University of California Cooperative Extension • Stanislaus County

California Dairy Newsletter

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Increase Efficiency to Reduce your Carbon Footprint

Nyles Peterson, UCCE San Bernardino County

The first article in this series (November 2009) gave some basic information about greenhouse gases and carbon footprints. In this article, I hope to give you some general areas that you can pursue to lower the carbon footprint of your dairy operation.

You already know that managing your herd to produce more milk per cow can make you more money. But did you know that it is also an excellent way to decrease the carbon footprint of your dairy? The bottom line (when it comes to the environment) is that using fewer resources to produce more milk will improve your herd’s carbon footprint.

By increasing production per cow, the dairy industry as a whole has made excellent progress. Based on Capper et al. (2009), the number of dairy cows in the United States has dropped from 25.6 million in 1944 to 9.2 million cows in 2007. Even with this drop in cow numbers, milk production increased from 117 billion pounds in 1944 to 186 billion pounds in 2007. Using pounds of carbon dioxide per gallon of milk as the carbon footprint value, the dairy industry's footprint dropped from 31 pounds per gallon of milk in 1944 to 12 pounds per gallon in 2007. This represents a 41% decrease in the total carbon footprint for U.S. milk production.

In addition to optimizing milk yields, you can lower your herd’s carbon footprint by working to improve the genetics, nutrition, herd health and animal comfort. For example, by feeding more concentrates, you can reduce your dairy’s carbon footprint. Methane is produced during digestion of feed by the microbes in the rumen. The amount of methane produced is mainly dependent on the diet A high starch diet will produce less methane than a high forage diet.

Efficiency also results in reduction in resource use and waste output. For example, by taking measures to reduce the amount of fossil fuel you use to produce milk on your dairy, you will reduce its carbon footprint and probably reduce the cost of milk production. Modern dairy systems only use 10% of the land, 23% of the feedstuffs and 35% of the water that was required to produce the same amount of milk in 1944. Similarly, in 2007, dairy farming produced only 24% of the manure and 43% of the methane output per gallon of milk compared to farming in 1944. The dairy industry as a whole deserves a pat on the back, and by continuing to focus on these areas, you can reduce your carbon footprint as well as improve your production per cow.

Matching Animal Requirements with Feeding Practices

Jed Asmus, Independent Nutritionist and
Jennifer Heguy, UCCE Stanislaus and San Joaquin Counties

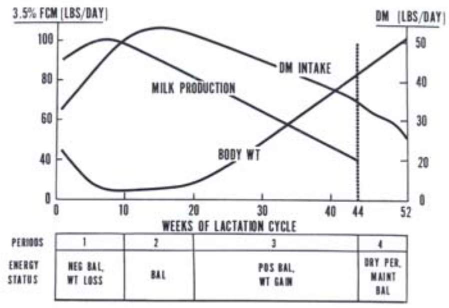

FIG. 11.1 Trends in milk production, feed dry matter intake, and body weight change during the lactation cycle.

Our last article talked about the cost of feeding excess. This follow up article expands upon the topic by explaining the logic and lost opportunities associated with over supplying nutrients.

In this article, we discuss the intricate relationships between milk production, dry matter (DM) intake and body weight, and how your animals' nutritional needs are determined by stage of lactation and level of production. The first part of the article will describe the lactation cycle (**Figure 11.1**, see reference), followed by an example of how feeding your animals properly will keep your animals healthy and keep money in your pocket.

When a cow calves, she enters a period of **negative energy status**, caused by DM intake limiting her ability to meet the demands of lactation. This will be the case for approximately the next 10 weeks of lactation. Energy is partitioned to the mammary gland for milk synthesis, and because she cannot consume enough DM to meet the demand of lactation, she takes it from her body reserves, and body weight decreases. For this reason, she is at a high risk for metabolic diseases, especially during the transition period. The transition period is comprised of the three weeks before and after calving, and is the time when milk fever, ketosis, retained fetal membranes, metritis and displaced abomasum primarily affect cows.

After production peaks at around 56 days in milk (DIM), the cow's production slowly tapers off. This is matched with increased intake, which reaches the highest levels between weeks 10 and 20 of lactation. During this time, the cow is in a state of **balanced energy status** (bodyweight is maintained).

The third period, **positive energy balance**, is when the cow compensates for the body weight lost in the previous two periods. Dry matter intake continues to taper off, but is at a level that allows for milk production (decreasing), continued weight gain, as well as maintenance of pregnancy. Weight gain continues throughout the **dry period** as the cow approaches the transition period.

