Effect of Weeding Methods on Nitrogen Mineralization and Rice Growth

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Weed control is one of the important practices in rice cultivation. Intercultivation is done by rotary weeder with or without an engine and it works as secondary tillage into the surface soil. By breaking soil structural elements, tillage may also cause nitrogen (N) mineralization by exposing physically protected organic matter to microbial consumption (Elliott, 1986; Beare et al., 1994). However, Franzluebbers (1999) reported that recently exposed organic matter may cause N immobilization, thus reducing soil N available for plant uptake. On the other hand, by using intercultivator for weeding, it might help to increase the rice yield via incorporating N fixing algae (Blue-Green Algae) into the paddy soil. Therefore, the objective of this study is to know the effect of different times of intercultivation on N fertility and rice growth.

Materials and Methods

Transplanting had been done in 12th May, 2009 in Yamagata University Farm. Rice variety was *Sasanishiki* with the spacing of 15 cm × 30 cm. This experiment was conducted as preliminary experiment with no replication. There were three treatments (shown in *Figure 1*) for studying N mineralization and plant growth.

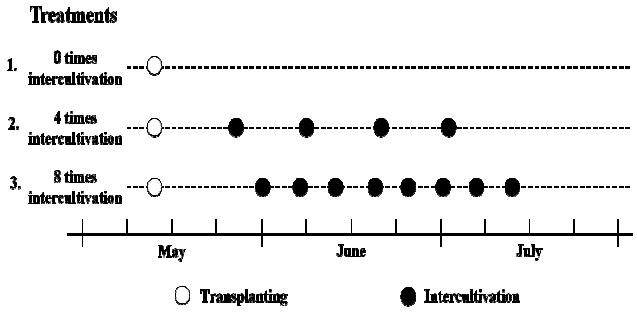

***Figure 1*:** Schematic diagram of treatments on different times of intercultivation under without herbicide application.

For studying N mineralization, the two layers of soil profile were collected in each plot (shown in *Figure 2*). Gross N mineralization and total organic N affected by different intercultivation times were evaluated at each soil layer. N fertility in soil was evaluated by mean of gross N mineralization as an index for the amount of total mineralizable N due to two week incubation method at 30 ºC and ^{15}N labeling with isotopic technique. Kjeldahl method was used for soil organic N analysis in this study.

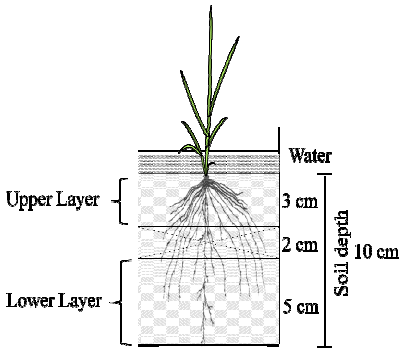

***Figure 2*:** Showing two soil layers to be collected in different depth of plowing depth. (3 to 5 cm depth of soil was removed for sampling because intercultivator affects up to depth of 5 cm)

Results and Discussions

Figure 3 shows the gross N mineralization affected by different times of intercultivation in upper and lower layer. Gross N mineralization of 0 times intercultivation was higher than that of others at upper soil layer in the active tillering period (19th June and 1st July). Those are no considerable difference among treatments at lower soil layer. It might indicate that intercultivation could inhibit degradation of organic N in surface soil.

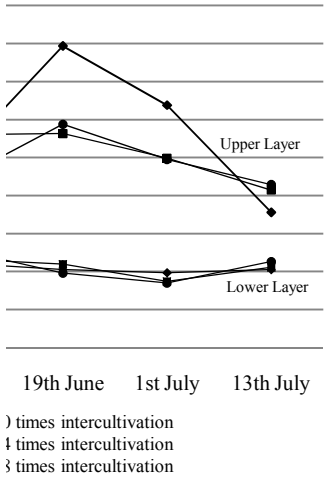

***Figure 3*:** Gross N mineralization of NH_4^+-N in two soil layers under different times of intercultivation.

The total organic N at upper layer became gradually increased from maximum tillering stage to harvest although it was almost the same until maximum tillering stage.

