

Dairy Session

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Nutrition Management Programs for Dairy Herds

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I. Introduction: Nutrition and Herd Health

The times are changing. The accumulation of surplus dairy products has combined with a distressed national economy and high interest rates to set the stage for an intense economic squeeze on our dairy farms during the coming years. Like all good businessmen under pressure, most dairymen will look at their expenditures, cut what they can, and then look for ways to increase the efficiency of their operations. Total herd health programs should contribute to increased efficiency and should thrive in these times. Ineffective programs will be in trouble.

Concepts of herd health programs are changing. As a new veterinary graduate of 1977, my concept of a dairy herd health program consisted of a well defined reproductive program, a somewhat confused vaccination program, and some rather vague ideas about rearing calves and controlling mastitis. That concept has changed. The best people in our profession have reshaped herd health into something much more capable of dealing with problems limiting dairy production. The emphasis has changed from health toward production with health. Dr. Paul Blackmer¹ has characterized a dairy herd health program as including eight components:

1. Veterinary—client meetings
2. Calf management
3. Reproductive program
4. Mastitis management
5. Vaccination program
6. Parasite management
7. Nutrition management
8. Individual animal care

It is time for us to abandon the idea that a herd health program starts with a plastic sleeve. We must become problem oriented. The program starts with a meeting between client and veterinarian to identify problems, define responsibilities, and set goals. Ultimately, all problems must be evaluated within the context of production goals. A priority list should be made. If subclinical mastitis appears to be the primary production limiting problem, we should set that plastic sleeve aside and grab our Detco recorder and flowmeter and some culture tubes and go. If nutritional

mismanagement shows everywhere, we should grab our scale, our hay probe, our calculator and go. If the replacement heifers are physiological cripples, the program should start in the calf barn. And if our client has a barn full of open cows going dry, we should get that sleeve back on.

I used to wonder why the reproductive program my practice offered had been so overwhelmingly accepted by our good producing dairymen and so nearly totally rejected by our poorest. I now believe that we were offering the wrong program at the wrong time. The effect of a reproduction program on a farm's cash flow is entirely negative during its first year. Typically the dairymen who operate at the lowest production levels lack both the intellectual fortitude and the cash flow to support a reproductive program to the point where it produces fresh cows. Approaching these herds from a production problem basis, we usually begin with nutrition and mastitis control. It is often possible to make a 25% increase in milk production within two months on these farms. In addition to more milk to sell, these dairymen find themselves with two new things; confidence in the program and cash to pay for it. And with confidence and cash, the other aspects of herd health work fall easily into place. Production oriented herd programs have enabled us to extend herd health work onto the poorest dairy farms we serve, to the dairymen who need them the most.

It is time that we begin to measure the success of herd health programs on two criteria:

1. Milk production
2. % of cows dying or leaving the herd for non-dairy purposes

For too long, I measured the success of my work in terms of calving interval, somatic cell counts, and calf mortality rates. In doing so, I allowed myself to feel good about various activities and yet ignore the overall purpose of all this activity. Why achieve a 12 month calving interval if the cows come fresh with blind quarters? Why lower somatic cell counts if protein deficits already have a lid on production? Why develop a sophisticated milk cow ration if the herd consists of hypoxic lungers that barely survived calthood?

By coming to terms with the ultimate purpose of our work, we are forced to look beyond partial successes and deal with the significant production problems of each client. No longer can I pat myself on the back for good reproductive performance of a herd whose owner is going broke due to low milk production.

Of all the aspects of total herd health programs, my involvement with nutrition came last. And of all aspects of herd health, my involvement with nutrition came hardest. My experience is typical of our profession in general. Why? There are so many reasons for us to be actively involved with nutrition. As veterinarians, we are often the first persons to diagnose the manifestations of nutrition mismanagement. We are on the farms regularly, we have a trained sense of animal well-being, and we have the respect of our clients. Why is it so difficult?

We may talk of time pressure from our other work and of competition for influence from feed company representatives, but the plain truth is that our formal education leaves us rather poorly trained in matters of nutrition. It is a sad and a simple fact that when I graduated from veterinary college I knew the milligrams of dexamethasone and grams of glucose needed to treat a cow for ketosis, but I had no idea of the energy requirements or the feeding practices needed to prevent her from getting it in the first place. It is a sad and a simple fact that I knew the positive signs of estrus and could even do a reasonable job of predicting it from rectal palpation, but I had no notion of the balance of energy, phosphorus, and vitamin A needed for her to express it in the first place. These are sad and simple facts that the curriculum committees of our veterinary colleges need to face squarely and face soon if the intent is to produce veterinarians capable of the work that will be demanded of them.

