THE CLINICAL EXAMINATION OF CATTLE
Pt. 2. Examination of the Herd

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"The principal objective of making a herd examination is to make a herd diagnosis so that a herd treatment or control program can be applied"

Introduction

To conduct a thorough clinical examination of one animal, making sure that no part of the examination is omitted, is difficult enough. To do the same thing with a herd or group of cattle has to present more of a problem, if for no other reason than that it takes a lot longer. These are other reasons why it is more difficult:

- In most cases there are variations in the clinical signs observed and there are then difficulties in deciding how many animals should be examined to ensure that the entire range of clinical (or clinico-pathological) findings is included when defining the problem.
- A large part of the value of examining a herd is that it is then possible to determine the prevalence of the disease in it. Again, there is the problem of deciding how many to examine in order to have an adequate sample. There is also the problem of deciding *which* animals to include in the sample. To determine prevalence it is as necessary to examine non-sick animals as well as sick animals.

To examine all of the cattle in a herd is often not possible because of the cost involved and the principal decision before beginning the examination of a herd is to establish what the costs and benefits are likely to be and then to decide on a procedural pattern which will not sacrifice accuracy for speed and, on the other hand, will not spend unnecesary time accumulating unnecessary information. This paper is presented in order to provide some ground rules, some guidelines, for the field veterinarian faced with the task of examining a group of animals.

Veterinarians have always been accustomed to examine herds of cattle in matters relating to the rate of occurrence of disease, e.g., brucellosis and the detection of carriers of disease, e.g., tuberculosis. However, these have usually been total herd surveys for the identification of individual animals so that they could be treated or culled. They have been tasks related to infectious disease and have been principally the domain of the government veterinarian or a contracted private practitioner. At the present time there is a growing emphasis on those diseases in which a herd diagnosis is the only practicable diagnosis, and on those diseases caused by management errors or inadequacies in which a specific etiological agent or factor cannot be identified. In these circumstances an examination of the herd is required. This includes the following items:

History — especially management and the records relating to it,

Examination of the environment — especially nutrition, housing, milking procedure,

Clinical examination — as already described, and

Clinico-pathological examination including chemistry, microbiology, parasitology, radiology.

Production data in those herds where the problem is not one of clinical disease in the usual sense, but where it is one of failure to meet the performance target used, e.g., low milk production, low calf weaning percentage, low weight gain to weaning, inadequate growth of dairy heifers.

Before setting out the rules of procedure for herd examination it is best to identify "herd diagnosis" and other related forms.

Types of Diagnosis

A. *The Etiologically-Specific Diagnosis* is the only completely definitive diagnosis because it identifies the lesion and the causative agent, e.g., pneumonic pasteurellosis. It is applicable only to individual animals because the presence of the causative agent has to be established in each.

B *The Patho-Anatomic Diagnosis* stops short of being definitive because only the system affected and the nature of the lesion are identified. Although it is incomplete it is the only available diagnosis in many diseases, e.g., left abomasal displacement, in which no causative agent can be specified. It includes functional diseases in which there is an identifiable abnormality, often clinico pathological, e.g., paresis caused by hypocalcemia in milk fever, but no anatomical lesion. It is also used to include those diagnoses in which there is neither anatomical nor clinicopathological

lesion and in which the only detectable abnormality is one of physical function, e.g., spasmodic colic, epilepsy.

C. *The Response Diagnosis* in which a means of prevention or cure of a disease may have been identified but the cause of the disease has not, e.g., selenium-responsive unthriftness in cattle.

D. *The Undifferentiated Diagnosis,* e.g., weaner ill-thrift, in which neither the lesion nor the system nor the causative agent are nominated. There is an increasing tendency to use "thin calf syndrome", "thin sow syndrome", "slow-horse syndrome", and especially in cows the all-embracing "parturition syndrome".

E. *The Non-Disease Diagnosis.* This is a contradiciton in terms. Diagnosis means definition of the nature of disease. The expression is meant to highlight the common error of equating the presence of a pathogenic agent with the existence of disease. The agent may be latent or there may be only traces of its passing. Examples are the Salmonella carrier and the cow which is seropositive for a bluetongue virus.

