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Benefits of Nano Fertilizer over Conventional Fertilizers

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Introduction

Nano-formulations or nano-sized fertilizers are made from ammonium humate, ammonia, urea, peat, plant wastes, and other synthetic fertilizers. An example of nano-formulation is nano-sized nitrogen (N) fertilizer which is prepared as a result of deposition of urea on calcium cyanamide. Conventional or synthetic fertilizers are created from natural sources of nutrients using manufactured processes. Conventional fertilizers provide nutrients in a concentrated form that plants can readily use.

Why is the Use of Nano-Fertilizers Better than Conventional Fertilizers?

The unique properties of nanoparticles, such as high sorption capacity, the increased surface to volume ratio, and controlled-release kinetics to targeted sites, make them a potential plant growth enhancer. Because of these characteristic features, nano-structured fertilizers can be used as a smart delivery system of nutrients to the plant. Nano-fertilizers are released very slowly in comparison to conventional fertilizers. This approach improves nutritional management, i.e., increasing the nutrient-use efficiency and decreasing nutrient leaching into groundwater. Nano-fertilizers are specifically designed to release active ingredients in response to biological demands and environmental stress. Scientists have further stated that nano-fertilizers increase agricultural productivity by improving photosynthetic activity, seedling growth, rate of seed germination, nitrogen metabolism, and carbohydrate and protein synthesis.

Nano fertilizers offer benefits in nutrition management through their strong potential to increase nutrient use efficiency. Nutrients, either applied alone or in combination, are bound to nano-dimensional adsorbents, which release nutrients very slowly as compared to conventional fertilizers. This approach not only increases nutrient-use efficiency, but also minimizes nutrient leaching into ground water. Furthermore, nano fertilizers may also be

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used for enhancing abiotic stress tolerance and used in combination with microorganisms (the so-called nano biofertilizers) provide great additional benefits. However, although the benefits of nano fertilizers are undoubtedly opening new approaches towards sustainable agriculture, their limitations should also be carefully considered before market implementation. In particular, the extensive release of nanomaterials into the environment and the food chain may pose a risk to human health. In conclusion, although nano fertilizers use in agriculture is offering great opportunities to improve plant nutrition and stress tolerance to achieve higher yields in a frame of climate change, not all nanomaterials will be equally safe for all applications. The risks of nano fertilizers should be carefully examined before use, and further biotechnological advances are required for a correct and safe application of nanomaterials in agriculture.