

FARM MANAGEMENT: THE “INVISIBLE COW” IN HERD HEALTH PRACTICES?

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Take home messages

- Dairy farm management comprises external farm and internal cow management.
- External management deals with eight operational farm functions, which are controlled by the farmer while internal management is involved with a number of biological systems, which are under the control of the autonomic nervous system.
- The management activities of the internal biological systems are not visible to the naked eye, as might be some unobserved or neglected external management activities. Together they have been labelled as “the invisible cow”.
- Veterinary food animal practitioners need a deep insight into the interrelated management activities of external farm functions and internal biological systems in addition to their clinical skills.
- External management manipulates internal management.
- Management of the biological systems inside the cow determines cow and herd performances.
- Manipulation of external management activities will only result in a more consistently healthy and productive herd performance when there is a thorough understanding of the impact of the visible and ‘seemingly invisible’ external management practices and environmental conditions upon the functioning of operational biological systems and processes inside the cow.
- Herd performance can be analyzed via either an outside-inside or an inside-outside approach.
- The inside-outside approach addresses management activities of 1) of internal biological systems and 2) external operational farm functions.
- The concept of the inside-outside analytical herd performance approach can be easily incorporated into veterinary management advisory services.
- To make the veterinary food animal practitioner a better advisory partner for the dairy farmer, veterinary and agricultural academic organizations should offer food animal veterinarians master’s courses in Herd Health and Production Management, under mutual responsibility.

INTRODUCTION

Due to the fact that dairy herds increase in size and that dairy farmers have to fulfill consumer demands and government regulations they are forced to manage their farms more efficiently, economically and innovatively. This puts a heavy load on management capabilities. Dairy farm management comprises external farm and internal cow management. Both external and internal management activities have the ultimate goal of bringing the genetic makeup of the cow to full expression for health and reproductive performance, and milk production. The question is whether veterinarians are able to adequately support dairy farmers’ in their daily management, because limited attention is paid to the ins-and-outs of farm management in the veterinary curriculum.

The objectives of this presentation are to emphasize the importance of management in relation to health and reproduction performance and milk production. This will be done by first studying the characteristics of external farm management and internal cow management and to identify the relationships between their components. Subsequently, the concept of the “invisible cow” in management will be presented. Special attention will be paid to the contrast between the outside-inside and the inside-outside approaches to herd performance analysis.

Finally, the implementation of the inside-outside analytical herd performance approach in veterinary management advisory services will be discussed.

CHARACTERISTICS OF EXTERNAL FARM AND INTERNAL COW MANAGEMENT

External dairy farm management deals with the regulation, manipulation, and control of eight interrelated operational farm functions, each with its own specific processes (1). These are crop/fodder production, nutrition, replacement rearing, health care, reproduction, milk production, buildings/labor/equipment, and financing/budgeting or cash management (Figure 1, left). External management also includes manipulation of environmental conditions related to these functions. Each of the eight operational functions is made up of a number of components. For example, health care comprises infectious and metabolic diseases.

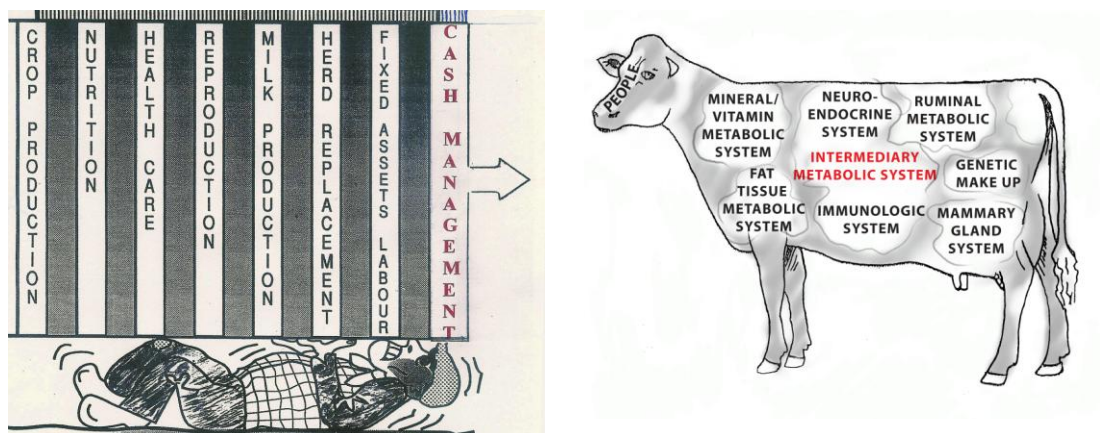


Figure 1. External (left) and internal (right) operational functions controlled by management of the farmer and the cow respectively

