BIOFERTILIZER USAGE FOR SUSTAINABLE AGRICULTURE – REVIEW OF CHALLENGES AND STRATEGIES

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Abstract: Ever increasing demand for food essentially increases the volume of fertilizer application globally in the agricultural sector. At present, the annual global consumption of chemical fertilizer in agriculture amounts to 200 million metric tons. Toxic compounds present in chemical fertilizer leads to contamination of food, feed, and water bodies, and land deterioration, including soil infertility and ecosystem disruptions affecting food security, human health, and well-being. Additionally, chemical fertilizer production depletes finite natural resources. Therefore, there is a growing interest in replacing them with biofertilizers composed of living microorganisms as an efficient, environmentally friendly alternative. Biofertilizers improve plant growth and development by increasing nutrient availability through nitrogen fixation and solubilizing phosphorus, potassium, sulfur, and other micronutrients. Furthermore, they reduce the water contaminations in tank cascade systems and improve soil health and quality of yield while protecting plants from both biotic and abiotic stresses with using the secretions of microorganisms. Since tropical climates are more conducive for microorganisms, the use of biofertilizers become more attractive in tropical countries including Sri Lanka. However, despite the numerous advantages of biofertilizers, their low nutrient content, limited shelf life, lack of timely availability of microbial cultures and carrier materials, inadequate awareness, and poor technical know-how for application are the identified challenges. Overcoming these challenges involves enriching microbial growth by adding green manure, wood ash, and plant residues to provide essential nutrients. Additionally, extending the survival and effectiveness of microorganisms can be achieved through the use of vacuum packaging and frozen storage. Furthermore, it is crucial to adopt site-specific applications that incorporate a mixture of microbial strains, taking into account the knowledge of soil ecology to attain synergistic effects with biofertilizers. The implementation of governmental policies as well as the improvement of research and infrastructure facilities are critical for promoting biofertilizers as a sustainable tool for achieving food security.

Keywords: Food security; Human health; Microorganisms