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Whole-of-season evaporation and CO_2 exchange by sugarcane crops

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The high soil moisture regimes, high soil temperatures and high levels of available carbon that characterise sugarcane culture can be expected to promote high evaporation rates and intensify the normal processes of carbon cycling in sugarcane soils. This paper reports micrometeorological studies of the exchanges of solar radiation, heat, water vapour and CO_2, made over the complete growing seasons of two sugarcane crops. One is a 1^{st} ratoon crop growing on an acid-sulfate soil (ASS) in a sub-tropical region in the south of the Australian sugarcane belt (at 149^o25'E, 28^o19'S), where the practice is to burn the foliage of the crop immediately before harvest. The other is a crop of 5^{th} ratoon trash-blanketed cane in the tropical north of the belt (at 149^o10'E, 21^o10'S), where the soil and cultural practices are considered to be more representative of the industry. The trash-blanket comprises the foliage stripped from the crop during harvesting and left as a mulch on the surface of the ground. Both crops were fertilised with 160kg ureaN/ha. The growing season for the southern crop was 342 days and that for the northern crop 292 days. The total seasonal rainfall for the southern crop was 1879 mm and that for the northern crop, 1924mm. The average maximum temperature during the growing season at the southern site was 26.4^oC and the average minimum, 15.3^oC. The corresponding temperatures for the northern site were 26.1^oC and 19.0^oC. Measurements included the components of the energy balance, eddy covariance measurements of sensible heat flux, evaporation and CO_2 exchange in the air layer above the crop, chamber measurements of fluxes of CO_2 from the ground surface and measurements of soil moisture and soil temperature. Evaporation

rates from both crops were similar, averaging around 2mm/d for their growing seasons. Both crops sequestered similarly large amounts of CO_2 from the atmosphere, 52t/ha for the southern crop and 56t/ha for the northern crop, but there were different contributions from “soil” respiration, 28t/ha in the south and 10t/ha in the north. The methodologies used and the soil, agronomic and climatic factors controlling the energy and gas emissions will be discussed.