

INTEGRATED DAIRY HERD HEALTH MANAGEMENT AS THE BASIS FOR PREVENTION

Geïntegreerde bedrijfsbegeleiding bij melkvee: basis voor ziektepreventie

A. de Kruif, G. Opsomer

Department of Reproduction, Obstetrics and Herd Health. Ghent University, Faculty of Veterinary Medicine, Salisburylaan 133, 9820 Merelbeke, Belgium
Aart.dekruif@UGent.be

ABSTRACT

The traditional role of the veterinarian as the healer of individual sick cows has been complemented by the delivery of integrated health programmes concentrating on the prevention of diseases and the performance of the dairy herd. Modern animal health care requires excellent housing facilities and a close cooperation between a competent veterinarian and a skilled farmer/manager. An integrated herd health programme plays a key role in preventing diseases. This will improve animal health and welfare and guarantee a high quality and wholesomeness of foods from animal origin. Nevertheless medicines remain necessary, but must be administered under strict controlled conditions.

SAMENVATTING

De traditionele rol van de dierenarts als de genezer van individuele zieke koeien is uitgebreid tot het niveau van geïntegreerde bedrijfsbegeleiding, waarbij het voorkomen van ziekte en het verbeteren van de productie van de melkveekudde centraal staan.

Moderne dierengezondheidszorg vereist een excellente huisvesting en een nauwe samenwerking tussen een competente dierenarts en een ervaren veehouder/manager.

Een geïntegreerd bedrijfsbegeleidingsprogramma speelt een sleutelrol in het voorkomen van ziekten. Dit zal de dierengezondheid en het dierenwelzijn ten goede komen en het garandeert dat het voedsel van dierlijke oorsprong van optimale kwaliteit is. Toch blijven medicijnen noodzakelijk, maar deze mogen slechts toegediend worden onder strikte voorwaarden.

INTRODUCTION

Consumers demand to have access to their daily food, including meat and milk at a reasonable price. This resulted in the industrialization of animal farming. The process comprised the concentration of animals in large units and the minimization of investment costs for animal facilities. During the last years this process has been intensified by increasing competition between food producing countries. Import barriers and high tariffs have vanished partly, resulting in more free trade and competition in farm products.

In addition to these developments considerable attempts have been made to improve individual productivity by selected breeding. This resulted in extremely

high producing cows. However, as a consequence of this forced selection some adverse effects have arisen such as a higher susceptibility to different diseases.

All these developments have resulted in production units where large numbers of high yielding cows are kept under minimal conditions. It is therefore easy to understand that diseases are a common phenomenon in such herds. As a consequence intensive medication is sometimes necessary to prevent or to solve herd health problems. Typical examples of encountered diseases are mastitis and lameness.

The intensive use of medical products has initiated questions from consumers directed to animal welfare under these conditions, and the potential risk of occurrence of undesirable residues in foods of animal

origin. Despite regulatory attempts including pre-marketing approval of pharmaceuticals and regular inspection and surveillance programmes, consumers are still concerned about the potential hazards of medicines used in animal production. Thus, strategies have to be developed to increase animal welfare and to reduce the amount of residues in food of animal origin (de Kruif, 1998).

Consequently, the questions are: how to keep animals in good health and how to improve animal welfare on the one hand and how to produce safe food for a reasonable price. It is clear that both questions are linked and that the veterinarian faces a major challenge and responsibility on these issues. Veterinarians need to be proactive about health and welfare requirements and on the proper use of pharmaceuticals/medicines.

ANIMAL HEALTH AND WELFARE

Health status is influenced by several factors, the most important being housing conditions, climate, hygienic measures, infections, animal breeding and selection and last but not least the farmer's management.

The aetiology of most herd health and welfare problems is complex and attempts to attribute them to single causes should be treated with grave suspicion (Webster, 1997). Likewise, the aetiology of foot lameness, once again is complex, involving genotype, nutrition, housing and behaviour. Also mastitis in dairy cows is a multifactorial disease. The conventional, but abnormal process of twice-daily milking allows 10 times the normal amount of milk to accumulate in the udder. This undoubtedly predisposes to mastitis. Other factors involved in mastitis are the milking machine, housing and the farmer's management. The latter can be improved by education and up-to-date advice; however, improvement of machines and housing conditions requires considerable financial investment (Radostits, 2001).