Internal cow management is involved with the regulation of the functioning of a number of biological systems inside the body such as; the intermediary metabolic, immunologic, neuro-endocrine systems, and others (Figure 1, right). They are managed by the autonomic nervous system via homeostatic and homeorrhetic control mechanisms in a very coordinated manner (2).

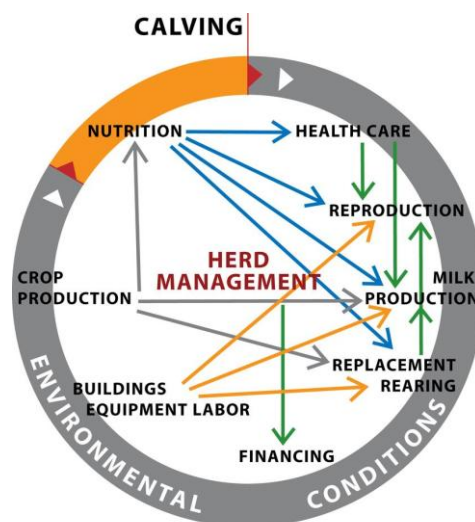


Figure 2. Some interrelationships between external dairy farm functions

The management of each of the eight operational dairy farm functions must always be monitored in conjunction with other external functions and never in isolation. For example, management of reproduction is closely related to nutrition, labor, equipment, and housing as well as to health care and milk production (Figure 2). Farm advisors therefore should not think about management of reproduction, nutrition, milk production, etc., as exclusive or distinct concepts, but rather as integrated management activities. Changes in management activities in one operational function always have direct or indirect effects on other functions. The same applies to operational management activities inside the body. In addition, external management activities continuously influence internal operational management activities (Figure 1). For example, the external operational farm function of crop production may influence intermediary metabolism through nutritional management in many ways. Subsequently, intermediary metabolism influences external performances of health, reproduction, milk production, growth of replacements, etc.

This means that nutritionists not only need to delve continuously into the depths of biochemistry but also to make a concerted effort to understand the basics of immunology, while immunologists need to become comfortable with the fundamentals of nutrition (4,5).

THE “INVISIBLE COW”

Management activities are either visible or invisible. Management can be compared to an iceberg of which only a small part is visible (Figure 3). For dairy farms we label the invisible part of management activities as the “invisible cow”. It comprises a number of components: 1) all managerial activities regulating biological functions inside the cow, 2) managerial activities regulating external operational farm functions and environmental conditions that are not observed or are neglected by the veterinary farm advisor, and 3) managerial activities that might not be reported to the veterinary advisor by the farmer. It should be realized that ‘invisible’ management activities might represent very decisive key factors in veterinary advisory management support services.

Examples of invisible management activities regulating operational body functions:

Examples of invisible internal management activities are the autonomic regulation of coordinated gene expression that controls cow performance, management activities of reproductive processes and many other biological systems. Internal management of biological systems can become indirectly visible in the form of health and reproductive performance and milk production parameters. Examples are prolonged intervals to first estrus, which reflect disturbed interactions between the hypothalamus, hypophysis and ovaries.

Invisible management activities can also be made visible by conducting laboratory tests. Well-known indicators of internal management activities of biological systems are NEFA or ketone blood concentrations, liver enzymes and other parameters.

Examples of seemingly invisible (unobserved) management activities that regulate external operational farm functions:

- Differences between what is recommended by the farm advisor and what is actually done by the farmer,
- Management changes in grouping or feedbunk strategies,
- Dietary inconsistencies with regard to protein, energy, dry matter content, forage quality, particle size, the rumen digestible and indigestible starch and protein ratios, the saturated and unsaturated fatty acid ratio, uncontrolled provision of anionic salts, vitamins and minerals, etc.,

- Suboptimal skills of the farmer and/or farm advisor: 1) to properly evaluate, analyze, and interpret milk production tests or other data calculated on a herd, group, or cow basis, or 2) to recognize the differences between printed forage laboratory test results and the actual quality of the forage that is being fed, etc.,

