KSU BEEF STOCKER FIELD DAY

September 22, 2011
KSU Beef Stocker Unit

PROCEEDINGS
# Table of Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
<td>1</td>
</tr>
<tr>
<td>Welcome and Thank You</td>
<td>2</td>
</tr>
<tr>
<td>Program Agenda</td>
<td>3</td>
</tr>
<tr>
<td>Cattle Market Outlook</td>
<td>5</td>
</tr>
<tr>
<td>Dr. Glynn Tonsor, Kansas State University</td>
<td></td>
</tr>
<tr>
<td>How Much Can I Pay for Grass?</td>
<td>22</td>
</tr>
<tr>
<td>Dr. Kevin Dhuyvetter, Kansas State University</td>
<td></td>
</tr>
<tr>
<td>A Systems Perspective to Managing Yearlings</td>
<td>32</td>
</tr>
<tr>
<td>Dr. Gerald Horn, Oklahoma State University</td>
<td></td>
</tr>
<tr>
<td>Managing Stocker Cattle for Growth and Health:</td>
<td>68</td>
</tr>
<tr>
<td>Applying Science and Technology to Improve Forage-Based Beef Production</td>
<td></td>
</tr>
<tr>
<td>Dr. Mark Branine, Pfizer Animal Health</td>
<td></td>
</tr>
<tr>
<td>Byproduct Storage Systems – What Works</td>
<td>83</td>
</tr>
<tr>
<td>Dr. Justin Waggoner, Kansas State University</td>
<td></td>
</tr>
<tr>
<td>Vaccineology</td>
<td>94</td>
</tr>
<tr>
<td>Dr. Greg Hanzlicek, Kansas State University</td>
<td></td>
</tr>
<tr>
<td>By-products and Corn Processing for Lightweight Cattle</td>
<td>107</td>
</tr>
<tr>
<td>Dr. Sean Montgomery, Corn Belt Livestock Services</td>
<td></td>
</tr>
</tbody>
</table>
Welcome to the 12th annual KSU Beef Stocker Field Day. We appreciate your attendance and support of this educational event. We are fortunate to have assembled an outstanding list of presenters and topics that we believe are relevant to your bottom line.

As always, if you have any questions on the program or suggestions for future topics, please let us know. Our strength in delivering relevant information lies in working closely with you, our stakeholder.

Sincerely,

Dale A. Blasi, PhD
Extension Beef Specialist
Department of Animal Sciences and Industry
College of Agriculture

THANK YOU

We would like to express a special “THANK YOU” to Pfizer Animal Health for their support of today’s educational program and activities for the beef stocker segment. With their financial assistance, we are able to deliver the caliber of programming that today’s events have in store for you. Please take a moment to stop by their display to see the line of products that they have to offer.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>9:30 a.m.</td>
<td>Registration/Coffee</td>
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<tr>
<td>10:15 a.m.</td>
<td>Introductions</td>
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<tr>
<td>10:30 a.m.</td>
<td><strong>Cattle Market Outlook</strong></td>
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<td><em>Dr. Glynn Tonsor, Kansas State University</em></td>
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<tr>
<td>11:15 a.m.</td>
<td><strong>How Much Can I Pay for Grass?</strong></td>
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<td><em>Dr. Kevin Dhuyvetter, Kansas State University</em></td>
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<tr>
<td>12:00 Noon</td>
<td>Barbecue Lunch</td>
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<tr>
<td>1:30 p.m.</td>
<td><strong>A Systems Perspective to Managing Yearlings</strong></td>
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<td>2:15 p.m.</td>
<td><strong>Managing Stocker Cattle for Growth and Health:</strong></td>
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<tr>
<td></td>
<td><em>Dr. Mark Branine, Pfizer Animal Health</em></td>
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<tr>
<td>3:15 - 5:30 p.m.</td>
<td><strong>Breakout Sessions</strong></td>
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<td><strong>Byproduct Storage Systems – What Works?</strong></td>
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<td></td>
<td><em>Dr. Sean Montgomery, Corn Belt Livestock Services</em></td>
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<tr>
<td>5:30 p.m.</td>
<td>Complimentary Cutting Bull’s Lament BBQ</td>
</tr>
</tbody>
</table>
OVERVIEW

• FEEDSTUFFS:
  – Drought: triggering liquidations; expensive and “hard to find” forage and grain for feed…
• SUPPLY:
  – Short-run (drought) vs. long-run (herd) perspectives
    • Shrink cow herd, expansion uncertainty
    • Structural changes underway…
• DEMAND:
  – Export demand remains strong
  – Domestic demand surpassing expectations but remains worrisome…

July '11: 40% of Beef Cows in States with > 40% Poor to Very Poor Pasture Conditions (was 4% in 2010)…

U.S. Drought Monitor

September 13, 2011

US Drought Monitor 2011
**HEIFERS HELD AS BEEF COW REPLACEMENTS**

July 1, U.S.

**July 1st Canadian Inventory down 2%; BUT +7% in heifer retention...**

**Will U.S. national herd expand by 2014???
-- who & where will expansion occur???

**Pre-Report Estimates (Sept. 23 release):**
- On Feed Sept 1 (up 7.9%) (+6.1% to +9.1%)
- Placed in August (up 7.7%) (+0.4% to +12.3%)

**CATTLE ON FEED**

US Total, Monthly

**CATTLE PLACED WEIGHING LESS THAN 700 POUNDS**

1,000 Plus Capacity Feedlots, U.S., Monthly
Actual Quantity & Price Changes:
1980: 76.6 lbs (per capita cons);
      $2.83 (real choice price)
2010: 59.6 lbs (per capita cons);
      $2.01 (real choice price)

Year-over-Year increases since Q3 of '10…

US BEEF AND VEAL EXPORTS
As a Percentage of Production, Carcass Weight, Annual

US BEEF AND VEAL EXPORTS
Carcass Weight, Monthly
US BEEF EXPORTS TO MAJOR MARKETS
Carcass Weight, Monthly

MED. & LRG. #1 STEER CALF PRICES
400-500 Pounds, Southern Plains, Weekly

MED. & LRG. #1 FEEDER STEER PRICES
700-800 Pounds, Southern Plains, Weekly
SLAUGHTER STEER PRICES
6 Market Weighted Average, Weekly

JAN APR JUL OCT

Livestock Marketing Information Center
Data Source: USDA-AMS

ESTIMATED AVERAGE COW CALF RETURNS
Returns Over Cash Cost (Includes Pasture Rent), Annual

Livestock Marketing Information Center
Data Source: USDA-AMS & USDA-NASS, Compiled & Analysis by LMIC

BUY/SELL MARGINS
S. Plains, Mar. 7-800 lb. Steer as % of Nov. 5-600 lb. Steer
9/21/11 Salina, KS Situation:

- Basis.com forecasted price of 800 lb steer March 1, 2012 is $137.37/cwt

- What is break-even purchase price of a 500 lb steer purchased on October 1, 2011? – forecasted price is $165.67

Breakeven Buying Price Worksheet

<table>
<thead>
<tr>
<th>Selling weight after shrink (pay-weight)</th>
<th>Expected selling price ($/cwt)</th>
<th>Average Daily Gain (pay-to-pay)</th>
<th>Feeding cost of gain ($/cwt)</th>
<th>Interest rate on feeder</th>
<th>Percent death loss*</th>
<th>Costs per head (trucking, etc.)**</th>
<th>Desired profit per head</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>$137.37</td>
<td>2.00</td>
<td>$75.00</td>
<td>7.00%</td>
<td>2.00%</td>
<td>$10.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

* Enter ONLY if death loss is NOT included in feeding cost of gain, otherwise enter zero.
** Do not enter any costs included in feeding cost of gain.

Expected Sales Price: $137.37/cwt:

Expected Return: $1.35/head [5.0 * ($165.40 - $165.67)]
"Buy-Sell" spreadsheet tool
(http://www.agmanager.info/livestock/budgets/production/beef/cattlebuysell.swf)

Expected Purchase Price: $165.67/cwt
Feeding COG $70 = +$12.65/head Expected Return
Feeding COG $80 = -$15.35/head Expected Return

Based on a purchase price of $137.3/cwt.

As of: 9/20/11
Projected Year for 660 Lbs. Steer at Selected Kansas Auctions
QUARTERLY FORECASTS (LMIC: 9/20/11)

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>Live Steer</th>
<th>% Chg.</th>
<th>Average</th>
<th>% Chg.</th>
<th>Weigh</th>
<th>% Chg.</th>
<th>Slaughter</th>
<th>% Chg.</th>
<th>Production</th>
<th>% Chg.</th>
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<tbody>
<tr>
<td>2011</td>
<td>I</td>
<td>110.12</td>
<td>23.11</td>
<td>129.06</td>
<td>78.11</td>
<td>129.06</td>
<td>78.11</td>
<td>129.06</td>
<td>78.11</td>
<td>129.06</td>
<td>78.11</td>
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<tr>
<td></td>
<td>II</td>
<td>112.79</td>
<td>17.08</td>
<td>132.03</td>
<td>104.60</td>
<td>132.03</td>
<td>104.60</td>
<td>132.03</td>
<td>104.60</td>
<td>132.03</td>
<td>104.60</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>7.95</td>
<td>201.12</td>
<td>58.15</td>
<td>150.15</td>
<td>58.15</td>
<td>150.15</td>
<td>58.15</td>
<td>150.15</td>
<td>58.15</td>
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<td></td>
<td>IV</td>
<td>7.91</td>
<td>201.12</td>
<td>58.15</td>
<td>150.15</td>
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<td>58.15</td>
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<tr>
<td>Total</td>
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<td>112.79</td>
<td>17.08</td>
<td>132.03</td>
<td>104.60</td>
<td>132.03</td>
<td>104.60</td>
<td>132.03</td>
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<td>132.03</td>
<td>104.60</td>
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Source: USDA-AMS, FOB & 5¢/Lbs. Gulf, Kansas State University...
Looking Beyond Today’s Ps & Qs

Beef industry changes underway…

• BEEF Magazine Poll (N=99 as of 8/17)
  – “If you had to liquidate cattle this year because of flooding or drought, what do you plan to do with the proceeds?
    • 47% Restock with cows when conditions improve
    • 9% Restock but change production models (e.g., buy stockers rather than cows)
    • 27% Keep the cash; leave the business
    • 6% Reinvest the cash in another non-livestock ag enterprise
    • 10% Don’t know

• Sales value of cull cows is about = for all
  – Those with higher costs, opportunities to row crop, etc. may increasingly exit
  – Expansion will not come from those with higher costs and notable alternative opportunities…

Beef industry changes underway…

• Expansion of stocker segment continues…

• Feedlot closeout trends:
  – Increasing final weights, ADG, & Feeding costs
  – Decreasing DOF & Feed-to-Gain

• Overall movement to more forage based gain = opportunity for cow-calf/stockers with associated comparative advantages…
Policy/Regulation Issues & Trends

• GIPSA “fair market” proposed rules / “anti-competition” listening sessions …
  – No timetable on USDA’s ben.-cost assessment…
• environmental regulation concerns
• WTO MCIOOL ruling in fall of 2011?
• animal welfare/mandatory labeling?

  – Is overall uncertainty holding back investment throughout supply chain???

Ending thought…

• Beef-cattle industry is facing increasing volatility and uncertainty while also being asked to do more with less…

• Increased risk may signal opportunity and higher average returns…
  – within industry variations in views and comparative advantages will determine the ability to profit and shape future of industry…

More information available at:
AgManager (http://www.agmanager.info/)

Glynn T. Tonsor
Assistant Professor
Dept. of Agricultural Economics
Kansas State University
gtt@agecon.ksu.edu
Other References of Notable Interest:

  - Value of Gain (Situation and Decision Tool Overview)
  - Cattle Cycles (Historical Overview and Implications)
  - KSU-Beef Replacement (Calculate Economic Value of Purchasing Replacements)

Notable AgManager Resources ([http://www.agmanager.info/livestock/marketing/](http://www.agmanager.info/livestock/marketing/))

- Weekly commentary & newsletters
- Current & historical price information
- Risk management/forecasting tools

Weekly Email Distribution of AgManager Updates


OR email your request to:
- Rich Llewelyn
[rilewely@AGECON.KSU.EDU](mailto:rilewely@AGECON.KSU.EDU)
Regular Newsletters & Commentary

• KSU Radio Interview
  – Weekly, released on Mondays (Tonsor, Mark, Peel, LMIC)

• “In the Cattle Markets”
  – Weekly (Mark, Feuz, Petry, Riley/Anderson)

• Recent Cattle Finishing Returns
  – Monthly updates based on Focus on Feedlots newsletter

Regular “Situation Update” Commentary: LMIC

• “Chart of the Week”

• “Weekly Price & Production Summary”

• “Quick Market Reports”

Current Price & Basis Information

• Futures Markets
  – LC, FC, LH & C, SB, S, W

• Cash Markets
  – [http://www.agmanager.info/livestock/marketing/graphs/default.asp#Price Charts](http://www.agmanager.info/livestock/marketing/graphs/default.asp#Price Charts)
  – [http://www.agmanager.info/livestock/marketing/database/default.asp#Cattle and Beef Databases](http://www.agmanager.info/livestock/marketing/database/default.asp#Cattle and Beef Databases)

• Basis (Cash - Futures) Information
  – [http://www.agmanager.info/livestock/marketing/graphs/default.asp#Basis Charts](http://www.agmanager.info/livestock/marketing/graphs/default.asp#Basis Charts)
Risk Management and Return Forecasting Tools Available:

- Feeder Cattle Sales Risk Management Tool,
  - Compare expected sales prices of alternative FC marketing strategies
  - ([http://www.agmanager.info/livestock/marketing/LRP/default.asp](http://www.agmanager.info/livestock/marketing/LRP/default.asp))

- Feedlot Profitability Tool: NAIBER's Feeding Risk Analyzer
  - Forecasts feedlot returns and variability in returns for future placements
  - ([http://www.naiber.org/cattleriskanalyzer/](http://www.naiber.org/cattleriskanalyzer/))

- BeefBasis.com
  - Decision support for hedging feeder cattle (output for cow-calf; input for feedlots)

Other References of Interest:

- March '11 ERS Report on Cow-Calf Industry

- Beef Demand Information
  - Journal articles, fact sheets, annual & quarterly demand indices
  - ([http://www.agmanager.info/livestock/marketing/BeefDemand/default.asp](http://www.agmanager.info/livestock/marketing/BeefDemand/default.asp))

- Animal Well-Being Information
  - Journal articles, fact sheets, and short video summaries
  - ([http://www.agmanager.info/livestock/marketing/AnimalWelfare/default.asp](http://www.agmanager.info/livestock/marketing/AnimalWelfare/default.asp))

- Animal Identification & Traceability Information
  - Animal records, fact sheets, and short video summaries
  - ([http://www.agmanager.info/livestock/marketing/AnimalID/default.asp](http://www.agmanager.info/livestock/marketing/AnimalID/default.asp))

TOTAL CATTLE NUMBERS JANUARY 1, 2011
(1000 Head)
How Much Can I Pay for Grass?

