Tropentag, September 15-17, 2021, hybrid conference

"Towards shifting paradigms in agriculture
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Coping with Erratic Rainfall: A Model Approach for Improving Maize Sowing Date

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Abstract

The objectives of this study were to (i) evaluate the ability of the Water, Nutrient and Light Capture in Agroforestry Systems (WaNuLCAS) model for predicting maize performance under rainfed conditions, (ii) assess the performance of maize under various sowing date options to sustain maize yields, and iii) identify the best sowing option under irregular rainfall. A two-year data set with various sowing dates from a field experiment in northern Thailand was used to calibrate and validate the model. Results indicated that WaNuLCAS was able to predict maize yield well (Goodness-of-fit statistics: R^2=0.83; EF=-0.61; ME=0.16; CRM=0.02; CD=0.56). An analysis of past rainfall data (1970–2018) of the Phitsanulok province, northern Thailand, indicated that only 27.1 % of the years corresponded with the long-term mean, while the same percentage was either moderately dry or moderately wet. The remaining years (19 %) were very wet or very dry, making sowing date decisions difficult. Five sowing date options were simulated using WaNuLCAS, i.e. farmers' practice (FP), 15, 30, and 45 days before FP, and staggered planting (a combination of them) as a strategy to cope with rainfall variability. Simulations revealed that under current rainfall conditions water was the most limiting factor for growth and yield of maize while nutrients (N and P) had only minor impact. Maize water uptake was significantly correlated with yield formation (R^2: 0.45). Sowing maize 30 days before FP or staggered planting are suitable options for farms prone to irregular rainfall conditions, the later particularly when no distinct weather forecasts are possible. Both options reduced the risk of crop failure while maintaining yields under these conditions.

Keywords: Climate change, decision support tool, growth and yield limitation, staggered planting, upland area

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