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Effect of increased fresh-cut pasture intake on dairy goat milk production: Case study

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Abstract. The New Zealand dairy goat industry is a world leader in the production of goat milk-based paediatric formulae. Increased milk production per goat is necessary to support the growing demand for goat milk products. One way of achieving this is by optimisation of the cut-and-carry feed supply system. The effect of feeding system on milk production was investigated on two farms: low input (LI) and higher input (HI), from August 2013 to May 2014. Fresh pasture contributed 51% and 34% of dietary energy offered on LI and HI farms, respectively, whereas grain supplements contributed 28% and 39% of dietary energy on LI and HI farms. There were differences between the LI and HI farms in key measures of forage supply: dry matter (DM) intake (2.8 vs 2.4 kg DM/hd/day), energy intake (35 vs 29 MJME/hd/day), and protein intake (513 vs 320 g/hd/day) for LI and HI respectively. Goats on LI farm had greater average lactation milk solids (+11 kg MS/hd/year) and milk protein (+3 kg/hd/year) yields than goats on HI farm (104 kg MS/hd/year and 28 kg milk protein/hd/year). The greater production per goat on the LI farm was driven by higher intakes of DM, energy and protein, underpinned by the large proportion of fresh pasture in the diet. The higher level of supplement use on the HI farm did not result in greater production because of the lower quality of the diet overall.

Keywords. Fresh-cut pasture – Dairy goat – Intake – Milk solids.

Effet d'une augmentation d'apport d'herbe fraîche sur la production de la chèvre laitière : Étude de cas

Résumé. La filière caprine en Nouvelle Zélande est un leader mondial dans la production de lait infantile à base de lait de chèvre. Une augmentation de la production laitière par chèvre est essentielle pour faire face à la demande croissante pour ce produit. L'effet du système alimentaire sur la production laitière a été étudié dans deux élevages : 'niveau d'intrants faible' (LI) et 'niveau d'intrants élevés' (HI) d'Aout 2013 à Mai 2014. L'herbe fauchée (affouragement en vert) constituait 51% et 34% de l'apport énergétique total par la ration (en moyenne par chèvre) en élevage LI et HI, respectivement. Les concentrés constituaient 28% et 39% de l'apport énergétique total en élevage LI et HI. En moyenne pour la saison, nous avons observé des différences entre élevages en termes d'ingestion de matière sèche (MS ; 2,8 vs 2,4 kg MS/j), ingestion d'énergie (35 vs 29 MJ ME/j), et de niveau d'ingestion de protéines brutes (513 vs 320 g/j) pour LI and HI respectivement. L'élevage LI a atteint des niveaux de production de matières utiles (MU) et protéines du lait par chèvre plus élevés (+11 kg MU/an et +3 kg protéines/an) que l'élevage HI (104 kg MU/an et 28 kg protéines/an). Le meilleur niveau de production en élevage LI s'explique par des niveaux moyens d'ingestion de MS, énergie et protéines brutes plus élevés, soutenus par une large proportion d'herbe fauchée dans la ration.

Mots-clés. Affouragement en vert – Chèvre laitière – Ingestion – Matières utiles.

I – Introduction

The New Zealand (NZ) goat milk industry is the world leader in production and marketing of premium-value goat milk paediatric formulae. Due to increased demand for these products from international markets, there is a pressing need for increased dairy goat milk production in NZ. One method of achieving this is by optimisation of feeding systems. Feed supply systems for dairy goats in NZ are unique, typically including a large quantity of fresh pasture in the diet delivered via a cut-

and-carry system to goats housed indoors. Fresh pasture is the cheapest feed available to feed goats in NZ (Solis-Ramirez *et al.*, 2012). This confers a competitive advantage over many European nations where feed supply systems are based on more expensive conserved or manufactured feeds. There is considerable variation within pasture-based dairy goat feeding systems in NZ. This variation has not previously been described and its impact on animal performance is not well understood. The work presented in this paper summarises one component of a three year on-farm research project. The aim was to collect data on feeding systems across high producing dairy goat farms and investigate the effects of different feeding systems on dairy goat milk production.

