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A three-year study by the University of Western Australia will investigate the development of water repellency under a sand-based turfgrass system

Managing water repellency in turfgrass grown in sandy soils

Throughout Australia, turfgrass producers and managers are under increasing pressure to restrict their water use. Irrigation scheduling based on the replacement of a proportion of net evapotranspiration (ET) is strongly advocated as a means to improving water-use efficiency. However, whilst ET-replacement irrigation can optimise watering regimes it has also been shown to increase the incidence of soil water repellency on sandy-textured soils.

Soil water repellency decreases water use efficiency by causing irrigation water to unevenly infiltrate the soil surface, bypassing a proportion of the turfgrass roots, causing localised areas of turfgrass death. Decreasing the incidence of water repellency in turfgrass systems requires an understanding of the contributing factors and the development of corrective procedures.

Corrective techniques for water repellency include application of a wetting agent, core cultivation, and thorough watering. A number of factors influence the effectiveness of wetting agents, so choosing a wetting agent is not a particularly straight forward process. Furthermore, strategies for optimising the use of wetting agents under Australian turfgrass conditions have not been reported in the scientific literature.

Turfgrass renovation techniques that prevent thatch and mat accumulation may also be an approach to minimising the severity of water repellency, as soils high in organic matter can exhibit water repellency. Yet, information on the effectiveness of regular renovation to reduce the incidence and severity of water repellency in sand-based turfgrass systems is currently lacking and also requires further investigation.

A three-year research project being conducted by the University of Western Australia (UWA) aims to maximise turfgrass water use efficiency for warm-season turfgrasses grown under Australian conditions by decreasing the incidence and severity of soil water repellency. UWA researchers give an overview of this new HAL-funded research project.

The overall objective of the University of Western Australia's (UWA) field-based project is to maximise turfgrass water use efficiency for warm-season turfgrasses grown under Australian conditions by decreasing the incidence and severity of soil water repellency. Specifically, the project will:

- Investigate the development of water repellency under a sand-based turfgrass system so as to determine the conditions that it occurs (Experiment 1);
- Evaluate the suitability of laboratory-based tests for predicting the effectiveness of wetting agents (Experiment 2);
- Determine if the timing and formulation affects wetting agent effectiveness (Experiment 3);
- Assess if turfgrass renovation techniques minimise the development of soil water repellency in sand-based turfgrass systems (Experiment 4).

EXPERIMENTAL APPROACH

The three-year study will utilise turfgrass plots planted in 2005 at the UWA Turf Research Facility, and which consisted of 'old' turfgrass (i.e. 20-year-old turfgrass that includes 50mm mat) and turfgrass established from new sod (i.e. 20 week old turfgrass). Including turfgrasses of two ages will enable techniques for managing soil repellency to be investigated on soil containing two contrasting soil organic matter contents. The study includes four main experiments.

EXPERIMENT ONE

Under what environmental conditions in a Mediterranean-type climate does soil water repellency develop?

Understanding the development of water repellency in turfgrass is required for establishing strategies for overcoming water repellency. The aim is to determine the timing and extent of the development of water repellency in turfgrass of two organic matter contents, and in the absence of corrective measures.

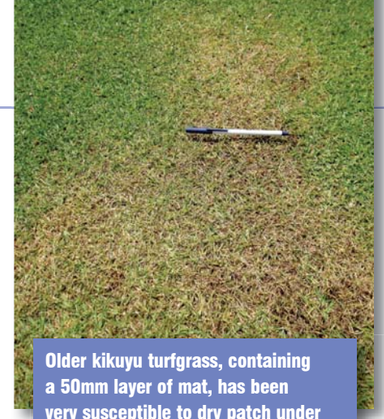
Soil water repellency, soil water content and turfgrass quality (colour, surface hardness) of each turfgrass age will be measured frequently during the growing season to determine the rate at which repellency develops. In addition, soil water content and water repellency will be measured at various soil depths to determine the soil depth to which repellency develops.

Soil water repellency will be measured using both the 'water droplet penetration time' and the 'molarity of ethanol droplet' (MED) tests. Measures of soil water repellency will be related to soil water contents to determine the critical water content at which repellency develops, and to assess if this value varies depending on the organic matter content of the soil.

EXPERIMENT TWO

Are laboratory-based tests suitable for predicting wetting agent effectiveness?

Turfgrass managers are faced with a selection of products when choosing a wetting agent. Selecting a suitable wetting agent can be difficult as the action of wetting agents is not always fully understood, and it is apparent that a single wetting agent may not be suitable for all soil types and climates.



Older kikuyu turfgrass, containing a 50mm layer of mat, has been very susceptible to dry patch under ET-replacement irrigation in summer

The aim of this experiment is to assess the suitability of simple laboratory tests for testing wetting agents in terms of their immediate and residual effects. Furthermore, the success of the laboratory tests to evaluate the potential benefits of wetting agents will be tested in the field.

EXPERIMENT THREE

What factors affect the longevity and effectiveness of wetting agents?

This experiment will determine if the effectiveness of wetting agents can be improved by either choice of formulation or frequency of application. The field investigation will be designed in consultation with the turf industry utilising the findings from Experiments 1 and 2, and will monitor the development and extent of water repellency under different wetting agent treatments (e.g. formulations), using the methods outlined in Experiment 1, and in comparison to untreated turfgrass plots.

EXPERIMENT FOUR

How effective are renovation treatments at reducing the development of soil water repellency?

