



## Usefulness of Nano Urea in Indian Scenario:

### Advantages or Disadvantages

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Urea is a solid organic compound whereas granular. The chemical formula of urea is  $(\text{NH}_2)_2\text{CO}$ . Urea is one of the superlative nitrogen rich fertilizers which is easily converted into ammonia in the soil. Role as an essential key element for plants. It is used in agriculture as a nitrogen-rich chemical fertilizer to meet the nitrogen deficiency in crops, but less than half of it is available to the plants while the rest of the urea gets destroyed in the soil and air. Which also causes pollution. Granular urea is water soluble which can cause considerable losses by leaching, de-nitrification and volatilization.

Nano liquid Urea is a chemical fertilizer based on nano technology. Nano liquid Urea is used as a foliar spray due to which it helps in efficient absorption and penetration of nitrogen into the leaves and can vest it to specific parts of the plant where it is need. At the same time, it releases nutrients in a controlled form, hence less amount of fertilizer is used, which also reduces pollution.

Nano urea was invented by scientist Ramesh Lalia and his team at Indian Farmers Fertilizer Cooperative Limited (IFFCO) (Shri D.N.A., 2022). It was developed indigenously at the Nano Biotechnology Research Center in Gujarat with the vision of self-reliant India. Its commercial production was started in 2021, the price of which was kept at ₹ 240 per 500 ml bottles. IFFCO has claimed that this bottle contains 40000mg/l nano particles and 400 ppm nitrogen, which provides the same amount of nutrition to plants as a conventional 45 kg bag of urea. It is enough to use it at the rate of 500ml per acre. Nano Urea has roll in as a sustainable option for the farmers and is helping them move towards smart agriculture.

### Method of use of nano urea

Nano urea is gainable in the markets in liquid form so it can be applied as a spray.

- Make a good solution of 2–4ml Nano Urea (4% N) in one liter of water and spray it on crops.
- For best effect from Nano Urea, it should be sprayed when your crop and plants have 2 leaves.
- First spraying should be done during growth and emergence phase (30-35 days after germination or 20-25 days after planting).
- Second spraying should be done 20-25 days after the first spraying or before flowering of the crop.

### Importance of Nano Urea

According to Indian Farmers Fertilizer Cooperative Limited, Nano Urea is environment friendly. Because it does not cause pollution by dissolving in underground water like traditional urea. It increases crop production by increasing photosynthesis rate in plants and also reduces the cost of fertilizer in the crop. Nano Urea helps in maintaining the quality of

soil, air and water. Its transportation and storage charges are low due to which it is easily available to the farmers at low charges. It helps in reducing global warming. International Rice Research Institute (IRRI) I.S.A.R.C. according to the preliminary report of the trial (Kharif 2021), if India brings 50% of its rice growing areas under nano urea, it can reduce greenhouse gas equivalent of 4.6 billion tonnes of carbon dioxide.

### **Side effects of excessive use of urea**

In India, during the period of Green Revolution in 1966-67, chemical fertilizers had improved agriculture. Due to man's increasing ambition and desire to produce more in limited land, he started using chemical fertilizers indiscriminately. The result of which was that the amount of organic matter in the soil kept decreasing. Due to intense use of poisonous chemicals, the balance of the cycle of organic matter in the land deteriorated day by day and the land became infertile. Due to which serious problems like non-germination of seeds, decrease in crop production, high cost of chemical fertilizers are increasing every day. Due to which farmers are start up to see a deal of farming losses.

### **Precautions while using nano urea**

Farmers should keep some things in mind while using liquid nano urea as crop fertilizer -

- Before using Nano Urea, shake up the bottle well and then use it.
- For uniform spraying, flat fan nozzle sprayer should be used.
- It should be sprayed in the crop in the morning or evening time.
- If the crop adopt rain within 12 hours of its spraying, the spray should be repeated as rain water washes away the fertilizer.
- It is very important to have moisture in the soil for good results and results of nano.

### **Different opinions of scientists on the effect of nano urea**

IFFCO had claimed at the time of Nano Urea launch that 500 ml that one nano urea in that bottle has the ability to provide nitrogen compeer to one bag of normal urea. According to IFFCO, nitrogen in Nano Urea is in the form of minor particles which are a hundred times thin than a sheet of paper. To check Nano Urea effectiveness, trials were conducted on about 11,000 agricultural fields on 94 crops in the country. In which an average increase of 8 percent was seen in the yield of crops. IFFCO has claimed that this increases production and also decrease charge. The research of Punjab Agricultural University (PAU) and the report of Denmark scientists have raised questions on the effectiveness of this Nano urea of IFFCO.

Researcher Max Frank of the department of Plant and Environment Sciences at the University of Copenhagen, Denmark, and Professor Soren Husted of the University of Copenhagen raised doubts on the quality and characteristics of nano urea based on scientific evidence due to the ambiguity (Vivek Mishra, 2023). An opinion paper by Max Frank and Soren Husted published on July 2023 under a Creative Commons license. The title of this opinion paper was 'India's Largest Fertilizer Manufacturer Misleading Farmers and Society Using Dubious Plant and Soil Science'. In which it was said that nano urea was reassert to be useless for the farmers. Farmers' production is being affected by this. We question this when compared with the scientific literature available in reputable journals. IFFCO had claimed through Nano Liquid Urea that for foliar spraying, a Nano Urea bottle of 500g volume which contains only 20g of nitrogen is equivalent to a 45 kg bag of conventional urea which contains 21 kg of nitrogen. Max Frank and Soren Husted said that if this were the case, the nitrogen present in nano liquid urea would increase the nitrogen use efficiency in crops by 1000 times compared to solid urea. The expectancy shown by IFFCO are far from the reality and may lead to huge loss in crop yield to the farmers which may lead to serious food security and livelihood of the farmers. "This may also hamper new products." The report states that before launching a product in the market, its effectiveness should be scientifically

proven. Based on the available scientific confirmation regarding foliar spray nano fertilizers, it can be said that they were wrongly brought into the market with false claims. There is no scientific claim about its good effect on the environment.