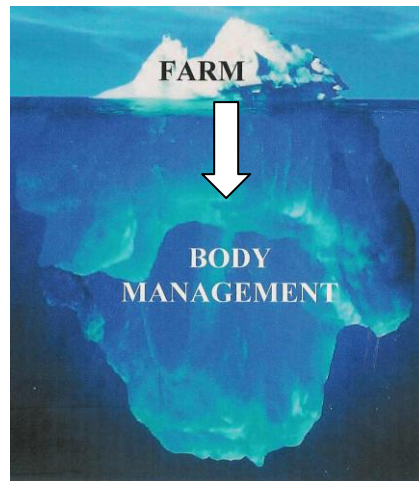


Figure 3. Digital composite of an iceberg (Clevenger, 1999)

Examples of external management activities that might not be reported to the advisor:

- Temporary loss of motivation by the farmer/herd manager who, for unknown reasons, neglects recommendations given, even when a positive outcome is ensured,
- Incorrect answers by the farmer to advisor questions whereby the latter may come to the wrong conclusions,
- Withholding of information by off-farm companies or by the farmer about activities that the veterinarian or nutritionist has no knowledge of or no opportunity to observe. For example, an unknown change in the composition of feed components in concentrates by the feed company.

Invisible and seemingly invisible managerial practices may play an essential role in dairy herd performances. If not taken into account during a farm inspection they may be responsible for unsuccessful advisory service outcomes. One of the advisor’s most important, yet least recognized roles is therefore to help make the invisible visible for the farmer, thereby enhancing the level of clarity and understanding of actual herd performance. To do this veterinary farm advisors have to become detectives during a farm inspection and users of their own observational “laboratory,” which includes all their physical senses. In addition, advisors should train themselves to ask crucial questions and to listen very closely to the answers given by the farmer.

The advisor should also realize that farmers often don’t have an idea on what is happening within and between the biological systems inside the cow and that these biological systems have their own rhythm. They might also be unaware of the fact that the functioning of the internal biological systems determines the level of herd performance. In turn, the cow does not understand what the farmer wants or cannot fulfill the farmer’s demands because the farmer speaks the language of profits instead of the “biological language” used by the cow. Increases in herd size and adoption of automation also increase the distance between the farmer and the cow.

FARM ADVISORY SUPPORT SERVICES

OUTSIDE-INSIDE AND INSIDE-OUTSIDE HERD PERFORMANCE ANALYSIS APPROACHES

Herd management can either be analyzed from the outside or the inside of the cow. Both approaches will be discussed in more detail in the next paragraphs.

Outside-Inside Herd Performance Analysis Approach

Traditional outside-inside analysis approaches commonly start with a farm/herd inspection thereby searching for risk factors related to actual management practices and environmental conditions (Figure 4, left). A retrospective monitoring, evaluation, and analysis of health, reproductive, and milk production data then follow this. Examples include analysis, and interpretation of herd milk production test data, somatic cell counts, body condition scores, reproductive data, laboratory test results, environmental conditions, and many others. Trends in outcomes of these activities are used as clues to solve problems by curative actions.

