



Nano Urea: A Benefit to Indian Farmers and the Environment

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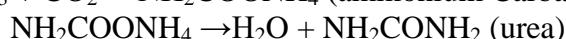
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Prills/granular urea are not only expensive for producers, but they may also be harmful to humans and the environment. Furthermore, nano urea may be used to improve abiotic stress tolerance. Nano-Urea reduces environmental pollution while also improving the physiological characteristics of wheat grown under drought stress conditions. The nano urea has a higher surface area due to the smaller size of the nano particle and has a good sensitivity and solubility in water. When Nano Urea is sprayed on leaves, it smoothly enters through stomata and other openings and is absorbed by plant cells. It is distributed fairly from source to sink within the plant as needed via phloem. Unused nitrogen is stored in the plant vacuole and slowly released for proper plant growth and development. Nano Urea (Liquid) will be available to farmers at a 10% discount over a bag of urea and will not be subsidised by the government. Because one 500 ml bottle is equivalent to one bag of regular urea fertiliser, transportation would be simpler and more cost effective. Because of nano urea's ultra-surface properties, it is absorbed by plants when sprayed on their leaves. Nano urea is an important tool in agriculture for improving crop efficiency, yield, and quality parameters while increasing nutrient use efficiency, reducing fertiliser waste, and lowering cultivation costs. Nano-urea is very effective in precision agriculture for precise nutrient management by matching the crop growth stage for nutrient and may provide nutrient throughout the crop growth period. Nano-Urea boosts crop growth to optimal concentrations. A further increase in concentration may inhibit crop growth due to nutrient toxicity. Nano-Urea increases the surface area of the plant for various metabolic reactions, increasing the rate of photosynthesis and producing more dry matter and crop yield. It also protects the plant from various biotic and abiotic stresses. Nano fertilisers are the new frontier of nanotechnology in the pursuit of sustainable agriculture.

Manufacturing

The Nano Urea manufacturing method simplifies the development of nanoscale materials for improved crop production while significantly reducing agrochemical leaching into the soil. Nano Urea (Liquid) contains nano scale nitrogen particles with a larger surface area (10,000 times greater than 1 mm Urea prill) and a higher particle count (55,000 nitrogen particles greater than 1 mm Urea prill). Furthermore, the use of nano urea (liquid) increases yield, biomass, soil health, and nutritive value.

Traditionally, ammonia and carbon dioxide are used as reactants in the production of urea. The ammonia and carbon dioxide are fed into a reactor that is kept at 180-210°C and 180 bar pressure. The reactions involved in the production of urea are as follows:



Both reactions are reversible, with the first being exothermic and the latter being endothermic. Typically, the overall conversion rate of CO₂ to urea is around 65%. The methods described herein allow for an increase in conversion rate to more than 85% as well as the production of urea particles with superior properties. The methods described herein can be used to create a nano-urea that is easily absorbed in the soil and undergoes controlled hydrolysis to ammonia. The method employs a spinning cone reactor as a Surface for carrying out nano urea synthesis. This technology employs rotating surfaces in systems with limited heat and mass transfer to achieve good mixing and product yield for viscous fluids. The primary reactants (ammonia and carbon dioxide) are reacted on spinning cones that are axially rotated on a common shaft in this method. The centrifugal forces generated by the cones' spinning cause shearing and the formation of thin films, resulting in process intensification and improved heat and mass transfer rates. Furthermore, this mechanism facilitates spray characteristics of the nano urea particles and can obtain High surface area for desired product properties.

Profit

1. Reduces the need for traditional urea by 50% or more due to no leaching and lower other losses in Nano Urea.
2. Required in smaller quantities but produces more. One bottle of Nano Urea (500 mL) has the same efficacy as one bag (45 kg) of urea.
3. Products that are sustainable help boost soil, air, and water quality, which aids in addressing global warming concerns.
4. Less expensive than traditional urea due to lower transportation and handling costs.
5. Reducing farmers' input costs leads to an increase in farmers' income.
6. Improves crop productivity, soil health, and produce nutritional quality.
7. Nano Urea is being developed to replace conventional urea, and it has the potential to reduce urea consumption by at least 50%. It has 40,000 parts per million (ppm) of nitrogen in a 500 mL bottle, which is equivalent to the nitrogen nutrient impact of one bag of conventional urea, which is 50 kg. Environmentally friendly products improve soil, air, and water quality, which aids in addressing global warming concerns.
8. Around 11,000 farmer field trials on more than 94 crops were conducted across India to test its efficacy, with results showing an average 8% increase in crop yields.
9. Nano urea has been added to the government's Fertiliser Control Order following field trials on 43 crops conducted by the National Agriculture Research System (NARS), 20 ICAR research institutes, State Agriculture Universities, and Krishi Vigyan Kendras.

Procedure of Application

Spray 2 to 4 ml of Nano Urea in one Liter of water on crop leaves during active growth stages. Apply two foliar sprays for the 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) and the second spray should be applied 20-25 days after the first spray or before flowering in the crop. Don't reduce the nitrogen base dose. Only top-dressed urea application should be reduced. The number of nano urea sprays can be increased depending on the crop and its nitrogen requirements.

Guidelines for the Use

1. Shake the bottle thoroughly before using.
2. Spray the leaves with flat fan or cut nozzles.
3. Spray in the morning or evening to avoid dew.
4. If rain falls within 12 hours of the Nano urea spray, it is recommended that the spray be repeated.

5. Nano Urea mixes easily with biostimulants, 100% watersoluble fertilisers, and agrochemicals. Before mixing and spraying, always perform a jar test to ensure compatibility.
6. Nano urea should be used within two years of its manufacture date for best results.

Warnings and Safeness

1. Nano-Urea was tested for bio safety and toxicity in accordance with the Department of Biotechnology (DBT), Government of India, and OECD international guidelines.
2. Nano urea is non-toxic and safe for the user; however, it is recommended that a face mask and gloves be worn when spraying on crops.
3. Keep away from children and pets and store in a dry place away from high temperatures.

Conclusion

The specific surface area of nano urea is very large. Because of the nano-sized particles, nano urea is directly applied to crops as a foliar spray and is directly absorbed by the stomata of leaves. Nano urea has lower losses than conventional urea. It improves crop growth parameters, yield, and nutrient utilisation efficiency.