Wet Distillers Grains and Ratios of Steam-Flaked and Dry-Rolled Corn

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Introduction

Numerous studies have examined effects of feeding wet distillers grains plus solubles (WDGS) in combination with steam-flaked corn (SFC). Results from one of those studies indicated an interaction between SFC and WDGS (2007 Nebraska Beef Cattle Report, pp. 33).

Few data exist examining effects of feeding combinations of corn processed by different methods fed with WDGS. Therefore, the objective of the current study was to determine effects of feeding different ratios of dry-rolled corn (DRC) and SFC in diets that contain 35% (DM) WDGS on finishing performance and carcass characteristics.

Procedure

Yearling British x Continental steers (n = 480; initial BW = 779±51 lb) were used in an experiment conducted at the University of Nebraska–Lincoln (UNL) Panhandle research feedlot. Prior to the start of the experiment, cattle were given Bovi-Shield® Gold, Vision® 7, Safe-Guard®, Revoral® XS, and an electronic and visual ID. Cattle were limit fed (2% of BW) a 50% forage, 50% WDGS diet for a total of five days before the initiation of the trial. Steers were individually weighed two consecutive days (day 0 and day 1) after the limit feeding period to obtain an initial BW. Cattle were stratified by BW within three weight block (light, medium, and heavy) and assigned randomly to 40 pens (12 steers/pen). Dietary treatments (n = 10; four replications) were assigned randomly to pens within BW block. Treatments were ratio of SFC:DRC (SFC:DRC 0:100, 25:75, 50:50, 75:25, 100:0, % of corn DM) with or without 35% (DM) WDGS. Cattle were individually weighed at the end of the trial. Carcass adjusted performance was calculated using carcass weights adjusted to a common dressing percentage of 63%. Cattle were on feed for 160 days.

Incremental percentages of corn

Table 1.  Experimental diets (DM basis).

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>100:0</th>
<th>75:25</th>
<th>50:50</th>
<th>25:75</th>
<th>0:100</th>
<th>100:0</th>
<th>75:25</th>
<th>50:50</th>
<th>25:75</th>
<th>0:100</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRC²</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>25</td>
<td>0</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>25</td>
<td>0</td>
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<tr>
<td>SFC²</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>25</td>
<td>0</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>25</td>
<td>0</td>
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<tr>
<td>WDGS³</td>
<td>50</td>
<td>25</td>
<td>12.5</td>
<td>6.25</td>
<td>3.12</td>
<td>50</td>
<td>25</td>
<td>12.5</td>
<td>6.25</td>
<td>3.12</td>
</tr>
<tr>
<td>Corn Silage</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
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</tr>
<tr>
<td>Urea</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
</tr>
<tr>
<td>SBM</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Lab Analyzed Nutrient Composition

| CP %        | 12.3 | 12.2 | 12.2 | 12.2 | 12.2 | 16.1 | 16.1 | 16.1 | 16.1 | 16.1 |
| NDF %      | 12.6 | 12.3 | 12.0 | 11.8 | 11.5 | 22.6 | 22.4 | 22.3 | 22.1 | 21.6 |
| Fat %       | 2.8  | 2.8  | 2.9  | 2.9  | 3.0  | 5.6  | 5.6  | 5.6  | 5.7  | 5.7  |
| Starch %   | 61.5 | 61.5 | 61.4 | 61.4 | 61.3 | 37.6 | 37.6 | 37.7 | 37.6 | 37.5 |
| S %        | 0.12 | 0.12 | 0.13 | 0.13 | 0.13 | 0.26 | 0.26 | 0.26 | 0.27 | 0.27 |

Formulated Nutrient Composition

| Ca %     | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 |
| P %      | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 |
| K %      | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 |

Summary

Feeding different ratios of dry-rolled corn (DRC) and steam-flaked corn (SFC) in diets that contain 0 or 35% wet distillers grains plus solubles (WDGS) was evaluated. As SFC replaced DRC in diets containing no WDGS, F:G improved. Varying SFC and DRC ratio in diets containing 35% WDGS did not impact F:G. Feeding WDGS increased hot carcass weight, and fat depth while feeding different ratios of corn impacted marbling deposition. Wet distillers grains appears to reduce the positive impacts of feeding SFC in finishing diets when included at 35% of diet DM.