F. *The Herd Diagnosis* is the diagnosis of a disease as being the cause of the problem observed in a herd. It infers that treatment or control measures for the disease are appropriate at the herd level. It may be made as a result of any of the following:

- summation of the clinical and/or pathological findings in a sufficient sample of cattle. This may include such non-specific identities as "weaner unthriftiness", low herd milk production and so on.

- especially when the findings in individual animals are inconclusive, due either to the low level of efficiency of a laboratory test, or to the passage of time since the clinical syndrome was apparent. It is then common to nominate a particular disease as the cause of the problem, without nominating individual cattle as being affected.

- response of the herd to a herd-wide treatment or control program.

The Examination of the Herd

As in the clinical examination of the individual animal where there are two stages in the examination (general examination of the body as a whole, and then special examination of the system(s) involved, there are two stages in the examination of the herd:

1. General Examination of the Herd to establish the nature of problem.
2. Special Examination of the Problem Identified, e.g.:
   Abortion
   Reproductive inefficiency
   Mastitis
   Weight loss
   Poor milk production
   Pneumonia

The objectives are two-fold:

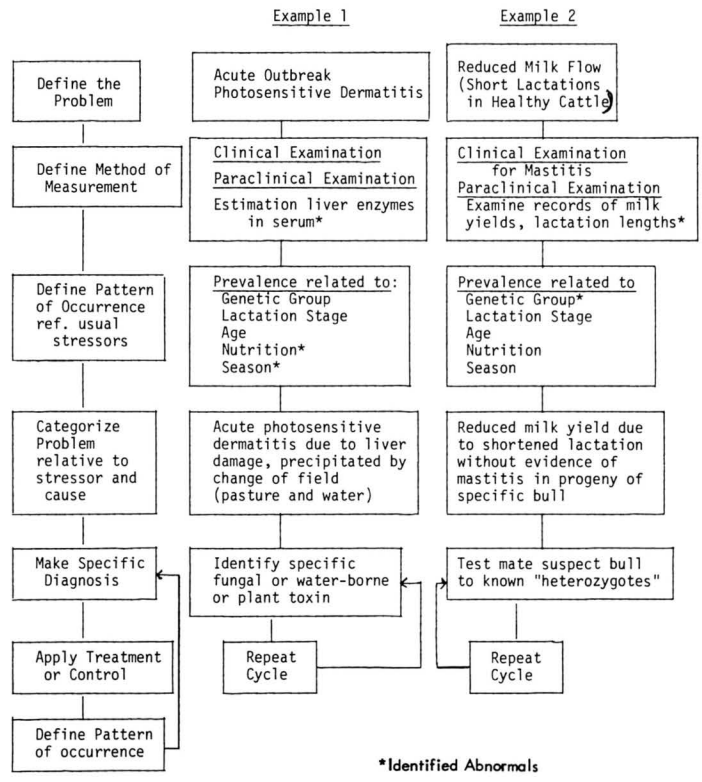
2.1 To identify an "etiologically-specific" or at least a "responsive diagnosis".

2.2 To identify the predisposing factors or stressors which may have promoted what might have been an individual disease up to the level of being a herd problem requiring a herd diagnosis and a herd treatment or prevention program.

General Examination of the Herd

As set out in Figure 1, there are several procedural steps. The first is to define the problem. In example 1 this is photosensitive dermatitis; a clinical examination has revealed that a number of adult cattle have suddenly become affected with a severe dermatitis affecting only unpigmented skin on the dorsum of the body. The basis for the diagnosis is decided to be by the readily recognizable clinical signs and the presence or absence of acute liver injury. Because the disease has occurred suddenly/acutely and in an examination for stressors or predisposing causes the food supply and the drinking water seem likely sources. A recent change in one or both suggests inspection of the environment in search of a pasture fungal toxin, a water-borne algal one or a plant poison.

Fig. 1 PROCEDURE FOR EXAMINATION OF A HERD OF CATTLE



In example 2 a similar sequence of steps indicates that the abnormality is a reduced length of lactation without mastitis, all affected animals being progeny of a particular bull. In both cases a definitive final diagnosis depends on positive identification of the causative agent.

