Protocol on how to safe water & fertilizers in horticulture

Fruit vegetable crops

1. Reduction of water input

1.1 By the use of tools

- Which sensors?

Soil sensors such as tensiometers (real-time measurements, cheap, easy to use) measure the relative water content of soil/substrate. Absolute values of the water content depend on the soil type. These sensors can be used to monitor the effect of water reduction on the soil/substrate and the plant and can thus significantly reduce the amount of water use. More advanced plant-based tools are also available, e.g. dendrometers (measurement of stem diameter variation), sapflow sensors,…, but advice and help of researchers or other external parties is recommended.

- How to use soil sensors?

- Place sensors scattered in the greenhouse, tunnel, field at different depths at the edge and in the middle of the area. Tensiometers are coupled with a datalogger, the characteristics of the soil are continuously monitored.
- Follow up the evolution of the relative water content at the different depths and increase irrigation when soil water content decreased between 2 consecutive descending depths (e.g. between -30 cm and -40 cm) or reduce irrigation when soil water content increases at these depths.

➔ On the Bio4safe-project page (https://bio4safe.eu/sensors), you can find information leaflets about different types of soil sensors (WET-sensor), dendrometers (LVDT) and sapflow sensors (Exoskin).

1.2 By combining tools and biostimulants

Soil sensors and the more advanced tools can be used in combination with biostimulants, which can influence plant tolerance against drought stress. You can find the most suitable biostimulant for your case in our online Bio4safe database.

- How to use Bio4safe-database?

- Surf to https://bio4safe.eu/
- Click on the button '**Crop group**' and select '**Fruit vegetable crops'**
- If you want, you can further filter your search result for the desired effect. (E.g. 'Increased drought stress tolerance)
- Click on one of the listed products you are interested in for more detailed information.

2. Reduction of nutrient input

2.1 By the use of tools

- Which sensors?

Non-destructive optical sensors that pick up indicators of nutrient stress such as early decrease in chlorophyll and increase in secondary stress metabolites (phenolics, anthocyanins), e.g. Dualex Scientific (fast, cheap and easy to use, but control needed) or increase in chlorophyll fluorescence e.g. Pocket PEA (fast, easy to use software, cheap). These sensors can give a good indication of the presence of stress if slight visual color differences become visible (more severe stress). If there is nothing noticeable visually, it is recommended to combine the sensors with isotope analyzes or other destructive laboratory analyzes.

- How to use non-destructive optical sensors?

- Perform scattered measurements on the youngest, fully developed leaf of representative plants every 1 a 2 weeks. Remind yourself that the pigment content doesn't change quickly when a plant experiences stress.
- Compare indices of plant in nutrient stress with plant 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.

2.2 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 situation in our online Bio4safe database.

- How to use Bio4safe-database?

- Surf to https://bio4safe.eu/
- Click on the button '**Crop group**' and select '**Fruit vegetable crop'**
- 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: Tomato (*Lycopersicum esculentum var. Paola*)

1. Reduction in irrigation

A **reduction of 20 % in irrigation** given by a dripping system (**first growth stage: 1920 mL/day/m² instead of 2400 mL/day/m²; second growth stage: 2560 mL/day/m² instead of 3200 mL/day/m²; with 14 plants on 4.4 m²**) is possible without affecting fruit quantity or quality. Some biostimulants seems to improve the fruit caliber, even in stress conditions but no statistical differences.