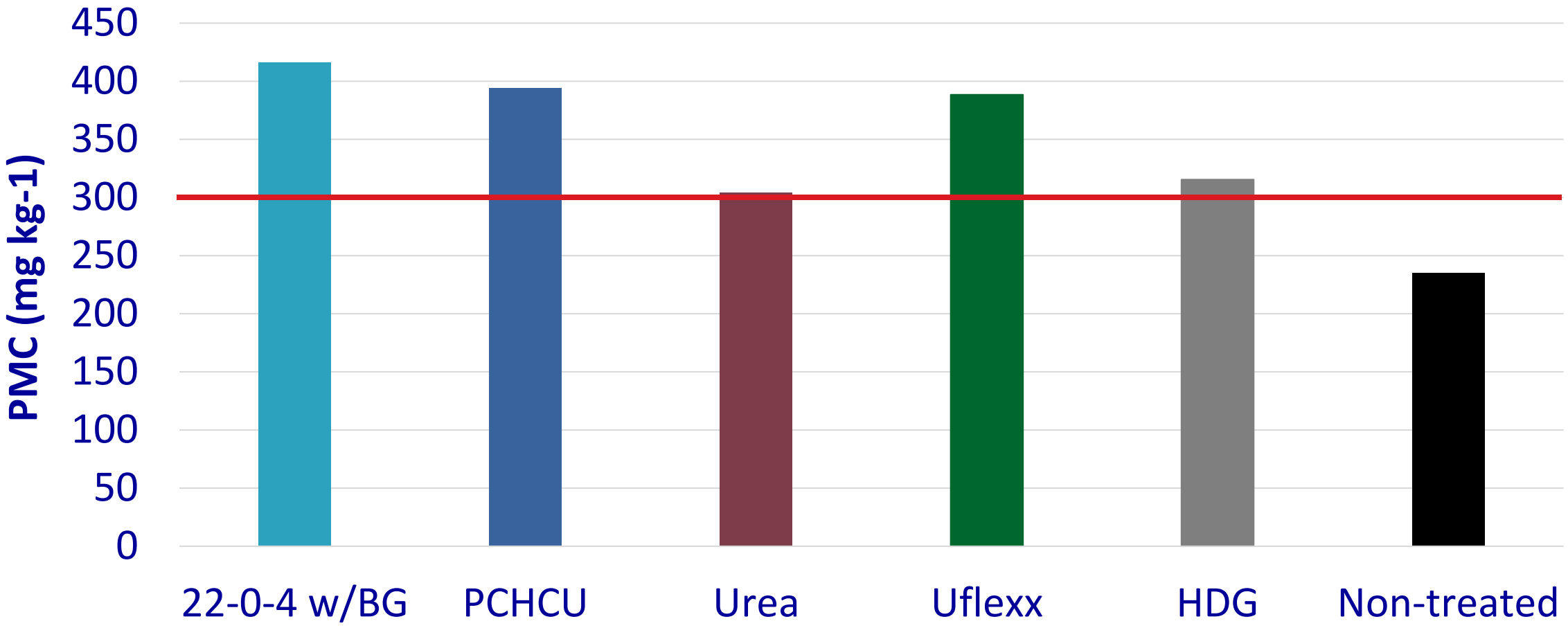
Native Soil Average – 511 mg kg^{-1}

Microbial Activity – Clay Loam



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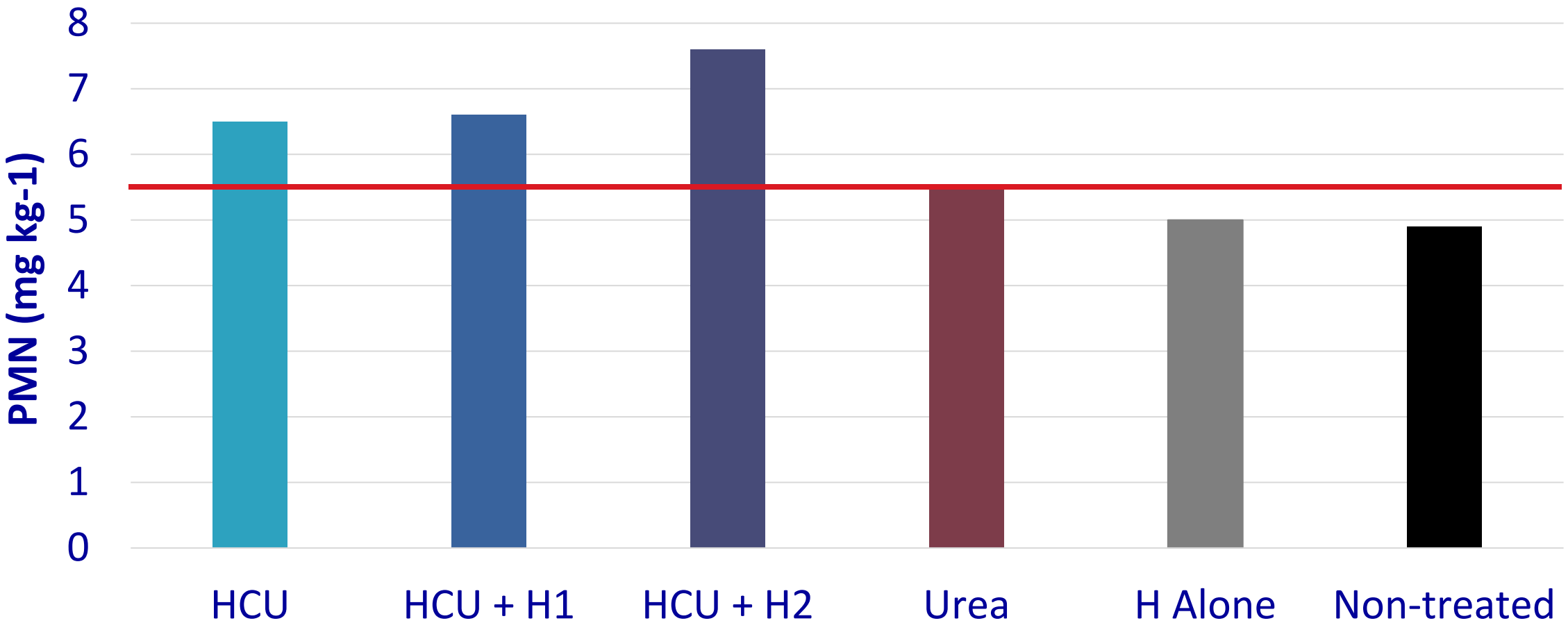
Nitrogen Mineralization – USGA



