

No. 0630

## Study on the Salt-Stress Tolerance in Barley Varieties – Development of a Selection Method for the Salt-Tolerant Varieties in Barley

Sunao Yamazaki<sup>1</sup>, Jinghua Zhang<sup>2</sup>, Yuji Takao<sup>2</sup> and Masaya Nishiyama<sup>2</sup>

<sup>1</sup>Yokohama College of Pharmacy, <sup>2</sup>Faculty of Environmental Studies, Nagasaki University

### Summary

More than 10,000 varieties of barley are cultivated in the worldwide agricultural fields under different types and degree of environmental stresses, such as drought, salinity, high temperature, etc. How do they respond and adapt to the stresses they suffered during their growth? To estimate the stress-response relationship in each variety of barley, the content of the major compatible solute, glycinebetaine (GB), in young shoot of barley was determined by the low-pH capillary electrophoresis. More than 300 varieties collected all over the world were grown under the presence and absence of drought stress and the GB content of young shoots were analyzed. Fourteen cultivars whose salt-stress tolerance has been physiologically established (7 strong and 7 sensitive) were first grown in the same way. Based on the GB content, a linear discriminant function  $Z$  was obtained, where  $Z > 0$  is salt-tolerant and  $Z < 0$  salt-sensitive. Using this function, 299 salt-tolerance-unknown samples were well discriminated with 157 being tolerant and 142 being less tolerant or sensitive. The average GB content of 299 samples was 58  $\mu\text{mol/g}$  d.w. under the control (irrigation) condition whereas under the drought condition it increased 97  $\mu\text{mol/g}$  d.w. The content was widely distributed from 40  $\mu\text{mol/g}$  d.w. in the lowest to 220  $\mu\text{mol/g}$  d.w. in the highest under drought condition, which correspond to the  $Z$  value being  $-40 < Z < 80$ . The highest GB content is almost equivalent to that of halophytes.

The GB content of 37 samples of Ethiopian origin out of 299 samples was reversely correlated to the annual precipitation of the producing area. The reason could be attributed that these samples are of native origin and cultured without irrigation except natural precipitation. This means repeated culture in the same environment, the plant acquires the memory in its gene of the shortage of water they need in the culture land.

As it is known that the amount of GB induced is dependent proportionally on the strength of environmental stresses, the  $Z$  value could be the expression of the total burdens that plants suffers from environment in spite of the types of stresses. The value is therefore convenient to evaluate the stress-tolerance of each variety. The present method to determine GB in young shoot of barley could be a good candidate as the first screening method prior to the actual field selection of tolerant species in which time and labor for selection could be drastically minimized.

The method is applicable not only to the selection of tolerant species of other GB-producers, such as wheat, alfalfa, etc., but also to that of the GB-related compatible solutes, trigonelline, proline, prolinebetaine, etc.