Modifying sugarcane irrigation to account for a shallow water table

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Abstract

Soil water potential was monitored at a site near Bundaberg for a rainfed and fully irrigated treatment to determine the influence of a shallow water table on the water balance of a sugarcane crop. While subirrigation from water tables is practiced overseas, little is known about the potential water supply from shallow water tables in the Australian sugar industry. As farmers do not generally monitor for shallow water tables, the potential to increase irrigation water use efficiency is high given that shallow water tables are common through most sugarcane growing regions. Soil water potential measured with Campbell 229 probes showed little difference between the rainfed and fully irrigated treatment at depths below 0. 15 m, for a water table fluctuating between 0.57 and 1.45 m. The results suggest that surface applied irrigation can be greatly reduced where shallow water tables are within 1 m of the surface. These findings are of particular significance for areas where irrigation water allocations are below the sugarcane crops water requirements.

Key Words

Water use efficiency, capillary rise, upflow, crop water use/uptake

Introduction

Shallow water tables are a common feature in sugarcane growing areas of Australia, yet their contribution to the water balance in a sub-irrigation context is largely unknown. The magnitude of upflow possible from water tables of different depths has not been quantified, and will be dependent on soil type, evaporative demand and plant characteristics (1). Irrigators in Australian sugarcane areas view shallow water tables in a waterlogging context only and generally neglect their presence below 0.5 m. The most common form of scheduling irrigation is the use of Class A pan evaporation with a crop factor. As this scheduling method will not account for upflow, the potential for over-irrigation and inefficient use of scarce water resources is high. This field experiment was undertaken to determine the magnitude of upflow from a naturally occurring shallow water table for a sugarcane cropping system. The aim was to establish by how much surface irrigation could be reduced when water tables are within a few metres of the surface.

Methods

Campbell 229 soil water potential probes were installed in November, 2000 at a site in Bundaberg (24?49' 06” S, 152?21' 01” E) at depths of 0.15, 0.4, 0.5, 0.65, and 0.85 m in the rainfed treatment, and at 0.15, 0.4, 0.5, 0.65 and 0.95 m in the treatment where irrigation was scheduled daily using a pan factor of 0.8 and applied via subsurface drip irrigation. Sensors were placed midway between the row and inter row, with a distance of six cane rows separating the two treatments. Data was collected hourly via a logger system from November 30, 2000 through to harvest on the 27th August, 2001. During this time the water table fluctuated between 0.57 and 1.45 m.

Results

When water tables were above 1 m (Nov-Feb), there was little difference in soil water potentials at all depths (Figure 1a). When water tables were deeper (1 –1.45 m), differences in soil water potentials were

more apparent at sensors close to the surface (Figure 1b). Even when water tables were at their deepest (1.45 m), soil water potentials at depths below 0.4 m in the rainfed treatment were still wetter than 1 bar, the recommended refill point for irrigation.

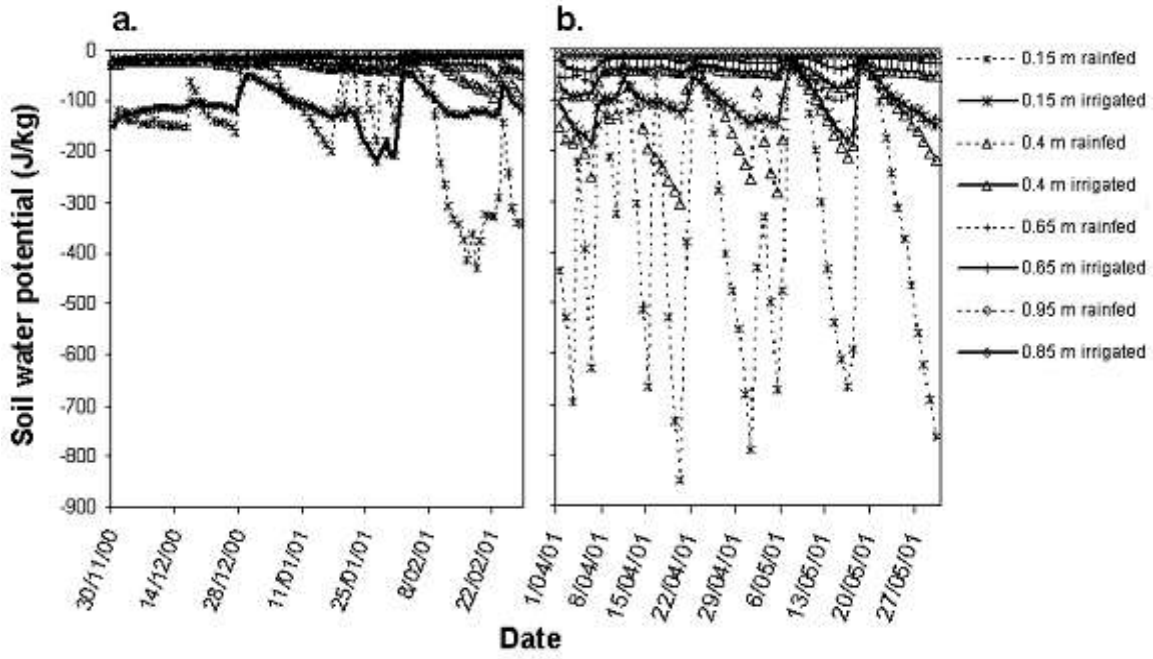

Figure 1. Soil water potentials for rainfed and irrigated treatments where a) the water table was above 1 m and b) the water table was between 1 and 1.3 m.

Conclusion

These results suggest that for this soil type, surface irrigation would not be required for water tables within 1.45 m of the surface. At deeper water table depths, the complementary use of surface irrigation with upflow from the naturally occurring water table is required. The amount of surface irrigation needed will depend on the water table depth, which provides a strong reason for actively monitoring water table depths to support scheduling irrigation. These results confirm that where sugarcane grows above shallow water tables, the potential for increasing the efficiency of surface applied irrigation water is high. Capturing the benefits however will require changing scheduling methods to incorporate soil water based information to account for the upflow form the water table.

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References

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