2009

Effects of Feeding High Levels of Byproducts in Different Combinations to Finishing Steers

Mallorie Wilken  
*University of Nebraska-Lincoln*

Matt K. Luebbe  
*University of Nebraska-Lincoln*, mluebbe2@unl.edu

Galen E. Erickson  
*University of Nebraska-Lincoln*, gerickson4@unl.edu

Terry J. Klopfenstein  
*University of Nebraska-Lincoln*, tklopfenstein1@unl.edu

Joshua R. Benton  
*University of Nebraska-Lincoln*, jbenton2@unl.edu

Follow this and additional works at: https://digitalcommons.unl.edu/animalscinbcr

Part of the Animal Sciences Commons

Wilken, Mallorie; Luebbe, Matt K.; Erickson, Galen E.; Klopfenstein, Terry J.; and Benton, Joshua R., "Effects of Feeding High Levels of Byproducts in Different Combinations to Finishing Steers" (2009). *Nebraska Beef Cattle Reports*. 534.  
https://digitalcommons.unl.edu/animalscinbcr/534

This Article is brought to you for free and open access by the Animal Science Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Nebraska Beef Cattle Reports by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.
Effects of Feeding High Levels of Byproducts in Different Combinations to Finishing Steers

Mallorie F. Wilken
Matthew K. Luebbe
Galen E. Erickson
Terry J. Klopfenstein
Josh R. Benton

Summary

A finishing experiment was conducted to determine the effects of feeding wet distillers grains plus solubles (WDGS) and wet corn gluten feed (WCGF) with or without corn on feedlot performance and economics. Six treatment diets were evaluated: 1) 83% corn; 2) 44% WDGS and 44% corn; 3) 33% WDGS, 33% WCGF and corn; 4) 33% WDGS, 33% WCGF and soyhulls; 5) 44% WDGS and 44% WCGF; and 6) 66% WDGS and grass hay. The highest average daily gain (ADG) and lowest feed-to-gain ratio (F:G) were observed with cattle fed 44% WDGS and corn. The poorest ADG and F:G were observed with cattle fed WDGS, WCGF and soyhulls. All other diets were intermediate in performance. Largest profit was from steers fed 44% WDGS and corn.

Introduction

Wet distillers grains plus solubles (WDGS) and wet corn gluten feed (WCGF) can replace corn in feedlot diets and will generally improve performance when fed up to 30% to 40% of the diet (2008 Nebraska Beef Report, pp. 35-36; 2007 Nebraska Beef Report, pp. 33-34; 2008 Nebraska Beef Report, pp. 25-26; 2007 Nebraska Beef Report, pp. 27-28), and are often cheaper than corn. The objective of the current study was to evaluate performance, carcass characteristics and economics when finishing cattle on diets containing WDGS or combinations of WDGS and WCGF at inclusions much greater than those studied in previous research.

Procedure

Finishing Performance

A finishing trial was conducted at the University of Nebraska Research Feedlot near Mead, Neb., using 288 yearling crossbred steers (BW = 823 ± 27 lb). Prior to initiation, steers were limit fed for five days to minimize gut fill differences. On day 0 and day 1, individual steer initial BW data were collected. Steers were blocked by BW, stratified within block and assigned randomly to pen. With eight steers per pen, pen was assigned randomly to one of six diet treatments. A total of 36 pens were utilized to provide six replications per treatment.

