GRASSLAND QUALITY AND YIELD ESTIMATION USING DRONES IN FINLAND – THE FRAMEWORK AND FIRST RESULTS OF THE DRONE KNOWLEDGE PROJECT

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Introduction

Grass swards are harvested three times in season in Finland, and fertilizer is applied similarly three times – once for each harvest. Timely information of the yield and quality would be highly valuable for making decisions on harvesting time, and rate of fertilizer application. The quality and quantity in grass sward changes rapidly in Nordic long day conditions particularly in Spring growth.

Framework for data production

In order to generate variation into the study swards, we established in summer 2017 experiments using nitrogen fertilizer application rates from 0 to 150 kg N/ha, and used four harvesting dates in the Spring harvest. For the second harvest a similar experiment was established with three harvest dates. Reference measurements included grass height, fresh and dry matter (DM) yield, DM percentage, and feeding quality characteristics by NIRS method at the Valio laboratory. Plot size was 1,5 m by 3 m. Larger plots with smaller number of treatments were used to facilitate comparisons to spectral data obtained by satellites. Drone based hyperspectral imaging was carried out by the FGI using the miniature hyperspectral camera based on Fabry-Pérot interferometry as well as using high spatial resolution photogrammetric cameras. Additionally, the novel VTT developed prototype hyperspectral imaging system functioning in spectral range of 400 nm to 2150 nm was used for the measurements in the 2nd harvest.

Preliminary results and outlook

In the spring growth the mean fresh yield in the six fertilizer application treatments (four replicates) ranged from 1 320 to 24 710 kg/ha, and DM yield ranged from 490 to 5 600 kg DM/ha according to nitrogen application rate and harvest date. In the second harvest (growth from 19.6. to 25.7., 1.8. and finally to 15.8.) the fresh yield ranged from 3 020 to 47 410 kg/ha, and DM yield ranged from 750 to 9 690 kg DM/ha. Swards were timothy-meadow fescues mixtures dominated by timothy. In order to produce spectral library of all main forage species we made additional spectral measurements at the Boreal Plant Breeding Ltd grass variety trials.

We will obtain the feeding quality data of the material later this year, and process the obtained data. Yield estimation field work will continue in summer 2018. Aim is to produce a service for farmers for grass sward yield and quality estimation, specifying variation within a field, thereby helping in timing of harvest, and determining fertilizer application rates prior and/or after harvest and within field.

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Fig. 1. Team is starting hyperspectral data collection prior to 3rd harvest date at Jokioinen test sward on 19th of June 2017. Previous reference harvest was taken 4 days earlier.

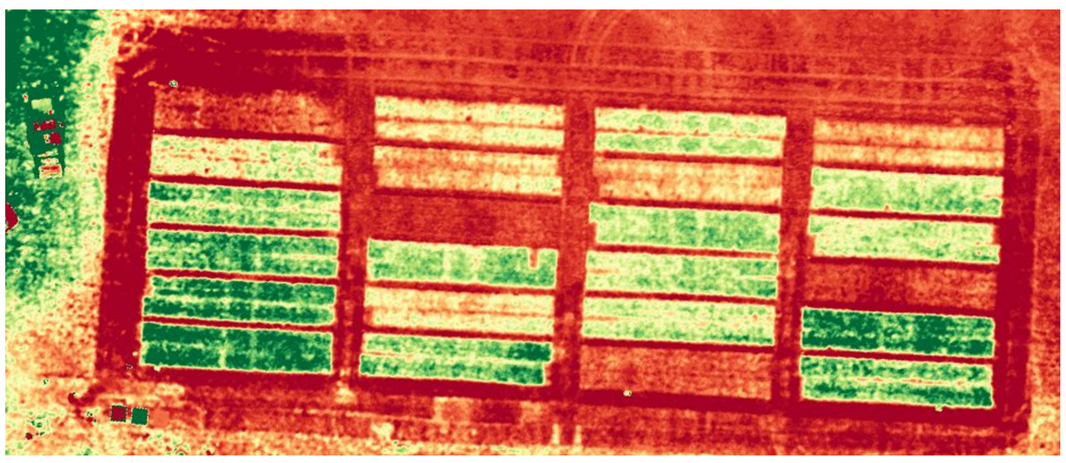

Fig. 2. Fertilizer application rates were applied to 3 m by 13 m plots, and harvest at different dates were taken diagonally to fertilizer application rates (1,5 m x 3 m) . Four replicates were used. RGB picture of the test field prior to first harvest on 6.6.2017.

