The effect of crop residue layers on evapotranspiration, growth and yield of irrigated sugarcane†

FC Olivier* and A Singels
South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe 4300, South Africa

Abstract

A layer of harvest residues from the previous crop can reduce wasteful evaporation from the soil surface and thereby increase the efficiency of use of limited water resources for agricultural production. The practice of harvesting sugarcane green and leaving crop residues in the field, as opposed to burning the residue, has been re-adopted in many sugarcane industries worldwide. However, a better understanding of the dynamic impacts of residue layers on various aspects of the cropping system is required to (1) enable the formulation of sets of best management practices for specific production scenarios, and (2) promote the use of residue layers in areas where it is desirable and has not been adopted, such as irrigated sugarcane production in South Africa. The objective of this study, therefore, was to quantify the effect of 2 different types of residue layers on crop growth, cane yield and evapotranspiration of fully irrigated sugarcane. A layer of cane tops and dead leaves (Trash) and a layer of green tops (Tops) were applied to the soil surface of sugarcane crops (plant crop and first ratoon crop of variety N14) grown on lysimeters at Pongola, South Africa. Observations of crop growth (stalk population, stalk height, canopy cover), cane yield and evapotranspiration for these treatments were compared to that of a bare soil treatment. The data were also used to derive values of crop evaporation coefficients for different development phases and these were compared to FAO56 recommendations. Initial stalk population in the plant crop and radiation capture in the plant and ratoon crop were affected negatively by crop residue layers, but without significantly reducing final stalk population and cane yield. Peak stalk population occurred later in crops grown in residue layers, but peak and final stalk populations were unaffected. Evapotranspiration was reduced by both residue layers, mainly due to a slower developing canopy (reduced transpiration) and reduced evaporation from the soil, during the pre-canopy phases. Increased drainage was observed under residue layers, emphasising the importance of accurate irrigation scheduling to avoid water logging. The FAO56 methodology for calculating crop evaporation coefficient values for the initial, development and late season phases are supported by the results obtained here. Crop evaporation coefficient values were significantly reduced by residue layers. It is important that irrigation scheduling practices be adjusted to realise the potential water savings of sugarcane production systems that make use of residue layers. This study provides the information required to do that. The information could also be used to improve the ability of the crop models to accurately simulate crop growth and evapotranspiration in a residue layer cropping system.

Keywords*:* water use, irrigation, stalk population, canopy development, lysimeter, crop evaporation coefficient, trash blanket