Challenges in the Further Development of Dairy Herd Health and Management Programs

N. B. Williamson
Dept. of Large Animal Clinical Sciences
College of Veterinary Medicine
University of Minnesota
385e AnSci/VetMed
1988 Fitch Ave.
St. Paul, MN 55108

Paper presented at the XIIIth World Congress on Cattle Diseases, Durban, S. Africa, Sept. 17-21, 1984.

Introduction

Dairy herd health and management programs are now an accepted part of dairy practice in the major dairying countries of the world. Certain characteristics common to programs include reproductive monitoring and treatment, mastitis control, nutritional control, advice on herd breeding policies and the implementation of techniques to control production limiting disease. Other aspects which are emerging as important components of successful herd health programs are the use of computers in their operation and the development of techniques to encourage the adoption of currently available technology by farmer participants.

Advances in the Use of Computer Programs

The major advance in the use of computer programs is their acceptance as a tool in providing herd health and management services. Computerized herd health programs are very fashionable and many programs are now available. However, their quality varies considerably. Many programs provide excellent facility of sorting and listing. These functions are relatively easily programmed with the new software tools which are available on microcomputers. Many specific function programs are also available to aid with herd analysis and monitoring. These include programs to allow ration analysis, ration balancing, feed planning for pastured cattle, analysis of the costs of mastitis, the fertilizer value of manure and the evaluation of ventilation systems for calf housing, to name a few examples. The availability of microcomputers has allowed the rapid increase in this type of special purpose program. Use and experience in operation is making many of these programs more sophisticated and very useful.

A smaller but growing number of integrated computer programs for herd management are available. These take a systematic approach to herd health and management. They are designed to provide ongoing monitoring of herd performance which is compared to targets for performance. The targets are based on theoretical objectives and experience with peer herd achievement. The better programs have rapid data entry for cow data, extensive error checking routines, and ease in the correction and deletion of incorrect entries. A major limit of a number of microcomputer-based programs is very slow data entry, generally because the programs are very "user friendly." Although user friendly programs are desirable, if data entry is too slow the programs become uneconomic or intolerable to the user.

The advent of powerful microcomputers has created an opportunity for veterinarians to provide greatly enhanced services to clients with rapid collation, analysis and interpretation of data. It also provides some potential problems. Computers are now so inexpensive that they are also directly accessible to many farmers. Progressive farmers throughout the world are already using microcomputers to aid farm management. There is a danger that farmers will believe that since they can produce a number of lists and analyses, they can successfully operate health and management programs themselves, in isolation from veterinary inputs. A major benefit of the health and management approach is that a farm's performance is reviewed by a trained professional who not only recognizes limitations in current performance, but has the skill, techniques and access to facilities and services which enable further definition of the etiology of inadequate performance. A major component of any health and management service is the development of alternative strategies to enable farmers to realize their herd's production potential. The recognition of the possible opportunities to improve herd productivity and the development of management options to exploit them is a key role of the veterinarian providing health and management services. In general, farmers do not have the necessary training and experience to do this.

The development of a system to prevent the fragmentation of information services to dairy farmers must receive urgent attention. Programs to allow on-farm production recording are available and do offer some advantages to progressive commercial dairy farmers. However, there is a real danger that the widespread adoption of this type of program could erode the data-bases which are used for genetic improvement programs, which could obviously limit the rate of

genetic progress. It is critical that systems are developed to ensure that this type of information is not lost.

In Minnesota we are working to develop means of transferring useful information between herd health and herd improvement data files. We are also involved in actively encouraging coordination between herd health and herd recording services at the regional and national level. A system which allows the orderly collection of information about breeding, production and disease will be a valuable resource for disease monitoring, productivity monitoring and particularly in allowing the epidemiological and economic study of the impact of disease and management on productivity.

An ideal configuration for an information system to serve dairymen would include an on-farm component, a service in the veterinarian's office which could receive information electronically from the farm computer, and one of several mainframe computers which would also transfer records to and from the farm and veterinarian's office. Such a system allows for backup of information, a minimum of duplicate recording and access to information which is useful at the farm, practice, state, regional or national levels.

