# Nutritional Strategies for Small Herds

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Effective herd health programs are traditionally based on strategies to control disease prevalence so that farm profit is maximized. In the past veterinary services focused on improving production efficiency primarily through reproductive consultation and mastitis control programs. Veterinary nutritional consulting has only recently become an integral component of herd health programs and it is gradually becoming recognized that sound management advice in this area may have a greater impact on economic efficiency than other traditional services. A survey of ration evaluation revealed a mean potential 14% feed cost saving through ration reformulation.

Nutrition is an important economic input component for the dairy herd, large or small. Feed can range from 40-60% of the value of milk production depending on herd size and on efficiency of production. Small herds, which do not enjoy the economies of scale effects on feed prices realized by large herds will tend to have higher feed cost/lb of product produced. Inefficient feeding programs will have a higher proportional effect on small farm profitability.

Table 1.

Projected Feed Savings[1]

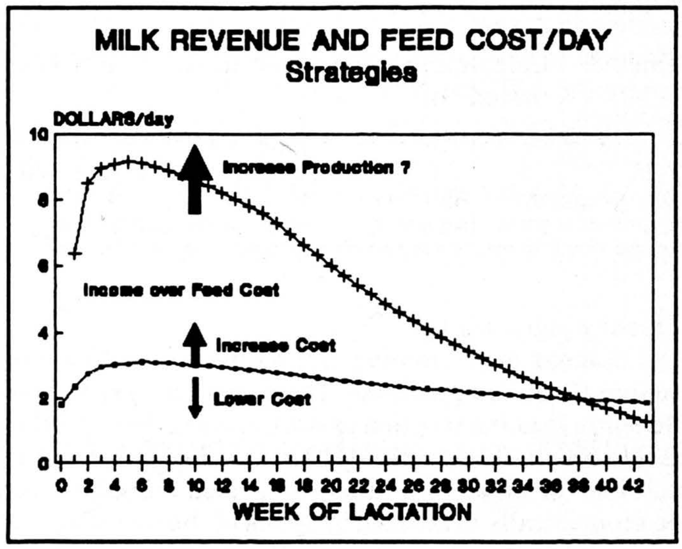
| Projected Feed Savings % of Current Feed Cost | Number of Farms |
|---|---|
| 0-5 | 0 |
| 6-10 | 6 |
| 11-15 | 3 |
| 16-20 | 4 |
| 21-25 | 2 |
| Mean 14.4 +- 6.3 | Total 15 |

[1]Farms visited by veterinarians in the Section of Nutrition, New Bolton Center, University of Pennsylvania.

Feeding efficiency can be divided into two phases; 1) feed selection, 2) feed delivery. Each of these phases offers opportunity for controlling cost or effecting production.

## Feed Selection

Selecting cost efficient feed is the first step to having efficient production. One nutritional strategy would be to decrease cost while maintaining or improving production. Another strategy would be to increase feed cost by using a new supplement and hopefully increase production to cover the associated cost. To facilitate decision making regarding these strategies, we find it useful to be able to economically evaluate feed ingredients. The economic value of feed ingredients is based on nutrient composition and nutrient density. Many methods have been developed to economically evaluate nutrient composition. Substitution valuation methods and linear programming techniques are the most common.




*Substitution method*

The substitution method used to estimate ingredient value is based on the assumption that economic value of an ingredient is the sum of its nutrient composition multiplied by economic weight factors for each nutrient in the ingredient. Energy and protein content are the major nutrients that determine economic value. Approximately 90% of the variation in feed prices are attributable to these two nutrients. Economic weight factors for nutrients can be determined by using as references, feeds which are commonly traded. Normally an energy source (shelled corn) and a protein source (soy bean meal) are selected as reference feeds (Table 2). The substitution value of a particular feed ingredient can be calculated by multiplying the economic weight factors

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by the nutrient content of the feed ingredient. Substitution values thus represent costs of supplying the same amounts of nutrients contained in one ton of feed by a combination of the reference ingredients (Table 3). However it is important to realize that this method does not take into account the value of nutrient density in the feed but only the amounts of nutrients. Hence, the combination of reference feeds needed to deliver the same amount of nutrients in one pound of the feed being evaluated may exceed 1 pound in total weight.

Table 2. Calculation of economic nutrient weights.

Let X = $/(% of crude protein in a feed)/ton of feed
Y = $/(mcal/lb of net energy in a feed)/ton of feed

| Base feeds: | Market $/ton | CP Factor | CP% | NE Factor | NE (mcal.lb) |
|---|---|---|---|---|---|
| Soy bean meal | 200 = | X | 48 + | Y | .75 |
| Shelled corn | 100 = | X | 8.9 + | Y | .82 |

Solving the simultaneous equations for X and Y yields
Y = $105
X = $237

Table 3. Calculation of the substitution value of a feed ingredient.

| Feed | X | CP% | Y | NE(MCAL/LB) | | Substitution Value |
|---|---|---|---|---|---|---|
| Corn Silage | 237* | .028 + | 105 | .25 | = | $32.89 |
| Hay | 237* | .082 + | 105 | .53 | = | $75.08 |

*Linear programming*

Linear programming techniques are used for resource allocation problems. These methods are very efficient in that if a solution exists (ie. is feasible and thus meets all constraints) it will also be the lowest in cost possible (or maximum in profit). A feed ingredient can be economically evaluated in terms of the cost of combinations of other ingredients. Reduced costs tell the change in price needed for a feed ingredient to be included in a mix and hence can be used to calculate the opportunity price. It is important to realize that the calculated reduced cost of a feed ingredient is based on the assumption that all other costs and constraints are constant (Table 4).

