

An on-farm study of late pregnancy and lactation performance of ewe lambs and their progeny on lucerne or pasture

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Abstract

An on-farm demonstration compared the use of perennial ryegrass based pasture or lucerne as the forage source for in-lamb ewe lambs from 2 weeks prior to lambing until weaning in the Te Anau basin. This demonstration, over 2 years, used 632 and 506 in-lamb ewe lambs in 2013 and 2014 respectively with approximately 50% being single-bearing and 50% twin-bearing in both years. Pasture and lucerne were set stocked until docking at approximately 33 days of age and then rotationally grazed thereafter until weaning at approximately 110 days of age. Ewe liveweights and body condition scores tended to be higher when grazed on lucerne during spring and all ewes were at or near two-tooth mating weights at weaning (67 kg). Lamb liveweights at 110 days of age were similar from the pasture and lucerne (33.4 kg). Lamb losses were greater on lucerne (37%) than pasture (28%) in both years, and led to a significantly lower lambing percentage on lucerne. Stocking rate chosen based on previous pasture growth records and potential lucerne yield was greater on lucerne (11.7 ewes/ha) than that on pasture (9.4 ewes/ha). The combined liveweight gain of ewes and their lambs per hectare was significantly greater from lucerne (492 kg/ha) than pasture (398 kg/ha). Scanning data from the second mating was 201% and 189% in ewes that had grazed on lucerne or pasture during the previous lactation respectively, while ewes weighed 67.7 and 65.1 kg at mating respectively. Lucerne can be used as a forage option to increase the performance of bred ewe lambs but the grazing of young lush growth should be avoided to reduce potential animal health issues.

Keywords: body condition score, ewe lambs, lamb liveweight gain, lamb survival, reproduction

Introduction

Ewe lamb breeding has the potential to increase the efficiency of the ewe flock by providing more lambs (Kenyon *et al.* 2004) and improving lifetime performance (Kenyon *et al.* 2011). However, the breeding of yearling ewes has a significant amount of uncertainty associated with it that limits its use in the New Zealand flock (Kenyon *et al.* 2004; Stevens *et al.* 2003). One key issue is the surety of producing a good

lamb as well as a well grown ewe lamb that will enter the flock at target two-tooth body weights (Kenyon *et al.* 2004; Stevens *et al.* 2003). Feeding of the ewe lamb and her lamb(s) during lactation is a major cause of this uncertainty. The growing use of lucerne as a grazing option during lactation (Anderson *et al.* 2014; Avery *et al.* 2008; Stevens *et al.* 2012) may provide forage that can remove some of this uncertainty and ensure that both the ewe lamb and her lambs reach target weaning weights (Corner-Thomas *et al.* 2014) to contribute usefully to future production.

Lucerne was grazed with ewe lambs during lambing and the subsequent lactation. It was compared with a standard perennial pasture grazing system in an on-farm setting to investigate the potential for lucerne to meet the feed requirements to grow a ewe lamb to an acceptable two-tooth mating weight and to wean a lamb of economic usefulness.

Methods

An on-farm demonstration of the use of perennial ryegrass based pasture or lucerne as the forage source for bred yearling ewes was set up at the Stuart breeding-finishing farm owned by Landcorp Farming Ltd in the Te Anau basin (-45.524 S; 167.700 E). The soil type was a firm Brown allophanic soil of low water holding capacity (90 mm AWHC to 60 cm), high P retention (>66%) with a discontinuous pan at approximately 40 cm. The lucerne soil had an Olsen P of 9, a pH of 6.1 and a K quick test level of 4 in the top 15 cm of the soil profile. A capital dressing of 27 kg P was applied to attain an Olsen P value above 15. The pasture had an Olsen P concentration of approximately 21, a pH of 5.8 and a potassium concentration of 4 in the top 7.5 cm of the soil profile. Fertiliser was applied in September of each year, being 0, 40.6, 150, 50.3, 30, and 97 kg/ha of N, P, K, S, Mg and Ca respectively for the lucerne and 30.3, 20, 15, 23.8, 0, and 0 kg/ha of N, P, K, S, Mg and Ca respectively for the pasture. Rainfall, soil moisture (at 400 mm soil depth) and air temperature were measured at an on-farm weather station approximately 2 km from the experimental site. Approximately 610 and 360 mm rainfall was recorded in 2013 and 2014 over the period of the demonstration (Figure 1) with extended periods of soil moisture deficit. Average air

