



Nano fertilizers and their role in agriculture

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Introduction

Agriculture is the backbone of our country; it is not only filling the belly of people but also it is the part of economy. According to 2014-15 censuses, India's population is almost equal to 1.27 billion. In concern of providing food to such a big population there has to be new technologies resulting in more yield. Meanwhile, nature is complex which will have imbalances which directly affects plants and crops indirectly animals and human. In addition to this, other factors like deficiencies in macro and micro nutrient content, industrialization, depletion of water source, difference in soil condition, and erosion of top soil affect crop productivity. Among these, deficiency in macro and micro nutrient can be avoided by use of full-fledged macro and micro nutrients. About 35-40 % of the crop productivity depends upon fertilizer, but some of the fertilizers affect the plant growth directly, to overcome all these drawbacks a smarter way is use of nanotechnology. Developing nano based fertilizer would increase the nutrient use efficiency (NUE) by three times and also provides stress tolerating ability. Besides it builds carbon uptake, improves soil aggregation and can be used irrespective of crop. Since these nano fertilizers contain nutrients, growth promoters encapsulated in nano scale polymers, they will also have a slow and a targeted efficient release, which increases productivity of the crop on one hand and decreases residual effect on the other.

Nano fertilizers

Fertilizer plays pivotal role in the agriculture production up to 35 to 40 % of the productivity. To enhance nutrient use efficiency and overcome the chronic problem of eutrophication, nano fertilizer might be a best alternative. Nano-fertilizers are the synthesized material, with the help of nano technology used to improve the fertility of soil for a better yield and increased crop quality. They are also called smart-fertilizers (Chinnamuthu and Boopathi, 2009). It is complete bio-source eco-friendly

and improves soil aggregation, moisture retention and carbon build-up. There is no health hazard and is suitable for all crops including food grains, vegetables and horticulture crops. An attempts are made to synthesize nano fertilizers in China, Germany and USA in 2006. Nano-fertilizers are more beneficial as compared to chemical fertilizers Three-times increase in Nutrient Use Efficiency (NUE), 80-100 times less requirement to chemical fertilizers, 10 times more stress tolerant by the crops, 30 % more nutrient mobilization by the plants, 17-54 % improvement in the crop yield and Improvement in soil aggregation, moisture retention and carbon build up.

Impact of nano fertilizer on agriculture

Using nano fertilizer to control delivery of nutrients can be a powerful tool towards attaining sustainable agriculture and environment. Nano fertilizers with quick absorption and optimized release of nutrients to the plant are going to replace conventional fertilizers. Still little progress has been made respect of the use of nano particles to improve soil quality and in reclamation of disturbed lands. Possibly no claim is more appealing than increasing the efficiency of fertilizers and reducing the negative environmental effects due to chemical fertilizers through nanotechnology. Agricultural plants need optimized management as well as appropriate weather and soil condition for maximum usage of environment potentials and therefore best performance. Some of the organisms are known to synthesize the nano-particles with different size, properties and chemical compositions. Biosynthesis of metal nano-particles can be squeezed from distinct parts of the plant is the best and efficient method of synthesis at a very low cost (Pattanayak and Nayak 2012). The rising nano-strategies signify that due to the high surface area to volume ratio, nano fertilizers would be a revolution in the agricultural field.

Achievement of nano fertilizers

Enhancement in fertility and the instinct of self-preservation greatly enhanced the productivity, quality of a crop. This translates into an improvement in three major areas of production

Yield: Nano fertilizers increase yields by an average of 20 %, and for some crops even more. This composite number implies growth in leaf, biomass, fruit and grain separately. For example, in some experiments sunflower seed yields increased by 50 % and in cucumber trials yield increases up to 25 %.

Nutritional Value: Results showed an increasing effect of about 10 % in both protein and sugar content of treated plant for most of plants.

Health: Overall health of the plant is enhanced, making it more resistant to severe weather and extreme environmental conditions.

Conclusions

Application of nanotechnology in agriculture, even at its global level, is at infancy stage. Nano science is leading to the development of a range of low-cost nano technological applications for increased plant growth. Nano particles and nano capsules provide an efficient means to distribute pesticides and fertilizers in a controlled fashion with high site specificity reduce the collateral damage. Following facts could enhance the usage of nano fertilizers:

- Nano fertilizers are advantageous over conventional fertilizers as they increase soil fertility and crop quality.
- They are nontoxic and less harmful to environment and humans as compared to conventional ordinary fertilizers.
- They minimize cost and maximize profit because they are used in very small quantities.
- It is just the beginning of a new advanced era and there is a great need of agricultural technique modification to fulfill the requirement of upcoming generations.

