Beef Systems Approaches to Production Management

Dale M. Grotelueschen, DVM, MS
Great Plains Veterinary Educational Center
University of Nebraska
Clay Center, Nebraska
Global demand for food, feed & fiber will nearly double over the next 40 years.

Source: U.S. Census Bureau, International Data Base, June 2009 Update.
DOMESTIC BEEF PRODUCTION AND JAN. 1 TOTAL CATTLE INVENTORY

Total Cattle Jan. 1 (000 head)

- Total Cattle Inventory, 1/1
- Domestic Beef Production

Beef Production, Billion Pounds, Carcass Weight

Efficiencies of production & technology
Getting Real About the High Price of Cheap Food

By BRYAN WALSH  Friday, Aug. 21, 2009

Correction Appended: Aug. 20, 2009
From a Systems Perspective

Food Systems

Beef Industry Systems

Ranch/Farming Systems

Beef Enterprise Systems
Deloitte Food Value Equation Survey 2015
Capitalizing on the shifting consumer food value equation.

The consumer value driver plate

Source: Deloitte Food Value Equation Survey 2015, Deloitte Analysis
About half of consumers surveyed indicated they weigh Evolving value drivers more heavily than Traditional ones.

- Traditional consumers say they prefer traditional value drivers
- Evolving consumers say they prefer evolving value drivers

Source: Deloitte Food Value Equation Survey 2015, Deloitte Analysis
Farmers as a percentage of the U.S. labor market

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>38</td>
</tr>
<tr>
<td>1910</td>
<td>31</td>
</tr>
<tr>
<td>1920</td>
<td>28</td>
</tr>
<tr>
<td>1930</td>
<td>21</td>
</tr>
<tr>
<td>1940</td>
<td>18</td>
</tr>
<tr>
<td>1950</td>
<td>12.2</td>
</tr>
<tr>
<td>1960</td>
<td>8.3</td>
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<td>1970</td>
<td>4.6</td>
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<td>1980</td>
<td>3.4</td>
</tr>
<tr>
<td>1990</td>
<td>2.6</td>
</tr>
<tr>
<td>2000</td>
<td>1.9*</td>
</tr>
</tbody>
</table>


* USDA Publication: The 20th Century Transformation of U.S. Agriculture and Farm Policy Electronic Information Bulletin Number 3, June 2005; authors: Carolyn Dimitri, Anne Effland, and Neilson Conklin
Some Drivers

- Primary purpose of animal agriculture is food production
- Humans are emotion driven beings
- Attitudes and perspectives of US and world populations are changing
- Increasing world human population & development requires increased food and fiber supplies
- Global resources are limited
- Production level animal care and use of science and technology offers current and future solutions
Historical Perspective of Veterinary Medicine
MINERAL INTERRELATIONSHIPS

Mineral Levels in Animal Health
Puls, 2nd Ed, 1994, p 12,
Systems Thinking enables us to....

- Recognize the often hidden and unintended consequences of our actions
- Change or own thinking to match the way complex systems operate
- Change our behavior so we work with these complex forces instead of against them to achieve what we want
- Think effectively about change - the short term as well as long term
- Expand the choices available to us & focus on higher leverage changes
See trends and structure and create explanations for why things are happening.

Apply system archetypes to your own situations.

Identify mental models and their role in structure.

Plan and evaluate actions to improve system performance.
Observations about Systems

- Many of today’s problems were yesterday’s solutions
- The Law of Unintended Consequences
- The Law of Worse Before Better - what works in the short term often makes things worse in the long term, what works in the long term often makes things worse in the short term
- The Law of Compensating Feedback – The harder you push on the system the harder the system pushes back
- We are prisoners of systemic forces to the extent we are unaware of their existence and do not appreciate their power.
Observations about Systems

- Systems naturally resist change despite how well intended efforts to improve performance are.
- We spend enormous time, effort and money fixing problems we don’t really understand.
- We often look at the world through a soda straw.
- Real leverage points in the system are displaced both in time and in space from symptoms.
- Collective awareness of the system can produce shifts needed to produce real, sustainable change…when we see it, we no longer have to be controlled by it.
The Iceberg Framework

(One of several Systems Thinking components)
What Happened?
What’s been happening?
Why?