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Can we Decrease Nitrogen Inputs?

Treatment – Clay Loam
22-0-4 w/BG
PCHCU
PCHCU (3/4X)
Urea (3/4X) + HDG
Urea (1/2X) + HDG
Urea
Uflexx
HDG
Non-treated

Treatment - USGA
HCU
HCU (2/3X)
HCU + HDG
HCU + BG
Urea
HDG
Non-treated

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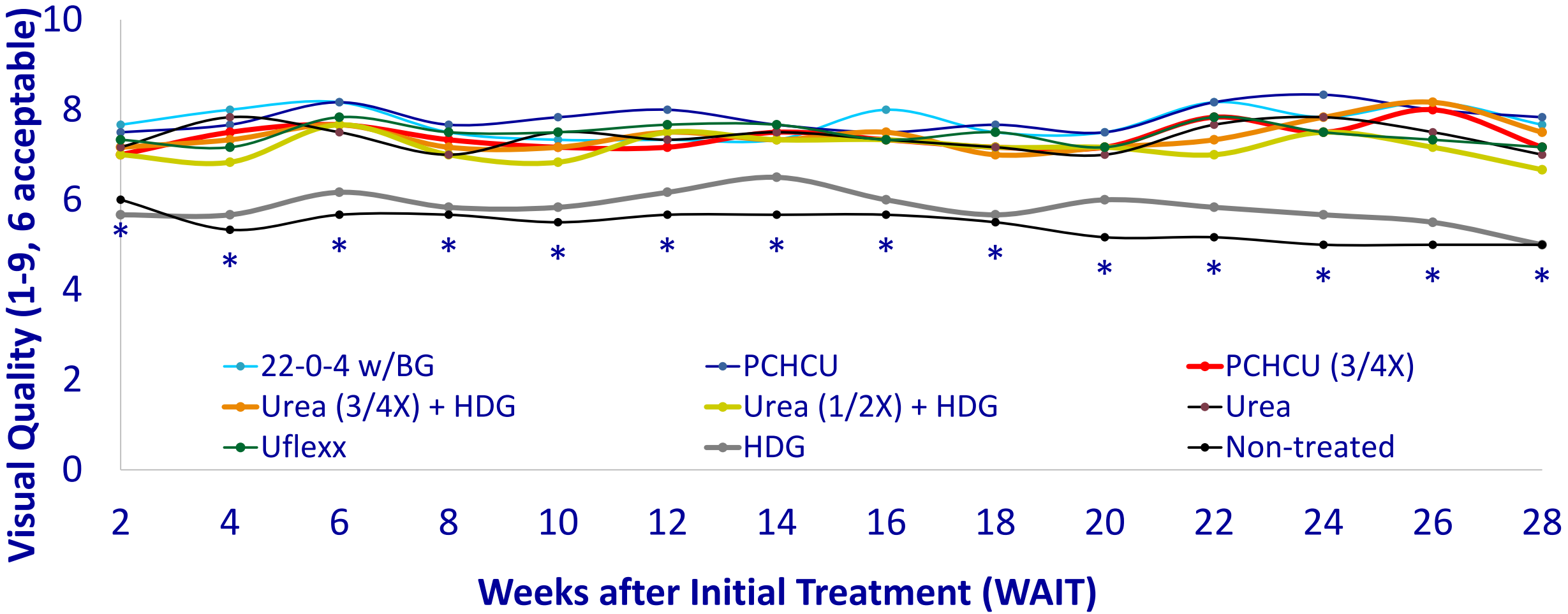
Visual Quality – Clay Loam



