Research and extension services

UNDERSTANDING GRAZING DECISIONS ON TASMANIAN DAIRY FARMS

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Abstract

Improving pasture utilisation on Tasmanian dairy farms is a key focus of research, development and extension programs, through increasing farmer awareness, knowledge and use of best practice pasture management practices. Recommended practices include using pasture management tools to provide objective information about pasture quantity, increasing control, flexibility and accuracy around pasture management decisions. A survey of 162 Tasmanian dairy farmers found large variation in tool use, and investigated the relationship between current tool use and key grazing management decisions. Key decisions include assessing pasture quantity (pre-grazing cover), grazing intensity (post-grazing residual), determining rotation length, and determining the level of non-pasture, supplementary feed required. There was a significant relationship between currently measuring pasture and using that information to assess pre and post-grazing cover, and decisions on rotation length ($P<0.05$). The relationship between currently measuring pasture and using that information to make decisions on supplement feeding was not significant. Using pasture measurement data can assist in increased accuracy in supplement allocation, with inaccurate allocation resulting in potential over-feeding, substitution of supplement for pasture, reduced pasture regrowth, quality and utilisation. Extension can increase farmer knowledge and understanding of how pasture measurement data can be used to make more informed grazing decisions, and subsequent increase pasture utilization, milk production and farm profitability.

Keywords: Extension, grazing management decisions, pasture management, supplement feeding

Introduction

Improving pasture management has been a focus of research, development and extension (RD&E) in the Tasmanian dairy industry. Optimising pasture management and the subsequent increase in pasture utilisation are positively associated with dairy farm efficiency and profitability (Dillon et al. 2005; Lane 2014).

RD&E programs have aimed to increase pasture utilisation through increasing awareness, knowledge and use of best practice pasture management principles and practices. Extension programs providing an ongoing, facilitative learning process have been more effective than single training sessions in adoption of knowledge intensive practices, as they encourage farmers to learn about recommended practices while working collaboratively to address challenges and adapt practices to their farm management (Ingram 2008; Turner et al. 2017). Recommended pasture management practices include use of pasture management tools and technologies that have been developed to assist decision making, such as a rising plate meter or CDAX bike reader. Using these tools can increase farmer knowledge, skills and confidence by providing objective information about pasture quantity, giving increased control and flexibility around pasture management decisions, and subsequently increase productivity (O'Donovan et al. 2002; Turner & Irvine 2017). In practice, using tools to measure pasture is a quick and effective way of assessing total forage growth and yield, with more accuracy than visual assessment (Stockdale 1984; Scrivner et al. 1986). Pasture management practices involving measuring are knowledge intensive, with farmers requiring ongoing support as they learn to implement and adapt them to their own farming system (Ingram 2008; Turner & Irvine 2017).

Focusing on grazing management is becoming increasingly important in an attempt to reduce dependency on purchased supplements, while retaining advantages of utilising pasture as a low cost, high quality feed source (Clark et al. 2007; Beukes et al. 2018). Despite focused efforts, average pasture consumption and utilisation on Tasmanian dairy farms is still well below potential (Dairy Australia 2015; Tasmanian Institute of Agriculture 2017), and large variation exists in the adoption and implementation of recommended practices (Hall et al. 2017).

Pasture availability is one of the most influential factors in deciding how much supplement to feed (Macdonald et al. 2010). Accurate daily allocation of pasture and supplement are important for optimising pasture utilisation (Fulkerson et al. 2005). Though the benefits of measuring pasture and the provision of objective pasture measurement data to farmers has been demonstrated (Stockdale 1984; Scrivner et al. 1986; O'Donovan et al. 2002; Turner & Irvine 2017), little is known about how farmers are using this information to make decisions about grazing management. Macdonald et al. (2010) outlined several key grazing management decisions, including when to graze and grazing interval; grazing intensity (measured by post-grazing residual height; a high residual suggests cows are not eating very much, a low residual suggests cows are not receiving enough feed); and rotation length (grazing duration). These management decisions have impacts on animal and pasture performance in terms of quality and quantity of pasture, feed intake per cow, pasture regrowth, and supplement feeding (Lee et al. 2008; Beukes et al. 2018).

