Hans H. Ruthenberg-Graduierten-Förderpreis 2006/

Hans H. Ruthenberg Award for Graduates 2006

Marcus Nagle "Comparison of Partial Rootzone Drying with Other Irrigation Regimes on Yield and Quality of Mango"

Hohenheim University, 2005

Summary
Irrigation performs a vital role in providing water to fruit crops which allows for a consistent harvest of high quality fruits. Mango is increasingly cultivated worldwide under irrigation, as is the case in Thailand where mangoes are produced for local consumption and as a cash crop. Consequently, water supply is becoming a major concern due to growing scarcity in addition to increased demand and competition for water resources. Therefore, raising the water-use efficiency (WUE) of mango trees under irrigation is a possibility for improving the situation. One solution offered for achieving this is the use of deficit (reduced) irrigation. Partial Rootzone Drying (PRD) is a promising reduced irrigation technique that currently has little application in Thai mango production, but saves water via a special irrigation pattern and does not significantly impact harvest in numerous other crops.

Previous research done within the Uplands Program (SFB 564) in northern Thailand during 2004 season showed that PRD compared with conventional mango irrigation saved water without negatively affecting yield. However, these results need to be reconfirmed and, moreover, the effect of PDR on mango fruit quality is still unknown. To fill this gap in knowledge, further investigations are essential. The aim of this study is to determine the effect of PRD on yield and quality of mango in respect to Conventional Irrigation (Cl) and corresponding Deficit Irrigation (D150) techniques using a Non-Irrigated (N1) treatment as the control. Based on the state of the art, it was hypothesized that not only would PRD increase WUE, but it would also have a positive effect on fruit yield and quality.

Trees grown under the respective irrigation regimes in an experimental mango orchard in northern Thailand supplied the fruit for analysis. Experiments were divided into preharvest, harvest and postharvest phases. Harvest analyses including yield per tree, average fruit weight and size class distribution were conducted for part of the orchard. For pre- and postharvest experiments, three trees per treatment were selected and monitored for quality around the harvest time and during postharvest ripening, respectively. Laboratory analyses were conducted in terms of physical characteristics of the fruits (size, weight, proportions, color and firmness) and chemical characteristics (total soluble solids, pH, total acidity and carbohydrates). A postharvest sensory evaluation was also conducted using a mixed Thai-German panel. ANOVA was used to detect differences between treatments and LSD was used to measure significance.

The results of these experiments showed that PRD reduced yield in comparison to Cl, but did not differ from D150. Higher yields were found for PRD than the control. PRD did no affect fruit quality in compared to the other treatments, but led to an increased proportion of edible parts of the fruit and PRD fruits were preferred by sensory evaluators in respect to appearance and overall acceptance. WUE of trees grown under PRD almost doubled in comparison with Cl and was comparable to D150.

Current recommendations concerning the most advantageous reduced irrigation technique for application in the local farming systems of northern Thailand should, based on this study, favor the use of PRD. The reduced yields experienced must be weighted against the benefits of decreased water requirements.

With the monitoring of quality parameters in this study, it was also possible to investigate the determination of optimal harvest time of mango. Field determination of mango maturity is a subjective task by convention, but the stage of development at harvest is paramount for ensuring the highest end product quality. Analysis of the results showed that observance of single parameters such as sugar levels and carbohydrate ratios cannot be used alone in determining the optimum time of harvest maturity.