

Use of multiple sensors to determine multiple, co-occurring wheat stressors

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Simultaneous indirect measurement of water status, nitrogen deficiency, leaf diseases, and weed patches in the field may allow us to correct N application rates according to the true needs of the crop plants. For comprehensive assessment of a cropping system multi-sensory data collection and data fusion are the emerging technologies.

This study represents the final stage of a four-year research project (Multisens; www.bioforsk.no/multisens), exploring the use of indirect sensor measurements for determination of water and nitrogen status, and disease and weed infestations in wheat. We present the results from field trials, aiming to assess methods for determining the co-occurring stressors.

The field trial included different combinations of stressors: N-demand, sub-optimal water status, weeds and leaf diseases. We used sensors for indirect canopy measurements (spectroradiometers, thermal camera, fluorometer and an RGB camera), which were operated partly from a robot and partly from a drone. The sensor measurements were conducted at various growth stages with subsequent reference plant status registrations. A selection of data pre-processing, and multivariate analysis methods were used.

Our study gives a novel demonstration on how the combination of multiple sensors may provide information needed to separate and identify various crop stressors under field conditions.