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Nanotechnology in Precision Framing

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SUMMARY

Conventional cultivation of crop with extensive used of agrochemicals can't make full stomach of the over increasing population and restore ecosystem. Instead it will make more difficult. However with the upcoming science and technology, crop production can be increased with less effect on the environment. Nanotechnology is an interdisciplinary science that can apply in all stage of agricultural production processes. With nanotechnology, agricultural inputs can be precisely applied by releasing slowly in order to reduce losses and effective absorption by the crop plants and thereby increasing food production.

INTRODUCTION

Nanotechnology is an interdisciplinary science that deals at a scale of 100nm or less. It is an emerging and fast growing field of science that offers better built, safer environment, long-lasting, cost effective and smart products that will find wide application in household, communication, medicine, agriculture and food industry, chemists, physicists, engineers and electronics. India is one of the developing countries, its main occupation is agriculture and agriculture not only feed its population but also the country economy depends on it. However, its production with imbalance use of chemicals fertilizer, pesticide and others lead to destruction of environment creating more problems in crop production. Normally fertilizer is used to supply nutrients for crop growth and development but its misused leads to different soil problems like salinity, acidity and develops deficiencies of some micro and macro nutrients. Recently precision farming or satellite farming or site specific farming is becoming a key component of modern agricultural revolution. With the intervention of nanoencapsulated fertilizers, pesticides and herbicides, adoption of precision of farming will be more easy and effective in slow and sustained release of nutrients and agrochemicals. With this, various problems of conventional agriculture can be reduced to some extent and prevents deterioration of environment through agriculture.

Nanoencapsulated Chemical Fertilizers and Biofertilizers in Precision Farming

Indian soil is deficient with micronutrients like zinc, iron, manganese and boron. Zinc deficient soil can be corrected by application of zinc oxide and zinc sulphate. However, its availability to the plant is limited by pH of the soil. Alkaline soil reduces solubility of zinc and increased high content of calcium carbonate which can absorb and precipitate zinc. Such problems of zinc deficiency can be reduced by providing nanoencapsulated zinc oxide. It can be made in two methods viz. chemical and biological methods. Biological methods of synthesizing nanoparticles of zinc oxide become more popular as chemical methods uses toxic chemical but in case of biological methods plant extract is used which is cost effective and eco-friendly. Zinc oxide nanoparticles made from leaf extract of *Moringa oleifera* have been tested of its antibacterial activity against bacterial strains like *Staphylococcus aureus, Bacillus subtilis, Pseudomonas aeruginosa*, *Proteus mirabilis*, *Escherichia coli* and fungal strains such as *Candida albicans and Candida tropicalis* by using agar disc diffusion (Elumalai *et al*., 2015). The production of food can be increased by application of chemical fertilizers like urea, ammonium sulphate or nitrate or phosphate, SSP, MOP etc. But the plant can absorb only few parts of it and other part get loss (around 40-70% of nitrogen, 80-90 % of phosphorus and 50-70% of potassium) due to fixation by the clay minerals, leaching, volatilization etc. which caused groundwater pollution, eutrophication of surface water bodies. It is estimated that of the applied fertilizer is lost. However modern approach like nanoparticles coated urea, SSP, MOP, phosphate etc., can be used to avoid such problems. It has the potential to release plant nutrients very slowly as compared to normal fertilizers and make effectively available for plant to absorb. In sulphur deficient soil, application of nanocoated sulphur is very effective in slow and constant supply for plant. Nanoparticles can induce maximum absorption of nutrients by plants. Plants can increase their resistance against diseases by forming film on the cell wall of fungi or bacteria with nanofertlizers encapsulated nanosilica.

Biofertilizer consist of living organisms like microorganism, plants etc. its uses is eco-friendly and improve soil fertility and enhance soil microbial population. However, its drawback like shortage of shelf life,

sensitivity in temperature makes lesser adaptation by the farmers. Most of the farmers want fast and very effective product for their plant growth, and moreover lack of knowledge leads to improper application of chemical fertilizers, pesticides and herbicides. Microorganisms susceptible to desiccation can be applied in water in oil emulsion formulation that helps in long storage and proper distribution. In this case, sedimentation create problems during storage. With the advance in technology, nanoparticles with hydrophobic silica can be used to reduce cell sedimentation and induce cell viability by thickening the oil phase during storage (Vandergheynst *et al*., 2007).

Nanoparticles for Pest and Disease Control

Chemical pesticides have large impact on environment. And improper use of pesticides can develop resistant pests which are very hard to control or manage in future. Nano pesticides is designed in order to protect the ingredient from environmental conditions further enhance its persistence. It can increase effective of insecticidal value with controlled released of active ingredients. Some researcher had already reported that efficacy of plant based nano pesticides against arthropod pests of economic importance, including moths and beetles .Other than this; artificial polymer free nano permethrin can be an effective larvicide. Nano form of carbon, silver, silica and alumina-silicates can be used in controlling plant diseases. Nanoparticle coated silver can be used as antibacterial, antifungal agents. Nanosilica treated maize has been screened against poly-pathogens, *Fusarium oxysporum* and *Aspergillus niger* as compare to silica applied in bulk. However, the efficiency of nanosilica depends on the size and shape and increased with decreasing particles size.

Nanoherbicides : Maximum loss of the agricultural production is due to weed infestation. Weed has to keep under control upto which its effect become no effect on the crop growth and development. Conventional way of controlling weed needs much more labour and consume more time. Using herbicides can effectively control weed within a short period of time. However, its improper used has great impact on environment, decrease soil fertility and create soil pollution. In addition to this, evolution of herbicide resistant weeds due to the disproportionate use of herbicides for constant and longer period of time. With the intervention of nanotechnology, nanoparticle coated herbicides has been developed and enter into the root system of weed and inhibit the metabolic pathway of glycolysis that leads to death of plants. In addition to all the above, nanotechnology can be used in many other beneficial ways like biosensor that can detect any specific biological or chemical compound which can be used in precise application of agricultural inputs.

CONCLUSION

All over the world, agricultural production needs to be increased in order to feed the over increasing population. But intensive agriculture with excessive use of agrochemicals leads to deterioration of environment, like pollution ground water. And make the top soil unsuitable for crop to grow. However with the intervention of new technology like nanotechnology that can be applied in precision farming. This techniques leads to enhance crop yield and at last we can feed our people and sustain our environment for better future.

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