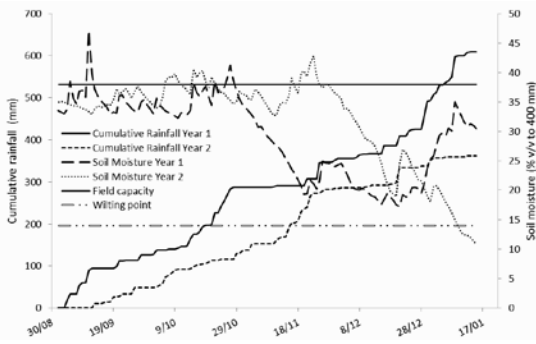


Figure 1 Cumulative rainfall and soil moisture status recorded during the 2013 and 2014 experimental periods with field capacity and wilting point represented as horizontal lines.

temperature was near the long term average in 2013 but lower than the long term average in November of 2014 (data not shown).

This demonstration ran over 2 years using 632 and 506 in-lamb ewe lambs in 2013 and 2014 respectively with approximately 50% being single-bearing and 50% twin-bearing in both years. Each year the twin- and single-bearing ewes were split into two groups and stocked on either lucerne or perennial ryegrass/white clover based pasture. Single- and twin-bearing ewes were kept separate until docking on each pasture type, and then combined in a single grazing mob until weaning. All ewes remained in the mob regardless of lamb losses. Pasture and lucerne were continuously grazed from 2 weeks prior to the planned start of lambing on 25 September until docking at approximately 33 days of age (assuming a mean lambing date of 10 days post start of lambing) and then rotationally grazed thereafter until weaning at approximately 110 days of age. Fibre was supplied as baleage and salt was available continuously throughout. Stocking rates were chosen based on previous pasture growth records and potential lucerne yield calculated using the methodology described by Stevens *et al.* (2012). Forage growth surplus to requirement was removed from the grazing rotation for consumption by other livestock classes or conservation. If forage supply did not meet a minimum pasture cover of 1000 kg DM/ha then more land was made available for grazing. Pasture and lucerne forage production was measured from December 2013 to January 2015 using a pre-trimmed cage technique with forage being harvested at monthly intervals using a lawn mower and samples taken for dry matter determination. There were five pasture sites and one lucerne site measured with paired cages at each site.

Liveweight and body condition score of the ewes were measured at the start of the demonstration, at docking and again at weaning. Lamb liveweight was

recorded at docking and weaning. Records were kept of grazing events and both ewe and lamb losses. The liveweight of the ewes at their second mating, at 18 months of age, and the resultant ultrasound pregnancy diagnosis was also recorded.

The results were analysed using ANOVA (Genstat 16th edition) using Forage and Litter size as fixed effects and Years as replicates. The interaction was not significant and assigned to error to improve the power of the analysis. Liveweight gain of lambs was calculated using an average lambing date of 5 October and a birth weight of 4 kg (Corner-Thomas *et al.* 2014). The area of pasture and lucerne were calculated and an average stocking rate over the lactation period applied. The power of this demonstration is low and so trends ($P < 0.1$) are brought to the reader's attention, as well as significant results.

Results

The grass based pasture cover during the 2013 lactation period was 1250 kg DM/ha at the beginning of the grazing period and declined to 950 kg DM/ha by 33 days post-lambing. Pasture area allocated increased from 28 ha to 40 ha after 33 days and the pasture cover increased to approximately 1400 kg DM/ha by day 110 post-lambing. Pasture cover was 2000 kg DM/ha at the beginning of the demonstration period and did not decline below 1400 kg DM/ha during the 2014 lactation period. The lucerne was approximately 10 cm in height at the beginning of the grazing period and average height increased throughout the lactation period to 25 cm.

The measured annual forage production was 7990 and 8480 kg DM/ha (SED=722 kg DM/ha) for the pasture and lucerne respectively during the second year. During the spring the lucerne grew at an average of 44 kg DM/ha/day while the pasture grew at 37 kg DM/ha/day (SED=4.9 kg DM/ha/day). The result was 5610 and 4610 kg DM/ha for lucerne and pasture respectively during the 126 day grazing period from early September to early January.

