Estimating farm pasture cover using a limited number of paddocks

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**ABSTRACT**

The amount and rate of change of pasture availability on dairy farms, often referred to as farm pasture cover, expressed as kg DM/ha, is a key metric for making daily and seasonal management decisions. However, regular farm walks to determine farm pasture cover are conservatively estimated as occurring on only 10% of Tasmanian dairy farms with, “lack of time” quoted by farmers as the main reason for this not occurring. For a given dairy farm implementing rotational grazing, a gradient in pasture biomass between paddocks will exist. A review of historical farm walk data from the Tasmanian Dairy Demonstration Farm and two commercial farms, showed that determining the gradient between the highest three and lowest three paddocks provided an adequate correlation with total farm pasture cover. Based on this historical analysis and feedback from farmer groups, a pasture farm cover estimator was developed. The tool has three simple viewing pages: 1. a data entry page where farm walk data is entered and a farm pasture cover estimate is provided; 2. a paddock management page where the individual paddocks are displayed and can be removed, added or edited; and 3. an historical page where data for each individual paddock or farm can be stored and viewed. This paper provides a comprehensive description of the farm pasture cover estimator and the underpinning historical analysis.

**Keywords:** average pasture cover; farm pasture cover estimator; historical analysis.

**INTRODUCTION**

For pasture based dairy systems, the consumption of home-grown herbage is a key contributor to farm profitability (Fulkerson & Doyle, 2001). Improving grazing management has long been viewed as critical for lifting on farm pasture production and consumption. In order to make the best pasture management decisions, there is a requirement to have an accurate assessment of feed availability at any point in time. Determining average pasture cover (APC) is one of the key on-farm assessments to achieve this. Regularly assessing the APC allows for the early identification of forage surpluses and deficits, which provide farmers with the knowledge to develop accurate feed budgets, plan feed requirements and make better overall grazing management decisions. Although there are a number of forage assessment techniques currently available to farmers for assessing pasture cover on farm, it is estimated that only 10% of Tasmanian dairy farms regularly measure APC, with “lack of time” quoted by farmers as the main reason for this not occurring (pers. comm.).

Piggot (1986) recognised the impracticality of measuring or estimating the APC of every paddock on the farm, and introduced the concept of taking limited assessments of the highest and lowest yielding paddocks. Piggot (1986) concluded that in the mid and lower Northland region of New Zealand farm pasture cover estimates can be gained by averaging the estimates from paired groups of the highest and lowest yielding paddocks. On most dairy farms each paddock is likely to constitute between 1 and 5% of the total farm area (20 to 100 paddocks), and under a rotational grazing system there will exist a linear relationship (wedge) between the paddocks with the highest and lowest biomasses. The current study hypothesised that there is an \(x\) number of paired paddocks, defined as the highest and lowest biomass paddocks, required to determine the slope of this line (wedge), thus allowing for an adequate assessment of APC at any given point in time. Reducing the number of paddocks required to provide an adequate assessment of APC would significantly reduce the time needed for assessments and therefore increase the likelihood of dairy farmers making regular assessments. In addition, assessing the highest and lowest biomass paddocks, which would be the paddocks next due for grazing and the most recently grazed paddocks would provide an adequate estimate of pre grazing biomass and post grazing residuals. This study also aimed to develop an APC estimation tool for farmers to use.

**MATERIALS AND METHODS**

Individual paddock biomass data was collected and collated over a 12 month period from two commercial farms, sites 1 and 2. Historical farm pasture cover data was also collected and collated over 24 months from the Tasmanian Dairy Demonstration Farm (TDDF), site 3. Details of each site are provided in Table 1.
At each site, all paddocks on the milking platform were walked either weekly or fortnightly and an assessment made of pasture biomass in each paddock using a calibrated rising plate meter (Earle & McGowan, 1979). The same person made these assessments at Sites 1 and 2, and a second person made the assessments at Site 3, for the entirety of the measurement period. Pasture biomass assessments were collated and sorted, based on pasture biomass (kg DM/ha) for each paddock by each date of assessment. Pasture biomass for each paddock was multiplied by the paddock area and summed to give total farm biomass (kg DM/farm). The APC (kg DM/ha) for the farm was then calculated by dividing total farm biomass by the farm area. The highest and lowest biomass paddocks were used to calculate the APC in the same method as above. This assessment was repeated using the two highest and two lowest biomass paddocks, repeating this step until the 10 highest and 10 lowest biomass paddocks were assessed. A correlation between “actual” farm APC using all paddocks and the 1 to 10 lowest and 1 to 10 highest biomass paddocks was undertaken for a 12 month period for each site.

