

Adaptability to Organic Cultivation and Weed Competitiveness among Rice Varieties Grown in the Shonai Region since the Meiji Era

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With the depletion of fertilizer resources and the increase of drug-resistant pests, there is a need to promote sustainable agriculture. Organic agriculture requires that no chemically synthesized fertilizers or pesticides be used, and it is hoped that the environmental benefits, such as the prevention of water pollution through reduced use of chemical fertilizers and pesticides, will lead to better health and welfare for people from the perspective of the SDGs. In organic cultivation of paddy fields, weeding is time-consuming and labor-intensive, and varieties that are highly competitive with paddy weeds are in high demand. On the other hand, about 120 years ago, Japanese rice cultivation was traditionally organic, without the use of chemical fertilizers and pesticides. Older varieties cultivated in the past are considered to be more adaptable to fertilizer-free cultivation and more competitive with paddy field weeds. In this study, five rice varieties cultivated in the Shonai area at different generations were grown in the same field, and their growth and yield, weed production, and nitrogen uptake were investigated to determine the differences in applicability to organic cultivation and weed competitiveness among the rice varieties.

In the summer of 2022, four repetitive weeding and no weeding zones were established in a paddy field (Photo 1) on the grounds of the Faculty of Agriculture, Yamagata University, and the five varieties listed in Table 1 were transplanted on May 31. Five manual weeding operations were conducted in the weeding area during the first semester of rice growth. During the entire growth period, weekly surveys of rice growth (grass height, number of tiller, and leaf color values) were conducted in each treatment area. Just prior to harvest, rice and weed biomass surveys were also conducted to determine nitrogen uptake by the rice and weeds. At harvest time (September 22), nine plants were harvested, and rice yield and its components were subsequently investigated.

Table 1. Varieties used in this study

Variety name (abbreviation)	Year of variety registration
Kamenoo (Ka)	1896
Rikuu 132 (Ri)	1921
Sasanishiki (Sa)	1963
Haenuki (Ha)	1993
Tsuyahime (Tu)	2009

The results showed that the relatively newer varieties produced more rice paddy yield in the weeding area than the older varieties with 458, 392, 538, 487, and 472 g/m² for Kamenoo, Rikuu 132, Sasanishiki, Haenuki and Tsuyahime, respectively (Fig. 1). Weed biomass in the no weeding plots was 200, 273, 329, 313, and 428 g/m², respectively, in the same order of oldness as above, with the older variety treatments producing more weeds. The percentage yield loss without weeding, calculated from the no weeding and weeding rice yields, was 38, 55, 68, 66, and 70%, respectively, in the same order of oldest to youngest, with the newer varieties having a higher yield loss rate (Fig.2). These results suggest that older varieties are more competitive with weeds than newer varieties and can be applied to organic rice cultivation.



Fig. 1. Rice yield of rice varieties of different ages in weeding and no weeding areas

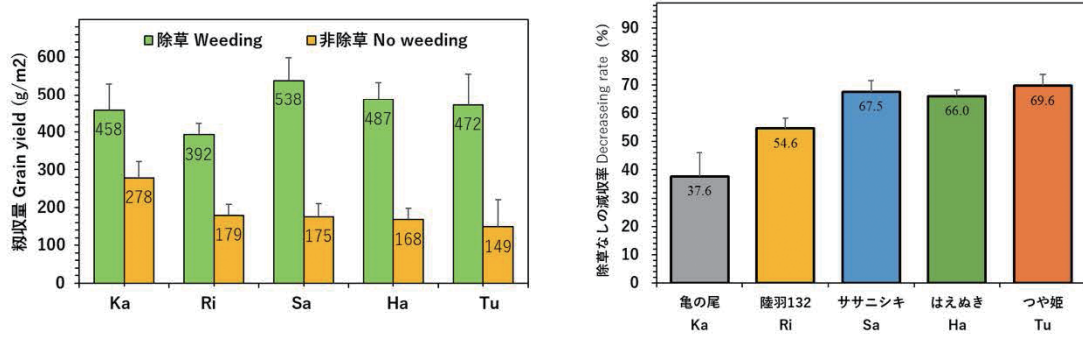


Fig. 2. Yield reductions for rice varieties of various ages

Keywords: organic rice cultivation, weed competitiveness, variety, Shonai area

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