The pre-lambing liveweight of the ewes was similar on both forages, but was greater in twin-bearing ewes than single bearing ewes (Table 1). Liveweight of the ewes was lower at the beginning of the demonstration in 2013 (52.0 kg) than in 2014 (61.2 kg) though the gap between the liveweights at weaning was less, being 64.9 and 68.5 kg in 2013 and 2014 respectively. By 33 days post-lambing the ewes on lucerne were heavier than ewes on pasture ($P=0.078$) while the liveweight gain from pre-lambing to 33 days post-lambing was greater ($P=0.045$) in ewes grazing lucerne than pasture. Liveweight of ewes grazing lucerne was also higher ($P=0.083$) than ewes grazing pasture by weaning at 110 days post-lambing. The liveweight of single and twin

bearing ewes were similar at 33 and 110 days post-lambing, though the liveweight gain of single bearing ewes to 33 days post-lambing was greater ($P=0.089$) than that of twin bearing ewes.

The body condition score of ewes grazing lucerne was higher ($P=0.078$) than ewes grazing pasture by 33 days post-lambing. The body condition score of single bearing ewes was greater ($P=0.08$) than twin bearing ewes by 110 days post-lambing.

Lambs were heavier ($P=0.074$) on lucerne at 33 days post-lambing than on pasture (Table 2). Liveweight gain of lambs on lucerne to 33 days post-lambing was greater ($P=0.082$) than that of lambs on pasture. By 110 days of age the lambs on pasture and lucerne had similar liveweights (33.4 kg/hd) with no difference in liveweight gain between days 33 and 110 post-lambing. Single born lambs were 5 kg/hd heavier ($P=0.04$) than twin born lambs at 110 days post-lambing. Lamb growth rate was greater ($P=0.04$) in single born lambs from birth to 33 days of age. Lamb liveweights at 110 days post-lambing were 30.8 and 32.4 kg in 2013 and 35.1 and 32.5 kg in 2014 for the lucerne and pasture, respectively.

Yearling ewe losses were approximately 3.5% and not different ($P=0.50$) for both pasture and lucerne, and for single bearing and twin bearing yearling ewes

(Table 3). Lamb losses were greater ($P=0.089$) on lucerne than pasture. Final lambing percentage was greater for yearling ewes lambing on pasture than on lucerne, and was greater ($P=0.018$) for twin bearing than single bearing yearling ewes. Stocking rate on the lucerne was 11.7 ewes/ha and higher ($P=0.01$) than on the pasture (9.4 ewes/ha).

Liveweight gains were calculated per ewe lambing and per hectare to estimate the efficiency of the treatments. Lamb liveweight gain per ewe lambing was greater ($P=0.05$) for pasture than for lucerne, but liveweight gain of the ewe was higher ($P=0.051$) on lucerne than pasture. The total liveweight gain of lamb and ewe combined per ewe lambing was not different ($P=0.91$) when ewes were lambed on pasture or lucerne. However, the total liveweight gain per hectare was greater ($P<0.001$) on lucerne than on pasture. Twin bearing ewes produced a greater lamb liveweight gain both per ewe lambing ($P=0.027$) and per hectare ($P=0.005$) than ewes bearing single lambs.

Pregnancy diagnosis by ultra sound was performed on the ewes when they reached their second mating. The ewes that had grazed lucerne in late pregnancy and lactation had a pregnancy rate of 201% compared with 189% in ewes that had grazed on pasture ($P=0.072$). Ewes that had grazed lucerne during lactation had a

Table 1 Liveweight before lambing and liveweight and body condition score at 33 and 110 days post-lambing, and the changes of both over that time in ewe lambs bearing single or twin lambs grazing either perennial ryegrass-based pasture or lucerne. Means represent data from 2013 and 2014.