In the United States some moves towards this type of configuration are occurring. Several of the Dairy Herd Improvement Associations allow on-line access to information and a number of associations have expanded the amount of analysis which is useful to the operation of health and management programs. Preliminary meetings have been held to plan the establishment of regional data bases for health information for dairy cattle. At the University of Minnesota we are working on the transfer of specific key information from DHIA records to our DairyCHAMP (Computerized Health and Management Program).

The current level of sophistication in the use of computerized monitoring programs is generally quite low. A need exists to improve the diagnostic power of programs by the identification of key indicators of herd performance. There is currently a tendency to produce many lists sorted in various ways rather than key indices of performance. Indices, such as the ratio of single to double length interestral intervals, (Williamson, 1981) better allow herd monitoring than a listing of cow histories no matter how the histories are sorted. Techniques are being developed to utilize pattern analysis in medical diagnosis and it is likely that these will prove valuable in the diagnosis of specific herd conditions. These computerized techniques simultaneously evaluate a number of separate indices and recognize specific abnormal patterns as being characteristic of certain diagnoses. This type of analysis can be valuable in the interpretation of computer produced monitoring indices. For example, in Australian dairy herds a simultaneous decrease in the proportion of cows in heat by 60 days after calving and in conception rate in association with an increase in the proportion of cows with inactive ovaries was diagnostic of nutritional inadequacy. As pattern analysis techniques develop, our ability to recognize specific conditions should be greatly enhanced.

A common current problem which is evident in the United States, and probably is occurring elsewhere, is that practitioners (who generally are naive regarding the operation of computerized health and management programs) are attempting to decide which programs will suit their needs to purchase them for their practice personal or small business computers. Since they have no experience on which to make a judgement a number of inappropriate choices are being made. Before making a commitment to the purchase of hardware and software for herd health and management activities, veterinarians thinking of operating computerized health and management services should gain experience by utilizing bureau services for 2 or 3 years. Such systems are operated through the Daisy service at the University of Reading in England, the University of Melbourne program in Australia, the State University of Utrecht program in The Netherlands, FAHRMX through Michigan State University and the DairyCHAMP program at the University of Minnesota in the United States. Certain DHIA centers in the United States also provide the ability to allow some degree of customization of herd health through their on line access to their computer systems.

Another application of computers on the farm will be in the automated identification and recording of useful production, physiological and behavioral information about cows to aid in the detection of disease and of estrus. Prototype systems are currently under development and field testing.

Herd Reproduction Control

The benefits from improving herd reproductive performance are substantial and have frequently been underestimated. Various changes in production outcomes may occur as a result of improvements in herd reproductive performance. These include more compact calvings, less enforced culling which may lead to either higher voluntary culling levels or the availability of increased numbers of replacement animals for sale. This makes evaluation of the benefits from field studies of improvements in reproductive performance difficult, since it is not possible to predict how farmers will choose to take the benefit of improved reproductive efficiency. However, there is evidence that improving herd reproductive performance increases economic returns (6, 11).

Techniques are now available to help control reproductive performance in herds. Although sub-optimal reproductive performance is due to inadequate heat detection in many areas of the world, it is also true that in most developed countries, (which include the major dairying nations), labor is a limiting resource. Thus attempts to improve heat detection by increasing the labor inputs meet with little success, because labor intensive techniques are unacceptable to farmers with limited labor resources.

Techniques and products have become available which enable the elimination or reduction of heat detection effort and the enhancement of fertility, particularly of problem breeders. Although it is true that the prevention of inadequate reproductive performance is achieved by attention to proper management, feeding, breeding technique, disease control and the use of high fertility bulls or semen, there may well be a place for the limitation of labor inputs in breeding management through the use of prostaglandins and/or progestagens (4, 12, 13). Such techniques could fit well into programmed herd health and management activities, since treatment groups can be forecast by computer and treatments applied in a routine fashion at regular herd visits. Routine treatments to enhance fertility may also have a role to play in regular herd fertility programs, since a number of studies show a fertility enhancing effect of routine hormonal treatments (3, 8, 9, 14).

The major challenge for the future of herd reproductive programs is to develop systems of delivery for current technology, which already has the potential to substantially improve herd reproductive performance and for the new techniques in reproduction which will surely continue to develop. Any developing system will need to address the human element in reproductive control, either by replacing it, (through the use of automatic computer technology), or by developing acceptable systematic approaches to herd fertility management which require low labor inputs. Inadequate estrus detection may be one aspect of management which will prove susceptible to the application of computer technology. A number of attempts to automate estrus detection have shown promise, but have produced inconsistent or inadequate results when used alone. If techniques such as pattern analysis are applied to these various approaches in combination, together with information such as previous heats, the accuracy of automatic heat detection could be greatly enhanced.

