

Development of Organic Rice Paddy Cultivation Techniques Using Paddy Field Ecosystems

— Effects of Cover Crop and Puddling on Weeds and Paddy Rice —

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As global warming and other changes in the environment become more apparent, it is desirable to establish organic farming techniques without chemical fertilizers or pesticides to contribute to the reduction of greenhouse gas emissions. To reduce the application of chemical fertilizers and pesticides, it is necessary to understand their ecological characteristics by observing rice and weed in organic paddy field. Therefore, we conducted an organic paddy field experiment using Italian ryegrass as a cover crop to evaluate the effects of cover crop and weeder use on weed and rice growth (the field experiment), and to determine the effects of cover crop and puddling on weed establishment (the pot experiment).

Field experiment: We have conducted field experiment in the organic paddy field in Center for International Field Agriculture Research & Education, Ibaraki University (36.032342, 140.211115, field area: 50 m×72 m) since 2019. Two treatments were established, treatment with cover crop (CC), and treatment without cover crop, fallow (FA). Italian ryegrass (sown in November and harvested in April) as cover crop was used. Puddling was conducted 3 times before transplanting paddy rice. Rice, Koshihikari was transplanted in late May to early June. The number of weeds, their dry weight and rice yield were measured. Pot experiment: Pots (1/10000a) were filled with CC and FA soil, respectively. For puddling, soil and water in the pots were mixed with a spatula after flooding. To investigate the effects of CC application and puddling (1 to 3 times) on weed development, the number of weeds and their dry weight were measured.

In the field experiment in 2020, weeds had lower grass height and smaller leaf blades in organic paddy fields than in conventional paddy fields. In both 2021 and 2022, weeds tended to be suppressed in the CC treatment, compared to the FA in organic paddy field. Even without a weeder, rice yield was similar to those obtained with a weeder. In the pot experiment, the number of weeds decreased as the number of puddling times increased. The reduction rate of weed number was particularly higher in the CC treatment.

From these findings, the combination of cover crop and multiple puddling has the potential to suppress weed development even when weeders are not used. In the future, it is necessary to clarify the details of the factors that suppress weed development. Detailed observation and investigation of weeds and rice growth under organic cultivation management are expected to be important roles in establishing a new organic cultivation system.

Keywords: cover crop, puddling, weed

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