



# Nano urea fertilizer

boon for agriculture

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Nano fertilizers are important tools in agriculture for increasing nutrient use efficiency, reducing fertilizer waste, and reducing cultivation costs by improving crop growth, yield, and quality metrics. Nano-

fertilizers are very effective for precise nutrient management in precision agriculture as they match the crop growth stage for nutrient and may supply nutrient throughout the crop growth period. Nano-fertilizers

boost crop growth up to optimum concentrations; but, due to nutrient toxicity, additional increases in concentration may limit crop development. Nano-fertilizers improve the surface area available for various

metabolic reactions in the plant, resulting in a faster rate of photosynthesis and increased dry matter and crop output. It also protects the plant from various biotic and abiotic stresses.

#### **Challenges & Solutions of present agricultural practices**

Chemical-intensive agriculture is prevalent nowadays, with higher doses of pesticides used for insect, disease, weed, and nutrient management in order to maximize productivity per unit area while neglecting natural resources and ecosystems.

resources. Solution: Increase the efficiency of fertilizer nutrient usage while lowering doses. High transportation cost of fertilizers due to large quantity requirement. Solution: Reduces the application rate of fertilizers. More fertilizer waste occurs as a result of overdosing in crop production. Solution: Value-addition to traditional fertilizers and reduce doses per unit area. Soil deficient in multiple nutrients. Combining macro and micronutrient sources is the solution.

Fertilizers currently contribute 50% of agricultural production, although the usage of higher dosages of fertilizers does not ensure improved crop yield, but it does lead to various issues such as soil deterioration and pollution of surface and subterranean water

#### **Nanotechnology applications in agriculture**

Nanotechnology now provides various nano devices and nano materials that have a unique role in agriculture, such as nano biosensors to detect moisture content and nutrient status in the soil and also applicable for site specific water and nutrient management, Nano-fertilizers for efficient nutrient management, Nano-herbicides for selective weed control in crop fields, Nano-nutrient particles to increase seed vigor, Nano-pesticides for efficient pest management. Alginate/chitosan nano-particles can be use as

herbicide carrier material especially for herbicide such as paraquat. Nano herbicides are effective in weed management. Weed control with nano pesticides is successful. As a result, nanotechnology will play a larger role in crop production while also ensuring environmental safety, ecological sustainability, and economic stability. Nano particles made with nanotechnology can be used throughout the value chain of the entire agriculture production system.

#### **Introduction**

Urea is a crystalline organic molecule that is white in color. Because of its high nitrogen content, it is the most significant nitrogenous fertilizer in the country (46 percent N). It is utilized as a cattle feed supplement to replace a portion of the protein requirements, in addition to its application in crops. It also has a wide range of industrial applications.

the Government. The Central Govt. pays subsidy on urea to fertilizer manufacturers on the basis of cost of production at each plant and the units are required to sell the fertilizer at the government-set Maximum Retail Price (MRP). As a result, no one can sell urea for more than the government's MRP. Under the Concession Scheme, the MRP for each fertilizer is indicative in nature.

Urea is the only fertilizer at present with pricing and distribution being regulated by

#### **Issues plaguing the Urea Sector**

CPCB has placed India's fertilizer business in the "red category" of polluting industries. Ammonical and Kjeldahl nitrogen, as well as cyanides in various amounts, are found in urea plant wastewaters. This results in water pollution issues. According to the Centre for Science and Environment's innovative Green Rating Project (GRP) Report, the sample of groundwater and effluents analyzed in the lab exhibits significant levels of pollutants (far

#### **How to address the issues**

Indian agriculture must move away from the current practice of using urea in bulk to a more precise supply of nutrients. To increase nitrogen, use efficiency from the present 30-35 percent to more than 60 percent, the industry must develop new and creative

#### **What is Nano Urea Liquid?**

Food and agriculture are essential for all living things on our planet. Fertilizer use has increased as the world's population has risen and food demand has increased. However, farmers have traditionally grown crops using traditional methods for a long time. This includes supplementing plants' nitrogen requirements with urea to boost food crop yields.