Mastitis Control

Major advances in the control of mastitis have resulted in the ability to successfully reduce the prevalence of endemic organisms such as *Streptococcus agalactiae* and *Staphylococcus aureus* to levels at which their economic impact is small. However, a persisting problem in intensive dairying situations is the occurrence of acute and peracute mastitis due to the opportunistic coliforms and streptococci other than *S. agalactiae*. This problem can be a severe one and it has a negative impact on the operation of a mastitis control program when, despite apparent success in controlling endemic mastitis, repeated clinical cases occur due to these environmental pathogens. It is a very negative influence on the motivation of farmers, particularly when deaths occur due to peracute coliform infections.

This type of infection is not solely a consequence of decreasing the antigenic stimulation and cell counts of cows in herds which have mastitis well controlled. In Australia and New Zealand many herds have achieved very low cell counts and yet do not succumb to these opportunistic infections. In dairying areas where cows are more intensively housed such as the United Kingdom and the United States, this problem has emerged in association with the control of endemic pathogens and the reduction of somatic cell counts. The obvious difference between these situations is the absence of any form of housing in Australia and New Zealand.

There is a dearth of knowledge on the epidemiology of the opportunist pathogens. Basic epidemiological knowledge of the responsible organisms in the environment and their pathogenesis in the cow is required so that adequate control strategies may be developed and so that economically sound advice can be given regarding control. There is currently insufficient knowledge to allow an informed decision on whether it is better to treat all cows at drying off or to selectively treat only diagnosed infected cows or quarters. Treatment of every quarter may increase the susceptibility to coliform infection. However, a failure to treat all quarters may increase the incidence of new infections in the dry period and increase the chance of infected cows escaping dry period therapy. Both of these factors would be costly in terms of lost milk production. Several groups are investigating the epidemiology of coliform infections and will hopefully provide the information to anwser some of these questions.

A second major area of challenge in mastitis control is the development of methods to cause the further adoption of sound control practices. Surveys show that although the adoption of sound control techniques has increased, many farmers still do not completely follow recommended practices. It has also been noted that farmers may believe that they are following recommended practices but are not doing so due to their lack of understanding of the basis of recommendations or of the details of the application of recommended techniques. Farmers may stop teat dipping when the clinical prevalence of mastitis falls as a result of a control program, believing that they have the disease cured. They have failed to realize that constant control is required to maintain a low level of subclinical infection and the resulting low clinical prevalence (provided that environmental mastitis is not a problem in the herd).

Our work shows that very few farmers who have regular fertility services provided by their veterinarians participated in regular mastitis control services (16). However, it is possible to design mastitis control education and delivery programs which can be an integral part of herd health programs and which should address the real needs of farmers. Veterinarians are failing to take the opportunity to develop mastitis control programs as a part of their whole herd health program services. This is difficult to understand, since it has been repeatedly and convincingly shown that mastitis control is a very profitable investment for farmers. It has also been shown that the veterinarian is viewed by the farmer as the best source of information which will allow the

reduction of mastitis levels in a herd. There is scope for improved marketing of veterinary skills in mastitis control.

Nutritional Control

No involvement in herd health and production control can proceed far without encountering nutrition as an area requiring investigation. Frequently inadequate herd fertility can be directly attributed to inadequate or imbalanced nutrition. Herd metabolic disease requires nutritional evaluation, as does production below expected levels. Any consideration of herd nutrition should start with the basics. Many veterinarians feel inadequate to deal with complex nutritional problems, and they probably are. However, the majority of nutritional problems which are encountered are not complex, but relate to relatively simple to identify feeding errors which often occur due to guesses and assumptions. Any nutritional evaluation of dairy rations requires an estimate of feed requirements and the measurement of feed supplied. It is also important that rations are balanced. Knowledge of the analysis of feeds and of intakes is relatively easy to acquire in fully-fed herds but is much more difficult to acquire in grazing herds.