Dr. Kevin Dhuyvetter
Kansas State University

Everything is in the words we use...

Which of the following questions are we trying to answer?

- How much can I pay for grass?
- How much do I have to pay for grass?
- How much is grass worth?
- How much should I pay for grass?
How much can I pay for grass?

- Estimated based on value of gain and non-pasture cost of gain in two different summer grazing programs

- Short-season (SS)
  - 75 days (May 1 to Jul 15)
  - ADG = 2.2 lbs (total gain of 165 lbs/head)

- Full-season (FS)
  - 150 days (May 1 to Oct 1)
  - ADG = 1.75 lbs (total gain of 262.5 lbs/head)

How much can I pay for grass? -- Value of gain


Prices have been increasing, but what about the value of gain?
How much *can I pay* for grass? -- Value of gain

**Average Value of Gain for Summer Grazing Programs**

- May 500 lbs to Jul 665 lbs
- May 500 lbs to Oct 763 lbs

<table>
<thead>
<tr>
<th>Year</th>
<th>Value of gain, $/cwt</th>
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<tbody>
<tr>
<td>1992</td>
<td>80-120</td>
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<tr>
<td>1994</td>
<td>80-120</td>
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<tr>
<td>1996</td>
<td>80-120</td>
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<td>1998</td>
<td>80-120</td>
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<td>2000</td>
<td>80-120</td>
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<td>2002</td>
<td>80-120</td>
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<td>2004</td>
<td>80-120</td>
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<tr>
<td>2006</td>
<td>80-120</td>
</tr>
<tr>
<td>2008</td>
<td>80-120</td>
</tr>
<tr>
<td>2010</td>
<td>80-120</td>
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</tbody>
</table>

Value of gain: Avg = $61.52 ($1.41 to $129.95)

How much *can I pay* for grass?

Cost of gain:

- Non-pasture costs based on historical projected budgets (total costs included)
  - Short-season (SS)
    - Per head: Average = $46.83 ($35.45 to $66.20)
    - Per cwt: Average = $28.38 ($21.48 to $40.12)
  - Full-season (FS)
    - Per head: Average = $71.42 ($56.07 to $97.45)
    - Per cwt: Average = $27.21 ($21.36 to $37.12)

How much *can I pay* for grass?

**Return to Pasture (value of gain less non-pasture cost)**

- SS ($20.20)
- FS ($22.15)
How much \textit{can I pay for grass}?\hfill

\begin{itemize}
  \item \textbf{Return to Pasture (value of gain less non-pasture cost)}
    \begin{itemize}
      \item SS ($20.20): Bluestem Report=$18.04
      \item FS ($22.15): Bluestem Report=$15.33
    \end{itemize}
  \end{itemize}

\textbf{What can be paid > what was paid}\hfill

\begin{itemize}
  \item 55% (SS) and 70% (FS) of the time.
\end{itemize}

\textbf{Different ways of determining rental rates...}\hfill

- How much \textit{do I have to pay for grass}?  
  \begin{itemize}
    \item Only “need” to pay what it takes to get the land rented (what are others in the area paying?)
    \item Average rental rates reported by USDA/KAS
      \begin{itemize}
        \item CRD / County-level (1972-2011)
        \item Bluestem pasture report (1978-2009)
      \end{itemize}
    \item Potential problems with reported averages
      \begin{itemize}
        \item Do the averages reflect your situation?
        \item Many reasons rates should vary from what others are paying
        \item Averages are likely biased relative to market for “new” land
      \end{itemize}
    \item \$/ac rates have little meaning (use for indexing?)
  \end{itemize}

How much \textit{do I have to pay for grass}?  

\begin{itemize}
  \item [Graph, Kansas Cash Rent for Pasture, showing trends over time]
  \item Source: Kansas Agricultural Statistics
\end{itemize}
How much do I have to pay for grass?

Bluestem Pasture Rents over Time

- Stockers (+1.3%)
- Cow/calf pairs (+2.1%)

Source: Kansas Ag Statistics, KSU projections for 2010 and 2011

Different ways of determining rental rates...

- How much is grass worth?
  - Calculated based on cost of gain from drylot program
  - SS/FS stocker programs versus drylot gain
    - SS daily feed: 5 lbs hay, 8.65 lbs corn, 1.7 lbs sbm
    - FS daily feed: 8 lbs hay, 7.25 lbs corn, 1.4 lbs sbm
  - Cow-calf (spring calving) versus drylot
    - Daily feed: 26 lbs hay, 2.0 lbs corn, 1.0 lb sbm
  - Monthly average prices for May-Oct
    - Difference vs Bluestem rental rate -- $/hd, $/ac, %

Prices of other feedstuffs are up significantly...

Price of Various Feed Ingredients

- Corn ($4.91)
- Hay ($3.13)
- SBM ($10.86)

Prices of other feedstuffs are up significantly...
How much is grass worth?

Stocker Pasture Rental Rate vs. Drylot Feed Costs – 150 days

Cost, $/head

Difference, $/acre

Stocker Pasture Rental Rate vs. Drylot Feed Costs – 75 days

Cost, $/head

Difference, $/acre

Stocker Pasture Rental Rate vs. Drylot Feed Costs – 183 days

Cost, $/head

Difference, $/acre
• How much should I pay for grass?
  – Very normative question, thus there is not a “right” answer to this question.
  – However, if your rent has not changed for 5, 10, or 20+ years, likely you should be paying more than you are.

Different ways of determining rental rates...

• How much can I pay for grass and what is grass worth?
  Difference between what could be paid for grass and what grass is worth compared to Bluestem Report rate (all values are $/acre)

<table>
<thead>
<tr>
<th>Time period</th>
<th>Value of Gain</th>
<th>Alternative Feedstuffs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SS FS</td>
<td>SS FS Cow-calf</td>
</tr>
<tr>
<td>1992-96</td>
<td>-2.93 $3.68</td>
<td>$12.26 $8.38</td>
</tr>
<tr>
<td>1997-01</td>
<td>-5.52 $-2.21</td>
<td>$9.18 $10.60</td>
</tr>
<tr>
<td>2002-06</td>
<td>$11.05 $20.40</td>
<td>$10.05 $9.52</td>
</tr>
<tr>
<td>2007-11</td>
<td>$6.03 $12.47</td>
<td>$25.79 $16.65</td>
</tr>
<tr>
<td>1992-11</td>
<td>$2.16 $6.82</td>
<td>$12.96 $11.02</td>
</tr>
</tbody>
</table>

• While values vary, hard to argue that pasture rates won’t be increasing in the future.
Questions

- How much can I pay for grass?
  - Estimated based on value of gain/expected value of gain in a summer grazing program

- How much do I have to pay for grass?
  - What are others paying (i.e., publicly reported rates)

- How much is grass worth?
  - Calculated based on cost of gain from drylot program

- How much should I pay for grass?

How much can I pay for grass?
Initial Stocking Rate, Standing Crop, Forage Allowance for "Control" Steers. (Means for recent years at Marshall)

- Placement Date: November 7 – 14
- Initial Standing crop, lb DM/acre: 1100
- Stocking Rate, 1.8 acres/steer or 0.56 steers/acre.
  - 310 lb of cattle/acre
  - 350 lb of forage DM/100-lb steer body wt.
- Steer wt gain (fall-winter): 2.35 lb/day
Grazing cattle on wheat pasture is a production risk management practice!

**Producer owns wheat pasture and cattle (112 days grazing):**
- Wt gain = 2.20 lb/d @ $0.55/lb = $139/steer
- Stocking rate at 1.8 acres/steer
- Profit/steer = $126
- Returns to wheat & cattle = $265 or $147/acre.

**Farmer who owns wheat pasture:**
- Wt gain = 2.20 lb/d @ $0.55/lb = $139/steer
- Stocking rate at 1.8 acres/steer
- Profit/steer = N/A
- Returns to wheat = $77/acre.

**Bellwether Management Practices for Growing Cattle on Pasture . . .**
I. Implants

- Deliver growth-promoting, anabolic compounds
- Increase ADG
- Increase protein deposition and decrease fat deposition
- Shifts growth curve to the right
- Increases nitrogen retention
- Provide the greatest return per $ invested of any management practice

Recent Implant Studies on Wheat Pasture

<table>
<thead>
<tr>
<th></th>
<th>ADG, LB</th>
<th>Component</th>
<th>Component</th>
<th>Revior-G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>E-S w/Tylan</td>
<td>TE-G w/Tylan</td>
<td></td>
</tr>
<tr>
<td>Horn et al., 2006-07</td>
<td>Steers; 89 days</td>
<td>2.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.70&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.64&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sharman et al., 2009-10</td>
<td>Steers; 111 days</td>
<td>2.10</td>
<td>2.42</td>
<td>+0.31 (15%)</td>
</tr>
</tbody>
</table>

08-11-10
Effects of implanting on wheat pasture on carcass value

- Carcass weight increased 33 lb.
- REA tended to be increased
- Did not affect marbling score
- Did not change distribution of carcass quality grades

Match the Hatch...

Bellwether Management Practices for Growing Cattle on Pasture (con't)

II. Strive to get an efficacious dosage of an ionophore into your cattle.
R-1620 Studies on Wheat Pasture

Treatments:

- Negative control (NC) - Wheat pasture; no supplement.
- Mineral mixture without monensin (MIN)
- Mineral mixture with 1620 grams/ton of monensin (RMIN)

Mineral Mixture Intake\(^1\) (as-fed lb/steer/day)

<table>
<thead>
<tr>
<th>Year</th>
<th>MIN(^2)</th>
<th>RMIN(^2)</th>
<th>Monensin(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01(^4)</td>
<td>0.47 ± 0.11</td>
<td>0.10 ± 0.02</td>
<td>83 ± 17</td>
</tr>
<tr>
<td>2001-02(^4)</td>
<td>0.52 ± 0.13</td>
<td>0.15 ± 0.02</td>
<td>125 ± 16</td>
</tr>
<tr>
<td>2004-05(^3)</td>
<td>0.43 ± 0.03</td>
<td>0.16 ± 0.03</td>
<td>129 ± 22</td>
</tr>
<tr>
<td>2005-06(^3)</td>
<td>0.40 ± 0.06</td>
<td>0.18 ± 0.02</td>
<td>148 ± 18</td>
</tr>
<tr>
<td>Combined</td>
<td>0.46 ± 0.10</td>
<td>0.15 ± 0.04</td>
<td>121 ± 29</td>
</tr>
</tbody>
</table>

\(^1\) Year means ± SD
\(^2\) MIN = non-medicated, free-choice mineral mixture; RMIN = free-choice mineral mixture with 1,620 mg monensin/lb.
\(^3\) Monensin intake from RMIN, mg steer\(^{-1}\) d\(^{-1}\).
\(^4\) Gibson (2002).
\(^3\) Fieser et al. (2007).
\(^*\) P ≤ 0.05.
ADG₁ (lb/steer/day)

<table>
<thead>
<tr>
<th>Year</th>
<th>NC²</th>
<th>MIN²</th>
<th>RMIN²</th>
<th>SEM²</th>
<th>P-value²</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01³</td>
<td>0.69a</td>
<td>0.91ab</td>
<td>1.20a</td>
<td>0.132</td>
<td>0.04</td>
</tr>
<tr>
<td>2001-02³</td>
<td>2.40b</td>
<td>2.59b</td>
<td>2.71b</td>
<td>0.026</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>2004-05⁵</td>
<td>1.23</td>
<td>1.31</td>
<td>1.66</td>
<td>0.186</td>
<td>0.09</td>
</tr>
<tr>
<td>2005-06⁵</td>
<td>1.91a</td>
<td>2.39a</td>
<td>2.54a</td>
<td>0.095</td>
<td>0.01</td>
</tr>
<tr>
<td>Combined</td>
<td>1.56a</td>
<td>1.80a</td>
<td>2.03a</td>
<td>0.362</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

¹ ADG = Average daily gain
² NC = negative control; MIN = non-medicated, free choice mineral; RMIN = free-choice mineral mixture with 1,620 mg monensin/lb.
³ n = 12 for Gibson, 2002; n = 10 for Fieser et al., 2007.
⁴ Observed significance level for the main effect of treatment.
⁵ Calculated from data of Gibson, 2002.
⁶ Calculated from data of Fieser et al., 2007.

Feeding R-1620 Mineral Mixtures to Stocker Cattle on Wheat Pasture (Will it pay?)

- Cost/ton is HIGH. $980/ton
- Consumption/cost per animal is low.
  0.15 lb/day x 110 days x $0.49/lb = $8.09/steer
- ADG response: + 0.45 lb as compared with "negative control"
- Gross return/steer: + $35.47 (+ 49.5 lb of added gain x $ 0.88/lb value of gain) minus $8.09).
Grazing treatments:

1. High Gain Wheat (HGW; 2.67 lb/d)
2. Low Gain Wheat (LGW; 1.34 lb/d)
3. Native Range (NR; 0.33 lb/d supplemented with 2.0 lb/d of 41% CP supplement) 

Carcasses at end of winter grazing

HGW, 20.5% fat
LGW, 13.6% fat
NR, 6.1% fat

Differences in ADG during winter grazing and initial empty body/carcass fat did not affect rate of empty BW gain or gain efficiency during finishing.