1DRC=dry-rolled corn.
2SFC=steam-flaked corn.
3WDGS=wet distillers grains plus solubles.
4Formulated to provide 30 g/ton Rumensin and 90 mg/steer/day Tylan®.
Animal performance, DMI variance, and carcass data were analyzed using the mixed procedure of SAS (SAS Inst. Inc., Cary, N.C.) as a randomized complete block design with pen serving as the experimental unit. Factors included in the model were corn processing ratio, WDGS, corn processing ratio x WDGS, with BW block as a fixed variable. If the corn processing ratio x WDGS interaction was significant ($P < 0.05$), simple effect means and $P$-values were reported and if a significant interaction was not detected, only main effect means and $P$-values were reported. Orthogonal contrasts were used to detect linear, quadratic, cubic, or quartic effects of corn processing ratio. The Proc Glimmix procedure of SAS was used for determining differences in liver score data.

### Results

There was a significant corn processing ratio x WDGS interaction for carcass adjusted F:G ($P = 0.03$; Table 2). Steers fed diets containing WDGS exhibited heavier final BW, greater ADG, and DMI ($P < 0.01$). Gain for steers fed diets containing no WDGS tended ($P = 0.07$) to increase linearly as SFC replaced DRC. Feed conversion improved quadratically ($P < 0.01$) as SFC replaced DRC in diets containing no WDGS (Figure 1). In this study, the numerically optimal ADG for cattle fed corn diets with no WDGS appeared to be diets with 75% SFC, 25% DRC (% of corn DM). Cattle

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### Table 2. Effect of corn processing ratio and wet distillers grains with solubles (WDGS) on finishing performance.

<table>
<thead>
<tr>
<th>Item</th>
<th>0 WDGS</th>
<th>25 WDGS</th>
<th>50 WDGS</th>
<th>75 WDGS</th>
<th>100 WDGS</th>
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<tbody>
<tr>
<td></td>
<td>0:100</td>
<td>25:75</td>
<td>50:50</td>
<td>75:25</td>
<td>100:0</td>
</tr>
<tr>
<td>Carcass Adjusted Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial BW, lb</td>
<td>778</td>
<td>776</td>
<td>781</td>
<td>780</td>
<td>779</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>1392</td>
<td>1405</td>
<td>1404</td>
<td>1424</td>
<td>1397</td>
</tr>
<tr>
<td>DMI, lb/day</td>
<td>25.3</td>
<td>24.8</td>
<td>23.7</td>
<td>24.1</td>
<td>23.0</td>
</tr>
<tr>
<td>ADG, lb/day</td>
<td>4.30</td>
<td>4.40</td>
<td>4.37</td>
<td>4.50</td>
<td>4.33</td>
</tr>
<tr>
<td>F:G</td>
<td>5.88</td>
<td>5.62</td>
<td>5.43</td>
<td>5.35</td>
<td>5.29</td>
</tr>
</tbody>
</table>

1 SFC:DRC = steam-flaked corn:dry-rolled corn.
2 $P$-value calculated from G:F.

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![Figure 1. Effect of corn processing ratio and wet distillers grains with solubles (WDGS) on feed efficiency. Data indicate an interaction ($P = 0.03$) between WDGS and ratio. Both WDGS and steam-flaked corn:dry-rolled corn (SFC:DRC) impacted F:G ($P < 0.01$). A cubic and quadratic effect ($P < 0.01$) due to SFC:DRC was detected for F:G.](image-url)
Table 3. Effect of corn processing ratio and wet distillers grains with solubles (WDGS) on carcass characteristics.

<table>
<thead>
<tr>
<th>Item</th>
<th>SFC:DRC1</th>
<th>WDGS</th>
<th>SEM</th>
<th>P-value2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass Data</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW, lb</td>
<td>897</td>
<td>885</td>
<td>7.7</td>
<td>0.17 &lt; 0.01 0.42</td>
</tr>
<tr>
<td>Marbling3</td>
<td>0.64</td>
<td>0.62</td>
<td>0.02</td>
<td>0.83 0.01 0.54</td>
</tr>
<tr>
<td>LM area, in²</td>
<td>13.0</td>
<td>13.1</td>
<td>0.19</td>
<td>0.51 0.25 0.96</td>
</tr>
<tr>
<td>Yield grade6</td>
<td>3.74</td>
<td>3.63</td>
<td>0.07</td>
<td>0.70 &lt; 0.01 0.89</td>
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<tr>
<td>PYG6</td>
<td>3.59</td>
<td>3.54</td>
<td>0.03</td>
<td>0.61 &lt; 0.01 0.94</td>
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<tr>
<td>Liver Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>10.42</td>
<td>7.98</td>
<td>5.38</td>
<td>8.05</td>
</tr>
<tr>
<td>A+</td>
<td>6.25</td>
<td>3.36</td>
<td>2.15</td>
<td>2.97</td>
</tr>
<tr>
<td>0</td>
<td>83.33</td>
<td>88.61</td>
<td>92.47</td>
<td>88.98</td>
</tr>
</tbody>
</table>

