Herd health surveillance and management in an integrated HACCP based system

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Abstract

Future herd health management systems need to focus on precaution and documentation of how product and process failures are prevented. HACCP-based herd health surveillance schemes have been developed for dairy cattle herds, organic pig and egg production systems and for mink production in Denmark. The generic part of such systems, including definition of hazards and risk factors, can be developed through expert opinion panels. The development of sets of control points, alarm values and corrective actions need typically to be farm specific. On-farm systems focusing on broad topics such as animal welfare and food safety tend to grow too big to be operational. It is suggested that a part of the system is controlled through 'good management practice' leaving only a few hazards to be controlled by control points, alarm values and corrective actions.

Introduction

During the last twenty years it has been generally accepted that health promotion in livestock production is an integrated and holistic approach focusing on the herd rather than the individual animal. Health management can be defined as the promotion of health, improvement of productivity and prevention of diseases in animals within the economic framework of the producer and industry, while reconsidering animal welfare, food safety, public health and environmental sustainability (LeBlanc et al. 2006). However, the last part of the definition, focusing on societal expectations, seems to be ever more important emphasizing a table-to-farm chain approach. The consumer, through retailer controlled certification schemes, and the society, through rules and regulations, play a major role for the modern livestock producer. Hence herd health management schemes must not only integrate aims such as animal welfare, food safety and environmental protection but also allow the farmer to document required qualities linked to product and production process.

Focusing on maintenance of health and even more important to avoid food hazards and animal welfare problems precaution is central. Often we want to avoid some events which seldom occur and we therefore need to monitor not the events themselves, but risk factors. One of the concepts, which have attained increasing interest, is the HACCP (Hazard Analysis Critical Control Points) concept. The idea to use this concept at farm level was suggested ten years ago (Noordhuizen & Welpelo 1996). Since then it has been suggested for various areas within the primary production (Cullor 1997; von Borell 2000).

A HACCP based farm concept

The idea in the HACCP concept is to prevent specified problems by continuous control of critical control points indicating an increase in a certain risk of the problem. If an alarm value for a certain control point is reached then a predefined corrective action should be taken in order to decrease the risk.

In the food industry the concept is linked to food safety hazards (Hulebak & Schlosser 2002). In the primary production it is desirable to broaden the concept so it includes all types of 'events to be avoided'. At the Danish Institute of Agricultural Sciences we have worked on the concept across different species where we have included events such as specified diseases and animal welfare

problems and to some extent also production failures. For each hazard we have identified major risk factors. For each risk factor one or more control points has been identified. For each control point we have specified an alarm value and for each alarm value (exceeded) we have specified a corrective action. The method has been developed for dairy herds with automatic milking systems (AMS) (Sørensen et al 2004, Rousing 2005), for organic sow herds (Bonde & Sørensen 2004), for mink production (Møller 2004) and for organic egg production.

In organic sow herds an important animal welfare problem like piglet mortality has to be controlled by preventative measures. A major cause of pre-weaning mortality in organic piglets is crushing by the sow, and risk factors for this are related to the design and dimensions of the farrowing hut, the quality of the bedding, disturbances from predators and other animals, sow condition as well as litter condition. Potential control points targeting piglet mortality could be related to the straw type and amount provided for bedding, timing of the introduction of the sow into the farrowing facility, litter size, and disease in the sow. Corrective actions could be related to the provision of more high-quality bedding material, increased surveillance of sows with late introduction to the farrowing pen, and extra care to large litters and litters from sows with health problems. Other health and welfare problems included in the HACCP concept for organic sow herds are diarrhoea in weaned pigs, and poor body condition and lameness in sows.

During the first year after implementing the robots, an AMS dairy herd may face problems with milk quality, reproduction, milk production, and cow health and behaviour. We identified more than 30 important hazards potentially causing problems in new AMS herds. The major task was to make this operational and still maintain a systems orientated approach.

In mink production we have focused on prevention of preweaning diarrhoea and kit mortality. The hazard of inadequate energy supply in critical periods have been analysed, CCPs identified, and critical limits established for on-farm use. Due to a time lag in the health management feed back cycle, preventive measures like HACCP are well suited for the strict seasonally synchronised mink production.

Specifying hazards, risk factors and control points through expert opinion panels

Identification of a set of hazards, risk factors and control points is a major task. It can be done empirically and directly if a comprehensive data set is available but this is often not the case. Identification could also be done by a literature review. However, often the information needed will not be available. In such a situation it has been suggested to use expert panel analyses and a Delphi approach (van der Fels-Klerx et al. 2002; Sørensen et al 2002). In the Delphi approach a panel of experts is asked to complete a sequence of questionnaires separately. This is illustrated in the following example.

In organic egg production the HACCP system was created to prevent selected problems that can compromise animal health or welfare. Initially an expert panel was assembled for a Delphi analysis, comprising 18 experts, with experience in on-farm research and organic egg production. Experts were recruited from 9 different countries, with only one representative per institute, and all were anonymous to each other. In the first part of the Delphi analysis an extensive list of animal health and welfare hazards experienced in organic egg production was constructed after suggestions from advisors and scientists. The expert panel rated each hazard according to both occurrence and severity. All hazards scoring high in both occurrence and severity, or maximum points in either severity or occurrence were selected, resulting in ten hazards: hunger, thirst, piling, crop impaction, blackhead, pasteurella, bone fractures, predators, cannibalism, and red mites. The expert panel was then asked to list all possible risk factors for these ten hazards, creating combined lists of 9-21 risk factors for each problem. The most important risk factors were selected in a second rating

procedure, resulting in 39 different risk factors for the ten hazards (1-8 risk factors/hazard). Finally the experts were asked to suggest control points for each risk factor and alarm values for each control point, to ensure that the risk factors are managed correctly.

Discussion

Several HACCP based systems have been developed for on-farm use. A major task is to do a thorough evaluation on the applicability of the systems in practice. This is a major problem not only for HACCP based systems, but for all complex herd health management schemes. We are using three different approaches. Qualitative interviews with farmers, epidemiological analysis using a control group, and simulation analysis using a complex herd production simulation model.

The value of the HACCP concept lies in the control of events that must be avoided on-farm, where the only control option available is prevention. Any treatment of the problem when actually present in the herd is either too late (for example mortality) or very resource demanding. A HACCP based system is less likely to be applicable for control of problems that can be treated satisfactorily if they occur in the herd or problems that are accepted at a low level on-farm.

A general experience with on-farm HACCP based systems focussing on animal health and welfare is the risk of growing too complex. Due to the hierarchical tree structure (hazards, risk factors, and control points) a large number of control points may be the result. It is therefore often necessary to narrow the number of hazards down to a few with controllable risk factors. This requires that the level of the residual risk factors is controlled by a 'Good management practice'-approach describing the management without requiring control points and alarm values.

Should the HACCP based farm management systems be generic or farm specific? In the food industry each system is specific and controlled by a local HACCP group. Development of a HACCP based system is expensive. It would therefore be desirable for the livestock farm to use a generic system. A compromise could be to develop a generic set of hazards and risk factors and develop control points, alarm values and corrective actions locally.

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