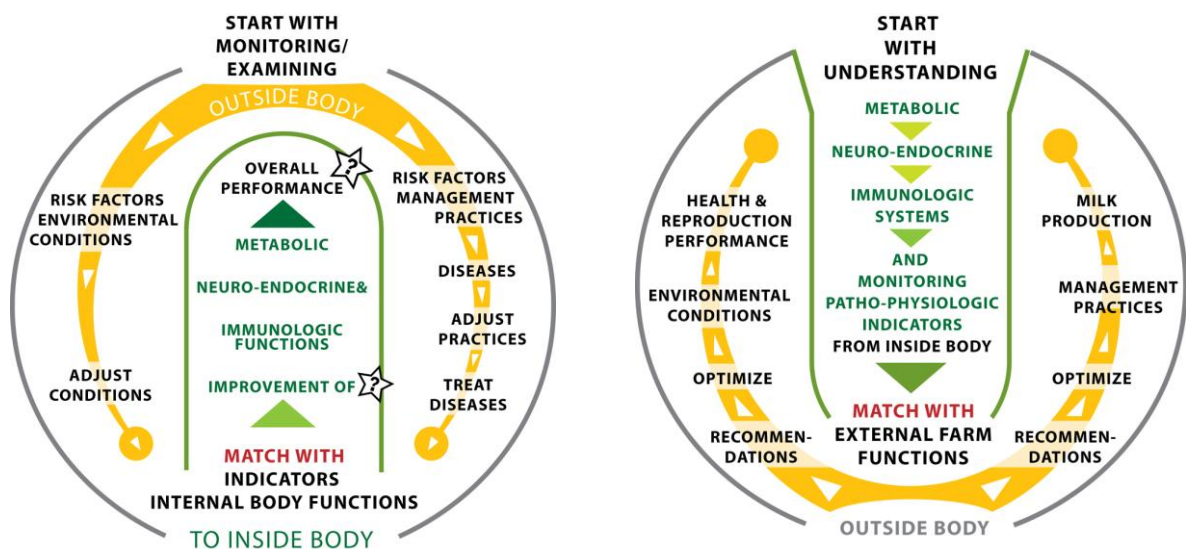


Figure 4. Inside-outside versus outside-inside herd performance analysis approaches

Within this approach treatments and adjustments are often restricted to a rearrangement of some external management activities, merely reacting to inadequate management in one or more operational farm functions. However, rearrangement of external management activities only lead to restoration of disturbed herd performances when they are causally related to processes within internal management systems such as intermediary metabolism or immunologic processes, etc. It should be stressed that herd performances are ultimately the result of management activities of internal biological systems, which are continuously influenced by external management practices and environmental conditions. External management is only a steering wheel for internal management of the cow. If external management activities do not line up with management activities inside the cow such as intermediary metabolism and immunological processes, the measures taken will most often not result in desired improvements in herd performance. Treatments or adjustments of disturbances that are only taken at the level of external management can be characterized as making change by hoping for positive outcome.

A diagnosis of a disturbance can therefore never be considered as an endpoint but instead as a starting point to search for underlying causal management activities within

internal operating biologic systems that contribute to disease and production inefficiencies. A crucial question is whether the management advisory services offered by the food animal veterinary practitioner is only directed at management activities of external operational farm functions and not towards creating optimal conditions for proper autonomic management of operational systems inside the cow.

Inside-Outside Herd Performance Analysis Approach

The “inside-outside” herd performance analysis approach, studies performance and performance-related problems from the inside of the cow instead of from the outside (Figure 4, right). This concept requires an in-depth understanding of the functioning and management of metabolic, neuro-endocrine, and immunologic operational systems inside the cow. Likewise, an appreciation is required of the limits of physiologic adaptations to physical and pathological stress.

The inside-outside approach starts with recapitulating available knowledge about the functioning of internal operational biological systems and continues with a search for relevant indicators of disturbed operational biological systems and processes by the farm advisor. The details of intermediary metabolism are central to understanding the processes in other internal systems and the external operational functions. For example, the advisor must understand how the Krebs cycle functions within the mitochondria of body cells and rumen bacteria and how it is influenced by external managerial activities such as nutritional management or stress caused by changing environmental conditions. Likewise, immunologic (udder defense) and reproductive (anovulatory) events are intertwined with intermediary metabolism and influenced by external operational functions.

If indicators of disturbed operational biological systems and processes are found, they are matched with actual external operational management activities and (adverse) environmental conditions that could be responsible. The matching activities will often lead to a diagnosis of one or more suboptimal performances. Recommendations then have to be formulated for adjusting external managerial practices and environmental conditions. Treatments and adjustments should not only be directed at curing disturbances in one operational farm function but also at correcting disturbances in other external functions. In addition, connections with potentially underlying causes in internal operational systems have to be examined and if found adjusted via related external functions.

This means that in case of clinical mastitis, as a component of the operational function of health care, treatments should always be followed with a thorough examination of other external operational functions such as nutritional management, labor, buildings, and equipment etc. Subsequently an examination of internal operational biological systems that are causally related to the disturbed intramammary infection resistance should be performed. This may lead to detection of a negative energy status, a disturbed calcium metabolism or other disturbances within internal systems. It is at the level of internal operational body systems where actual interactions with external managerial activities and environmental conditions take place. It is also the place where preventive and curative activities should start. In so doing, existing problems are then addressed at their roots and in a holistic manner.

The inside-outside approach cannot only be used to solve but also to prevent problems and to predict what will happen if recommendations are not implemented. The approach is therefore a double-edged sword that may cut in two directions.