II – Materials and methods

Feeding and milk production data was collected from four farms selected on the basis of high per goat milk production [over 100 kg milk solids (MS) per goat/year] with a range of feeding systems. Results from two of the four case study farms are presented in this paper: the LI farm had a low input of supplementary feeds to fresh-cut pasture in the supply system, whereas the HI farm had a higher input of supplementary feeds. The number of milking goats was 576 and 692 at peak milk on LI and HI farms, respectively. Goats kidded once a year, between the end of June and end of August.

Farmers' records and samples of feed supplied to the milking goats were collected fortnightly from August 2013 to May 2014 (i.e. one milking season). Fresh-cut pasture was sampled along the feed lines, immediately following feeding while silage and grain supplements were sampled directly from bales/silage pit being fed on the day. Feed samples were analysed for dry matter content, crude protein content and metabolisable energy using near infra-red spectroscopy (MPA FT-NIR Analyzer; Bruker Pty Ltd, NZ). Every week of the study, farmers recorded the quantities of feeds supplied to goats, quantity of feed refusals, and the timing of feedings. Feeds supplied were weighed with on-board scales in the feed-out wagon. This method was also used to weigh feed refusals. Representative samples of feed refusals were taken fortnightly and a sub-sample was analysed for nutritive value. Further sub-samples were processed to determine the proportions of each feed type refused, e.g. pasture silage, maize grain, etc. The quantity and quality of refused feeds could then be calculated on a weekly basis.

Total herd milk production and composition data was provided by the processor for each sampling day as well as total season milk solids production on each farm. Comparisons of the two case study farms in terms of animal production, average feed intake and feed quality could then be made.

III – Results and discussion

1. Feed supply systems

Fresh-cut pasture was supplied throughout the season (August to May) on LI farm (Fig. 1), whereas it was supplied from August to late January on HI farm (Fig. 2). Fresh-cut pasture contributed 51% and 34% of total dietary energy supplied on LI and HI farms, respectively, over the entire milking season. Energy-rich supplements contributed to 28% and 39% of total dietary energy on LI and HI farms. Pasture silage was introduced on LI farm from February to fill the shortage in fresh pasture caused by drought conditions (Fig. 1). By contrast, pasture silage was supplied all year round on HI farm (20% of dietary energy overall). Forage supplements (maize silage and green-feed maize) were supplied between February and April on HI farm while fresh-cut pasture was not offered during this time (Fig. 2).

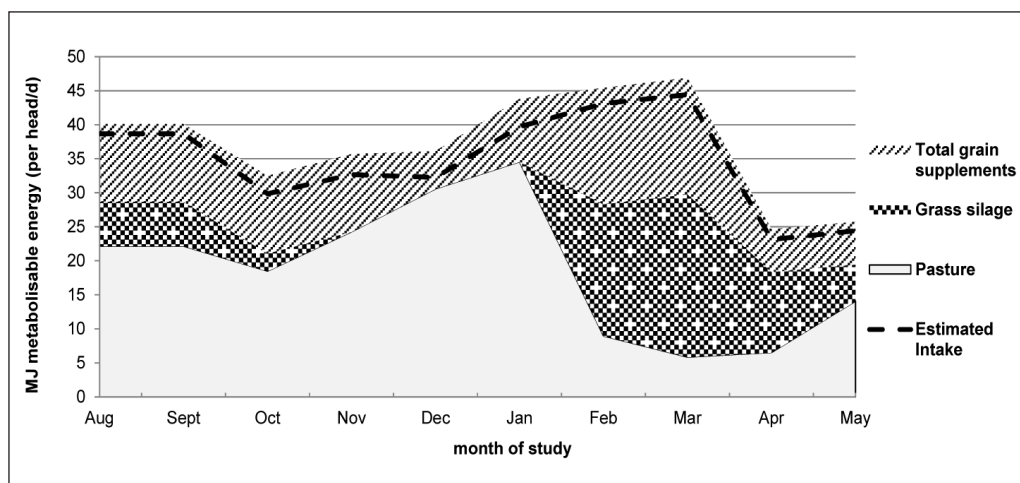


Fig. 1. Metabolisable energy supply on LI farm (in MegaJoule per goat, per day). Estimation of refusals allowed an estimation of daily energy intake.

