Salt priming improves establishment of *Distichlis spicata* under saline conditions

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Abstract

Salt priming as a tool to establish *Distichlis spicata* (L.) Greene cv. Yensen-4a (NyPa Forage) plants into saline conditions was investigated in sand culture. Plants were pre-treated with 3 levels of salinity (0, 2 and 4 g NaCl/kg) for 36 days and then transplanted into four salinity treatments of 0, 2, 4 and 8 g NaCl/kg sand. Plant survival and shoot dry matter production were measured. Plants pre-treated with 4 g NaCl/kg produced a 6-fold increase in dry matter compared with plants pre-treated with 0 or 2 g NaCl/kg when transplanted into sand containing 2 g NaCl/kg. Survival was also higher with plants that had been pre-treated with 2 and 4 g NaCl/kg salt prior to transplanting compared with plants that had not been exposed to NaCl prior to transplanting. The results suggest that salt priming improves establishment of *Distichlis spicata* when grown under moderately saline conditions.

Key Words

Salt priming, Vegetative establishment, *Distichlis spicata*, NyPa Forage, Saltland pasture, Halophyte.

Introduction

Salinity has long been part of the Australian landscape as early explorers reported that river water was too saline to drink (Mackay 1990). However, large areas of agricultural land have become progressively saline since European settlement, partly due to 'leaky' agricultural systems that do not utilize all the rainfall. Most land managers concede that salinised land has been lost for agriculture, yet there is now increased interest in developing halophytic plant systems to productively use saline land. *Distichlis spicata* (NyPa Forage) is a male clone C4 halophytic grass that has been selected to grow in wet saline soil (Yensen and Bedell 1993). Its C4 characteristics mean that most growth occurs during the summer months. It therefore has the potential to provide out-of-season forage in the dry summer months in southern Australia. However, establishment of vegetative plants/cuttings in wet discharges sites has been problematic due presumably to the hostile saline conditions during the establishment phase. This experiment tested the hypothesis that salt priming would improve the establishment of *D. spicata* plants when established into saline conditions.

Methods

The experiment was conducted in a glasshouse at La Trobe University, Bundoora Victoria (37?42'S, 145?02'E), and commenced in January and completed in June 2005. The experiment was set up as a randomised block design with the factorial combination of 3 pre-treatments and 4 treatments of salinity. Pre-treatment consisted of 3 levels of salinity, 0, 2 & 4 g NaCl/kg sand, in large plastic boxes filled with fine white quartz sand with basal nutrients incorporated. Rooted cuttings of *D. spicata* were allowed to establish for 2 weeks before NaCl was added to the respective pre-treatments. After 36 days of pre-treatment, three plants were transplanted into 200 mm pots filled with fine white quartz sand amended with basal nutrients, to which 4 salt treatments were applied, including 0, 2, 4 & 8 g NaCl/kg sand. A constant watertable of 0.5 cm was maintained by placing glass bottles filled with deionised water upside down into PVC tubes. Plants were grown for 63 days and then assessed for survival and shoot dry matter.

Results

The main salt treatments had a more marked effect on survival than did salt pre-treatment (Table 1). Increasing the post-transplanting salt level decreased the survival, with the highest level of 8 g NaCl/kg sand restricting survival to less than 1 plant per pot.

Table 1. Plant survival (plants alive per pot) at the completion of the experiment

Treatment (g NaCl/kg sand)	Pre-Treatment (g NaCl/kg sand)	Number of live plants per pot (maximum 3)
0	0	2.75
	2	2.25
	4	2.50
2	0	1.50
	2	1.75
	4	2.50
4	0	1.50
	2	1.25
	4	1.75
8	0	0.25
	2	0
	4	0
LSD (P=0.05)		1.12

The new growth following transplanting was affected by treatments, resulting in a highly significant interaction between pre- and post-transplanted salinity levels ($p<0.01$) on dry matter production at harvest (Figure 1). There was nearly a 6-fold increase in dry matter production of the plants pre-treated with 4 g NaCl/kg sand compared with plants pre-treated with 0 and 2 g NaCl/kg sand when grown in 2 g NaCl/kg sand. However, when plants were pre-treated with 4 g NaCl/kg sand and then transplanted into sand containing no salt, they produced approximately half the dry matter of plants that had been pre-treated with nil salt. The treatment of 8 g NaCl/kg resulted in minimal dry matter accumulation irrespective of the pre-transplanting salt exposure.

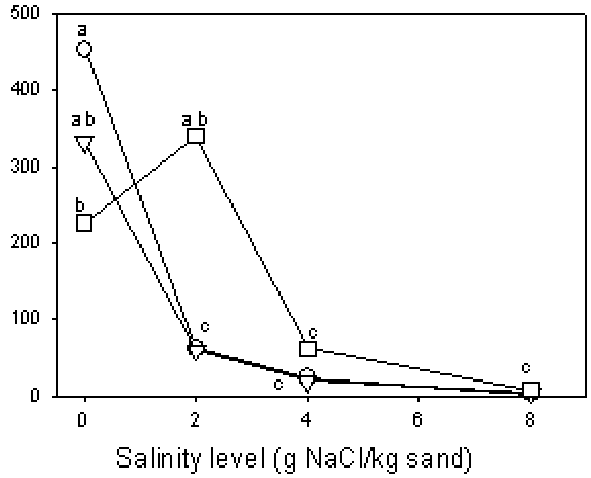

Figure 1. The effect of the pre-transplanting salt treatment (○, ∇, □ for nil, 2 and 4 g NaCl/kg sand respectively) on the dry matter production of new shoots of *Distichlis* plants 63 days after transplanting into sand containing increasing concentrations of g NaCl/kg sand. Means with the same letter do not differ significantly at p>0.05.

Conclusion

This suggests that salt-priming will be a useful tool for establishing *D. spicata* transplants in saline environments. Salt priming was shown to increase plant survival and shoot dry matter production.

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References

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