

## Rice genotypes for higher nitrogen use efficiency in lowlands

Dinesh Kumar<sup>1</sup>, Arti Bhatia<sup>2</sup>, Shweta Mehrotra<sup>1</sup>, Anita Kumawat<sup>1</sup>, Vaibhav Baliyan<sup>1</sup>, A. Price<sup>3</sup>, A. Moring<sup>4</sup>, U. Dragosits<sup>4</sup>, N. Raghuram<sup>5</sup>, Mark A. Sutton<sup>4</sup> and H. Pathak<sup>6</sup>

<sup>1</sup>Division of Agronomy, ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India

<sup>2</sup>Center for Environment Science and Climate Resilient Agriculture, ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India

<sup>3</sup>University of Aberdeen, School of Biological Science, Rm 1:07 Cruickshank Building, Aberdeen, AB24 3UU, Scotland, UK

<sup>4</sup>Centre for Ecology and Hydrology (CEH), Edinburgh Research Station, Bush Estate, Penicuik, EH26 0QB, Scotland, U.K.

<sup>5</sup>School of Biotechnology, Guru Gobind Singh Indraprastha University, Sector 16C, Dwarka, New Delhi 110 078, India

<sup>6</sup>ICAR-National Rice Research Institute, Cuttack 753 006, Odisha, India

E-mail: dineshctt@yahoo.com

### Abstract

Nitrogen use efficiency (NUE) of fertilizer urea is generally <40% in lowland rice. It causes economic losses and pollution of air and water. Use of nitrogen-use efficient genotypes can help in increasing the NUE of applied N. A two-year field study screened the nitrogen-use efficient genotypes of rice under varied rates of N application. Genotypes of rice influenced the NUE significantly. Genotypes Nidhi, CR Dhan 310 and Nagina 22 were most N-use efficient among the 10 genotypes screened. These genotypes had higher harvest index and grain yields during both the years.

Keywords: Fertilizer nitrogen, genotypes, lowland rice, nitrogen use efficiency

---

### Introduction

Nitrogen use efficiency (NUE) of fertilizer N in rice, particularly under lowlands, is <40%. It results in reduced farm profits, water quality and air quality. Split N application, use of slow release N fertilizers and nitrification inhibitors have been suggested to increase NUE. However, such approaches still remain unpopular among the farmers (Kumar et al., 2010). More reliable and environment-friendly option could be to find the genotypes, which are N-use efficient.

### Materials and methods

A field experiment was conducted at the ICAR-Indian Agricultural Research Institute, New Delhi during the wet seasons of 2017 and 2018 to screen the rice genotypes for higher NUE. Treatments were combinations of 10 genotypes and 3 N levels (0, 50 and 100% of the recommended dose, i.e., 120 kg N ha<sup>-1</sup>), allocated in a split-plot design with 2 replications.

### Results and discussion

Highest grain yield was recorded at 100% N rate, which was significantly higher than 50% N. Among genotypes, Nidhi produced highest grain yield. The next best genotypes were CR Dhan 310 and Nagina 22, both producing significantly greater grain yields over BPT 5204, MTU 1010, Rasi, Pusa 44, Panvel, CR Dhan 311 and Taipe 309. These differences were caused by the variations in their harvest index. Genotype Nidhi recorded the highest harvest index. Plants grown under 100% N rate had a relatively higher root growth as compared to the nitrogen limiting treatment. Genotype Nidhi had higher root growth. The NUE indices, viz. agronomic efficiency (AE) and partial factor productivity (PFP) decreased with an increase in N rate from 50% to 100% recommended dose. Nidhi recorded the highest values of AE and PFP. Agronomic efficiency of the genotypes MTU1010, BPT 5204, Pusa 44, Nagina 22, Panvel, CR Dhan 310 and Taipe 309 were at par.

### Conclusion

Rice genotypes Nidhi, CR Dhan 310 and Nagina 22 may be considered as N-use efficient in lowlands.

### **Acknowledgements**

The authors duly acknowledge the financial assistance received from BBSRC, UK and DBT, India to conduct this study under the project “Newton-Bhabha Virtual Centre on Nitrogen Efficiency of Whole-cropping Systems for improved performance and resilience in agriculture (NEWS India-UK)”.

### **References**

Kumar D, Devakumar C, Kumar R, Das A, Panneerselvam, P and Shivay YS 2010. Effect of neem-oil coated prilled urea with varying thickness of neem-oil coating and nitrogen rates on productivity and nitrogen-use efficiency of lowland irrigated rice under Indo-Gangetic plains. *J. Plant Nutr.* **33** 1939–1959, 201