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New technologies as a basis to improve N fertilization

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Efficient nitrogen (N) management contributes to sustainable agriculture. Innovative tools and techniques are needed to increase plant productivity without negatively impacting soil quality and the environment, with e.g. N losses into waters and atmosphere. In the Horizon 2020 project FATIMA, we used Sentinel-2 satellite data to examine test fields in the Austrian pilot area "Marchfeld", east of Vienna. In this intensively used agricultural region efficient, site-specific N fertilization strategies that take into account the actual spatial variability of soil properties and plant growth are needed. To test and validate the impact of variable rate fertilization, we conducted large-scale field trials with winter wheat and different mineral N-fertilizer stages (N0: 0 kg N ha-1; N1: 60 kg N ha-1; N2: 120 kg N ha-1; N3: 180 kg N ha-1 as calcium ammonium nitrate) in 2016 and 2017. The correlation between winter wheat yields and the leaf area index (LAI) derived from both ground-based measurements and satellite-based models was significantly positive.
The correlations between ground-based LAI and satellite-derived LAI showed a significant positive relationship of R2 = 0.83 (2016) and R2 = 0.93 (2017) for all measurements, which indicates the high potential of remote sensing data in agriculture. With the launch of the Copernicus Sentinel-2 mission, the accessibility and availability of satellite data has improved. The images provided by satellite platforms give a synoptic overview of the land surface, allowing a monitoring of plant growth and potential productivity in high resolution (10m x 10m).
As a further result of the FATIMA project, potential productivity maps based on Sentinel-2 images were created, which depict the conditions of the soil and thus enable site-specific N fertilization. These new technologies may not only contribute to yield optimization, but also help to minimize N losses into groundwater and air.

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