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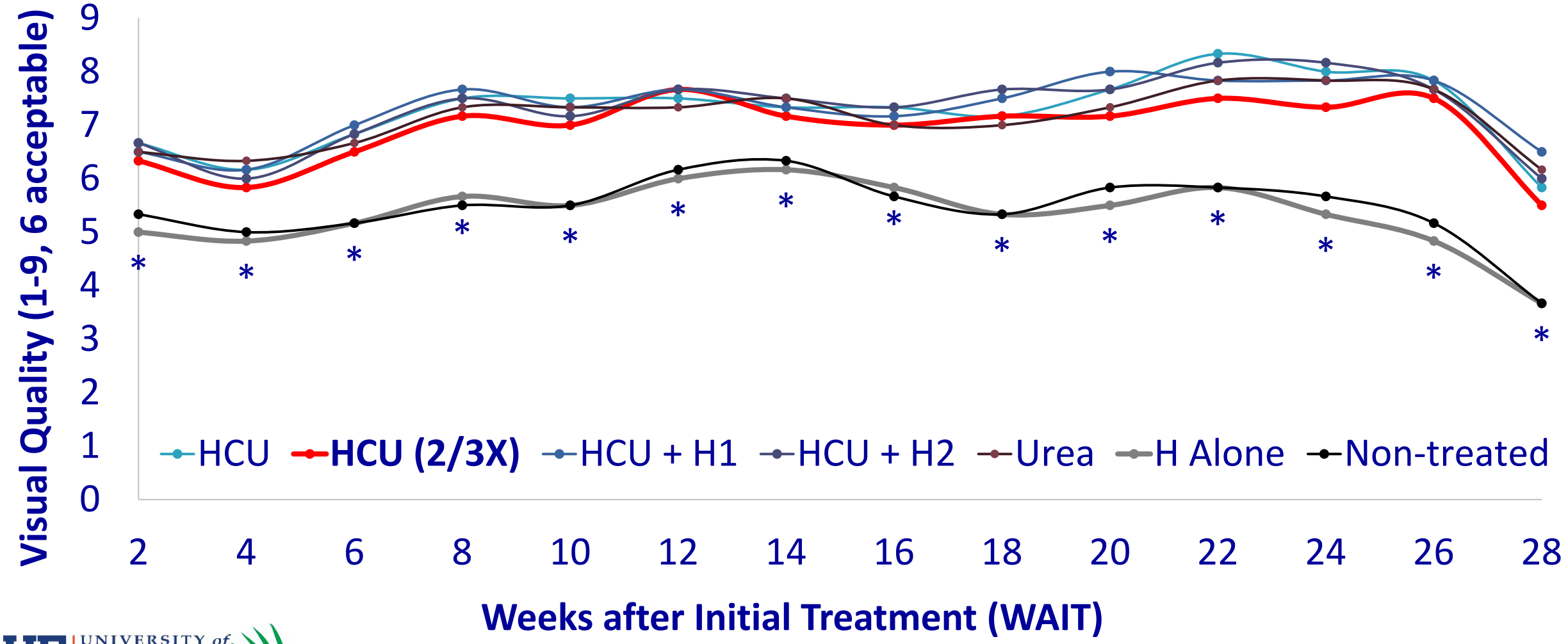
Visual Quality – USGA



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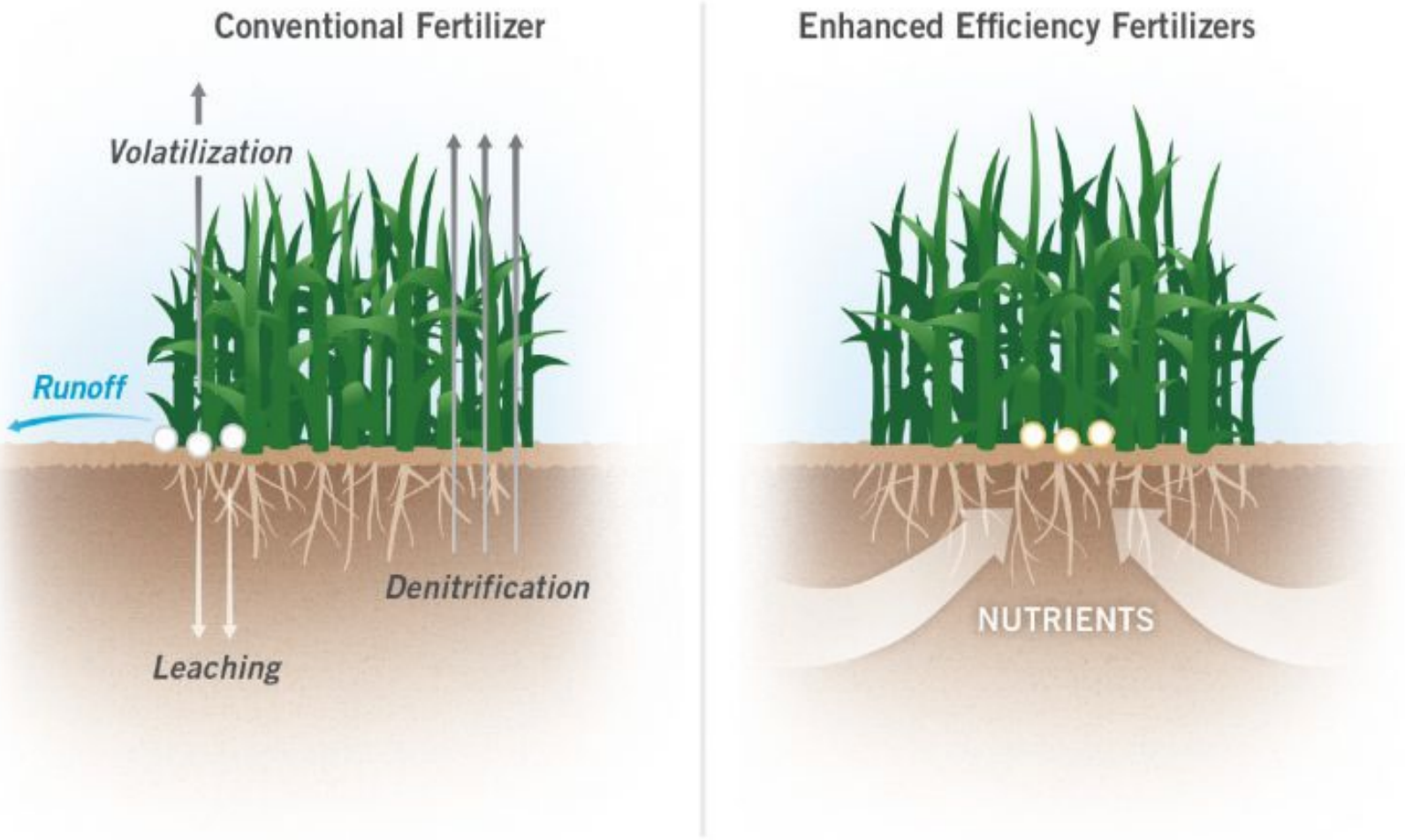
Enhanced Efficiency Fertilizer (EEF)