As a conclusion it can be stated that pushing of animals to the limits of productivity is a matter of real concern. The physiological demands are extremely intense. It is not realistic to expect the demands to be reduced. Meeting the food needs of the exploding world population and making good existing food deficiencies, without further destroying the productivity and resources of the environment is only possible by modern, intensive farming methods. Extensive agriculture is not viable anymore. It will not meet world demand for food and will engulf what is left of the natural environment. Nevertheless, there is still a

need to improve animal welfare in intensive farming conditions (Avery, 1997). However, it is very difficult to apply a cost-benefit analysis of all farm procedures which weighs the cost to the animal in terms of suffering, against the likely benefit to society. Obviously the higher the cost, the higher the need for justification. In particular cases the animals need the protection of new law that seek to balance any costs to the animals against the potential real benefit to man.

As it is not realistic, because of demands for cheap daily food and of increasing competition, to expect that animal health problems will vanish gradually one has to accept the presence of impaired health and thus the necessity of medicines. Even if animal welfare improves in the future, large production units will remain, providing a good opportunity to a large number of diseases to affect the animal's health and welfare.

Consequently, the next question is: what can be done to minimize the effects of diseases and how to prevent diseases. To this end herd health management and surveillance programmes have been developed.

HERD HEALTH PROGRAMMES

Because there is such a close relationship between animal health and production, health management has already a long history. Originally it emphasized on the eradication of contagious diseases such as brucellosis and foot-and-mouth disease. Later on the emphasis was on the individual cow affected with a clinical disease. About 30 years ago subclinical disease in its broadest sense was recognized as the major cause of economic loss. Good examples are subfertility and subclinical mastitis. It turned out that regularly scheduled visits to farms to examine health and production status of the herd were effective in improving the status. Herd health programmes were developed. It is now generally agreed that diseases, many of which cause no recognizable clinical signs, are the most important contributors to reduced productivity. Each dairy herd presents a unique combination of factors contributing to suboptimum performance. It is the veterinarian's main task to implement an integrated animal health and production management system in order to prevent clinical and subclinical diseases. The final goal is to eliminate production inefficiencies which are caused by factors that impair animal health and animal welfare.

As the biological or chemical agents which may cause food poisoning accompany the animals from the stable via the dairy-factory or slaughterhouse to

the "table", any attempt to maintain a high level of production of consumer goods without taking into account what is happening in the stable is doomed to failure. For this reason herd health surveillance programmes have been developed and are currently implemented. The key person in these programmes is also the veterinarian. He has to ensure that the animals or animal products entering the food chain (dairy, slaughterhouse) are free from disease and residues.

Hence an integrated herd health programme can be considered as a combination of a management programme and a surveillance programme and as a total quality assurance system. It is a combination of regularly scheduled veterinary activities and good herd management designed to achieve and maintain optimum animal health and production. Herd health programmes vary from simple systems, for example regular visits to examine cows and to make recommendations for the control of disease, to intensive total programmes including recommendations on nutrition, housing, genetic improvement, cashflow, animal welfare, the use of medicines and food quality.

As a consequence of these developments the traditional role of the veterinarian as the healer of individual sick cows has been complemented by the delivery of integrated health programmes concentrating on the prevention of diseases and the performance of the dairy herd. Such management programmes will lead to the most efficient economical and profitable production of dairy products, taking into account the demands of the modern consumer (de Kruif *et al.*, 1998; Radostits, 2001).

PRINCIPLES OF INTEGRATED HERD HEALTH

There are 3 requirements for a successful herd health programme:

- a competent veterinarian
- a farmer who is committed to the programme
- a good data recording system.

Livestock producers perceive dairy cow practitioners as knowledgeable and skillful in the diagnosis and treatment of sick animals and reproductive performance but they also perceive that the practitioners knowledge of nutrition, herd management and economics is weak. To be involved in integrated herd health the veterinarian has to improve his knowledge and skills. He has to be a species specialist who can provide a comprehensive economically-based health and pro-

duction management veterinary service needed by the farmer.