Despite the fact that nutrient requirements change as an animal proceeds through her lactation, it is not uncommon for dairy producers to feed all lactating cows one ration. The idea behind this practice is that by feeding one ration to the herd, there is little chance of under-feeding the lower-producing cows, ensuring maximum milk production. However, the cost of this practice is rarely justified with more milk, or more importantly, increased profits. Let's work through an example to illustrate our point (all milk production numbers are presented as fat corrected milk).

In our example, we will assume the lactating herd is broken up into two groups, high production and late lactation. Currently, they are fed one ration designed to meet the requirements of the highest producing cows in the herd (80 lbs milk). The ration costs $5.50 per head per day for high cows consuming 57 lbs of dry matter. The late lactation cows are producing 60 lbs of milk and eating 54 lbs of dry matter (Table 1, next page).

In this example, the average feed cost to produce 100 lbs of milk is $7.65 per head per day. While the average feed cost per hundred weight in our herd is $7.65, the cost for the high string is $6.88 while the low string is $8.68. This large divide in the cost to produce milk is caused by two factors: 1) Late lactation cows are producing less milk, while their intakes are relatively high, and 2) These cows are consuming a diet that is supplying nutrients above their requirements, and the extra energy, protein, etc. is going on their back in the form of fat and out into the environment in the form of feces. The opportunity to decrease the cost per hundred weight and save feed comes from feeding your lower producing cows a ration that is designed to meet their required intake levels (three lbs lower than your high cows) and is less nutrient dense. In general, lower cost ingredients contain fewer nutrients, and can be fed at higher levels to the lower producing cows, based on their biological needs.

A great way to determine if you are feeding excess protein is to measure milk urea nitrogen (MUN). Milk urea nitrogen increases when the cow is being provided excess protein beyond her biological needs. Ideally, string MUN's will run between 10 and 14 mg/dl. A sample above 14 mg/dl is an indication that excess protein is being fed, and it may be beneficial to reevaluate the ration.

Another tool to evaluate the nutritional status of your herd is to measure feed efficiency. Feed efficiency is the amount of milk produced (fat corrected), divided by the amount of dry feed consumed on a daily basis. Using our example herd, the average feed efficiency is 1.26 lbs of milk per pound of DM consumed. For comparison, the low string is 1.11 while the high string is 1.4 lbs of milk per pound of DM feed consumed. The benchmark for feed efficiency is somewhere in the range of 1.4-1.6 lbs of milk per pound of DM feed consumed, but will fluctuate depending on stage of lactation and animal age. In the above situation, we are over feeding nutrients to an already less efficient group of animals. While changing nutrient density will not affect feed efficiency (still consuming the same amount of DM), it will decrease the cost of feed (lower priced ingredients) thus increasing your return on investment.

The information in this article is presented to help you better understand the principles of proper feeding management. In the example above, feeding one ration to the entire lactating herd was increasing the cost of producing milk . Feeding according to animal requirements is good for the animal, the bulk tank, as well as the pocketbook.

Table 1. Example Scenario

	High	**Low**	**Average**
DMI	57.0	54.0	55.5
$/head/day	$5.50	$5.21	$5.36
Milk (fat corrected)	80.0	60.0	70.0
$/cwt	$6.88	$8.68	$7.65
Feed Efficiency	1.4	1.1	1.3

Figure Reference: Bath, D., Dickinson, F.N., Tucker, H.A., and Appleman, R.D. Dairy Cattle: Principles, Practices, Problems, Profits. Philadelphia: Lea & Febiger, 1985. Print.

Foreman Training Video Tapes

Gregorio Billikopf, UCCE Stanislaus County

Growers and producers may now view video tapes useful for Spanish-speaking foreman training. They follow the book *Labor Management in Agriculture: Cultivating Personnel Productivity*. The first two videos focus on employee discipline.

Farm employers would do well to first share the first video (**Video 14-001**) with supervisors and give them the assignment to engage workers in conversation before praising. Praise must be sincere, of course. In the next video (**Video 14-002**), the 7 steps to more effective employee discipline are depicted. Once again, front end supervisors begin by engaging employees. We do not want workers to think, however, that every time a supervisor shows an interest in them, it follows that there is a correction coming. That is why it is so important for the supervisors to master the simple steps in the first video before watching the second.