Analysis and measurement are the critical ingredients of a successful nutritional advisory service. It cannot be assumed that the farmer knows the exact weights of amounts of feeds fed. The only way to determine intakes is to measure them right from the start in any nutritional evaluation. If this is done as a routine initial step in ration work, it saves the embarrassment of having a ration as described by the dairyman turn out to be something which is either impossible for the cow to consume or which could not possibly support the production levels being achieved. When this occurs, you are faced with the choice of disregarding the information provided by the farmer and estimating inputs or with measuring feed intakes and proving the farmer wrong. Neither prospect is desirable. Thus it is best to measure intakes right from the start. Similar arguments can be put for having forages analyzed, at least in the midwestern United States, where alfalfa hay can vary in crude protein content anywhere from 12% to 24%.

Computers and integrated herd health and management programs enhance the potential for veterinarians to provide better nutritional advisory services. A knowledge of the calving dates, breeding dates and pregnancy status of cows allows a forecast of projected nutritional requirements for a herd for the next 7+ months. This has been exploited in the University of Melbourne's computerized health and management program to project herd feed requirements in a feed planning table. In some dairying areas, large amounts of feed are preserved and stored to feed cows for winter or throughout the year. It should be possible in these areas to project the herd requirements, inventory the feed available and analyze its quality, and then project feeding programs which will optimize the utilization of the available feeds over the feeding period. In a pasture situation, the projections of feed availability must presume standard pasture growth patterns and then estimate or measure pasture growth periodically to monitor if growth is following expected trends (5).

Heifer Management

The development of heifer health and management programs have been long recommended but have lagged behind developments in other areas. There does appear to be a considerable potential to improve the efficiency of replacement raising programs. This is largely because heifers from the time of weaning until herd entry are the most neglected group of livestock in the herd.

In Minnesota dairy herds the average age of calving for first calf heifers in DHIA herds is 28 months. It is possible that this interval could be rapidly reduced simply by educating farmers to recognize the appropriate stage at which to breed heifers. The author has observed on several occasions that heifers are not being bred until weights of 1000 to 1100 pounds, well above the recommended breeding weights for Holstein heifers. When the farmers were questioned regarding the weights at which they desired to breed heifers, they responded with the generally accepted target weights recommended of 700 to 750 pounds. This again illustrates the need to take measurements rather than to ask the farmer for information and accept that he is able to supply accurate answers.

Heifers in some other environments have problems of the opposite type where they are simply allowed to graze on poor quality, low value land. In this situation a more common problem is that the heifers do not reach an adequate size of weight for puberty to occur until they are much older than is desirable in seasons of unfavourable pasture growth.

Methods of monitoring heifer growth have been described (2) and their application should ensure that the heifers will be raised at a satisfactory rate and that they will be bred at an appropriate size.

Growth promotants of various types are available which enhance feed conversion efficiency. Although some of these have not been recommended for use in breeding animals in the past, their use is now being investigated in replacement breeding and production animals. These compounds have a proven potential to accelerate growth and their use in improving the efficiency of replacement production.

A number of other techniques may improve heifer management, accelerate growth and reduce the costs of raising herd replacements. Treatment for nematode parasites in heifers has proven to be a practical and economical technique to enhance growth rates and reduce their raising costs (7).

The potential to accelerate genetic progress in herds by artificially breeding heifers to proven sires is one that is far from being fully exploited. The ability to synchronize estrus in heifers makes their artificial insemination a practical

proposition in well organized herds. If this is what is needed to have heifers bred to proven sires then it should be implemented, particularly when replacement rates are high as in many areas of the United States where rates of 30% to 35% of the herd per year are typical. In this situation heifers must necessarily provide a large proportion of the herd's replacements each year.

Evaluation of Procedures

It is necessary to justify what we do and recommend on farms by economic analysis. There will be an increasing role for budgeting the projected impact of proposed management changes on farms before the changes are made. This task will be made easier by special purpose programs which are directed at evaluating the benefits of disease control or management change. The availability of spread sheet computer programs which allow recalculation of budgets after changing various conditions or inputs (such as product prices or production responses) will make this type of economic projection easier to provide.