- Decrease potential losses to environment
- Slow or controlled released fertilizers
  - Coatings, inhibitors

https://www.vantrumpreport.com/2021/10/27/next-gen-fertilizer-winners-highlight-new-technologies-and-products/

Lab Test

https://edis.ifas.ufl.edu/publication/HS1227

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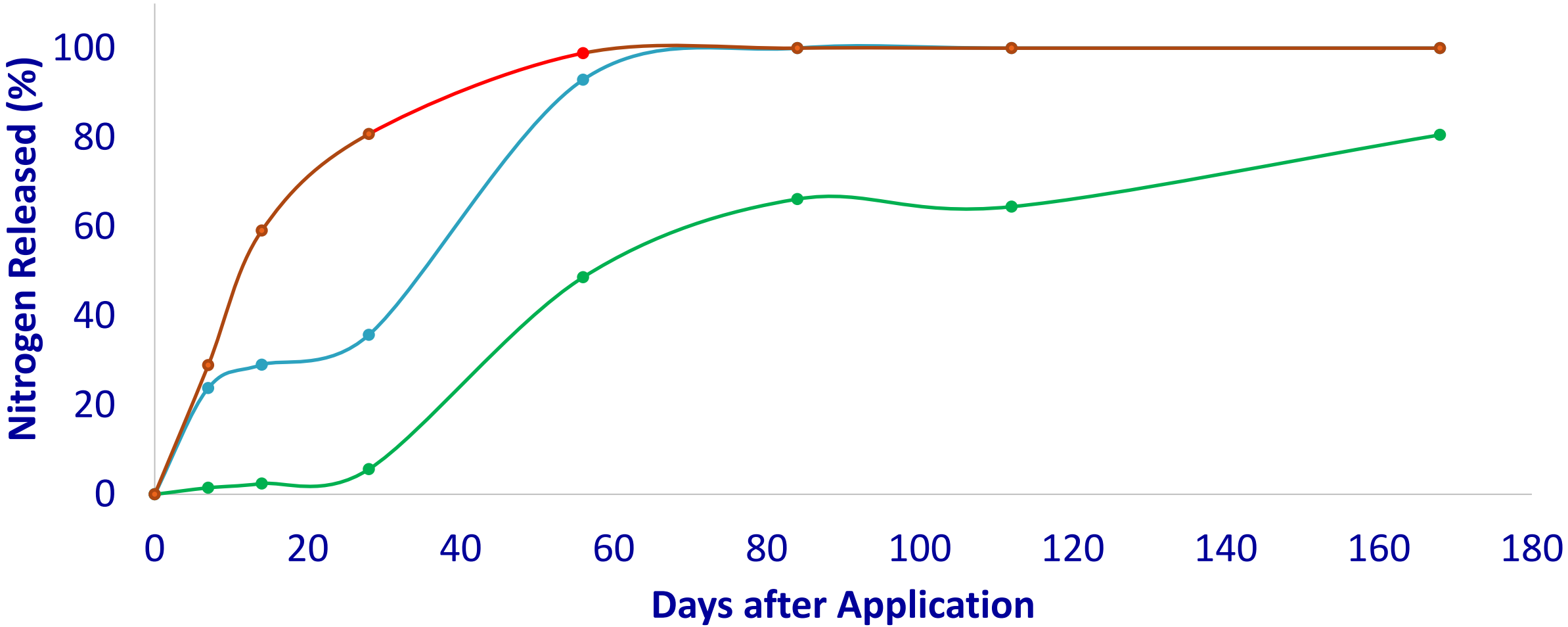
Field Method – Mesh Bags

Nitrogen Release Curve



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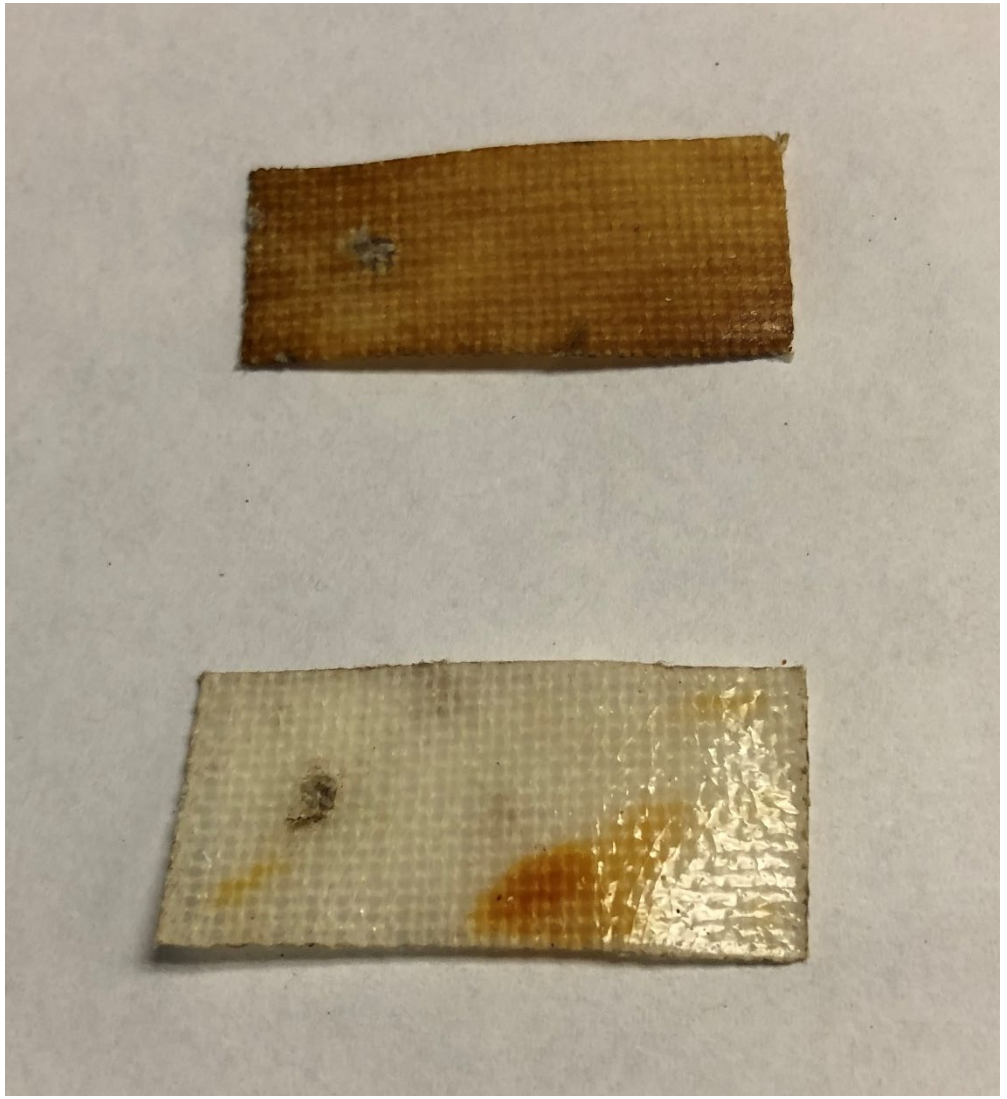
Nutrient-Use Efficiency – Ion Resin Strips

