SOLID
Sustainable Organic and Low Input Dairying

Deliverable Factsheet

Date: 6 June 2015

Deliverable No.	D3.4. Report on improved prediction of energy requirements for cows given high forage diets
Working Package	WP3. Novel forage based strategies to improve animal productivity and milk quality, animal health and welfare in organic and low input dairy systems
Partner responsible	AFBI (Dr Tianhai Yan)
Other partners participating	
Nature	[R]
Dissemination level	[PU]
Delivery date according to DoW	M52 (31 July 2015)
Actual delivery date	M51 (6 June 2015)
Finalization date	6 June 2015
Relevant Task(s):	Task 3.3. To derive estimates of energy utilization by dairy cows on high forage diets

Brief description of the Deliverable

This study was to evaluate the effect of dietary forage proportion (FP) on ME requirement for maintenance and the efficiency of ME use for lactation using calorimeter data collated from studies undertaken at AFBI. The effect of FP was evaluated by dividing the whole dataset into four groups according to the FP ranges, categorizing as FP<30%, FP=30%–59%, FP=60%–99%, and FP=100%. The ME_m for individual cows was calculated from heat production minus energy losses from inefficiencies of ME use for lactation, energy retention and pregnancy, and k_l was obtained from milk energy output adjusted to zero energy balance ($E_{l(0)}$) divided by ME available for production. Data were analysed using ANOVA and regression techniques. ANOVA results showed that increasing FP increased ME_m ($MJ/kg^{0.75}$) ($P < 0.001$), with the exception that the increases did not reach significance between FP=60%-99% and FP=100%. However, the FP had no significant effect on the k_l values. The effect of FP was also evaluated using the linear regression technique relating milk energy output adjusted to zero energy balance to ME intake. The results demonstrated that with a common coefficient, the constants (taken as net energy requirement for maintenance) significantly increased ($P < 0.001$) with increasing FP, although the increase between FP=60%-99% and FP=100% did not reach significance. These results indicate that using

the current energy feeding systems to ration dairy cows managed under low input systems may underestimate their feed requirement, thus reducing the production efficiency, because the majority of feeding systems adopted globally do not differentiate the maintenance energy requirements between input systems.
These results have been presented in a paper submitted to *Journal of Dairy Science*.

Target audience(s)

Project team, Stakeholder platform, Stakeholders, Researchers.

Executive Summary

The objective of the present study was to examine the effect of dietary forage proportion (FP) on metabolisable energy (ME) requirement for maintenance (ME_m) and the efficiency of ME use for lactation (k_l) in lactating dairy cows. Data used were derived from 32 calorimetric chamber experiments undertaken at AFBI between 1992 and 2010, including 818 data from Holstein-Friesian (HF), 50 from Norwegian and 62 from HF crossbred with Jersey or Norwegian. Animals were offered forage only diets (n = 66) or total mixed diets (n = 864) with FP ranging from 18% to 87% (dry matter basis). The effect of FP was evaluated by dividing the whole dataset into four groups according to the FP ranges, categorizing as FP<30%, FP=30%–59%, FP=60%–99%, and FP=100%. The ME_m for individual cows was calculated from heat production minus energy losses from inefficiencies of ME use for lactation, energy retention and pregnancy, and kl was obtained from milk energy output adjusted to zero energy balance ($E_{l(0)}$) divided by ME available for production. Results from the analysis of variance showed that increasing FP significantly reduced ME intake and milk energy output ($P < 0.001$), although the differences between the 2 low FP groups were not significant. However, increasing FP significantly increased the ratio of heat production over ME intake and ME_m ($MJ/kg^{0.75}$) ($P < 0.001$), with the exception that the increases did not reach significance in heat production/ME intake between FP<30% and FP=30%-59%, or in ME_m between FP=60%-99% and FP=100%. However, the FP had no significant effect on the k_l values which were similar among the 4 groups of cows. The effect of FP was also evaluated using the linear regression technique relating $E_{l(0)}$ to ME intake. The results demonstrated that with a common coefficient, the constants (taken as net energy requirement for maintenance) significantly increased ($P < 0.001$) with increasing FP, although the increase between the 2 high FP groups did not reach significance. For a cow with a live weight of 600 kg, the increase in ME_m for the 2 high FP groups is calculated to be 2.5 or 8 MJ/d when compared with FP of 30-59% or < 30%. It is concluded that increasing diet FP had no effects on k_l but significantly increased maintenance energy requirement ($MJ/kg^{0.75}$). These results indicate that using the current energy feeding systems to ration dairy cows managed under low input systems may underestimate their feed requirement, thus reducing the production efficiency, because the majority of feeding systems adopted globally do not differentiate the maintenance energy requirements between

input systems.
Potential Stakeholder impact(s) The results obtained in this task provide stakeholders with updated information for robust rationing of dairy cows to improve production efficiency and reduce environmental footprint.

Interactions with other WPs Deliverables / joint outputs			
WP no.	Relevant tasks	Partner(s) involved	Context of interaction
WP3	Task 3.4	ZALF, AFBI, BOKU, CSIC, INCDBNA, MTT	Provide updated information on energetic efficiency of dairy cows for whole farm modelling of feeding efficiency