Minimizing ammonia volatilization from urea, improving lowland rice (cv. MR219) seed germination, plant growth variables, nutrient uptake, and nutrient recovery using clinoptilolite zeolite

ABSTRACT

The anionic nature and high cation exchange capacity (CEC) of clinoptilolite zeolite can be exploited to reduce ammonia (NH3) loss from urea and to improve soil chemical properties to increase nutrient utilization efficiency in lowland rice cultivation. A closed-dynamic airflow system was used to determine NH3 loss from treatments (20, 40, and 60 g clinoptilolite zeolite potī 1). Seed germination study was conducted to evaluate the effects of clinoptilolite zeolite on rice seed germination. A pot study was conducted to determine the effects of clinoptilolite zeolite on rice plant growth variables, nutrient uptake, nutrient recovery, and soil chemical properties. Standard procedures were used to determine NH3 loss, rice plant height, number of leaves, number of tillers, dry matter production, nutrient uptake, nutrient recovery, and soil chemical properties. Application of clinoptilolite zeolite (15%) increased shoot elongation of seedlings and significantly reduced NH3 loss (up to 26% with 60 g zeolite potī 1), and increased number of leaves, total dry matter, nutrient uptake, nutrient recovery, soil pH, CEC, and exchangeable Na+. Amending acid soils with clinoptilolite zeolite can significantly minimize NH3 loss and improve rice plant growth variables, nutrient uptake, nutrient recovery, and soil chemical properties. These findings are being validated in our ongoing field trials.

Keyword: Clinoptilolite zeolite; Lowland rice; Nutrient recovery; Nutrient uptake; Soil chemical properties