

The UWA trial examined the impact of saline irrigation on four species of turf. Clockwise from left are plots of saltgrass, kikuyu, seashore paspalum and marine couch

Over the past two years researchers from the University of Western Australia have been conducting a study into the effects of irrigating halophytic turf species with saline ground water.



Halophytic turfgrasses and their potential use on salt-affected areas

A two-year field study conducted at Wagin (230km southeast of Perth) has demonstrated the potential to use saline groundwater (salinity approximately one-quarter of sea water) to irrigate halophytic turfgrasses.

The research has been a collaborative project among the Shire of Wagin, The University of Western Australia (UWA) and the Rural Towns - Liquid Assets Program of the Department of Agriculture and Food WA

BY GHAZI ABU RUMMAN, ED BARRETT-LENNARD AND TIM COLMER

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The reuse of saline groundwater was concerning the Shire of Wagin where three bores are pumping up to 650 kilolitres per day to de-water areas of the town threatened by rising groundwater. Currently the water is disposed to a nearby salt lake. The potential

to use this saline groundwater to irrigate turf was determined in our research. Four turfgrass species were evaluated:

- *Distichlis spicata* (saltgrass)
- *Sporobolus virginicus* (marine couch)
- *Paspalum vaginatum* (seashore paspalum)
- *Pennisetum clandestinum* (kikuyu)

Three of the four species evaluated are halophytic grasses (saltgrass, marine couch and seashore paspalum). Halophytes are “salt-loving” plants and grow naturally in salt-affected soils. The plots were irrigated daily at 60 per cent replacement of net evaporation during September to May. The soil at the research site is a gravel-loam and we installed a drainage system leading to a sump, with this water also disposed into the nearby salt lakes. Thus, there was no significant rise of the water table during our experiments.

RESULTS

The four species showed variation in tolerance to salinity. Colour retention was excellent in saltgrass, marine couch and seashore paspalum after imposing saline water irrigation. The colour of saltgrass was even increased under saline water irrigation. By contrast, kikuyu turned brown (Figure 1).

Soil salinity was assessed using an EM38



Soil salinity was assessed using an EM38 and also by collecting soil samples down to 50cm

(as shown in the photo left) and also by collecting soil samples down to a depth of 50cm. A strong correlation was found between the two methods ($r^2=96\%$). Salts increased in the soil during the nine month irrigation season of this study, but then declined as salts were leached from the top soil to the sub-soil during winter.

The halophytic grasses demonstrate several mechanisms to tolerate high salt levels. Foremost is the ability to regulate tissue ion concentrations. Regulation of tissue Na^+ and Cl^- is particularly important, as these ions can accumulate to toxic levels and kill leaf cells. The tolerant grasses also adjust the internal osmotic potential to suit the external one; soil water potential becomes more negative due to the use of saline water. Water becomes less available to most plants as soil water potential becomes more negative, but the “osmotic adjustment” enables the halophytic plants to continue to function.

The four species in this study differed in vigour (i.e. growth). Seashore paspalum produced almost four times more clippings than the slowest-growing species. Marine couch grass is very slow-growing, so establishment and recovery after wear would take longer than seashore paspalum. Clipping dry weights

in kg/m^2 collected over six months were 1.5, 0.7, 0.5 and 0.3 in seashore paspalum, kikuyu, saltgrass and marine couch respectively.

Some other interesting observations were made during the trials. Plots irrigated with saline water during the dry period retained better colour during the cold winter months, than plots irrigated with fresh water. Perhaps solute accumulation during the saline irrigation phase helped protect against cold damage during the subsequent winter?

Use of saline water also cut down the requirement for weed control. There were no weeds within or around plots irrigated with saline water whereas 14 different weeds were present in plots irrigated with fresh water.

Daily water use was measured using weighing lysimeters. Measurements were taken three days after clipping the plants. Saline water use was highest in saltgrass at 75 per cent of net evaporation while it was lowest in kikuyu at 64 per cent.

CONCLUSION

In conclusion, halophytic turfgrasses could be used in salt-affected areas where fresh water resources are limited. Use of saline water, however, will require a well integrated management plan, especially with emphasis

to capture and appropriately dispose of drainage, so as to prevent off-site impacts. Well-designed drainage systems should also prevent waterlogging, as if waterlogging occurs with salinity the combined effects can be very damaging to poorly-adapted species.

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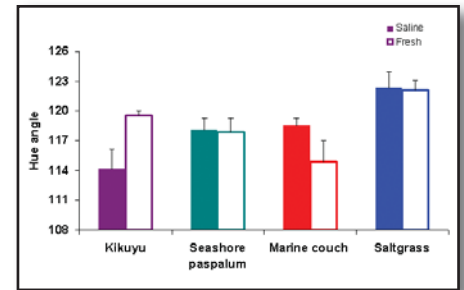


Figure 1: Response of colour for four turf species irrigated with saline or fresh water during summer 2007. Colour was assessed by measuring hue angle using a chromameter (higher hue angle indicates greener turf).