Contrary to industry dogma and Level 1 model of Beef Cattle NRC
Feed: Gain vs. Empty Body Fat

\[ Y = 5.7054 + 0.0432 \times \text{EBF} \]

\[ R^2 = 0.17; \text{RMSE} = 0.26; P = 0.35 \]
Intensive Early Stocking (IES) vs. Season-Long Summer Stocker Programs

<table>
<thead>
<tr>
<th></th>
<th>IES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feedlot</td>
<td>IES</td>
<td>SL</td>
</tr>
<tr>
<td></td>
<td>4/15-5/1</td>
<td></td>
<td>12/2</td>
</tr>
<tr>
<td></td>
<td>(480 lb)</td>
<td>280 lb**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+188 lb*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(668 lb)</td>
<td>7/15</td>
<td></td>
</tr>
</tbody>
</table>

* 2.08 lb/day x 90 days
** 1.83 lb/day x 153 days

Stocker Performance
(IES vs. SLS Grazing Management)

<table>
<thead>
<tr>
<th>Item</th>
<th>IES</th>
<th>SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Steers</td>
<td>267</td>
<td>266</td>
</tr>
<tr>
<td>No. Treatment means</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Winter phase

<table>
<thead>
<tr>
<th>Item</th>
<th>IES</th>
<th>SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, d</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>Total gain, lb</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>0.52</td>
<td></td>
</tr>
</tbody>
</table>

Summer phase

<table>
<thead>
<tr>
<th>Item</th>
<th>IES</th>
<th>SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, d</td>
<td>72</td>
<td>142</td>
</tr>
<tr>
<td>Total gain, lb</td>
<td>115</td>
<td>208</td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>1.87</td>
<td>1.47</td>
</tr>
</tbody>
</table>

Finishing Performance
(IES vs. SLS Grazing Management)

<table>
<thead>
<tr>
<th>Item</th>
<th>IES</th>
<th>SLS</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days on feed, d</td>
<td>147</td>
<td>132</td>
<td>10</td>
<td>0.14</td>
</tr>
<tr>
<td>Initial BW, lb</td>
<td>703</td>
<td>798</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>1201</td>
<td>1228</td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>3.52</td>
<td>3.39</td>
<td></td>
<td>0.32</td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td>23.46</td>
<td>23.48</td>
<td>0.90</td>
<td>0.98</td>
</tr>
<tr>
<td>DMI, % BW</td>
<td>2.46</td>
<td>2.33</td>
<td>0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>F.G., lb/lb</td>
<td>6.68</td>
<td>7.03</td>
<td>0.44</td>
<td>0.21</td>
</tr>
</tbody>
</table>
Feed:Gain vs. Placement Weight

IES (solid line)  SLS (dashed line)

IES: \( Y = 4.1338 + 0.0036 \times BW \)
SLS: \( Y = 0.1197 + 0.0087 \times BW \)

IES vs. SLS: \( P = 0.36 \)

Oklahoma Gold Supplementation Program

- 38 – 41% CP all-natural suppl.
- Feeding rate: 1 lb/day or 2 lb every other day
- Mean response (7-trial summary):
  - Daily gain: + 0.38 ± lb
  - With monensin\(^b\): + additional 0.15 – 0.20 lb = 0.53
  - 0.58 gain response
  - Supplement Conversion: 1/0.53 = 1.9 lb per lb of increased weight gain per head

\(^a\) Lalman, 2008; \(^b\) Lusby et al, 1984 and McCollum et al., 1988

Supplements

<table>
<thead>
<tr>
<th>Ingredients, %DM</th>
<th>CSM</th>
<th>DDGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSM</td>
<td>30.70</td>
<td>31.44</td>
</tr>
<tr>
<td>DDGS</td>
<td>34.14</td>
<td>63.11</td>
</tr>
<tr>
<td>Wheat middlings</td>
<td>27.16</td>
<td></td>
</tr>
</tbody>
</table>

ICSM  DOGS
Protein Source

- **CSM**: 2.05
- **DDGS**: 2.16

*P < 0.05*

Regression of feedlot performance (ADG, DMI, F:G) on stocker period characteristics

- Dataset of yearling production systems that differed for one or more of the following:
  - ADG during stocker period
  - Length (days) of stocker period
  - Total BW gain during stocker period
  - Feedlot placement BW

- 12 studies, 31 treatment means, 1022 steers

- Regression analysis conducted between finishing performance and stocker period characteristics

DMI vs. Placement Weight

\[ Y = 18.8058 + 0.0060 \times \text{BW} \]

\( R^2 = 0.29; \text{RMSE} = 0.58; P = 0.03 \)
### Summary

Growing cattle to heavier weights on grass...

- Decreases BE selling price of cattle ("cheapens cattle back") prior to feedlot placement
- Increases final live and carcass weights
- Feed DM:Gain increased 0.20 lb per 100 lb increase in placement wt.
- Mother nature doesn’t give us many “free lunches”!
- Many options
- Challenge is finding the "ever changing" optimaums.
General Comments

- Cost of weight gain by cattle on grass is higher and will continue to increase.
- All input costs (fuel, fertilizer, feed, trucking, etc) for the stocker/feeder operator have increased.
- The beef cattle industry must embrace every proven "efficiency improving technology" to:
  - Increase cost competitiveness of the industry as a whole
  - Meet the increasing global demand for animal protein

Thank you.
A Systems Perspective to Managing Yearlings in the Southern Great Plains

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Department of Animal Science
Oklahoma State University, Stillwater

Introduction

The price of feed grains has dramatically increased in recent years because of increased demand for export markets and ethanol production. Corn grain in the southern Great Plains is costing $7.85/bu (TCFA Market Report; September 16, 2011) and cost of finishing diets is upwards of $350/ton (DM basis). Feed costs of this magnitude are not economically sustainable for the beef industry and utilization of less expensive ethanol co-products in finishing rations has limitations. Part of the solution to this problem will be to take advantage of the unique ability of beef cattle to utilize forages to grow them to heavier weights prior to placing them on feed. However, a myriad of stocker production systems exist and the influence of previous grazing systems on subsequent feedlot performance is not completely understood. Therefore, the objective of this paper was to evaluate the effect of stocker production systems in the Southern Great Plains on subsequent feedlot performance and carcass characteristics of finished cattle.

Methods

Studies were obtained from the literature evaluating feedlot performance and carcass characteristics of steers from Southern Great Plains growing/finishing beef cattle production systems. Datasets were compiled using treatment means to compare calf-fed vs. yearling production systems, winter wheat pasture vs. winter/summer tallgrass native range stocker production systems or stocker production systems using intensive early stocking (IES) vs. season-long stocking (SLS) management on summer pasture. A fourth dataset consisted of treatment means of yearling production systems from the above studies plus 5 additional studies, and was used to evaluate the relationship between performance during finishing and characteristics of the stocker period. Characteristics of the stocker period included length of the stocker period from weaning in the fall to feedlot placement, total BW gain during the stocker period, rate of gain during the stocker period, and placement BW. Start dates for the stocker period and winter performance were not available for 6 of the 31 treatment means (3 studies comparing IES and SLS systems), thus length of the stocker period was estimated from December 1 and rate of gain during the winter portion of the stocker period was estimated at 0.50 lb/day for these observations based on previous studies of steers grazing dry winter forage (Gill et al., 1991; Choat et al., 2003; Hersom et al., 2004a; Sharman et al., 2010; Sharman et al., 2011).
Regression of finishing performance traits (ADG, DMI, feed:gain) on stocker period characteristics was conducted using a mixed model (SAS Inst. Inc.) with study and study × independent variable interactions as random effects. A fifth dataset consisted of treatment means of growing programs (drylot or pastured) that included estimates of empty body fat at start of the finishing phase. Data were compiled from 6 studies that included Gill et al. (1993a,c), experiments 1 and 2 of Hersom et al. (2004a), McCurdy et al. (2010a), Coleman et al. (1995a, b) and Sainz et al., 1995. This dataset was used to evaluate the relationship between performance during finishing and initial finishing empty body fat. Regression of finishing performance traits (ADG, DMI, feed:gain) on initial finishing empty body fat was performed as described above. The quadratic term was evaluated in all regression models (stocker period characteristics and initial empty body fat) and was observed to be not significant (P > 0.15) in all cases. Details of studies included in each of the datasets and the statistical analyses are included in the paper of Lancaster et al., 2011.

Results and Discussion

Comparison of Growing/Finishing Systems

**Wheat Pasture vs. Native Range.** Data for steers previously grazing winter wheat pasture vs. winter/summer tallgrass native range are presented in Table 1. Average daily gain during finishing was similar between wheat pasture and native range steers, but numerically wheat pasture steers gained 0.3 lb/day less. Wheat pasture steers consumed less (P < 0.05) feed than native range steers, such that feed efficiency was similar. Carcass weight, ribeye area, and yield grade were similar between wheat pasture and native range steers, but native range steers had greater (P < 0.05) marbling scores than wheat pasture steers. Inconsistent results were reported among individual studies for ADG, DMI and feed:gain. Sharman et al. (2010) reported no differences in ADG, DMI, or feed:gain between steers previously grazing wheat pasture or native range. However, Gill et al. (1993a) reported that steers previously grazing wheat pasture had greater ADG and lower feed:gain, but similar DMI compared with steers previously grazing native range. Sharman et al. (2011) observed that steers previously grazing native range had greater ADG and DMI, but similar feed:gain compared with steers previously grazing wheat pasture. In contrast to the finishing performance data, results for carcass weight, REA, marbling score, and yield grade were consistent among individual studies; carcass characteristics were similar between steers that previously grazed wheat pasture or winter/summer tallgrass native range. However, in 2 of the 3 studies native range steers had numerically greater marbling scores than wheat pasture steers resulting in significantly greater marbling scores in our analysis.

Managing Cattle on Wheat. Some key management practices for growing cattle on wheat pasture include (1) stocking rate, (2) planting date and wheat variety
selection, and (3) use of various supplementation strategies. In any grazing program stocking rate is the “holy grail” of cattle performance. Winter wheat forage mass typically varies tremendously both within and among years. Using non-linear regression procedures to fit quadratic models with a plateau function, plateaus for diet organic matter disappearance, forage intake, and estimated daily gain were achieved at forage allowances between 20 to 24 kg DM/100 kg BW/day, and decreased markedly at herbage allowances below this range (Redmon et al., 1995). Similarly, Pinchak et al. (1996) reported that ADG of steers grazing wheat pasture increased as forage allowance increased up to 27.3 kg DM/100 kg BW/day. Further increases in forage allowance had little effect on ADG. While these 2 studies are in good agreement, forage allowance expressed as kg DM/100 kg BW/day is not a “user friendly” observable management variable. In a planting date by stocking rate study, Fieser et al. (2006) reported that ADG, total steer gain, and grain yield all responded in a quadratic (P ≤ 0.06) manner and peaked around a forage allowance of 700 kg DM/100 kg BW.

Length of the grazing period and total weight gain by cattle on dual-purpose wheat are greatly influenced by the combination of planting date and variety selection. Fieser et al. (2006) reported that all cattle performance measures were greater (P ≤ 0.01 for early- [September 4] than late-planted [September 25] wheat). Early planting provided 24 more grazing days than late planting (120 vs. 96 days). Averaged across all stocking rates, weight gain/steer and gain/acre were increased 95 and 55 lb, respectively, by early planting whereas grain yield was decreased 8 bu/acre. Edwards et al. (2011) summarized 11 years of Oklahoma data comparing wheat grain yield from dual-purpose and grain-only systems. The dual-purpose system had an inherent yield disadvantage of 3.5 bu/acre that was primarily attributed to early planting. After adjustment for the early planting penalty, wheat yield in the dual-purpose system was approximately 93% of that in the grain-only system. The data indicate that once the decision is made to plant early and implement the dual-purpose system, the impact of grazing on grain yield is minimal. In studies reported by Horn et al. (1996) and Paisley (1998a) stocking rate had a much greater effect on total gain per steer and gain/acre than wheat variety. We have not conducted recent variety by stocking rate grazing trials. Date of first hollow stem can differ by as little as 14 days and as much as 21 days among hard winter wheat varieties in the southern Great Plains. Length of the grazing period for dual-purpose enterprises can be increased by selecting varieties that are later maturing with respect to when they reach first hollow stem.

Horn et al. (2005) and Horn (2006) reviewed several supplementation strategies for growing cattle on wheat pasture. One is a small-package monensin-containing energy supplement designed to provide (1) additional degradable OM relative to the excess degradable N in wheat forage and increase non-ammonia nitrogen supply per unit of ME, and (2) monensin to improve the economics of the supplementation program and to decrease bloat (Branine and Galyean, 1990; Paisley et al., 1998a,b). Feeding rate is 2 lb/head/day or 4 lb every other day,
and ADG was increased by $0.44 \pm 0.16$ lb/day (7 trial summary) with a mean supplement conversion (lb of supplement per lb of increased weight gain) of $4.83 \pm 1.22$. In all trials control cattle had free-choice access to a non-medicated high-calcium mineral mixture. Analysis of the data using a normal probability distribution function shows that the probability of obtaining at least a 0.35 or 0.40 lb/day improvement in ADG is 71% and 60%, respectively.

