Effect of SRI on the Reduction of Irrigation Requirement and NPS Pollution Discharge from Runoff Plots in Korea

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Water competition among domestic, industrial and agricultural sectors has been gradually heightened recently in Korea as a lack of water supply is expected in the near future. About 46% of the nation's water use is consumed in paddy farming to produce rice. And the conservation of water resource and quality in agricultural sector is a pending issue in the nation's long-term water management plan.

New paddy rice farming techniques that use significantly less irrigation water are urgently required. System of Rice Intensification (SRI) that is now well known to produce more rice with less water consumption has not been tried in Korea yet. And environmental effect of SRI on non-point source (NPS) pollution and greenhouse gases (GHGs) has not been well investigated.

The objective of this study was to measure the effect of SRI on NPS pollution and GHGs as well as water use and rice yield in a Korean paddy condition. Eight experimental runoff plots 5x15 m in size were prepared at an existing paddy field. Runoff and water quality were measured during the 2010 and 2011 growing seasons while a Japonica rice variety was cultivated. GHG emissions were measured in 2011 growing season.

Rice plants grew better and healthier in SRI plots than in conventional (CT) plots. Rice yield from SRI plots was slightly lower than that from CT plots in the 1st year. But in the 2nd year, rice yield increased by 109-120%. In the 1st year, 35-day old seedlings were transplanted one plant per hill. But in the 2nd year, 25-day seedlings were transplanted. If 15-day old or younger seedlings are transplanted in the future study, rice yield could be higher.

Irrigation requirement of SRI plots compared to CT plots was reduced by 56% and 49.4% for the 1st and 2nd years, respectively, meaning that about 50% of irrigation water could be saved. Runoff from SRI plots decreased by 5~15% compared with that from CT plots.

Average NPS pollutant concentrations in runoff from SRI plots during rainfall-runoff events in 2010 were SS 89.4 mg/L, COD_{Cr} 26.1 mg/L, COD_{Mn} 7.5 mg/L, BOD 2.0 mg/L, TN 4.2 mg/L and TP 0.4 mg/L. Except for COD_{Cr} and TN, these concentrations were significantly lower than from CT plots. Measured pollution loads (2-year average) from SRI plots were SS 728.7 kg/ha, COD_{Cr} 205.1 kg/ha, COD_{Mn} 58.6 kg/ha, BOD 21.8 kg/ha, TN 46.5 kg/ha, and TP 3.2 kg/ha. These were 23 to 45.4% lower than from CT plots.

GHG emissions from SRI plots in 2011 were reduced by 71.8% compared to CT plots, meaning that SRI could help contribute to easing the greenhouse gas accumulation in the atmosphere.

It was believed that SRI is a promising paddy farming technique that could increase rice yield, and reduce irrigation water requirements, NPS pollution, and GHG emissions not just in Korea but also other rice-farming countries all over the world. However, it was recommended that long- term studies under different conditions such as rice variety, soil texture, water source, climate, etc. need to be conducted for reliable data for the development of environmental policies related to NPS pollution and GHG emission control and management.