The question raised by Danish scientists was dismissed as a foreign conspiracy, but now Punjab Agricultural University (PAU) has also raised questions on Nano Liquid Urea, to which IFFCO or the Government of India has no answer. PAU scientists have raised questions on the efficacy of nano urea in their research. PAU is a well-known agricultural university of the country, whose report is important in itself. A team of scientists, including Rajeev Sikka, principal chemist, Department of Soil Science at PAU, and Anu Kalia, Department of Nanotechnology, conducted research for two years to investigate the effects of nano urea on the yield of rice and wheat. In which it was found that due to use of nano urea, there was a huge decline of 13 percent in the yield of rice and 21.6 percent in the yield of wheat (Agriculture World, 2024). PAU expert Rajeev Sikka said, even if 100 per cent yield is achieved by this nano urea formulation, the required nitrogen nutrient may not be provided by the higher yield compared to the nitrogen provided by a 45 kg conventional urea bag. " Sikka also said that, the reserves of nitrogen in the soil are limited and depleting, so year after year, if we spray nano urea on the leaves and do not replenish the nitrogen in the soil, then the nitrogen in the soil gets depleted. There will be a reduction and this reduction will be gradual. Scientists say that "due to decrease in nitrogen content, the amount of protein also decreases." This is a matter of concern for a highly populated country like India because grains are the main source of protein and carbohydrates in India and if there is a deficiency of protein in the grains then people face diseases and malnutrition caused by protein deficiency. may have to. Apart from this, the cost of nano urea formulation was 10 times more than that of granular urea, which would increase the cost of farming for farmers.

Nano Urea has been prepared by Indian Farmers Fertilizer Cooperative Limited, which is not only the most prestigious and largest fertilizer company of the country but is also the number one cooperative company in the world. The Government of India is also vigorously promoting its discovery because there is no subsidy of any kind on it. Whereas the government has to bear huge subsidy on the sack of normal urea. Fertilizer subsidy in the country is around Rs 2.5 lakh crore, in which urea has the highest share. Farmers of Rajasthan have also raised questions from time to time regarding Nano Urea. Questions have been raised on this many times in Parliament also. When a question was raised about this in Rajasthan in December 2022, in response the Minister of Chemicals and Fertilizers, Dr. Mansukh Mandaviya had said, "This is indigenous research. This is for the farmers of the country and other countries of the world are also looking towards it. We should not raise such questions in our country without any reason which would give any lobby in the world an opportunity to point fingers at nano fertilizer or our research approval bodies. It has been brought to the market after studying every single point in depth and detail."

### **Future possibilities regarding nano urea**

IFFCO's Nano Urea has significantly reduced the damage caused by indiscriminate use of fertilizers. Earlier, applying dry fertilizers was increasing soil pollution, but now with nano liquid fertilizers it has become easier to ensure balanced supply of fertilizers to the crop. IFFCO Managing Director Awasthi said that only last year, Prime Minister Narendra Modi established the world's first nano urea plant in Kalol, Gujarat. The 5th Nano Urea plant is going to be established soon in Jharkhand, after which the production of liquid urea will reach 30 crore bottles by the year 2024. This is equivalent to 135 lakh tonnes of solid i.e. conventional fertilizer. Apart from Gujarat and Jharkhand plants, Nano Urea plants of Bareilly, Prayagraj and Bangalore will also contribute in this work. Now gradually IFFCO's nano fertilizers are making their mark at the international level. Plans are being made to

distribute it all over the world. Recently India had delivered 100 tonnes of nano urea to Sri Lanka. There, farmers were in urgent need of urea after the President's decision to ban the import of chemical fertilizers. According to the report, Nano Urea is already being exported to Sri Lanka, Nepal, Kenya, Suriname and Mexico, but now there is a plan to increase the scope of export to 25 countries, for which samples have been sent to these countries. In this matter, US Awasthi, Managing Director of Indian Cooperative Farmers Fertilizer Company, while talking to the media, said that samples of nano fertilizers have been sent from 25 countries, from which approval is expected, although Brazil has given official approval, but demand is expected from other countries also. Leading fertilizer cooperative Indian Farmers Fertilizer Cooperative Limited has signed an agreement with California-based Kapoor Enterprises for export of Liquid Nano Urea to the US. This agreement was signed on June 2023 during Prime Minister Narendra Modi's visit to America. IFFCO has now started exporting nano liquid urea to the United States, the cooperative said in a statement.

### **Conclusion**

The discussion in this article suggests that the claim of achieving grain yields equivalent to the recommended dose of conventional urea with IFFCO Nano Urea will require long-term evaluation for at least 5-7 years. The results so far are not encouraging and caution is needed in using nano urea for rice and wheat. It would be logical to recommend it only after some long-term research.