THE INSIDE-OUTSIDE VETERINARY FARM MANAGEMENT ADVISORY SERVICE MODEL

The inside-outside herd performance analysis approach can be easily incorporated into an overall veterinary farm management advisory service-model (Figure 5). The model connects interactions between the cow, farmer, and farm advisor. Because the cow is at the center of the model the first step is to retrieve data on the indicators of “invisible” internal management activities that form the backbone of the advisors’ analytical approach. Data collection on indicators seems simple, yet it is often the hardest step. If indicated, laboratory tests should be conducted to become better informed and thus achieve a better understanding about the actual state of performance of the internal operational systems.

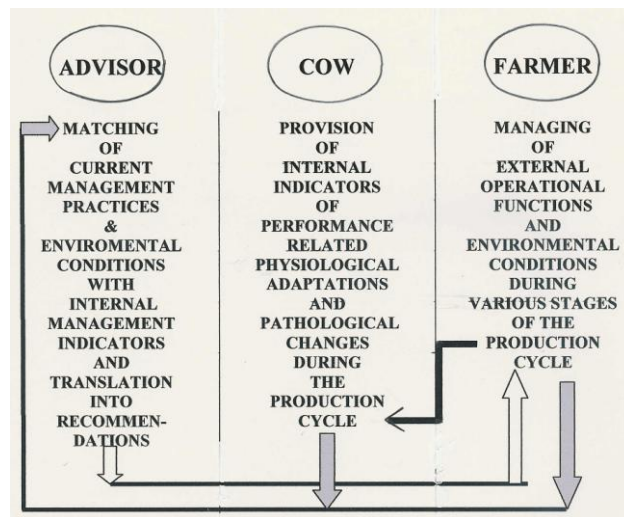


Figure 5. Working model for inside-outside farm management services

The second step is to find out what management practices of external operational functions are known and executed by the farmer. It also requires detecting, as much as possible, those practices that are “unknown” and thus “seemingly invisible” and not executed by the farmer. Effort should be made to make them visible by interviewing the farmer in combination with a thorough farm and data inspection.

The third step includes matching the internal and external information sources together. This includes indicators of internal management activities, inadequate external farm management practices, and adverse environmental conditions. Everything that has been observed and heard must be evaluated while contemplating processes that are taking place inside the cow. It should then be determined which of these biological processes are affected and how the invisible processes might influence and improve external cow and herd performance. After matching all relevant factors, the results are translated into understandable recommendations for the farmer. The implementation of recommendations depends heavily on the readiness of the dairy farm management team to make changes to their management practices so as to improve operational functions inside the cow and subsequent herd performance as a whole. To stimulate cooperation of the farmer goals must be set with the aim to evaluate progress regularly and to show improvements.

Example of inside-outside advisory services

Figure 6 presents an example of the inside-outside approach, which deals with heat stress. Each consists of three stages: 1) physiological changes, (patho) physiological developments and adaptations of the cow to events over time; 2) the actual management

activities of the farmer to respond positively or negatively to these events; and 3) responses of the farm advisor after matching the various findings.

