Effects of Elevated Salt Concentration on Growth and Development of Marine Couch

University of Melbourne's Dr David Aldous outlines his research into comparing the growth responses of four marine couch grass accessions from southeast Queensland to elevated salt concentrations.

Increasingly, golf course architects and superintendents are called on to design and manage saline environments particularly when in association with new course and sports field development.

In addition there has been an increasing need to make better use of alternative water sources (effluent, waste, recycled, grey) in establishing and managing grassed areas (3,6,7). In recent years there has also been an increasing interest in the use of salt-tolerant grasses for many sport and recreation areas (3,9).

Three coastal zone grasses that have shown promise, particularly under northern Australian conditions, include *Paspalum vaginatum* Swartz. (Seashore paspalum), *Zoysia macrantha* Willd. (Prickly couch), and *Sporobolus virginicus* (L.) Kunth (marine couch) (4,7). Seashore paspalum and marine couch have been observed growing under extreme saline environments with an electrical conductivity (EC_w) between 25-50 $dS.m^{-1}$(1). Salt water has an EC_w between 43-54 dS/m^{-1} or ~32,000 ppm of dissolved salts (3).

Coastal sand dunes, mudflats and salt marshes are the principal natural habitats of marine couch around Australia (4) and the plant has demonstrated considerable morphological plasticity in adapting to elevated salt concentrations (2,13).

The objective of this greenhouse investigation was to compare the more significant growth responses of four marine couch grass accessions from southeast Queensland to elevated salt concentrations.

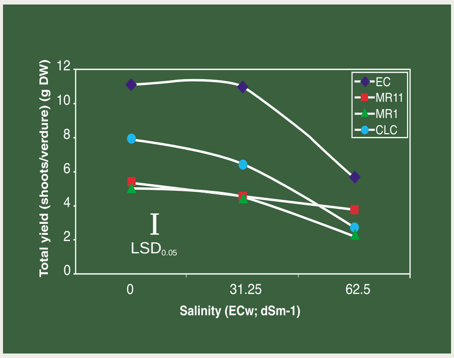

Figure 1. Total yield (shoots/verdure)

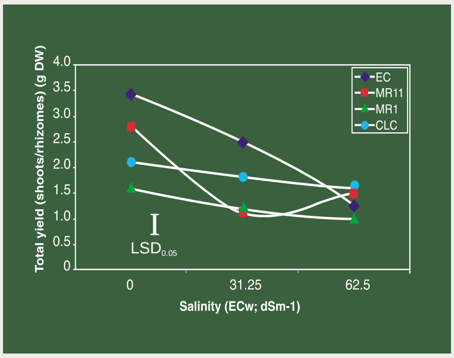

Figure 2. Total yield (shoots/rhizomes)

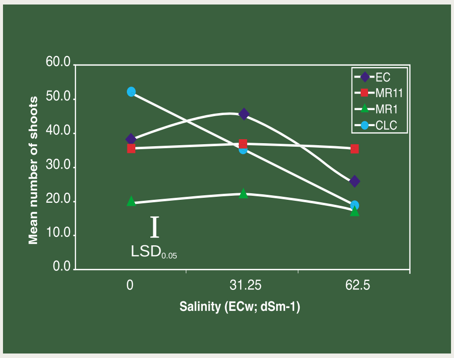

Figure 3. Mean number of shoots

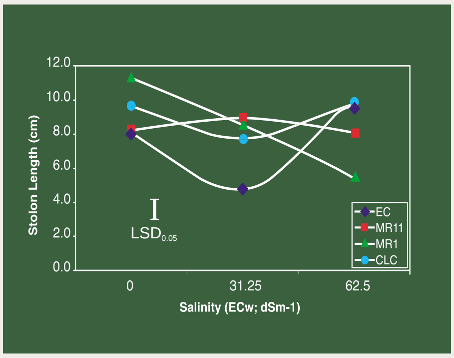

Figure 4. Stolon length

Materials and Methods

Four accessions of marine couch were collected from three coastal habitats in southeast Queensland:

- Coombabah Lake Catchment (CLC) on the Gold Coast, a region of high salinity;
- Mooloolah River (MR1 and MR11) on the Sunshine Coast, a region of medium salinity;
- Eli Creek (EC) on Frazer Island, a region of low salinity.

marine couch sprigs were grown in plastic containers for five weeks in a greenhouse. These containers were then placed onto a felt pad and sub-irrigated with saline treatments of 0, 31.25 and 62.5 $dS.m^{-1}$ (EC_w) for 14 weeks.