The success of a herd health programme depends heavily on the farmer's skills and ability to comply with the recommendations of the veterinarian. A bond of confidence between the farmer and the veterinarian is extremely important. The farmer should be motivated to start a herd health programme and to keep the programme going.

The data recording system should be as simple as possible. It is one of the most important components of any herd health programme (Fetrow, 1993). Many different systems are available and the types of records used vary considerably. The simplest and most common form, used in dairy herds is the manual handling of records. Manual systems have been proven satisfactory for 50-100 cow herds. As herds become larger manual methods are less satisfactory. This has led to the use of the computer. The computer is able to store a large amount of data, can prepare action lists, analyse data and provide a summary of up-to-date performance. However modern systems of computerized data recording are often too complex resulting in too time consuming entering and analysis of the provided data.

The challenge for the veterinarian is to determine what services are needed by the dairy farmer and how these services can be delivered economically. The farmer must be convinced of the high merit of the programme and of its cost-effectiveness. If necessary the programme can be started on a partial basis (Wassell, 1995). For example a programme to improve reproductive performance or milk quality. Later on the other parts of the programme can be implemented.

Ideally an integrated herd health programme related to prevention consists of the following parts : fertility, udder health and milk quality, nutrition and metabolic diseases, control of infectious diseases, lameness, housing, health of calves and heifers, animal welfare, the use of medicines and food safety. An integrated approach to the dairy herd in stead of focusing on separating disciplines e.g. fertility or milk quality has many advantages. It permits a total overview of the dairy herd and should always be advised (de Kruif *et al.*, 1998 ; Radostits, 2001).

BENEFITS AND COSTS OF A HERD HEALTH PROGRAMME

Cost-effectiveness of a herd health programme is essential. There is little information on the total benefits and costs for health management. Enhancement

of the profitability of the farmer is the primary objective of a health programme. When performance has improved it is difficult to identify which factor is responsible. Veterinary services have many costs. The most important are costs for the services on the farm, the time required for the analyses of data and the preparation of reports and advices and the costs of medicines and vaccines.

The perception by the farmer that veterinarians are not production oriented has been one of the constraints of more widespread employment of veterinarians as health management advisers (Radostits, 2001).

Based on cost-benefit analyses techniques, the net return to the farmer of money spent on veterinary services directed toward an integrated herd health programme has been calculated for some specific disease control techniques such as control of mastitis and improved reproductive performance. The net returns have been in the order of 200-500 %.

PROTOCOL OF AN INTEGRATED HERD HEALTH PROGRAMME

The components of a herd health programme include regularly scheduled farm visits, the recording and analysis of animal health and production data, the provision and coordination of advice by the veterinarian and good farm management by the producer.

The frequency of the farm visits depends mainly on the size of the herd and the existence of disease problems. Monthly visits are common for 50 - 100 cow herds. Weekly visits are necessary for very large herds.

The major objective of the programme is to support farmers in reaching their targets of performance and farm goals. During the first visit these targets should be discussed and set e.g. calving interval or milk quality. The objectives are set in the light of risk assessment and a cost-benefit analysis of what can realistically be achieved. Objectives will be different for each farm and will depend on a range of factors relating to herd health status, animal welfare, housing and nutrition.

The objective of each of the following visits is to determine the actual performance of herd health and production, compare it with targets of performance and farm goals and decide which performance index is abnormal. The veterinarian then analyses the problem and attempts to determine the cost of the shortfalls in health status and to formulate cost-effective corrective action. Before each of the following visits the veterinarian accesses the specific database for up

to date information about the herd in question. Each visit will involve a clinical examination of the animals and at the end of the visit a herd management meeting (de Kruif *et al.*, 1998; Radostits, 2001).

The farm visit is also part of a surveillance system designed to detect or predict health and production problems before they become economically significant and to indicate the corrective action necessary. Disease prevention should be a major item at each visit. Each herd management meeting should provide a summary of the herd health and production status, the diagnoses made and the reasons for failure to achieve the preset goals and recommendations for corrective actions. Furthermore general advice is given. This advice does not originate from the monitoring programme and is directed at the prevention of specific diseases e.g. Infectious Bovine Rhinotracheitis or milk fever (de Kruif *et al.*, 1998).