In the first example a presumptive diagnosis would be made based on the presence of the agent, e.g., many fungal spores in pasture and of typical hepatic pathology. In the second example a test mating would be the only complete identification of cause. In almost all such situations an etiologic diagnosis will not be possible for reasons of cost. A presumptive "herd diagnosis" would be a common endpoint, with the diagnosis being tested by application of control measures for the entire herd, removal from the toxic environment in example 1, and discontinuing breeding females to the donor bull in example 2. If the disease is still present on reassessment after this manoeuvre it is necessary to go back and reassess the original specific diagnosis.

Problems encountered in general examination of herds

The advantage of a herd examination over the examination of a single animal is that a good patho-anatomic diagnosis based on clinical signs and pathological findings is greatly strengthened if there are also epidemiologic details relating to rate of spread, prevalence, source of infection, and to the presence of predisposing causes (usually in the form of stressors). The problems commonly encountered in making a herd diagnosis, most of them problems in making an examination of a herd, include the following:

- Insufficient sick animals to establish the standard clinical picture, e.g., a single case of "head and eye form" of bovine malignant catarrh.
- A variable clinical (or pathological or clinicopathological picture) so that the problem cannot be accurately defined, e.g., abomasal ulcer in adult cows, enzootic bovine leucosis, chronic peritonitis, traumatic reticuloperitonitis.
- The presence of two diseases, each with a clearly defined symptomatology, e.g., erosive lesions of the oral mucosa caused by papular stomatitis, and diarrhea caused by ostertagiasis.
  Both diseases are likely to have a high prevalence and their presence in the one animal may suggest that a viral mucosal / diarrheal disease such as bovine viral diarrhea is present.
- The presence of subclinical disease. Diseases that require expensive and time-consuming laboratory tests are accompanied by logistic and financial problems when many animals have to be examined. A good example is hypocuprosis.
- When a disease has a damaging environmental factor (a stressor) as a primary or predisposing cause there is often great difficulty in defining it. This may be so, for example, in a nutritional deficiency of copper in a marginally deficient area. In these circumstances the rate of growth of the pasture, in itself dependent on rainfall and season of the year, may decide whether or not clinical illness appears.

In all of the above situations careful use of the herd as a data base will help resolve the problems. The three principal guidelines are:

1. When attempting to define the problem use as many affected animals as possible.
2. Compare the lesions and clinicopathological findings of the affected animals with those of an equal number of those animals which are apparently free of the disease. This will determine whether the lesion or sign is an essential prerequisite for a diagnosis or is a chance occurrence. This is set out graphically in figures 2 and 3. In the latter, a further subdivision into three groups will help to establish the validity of the lesion as part of the disease and also to identify what are the likely predisposing factors or stressors.
3. In the case of diseases in which subclinical disease or latent infection (infection without disease) occur, the animals being used in the study should be examined in both modes, clinical and paraclinical (biochemical, microbiological especially seroconversion, radiological). A clinical examination is frequently omitted in these circumstances and perfectly visible, significant lesions and signs are unfortunately omitted from the findings.

Fig. 2 **USING THE HERD AS A DATABASE**
Significance of lesions, e.g., papular stomatitis s