	Forage				Pregnancy status			
	Pasture	Lucerne	sed	P value	Single	Twin	sed	P value
Pre-lambing liveweight (kg)	56.7	56.7	0.37	0.924	54.7	58.7	0.37	<0.001
Liveweight 33 days post-lambing (kg)	58.9	66.4	3.15	0.078	63.4	61.8	3.15	0.635
Liveweight at weaning (kg)	64.6	69.2	1.97	0.083	68.4	65.5	1.97	0.217
Liveweight gain to 33 days post-lambing (g/d)	43	213	59	0.045	195	62	59	0.089
Liveweight gain post-lambing to weaning (g/d)	74	39	31	0.321	66	47	31	0.57
Body condition score 33 days post-lambing	2.7	3.2	0.22	0.078	3.1	2.7	0.22	0.143
Body condition score at weaning	3.25	3.50	0.12	0.12	3.51	3.23	0.12	0.08
Body condition score change	0.60	0.31	0.16	0.14	0.39	0.52	0.16	0.449

Table 2 Liveweight and liveweight gain of lambs at 33 and 110 days post-lambing born to ewe lambs bearing single or twin lambs grazing either perennial ryegrass-based pasture or lucerne. Means represent data from 2013 and 2014.

	Forage				Pregnancy status			
	Pasture	Lucerne	sed	P value	Single	Twin	sed	P value
Liveweight 33 days post-lambing (kg)	13	14.9	0.78	0.074	15.2	12.8	0.78	0.037
Liveweight at 110 days of age (kg)	33.4	33.3	1.6	0.955	35.8	30.9	1.6	0.04
Liveweight gain to 33 days post-lambing (g/d)	266	322	24	0.082	330	258	24	0.039
Liveweight gain from 33 to 110 days of age (g/d)	265	242	17	0.244	269	238	17	0.14

mating weight of 67.7 kg while those that had grazed pasture were 65.1 kg ($P=0.078$).

Discussion

The dry matter production of the lucerne was greater than that grown by the pasture and provided feed to support the chosen stocking rates in both years (Table 3). However, the opening stocking rate was too high for the pasture during 2013 due to the slow growth even though the temperatures were near average. The rainfall was above average in 2013 but well below average in 2014 (Figure 1). Overall the lucerne provided a more consistent supply of feed. The deeper rooting nature of lucerne may have assisted in providing continued access to water even when the soil moisture in the top 400 mm declined to levels that were near wilting point (Figure 1).

The overall increases in individual production measures for the ewes (Table 1) and the lambs (Table 2) when lucerne was grazed were similar to those reported for bred ewe lambs grazing lucerne or herb-based forages when compared with pasture (Corner-Thomas *et al.* 2014). Lamb growth until day 33 was higher on lucerne than pasture (Table 1) and reflects other results (Corner-Thomas *et al.* 2014; Stevens *et al.* 2012). The lamb growth rate between day 33 to 110 was relatively constant on the ryegrass based pastures in both years but slower in 2013 than 2014 for lucerne. The lower result in 2013 may have been due to a more rapid rotation as soil moisture declined during November (Figure 1). The less mature, higher quality lucerne being consumed may have caused the visible signs of photosensitivity such as lesions on the face and ears, and poor digestive efficiency. The photosensitivity response of the lambs may be due to their very low fibre intakes, leading to poor rumen development and potential acidosis. This in turn may lead to chlorophyll crossing the gut lining and remaining active in the blood supply causing the photosensitivity. No signs of photosensitivity were

recorded in 2014. The liveweight gain to weaning was much greater as lower forage growth and drier conditions resulted in a slower rotation which produced a more mature crop with a higher fibre content.

Lamb survival was one factor that declined when lucerne was used (Table 3). Interestingly Corner-Thomas *et al.* (2014) noted a decline in singleton lamb survival on both lucerne and pasture from approximately 85% in the first year to 64% in the second year. Some improvement in lamb survival in high quality herb and lucerne type forages has been measured (Hutton *et al.* 2011; Kenyon *et al.* 2010) and potentially attributed to the extra shelter that may be available due to plant height (Hutton *et al.* 2011). This does not appear to be the case here (Table 3), and may be related to the potential for the longer lucerne to provide a wetter environment. Rainfall during the main lambing period from late September to late October was greater in the second year than the first year (Figure 1) and may help explain the increase in lamb mortality between the years. Lower lamb survival caused a decline in efficiency of the system as the lamb liveweight per ewe lambing was lower for the lucerne than the pasture (Table 3). There are several potential causes of differences in lamb survival. These may include stocking rate, familiarity with the diet, transition to lucerne and vaccination history. The ewe lambs began grazing the lucerne 2 weeks before lambing and gained weight over this time, suggesting that familiarity with the feed and transition were not issues. The vaccination programme of the ewe lambs was a standard clostridial vaccination programme. Stocking rates chosen were moderate and there is little evidence of stocking rates of this magnitude influencing lamb survival. The lamb deaths occurred mainly within the first 5 days of birth. The longer height of lucerne may have meant that ewes and lambs became separated and mismothered due to the ewes inexperience. This issue needs to be

