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Impact of Nano-Sensors in Agriculture for Sustainable Crop Improvement

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SUMMARY

Nanotechnology is a fresh finding that is being researched in practically all industries and is benefiting; it may bring more precise solutions to present agricultural difficulties. Sensors and fertilisers are used in a variety of research activities, thus this study examines the numerous types of fertilisers that have been developed as well as facts about sensors in same sector. Nanotechnology principles can assist farmers in testing the impact before and after, as well as providing input options for a better outcome. Controlled application of technology will aid in long-term viability. Concerned about the environment and farmers, the technologies will aid agricultural engineering as technology is overcoming all local beliefs and ethics, thereby reducing agriculture's major challenges. Technology is more readily available..

INTRODUCTION

Agriculture has traditionally been the lifeblood of many emerging nations. It not only fills people's stomachs, but it also helps them save money. According to census data from 2014-2015, India's population is about comparable to 1,270,272,105 (approximately 1 billion), which is a massive figure. In order to feed such a large population, a new technology that produces greater yield in a shorter amount of time is required. In this way, nature is complicated, and there will be imbalances that effect plants and crops directly, as well as animals and humans indirectly. Deficits in macro and micronutrient content, population boom, industrialization, exhaustion of water sources, differences in soil condition, and loss of top soil are all variables that affect agriculture, according to this. The fundamental rationale for using fertiliser in agriculture is to provide full-fledged macro nutrients, which are frequently lacking in soil. Fertilizer accounts for 35-40% of agricultural productivity, although some fertiliser has a direct impact on plant growth. To solve all of these disadvantages in a more intelligent manner, nanotechnology is one of the sources. Given the importance of fertilisers, developing nano-based fertilisers would be a novel technology in this industry. Fertilizers can sprayed in a variety of methods, including on soil, leaves, and even aquatic habitats; these inorganic fertilisers are used to give three major components in equal ratios: nitrogen, phosphorous, and potassium.

Nano Sensors: Carbon Nano tube

Tubes have a cylindrical shape and are generally made of carbon molecules, with the number of walls varying. These carbon molecules is held in place by a weak van der Waals force, allowing them to be used in particle packaging, filtration, energy storage devices, environmental monitoring, and many other applications. The versatility of the programme is the sole reason for its widespread use. When that comes to agriculture, these multi-walled carbon nano tubes had helped to boost growth rates, water intake, and the uptake of important minerals from the soil. Different yields were detected when different ranges of carbon tubes were incorporated, as well as when any external Fe supplement gave the Ca ion achieved balance that maintained the yield. This multiwalled tube with a concentration of 50 g ml-1 has shown to improve the length both root growth, seed germination time, growth, and had a well-developed root system in other crops such as maize, wheat, peanut, and garlic. Tomato output increased after treatment of fullerene, which is an astonishing event in agriculture. C nano tubes assist plants keep their water content and also improves the production rate dramatically with very little nano material, such as just 50 g ml1.

Nano Aptamers

Aptamers are mono nucleic acids that can be generated in vitro and work on the principle for target binding with high affinity. They are mono nucleic acids that fit for the target in all directions, generating three-dimensional structures with rigorous bonding. Aptamers are chosen for various processes based on a set of parameters, which includes the size in the range between nano and pico molar ranges.

SELEX

(Systematic Evolution of Binding by Exponential Filtration) This type of sensor may detect plant illnesses, crop resistances, and yield production more precisely and effectively. Early detection is essential irradiate problems before they become serious. To determine the right regulation occurring in the system, a sensor was devised to monitor intercellular signalling using a photoluminescence aim specific device, i.e. insulin binding aptamer, to monitor the extinction of lights off cells in order to obtain the signal. With the luminescence assay technique, an effective aptamer sensor was designed to monitor overall toxicity level for food that is preserved for consumption in cases dealing the herbicide or pesticide (Atrazine or Malachite green, respectively).

Smart Dust Technology

The main goal of developing smart dust equipment was to keep track of environmental dangers, energy consumption, and raise public awareness about these issues. It can nearly sense everything in its environment, such as monitor temperature, track traffic, and so on. It acquires popularity as a result of how it operates. It could be monitored by wireless radios and transducers regardless of the sensor's position, and its small size makes it undetected. These are the devices, which are made up of micro-sized electrochemical sensors. Huge power of sensing environmental changes, automation, and computer have brought it to a higher level, but there are still major negatives to this technology, such as the influence on the environment, toxicity, and how far will it go.

Wireless Sensors

Technology has progressed to the point that it is now possible to monitor all activities from any location, eliminating that by being present at the area where the activity is taking place. Wireless technologies have been created for the same reason, but they are still in their infancy, undergoing all of the necessary field trials before being fully utilised. Despite this, it can be used in situations where wireless system and transducer-based sensors are used. These sensors aid in the maintenance of optimal plant growth by continuously monitoring soil and ambient variables. At the field, there is CCTV placed that takes pictures of the site, and it is simple to keep track of everything.

