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# Effect of maturity in timothy on silage quality and lamb performance

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**SUMMARY** – This study was conducted to elucidate the effect of harvest time (plant maturity) on forage quality and animal performance in growing lambs. The silage, mostly timothy (*Phleum pratense* L.) was harvested at three occasions with increasing maturity during summer growth and ensiled in bunker silos. Forage quality was monitored with chemical analysis and with an *in vitro* gas production (GP) technique, determining the potential degradability of organic matter (OM) and neutral detergent fibre (NDF). There were clear differences between the different cutting times in *in vitro* degradability of OM and NDF as well as in GP kinetics. The different silages were fed *ad libitum* to growing lambs. Maturation in timothy had a profound effect on silage intake as well as on live weight gain of the lambs.

**Keywords:** Lamb, silage intake, plant maturity, neutral detergent fibre, degradation kinetics.

**RESUME** – "Effet de la maturité de la fléole des prés sur la qualité de l'ensilage et les performances des agneaux". Cette étude a été menée pour expliquer l'effet de la période de récolte (maturité de la plante) sur la qualité fourragère et les performances animales chez des agneaux en croissance. L'ensilage, essentiellement de la fléole des prés (*Phleum pratense* L.), a été récolté à trois reprises selon une maturité croissante pendant la croissance d'été et ensilé dans des silos type "bunker". La qualité du fourrage a été contrôlée par des analyses chimiques et par une technique de production de gaz *in vitro* (GP), en déterminant la dégradabilité potentielle de la matière organique (OM) et la fibre neutro-détergente (NDF). On a trouvé des différences claires entre les différentes périodes de coup concernant la dégradabilité *in vitro* de la OM et la NDF, ainsi que la cinétique de GP. Les agneaux en croissance ont reçu différents ensilages *ad libitum*. La maturité de la fléole des prés a eu un effet marqué sur la consommation d'ensilage ainsi que sur le gain de poids vif des agneaux.

**Mots-clés** : Agneau, ingestion d'ensilage, maturité de la plante, fibre neutro-détergente, cinétique de dégradation.

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## Introduction

Many Swedish lamb producers have changed their production from mainly slaughtering lambs directly after the pasture season towards systems with increased indoor feeding. Therefore there is a need for more knowledge concerning the voluntary feed intake of lambs. Silage intake in ruminants is regulated by a complex integration of regulatory signals to the nervous systems (Forbes, 1995). Important factors are animal characteristics and the quality of feed. Physical regulation of intake has been closely related to the amount and rate and extent of degradation of neutral detergent fibre (NDF) (Van Soest, 1994). In a comparative study of five years of lamb experiments at the Forage Research Centre in Umeå, Måntelius (2000) found that dry matter (DM) intake in percent of live weight (LW) decreased when the contribution of NDF in the feed ration increased. In the study NDF intake was found to be on average 1.5% of LW when silage was fed alone.

It is well known that the NDF content of plants increases and the degradability of NDF decreases as the plant matures. Increased maturity also reduces the crude protein (CP) content of the plant. Meissner *et al.* (1989) studied rams fed lucerne. In spring the intake was 20.5 g degradable organic matter (DOM) /kg  $W^{0.75}$ /day. Later in the summer the intake had decreased to 13.7 g DOM/kg  $W^{0.75}$ /day. In an Irish study intake of silage harvested after 6 weeks growth (leafy stadium) was 787 g DM/lamb and day. When harvested later (at blooming) silage intake was only 437 g DM/day (Fitzgerald, 1987).

In early cut silages the contribution of NDF is less than 50 percent and the main part of the degradable matter is soluble and readily degradable in the rumen. Recent progress in the

development of the gas production (GP) *in vitro* technique for studying rumen degradation (Cone *et al.*, 1997) have made it possible to routinely monitor the degradation of soluble and non-soluble fractions of silages. The obtained kinetic parameters can be used to predict the intake of forages. Rodrigues *et al.* (2002) found that GP profiles fitted to a Michaelis-Mentens equation had good possibilities to predict forage intake in sheep.

The aim with this experiment was to monitor the effect of maturation in timothy on silage quality, voluntary silage intake and live weight gain in growing lambs.

## Materials and methods

Silage, consisting mainly of timothy (*Phleum pratense* L.), was harvested during spring growth at three different stages of maturity. At early harvest (E, June 16) no ears were seen. At mid harvest (M, June 20) 1-2 cm of the ear was seen in less than 50% of the plants, while at late harvest (L, June 26) there was 5-10 cm of straw under the ear in more than 50% of the plants.

The silage was precision chopped and stored in bunker silos. Chemical analyses were made for CP and NDF. Degradation characteristics were analysed with a fully automated *in vitro* GP system (Cone *et al.*, 1997). The data describing the cumulative GP were fitted to a Michaelis-Mentens equation described by Groot *et al.* (1996). From the degradation model the time for maximum fractional rate of GP (T-max, h) and the maximal fractional GP rate (R-max, h<sup>-1</sup>) were estimated. Potential degradability of organic matter (OMD) and NDF (NDFD) were determined after 72 h of *in vitro* incubation.

