



Improving Feed Efficiency

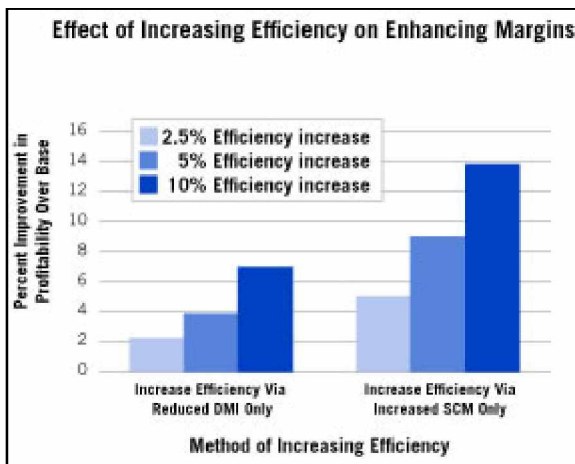
After nearly a year of low milk prices, dairy producers across the nation are becoming very good at finding ways to reduce costs and stretch that hard earned dollar as far as it will go. Like many of your counterparts, you have probably looked at nearly every aspect of your dairy to find opportunities for improvement. Have you considered the feed efficiency of your dairy herd? While we frequently talk about the feed/lb. of gain in steers and feeder cattle, how much do we really take feed efficiency into account when looking at our milking cows?

Feed efficiency is determined by taking the pounds of energy corrected milk (ECM) or fat corrected milk (FCM) divided by pounds of dry matter intake.

FEED EFFICIENCY = MILK PROD. ÷ DMI

The ideal feed efficiency for a dairy herd is in the range of 1.4 to 1.8. That means that for every pound of dry matter consumed, the cow produces 1.4 to 1.8 pounds of milk.

There are two different approaches to looking at improving feed efficiency—increase milk production while maintaining dry matter intake OR maintaining milk production while reducing dry matter intake. Essentially the both come down to



making more milk per pound of feed. Is one method more advantageous than the other? Arm & Hammer Animal Nutrition states that the greatest improvement in profitability comes by INCREASING MILK PRODUCTION. (See chart at bottom left.) The chart compared these figures against a baseline animal producing 85 pounds of milk and consuming 56 pounds of dry matter. Solids-corrected milk (SCM) price accounts for fat and protein premiums and is set at \$14/cwt. With feed costs @ \$0.12 per pound.

In another study, Zinpro Corporation research showed a significant economic advantage by improving feed efficiency from 1.4 to 1.5, while maintaining milk production for a 1,000 cow dairy. (See Table 1 below.)

Herd Size, cows	Milk Yield, lb/day	Dry Matter Intake, lb/day	Feed Cost, \$/lb DM	Feed Efficiency	Feed Cost, \$/Year	Profitability Advantage
1000	75	53.6	\$0.07	1.40	\$1,369,480	
1000	75	50.0	\$0.07	1.50	\$1,277,500	\$91,980

While what and how you feed does greatly impact your feed efficiency and profitability, there are also a number of non-feed factors that are involved. They include:

- Milk composition (fat, protein content)
- Increased maintenance requirements due to heat or cold stress
- Energy expenditure for walking long distances to and from the milking facility, pasture, pens
- Change in body weight due to growth and body weight loss and gain with lactation progression

Excerpts from an article published by Zinpro explains in more detail.

Improving Feed Efficiency of Dairy Cattle

by M. T. Socha, PhD, and D. J. Tomlinson, PhD,
Zinpro Corporation

Adjusting for these factors that affect feed efficiency allows nutritionists to obtain a better estimate of the true conversion of feed to productive purposes, such as tissue accretion, activity, and milk production.

Fat and protein content of milk are the primary determinants of milk energy content. A cow producing 77.1 lb/day of milk containing 3.5% fat and 3% true protein produces as much milk energy as a cow producing 72.0 lb/day of milk containing 3.9% fat and 3.2% protein.

Energy Expenditure for Temperature Stress

Heat stress has been reported to increase maintenance requirements by up to 29%. For a 1,400 lb cow this equates to 2.96 Mcal of additional NEL/day. Increased maintenance requirements result from cows panting to dissipate heat.

Cold stress also appears to affect feed efficiency by both reducing dry matter digestibility and diverting nutrients to heat generation. It has been reported that cold stress reduces dry matter digestibility by 1.8% for each 50° F reduction in temperature below 68° F. Much of the cold stress reduction in digestibility is attributed to increased passage rate of feed through the digestive tract. In addition, maintenance requirements have been estimated to be 51% higher at -4° F as compared to 64° F for a 1,323 lb cow producing 60 lb of milk containing 3.7% fat (NRC, 1981). However, cold stress adjustments for dairy cattle appear to be based upon limited data. There is little doubt that cold stress increases maintenance requirements of lactating dairy cattle. To what extent cold stress increases maintenance is unclear.

Energy Expenditures for Excess Walking

On some dairies, cows walk considerable distance from their pen or paddock to the milking center and energy expended for walking needs to be accounted. For a 1,400 lb cow, milked three times a day and housed in a pen that is 1,000 ft from the middle of the pen to the milking center, maintenance requirement increases by 5.2%. Therefore, the energy

equivalent of 1.7 lb of energy-corrected milk (3.5% fat and 3% protein) per day is utilized for walking to and from the milking center.

