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Water Use and Drought Stress Reaction in Greenhouse Split-Root Lychee

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Abstract

Lychee (*Litchi sinensis*) is one of the predominant fruit crops in upland areas of Northern Thailand, where it is produced during dry season under irrigation. As water is an increasingly scarce resource in the hillsides, strategies for more efficient water use are fundamental for sustainable increasing agricultural production. Partial Rootzone Drying (PRD) is a novel irrigation technique which is based on the induction of changes in the plant hormonal balance. By targeted withdrawal of irrigation water an increased level of Abscisic Acid (ABA) is obtained, which makes the plant reduce its stomatal aperture and thereby decrease water consumption. The reduction in biomass production is directed to reduce vegetative growth, while yield is widely unaffected.

To test the response of lychee to PRD, 30 two years old trees were exposed to different irrigation treatments under controlled conditions. The trees were grouped in four groups with the following irrigation treatments: a.) full irrigation, as previously measured b.) PRD with 50% of full irrigation, changing the irrigated sides every two weeks c.) 50% of full irrigation, evenly distributed and d.) no irrigation. The trees were watered in a three days interval. Water consumption was measured gravimetrically. Evaporation was prevented by covering with a plastic sheet. Soil moisture was controlled by use of TDR probes. Twice a day (morning and afternoon) the stomatal resistance has been measured with a transportable Porometer AP4 (Delta T, Cambridge). At three dates leaf samples have been tested on there ABA content.

After three months of experiment no significant differences could be found in the response to drought stress of PRD and deficit irrigated trees. After two weeks of undergoing the same treatment, stomatal resistance and water consumption did not vary significantly. Also the levels of ABA in the leaves did not differ among the stressed treatments. As the response to drought stress might considerable vary for bearing trees, field experiments in Thailand are projected to give additional information about the yield response of lychee to deficit irrigation.

Keywords: Abscisic Acid (ABA), irrigation, partial rootzone drying (PRD)