

Enhancing rice productivity

by using nutrient expert

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Rice productivity declines due to greater loss of nutrients from the root zone of crop. Rice productivity can be increased by minimizing nutrient losses in the environment by managing nutrient supply to the root zone within a reasonable range which realizes the biological need of crop to match nutrient requirement of crop and controls nutrient losses. To achieve this goal, use of Nutrient Expert is needed for supplying nutrients in right amount and at right time.

Key words: Nutrient Expert, Nutrient management, Rice productivity

RICE (*Oryza sativa*) is the most important staple food crop for more than half of the global population. In India, rice production has increased five-fold from about 20 million tonnes (Mt) in 1950-51 to more than 112.91 Mt in 2017-18. This increase in production is attributed to the development of fertilizer responsive and high-yielding varieties.

The Nutrient Expert (NE) fertilizer decision support tool, developed by International Plant Nutrition Institute (IPNI), is an easy to use, interactive computer based decision tool that provide balanced

nutrient recommendation for rice, wheat and maize for individual farmer's field. The tool estimates the attainable yield for a farmer's field based on the growing conditions, determines nutrient balance in the cropping system based on yield, residue management and fertilizer/manure applied in the previous crop. It combines all such information with expected N, P and K response in the concerned field to generate a location-specific nutrient recommendation.

Fertilizer N-use efficiency varies from 18-40% in rice soils, because applied inorganic N is rapidly lost

from the soil by ammonia volatilization and denitrification. Urea is the principal nitrogenous fertilizer in rice-growing Asian countries. Higher loss of N from urea necessitates an innovative application of technique to increase the N-use efficiency. Proper management of N is essential for achieving higher productivity, maximizing nutrient use efficiency (NUE) and improving environmental safety by ensuring minimal losses of applied N. However, efficiency of applied N fertilizer primarily depends on the form of N applied and the ecosystem in which they are used.



Fig. 1. Rice growth at 60 DAS under Nutrient Expert based NPC application. (a) Neem Coated Urea (NCU), (b) Neem Coated Urea (NCU) + Vermicompost N Omission, (c) N omission, and (d) Control

Nutrient management

Nutrient Expert is a unique tool for large-scale implementation of site-specific nutrient management in India, where, over 86% of the smallholder farmers do not have access to soil testing. Its capability to provide balanced and location specific fertilizer recommendation on the basis of farmer resource availability, is critical for adoption of improved nutrient management practices by the variable resources endowed farmers of the country. NE recommends a right rate of NPK in right time to enhance the crop productivity. In this context, application of nitrogen at the right rate (NE), right time (NE) and

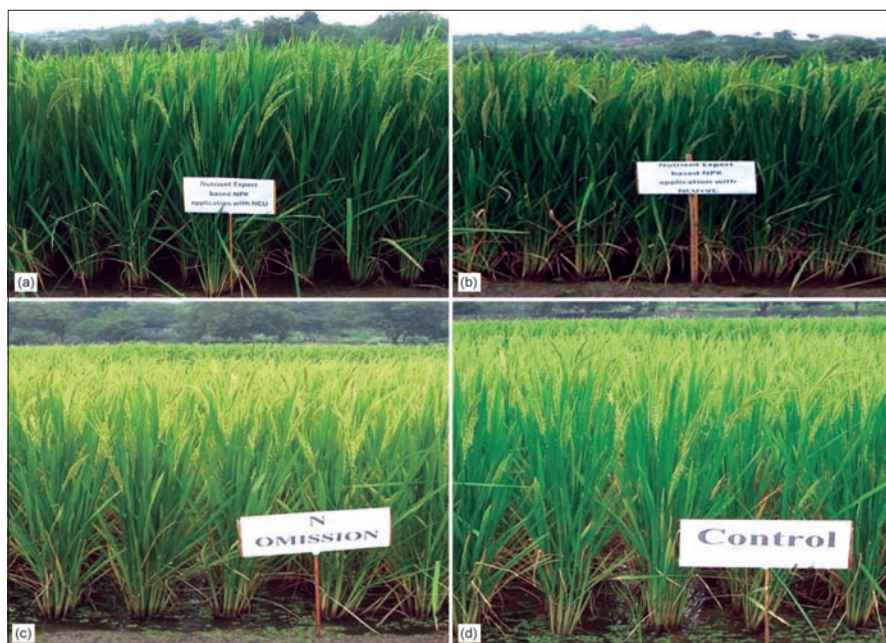


Fig. 2. Rice growth at 95 DAS under Nutrient Expert based NPK application. (a) NCU, (b) NCU + Vermicompost, (c) N Omission, and (d) Control

right source (Neem Coated Urea (NCU) + Vermicompost (VC).

Right rate of N

On average, rice needs about 15 to 20 kg of N to produce 1 t/ha of grain yield. This indicates an uptake requirement of approximately 100 kg N both from soil and fertilizer sources to produce 5 t/ha of grain yield.

In response, the International Plant Nutrition Institute (IPNI), in collaboration with Indian Institute of Rice Research (IIRR) and other national partners, developed the NE fertilizer decision support tool. NE is a 4R compliant tool that provides field-specific fertilizer recommendations to small holder farmers.

Right time of N application

Rice requires N at different growth stages and N fertilizers should be applied at these physiological stages. This may help in the availability and absorption of N during the critical growth stages of rice leading to better utilization of the nutrient by using of NE deciding the timing for N top dressing.

Right N source

Urea has been challenged as an N source for rice due to leaching losses in coarse-textured soils and surface runoff, which could be offset with the use of slow-release fertilizers like neem-coated urea (NCU) and vermicompost. The co-ordinated studies conducted by the IIRR

showed an increase in N response (33.1 kg grain/kg N) with NCU at Ghaghraghat (Uttar Pradesh), while the lowest N response (4.3 kg grain/kg N) was recorded with prilled urea (PU) at Chinsurah in West Bengal.

NCU and vermicompost helped in reducing denitrification, leaching and volatilization losses by inhibiting the nitrification process and accelerated the N availability while saving the N use, indicating that NCU and vermicompost could be a right source of N fertilizer for sustaining rice production.

Very fast growth of rice plants was observed under NE based application with NCU and NCU+VC than N Omission and Control (Figs. 1 and 2). Higher numbers of tillers and panicles was observed under NE based application with NCU and NCU+VC than N Omission and Control. Early maturity was observed in rice plants under control and N Omission than NE based application with NCU and NCU+VC.

CONCLUSION

Nutrient Expert is a nutrient decision tool by which nutrients were applied in right rate and right time by NCU and NCU+VC, which reduced the loss of nutrients and enhanced the growth and yield attributing characters.

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- ICAR-Enterprise resource planning (ERP) System to this manage the human resource in information of the council including pay roll, finance and budgeting.
- KVK Knowledge Network Portal (<http://kvk.icar.gov.in>) to share basic information and facilities of KVKs with contingency plans, demonstration schedule, and advisories.
- Management System for Post-Graduate Education (MSPGE) enabling academic and e-learning modules while also being a repository of academic records
- E-Samvad, an online interface of the Council to answer citizens queries.
- KRISHI –A knowledge repository portal of digital information pertaining to research experiments, outputs, publications, etc.
- E-Krishi Manch, a dedicated portal for farmer-scientist interaction.