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Meeting the future demands for grassland production

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Lamb growth on pastures containing chicory (*Cichorium intybus*) under spring and summer grazing conditions

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Abstract

Mountain grazing conditions represent a constraint on lamb growth performance for various reasons. One approach to counteract these effects is to graze lambs on improved pastures. We tested the effects of grazing ewes and/or their lambs on established grass-clover (GCM), chicory alone (CHA), and grass-clover-chicory (GCC) stands on spring (Exp.1) and summer (Exp.2) pastures on lamb performance. We hypothesized that CHA and GCC would sustain higher spring and autumn daily gain of lambs compared with GCM. In Exp.1, 12 twin-rearing ewes together with their 24 lambs were randomly allocated into three sward types replicated twice (n=2 ewes, 4 lambs/replicate) and monitored for 25 d before sending to mountain pasture. In Exp.2, 24 weaned lambs from the mountain pasture were again randomly allocated to one of the above pasture types and grazed for 28 d. We observed differences in chemical composition and estimated energy values between swards containing chicory and GCM swards. However, these did not affect lamb performance during both experiments, contrary to our previous findings, suggesting that grazing sheep either selected against chicory, or the observed differences in chemical composition among sward types were not strong enough to influence performance, or a combination of the two possible effects.

Keywords: chicory, lamb, growth, grazing

Introduction

Sheep comprise a substantial part of the livestock in Norway and grazed pastures contribute a large part of the feed that supports the sheep production. Most of the sheep population is kept on rangeland pastures from May to October. Prevalence of predators and parasites, restricted opportunities for direct and frequent monitoring, and requirement of a large grazing area to compensate for low forage quality are some of the constraints of rangeland pastures for sheep production. Established pastures close to farms provide buffer feed before sending and after collecting the flock from range pasture, along with concentrate supplementation. Therefore, there is a need to improve growth performance and feed-use efficiency of lambs by using alternative feed resources. In this regard, forage chicory (*Cichorium intybus*) has been shown to be high yielding and a good source of nutrients for grazing lambs either sown alone or in a mixed stand with conventional grass-clover (Golding *et al.,* 2011; Kidane *et al.,* 2009, 2014).

We hypothesized that chicory alone (CHA) or in mixture with the grass-clover stand (GCC) would sustain higher spring and summer daily gain of lambs compared with a grass-clover mixture (GCM). This was tested using performance of suckling-grazing (Exp. 1) and weaned (Exp. 2) lambs.

Materials and methods

The experiments were conducted with grazing ewes and lambs (Exp. 1; 24 lambs for 25 days) and weaned lambs (Exp. 2; 24 lambs for 28 days) on a second-year regrowth of pastures established as CHA, GCC and GCM. The experiments were conducted in Møre og Romsdal county (Tingvoll, Norway) and details on sward establishment and management are reported in Kidane *et al.* (2014). Lambs were randomly

allocated into one of the three pasture sward types, replicated twice (2 plots; 4 lambs/replicate) after adjusting for initial body weight (BW). Lamb BW was monitored by weighing every other week. Herbage crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF), non-fibre carbohydrate (NFC) and mineral composition were analysed as described in Kidane *et al.* (2014) on hand-cut samples collected every other week.

Data collected in the experiments were merged and analysed using repeated measurements ANOVA with SAS Mixed Models (SAS for Windows 9.4, SAS Institute Inc.; Cary, NC, USA) accounting for the fixed effects of the experiment. For BW, initial weights were used as covariates.

Results and discussion

Sowing chicory alone improved nutrient composition and energy values relative to the grass-clover stand, with increased CP, NFC, mineral composition and net energy values (Table 1). However, contrary to our hypothesis, lamb growth was not affected by the grazed forage type in any of the experiments (Figure 1.; $P>0.1$). It is possible that the nutrient requirements of lambs were not restricted in the GCM pasture, and effects of the observed differences in chemical composition were subtle.

Furthermore, previous reports of improved growth performance of lambs when grazing CHA or GCC compared with other swards were seen with relatively longer grazing periods (Kidane *et al.*, 2009, 2010, 2014; Komolong, 1994) than the 25 or 28 days used here. Lastly, it is difficult to imitate herbage samples to match that of the actual herbage dry matter as consumed by grazing lambs. Therefore, the nutrient

Table 1. Chemical composition (g kg^{-1} DM, unless otherwise mentioned) of herbage samples taken at three cutting points (start, middle and end of grazing) from grazed paddocks.[1]