II. Nutrition Concepts: Focal Points of Field Application

Nutrition is a complex science and it is very easy to lose direction in the midst of NPN, Mcal NEL, ADF-nitrogen, protected fat, lower intestinal tract buffers, and beta-carotene. In the delivery of nutrition management services to my clients, I try to focus attention on four broad areas:

1. Dry matter intake (DMI)
2. Forage to concentrate ratios (F:C)
3. Forage quality
4. Rumen stability

There is a tendency to focus attention upon minor additives to a grain mix when production and health problems appear. Clients will want to add iodine or selenium or sodium bicarbonate rather than deal with the basic soundness of the ration or the discipline of their feeding practices. While minor additives certainly deserve attention, that attention should be given only after the basic issues are resolved.

Dry Matter Intake

I view the determination of accurate dry matter intake (DMI) figures as the foremost question to be answered in the delivery of a nutrition service. Great pains are justifiable. Once determined, *actual DMI is compared to predicted DMI*. All sorts of predicted DMI formulas exist, but most have too many exponents for me to comprehend. I like the Iowa State formula which I remember as a 2-1-3 rule: predicted DMI equals 2% of body weight plus one-third of the weight of 4% fat-corrected milk. For example, consider a 1300 lb. cow producing 60 lbs. of 4% milk:

$$\begin{aligned} 1300 \text{ lbs.} \times .02 &= 26 \text{ lbs.} \\ .33 \times 60 \text{ lbs.} &= 20 \text{ lbs.} \\ \text{Predicted DMI} &= 46 \text{ lbs.} \end{aligned}$$

The figures generated with this formula are very similar to those produced with the Ohio State formula, but they are higher than NRC and California predictions. I find the higher figures to be very accurate when feedstuff quality and management skills are optimal.

If actual DMI figures are significantly less than predicted, my job is to determine why. Trouble-shooting will center on these areas:

1. As-fed intake (AFI)
2. Availability and palatability of feedstuffs
3. Availability and quality of water
4. Environmental factors

1. As-Fed Intake

As dairymen move toward more and more ensiled feedstuffs, concern with as-fed intake grows. It is difficult for cows to consume much over 100 lbs. of as-fed feedstuffs per day. Rations based on corn silage, haylage, and high-moisture corn can reach 100 lbs. AFI very easily.

2. Availability and Palatability of Feedstuffs

Availability and palatability of feedstuffs involves many factors. If alfalfa is harvested at late maturity, consumption will decrease drastically. Forages ensiled at inappropriate moisture levels may heat badly, reducing both feeding value and consumption. Sometimes dairymen simply do not place enough feedstuffs in front of their cows by enforcing the misguided notion that the mangers must be eaten clean before another feeding is offered. Sometimes the quantities fed are too large and too infrequent with resulting deterioration as the feeds sit exposed. Bunk space may be inadequate and the small and timid cow may be denied access. Sometimes access is a question of time, not space, as in many parlor grain feeding systems. As delivery systems become more mechanized, the accuracy and maintenance of self-feeding devices warrants our attention. Mechanized delivery systems may cause stratification of nutrients within the system which in turn can reduce palatability and consumption. Palatability of protein and mineral supplements has become more important with the increased feeding of high-moisture corn. The majority of my clients

switching to high-moisture grains have neglected to install mixing facilities to blend supplements with those grains, choosing instead to top-dress these items in a piecemeal fashion. This intensifies problems of refusal and therefore balance.

4. *Availability and Quality of Water*

Dry matter intake seems to be directly related to water consumption. I see one side of this problem when I cannot fill my water bucket in the milkroom when the cows are drinking. The other side of this problem concerns fouled water cups and tanks as well as septic sources of the water supply itself. Stray voltage problems concerning the water distribution system need to be considered.

4. *Environmental Factors*

Environmental concerns center upon light, heat, humidity, and odor. DMI is usually improved with housed cattle if lights remain on 16 hours a day. DMI will be suppressed in summer heat, especially at unshaded outdoor feedbunks and inside poorly ventilated humid barns. The presence of rotten, putrid feedstuffs in the corners of bunks and mangers will suppress intake.

Forage to Concentrate Ratios

The conventional Minnesota milk cow ration is based on alfalfa, some corn silage, and concentrates of shelled corn, oats, barley, and soybean meal. Using these feedstuffs, I try to develop feeding programs where forages account for 60% of the DMI and concentrates 40% for the average cow in the herd. We will allow that ratio to reverse itself to 40:60 only for cows while production exceeds 100 lbs. of milk per day.

