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Establishment of Cultivation System of Japanese Pear and Apple by Diluted Sea-Water
～The Clarification of Salt Tolerant Mechanism of the Rootstocks～

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Summary

In this experiment, the salt-tolerant apple rootstock was selected. Moreover, the amelioration method of root growth reduction under NaCl stress in both Japanese pear and apple rootstocks was revealed.

The salt tolerance was compared in 5 *Malus* rootstocks: *Malus pruniforia* ver. Ringo, JM1, JM2, JM7 and Aodai3. Two-year-old rooted cutting were subjected to each of 50 mM, 100 mM, and 150 mM NaCl solutions, and leaf injury, shoot growth, stem water potential, and mineral uptake were evaluated. JM2 showed the highest salt tolerance with little visible symptoms of injury even in the 150 mM NaCl treatment. JM2 also showed a slight decrease of stem water potential under the NaCl treatment. Moreover, Na and Cl accumulation in the leaves were lesser than the other rootstocks. In contrast, *M. pruniforia*, and JM1 exhibited lower salt tolerance with severe leaf injuries and more accumulation of Na and Cl in the leaves. The salt tolerance of 5 *Malus* rootstocks was ranked as followings; JM2＞Aodai3＞JM7＞*M. pruniforia*＞JM1.

To understand the roles of Ca in enhancement of salt tolerance in *Pyrus* and *Malus* seedlings, a hydroponics culture experiment was conducted. When the NaCl concentration in the growth solution was stable, the increase of $CaCl_2$ concentration ameliorated the root growth reduction. When the $CaCl_2$ concentration in the growth solution was stable, the decrease of NaCl concentration accelerated the root growth. This phenomenon was observed both *Pyrus* and *Malus* seedlings. The increase of Na contents and decrease of K contents in the roots were suppressed by $CaCl_2$ addition. These results implied that the root growth reduction in NaCl solutions was coursed by Na to distract the selective permeability on cell membrane. As a result, K in the root was lost and an excess amount of Na was observed. The $CaCl_2$ addition may mitigate the NaCl effect to maintain the selective permeability on cell membrane, therefore, Na uptake by root is suppressed and the growth is maintained in the NaCl solutions.

In conclusion, *Pyrus betulaefolia* and JM2 is a suitable rootstock for Japanese pear and apple cultivation using diluted sea-water, respectively. These rootstocks are also suitable for the cultivation at Tsunami suffered orchard. To harvest the high quality fruits, we have to make a growth protocol to combine the stress reduction by $CaCl_2$ addition, suitable pruning and fertilization.