ITEMS TO EXAMINE OR TO MONITOR DURING A HERD VISIT

The different components of a dairy herd health programme which are related to prevention of diseases or/and production inefficiencies are:

1. Managing reproduction. Activities related to reproduction still form in the majority of cases the foundation services for which the dairy farmer finds veterinary intervention very useful. It is the basis for most regularly scheduled veterinary visits. These visits present excellent opportunities for in – depth discussions about the herd's reproductive performance but also about other diseases, production inefficiencies or management problems, that affect the farmer's income. Poor reproductive performance does have serious financial implications. The association between reproductive performance and finances is difficult to investigate. For example estimates in the USA for the cost of a day open above the target level (100 days) have varied from \$ 0,78 to \$2,03. Reproduction can be measured in many ways. No single parameter is capable of yielding the complete picture, hence reproduction is viewed in a number of ways. Reproductive outcomes such as days from calving to conception, first service conception rate, services per conception, measures of oestrus detection and abortion rates are of primary importance. By implementing a herd health programme reproductive performance can easily be monitored.

If reproductive performance is insufficient a diagnosis should be made, corrective measures should be taken and the effects monitored. For example corrective actions and also preventive measures may be directed to improvement in oestrus detection, the use of oestrus detection aids, the treatment of cows, improvement in the feeding programme and training in good insemination technique (de Kruif and Brand, 1978).

2. Udder health and milk quality. Udder health and mastitis control is also one of the major reasons for which the dairy farmer finds veterinary intervention very useful : detailed mastitis control measures have been outlined and described (de Kruif *et al.*, 1998 ; Radostits, 2001). With proper implementation these programmes cause a decrease in the prevalence of common contagious mastitis pathogens. Herds that have implemented a comprehensive mastitis control programme also need to develop strategies to control infection with environmental organisms and need to use an effective monitoring system for new infections (Smith *et al.*, 1985). Mastitis causes greater economic losses to the dairy industry than any other infectious disease. Much of these losses relate to lost production from inflammation in the infected quarters.

Mastitis can not be eradicated from a dairy farm, but it can be reduced to an acceptable level by preventive measures. Prevention of new intramammary infections focuses on lactating cows, and the events that occur immediately before, during and after milking. Management practices and the proper function of the milking machine play the most important role in the prevention of mastitis (Spencer, 1989).

Consumer demands for safe, high quality dairy products that are produced by healthy cows in welfare friendly environments are the driving force behind the need to further improve mastitis control in dairy herds.

3. Lameness. Lameness is considered to be the third most economically important disease after reproductive failure and mastitis. Most cases of lameness are due to lesions of the feet. These are associated with herd-level or individual cow-level risk factors. Herd-level factors include housing, nutrition and foot trimming. The most important individual cow factors are stage of lactation, claw angle and age.

The control of lameness is based on providing cubicle design and bedding, flooring and hygiene,

adequate foot trimming, the use of foot baths and a balanced diet (de Kruif *et al.*, 1998 ; Radostits, 2001).

4. Control of infectious diseases : Infectious diseases can result in major economic losses. The control of these diseases must be considered in any dairy health programme. Outbreaks of diseases that are on list A of the « Office International des Epizooties (OIE) », for example foot- and mouth disease, are especially feared for they have the potential for rapid spread. Some other diseases have been eliminated by official governmental eradication schemes : brucellosis, leucosis and tuberculosis. The most important infectious diseases affecting dairy cows are IBR, bovine viral diarrhoea-mucosal disease (BVDV), Johne's disease, leptospirosis, salmonellosis, fascioliasis, infectious bovine keratoconjunctivitis and those causing mastitis, lameness and problems in young cattle. Prevention, control and eradication are used in association with infectious disease control. In the prevention of many infectious diseases for example salmonellosis or mastitis risk factors play an important role. During regular herd health or emergency visits a veterinarian may recognize the presence of certain risk factors known to predispose to disease. If corrective action is recommended it may be possible to prevent the disease or minimize its incidence. For most of the common types of infectious diseases there is little evidence that the differences in disease levels among herds can be attributed to microbiological differences among herds (Hancock and Wikse, 1988). Most of the differences in disease levels can however be attributed to differences in the host and environmental factors under the control of management.