The six treatments included: 1) control (CORN) of 82.5% dry-rolled corn (DRC) and 5.0% molasses; 2) 43.8% WDGS and 43.8% DRC (WDGS:corn); 3) low blend with 32.8% WDGS, 32.8% WCGF and 21.9% DRC (LowBlend:corn); 4) soyhulls blend with 32.8% WDGS, 32.8% WCGF and 21.9% soyhulls (LowBlend:hulls); 5) high blend with 43.8% WDGS and 43.8% WCGF (HighBlend); and 6) 66.5% WDGS and 21.9% grass hay (WDGS:hay) all on a DM basis (Table 1). All diets contained 5.0% supplement and 7.5% alfalfa hay. WDGS was purchased at a commercial corn dry-milling plant (Abengoa Bioenergy, York, Neb.) and contained 32% dry matter (DM), 31.6% crude protein (CP), 13.8% fat and 0.75% sulfur. WCGF (SweetBran®, Cargill, Blair, Neb.) contained 26.7% protein, 4.7% fat and 0.56% sulfur. The supplement used for CORN was formulated to have a diet CP of at least 13.0% and included 1.10% urea. Supplement for the byproduct diets was calculated to keep the Ca:P ratio at 1.2 to 1. Supplement also were formulated to provide Rumensin® (Elanco Animal Health) at 320 mg/steer/day, Tylan® (Elanco Animal Health) at 90 mg/steer/day, and thiamine at 130 mg/steer/day.

Steers were adapted to diets for 21 days and received a delayed implant of Revalor-S (Intervet, Millsboro, Del.) 28 days after trial initiation. Steers were fed for 141 days and were slaughtered at a commercial abattoir (Greater Omaha, Omaha, Neb.). Hot carcass weights (HCW) and liver scores were collected on the day of slaughter. After a 48-hour chill, LM area, 12th rib fat thickness and USDA marbling scores were recorded. USDA yield grade (YG) was calculated from HCW, fat depth, LM area and an assumed 2.5% kidney, pelvic and heart fat (KPH). A common dressing percentage (63%) was used to calculate the carcass adjusted performance of final BW, ADG and feed efficiency. Feed efficiency was analyzed as G:F and presented here as F:G.

Lab Analysis

Weekly feed samples were taken and DM tested using a 60° forced air oven for 48 hours. Composite samples for each ingredient over the feeding period were analyzed for CP, fat and

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CORN</th>
<th>WDGS: corn</th>
<th>Low Blend: corn</th>
<th>Low Blend: hulls</th>
<th>High Blend</th>
<th>WDGS: hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>DRC¹</td>
<td>82.5</td>
<td>43.8</td>
<td>21.9</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>WDGS²</td>
<td>—</td>
<td>32.8</td>
<td>32.8</td>
<td>32.8</td>
<td>43.8</td>
<td>65.6</td>
</tr>
<tr>
<td>WCGF³</td>
<td>—</td>
<td>—</td>
<td>21.9</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Soyhulls</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>21.9</td>
<td>—</td>
<td>21.9</td>
</tr>
<tr>
<td>Grass hay</td>
<td>5.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Molasses</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Supplement</td>
<td>0.153</td>
<td>0.403</td>
<td>0.474</td>
<td>0.476</td>
<td>0.587</td>
<td>0.549</td>
</tr>
</tbody>
</table>

¹Dry-rolled corn.
²Wet distillers grains plus solubles.
³Wet corn gluten feed.
sulfur (S). The combustion method was used for CP analysis (AOAC 990.03). Fat was analyzed using a gravimetric fat procedure modified at the University of Nebraska. Samples were sent to a commercial laboratory for sulfur analysis. Diet CP, fat and sulfur are presented in Table 1.

**Finishing Economics**

Economic analysis was performed on all six diets using 2007 average prices from Livestock Market News, AMS-USDA. Initial steer price was calculated as average initial BW of pen multiplied by 2007 USDA Nebraska auction market price ($107.74/cwt). Final steer price was calculated similarly with average final BW of pen as the experimental unit. The effects of increasing corn price to $3.50, $4.50 and $5.50 /bu also were analyzed, with WDGS considered at three different percentages of corn price (65%, 75% and 85%). All other feed prices remained the same, and feed prices remained the same, and least for steers fed LowBlend:hulls. Fat thickness was greater for steers fed WDGS:hay diet, despite a dietary S of 0.59%. No steers were diagnosed with polio on the WDGS:hay diet, despite a dietary S of 0.55%.

