Tropentag, September 15-17, 2021, hybrid conference

"Towards shifting paradigms in agriculture
for a healthy and sustainable future"

Nitrogen Forms Differentially Affect pH and Response of Rice on Contrasting Soil Types

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Abstract

Rice is grown in two known systems in the Philippines, irrigated which is characterised by the presence of water throughout the growing period and rainfed that depends solely on rainwater. Theshift in rhizosphere systems may occur under rainfed conditions from anaerobic to aerobic and vice-versa. These changes may create an environment, which can affect physicochemical properties of soils and consequently altering nutrients availability (macro andmicro) and their uptake. In this study, we hypothesized that the pH and the performance of rice will be affected differentially by the applications of different nitrogen forms on contrasting soil types. This study was conducted in the greenhouse condition of the Institute of Crop Science and Research Conservation in the University of Bonn, Germany. A pot experiment with three soil types with contrasting inherent pH (acidic, neutral and alkaline), three nitrogen forms (NH_4^+, NO_3^-, NH_4NO_3) and two rice genotypes (IR64 and Nipponbare). Bromocresol purple staining showed that rhizosphere of ammonium-fed rice was acidified with pH value of 4. Whereas, alkalinization was observed on the nitrate-fed rice with pH value of 6 – 7. All nitrogen forms were able to increase the pH level of acidic soil (from 4.0 increased up to 4.5) and neutral soil (from 6.9 increased up to 7.3). Shoot dry biomass of both genotypes were higher on acidic soil regardless of the nitrogen forms. Moreover, biomass of rice genotypes was lowest on alkaline soil and NO_3^--fed plants showed relatively lower dry biomass (10 % less) than other nitrogen forms in acidic soil. Rice on alkaline soil has the lowest uptake of Zn with less than 5 mg plant-1 and highest in acidic soil with more than 60 mg $plant^{-1}$ in all nitrogen forms. This study showed that the inherent soil pH was influenced by the different nitrogen forms and thus affects rice performance.

Keywords: Ammonium, nitrate, nutrient management, *Oryza sativa*, system shift

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