Another approach that delivers similar results is based upon another 2-1-3 rule. Forage DMI is set at approximately 2% of body weight and concentrates are fed to the majority of the herd at a rate of about one lb. per 3 lbs. of milk produced. For example, a herd of cows with an average body weight of 1350 lbs. are averaging 54 lbs. of 4% milk per day. The overall feeding plan would look something like this:

lbs. 4% milk	lbs. forage DMI	lbs. conc. DMI	F:C ratio
30	27	10	73:27
60	27	20	57:43
90	27	30	47:53
Herd Average			
54	27	18	60:40

In fact, the ratio for the low to average cows would be shifted even more toward forages while the ratio for very high producers may shift a bit more toward concentrates. This general format is consistent with very high production and with health. In general, major shifts toward forages will tend to limit production while major shifts toward concen-

trates tend to kill cows through all manner of foot, liver, and digestive problems.

Forage Quality

There's an old saying that when the top dairyman in the area goes by with his mower, drop what you're doing and go mow hay too. It's right on the mark. We cannot formulate a concentrate mix to compensate for the low energy value of poor forages. Yes, protein levels can be adjusted and the cow's needs can be met. But our problem is energy. Energy intake determines the upper limits of milk production and clients need to understand this. Because of limits of dry matter intake, high producing cows cannot consume enough feedstuffs to meet energy needs in early lactation. There is simply no room in her ration for poor quality, low energy forages. Last summer, I saw alfalfa analyses NE_L values ranging from .46 to .73 Mcal per lb. of dry matter. The energy density of a forage is largely a result of management decisions. On the other hand, the energy density of a grain will show little variation and is not as responsive to management skills. The point needs to be made that next winters production limits are being determined in this summers hayfield and cannot be corrected with a little soybean meal next fall. Investment in harvesting equipment and storage structures to aid the harvest of high quality forages during adverse weather should be supported because Minnesota does have some weather like that.

Rumen Stability

Rumen stability is essentially a relationship between nutrients and time. Nutritionists balance rations on the basis of nutrients per cow per day. We need to focus on that "day". We need to concern ourselves with the balance at 6:00 a.m. and 9:15 a.m. and at 5:30 p.m. We need to minimize rumen pH fluctuations and optimize rate of passage.

I try to convince my clients that their self-image should include a vision of themselves as Ernest and Julio Gallo or maybe Joseph Schlitz. Their job is not to go feed the cows but to supervise the fermentation vats, to manage the brew. The image carries with it all sorts of connotations of stability and care and control. In a very practical sense, I stress five points:

1. Maximal mixing: Ideally, every mouthfull should be balanced. Total mixed rations are optimal and piecemeal systems of hand-fed ingredients are less attractive in terms of rumen stability.
2. Feeding order: I deal primarily with piecemeal feeders of one degree or another. The basic rule is that the cow is fed something requiring cud formation before concentrates are fed. The goal is to manipulate saliva as a primary rumen buffer.
3. Feeding frequency: Like a steady-state system, the goal is small quantities in and small quantities out at very frequent intervals. Small and frequent feedings encourage

maximal freshness, maximal intake, and maximal efficiency of nutrient utilization.

4. Physical characteristics of feedstuffs: The buzzwords here are long and coarse. With forages, I try to relate concepts of effective fiber as opposed to crude fiber and to encourage long hay and long chopped forages. With grains, I try to relate concepts of slowing the release of starch to rumen microflora by avoiding fine ground grains.

5. Limited grain per feeding: I rather arbitrarily recommend that 9 lbs. of high moisture shelled corn or 11 lbs. of complete grain is the maximum allowed in a single feeding. One has to take a position somewhere and I stopped there.

III. Nutrition Programs: Development of an Ongoing Service

Nutrition programs should be and can be a vital element of total herd health programs. In order to become an ongoing program, it must be viewed as profitable and satisfying by both veterinarian and client. Neither the veterinarian or client can view the venture as an annual delivery of a grain mix recipe or the program is destined to fail. I have begun many nutritional efforts: some went on to become programs, others died as a single shot ration balancing session. The remainder of this discussion will focus on what I view as the essential elements of an ongoing service.

Veterinarian—Client Meetings

The program starts with a meeting, a problem list, and some realistic goals. I will not conduct this meeting across the broad back of a cow. I want this meeting in the dairyman's office or at his kitchen table. Coffee and cookies help. If the meeting is held in the cow barn, distractions occur. I will want to establish production goals or determine forage inventory and that dairyman will keep looking back and forth between me and something way down that barn and pretty soon that nutrition consultation is turned into a teat opening session for some slow milking heifer. Essential information gathered here includes cow numbers, current production data, forage and grain inventory, mixing facilities, batch size, feeding schedules, and such. I DO NOT ask for weights of feedstuffs fed. The discussion should search out attitudes toward purchased feeds, grain feeding tapes, challenge feeding, dry cow separation, animal groupings, and such.