Steers fed WDGS:hay had greater DMI (Table 2) than those fed WDGS:corn and HighBlend (P < 0.01). Intake for steers fed HighBlend was the lowest compared to all diets (P < 0.01). ADG was greatest for steers fed WDGS:corn and least for steers fed LowBlend:hulls. Steers fed WDGS:corn had lower F:G compared to all other diets (P < 0.01). Steers fed LowBlend:hulls had the highest F:G (P < 0.01). Interestingly, steers fed WDGS:hay and HighBlend and steers fed CORN had similar ADG and F:G. This analysis was performed with the animals remaining after eliminating from treatment those that died or were removed. The results would not be as favorable for steers fed HighBlend or steers fed LowBlend:hulls if the deads and removals had been included in the analysis.

Steers fed LowBlend:hulls had the lowest marbling scores and were statistically different (P < 0.01) for WCGF, and least for steers fed LowBlend:hulls. ADG was greatest for steers fed WDGS:corn and least for steers fed LowBlend:hulls. Steers fed WDGS:corn had lower F:G compared to all other diets (P < 0.01). Steers fed LowBlend:hulls had the highest F:G (P < 0.01). Interestingly, steers fed WDGS:hay and HighBlend and steers fed CORN had similar ADG and F:G. This analysis was performed with the animals remaining after eliminating from treatment those that died or were removed. The results would not be as favorable for steers fed HighBlend or steers fed LowBlend:hulls if the deads and removals had been included in the analysis.

Steers fed LowBlend:hulls had the lowest marbling scores and were statistically different (P < 0.01) from all other diets. Fat thickness was greatest for steers fed LowBlend:corn and lowest for those fed CORN. Steers fed CORN were also significantly different (P < 0.05) from all other diets for fat thickness and had the lowest calculated Yield Grade (YG). Only steers fed LowBlend:hulls were similar to CORN fed steers for calculated YG (P < 0.05).

(Continued on next page)

---

**Table 2. Effect of byproduct finishing diets on performance and carcass characteristics.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CORN</th>
<th>WDGS:corn</th>
<th>Low Blend:corn</th>
<th>Low Blend:hulls</th>
<th>High Blend</th>
<th>WDGS:hay</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FW, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IW, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW, lb</td>
<td>877b</td>
<td>916b</td>
<td>888b</td>
<td>850b</td>
<td>871b</td>
<td>875b</td>
<td>8</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Marb</td>
<td>516b</td>
<td>513b</td>
<td>502b</td>
<td>460b</td>
<td>492b</td>
<td>491b</td>
<td>13</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>LM area, sq. in.</td>
<td>14.1</td>
<td>13.8</td>
<td>13.7</td>
<td>13.5</td>
<td>13.6</td>
<td>13.6</td>
<td>0.3</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>12th rib fat, in.</td>
<td>0.43b</td>
<td>0.52bc</td>
<td>0.55b</td>
<td>0.46ab</td>
<td>0.51bc</td>
<td>0.52bc</td>
<td>0.03</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Yield grade</td>
<td>2.9b</td>
<td>3.4b</td>
<td>3.4b</td>
<td>3.1b</td>
<td>3.2b</td>
<td>3.3b</td>
<td>0.1</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

1CORN = control diet of 82.5% DRC; WDGS:corn = 43.8% WDGS and 43.8% DRC; LowBlend:corn = 32.8% WDGS, 32.8% WCGF; 21.9% DRC; LowBlend:hulls = 32.8% WDGS, 32.8% WCGF, 21.9% soyhulls; HighBlend = 43.8% WDGS and 43.8% WCGF; WDGS:hay = 32.8% WDGS, 32.8% WCGF, 21.9% grass hay.

2IW = initial weight; FW = final weight; DMI = dry matter intake; ADG = average daily gain; F:G = lb of feed consumed per lb of weight gained.

3HCW = hot carcass weight; Marb = marbling score: 400 = slight 0, 500 = small 0, etc.; LM area = longissimus dorsi muscle area; Yield grade = calculated USDA yield grade (yield grade = 2.5 + (2.5*12th rib fat) + (0.2*KPH%) + (0.0038*HCW) – (0.32*ribeye area).

