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Effects of Alley-cropping Systems on Crop Productivity and Water Use Efficiency in Semi-desert Region of Northern Sudan

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Abstract

A series of experiments were conducted in the semi-desert regions of Northern Sudan during 1998–2000, to investigate the potential of alley cropping system for exploiting residual water in the surface horizons and beyond the rooting depth of associated crops. The first experiments were assigned in RCB design, replicated 3-times. Three N-fixing trees were used in the alley cropping hedgerows, namely, *Acacia ampliceps*, *Acacia stenophylla* and *Leucaena leucocephala*. Regular monitoring was carried out for determining water use in the system. In the second experiment, monitoring of *A.stenophylla* alley cropping microclimate was studied, including measurements of solar radiation, wind speed, relative humidity, maximum and minimum temperatures, and shade movement. Changes in the alley cropping microclimate were quantified, and related to plant responses and growth of all components of the system. The obtained results showed that there were complex interactions and extensive overlap between different climatic factors and water use in the system. In the first experiment there were significant differences ($p = 0.01$) among the tree species in their abilities to extract the water from the different soil horizons as the trees differed in their growth nature and competitive interactions. The *A.stenophylla* tree, with its deep roots and open canopy, gave the highest saving in irrigation water. On monthly basis, the maximum savings occurred during June. In the second experiment, the Carrot yield increased over the control by 487% and its yield increased as the solar radiation decreased across the different zones of the alley. Similarly, sweet pepper gave a total yield of 5833 kg/ha of fruit fresh weight. High wind speed and solar radiation, which characterised this season tended to cause water stresses for the plants growing in the control.

Keywords: *Acacia stenophylla*, Alley cropping, semi —desert, Solar radiation , Water use