

Raided farming systems in the Central Highlands of Kenya have beer agricultural productivity. high temporal variability of rainfall recurrent droughts is among the most important factors affecting agriculture study was set up with the objective of evaluating the effects of planting dates and rainfall variability on observed and simulated maize performance and to assess AquaCrop model performance and efficiency. The study was carried out in Mbeere District in Kenya, representing a low potential area in terms of agricultural productivity due to low and erratic rainfall. The trial followed a 3 x 2 split-plot design replicated thrice in randomized complete blocks. The main factors were three staggered planting dates (dry planting, wet planting and late planting) while the sub factors were two maize varieties. Phenological stages' durations, daily rainfall, maximum & minimum temperature, grain and biomass yields were key parameters. An AquaCrop model simulation exercise was carried out after model parameterization and calibration using crop, soil and climatic data collected from the trial site. Analysis of variance was used for analysis of the experimental data and the differences between treatment means were examined using least square difference at 5% level of significance. The performance and efficiency of the model was evaluated using root mean square error and correlation coefficients. The trial results showed that, relative to late planting, dry planting increased maize stover yields by 53% (significance $p=0.05$) during the long rains season of 2009 (LR09), followed by wet planting that led to a 19% increase. During the short rains season of 2009 (SR09), there was 27% increase in the stover of dry planted maize while wet planting effect was not significant. There was no observed significant effect of planting dates on maize stover in long rains season of 2010 (LR10) probably due to relatively high amounts of rainfall. Due to early rainfall cessation in LR 2009, no grain yields were realized. In SR 09, dry planting increased grain yields by 77% compared to late planting while wet planting effect was negligible (significance $p=0.05$). In LR10, dry planting increased grain yields by 26% while wet planting led to 24% decrease probably due to the rainfall pattern during the onset of the season. Simulated results using AquaCrop model followed the same trend as the observed yields. The observed effects of planting dates were mainly caused by rainfall patterns and amounts. The study highlighted the importance of planting dates in relation to rainfall onset, pattern and amounts as a key farm management practice that has a direct impact on maize productivity.