1SFC:DRC = steam-flaked corn:dry-rolled corn.
2P-values for liver score data were generated in Glimmix and came from the protected F test.
3Marbling score: 400 = Slight, 450 = Slight50, 500 = Small.
4Linear effect of SFC:DRC ratio (P = 0.02).
5Calculated as 2.50 + (2.5*fat depth, in) - (0.32*LM Area, in²) + (0.2*2.5 KPH) + (0.0038*HCW, lb).
6PYG = Preliminary yield grade.

fed diets containing all SFC with no WDGS experienced a 12.3% improvement in F:G compared to steers fed all DRC and no WDGS. This response in F:G is fairly typical. Feed conversion was not different (P > 0.05) across the different corn processing ratios for cattle fed WDGS; however, steers fed diets with all SFC had 4.3% better feed conversion compared to cattle fed all DRC with WDGS.

There were no corn processing ratio x WDGS interactions (P = 0.14) for carcass characteristics (Table 3). Cattle receiving the 35% WDGS treatment diets had heavier carcasses (920 lb; P < 0.01) compared with steers that were fed no WDGS (885 lb). Marbling was not impacted by WDGS (P = 0.22). Cattle fed WDGS diets had greater back fat thickness (P = 0.01) compared with cattle fed 0 WDGS. Steers consuming finishing rations with 35% WDGS had greater calculated yield grade and preliminary yield grade (P < 0.01) compared with cattle fed control diets with no WDGS. Data indicate no effect (P = 0.95) of WDGS inclusion on liver abscesses. Marbling increased linearly as DRC replaced SFC (P = 0.02). Fat depth was unchanged (P = 0.54) across the different corn processing ratios. There was a tendency for cattle fed diets containing DRC to have numerically (P = 0.06) less severe abscessed livers (A+, adhered) compared with cattle fed rations with 100% SFC. This is likely due to a dilution effect of DRC in reducing the level of highly fermentable starch coming from SFC and presumably acidosis. Longissimus muscle area was not different for cattle fed WDGS or among corn processing ratios.

No interaction (P = 0.95) between corn processing ratio and WDGS was observed for DMI variation. As SFC replaced DRC, intake variation was not different (P = 0.73) across the different corn processing ratios. Lack of intake variation suggests that feeding had little impact on inducing subacute acidosis. In this study, simple correlation between SFC bushel weight variance and intake variance was measured. Steam-flaked corn bushel weight averaged 31.5 lb/bu and had an average weekly standard deviation of 1.6 lb with a minimum flake density of 27.5 lb/bu and a maximum of 34.5 lb/bu. There was a very low correlation (r ≤ 0.17) between SFC bushel weight variance and intake variance. Most of the bushel weight variation was attributed to two loads of SFC (27.5 lb/bu) that were delivered on two consecutive loads and were fed over a five-day period. Intakes for all SFC treatments during this five-day period did not decrease in response to the more heavily processed SFC. Cattle fed diets containing 35% WDGS experienced less DMI variation (P < 0.01; 0.39 lb) than steers fed diets without WDGS (0.64 lb), which would suggest that steers fed WDGS experienced lower incidence of acidosis compared with steers not fed WDGS.

In summary, an interaction between corn processing ratio and WDGS occurred. Including WDGS in the finishing ration increased final BW, ADG, and DMI. Also, feed conversion was significantly improved by the addition of 35% WDGS in the diet. Feed conversion improved 4.3% when cattle were fed all SFC and 35% WDGS compared to steers fed all DRC and 35% WDGS. Cattle fed 0 WDGS experienced a quadratic improvement in F:G which resulted in a positive associative effect. The reason why F:G responded quadratically in steers fed diets with no WDGS is likely due to the reduction of acidosis by the addition of DRC which is less prone to induce sub-acute acidosis than SFC.