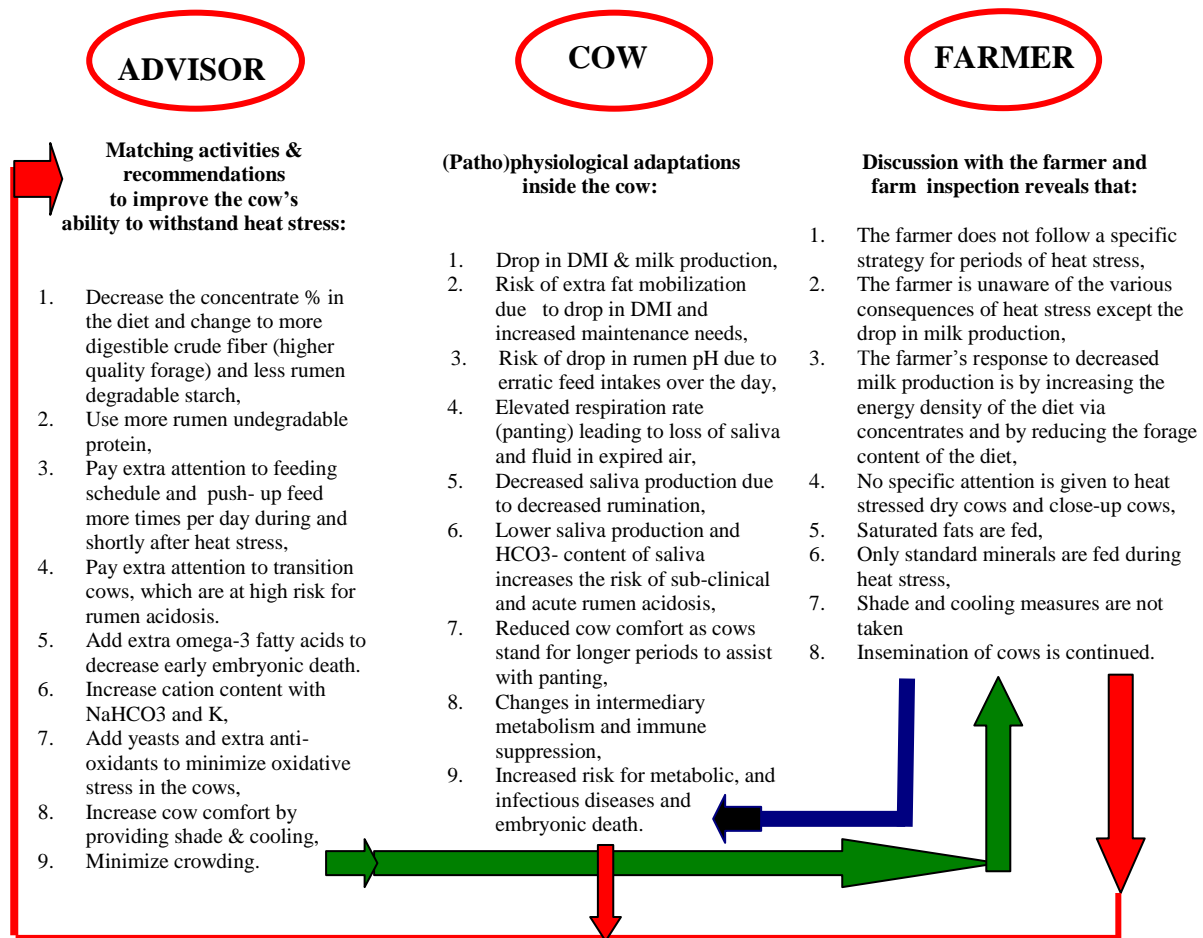


Figure 6. Practical example of interactions between the cow, farmer, and farm advisor during heat stress

Traditional services have a common way of approaching problems namely reducing the number of cows that deviate from preset targets in order to obtain a healthier herd. In contrast, the inside-outside approach is directed at obtaining a healthy herd by optimizing operational biological systems inside the cow. The starting point is not the detection of external risk factors that might be related to a problem but the search for indicators of underlying disturbed operational systems at the organ, tissue, and even molecular levels.

DISCUSSION

Many food animal veterinary practitioners complain that owners of large dairy herds are not making full use of their services suggesting that a gap exists between what veterinary advisors are currently offering and what large dairy farmers need. To close the growing gap between food animal practitioners and farmers veterinary farm advisors should improve their insights into the breadth and depth of complex management activities related to external operational functions and internal biological systems. Daily external operational management practices of the farmer, the farm environmental conditions, and the management of the cow's internal operational biological systems determine the profitability of a dairy enterprise. They

also should renew or update their knowledge in biochemistry, immunology, endocrinology and other relevant disciplines and effects of external management practices and environmental conditions on these functions. The holistic inside-outside advisory service model presented in this paper is an important tool that can be used to accomplish this. A holistic approach to dairy herd veterinary management advisory services includes evaluation of all farm management practices and environmental conditions in connection with biological systems inside the cow (4,5).

In our opinion, the management-oriented education of the veterinarian has to be strengthened within the actual overwhelming disease-oriented education. This strengthening will provide the food animal veterinary practitioner more insight into how individual cow and herd performances are influenced by managerial practices and environmental conditions. Special attention should be given to nutrition and related interrelationships with biochemistry, immunology and other physiologic functions.

Veterinary and agricultural academic organizations should discuss the possibility of offering veterinary students that are interested in becoming food animal practitioners, joint master's courses in farm management and related subjects.

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