Effects of K^+ on Na^+ Uptake and Accumulation in a Wild Halophyte Grass *Suaeda maritime*

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Key words: K^+ transporters, $^{22}Na^+$ influx, Na^+ accumulation

Introduction Limiting Na^+ uptake and accumulation in the cytosol is the key measure to improve plant salt tolerance (Flowers, 2004). However, Na^+ uptake pathways in higher plants are not so clear by now. Wang *et al*. (2007) reported that two distinct low-affinity Na^+ uptake pathways exist in *S. maritima*: Pathway 1 might be mediated by a high-affinity K^+ transporter under 25 mM NaCl that is insensitive to TEA^+ or Cs^+, but sensitive to Ba^{2+} and pathway 2 by an AKT1-type channel under 150 mM NaCl that is sensitive to TEA^+, Cs^+, or Ba^{2+}. Here we reported that the turning-point of external salt concentrations for the two pathways and the effects of K^+ on $^{22}Na^+$ influx and accumulation in *S. maritima*.

Materials and methods 17-day-old seedlings were transferred to non-KNO_3 Hoagland solution supplemented with 3 concentrations (0, 10, and 50 mM) of KCl and various concentrations (2.5 to 200 mM) of NaCl for 3 d before being transferred to equivalent solutions labeled with $^{22}Na^+$ or harvested for measurements of influx or concentrations, respectively. Values are means SD(n=6 for influx or 8 for concentration test) and bars indicate SD (P<0.05, Duncan test).

Results Ba^{2+} inhibited $^{22}Na^+$ influx significantly under various NaCl concentrations, however, TEA^+ showed significant effects in reducing $^{22}Na^+$ influx when the external NaCl concentration was above 100 mM (Figure 1). 10 mM KCl had no significant effect on $^{22}Na^+$ influx under various NaCl concentrations, but 50 mM KCl blocked $^{22}Na^+$ influx significantly when NaCl concentration was above 100 Mm(Figure 2). 10 and 50 mM KCl both reduced NaCl concentration in roots under various NaCl concentrations (Figure 3), however, NaCl concentrations in shoots were reduced by 50 mM KCl when external NaCl concentration was below 75 mM and by 10 mM KCl when below 25 mM (Figure 4).

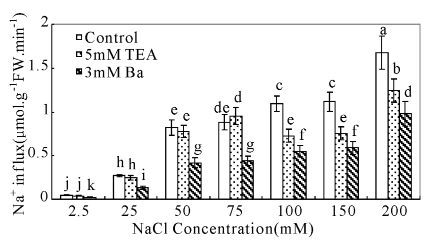

Figure 1 *Effects of TEA^+ and Ba^{2+} on $^{22}Na^+$ influx.*

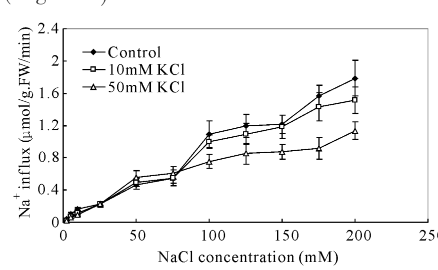

Figure 2 *Effects of K^+ on $^{22}Na^+$ influx under various NaCl concentrations.*

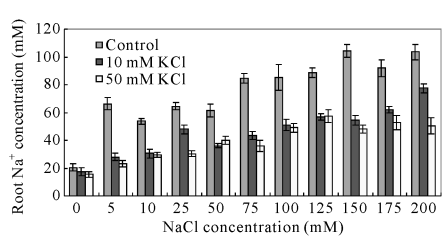

Figure 3 *Effects of K^+ on Na^+ accumulation in roots.*

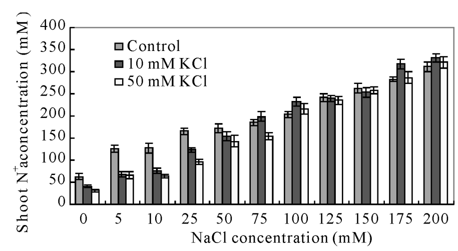

Figure 4 *Effects of K^+ on Na^+ accumulation in shoots.*

Conclusions The turning-point of external salt concentrations for the two pathways was between 75 and 100 mM. K^+ (10 or 50 mM) had no effect on $^{22}Na^+$ influx at concentrations below 75 mM NaCl, but $^{22}Na^+$ influx was inhibited by 50 mM K^+ when the external concentration of NaCl was above 75 mM. However, the affecting mode of K^+ on NaCl concentration in both roots and shoots with increasing external concentration was different from that on $^{22}Na^+$ influx.

Reference

Flowers T J. (2004) Improving crop salt tolerance. *Journal of Experimental Botany* 55: 307-319.
Wang S. M., Zhang J. L., Flowers T. J. (2007) Low-Affinity Na^+ Uptake in the Halophyte *Suaeda maritima*. Pl*ant physiology*, 145: 559-571.