For certain infectious diseases the prevalence of infection can be monitored over time by regulatory laboratory examination of a small, random sample of the population, for example BVDV. Based on a sero-epidemiological profile the presence of several diseases can be followed.

For most of the common infectious diseases the complete elimination of disease is not necessary because there may be a level of disease in the population below which the cost of further expenditure on elimination would be greater than the benefits derived.

To eliminate some specific pathogens and hence disease from a herd, eradication is used e.g. BVDV, Johne's disease and leptospirosis. In countries with national programmes for the eradication of a

disease, for example BVDV, the testing of bulk tank milk for the presence of antibodies is an excellent diagnostic aid for detection of infected herds (Radostits, 2001).

To prevent the spread of infectious agents from infected animals to susceptible animals or to prevent the introduction of infected animals into a herd, vaccination and/or management practices can be used. The decision to use a vaccine for the control of any disease must be based on considerations of the prospects for its control by other techniques, such as removing or reducing the effects of risk factors. When vaccination is used it must be established that an immune response actually can protect against the disease in question. It must be stressed that management practices are extremely important in preventing the spread of infectious diseases. A closed dairy herd system, in which producers do not purchase animals and do not take cows to shows or fairs, is very beneficial and should be advised. It is technically possible and is economical. It can prevent the introduction of infectious agents, such as IBR, BVDV, paratuberculosis and salmonellosis and can be a good starting point for eradication of these infections from the herd when present (Van Schaik *et al.*, 1998). If animals are to be introduced into a herd they should be quarantined in an isolation facility for a specified period.

Veterinarians must assist farmers in developing methods that prevent the spread of infectious diseases.

5. Nutrition and metabolic diseases. Many health problems of a dairy herd relate in some way to the feeding programme. Small changes in feeding may bring about large changes in health and productivity. For this reason veterinarians must become actively involved in the herd's feeding programme.

If a veterinarian is providing nutritional consulting services then a routine monitoring service is essential. There are many parameters that can help to determine the adequacy of a feeding programme, for example milk production and milk components, fecal consistency and body condition scoring.

Diseases commonly viewed as metabolic diseases include ketosis, hepatic lipidosis, milk fever, displaced abomasum, rumen acidosis and retained placenta. Most of these diseases can be avoided if attention is paid to the fundamentals of feeding

dairy cows including dry cow rations (de Kruif *et al.*, 1998).

6. Housing. The goal in housing design is to provide an environment for the animal that has a positive influence on the animal's health, welfare and production. This includes stalls and beddings, ventilation, access to feed and water and walking surfaces.

Many diseases are associated with housing: diseases of the respiratory tract, mastitis, lameness, parasitism and behavioural abnormalities (teat sucking).

The effects of housing and environment are complex and there is usually no simple solution to a particular problem. Agricultural engineers should be consulted. Decisions about replacement farm facilities must be preceded by a conscious determination of the management style and practices. New facilities must be designed to meet the requirements of the cows (Goodger, 1996 ; Radostits, 2001).

7. Health of young stock/replacement heifers. One of the most important aspects of a dairy enterprise is to raise sufficient quantities of well grown heifers to calve by 24 months of age.

In order to be prepared for calving at this age heifers need to be large enough to calve without an increased rate of dystocia. This objective involves nutritional management to promote an optimum growth rate. Also the prevention of diseases is a major factor in the ability of heifers to meet the objective of 24 months of age at first calving.

The major areas of management of health in heifers involve the control of parasites, certain bacterial and viral diseases of the respiratory and gastrointestinal tracts and udder health (de Kruif *et al.*, 1998).

