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## Nano Urea: Basic Concepts

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### Abstract

Nano urea is a sustainable option for farmers towards smart agriculture. Nano urea are gaining importance in Indian agriculture in increase nutrient use efficiency, increasing crop yields, and reducing excessive use of synthetic fertilizers. The quantity of synthetic urea being applied by the farmers supply nitrogen to their crops can be successfully reduced to 50% by using nano urea. Required in small quantities compared to bulky nitrogenous fertilisers like urea, it is easy to store and transport. Farmers can easily carry bottles of nano urea over bulkier urea bags, which have a substantial influence on relative logistics and warehousing costs. This article will help to farmers and policy makers to understand about nano urea.

### Introduction

Nano-fertilizers are growing rapidly in agriculture as a way to boost crop yields, improve nutrient resource use efficiency, and reduce the usage of chemical fertilisers. Nano Urea is a new Agri-input based on nanotechnology that supplies nitrogen to plants. IFFCO - Nano Biotechnology Research Centre (NBRC) Kalol, Gujarat developed Nano Urea (Liquid) for the first time in the world using a proprietary patented technology. Nano Urea is a long-term solution for farmers who want to practise smart agriculture while also combating climate change. Because nano urea has a suitable particle size of 20-50 nm and a higher surface area (10,000 times that of a 1 mm urea prill) and number of particles (55,000 nitrogen particles over 1 mm urea prill), it is bio-available to plants as a fertiliser. As a result, nano urea boosts crop availability by more than 80%, resulting in increased nutrient-use efficiency (Kumar *et al.*, 2020).

Nano Urea, which enhances precision and sustainable agriculture, is a potential component of 4R-nutrient stewardship. It encourages clean and green technologies because its industrial production is cheap on the both resources and energy. Furthermore, Nano urea aids in the reduction of environmental impact by lowering nutrient loss from agriculture fields in the form of leaching and gaseous emissions, both of which contribute to pollution and climate change (Figure 1).

### Advantages of Nano Urea

- Increased crop yields; because, Nano Urea particles are easily available to crops due to their small size and high surface area to volume ratio.
- Increased chlorophyll and photosynthesis in leaves, as well as an increase in root biomass and the number of effective tillers/ branches, result in higher crop yields.
- According to 11,000 field trials done across India during 2019-20, average yields increased by up to 8%.



Figure 1: Liquid Nano Urea

- Nano Urea increases farmers' revenue by lowering input costs, increasing crop yields, and improving crop quality.
- Crops grown using nano urea are completely safe to eat. In terms of protein and nutrient content, the nutritional quality of harvested produce is superior.
- Reduction in chemical fertilizer usage.
- Nano Urea makes the use of bulk nitrogen fertilisers like urea more efficient.
- One bottle of IFFCO nano urea (500 ml) has the ability to replace at least one bag of traditional urea due to its increased use efficiency.
- It is environment friendly; because, its production is energy and resource friendly and it reduces the amount of bulk urea used, as well as the associated volatilization, leaching, and run-off losses.
- Required in small quantities compared to bulky nitrogenous fertilisers like urea, it is easy to store and transport. Farmers can easily carry bottles of Nano Urea over bulkier Urea bags, which have a substantial influence on relative logistics and warehousing costs.

### The Science behind Nano Urea

In the Nano Urea (Liquid), 4 percent nanoscale nitrogen particles are present. Nanoscale nitrogen particles are smaller (30-50 nm) and have greater surface area and particles per unit area than traditional urea. Because nano

urea solutions can easily penetrate the plant's cell wall, they result in more effective nitrogen absorption, higher physiological growth, and grain production when sprayed foliar (Kumar *et al.*, 2021).

### Application Time and Method

Spray 2-4 ml of Nano Urea (4 percent N) per litre of water on crop plants during active growth stages. Apply two foliar sprays for best results: 1<sup>st</sup> spray, when tillering/branching is active (30-35 days after germination or 20-25 days after transplanting) and 2<sup>nd</sup> spray at 20-25 days after the first spray or before the crop flowers. Depending on the crop, the duration of the crop, and the overall nitrogen requirement, the number of Nano Urea sprays can be increased or decreased (Figure 2).



Figure 2: Different stages of fertilizer spray

### Crops Suitable for Nano Urea Application

All crops, including cereals, legumes, vegetables, fruits, flowers, medicinal plants, and others, can be sprayed with nano urea.

### Precautions and Safety

Nano urea is non-toxic, safe for humans and animals, but it is recommended that you wear a face mask and gloves when spraying on the crop. Store in a cool, dry location away from direct sunlight.



Figure 3: Precautions and safety measures

## General Instructions

- Before using, give the bottle a good shake.
- For uniform foliage spraying, use flat fan or cut nozzles.
- Spray early in the morning or late in the evening to avoid dew.
- If rain falls within 12 hours of the Nano Urea spray, it is recommended that you repeat the spray.
- Nano Urea can be combined with biostimulants, 100% water-soluble fertilisers, and suitable agrochemicals with ease. Before combining and spraying, it is generally a good idea to conduct a jar test to ensure compatibility.
- Nano Urea should be utilised within two years of its manufacture date for best results.

## Conclusion

In agriculture, nano-fertilizers are gaining popularity as a technique to increase crop yields, improve nutrient resource utilisation efficiency, and reduce the use of

chemical fertilisers. By spraying two times with Nano-N, nano fertilizers in general, and Nano-N in particular, will be able to reduce urea usage by 50%. The government's policies and support for nano fertilizers will alter Indian agriculture and contribute to its long-term viability.

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