The amount of total organic N has no clear difference among the treatments (shown in *Figure 4*).

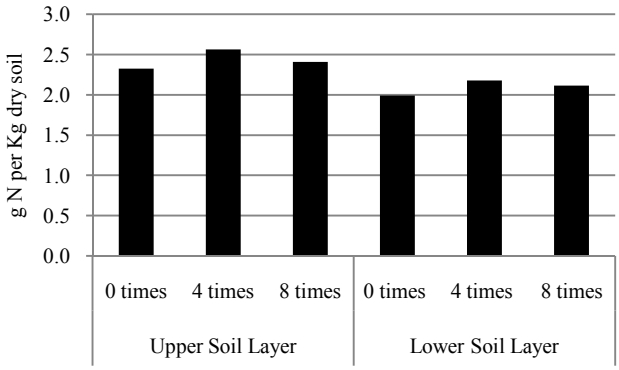

***Figure 4*:** Soil organic N in upper and lower soil layers at harvest time (30th Sept, 2009).

Plant height and tiller numbers were collected in each treatment as shown in *Figure 5* and *Figure 6* respectively. There are no differences among the treatments.

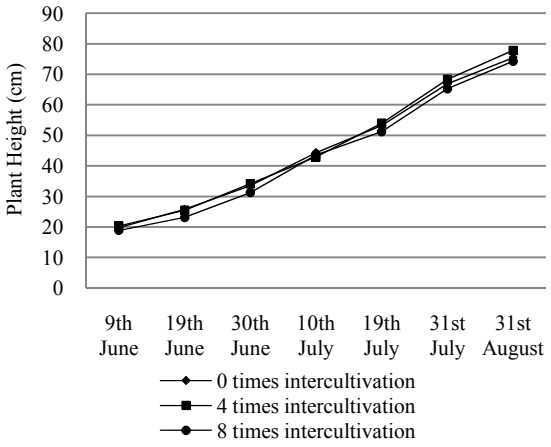

***Figure 5*:** The plant height of rice among the different times of intercultivation.

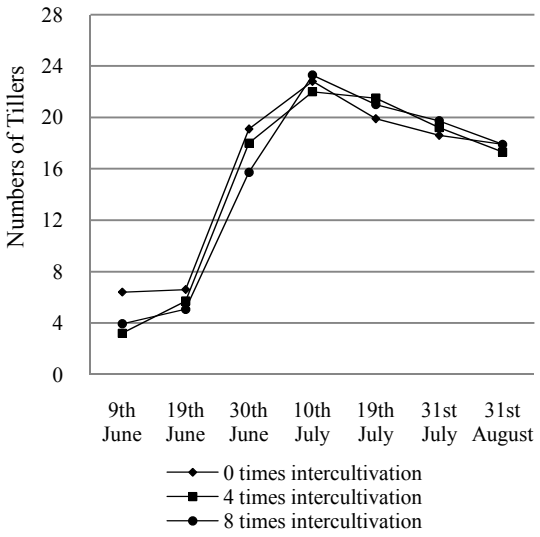

***Figure 6*:** The tiller numbers of rice among the different times of intercultivation.

Conclusion

Because this experiment was conducted as preliminary experiment with no replication, the results were obtained only as trends. According to this experiment, intercultivation can inhibit degradation of N fertility into the surface soil of paddy field. However, there is no clear difference in soil organic N and growth of rice among the treatments. Additionally, it would be found that the upper layer (0 – 3 cm) of paddy soil contributed more mineralized nitrogen rather than lower layer (5 – 10 cm) within plowing depth. These data indicate that the upper thin layer of paddy field is important for maintenance of soil fertility, but the mechanism is still unknown. To confirm these results, it is needed to conduct statistically by using experimental design.