However, while urea helps in agricultural productivity, it can be damaging to the environment if applied regularly and excessively. Plants do not use around 40% of urea, according to research, resulting in its dispersion in soil and groundwater. Furthermore, too much urea produces nitrous oxide, a dangerous greenhouse gas that harms the ecosystem. Farmers, on the other hand, suffer a number of issues without urea, including low crop yields and an inability to make a livelihood. So, what is the solution? IFFCO introduced the first Nano Urea, a game-changing solution to the problems associated with urea use. For the past five decades, IFFCO has been working for farmers with the goal of increasing crop

beyond allowed limits). Excessive use of urea on crops has negative consequences for soil, crop quality, and the whole eco-system, as well as pest and insect infestations. Too much urea harms plants: nitrogen slows or prevents seed germination, and too much nitrogen can cause crops to "burn." However, India's urea sector consumes a lot of water, which can be cut in half by adopting recycling and reuse methods.

products. (Nano Urea could be a game-changer.) This will save money on urea, improve soil health, boost yields, and minimize N<sub>2</sub>O emissions. Nitrogen fertilizer production will have to shift away from fossil fuels and toward renewable.

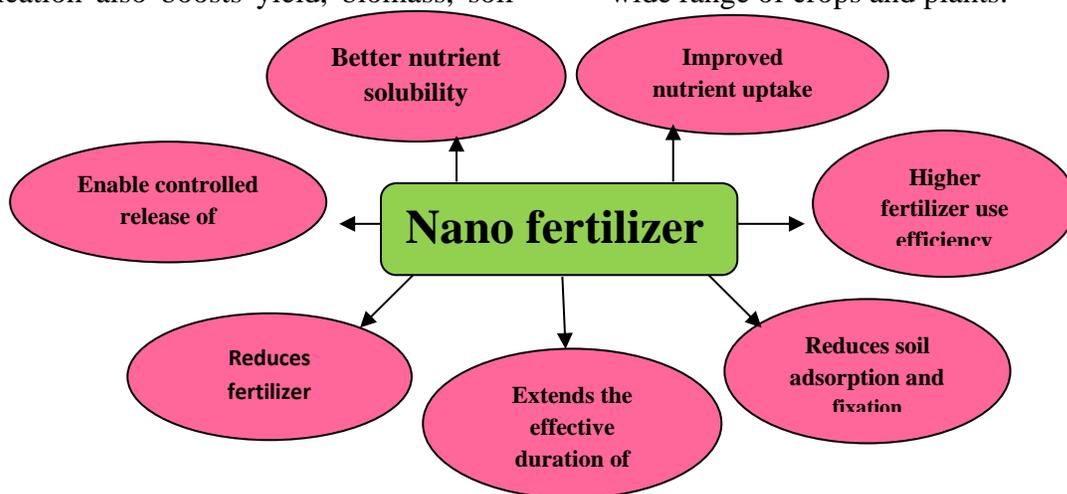
yields, restoring soil fertility, and providing farmers with social and economic independence. Nano urea was invented by Ramesh Raliya. Since 2015, he has been working on the development of nano urea, and since 2019, he has been an active participant in the nationwide nano urea study. The revolutionary product was created at IFFCO's Nano Biotechnology Research Center in Kalol, Gujarat (NBRC).

Indigenously created Nano urea is a liquid that provides essential Nitrogen to plants. Nitrogen is necessary for plants to produce amino acids, pigments, enzymes, and genetic material. Nano urea liquid is a nanotechnology-based solution that has addressed various issues with traditional agricultural fertilizers. In 2019-20, seven ICAR research centers and universities conducted nano urea trials as part of the National Agriculture Research System (NARS). Nano Urea has shown various advantages over regular nitrogen supplementing methods.

Nano scale fertilizers are the next milestone in nanotechnology's journey towards a more

sustainable agriculture. The Nano Urea manufacturing process is a simple way to develop nano scale materials for improved crop productivity while reducing agrochemical leaching into the soil. Nano Urea (Liquid) includes nitrogen particles with a smaller surface area (10,000 times that of a 1 mm Urea prill) and a higher number of particles (55,000 nitrogen particles over 1 mm Urea prill). Nano urea (liquid) application also boosts yield, biomass, soil

health, and nutritional quality of the crop. Nano urea made with nanotechnology contains nano scale Urea particles. Nano Urea particles have an average physical size of 20 to 50 nanometers. In its nano form, Nano Urea comprises 4% nitrogen by weight. Nano Urea contains enough nitrogen to meet the crop's nitrogen needs. It has higher use efficiency than traditional urea. Nano urea can be used as a nitrogen supply for a wide range of crops and plants.