8. Culling and genetic improvement strategies. The increasing of cow longevity is receiving growing attention in the dairy industry. Monitoring the reasons cows are culled helps to identify health management problems that may be impairing the profitability of the herd. A culling rate between 20 to 25 % is the economical optimum (Rogers *et al.*, 1998). Genetics has proved to be a powerful strategy for improving productive efficiency of dairy cattle. However the improvement in production has come at the cost of some loss in virtually every other aspect of dairy cow function. It is imperative that health and reproductive performance be given increased emphasis in genetic improvement programmes. Genetics can be used

as a tool for preventive medicine. Genetic programmes for health traits and genetic improvement for disease resistance can become effective adjuncts to the other methods of preventive medicine.

Therefore disease record systems for individual animals must be developed. These records can be used in genetic evaluation systems to facilitate selection for health traits (Emanuelson, 1988). The practicing veterinarian has a key position regarding such a record system.

9. Animal welfare.

A herd health programme should also provide the farmer with the opportunity to set objectives for achieving an optimal animal welfare classification as an integral part of the programme.

For many years, the discussion of animal welfare was dominated by the concept of behavioural freedom and the extent to which this might be compromised in intensive husbandry systems. The Brambell Committee (1965) proposed that all farm animals should at least have the freedom to "stand up, lie down, turn around, groom themselves and stretch their limbs". These minimal standards (which still have to be achieved) concentrate almost exclusively on one aspect of behaviour: comfort seeking.

At this moment a more comprehensive definition is proposed for first analysis of all the factors likely to influence the welfare of farm animals, whether on the farm itself, in transit or at the point of slaughter (Webster, 1997). This definition encompasses freedom from thirst, hunger and malnutrition, from discomfort, from pain, injury and disease, from fear and distress and freedom to express normal behaviour.

For example in the dairy cow potential contributions to poor welfare are: hunger or acute metabolic disease due to imbalance between food availability and requirements; chronic discomfort through bad housing; chronic pain through lameness or metabolic exhaustion after prolonged high production.

One has to realize that freedom from disease means that if diseases or infections develop, an immediate treatment must be started preventing unnecessary suffering of the animals. In that way medicines and vaccines do play an important role in improving animal welfare. The food animal practitioner is considered by those outside of the profession as the ultimate advocate for animal well being. This position requires that practitio-

ners provide leadership in the development of acceptable humane standards in farm animal agriculture (AVMA at work 1994).

10. The use of medicines and food safety.

In the past, the far most important tasks of the veterinarian were the control of the herd health status and the cure of animals. The prevention of health problems and the application of treatments remain quintessential, but under consumer and political pressure food safety issues are increasingly important.

If it is necessary to use pharmaceuticals either for prophylactic and/or curative treatment then clear (written) instructions have to be provided, allowing a proper and selective use of pharmaceuticals. This includes also the consideration of adequate withdrawal periods to prevent residues in foods of animal origin. Thus, residue levels exceeding the MRL values (maximum permissible residue level) can be prevented by proper management.

It is an illusion to believe that all food from animal origin can be produced by low yield farming without the proper use of pharmaceuticals. Antibiotics, anti-parasitaires, vaccines and other medications are indispensable, but must be used under strict conditions in search for an optimal policy against specific contagious diseases. The veterinarian who is responsible for herd health surveillance will also be responsible, together with the farmer, for the prevention, surveillance and monitoring of residues of these pharmaceuticals in milk and beef. The practitioner should fully understand and establish a client's drug use protocol and residue avoidance plan (de Kruif, 1998).

Veterinarians are the first line of defense on food safety and are capable of making the informed decisions necessary to protect human food safety while providing comprehensive health management advice to owners (Radostits, 2001).

During the examination of animals a survey of contagious diseases is carried out to identify outbreaks at the earliest possible stage. Procedures in ongoing eradication programmes will be carried out during the visit. Also during the visit, a number of samples (blood, urine, faeces etc.) can be taken for laboratory analysis to monitor the health status of the herd in relation to epizootic and zoonotic diseases of importance. Controlling of zoonosis by a herd health surveillance programme is sometimes easy, for example brucellosis

and leptospirosis in cows, but is sometimes very difficult, for example salmonellosis and Vero Toxigenic *E. coli* (VTEC) infections. New disease monitoring strategies and more research are required to reduce the number of infected herds and animals and to reduce its (minimal but hazardous) contamination potential for humans.

