Herd Monitoring and Information Analysis

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If you can't measure it, you can't manage it.

Corollary: ***If you aren't measuring it, you aren't doing as well as you think you are.***

Overview

Because computerized herd monitoring and information analysis is a relatively new development, it and the veterinarian's role in it are still evolving rapidly. The application of the computer to herd information began in two areas. As part of the emergence of artificial insemination in the 50's, the USDA established the Dairy Herd Improvement Association (DHIA) to calculate the genetic merit of bulls by using central mainframes to analyze mailed-in production data. When large commercial feedlots emerged subsequent to the development of the IBR vaccine in the 60's, they began using minicomputers to track the performance of pens of cattle. As breeding herd size increased in the swine industry, detailed production accounting systems such as Swine Graphics emerged to improve production management.

With the emergence of the personal computer subsequent to the development of integrated chips in the late 70's, computer processing power became much more affordable and accessible and these systems moved from central processing facilities to the farm level. As herds increased in size, managers needed "list generators" to track individual animals and generate management lists of what animals needed moved, vaccinated, checked or culled as they moved through the production cycle. Previously, managers in small herds could remember enough information about each individual in the herd or in moderate-sized herds they kept simple paper records, calendars and breeding wheels to track animals through their production cycle. PigCHAMP was one of the early on-farm systems in the swine industry and DairyComp305 was one of the early on-farm systems in the dairy industry, both developed primarily by veterinarians. Because new measuring and data capture technologies, scoring systems and management strategies are continually emerging, veterinarians need to understand the benefits, costs and pitfalls of these.

Purposes of Data Collection, Monitoring and Analysis

1. **Detect deviation from expected performance**

   Requires sound basis for comparison

   - **Industry Performance Benchmarks** (see references below)
   - Historical performance

     Previous group performance

     Previous season for seasonally affected production system

     Previous similar groups
   - Performance of similar area herds
   - "Rules of Thumb"

     Ex: Proportion of cows that should be laying down chewing their cud in a freestall facility if adequate cow comfort is present

2. **Detect systems that are going out of control**

   Goal is to minimize variation and maximize consistency

   The reason for creating standard protocols

   Requires regular data collection to establish time series and control bounds

3. **Solve production problems**

   Investigations - Determine what events or factors are associated with a problem

4. **Motivate producers**

   Performance comparisons are a powerful motivator among elite producers.

Value of information vs. cost of data collection and analysis

1. Producer has to believe that the information from monitoring has sufficient value to justify investing scarce resources in collecting, entering and storing the data on a routine basis or in paying someone else to do it.
   - Producer action horizon is usually shorter than the veterinarian's

- Producer is usually collecting data to facilitate daily day-to-day management

  List generation - What cows to move where when or do what to who.

2. The veterinarian must minimize the cost of data collection, efficiently summarize it and effectively present the information.
   - Know efficient strategies that can be adapted to fit into the producer's current system

     Ex: BCS scoring during handling, PalmPilot-based data capture
   - Use other existing data flows that aren't tracked as secondary data in the absence of primary data

     Ex: Receipts for trucking to establish feed flow
   - Utilize trained technicians to reduce labor cost but maintain performance in data collection and analysis (Dr. John Day)
   - Hone applied barnyard epidemiology skills to minimize time required and maximize validity of conclusions

     Know how to define and establish risk cohorts of animals

     Know what causes bias in results and how to minimize it

     Know how to carry out valid clinical trials in clients herds
   - Automate the data analysis as much as possible through basic programming

     Scripts for DC 305 Consultant

     Macros for Microsoft Excel

Strategies

1. Continuous monitoring - every batch or individual fed, or produced or measured

   Ex: Bulk tank milk shipment weights, processor milk component analyses, dry matter intake (EZ-Feed), rectal palpation results
2. Repeated monitoring

   Ex: Monthly individual cow milk yield and component testing (DHIA)
3. Cross-sectional monitoring

   Applied at one point in time for selected animals in different points in the production cycle

   Ex: "Snapshot" dairy body condition scoring

   Note that this often requires the assumption that the animals longer in the production cycle followed the same trend as animals earlier in the production cycle currently represent.

