An Overview on Applications of Nano Technology in Agriculture.

Tamanna Mehta

GGDSD College,Sector 32,Chandigarh,160030,India

A B S T R A C T

Nanotechnology has brought huge advancements in the field of agriculture. Nanotechnology has the main aim to enhance the crop production and to decrease the need of pesticides in the field which directly or indirectly helps in increasing the crop yield, which is required to meet the needs of the growing population. This is majorly fulfilled by the use of nano-based pesticides and fertilizers which are the utmost contribution of nanotechnology in the field of agriculture. By nanotechnology we can not only create insect resistant varieties but also, we can minimize the bad impact of fertilizers or pesticides on soil or water by following the precise farming techniques and other innovations by nanotechnology. Many gas sensors and nano smart dust have been invented by the researchers and by using them now we can evaluate the level of environment pollution in few seconds. All these applications are due to the physiochemical properties of nanoparticles which includes its morphology, high reactivity and its high surface area. A wide range of negative effects have been observed of nanoparticles on plant system but despite of toxicity still the experiments conducted on them have given us huge applications of their usefulness in agriculture

Keywords: Nanotechnology, crop improvement, nano pesticides, nano fertilizers, Agriculture.

1. Introduction

Agriculture is the basic building block of any country, directly or indirectly mankind is totally dependent upon agriculture. Here are many factors which are bringing our resources under stress these factors like climate change, energy constraints, etc are the direct result of the human activities. Where as on one hand our resources are depleting day by day on the other hand as a food source agriculture is becoming important in the world.(Brennan, 20212). As the world's population is increasing day by day, modern technologies are present to fulfil their needs. Nanotechnology is the branch of science which helps in the upliftment of agriculture and to transform the related branches of agriculture like fisheries and aquaculture.

Nanoparticles related to agriculture requires utilization of the nanoparticle in crop improvement or in increasing crop yield. Now a days, main focus of nanotechnology is not only in the protection of plants or to monitor the growth of the plant but also in the identification of diseased plant or animal and to increase the quality as well as yield of the crop. It is observed and believed that new advancement in the technologies will fulfil and secure the need of the growing world and also will provide a huge variety of health and economic advantage. As nanotechnology helps us to see the structures at atomic and molecular level and this will allow them to create nano- meter scale structures. Nanotechnology is the branch in which particles are arranged in one way or the other to create new devices and materials which is going to have different properties to that of the properties of used nanoparticles in it. Many studies have been reported claiming nanoparticles not always show toxic effects but also show positive and sometimes consequential effects on plants. The chemical composition, chemical structure, size and surface area of nanoparticles are assumed to be closely related with the mechanism as the exact mechanism of nontoxicity still remains unknown.

2. CURRENT STATUS OF NANOTECHNOLOGY IN AGRICULTURE.

More than 60% of total population of the world is dependent directly or indirectly on the agriculture for their livelihood. As nanotechnology has the advantage of providing accurate nutrients and pesticides delivery which directly contributes in increasing crop yield. Particle farming is considered to be one of the common applications of nanotech in agriculture. In this, crops are grown in definite soil and from there, they get extracted for industrial use. It has been observed by some researchers that the gold nanoparticles can be extracted from the plants which are grown in the gold rich soil. This is purely due to the accumulation done by the roots of these plants. Once harvested many procedures are followed to extract gold nanoparticle from plants (Kalaugher, 2002).

Researchers have found out that nanoparticles have both positive as well as negative impact on the plants and this is purely based upon the size, composition, chemical properties of the particles. (Siddiqui et al., 2015). The genetic information of the plants can also be altered through nanotechnology as it can provide us the ease to deliver the gene at the target site easily. Nano fertilizers are now being used in a high amount due to

their good outcome like they decrease eutrophication and contamination of ground water.so, they are preferred more than conventional fertilizers. (DeRosa et al., 2010; Bhalla and Mukhopadhyay, 2010; Mukhopadhyay and Sharma, 2013).

2.1 NANOPESTICIDES

Nano pesticides are considered to be used in agriculture to increase the yield and the efficiency of the crop. Major range of products are available related to nano pesticides in the market. Many researches have been performed in which formulation, characterization and the effect of nanoparticles have been seen on the plants and then their applications have been studied in terms of disease resistance and management. (Al-Samarrai, 2012). The ability of the nanoparticles to work against insects and their impact on the field have also been reported. (Bhattacharyya et al., 2010).

2.2 NANOFERTILIZERS

The delivery of nutrients to target site in a controlled way is achieved by nano fertilizers which not only helps in increasing the yield but also prevents the water pollution to occur which take place in the case of using conventionally used fertilizers. It is also observed that nano fertilizers can cause increase in the elemental efficiency and on the other hand toxicity of soil decreases. In the latest study it was reported that by the combined application of the Biochars and chemical fertilizers, we can see the increase in the productivity of wheat crop and improvement in soil quality was also observed. (Sadaf et al., 2017).

2.3 NANOTECHNOLOGY FOR CROP IMPROVEMENT

A large number of metal based, nonmetal based and carbon-based nanoparticles are used in high amount as they have good impact on crop improvement in terms of yield. (Nair et al., 2010). It has been observed that use of nanoparticles helps in advancement of physiological parameters of the plant which includes the root length, shoot length, germination percentage and other physiological factors. It has also been observed that process like photosynthetic rate and nitrogen assimilation has been seen increased in some crops including soyabean (Agrawal and Rathore, 2014), and peanut (Giraldo et al., 2014), spinach (Gao et al., 2006).

Nanotechnology provides a platform to create genetically modified plant, drug resistant plant or create a new tool and technology for improving yield by delivering nutrients and drugs at a specific site.

3. CONCLUSION

Many more areas of agriculture are still been untouched by nanotechnology. Nano pesticides and nano fertilizers are the potential applications along with the particle farming. Still there is vast range of advantage in the terms of nanotechnology in agriculture. Nanotechnology empowers the farmers to use pesticides or fertilizers in a more effective way as the nanotechnology believes in giving a high output by providing low input. As there are still negative effects of nanoparticles on plants but current researches are going to overcome these impacts. Also, current researches are going to touch the untouched areas of the nanotechnology in terms of agriculture.

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