- Ion resin extractions
- Measure plant-available nitrogen
  - NO_3 & NH_4



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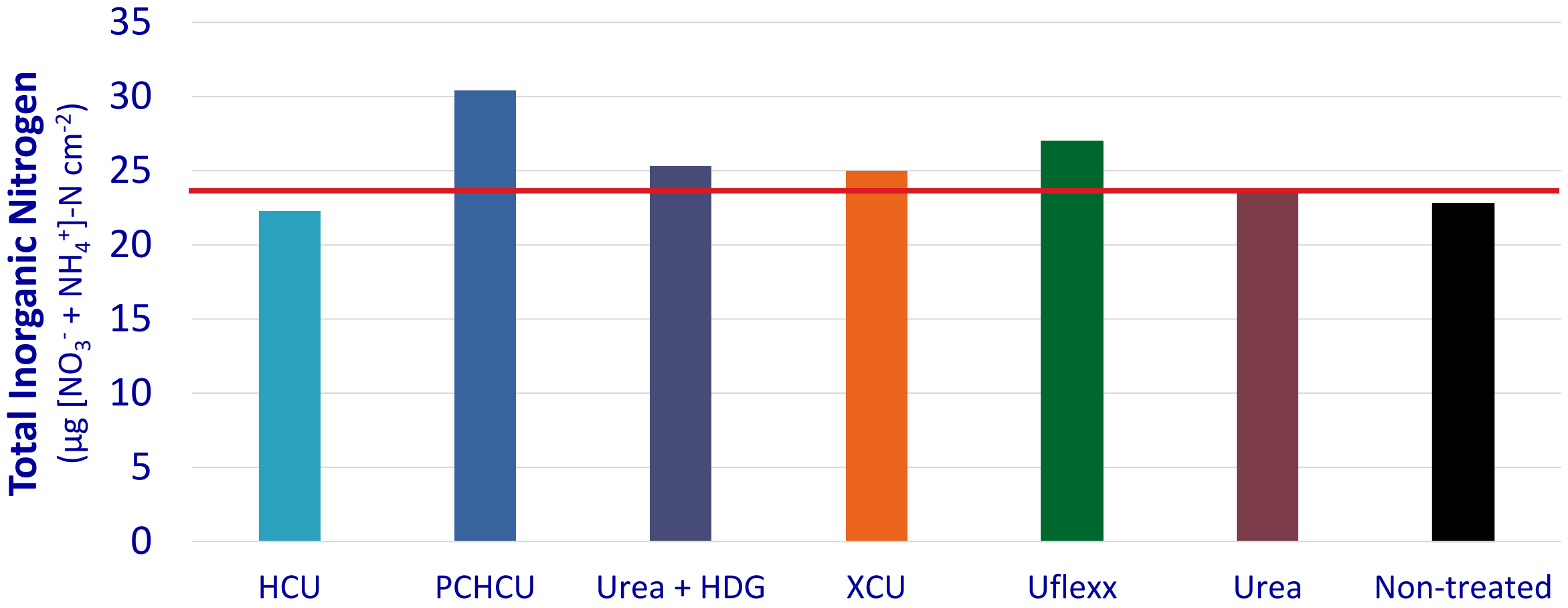
Plant-Available Nitrogen



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Stress Tolerance – Simulated Traffic

