Microbial Bootstrapping in Regenerative Soil Systems

Michael Smith et al.

Abstract

This study integrates phospholipid fatty acid (PLFA) microbial analysis with field-scale yield data to evaluate the effects of REGENiGROW™ and REGENiCHARGE™. Results demonstrate a 17–27× increase in microbial biomass and corresponding yield increases, with optimal performance at intermediate dilution rates, supporting a Rhizosphere Bootstrapping Threshold.

Keywords: soil microbiome, biostimulants, biochar, PLFA, regenerative agriculture

Introduction

Regenerative soil systems can be accelerated through biological activation and structural carbon stabilization. This work introduces a microbial bootstrapping framework linking microbial activation to yield.

Materials and Methods

Five field plots received soil and foliar applications of REGENiGROW™ at 3%, 6%, and 12%, applied weekly for a period of 2 months. Plants were watered normally between treatments as needed. At the end of the 2 month trial, concurrent PLFA sampling was conducted. Yield data were collected from a Maui lettuce experiment.

Results

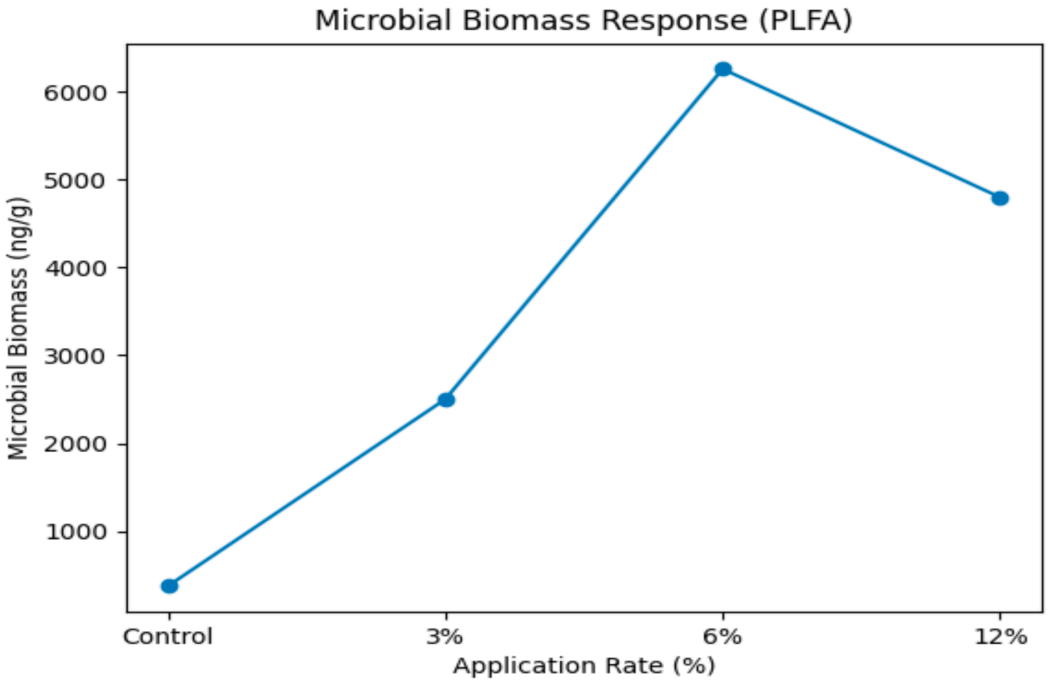
Microbial biomass increased from 372 ng/g to >6,000 ng/g (17–27×). Yield peaked at 9.5 lbs under ½ cup treatment compared to 4.0 lbs in the control group, aligning with microbial activation thresholds. See accompanied graphs.