The emergence of this type of analysis requires the development of a considerable body of information on the quantitative pathology of disease and on the physical production response to disease control and management change. This body of information is as yet largely non-existent with a few exceptions. Computer simulation models will play a considerable role in enabling these projections to occur. At the University of Minnesota we are working on the development of a model of reproduction and replacement which will simulate not only the physical and biological effects of alternating herd reproductive parameters but also the financial implications such as the effects on income and taxation. If these considerations are important to a farmer's decision on whether to implement a management change, then they must be considered in any projections.

Encouraging and Facilitating Participation

Perhaps the greatest challenge in the further development of herd health and management programs is the evolution of techniques to encourage participation of veterinarians and farmers in this type of activity. It was believed that the demonstration of economic advantage would be a major motivation for farmer participation in health and management programs. However, despite the repeated demonstrations of the economic efficacy of these programs around the world, the proportion of farmers participating in this type of program is still low. It is now obvious that farmers need more than just the information that these programs are profitable to motivate them to participate. There needs to be a belief on the part of the farmer that the program will work for him on his farm, and that the amount of investment and effort involved will not exceed the benefits deriving from the program.

We are attempting to enhance the farmers realization that management changes should be instituted on his farm by developing herd specific computer simulation models which will project expected herd calving intervals and culling rates if performance in heat detection, conception efficiency, abortion rate and other relevant indices is similar to recent levels. Farmers may be more motivated to avoid the prospect of poor herd performance than to change practices after the poor performance has already been achieved.

There is much available technology for herd health and management control which has been shown to be effective and profitable in isolation, but which is still not being widely applied in the field, certainly not as a part of a total herd health program. The simultaneous application of this technology requires a complex and integrated system to be developed to allow performance to be regularly reviewed so that performance and progress can be evaluated and opportunities for improvement be identified. However, the complexity of the system must be transparent to the users, so that the system is simple and easy to use, especially for farmers. A good example of the way in which a complex system can be interfaced in a simple form to farmers is in the use of pocket diaries as data input forms for computerized record systems (1).

One of the major limits to the adoption of health and management programs is the failure of veterinarians to become involved. Uncertainty of what procedures to conduct and when to do them has been a factor causing the reluctance of some veterinarians to provide more than reproductive herd health management programs. One approach which eases the uncertainty of veterinarians regarding what is necessary and appropriate in a herd health program is the development of outlines of procedures and checks to be undertaken at critical times throughout the year. Such lists were developed for seasonal dairying herds in Australia and have recently been published for Dutch dairy herds (10). Lists like this could be developed for herds in all areas and appropriate selections of animals and reminders can be programmed in to computer based herd health and management programs.

References

1. Cannon, R.M., R.S. Morris, N.B. Williamson, C.M. Cannon, and D.C. Blood: 1978 Aust. Vet. J., 54:216. 2. Clapp, H.J.: 1982 Ontario Ministry of Agric. and Food, Fact Sheet No. 82-064. 3. Etherington, W.G.: 1983 The Compendium on Contin. Educ. for the Pract. Vet. - Spec. Edition, 16. 4. Folman, Y., M. Kaim, Z. Herz and M. Rosenberg: 1984 J. Dairy Sci. 67:153. 5. Gallagher, A.P. and P. Brightling: 1981 Feeding Dairy Cows - A Feed Planning Handbook, Tech. Report Series No. 39. 6. Galton, D.M., H.I., Barr and L.E. Heider: 1977 J. Dairy Sci. 60:1117. 7. Herd, R.P. and L.E. Heider: 1980 J. Am. Vet. Assc. 177:51. 8. Macmillan, K.L. and A.M. Day: 1982 Theriogenology 18:245. 9. Moller, K. and E.D. Fielden: 1981 N.Z. Vet. J. 29:214. 10. Noordhuizen, J., Brand A. 11. Olds, D., T. Cooper and F.A. Thrift: 1979 J. Dairy Sci. 62:1167. 12. Seguin, B.E.: 1983 The Compendium on Contin. Educ. for the Pract. Vet.—Spec. Edition, 22. 13. Seguin, B.E.: 1979 The Compendium on Contin. Educ. for the Pract. Vet. 1:S33. 14. Seguin, B.E., D.J. Tate and D.E. Otterby: 1983 J. Am. Vet. Med. Assc. 183:533. 15. Williamson, N.B. Vet. Clin. Nth. Am. 16. Williamson, N.B. and W.B. Brown: 1983 Proc. 22nd Ann. Meeting, Nat'l Mastitis Council, 33.