## Comparing different calibration strategies for the DSSAT-Nwheat model building on an extensive experimental data set for Germany

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Crop models are widely used in agronomic research. They can provide crucial information and decision support for crop management, crop breeding, climate change impact assessment and adaptation, as well as policy advice. Prior to model application, a crop model needs to be calibrated, i.e., crop coefficients are estimated by minimizing the error between observed and simulated crop growth and yield data. Neglecting model structural uncertainty, crop simulation accuracy relies entirely on model calibration if building on a robust experimental data set.

The calibration procedure is often conducted in an unstandardized and non-reproducible manner, with a substantial impact on the final coefficient setting. As a result, the same model and dataset may provide a broad range of model predictions from various users, depending on the crop modelers' experience and respective calibration procedure.

DSSAT-Nwheat is a freely available and globally employed crop model. However, Nwheat was rarely used in Germany. Hence, model calibration and validation are required prior to simulating the performance of specific German cultivars under German growth conditions.

We propose, execute, and comparatively assess six alternative calibration strategies. For this, we built on a vast cultivar-specific field experiment dataset of about 100 site-years per cultivar, which covers a wide range of growing conditions. We performed the calibration using the time-series estimator (TSE) for the DSSAT modeling system, allowing a coordinated calibration of multiple cultivar coefficients.

In combination with two calibration data sets (with yield component data vs. no yield component data), we applied three calibration strategies; we followed several coefficient combinations in strategies, reducing the error for different variables, taking into account the classical approach of initially calibrating phenology, then growth and finally grain yield.

Our study showed that TSE for model calibration, coupled with yield component data and strategy with giving weight to grain yield in each step, is a promising method for improving prediction capability in a reproducible way.