**What are the benefits of nano fertilizer: Nano Urea?**

Nano Urea is a breakthrough product that employs nanotechnology to meet the nitrogen needs of plants. Nano Urea is examined for toxicity and biosafety, among other advantages. It is safe for humans, animals, birds, and soil organisms and is approved for use. In comparison to 2.5 bags of urea, a 500 ml Nano Urea bottle can provide 40,000mg/ml of Nitrogen, which is enough to provide Nitrogen to one acre of cropland. The crop production increased by roughly 8% in the Nano Urea studies. The nanotechnology-based product is the most advanced nitrogen fertilizer with enhanced efficiency. Nano Urea is cost-effective and required in low quantities. The most important advantage of employing Nano Urea for agriculture is its

low environmental impact. As a result, greenhouse gas emissions will be reduced, and air and water quality will improve. One nano urea liquid particle is 30 nanometers in diameter, with 10,000 times higher surface area to volume size than normal granular urea. The nano urea liquid is absorbed more effectively by plants when sprayed on their leaves due to its ultra-small size and surface characteristics. Apart from being cost-effective, nano urea liquid also promises to provide a sustainable solution for plant nutrition as despite lower usage than its current version, it provides higher nutrient efficiency for crops. Only 30-50 percent of nitrogen from urea is currently utilized by plants in farms, with the remaining portion

going to waste due to rapid chemical transformation due to leaching, which contaminates soil and water bodies, and volatilization, which causes nitrous oxide emissions into the atmosphere, resulting in air pollution and global warming, as well as low nutritional efficiency for the crop. However, while conventional urea is effective just for 30- 50 per cent in supplying nitrogen to plants, the effectiveness of the nano urea liquid is over 80 per cent. One of the main reasons for this boost in efficiency is because nanotechnology, which is at the base of this new type of urea, allows for the

creation of ultra-small particles with greater surface-mass ratios, which aid in the regulated delivery of plant nutrients. When these nano particles penetrate plant parts that require nitrogen, they release nutrients in a controlled manner, lowering usage and reducing waste into the environment. Furthermore, in addition to improving crop yield, soil health and nutritional quality of crop, nano urea has also been assessed for biosafety and toxicity according to norms followed in India and the international guidelines developed by OECD, which are adopted and accepted worldwide.

#### **Rate, time & method of application**

Spray 2 to 4 mL Nano urea per Liter of water on crop plants during active growth phases. Apply two foliar sprays for best results. The first spray should be applied during the active

tillering / branching stage (30-35 Days after Germination or 20-25 Days after Transplanting). 2nd spray 20-25 days after 1<sup>st</sup> spray or before flowering in the crop.

#### **Application instructions**

- Shake well the bottle before use.
- Spray on the leaves with a flat fan or cut nozzles.
- Spray during morning or evening hours to avoid dew.
- If rain falls within 12 hours of the Nano urea spray, it is recommended that repeat the spray.

- Nano Urea can easily be mixed with biostimulants, 100 % water-soluble fertilizers and agrochemicals. Before mixing and spraying, it's usually a good idea to do a jar test to ensure compatibility.
- Nano urea should be utilized within two years of its manufacture date for best results.

#### **Safety & precautions**

- Nano-Urea has been assessed for bio safety and toxicity in accordance with the Department of Biotechnology (DBT) of the Government of India's guidelines as well as OECD international criteria.
- Nano urea is non-toxic and safe for humans and animals; however, it is

- recommended that you wear a face mask and gloves when spraying on the crop.
- Keep out of the reach of children and pets and store in a dry place away from high temperatures.

#### **Future Prospects of Nano Urea**

Nano Urea is ready to revolutionize farming with its high efficiency and little environmental impact. With its high efficiency and little environmental impact, Nano Urea is poised to transform farming. This long-term fertilizer substitute will

benefit the agriculture industry and increase farmers' income by allowing them to cultivate high-yield crops at a low cost. Several Indian states are using a sustainable form of fertilizer supplementation for crops. The state of Telangana, for example, has

accepted Nano Urea and is promoting it on a massive scale. India also intends to distribute the product globally in order to help the country's farmers.

### Conclusions

To overcome the imbalanced and excessive usage of conventional urea, IFFCO developed a nanotechnology-based Nano Urea (Liquid) fertilizer in India. According to the problem of environmental pollution and the global hunger dilemma, it appears that the use of nano-urea can not only reduce environmental pollution, eutrophication, groundwater pollution, and diseases caused by overuse of conventional urea prills/granular, but also improve the physiological traits and yield of crops due to

With the rest of the globe, India is paving the way for a healthy, prosperous, and long-term future.

smaller particle diameters, with more penetration into the roots and leaves of plants. Therefore, it is recommended to replace conventional fertilizers with nano-urea, especially in sandy soils due to the possibility of more leaching of conventional urea fertilizer and groundwater pollution. The biotic and abiotic constraints that restrict agricultural output also have an impact on human health and the usage of specialized nano fertilizers to boost crop yields.