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Parameterisation and Modelling of Growth and Yield Development of Mango (*Mangifera indica* L.) in North Thailand with Application of the WaNuLCAS Model

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Abstract

In mountainous areas of North Thailand soil erosion is a severe problem, resulting from population growth and expansion of agricultural land into fragile uplands. Mango, one of the major fruit crops in Thailand, can be an alternative to annual crops and is, thus, an option to prevent soil degradation. To test mango growth under different environmental conditions and in diverse agricultural systems modelling can be a useful tool. The aim of this study was to parameterise mango growth of the Thai varieties “Chok Anan“ and “Nam Dok Mai” for two sites in North Thailand for the calibration of WaNuLCAS 3.2 (Water, Nutrient, and Light Capture in Agroforestry Systems). Data collection for the parameterisation took place at Mae Jo mango orchard, north of Chiang Mai, which is managed with four irrigation treatments and at the Multiple Cropping Centre of Chiang Mai University, North Thailand. To access mango parameters ten farmers were surveyed, three expert interviews were conducted and the leaf area index (LAI), leaf weight ratio (LWR), specific leaf area (SLA), a functional branch analysis (FBA) and root length density (RLD) were measured. The parameters were statistically evaluated and used to create a mango tree data set for the model and calibrated thereafter. Results showed that the LAI of Chok Anan mango differed with measuring time and with respect to pruning but not between irrigation treatments. In contrast irrigation increased the SLA. RLD was not different between the mango varieties Chok Anan and Nam Dok Mai. Furthermore scenarios with irrigation, off-season production and intercropping were run to characterise tree growth changes in response to crop management options. The WaNuLCAS model simulated mango LAI and fruit biomass well, whereas tree biomass, height and diameter as well as irrigation and especially off-season production showed somewhat poorer results. In conclusion mango growth was satisfactorily modelled by WaNuLCAS under the given conditions. The model may, thus, contribute to identify and evaluate options for alternative cropping systems, but the mango tree data sets still have to be validated for future general use.

Keywords: mango modelling, model performance, parameterisation, simulation scenarios