Economic Aspects of Nutritional Monitoring on Dairy Herds

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Veterinary nutritional services are an integral part of the herd health services offered to dairy clients (1). Nutrition plays a vital role influencing the production efficiency of the herd both on a disease and input cost level. Feeds form approximately 40-60% of the total input cost of milk production. More importantly the feeding program is a cost center that can be effectively controlled at minimal additional cost. The veterinarian can play the vital role in providing unbiased nutritional services at relatively low cost. The purpose of this talk is to go over the nature of this service.

A nutritional service can be broken down into three main areas of routine activity in which the veterinarian can play a vital role: 1) Feed Selection, 2) Feed distribution, and 3) Monitoring production efficiency. Each of these areas will be discussed in detail.

Feed Selection

Feed selection is an important part of the nutritional service and forms the backbone of the feeding program. Producers are faced with the problem of selecting from a variety of sources the combination of feeds that will help maximize his long term profits. Selected feeds should fit in with the feeding program and be economically efficient. Veterinarians can help in this selection process by giving unbiased advice.

The first part of the feed selection process involves knowing the nutrient content of the feed. For grains that are commonly traded, NRC (National Research Council) (2) tables can provide their approximate nutrient analysis. Forages and unusual feeds require nutrient analysis to be performed by laboratory methods. It is important to realize the limitations of laboratory analysis. A recent laboratory survey project conducted by the Nutrition Section of New Bolton Center, found that dry matter, acid detergent fiber, crude protein, calcium and phosphorus had coefficients of variation (standard deviation/means of samples) of ranging 5-12% while magnesium, potassium, copper, zinc, iron and manganese had coefficients of variation ranging from 11-29% (Table 1). Hence our ability to accurately access nutrient quality and therefore economic value is somewhat limited.

Forages and grains are evaluated according to nutrient composition and market prices by an algebraic procedure similar to a formula described over 50 years ago (3). The algorithm uses Net Energy Lactation and crude protein as the nutrients to determine the economic value of a feed (4).

TABLE 1. Nutrient Analysis.

Nutrient	Mean	Coefficient of Variation
Dry Matter %	31.9	5.3
Crude Protein %	17.8	8.8
Acid Det. Fiber %	39.1	6.5
Calcium %	1.06	12.1
Phosphorus %	.32	11.7
Magnesium %	.40	18
Potassium %	3.3	21
Copper PPM	9.9	22
Zinc PPM	30.2	12
Iron PPM	489	29
Manganese PPM	57	11

* 6 Replicate Samples Sent to 5 Forage Labs.

Nutrient price parameters (X, Y) are calculated by using two reference feeds of known market price, normally in our area soybean meal (48%) and shelled corn (Table 2). A replacement cost or implicit value for each feed is calculated using these price parameters and the feed's energy and protein composition. The economic value of a feed is related to its nutrient composition. Nutrients most commonly used to economically value feeds are crude protein and net energy. These nutrients account for approximately 90% of the variation in price seen in feeds. We will commonly use soy bean meal and shelled corn as base feeds to estimate the economic nutrient value ($ value of CP%, $ value of energy), since these feeds have well established market prices. These nutrient values can also be used to estimate the substitution value for forages.

This valuation format allows us to estimate the economic value associated with forage nutrient quality. Economic substitution values are calculated for a forage and then compared to the economic substitution value for a "goal" forage (usually the NRC nutrient analysis for the forage). The difference represents the potential loss or gain associ-

TABLE 2.

Base feeds SMB 48% and Shelled Corn

		CP%	NE (MCALS/LB)
SBM	$200/ton =	X 48%	+ Y .75
Corn	$100/ton =	X 8.9%	+ Y .82

Solution: Y = 92.3 X = 271.6

	CP%		NE	Substitution $
Corn Silage	271*.028	+	92.3*.25	$30.66/ton
Hay	271*.082	+	92.3*.53	$71.14/ton

ated by having a protein and energy composition different from the goal. This method of economically monitoring forage quality forms a powerful incentive for producers to improve nutrient quality.