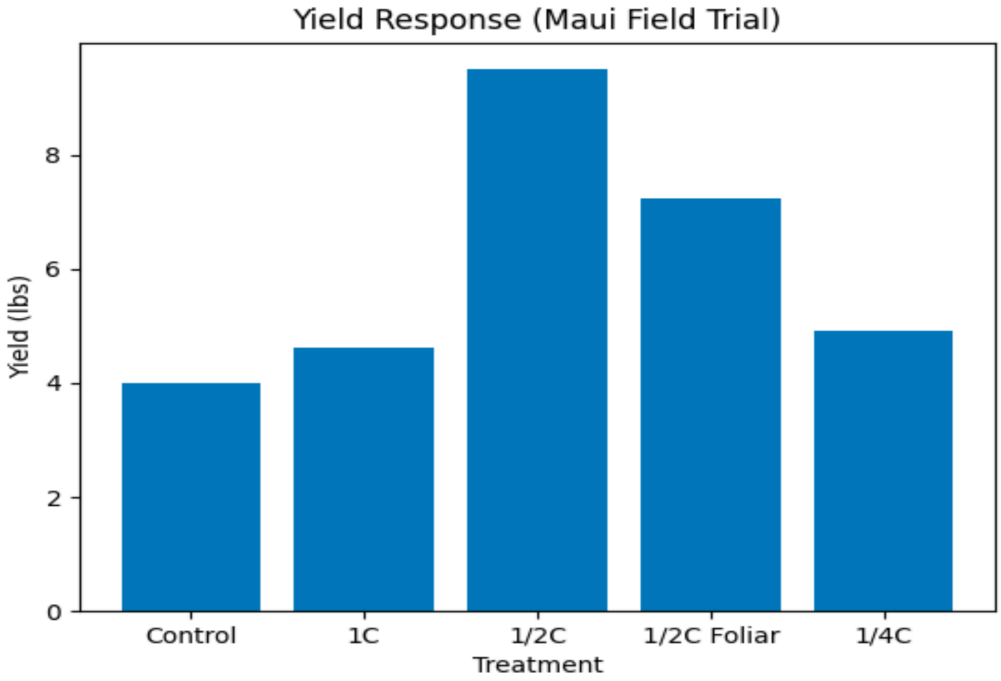
Discussion

The alignment between microbial biomass and yield peaks supports a microbial bootstrapping model and suggests a direct link between soil biology and agronomic performance.

Conclusion

The REGENiGROW™ and REGENiCHARGE™ system forms a scalable, carbon-negative soil system improving microbial and crop performance.





Author Biography

Michael Smith is the founder of REGENiTECH LLC, headquartered in Whitefish, Montana. With over 40 years of experience in computational physics, artificial intelligence, and systems modeling, his work has spanned animation, simulation, and behavioral modeling across industries including aerospace, gaming, and scientific research. His current work focuses on biomimicry-driven biorefinery systems and regenerative soil technologies. Smith's groundbreaking biorefinery innovations are featured in the award-winning documentary 'The Need To Grow', highlighting scalable solutions for soil regeneration, carbon sequestration, and sustainable agriculture.

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References

Bloom, A.J., Sukrapanna, S.S., and Warner, R.L. (1992). Root respiration associated with ammonium and nitrate absorption and assimilation by barley. Plant Physiology, 99, 1294–1301.

du Jardin, P. (2015). Plant biostimulants: Definition, concept, main categories and regulation. Scientia Horticulturae, 196, 3–14.

Jones, D.L., Healey, J.R., Willett, V.B., Farrar, J.F., and Hodge, A. (2005). Dissolved organic nitrogen uptake by plants—an important N uptake pathway? Soil Biology & Biochemistry, 37, 413–423.

Kuzyakov, Y., and Xu, X. (2013). Competition between roots and microorganisms for nitrogen: mechanisms and ecological relevance. New Phytologist, 198, 656–669.

Näsholm, T., Kielland, K., and Ganeteg, U. (2009). Uptake of organic nitrogen by plants. New Phytologist, 182, 31–48.

Raun, W.R., and Johnson, G.V. (1999). Improving nitrogen use efficiency for cereal production. Agronomy Journal, 91, 357–363.

Tilman, D., Cassman, K.G., Matson, P.A., Naylor, R., and Polasky, S. (2002). Agricultural sustainability and intensive production practices. Nature, 418, 671–677.

Vance, C.P., Uhde-Stone, C., and Allan, D.L. (2003). Phosphorus acquisition and use: critical adaptations by plants for securing a nonrenewable resource. New Phytologist, 157, 423–447.