Effects of Bottom Sediment-Like Tsunami Deposit on Soil and Paddy Rice Growth

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Introduction

Tsunami caused by Tohoku Region Pacific Coast Earthquake damaged extremely huge area of farmlands (23,600 ha) in Tohoku region. Tsunami brought seawater and tsunami deposits in farmlands. Clayey tsunami deposits, partly composed of bottom sediments, has potential to increase soil salinity because they can hold much seawater and are not easily desalinated by rain or irrigation water. Although the deposit should be removed from farmlands, in fact they are incorporated into the surface soil when their thickness are less than 5 cm. Objective of this study is to investigate the effect of clayey tsunami deposits on soil and the rice growth when they are incorporated into soil.

Materials and Methods

Clayey tsunami deposit was collected from a tsunami-attacked field of Higashi-matsushima city, Miyagi in April, 2012. The deposit had a high content of salt with high electric conductivity (EC, material to water ratio of 1:5) of 3.7 dS m^{-1} and a part of the deposit was desalinized by fresh water into 0.28 dS m^{-1}. The original and desalinized deposits were mixed at the ratio of 1:5 (deposit: soil, v/v) with paddy soil (non tsunami-affected Alluvial soil) and packed into 1/2000a pot. A control treatment (no added deposit) was also prepared. We measured rice growth and yield, and silica concentrations in soil solutions and exchangeable cations of soils after harvesting.

Results

The desalinized deposit addition treatment (DD) enhanced rice growth (stem number per hill) and brown rice yield due to the increase of nitrogen mineralized from the tsunami deposit, while the original deposit addition treatment (OD) decreased rice growth and yield compared with the control treatment due to severe salt injury. Silica concentrations in soil solutions were kept higher in OD and DD treatments than the control soil. Exchangeable magnesium and sodium of soils extremely increased with the addition of original tsunami deposits and increased a little bit in the DD treatment compared with the control treatment. It was concluded that the clayey tsunami deposit gave decomposable organic nitrogen, soluble magnesium and silica to surface soils as nutrients and increased rice growth, but caused salt injury mainly due to the increase of soluble sodium in soil when it was incorporated into soil without desalinization.