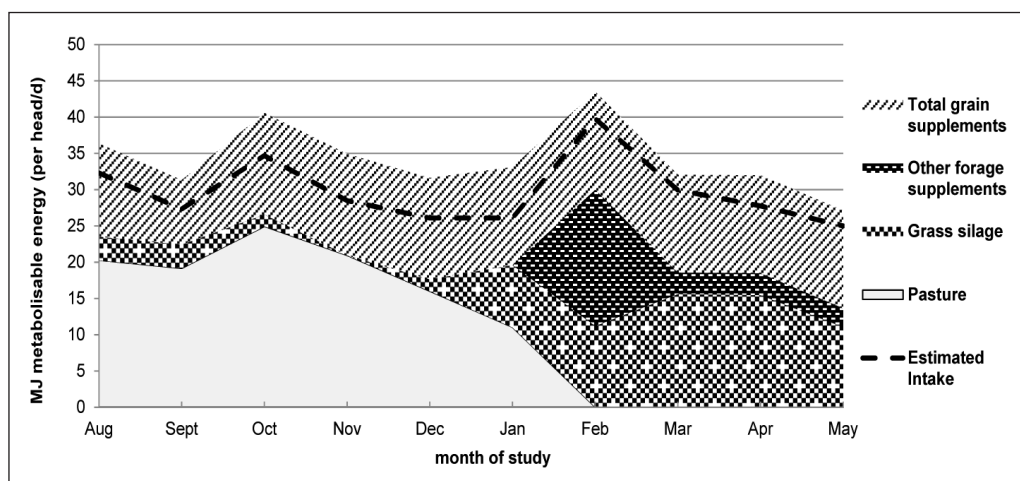


Fig. 2. Metabolisable energy supply on HI farm (in MegaJoule per goat, per day). Estimation of refusals allowed an estimation of daily energy intake.

2. Animal production

Goats on LI farm had greater average MS yield per day (+0.03 kg MS/hd/d; Fig. 3) than goats on HI farm (0.33 kg MS/hd/d). Total lactation milk solids (+11 kg MS/hd/year) and milk protein (+3 kg/hd/year) yields of goats on LI farm were greater than goats on HI farm (104 kg MS/hd/year and 28 kg milk protein/hd/year, respectively).

The differences in total MS production between LI and HI farms were also reflected in peak MS yield data: 0.47 kg MS/hd/d (3.70 L/hd/d) on LI farm vs 0.39 kg MS/hd/d (3.25 L/hd/d) on HI farm.