Because of the added cost of hand feeding on pasture, Gibson (2002), Horn et al. (2002), and Fieser et al. (2007) evaluated the use of monensin-containing mineral mixtures ("R1620") on intake and weight gain of wheat pasture stocker cattle. In each of 4 trials (i.e., 4 years), three common treatments were: (1) negative control (NC), no mineral or any other supplement; (2) free-choice non-medicated mineral (MIN); (3) free-choice, medicated mineral containing 1,620 g monensin/ton (RMIN). Mean daily intakes of the MIN, RMIN mineral mixtures, and monensin over the 4 trials were $0.46 \pm 0.19$ lb, $0.15 \pm 0.07$ lb and $121 \pm 29$ mg/head. The RMIN increased ADG ($P < 0.01$) by 0.23 lb/day compared with MIN and by 0.47 lb/day compared with the NC. The probability of obtaining at least a 0.40 or 0.45 lb/day improvement in ADG due to providing RMIN was 70% and 54%, respectively.

**Intensive Early vs. Season-Long Stocking.** Steers grazing summer pasture using season-long stocking management entered the feedlot at heavier BW compared with steers under intensive early stocking management (Table 2). Average daily gain, DMI, and feed:gain were similar between summer pasture production systems. Carcass weight, REA, marbling score, and yield grade were also similar between intensive early stocking and season-long stocking systems. Results of finishing ADG among individual studies were inconsistent. Brandt et al. (1995) and Gill et al. (1993a) reported that IES steers had greater ADG compared with SLS steers, but Gill et al. (1991), Gunter and Phillips (2001), and Bodine et al. (2002) observed no difference in ADG. Although all studies consistently reported no difference in DMI between IES and SLS steers. Similar to ADG, results of feed:gain were inconsistent among individual studies. Brandt et al. (1995) and Bodine et al. (2002) observed that IES steers had lower feed:gain compared with SLS steers, but Gill et al. (1991) and Gill et al. (1993a) observed that feed:gain was similar. Only Brandt et al. (1995) reported a difference in carcass weight with SLS steers having greater carcass weight than IES steers. Consistent among individual studies, no differences in marbling score or yield grade were observed between steers under intensive early stocking or season-long stocking systems.

**“Oklahoma Gold” Supplementation Program.** The “Oklahoma Gold” supplementation program was developed to meet the degradable intake protein (DIP) deficiency, during mid- to late-summer, of stocker cattle grazing tallgrass native range under season-long grazing management. The 38-41%, all-natural crude protein supplement was designed for a feeding rate of 1 lb/head/day or 2 lb/head every other day. In a summary of 7 trials evaluating this supplementation
program, ADG was increased 0.38 lb/day and supplement conversion averaged 2.77 (Lalman, 2008). Addition of monensin to this supplement to provide 100 mg/head/day has increased ADG by an additional 0.15-0.20 lb and decreased supplement conversion to about 1.9 (Lusby et al., 1984; McCollum et al., 1988). This supplementation program has been a “game changer” for many of our producers and has greatly improved the profitability of season-long stocker programs on tallgrass native range.

Thus, there are many ways by which the beef cattle industry can add weight to cattle and cheapen them back (i.e., decreased breakeven selling price) prior to placement on feed. However, mother-nature doesn’t give us many “free lunches”. In our analysis, feed:gain was similar for wheat pasture vs. winter/summer tallgrass native range cattle and IES vs. SLS cattle, although feed:gain was numerically 4 and 5% greater (i.e., poorer) for native range and SLS cattle, respectively. In a comparison of multiple production systems, Gill et al. (1993a) reported that native range steers entered the feedlot 118 lb heavier, but had 26% greater feed:gain than wheat pasture steers (7.95 vs. 6.32; P < 0.05). Of the studies that we included in the IES/SLS dataset, the two-year study on tallgrass native range by Brandt et al. (1995) had by far the largest number of cattle (144/year). In this study, SLS cattle (averaged across implant treatments) were 86 lb heavier at feedlot placement and feed:gain was increased 8.8% (6.42 vs. 5.90; P < 0.05) compared with IES cattle. Comparison of feedlot performance of IES vs. SLS cattle is confounded by different placement weights and potentially large environmental differences because the cattle are in the feedlot at different times of the year. Drouillard and Kuhl (1999) included an excellent discussion of this in their review paper. Therefore, the positive attributes resulting from one segment (i.e., increased placement BW and decreased breakeven selling price) are often accompanied by decreased biologic efficiencies (i.e., lower feed efficiency during finishing) in the next segment. The challenge is to find the optimums.

Regression Analysis of Finishing Performance

Regression coefficients of finishing performance with stocker period characteristics are presented in Table 3. Finishing ADG was not influenced by any of the stocker performance traits. Feed DM intake during finishing increased as length of the stocker period increased (Figure 1), total gain during the stocker period increased (Figure 2), and as placement BW increased (Figure 3). Feed:gain during finishing increased as total gain during the stocker period (Figure 4) and placement BW (Figure 5) increased. The regression equation using placement BW only explained 29 and 39% of the variation in DMI and feed:gain during the finishing phase, respectively, but the model could predict DMI to within 0.58 lb/day and feed:gain to within 0.18 lb feed/lb gain. Based on observed differences in the literature, these values are reasonably acceptable to estimate changes in feed intake and feed efficiency of feedlot cattle. For each 100 lb increase in placement BW feed DM:gain during finishing increases by 0.20
lb or about 3.3%. However, carcass weight also increases by 17 lb ($P < 0.05$; data not shown). A 3.3% increase in feed:gain is very substantial especially with high ration costs. However, the decreased total feed consumed and greater carcass weight may compensate for the increased feed:gain associated with adding an additional 100 lb BW during the stocker period. Using the relationships from our data, finishing a 700 lb steer to 1300 lb with a feed:gain of 6.05 lb DM/lb gain will require $635 in feed costs at a ration cost of $350/dry ton, but adding 100 lb of BW during the stocker period will reduce feed costs to $576 for a 800 lb steer to reach a finish BW of 1327 lb (assuming dressing percentage of 64%) even though feed:gain increased to 6.25 lb DM/lb gain (i.e., 3.3% greater than 6.05). Therefore, even though feed:gain is expected to be poorer as cattle enter the feedyard at heavier weights, a substantial savings in feed costs may be realized by increasing weight gain on pasture.

Results are similar for total gain during the stocker period and placement BW because these two variables are inextricably linked. However, length of the stocker period can be independent of total gain and placement BW. Regression of finishing DMI on length of the stocker period and placement BW revealed that length of the stocker period was still significantly ($P = 0.06$) related to finishing DMI, and placement BW tended to be significantly related ($P = 0.12$). This result indicates that cattle entering the feedlot at a greater age will consume more feed even though placement BW may not be larger (i.e., greater intake as percentage of BW). However, this may be confounded by previous diet. Cattle entering the feedlot at a greater age have most likely been backgrounded on dry winter forage followed by summer grazing programs where cattle consume moderate to low-quality forage leading to increased gastrointestinal tract weight (Hersom et al., 2004a,b). In our analysis, cattle that previously grazed dormant winter/summer tallgrass native range (average length = 255 d) had greater feed intake as percentage of BW during finishing than cattle that previously grazed winter wheat pasture (average length = 121 days; Table 1).

Regression analysis was conducted to evaluate the relationship between feed:gain during finishing and placement BW for IES and SLS stocking management systems (Figure 6). Consistent with our previous analysis (Figure 5), feed:gain increased as cattle entered the feedyard at heavier weights. However, the intercept by stocking management and slope by stocking management interactions were not significant ($P > 0.30$) indicating no difference in the relationship of feed efficiency during finishing with placement weight between IES and SLS management systems. This suggests that type of summer pasture stocking management does not affect the relationship between feed:gain and placement BW. However, given the trend lines illustrated in Figure 6 and the fact that only 5 data points were available for each pasture stocking system, feed:gain for SLS steers may increase more rapidly as placement BW increases. A larger dataset is needed to adequately evaluate whether differences exists between SLS and IES steers with respect to feed efficiency.
It is generally considered that ADG and feed efficiency decrease during finishing as initial body fat increases. In contrast, our analysis revealed that initial finishing empty body fat did not significantly affect ADG, DMI, or feed:gain (Figure 7) during finishing. In 2 experiments, Hersom et al. (2004a) observed no difference in feed efficiency during finishing of steers ranging in empty body fat from 4 to 20% at the start of finishing. Gill et al. (1993a,c) observed that steers previously grazing wheat pasture had lower feed:gain than steers grazing winter/summer native range using intensive early stocking or season-long stocking management; however, wheat pasture steers were intermediate in terms of empty body fat percentage resulting in no clear relationship between empty body fat and feed efficiency during finishing. Coleman et al. (1995a,b), Sainz et al. (1995), and McCurdy et al. (2010a) observed that fatter steers had improved feed efficiency during finishing, but these steers had been limit-fed a high-grain diet during the backgrounding period and this response may have been due to compensatory gain. Therefore, within the range of typical stocker and backgrounding programs, accumulating greater empty body fat during the stocker period may not negatively affect finishing performance.

In Search of a Common Thread

Reynolds et al. (1991) fed growing beef heifers two types of diet (75% alfalfa or 75% concentrate) at two levels of intake and measured the partitioning of ME between heat energy and tissue energy (i.e., energy retention). Their conclusion was that the metabolism of visceral tissues dominates the partitioning of ME to heat energy and tissue energy. Hersom et al. (2004a,b) grew steers on wheat pasture at low and high rates of gain and on dormant native range with protein supplement. Live weight gains and empty body fat at the end of the growing phase, averaged across two years, were 2.66, 1.35 and 0.34 lb/day and 19.7, 13.0 and 5.5%, respectively, for the high-gain wheat pasture (HGW), low-gain wheat pasture (LGW) and native range (NR) steers. Proportional mass of the total GIT, g/kg EBW, and calculated heat production (Mcal/100 kg EBW/day), as an estimate of maintenance energy requirements, were both lower (P < 0.05) for HGW than NR steers. Feed intake during finishing (% of mean BW) by HGW steers was lower than NR steers. However, even though empty body fat of HGW steers was considerably greater, empty body ADG and feed:gain were not different among the three treatments.

McCurdy et al. (2010a,b) grew fall-weaned steer calves on three growing programs prior to placement on feed. Growing programs were: 1) grazed on wheat pasture (WP); 2) fed a sorghum silage-based diet (SF); or 3) program fed a high-concentrate diet (PF). Program-fed steers had higher ADG and lower feed:gain during finishing than steers fed the forage-based growing diets even though PF steers had the greatest empty body fat at feedlot placement. The
improvement in feed:gain was attributed to less accretion of visceral organ mass resulting in decreased maintenance energy requirement of PF steers. Similarly, Sainz et al. (1995) reported a 21% reduction in maintenance energy requirement during finishing for steers limit-fed a high-concentrate diet during the growing phase compared with steers ad libitum-fed a forage diet, even though empty body fat was greater for the concentrate-fed steers. Collectively, these studies reinforce the concept that feed intake and type of diet (i.e. caloric density, forage to concentrate ratio, forage nutritive value, etc) during the growing phase affect visceral organ mass and maintenance energy requirements of beef cattle during the finishing phase.

These data suggest that performance of cattle making rapid gains on pasture before entering the feedlot contradicts NRC (1996) prediction that performance is negatively related to initial body fat. Variation in mass of specific organs/tissues of the portal-drained viscera resulting from stocker programs are most likely involved in altering maintenance energy requirements. Therefore, we suggest that type of diet, forage quality, and energy intake during the stocker period have a greater effect on energy retention and feed efficiency during finishing than empty body fat (i.e., fleshiness) of stocker cattle.

Conclusions

Use of Southern Great Plains stocker production systems to add weight to cattle can significantly decrease days on feed and total feed consumed while increasing carcass weight and quality grade compared with calf-fed cattle. There are many ways by which the beef cattle industry can add weight to cattle prior to placement on feed. In the Southern Plains, the primary stocker production systems for fall-weaned calves are grazing winter wheat pasture prior to finishing, or grazing dormant winter forage followed by intensive early or season-long stocking on summer pasture prior to finishing. Results of our meta-analysis indicate minimal differences between these stocker production systems in feedlot performance or carcass characteristics. However, increasing weight gain on pasture reduces feed efficiency during finishing, but increases carcass weights and shortens days on feed. In addition, energy intake and type of diet can significantly affect gastrointestinal tract weight (i.e., low-quality forage increases gastrointestinal tract weight) and visceral organ mass (i.e., high energy intake increases liver mass), which increases maintenance energy requirement and decreases feed efficiency. Price relationships between feeder and fed cattle will dictate the profitability of increasing weight gain on pasture, but a substantial reduction in gain efficiency may be overcome by reducing days on feed and total feed consumed in combination with increased carcass weights.
Literature Cited


Table 1. Feedlot performance and carcass merit of yearling steers that previously grazed winter wheat pasture or winter/summer tallgrass native range

<table>
<thead>
<tr>
<th>Item</th>
<th>Wheat</th>
<th>Native Range</th>
<th>SEM¹</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Steers</td>
<td>84</td>
<td>92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Treatment means</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stocker performance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Winter phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length, d</td>
<td>121</td>
<td>161</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total gain, lb</td>
<td>258.1</td>
<td>135.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>2.29</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Summer phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length, d</td>
<td></td>
<td>94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total gain, lb</td>
<td></td>
<td>168.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td></td>
<td>1.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Finishing performance</strong>²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days on feed, d</td>
<td>123</td>
<td>112</td>
<td>7</td>
<td>0.35</td>
</tr>
<tr>
<td>Initial BW, lb</td>
<td>822.4</td>
<td>859.5</td>
<td>28.4</td>
<td>0.39</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>1279.7</td>
<td>1311.1</td>
<td>30.9</td>
<td>0.24</td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>3.72</td>
<td>4.02</td>
<td>0.33</td>
<td>0.27</td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td>23.72</td>
<td>26.08</td>
<td>0.72</td>
<td>0.01</td>
</tr>
<tr>
<td>DMI, % BW³</td>
<td>2.26</td>
<td>2.41</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>F:G, lb feed/lb gain</td>
<td>6.38</td>
<td>6.66</td>
<td>0.46</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>Carcass characteristics</strong>⁴</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW, lb</td>
<td>812.3</td>
<td>820.9</td>
<td>15.4</td>
<td>0.49</td>
</tr>
<tr>
<td>Dress, %</td>
<td>63.48</td>
<td>62.65</td>
<td>0.59</td>
<td>0.12</td>
</tr>
<tr>
<td>Ribeye area, in²</td>
<td>12.80</td>
<td>13.22</td>
<td>0.61</td>
<td>0.36</td>
</tr>
<tr>
<td>REA, in².100 lb HCW⁻¹</td>
<td>1.57</td>
<td>1.61</td>
<td>0.05</td>
<td>0.55</td>
</tr>
<tr>
<td>12⁰ rib fat thickness, in</td>
<td>0.61</td>
<td>0.55</td>
<td>0.04</td>
<td>0.24</td>
</tr>
<tr>
<td>KPH, %</td>
<td>1.98</td>
<td>2.14</td>
<td>0.13</td>
<td>0.39</td>
</tr>
<tr>
<td>Marbling score⁵</td>
<td>419</td>
<td>435</td>
<td>4.3</td>
<td>0.04</td>
</tr>
<tr>
<td>Yield Grade</td>
<td>3.50</td>
<td>3.16</td>
<td>0.16</td>
<td>0.18</td>
</tr>
</tbody>
</table>

