

Dielectric response of nitrogen in soil amended with chicken litter biochar and urea under *Oryza sativa* L. cultivation

ABSTRACT

Unbalanced utilization of nitrogen (N) rice not economically viable neither is this practice environmental friendly. Co-application of biochar and urea could reduce the unbalanced use of this N fertilizer in rice cultivation. Thus, a field study was carried out to: (i) determine the effects of chicken litter biochar and urea fertilization on N concentration in soil solution of a cultivated rice (MR219) using dielectric measurement at a low frequency and (ii) correlate soil dielectric conductivity with rice grain yield at maturity. Dielectric response of the soil samples at 20, 40, 55, and 75 days after transplanting were determined using an inductance–capacitance–resistance meter HIOKI 3522-50 LCR HiTESTER. Selected soil chemical properties and yield were determined using standard procedures. The dielectric conductivity and permittivity of the soil samples measured before transplanting the rice seedlings were higher than those for the soil samples after transplanting. This was due to the inherent nitrogen of the chicken litter biochar and the low nitrogen uptake at the transplanting stage. The soil N response increased with increasing measurement frequency and N concentration. The permittivity of the soil samples was inversely proportional to frequency but directly proportional to N concentration in the soil solution. The estimated contents of N in the soil using the dielectric conductivity approach at 1000 Hz decreased with increasing days of fertilization and the results were similar to those of soil NH_4^+ determined using chemical analysis. The conductivity measured within 1000 Hz and 100,000 Hz correlated positively with the rice grain yield suggesting that nitrogen concentration of the soil can be used to estimate grain yield of the cultivated rice plants.