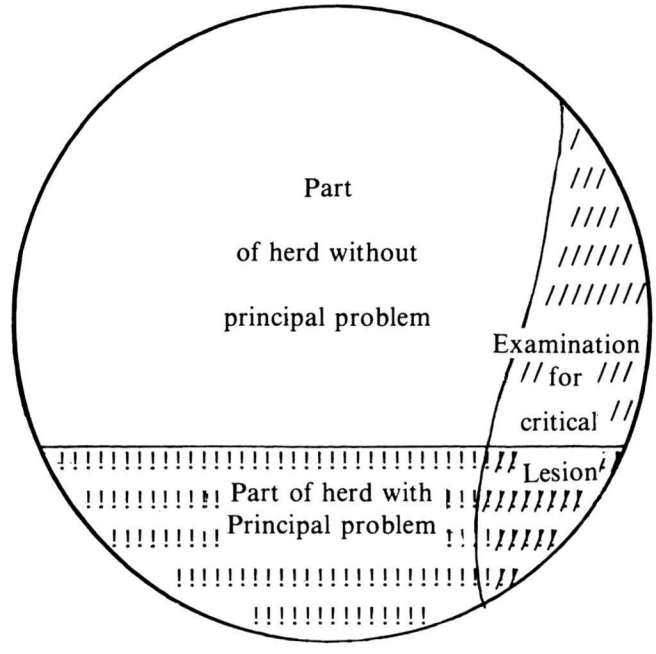
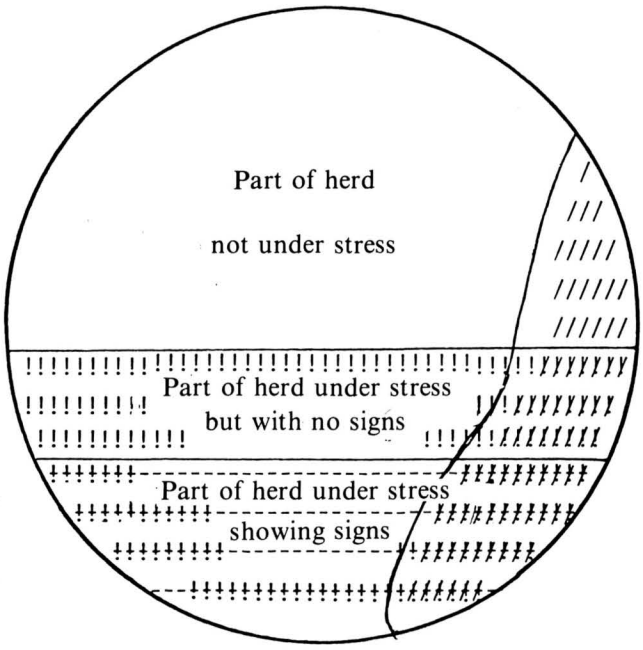


Fig. 3 **USING THE HERD AS A DATABASE**
e. g. **Compton Metabloic Profile and Hypophosphatemia**



Special Herd examinations

It is not possible in the scope of this paper to set down procedure guides (protocols) for the examination of all special disease situations in herds. However, some summaries are provided. The value of such protocols is that they act as check lists to ensure that answers to all the critical questions are obtained. The examination may be carried out in several ways, for example by a single visit technique or by monitoring over a period of time. The protocols cited are all single visit programs and would be varied to a degree if they were to be used over a period. Although it is written into them it is axiomatic that they should be cost-effective and the costs of all procedures should be pared to a minimum, consistent with accuracy, to ensure this. The procedures are also written to cope either with a problem occurring in a herd with a herd health program, in which an alarm is sounded if performance or prevalence deviates significantly from the target for the particular parameter (e.g., bulk milk cell count in mastitis), or for a standard herd in which the alarm is raised by the increased prevalence of a clinical disease such as mastitis.

Construction of a Protocol

The preparation of a special document to be used when investigating a herd disease is important enough to warrant discussion. It is a counterpart of a clinical examination of a single animal, but is different in that it sets out to find epidemiological data to help both in diagnosis and in determining prevalence. For this reason it needs a structured epidemiology section as well as a structure clinical signs section which itemizes temperature, pulse rate, respiratory rate and so on. The stages in the development of the protocol are:

1. Defining the objective. This can be done by a decision tree (see Fig. 4) which was designed for arriving at a diagnosis, or in tabular form (Fig. 5) which was originated to identify the stressors influenced the appearance of the disease.
2. Prepare a check list of items as set down in examples 1 and 2 to which answers need to be obtained to satisfy the objectives.