Reducing the thatch and mat content of turfgrass has been suggested as an approach to decrease the development and severity of water repellency. This experiment will compare the relative effectiveness of various renovation techniques to minimise the development of water repellency in younger and older kikuyu turfgrass.

Measurements initiated in 2005 to investigate the effectiveness of thatch/mat control techniques on soil organic matter ▶

contents, water infiltration rates and turfgrass growth and quality will also continue.

Renovation treatments are:

- No renovation (control);
- Scarifying and sweeping (one time per year, spring);
- Coring and sweeping (one time per year, spring);
- Sanding (5mm, two times per year, spring and autumn); and
- Coring and sweeping (one time per year, spring), plus topdressing (5mm, two times per year, spring and autumn).

RESEARCH OUTCOMES

The benefits of the research to the turfgrass industry will including cost savings, improved turfgrass surfaces, better environmental management, and an improved public perception of turfgrass management. Research findings will be published in national industry journals and international scientific journals, and presented at national and state conferences, for the benefit of the wider Australian turfgrass industry.

ACKNOWLEDGEMENTS

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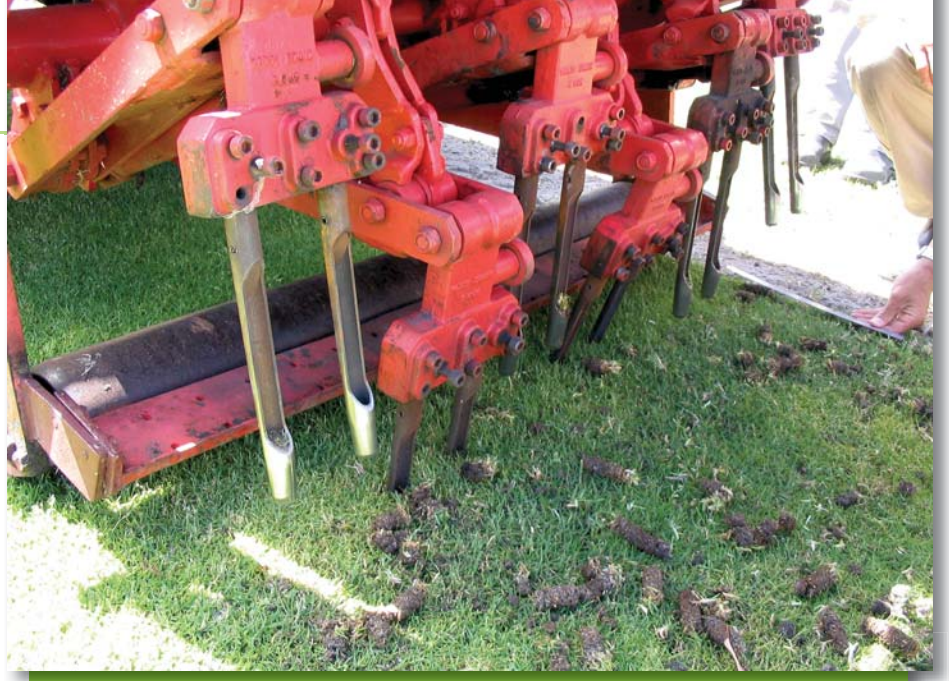

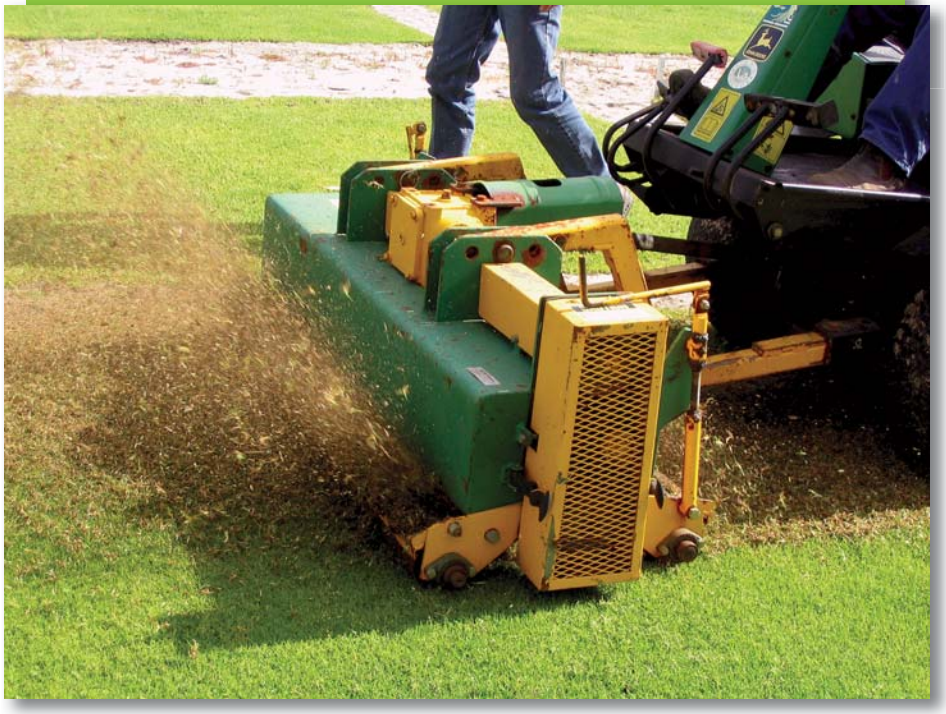

The UWA Turf Research Program will assess the effectiveness of various renovation treatments, including coring (above) and scarifying (below), to minimise the development of water repellency in turfgrass