¹SEM = standard error of the mean.
²ADG = average daily gain; DMI = dry matter intake; F:G = ratio of feed to gain.
³DMI, % BW = DMI divided by the average of initial and final BW multiplied by 100.
⁴HCW = hot carcass weight; REA = ribeye area; KPH = kidney, pelvic and heart fat.
⁵Marbling grid: 300 = Slight⁰⁰, 400 = Small⁰⁰, 500 = Moderate⁰⁰.
### Table 2. Feedlot performance and carcass merit of yearling steers from intensive early stocking (IES) and season-long stocking (SLS) grazing management systems

<table>
<thead>
<tr>
<th>Item</th>
<th>IES</th>
<th>SLS</th>
<th>SEM(^1)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Steers</td>
<td>267</td>
<td>266</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Treatment means</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Stocker performance**

- **Winter phase**
  - Length, d: 161
  - Total gain, lb: 84.1
  - ADG, lb/d: 0.52

- **Summer phase**
  - Length, d: 72
  - Total gain, lb: 115.1
  - ADG, lb/d: 1.57

**Finishing performance**

- Days on feed, d: 147, 132, 10, 0.14
- Initial BW, lb: 703.1, 788.1, 47.1, 0.01
- Final BW, lb: 1200.9, 1227.7, 15.6, 0.25
- ADG, lb/d: 3.52, 3.39, 0.22, 0.32
- DMI, lb/d: 23.46, 23.48, 0.90, 0.98
- DMI, % BW\(^4\): 2.46, 2.33, 0.07, 0.03
- F:G, lb feed/lb gain: 6.68, 7.03, 0.44, 0.21

**Carcass characteristics**

- HCW, lb: 758.1, 768.9, 15.1, 0.52
- Dress, %: 63.12, 62.61, 0.70, 0.34
- Ribeye area, in\(^2\): 13.00, 13.12, 0.22, 0.55
- REA, in\(^2\)·100 lb HCW\(^{-1}\): 1.71, 1.72, 0.04, 0.62
- 12\(^{th}\) rib fat thickness, in: 0.46, 0.45, 0.03, 0.91
- KPH, %: 2.04, 2.06, 0.09, 0.86
- Marbling score\(^6\): 408, 409, 10, 0.90
- Yield Grade: 2.88, 2.83, 0.12, 0.65

\(^1\)SEM = standard error of the mean.

\(^2\)Data for the winter phase of the stocker period was not reported except for Gill et al (1991). Expected winter performance was estimated from December 1 to start of summer grazing for each study using previously published results of cattle grazing dry winter forage as outlined in the methods of this paper.

\(^3\)ADG = average daily gain; DMI = dry matter intake; F:G = ratio of feed to gain.

\(^4\)DMI, % BW = DMI divided by the average of initial and final BW multiplied by 100.

\(^5\)HCW = hot carcass weight; REA = ribeye area; KPH = kidney, pelvic and heart fat.

\(^6\)Marbling grid: 300 = Slight\(^{00}\); 400 = Small\(^{00}\); 500 = Moderate\(^{00}\).
Table 3. Intercept and slope (± SE) of the regression\(^1\) of finishing performance traits on stocker performance traits, placement body weight, and initial finishing empty body fat

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable(^2)</th>
<th>R(^2)</th>
<th>RMSE(^3)</th>
<th>Intercept Estimate</th>
<th>Estimate</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocker period length, d</td>
<td>Finishing ADG, lb/d</td>
<td>0.23</td>
<td>0.0937</td>
<td>3.5595 ± 0.1817</td>
<td>0.001533 ± 0.001081</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Finishing DMI, lb/d</td>
<td>0.41</td>
<td>0.5285</td>
<td>21.4626 ± 0.7374</td>
<td>0.009857 ± 0.004136</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Finishing Feed:Gain</td>
<td>0.06</td>
<td>0.0637</td>
<td>5.9459 ± 0.2399</td>
<td>0.000945 ± 0.001524</td>
<td>0.55</td>
</tr>
<tr>
<td>Stocker period total gain, lb</td>
<td>Finishing ADG, lb/d</td>
<td>0.01</td>
<td>0.0243</td>
<td>3.8873 ± 0.1663</td>
<td>-0.00023 ± 0.000748</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Finishing DMI, lb/d</td>
<td>0.22</td>
<td>0.5562</td>
<td>21.8843 ± 0.7190</td>
<td>0.005916 ± 0.002842</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Finishing Feed:Gain</td>
<td>0.44</td>
<td>0.1786</td>
<td>5.6083 ± 0.1790</td>
<td>0.002259 ± 0.001035</td>
<td>0.05</td>
</tr>
<tr>
<td>Stocker period ADG, lb/d</td>
<td>Finishing ADG, lb/d</td>
<td>0.03</td>
<td>0.0545</td>
<td>3.9370 ± 0.1588</td>
<td>-0.07528 ± 0.1188</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>Finishing DMI, lb/d</td>
<td>0.01</td>
<td>0.1128</td>
<td>23.2930 ± 0.6930</td>
<td>0.1537 ± 0.4775</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Finishing Feed:Gain</td>
<td>0.04</td>
<td>0.0851</td>
<td>6.0444 ± 0.2406</td>
<td>0.1179 ± 0.1820</td>
<td>0.53</td>
</tr>
<tr>
<td>Placement body weight, lb</td>
<td>Finishing ADG, lb/d</td>
<td>0.00</td>
<td>0.0072</td>
<td>3.8972 ± 0.4626</td>
<td>-0.00006 ± 0.0000624</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>Finishing DMI, lb/d</td>
<td>0.29</td>
<td>0.5802</td>
<td>18.8058 ± 1.8449</td>
<td>0.006065 ± 0.002437</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Finishing Feed:Gain</td>
<td>0.39</td>
<td>0.1771</td>
<td>4.6511 ± 0.5521</td>
<td>0.001996 ± 0.000775</td>
<td>0.03</td>
</tr>
<tr>
<td>Initial finishing empty body fat, %</td>
<td>Finishing ADG, lb/d</td>
<td>0.05</td>
<td>0.0517</td>
<td>3.7593 ± 0.2615</td>
<td>-0.00799 ± 0.02100</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Finishing DMI, lb/d</td>
<td>0.05</td>
<td>0.2010</td>
<td>22.2426 ± 0.9683</td>
<td>0.03114 ± 0.07996</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>Finishing Feed:Gain</td>
<td>0.17</td>
<td>0.2626</td>
<td>5.7054 ± 0.6421</td>
<td>0.04325 ± 0.04230</td>
<td>0.35</td>
</tr>
</tbody>
</table>

\(^1\)Regression analysis was conducted by evaluating the relationship between each of the finishing performance traits and stocker performance traits using a mixed model to adjust for difference in the relationship within individual studies.

\(^2\)ADG = average daily gain; DMI = dry matter intake.

\(^3\)RMSE = root mean square error, which is an estimate of the precision of the regression model.
Table 4. Description of additional studies with yearling production systems included in the fourth dataset to evaluate the relationship of finishing performance with length of stocker period, rate of gain and total gain during the stocker period, and placement body weight

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment Description</th>
<th>No. Animals</th>
<th>Feedlot Placement</th>
<th>DOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>McMurphy et al., 2011</td>
<td>Summer-weaned steers grazed late summer and fall native range</td>
<td>34</td>
<td>December 1</td>
<td>147</td>
</tr>
<tr>
<td></td>
<td>Summer-weaned steers grazed late summer and fall native range followed by winter wheat pasture</td>
<td>30</td>
<td>March 12</td>
<td>116</td>
</tr>
<tr>
<td>Capitan et al., 2004</td>
<td>Fall-weaned steers grazed winter wheat pasture followed by summer pasture</td>
<td>48</td>
<td>August 19</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Fall-weaned steers grazed winter dormant native range followed by summer pasture</td>
<td>50</td>
<td>August 19</td>
<td>83</td>
</tr>
<tr>
<td>Choat et al., 2003</td>
<td>Fall-weaned steers grazed winter wheat pasture</td>
<td>59</td>
<td>May 10</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Fall-weaned steers grazed winter dormant native range</td>
<td>38</td>
<td>May 10</td>
<td>130</td>
</tr>
<tr>
<td>Hersom et al., 2004; exp. 1</td>
<td>Fall-weaned steers grazed winter wheat pasture at a low stocking rate</td>
<td>16</td>
<td>April 6</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>Fall-weaned steers grazed winter wheat pasture at a high stocking rate</td>
<td>16</td>
<td>April 6</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>Fall-weaned steers grazed winter dormant native range</td>
<td>16</td>
<td>April 6</td>
<td>163</td>
</tr>
<tr>
<td>Hersom et al., 2004; exp. 2</td>
<td>Fall-weaned steers grazed winter wheat pasture at a low stocking rate</td>
<td>16</td>
<td>May 10</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Fall-weaned steers grazed winter wheat pasture at a high stocking rate</td>
<td>16</td>
<td>May 10</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>Fall-weaned steers grazed winter dormant native range</td>
<td>16</td>
<td>May 10</td>
<td>158</td>
</tr>
</tbody>
</table>
Table 5. Description of additional studies included in the fifth dataset to evaluate the relationship of finishing performance with initial finishing empty body fat

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment Description</th>
<th>No. Animals</th>
<th>DOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleman et al., 1995a, b</td>
<td>Weaned steers fed a sorghum silage-based growing diet for 145 days in drylot prior to finishing</td>
<td>32</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>Weaned steers limit-fed a corn grain-based diet to match rate of gain of silage-fed steers for 145 days in drylot prior to finishing</td>
<td>32</td>
<td>105</td>
</tr>
<tr>
<td>Sainz et al., 1995</td>
<td>Weaned steers fed an alfalfa hay/oat straw-based diet in drylot to gain 240 lb body weight prior to finishing</td>
<td>30</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>Weaned steers limit-fed a corn grain-based diet in drylot to match rate of gain of alfalfa hay-fed steers prior to finishing</td>
<td>30</td>
<td>89</td>
</tr>
</tbody>
</table>
Figure 1. Relationship between feed intake during finishing and length of the stocker period from weaning in the fall to feedlot placement. IES = intensive early stocking management system, SLS = season-long stocking management system, and Other = production systems described in Table 4. See Table 3 for regression statistics.

Figure 2. Relationship between dry feed intake during finishing and total gain during the stocker period. IES = intensive early stocking management system, SLS = season-long stocking management system, and Other = production systems described in Table 4. See Table 3 for regression statistics.
Figure 3. Relationship between dry feed intake during finishing and placement body weight. IES = intensive early stocking management system, SLS = season-long stocking management system, and Other = production systems described in Table 4. See Table 3 for regression statistics.

Figure 4. Relationship between feed efficiency during finishing and total body weight gain during the stocker period. IES = intensive early stocking management system, SLS = season-long stocking management system, and Other = production systems described in Table 4. See Table 3 for regression statistics.
**Figure 5.** Relationship between feed efficiency during finishing and placement body weight. IES = intensive early stocking management system, SLS = season-long stocking management system, and Other = production systems described in Table 4. See Table 3 for regression statistics.

**Figure 6.** Relationship between feed efficiency during finishing and placement body weight for steers that previously grazed summer pasture under intensive early stocking (IES; solid line) or season-long stocking (SLS; dashed line) management. For IES, \( y = 4.1338 + 0.003623 \times \text{BW} \). For SLS, \( y = 0.1197 + 0.008773 \times \text{BW} \).
Figure 7. Relationship between feed efficiency during finishing and initial finishing empty body fat. Treatment means of individual studies are represented by different symbols according to the legend. See Table 3 for regression statistics.
Notes – Notes -- Notes
Managing Stocker Cattle for Growth and Health: Applying Science and Technology to Improve Forage-Based Beef Production?

Dr. Mark Branine
Pfizer Animal Health

MANAGING STOCKER CATTLE
FOR GROWTH AND HEALTH

Applying Science and Technology to Improve Forage-Based Beef Production

Manual Vela, Central Life Sciences
Mark Branine, Pfizer Animal Health

A “Funny” Thing happened to the Cattle Industry

It Changed

Development of Cattle Feeding Industry

Current cattle feeding industry has evolved during an age of relatively inexpensive energy and grain
When Corn was $3.60/Bu  Oil - $40.00
When Corn was $7.00/Bu  Oil- $100.00
Where will it go……."OGK"

Ethanol predicted to consume more corn than livestock

(26 Aug 2011) For the first time in US history vehicles are predicted to use more corn than livestock this year. According to USDA estimates, 5.1 billion bushels of corn will be used to make ethanol this year, compared to 4.9 billion for livestock feed.

"Ethanol is taking a larger and larger share of production," said Seth Meyer, an MU agricultural economist with the Food and Agricultural Policy Research Institute. "I know it’s been overtaking feed for a long time."

Parcell describes it as a perfect storm, this combination of ethanol-boosting government policies, jumps in oil prices starting in 2007 and a world economy that wants more meat. All these factors contribute to the exploding global demand for corn, which has significantly increased in price.