Energy Expenditure for Growth and Adjustment for Stage of Lactation

From a large data of over 17,000 data points, it was estimated that first lactation heifer and mature cow are deriving the energy equivalent of 3.8 and 10.7 lb/day of milk (3.5% fat and 3% protein) from body stores prior to 41 days in milk (DIM). In late lactation (after 105 DIM), the first-calf heifer and mature cow are diverting the energy equivalent of 4.6 lb/day of milk (3.5% fat and 3% protein) towards body weight gain. Between 41 and 105 DIM, first-calf heifers are diverting the energy equivalent of 4.6 lb/day of milk towards growth, while body weight of mature cows remains relatively constant during this time period. It is noteworthy that the first-calf heifer derives less energy from tissue reserves in early lactation than mature cows. Once cows begin regaining body weight, first-calf heifers divert the same amount of energy towards tissue accretion on a daily basis as mature cows, but have more days of tissue accretion reflecting continued growth of first-calf heifers.

Other Factors Affecting FE

A number of factors can affect FE **including acidosis, excess shrink due to inaccurate feed mixing and delivery, and bird and pest infestations**. Obtaining a more accurate estimate of the true FE on a dairy can help producers find ways to get more milk out of the feed provided to cows. In addition, obtaining a more accurate FE value can help producers determine the cost effectiveness of various technologies, such as balancing diets for amino acids, formulating diets to more closely meet nutrient needs of cows, feeding more digestible feedstuffs, using rbST, feeding monensin, extended day lighting, and various grain processing methods.

Generally, increasing milk production increases FE as maintenance requirements comprise a smaller portion of nutrient requirements. Table 3 (next page) provides an example comparing the FE of a cow producing 70 lb of milk versus a cow producing 95 lb of milk. Assuming that body weights of both cows are static, 30.8% of dietary energy is devoted for maintenance requirements in the cow producing 70 lb of milk versus 24.7% of dietary energy for maintenance

Body Weight, lb	Milk Yield, lb/day ^a	Maintenance Requirement, Mcal	Production Requirement, Mcal	% of Energy Requirement Used For Maintenance	NRC (2001) Estimated DMI, lb/day	Feed Efficiency
1400	70	10.1	22.7	30.8%	49.8	1.41
1400	95	10.1	30.8	24.7%	58.4	1.63

^a Contains 3.7% fat and 3.1% protein

for the cow producing 95 lb of milk. Using NRC (2001) predicted dry matter intake (DMI), FE for the cow producing 70 lb of milk is 1.41, while the FE of the cow producing 95 lb of milk is 1.63. Thus, increasing milk production should improve FE, and producers are discouraged from restricting dry matter intake as a means of improving FE.

Lameness and disease also affect FE. Most immune responses to pathogens are accompanied by a systemic acute phase protein response, which is characterized by decreased appetite and a shift in nutrient use away from growth and milk production toward production of acute phase proteins and other immune components. For example, under normal conditions, 1.17% of lysine consumed by young chicks is utilized for immune processes, while under a disease challenge, 6.71% of lysine consumed by young chicks is used for immune processes.

Trace minerals also affect FE as they are essential for maintaining optimal health and performance of animals. The impact of trace minerals and trace mineral status on feed efficiency is clearly illustrated in a trial conducted by Colorado researchers. In this trial, calves that received a diet with no supplemental zinc (diet contained 17 ppm zinc) for 28 days had 50% decrease in FE as compared to calves that received a diet containing 40 ppm zinc (23 ppm supplemental zinc from zinc sulfate; see Table 4). The decrease in FE for the calves receiving no supplemental zinc was attributed to both a 46% decrease in average daily gain and a 6.7% increase in dry matter intake. During the 14-day repletion phase, calves receiving zinc methionine (ZINPRO®*) returned to control FE levels three times faster than calves receiving zinc sulfate. Similarly, in a 22-trial feedlot summary, supplementing feedlot cattle with 360 mg of zinc from

zinc methionine (ZINPRO) improved feed efficiency by 4.05%.

Item	Control ^a	No Added Zn ^b
	(40 ppm Zn, ZnSO ₄)	(17 ppm Zn)
ADG, lb	1.30 ^y	0.70 ^z
DMI, lb/day	13.4	14.5
Gain/feed	0.10 ^y	0.05 ^z
Plasma Zn, mg/l	0.97	0.84
Liver Zn, ppm	106	101

Increasing levels of cobalt in lactating dairy diets have also been shown to improve FE. In a summary of two trials, supplementing lactating dairy cows with approximately 10 mg of cobalt from cobalt glucoheptonate (CoPRO®*) improved FE by 2.56%, while supplementing lactating dairy cows with approximately 20 mg of cobalt improved FE 7.37%. It should be noted that cobalt content of the control diet in both experiments was in excess of NRC (2001) requirements.

Conclusion

Feed efficiency is becoming an increasingly important production measure as dairy management becomes more refined. However, to effectively evaluate FE, it must be standardized for milk composition, changes in body condition, environmental factors, and exercise. Numerous factors, including rBST, monensin, extended day lighting, and trace mineral nutrition affect FE.

Contact your Doby Area Nutrition Consultant for assistance in reviewing your ration and looking for ways to improve your herd's feed efficiency.