Introduction

Reclamation of oil and gas-disturbed soil is challenging due to diminished function (i.e. soil physical, chemical, and biological properties) from the loss of soil organic carbon (SOC) and potential mixing of topsoil and subsoil. Biostimulants are a set of organically-derived agro-products which are applied to soil to improve SOC formation, microbial nutrient cycling, and crop yields in agricultural settings and may be a tool for improving reclamation success. However, studies on the ability of biostimulants to enhance reclamation in disturbed soils are limited. Thus, understanding how, or if, biostimulants can efficiently improve reclamation success is important. Accordingly, research was conducted to determine if biological metrics were affected by biostimulant in soil collected from an active pipeline installation project.

Objectives and Study Design

This study was conducted in a greenhouse using a completely randomized design with five soil treatments, three biostimulant treatments, and was replicated four times. Our objectives were:

- Evaluate how biostimulant and soil blending affects hard red spring wheat growth
- Determine how plant roots and arbuscular mycorrhizal fungi (AMF) symbiotic relationships respond to soil treatments
- Investigate biostimulant effects on microbial abundance and microbial CO₂ efflux

Methodology

Microbial CO₂ Efflux
- Total CO₂ efflux rate (g CO₂ m⁻² h⁻¹) was quantified following Breker et al. (2018)
- CO₂ was read every three days for one week; then once every seven days thereafter

Hard Red Spring Wheat
- 14 d after mixing, 10 seeds per pot were planted and fertilized upon first watering.
- Wheat plants were thinned to 5 plants per pot upon emergence

AMF colonization:
- Roots were washed free of soil and stained following the procedures of Phillips and Hayman (1990) and quantified following a modified Allen and Allen (1980) method

Phospholipid Fatty Acid (PLFA) analysis:
- Soil samples were collected and analyzed following Breker and Sasser (2012)

Biostimulant Treatments

Blended subsoil and topsoil with no biostimulants added

Control

Profile ProGanics™

Liventia SSB®

Results

1. Hard red spring wheat aboveground and root biomass yields and select soil properties.

2. Microbial group abundances among soil and biostimulant treatments

Conclusion

Overall, soil treatments or biostimulants contained significant responses with AMF root colonization

ProGanics™ produced the greatest cumulative CO₂ efflux and averaged 3.6 g CO₂-C/m² per day

Average topsoil blend rates were similar to rates observed in an undisturbed ND grassland soil

Regardless of topsoil concentration, blending it with topsoil enhances microbial activity and is beneficial to soil processes

However, improved microbial activity did not result in improved wheat growth in this 40-day study

References


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