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BRIEF COMMUNICATION: Milksolids production of dairy cows grazing lucerne and perennial ryegrass in spring

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Introduction

The potential of New Zealand grazing systems is dependant on the dry matter (DM) yield, nutritive characteristics, and utilisation of pasture. The most common pasture is a mixture of ryegrass and white clover, which is tolerant of a wide range of environments and management (Kemp et al. 1999). However species such as these with shallow root systems and poor growth in high temperatures will have reduced herbage accumulation and quality during dry summer periods (Hoglund & White 1985). As demand for irrigation has increased to alleviate these problems, it has also raised questions about water allocation impacts on dairy farm production and profit (Thorrold et al. 2004). For Canterbury, which experiences hot, dry summers, lucerne is a potential source of high quality feed due to its active warm season growth and greater water use efficiency (Mills & Moot 2010). Much of the recent research on lucerne in livestock systems has focussed on sheep and beef in dryland situations (Mills & Moot 2010). There is limited information on the productivity of dairy cows grazing lucerne (Bryant 1978).

The purpose of this research was to compare milk production of dairy cows grazing lucerne as a sole or partial diet with cows grazing standard ryegrass clover pasture in spring. The hypothesis being that in spring there will be very little difference in milk production due to the high quality of both lucerne and grass pastures.

Materials and methods

The experimental design was a completely randomised design consisting of three replicates of three grazing treatments: Grass only (G), Grass and lucerne (GL) and Lucerne only (L). The experiment was established at the Lincoln University Research Dairy Farm and included three lucerne paddocks (cv. Force Four) and three tetraploid perennial ryegrass paddocks (cv. Bealey) sown with Kopu white clover. Each 1.5 ha paddock was mown between 22 to 24 August 2012, four weeks before the start of the experimental period. The experimental area was irrigated using a centre pivot irrigator, with dairy effluent also applied during non-grazing periods.

On 13 September 2012, 45 Friesian x Jersey dairy cows were blocked into five groups of nine cows based on milksolids (MS) production, live weight and age. One cow from each group was then randomly allocated to the nine treatment combination. All animals were given a rumensin capsule (Elanco ™, Auckland, New Zealand) to prevent bloat and were gradually adapted to diets over the next four days. By the start of the 13 day measurement period which began on 18 September, all cows received an allowance of 17 kg DM/day above a post grazing residual of 1,500 kg DM/ha. Herbage mass (kg DM/ha) was determined by a rising plate meter for grass diets and by a calibrated sward stick for lucerne diets (Manufacturer's calibration: (140 x Rising plate meter height) + 500). Twenty pre- and post-measurements were taken for calibration data. The following equation was used for lucerne mass of (86.5 x Rising plate meter height + 215.9) (R^2 = 0.96). Paddocks were created using temporary polywire fence tape. Cows on G and L treatments were moved to a new break daily after the morning milking while cows in the GL treatment were moved onto the new grass following the afternoon milking and lucerne following the morning milking. Paddock size for the GL treatment was adjusted so that half their daily allowance was available on each herbage. Samples of herbage were collected to ground level before and after grazing and separated into sown and unsown species. Lucerne was separated into leaf and stem components. Samples were oven dried at 60°C, weighed, ground through a 1 mm sieve and scanned for chemical composition using near infrared spetrophotometry. Metabolisable energy (ME) content (MJ ME/kg DM) of both grass and lucerne diets were calculated using the equation recommended by CSIRO (2007):

$$ME = 0.138 \times DOMD - 2.577$$

where DOMD = Digestibility of the organic matter in the dry matter.

Milk yield was recorded daily (DeLaval Alpro Herd Management System, DeLaval, Tumba, Sweden). Two subsamples were collected for every cow at morning and afternoon milking on Days 3, 7, 10 and 14 to determine milk composition. Mean milk yield, fat, protein and total MS yield averaged across days were analysed across three treatments by three replicates using the one way ANOVA procedure of GenStat (Payne et al. 2009).

Table 1 Milk production variables and total two-week milk yield for dairy cows in early grazing either grass/white clover pasture, lucerne in the morning followed by grass in the afternoon, or lucerne. SED = Standard error of the difference.

Variable	Pasture type			Pooled standard error of difference	P value
	Grass	Grass and lucerne	Lucerne		
Milk yield (kg/cow/d)	26.4	26.4	25.3	1.1	0.57
Milk solids (kg MS/cow/d)	2.23	2.28	2.20	0.07	0.57
Milk protein (kg/cow/d)	0.97	0.96	0.92	0.03	0.25
Milk fat (kg/cow/d)	1.27	1.32	1.28	0.05	0.54
Milk protein (%)	3.75	3.63	3.65	0.08	0.38
Milk fat (%)	4.92	5.03	5.11	0.16	0.52
Total milk (kg/cow)	343	344	329	14	0.57

Table 2 Pre- and post-grazing herbage mass and the proportion of nutritive components in the ryegrass/clover and lucerne herbage mass pre-grazing.