Fig. 4 Key to Poor HERD Body Weights - Beef Cattle

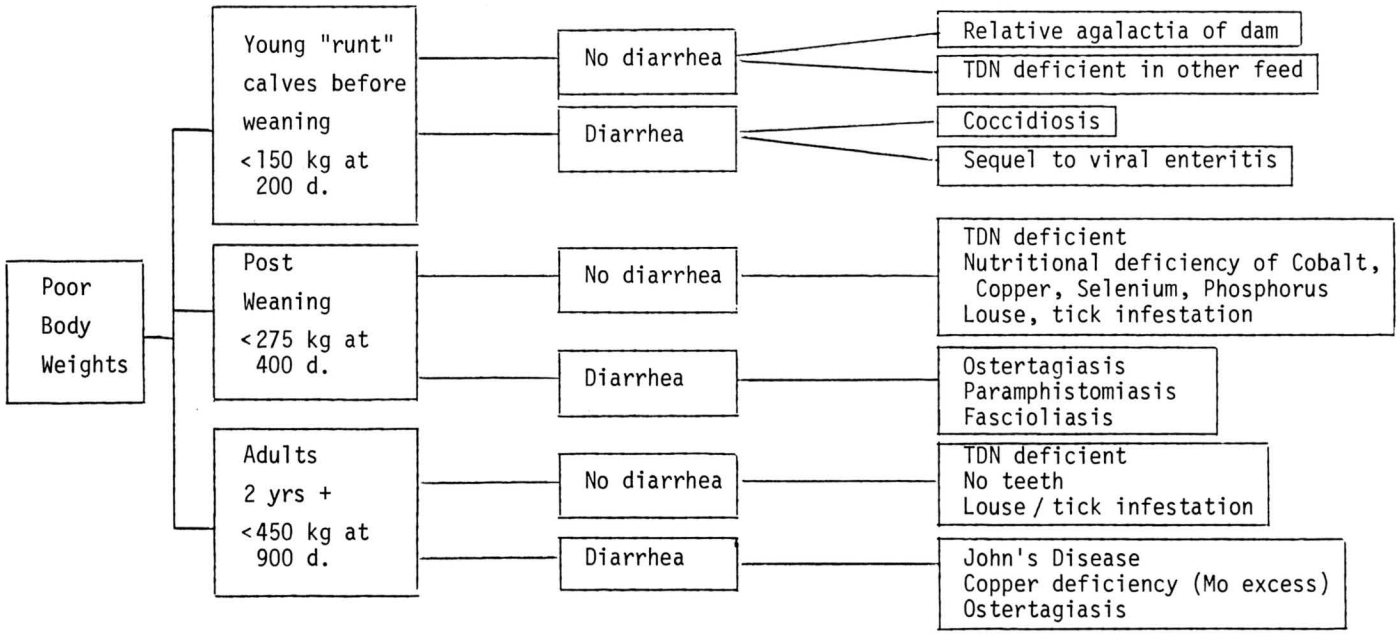


Fig. 5 **TABLE FOR DEFINING THE PATTERN OF OCCURRENCE (e.g., Short Lactations)**

AGE Cases	0-48 hrs --	2-30d --	1m-6m --	6m-2y --	3-4y 12	5y+ 0
Out of	--	--	--	--	20	8
PROGENY of	Bull 1	Bull 2	Bull 3	Bull 4	Bull 5	Bull 6
Cases	12	0	--	--	--	--
Out of	20	80	--	--	--	--
SEASON	JF	MA	MJ	JA	SO	ND
Cases	-6	6-				
Out of	-100	100-				
FEED PLAN Cases	1 12	2	3	4	5	6
Out of	100					
Lactation Stage Cases	0-48hrs	2-50d	50-200d 4	200-300d 8	DRY	
Out of			100	100		

3. Design a protocol (like a questionnaire) which is applicable to the particular disease which is being investigated. Fig. 6.

Example 1

Procedure for the Examination of a Herd with a Mastitis Problem (1 Visit, Cost Effective)

1. *Previsit*
   Ensure mastitis is the problem - record of BMCC or ICMCC (Individual Milk Cell Count).
   Check prevalence record (preceding 3 months cell count record).
   Have mechanic check machinery including free electricity.

2. *Visit* — before milking (a.m. best)
   Check cups, inflations
   Bedding and stalls

Fig. 6 HERD EXAMINATION PROTOCOL
(Sample 1 of 4 pages)

Owner's Name: _____

Owner's Address: _____

Respondent: _____ Date: _____

Recorder: _____

1.0 Description of Abnormality

1.1 Abnormality is clinical/subclinical. Describe

1.2 Number affected _____out of population size of _____

1.3 Other affected populations and sizes under same control:
1 _____, 2 _____, 3 _____.

1.4 Other unaffected populations and sizes "in contact" but not under same control:

1.5 Case mortality. All cases _____out of _____:
untreated cases _____ of _____.

1.6 Average duration of abnormality.

2.0 Case Distribution

N.B. Quote all numbers affected as a fraction of numbers in group.

2.1 Case distribution by age. Number of cases which were:
Weaned _____; Weaned to 1 yr. _____; 1-2 yrs. _____
Adult _____.

