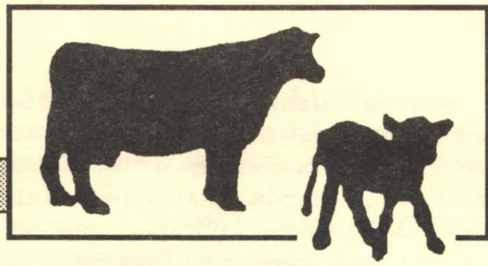
Virginia Cooperative Extension
Virginia Tech • Virginia State
REPRINTED 1992



Dairy
PUBLICATION 404-150

Economics of Forage Testing and Feeding Balanced Rations

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It is generally acknowledged that feed represents about 50% of the cost of producing milk and purchased feed about 30%. In 56 Virginia and West Virginia dairy herds during 1985, purchased feed amounted to 29% of the total cost. These purchased feed costs, per cow or per cwt milk, were lower in the more profitable herds. One way to reduce feed costs and increase milk sales is to harvest forage at its optimal stage of maturity and then properly supplement this forage with desired amounts of energy, protein, minerals, vitamins, and fiber.

As an example, in a Wisconsin study, alfalfa hay was cut in the pre-bloom, early-bloom, mid-bloom, or full-bloom stage and supplemented with four levels of concentrate (20, 37, 54, and 71% of the ration). Yield of 4% fat-corrected milk was greatest with the highest quality forage, regardless of the level of concentrate supplementation (Kawas et al., 1983). Income over feed costs were estimated to decrease with advancing alfalfa maturity. Increasing the level of concentrate feeding could not offset the effects of lower quality forage (Table 1). Higher concentrate levels can depress milk fat test and cause such health problems as abomasal displacements.

Table 1. Effect of stage of maturity in alfalfa on income over feed costs.

Stage of maturity at harvest	% Concentrate in Ration			
	20	37	54	71
	-----Income Over Feed Cost ($/cow daily)---			
Pre-bloom	9.15	9.41	9.55	9.08
Early-bloom	7.95	8.16	8.29	8.10
Mid-bloom	6.61	6.64	7.10	6.01
Full-bloom	5.67	5.60	6.80	6.91

Calculated from data of Kawas et al. (1983).

Dairy producers have had access to forage testing, ration balancing, artificial insemination, and Dairy Herd Improvement programs for some time. The benefits of these programs were examined through a survey of 2,712 dairy herds in 11 southern states (Carley and Fletcher 1986). Herds that used either forage testing or ration formulation or both produced 693 lb more milk per cow during a 12-month period than herds that used neither. It was not reported how many herds used these programs. The survey indicated a 52% probability that Virginia dairy farmers would use all these practices compared to only a 19% probability that dairy farmers in the state with lowest increase in milk yield would use these practices. Of the 11 states, Virginia dairy farmers made greater use of these practices.

During a 12-month period, 29 Virginia dairy herds were involved in a field study on the use of forage testing and computerized ration formulation (Jones et al., 1978). Eleven herds made no use of the service. Their rolling herd average decreased by 86 lb per cow compared to a state average increase of 431 lb. There were 5 herds that made occasional use of the program, and these herds increased 484 lb per cow. The remaining 13 herds used the programs regularly. Their average increase in milk yield was 779 lb per cow, or 865 lb more than the herds that did not use the program. Income over feed cost was projected to be $52.60 per cow higher in the herds that made regular use of the programs. During the 12 months, they received 7.2 formulations compared to 4.8 formulations in the occasional-use herds. An average of five samples was submitted at each formulation request, including two forage and two concentrate mixes. If all samples had been analyzed for dry matter, crude protein, and acid detergent fiber (assumed cost of $10 per sample) and every sample was tested twice annually for minerals ($18.50 per sample, complete analysis), feed analysis would have cost $454 per year. Computer time cost $188 for all formulations, thus, the total cost was an average of $642. The increased income over feed costs for a 100 cow herd would have amounted to $5,260. Forage testing and ration formulation was estimated to return $4,618 or a return of $7.19 for every $1.00 cost. A survey of 240 Virginia dairy herds in 1983 revealed that over 50% of the herds used forage testing and ration balancing offered by the Extension service.