SUBJECTS TO DISCUSS AT THE MANAGEMENT MEETING

Important topics to discuss at the meeting with the management at the end of a visit are:

- a) problems due to herd management practices, e.g. oestrus detection, feeding, husbandry conditions, the introduction of new animals, production performance;
- b) infections caused by, for example, parasites, viruses and pathogenic or potentially pathogenic micro-organisms;
- c) prophylactic and metaphylactic procedures to protect animals;
- d) procedures required to determine causes of disease or poor health conditions in the herd, for example post mortems, slaughterhouse data, sampling for laboratory analysis, drug resistance analysis and special registrations;
- e) special procedures for monitoring clinical or sub-clinical zoonotic disease in the herd including the official epizootic and zoonotic surveillance programmes;
- f) further work to be done to achieve objectives agreed for the herd in terms of increased health status, increased production performance, etc.
- g) transport control for both residues and welfare issues.

AFTER THE VISIT

Following the visit:

- a) the veterinarian submits a written report describing the problems and the conclusions of any investigation, together with proposed action to solve the problems and to improve or maintain the herd health status;
- b) the veterinarian prescribes any necessary veterinary medical products;
- c) certificates of the herd health status (standardized) are prepared as the health status will have an im-

act on the later processing procedures of the products from the farm.

The key data, the written report including results of special registrations, post mortems, laboratory diagnosis, etc., prescribed and used medicines, diseases diagnosed and treatments carried out will be kept in records at the farm and by the herd veterinarian.

Before advising a new change, some consideration should be given to whether the programme is less costly than the problem, and the value of the programme should be weighed by its probability of success. The specific nature of the corrective action should be recorded and monitored. Failure to achieve the desired results may necessitate a reinvestigation of the problem in greater depth (de Kruif *et al.*, 1998 ; Radostits, 2001).

FUTURE DEVELOPMENTS

In the future farmers will have to produce according to a total quality assurance system.

Quality is now defined in a broad sense: not only the product is involved but also the production method and the production unit surroundings. Instead of only the end product, the whole production process needs to be controlled. First of all, a general change in attitude and mentality of the farmer is needed based on a Good Agricultural Practice (GAP) code. Elements of this code refer to hygiene procedures and to standard operating procedures. A veterinarian who wants to serve in a quality assurance system needs to act according to a Good Veterinary Practice (GVP) code.

A herd health programme can be incorporated in different concepts of quality management, hazard analysis critical control points (HACCP) and ISO-9000 series. For the application of quality management to animal health care, a HACCP concept is preferred at this moment, in comparison to ISO-9000. (Noordhuizen and Welpelo, 1996; Noordhuizen and Wentink, 2001)

HACCP emphasizes prevention in the avoidance of food safety problems. HACCP combines common sense with an evaluation of risks, in order to identify the points along the food production chain where possible hazards may occur (critical control points (CCP)), and then to strictly manage and monitor these points to make sure the process is under control. Examples of CCP on a dairy farm are bacteria counts per ml milk and milking machine cleaning water temperature. It is common sense and obvious that any

quality assurance system based on the HACCP system is most successful in keeping food safe when it is used throughout the entire food production chain from farm to table (Blaha, 1997). The concept of quality assurance is as simple as considering what can go wrong in production that could cause a quality defect and figuring out how to prevent it from going wrong.

In future quality control will go beyond the current issues of food safety or quality. It is very likely that animal health and welfare will be included. In this instance practical health and welfare scoring indices have to be developed.

An example of such a quality management system is the Veterinary Herd Controlling (VHC) system (Mansfeld, 1998). It is herd directed and involves all aspects of HACCP.

Modern animal health care requires excellent housing facilities and a close cooperation between a competent veterinarian and a skilled farmer/manager. An integrated herd health programme plays a key role in preventing diseases. This will improve animal health and welfare and guarantee a high quality and wholesomeness of foods from animal origin. Nevertheless medicines remain necessary, but must be administered under strict controlled conditions.

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