AKEY
Dairy Newsletter
www.akey.com * Dairycattlenutrition.com Jan/Feb 2009

Green Efficiency

Green is a popular term these days. As relates to our environment, we are encouraged to be more responsible as to what resources we use and what resources we might potentially pollute. In calves, we know the benefits of feeding for faster rates of gain than were conventional 10 to 15 years ago. One of the biggest potential benefits relates to if calves can double their birth weights by 2 months of age, first lactation milk production could be increased to more than offset any costs during the early calf-rearing phase. Another benefit is reducing the time to first calving, the period where the heifer is not making the dairy any money. Yet another is to lower the cost per unit gain. Each of these benefits relates to netting the dairy more money. An environmentally green impact may not be achieved with each of the rapid growth calf programs. Many of the programs marketed today over-feed several nutrients and the calf is excreting more of these nutrients into the environment. Crude protein or nitrogen is one such nutrient that can have a negative environmental impact and is expensive, especially when it is coming from milk ingredients. Look at the data below from a recent experiment. The calves fed the 28% crude protein (CP), 20% fat MR powder at 2.5 lb/day consumed approximately 20 lb more protein (about 33% more) than calves fed Pinnacle MR (26% CP, 17% fat powder) fed at 1.5 lb daily, yet they did not gain more body weight (BW). Additionally, these calves were about 30% less efficient at converting protein to BW compared to calves fed Pinnacle. Comparison among the other MR program, White Gold, reflect similar efficiencies of protein use, which indicates a balance of protein to energy fed, although the calves fed Pinnacle MR gained more BW than calves fed the conventional White Gold MR (20% CP, 20% fat powder) program. It is obvious that all calf programs are not 'green'. We promote Pinnacle as being the optimum growth formula designed through extensive research to offer the maximum return on one's investment. It is also good for our environment, too.

Table 1. Data for 0 to 84 days of age

Milk Replacer	White Gold	Pinnacle	Pinnacle	28-20
Feeding rate, lb/d	1.0	1.5	1.5	2.5
Weaning age, days	42	42	28	49
Total BW gain, lb	120	140	145	138
Total CP intake, lb	56.5	65.4	69.5	88.4
lb BW gain/ lb CP intake	2.1	2.1	2.1	1.6

Effect of NDFd on Milk Production and Intake

The University of Wisconsin reported a study in the Journal of Dairy Science about the effects of NDF level and digestible NDF (NDFd) on dry matter intake (DMI) and milk production. They used early lactation cows producing on average 85 lb of milk per day. Treatment diets were 28 or 32% dietary NDF (DM basis) and 2 levels of straw NDF digestibility. Straw was treated to increase NDFd of the diet, so that nutrient composition was similar. Diet composition can be found in table 2. Diets contained 50% DM, 17.5% CP, 30% starch in 28% NDF diet and 26% starch in the 32% NDF diet. NDFd was 46% for diets with untreated straw and 53% for diets with treated straw.

Table 2: Diet composition (lb DM/hd/d)

	28% NDF	32% NDF
Straw	4.2	8.0
Alfalfa Silage	10.8	11.6
Corn Silage	13.8	11.2
Cracked Corn	14.8	12.6
Corn Gluten Meal	2.0	2.1
48 % Soy Bean Meal	3.3	3.3
Di Cal P	0.25	0.25
MagOx	0.05	0.05
Limestone	0.10	0.10
Salt	0.25	0.25
VTM	0.15	0.15

Rumen fermentation was not affected by feeding diets that differed in NDFd. Ruminal NDF passage rate was slower for cows fed 53% NDFd

versus 46% NDFd. Regardless of dietary NDF concentration, increasing NDFd improved intake and production in early lactation dairy cows. In this study NDFd was artificially affected by treating a source low in NDFd with ammonia to improve NDFd. Results of this study showed that increasing NDFd gave an improvement of 5% in milk production with the same DMI. Digestibility of the forages will become more important with decreased milk price.
Kendall et al. (2009) JDS 92: 313

Carbon Footprint of Dairy Cows
A lot of dairy magazines write about the greenhouse gas (GHG) emission of dairy cows. This topic gets a lot of interest due to the suspected relation of GHG emission and climate change. You might wonder what the role of agriculture and dairy cows is in GHG emission. Globally, animal agriculture is estimated to contribute approximately 10-18% of total GHG emissions with a majority of this emission coming from enteric fermentation of ruminants. At the Cornell Nutrition conference Dr. Judy Capper showed that in the US, the Environmental Protection Agency (2008) estimated that all agricultural practices (crops, animals, horticulture etc) only contributed 6% of national GHG emissions, and that dairy production only comprised 11% of the animal agriculture portion. Thus, dairy production in the US accounts for approximately 0.7% of annual GHG production, which is lower than the global average. One of the main reasons why the dairy industry has lower GHG emissions is the higher productivity of US dairy cows. For a fair comparison of GHG emission between dairies, states or countries it is better to estimate the carbon footprint of milk rather than look at GHG emission of cows.

What is a carbon footprint? The carbon footprint is a measure of the total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product. For milk this means that you try to estimate the amount of GHG being released for each activity necessary to produce a gallon of milk. Main contributors would be fertilizer, feed production, enteric fermentation, manure, energy on farm, processing, transport and retailer. Often a carbon footprint is expressed in CO_2 equivalents. The reason for doing this is that there are different GHG, like carbon dioxide, methane, nitrous oxide and others. They all have a different impact on the atmosphere. Methane for example is estimated to be 23 times more potent as a GHG than carbon dioxide.
Besides an estimate of the amount of GHG released to produce a gallon of milk, the carbon footprint tells you something about the efficiency of producing a gallon of milk. In figure 1 it can be seen that the emission of GHG per cow doubled from 1944 till 2008, but the Carbon Footprint for a kg of milk was reduced from 3.6 to 1.3 kg CO_2eq per kg milk. An article of the Wall Street Journal estimated that 28% of the GHG emission is coming from enteric fermentation.

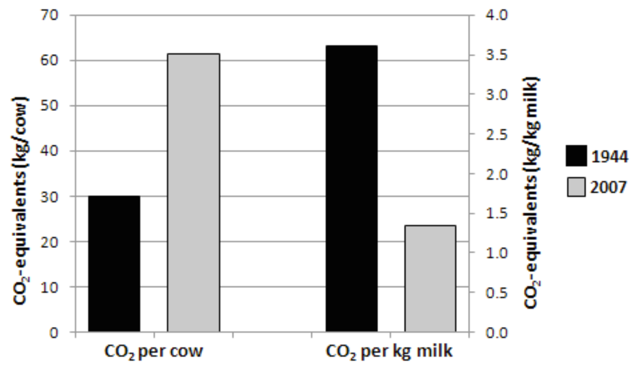

Figure 1. Carbon Footprint per and per kg milk for 1944 and 2007 US Dairy production systems (Capper et al. 2008)

Methane is produced during digestion of feed by the microbes in the rumen. Garcia and Linn (2008) estimated that a modern US dairy cow produces about 332 g of methane per cow per day from fermentation. The amount of methane produced is mainly dependent on the diet. A high starch diet will have a lower methane production than a high forage diet. Monensin will reduce methane production about 7%. The US dairy industry is implementing these practices already, which explains why the carbon footprint is lower compared to the global average. As stated before, the carbon footprint tells you something about the efficiency of milk production. If the US dairy industry is able to increase productivity per cow or per kg of DMI and make measures to reduce the amount of fossil fuel to produce dairy products it will reduce its carbon footprint and probably reduce cost of milk production.

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