

Nanofertilizers - Advancement towards Agriculture

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Abstract

After green revolution Agriculture wants some changes with Keeping in mind Shortage in arable lands, water resources, environmental pollution, Risk towards health hazards etc. Increase of resource use efficiency with less damage to production by agronomic practices is a big challenge for modern agriculture. In the concept of modern agriculture nanofertilizer is such an important tool helps to increase not only crop yield but also various factors like growth, increase nutrient use efficiency, reduce wastage of fertilizers ,cost of cultivation, save from environmental pollution etc. Nano fertilizers play effective role for site specific nutrient management in precision agriculture with complementing the crop growth stage for nutrients and provide nutrients throughout the crop growth period. Targeted delivery, slow and controlled release are the principle mechanism role in nanofertilizers. It also prevents plant from different biotic and abiotic stresses of environment. Secure and safe water resources use, energy conversion is other uses of nano particles are also involved in this. Nanofertilizers can increase crop growth up to optimum concentrations but further more increase in concentration inhibit the crop growth as the toxicity of elements present in it. Hence nanofertilizers have a high potential for growth towards sustainable agriculture.

Introduction

Agricultural cropping systems involves large amount of fertilizers, pesticides, herbicides and other chemicals to achieve more production per unit area. Using these chemicals and fertilizers leads to several problems to lithosphere, hydrosphere, atmosphere and biosphere. Low input use efficiency, decrease quality of food material, develop resistance in different weeds towards herbicides, diseases and insects infestation, low income from the production, soil degradation, deficiency of micro nutrients in soil, toxicity to different beneficial living organism present in the soil etc, are the drawbacks of conventional

agriculture. Despite these problems there is also a challenge to feed the rapid growing population in this world. In future, there should be need to produce nutritive agricultural produce rich in protein and other essential nutrients. To solve these problems in crop production nano fertilizers, nano pesticides and nano herbicides proves to be effective in agriculture for better pest and nutrient management. Nanoparticles are very small size molecules with a size range of 1–100 nm with different physical and chemical properties. Nano fertilizers are classified into three categories macro nano-fertilizers, micro nano-fertilizers, and nano-particulate fertilizer.

Benefits of Using Nanofertilizers

- Supply exact amount of nutrients for enhancing plant growth through foliar and soil applications.
- low-cost
- sustainable sources of plant nutrients
- Have a high fertilizer use efficiency
- Play a key role in preventing pollution.

Bioactive Compounds Coated With Nano-Particles

Nano-encapsulation systems provide stability to bioactive compounds that are susceptible to adverse conditions such as heat, U.V rays and oxidation. Nano encapsulation is a new nanotechnology that allows active ingredients to be released from capsules or particles in a controlled and gradual manner. Different release mechanisms like dissolution, diffusion or biodegradation may be used to deliver the bioactive compounds in nano-encapsulated materials. Many micronutrients like silicon, zinc, copper and iron etc. are used in plant growth management now a days.

Uses of Nanofertilizers

Nano-particles have more penetration capacity, surface area and use efficiency so it shows better result. Nanofertilizers provide more surface area for different metabolic reactions in the plant body which helps to increase rate of photosynthesis to produce more dry matter and yield of the crop. They provide nutrients to plants in an available form so help to increase in nutrient uptake by plants and boost plant production. Foliar application is the most efficient method of correcting nutrient deficiencies and increasing crop yield and quality .In addition, it

also reduces environmental contamination and increases nutrient use efficiency by using less amount of fertilizers applied to the soil.

Nano NPK formulation can penetrate the leaves stomata through the gas exchange. Salinity and drought are two abiotic stresses that adversely affect crop production. Ionic and osmotic stresses cause nutrient imbalance, membrane damage, and enzymatic inhibition in plants. Soil salinity harms plant water supply, critical nutrient absorption, and crop yields and quality. Rock phosphate is used as nano form increases availability of phosphorus to the plant by direct application of rock phosphate nano particles on the crop prevent fixation in the soil. There is no silicic acid, iron and calcium as the barrier for fixation of the phosphorus so it increases phosphorus availability to the crop plant.

Conclusion

Nanotechnology used in agriculture is still in a progressive manner. However nanofertilizers have the potential to transform agricultural systems up to certain extent. The use of various nano-fertilizers impact on crop production through reducing fertilizers costs and emission risks to environment. Nano-fertilizers are more soluble, reactive, and they can increase penetration that allows for targeted delivery and controlled release at site specific management. Crop growth, yield, quality, and nutrient use efficiency are all improved by nanofertilizers which reduce abiotic stress and heavy metal toxicity.