



Nano Fertilizer: An Overview

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Nano fertilizers are the important tools in agriculture to improve crop growth, yield and quality parameters with increase nutrient use efficiency, reducing wastage of fertilizers and cost of cultivation. Nano-fertilizers are very effective for precise nutrient management in precision agriculture by matching the crop growth stage for nutrients and may provide nutrients throughout the crop growth period. Nano-fertilizers increase crop growth up to optimum concentrations further increase in concentration may inhibit plants. the crop growth due to the toxicity of nutrients. Nano-fertilizers provide metabolic reactions in the plant which increase the rate of photosynthesis and produce more dry matter and yield of the crop. It is also preventing plants from different biotic and abiotic stress.

What is Nano Fertilizer?

Nano fertilizers are synthesized or modified forms of traditional fertilizers, fertilizers bulk materials or extracted from different vegetative or reproductive parts of the plant by different chemical, physical, growth mechanical or biological methods or leaves. with the help of nanotechnology used to improve soil fertility, productivity and quality of agricultural produces Nanoparticles can be made from fully bulk materials at the nanoscale physical and chemical properties are different than bulk material Rock phosphate if used as nano form may increase fertilizer availability of phosphorus to the plant because direct application of tock phosphate nanoparticles on the crop may prevent fixation in the soil similarly there is no silicic acid, iron and calcium for fixation of the phosphorus, hence it increases phosphorus availability to the crop

Important Properties of Nano-Fertilizer

1. The nano-fertilizers have a higher surface area it is mainly due to the very less size of particles which provide more sites to facilitate the different metabolic processes in the plant system result production of more photosynthesis. They have high solubility in a different solvent such as water. size of nano-fertilizers is less than 100 nm which facilitates more penetration of nano parnanoparticleshe plant from applied the surface such as soil or leaves.
2. They have a large surface area and particle size less than the pore size of mot and leaves of the plant which can increase penetration into the plant from the applied surface and improve uptake and nutrient use efficiency of the nano-fertilizer.
3. Fertilizers encapsulated in nanoparticles will increase the availability and uptake of nutrients to the crop plants.
4. Zeolite-based nano-fertilizers are capable to release nutrients slowly to the crop plant which increases the availability of nutrients to the crop throughout the growth period.

5. The main reason for high interest in fertilizers is mainly their penetration capacity, size and very higher surface area which is usually different from the same material found in bulk form

Types of Nano-Fertilizer

1. Nitrogen nano-fertilizer

To overcome the problems associated with nitrogen leaching during fertilization, different approaches such as polyolefin resin-coated urea, neem coated urea, sulphur coated urea were taken to control the N release. However, slow-releasing fertilizers are often expensive and the release of N is slow at the time of high nitrogen. N loss can also be reduced using cation) exchanger as additives in fertilizer to control NH release. The retention and timely release of needed nutrients by zeolite overall crop yield. Clinoptilolite zeolite (CZ), a porous mineral with high cation exchange capacity (CEC, up to 300 cmol (p+) and with a great affinity for NH₄ has been used to reduce NH₃ emission from farm manure and to eliminate NH₃ toxicity to plants.

2. Phosphatic nano-fertilizer

Phosphatic fertilizers are mainly manufactured from rock phosphate ores In India, out of 260 million tonnes (MT) of recoverable reserves of rock phosphate approximately 20 Mt only have been estimated to be of high grade which is being mined by different government agencies for commercial purposes. The depletion of high-grade phosphate ores has brought about the search for suitable) economically viable technique process for beneficiating available low-grade phosphate reserves because of this, rock phosphate (HGRP3 and Stone 3) nanoparticle was prepared by grinding it in a high energy ball mill.

3. Potassic nano-fertilizer

The slow and steady release of K from nano-zeolite gave the reason that it may be due to the ion exchangeability of the zeolites with selected nutrient cations, zeolites can become an excellent plant growth medium for supplying plant roots with additional vital nutrient cations and anions Zeolite. can he nutrients. Their selectivity of ion exchange on zeolite was determined in an order of $K^+ > NH_4^+ > Na^+ > Ca_2^+ > Mg_2^+$.

4. Secondary nutrients nano-Fernando-fertilizer were conducted to evaluate the effect of MgO nano parnanoparticlesn maize plant (*Zea mays* L.) in three phosphorus (P) deficient benchmark soils of India. Application of MgO nano parnanoparticles enhanced the enzymatic activities like root phytase and phosphatase, particularly in P deficient situations. With the application of both P doses and MgO nanoparticles spray increased the different growth parameters of plants like foot length, root volume, dry foot length, root volume, dry weight of shoot and root, etc. irrespective of soils.

5. Micronutrients nano-fertilizer

Zinc oxide nanoparticles were shown to enter the root tissue of ryegrass and germination.

Advantages of Nano-Fertilizers over Traditional Fertilizers

1. Nano fertilizers are advantageous over conventional fertilizers as they increase soil fertility yield and quality parameters of the crop.
2. They are non-toxic and less harmful to the environment and humans.
3. They minimize cost and maximize profit.
4. Nanoparticles increase use efficiency and minimize the costs of environmental protection.
5. Improvement in the nutritional content of crops and the quality of the taste.
6. Optimum use of iron and increased protein content in the grain of wheat.
7. Enhance growth by resisting diseases and improving the stability of the plants by anti-bending and deeper rooting of crops.

8. Also suggested that balanced fertilization of the crop plant may be achieved through nanotechnology.

Conclusion

The application of different nano-fertilizers has a greater role in enhancing crop production this will reduce the cost of fertilizer for crop production and also minimize the pollution hazard. The application of nano-fertilizers in agriculture should have a greater concern to society. Fertilizer nutrient use efficiency in crop production can be enhanced with the effective use of nano-fertilizers. Nano fertilizers improve crop growth and yield up to optimum applied doses and concentration but they also have an inhibitory effect on crop plants if the concentration is more than the optimum which result reduces the growth and yield of the crop.