On-farm monitoring of sheep and pasture production in the EverGraze northern New South Wales project

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Abstract: *For commercial sheep mobs monitored in 2008 and 2009 as part of the EverGraze project on the North-West Slopes of New South Wales, there was a significant ($P < 0.05$) linear relationship between lamb weaning percentage and ewe fat score throughout the reproductive cycle. In both years, correlation coefficients were highest for ewe fat scores at joining. There were no significant relationships between green herbage availability in five different periods throughout the reproductive cycle and ewe fat score at the end of each period. However, for all of the native perennial grass pastures monitored the available green herbage mass was below the minimum benchmark level for spring lambing ewes in the critical June to September period. Our data reinforced the need to integrate native grass pastures with paddocks of either lucerne or forage oats and/or the provision of adequate protein and energy supplements to achieve high weaning percentages.*

Key words: green herbage mass, ewe fat score, weaning percentage, native pastures

Introduction

Previous studies of native perennial grass-based pastures on the North-West Slopes of New South Wales (NSW) have shown that these grasslands were low productivity pastures, best suited to wool production and store cattle (Lodge and Roberts 1979; Lodge and Whalley 1983, 1989; Lodge *et al.* 1991; Lodge 2011). However, in response to variable and mostly dry seasons, low wool prices and declining sheep numbers in the region over the past 20 years, native pastures are increasingly being used in both sheep and cattle breeding enterprises. Based on known forage quality and seasonal growth rates for both C_3 and C_4 native perennial grasses (Lodge and Whalley 1983, 1989; McDonald 1996) it is highly unlikely that most native perennial grass-based pastures would be able to meet the protein and energy requirements of breeding livestock, unless their use on-farm was integrated with other forage sources such as oversown subterranean clover (*Trifolium subterraneum*), lucerne (*Medicago sativa*), sown temperate or tropical perennial grass-based pastures, forage oats (*Avena sativa*), or other forms of supplementation.

A mismatch in the seasonal quality and quantity of the regional pasture base and the known demands for grazing livestock was highlighted by McDonald and Bell (1995) and Lodge *et al.* (2003). Further, pasture benchmarks (ProGraze manual 2006) calculated from GrazFeed for the minimum green herbage mass (68% digestibility) required to maintain satisfactory production levels in sheep, clearly indicated the inadequacy of most native perennial grass pastures, particularly in winter-early spring. These values are 600 kg of green dry matter (DM)/ha for dry sheep, 700 kg DM/ha for ewes in mid-pregnancy, 1200 kg DM/ha for those in the last month of pregnancy and 1700 kg DM/ha for lactating ewes. Green herbage with a digestibility of 60% was not considered suitable for ewes in late pregnancy or for lactation. For these benchmarks, pastures were assumed to have 500 kg DM/ha of dead material (47% digestibility) and a legume content of 15%.

In the current study, we used on-farm data from the North-West Slopes of NSW to examine the relationship between green feed availability, ewe fat score and sheep performance. Fat scoring (White and Holst 2006) is a simple, objective measure to assess livestock condition that can provide information on the adequacy of feed supply. The reported study was part of the National EverGraze program in northern NSW designed to increase the profitability of sheep producing properties (Lodge *et al.* 2008). While the focus of this paper is the relationship between lamb weaning percentages and ewe

fat scores and pasture green herbage mass at different stages of the ewe reproductive cycle, the process of on-farm data collection also provided a unique opportunity to observe some day-to-day practices.

Methods

In both 2008 and 2009, up to 15 commercial properties were monitored to gather on-farm data related to ewe production and pasture/forage systems. For individual sheep mobs on each property (23 in 2008 and 21 in 2009), data were collected on weaning percentage (the number of lambs weaned as a proportion of the total number of ewes joined) and mean ewe fat score, assessed on 40 randomly selected ewes in each mob.

Pasture or forage paddocks that were grazed by a sheep mob were assessed every time the mob entered or was removed from each paddock. If animals remained in a paddock for an extended period, then samples were taken at 6 weekly intervals. At theses times total herbage mass, the proportion of green (green herbage mass), the proportion of sown species, litter mass and ground cover were assessed. Since native perennial grass pastures were the focus of the EverGraze project in this region, these were the dominant pasture type sampled, together with lucerne and forage oats.

These data were used to explore the relationships between lamb weaning percentage in 2008 and 2009 and ewe fat score at joining, 100 days pregnancy, pre-lambing (~1 month), lamb marking and weaning, and the available green herbage mass (kg DM/ha) for Merino ewes joined to Merino or terminal sires and lambing in spring. In both years, the mean green herbage mass available to each mob was calculated for the following periods: lamb weaning to ewe joining; joining to 100 days pregnancy; 100 days pregnancy to pre-lambing; pre-lambing to lamb marking, and marking to weaning. Data were excluded from the linear regression analyses if the green herbage mass was mainly stem material and so unlikely to have a digestibility greater than the required 68% (ProGraze manual 2006). Similarly, data for sheep mobs that were fed hay, grains or pelleted feeds were also excluded from the regression analyses. Fat score data were also grouped for different pasture types to examine their effect on lamb weaning percentage.

Results and discussion

In both 2008 and 2009, the linear relationship between ewe fat score at each sampling time and lamb weaning percentage (Table 1) was always significant (P <0.05), with the correlation coefficient (r) ranging from 0.73 (lamb marking in 2008) to 0.95 (joining in 2008). However, in both years there was no significant relationship between mean green dry matter available in each period and weaning percentage, with the r-value always being <0.34 (data not presented). The relationship between ewe fat score at the end of a period and the green herbage mass available in that period was also not significant for fat scores taken at joining, 100 days pregnancy, pre-lambing, marking and weaning (r-value <0.41, data not presented).