Higher corn prices provide incentives for farmers to grow more corn. They have also forced the livestock industry to reconsider its options. Livestock producers are looking for lower-cost alternatives, such as distiller grains created during the production of ethanol.

CAST Website

New Normal: Beef Production Systems in the Age of Expensive and Limited Grain and Energy Supplies

- Reduced supply and increased price of corn
- Increased use of by-products
- Economic effects
  - Cost
  - Profitability
- Are there Alternatives?
**The Stocker Program**

- Gain Response
- Morbidity
  - 1st Pulls
  - 2nd Pulls
  - Chronics
  - Med Cost
- Mortality
  - <2%
  - 3.5wt – 7.5wt
  - Genetics
  - Nutrition (then & now)
  - Prior Health Program

All of this for $.50 $1.00 $1.25 $1.50 $2.00.../hd/day

---

**“Permanently Higher Grain Prices are a Game Changer for US Beef Industry”**

- Shift from grain intensive to forage intensive systems to maintain competitiveness
- Higher grain prices increases the value of forage-based beef production
  - Increased potential for forage-based beef production
  - Cattle grown on forage longer to heavy weights
  - Heavier in-weights for entry into feedlot > reduced days on feed > decreased total grain use

---

**“The beef industry can survive high corn (grain) prices better than pork and poultry industries”**

- Ruminants have the capability to utilize both forages and grain-based diets, but...
  - Ruminants will always be less efficient in utilizing grain than pork and poultry
- Challenge:
  - Development of production systems that allow for efficient and profitable production of high quality beef using minimal inputs of grain
Goal: Efficient production of heavier weight cattle on pasture, range or alternative forage-based system
- Decrease number days on a grain-based finishing diet
- Maintain current standards of beef quality (marbling & tenderness)

Potential Methods:
- Managing the livestock – forage management interface
- Application of pharmaceutical technologies for health and productivity

2011 the Year of the “Efficiencies”

Market Strategies
- Niche Markets
  - Organic
  - Natural
  - Pure Breed
- Sale Barns
  - Video

Minerals (King Ranch Study)
- Conventional / Tabs
- Internal / External
- Parasite Control
  - Feed Thru External
  - Dewormer

Feeding Programs
- Forage
  - Stocking Rates
  - Delivery System
  - Forage Enhancing

Vaccines
- Blackleg
- Vibrio-Lepto
- BVD

Implants / Ionophores/Feed Additives
- Gain Response

Limitations of Forage-Based Beef Production
(D. Anibal Pontoniego, INTA)

Metabolizable energy extraction by ruminants from fibrous diets

Uncertainty:
1. Forage quality
2. Distribution (spatial and temporal),
3. Quantity (drought)
**Nutritional Component**

<table>
<thead>
<tr>
<th>Nutritional Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter content, %</td>
<td>Above 20</td>
</tr>
<tr>
<td>Crude protein, %</td>
<td>Range 14 to 18% DM</td>
</tr>
<tr>
<td>Neutral detergent fiber, %</td>
<td>Below 40</td>
</tr>
<tr>
<td>Acid detergent fiber, %</td>
<td>Below 25</td>
</tr>
<tr>
<td>In vitro digestibility, %</td>
<td>Above 85</td>
</tr>
<tr>
<td>DM intake, % BW</td>
<td>Above 2.5</td>
</tr>
<tr>
<td>ME concentration, Mcal/kg DM</td>
<td>Above 2.4</td>
</tr>
</tbody>
</table>

**Forage Intake**
- Quantity
- Digestibility
- Rate of passage

**Nutrient Density of Forage**
- Forage type
- Stage of growth
- Soil fertility

**Protein and Digestibility of Native Range Forage during summer**

- Two-Year Summary: Bogle, Engle and McCullough
Energy level of grasses are low in winter, increase in value in spring and remain high until frost.

Dry cows require 48% TDN, pairs 52%, and heifers 60% TDN.

Crude protein in grasses increases with grass growth in the spring and then undergoes a summer slump, recovering in the fall and sharply declining after frost.

Dry cows require at least 7%, pairs 10-12%, and replacement heifers 12-14% CP.

Like CP, phosphorus in grasses increases with grass growth in the spring and then undergoes a summer slump, recovering in the fall and sharply declining after frost.

Dry cows require at least .2%, pairs .3%, and replacement heifers .3% P.
Conventional Feeds
- Protein / Energy / Minerals
- Bulk, Sacked (Hand Fed, Feeders)

Commodities (Hand Fed)
- Extension Programs
  - DDG
  - CSM
  - WCS
- Corn

Delivery Products
- Blocks
- Liquid Feed
- Tubs
- Chemical
- Cooked
The Stocker Implementation

- Pasture Programs
  - Grass Management Programs
    - Utilize forage as the primary diet and enhance the productive performance of calves and stockers on native ranges or improved forages
  - Oklahoma Gold
  - Oklahoma SuperGold
  - Oklahoma Green Gold
  - Highly Digestible Fiber

1 pound of a 38%-41% High Protein Product

- Plus Rantocin, Bovatec (Aureomycin)
- Forage intake – Increases 20-30%
- Forage Digestibility – Improved 15-20%
- 1 lb yields .4 + .2 gain

Key Point
- Do Not Overgraze Pastures
- Late Summer – Early Fall

2.5 Lbs of a 25% High Quality Protein & Energy Product

- Best if Digestible Fiber ingredients are used
- 2.5 lbs. yields .7 + .2 Gain
- Depends on both forage as well as gain response desired

Oklahoma Gold

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- Depends on both forage as well as gain response desired
Oklahoma Green Gold

- Designed for winter pastures
  - Energy supplement to balance the high protein to energy ratio
  - 80-85% concentrate
  - Converts at 5 to 1

3-Phase Seasonal Feeding Program

I Don’t Know of a Keep It Simple Stupid Feeding Program
Continue Working on Enhancing Performance – Both Forage and Cattle (ADG and Health) at the most economical feeding programs Possible

1. Seasonal Feed
   A. High Protein Feeding (1-2 Lbs) (May-Oct)
   B. Mid Level Protein and Energy Feeding (2.5-5 Lbs) (Jan?-Mid July)
   C. Energy Feeding (2-4 Lbs) (Winter Forage)

2. Ration “Full Feed” Last 10–14 Days
   Depends On Forage Availability
   1. Dec-March 1
   - Ideality – Where are the cattle Going
   - Think “Microbial” Shift – Performance - 20:80 Rule

3. Mineral (Insurance)
   - Palatable
   - Free Choice
   - Conventional or Tub
The Prediction Response

- Response to an Energy Feed - .09 GAIN/Lb Feed
- One time Response to a High Protein Feed - .32 Lb GAIN/Day
- Response to a Protein Supplement - .09 GAIN/Lb Feed/Day
- Response to Ionophore at the Proper Level - .15-.2

1 Lb. High Protein Cube @ Bovatec - .32 + .09 + .2 = .61 Improvement - $.23
2 Lb. High Protein Cube @ Bovatec - .32 + .09 + .09 + .2 = .70 Improvement - $.46
4 Lb. Energy Feed @ N0 Bovatec - .09 + .09 = .36

- No Negative Impact on Forage and Digestibility
  - No negative associative effect (starch)
  - Rumen Environment not impacted
  - No Microbial Shift

Corn
- .3% BW - Reduction fiber digest
- Neg impact will occur when fed @Levels greater than .5% BW
- 5 set str = 2.5 Lbs. Corn

Highly Digestible Fiber

Highly Digestible Soybean Hulls

When supplemented @ less than .5% BW, the energy value of SBH is equivalent to corn (90% TDN, Dry matter basis)

- Research @ University of Florida
- Other HD Fiber Feedstuffs
  - Corn Gluten Feed
  - Brewers Grain
  - Beet Pulp

Remember Always watch the Fat % in all diets
### Predicted Added Performance

<table>
<thead>
<tr>
<th>Product</th>
<th>Feeding Rate/Lb/Day</th>
<th>Expected Performance</th>
<th>$ Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Cube 1</td>
<td>1.2</td>
<td>6</td>
<td>25/46</td>
</tr>
<tr>
<td>HP Cube 2</td>
<td>1.2</td>
<td>4</td>
<td>25/46</td>
</tr>
<tr>
<td>HP Liquid Feed (32)</td>
<td>1.2</td>
<td>4</td>
<td>15/30</td>
</tr>
<tr>
<td>HP Cooked Tub</td>
<td>1.2</td>
<td>4</td>
<td>25/46</td>
</tr>
<tr>
<td>HP Chemical Tub</td>
<td>1.2</td>
<td>4</td>
<td>NA</td>
</tr>
<tr>
<td>HP Block 1</td>
<td>2.3</td>
<td>9</td>
<td>38/72</td>
</tr>
<tr>
<td>HP Block 2</td>
<td>2.4</td>
<td>4</td>
<td>20/40</td>
</tr>
<tr>
<td>HP Liquid Feed (32)</td>
<td>2.3</td>
<td>4</td>
<td>20/36</td>
</tr>
<tr>
<td>HP Cooked Tub</td>
<td>2.4</td>
<td>4</td>
<td>40/80</td>
</tr>
<tr>
<td>HP Chemical Tub</td>
<td>2.4</td>
<td>4</td>
<td>36/72</td>
</tr>
<tr>
<td>Energy Ration</td>
<td>1-3.4</td>
<td>4</td>
<td>TBD</td>
</tr>
<tr>
<td>Mineral Tub</td>
<td>1.25</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Sacked Mineral +I</td>
<td>1.25</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>DDG</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Stockers

- **500 lb steer**
  - $160.00/cwt ($800.00)
- **800 lb steer**
  - $123/cwt ($984.00)

The key is to get him to 800 lbs for less than $1.23/lb of Gain.

### Current Situation

- [Graph showing Beef Production vs. Cattle Inventory](#)
### Technology Applications to U.S Beef Production - 1955 to 2010

- Improved efficiency of beef production
- Reduced production costs
- Improved health and well being of cattle
- Reduces the impacts of beef production on land use and environment
- Maintains steady consistent supply of high quality beef products at an affordable price to the consumer

__Elam and Preston, 2004__

### Effect of Pharmaceutical Technologies on Average daily Gain in Stocker Cattle

<table>
<thead>
<tr>
<th>Technology</th>
<th>Effect on daily growth rate, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anabolic Implants</td>
<td>12.85</td>
</tr>
<tr>
<td>Ionophores</td>
<td>7.74</td>
</tr>
<tr>
<td>Sub-therapeutic antimicrobials</td>
<td>6.87</td>
</tr>
<tr>
<td>Dewormers</td>
<td>17.79</td>
</tr>
<tr>
<td>Fly control</td>
<td>8.69</td>
</tr>
</tbody>
</table>

__John Lawrence and Maro Ibarburu, “Economic Analysis of Pharmaceutical Technologies in Modern Beef Production” Iowa State University__

### Estimated Cost of Production Impact of Pharmaceutical Technologies in Stocker Operations - 2005 data

<table>
<thead>
<tr>
<th>Technology</th>
<th>Break-even Price Reduction, %</th>
<th>Cost Savings per animal, $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anabolic Implants</td>
<td>2.54</td>
<td>18.19</td>
</tr>
<tr>
<td>Ionophores</td>
<td>1.46</td>
<td>11.93</td>
</tr>
<tr>
<td>Sub-therapeutic antimicrobials</td>
<td>1.22</td>
<td>9.57</td>
</tr>
<tr>
<td>Dewormers</td>
<td>2.74</td>
<td>20.77</td>
</tr>
<tr>
<td>Fly control</td>
<td>0.80</td>
<td>6.28</td>
</tr>
<tr>
<td>Combined technologies</td>
<td>10.40</td>
<td>80.79</td>
</tr>
</tbody>
</table>

__John Lawrence and Maro Ibarburu, “Economic Analysis of Pharmaceutical Technologies in Modern Beef Production” Iowa State University__
The 10 Hurdles

- 94% - Blackleg
- 86% - Shipping Fever / Pneumonia
- 86% - BRD
- 94% - Mineral
- 75% - Salt (yellow/white)
- 12% - Vitamin
- 10% - Liquid Feed
- 10% - Blocks
- 88% - Cake
- 45% - Tubo
- 100% - Forage

Cattle Husbandry Management
A “Team” Approach

Systems Approach
# Byproduct Storage Systems – What Works

Dr. Justin Waggoner  
Kansas State University

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## By-product Storage Systems (What Works)

### Byproducts

- Corn gluten feed
  - Dried (flakes or pellets)
  - Wet
- Distillers products
  - Dried
  - Modified
  - Wet

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## Dry Storage

[Image of dry storage structures]

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**Dry Storage**

- Overhead storage systems work with DDGS and pelleted corn gluten feed
  - Results have been mixed (Bridging)
    - Temperature and moisture
    - Feed should be cool and ~90% dry for success
- Commodity bay storage facilities work well with dried forms
  - Covered, 3 sided structure (wind loss)

**Bulk Density**

- Bulk Density lbs/cubic foot
  - Ground corn = 40
  - Dried distiller’s grain = 18-20
  - Wet distiller’s grain = 55-60
  - Dried corn gluten feed (pellets) = 26-33
  - Wet corn gluten feed = 25-30
- Most bins built on average of 50 lbs/cubic foot

**Bagging (modified and wet products)**

- Must be packed under low/no pressures to avoid bag failure
**Bunkers (using forage as bulking agent)**

- Key is to achieve a blend of forage and WDGS that may be packed
  - Proportions vary based on moisture content

**WDGS Bunker Storage Projects**

- Conducted 2 independent studies to assess the effects of storage on WDGS
  - A third project is in progress

- Objectives
  - Minimize labor and expense
  - Evaluate storage methods that will work on both large and small operations
### Average WDGS Temperature

![Average WDGS Temperature graph]

### Effect of Storage on Nutrient Composition

<table>
<thead>
<tr>
<th>Item</th>
<th>0 day</th>
<th>208 day</th>
<th>SEM</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM, %</td>
<td>36.3</td>
<td>36.7</td>
<td>0.49</td>
<td>0.64</td>
</tr>
<tr>
<td>CP, %</td>
<td>30.9</td>
<td>30.8</td>
<td>0.37</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>ADF, %</td>
<td>11.5</td>
<td>13.7</td>
<td>0.60</td>
<td>0.24</td>
</tr>
<tr>
<td>NDF, %</td>
<td>25.0</td>
<td>26.9</td>
<td>0.41</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>ADIN, %</td>
<td>3.3</td>
<td>4.1</td>
<td>0.24</td>
<td>0.25</td>
</tr>
<tr>
<td>Ca, %</td>
<td>0.08</td>
<td>0.08</td>
<td>0.02</td>
<td>0.62</td>
</tr>
<tr>
<td>P, %</td>
<td>0.91</td>
<td>1.04</td>
<td>0.07</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>S, %</td>
<td>0.67</td>
<td>0.63</td>
<td>0.02</td>
<td>0.69</td>
</tr>
<tr>
<td>pH</td>
<td>4.0</td>
<td>4.0</td>
<td>0.10</td>
<td>0.43</td>
</tr>
</tbody>
</table>

1. Effect of storage

### Mold and Aflatoxin

- To date we have not encountered any mycotoxin or aflatoxin levels in stored WDGS that would require any special feeding considerations
  - 3 studies

- A mycotoxin screen is recommended for WDGS stored in bunkers
Shrink and Total cost at Feedout

- Shrink losses have ranged from 6-20%
  - Typically estimate 10% shrink

- Total inputs for bunker storage
  - ARCH Hays (2009/2010 bunkers)
    - In cost = $60/ton
    - Feed out = $65.44 (shrink, plastic, labor, etc.)