One of the objectives of this study was to identify whether farmers are using a tool to measure pasture, and whether farmers are using that pasture measurement data to make key grazing management decisions. Understanding how farmers are using pasture measurement data is

necessary to identify possible knowledge gaps, and opportunities to add to farmer awareness and knowledge of how to use pasture measurement information. This information can be incorporated into extension programs to increase farmers skills and use of pasture measurement data, leading to more informed decision making, and potential improvement in pasture management and utilisation.

Methods

A quantitative survey was mailed to 440 Tasmanian dairy farm businesses, conducted on an opt-in basis. The person responsible for making the pasture management and grazing decisions on farm was asked to complete the survey. The survey collected information on farmer demographics (including age, experience and education), farm characteristics (including herd size, farm area, and region), level of involvement with extension activities, and past and current use of pasture measurement tools. For more detail see (Hall et al. 2017).

The survey included a section on how farmers make four key grazing management decisions: how much supplement to feed, pasture quantity assessments (pre-grazing cover and post-grazing residual), and rotation length. A range of responses was provided for each question, with responses categorised into two groups: decisions based on using measurements and/or measurement data, and decisions not based on measurements (Table 1).

Table 1. Categorisation of responses for the four grazing management decisions

Grazing decision question	Responses categorised 'based on measurements'	Responses categorised 'not based on measurements'
1. How do you usually determine how much supplement to feed?	• From measuring average pasture cover across my whole farm • From measuring pre and/or post grazing residuals	• Eyeball of pre and/or post grazing cover • Dropping milk levels in vat • Observing cow behaviour • Usually feed a set amount of supplement
2. How do you usually make decisions about rotation length?	• Physically assess leaf stage every 1-2 weeks • Use TIA research farm report or online leaf stage calculator	• My rotation length doesn't change very much, or I use a set rotation • Adjust it according to changes in seasonal conditions
3. How do you assess what the pre-grazing cover of a paddock is?	• Always measure pre-grazing cover with a pasture measurement tool • Use figures from a regular farm walk • Assess pre-grazing cover by eye and occasionally check with a pasture measurement tool	• I don't assess pre-grazing cover • Assess pre-grazing cover by eye
4. How do you assess post grazing residual length in a paddock?	• Always measure post-grazing cover with a pasture measurement tool • Use figures from a regular farm walk • Assess post-grazing cover by eye and occasionally check with a pasture measurement tool	• I don't assess post-grazing cover • Assess post-grazing cover by eye

Survey data were analysed using the program Statistical Analysis System (SAS University Edition 5.1.17). Results were reported using descriptive and inferential statistics, with summary statistics and correlations produced. The logistic procedure was used to examine which demographic and farm variables were related to respondents making grazing decisions based on measurements. The logistic procedure provides odds ratio values that reflect the likelihood of a response in relation to

the explanatory variable used, in this case 'measure'. Comparisons were made using chi-square values, with the level of significant considered at $p < 0.05$. The frequency procedure in SAS was also used to gain insight into current and past tool use, attendance at extension activities, and grazing management decisions based on measurements.

Results

Table 2 displays the summary statistics for the 162 farmers who returned their survey (return rate 38%).

