# Session 2.4 Soils and Crop Damage

*Oral Presentation*

***Title:*** **Modeling intercropping with cereals in smallholder agrosystems. From lessons learned in central Brazil to their application in the Peanut Basin in Senegal**

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*Abstract:* In most areas of sub-humid tropics where the rainy period is too short to allow a system with a succession of crops, intercropping is an option to diversify culture and enhance agrosystems resiliency. However, interactions among associated crops (facilitation and/or competition) are complex, variable in time and will depend on the characteristics of each crop and the management of the whole system. Understanding and quantifying these complex interactions and their impacts on the agrosystem productivity require to consider temporal dimension. In fact, one-off measures or entirely experimental approach cannot adequately answer these questions. However, crop modeling can complete experimental approaches by taking better account of changing interactions over time, allowing dynamic quantification of the flow of resources and their distribution. We will present an example of intercropping model with maize using STICS-CA model, adjusted calibrated and then evaluated for the Brazilian Cerrado system. We will then discuss on how to use a similar approach for millet-cowpea intercropping systems in the Senegalese peanut Basin.

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*Oral Presentation*

***Title:*** **Soil organic matter and sensitivity to climate change. Can we disentangle correlation and causation?**

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*Abstract:* About half of the agricultural soils are degraded. Erosion of agricultural land would cause emissions of 0.3–1.0 Gt C/yr and the annual cost of fertilizer to replace nutrients lost to erosion would be US $ 110 – 200 billion. Soil restoration through increased soil organic matter content has potential for reducing yield variability and for both climate change adaptation and mitigation. This potential will be explored by the 'Soils for food security and climate, 4 per 1000' initiative of COP21 through an international research program in close collaboration with AgMIP and with the GRA (Global Research Alliance on agricultural greenhouse gases). In this context, we will present first results of a model inter-comparison exercise testing the predictive ability of simulation models for both soil organic carbon (SOC) stocks and yields in arable crop rotations and temperate grasslands. A total of 24 models used in 11 countries for the prediction of GHG emissions in crop and grassland systems are contributing. The study has been set up with five successive steps that gradually release information to the modeling groups, ranging from fully-blind application of the models to complete availability of the experimental measurements. Here, we present results showing modeling uncertainties for SOC stock changes, with comparisons to observed data in the case of grassland experiments. Moreover, the sensitivity to climatic drivers of calibrated models has been analyzed within the AgMIP livestock and grassland group and projections of climatic impacts on yields and soil carbon are shown. From these first results, we discuss how to systematically test through modeling the role of soil organic matter for changes in crop yields and in sensitivity to climate change. We also speculate that simulation models could in the future be used to disentangle between correlation and causation in plant-soil relationships leading to improved crop and pasture adaptation to climate change when soil organic matter is high.