Component	Plant type			Pooled standard error of difference	P value
	Ryegrass	Lucerne			
	Whole plant	Leaf	Stem		
Pre-grazing mass (kg DM/ha)	3,210	3,839		86	**0.007**
Post-grazing mass (kg DM/ha)	1,639	1,866		18	**<0.001**
Acid detergent fibre (g100 g DM)	22.0[b]	22.5[b]	34.3[a]	2.8	**0.007**
Neutral detergent fibre (g100 g DM)	40.0[a]	25.4[b]	43.8[a]	4.4	**0.01**
Crude protein (g100 g DM)	15.5[b]	26.0[a]	16.7[b]	2.4	**0.009**
Soluble sugar and starch (g100 g DM)	29.1[a]	11.3[b]	17.5[b]	2.5	**0.001**
Digestible organic matter (g100 g DM)	82.4[a]	73.9[b]	59.4[c]	3.5	**0.002**
Metabolisable energy (MJ ME/kg DM)	13.1[a]	11.6[b]	9.4[c]	0.5	**0.001**

Results and discussion

Mean milk and MS yields were similar between G and L swards, averaging 26 kg/cow/d and 2.23 kg MS/cow/d respectively (Table 1). This is in contrast with Bryant (1978) who reported a reduction in milk yield by cows grazing lucerne (19.2 kg and 1.61 kg MS/cow/d) compared with pasture (20.8 kg and 1.76 kg MS/cow/d) in early lactation. Increases in milk production in the current experiment might also have been expected due to the higher energy content of grass/clover diets (13.1 MJ ME/kg DM) compared with lucerne (11.6 and 9.4 MJ ME/kg DM leaf and stem. Table 2). However, lucerne leaf contained significantly more crude protein which may have improved milk production relative to grass which was relatively low in protein.

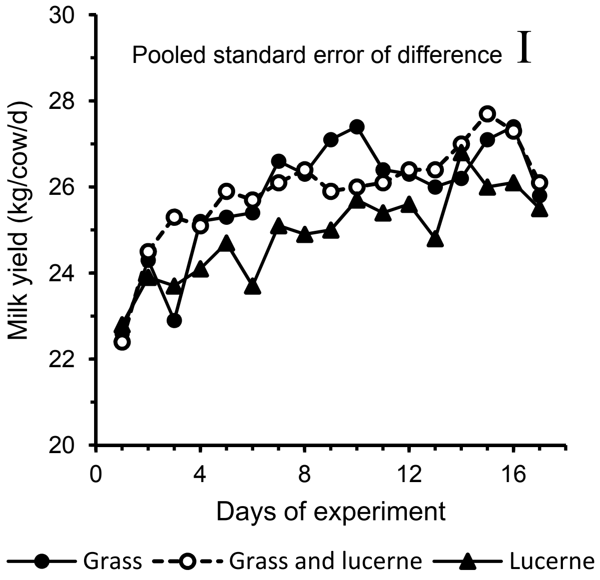
Moreover, Burke et al. (2000, 2006), who compared lucerne and ryegrass with very similar nutritive composition to that observed here, found that when compared with grass, lucerne had a faster degradation rate and a more favourable volatile fatty acid profile on account of a lower acetate:propionate ratio (Burke et al. 2006). Lactating animals have a high demand for amino acids for milk protein synthesis. Increased propionate spares animo acids during gluconeognenisis. However, despite differences in the digestbibility of the organic matter and ME content, milk production was not affected by treamtent which is in line with other published results Bryant (1978).

Daily dry matter intakes (DMI) based on pre- and post-grazing herbage mass, were similar for G, GL and L with cows consuming 15.3, 15.0 and 15.2 ± 0.26 kg DM/cow/d respectively (P >0.10). Consumption of nutrients on lucerne pastures was in favour of leaf components, due to the large reduction in leaf to stem ratio after grazing compared with before. Before grazing lucerne leaf accounted for 55 ± 0.16% of the lucerne plant. After grazing cows had removed 85% of the available leaf and only 6% of the upper stem.

Woodward et al. (2010) in an indoor study noted an increase in DMI and a corresponding dip in MS production when cows were transferred from grass to lucerne. However in this study there was no decline in intake or milk yield (Figure 1) during the transition from grass to lucerne (Days 1 to 4). This may reflect that effect of feeding lucerne during the transition is small, particularly when lucerne is added to the diet incrementally with pasture as was the case here.

There was no difference in milk yield between the temporal sequence GL treatment and L or G treatments. This contrasts with previous studies (Rutter et al. 2003) which showed that offering pure clover in the morning and pure grass in the afternoon increased DMI and milk yield compared to the mixed pasture

Figure 1 Milk production (kg/cow/day) of dairy cows in early lactation grazing either grass/white clover pasture, lucerne in the morning followed by grass in the afternoon, or lucerne. Days 1 to 4 were the adaptation period and Days 5 to 17 were the measurement period.



diet. However, under the management conditions of the current study and the high pasture quality observed here, no repsonse to temporal seperation of grass and lucerne was observed. The results from this early lactation study suggest similar milk production from lucerne and grass pastures. Further work will consider responses at later stages in lactation and where fluctuations in pasture quality may occur.

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