The experimental design was a randomised complete block of three treatments and four replications. On the 31st, 63rd and 95th day measurements were taken on stolon length, tiller and leaf number. At the conclusion of the project total dry weight of leaf, verdure (crown included), roots, rhizomes, and plant height were taken.

Results and Discussion

Total plant dry weight of all accessions was negatively correlated with elevated salinity treatments. Increasing tolerance to these elevated salt concentrations ranged from the EC and CLC accessions through to the MR accessions.

The research confirmed the work of Naidoo and colleagues (10) that concentrations of 20-80 per cent seawater would significantly reduce total biomass and growth of roots and shoots of marine couch.

This work suggests that the growth of marine couch can be sustained at salt concentrations of 31.25 $dS.m^{-1}$, with growth commencing to decline at ~ 40.00 $dS.m^{-1}$ and rapid decline occurring at a salt concentration of 62.5 dSm^{-1}.

Results also confirm the work of Naidoo and Naidoo (11) and Rozema (12) that found a relationship between the salt secreted from the grass at low to moderate salinities, and the salt solution of the habitat. The EC accession grows in a naturally low salinity habitat and exhibited the highest total plant weight, while MR 1, MR 11 and CLC were found growing in medium and strong salinity habitats respectively and total yields were lower (Figure 1).

Rhizome and root dry weights and rhizome numbers were negatively correlated with elevated salt concentrations. When comparisons were made with their controls, accessions MR 1 and 11 and CLC showed a 26 per cent decline in rhizome and root dry weights and only a 3 per cent decline with the ER accession at the 31.25 dS.m $^{-1}$ salt concentration. At 62.5 dS.m^{-1}, all accessions recorded a decline in rhizome and root dry weights (Figure 2).

Figure 3 shows that, with the exception of the CLC accession, mean shoot numbers were sustainable at a 31.25 dS.m^{-1} salt concentration, but declined when the accessions were grown in solutions maintained at 62.5 dS.m^{-1}

All accessions recorded an improvement in stolon length (Figure 4), as well as leaf emergence and tiller number after 31 days at 31.25 dS.m^{-1}, but recorded reduced growth in these growth characteristics at the higher salt concentration. There was a lack of significance in both these growth characteristics after 63 and 95 days.

Conclusions

Considerable potential exists in selecting appropriate *Sporobolus* R.Br. accessions for use in salt affected turf areas, or where recycled water is to be used as an irrigation source. Accessions from low salinity habitats such as Eli Creek (EC) were sustainable at 31.25 dS.m^{-1} salt concentration, whereas accessions originating from medium (Mooloolah River, MR1 and 2) and high (Coombabah Lake Catchment, CLC) salinity habitats had lower yield data.

Results indicate that total yield of shoots and verdure, roots and rhizomes, as well as tiller number, stolon length, new leaf growth and plant height for all accessions were sustainable at salinity levels of 31.25 dS.m^{-1}. However salinity levels of 62.5 dS.m^{-1} do not appear to be conducive for growth and development.

Characteristics exhibited by marine couch growing under elevated salt concentrations are a lowered shoot and rhizome/root dry weight, reduced numbers of rhizomes, an increase in plant height, and the presence of salt secreted onto the leaf surface.

Acknowledgements

The AGCSA is grateful to the author for allowing publication of this research in Australian Turfgrass Management Magazine. This is an extract of the paper presented at the 1st International Conference on Turfgrass Management and Science on Sports Fields, 2-7 June, 2003, Athens, Greece. Dr David Aldous is Associate Professor, School of Resources Management, at the University of Melbourne's Burnley Campus.

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