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Efficiency of water use by cactus pear (*Opuntia* spp .)

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Key words : biomass , cladode mass , water utilization

Introduction Studies on water utilization of cactus pear (*Opuntia* spp .) at plant community level in field conditions over a full growing season have not often been reported (Snyman , 2005) . Therefore , this study was aimed at quantifying the water utilization for one to four-year-old plants of the widely cultivated *Opuntia ficus-indica* (green cladode) and the wild species *O . robusta* (blue cladode) .

Materials and methods The research was conducted in a semi-arid summer rainfall (annual average 530 mm) region of South Africa (30°15′S , 27°10′E , altitude 1 ,652 m) . Soils in the study area are mostly fine sandy loams . Planting took place in dry land conditions with soil well cultivated (300 mm deep) before planting . Super phosphate was added at 300 kg/ha (30 kg P/ ha) , with 20 kg/ha of N-fertilizer applied at establishment . As top dressing at the beginning (August) of the second , third and fourth growing seasons , 60 , 90 and 120 kg N/ha were applied , respectively . For the second , third and fourth years 10 , 15 and 20 kg P/ha were added respectively . Weed control was done chemically . The planting (one-year-old cladodes) of the species *Opuntia ficus-indica* (cultivar Morado) and *O . robusta* (cultivar Monterey) took place in two rows , with 5 m spacing between rows and 2 m within a row (1 000 plants/ha) . At the end of each growing season , three plants per species were randomly selected and studied . Water utilization (WU) is defined as the amount of plant material (dry matter of cladodes) produced per unit of water used (evapotranspiration) . The utilization of water was calculated by only taking the newly formed cladodes into account . Evapotranspiration was determined by the soil-water balance equation as described by Snyman (2005) .

Results and Discussion Both species showed a drastic increase in production , on reaching maturity , to the extent that *O . ficus-indica* and *O . robusta* , respectively , increased production 15 .2-and 17 .4-fold from the first to the fourth season with . Yields were 4 460 and 3 710 g DM/plant or kg DM/ha , respectively , for *O . ficus-indica* and *O . robusta* respectively for three-year-old plants , compared to 9 665 and 8 378 kg DM/ha for four-year-old plants . *Opuntia ficus-indica* converted water more efficiently ($P \leqslant 0.01$) into plant production than *O . robusta* during all four growing seasons . The utilization of water also increased in efficiency , as did plant production , as plants aged , from establishment up to four yearsold . The low WU obtained for both species of one-year-old plants (1 .67 and 1 .30 kg DM/ha/mm , respectively , for *O . ficus-indica* and *O . robusta*) can be attributed to the poor fodder production of cactus pear over the first year of establishment . After three and four years of establishment , *Opuntia ficus-indica* produced , as much as , 11 .99 and 17 .26 kg DM/ha for each mm of water used , compared to a WU of 10 .57 and 14 .96 kg DM/ha/mm for *O . robusta* .

Conclusions This provides some information on the monitoring of the production and water-use of *Opuntia* over the first few years of establishment . This crop can utilize the more arid areas to their full potential . Concerning the interest in global warming , the value of this crop must not be underestimated for the future .

Reference

Snyman , H .A . , 2005 . A case study on *in sito* rooting profiles and water-use efficiency of cactus pears , *Opuntia ficus-indica* and *O . robusta* . *Professional Association for Cactus Development* 7 , 1-21 .