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Organic farming, one of the leading sustainable agricultural systems, has recently been focused. In organic rice farming, it is crucial to enhance seedling quality since the seedling quality affects the grain yield through plant growth in paddy field. In the rice nursery, root system could be the important part in relation to nutrient uptake until transplanting and the seedling establishment after transplanting. However, there are few studies about root system in organic nursery. In this study, we investigated the rice seedling including root system of organic rice seedling with root model compared to the conventional seedling.

At first, we investigated the various shoot and root traits of organic rice (var. Hitomebore) seedling compared to the conventional seedling in the actual nursery on Kawatabi Field Science Center. Next, we set up the experiment that rice plants were grown with four different plant densities (10,14,19,23 plants/pot simulating 35, 50, 65, 80 g grain/nursery box, respectively) in the small pots with simulated organic nursery. We also measured the shoot and root traits of seedling in this experiment. Using the root model with the datasets of these experiments for the validation, we predicted the root length density and nitrogen uptake throughout rice growth in the nursery.

The shoot dry weight per plant height, which is the index of seedling quality, is significantly higher in the organic nursery than in the conventional nursery. Both total root length and nodal root number are also significantly greater in the organic nursery than in the conventional nursery. These results suggested that root system could relate to seedling quality. In the pot experiments with the different plant densities, the shoot and root traits were no significant differences. The low seedling density could have minor effects in seedling on the organic nursery. Using root model, we predicted that nitrogen uptake per plant and root length density throughout plant growth in the organic nursery were greater than in the conventional nursery because of the condition of fertilizer and plant density. The rice seedling of organic farming could have better nitrogen status and more apposite root length density than that of conventional farming. In sensitivity analysis which changed plant density in root model, seeding 40-60 g grain per nursery box was most appropriate in organic farming. These estimates could lead to the capacity development of organic rice farming.