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Field Measurements of the CO_2 Evolution Rate under Different Crops During an Irrigation Cycle in the Mountain Oasis Balad Seet, Oman

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Abstract

Our knowledge of the agricultural sustainability of the millennia old mountain oasis in northern Oman is restricted in particular with respect to C and N turnover. For millenia oasis agriculture has been the backbone of rural livelihood in the desertic Sultanate of Oman. However, little is known about the functioning of these oasis systems, in particular with respect to the C turnover. The objective was to determine the effects of crop, i.e. alfalfa, wheat and bare fallow on the CO_2 evolution rate during an irrigation cycle in relation to changes in soil water content and soil temperature. The gravimetric soil water content decreased from initially 24 % to approximately 16 % within seven days after irrigation. The mean CO_2 evolution rates increased significantly in the order fallow (27.4 mg $C/m^2 \cdot h$) ¡ wheat (45.5 mg $C/m^2 \cdot h$) ¡ alfalfa (97.5 mg $C/m^2 \cdot h$). It can be calculated from these data that the alfalfa root system contributed nearly 4 times the amount of CO_2-C than the wheat root system. The decline in CO_2 evolution rate, especially during the first four days after irrigation, was significantly related to the decline in the gravimetric water content, with $r = 0.70$. CO_2 evolution rate and soil temperature at 5 cm depth were negatively correlated ($r = -0.56$, $n = 261$) due to increasing soil temperature with decreasing gravimetric water content. This study was part of a larger project focusing on the sustainability of oasis systems, especially with respect to the question of how the current levels of agricultural inputs affect C and nutrient balance under regular irrigation and high ambient temperatures.

Keywords: Arid climate, soil respiration, sustainability

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