- 3 traffic events per week
- 25 total traffic events

Before and After

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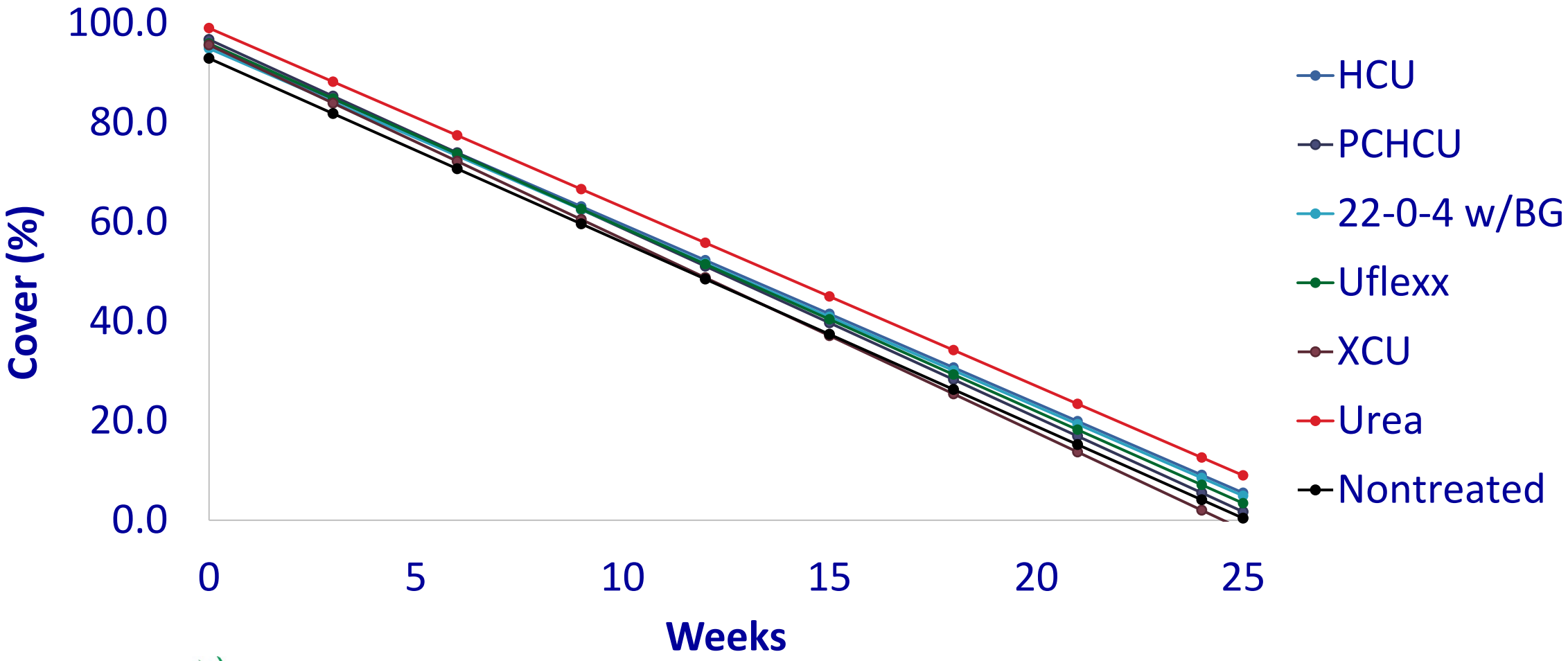
Traffic – Percent Green Cover



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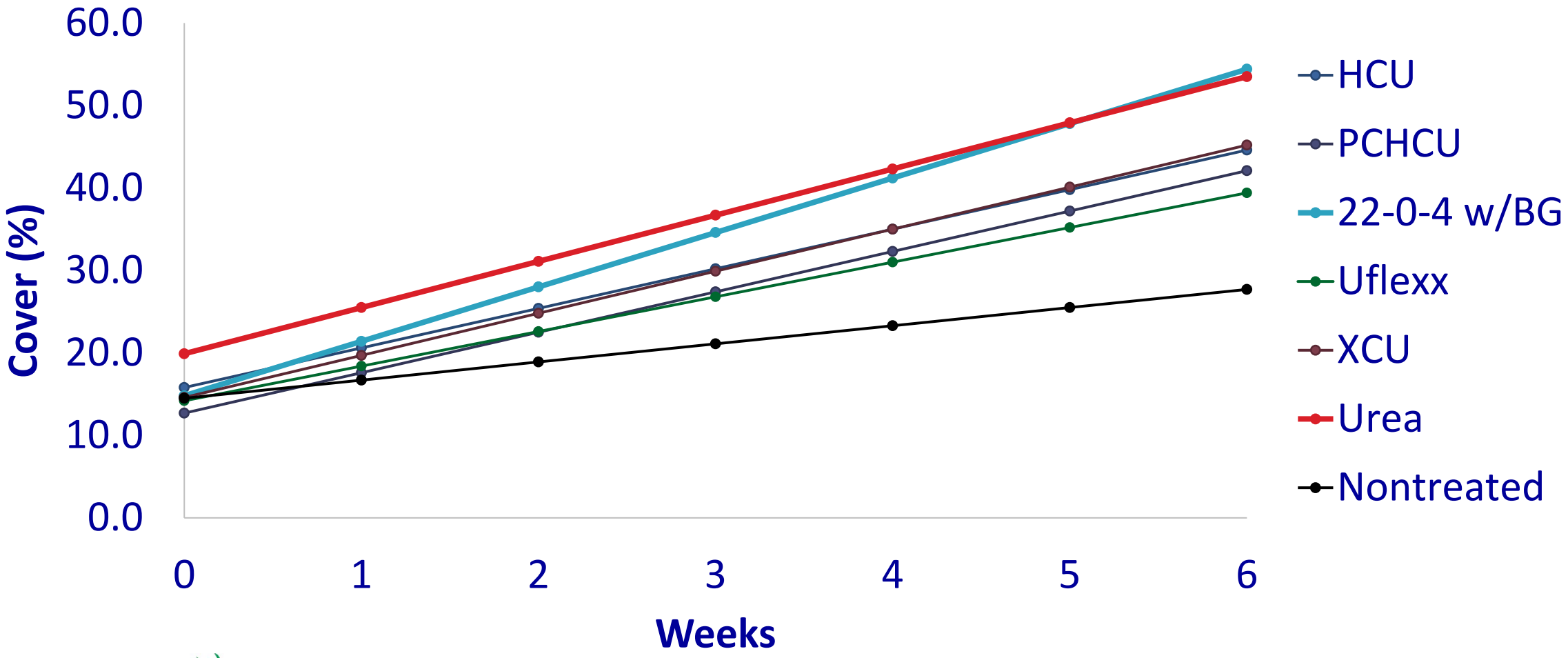
Recovery – Percent Green Cover