Current WDGS Storage Project

3 covering systems (plastic, salt, uncovered)

1 load bunkers limestone base, highway dividers
Concrete Silage Bunker  
(20 Loads)
Bale and Concrete Divider bunkers

Bale and Concrete Divider bunkers
Trench silo (30 loads)
Vaccineology

Dr. Gregg Hanzlicek
Kansas State University

Outline
- Types of vaccines
- Vaccination program goals
- USDA vaccine label claims
- Why vaccines may fail to protect
- Study comparing two preventive health programs

Prevention of Disease at the Herd Level—ULTIMATE GOAL

- We are striving to ensure that herd protection (immunity) is above the level of disease challenge

Protection

Healthy

Disease Challenge
• If the protection level decreases to a lower level than the disease challenge OR the disease challenge increases to above the protection level = UNHEALTHY

Protection vs Disease Challenge

• Protection: colostrum antibodies, vaccinations, dewormers, proper nutrition, metaphylaxis

• Disease challenge: overcrowding, commingling, sanitation, biosecurity, other diseases

Disease Does Not Occur When There is a Balanced State

Bacteria:
- Colonization factors
- Toxins
- Enzymes
- Outer membrane proteins

Host:
- Skin as a barrier
- Coughing/cilia
- White blood cells

Adapted from: Rice, 2008
Other Factors Tip Balance in Favor of the Bacteria

Host:
- Skin as barrier
- Coughing/Cilia
- White blood cells

Bacteria:
- Colonization factors
- Toxins
- Enzymes
- Outer membrane proteins

Adapted from: Rice, 2008

Our Interventions Attempt to Restore the Balance

Host:
- Skin as barrier
- Coughing/Cilia
- White blood cells

Bacteria:
- Colonization factors
- Toxins
- Enzymes
- OMP

Vaccines
- Management
- Antibiotics

Adapted from: Rice, 2008

Vaccination program goals

- Stimulate an adequate immune response
  - The goal of any vaccination program

- Prevent clinical and subclinical disease
  - Clinical: Reduce treatments costs, mortality & production losses
  - Subclinical: Reduce mortality/Reduce production losses

- Prevent shedding
  - For organisms not normally present in calf populations
    - Some of the viruses: what about bacteria?
    - Is BRDC a contagious disease?
Herd Immunity

- Minimize disease impact with high proportion of protected (immune) animals
- Immunity of less than 100% is often sufficient

- DZ = diseased
- S/I = susceptible/infected
- P = protected (immune)

The concept of “Herd Immunity”

- Transmission of communicable diseases will not continue within a group of animals if the percentage of resistant (protected/immune) animals in the group is above a certain threshold—(70%-80%?)
- On the other hand if the number of animals within a space (pen) is high or the “bug” dose is sufficiently high, all animals within the pen may be effectively susceptible to infection even with adequate vaccination.

Vaccines and vaccination programs

- No vaccine or vaccination program is 100% effective
Reasons vaccines/programs may fail to protect

- Administered at the improper time
- Administered inappropriately
- Inappropriately handled
- Animal does not respond
- Vaccine strain does not match field strain

Reasons vaccines may fail to protect

Administered at the "improper" time
- Maternal antibodies present
  - Antibodies interfere with both MLV & Killed vaccines (Myth/measuring the wrong thing?)
- Calf is already incubating the disease
- Vaccines administered upon arrival
  - When does exposure occur?
    - Prior to or shortly after delivery (salebarn, pot, commingled pen)
  - How long after vaccination before an active immunity occurs?
    - Modified live—antibodies (protection) present in 4-5 days (?)
    - Killed—antibodies (protection) present in 10-14 days (?)

Reasons vaccines may fail to protect

Vaccine inappropriately handled
- MLV (Modified Live Vaccine) left in sun/allowed to heat
- MLV given when ambient temps >90°F
- MLV administered in a vaccine gun containing disinfectant
- Killed vaccine that was frozen then thawed
- Expired vaccine
Reasons vaccines may fail to protect

Administered inappropriately
- Intramuscular vaccine given subcutaneously or vice versa
- Injectable vaccine given intranasally
- Vaccinate the hair and not the animal (or reduced dose)
- Killed vaccine not boostered or poor booster timing

1 dose vs. 2 dose killed vaccine

A booster 10-28 days later is essential for adequate protection

Reasons vaccines may fail to protect

Animal does not respond to the vaccine
- Age: maternal antibody blocked; maternal antibodies interfere with MLV & Killed vaccines (Myth/Measuring the wrong thing?)
- Immunosuppressed animal: stress (travel, commingling, dietary change, social disruption, other pathogens such as BVDV)
- Genetics
- Concurrent diseases (BVDV, Mycoplasma, etc.)
- Bad luck (response is not absolute)
Reasons vaccines may fail to protect

Vaccine strain/serotype does not match field strain

- Not all vaccine strains protect against all field strains
  - Depends some on how closely the strains are related
- Most BVDV field strains are 1b whereas vaccine strains are 1a
  - Vista™ products have been shown to have the ability to protect against 1b challenge after inoculation with the Vista™ that contains strain 1a.

Vaccine label claims

- **Prevention of infection**: A claim that it is intended to prevent infection may be made only for products able to prevent all colonization or replication of the challenge organism in vaccinated and challenged animals.
- **Prevention of disease**: A claim that it is intended to prevent disease may be made only for products shown to be highly effective in preventing clinical disease in vaccinated and challenged animals.
- **Aid in disease prevention**: A claim that it is intended to aid in disease control may be made for products which have been shown to alleviate disease severity, reduce disease duration, or delay disease onset.
- **Aid in disease control**: A claim that it is intended to aid in disease prevention may be made for products shown to prevent disease in vaccinated and challenged animals by a clinically significant amount.
- **Other claims**: Products with beneficial effects other than direct disease control, such as the control of infectiousness through the reduction of pathogen shedding, may make such claims if the size of the effect is clinically significant and well supported by the data.
Vaccine Approval by USDA

- Does NOT require evidence of field efficacy
- Subsequent lack of field efficacy does NOT jeopardize the USDA license
- Link to “Veterinary Services Memorandum No. 800.202 “General Licensing Considerations: Efficacy Studies”
  

“The effect of an intervention program in the population is often termed effectiveness.” USDA memorandum

Vaccine approval by USDA, cont.

“USDA vaccine licensing does not require evidence of efficacy in cattle under normal farm and ranch conditions and only requires evidence of efficacy against specific aspects of disease.”

Vaccineology Recommendations

- Work with your veterinarian for help choosing the appropriate vaccines for YOUR operation
  - No one program fits all operations!!
- Work with your veterinarian to set up appropriate vaccination schedules
  - Timing is important!!
- Work with your veterinarian to set up appropriate vaccination monitoring systems
  - Is my program working??
A field study evaluating health, performance, and behavior differences in crossbred beef calves administered different vaccine-parasiticide product combinations

Published in Vaccine 2010; 28 : 5998–6005

Gregg A. Hanflick, Brad J. White, David G. Renter, Dale E. Blain

Study Objective

• Compare health, performance, and behavior differences between two stocker-calf arrival health programs—one a minimally invasive program (MIN) and the other a more invasive program (MOR).

• Hypothesis: calves administered the minimally invasive program may outperform in health and performance and behave differently than calves administered the more invasive program.

Minimal Invasive (MIN)

• Arrival
  o 1 intranasal 4-way BRDC viral vaccine
  o 1 subcutaneous 2 cc Clostridium
  o Oral parasiticide
  o Topical parasiticide

• Revaccination (day 28)
  o 1 subcutaneous 2 cc Clostridium

More Invasive (MOR)

• Arrival
  o 1 intramuscular 4-way BRDC viral vaccine
  o 1 subcutaneous 5 cc Clostridium
  o 1 subcutaneous parasiticide

• Revaccination (day 28)
  o 1 single antigen BRDC intramuscular vaccine
  o 1 subcutaneous 5 cc Clostridium
Outcomes

- Call aversion to program administration (arrival only)
  - Vocalization
- Health: bovine respiratory disease (BRDC)
  - Mortality
  - Morbidity
  - Case fatality
  - 1st treatment success
  - Chronicity

- Performance
  - ADG
    - Arrival to day 28
    - Day 28 to day 42
    - Arrival to day 42
  - Feed to gain
  - Feed intake (feed delivered)

- Behavior: 3 weeks after arrival and 2 weeks after revaccination (day 28)
  - Mean steps taken/24 hours
  - Percentage of time spent lying down/24 hours

Study overview

- Kansas State Beef Stocker Unit (KBSU)
- Two replicates
  - Approx. 300 calves each
  - 3 truckloads/replicate
- Approximately 42 days in length
- Crossbred bulls and steers
- Purchased through order-buyer
- Each truckload housed within 8 pens
  - 11-14 calves per pen

Percentage Vocalizing at Initial Program Administration

<table>
<thead>
<tr>
<th>Program</th>
<th>MIN</th>
<th>MOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocalizing%</td>
<td>40.0%</td>
<td>46.2%</td>
</tr>
</tbody>
</table>
### Health—(BRDC)

#### Percentages and p-values for health outcomes by program

<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>Program</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity</td>
<td>MIN 59.7% (184/308)</td>
<td>MOR 47.3% (146/305)</td>
</tr>
<tr>
<td>Mortality</td>
<td>MIN 3.5% (11/308)</td>
<td>MOR 1.9% (6/305)</td>
</tr>
<tr>
<td>Case Fatality</td>
<td>MIN 5.9% (11/184)</td>
<td>MOR 4.1% (6/146)</td>
</tr>
<tr>
<td>Chronic</td>
<td>MIN 16.8% (31/184)</td>
<td>MOR 11.6% (17/146)</td>
</tr>
<tr>
<td>1st Treatment success</td>
<td>MIN 39.1% (72/184)</td>
<td>MOR 35.6% (52/146)</td>
</tr>
</tbody>
</table>

### Performance

#### Combined Reps

<table>
<thead>
<tr>
<th>Production parameter*</th>
<th>MIN</th>
<th>MOR</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG (lbs) arrival to day 28</td>
<td>2.74</td>
<td>2.95</td>
<td>0.04</td>
</tr>
<tr>
<td>ADG (lbs) day 28 to day 42</td>
<td>2.18</td>
<td>2.27</td>
<td>0.46</td>
</tr>
<tr>
<td>ADG (lbs) arrival to day 42</td>
<td>2.55</td>
<td>2.71</td>
<td>0.04</td>
</tr>
<tr>
<td>Feed: gain (lbs as fed: lbs gain)</td>
<td>7.31</td>
<td>6.91</td>
<td>0.72</td>
</tr>
<tr>
<td>Feed intake (mean pounds/pen/day)</td>
<td>192.3</td>
<td>191.8</td>
<td>0.07</td>
</tr>
</tbody>
</table>

*Model included program as fixed and load and replicate as random effects

### Behavior—steps taken/24 hours

| Least square mean steps taken per 24 hour by program* |
|-----------------|-----|-----|---------|
| Arrival (day 1-13) | MIN 2620 | MOR 2449 | 0.07 |
| Revaccination (day 28-42) | MIN 3584 | MOR 3362 | 0.23 |

*Gender, replicate and pen random effects
**Behavior:** Percentage of time lying down, revaccination to day 41 (morbid calves removed from data set)

- **Summary**
  - Unique study looking at complete arrival health programs
  - Neither program was particularly effective in preventing BRDC in this study
  - Differences found:
    - Vocalization
    - Morbidity
    - Average daily gain
    - Activity
Notes – Notes -- Notes
**By-products and Corn Professing for Lightweight Cattle**

Dr. Sean Montgomery  
Corn Belt Livestock Services

---

### Corn Byproducts and Corn Processing for Lightweight Feeder Cattle

Sean P. Montgomery, Ph.D., PAS  
Beef Cattle Nutritionist  
Corn Belt Livestock Services

---

#### Dry Milling

- Corn  
  - Grind  
  - Wet  
  - Cook  
  - Fermentation  
  - Yeast  
  - Enzymes  
  - Still  
  - Ethanol  
  - CO₂  
  - Stillage  
  - Solubles  

- WDGS, DDGS

#### Wet Milling

- Corn  
  - Steep  
  - Grind  
  - Steep Liquor  
  - Separation  
  - Starch  
  - Gluten meal  
  - Oil  
  - Bran  
  - WCGF  
  - DCGF

---

Beef Stocker 2011 Field Day  
September 22, 2011  
Page 107
Comparing DGS and CGF

<table>
<thead>
<tr>
<th></th>
<th>DGS</th>
<th>CGF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Fat</td>
<td>10 - 14</td>
<td>3 - 3.5</td>
</tr>
<tr>
<td>ADF</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>NDF</td>
<td>46</td>
<td>40</td>
</tr>
<tr>
<td>NE gain</td>
<td>0.78 - 0.85</td>
<td>0.60 - 0.65</td>
</tr>
<tr>
<td>CP / DIP</td>
<td>30 / 45</td>
<td>20 / 75</td>
</tr>
</tbody>
</table>

Effect of WCGF on Ruminal pH

![Graph showing pH levels over time for WCGF and Corn](image)

Effect of WCGF (P < 0.01). Montgomery et al. (2004).