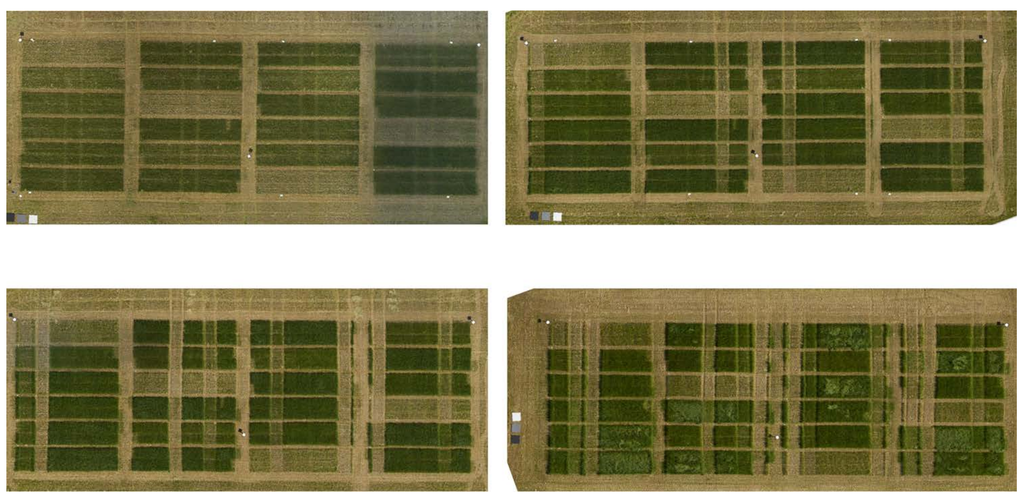

Fig. 3. Ortomosaics of the trial site prior to reference harvests on 6.6., 15.6., 19.6. and 28.6.2017 in Jokioinen. On the last date lodging of the most heavily fertilized plots is visible.

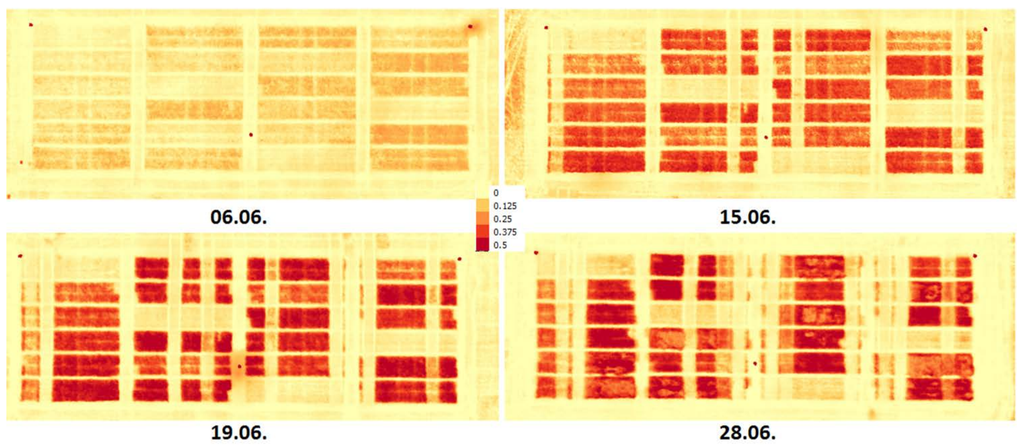

Fig. 4. UAV grass sward height (m) on 6.6., 15.6., 19.6. and 28.6.2017 in Jokioinen.

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