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How weather uncertainty impacts the predicted yield in an agricultural decision support tool?

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How weather uncertainty impacts the predicted yield in an agricultural decision support tool?

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Abstract: Crop models dynamically simulate nutrient and water cycles on a daily basis to predict crop growth and yield. They can be integrated into decision support systems (DSS) dedicated to helping farmers improve their profitability and sustainability by pro-actively adapting their cultural practices (for example irrigation and fertilization). One key challenge is then the use of appropriate input data, and in particular of weather data: current weather data drive the simulation of the daily crop growth, seasonal forecasts are used to predict the yield at the end of the growing season, and both are elements on which farmers base their strategical and tactical decisions. Some farmers have their own weather stations but most of them do not gather all the required weather data. Thus most crop models are run using gridded weather data. The uncertainty in weather data is due to both the spatial resolution of gridded data and the use of seasonal forecasts. It may have a crucial impact on the accuracy and the robustness of crop models, and therefore on the farmers' decisions. In this study, we will take as an example the crop models incorporated into two software (CropWin®-Corn, CropWin®-Soybean) dedicated to farmers. We will present (i) the magnitude of differences between observed, gridded data and seasonal forecast, (ii) the impact of uncertainty in weather data on the yield predicted for three contrasted climates, based on a sensitivity analysis. Our results may give insights in the identification of key weather variables for which it is important to reduce the uncertainty over the growing season. Finally, we will discuss the consequences of weather uncertainty in the robustness of crop models integrated into DSS.

Keywords: decision support systems; crop models; uncertainty; weather data