VM 577P

Integrated Management Approach & Principles

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Integrated Proactive Production System Approach

Problem:

- Current approaches are single agent or problem focused, case-by-case approaches to solving that problem
- Because producers view a control program as an unnecessary expense until their herd is infected with the agent or they recognize the problem, producers are unlikely to act proactively

Solution:

- Develop an integrated approach to risk, welfare, and quality management
- Because approach is risk factor focused, investment covers multiple agents
- Because “per agent” cost is lower and this approach is based on providing general “insurance”, adoption will be higher than for current focused programs
- Incorporating the product quality and animal welfare sides increases overall program benefit
- Professional association provides the framework for materials development and bureau services

Program development process

- Integrated comprehensive risk management
  - Develop risk assessment systems and evaluate by applying to cohorts of regional cow-calf and dairy herds
    - Enteric disease (MAP, Salmonella) based on Johnes Working Group models
    - Lameness – metabolic and infectious
    - Reproductive – BVD, trich, Brucella
    - Respiratory
    - General biosecurity and biocontainment
  - Incorporate validated scoring systems (e.g., body condition, lameness, . . .)
  - Survey producers to determine current problems
  - Establish early warning of emerging and approaching agents
- Select and integrate cow-calf production accounting system
  - Must function within and add value to cow-calf production system
- 3rd party auditing for label programs
  - Veterinarian training and certifying materials
  - Use a systematic approach to herd investigations and audits

Evidence of need for integrated programs

- 2 decades of NAHMS surveys show:
  - Little evidence of improving producer disease knowledge or program compliance
  - Continuing significant prevalence of established management and husbandry risk factors
- Studies show producers respond to direct incentives in milk quality programs and adoption of control practices but not to evidence of economic benefit
- The economics of disease control programs focused on individual agents lead to rational producer choices that are seen as irrational by veterinarians
Commercial livestock farms require a whole systems approach to improvement and problem solving

- Large farms are interlocking enterprises (e.g., farming, young stock, milking herd) with resources (e.g., land, capital, facilities, labor, equipment, management expertise) for subsystems (e.g., feeding, milking, breeding, waste management, fiscal and labor management) organized into a production system
- Because of inherent lag between events and outcomes, the passage of time may make the problem and manifestation appear unrelated
- A problem in one part of the system may manifest as a breakdown in another that increases with time
- In systems diagnosis, “starting with history discourages the common and distracting tendency we all have to define a problem not by the system’s actual behavior, but by the lack of our favorite solution” (Donella Meadows)

Ag animal veterinary SWOT analysis

Threats:
- Increasing scale: 6% of livestock-producing farms generate 71% of livestock sales and 3% of dairies produce > 50% of the milk
- Veterinary usage is declining as herd scale increases and farm labor specializes, decreasing value of conventional services
- Demand is shifting from traditional technical to knowledge-based services

Opportunities:
- Demand for third party certification is increasing
- Producers rank veterinarians high as an information source

Weakness:
- Critical skills for this type of practice are not well developed in traditional curriculums

Proposal – Integrated program using peer swapping

- Need arm’s length for third-party verification
- Justification for specialized expertise
  - If expertise can be extended across sufficiently large areas and herd numbers, investing time in developing unique expertise is justifiable
  - E.g., employee safety, HACCP, environmental, animal welfare
  - OSHA, EPA, state regulatory requirements
  - With increasing scale of livestock agriculture, agricultural exemptions from regulation are disappearing
- Swap herd audits with colleagues in other similar production regions
  - They audit your herds, you audit theirs
  - Another set of trained eyes will see the “dirty socks” you are overlooking
  - Capitalizes on progressive producers’ desire for continuous improvement
  - $1,500 per herd (?) annually?
- Professional association coordinates materials development and oversees swap bureau services
Proactive Integrated Approach to Livestock Production (PIALP)

System evaluation is based on fundamental concepts and principles:

Herd biosecurity has two primary components:
1) Reduce risk of introducing infection
   - Most nasty infectious diseases are "Bought and Paid For"
   - Testing and quarantine of purchased animals isn’t sufficient, particularly for this infection
   - Buy replacements from known status sources

2) Reduce risk of transmitting infection within herd
   - This has to be the main focus for control for most herds!