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Improve Soil Health/Reduce N

Treatment
Granular Humic Substance
Liquid Humic Substance
Biochar
Microbial Inoculant
Fertilizer Alone (1/2 Rate)
Compost
Fertilizer Alone (Full Rate)
Non-treated

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Alternative Fertilizer Sources

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Algae-based Fertilizer

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Greenhouse Study

Pure algae

Algae + cellulosic filler (Blended)

Milorganite

Urea

Non-treated

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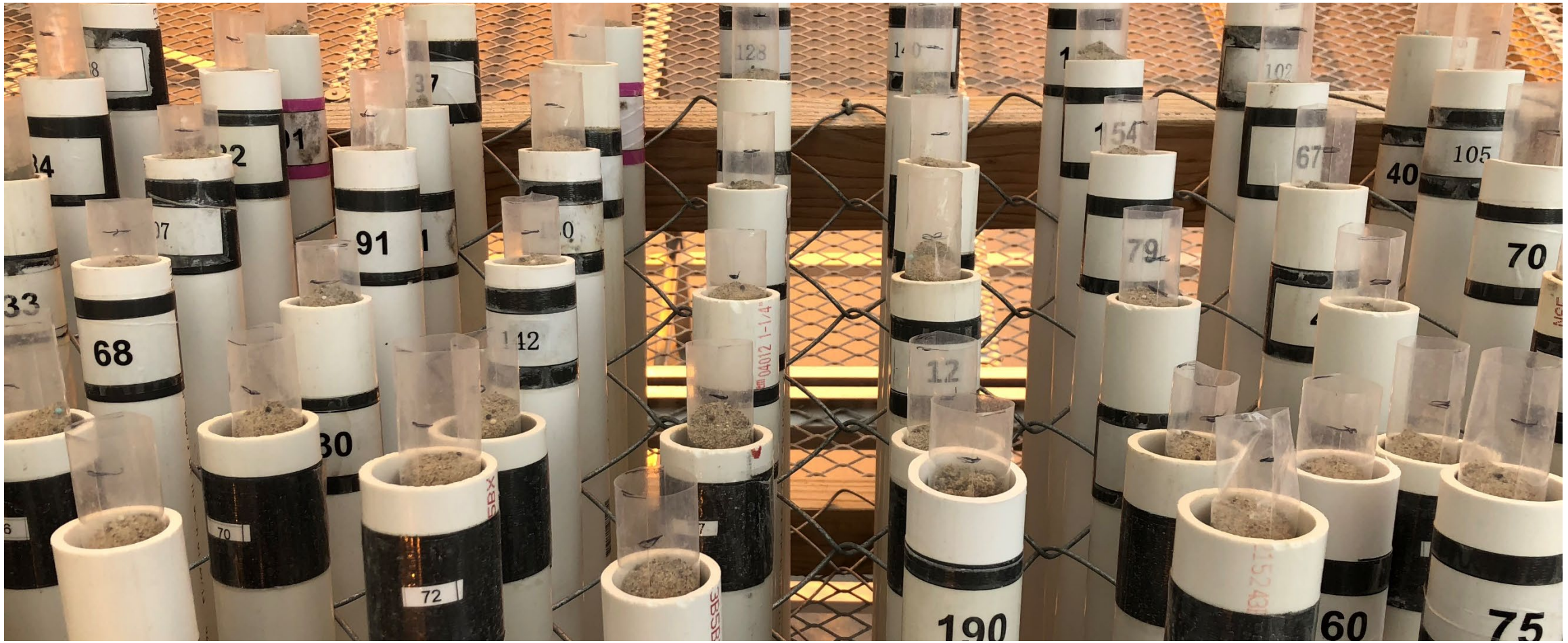
Field Study