There are some situations where the 7 steps do not work without some important modifications. New videos will be added to this page: http://www.cnr.berkeley.edu/ucce50/agro-laboral/7libro/002s.htm

If the videos do not open, try downloading Real Player and Adobe Flash Player. These may be respectively downloaded from: http://www.real.com/ and http://www.adobe.com/products/flashplayer/ .

This is a public service of the University of California.

Milk Urea Nitrogen

Noelia Silva-del-Río, UCCE Tulare County

What is Milk Urea Nitrogen?
Milk urea nitrogen (MUN), the concentration of urea in milk, is a tool to monitor the efficiency of crude protein utilization in dairy cows.

In the rumen, microbes degrade dietary protein to ammonia. When ammonia is coupled with fermentable carbohydrates, rumen microbes are able to capture the nitrogen and synthesize amino acids and microbial protein. However, excess ammonia in the rumen is absorbed across the rumen wall and taken to the liver to be converted to urea. Blood urea is freely diffusible to milk, and therefore, MUN reflects the urea concentration in blood.

What factors influence Milk Urea Nitrogen?
The factors that influence MUN concentrations the most are the concentration and balance of nutrients in the diet. Feeding the following rations will result in wasted feed protein and high MUN values:

- Rations high in crude protein.
- Rations high in rumen degradable protein and soluble protein.
- Rations low in fermentable carbohydrates.

Other factors that affect the MUN concentrations are:

- Water intake: increasing water intake and urine production decreases MUN.
- Dry matter intake: MUN is at its highest 6 hours after feeding and at its lowest prior to feeding.
- Time of feeding related to milking: MUN are usually lower in a.m. samples than p.m. samples.
- Level of production: MUN is higher in high producing herds than in low producing herds.
- Method of feeding: separate ingredient feeding increases MUN more than TMR feeding.
- Parity: MUN is higher in multiparous cows.
- Season: heat stress increases MUN values.
- Milking frequency: herds milked 3 times a day usually have higher MUN than those milked 2 times a day.

How should I use MUN values?
Research studies suggest that the most desirable MUN for Holstein cows range from 10 to 14 milligrams per deciliter (mg/dl). High concentrations of MUN (> 14 mg/dl) indicate an excess in protein feeding and/or deficiency in rapid fermentable carbohydrates. Low concentrations of MUN (< 10 mg/dl) indicate protein-limited diets. If MUN values are outside the normal range, the ration, the milk components, the feeding program and the nutrient balance should be evaluated.

As previously described, many factors affect the MUN values across herds and within herds. The variation is so wide that MUN in individual Holstein cows ranges from 5 to 20 mg/dl. So every herd can have a **different optimal MUN** concentration. Individual cow samples should be summarized into groups to establish the different baselines. The cow group baselines may range from 8 to 16 mg/dl.

Changes in MUN baseline greater than 2 to 3 points should be investigated to identify the factors causing the shift. High **cow-to-cow variation** within a group, even if MUN falls within the normal range, suggests feed bunk problems such as feed mixing, delivery or sorting.

What should I do if MUN falls outside the normal range?
If MUN indicates inefficiency in protein feeding, you should evaluate your feeding program:

- Are the cow rations formulated to target the nutrient requirements especially for crude protein, rumen degradable protein, rumen undegradable protein, starch and sugars?
- Is the ration balanced based on current feedstuff lab analysis?
- Do you routinely reformulate the rations based on dry matter?
- Are your employees following the proper loading instructions? Are they consistent in their mixing and delivery time practices?
- What is the feed efficiency and conversion of nitrogen from feed to milk?

For instance, MUN may increase when cows are switched to corn silage that is less processed or has lower fermentable carbohydrates. Similarly, an increase in MUN is expected when cows are offered a new alfalfa hay higher in crude protein, or a new protein source with a larger fraction of rumen degradable protein.

Take home message
MUN is another tool to monitor the nutritional protein status of dairy cows. MUN values should only be interpreted after examining the entire feeding program.

MUN values are highly variable across herds, so the greatest benefit is to evaluate a group of cows within a herd, and the cow-to-cow variation within a group.

When the Media Calls…

Betsy Karle, UCCE Glenn & Tehama Counties

Nothing seems to strike fear like a call from the media. In recent months, they have been none too kind to our industry, but as dairy producers you really do have the opportunity to tell your story. More often than not, a local station or publication is looking for input about an issue that is important to the community. These are great opportunities to put a face to the farmer and build trust among consumers.