Risk factors have three main types

Introduction Risk Factors

Clinical Case Risk Factors

What introduces the infection into a herd?

What do clinical cases develop?

What maintains the infection cycle in a herd?

What animal is most susceptible to infection?

Depends on the agent –
The Calf, The Transition Cow, The Weaned Calf

By what routes can they be infected?

Orally (any shedding animal – milk, manure)

Intrauterine (calf’s infected dam only)
Johnes as Example: Infection resistance is high by a year of age

Recall the MAP escape routes

The main focus is preventing the MAP fecal-oral transmission cycle

Risk factors for maintaining MAP infection are common (1996 USDA NAHMS)
Within herd MAP control has 3 main components

Reduce transmission by:
- Proper manure management (*All manure is suspect!*)
- Proper colostrum and milk management
- Better management of infected animals

**Note:** Implementing these management practices also reduces the transmission of other common infectious enteric diseases!

Certified vets perform herd risk assessment
Example of general “Herd Hardening”

Johne’s and Beyond (National Johne’s Working Group)

Goal: Develop similar materials for the common herd problems

On unoriginal thoughts:

The secret to creativity is knowing how to hide your sources

Albert Einstein

Albert Einstein’s more relevant quotes:

The significant problems we have cannot be solved at the same level of thinking we were at when we created them

Insanity: doing the same thing over and over again and expecting different results

We do this a lot with disease problems such as lameness, calf scours, and bovine respiratory disease
On the other hand:

If you can’t dazzle them with dexterity, baffle them with bullshit

Professor H. Hill

Which this is you will have to figure out

What are the best ways to deal with herd infectious and other endemic disease problems?

Given that most infectious agents remaining as problems (we’ve gotten rid of the easy ones):

— Are ubiquitous (holoendemic)
  • If they haven’t been found on a farm, they likely haven’t looked for hard enough
— Survive well in the environment
— Aren’t reliably curable with drugs
— Establish carrier states in herdmates
— Vaccines are not 100% effective (if available)
— Often co-evolved with their bovine host

What is the best approach?
What is needed for that approach?
How can these be captured in scoring systems?

Prevention beats cures every time

Cures are “stop loss” at best

Animals in a group have different infection and disease statuses

A herd (and you) have to manage holoendemic agents as though animals are present in all of these states
Animals in a group have different infection and disease statuses - for PDF

<table>
<thead>
<tr>
<th>Exposure Status</th>
<th>Un-exposed</th>
<th>Exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection Status</td>
<td>Un-infected</td>
<td>Infected</td>
</tr>
<tr>
<td>Disease Status</td>
<td>Sub-Clinical</td>
<td>Clinical Disease (Apparent)</td>
</tr>
<tr>
<td></td>
<td>Morbidity (Sickness)</td>
<td>Mortality</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
<td>Severe</td>
</tr>
</tbody>
</table>

A herd (and you) have to manage holoendemic agents as though animals are present in all of these states

The disease “Iceberg” means most diseased animals are not detectable visually

- Most infections are subclinical
  - Typically > 10:1
- Can’t identify every infected animal easily
- Important because some animals are more susceptible than normal
  - Neonates
  - Animals with other diseases

The goal is reducing infection transmission between infected and susceptible in a herd

- Reproductive Ratio ($R_0$) is the number of secondary infections due to each infection
  - $> 1$: Infection spreads
  - $= 1$: Infection is stable
  - $< 1$: Infection dies out
- Hard to reduce in intensive management
  - agents co-evolved and survived with hosts when they were extensive, free-ranging

Goal: Separate the susceptible from the potential subclinical

Infection transmission occurs in two forms

- Vertical transmission can occur:
  - *In utero* – born infected!
  - During birth
  - Infected colostrum
  - Suckled milk

Goal: Get $R_0$ less than 1 so agent disappears from herd
Transmission has three steps – escape, environmental survival, and infection

Infectious agents get out and in many ways

For most “enterics,” the major transmission cycle is fecal-oral and fecal exposure is the major risk

Looking at the question another way

\textbf{Farm Level Reality – Most diseases are endemic}

\textbf{The most important question:}
If almost \textbf{all} herds have these infectious agents, why do \textbf{few} herds have animals \textbf{sick} with them?