Quality enhancement of agri-products:

The nutritional characteristics and health-related benefits of agricultural products made possible by nanotechnology have piqued the interest of consumers and also the agri-food business. According to studies, the zinc spray with nanoparticles is necessary to boost vegetarian energy, fat, and fibre in Indian diets. Many studies are currently underway to determine the genotoxicity of nanomaterials, as well as to design and test numerous nanoparticles can protect crops with fungal diseases (Hiregoudar, 2014). Because of its special and unique character, gold has been a desirable and useful metal from its inception. Gold nanoparticle development offers a wide range of commercial uses. The detection relies driven by the fact that perhaps the colour of these microparticles is influenced by the shape, volume, refractive indices of the adjacent medium, and the proximity between gold nanoparticles. A noticeable shift in the Surface - enhanced raman Response (SPR) absorption maximum can be caused by even minor changes in the above parameters. The particular molecules bind here to gold nanoparticles by adsorption at the particle's surface, changing their RI (ocular index) of both the gold nanoparticles in the process. If the biomolecules to just be attached be larger than just the gold nanoparticles, just a few molecules will also be adsorbed on the nanoparticle surface, resulting in lump formation and colour change.

Advantages of Nano Fertilizers

Nano coatings technology technology can help decrease expenses and boost productivity on the farm in a variety of ways. For growers, keeping products refrigerated or livestock at a safe temperature can be a huge concern. Bee hives, too, can be safeguarded. Cold rooms can really be covered to cut down on temperature transmission by 40%, lowering the demand for refrigeration. Condensers can also be coated to improve their

efficiency. Nano coatings have a lot of potential in this area. Without the need for detergents or strong cleaning chemicals, one can produce a "easy-clean" with anti-corrosive coating on stone, wood, glasses, metal, plastic (nearly any surface) around in the farm by simply coating it. Cleaning cycles become significantly easier with a 40% reduction in water use and labour. Mildew, mould, and corrosion can cause serious damage to farm buildings, fences, and assets. Rain, bacteria, and environmental corrosion may all wreak havoc on surfaces, but nanotechnology can aid here as well. Using ecologically friendly nano solutions, painted surfaces can last up to 21 years and longer. To work securely in wet and damp situations, all wires can be nanomimized. Dirt causes loss of wool in healthy sheep, according to some sheep producers. Nanomaterials might even be then used manage fertiliser release, ensuring that nutrients are solely consumed by plants and also not lost to unwanted targets such as soil, water, other microorganisms.

Disadvantages of Nanotechnology

The catchy word 'Nanotechnology' also carries with it some concerns and issues for human health and the environment. When it comes to danger and safety, just a small portion of the population will be affected. Initial research on nanomaterials revealed substantial health risks and toxic consequences, as well as tissue damage affecting all vital organs when they were introduced into the human body. Because of its antimicrobial properties, another emerging procedure is using silver nano particles to deliver fertilisers to plants. However, studies have found that it poses a serious threat to the ecosystem, causing cellular damage, reducing annual grass growth, and depleting photosynthesis in algae (chlamydomonasreinnardtii). Some plant species usually hire such nano particle maximum that accumulate in their tissue beyond the limit, making silver nano particles difficult to remove. Soybean, a major cash crop in much of the country, was grown with nanomaterials created with fossil fuel equipment, allowing NNM to be deposited on the crop locally. The effects on plant-microbe interaction impacting N2 fixing symbiosis, for which some metals are susceptible, were seen in regular waste water treatment plants.

CONCLUSION

Nanotechnology is still in its early stages in many industries, and viewing AI's new innovations clearly shows that it has a lot of potential. As with any new technology, there will be objections and rejections, but conquering together all myths and ethics, this will reach new heights in its own time. When compared to traditional test techniques, there is a significant difference in terms of accuracy, cleverness, efficacy, cost of operation, convenience of building, and many other factors. However, when this comes to agriculture, it still lags behind all other strategies. The only solution is to teach individuals who are interested, supply them with a few sample products, but have them utilise them in order to gain the same pupil's satisfaction with technology.

More creative procedures and researches can always be carried out if both the entities work together, but due to a lack of information among the general public, many hopes of prestigious institutions and young blossoming research fellows' innovative ideas are dashed. This technology will aid in the feeding of generations, not just one. The hazards of consuming and conducting a few operations are being raised rather than the technology's benefits and effectiveness. Despite these difficulties, nanotechnology research continues, and there'll be a day in the not-too-distant future when nanotechnology is widely accepted.

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