**RESULTS**

Using the data collated over a 12 month period, there was a greater than 0.85 correlation between actual farm APC using all paddocks and the estimated farm APC using only the highest three and lowest three biomass paddocks for each site. As the number of paired paddocks (highest and lowest) assessed increased, there was an increase in the correlation between the estimated and actual farm APC. This relationship was best explained using a singular rectangular hyperbola and is shown in Figure 1. The differing correlation lines in Figure 1 highlight the variation between farms, paddock size and the requirement for assessing a minimum number (> 6) paddocks to ensure a satisfactory correlation (> 0.85) between the estimated farm average pasture cover and the calculated farm APC using all paddocks.

Estimated farm APC using the highest three and lowest three biomass paddocks was graphed over a 12 month period against actual farm APC (Figure 2). The correlation between the estimated and actual farm APC was 0.92, 0.95, 0.93 and 0.86 for site 1, 2 and 3 (July 07 to July 08, July 08 to July 09 for site 3), respectively.

**DISCUSSION**

At site 1, farm APC was generally overestimated when only the highest three and lowest three biomass paddocks were used, with the largest differentiation between estimated and actual APC occurring during early spring. At site 2, there was good agreement between the estimated and actual APC during winter, early spring and autumn when the highest three and lowest three biomass paddocks were used, but during late spring and summer there was a considerable overestimation of APC. At site 3, there was generally strong agreement over both years between estimated and actual APC, with a tendency to overestimate APC during the late spring to early summer period and in the second year (2008/09) and a tendency to underestimate APC during late summer and autumn. Although using the highest three and lowest three biomass paddocks can be viewed as an acceptable surrogate to assessing all paddocks, with correlations of 0.85 and higher, there is less confidence in the estimation of APC during spring and summer using this method. Early identification of the spring surplus is considered to be a key step towards improving pasture management and a full farm assessment of APC is therefore considered to be most appropriate method during this time.
FIGURE 1: Correlation between the estimated farm average pasture cover (APC) using an increasing number of paired paddocks (highest and lowest biomass) and the calculated farm APC using all paddocks at sites 1 (a), 2 (b) and 3 (c-2007/08 and d-2008/09)

Early identification of a feed deficit is also quite critical to successful pasture management and periods where a feed deficit is likely to occur a full assessment of APC would be recommended in preference to assessing a reduced number of paddocks.

Based on the historical analysis presented in this paper and feedback from farmer discussion groups, the farm pasture cover estimator was developed to allow farmers to enter their farm walk readings and receive an estimate of APC without having to measure each paddock on the farm. One of the three viewing pages of the tool is shown in Plate 1; a data entry/pasture estimator page where farm walk data is entered and the calculation of APC is displayed. There is also a paddock management page, where the individual paddock readings are displayed and can be removed, added or edited, and a history viewing page where the data collated from each farm walk (individual paddock or farm pasture cover history) can be stored, retrieved and viewed. The above tool is being evaluated for use by the extension staff associated with the Tasmanian Institute of Agricultural Research Dairy Centre.
FIGURE 2: Seasonal changes in farm pasture cover (kg DM/ha) at sites 1 (a), 2 (b) and 3 (c and d) as estimated using the top three and bottom three paddocks (dotted line) and the actual farm pasture cover calculated from all paddocks (solid line).

PLATE 1: A screenshot of the data entry page of the farm pasture cover estimator.
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REFERENCES