2.2 Case distribution by sex. Number of cases which were:
Male entire _____, Male castrate _____, Female _____.

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2.3 Case distribution by breeding group. Number of cases sired by: Sire 1_____, Sire 2_____, Sire 3_____
Sire 4_____.

2.4 Case distribution by reproductive cycle group.
Number of cases in: lactating females_____,
dry pregnant females_____, parturient females_____,
and/or mating females_____, females not yet of breeding age_____.

2.5 Case distribution in time. Number of cases in last 12 months: Month 1 , 2 , 3 , 4 , 5 , 6 ,
7 , 8 , 9 , 10 , 11 , 12 .
Number of cases 2 years ago_____, 3 years ago_____.

2.6 Case distribution by nutritional group. Number of cases in animals: at pasture_____, and hand fed_____,
irrigated pasture_____, cropped_____, zerograzing_____,
housed_____.

3.0 Management Description

3.1 Enterprises.
No. 1: Total animals____on____acres____hectares, in____ paddocks.
No. 2: " " ____ " ____ " " ____ "
No. 3: " " ____ " ____ " " ____ "

3.2 Dominant pasture species.

3.3 Fertility: high/fair/poor.

3.4 Average annual rainfall:_____ ins. mms.

3.5 Shelter available: treeless-windswept/timbered/flat/folded/steep and hilly/marshy.

3. *Visit - during milking*
   Premilking udder sanitation
   Strip cup or floor patch (in-line filter)
   Milk sample (10% of herd)
   Teat dip
   Milking technique
   Examine teat/udder skin

4. *Visit - after milking*
   Detailed exam special cows (palpation lymph nodes, mammary tissue).
   Condition of lanes, ramps, entrances.
   Examine milk (physical, CMT, culture CMT/I's or above).
   Check treatment materials (bulk containers, contaminated tubes).

5. *Post Visit*
   Report laboratory findings (cultural sensitivity)
   Recommend treatment/control procedures
   Advise resampling

Example 2

Procedure for the Examination of a Herd with a Reproduction (or Abortion) Problem (1 Visit, Cost Effective)

1. *Previsit*
   Ensure problem exists (compare record of performace with targets for each mode).
   Determine which mode of reproductive efficiency affected (anestrus, failure to breed, etc.,) by check of records.
   Need Preset Targets for each mode (e.g., calving to conception interval, percent on heat by 60 days post-calving).

2. *Visit*
   Examine cows' breeding history.
   Physically examine cows' genitalia by rectum.
   Physically examine ditto by vaginal speculum when indicated.
   Record bodily condition or body weight.
   Select mode where problem exists (see diagnosis of mode).
   Select specific etiology (see etiological diagnosis) - requires submission of laboratory samples.

3. *Post-Visit*
   Conduct interactive (response) trials, e.g., feeding trial, heat mount detectors
   Recommend control programs emanating from laboratory tests.
   Maintenance surveillance.

Diagnosis of *Mode* of Reproductive Efficiency

Mode	Diagnostic Features in Cow's History	Diagnosis by Physical Examination
1. *Anestrus*	No visible estrus recorded (NVE)	+ No structures on ovaries
2. *Failure to breed*		
2.1 Estrus detection error	NVE or NVE	+ Corpora lutea present + Not pregnant on pregnancy exam
2.2 Management decision	Heats not served recorded	--
3. *Failure of fertilization*		
3.1 Conception Failure	(i) Failure to conceive (FTC, Repeat Breeder) (ii) FTC	(i) Endometritis on rectal or visual vaginal (ii) No endometritis
3.2 Semen Donor Failure Inseminator	Conception Rate (CR) ist Service (cf other inseminators)	--
Bull or Semen	CR 1st Service (cf other donors) CR 1st Service (cf other herds)	
4. *Early Embryonic Death*	(i) Interestral period >18-24 d (ii) Recheck pregnancy diagnosis (on heat after pregnancy (P) diagnosed)	-- (ii) NP after previous P or high % of cows presented as pregnant are not
5. *Abortion*	Abortion seen (as % of pregnancies)	as for early embryonic death

Diagnosis of *Etiology* of Reproductive Inefficiency

(Sample Only - 2 Modes Only)
Mode 1 - Anestrus

Nutritional Causes

Check Diet TDN content by:
Theoretical analysis (Feed Tables) or
Actual lab analysis or
Feeding response trial

