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Editorial

Nanotechnology in Farming Sustainability

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Modern farming practises heavily rely on the extensive application of chemical pesticides, which have been associated with adverse effects on human health and the environment. The usage of chemical agro inputs has expanded in Indian agriculture since the Green Revolution was announced. A pesticide is a substance that repels, disables, or kills pests. It can be chemical or biological, such as a virus, bacteria, antimicrobial, or disinfectant. It is widely used to get rid of or manage a variety of agricultural pests that can hurt animals and crops and lower farm output [1]. Due to its ability to boost agricultural yield and provide enough food to feed the world's expanding population, pesticides and fertilisers have proven to be beneficial to farmers and citizens everywhere [2]. However, the use of several pesticides in agriculture has been stopped [3]. Synthetic input residue affliction is particularly prevalent in Indian agriculture [4]. Pesticide residues were discovered in 56.3% and 39.7%, respectively, of the samples from the Food and Drug Administration's (FDA) Total Diet Study (TDS) examination of 98.7% of imported human foods and 89.1% of domestic samples [5]. It might imply that lethal diseases in humans, animals, and birds are being brought on by pesticide traces.

Providing food security for the world's rapidly expanding population is the most urgent global challenge we face. As the world population exceeds 9 billion by 2050, it is predicted that the demand for food would increase from 59 to 98%. The agricultural sector heavily relies on water, fertilisers, and pesticides to improve production [6]. Even the smallest objects can have a significant impact. Science is about enormous ideas that have the power to transform the world. One of the earliest human innovations is agriculture, but nanotechnology offers contemporary breakthroughs that have the potential to dramatically increase the efficiency of our food supply while also lowering the environmental effect of its production. Through intense and extensive agriculture, farmers from around the world will concentrate on utilising new inventions and technologies to boost crop production [7]. Precision farming and the use of nano-modified stimulants are supporting current attempts. Fundamental components of food security that can be enhanced by advancements in nanotechnology research include agricultural effectiveness, soil development, safe water usage, food distribution in stores, and food quality (Figure 1).

Figure 1: Applications of nanotechnology in agriculture.

The usage of conventional chemical fertilisers can be decreased by the use of environmentally friendly technologies, and pesticide formulation is a solution to this damage condition. High-quality agricultural production is at risk from weather variations, which reduces income and production swings. The impact of nanotechnology in the future is a topic of discussion among scientists. Numerous major issues in agriculture, including higher

production, quality, quantity, nutrition and disease resistance, will be successfully addressed by the nanotechnology-based approach. Additionally, it might be used in genetic engineering, the use of pesticides, the supply of chemical pesticides, and the use of intelligent fertilisers. Nanotechnology is also less expensive and more environmentally friendly than traditional types of treatment and fertiliser. In fact, using fewer pesticides and fertilisers could result in fewer hazardous substances being discharged into the environment thanks to nanotechnology. By reducing the toxicity and contamination of synthetic chemicals in nearby habitats, it can benefit public health and ecosystems. The distinctive physicochemical qualities of nanomaterials, such as their vast surface area, size, and form, as well as their catalytic reactivity, have the potential to open up new perspectives and usher in fresh approaches to agriculture. Nanotechnology faces many of the same problems as new technologies do, including questions about the toxicity and environmental effects of nanomaterials, their possible effects on the world economy, and conjecture about various end-of-life scenarios. Both developed and poor countries are affected negatively by pesticide use. Long-term natural resource conservation and agricultural productivity are the goals of sustainable agriculture.

Producing foods of exceptional quality in greatly better practical forms and increasing nutrient bioavailability are both possible due to nanotechnology. The expansion of nanotechnology's use in crop production and food processing is the subject of numerous research studies. The most exciting possibilities for the creation of novel and enhanced agricultural products are made possible by nanotechnology.

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