Contribution ID: **134** Type: **Poster**

Biochar and Quantum Nanoparticles: Transforming Agriculture for a Sustainable Future

The integration of biochar with quantum nanoparticles (QNPs) presents an innovative strategy for advancing sustainable agricultural practices. Biochar, a carbon-rich material derived from Silkworm excreta, is well-regarded for its ability to enhance soil fertility, water retention, and microbial health. When combined with quantum nanoparticles, biochar's benefits can be greatly amplified, unlocking fresh avenues for precise nutrient management, increased crop productivity, and soil restoration. Quantum nanoparticles, characterized by their unique quantum properties including a high surface area, tunable chemical reactivity, and enhanced transport capabilities, can be engineered for targeted nutrient release, ensuring that plants receive the required nutrients at optimal times. Furthermore, QNPs show promise in boosting microbial activity, accelerating composting, and aiding in the remediation of contaminated soils. The synergy between biochar and quantum nanoparticles holds significant potential for climate-smart agriculture, providing sustainable solutions for nutrient recycling, water conservation, and reducing dependence on synthetic fertilizers. However, challenges related to the environmental impact, long-term stability, and cost-effectiveness of these quantum nanomaterials must be thoroughly investigated through extensive research and field trials.

Keywords: Biochar, quantum nanoparticles, soil fertility, water retention, Synthetic fertilizers.

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Track Classification: Biological Sciences