Digestibility and Passage Rate

<table>
<thead>
<tr>
<th>Item</th>
<th>WCGF</th>
<th>Corn</th>
<th>P =</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM</td>
<td>86.8</td>
<td>84.0</td>
<td>0.02</td>
</tr>
<tr>
<td>NDF</td>
<td>75.7</td>
<td>58.2</td>
<td>0.01</td>
</tr>
<tr>
<td>Starch</td>
<td>96.7</td>
<td>92.7</td>
<td>0.03</td>
</tr>
<tr>
<td>Passage rate, %/h</td>
<td>3.8</td>
<td>2.7</td>
<td>0.01</td>
</tr>
</tbody>
</table>

*aBoth diets contained 20% hay; WCGF diet = 40% WCGF. Montgomery et al. (2004).*
WCGF in Growing Diets

Ah level x WCGF level interaction (P < 0.01).

Montgomery et al. (2003).

Fecal Starch and Starch Digestion (64-Trial Summary)

Zinn et al. (2002).
### Fecal Starch Equations

- **Total Tract Starch Digestion (TTSD)**
  \[
  TTSD = -0.6489(\%FS) + 100.5
  \]
- **Net Energy for Maintenance (NEm), Mcal/lb**
  \[
  NEm, \text{ Mcal/lb} = \frac{(2.50 - (0.021(\%FS)))}{2.204}
  \]
- **Net Energy for Gain (NEg), Mcal/lb**
  \[
  NEg, \text{ Mcal/lb} = \frac{(0.877(\%FS)) - 0.41}{2.204}
  \]

Adapted from Zinn et al. (2002).

### Fecal Starch Results

- **Whole Corn**
- **Rolled Corn**

![Graph showing Fecal Starch Results](image-url)
**Fecal Starch Results**

<table>
<thead>
<tr>
<th>TTSD, %</th>
<th>Whole Corn</th>
<th>Rolled Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>96</td>
<td>98</td>
</tr>
<tr>
<td>96</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>94</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>92</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>90</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>88</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>86</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>84</td>
<td>82</td>
<td>82</td>
</tr>
</tbody>
</table>

*TTSD = Total tract starch digestion.*

**Fecal Starch Results**

<table>
<thead>
<tr>
<th>NEg, Mcal/lb</th>
<th>Whole Corn</th>
<th>Rolled Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Diets Contained 25% WCGF (DMB)**

<table>
<thead>
<tr>
<th>Item</th>
<th>DRC</th>
<th>FGC</th>
<th>GHMC</th>
<th>SFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed:Gain</td>
<td>5.49a</td>
<td>5.29b</td>
<td>5.05c</td>
<td>4.91d</td>
</tr>
<tr>
<td>% Incr., diet</td>
<td>-</td>
<td>3.6</td>
<td>8.0</td>
<td>10.6</td>
</tr>
<tr>
<td>% Incr., corn</td>
<td>-</td>
<td>6.1</td>
<td>13.4</td>
<td>17.7</td>
</tr>
<tr>
<td>Fecal starch, %</td>
<td>19.2a</td>
<td>11.8b</td>
<td>8.4c</td>
<td>4.1d</td>
</tr>
</tbody>
</table>

*Means within a row with uncommon superscripts differ (P < 0.10).*  
*Expressed as % above DRC, calculated for diet and corn only (60%).*  
*Macken et al. (2003).*
### Diets Contained 32% WCGF (DMB)

<table>
<thead>
<tr>
<th>Item</th>
<th>WC</th>
<th>DRC</th>
<th>FGC</th>
<th>HMC</th>
<th>SFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed:Gain</td>
<td>5.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.56&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.35&lt;sup&gt;c&lt;/sup&gt;</td>
<td>5.29&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>5.21&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>% Incr., diet&lt;sup&gt;e&lt;/sup&gt;</td>
<td>-</td>
<td>6.6</td>
<td>10.1</td>
<td>11.1</td>
<td>12.4</td>
</tr>
<tr>
<td>% Incr., corn&lt;sup&gt;e&lt;/sup&gt;</td>
<td>-</td>
<td>12.5</td>
<td>19.2</td>
<td>21.1</td>
<td>23.6</td>
</tr>
<tr>
<td>Fecal starch, %</td>
<td>30.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.5&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>5.9&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>3.3&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a,b,c,d</sup>Means within a row with uncommon superscripts differ (P < 0.10).  
<sup>*</sup>Expressed as % above WC, calculated for diet and corn only (52.5%).  
Scott et al. (2003).

### Diets Contained 30% WDGS (DMB)

<table>
<thead>
<tr>
<th>Item</th>
<th>WC</th>
<th>DRC</th>
<th>FGC</th>
<th>HMC</th>
<th>SFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed:Gain</td>
<td>6.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.68&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>6.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.46&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.70&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>% Incr., diet&lt;sup&gt;e&lt;/sup&gt;</td>
<td>-</td>
<td>6.4</td>
<td>-1.3</td>
<td>10.0</td>
<td>6.1</td>
</tr>
<tr>
<td>% Incr., corn&lt;sup&gt;e&lt;/sup&gt;</td>
<td>-</td>
<td>10.4</td>
<td>-2.1</td>
<td>16.3</td>
<td>9.9</td>
</tr>
</tbody>
</table>

<sup>a,b,c</sup>Means within a row with uncommon superscripts differ (P < 0.05).  
<sup>*</sup>Expressed as % above WC, calculated for diet and corn only (61.4%).  
Vander Pol et al. (2006).

### Effect of WDGS on Receiving Cattle<sup>a,b</sup>

<table>
<thead>
<tr>
<th>Item</th>
<th>0</th>
<th>15</th>
<th>30</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, lb</td>
<td>10.47</td>
<td>11.37</td>
<td>11.11</td>
<td>0.27</td>
</tr>
<tr>
<td>ADG, lb</td>
<td>2.12</td>
<td>2.49</td>
<td>2.51</td>
<td>0.20</td>
</tr>
<tr>
<td>Feed:Gain</td>
<td>4.50</td>
<td>4.69</td>
<td>4.72</td>
<td>0.79</td>
</tr>
<tr>
<td>Morbidity, %</td>
<td>19</td>
<td>20</td>
<td>23</td>
<td>0.20</td>
</tr>
</tbody>
</table>

<sup>a</sup>180 high-risk crossbred steers (initial BW ± 468 ± 3 pounds).  
<sup>b</sup>Treatments were fed during a 42 day receiving period.  
Wagner et al. (2011).
Effect of WDGS on Receiving Cattle

<table>
<thead>
<tr>
<th>Item</th>
<th>0 WDGS</th>
<th>12.5 WDGS</th>
<th>25.0 WDGS</th>
<th>37.5 WDGS</th>
<th>P =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial BW, lb</td>
<td>465</td>
<td>458</td>
<td>461</td>
<td>461</td>
<td>0.78</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>558</td>
<td>551</td>
<td>549</td>
<td>553</td>
<td>0.61</td>
</tr>
<tr>
<td>DMI, lb</td>
<td>13.33</td>
<td>13.03</td>
<td>12.92</td>
<td>12.92</td>
<td>0.76</td>
</tr>
<tr>
<td>ADG, lb</td>
<td>2.64</td>
<td>2.58</td>
<td>2.64</td>
<td>2.64</td>
<td>0.76</td>
</tr>
<tr>
<td>Feed:Gain</td>
<td>5.00</td>
<td>5.26</td>
<td>4.76</td>
<td>4.76</td>
<td>0.36</td>
</tr>
</tbody>
</table>

*Treatments were fed during a 35 day receiving period. Smith et al. (2011).

KSU Experiment

- What are the effects of corn processing and feeding diets containing wet corn gluten feed (WCGF) to newly arrived calves?

KSU Experiment

- Two hundred seventy-nine newly arrived steers (initial BW = 508 lb)
  - 2 × 2 factorial arrangement of treatments
  - Treatments consisted of whole or dry-rolled corn with 0 or 30 percent Sweet Bran® brand WCGF
  - Steers were stratified by arrival weight and blocked by truck
KSU Experiment

- A total of 24 pens were used providing 6 pens per treatment
- Treatments were fed continuously for a total of 60 days (28 day receiving period followed by a 32 day growing period)

### Experimental Diets (% of DM)

<table>
<thead>
<tr>
<th>Item</th>
<th>WC 0 WCGF</th>
<th>DRC 0 WCGF</th>
<th>WC 30 WCGF</th>
<th>DRC 30 WCGF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole corn</td>
<td>47</td>
<td>29</td>
<td>47</td>
<td>29</td>
</tr>
<tr>
<td>Dry-rolled corn</td>
<td>47</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn supp.</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>WCGF supp.</td>
<td></td>
<td></td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Liq. molasses</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>WCGF</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Siverson et al. (unpublished).

### Diet Nutrient Composition (% of DM)

<table>
<thead>
<tr>
<th>Item</th>
<th>WC 0 WCGF</th>
<th>DRC 0 WCGF</th>
<th>WC 30 WCGF</th>
<th>DRC 30 WCGF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>0.62</td>
<td>0.62</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.43</td>
<td>0.43</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td>Salt</td>
<td>0.39</td>
<td>0.39</td>
<td>0.39</td>
<td>0.39</td>
</tr>
<tr>
<td>Potassium</td>
<td>1.17</td>
<td>1.17</td>
<td>1.19</td>
<td>1.19</td>
</tr>
<tr>
<td>Fat</td>
<td>3.46</td>
<td>3.46</td>
<td>3.07</td>
<td>3.07</td>
</tr>
<tr>
<td>ADF</td>
<td>15.80</td>
<td>15.80</td>
<td>17.44</td>
<td>17.44</td>
</tr>
</tbody>
</table>

Siverson et al. (unpublished).
### Effect of Corn Processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Whole</th>
<th>Rolled</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial BW, lb</td>
<td>508</td>
<td>508</td>
<td>0.70</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>711</td>
<td>711</td>
<td>1.00</td>
</tr>
<tr>
<td>DMI, lb</td>
<td>16.88</td>
<td>16.61</td>
<td>0.45</td>
</tr>
<tr>
<td>ADG, lb</td>
<td>3.40</td>
<td>3.39</td>
<td>0.93</td>
</tr>
<tr>
<td>Feed:Gain</td>
<td>4.98</td>
<td>4.99</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Siverson et al. (unpublished).

### Effect of WCGF

<table>
<thead>
<tr>
<th>Item</th>
<th>0 WCGF</th>
<th>30 WCGF</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial BW, lb</td>
<td>508</td>
<td>508</td>
<td>0.70</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>706</td>
<td>717</td>
<td>0.03</td>
</tr>
<tr>
<td>DMI, lb</td>
<td>16.47</td>
<td>17.02</td>
<td>0.13</td>
</tr>
<tr>
<td>ADG, lb</td>
<td>3.30</td>
<td>3.49</td>
<td>0.05</td>
</tr>
<tr>
<td>Feed:Gain</td>
<td>5.00</td>
<td>4.88</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Siverson et al. (unpublished).

### Energy Value of WCGF

- Based upon cattle growth performance and 1996 Beef NRC equations:
- The corn only diet provided 78 Mcal/lb of NEm and 50 Mcal/lb of NEg
- The WCGF diet provided 79 Mcal/lb of NEm and 51 Mcal/lb of NEg
Energy Value of WCGF

- Therefore WCGF calculates to contain 70 Mcal/lb of NEg or 101 percent the energy of whole or dry-rolled corn when fed with 35 percent hay on a dry matter basis.

Evaluating Ration Consistency

- Coefficient of variation (CV)
  - Describes the variation within a set of observations
  - Calculated by dividing the standard deviation of a set of numbers by their mean (expressed as a percent)
- Commercial feedlot industry targets a CV of 10% or less
Coefficient of Variation (CV)

<table>
<thead>
<tr>
<th>Nutrient CV, %\text{abc}</th>
<th>Feedlot</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7</td>
<td>8.9</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Nutrients analyzed consisted of DM, CP, ADF, Ca, P, K, and Mg.
*Calculated using a total of three bunk samples from each feedlot.
*Values reported on a dry matter basis. 


Coefficient of Variation (CV)

<table>
<thead>
<tr>
<th>Nutrient CV, %\text{abc}</th>
<th>Feedlot</th>
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</thead>
<tbody>
<tr>
<td>4.7</td>
<td>8.9</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rumensin CV, %\text{bcd}</td>
<td></td>
<td>22.7</td>
<td>11.9</td>
<td>1.4</td>
</tr>
</tbody>
</table>

*Nutrients analyzed consisted of DM, CP, ADF, Ca, P, K, and Mg.
*Calculated using a total of three bunk samples from each feedlot.
*Values reported on a dry matter basis. 


Rumensin Coefficient of Variation (CV)

\[
y = -6.82x + 27.9
\]

\[
R^2 = 0.9604
\]

Order of Corn By-product Inclusion

*Calculated using a total of three bunk samples from each feedlot.
*Values reported on a dry matter basis. 

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Department of Animal Sciences & Industry

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College of Veterinary Medicine

“Knowledge for Life”