

Key to boost nitrogen efficiency in rice found

Breakthrough promises to save input costs, reduce environmental pollution

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For generations, the efficient use of the nitrogen content in fertilisers by plants has been limited due to various challenges.

Now, in a significant finding, Indian researchers have identified the key to breaking this barrier, in the rice crop. They have found some easily identifiable visual features to differentiate high-yielding rice cultivars based on 'nitrogen use efficiency' (NUE).

Indian agriculture consumes over 30 million tonnes of chemical fertiliser N per year, but about 70 per cent of it is not utilised by crops and causes pollution of soil, water and air.

The immediate implication of the researchers' finding is that the fertiliser NUE could rise from the present 30 per cent. It will have dual benefits—save on input costs and reduce environmental

pollution. Nitrogen (N) compounds such as urea and ammonium nitrate are the most predominant and expensive components of chemical fertilisers. Traditionally, to increase crop yields and feed the growing population, farmers have been liberal with their usage of these fertilisers

Improving crop efficiency

"We have discovered the phenotype for fertiliser NUE in rice. It is crucial in seed germination and crop duration. It can also be used to screen robust rice cultivars," says the study, published in the October 1 edition of the journal *Frontiers of Plant Science* by N Raghuram and Narendra Sharma from the Guru Gobind Singh Indraprastha University, New Delhi.

According to the *Indian Nitrogen Assessment* (2017), co-edited by Raghuram, agriculture accounts for over 70 per



cent of all nitrous oxide emissions in the Indian environment, out of which 77 per cent is contributed by chemical fertilisers.

Nitrous oxide is a greenhouse gas (GHG) that is 300 times more powerful than carbon dioxide. It has replaced methane as the second largest GHG emission from Indian agriculture over the last 15 years.

"As 75 per cent of the market price of urea is subsidised, poor Nitrogen use efficiency harms recovery of investment worth tens of thousands of crores and in-

stead causes pollution. Drastic reduction in fertiliser usage without improving efficiency adversely impacts crop yields and farmer livelihoods. This is why we must improve the fertiliser NUE of crops," said Raghuram, who was recently elected the Chair of the International Nitrogen Initiative.

Foodgrain crops account for over 69 per cent of the total consumption of N fertilisers in India, with rice topping the list at 37 per cent, followed by wheat (24 per cent).

"We expect our findings in rice will also be relevant to

other crops, though it needs to be validated. In any case, rice has the least NUE among cereals and is consumed by over half of the world's population," Raghuram told *BusinessLine*.

The lack of a simple 'phenotype', or a visually identifiable feature to distinguish N-efficient and inefficient cultivars, has hampered crop improvement for NUE for over half a century, says V Sitaramam formerly of Pune University

The findings have shown the importance of germination for other traits, such as yield and stress. Germination and crop duration are such simple features that even farmers can screen and choose cultivars on that basis, while breeders can use them for crop improvement," he said.

"Reduction of crop duration has been an important research goal in Indian agriculture, but we have to be mindful of not losing NUE in the process," said Narendra Sharma.