Editorial

Power of conventional rice breeding

With the decreasing trend in rice consumption in Japan, breeding for new types of rice plant, which is a major responsibility of breeders has also become a political issue. The need for restoring Japanese agriculture and maintaining self-sufficiency in rice production has always been tightly linked to economic partnership agreements and trade liberalization. As a result, rice production has been restricted as a measure of balancing the supply and demand. Due to overproduction, hundreds of thousands of hectares of paddy fields remain idle and the government compensates affected farmers. The annual rice consumption per Japanese is around 60 kg and without any change in the eating habits and trade policies, the demand for an increase in production is not expected in the immediate future. As a measure of invigorating Japanese agriculture and maintaining agricultural self-sufficiency, rice research has been expanded to cover breeding objectives beyond eating quality, good yield, or resistance to various biotic and abiotic stress. The Ministry of Agriculture, Forestry and Fisheries launched a research program aimed at developing rice varieties suitable for whole crop silage (WCS) almost 10 years ago. The major goal is to breed new rice cultivars for consumption of domesticated animals such as cattle, pig, and chicken, and establish self-sufficiency in livestock feed supply. This program relies mainly on conventional breeding strategy for crossing and selection of desirable progenies based on phenotypes. The target phenotypes include increased biomass such as more leaves, high straw yield, and other traits useful for silage. Additionally, resistance to blast or bacterial blight disease, resistance to insect pests, and adaptability to regional climate conditions are also target traits to ensure high productivity and to reduce the overall cost of production. A group of 65 breeders from all over Japan headed by Dr. Hiroshi Kato of the NARO Institute of Crop Sciences, joined hands in a collaborative effort to tackle this project. This year, the Japanese Society of Breeding awarded this group of breeders in recognition of their contribution in breeding suitable rice cultivars for silage. The project continues with ongoing

efforts to breed cultivars with high total digestive nutrient (TDN) and improved feeding value. In the long run, this project may pave the way for self-sufficiency in locally produced feed for livestock.

It may be interesting to speculate how the recent advances in rice genomics could play a pivotal role in breeding new rice cultivars for WCS. The strategies adopted for this program rely mainly on conventional breeding methods, genotype analyses of established varieties, crossing of promising breeding lines, and selection of progenies. If a target phenotype can be associated to a genomic, parental lines for various traits can be easily decided and selection for progenies with desirable phenotypes can be easily accomplished. With the proliferation of high-speed next generation sequencing (NGS) technology, the genome sequence information of reference cultivars can now be obtained easily at a much lower cost. Comparison with a reference genome sequence could reveal a lot of valuable information including previously uncharacterized traits useful for WCS.

Breeding of new rice cultivars for WCS is a concrete example that the conventional method is still a reliable and powerful strategy for many plant improvement objectives. This strategy can be further enhanced with the utilization of the genome sequence information for detailed understanding of the genomic structure of both the parent cultivars and progeny lines, which could be a major advantage in obtaining the desired phenotypes. A lot of new tools such as molecular markers, reference genome sequence, informatics resources etc. have been generated from extensive research on rice genomics in the last 20 years. The WCS breeding project could benefit from these advances to increase the efficiency of conventional breeding strategies that could further optimize WCS for efficient utilization as livestock feeds.

Takuji Sasaki
Editor-in-chief
Tokyo University of Agriculture