Scientists remain sceptical about how nano urea benefits crops

While the inventor says farmers are benefiting from it, several experts have questioned the science underlying its efficacy

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Nano urea, a fertilizer patented and sold by the Indian Farmers Fertiliser Cooperative Ltd. (IFFCO), has been approved by the government for commercial use because of its potential to substantially reduce the import bill, but several experts have questioned the science underlying its efficacy.

Prime Minister Narendra Modi, while inaugurating a nano urea production plant at Kalol in Gujarat on May 28, said, "... A small bottle (500 ml) of nano urea is equivalent to one 50-kg bag of granular urea currently used by farmers."

IFFCO's nano urea contains nitrogen, an element critical for plant development, in the form of granules that are a hundred thousand times finer than a sheet of paper. At this nano scale, which is about a billionth of a metre, materials behave differently than in the visible realm.

Ramesh Raliya, 34, who is credited as the inventor of nano urea and is now a consultant with IFFCO, told *The Hindu* that his process used "organic polymers" that kept the nano particles of nitrogen stable and in a form that could be sprayed on plants.

Chemically packaged urea is 46% nitrogen, which means a 45-kg sack contains about 20 kg of nitrogen.

Contrastingly, nano urea sold in 500-ml bottles has only 4% nitrogen (or around 20 g). How this can compensate for the kilograms of nitrogen normally required puzzles scientists.

Plants need nitrogen to make protein and they source almost all of it from soil bacteria which live in a plant's roots and have the ability to break down atmospheric nitrogen, or that from chemicals such as urea into a form usable by plants.

To produce one tonne of wheat grain, a plant needs 25 kg of nitrogen. For rice, it is 20 kg of nitrogen, and for maize, it is 30 kg of nitrogen. Not all the urea cast on the soil, or sprayed on leaves in the case of nano urea, can be utilised by the plant. If 60% of the available nitrogen was used, it would yield 496 kg of wheat grain. Even if 100% of 20 g of nano urea, which is what is effectively available, is utilised by the plant, it will yield only 368 g of grain, said N.K. Tomar, retired Professor of Soil Science at Chaudhary Charan Singh Haryana Agricultural University, Hissar, Haryana.

Key element: Nano urea contains nitrogen granules that are a hundred thousand times finer than a sheet of paper. • VIJAY SONEJI

"Therefore, total attempt is futile and causing sheer wastage of money. This claim of IFFCO is unfounded and will be disastrous for farmers," he notes in a letter to the NITI Aayog as well as the National Academy for Agricultural Sciences. Dr. Tomar told *The Hindu* that they had not yet responded to his letter.

Dr. Tomar's views are seconded by I.P. Abrol, former Deputy Director-General, Indian Council of Agricultural Research (ICAR).

"Urea is highly water soluble and already reaches the lowest form of concentration when absorbed. How nanoparticles can increase the effectiveness of nitrogen uptake by being still smaller is unclear to me. That foliar spraying (spraying on leaves) improves fertilizer uptake is known for over half a century. So what's new here?" Dr. Abrol asked.

Unlike the coarse particles that farmers throw onto the soil during sowing, the nano particle form of nano urea, when applied on to the leaves, stimulates enzymes such as nitrase and nitrite reductase, which help plants metabolise nitrogen, Dr. Ramesh Raliya said.

Different parts of the plant contain nitrogen in varying proportions and because nano particles are so small and numerous, they have a lot more surface area relative to their volume, compared with the millimetre-size grains of urea that plants are exposed to nearly 10,000 times more in nitrogen.

'Nod based on existing rules'

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The Ministry of Chemicals and Fertilizers on Sunday said nano urea had been allowed for commercial use on the basis of the existing rules that provisionally allow fertilizers to be used based on data from only two cropping seasons.

"It has been wrongly quoted in the news report that the process has been 'fast tracked'. It is clarified that the established and existing procedure for registration of any fertilizer for notification as per Fertiliser Control Order (FCO), 1985 has been fully accounted for," the Ministry said in a statement.