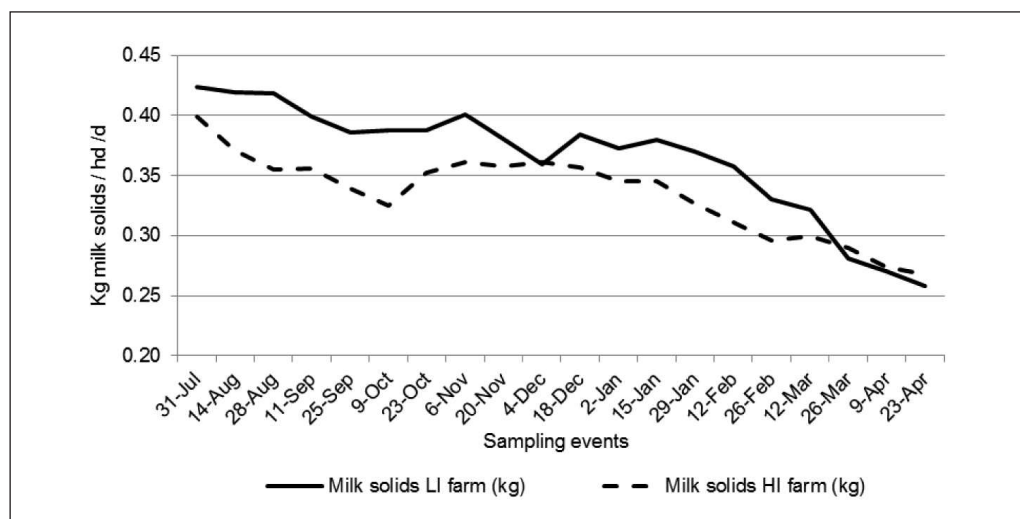


Fig. 3. Individual milk solids yields (kg/d) on LI and HI farms.

The differences in production performance reflected the differences in average dry matter (DM) intake (2.8 vs 2.4 kg DM/hd/d) and energy intake (35 vs 29 MJ ME/hd/d) on LI and HI farms, respectively, throughout the study. The average dietary ME content was not different between the two farms (11.5 and 11.6 MJ ME/kg DM on LI and HI farms) over the study. A key driver in the MS differences between the two farms may have been the protein content of the diet. The average dietary protein content of the diet was different between farms: 17.0 and 13.7% DM on LI and HI farms, respectively. This resulted in a lower average protein intake for goats on HI farm (320 g/hd/d) than on LI farm (513 g/hd/d) over the study.

There were two periods where differences in daily protein intake per goat between farms were especially pronounced. The first was during early lactation (August-September) when the LI farm fed 38% more protein than HI (580 vs 419 g/hd/d). The second period was from December to March, which coincided with severely dry weather conditions. During this time, LI farm fed 110% more protein (622 vs 294 g/hd/d). In this second half of the lactation in particular, the reduced protein intake on HI was likely explained by the replacement of fresh grass with ensiled forages (mostly pasture silage) which contributed 59% of dietary energy overall (Fig. 2).

Average crude protein content of the ensiled forages was low on HI farm (14.2% DM) when compared with the LI farm's pasture silage (16.8% DM, on average) and fresh pasture (22.4% DM, on average) supplied to goats between December and March. Restricted intake of dietary protein has negative effects on milk secretion (Morand-Fehr and Sauvant, 1978; Sahlu *et al.*, 1999). Milk solids production reflects the protein concentration of the forage supply between farms (Fig. 3) and suggested that the LI farm was able to achieve greater milk solids production through the supply of high quality pasture and pasture silage to milking goats.

IV – Conclusions

The majority of NZ dairy goat farmers rely on fresh-cut pasture to feed their milking goats. The utilisation of fresh-cut pasture as the predominant component in the goat's diet makes NZ dairy goat feed supply systems unique compared with European systems. High quality fresh-cut pasture confers a competitive advantage to NZ dairy goat farmers as fresh pasture remains the cheapest feed

available to dairy goats. However, there are risks associated with a production system relying on pasture, such as the variability in pasture supply and quality throughout the year. As observed in this study, shortages of fresh pasture during summer drought conditions needed to be balanced with ensiled forages such as pasture silage. The quality of pasture silage, however, is also highly variable and typically expected to be lower than well managed fresh-cut pasture. This was demonstrated in this study, where lower production per goat on the HI farm coincided with reduced dietary protein supply, which was likely the result of the lower quality of the forages being fed. In contrast, the greater production per goat on the LI farm was driven by higher intakes of total DM, energy and protein per goat, which was underpinned by the larger proportion of fresh pasture in the diet.

Despite the management challenges that fresh-cut pasture may present to farmers, this study highlighted the potential for increased milk solids production from maintaining high pasture and pasture silage quality. A focus on pasture management and silage making to maximise forage quality for goats is recommended to NZ dairy goat farmers.

Acknowledgments

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