Determination of Actual Dry Matter Intake

With the exception of the dairyman with electronic scales on a mixer box, I do not ask for weights fed. We weigh instead. I used to ask, but too often the dairyman did not know and gave me numbers anyway. Calculating the DMI produced numbers that could not be believed. Then my

choice was to embarrass my client by weighing and finding him wrong or to formulate a ration based upon my best guess. We weigh bales. We count pails of silage in the wheelbarrow or in the feedbunk and we weigh them. We weigh scoops and cups and handfuls. Samples for analysis may be collected at this time. No one is embarrassed, I show my concern for accuracy, and we determine actual intake.

Ration Formulation

At this point, we gather up our intake figures and go back to the kitchen table. I usually enter the intake figures and estimated feedstuff analysis into the memory bank of a programmable calculator and analyze the present ration. Then we compare the analysis to predicted needs at various levels of production. Discrepancies almost always appear and then the dairyman asks that wonderful magical question, "Well Doc, what can WE do to fix it?"

Well, what do we do to fix it? We are at the point where a new ration is going to be formulated. Do we do it ourselves or seek the services of a professional nutritionist? Linear programs in dairy ration formulation are available for small computers and programmable calculators. I have made extensive use of the TI-59 programs and module developed by Dr. Tim Lesch and offered through the American Association of Bovine Practitioners.² They are high quality programs and in capable hands can do a good job of ration formulation. Capable hands are the problem. IT IS VERY EASY TO FORGET THAT THESE PROGRAMS OFFER ARITHMETIC, NOT NUTRITION. When difficult choices must be made, these machines do not offer judgement or experience and successful nutrition is full of difficult choices. I have come full circle on this issue. As time goes on, I become more and more convinced that veterinarians involved in nutrition programs need the backup of a professional nutrition support service. I need and use such a service³ for much of the actual ration formulation, for consultation on problem herds and feeds, and as a source of continuing education. I see my programmable calculator becoming used more for troubleshooting unbalanced rations, as an unequalled teaching tool for myself and my clients, for support programs such as feed value calculations and silo capacity estimates, and to make minor adjustments of professionally balanced rations because of changing forages.

Ration Follow-Up and Evaluation

The performance of the rations should be reviewed on a regular basis. The logical time for this review is the regular scheduled herd health visit. Record systems are essential. DHIA records can provide most of the needed information. Acceptable information can be generated if the dairyman is willing to weigh individual cow milk and plot weights on production charts.⁴ While it is tempting to concentrate on the rolling herd average, ration evaluation needs to be more

critical. I find the following six factors useful in evaluation of performance:

1. *Income over feed cost:* Income over feed costs can be calculated rather easily by subtracting the value of one days feedstuffs from the value of the milk sold and dividing by the number of cows. More detailed instructions can be found in a classic discussion of practical nutrition published recently in *Veterinary Clinics of North America*.⁵ In addition to its face value, calculation of income over feed cost reinforces the emphasis upon forage quality and maximal forage usage and emphasizes my concern with the economic well-being of my clients.

2. *Average production peaks of cows and heifers:* Attention should be placed on both the level of each and the spread between the cow peak and heifer peak. The normal spread will be somewhere between 15 to 20 lbs. Very narrow spreads suggest problems in the cow herd and attention should be given to such practices as dry cow management, challenge feeding methods, and mastitis control. Very wide spreads suggest heifer problems and may point toward inadequate feedbunk space in group feeding areas, inadequate heifer size at first calving, and sometimes chronic calfhood disease.

3. *Shape of the lactation curve:* A picture is worth a thousand words and plotting production on lactation graphs⁴ can expose feeding management problems that talk will not discover. Failure of cows to reach a normal peak and then decline at normal rates needs to be discovered. These graphs help to demonstrate graphically to clients the importance of all sorts of feeding practices.

4. *Percentage of milk fat:* Abnormal milk fat often suggests both ration mismanagement and imminent health problems. Both abnormally low and high fat tests should cause concern. Low tests can be an enigma, but most can be solved through ration balancing and attention to rumen stability. On the other side, I have seen abnormally high fat tests in herds where subclinical ketosis was endemic.

