Using soil amendments to increase turf water use efficiency

THE UNIVERSITY OF WESTERN AUSTRALIA

TURF RESEARCH PROGRAMME

- **Substantial improvements in turf colour and water use efficiency were observed when fine-grained amendments were incorporated at 5–15 cm in a sandy soil.**
- **Good infiltration of irrigation water to a 5–15 cm amendment layer may reduce soil water evaporation losses by up to 20%.**
- **No improvement in turf colour was observed when amendments were incorporated in the surface of a sandy soil (0–10 cm).**

Background

The demand for water in our cities is expected to increase in the next decade due to population growth and a warming climate. As a consequence, in a city such as Perth, substantial water deficits are predicted to develop as early as 2020. As a significant proportion of metropolitan water is used for turfgrass irrigation, turfgrass managers are facing future water restrictions. Incorporating soil amendments into sandy soils may reduce deep water drainage and lead to a more efficient use of irrigation water.

Although there is a perception that soil amendment incorporation will be beneficial, this had not been independently tested. The effects of amendment incorporation on soft leaf buffalo turfgrass quality and growth was determined in a two-year field and a one-year soil column experiment at UWA's Turf Research Facility in Perth.

Incorporating amendments in the topsoil

Incorporating finer grained amendments (bentonite and kaolinite clays and compost) increased topsoil water holding capacity and reduced deep drainage compared to control plots or plots with larger grained amendments (Figure 1). However, also in control (untreated) plots none of the irrigation water drained beyond the root zone under a deficit irrigation regime.

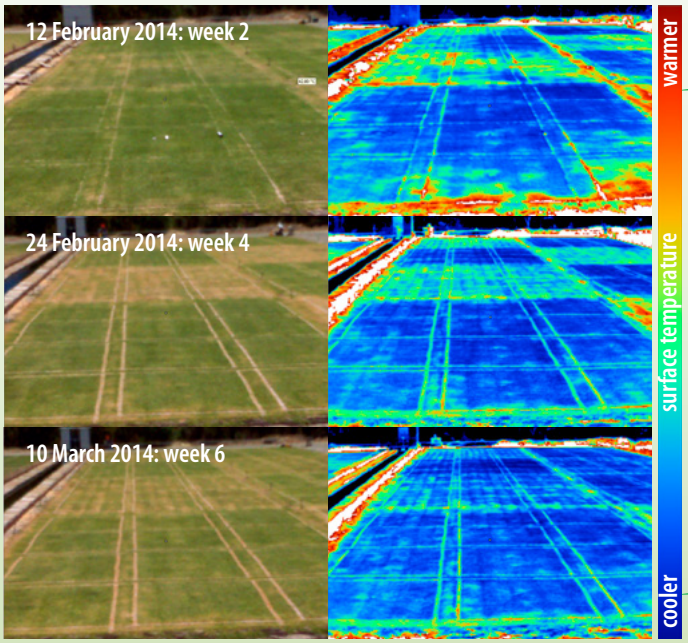

Figure 2. *Simultaneous colour and infrared images of the amendment turf trial during the first irrigation season. Irrigation treatments were organized in blocks of 12 plots with severe browning of plots clearly visible in week 4 in the low irrigation plots. Low irrigation plots were watered twice per week (43–50% ET replacement), whereas high irrigation plots received watering three times per week (65–75% ET replacement).*

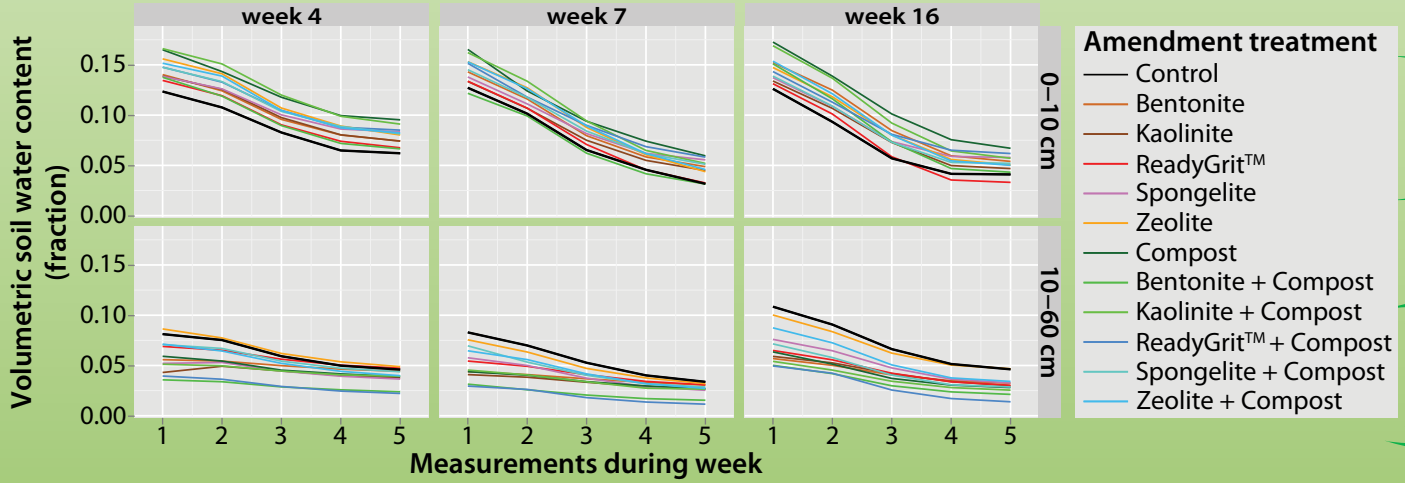

Figure 1. *Weekly decline in soil volumetric water content in the low irrigation treatment (43–50% ET replacement) during the second irrigation season. Plots were irrigated early Monday and Friday mornings. Detailed results can be found in Poot and Azam (2017).*

Plots with finer grained amendments, by retaining most water in the topsoil were more likely to lose irrigation water through soil evaporation and turf transpiration. Consequently, under both high and low irrigation rates, plots with topsoil incorporated amendments did not differ in colour from control plots (Figures 2 & 3).

