Indian Farmer
Volume 11, Issue 01, 2024, Pp. 25-26
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

Popular Article

OPEN ACCESS

Nano-biofertilizers

Dr. Swati Patel

Soil Science and Agril. Chemistry, Anand Agricultural University, Anand

**Corresponding author: swatichaudhary1722@gmail.com*

Received:25/12/2023 *Published:07/01/2024*

Agriculture is a major contributor to the GDP and a cornerstone of the economy in developing countries like India, where over 60% of the population depends on it for their livelihood. However, with a growing global population, there is an urgent need to increase crop production using sustainable approaches. Numerous methods have been adapted to enhance crop yield, soil fertility and sustainability. As a solution to this global problem, biofertilizers came into the picture and were proven to effectively increase crop yield and crop production. In addition, they are environmentally friendly and cost-effective. Biofertilizers consist of naturally occurring microbes with plant growth-promoting and/or disease-suppression activity. It is increasing food production, enhancing soil health, and controlling pathogens. Nanotechnology, being an emerging and promising area, has introduced another approach to increasing crop production by providing solutions to many glitches in agriculture production through the use of nanoparticles.

Nano-Biofertilizer Formulation

The combination of biofertilizers with nanofertilizers to enhance the overall impact and mitigate individual drawbacks is referred to as nano-biofertilizers. The approach to achieving this involves various methods and techniques, depending on the type of nanoparticles that encapsulate biofertilizers or the biofertilizers that adhere to nanoparticles. Nano-biofertilizers represent a convergence of nanotechnology and biotechnology in agriculture. This innovation leads to improved and gradual nutrient release attributes, coupled with decreased production costs for fertilizers and the potential reduction in the required amount of fertilizer application to plants. The gradual release of nutrients also increases the efficacy of the product. Encapsulation incorporates biofertilizer into the nanomaterial cover. This method involves the use of starch with a non-toxic substance like calcium alginate, which accelerates the growth of bacterial strains. Nanomaterials employed for the purpose of encapsulation can be nano-scale substances such as zeolite, chitosan, and polymers, as well as various metallic and metal-oxide compounds. The objective is two fold: to enhance nutrient uptake by plants and to reduce the ecological footprint of farming practices. Although nano-biofertilizers have been synthesized using multiple approaches, an in-depth understanding of their interaction with soil microbiota, soil components, plants, and endophytes is lacking, especially at the molecular level.

Since nano-biofertilizers are required in small quantities compared to other types of fertilizers, their utility for improving crop productivity, biofortification, and resistance to abiotic and biotic stresses is very promising, considering the goal of sustainable agriculture.

The imperative, therefore, is to optimize nutrient management while minimizing environmental harm. The journey of nano-biofertilizers from their inception to their current status as a transformative green technology for agriculture is emblematic of human innovation and our collective commitment to addressing the challenges of modern farming sustainably. The widespread problem of excessive reliance on chemical fertilizers to achieve greater crop yields has given rise to numerous environmental challenges. These include soil acidification and elevated emissions of nitrogen oxide (N_2O) and carbon dioxide (CO_2), which contribute to the intensification of the greenhouse effect and a decline in the organic content of the soil. To address these issues, Combining biofertilizers with nanoparticle-based formulations can enhance their shelf life and efficacy. Nanoparticle formulations facilitate the slow release of nutrients that are utilized by microbes over a longer period, resulting in more effective fertilizer usage by plants. Synthesizing and applying nano-biofertilizer is crucial to protect our environment and natural resources while meeting the needs of a growing population. Therefore, in the second approach for the use of nano-biofertilizers, a microbial consortium with the appropriate nanoparticles is applied to plants either by foliar application or by soil application in an appropriate quantity which is generally markedly less than the conventional fertilizers.

As we look to the future, it is clear that nano-biofertilizers will play a pivotal role in shaping a greener, more sustainable agricultural landscape, ensuring that we can feed the world's growing population while preserving the planet for generations to come.