POTENTIAL FOR SENSOR TECHNOLOGIES TO ESTIMATE DRY MATTER YIELD IN PASTURE CULTIVAR EVALUATIONS

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Grazed perennial ryegrass-based pasture is an important component of diets of dairy cows in south-eastern Australia with farmers having to make decisions on which cultivar is most profitable for their business. Plot trials are often used to estimate the relative merit of new pasture cultivars and are conducted in several ways. The most accurate of these is to cut, weigh and oven-dry a sample from a known area and scale to kilograms of dry matter per hectare (kg DM/ha). However, this is destructive and labour-intensive. Ground-based and aerial sensors offer potential to automate and reduce measurement time. Active optical sensor technologies, such as Greenseeker^{TM}, measure reflectance of near infrared and visible red light and calculate vegetation indices such as the normalised difference vegetation index (NDVI). The NDVI has been shown to be correlated to pasture biomass, particularly when combined with height due to saturation of NDVI at pasture masses >2,000 kg DM/ha.

A short-term study comparing NDVI and height measurements to pasture DM yield was conducted on an existing cultivar evaluation trial which tested 31 perennial ryegrass cultivars in 4 replicates. On 6 occasions between August and May, plots (5.0x0.8m) were measured with a Greenseeker^{TM} to obtain NDVI values and a rising plate meter to measure height prior to destructive biomass assessment. The destructive measurement involved mowing a 5.0x0.5m strip to a simulated grazing height of 5cm, weighing clippings and sampling for DM determination. Average NDVI and height measurements (NDVI x height) considered as a metric for each cultivar were compared to the average mown DM yield (DMY, kg DM/ha). This metric was significantly ($P<0.05$) correlated to DMY in each harvest. The strength of correlations varied from moderate ($r=0.43$) in August (winter) to strong ($r>0.80$) in the 3 harvests in spring and autumn. In August, water lying in the paddock may have affected the NDVI readings. The harvests with the highest correlation occurred when pastures were actively growing. Interestingly, in two harvests (December and May), NDVI was more highly correlated to DMY than when NDVI was combined with height. In contrast to all other harvests which had moderate to strong correlation between height and DMY, there was no correlation between height and DMY in December ($r=0.02$) suggesting an issue with the reliability of measuring compressed height on summer pastures. In May, the correlation between NDVI and DMY ($r=0.94$) was stronger than between DMY and height ($r=0.81$) due to favourable conditions for accurate measurement of NDVI (actively growing pasture and average DMY for each cultivar <1000 kg DM/ha). The lack of correlation in December may be addressed using technology such as ultrasonic sensors to measure height.

When all harvests were combined into a simple linear regression, there was a significant ($P<0.001$) correlation between DMY and (NDVI x height), with 87.5% of variation in DMY accounted for. Further work, assessing the adequacy of the regression model, and cross-validation analysis to test the ability to predict DMY from NDVI and height across seasons is required prior to scaling up to a paddock level.

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