AGROFORECAST webpage, IPB contribution

WP1

One of the first project activities within the work package 1 (WP1) of AGROFORECAST included a farm survey study with the overall aim to identify the needs and expectations of a potential decision support tool from a practical point of view. A strong involvement of farmers is especially important to ensure that forecasting systems developed are not only “usable” in scientific and technical terms, but also “useful” from practitioners’ perspective.

Farmers experience and suffer from changes in growing conditions. The survey results indicated that only a few farmers changed their management practices accordingly. 93% of the surveyed farmers experience changes in weather conditions at their farm (Figure 1a), including increases in temperature, wind, heat waves and drought periods, and decreases in rainfall and snow cover. However, only 42% changed their crop management due to changes in the prevailing weather conditions (Figure 1b). Most respondents were interested in using tools for estimating weather risks (72%), pests and diseases risk (66%), and optimal fertilization amount (58%) and time (55%) (Figure 1c). These results illustrate a gap between climate change impacts and crop management adaptation in Austrian cropping systems and suggest the promotion of agrometeorological forecasting systems to support in-season crop management. Farmers’ needs and expectations as identified with this survey are considered for the development of the agro-meteorological forecasting systems throughout the AGROFORECAST project.

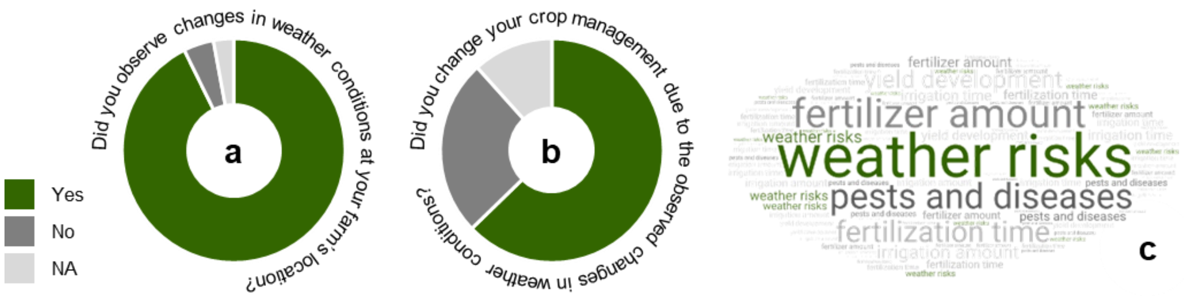

Figure 1: Selected results from the AGROFORECAST farm survey.

WP3 and WP4

Current N fertilization practices are largely based on empirical approaches representing crop demands in “average seasons”. While these “average” management practices have been relatively successful in the past, increased climate variability demands a more targeted N management in order to minimise inputs in less favourable seasons and maximise them in seasons with high yield potential. Thus, improving crop N use requires a shift from empirical “average” management of N towards highly optimised, site- and season-specific, and real-time management. In order to achieve that, we developed an integrated N management tool by linking the crop simulation model iCrop (Manschadi and Soltani 2021; Manschadi et al. 2021; Soltani and Sinclair 2012) with weather data (forecasts and historical records) and estimates of crop N status from the spectral CCCI-CNI index (Palka et al. 2021).

In this approach, the iCrop model is initialised for a specific field -reflecting local soil characteristics, management practices, and crop cultivar parameters- and run from sowing up to any date (=forecast date) during the season using the actual weather data (Figure 2). Thereby iCrop provides detailed information on season- and site-specific crop growth, N uptake, and soil water and N content until forecast date. To predict crop growth and development, N demand, and grain yield at harvest under various N fertilization levels, iCrop simulations are consecutively run with forecasted and historical weather data from analysis day up until harvest, providing range and probability distribution of likely crop yields, grain protein content, risk of N leaching etc.