In 16 West Virginia herds, 50% were reported to be underfeeding and the other 50% were overfeeding when nutrient intakes were compared to National Research Council recommendations (Varga et al., 1985). Only five of the 16 herds were within 2 Mcal NE lactation of NRC, but 70% were underfeeding phosphorus. On many of these farms, rations were improperly formulated due to either erroneous estimations of dry matter intake, changes in forage composition and nutritive value, or using NRC published values for forages rather than actual testing. The most prevalent problem in these herds was low fat test. This is often caused by excessive concentrate or energy consumption. The end result is higher feed costs, lower price for milk, and reduced profits, as well as potential herd health problems.

The economic value of forage testing and ration formulation can be further demonstrated by several examples where rations were formulated to supplement excellent, average, or poor quality forages (Table 2). The respective alfalfa silage was assumed to be pre-bloom, early-bloom, or full-bloom and the expected levels of milk production found in the study reported in Table 1 were used (87, 77, and 70 lb milk per day). Alfalfa silage and corn silage each were used at 50% of forage dry matter.

Table 2 shows average milk yield and income over feed cost for excellent, average, or poor quality alfalfa and corn silage. Also shown is the expected impact when each of these forage qualities is fed but forage quality assumed in ration formulation is different. In the first example, when forage quality was excellent but average value was assumed, fiber intake would be low due to higher concentrate feeding, and milk fat content would be depressed. The impact would be more severe if poor quality was assumed (lower milk yields, depressed fat test, and excessive weight gains).

Table 2. Expected animal response when fed lower quality forages or rations unbalanced for forage nutritive value.

Actual forage quality	Forage quality assumed in ration formulation	Expected animal response
Excellent	Excellent	85M, $7.70[a]
	Average	84M, $7.67 Low fiber intake Milk fat depression
	Poor	Low fiber and protein intake Reduced milk yield 77M, $7.01 Milk fat depression Excessive weight gain
Average	Excellent	77M, $6.79 Possible dietary calcium deficiency and effect on herd health
	Average	77M, $6.79
	Poor	Reduced milk yield 71M, $6.26 Low fiber intake Milk fat depression
Poor	Excellent	Reduced milk yield 64M, $5.57 Possible calcium deficiency
	Average	Reduced milk yield 66M, $5.82
	Poor	71M, $6.27

[a]Expected milk yield and income over feed cost per cow daily.

Cows fed average quality forage do not produce as much milk as when fed high quality forages, even when concentrate feeding levels are increased. If the average quality forage was supplemented as though it were better in quality, milk production probably would not be affected but the ration may be deficient in minerals such as calcium.

By assuming the forage is low quality, higher concentrate feeding results in low ration fiber content and milk fat depression. The ration would contain inadequate protein and milk yields would be reduced.

With poor quality forages, milk yields decrease if the nutritive value is overestimated because protein and/or energy intakes are lower than desired. Such practices are less economical.

Near-infrared reflectance spectroscopy (NIR) has been developed to provide quick and accurate estimates of forage nutritive value. NIR results are highly correlated to results from standard analytical methods. In one procedure, NIR provides information on forage composition for crude protein, acid detergent fiber, neutral detergent fiber, and minerals (calcium, phosphorus, magnesium, and potassium). For hay crop silages, heat-damaged protein can be estimated and crude protein content to be used in ration formulation can be adjusted. TDN and net energy values are not analyzed but are computed from fiber concentrations.

Conclusions

The most economical ration is a balanced ration. A balanced ration is one in which the feed requirements of the particular animal are completely met without an excess of any nutrient. This would include such nutrients as protein, energy, fiber, and the vitamins and minerals. The most economical feedstuffs are usually home-grown forages, which vary considerably in chemical and nutrient value. To properly and economically supplement these feedstuffs for maximum profit, the nutritive quality of these feeds must be determined as closely as possible. Currently, chemical analyses are the best predictors of chemical composition and nutritive value. For every dollar invested in feed analysis and ration formulation, a return of $7 should occur. Returns would be greater if more economical feed ingredients can be utilized. Harvesting of high-yield forage at optimal maturity and feeding in a balanced ration should reduce purchased feed costs, total cost of milk production, and allow dairy cattle to acquire maximal milk yields while maintaining desired herd health.

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