Plant-based Fertilizer



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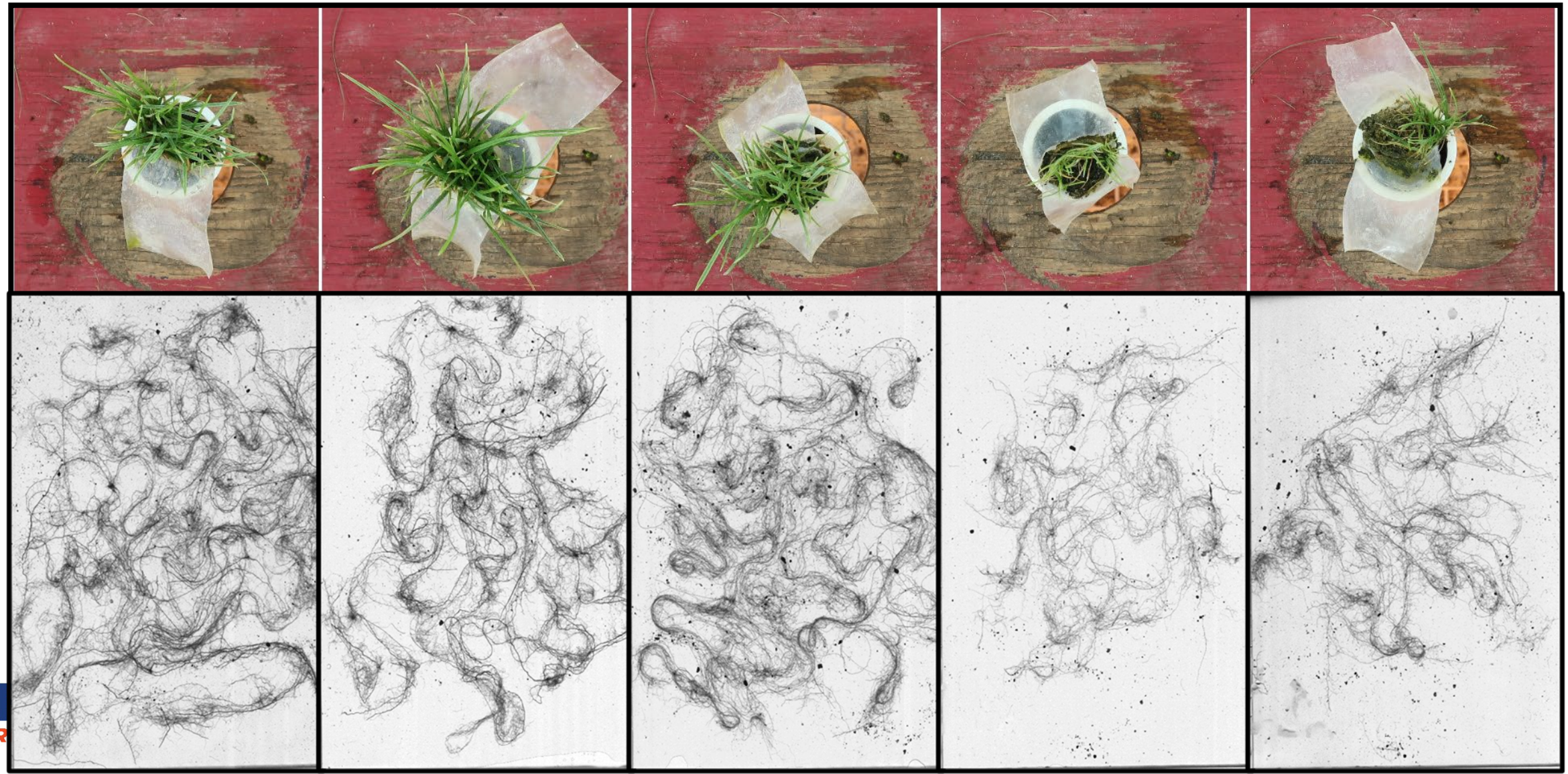
Vegetable Protein A

Vegetable Protein B

Vegetable Protein C

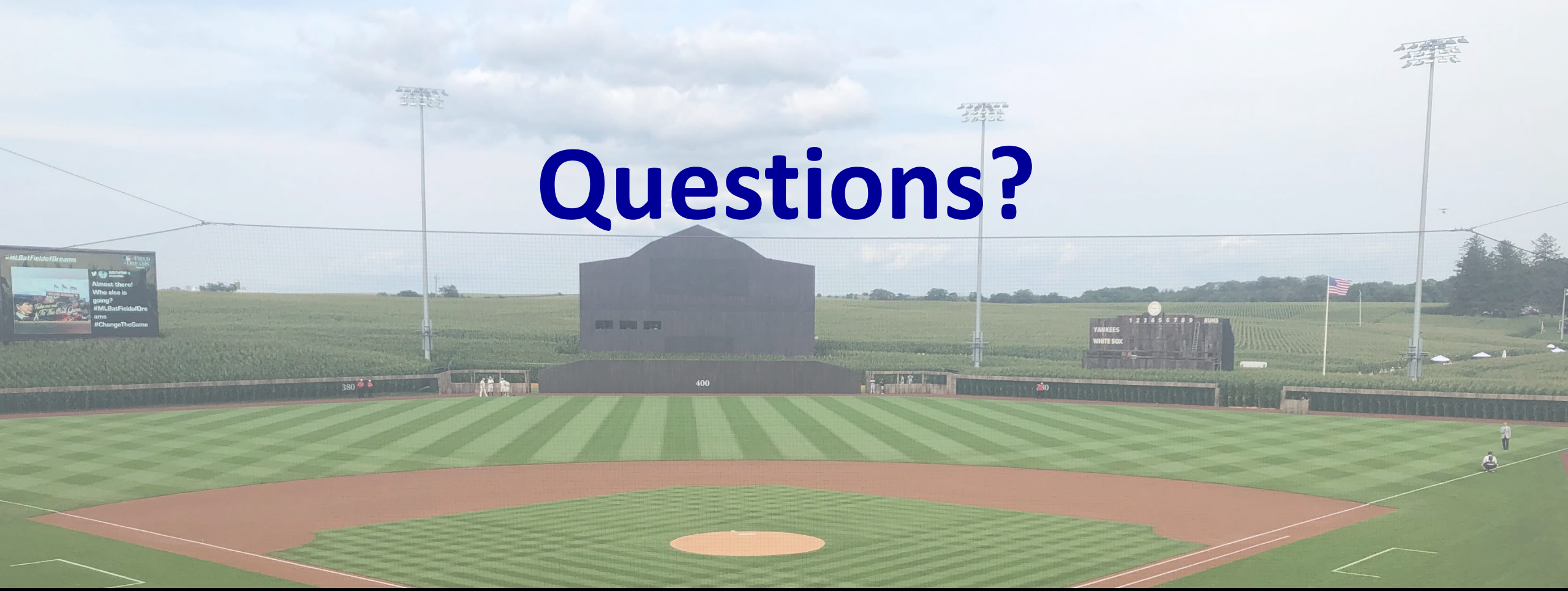
Non-treated

Urea



Sustainable Turfgrass Practices

- **Compost**
  - Increase organic matter, water holding capacity
  - Decrease irrigation, fertilizer?
  - Nutrient concerns?
- **Humic products**
  - Increase rooting, soil health
  - Decrease nitrogen fertilizer?
- **Alternative fertilizer sources**
  - Effective, sustainable, natural
  - Soil health benefits?



Questions?

AJ Lindsey

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Twitter: @AJLindseyTurf