Refined N-Fertilization of Winter Wheat: A model supported approach

1. Objectives

Nitrate (N) leaching into groundwater from agricultural sources has been identified as a major environmental issue within the European Union. Over-restrictive N fertilization is economically risky since it can cause reduced yield and baking quality. Hence, there is a need to adapted N fertilization planning to year-specific N demand of the crop. As the site-specific averages for yield and soil N supply are accessible to most producers, inter-annual variability of these values is the actual target of N fertilization planning.

In this context, we want to portrait a model supported automated online recommendation tool for N fertilization of winter wheat (*Triticum aestivum L.*). The tool is implemented at the ISIP internet platform (www.isip.de).

2. Materials and methods

The tool is based on the balance sheet method, modified by the mechanistic crop-soil model *HumeWheat* (Ratjen and Kage, 2015). *HumeWheat* is used for the year-specific adjustment certain balance-sheet components. For this purpose actual and historical weather records are used for the constitution of a relative prognosis via projections and reference calculations (Ratjen and Kage, 2015).

Field trails were carried out in order to evaluate the tool at 5 locations in Lower Saxony over the last 5 years.

A second evaluation, based on N response curves derived from N rate experiments. The dataset contained 72 collective seasons and was carried out at seven federal states across Germany. For both evaluations, the available weather data was limited until end of May (last N application). The site specific N rate, recommended by the respective provincial authorities, served as a reference for both evaluations. The calculations of the reference rates considered mineral soil N content at spring (0-

90cm), yield level (average yield over the last 5 years), preceding crop and expected protein content. In addition, the online tool uses soil texture, soil value (“Bodenwertzahl”), sowing date and a few input parameters which are available to every farmer.

The evaluation covers yield and grain protein content, N rate and N balance surplus (difference between the amount of fertilized N and grain N export). For the monetary evaluation, net revenue was calculated for different wheat at N price scenarios.

2. Results and discussion

Compared to the reference, the online tools achieved a slightly enhanced average net revenue at Lower Saxony (+ 66€ per ha). Regarding the evaluation via N response curves, the average net revenue was identically to the reference. The same applied to the grain yields and protein contents. However at the first evaluation the average N input could be reduced by 6 kg N/ha. At the second evaluation the N input could be reduced by 8 kg N/ha, on average. The standard derivation of the N balance surplus was smaller compared to the reference (29/ 37 kg N/ha). Although the results are encouraging, the concept still needs further improvement and refining with particular regard to N form, gaseous N losses, tillage, and environmental objectives.

4. Conclusions.

The combination of balance-sheet approach and crop-soil model allows the identification of year specific variation in fertilizer N demand. Therefore, this method can be seen as an additional important constituent in attaining a more effective N fertilization recommendation. The availability accurate local weather data

References

Ratjen, A.M., Kage, H., 2015. Forecasting yield via reference- and scenario calculations. Comput. Electron. Agric. 114, 212 – 220. doi:http://dx.doi.org/10.1016/j.compag.2015.03.020