   Applied at one time in production cycle to a group

   Ex: Body condition scoring of beef cows one month prior to start of calving
4. Linked - "If pattern 'X' appears, then go look at 'Y'"

   Higher aggregate measures to deeper more specific measures

   Easy, low cost measures to harder, more expensive measures

   Ex: Body condition score, milk fat test to NEFA's

Management Information Product

Plots - *"A picture is worth a thousand words"*

Know how to generate and manipulate scatterplots in Excel

Including the right data series

Adding smoothed trendlines

One sheet of summary information followed by detailed supporting information

Fully detailed reports are difficult to handle and are overwhelming to those unfamiliar with the reports or the process

Start with the simple and move to the complex

System Monitoring - to generate information from data that is quantitative in its initial form

Serum for passive transfer efficacy in calves
Milking system function - vacuum reserve recovery, pulsation pattern

Ration fiber - Penn Forage Box
Ration dry matter
Fresh cow monitoring
Dry cow urine pH monitoring

Scoring Systems - to generate information from data that is qualitative in its initial form

Convert subjective assessments to quantitative data for tracking and comparison

Scoring system needs to be soundly evaluated prior to use

Is it measuring what it is supposed to measure?

Strong predictive relationship with an important variable

Needs to be a "Critical control point"

Valid between observers and repeatable for same observer

When should it be done for the most good?

Preventive - sufficient time to intervene to prevent the problem

Ex: Body scoring beef cattle in mid-gestation

"Post-mortem" - prevent the problem from occurring again next year

Ex: Body scoring first calf heifers at breeding time to explain "sophomore slump"

What are the opportunities for piggybacking it on something else that is already being done?

Ex: Body condition scoring beef cows at fall preg check

Dairy Examples:

Somatic Cell Count - Bulk SCC, CMT
Body Condition Score
Heifer Girth Measure
Lameness Scoring
Sanitation Scoring
Manure Scoring
Teat end Scoring

Precautions and Problems:

1. **GIGO - *Garbage in, garbage out***

Remember, “In God we trust; all others must provide data.” If at all possible, don’t rely on perceptions or memories.

When using data from record systems, you must check the quality of the input data

Quick data quality checks

Logical consistency - Does this value make sense?

Use spreadsheet date calculations to determine gestation length and days open from prior calving date, breeding date and current calving date

Use spreadsheet Sort function to screen minimum and maximum values

2. **Dangling Numerator for Risk**

Risk is the number of events in a group over a defined period (numerator) divided by the number of animals at risk of that event in that group during the period (denominator).

Event counts are easy to get; the number at risk (denominator) is harder to get

No. of DA's in a period vs. the number of cows at risk of a DA in that period

Time interval in which high risk occurs

0 to 30 DIM?

Risk factors associated with that risk

Multiparous cows vs. primiparous heifers

The count of an event with constant risk will go up and down in parallel with the change in number of animals at risk of that event in a group even if the risk of the event is constant

Including animals not at risk of the event in the denominator underestimates the true risk.

3. **Missing Animals**

Any measure can be made to look good by either getting rid of the failures (culling, dying) or otherwise omitting them from the analysis.

Is the reproduction information from cull cows included in evaluating reproductive performance?

Are deads or opens included in analyzing production?

Does the production program include data from animals lost from the cohort being analyzed?

If some of it is "censored", truncated or missing from more than a small percentage of individuals, use nonparametric summary statistics appropriate for that type of data.

Survival curves, median time to status change (e.g., DIM to pregnancy) rather than means or averages.

Median days open rather than average days open

4. **Noise from natural variation in small numbers vs. time**

How many do you need to accumulate to obtain a reliable picture of what is going on?

How long do you do you accumulate numbers?

Too long - How much else changed during that period?

5. **Definitions**

"Hidden" definitions

What is the program calculating internally? What animals does it include or exclude?

Changing definitions over time or different definitions between comparison groups

Different producers and programs use different definitions for cases

6. **Other Pitfalls**

Tyranny of the group summary measure vs. the individual

Individuals in the tails are the ones to which most attention should be paid because that is where both the problems and opportunities lie.

Momentum and Lag

Changes in some measures occur long after the biological change occurred

Ex: Calving interval as a measure of reproductive performance lags by gestation length

Acute vs. chronic

Because of their longer duration, in cross-sectional monitoring chronic cases will be over represented and acute cases will tend to be missed.

Bias of the average vs. the median or percentiles

Ex: English majors in one Ivy League school's graduating class averaged $60K starting salaries.

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