Measuring Feed Efficiency
Why & How on the Back of a Napkin

Robert C. Fry[1]
Atlantic Dairy Management Services

FEEDING EFFICIENCY has been described in many ways in an effort to measure the production efficiency of converting dietary inputs into milk. Frequently it referred to as the dry matter efficiency (**DME**) and is simply calculat[1]ed as the pounds of milk produced divided by the dry matter feed consumed. Dependant on the stage of lactation the DME for a herd will be between 1.30 and 1.70. If the DME is calculated for individual production groups within a herd the values may range from 2.0 to 1.0 as a group of cows move along the lactation curve. Additional accuracy has been provided to the DME calculation by adjusting the milk production to a standardized milk fat and protein percentage. This calculation is a more accurate determination of feeding efficiency and is referred to as energy corrected DME (**EC-DME**).

Historically in non-dairy livestock production feeding efficiency has most often been described as the feed conversion ratio (**FCR**), and is a measure of the animal's efficiency of converting feed to productive body weight mass. Lower FCRs indicate more efficient conversion. For example, in the beef industry the typical FCR is 8:1 (also commonly referred to as the feed to gain ratio) and can be lowered when new technology or improved management systems are implemented. Ruminants on high forage diets will have higher FCR than the same species where forage and grain are used. Single stomach animals on an all grain diet will have the most efficient FCRs.

Each species has their specific bench marks and goals for FCRs. Feeder pigs have a FCR of 3.4 to 3.6. Atlantic salmon have a very good FCR of 1.2:1 whereas broilers 1.8:1, and layers 2:1. It is important to understand that industries using the FCR are measuring the dry weight of feed against the live or wet weight gain. For this reason at times in the fish industry FCRs of less than 1 : 1 are possible with commercial diets, as the pellet being fed is a "dry" diet, and a high percentage of weight gained by the fish, is water trapped in the tissues and cells.

In the dairy industry convention has adopted the inverse calculation of FCR to describe feed efficiency. Because the end product (milk) is 87% water the FCR calculation will be very low and usually less than 1.0. For example, if feed intake was 50 pounds and milk output was 80 pounds the FCR would be 0.625 (50÷80). The inverse of the feed conversion ratio becomes the feed efficiency of 1.60 (80÷50). Feed efficiency, contrary to FCR, is improved as the ratio gets higher.

Dairy feed efficiency monitoring is relatively new compared to other livestock species but never the less is quite an important indicator of profitability. Feed expenses

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[1] Contact at: 12246 Locust Grove Rd., Kennedyville, MD 21645; Email: rcfry@baybroadband.net

are often at least 50% of the total revenue on a dairy farm. Minor changes in the conversion of feed to milk will impact whole farm profitability. The gold standard for measuring feeding profit is the calculation for income over feed cost (**IOFC**). However this calculation is often cumbersome on a day to day or week to week basis because milk pricing is unknown until sometime in the future and changes in feed prices are often out of the control of management.

Feeding efficiency on the other hand is quite easy to calculate and is directly proportional to IOFC. In its most simplified form FE is calculated knowing two metrics, milk production and dry matter intake (**FE** = Milk ÷ dry matter intake). Because of breed, stage of lactation, season, and genetics a more correct measure of FE is calculated using energy corrected milk production. After adjusting milk volume for its butterfat and protein content the output of milk volume is more accurately associated with dry feed intake. The energy corrected DME (**EC-DMI**) formula adjusts milk to standardized butterfat and protein. The formula for calculating energy-corrected milk (**ECM**) is ((12.82*fat lbs)+(7.13*protein lbs)+(0.323*milk lbs)).

After correcting milk volume for butterfat and protein composition the EC-DME is a simple calculation dividing the DMI into the ECM. Key points to remember when evaluating EC-DME are "higher is better", early lactation will be higher than late lactation, diet formulation and feed additives will influence the ratio, higher digestible forages will drive the ratio higher. Most important is that EC-DME has a direct and positive influence on IOFC within the parameters under management control.

SESSION NOTES