Marginal nutrient values are also calculated and indicate the change in mix cost from increasing or decreasing a nutrient density level by one unit. Hence sensitivity of the total mix cost to marginal changes in each nutrient is known. Linear programming methodologies allow one to control the effects of nutrient density on feed value.

Table 4. Dual Cost (marginal values of nutrients) and Reduced Cost

**Dual Cost**

| Nutrients | Marginal value |
|---|---|
| Dry matter | $ 0 |
| Net energy | $ 10[1] |
| Crude protein | $ 28 |
| Bypass protein | $ 12 |
| Calcium | $ 0[2] |
| Phosphorus | $ 0 |

1) Mix cost will increase by $10 if net energy density is increased by one unit.
2) Mix cost will not change if the calcium density is increased by one unit.

**Reduced Cost**

| Name | Current $/Ton | Solution % of mix | Opportunity Price to include $/Ton |
|---|---|---|---|
| Haylage 1 | 30 | 0.0 | 28[1] |
| High Moisture Corn | 80 | 25 | 80 |
| Corn Silage | 25 | 0.0 | 15 |
| Distillers Grains | 180 | 60 | 161 |
| Soybean Meal 48% | 320 | 20 | 320 |
| Whole Cotton Seeds | 200 | 10 | 186 |

[1]The cost of HAYLAGE 1 will have to be reduced from $30/ton to $28/ton to be included in the mix.

*Feed Delivery*

The next level of potential inefficiency may exist at the feed delivery. There are a variety of systems ranging from individual feeding systems to groups. Each of these systems has advantages and disadvantages (Table 5).

Table 5. Advantages and Disadvantages of Feed Delivery Systems

| Feed System | Advantage | Disadvantage |
|---|---|---|
| **Stanchion** | Each cow is fed based on production and condition score<br>Precise nutritional and cow obvservation<br>Lowest feed cost | Pulsatile grain feeding<br>Labor intensive<br>Poor estimates of forage intakes |
| **Total Mixed Rations** | Efficient use of labor<br>Possible to focus attention on groups of cows in similar stages of lactation<br>Possible to manage larger numbers of cows<br>More constant nutrient deliver<br>Consistent feed source | Labor for regrouping cows<br>Decreases in production with cows changing groups<br>Optimum number of groups for ration balancing<br>Difficult to monitor individual cows<br>Potential over and under feeding individual cows |

## References

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# Increased reproductive losses in cattle infected with bovine pestivirus around the time of insemination.

**M. R. McGowan, P. D. Kirkland, S. G. Richards, I. R. Littlejohns.**
*Veterinary Record* (1993) 133, 39-43.

Unmated heifers seronegative to bovine pestivirus were used to investigate the effects on conception and embryo-fetal survival of pestivirus infection around the time of artificial insemination. The reproductive performances of three groups were compared; the control group did not become infected during pregnancy, group 1 heifers were infected by contact with a persistently infected cow and calf four days after insemination and group 2 heifers were infected intranasally nine days before insemination. Conception rates and embryo-fetal survival were monitored by serial serum progesterone assays, transrectal ultrasonography and manual palpation of the uterus. The conception rates (determined 20 days after insemination) of 60 per cent (nine of 15) and 44 per cent (eight of 18) for groups 1 and 2 were lower than the 79 per cent (11 of 14) achieved by the control group. The group 1 heifers subsequently experienced significant embryo-fetal loss, resulting in a pregnancy rate (determined 77 days after insemination) of 33 per cent (five of 15), significantly lower than the control group's 79 per cent (11 of 14). The pregnancy rate of the group 2 heifers 39 per cent (seven of 18) was also significantly lower than that of the controls, largely as a result of the group's poor conception rate. All the heifers diagnosed pregnant 275 days after insemination were induced to calve. No persistently infected calves were born.

# Associations between viral infections and respiratory disease in artificially reared calves.

**G. L. Caldow, S. Edward, A. R. Peters, P. Nixon, G. Ibata, R. Sayers.**
*Veterinary Record* (1993) 133, 85-89.

Market-purchased, week-old, dairy bred calves entering a commercial calf-rearing unit were blood sampled at six-week intervals until three months old. Viral infections were monitored by ELISA for antibodies to bovine herpesvirus 1, bovine respiratory syncytial virus, parainfluenzavirus-3, bovine adenovirus subgroup 1 and bovine viral diarrhoea virus (BVDV). The immunoperoxidase test was used to detect BVDV in serum. The total immunoglobulin concentration in the initial blood sample was measured by the zinc sulphate turbidity test. The relationship between clinical respiratory disease, viral seroconversion and the initial concentration of serum immunoglobulin was investigated by the use of the relative risk statistic, Fisher's exact test, x2 techniques and the correlation coefficient. Treatment rates for respiratory disease of 45 per cent were observed during the first period of the study and 19 percent during the second period. During the first period there was a significant positive association between clinical respiratory disease and seroconversion for all the viruses except parainfluenzavirus-3 and BVDV, but in the second period there was no such relationship. Similarly, in the first period, but not in the second, there was a significant negative association between clinical respiratory disease and both antiviral immunoglobulin as measured by ELISA and total immunoglobulin as measured by the zinc sulphate turbidity test. Two of the 536 calves that survived to three months of age were found to be persistently infected with BVDV.