There is a plethora of resources within our industry to help you with the media, including Farm Bureau, California Milk Advisory Board, and Dairy Management Inc. There is really no replacement for a good lesson in media training, which I would encourage all dairy producers to pursue. Most farmers would love to leave this task to industry representatives, but the fact is the media wants to hear from you, and not someone who is removed from the farm. The following are my suggestions to help you conduct an interview with confidence.

When first contacted, ask for the reporter's contact information, what their deadline is, and who else the reporter is interviewing. Also, confirm that you are clear on the focus of the story. Offer to return the call, so you'll have time to gather the information you need. This is a good time to contact your Farm Advisor or promotion organization to ask for tips. Return the call promptly. Once you are actually doing the interview, be sure to speak in complete sentences so your remarks are less likely to be taken out of context and are clearer to the audience. If you are being challenged by a less than friendly reporter, continue to emphasize your points (I suggest the consumer tested key messages from DMI). You don't have to answer specific leading questions, but you should respond with a message that you want to communicate. Of course, they may not use it, but you've avoided a tricky tactic and have used the opportunity to make a point that you think is important.

Most of the same techniques apply to on-camera interviews, but it is also helpful to ask for a preview of the questions they will ask. This gives you a chance to think about the important points to emphasize when asked those questions. Most times these are not live interviews, so you can always ask for a retake if you are not comfortable with your response. Also, it's OK to say "I don't know" if you don't feel you have enough information to answer a question. You can offer to follow up once you're able to find the answer, or answer the more general question. For example, I was recently asked how much water a dairy cow uses in one day. Since this can range astronomically from dairy to dairy, I was hesitant to answer the direct question. Instead, I quoted the amount of water a cow drinks in a day and then explained how water is recycled on a dairy from milk cooling to barn washing to lane flushing to crop irrigation. This author was quite surprised and explained to me that she teaches a community college class and was planning to share this information with her students. In this case, the general information was much more valuable than the actual number range that is so variable.

Usually, the media will want pictures and or video to accompany the story. Of course you have every right to decline, but you can also be very specific about what you'd like them to photograph. A picture under your guidance is always better than one taken from the side of the road without permission. Accompany the photographer and show them setups that would make good visuals. Think of a dairy magazine cover—these are the images that are the most useful for the media. Head shots of cows, parlor shots, calves outside of their hutch, kids and family are all great photo opportunities.

After the piece has run, follow up with a note or email to the reporter and cc their editor. Assuming it was a fair piece, thank them for giving you the opportunity and offer to be a resource in the future. Be sure to check the news story online and respond to any comments if you can offer insight.

For more info and key messages:
http://www.dairycheckoff.com/DairyCheckoff/YourStory/CommunicatingWithYourCommunity/Communicating-With-Your-Community

Incinerators—Yes or No for Mortality Management?

Deanne Meyer, UCCE Livestock Waste Management Specialist and Betsy Karle, UCCE Glenn & Tehama

Once again, this year's World Ag Expo generated what at face value appeared as a simple question. Is it okay to use an incinerator on my farm for mortality management? As it turns out, this is actually a series of questions and the final answer will vary depending on where the dairy is located and the quality of the air in that specific District. The first question is-"Is it legally okay for me to use an incinerator for mortality management?" and the second question is "How do I go about getting an incinerator permitted?" Depending on the answers to these questions, one might even ask another question "Is it okay for me to use a specific make/model of incinerator?" Of course, even if you can get permission to use an incinerator from the local Air District, there is an additional consideration "What do I do with the residual material when I'm done (is my Regional Water Quality Control Board okay with me land applying the residue)?" Let's deal with the first questions first!

One important point to note is that an incinerator is a stationary source of emissions and subject to getting permission and potentially permitting in many of our air districts. This is organized by Air District since the answers vary by District. **If you're even remotely considering purchase and use of an incinerator, contact your local Air District BEFORE spending a penny.**

San Joaquin Valley Air District: The San Joaquin Valley Air District currently permits larger dairy facilities. The District is in the process of modifying emissions factors as well as reducing the threshold of emissions necessary to require permits. As a result, nearly all dairies in the District will need permits for components associated with their dairies (most probably by fall, 2010). The trigger to require a permit to operate is when a facility exceeds the 1/2 major source thresholds for NOx (oxides of nitrogen) and/or Volatile Organic Compounds (VOCs).