< 0.05). Interestingly, steers fed WDGS:hay and HighBlend and steers fed CORN had similar ADG and F:G. This analysis was performed with the animals remaining after eliminating from treatment those that died or were removed. The results would not be as favorable for steers fed HighBlend or steers fed LowBlend:hulls if the deads and removals had been included in the analysis.

Steers fed LowBlend:hulls had the lowest marbling scores and were statistically different (P < 0.01) from all other diets. Fat thickness was greatest for steers fed LowBlend:corn and lowest for those fed CORN. Steers fed CORN were also significantly different (P < 0.05) from all other diets for fat thickness and had the lowest calculated Yield Grade (YG). Only steers fed LowBlend:hulls were similar to CORN fed steers for calculated YG (P < 0.05).

(Continued on next page)
Due to cattle deaths and removals, economics were analyzed with these cattle not included (deads out) in performance calculations and with them included, as well as deads in.

As seen in Table 3, with deads out, WDGS:corn had the lowest breakeven price, along with the lowest cost of gain, and was statistically different (P < 0.01) from all other diets. LowBlend:hulls had the highest BE and highest COG (P < 0.01). Although economics were statistically similar to CORN, the performance of the steers fed LowBlend:hulls was much poorer. Another comparison of CORN to WDGS:hay was interesting as both sets of steers performed similarly in the feedlot, but the grass hay-fed steers had a higher price due to the price of corn.

With deads and removals included in the analysis, cattle fed HighBlend and LowBlend:hulls showed much lower profit than all other treatments. Steers fed HighBlend initially showed a profit of $19.31/head, but inclusion of cattle that died or were removed from treatment turned profit to a loss of -$126.73/head. Steers fed LowBlend:hulls with deads out had a profit of -$14.69/steer, which decreased to -$56.54/head with deads in because of a death (and removal) rate of 12.5% and 4.2% for HighBlend and LowBlend:hulls, respectively.

Steers fed WDGS:corn had the greatest profit (Table 4) regardless of corn price. These steers were the most efficient and sold the most weight. Steers fed WDGS:hay performed similarly to steers fed CORN; however, their profitability was greater due to feeding a less expensive diet and selling the same amount of weight.

With the increasing price of corn, the WDGS:hay diet became increasingly competitive in relationship to the CORN and the WDGS:corn diets. With corn at $5.50/bu and WDGS at 65% the price of corn, the WDGS:hay diet had nearly the same profitability as the WDGS:corn diet. Also, the WDGS:hay diet was consistently more profitable compared to the CORN diet at all price levels and percentages of WDGS.

From this study, we can conclude it is possible to feed byproduct diets with no corn and not forfeit feedlot performance compared to feeding corn diets. The best performance and economic results were observed with steers fed 44% WDGS with corn or a blend of WDGS and WCGF with corn, like the byproduct and corn combinations typical for Nebraska. Knowing that roughage can be substituted on an equal NDF basis (Benton et al., 2007 Nebraska Beef Report, pp. 29-32), grass hay, alfalfa hay or even cornstalks need to be included at higher levels in diets with very large inclusions of WDGS to manage dietary S as shown with the 66% WDGS and hay diet in this study. Even so, the optimum diet is dependent on prices of WDGS and WCGF relative to the price of corn.

1Mallorie F. Wilken, graduate student; Matthew K. Luebbe, research technician; Galen E. Erickson, associate professor; Terry J. Klopfenstein, professor; Josh R. Benton, research technician, Animal Science, Lincoln, Neb.

<p>| Table 3. Effect of byproduct finishing diets on economics. |</p>
<table>
<thead>
<tr>
<th>Treatment</th>
<th>CORN</th>
<th>WDGS: corn</th>
<th>Low Blend: corn</th>
<th>Low Blend: hulls</th>
<th>High Blend</th>
<th>WDGS: hay</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEADS OUT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE, $/cwt</td>
<td>91.91</td>
<td>87.41</td>
<td>90.07</td>
<td>93.24</td>
<td>94.01</td>
<td>0.91</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>COG, $/cwt</td>
<td>69.02</td>
<td>60.69</td>
<td>65.02</td>
<td>70.52</td>
<td>65.19</td>
<td>1.38</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>P/L, $/hd</td>
<td>6.64</td>
<td>70.63</td>
<td>30.43</td>
<td>-14.69</td>
<td>19.31</td>
<td>24.27</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>DEADS IN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE, $/cwt</td>
<td>91.49</td>
<td>86.99</td>
<td>89.66</td>
<td>96.82</td>
<td>93.66</td>
<td>3.40</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>COG, $/cwt</td>
<td>67.55</td>
<td>59.21</td>
<td>63.53</td>
<td>79.05</td>
<td>83.88</td>
<td>10.54</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>P/L, $/hd</td>
<td>10.76</td>
<td>74.74</td>
<td>34.54</td>
<td>-56.54</td>
<td>-126.73</td>
<td>28.38</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