The Iceberg View

Events
Trends and Patterns

Systems/Structures

React
Anticipate/Forecast
Change/Create

Systems/Structures
Influence Performance
Iceberg Exercise

- What happened?
- What are some key events or crises?
- Why is this a problem?
- What happened over time?
- What are the trends & patterns?
- Why did this happen?
- What are the forces & pressures at work?
- What is perpetuating the problem?
Iceberg Exercise

- What results are needed? What would it look like if the problem was fixed?
- Current reality?
  - Events and key trends
- Why do we have the current reality we have?
  - Structure
Navigating the Iceberg
Identify how you tend to see this issue

- An events perspective
- A trend or language perspective
- A structural perspective
The Language of Systems Thinking

The world is circular - not linear

From:
Problems or Crises

To:
Actions or Interventions

Problems or Crises

Actions or Interventions

Unintended & Delayed Consequences
Systems/Structures Influence Performance

Complex production systems
Many of today’s problems were yesterday’s solutions
Unintended consequences

Systems Approaches to Beef Production Management
Reproductive Performance

- Single most important economic trait in cow herds (Wiltbank, 1994)
- Reproductive diseases and conditions
  - Estimated to cost $13.10 to $14.90/beef cow/year.
  - Six times more costly to the beef industry than losses resulting from respiratory disease.
  - Cost 3.4 to 3.9% of beef cow/calf value of production.

(Bellows, et al. 2002)
Top 2 production factors with highest impact on cow/calf profitability (Hughes)

- % calf crop weaned
  - Number of calves weaned divided by number of cows exposed

- Pounds weaned/cow exposed
  - Pounds of calf weaned divided by number of cows exposed
Rank of Reproductive Traits on Profitability

#1 Percent calf crop
#2 Calving Distribution

Harlan Hughes
In North America, approximately 10% of the calf crop is lost between pregnancy diagnosis and weaning.

Impact of calving early in the calving season

When do your cows calve during your calving season?
Calving Distribution

- 70%
- 21%
- 6%
- 40%
- 30%
- 10%
- 10%
## Average Calf Weaning Weight by 21 Day Calving Period

<table>
<thead>
<tr>
<th>Calving Period</th>
<th>No. Calves</th>
<th>Avg WW</th>
<th>Diff from 1st 21 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st 21 days</td>
<td>150</td>
<td>556</td>
<td>0</td>
</tr>
<tr>
<td>2nd 21 days</td>
<td>94</td>
<td>516</td>
<td>-40</td>
</tr>
<tr>
<td>3rd 21 days</td>
<td>23</td>
<td>468</td>
<td>-88</td>
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</tbody>
</table>

NDSU Dickinson Research & Extension Center, 2002
Lifetime Average Calf Weight per Female As Affected by Date of Calving as a Two-Year-Old

Summary data: 5 TX herds, 1500+ head

L. R. Sprott, TX A & M, 2001
Lifetime Average Cost to Produce a Pound of Calf As Affected by Date of Calving as a Two-Year-Old

Summary data: 5 TX herds, 1500+ head

L. R. Sprott, TX A&M, 2001
Lifetime Average ROI per Female as Affected by Date of Calving as a Two-Year-Old

Summary data: 5 TX herds, 1500+ head

L. R. Sprott, TX A&M, 2001
Impacts of calving early in the calving season

- Early calving cows more likely to calve early the next year.

- Average longevity in the herd
  - Heifers calving early 1st yr---5.1 years
  - Heifers calving after 1st 21 days---3.9 years

- US MARC Data-longevity
  - Heifers calving 1st 21 d---8.2 yr
  - Heifers calving 2nd 21 d---7.6 yr
  - Heifers calving later---7.2 yr

Impacts of early calving

- Productivity advantages of offspring
  - Weaning weights
  - More calves per productive female-longevity
- Focus on heifers becoming pregnant the first 21 d of the breeding season.

