Introduction and Objective

- Intercropping is an agricultural practice of cultivating two or more crop species simultaneously in the same field.
- The main advantages of intercropping are an increase of the interception of solar radiation and increased nutrient supply when compared with sole crop systems.
- Develop a new intercropping model by integrating different modules using the Scientific Impact assessment and Modelling Platform for Advanced Crop and Ecosystem management (SIMPLACE) framework.

Modules Development

- Light competition module was selected from literatures with sensitivity and uncertainty analysis and feasibility check to model light transformation and allocation by considering both crop characteristics and arrangements of intercropping system (Fig. 1).
- Belowground water resource are calculated based on the root restriction factor (FRR) per layer. Water resource are firstly separated based on the ratio of FRRs, then limited with the crop water demand and surplus water can be redistributed to the other crop and soils per layer.

Model Establishment

- Original sole crop modules in SIMPLACE database were also modified to fit the intercropping system.
- Nitrogen allocation was presently considered by LINTUL5 module.
- New developed modules for both above-ground and below-ground competitions were coupled together with modified and original other SIMPLACE modules (Fig. 2) to establish the new intercropping model.

Background and Methodology

Field data were collected in Dassari, Burkina Faso. (Year: 2015 and 2016). Maize, millet, sorghum, and two cultivars of cowpea were planted in sole and intercropping systems respectively.

Model Calibration and Validation

- The new developed intercropping model was calibrated based on field data of sole crops in 2015 and validated with other field data in both 2015 and 2016.

Results

- Simulation accuracy was higher for cereals than legumes in sole crop systems.
- Environmental stresses varied with different crop cultivars and different crop growth periods.

Conclusion and outlook

- Novel modules for simulating aboveground and belowground competition have been integrated.
- The model can give us relatively accurate simulations for cereals, but relatively poor accuracy for legumes.
- To increase the accuracy, we are now developing new modules considering plant density.

Acknowledgement

This research has been funded by the German Federal Ministry of Education and Research (BMBF) within the WASCAL program (Funding number FKZ 01LG1202A).

References


Contact

Name: Wenzhi Zeng
E-mail: wzeng@uni-bonn.de
Phone: +49 228 737198
Fax: +49 228 73 2870
http://www.lap.uni-bonn.de/