

Guidelines for Evaluation of Nano-based Agri-input & Food Products in India

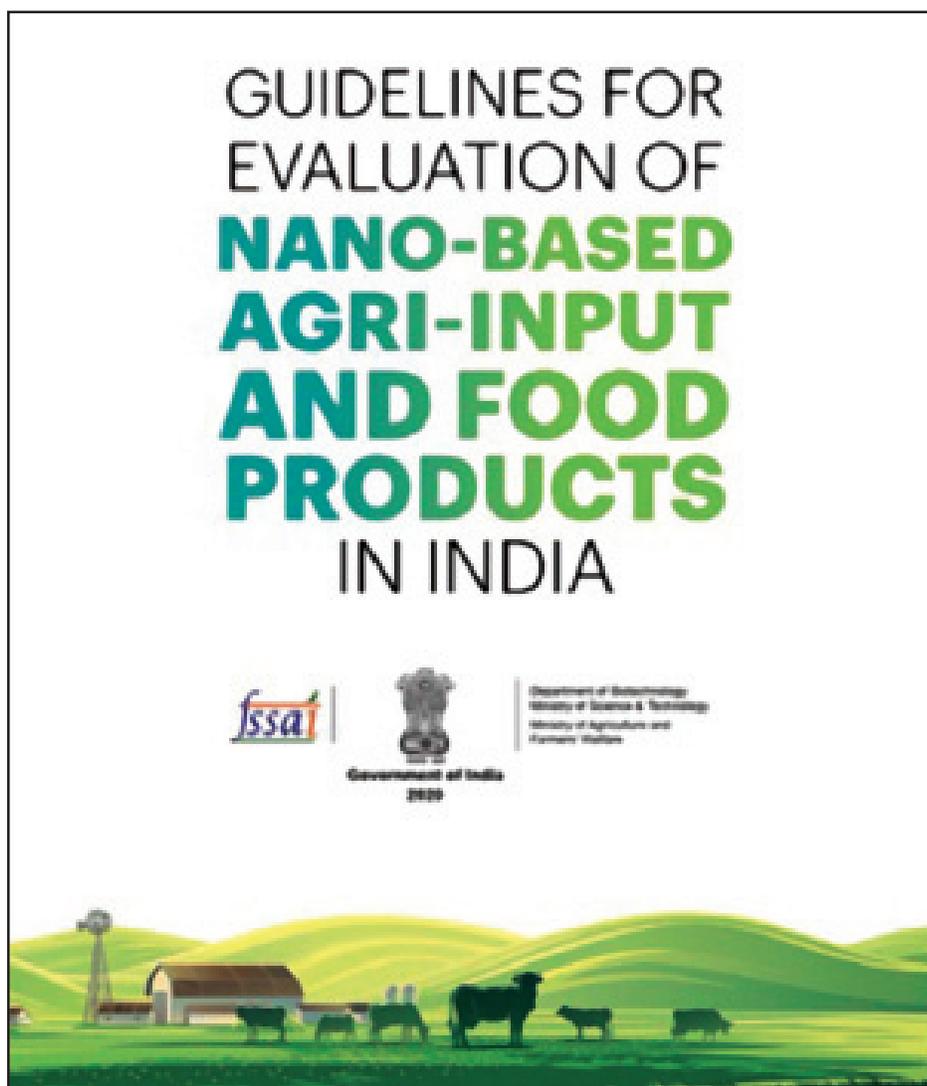
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AGRICULTURE accounts for 46% of land use (73% if the use of land under forest and pasture is included) in India with more than 54% of the workforce being dependent on agriculture for their livelihoods and sustenance. A productivity-based approach has resulted in input-intensive and environmentally exploitative agricultural production systems manifested in declining land productivity, soil erosion, water deficits, and loss of biodiversity.

The contemporary challenges of sustainability, food security and global climate change are engaging researchers in exploring nanotechnology as a novel source of key advancements for the agricultural sector. Regardless of the innumerable advantages of nanotechnology and the growing trends in publications and patents, nanoproducts in agricultural applications have not yet made it to the market. One major factor that could explain the scarcity of commercial applications is regulatory uncertainty and public perception for nanoproducts on the market.

