Precise Nitrogen – Increase nitrogen efficiency in crop production

Dennis Löwe

Julius Kühn Institute (JKI) – Federal Research Centre for Cultivated Plants, Institute for Crop and Soil Science, Braunschweig

E-mail of corresponding author: dennis.loewe@julius-kuehn.de

Nitrogen is considered the macronutrient that is most limiting for plant growth [1]. Due to this property, nitrogen is often distributed on farmers' farmland via synthetic fertilizers to achieve an optimized harvest. Since both over-fertilisation and under-fertilisation with nitrogen has negative consequences on the development and the final harvest and thus on the farmer's yield, fertilisation tailored to the individual crop is becoming increasingly important and desirable. The disadvantages of over- or under-fertilisation includes, for example, an increased susceptibility to diseases [2] or an increased risk of leaching into the environment.

In a global and national context, over-fertilisation with nitrogen fertilisers is a particular problem. Overall, since the 1960s, the global nitrogen use efficiency has fallen from approx. 68% to approx. 47% [3]. Thus today, half of the added nitrogen in the fertilizer is not converted into the plant product but would be lost in the environment.

In order to counteract the trend of non-plant and field-specific fertilization, a plant nitrogen estimation is to be carried out using modern remote sensing methods in order to give the farmer the possibility of site-specific fertilization.

Unlike traditional laboratory methods, remotely sensed plant analyses are non-destructive and can cover a vast area in a short time. A site-specific determination of the nutrient requirements of arable crops can lead to improved yields, lower fertilizer costs and a reduced risk of leaching into nature. Since the nutrient requirements of plants are strongly related to soil conditions, additional soil monitoring is useful.

In the project Precise Nitrogen, based on remote sensing data (mainly UAV and satellite) and a soil sensor network, strip trials are carried out on experimental fields in the Braunschweig area. In addition to fertilizer optimization, one of the main aims of the project is to make precision farming methods easily accessible to farmers and to optimize them through practical tips.

First interim results of the first year of the trial show problems with the soil sensory system and the implementation of the application maps. Initial evaluations of investigated fertilizer variants indicate the highest N efficiency with a combination of soil sensors and remote sensing data. A precise comparison of yields per fertilizers variant will allow further conclusions to be drawn once the harvest data is received.

In the trial year 2022, further in-situ measurements will be carried out to validate and optimize the remote sensing measurements.