Enhancing Profitability through Setting Strategic Feed Efficiency Targets

Michael F. Hutjens

Department of Animal Sciences, University of Illinois, 232 ASL, 1207 W. Gregory Drive, Urbana 61801
Email: hutjensm@uiuc.edu

Take Home Message

- Feed or dairy efficiency reflects the amount of fat-corrected milk produced per unit of dry matter consumed with an optimal range of 1.4 to 1.6.
- Days in milk, age, growth, body weight change, forage quality, and environmental factors will impact feed efficiency values.
- Dairy managers should monitor feed efficiency as feeding and management changes occur on their farms to evaluate the impact.

Feed efficiency can be defined as kilograms of milk produced per kilogram of dry matter consumed. Beef, swine, fish, and poultry industries have used feed efficiency (feed to gain ratios) as a benchmark for profitability. Monitoring feed efficiency (also referred as dairy efficiency) in the dairy industry has not been used as a common benchmark for increasing profitability and evaluating dry matter intake (DMI) relative to milk yield.

Economics of Feed Efficiency

With current milk prices, one way to maintain profitability without sacrificing milk production or herd health is by enhancing feed efficiency. Table 1 is an example of how improving feed efficiency impacts the bottom line. Herd A produced 36 kg (80 pounds) of milk consuming 26 kg (57 lb) of DMI for a feed efficiency of 1.40. Herd B produced the same amount of milk, but the cows consume only 36 kg (50 lb) of dry matter, for a feed efficiency of 1.60. Assuming feed costs of $0.15 per kg ($0.07 per lb) of dry matter, Herd B has a lower feed cost of $0.49 per cow per day compared to Herd A. Higher income over feed costs could be the difference between staying profitable or losing money. In addition, Herd B with the lower feed intake and higher feed efficiency will have lower nutrient excretion as manure. This will be important as manure regulations for whole-farm nutrient management are enforced by local, state, and national groups.

Table 1. Impact on feed costs in two herds with different feed efficiencies (Casper et al, 2003).

Measurement	Herd A	Herd B
Milk, kg/d (lb/d)	36.4 (80)	36.4 (80)
DMI, kg/d (lb/d)	25.9 (57)	22.7 (50)
Feed Efficiency	1.40	1.60
Milk Income @ $12/ 45 kg	$ 9.60	$ 9.60
Feed Costs @ $0.15/kg ($.07/lb) dry matter	$ 3.99	$ 3.50
Income of over feed costs	$ 5.61	$ 6.10
Cost to produce 45 kg (100 lb) milk	$ 4.99	$ 4.38

Optimizing feed intake is the “magic” term; not maximizing DMI. Higher nutrient demand for higher milk production led us to believe that maximum DMI must be achieved to meet these requirements. The more DM the cow eats, the more she will milk. For Holstein cows, each additional kilogram of DM consumed could lead to an additional two kilograms of milk. If one kilogram of dry matter costs 15 cents, two kilograms of milk can be worth 50 to 60 cents more income, or 35 to 45 cents more income over feed costs. This guideline assumes two points.

- Ration digestibility is constant (digestibility declines with increased DMI).
- All the nutrients consumed are converted to milk production after maintenance needs have been met (no growth or weight gain for example).

Composition of the diet (forage to grain ratio) and dry matter intake (multiples of maintenance) have marked effects on digestibility and subsequent energy values. Diets that do not promote optimal ruminal fermentation will result in an over-estimation of energy values.

▪ Factors Impacting Feed Efficiency

Feed efficiency (FE) values in the field can vary from 1.1 to 2.0 (Table 2). High producing herds fed a one group TMR will range from 1.4 to 1.6. Early lactation mature high groups of cows can approach 1.8. If cows lose body weight, FE values will increase as nutrients from body weight mobilization can contribute to milk yield. The following factors will shift FE values.

- Reducing days in milk can lead to higher FE values as cows direct more nutrients to milk production at the expense of growth and weight gain.
- Age or lactation number (first lactation cows) can lead to lower FE values as young cows divert nutrients to growth in mid and late lactation.
- Pregnancy requirements reduced FE values as the fetus requires additional nutrients.
- Cows gaining body weight will have lower FE values as nutrients are stored as body condition or fat.
- Digestible forages will enhance FE values as more nutrients are available for productive functions.
- Stimulating rumen fermentation while stabilizing the rumen environment will improve nutrient and fiber digestibility. Rumen acidosis will reduce FE values.
- Excessive heat and cold stress will reduce FE values as more nutrients are needed for maintenance requirements.
- Feed additives (such as rumen buffers, yeast cultures, and fermentation/digestion aids) and silage inoculants can improve FE values by improving digestion and/or nutrient availability.

