

Role of Blue-Green Algae (BGA) in Soil Fertility Improvement

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Abstract: *Blue-Green Algae (BGA), commonly known as cyanobacteria, are among the earliest photosynthetic organisms on Earth and hold immense potential for sustainable agriculture. Their natural capacity for biological nitrogen fixation and organic matter contribution makes them a valuable bio-input for enhancing soil fertility. In the context of declining soil health due to excessive chemical fertilizer use, BGA offers an eco-friendly alternative that not only enriches soil with essential nutrients but also improves soil structure, water retention, and microbial diversity. This article explores the physiological traits of BGA, mechanisms through which they enhance soil fertility, and their practical applications in agriculture, especially in rice-paddy ecosystems. Drawing upon current research findings, field case studies, and comparative analyses with conventional practices, this paper evaluates the agronomic, environmental, and economic implications of BGA usage. Furthermore, it addresses the challenges of large-scale BGA adoption and outlines necessary policy interventions and future research priorities. By integrating BGA into organic and integrated nutrient management strategies, farmers can move toward a more regenerative and resilient agricultural model. This article provides an in-depth academic overview of the role of BGA as a pivotal agent in sustainable soil fertility management.*

Keywords: *Blue-Green Algae*