Rice husk compost production and use in mitigating ammonia volatilization from urea

ABSTRACT

Using value-added products such as compost in farming systems could enable optimization of nitrogen (N) fertilizers whose world-wide demand is on the increase. The objectives of this study were to: (i) produce compost through co-composting rice husk (RH) with chicken dung slurry (CDS), chicken feed, and molasses, (ii) determine the effects of optimum rate of urea and RH compost on minimizing ammonia (NH_3) volatilization, and (iii) determine total N, exchangeable ammonium (NH_4^+), and available nitrate (NO_3^-) retained in soil following co-application of urea and RH compost. Compost was produced for 60 days by mixing RH, CDS, chicken feed, and molasses at a ratio of 20:1:1:1. The color of RH compost was dark brown and had significant amounts of major nutrients such as N (1.15%), phosphorus (3101 mg kg^{-1}), potassium (2038 mg kg^{-1}), calcium (863 mg kg^{-1}), magnesium (276 mg kg^{-1}), organic matter (OM) (60.67%), organic carbon (35.17%), and humic acids (5.87%). The C/N ratio of the RH compost was 30. The electrical conductivity and pH of the RH compost were 2.79 µS cm^{-1} and 6.55, respectively, and they were not phytotoxic because paddy seeds were successfully germinated in all of the RH compost extractants. The high cation exchange capacity (CEC) of the RH compost (100.67 $cmol_C$ kg^{-1}) at the end of composting was one of the determinant factors that controlled NH_3 loss from urea. The effectiveness of the RH compost in minimizing urea-N loss was determined using a close-dynamic air flow system. The RH compost significantly minimized NH_3 volatilization because of the high affinity of the RH compost for NH_4^+. An attestation of this reaction was that the high negative charges due to high CEC and OM of the RH compost temporarily protected NH_4^+ from being transformed into NH_3 gas. Further evidence is the higher soil total N and exchangeable NH_4^+ for the treatments with RH compost than with urea alone. High quality compost can be produced from RH to reduce urea-N from being lost from urea. For the optimum rate, co-application of 60 g RH compost and 2.9 g urea per trough is recommended to mitigate NH_3 volatilization instead of the existing practice (7.3 g urea alone per trough).