Examine Cows Physically
Body weight or
Body Condition Score or
Herd production of milk graph

Examine Cows by Lab Test
Energy - by VFA or blood glucose estimation
Protein - Total Serum Protein estimation
Minerals - Phosphorus (Serum inorganic phosphorus) estimation
- Copper - ceruloplasmin level
- Cobalt - FIGLU or MMA
— Selenium - glutathione peroxidase
All - Compton Metabolic Profile

Non-Nutritional Causes
Endocrine profile
F. S. H. administration

Mode 2 - Failure to Breed

1. *Poor Estrus Detection*
   1.1 Artificial breeding herds. Check by use of heat mount detectors or tail paint.
2. *Management Decision*
   2.1 Unavailability of donor
   2.2 Deferred breeding to maximize conception rate
   2.3 Rationalizing calving program

etc.,etc.!

Cattle Herd Problems Which Need Herd Examination Protocols

The need for these procedural guides will vary depending on local disease prevalences. The following is put forward as a basic list likely to be applicable in most places:

Reproductive Inefficiency
Subclinical Mastitis
Neonatal Mortality
Congenital Defects (Inherited and non-inherited)
Sudden Death
Poor Body Weight
Pica (depraved appetite)
Low Milk Production (includes low fat)

Special Situations Requiring Special Protocols in Cattle Herds

Common situations that call for special herd examinations and which are best dealt with in protocols prepared for the purpose are:

Measuring effectiveness of new drug, e.g., anthelminthic, mastitis treatment.

Detection of carrier animals, e.g., Salmonellosis, leptospirosis. This includes genetic "carriers" and carriers of parasitic disease.

Measurement of level of infection in a population as distinct from determining the prevalence of disease.

Examination of a population used as a sentinel for environmental contamination by poisonous substances, or substances deleterious to man if they reach the human food chain via food containing animal products.

Strategies in the Examination of Herds

There are four common strategies:

1. Single visit herd examinations
2. Continous monitoring
3. Interactive projects (response trials)
4. Examination of data

and any combination of these.

1. Single Visit Herd Examination

The objectives and activities include:

Identifying the Problem

Examination of Sick Animals. Clinical examinations are conducted to identify the critical clinical signs and the ranges of variability in them. Laboratory examinations are carried out on the same animals to identify clinicopathological changes. These findings should be able to be matched with the individual animals and their clinical signs. If a large number of sick animals is available the number which should be examined to describe the syndrome accurately usually varies between 7, if the syndrome is well-defined, and 20 animals, if there is much variability between animals in the clinical signs displayed.

Examination of Normal Animals. Each clinical case examined should be matched by a clinical examination of an apparently normal animal in the same group. This will check the validity of the syndrome previously described. The signs may be present in all animals in the herd and be related to another concurrent disease. A clinicopathological examination of these normal animals will provide normal clinicopathological parameters for the herd. The number of animals required will be the same as for the clinically affected group, 7 to 20 depending on the lack of variation of the syndrome.

Determination of the Cause

Samples of tissues, fluids and excretions likely to contain the relevant pathogenic agent should be collected from the same animals used to identify the problem. These specimens should also be identified so that they relate to the individual animals and their clinical signs.

Identification of Stressors

Clinical and clinicopathological examinations should be conducted on animals which have been exposed to the stressors being examined. These could include the animals already in the group of normal animals. An appropriate number of animals in each group is 7 head, although this number should be increased if the differences between groups are likely to be small.

Be Cost-Effective in Examination Procedure

This means reducing time spent on the farm and reduction of expensive testing to a minimum. The suggested techniques for effecting this are:

1. A structured protocol saves time, gives a basis for accurate records and reduces the possibility of error by omission.
2. A knowledge of the simple tests available (e.g., Figlu for cobalt deficiency, ceruloplasmin for copper).
3. Time saving sampling techniques, e.g., tail bleeding, the inverted rectal sleeve fecal sampler, the mastitis samplers complete milk parlor belt sampler.
4. An organized, methodical system for examination of the environment.