Table 2. Feed efficiencies in a commercial herd in Wisconsin based on age and days in milk (Hutjens, 2001).

Group	DIM days	Milk Kg(lb)	DMI kg(lb)	DE kg milk/kg DM
1st fresh	27	19 (42)	20.0 (44)	0.95
1st high	124	36 (79)	22.7 (50)	1.58
1st preg	225	29 (64)	24.1 (53)	1.21
2nd fresh	20	27 (60)	23.6 (52)	1.15
2nd high	80	46 (101)	26.4 (58)	1.74
2nd preg	276	39.5 (67)	24.5 (51)	1.31

Research on Feed Efficiency

Tennessee workers monitored 13 dairy herds over a 14 month time period evaluating feed efficiencies as the environment, herd, and feeds changed. Variables measured included temperature (< 21 degrees C and > 21 degrees

C), days in milk, dry matter intake, milk yield, milk fat percentage, acid detergent fiber, neutral detergent fiber, and forage level. As summer degrees, days in milk, kilograms of dry matter intake, percent forage in the ration, neutral detergent fiber percent, and acid detergent fiber percent increased, feed efficiency declined (this resulted in a negative correlations). For example, as days in milk increased from 150 to 200 days, feed efficiency would decline. Cool weather favored high feed efficiency (1.40) compare to warm weather conditions (1.31). Dairy efficiency and milk yield were positively correlated (more milk resulted in higher efficiency). Fiber intake and level reduced feed efficiency. The variation in these rations was limited reducing the impact on feed efficiency.

Genetics may also play a role in dairy efficiency. Daughters from high genetic merit bulls produced more milk than low genetic merit bulls even though feed intake was not different. The F1 Holstein-Jersey crosses demonstrated greater net efficiency than did the purebred Holstein or Jersey. It might be possible to select for more economic efficiency by focusing on dry matter intake, live animal weight, and/or other variables.

■ Fine Tuning Feed Efficiency

The following guidelines can be used to refine FE values measured on dairy farms.

- Correct for milk components as more nutrients are needed as milk fat and protein content increases. Values reported in this paper are based on 3.5 percent fat corrected milk (3.5%FCM). The following formula can by used:

  Kg 3.5% FCM = (0.4324 x kg of milk) + (16.216 x kg of milk fat)

- On the dairy farm, use the thumb rule of adding or subtracting 0.45 kg (1 lb) of milk for every one-tenth percentage point change above or below 3.5 percent fat test. For example, if a herd averages 31.8 kg (70 lb) of milk with a 3.9 percent milk fat, the estimated pounds of 3.5% FCM would be 33.6 kg (74 lb) instead of 31.8 kg (70 lb).

- Dry matter intake must be corrected for weigh backs or feed refusals. For example, a herd manager delivers 22.7 kg (50 lb) of dry matter per cow with a four percent feed refusal. The number to use in calculating FE is 21.8 kg (48 lb), not 22.7 kg.

- Another comparison is FE value compared to the milk yield using the “13 pound tax” (U.S.) or “6 kg tax” (Canada) for Holsteins (adjustment for maintenance). The “6 kg tax” for Holsteins reflects the ten megacalories (Mcal) of net energy needed for maintenance functions (higher for cows on pasture and experiencing heat/cool stress). The remaining nutrients above maintenance can be used for milk production or other productive functions.

Milk yield: (DMI consumed - 6 kg of DM) x 2

- For example, a herd consuming 25 kg of dry matter could support 38 kg of milk using the formula of 25 kg – 6 kg equals 19 kg times 2 (2 kg of milk per kg of DM) equals 38 kg of milk. For Jersey cows, use 4.5 kg of dry matter for maintenance.

References

Britt, J.S., R.C. Thomas, N.C. Speer, and M.B Hall. 2003. Efficiency of converting nutrient dry matter to milk in Holstein Herds. J. Dairy Sci. 86:3796-3801.

Casper, D, L Whitlock, D. Schauff, and D. Jones. 2003. Feed efficiency boosts profitability. Hoard's Dairyman Magazine. Sept 25.

Hutjens, M.F. 2001. Where are you on feed costs? Hoard's Dairyman. Jan 20

Oetzel, G.O. 2003. Personnel communication.

Veerkamp. R.F. 1998. Selection for economic efficiency of dairy cattle using information on live weight and feed intake: A review. J. Dairy Sci. 81-1109-1119

Wang, S, G.L. Roy, A.J. Lee, A.J McAlliser, T.R. Batra, and C.Y. Lin. 1992. Evaluation of various measurements of and factors influencing feed efficiency in dairy cattle. J. Dairy Sci. 75:1273-1280