Application of CROPGRO-PEANUT Model to Evaluate Groundnut Growth and Yield in some Farming Zones of Ghana

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The study reports on a validation test of the DSSAT-CROPGRO-Peanut model using data from field experiments, and subsequent application to assess yield variability of groundnut in three farming zones of Ghana. The model was evaluated for its performance by simulating the response of two groundnut varieties (Kpedevi short duration and Goronga, long duration), to planting dates {29/04/02 and 09/09/02} and planting densities {9 and 17 plants m^{-2}}. The model predicted the days to 50% emergence, flowering, pegging and pod formation within ±5 days of the observed values. Changes in leaf area index (LAI), and total dry matter significantly correlated with observed values [(R^2 = 0.81, and 0.97, respectively, for Kpedevi) and (R^2 = 0.86 and R^2 = 0.98, respectively, for Goronga)]. The model accurately simulated the differences in crop growth, yields at final harvest, densities and seasons. The results indicate that under biotic stress-free situations, the model can be used to predict groundnut growth and yields of Goronga and Kpedevi as influenced by planting date and planting density.

In the application study, the model was run to simulate groundnut yields over 30 years at 3 farming zones, namely, Legon, Kpeve and Akatsi. The generated yield data were ranked from the lowest to highest and were transformed into cumulative distribution functions (CDFs). The CDFs were obtained for 3 planting dates (09/04 = S1, 29/04 = S2, and 09/09 = S3) and 3 planting densities (17 plants m^{-2} = D1, 13 plants m^{-2} = D2, and 9 plants m^{-2} = D3). Pair-wise comparison of the CDFs indicated that: 1) Early planting of both Goronga and Kpedevi (19/04), resulted in a lower spread of yield distribution, higher yield and hence least chance of crop failure at Kpeve and Legon. In Akatsi, however, S2 was the preferred planting date for Goronga, although variability of yield data was also very high (CV > 32%). The overall comparison of the yield performance of groundnut at these planting dates followed the trend S1 > S2 > S3. 2) The general yield ranking of the strategies in which density was varied were D1 > D2 > D3. The only exception occurred with Goronga cultivar at Akatsi where the preferred density was D2 when sowing was done at S1, 3) Except at Legon, Kpedvi yielded higher at Kpeve and Akatsi than Goronga, irrespective of the planting date and density. Cultivar Kpedevi is therefore recommended for these farming zones. At Legon, however, the preferred cultivar was Goronga. In this case seed yield never fell below 1141 kg ha^{-1} 4) Comparing the three sites, when only yield performance was used as assessment criteria, Kpeve was found to be the most suitable site for cultivating Kpedevi, whereas Legon was preferred for Goronga.

CROPGRO-Peanut model, has therefore, shown significant benefit as a decision-support tool to design practices, that would improve groundnut production in Ghana.

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