### Pregnancy Rate in Cows Showing Estrus Early in the Breeding Period

<table>
<thead>
<tr>
<th>No. of Cows</th>
<th>Time of Estrus</th>
<th>Pregnancy Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>220</td>
<td>First 21 days</td>
<td>81.8%</td>
</tr>
<tr>
<td>65</td>
<td>After 21 days</td>
<td>58.5%</td>
</tr>
</tbody>
</table>

Maternal nutrient restriction from early to mid-gestation can lead to fetal growth retardation, with long term effects on offspring growth, physiology and metabolism.

Changes in placentomal differentiation in sheep were a function of nutrient restriction and breed.

Certain breeds seem better adapted to harsh environments and nutrient restriction with less impact on fetal growth.

Vonnahme, KA et al, Placentomal differentiation may compensate for maternal nutrient restriction in ewes adapted to harsh range conditions. JAS 2006 84:3451-3459
Fetal Programming

- Supplementing cows with protein during late gestation
  - Did not affect birth weight of calves
  - Did impact heifer calf weight and reproductive performance.

- Heifers from (ps) protein-supplemented cows were heavier at weaning and maintained this advantage through the beginning of the breeding season.

- Heifers from ps cows tended to have higher pregnancy rates (94% vs. 73%), calved earlier, and had a higher proportion of unassisted births (69% vs. 38%).

Martin et al Nebraska Beef Report 2006. Effects of dam nutrition on growth and reproductive performance of heifer calves
J. L. Martin, K. A. Vonnahme, D. C. Adams, G. P. Lardy, R. N. Funston JAS 2006
Synchronization Protocols

- Heifers
- Cows
Impact of Fixed-Time AI on Calving and Weaning

Control

Natural mating

TAI

GnRH

PGF

TAI + GnRH

CIDR

Natural mating

(Rodgers et al., 2011)
Impact of Fixed-Time AI on Calving and Weaning

(Rodgers et al., 2011)
Gain or Loss per Cow Treated

(Rodgers et al., 2011)
Model Assumptions

- Bull price: $3,250
- Salvage bull price: $75/cwt.
- Bull grazing, feed, maintenance: $365/year
- Interest: 7%
- Steer calf selling price 550 lb: $121/cwt.
- Semen: $13.00
- Reduction in bull/cow ratio: 1/17 to 1/34
Summary of Outputs

Increased returns $47.09
Decreased Costs $35.23
Decreased Returns $0.00
Increased Costs $33.18
Gain $49.14
<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Bull price</td>
<td>$4,000</td>
</tr>
<tr>
<td>Salvage bull price</td>
<td>$105/cwt.</td>
</tr>
<tr>
<td>Bull grazing, feed, maintenance</td>
<td>$550/year</td>
</tr>
<tr>
<td>Interest</td>
<td>6%</td>
</tr>
<tr>
<td>Steer calf selling price 550 lb</td>
<td>$165/cwt.</td>
</tr>
<tr>
<td>Semen</td>
<td>$20.00</td>
</tr>
<tr>
<td>Reduction in bull/cow ratio</td>
<td>1/17 to 1/34</td>
</tr>
</tbody>
</table>
Disease Control Fundamentals

Prevent Transmission

Biosecurity
Biocontainment

Eliminate Agent

Increase Immunity

Trichomoniiasis

Prevention: Keep it out (Biosecurity)!
Infected: Biocontainment with eradication—then biosecurity
Fundamental Components of BVD Control Plans

- **Biosecurity**: Prevent BVD entry into herds
  - Especially new herd additions, effective contacts

- **Targeted vaccination**: Prevent PI calves
  - In the event exposure occurs

- **Biocontainment**: Identify BVD infected herds
  - Test strategies to eliminate PI BVD animals

- **Surveillance/Monitoring**
Summary

- Food systems are complex
- Beef production systems are complex and are a component of food systems
- Use of goals, records and production benchmarks is helpful for Production Management decision-making
- There are many opportunities for improved productivity that can be achieved through systems approaches