These data indicated a strong correlation between ewe fat score throughout the reproductive cycle and lamb weaning percentage, with the relationship being strongest at joining in each year (Table 1). Clearly, ewes with high fat scores at joining had higher conception rates, which led to high lamb weaning percentages, with a fat score of 3.5 [the mid-point of the recommended fat score range at joining (Johnson 2005)] indicating a potential mean lamb weaning

Table 1. Linear relationships between ewe fat score (*X*) taken at five times throughout the reproductive cycle in sheep mobs and lamb weaning percentage (*Y*) in 2008 and 2009.

	Year	
Fat score	**2008**	**2009**
Joining	$Y = 25.7X\text{-}5.8$ $R^2 = 0.90$	$Y = 41.2X\text{-}49.9$ $R^2 = 0.77$
100 days pregnancy	$Y = 31.6X\text{-}12.5$ $R^2 = 0.76$	$Y = 30.3X\text{-}0.7$ $R^2 = 0.62$
Pre-lambing	$Y = 21.3X+24.9$ $R^2 = 0.77$	$Y = 32.6X\text{-}2.6$ $R^2 = 0.61$
Lamb marking	$Y = 17.8X+30.9$ $R^2 = 0.54$	$Y = 38.7X\text{-}18.5$ $R^2 = 0.57$
Weaning	$Y = 18.3X+32.4$ $R^2 = 0.60$	$Y = 38.5X\text{-}17.8$ $R^2 = 0.55$

percentage of 84% for the mobs scored and conditions experienced in 2008, and 95% for those in 2009.

Initially, the lack of a relationship between fat score at the end of a period and green herbage mass availability in that period appeared to be inconsistent with the expected outcome. However, closer examination of the data indicated that the required benchmark levels for green herbage mass, particularly in late pregnancy and lactation, were never met by the native grass pastures, and were only met by lucerne and forage oat paddocks on a few properties. Although total annual rainfall in 2008 and 2009 across the North-West Slopes of NSW was generally average or above average, autumns were very dry (Lodge and McCormick 2010), with autumn rainfall in Tamworth, for example, being 74 and 46% below average in 2008 and 2009, respectively. These dry conditions combined with low temperatures in winter, reduced the available green herbage mass of native pastures dominated by frost-sensitive C_4 grasses to generally <300 kg DM/ha in the critical June to September period and on these pastures lamb weaning percentages were 44–78%. Clearly, in both years, only those producers who had paddocks of lucerne or forage oats, or provided adequate levels of energy and protein supplementation in late pregnancy, were able to achieve weaning percentages >85% (Table 2).

In regard to day-to-day practices, many producers tended to combine and split sheep mobs throughout the year making it difficult to accurately keep track of stock numbers. Often paddock sizes were not known, none of the cooperating producers counted live lambs born and several different methods were used for calculating basic production statistics such as lambing and weaning percentages. Hence, conventional production measures such as stocking rate, ewe fecundity and lambing percentage were often not regarded by producers as metrics useful to their business. Methods of calculating lambing, marking and weaning percentages also need to be standardised so that they are comparable. Some producers were aware of the ProGraze green herbage mass benchmarks and the differing animal nutritional requirements throughout the reproductive cycle and actively managed to provide lucerne, forages and supplements to meet any deficits. Sowing of oats in late summer rather than late autumn was a useful strategy used by successful producers. No graziers on the properties monitored used fat scoring on a regular basis, and most used experiential knowledge rather than objective measurements to make grazing decisions. On many properties there was a constant conflict

Table 2. Mean ewe fat scores and lamb weaning percentages in 2008 and 2009 for a good native pasture (GNP, a mixture of C_3 and C_4 grasses, fertiliser applied and legume oversown and/or supplements used), a predominantly lucerne/forage oat system, a poor native pasture (PNP, predominantly C_4 grasses with lucerne and/or supplements used) and a unfertilised PNP. Values are meaned across mobs and farms.

Pasture type	Ewe fat scores						
	Weaning	Joining	100 days	Pre-lambing	Marking	Weaning	Weaning (%)
				2008			
GNP+fert+supplements	3.2	3.5	3.2	3.0	3.3	2.9	85
Pred. lucerne/forages	3.8	4.4	4.2	4.2	3.7	4.4	112
PNP+lucerne+supplements	3.7	4.3	4.3	2.7	3.8	3.7	89
Poor NP	3.0	3.2	2.5	2.3	2.7	2.6	72
				2009			
GNP+fert+supplements	2.9	3.2	3.0	2.7	2.6	2.8	79
Pred. lucerne/forages	4.4	4.2	4.4	3.9	3.4	3.6	112
PNP+lucerne+supplements	3.7	3.7	3.1	3.0	3.1	3.0	109
Poor NP	2.5	2.9	2.6	2.4	2.4	2.3	70

between the use of quality, green feed for cattle production and its availability for ewes and lambs, with the cattle often winning out. Successful sheep producers tended to confine joining to a 6–8 week period, sell trade quality lambs (~45 kg liveweight) using contracts and to scan ewes at 80–90 days pregnancy to detect dry, single and multiple lamb bearing ewes and to use this knowledge to make informed management decisions.

Acknowledgments

EverGraze is a Future Farm Industries CRC, Meat & Livestock Australia and Australian Wool Innovation research and delivery partnership. The Department of Primary Industries (formerly Industry & Investment NSW) is a core partner of the Future Farm Industries CRC. We gratefully acknowledge the interest and assistance of the cooperating landholders involved in the EverGraze northern NSW project.

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