\textbf{The answer – the presence of risk factors in those herds}
A particular infectious dose results in differing severity in a herd.

Goal: Reduce infectious dose, increase host resistance.

Clinical disease doesn’t occur when resistance is high relative to exposure dose.

Both vary over time and location as seasons change and animals move through the production cycle.

Pattern of Host Resistance - Calves

Pattern of Host Resistance - Cows

Most Infectious Diseases are Opportunists!

Note that there are more opportunists than there are vaccines!
Good vaccination provides marginal protection benefit

- Host Resistance
- Decreased Agent Exposure Dose
- No Disease
- Vaccinate
- Stress Event
- Disease!

High exposure, severe stress, or PPM overwhelm the best vaccine immunity

Clinical disease outbreaks result from a breakdown that initiates a vicious cycle

- Less Susceptible Hosts Now Affected!
- Higher Exposure
- Higher Shedding from Clinical Disease
- Lower Shedding from Subclinical Infection
- Heavier Environmental Contamination
- Moderate Contamination

Focusing on a “bug” keeps us stuck in a rut!

- Vaccinate it!
- The Animal Host
- The Disease Agent
- Kill with antibiotics!

Focus on the entire husbandry system rather than individual diseases and localized problems

- The Animal Hosts
- The Disease Agents
- The Environment (Housing, Nutrition, ...)

MANAGEMENT

Different diseases have common risk factors; for “maximum bang per buck” payoff focus on these first
Disease severity is determined by many factors

<table>
<thead>
<tr>
<th>Lower Severity</th>
<th>Higher Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Dose</td>
<td>Higher Dose</td>
</tr>
<tr>
<td>Middle Aged</td>
<td>Neonate or Elderly</td>
</tr>
<tr>
<td>Lower Stress</td>
<td>Higher Stress</td>
</tr>
<tr>
<td>Adequate Cu, Se, Vitamins A, E</td>
<td>Deficient Cu, Se, Vitamins A or E</td>
</tr>
<tr>
<td>No other diseases</td>
<td>Other diseases, co-infections</td>
</tr>
<tr>
<td>Higher social dominance</td>
<td>Lower social dominance</td>
</tr>
<tr>
<td>Lower producing</td>
<td>Higher producing</td>
</tr>
<tr>
<td>Higher specific immunity</td>
<td>Lower specific immunity</td>
</tr>
</tbody>
</table>

Horizontal Transmission Chain

- Infected Host
- Sheds Agent in oral & nasal secretions, urine, feces
- Contaminated Environment
  - Hands, Thermometers, Equipment, Feed, Water, Boots, . . .
  - Agent survives at Infectious Dose
- Susceptible Host
  - Becomes

Minimize infectious agent flow through all links of the transmission chain

- Infected Host
  - Sheds Agent
  - + Isolate
  - + Reduce shedding level
- Environment
  - (Hands, Housing, Food, Water...)
  - Agent survives at Infectious Dose
  - + Remove contaminated materials
  - + Increase agent death rate
- Susceptible Host
  - + Increase Resistance
  - + Isolate to minimize infectious dose

This flow will occur almost inevitably if the agent isn’t present now but the risk factors are!
"Harden" herd " by reducing infectious dose and shifting resistance curve

- Take advantage of increasing resistance with age
- Separate groups with high shedding risk from those with high acquiring risk
- Decrease survival opportunities of agents
- Address all the agent transmission routes
- Don’t overlook cycles in vermin species (flies, rodents, birds)

The greatest weakness of most strategies is the failure to address all the transmission routes