Table 2. Tool ownership and use for survey participants

Variable	Survey Sample (%)
Milking area, hectares	174
Herd size, no. of cows	410
Past tool use, % use:	64.8
Intensive (6 months or longer)	43.0
Non-intensive (less than 6 months)	57.0
Tool ownership, % yes	63.7
Current tool use, % yes	47.8
Attend general extension activities, % yes:	86.3
Never attend	13.7
Once a year	24.8
2 to 4 times a year	41.0
More than 4 times a year	20.5
Attended an activity specifically focused on pasture management, % yes	76.4
Make supplement decisions based on measurements, % yes	28.6
Make decisions about rotation length based on measurements, % yes	39.8
Assess pre-grazing cover based on measurements, % yes	42.2
Assess post-grazing residuals based on measurements, % yes	32.9
	n=162

**n=162, response rate of 38%*

Current tool use and grazing management decisions

Current use of a pasture measurement tool was significant for three of the four grazing decisions.

There was a significant relationship with current tool use and assessing pre-grazing cover based on measurements ($\chi^2_1 = 61.20$, $p < 0.0001$). Respondents who currently use a tool to measure pasture are 59.6 times more likely to report that they assess pre-grazing cover based on measurements (95% Wald confidence interval of 21.4 and 166.0).

Current tool use and assessing residual length based on measurements was also significant ($\chi^2_1 = 33.67$, $p < 0.0001$). Respondents who currently use a tool are 80.6 times more likely to report that they assess residual length based on measurements (95% Wald confidence interval of 18.3 and 354.9).

The relationship between current tool use and making decisions on rotation length based on measurements was significant ($\chi^2_1 = 7.87$, $p < 0.01$). Respondents who currently use a tool to measure pasture are 4.0 times more likely to report that they make decisions on rotation length based on measurements (95% Wald confidence interval of 1.5 and 10.5).

The relationship between current tool use and making decisions on supplement feeding based on measurements was not significant.

Attendance at general extension activities and grazing management decisions

There was a significant relationship between attendance at general extension activities and making decisions on supplement feeding based on measurements ($\chi^2_1 = 4.2$, $p < 0.05$). Respondents who have attended general extension activities are 8.5 more likely to make decisions on supplement feeding based on measurements (95% Wald confidence interval of 1.1 and 65.8).

There was a significant relationship between attendance at general extension activities and assessing residual length based on measurements ($\chi^2_1 = 4.8$, $p < 0.03$). Respondents who have attended general extension activities are 5.3 times more likely to assess residual length based on measurements (95% Wald confidence interval of 1.2 and 24.0).

The relationship between attendance at general extension activities and decisions on pre-grazing cover and decisions rotation length based on measurements were both not significant.

Table 3. Explaining grazing management decisions based on using pasture measurements

Variable		Description	χ^2 (P)	Odds Ratio	95% Wald Confidence Interval
Current tool use		Yes			
	Supplement feeding		0.002 (0.921)	>999.999	<0.0001, >999.999
	Pre-grazing cover		61.201 (<0.0001)	59.609	21.406, 165.994
	Residual length		33.667 (<0.0001)	80.569	18.293, 354.853
	Rotation length		7.875 (0.005)	4.000	1.519, 10.533
Attendance at general extension activity		Yes			
	Supplement feeding		4.196 (0.041)	8.498	1.097, 65.847
	Pre-grazing cover		3.499 (0.061)	3.027	0.948, 9.660
	Residual length		4.780 (0.029)	5.337	1.189, 23.953
	Rotation length		0.003 (0.960)	>999.999	<0.001, >999.999

Discussion

The benefits of measuring pasture and the provision of objective pasture measurement data to farmers has been well documented. The provision of pasture measurement data to farmers who have the capacity to interpret and use it, assists them in being able to make more informed grazing management decisions based on a more accurate assessment of pasture availability (O'Donovan et al. 2002). Variation in pasture allocation and availability can lead to wastage, under feeding, sub-optimal pasture residuals, reduced pasture growth, reduced quality, and the need to feed additional supplements (Donaghy & Fulkerson 2001; Fulkerson et al. 2005; Macdonald et al. 2010). Using pasture measurement tools is an important component in learning about pasture management principles and developing farmers knowledge and skills (Turner et al. 2017).