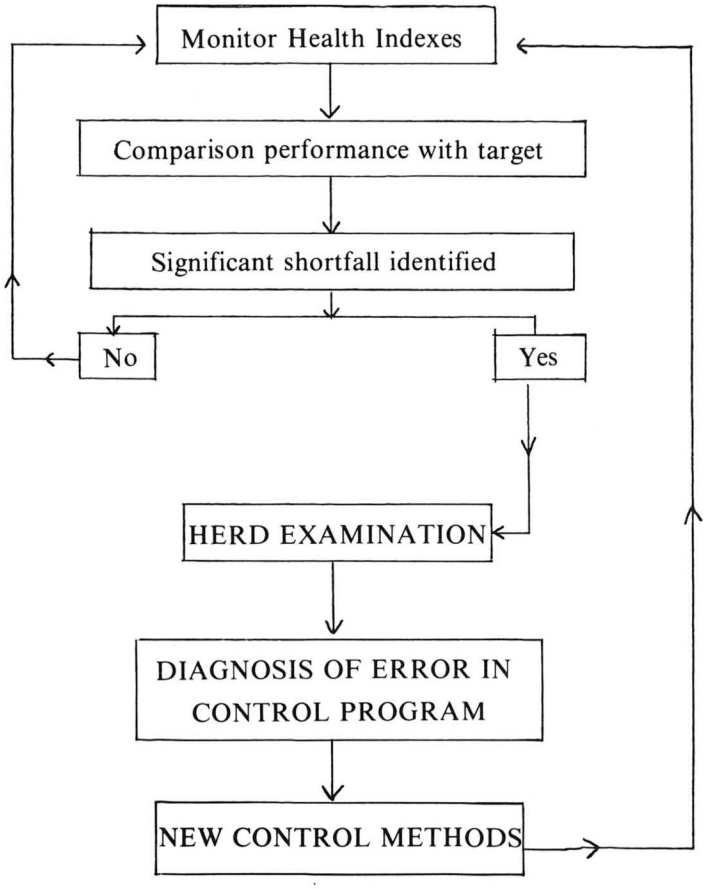
Avoiding the Introduction to the Herd or Spread Within the Herd of Any Disease

Continuous Monitoring

The common herd health program is a continuous monitoring exercise (fig. 7) with observations being made every day on health incidents, reproductive events and productivity and at less frequent intervals on paraclinical parameters such as individual milk cell counts. An analysis of the data is conducted at regular intervals, usually monthly, an action recommended when normal parameters, e.g., less than 4 cases clinical mastitis per 100 cows per 30 days, are exceeded.

Other monitoring programs include frequent periodic sampling for serological evidence of spread of infections such as leptospirosis or viral diseases. This is commonly associated with the establishment of sentinel herds which are employed for this monitoring purpose.

Fig. 7 HERD EXAMINATION IN A HERD HEALTH PROGRAM



Interactive Projects

Interactive projects are mostly response trials in which a hypothesis is tested by taking a particular positive action and observing the result. Nutritional response trials are the best example and trials concerning copper, cobalt and selenium are the most common. Test matings to identify genetic defects are also response trials. The use of embryo transfer from the one dam makes this a much more practical technique than previously. The use of heat mount detectors or tail paint to prove a hypothesis of poor estrus detection is another example of an interactive project.

Examination of Data

Epidemiological information can be readily extracted from records without actually seeing the cattle. This sort of numberical information is often used to compare the rate of occurrence of disease in a herd, and between years in the same herd, between herds and between areas. It is the basis of the target system used to encourage farmers to improve the efficiency of their operation.

Combinations of Strategies

A combination of these forms of examination is often a highly efficient and economic approach to the problem. In this way it is possible to examine the data relating to reproductive activity in a herd and deduce that a problem of no visible estrus occurs. Examination of the cows at a single visit could provide presumptive evidence that the fault is one of heat detection. An interactive project, using heat mount detectors, could confirm this.

Conclusion

A competent food animal veterinarian needs to be competent in three areas of professional activity. They are:

(1) The proper clinical examination of an individual animal with a view to making a diagnosis. It is then possible to institute etiologically specific treatment and additional general supportative treatment for the individual.

(2) The conduct of a proper examination of a herd or group of animals with a view to making a diagnosis of the problem affecting the herd, and recommending appropriate treatment and preventive measures. A herd examination may also be useful for several other less important factors.

(3) The conduct of a herd health program aimed at limiting the occurrence of the important diseases to economically acceptable levels.