

Protocol on how to safe water & fertilizers in horticulture

Cereals: Winter Wheat

1. Reduction of nutrient input

1.1 By the use of tools

- Which sensors?

Non-destructive optical sensors that detect indicators of nutrient stress such as an early decrease in chlorophyll and increase in secondary stress metabolites (phenolics, anthocyanins), e.g. Greenseeker (fast, cheap and easy to use). These sensors can give a good indication of the presence of stress if slight color differences become visible. If there is nothing visually noticeable, it is recommended to combine the sensors with isotope analyzes or other destructive laboratory analyzes.

- How to use non-destructive optical sensors?

- Perform every 1-2 weeks scattered measurements on a constant distance above the crop, e.g. with the Greenseeker. Remind yourself that the pigment content doesn't change immediately when a plant experiences stress.
- Compare indices of plants in nutrient stress with plants in optimal conditions to verify whether there is a shift in the pigment composition (less chlorophyll and more secondary metabolites) due to the presence of stress.

➔ On the Bio4safe project page (<https://bio4safe.eu/sensors>), you can find information leaflets about different non-destructive optical sensors

1.2 By combining tools and biostimulants

Non-destructive optical sensors can be used in combination with biostimulants, which can influence the nutrient use efficiency of plants. You can find the most suitable biostimulant for your specific case in our online Bio4safe database.

- How to use Bio4safe-database?

- Surf to <https://bio4safe.eu/>
- Click on the button '**Crop group**' and select '**Cereals**'
- If you want, you can further filter your search result for the desired effect. (E.g. 'Increased nitrogen 'N' use efficiency'; 'Increased phosphorous 'P' use efficiency';...)
- Click on one of the listed products you are interested in.



Case study: Winter wheat (*Triticum aestivum* var. 'Benchmark')

1. Reduction in fertilizers

When large amounts of nutrients are present in the soil, fertilizer application can be reduced. A good and structured sampling with analysis of the soil is therefore very important to keep a finger on the pulse.

This trial was performed on a sandy clay soil (45% clay parts; 1.7% organic matter). **About 108 kg N/ha is dosed in practice, but on a clay soil in total 135 kg N/ha fertilization is given in two doses post emergence.** To create stress conditions, 25 % less N was given. There was **no significant effect of the reduced nitrogen gift on yield** (ton/ha) (-0.7%), the **hectoliter weight** (-0.1%) and no difference in **thousand grain weight** (+0.6%) compared to the optimal control. A 25% reduction in fertilizer use was possible in this trial without loss of production. The tested biostimulants didn't have an additional value.

The use of soil moisture sensors is recommended. Moisture is necessary for fertilizers to work optimally.