Despite the focus on promoting and increasing farmer knowledge, awareness and understanding of pasture management practices, there is variation in adoption and use of recommended pasture management practices between dairy farmers. Less than half of Tasmanian dairy farmers are currently using a tool to measure pasture (Hall et al. 2017).

Few studies have identified how farmers are using pasture measurement data in their decision making. This study found that 42% of farmers are using measurement information to assess how much pasture is available in a paddock (pre-grazing cover), 33% to assess grazing intensity (residual length), and 40% to determine rotation length. However, only 29% of farmers are using measurements to determine how much supplement to feed.

Inaccurate allocation of supplement can lead to over-feeding of supplements, resulting in under-utilisation of pasture, as cows substitute supplement for pasture intake (Stockdale 2000). The increasing trend in supplement feeding (Tasmanian Institute of Agriculture 2017), combined with ineffective use of pasture as the cheapest feed source, can reduce dairy farm profitability (Stockdale 2000).

If objective data are to play a role in grazing management decision making, farmers must perceive value in data use (Eastwood & Kenny 2009). Farmers in this study are not using data to more accurately allocate supplements, and are not receiving the additional value and impact on pastue utilisation. Farmer perception of lack of value in pasture management tool use can result in reduced adoption and use long term (Cary et al. 2001). In many instances, the value of data is in reinforcing farmers own methods, developed based on experience and visual assessments (Eastwood & Kenny 2009).

Results of this study suggest that there are potentially further improvements to be made in farmers' management decisions regarding supplement feeding, which extension may have a role in supporting. However, calculating supplementary feed requirements has been a longstanding component of extension activities that focus on pasture management. Many farmers who have participated in pasture management training have therefore not adopted this component of recommended practices, and the reasons for this require further investigation. A survey of Tasmanian dairy farmers identified a trend of farmers feeding a relatively fixed amount of supplement, with changes generally made based on seasonal variation and experience, rather than on objective information (Raedts 2018). It is possible that farmers may choose not to use measurement data to this extent in their decision making, even if they are using data for other decisions, because they prefer a simple, time efficient, heuristic based approach described by Eastwood and Kenny (2009).

This study also found variation in the relationship between extension attendance and making grazing decisions based on measurements. In addition, only 20% of farmers attend extension activities on a regular basis (4 times a year or more). These results suggest that learnings from these activities may be inconsistent, particularly for knowledge intensive processes where continued, one-on-one support to develop farmers' knowledge and skills is absent (Turner & Irvine 2017). Hall et al. (in press) found that a lack of knowledge and skills required to incorporate measurements into on-farm management decisions can reduce intention and adoption behaviour.

There is a role for extension in increasing farmer awareness and knowledge about using pasture measurement data to inform decisions on supplement feeding. Additional support structures, or a simplified approach to using measurement data, may need to be provided for farmers to receive the additional benefit and improvements in pasture utilisation.

Conclusion

There remains variation in the adoption and implementation of recommended practices, and in farmers use of a tool measure pasture. This study found that farmers who currently measure pasture with a tool are using that information to assess pre-grazing cover, post-grazing residual, and to determine rotation length. However, farmers are not using the information to make decisions around supplement feeding, reducing the potential value they could receive from measuring. Incorporating measurement data to this extent in their decision making requires additional, ongoing support to assist farmers in developing their knowledge and skills.

Results from this study suggest there is a gap in farmers' knowledge about how to use pasture measurement data in supplement feeding decisions. Additional social research is necessary to understand why farmers are not using measurement data to make decisions on supplement feeding (and if they are not, how they are making these decisions), and how extension approaches could be modified to assist and support farmers. Regardless of the level of support received, there are farmers who may prefer to make more heuristic, experienced based decisions due to the complexity of incorporating measurement data into their decision making.

Additional support structures and a simplified approach to using measurement data may need to be provided if farmers are to be encouraged to incorporate measurements into decisions on supplement feeding, and to receive the value of doing so.

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