Parameter	Forage type			Experiment		SE	*P*-value				
	CHA	GCC	GCM	Spring	Summer		*ft*	*exp*	*cd*	*ft*exp*	*ft*cd*
CP	165^{a}	146^{b}	134^{b}	126	170	6.9	**	**	**	ns	ns
NDF	420^{b}	528^{a}	528^{a}	494	497	12.7	**	ns	**	ns	ns
ADF	293^{b}	316^{a}	307^{b}	294	317	8.6	*	**	**	ns	ns
NFC	305^{a}	226^{b}	238^{b}	280	233	12.2	**	**	**	ns	ns
Macro-minerals											
Ca	8.8^{a}	4.7^{b}	4.4^{b}	4.7	7.2	0.32	**	**	**	ns	ns
P	3.6^{a}	3.0^{b}	2.7^{c}	3.0	3.2	0.12	**	**	**	*	ns
K	29.2^{a}	22.7^{b}	21.4^{b}	22.2	26.7	1.28	**	**	*	ns	ns
Na	2.2^{a}	0.4^{b}	0.2^{b}	0.8	1.1	0.18	**	**	ns	*	ns
Micro-minerals (mg kg^{-1} DM)											
Fe	236^{a}	115^{b}	126^{b}	116	202	26.3	**	**	*	ns	ns
Zn	42.8^{a}	24.5^{b}	23.6^{b}	27.9	32.7	2.94	**	*	ns	ns	ns
Cu	6.64^{a}	4.61^{b}	4.36^{b}	4.17	6.24	0.221	**	**	**	ns	ns
Mn	89.0^{a}	62.7^{b}	56.2^{b}	58.8	79.9	5.55	**	**	*	ns	ns
Mo	1.93	1.48	1.49	1.87	1.40	0.385	ns	ns	ns	ns	ns
Total digestible nutrient (TDN, %), net energy for maintenance and for gain (MJ kg^{-1} DM)											
TDN	61.9^{a}	59.1^{b}	59.1^{b}	59.9	60.1	0.37	**	ns	**	ns	ns
NE_m	5.5^{a}	5.0^{b}	5.0^{b}	5.2	5.2	0.07	**	ns	**	ns	ns
NE_g	3.1^{a}	2.7^{b}	2.7^{b}	2.8	2.8	0.06	**	ns	**	ns	ns

[1] Standard error of forage type by experiment interaction term; CHA = chicory alone stand; GCC = grass-clover-chicory mixed stand; GCM = grass-clover mixed stand; *ft* = forage type; *exp* = experiment; *cd* = cutting date; DM = dry matter; CP = crude protein; NDF = neutral detergent fibre; ADF = acid detergent fibre; NFC = non-fibre carbohydrate; NE = net energy; SE = standard error; ** $P<0.01$; * $P<0.05$ and ns = not statistically significant. Means in a row with different superscripts are different at $\alpha=0.05$.

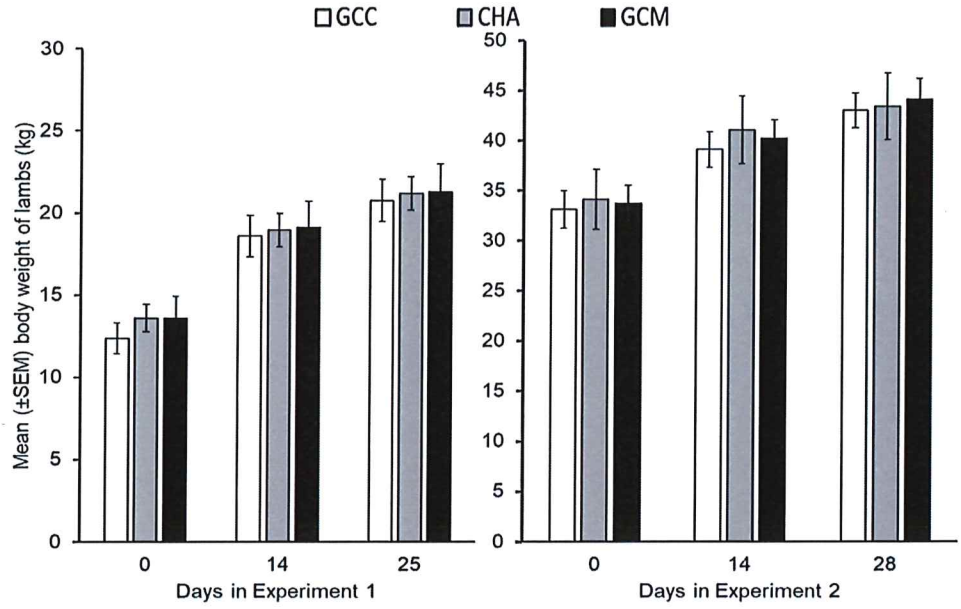

Figure 1. Body weight development of lambs during spring (Exp. 1) and summer (Exp. 2) grazing period. GCC= grass-clover-chicory mixed stand; CHA= chicory alone stand; GCM= grass-clover mixed stand; SEM = standard error of the mean.

intake achieved by lambs may not have been as contrasting as what is reported here due to the effects of selective grazing behaviour (Hodgson *et al.,* 1991) either averting or preferring a plant species (Nielsen *et al.,* 2009).

Conclusions

Inclusion of chicory in sown pasture swards improved nutrient composition and energy values but did not influence growth performance of lambs. This could be due to the short duration of our experiments in contrast to that of other reported results (Kidane *et al.,* 2009; Komolong, 1994).

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