Table 3 Losses of ewes and lambs, stocking rate and liveweight gain expressed per ewe lambing and per hectare by 110 days post-lambing, in ewe lambs bearing single or twin lambs grazing either perennial ryegrass-based pasture or lucerne. Means represent data from 2013 and 2014.

	Forage				Pregnancy status			
	Pasture	Lucerne	sed	P value	Single	Twin	sed	P value
Ewe deaths (%)	3.1	4.2	1.5	0.498	3.2	4.0	1.5	0.635
Lamb deaths (%)	26.2	36.1	4.4	0.089	26.5	35.8	4.4	0.103
Lambing percentage (% to ewes pregnant)	108	94	3.7	0.018	74	128	3.7	<0.001
Stocking rate (ewes/ha)	9.38	11.66	0.298	0.002	10.57	10.46	0.298	0.728
Lamb liveweight gain (kg/ewe lambing)	35.4	30.3	1.8	0.046	26.0	39.7	1.8	0.002
Ewe liveweight gain (kg/ewe lambing)	7.7	12.0	1.6	0.051	13.2	6.4	1.6	0.012
Total liveweight gain (kg/ewe)	43.1	41.8	2.4	0.908	39.2	46.1	2.4	0.027
Liveweight gain per hectare (kg/ha)	398	492	11.3	0.001	414	482	11.3	0.005

investigated further to improve the efficiency of lucerne use for breeding ewe lambs.

Ewe losses (Table 3) were relatively similar on both forages. The most significant cause recorded in 2013 was vaginal prolapse, approximately 60% of those recorded in the lucerne but only approximately 10% on pasture. There are many theories about vaginal prolapse but none have any evidence to support them. There were similar occurrences of vaginal prolapses (20%) on both forages in 2014. This difference between years may have been related to the liveweight gained until day 33 as it was much higher in 2013 (13.4 kg) than in 2014 (3 kg).

There is a need to understand the stocking rates required to make the system work. The farmer must ensure that feed supply is increasing to maximise production (Stevens *et al.* 2012). The farmer noted that the lucerne looked too short to graze, but the growth was great enough to achieve the aim of an increasing feed supply. This occurred in both seasons, contrary to the performance of the pasture, when more area was required for the pasture group in 2013. If the available area of pasture had not been increased then lamb liveweights and ewe condition may have been significantly compromised. This may have resulted in a significant flow-on effects on the future performance of the ewes, and required more feed and time to finish the lambs. This has been illustrated on this farm previously. In the 2012 season, yearling ewe breeding was followed by a 2-tooth scanning of 163% and a liveweight at scanning of approximately 55 kg.

Management requirements must be met when grazing lucerne to maximise performance. It takes time to understand the importance of keeping to the rules (Anderson *et al.* 2014). There is potential to improve productivity and profitability by altering the system by lambing on pasture and moving onto lucerne at an early age to avoid lamb losses.

Lucerne can be used as a forage option to increase the performance of lambing ewe lambs. Both per head and per hectare performance were increased, and ewe lambs and their lamb(s) met targeted liveweights by weaning. However, appropriate stocking rates and pasture management can also ensure that liveweight targets at weaning are met on perennial pasture. Poor grazing management in late lactation on lucerne in the first year led to lower lamb liveweight from lucerne at weaning. Issues with lamb death rates suggest that young ewes should not be lambed on lucerne, but introduced after lambing is complete. More research is required to understand this problem in greater depth to provide more robust management recommendations. Using lucerne after docking may dilute the impacts of lucerne in the system, as many of the gains from lucerne were greatest at docking.

While lucerne has a role in improving the performance

of young ewes and their lamb in spring, care needs to be taken to reduce lamb losses, and to follow best practice grazing guidelines to maximise lamb intakes in late lactation. Some animal health issues may present themselves but net benefits of lucerne grazing are still evident.

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