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The Application of Microalgae an Impending Bio-Fertilizer: Maize Cultivation as a Model

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Abstract

The increasing demand of food crops and decrease in productivity due to continuous use of chemical fertilizer has not only resulted in decline of crop yield, loss of fertility and degradation of soil but has also led us one step back in achieving sustainable agriculture. The use of algal bio-fertilizer provides an effective, ecofriendly and non-polluting approach in improving the productivity of crop by both nitrogen fixation and photosynthesis. Algal bio-fertilizers improve soil structure and increase yield productivity even if applied in a small area. The application of algal bio-fertilizers in plants has resulted in increase in root, shoot length with number of leaves and hence overall growth of the plant has been increased. India being one of the largest producer and consumer of pulses requires abundant amount of pulse production to fulfill the demands of ever growing populations which can be achieved by using algal bio-fertilizers.

Microalgae efficiently utilize and remove the nitrogen and phosphorus present in wastewater and assimilate these in valuable algal biomass. Yet, besides macronutrients such as N, P and K, microalgae also contain plant growth-promoting substances such as vitamins, carotenoids, amino acids and antifungal substances. In this study, the valorisation of microalgae as an organic slow-release fertilizer is presented.

The fertilizer potential of both fresh water and marine microalgal biomass was determined; more specifically dried microalgal biomass, cultivated on microalgae in various natural and chemical methods. In the first stage the mineralization rate of both types of biomass was determined. Also a dosage toxicity test for Ca²⁺ and Na⁺ was performed using seedlings of lettuce and garden cress, respectively. Subsequently, a greenhouse maize growth experiment was performed, wherein the fertilizer potential of both types of microalgal biomass was compared with conventional inorganic and organic microalgae fertilizers. The growth rate of the maize plants and the maize yield were assessed for each fertilizer treatment, as well as the leave composition and the water, sugar and carotenoid concentrations in the maize seed. The results of the study show there was no significant difference in plant growth between the fertilizer treatments with microalgae and the conventional algae fertilizer. This demonstrates the potential of microalgae an impending fertilizer for agriculture applications.

Keywords: Microalgae, Agriculture, Bio-fertilizer, Maize, Applications