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# Role of Nano-Urea in Indian Agriculture

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## Introduction

The word "nano" is derived from the greek word meaning "dwarf." IFFCO introduced the first nano urea; it is a solution for the drawbacks observed while using conventional urea. IFFCO has been working for the past five decades for the farmers with the mission of improving crop yields, enhancing soil fertility and enriching the lives of farmers with social and economic independence. Ramesh raliya is the scientist behind nano urea concept. He has been working on developing nano urea since 2015 and has been an active participant in the nationwide trial on nano urea from 2019. The innovative product was designed in Kalol, Gujarat, at IFFCO's Nano Biotechnology Research Center (NBRC). Indigenously created nano urea is a liquid that provides essential Nitrogen to the crop. Nitrogen is critical for producing amino acids, pigments, enzymes and genetic material in plants. Nano urea liquid is a nanotechnology-based product that has solved several problems associated with common agricultural fertilizers. Trials with nano urea were carried out at seven ICAR research institutes and universities in 2019-20 as part of the National Agriculture Research System (NARS). Compared to traditional nitrogen supplementation methods, nano urea has demonstrated several benefits.

## Chemical composition

Chemically, packed urea contains 46% nitrogen, so a 45 kg bag contains approximately 20 kg of nitrogen. In comparison, nano urea in 500 ml bottles contains only 4% nitrogen (or around 20 gm). IFFCO's Nano Urea provides nitrogen, an essential element for plant development, in the form of granules 100,000 times finer than a sheet of paper. Materials act differently than in the visible realm at this nanoscale, about a billionth of a metre. Plants require nitrogen for growth and development, they get practically all of it from

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soil bacteria that dwell in the roots and can convert nitrogen from air or nitrogen from compounds like urea into a form that plants can use easily.


**Impact of conventional urea on the environment**

Shri Dilip Shangani, Vice Chairman, IFFCO, said that nano urea is a product of the 21st century and is now essential to protect the environment, soil, air and water safe for upcoming generations. Only 30-50 per cent of nitrogen from urea is utilized while the rest goes waste which contaminates soil and water bodies. Low use efficiency and volatilization cause emissions of nitrous oxide in the atmosphere leading to air pollution and global warming along with low nutritional efficiency for the crop. Besides this, there is ammonia emission and eutrophication in water bodies. The leftover urea creates environmental pollution, harms soil health, delays maturity of the crop, reduces production and makes the plant more prone to diseases & insects attack.

**Advantages of Nano Urea**

Nano urea is a nanotechnology-based revolutionary agri-input which provides nitrogen to plants. It is a smart agriculture practice which helps the farmers and combat climate change. It helps to minimise the environmental footprint by reducing the loss of nutrients from agriculture fields in the form of leaching and gaseous emissions used to cause environmental pollution and climate change. It reduces the need for traditional urea by 50% or more. Less amount is required and more output is produced. One bottle of nano urea (500 ml) has the same efficacy as one bag of urea. Environmentally friendly products can improve soil, air and water quality which aids in addressing global warming issues. Cheaper

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than regular urea. It improves crop productivity and soil health thereby increasing nutritional quality.

**Benefits of nano urea over Conventional Urea**

Nano urea is tested for toxicity and biosafety. It is recommended for use and is safe for humans, animals, birds and soil micro-organisms. With 40,000 mg/ml of nitrogen in a 500 ml nano urea bottle can be sufficient for providing nitrogen to one acre of the field with crops compared to 2.5 bags of urea. The trials with nano urea have shown around an 8% increase in the crop yield. 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 critical benefit of using nano urea for agriculture is its minimal impact on the environment. This will result in reducing the release of greenhouse gasses.


**Mode of Action of Nano Urea**

One 500 ml bottle of nano urea is enough for applying twice over an acre of the crop plant. The size of one IFFCO Nano Urea particle is about 30 nanometer and when compared to the conventional urea, it has about 10,000 times more surface area to volume size. Nanotechnology enabled the design of ultra-small particles that gave higher surface-mass ratios, which get absorbed by the plants when sprayed on their leaves. Upon penetration, these nanoparticles reach parts of the plant where nitrogen is required and release nutrients in

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a controlled manner, thereby reducing usage while also reducing wastage into the environment.

**Future Prospects of Nano Urea**

Nano urea is ready to revolutionize farming with its high efficiency and minimal environmental effect. This sustainable substitute of fertilizers will improve the agriculture sector and enhance farmers income as they grow a high yield of crops at a low cost. Several states of India are adapting the sustainable method of supplementing nutrients to the crops. For example, the state of Telangana has embarked on using nano urea and has promoted it on a large scale. India also plans to distribute the product worldwide to benefit the farmers there. Recently, 100 tonnes of nano urea were delivered to Sri Lanka. The government of Sri Lanka had an urgent requirement of nano urea following the President's decision to stop imports of chemical fertilizers. With the world, India is leading towards a healthy, bountiful, and sustainable future.

**Concerns**

When absorbed, urea is water soluble and already has the lowest concentration. It is unclear how even smaller nano-particles can boost nitrogen uptake efficiency. Furthermore, scientists are unsure whether the product can reduce farmer's reliance on urea on its own. As basal nitrogen from urea is required during the early stages of crop development, conventional urea cannot be avoided. Minister of Health, chemicals and fertilizers has claimed that by 2025, India's domestic urea production, as well as production of nano urea, would together mean India would be 'self-sufficient'. It would no longer require the 90 lakh tonnes that it imported every year.

The Government of India is planning the concept of the 'One Nation-One Fertilizer Policy' (ONOF). It will be implemented in October 2022, under the scheme of PM- Bhartiya Janurvarak Pariyojana (PM-BJP). Under the policy, crop nutrients i.e. Urea, Di-ammonium phosphate (DAP), etc. will be sold under a single brand name, 'Bharat' irrespective of manufacturing companies.

**Conclusion**

IFFCO's Nano Urea is a huge step towards sustainable agriculture, reducing the environmental pollution and improving a food system that includes precision and smart farming. It is capable of revolutionizing the entire agriculture sector all over the world. The

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nano fertilizer would be more sustainable than conventional urea for the environment and reduce inputs, logistics and storage costs. IFFCO has planned an enormous countrywide campaign exercise to demonstrate and train the farmers on how to use and apply it. It will be primarily accessible to farmers through its cooperative sales and marketing channel besides its sale on IFFCO's e-commerce platform. This would allow Indian farmers to flourish through a timely supply of reliable, high-value agricultural inputs and services to take on other activities for their welfare.