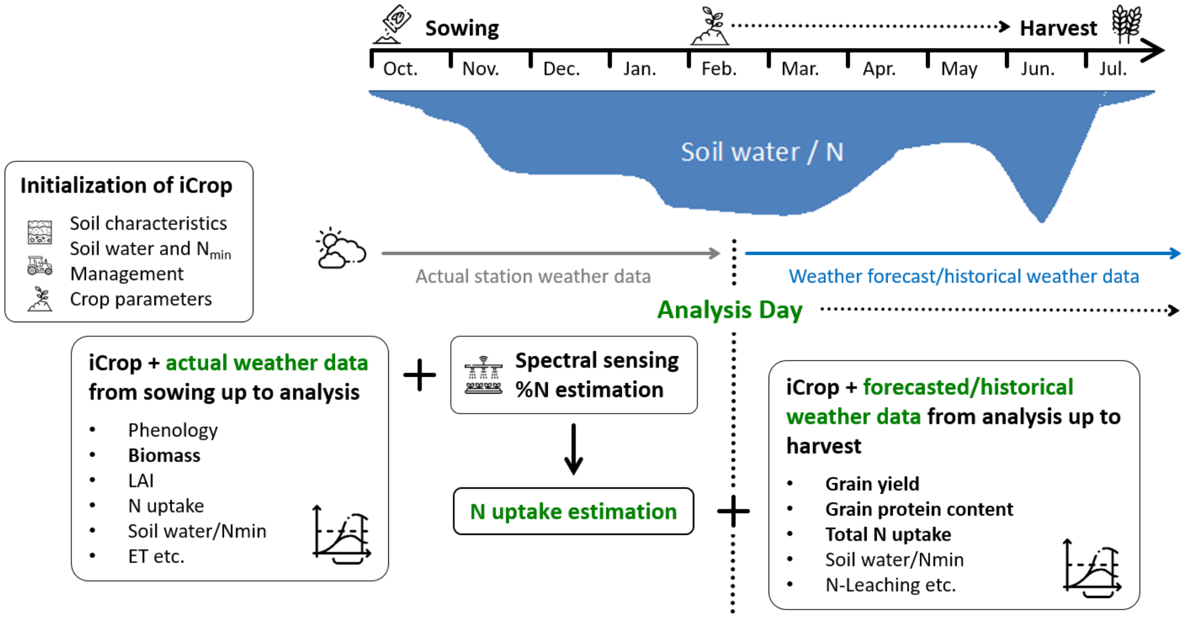

Figure 2. The integrated nitrogen management approach consisting of the iCrop model, actual and forecasted weather data, and real-time estimates of crop N status.

To evaluate the potential of the integrated N-management approach, we work closely with farmers where we divide dedicated fields into "Farm strips" where N-fertilizer is applied according to ordinary farm practice, and an "Model strips" (Figure 3). "Model strips" are fertilized in such a way that the mean grain yield and quality at harvest are equally high as within the "Farm strip". Every month, we include the most relevant simulation results in a “Crop Report” and share them with farmers to also seek practical feedback. This approach has been successfully tested in one farm in 2020/21 and will be further evaluated on two farms in 2021/22 in the Marchfeld region. Developing and evaluating this integrated N-management are ongoing activities within WP3 and WP4, and are also based on our survey results where farmers expressed their need for forecasting tools to estimate optimal fertilization amount and timing.

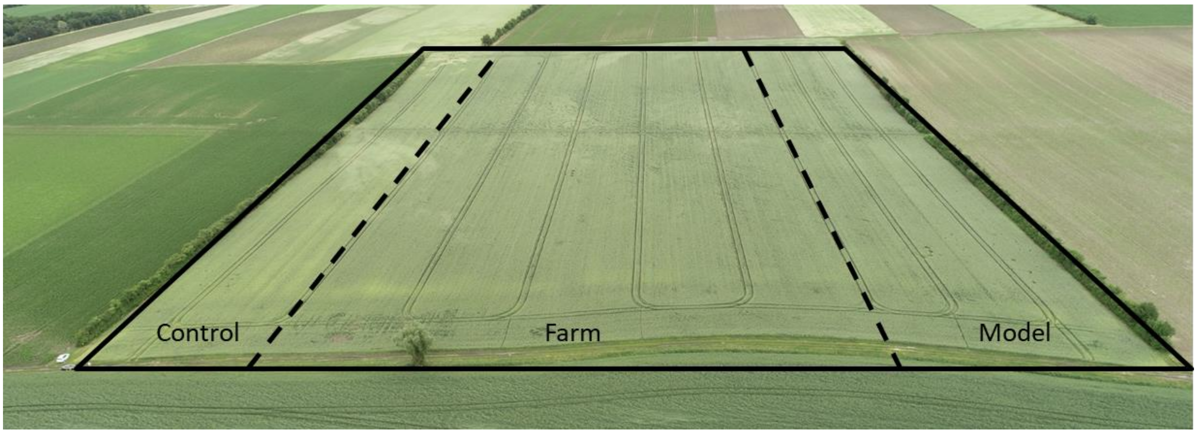

Figure 3: Example of one experimental field divided into “Farm” and “Model” strips for testing the applicability of the integrated nitrogen management approach. The “Control” in this example was a non-fertilized strip, maintained to also account for nitrogen mineralization at the location.

Manschadi, A. M., Eitzinger, J., Breisch, M., Fuchs, W., Neubauer, T., & Soltani, A. (2021). Full Parameterisation Matters for the Best Performance of Crop Models: Inter-comparison of a Simple and a Detailed Maize Model. *International Journal of Plant Production, 15*(1), 61-78. doi:10.1007/s42106-020-00116-2

Manschadi, A. M., & Soltani, A. (2021). Variation in traits contributing to improved use of nitrogen in wheat: Implications for genotype by environment interaction. *Field Crops Research, 270*. doi:10.1016/j.fcr.2021.108211

Palka, M., Manschadi, A. M., Koppensteiner, L., Neubauer, T., & Fitzgerald, G. J. (2021). Evaluating the performance of the CCCI-CNI index for estimating N status of winter wheat. *European Journal of Agronomy, 130*. doi:10.1016/j.eja.2021.126346

Soltani, A., & Sinclair, T. R. (2012). *Modeling physiology of crop development, growth and yield*. CABI International, UK.