GrassQ — precision grass measurement for the future

Darren Murphy and Bernadette O'Brien
Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Summary

- Optimising the measurement of grass quantity and quality is integral to increasing the efficiency of pasture utilisation.
- A precision grass measurement protocol has been prototyped for the rising plate meter (RPM) that involves sampling fields in a random stratified manner at a rate of 25–50 samples/ha.
- New sensor technologies are being developed along with an online decision support system to aid the onset of real-time precision grass measurement.

Introduction

GrassQ is a holistic grassland decision support system (DSS) that encapsulates a range of measurement technologies to provide yield and quality data to a cloud based platform, which can provide users with real time management information in the field. Novel systems of measuring grass yield and quality are currently under development at Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork. These systems include both ground based and aerial techniques, referred to as remote sensing. The prototype GrassQ DSS is designed to process data uploaded from all proposed measurement systems. An infographic outlining the GrassQ concept can be seen in Figure 1 below.

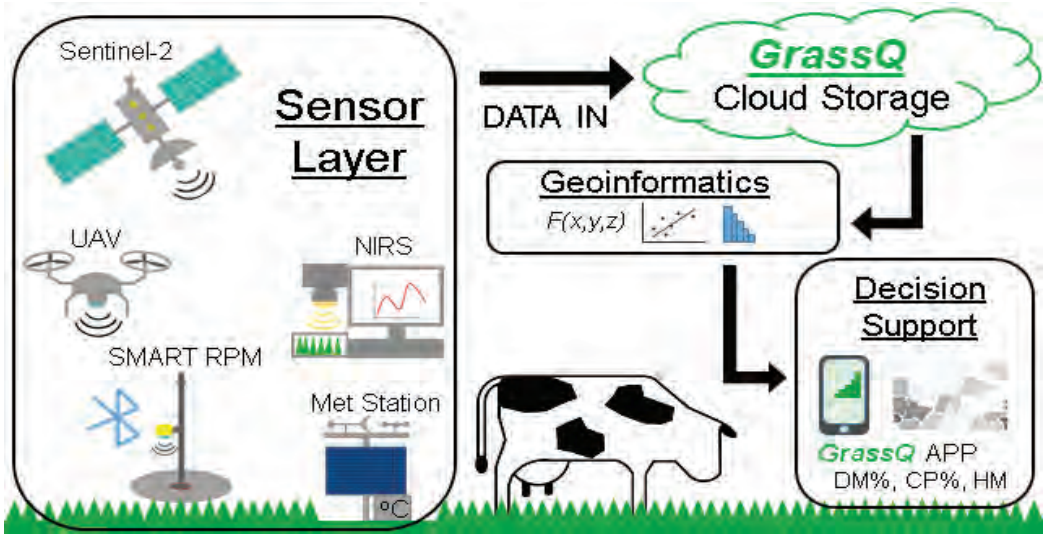

Figure 1. *Infographic of the GrassQ cloud based decision support system*

Moorepark trial work

Over the 2017 and 2018 grazing seasons, ground based measurements were recorded using a smart RPM and lab based near infrared spectroscopy (NIRS) on Moorepark trial plots and paddocks. Remote sensing was carried out using an unmanned aerial vehicle (UAV), and

data from the European Union's Sentinel-2 satellite (S2) was also collected. Measurement parameters included compressed sward height (CSH; mm), herbage mass (HM; kgDM/ha), dry matter (DM; g/kg) and crude protein (CP; g/kg). Reference measurements were carried out at Moorepark's Grassland Laboratory and all sample locations were geo-tagged to enable spatial mapping of all parameters.

Optimising the accuracy of the rising plate meter

The efficiency and accuracy of the RPM was evaluated as part of this study, with the aim of creating a precision sampling protocol to optimise how farmers measure their grass. Paddocks were blanket sampled at a rate of 320 plonks/ha in a random stratified manner to determine 'true mean' CSH. A simulation algorithm was developed to investigate the relationship between sampling rate and average height prediction error to determine optimum sampling rates for the RPM, which would minimise both sampling error and effort. Optimum sampling rates were found to be in the region of 25–50 plonks/ha, which results in a prediction error of less than 5%. Based on these findings, a precision sampling labour utilisation tool, that will prompt farmers on how best to measure grass using real-time GPS data, is being developed to be built into GrassQ.

Remote sensing and NIRS

Preliminary findings for NIRS indicate that fresh grass quality can be predicted with acceptable accuracy ($R^2 = 0.93$, $R^2 = 0.89$ for DM and CP) within a time frame of three to five minutes. Initial results for remote sensing are promising with HM prediction models for UAV ($R^2 > 0.8$) and Satellite ($R^2 > 0.7$) based sensors achieving reasonable levels of accuracy, although data from S2 was disrupted by cloud cover on numerous sampling dates. All sensing data along with ground based measurements will be uploaded onto GrassQ for processing and storage.

Conclusions

The prototype GrassQ DSS is complete and can be accessed at www.grassq.com. The DSS allows users to download and view interactive maps that illustrate the spatial variation of grass quantity and quality throughout their grazing platform. Furthermore, a prototype smartphone app has been developed so that GrassQ can be accessed by users in the field. The final stages of this project which is due for completion in 2019, will focus on the comparison and validation of all measurement systems. GrassQ will be a concept model for future updates to PastureBase Ireland.