In the feeding experiment, 39 crossbred ewe lambs, born around 2 June grazed with their dams until housing in the end of September. Indoors they were divided into nine groups with 4-5 lambs in each. The lambs had free access to silage and feed intake was registered daily. To avoid intake differences depending on varying protein content, the groups with M and L silage received some soybean meal. The experiment was designed as a 3 x 3 Latin square with three 3-week periods and one week for adaptation between the periods. The lambs were weighed two times in each period. Mean LW when the experiment started was 32.2 kg, and at the end the lambs weighed 45.6 kg.

## Results and discussion

Chemical composition and degradation characteristics of the silages are presented in Table 1. Increased maturity in timothy resulted in decreased concentration of CP, increased concentration of NDF and reduced degradability of OM and NDF. The early cut silage reached T-max first and had also the highest R-max, followed by mid and then late cut silages. The fitted GP profiles are presented in Fig. 1. The effect of increasing plant maturity on silage intake and LW gain (LWG) is seen in Table 2. The increased maturity of the plants resulted in reduced intake of DM and NDF as well as reduced LWG. Ruminants fed silage as the main component in the diets are mainly limited in intake by fill (Van Soest, 1994). Enhanced disappearance from the rumen caused by faster degradation could therefore have a positive effect on silage intake. The delayed harvests resulted in a slower GP, indicating lower availability of the feed to the microbes and reduction in the rate of degradation. The improved performance with decreasing maturity may be related to the faster degradation rates and the higher degradability of OM and NDF. Further studies at our department within this area will provide more results to enable modelling of the relationship between silage quality and animal performance in growing lambs.

Table 1. Chemical composition and degradation characteristics of the silages

Silage	DM (%)	CP (g/kg DM)	NDF (g/kg DM)	OMD (g/kg OM)	NDFD (g/kg NDF)	T-max (h)	R-max (h <sup>-1</sup> )
E	31.8	170	478	945	894	7.68	0.130
M	25.8	137	541	913	852	7.80	0.128
L	26.2	114	597	857	778	8.53	0.115
Effect				***	***		

\*\*p<0.01; p<0.001.

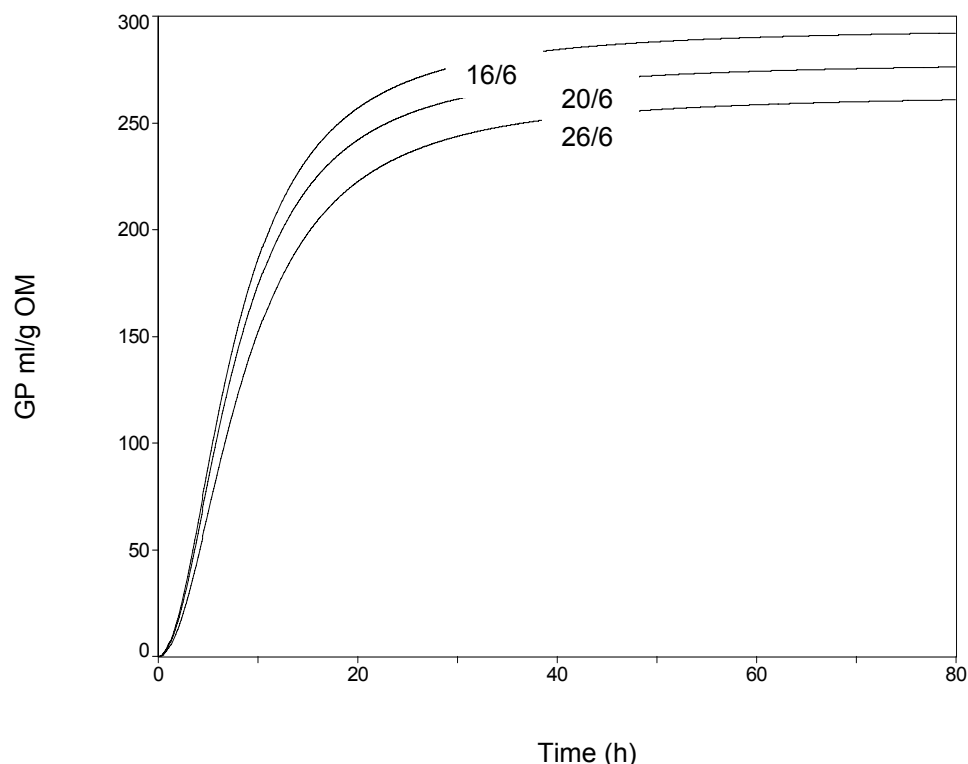


Fig. 1. Fitted gas production (GP) profiles *in vitro* at the different harvest occasions.

Table 2. Daily intake of silage DM and NDF and live weight gain

Silage	DM (kg/100 kg LW)	NDF (kg/100 kg LW)	LWG (g/day)
E	3.09	1.43	152
M	2.51	1.31	124
L	2.05	1.19	76
Effect	***	**	***

\*\*p<0.01; \*\*\*p<0.001.

## Conclusions

It was concluded that delayed harvest of timothy had a profound effect on silage quality, resulting in reduced intake and live weight gain. The reduced feed value could be detected by chemical analyses and *in vitro* GP recordings, which indicate that the analytical methods used in this study may be used to predict animal performance in growing lambs.

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