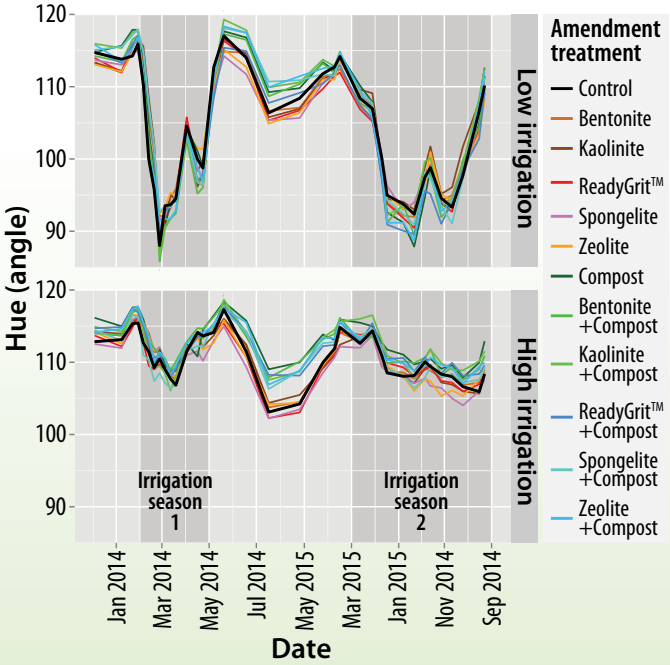

Figure 3. *Time course of turf colour as dependent on level of irrigation and amendment treatment. 'Hue values' below 100 were associated with clear loss of colour and development of brown and desiccated patches, whereas values above 110 were indicative of healthy turf. Note that compost amended plots were greener during winter periods as a result of likely higher soil available nutrients. See Poot and Azam (2017) for detailed results.*

Figure 4. *Example of differential turfgrass desiccation during severe drought stress in February 2016 in the soil column experiment (right), and a soil column at the final harvest with compost incorporated in a band at 5–15 cm depth (left).*

Incorporating amendments deeper in the soil profile

Placing amendments (bentonite or compost) in a band deeper in the soil profile (5–15 cm) improved turfgrass colour under limiting irrigation in a soil column experiment (Figures 4 & 5). Turfgrass columns in this treatment also tended to evaporate more water and had cooler surface temperatures, suggesting they had a better water supply.

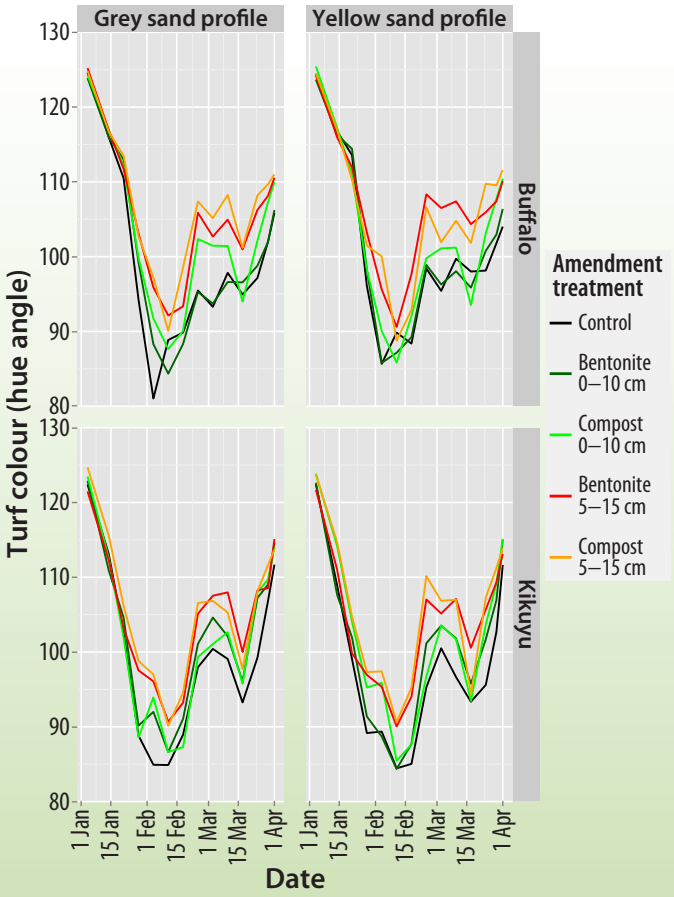

Figure 5. *Time course of turfgrass colour ('Hue value') as dependent on turf species, sand profile and amendment treatment, during the summer of 2016 in a soil column experiment. See Poot and Azam (2017) for detailed results.*

Hydrological modelling with bare soil suggested that deeper amendment bands can reduce soil evaporation by up to 20% when compared to non-amended controls. A surface layer of sand of at least 3 cm would allow irrigation water to infiltrate quickly, thereby reducing initial evaporative losses associated with slow infiltration. Once in the amendment layer the water would be more tightly bound and less likely to escape back to the atmosphere, reducing overall evaporative losses.

Further reading

Poot P and Azam G, 2017. Application of soil amendments to maintain turf quality on sandy soils under reduced irrigation. Final Report for Project TU13000, Horticulture Innovation Australia Ltd, Sydney. Available online.

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