

# Efficiency of Protein Utilisation In Lactating Dairy Cows – Long-Term Effects of Reduced Protein Supply

Appropriate dietary protein supply is crucial to the health and fertility of dairy cows and their ability to give high yields of milk. However, protein-rich feed supplements are expensive and can have a large environmental footprint such as soybean meal. Furthermore, if digestible protein is fed in excess of the animal's needs it will be degraded and its nitrogen (N) excreted in urine. Reducing the N concentration in cow manure will decrease the potential for gaseous nitrous oxide and ammonia to be emitted and prevent excess N from entering local watercourses.

## Dietary protein: how low can we go?

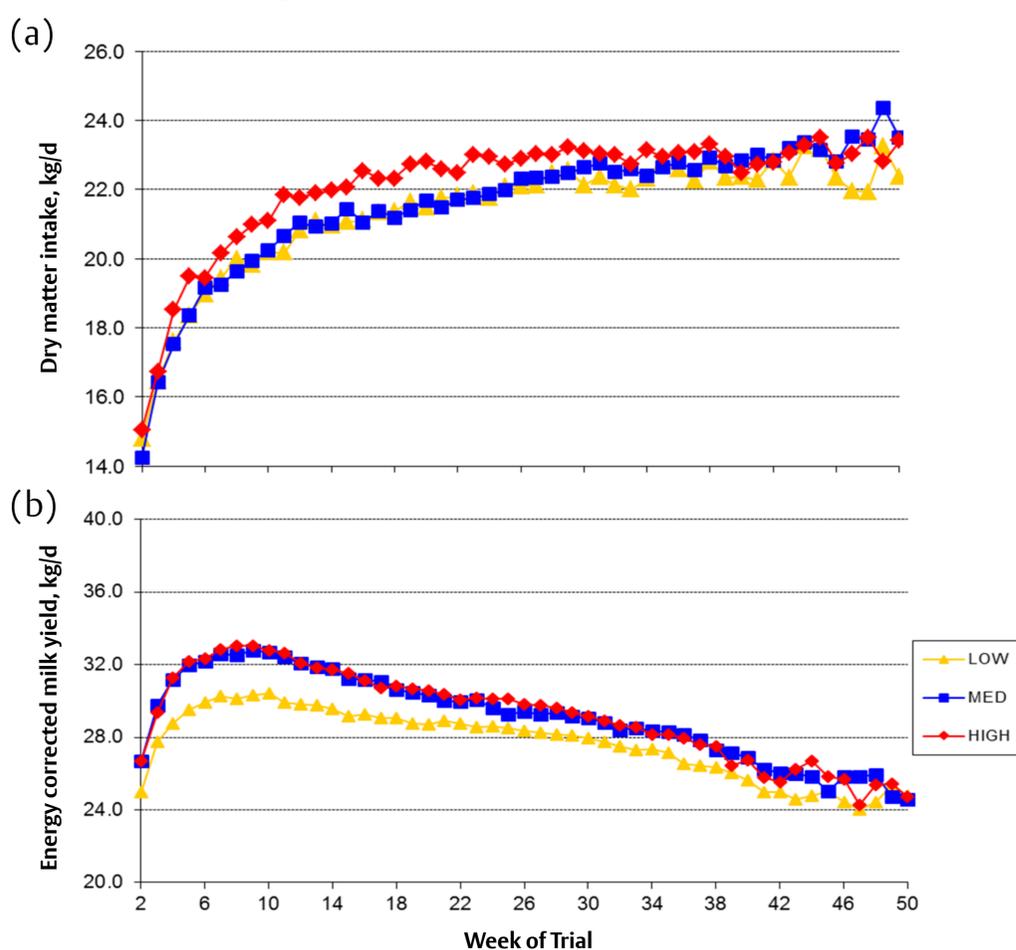
Short term studies have shown that reducing the crude protein (CP) concentration of the diet is a simple strategy that improves the efficiency of diet N utilisation, reducing wastage of N in manure. However the long-term effect of feeding lower protein diets over several lactations has never been examined in detail until now. The aim of the present study was to investigate whether feeding high (similar to commercial practice), medium, or low (below requirement) protein diets to dairy cows over multiple lactations affects their digestive function, health, and milk yield and composition. Results will be utilised as a basis for updating best practice guidelines for farmers.

## Project overview

This project is a collaborative study led by the University of Reading where, at the Centre for Dairy Research, 215 cows have been followed for three full lactations to assess the effects of the following dietary treatments over time:

- *High*: 18% CP; above metabolisable protein (MP) requirement
- *Medium*: 16% CP; at MP requirement
- *Low*: 14% CP; below MP requirement

Collaborators are measuring effects of reduced protein supply in growing and grazing dairy cows (Aberystwyth University and SRUC Crichton). Furthermore, all data from this extensive project will be utilised to model environmental (Rothamsted Research North Wyke) and economic (University of Reading) impacts at a farm level.



**Figure 1** The effect of feeding a low, medium or high protein diet to Holstein dairy cows in their first lactation on their (a) dry matter intake and (b) energy corrected milk yield (Reynolds *et al.* 2017).

## Progress and findings to date

The 6.5 year project began in 2012. Between 2013 and 2017 all animals on the study have been fed individually and their milk yield and composition, fertility, and health monitored. The final 1.5 years will be used to fully analyse the data and communicate final recommendations. Preliminary findings show promising results for cows fed the medium diet, with no loss of milk and improved efficiency in comparison to cows fed the high diet in the first year of the study (shown left). Reductions in milk yield for the low diet were less than expected, but researchers are continuing to determine if feeding the low protein diet has had long-term effects on cow fertility and health.

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