216. Effect of application rate of organic matter on the fate of nitrogen fertilizer in flooded soil at early growth stage of rice

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Introduction

Organic matter and chemical fertilizer enhance soil productivity and have positive effects on rice yields. However, at early growth stage, a kind of organic matter such as straw application inhibits rice growth because of adverse effects of low redox potential and organic acid by anaerobic decomposition. Therefore, absorption of nitrogen (N) derived from fertilizer can be reduced due to the inhibition of rice growth by straw application. Applied fertilizer-N is not only absorbed by rice plant, but also losses as N-gas. Loss of N in flooded soil is another possibility for the low recovery of fertilizer-N. The mechanism of N loss in flooded soil is characterized by a tight coupling between nitrification and denitrification reactions. Both nitrification and denitrification respond with soil redox potential and occur in soil surface and rhizosphere. Hence the fate of fertilizer-N in flooded soil may be influenced by positions of N applied. The aim of this research is to determine the effect of application rate of rice straw on the fate of fertilizer-N applied with different position.

Materials and Methods

A pot experiment was conducted at Yamagata University from October 2010 to January 2011. Haenuki (*Oryza sativa)* were planted in plastic tubes (50 ml) filled with 40 grams dry soil/tube. Soil was collected from a 0-10 cm depth of University's farm soil (Alluvial Soil). Rice straw was incorporated into soil with the rate of 3, 6, and 12 t/ha at 18 days before transplanting. Ammonium sulfate labeled with ^{15}N (3.4 atom%) was applied at the rate of 60 kgN/ha at 42 days after transplanting. The positions of N applied were 1) surface, 2) bottom, and 3) plow layer (all layer) in the pot. Total N concentration in soil and plant was determined by Kjeldahl method and ^{15}N concentration was determined using Ratio Isotope Mass Spectrometer.

Result and Discussion

(1) Plant dry weight decreased with the increasing rate of organic matter. (2) Absorption of N by plant derived from fertilizer showed few responses with the rate of organic matter. The recovery rate of fertilizer-N in plant was in the range of 64–75%. (3) Immobilization of fertilizer-N also showed few responses with the rate of organic matter. (4) N loss was not affected by the rate of organic matter irrespective of any N application methods. (5) Total N in plant decreased with the increasing rate of organic matter, though fertilizer-N in plant had few changes. The results obtained in this study imply that application of inorganic N at early growth stage can be used as a solution to sustain the poor growth of plants treated with heavy dose of organic matter.

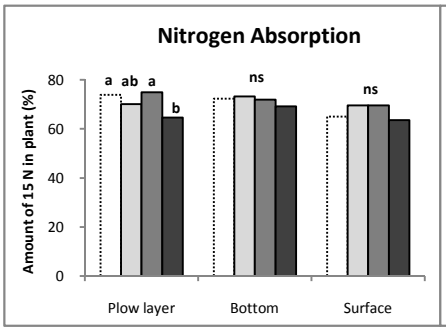

Figure 1

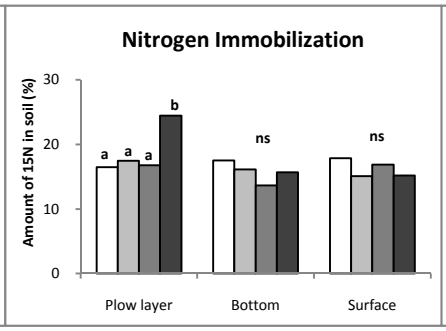

Figure 2

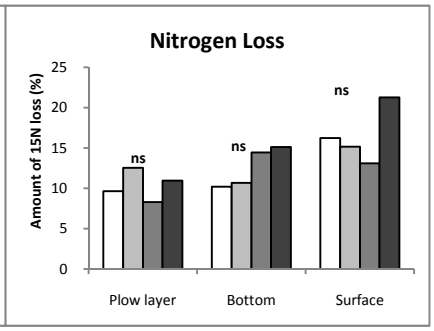

Figure 3

□: Control (without rice straw) ▒: Rice straw 3t/ha ▓: Rice straw 6t/ha ■: Rice straw 12 t/ha; **ns** : not significantly different