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Using Cropping System Models and Geospatial Tools to Bring Agronomy to Scale in the Savannahs of Nigeria

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Abstract

Crop yields in sub-Saharan Africa are generally low and vary significantly from one location to another due to a myriad of reasons including poor soil fertility, moisture stress, pests and diseases, and inappropriate agronomic practices. There is usually a huge gap between the yield attainable within any specific climate-soil zone and the actual yield realised by the average smallholder farmer. In order to close the gap, the underlying reasons for the low yields must be clearly understood. Cropping system models, if properly calibrated and validated, could assist in providing a better understanding of the reasons for the gaps. The use of such tools could assist decision-making at various stages including site selection, evaluation of various management options, and extrapolation and scaling-out of results obtained in trial sites. In the last three years, Bayero University has worked with IITA and other national and international research Centers to calibrate and validate the CERES-maize model for use as a decision support tool in the Savannahs of Nigeria. Experiments were conducted in 2013 and 2014 to generate genotype-specific parameters for calibrating the model, and on-station and on-farm trial data were used for model validation. Areas within the Savannahs of Nigeria were divided into climate-soil zones in which various production scenarios (variety × planting time × N application rates) were modeled. The outputs produced include yield maps and yield gap graphs, which will assist extension workers, researchers and policy makers in making decisions on alternative crop and soil management interventions and ex-ante evaluations of various production scenarios. However, the usefulness and the possible scaling-out of such results depends on the reliability and resolution of the input data used in validating the model and in characterising and delineating the climate-soil zones. The work currently being conducted on Maize (TAMASA) and Cassava will provide more data and a better understanding of the response of the two crops to various genotype × environment × management combinations. The findings from this work will have to be validated under realistic conditions. In order to find suitable areas for future validation trials, geo-spatial methodologies like similarity analysis and classification procedures are applied. Identifying and mapping areas with similar characteristics to existing trial sites helps to scale out the results while areas with significant environmental differences should be avoided for direct dissemination.

Keywords: CERES-maize model, moisture stress, pests and diseases, poor soil fertility, yield gaps

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