



## Nano Fertilizers in Sustainable Agriculture: A Case of Rice and Maize

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As the global population continues to grow, the demand for food production is increasing yet it must be met without compromising the health of our environment. This challenge has led scientists and farmers to explore sustainable solutions, and among the most promising innovations is the use of nano fertilizers. These fertilizers, developed using nanotechnology, are designed to enhance nutrient delivery to crops while minimizing waste and environmental damage. For crops like rice and maize, which are highly dependent on nutrients, nano fertilizers offer a potential pathway toward more efficient and sustainable farming.

### Understanding Nano Fertilizers

Nano fertilizers are nutrient formulations engineered at the nanoscale typically between 1 and 100 nanometers in size. Because of their small size and high surface area, they can release nutrients slowly and more precisely, improving absorption by plants.

Some of the most commonly used nano fertilizers include:

- Nano Urea – a nitrogen-rich alternative to traditional urea.
- Nano DAP (Di-Ammonium Phosphate) – provides phosphorus in a more efficient form.
- Nano Micronutrients – such as nano zinc, iron, and copper, essential for plant health.

These fertilizers are usually applied as foliar sprays, requiring only a small quantity to achieve noticeable results.

### Why Nano Fertilizers Matter for Rice and Maize

**1. Better Nutrient Use Efficiency:** Traditional fertilizers often suffer from poor efficiency. In rice cultivation, large portions of urea are lost through volatilization and leaching. Nano Urea, when sprayed at the active tillering and panicle initiation stages, can cut conventional urea usage by up to 50%, without reducing yield (IFFCO, 2021). In maize, early application of Nano DAP boosts root growth and nutrient uptake. According to research by the Indian Council of Agricultural Research (ICAR), maize plants treated with nano fertilizers showed a 15–20% increase in nitrogen and phosphorus uptake.

**2. Increased Yield and Crop Quality:** Field trials conducted by Tamil Nadu Agricultural University (TNAU) revealed that rice crops treated with two foliar sprays of Nano Urea (4 mL/L of water) achieved a yield increase of 8–10% compared to conventional methods. Maize crops treated with nano DAP and nano zinc showed improvements in cob weight, grain filling, and grain quality.

**3. Eco-Friendly Farming:** Because they are used in smaller amounts and absorbed more efficiently, nano fertilizers reduce greenhouse gas emissions and limit nutrient runoff. They also prevent salt accumulation in the soil, which is a common issue with excessive use of chemical fertilizers.

## Application Practices

### For Rice:

- Apply two foliar sprays of Nano Urea at 4 mL per liter of water.
- Recommended timing: 30–35 days and 50–55 days after transplanting.

### For Maize:

- Apply Nano DAP (75 mL per acre) at 20–25 days after sowing.
- Can be combined with nano micronutrients like nano zinc or nano iron for additional benefits.

Proper training in dilution, spraying, and safety is crucial for farmers to get the full benefit of nano fertilizers.

## Barriers to Adoption

Despite their benefits, nano fertilizers face several challenges:

- **Availability and Cost:** While effective in small amounts, nano fertilizers are not yet widely available in many rural areas.
- **Lack of Awareness:** Many smallholder farmers are still unfamiliar with how to use these products.
- **Safety and Regulation:** Long-term environmental impacts are still under review, and guidelines for proper use need to be more clearly communicated.

## Conclusion

Nano fertilizers offer a promising path toward more sustainable agriculture, especially for staple crops like rice and maize. By improving nutrient use efficiency, boosting yields, and reducing environmental harm, they represent a smart solution to one of agriculture's biggest challenges. With the right training, infrastructure, and policy support, nano fertilizers could become a cornerstone of climate-smart farming in the years to come.

## References

1. IFFCO (2021). Nano Urea: A Revolutionary Product for Indian Agriculture. Indian Farmers Fertilizer Cooperative Limited.
2. ICAR (2022). Annual Report on Nano Fertilizer Trials in Rice and Maize. Indian Council of Agricultural Research.
3. TNAU (2023). Field Evaluation of Nano Urea and Nano DAP in Major Cereal Crops. Tamil Nadu Agricultural University.
4. FAO (2021). The Role of Nanotechnology in Sustainable Agriculture. Food and Agriculture Organization of the United Nations.