5. *Health and body condition:* Metabolic and nutrition mismanagement diseases must be monitored. Special attention should be placed on rates of laminitis, ketosis, displaced abomasum, milk fever, retained placenta, udder edema, and unobserved estrus. Cow body condition is an important aspect of nutrition management and cow health, yet its importance is often poorly understood. A useful body condition scoring system was recently described in the *Journal of Dairy Science*.⁶ Body condition is dynamic: we need to be concerned with both absolute amount as well as rate of change. The major increase in condition should take place during the last 45 days of the lactation with a final increase during the last three weeks of the dry period. She should then lose weight uneventfully in early lactation and this loss must begin prior to challenge feeding.

6. *Heifer growth:* Heifer performance is best monitored by plotting growth charts and recording average age at first calving. Our emphasis on growth should include both height and weight. Height is easily measured. Weight can be quite

accurately estimated using standard weight tapes.⁷ Standard breed performance curves are published.⁸ Deviations from normal are usually either general smallness or excessive fat. While there are obvious genetic differences in growth rates, large deviations of entire groups of heifers are very graphically presented in this procedure and can be very effective in motivating changes in both rations and groupings.

Feedstuff Inventory Management

A nutrition management program eventually becomes entwined with feedstuff inventory. Short term aspects involve when to feed the highest quality forages, determination of feeding rates of limited feedstuffs, and preparation of new rations as specific feedstuffs are exhausted. Programs for the TI-59 calculator to estimate capacity of grain storage structures and silos have been very useful. Long term aspects of feed inventory management include concerns about the adequacy of storage structures, the adequacy of acreage allotments for forage production, and the introduction of special purpose crops for such uses as in dry cow rations and to meet fiber needs of milk cow rations.

Client Education

I believe that one of the crucial differences between a nutrition program and a grain mix recipe is a very deliberate educational effort. During the first months after a ration is in place, I try to present much of the material which was discussed earlier as nutrition concepts. Then on a very informal basis, I try to have a bit of information relating to nutrition that I have found interesting to talk about during the regular visits each month. I try to make the topics seasonal. Last November, we discussed a *Journal of Dairy Science* article relating DMI to the number of hours of light exposure. I was accused of working for the power company. In June, we argued about length of chop of haylage and effective fiber concepts. These topics stimulate me and give the nutrition program a vitality of its own. It also reinforces the fact that I want to be involved with all aspects of my clients feeding management.

Fees for Nutrition Management Services

To this point, I have focused entirely on making the nutrition program profitable and satisfying to the client. What about me? I have needs for profit and satisfaction too.

A nutrition program does not lend itself well to piecemeal charges. Do I charge \$12 for a discussion of challenge feeding and \$3 for spotting the overconditioned cow? Regarding fees, I view the nutrition program as consisting of two parts: on-farm time spent in consultation and ration follow-up, and off-farm time spent in continuing education and with ration formulation.

Fees for on-farm nutritional services must fit into a fee

structure which will accomodate other herd health services. During the first few years, I provided my on-farm nutritional services for no fee at all. Well accepted by clients, it eventually left me disenchanted. Next I started applying a \$15 consultation fee on all monthly herd checks where nutrition services were provided. However, that has come to seem rigid and often inadequate. I am now switching these clients to a fee structure based upon four items:

1. Mileage
2. On-farm time
3. Drugs and materials
4. Laboratory fees

Client acceptance has been good so far and I feel more comfortable.

Charges for off-farm services are determined by who formulates the ration. I have charged for my TI-59 balancing on a piecework basis: \$50 per ration. I become less and less satisfied with this fee as time goes on. The entire procedure averages just under 2 hours to complete when done carefully and the per hour return is not acceptable to me or my partners. I view the fee as inadequate, yet I have had some client resistance to it. Most of the feed companies will produce a computer balanced ration at no up-front cost and one piece of paper looks like another.

Rations formulated by the nutrition support service are paid for through premix sales. This has proven more satisfactory to both me and my clients. There is enough margin here to cover the nutritionist's time as well as my time spent preparing ration formulation requests and in

continuing education activities. With time and effort, comfortable relationships have been established with four local mills who cooperate with the premix program.

Profit and satisfaction. I love this work. As a boy, I knew that my father deeply respected our veterinarian. We even had a sort of pride that we could claim him as ours. But underlying this respect was the knowledge that his visits were linked with some disaster. I think that with total herd health work we can continue to earn that respect and also remove that linkage with disaster. With involvement in nutrition, we can move toward a relationship with clients where milestones like 20,000 lb. herd averages are marked with a call to the veterinarian, some whooping and yelling, and maybe some attempts to jump and touch the ceiling in the barn.

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