1CORN = control diet of 82.5% DRC; WDGS:corn = 43.8% WDGS and 43.8% DRC; LowBlend:corn = 32.8% WDGS, 32.8% WCGF, 21.9% DRC; LowBlend:hulls = 32.8% WDGS, 32.8% WCGF, 21.9% soyhulls; HighBlend = 43.8% WDGS and 43.8% WCGF; WDGS:hay = 32.8% WDGS, 32.8% WCGF, 21.9% grass hay.

2Dead or removed cattle due to treatment (9 total) not included in performance analysis to calculate economic value of treatments.

3Dead or removed cattle due to treatment (9 total) included in performance analysis to calculate economic value of treatments.

4Breakeven = (initial steer cost ($107.74/cwt) + feed cost + interest + health&processing + yardage + death loss) / FW.

5Cost of Gain = (feed cost + interest + health&processing + yardage + death loss) / (FW-IW).

6Profit/Loss = final steer value ($92.10/cwt) – (initial steer cost ($107.74/cwt) + feed cost + interest + health&processing + yardage + death loss) / FW.

7$0.50/steer applied.

8$20/steer applied.

9$0.33/steer applied.

101.5% death loss applied.

a,b,c,dWithin a row, means without common superscript differ (P < 0.05).

<p>| Table 4. Economic effects of increasing corn price in relationship to WDGS as a percent of corn price on profit or loss1 per dietary treatment relative to steers fed corn. |</p>
<table>
<thead>
<tr>
<th>Corn Price</th>
<th>WDGS Price2</th>
<th>CORN</th>
<th>WDGS: corn</th>
<th>Low Blend: corn</th>
<th>Low Blend: hulls</th>
<th>High Blend</th>
<th>WDGS: hay</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/bu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.50</td>
<td>65</td>
<td>—</td>
<td>87.23</td>
<td>30.98</td>
<td>-20.27</td>
<td>19.65</td>
<td>50.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>—</td>
<td>75.73</td>
<td>22.04</td>
<td>-29.11</td>
<td>8.34</td>
<td>32.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>—</td>
<td>64.24</td>
<td>13.10</td>
<td>-37.94</td>
<td>2.98</td>
<td>14.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.50</td>
<td>65</td>
<td>—</td>
<td>92.72</td>
<td>31.74</td>
<td>-4.32</td>
<td>24.60</td>
<td>71.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>—</td>
<td>77.94</td>
<td>20.25</td>
<td>-15.68</td>
<td>10.05</td>
<td>48.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>—</td>
<td>63.16</td>
<td>8.76</td>
<td>-27.03</td>
<td>4.51</td>
<td>24.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.50</td>
<td>65</td>
<td>—</td>
<td>98.22</td>
<td>32.50</td>
<td>11.64</td>
<td>29.55</td>
<td>92.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>—</td>
<td>80.15</td>
<td>18.46</td>
<td>-2.24</td>
<td>11.77</td>
<td>64.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>—</td>
<td>62.09</td>
<td>4.42</td>
<td>-16.12</td>
<td>-6.02</td>
<td>35.40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Profit/Loss = final steer value ($92.10/cwt) – (initial steer cost [price for CORN to breakeven] + feed cost + interest + health&processing + yardage + death loss).

2Price of WDGS as a % of corn price.

© The Board of Regents of the University of Nebraska. All rights reserved.