Nanoparticles possess unique properties due to their small size (1-100 nm) and large surface area which give them the benefit and edge over other existing products. However, the same property of small size and large surface area imparts toxicity to nanoparticles as they can easily diffuse and disperse through biological barriers. There have been reservations worldwide from the risk assessment point of view, which are also required to be critically examined for the safety of humans, animals and the environment. In absence of policy regulations, even the safe, green, low-cost efficacious nano-products are experiencing difficulties in reaching the market.

India, among the top three countries in nanotechnology, is ready to forge ahead at the global level by having first 'Guidelines for Evaluation of Nano-based Agri-input & food products in India' intended not only to ensure quality, safety and efficacy of these products but also to ease product development in nano, agri and food sectors. By providing evidence-based safety assurance through the use of the scientific framework in the





A 3D illustration of zinc oxide nanoparticles. Nanoparticles possess unique properties due to their small size and large surface area and have potential in agricultural applications. (Courtesy: <https://www.teriin.org>)

regulatory approval process, the safe nano-based agri & food products with clear benefits will likely drive the acceptability and its place in market among the common masses.

The safety evaluation of nanoproducts is more challenging than existing procedures of chemical toxicity or safety evaluation of other agriculture inputs and food products. The alteration of physical, chemical and biological interaction of the material in nano form (1-100 nanometer size) requires the development of a multidisciplinary approach for generating new alternative strategies and methods for safety evaluation.

The complexity of safety evaluation of nanomaterials is being recognized by academicians, industry and government regulatory authorities all over the world. These comprehensive and inclusive “Guidelines on evaluation of nano-based agri-input and food products in India” will encourage the scientific community to undertake user-inspired nano innovations for directed welfare of farmers & consumers, in particular, to minimize the quantity of sprayed chemical products, reduce nutrient losses in fertilization and increase yields through optimized water and nutrient management.

These guidelines have been timely prepared by the Department of Biotechnology, Ministry of Science and Technology along with Ministry of Agriculture and Farmers’ Welfare and Food Safety and Standards Authority of India, Ministry of Health and Family Welfare. These would help policymakers/regulators to make an effective framework for evaluation of nano-based agri & food products in India and may help in easing the regulatory approval for the products developed by researchers.

The global market for nanotechnology-based products, including agri-input products, is expected to reach \$125 billion in 2024. It is now well established that the future sustainable growth of agriculture would depend on innovative nano-interventions. Thus, nanotechnology has the potential to improve the use efficiency of nutrients through nanotechnology approaches.

India is one of the few countries conducting research in the area of nano-enabled fertilizer products. Clearly, the development and commercialization of nano-enabled controlled and smart release fertilizers will cater to the much-needed demand in this sector with high resource use efficiency. Nanoproducts that are conforming to the guidelines and risk assessment would be shouldering the scientific and social responsibilities of providing safe and sustainable solutions to mankind.

What better the product can do for the environment can be gauged by an example that the nanofertilizers are required to be applied only in a few grams per acre as compared to bulk fertilizers that are required in kg per acre and hence are of immense value not only to our farmers but also for the production and supply chain. Additionally, due to requirement in very small amount, the threat of residue-related hazards and carbon footprints are drastically reduced. If the conventional chemical fertilizer gets replaced by nano-fertilizer, it will not only reduce environmental pollution but also offer an alternative to fertilizer import in the country.

At this juncture, when self-sufficiency is the “mantra” of the Indian Government, this disruptive technology holds great promise to take the country in the direction of self-sufficiency for agri-inputs (fertilizers and pesticides) used in agriculture. The Guidelines would pave the way for the timely arrival of newer and greener nano-based agri & food products to the farming community by easing and shortening the product approval path and will help in the mission on “Doubling Farmer’s Income by 2022” and “National Mission on Sustainable Agriculture”.

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