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Poster Communication Abstract – 4.10

SUSTAINABLE APPROACHES FOR LETTUCE CULTIVATION: APPLICATION OF BIOCHAR, MICROBIAL CONSORTIA AND ARBUSCULAR MYCORRHIZAL FUNGI

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PGPM, biochar, lettuce, antioxidant compounds, mycorrhizal root colonization

Climate change challenges the agricultural system, necessitating innovative approaches for enhancing crop resilience.

Microbial biostimulants, such as arbuscular mycorrhizal fungi (AMF) and plant growth-promoting bacteria (PGPB), are

ecological innovations that complement traditional agricultural practices. These biostimulants establish mutual

symbiotic associations with crops and indirectly enhance nutrient bioavailability, inducing molecular, biochemical,

physiological, and morpho-anatomical responses that improve productivity and protect against diseases and abiotic

stresses. Biochar, derived from biomass pyrolysis, enhances soil properties as an efficient amendment, supporting

bacterial colonization due to its porous structure and elemental characteristics.

This study investigates the impact of PGPB, AMF, and biochar, both individually and in combination, on lettuce grown in

greenhouses and in the field. Non-destructive physiological measurements, including leaf chlorophyll content, stomatal

conductance, and thermal imaging of the plant canopy, were performed

throughout the growing season. Mycorrhizal

root colonization was assessed in greenhouse-grown plants to evaluate the beneficial symbiotic interaction. Metabolite

and antioxidant compound analysis provided insights into potential protective mechanisms against oxidative stress.

In the greenhouse experiment AMF treatment enhanced aerial biomass, indicating a positive influence on plant growth.

Additionally, all treatments, including the combination of PGPB and biochar, improved water-use efficiency through

increased transpiration. Microscopic observations showed increased colonization of mycorrhizal fungi in AMF-treated

plants, highlighting the importance of these beneficial symbiotic associations. This colonization likely facilitated nutrient

uptake, explaining the observed growth improvement. AMF treatment also significantly reduced phenolic

and flavonoid content in lettuce leaves, suggesting a reorganization of the antioxidant system due to improved nutrient

availability facilitated by mycorrhizal association. In the field experiment, the integration of PGPB and biochar treatments

stimulated aerial plant growth in terms of biomass and size, indicating improved productivity of lettuce. Additionally,

AMF treatment increased transpiration levels, potentially enhancing nutrient uptake and overall plant performance.

These results emphasize the potential benefits of integrating PGPB, AMF, and biochar treatments for enhancing lettuce

growth, productivity, and physiological responses. Further investigations under specific stress conditions will provide

valuable insights into the effectiveness of these integrated treatments in mitigating stress-induced impacts on crop

performance, thereby increasing crop resilience.

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