Effect of red, blue and white light on the growth, edible quality and yield of lettuce produced in urban hydroponic system

Summary: Urban agriculture (UA) is an important part of the «Smart City» concept. Urban food production, especially vegetables are of great potential in the future to reduce the burden of limited arable land. UA is of interest for all stakeholder groups including academia, private industry, policy makers and individual citizens with UN SDGs and circular economy as the corner stones. To achieve a sustainable development in urban agriculture, research and innovation efforts are needed. Investigation of the effect of various LED lights (red, blue and white) on the growth, edible quality and yield of lettuce using NIBIO's hydroponic vegetable production facility is the main goal of this MSc project. This thesis is a part of the ongoing EU-China H2020 SiEuGreen project (more info here). **The overall objective** of this MSc thesis is to reveal the optimal spectra combinations resulting in better taste and higher yield lettuce under well-controlled conditions.

Treatments:

1. Different light combinations: Light sources: Blue (450 nm), Green (520 nm), Red (600 nm); total photosynthetic photon flux density (PPFD) of 200 µmolm^{-2} s^{-1} with different ratios (R:B = 9:1, 8:2, 7:3; R:G:B = 9:1:0, 8:1:1, 7:1:2) (*Son, K.H. and Oh, M.M., 2015. Growth, photosynthetic and antioxidant parameters of two lettuce cultivars as affected by red, green, and blue light-emitting diodes. Horticulture, Environment, and Biotechnology, 56(5), pp.639-653. Zhao, Jiangsan; Kechasov, Dmitry; Rewald, Boris; Bodner, Gernot; Verheul, Michel; Clarke, Nicholas; Clarke, Jihong Liu (2020) Deep Learning in Hyperspectral Image Reconstruction from Single RGB images—A Case Study on Tomato Quality Parameters. Remote Sensing doi: 10.3390/rs12193258*).

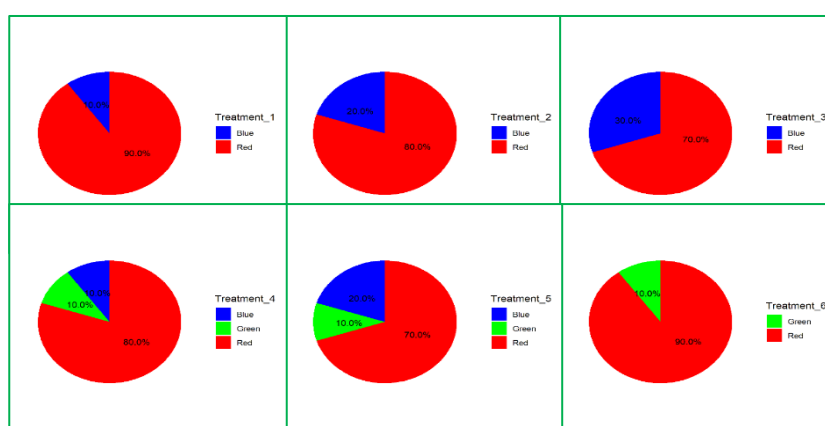   Light density of RGB are measured with a LI-COR light meter (model LI-250).

Figure 1. Six different light compositions in the experiment.

2. Different intermittent light exposure: continuous light (24h), intermittent Light/Dark cycle (1, 2), i.e. 16/8h; 8/4h

Figure 2. Two different intermittent light cycles in the experiment.

Measurements: 1) Size, the projected leaf area will be measured by deep learning or computer vision methods. 2) Chlorophyll content will be estimated through hyperspectral image reconstruction, calculating NDVI. 3) The fresh weight, including both shoot and root, of the lettuce: dried and weighed in the lab. 4) Sweetness: evaluated by a number of random consumers.

Subject area
   LED light, soilless hydroponics, urban food production, lettuce, food quality
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   Either Norwegian or English. Student can choose
Bachelor or Master thesis
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