Water Saving Potentials in Lychee Production
-Comparison of Irrigation Scheduling-

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Introduction and Objective

Water is limited for lychee irrigation in the tropical northern Thailand highlands. In the framework of the Uplands Program, focus is on water saving solutions in irrigation.

Previous investigations could already identify water saving potentials through regular system maintaining, site adapted irrigation techniques and TDR controlled irrigation. However, the impact of different irrigation scheduling on irrigation efficiency was not investigated so far.

The objective of this study was therefore to compare the following different irrigation scheduling, which are actually being tested in the field, via water balance modeling. Main focus was on water losses through evaporation and seepage.

1. Tensiometer controlled (TC): Irrigation is started at $h \leq -300$cm in 25 cm depth and is conducted for a time period of 5h.

2. CM-Tensio-Control (CM-TC): Irrigation is started at $h \leq -400$cm in 25 cm depth and stopped at $h \geq -300$cm in 50 cm soil depth.

Irrigation was carried out with a constant application rate of 72mm/d.

Materials and Methods

Modeling was executed for 40 days with the Hydrus 2D program (Simunek et al., 1999). Soil hydraulic properties and lychee tree characteristics were taken from previous studies.

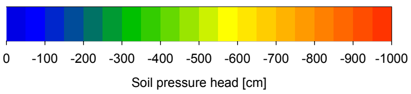
According to previous results root water uptake (RWU) at different distances from the tree trunk is similar within same horizons. In the vertical direction a RWU distribution of 1 : 0.82 : 0.63 : 0.52 : 0.18 along the five described horizons (0-15, 15-30, 30-50, 50-75, 75-100 cm) was inserted in the model.

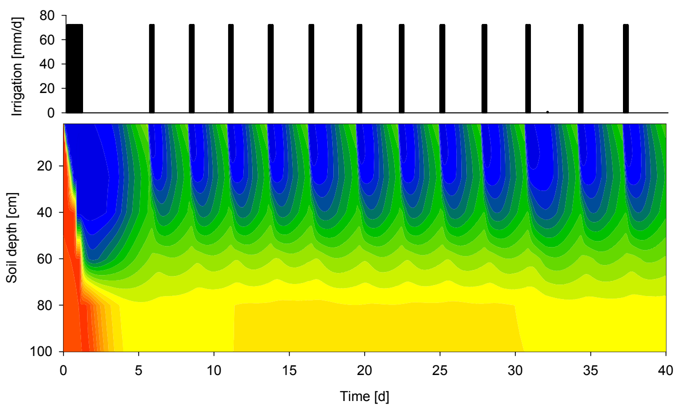
Usual climate data (measured on site) served as upper boundary condition; the lower boundary condition was set as "free drainage" (dh/dz =1). The initial soil water pressure head was defined with h = -1000 cm.

Because no data about the water stress characteristics of lychee trees was available, those of lemon provided by the Hydrus 2D database was used.

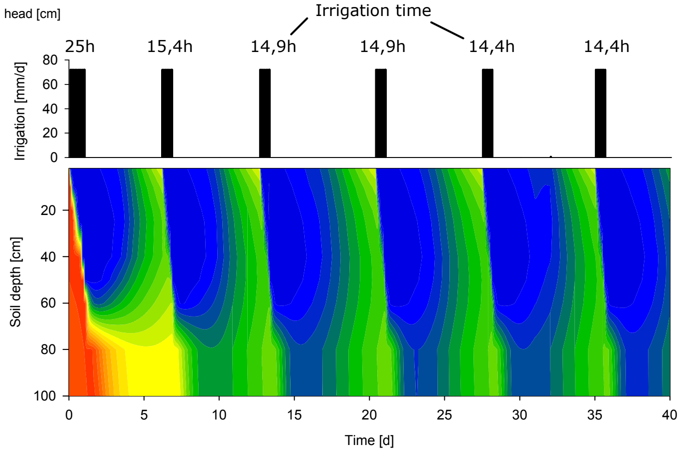
Results

Tensiometer controlled

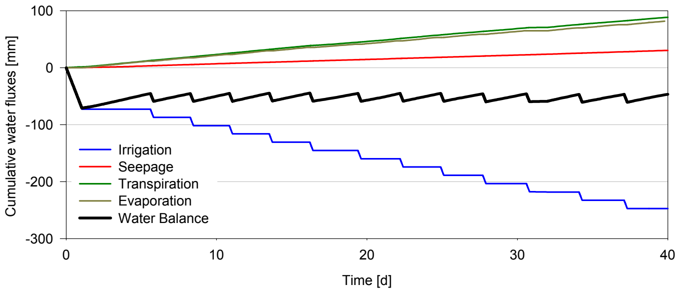


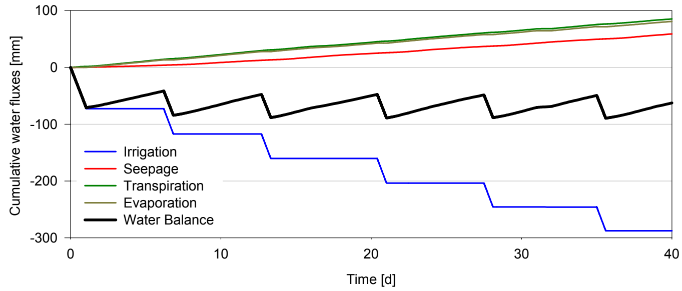


CM-Tensio-Control



Water balance differences





	Initial application [mm]	Interval [d]	Depth per irrigation event [mm]	Total irrigation applied [mm]	Cumulative transpiration [mm]	Cumulative evaporation [mm]	Cumulative seepage [mm]
TC	75	2.4 – 3.3	15	247	89	82	30
CM-TC	75	5.2 – 7.1	44.4	288	85	81	59

Findings

Even though the irrigation intervals were larger with CM-TC, cumulative evaporation losses were not reduced. Cumulative transpiration was similar in both treatments and both were suited for an optimal water supply.

Differences were detected in terms of seepage. Because of the higher irrigation depths per event with CM-TC, the wetting front moved deeper. As a consequence, cumulative seepage losses were approximately two times larger in CM-TC as in TC and caused in turn a higher total irrigation.

Based on these findings it is concluded that the average depth of the wetting front is essential for an efficient irrigation scheduling. The irrigation interval should only be enlarged as long as seepage losses do not increase. As the wetting front depends both on soil and plant characteristics, irrigation scheduling is site specific and must therefore be adapted to the respective environmental conditions.

References

Simunek, J., Sejna, M. and M.Th. van Genuchten (1999). Hydrus 2D Version 2.0. Simulating water flow and solute transport in two-dimensional variably saturated media. U.S. Salinity Laboratory, USDA/ARS Riverside, California. 227p.

Acknowledgement

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