New applications of linear programming (multi-period linear programming) are being applied to the ration formulation problem. Current linear programming techniques balance rations using current feed prices. The proposed multi-period linear programs will additionally use future prices of feeds, physical and economic inventory constraints to base the selection of feed ingredients for ration formulation (5). This will enable the producer to better plan his feed expenditures and storage and minimize feed price swings.

Feed Delivery

Feed delivery is an important part of the feeding program. In general, feed delivery systems which have a method of weighing feed realized higher production levels (Keown, 1987). For any herd, one extreme feeding system would be to feed each cow individually according to her maintenance and production requirements. This feed delivery system would have the cheapest feed cost but the highest labor cost. Grouping cows allows the labor cost to be reduced while the feed cost will increase according to the degree of overfeeding within any group.

The feed delivery system is also important in ensuring a balanced ration is delivered to the appropriate cows. Thus nutrient delivery, and economic efficiency must be considered when selecting a delivery system.

Nutritional Monitoring

The last important aspect of a nutritional service is monitoring the production and profit impact of the feeding program. Monitoring production has received a lot of emphasis and a number of indices have been developed. These indices usually measure a physical flow of input to output, such as grain to milk ratios or the measure ratio of a value of input to output such as feed cost/cwt. The producer is to use these indices as a guide to improving profit. To test how these indices correlate with profit/cow (income over feed cost IOFC) two farms were followed for five years and the correlations between indices and OIFC were calculated.

TABLE 3. Correlation of Common Production Measures with Income Over Feed Cost.

	Milk/Grain	Feed Cost/CWT	Grain $/CWT
	—.18	—.317	—.154
P	0.5	<.001	.10

The poor correlations show that these production indices are poor monitors of profitability.

A feed monitoring system is needed that is sensitive to changes in feed values and amounts as well as milk values and amounts. The system needs to reflect changes in profit that are due to actual changes in production efficiency versus changes associated with price changes. Performance ratios allow one to monitor these effects on profitability. Table 4 shows two periods of production information: milk produced, price, economic value and input used to produce this grain (it's quantity, cost, and value). From these values one can calculate the CHANGE RATIO which is simply the ratio of period 2/period 1's parameters. These represent the % change in quantity value or price for both inputs and outputs. PERFORMANCE RATIOS (change ratio output/change ratio input) can be calculated for the quantities, values and prices of the outputs and inputs. In the simple example, profits between the two periods have increased by 2.18%. Productivity (conversion of grain to milk) actually decreased profits by -.66% while price changes allowed profits to increase by 2.86—the total effect being a change in profit by 2.86%-.66% = 2.18%.

TABLE 4. Sample Calculations.

Output	Period One	Period Two	Change Ratio
Milk Lb. (Q)	19500	19700	Q2/Q1 = 1.01
Value $ (V)	2,048	2,069	V2/V1 = 1.01
Price $ (P)	10.50	10.50	P2/P1 = 1.00
Input			
Gain Lb. (Q)	5900	6000	Q2/Q1 = 1.017
Value $ (V)	531	525	V2/V1 = .989
Cost $ (P)	190	175	P2/P1 = .972
IOFC (1) = $1,517			
ICFC (2) = $1,544			
% Change in Profit = 2.18%			

TABLE 5. Performance Ratios.

Output	Output %	
Milk (Lb.) (Q)	1.01	
Value $ (V)	1.01	
Price $ (V)	1.00	
		Performance Ratios
Input	Input %	Output % / Input %
Grain (Lb.) (Q)	1.017	.993
Value $ (V)	.989	1.0218
Price $ (P)	.972	1.0286
Profits Increased (Value Performance Ratio — 1)	=	2.18%
Productivity Decreased (Quantity Performance Ratio — 1)	=	—.66%
Price Recovery Increased (Price Performance Ratio — 1)	=	2.86%

The proposed methodology can be expanded to incorporate several inputs (forage, grain, mineral etc) and several outputs. We feel that the above method will allow the producer to evaluate economic efficiency as a function of both productivity changes as well as prices changes.

References

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