If a dairy currently has a permit to operate, then submission of an Authority to Construct (ATC) permit application is required. The District staff will review the ATC and identify the Best Available Control Technologies (BACT) required to allow use of the incinerator. This process requires time, permit fees, and vendor supplied data. Permitting an incinerator also involves performing a health risk analysis in order to evaluate the health risk to the nearest receptors (businesses/residences). Permitting of an incinerator depends on total emissions calculated for the facility including the emissions from the incinerator. The use of the incinerator would be restricted to serving an agricultural/CAF (concentrated animal facility) farm. So, the emissions from the total farm, including the emissions from the incinerator, would be used to determine if the facility exceeded the 1/2 major source thresholds for NOx and/or VOC before a permit would be required. This is just the dairy permit to operate!

Believe it or not, the San Joaquin Valley Air District has a rule just for incinerating too: Rule 4302 - Incinerator Burning, applies to any incineration activity or equipment. This Rule requires that incinerators contain approved multi-chamber components. BACT (if the use of the incinerator is subject to a permit) requires the use of natural gas fuel and a secondary combustion chamber (after burn component) where temperature exceeds 1,600 F and a 0.5 second residence time. If the incinerator is not currently permitted, then it may need to be if the emissions exceed the ½ major source threshold for NOx and/or VOC.

There is an application filing fee of $71 and an hourly processing fee associated with analysis of each project. There is also an annual permit renewal fee which is dependent on the size of the equipment.

How do I know if a particular incinerator is okay to use? Ask the District. Contact the Air District staff to identify if sufficient information has been provided to the District on the specific incinerator. Contact Sheraz Gill at the San Joaquin Air District if you have questions (559) 230-5900. Aside from the logistical question "Is it legal for me to do this?" additional potential restrictions arise to address handling of ash (being sure it's not airborne) as well as final fate of ash. For dairies with Nutrient Management Plans, incorporation of ash into the farming system (land application) will most likely require a modification of the nutrient management plan and potential review by the Regional Water Quality Control Board. The Air Districts will also need to be informed as to how the ash is being disposed.

Improving Feed Efficiency:
Changes in Feed Intake, Milk Yield and Manure Production

Alejandro R. Castillo, UCCE Merced County

Feed efficiency can be defined as the amount of milk produced per unit of feed intake during a normal lactation, and will be affected by body weight changes and environmental factors (e.g. heat stress). For this reason, it is recommended to obtain an annual average of feed efficiency by keeping records of total milk output, including on-farm milk consumed, and cow intake (adjusted for refusals). To obtain more reliable numbers, total milk yield and cow intake should be adjusted. The milk yields should be adjusted for 3.5%-fat-corrected-milk and the intake by dietary dry matter content.

The aim of this newsletter is to discuss changes in feed intake, milk yield and fresh manure production by improving feed efficiency. Information on dry matter intake, milk yield, and estimations on fresh manure production were obtained from a survey of 40 dairy farms in Merced County, California. Dairy farms were divided into two categories, low milk yield and high milk yield (see Table 1), according to DHI information. Feed intake per farm was calculated for each lactating group based on the total daily amount of TMR supplied, divided by the number of cows in each feeding group, and corrected by estimated refusals. Fresh manure production for lactating cows was estimated based on the equation from J. of Dairy Sci. Vol. 88(1):3721, as follows: Manure Excretion (kg/cow per day) = Dry Matter Intake (kg/cow per day) * 2.63 + 9.4. (Note: values in Table 1 were converted from kg to pounds by multiplying by a factor of 2.2).

The results in Table 1 show differences in dry matter intake, milk production and manure production between herds with high and low feed efficiencies. Herds with high feed efficiency consumed 8% more dry matter, yielded 30% more milk per cow, and produced 7% more manure per cow per day; however, these cows produced 25% less manure per lb of milk. Data shown in Table 1 can easily be used to estimate net income changes using diet prices, manure management costs, and milk price. The increment of milk should be evaluated against the increase in cost of feed intake and the savings in manure management costs (energy and labor).

Table 1. Feed intake, milk yield and fresh manure production in herds with low and high feed efficiencies.

		Milk Yield Per Cow			
		Low	**High**	**Difference**	**Difference %**
Feed Efficiency	**lb milk/ lb intake**	**1.25**	**1.50**	**0.25**	**20.00**
Dry Matter Intake	**lb/cow/day**	**49.30**	**53.10**	**3.80**	**8.00**
Milk Yield (3.5% FC)	**lb/cow/ day**	**60.90**	**79.30**	**18.40**	**30.00**
Fresh Manure	**lb manure/cow/day**	**150.20**	**160.10**	**9.90**	**7.00**
Fresh Manure	**lb manure/lb milk/day**	**2.50**	**2.00**	**0.50**	**25.00**

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