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Corn Bran, Solvent-Extracted Germ Meal, and Steep Liquor Blends for Finishing Yearlings

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Cattle respond differently as the ratio of corn bran or corn bran with solvent-extracted germ meal to steep liquor/distillers solubles is changed in finishing diets.

Summary

Finishing performance of yearling steers was used to assess eight treatments containing corn wet milling byproducts. Interactions were encountered for dry matter intake, average daily gain and feed efficiency as level of dietary steep liquor/distillers solubles increased and corn bran and(or) corn bran with solvent-extracted germ meal decreased. Average daily gain and feed efficiency increased as steep liquor/distillers solubles replaced corn bran or a combination of corn bran and solvent-extracted germ meal. Steep liquor with distillers solubles had higher feeding value than corn bran or solvent-extracted germ meal and solvent-extracted germ meal had 19.9 percent higher energy than corn bran.

Introduction

Corn wet milling allows for separation of corn grain into several components. Products of wet milling are further refined to yield ethanol and fructose from starch, oil from corn germ and gluten meal from corn protein. Whereas these products are destined to be marketed outside the cattle industry, corn bran, solvent-extracted germ meal, steep liquor and distillers solubles are byproducts of corn wet milling and are typically combined to produce corn gluten feed.

Replacing a portion of the corn in finishing diets with wet milling byproducts can enhance feed intake, average daily gain and feed efficiency of cattle. The benefit derived by feeding corn milling byproducts can be influenced by the ratio of byproducts to corn dry matter. Furthermore, individual byproducts may interact when blended, depending on the level of dietary inclusion, affecting intake, gain and feed handling characteristics (1998 Nebraska Beef Report, pp. 50-53). The objective of this experiment was to determine the effects of various blends of corn bran, solvent-extracted germ meal and steep liquor with distillers solubles on feed intake, ADG and feed efficiency in finishing yearling steers.

Procedure

Medium framed yearling steers (n=280, 782 lb) were fed for an average of 116 days to assess performance associated with either four blends of corn bran (BRAN) and steep liquor/distillers solubles (STEEP) or four blends of BRAN, STEEP and solvent-extracted germ meal (GERM). The finishing trial was initiated in mid-September when yearlings entered the feedlot following summer grazing. Steers were blocked by weight into one of four blocks and assigned randomly to treatment. Three blocks contained nine steers per pen, one block eight steers, for a total of 35 animals per treatment. Byproduct blends comprised 30 percent of dietary dry matter in each of the following eight treatments: 1) 24 percent BRAN, 6 percent STEEP; 2) 21 percent BRAN, 9 percent STEEP; 3) 18 percent BRAN, 12 percent STEEP; 4) 15 percent BRAN, 15 percent STEEP; 5) 12 percent BRAN, 12 percent GERM, 6 percent STEEP; 6) 10.5 percent BRAN, 10.5 percent GERM, 9 percent STEEP; 7) 9 percent BRAN, 9 percent GERM, 12 percent STEEP; and 8) 7.5 percent BRAN, 7.5 percent GERM, 15 percent STEEP (Table 1).

(Continued on next page)

Table 1. Composition of finishing diets (percent of DM).

	Treatment							
	STEEP : BRAN ratio				STEEP : BRAN : GERM ratio			
Item	6:24	9:21	12:18	15:15	6:12:12	9:10.5:10.5	12:9:9	15:7.5:7.5
High-moisture corn	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
Dry-rolled corn	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Alfalfa hay	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Steep liquor[a]	6.0	9.0	12.0	15.0	6.0	9.0	12.0	15.0
Corn bran	24.0	21.0	18.0	15.0	12.0	10.5	9.0	7.5
Germ meal	—	—	—	—	12.0	10.5	9.0	7.5
Molasses	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Supplement[b]	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

[a]Steep liquor blended with distillers solubles
[b]Contains Vitamin A, D and E premix, minerals, Rumensin-80, and Tylan.

Finishing diets were formulated to contain a minimum of 12.5 percent CP, .7 percent Ca, .35 percent P and .7 percent K. Adaptation to high concentrate diets was accomplished over 21 days using diets containing 45, 35, 25 and 15 percent alfalfa hay (DM basis) and were fed for three, four, seven and seven days, respectively. Byproduct blends were maintained at 30 percent of dietary dry matter throughout the adaptation process. High-moisture corn and dry-rolled corn replaced alfalfa hay as steers were adapted to the 92.5 percent concentrate finishing diet which contained 25 g/ton Rumensin and 10 g/ton Tylan.

Before obtaining initial weights on two consecutive days, yearlings were fed a common 50 percent roughage diet at 2.0 percent of body weight for five days. Steers were implanted with Synovex® Plus™ on day one, and fed once daily throughout the trial. Fat depth, quality grade and yield grade data were collected following a 24-hour chill. Hot carcass weight was divided by a common dressing percentage (62) to estimate final live weights.

Results

An interaction ($P<.05$) occurred for dry matter intake, ADG and feed to gain when STEEP replaced BRAN or BRAN/GERM. Dry matter intake exhibited a quadratic ($P=.06$) response when STEEP replaced BRAN and a linear response when STEEP replaced BRAN/GERM ($P=.05$) (Figure 1). Within the BRAN treatments, dry matter intake increased from 6 to 12 percent STEEP, but decreased at the 15 percent STEEP level. In the BRAN/GERM diets, dry matter intake was greatest at the ratio of 15 percent BRAN and GERM to 15 percent STEEP, but was similar for other treatments.

A linear increase ($P<.01$) in ADG was demonstrated within the BRAN/GERM treatments as STEEP increased in the diet from 6 to 15 percent. (Figure 2). This treatment also exhibited a quadratic response ($P=.03$) for ADG due to the mean for 12 percent STEEP. Although the gain exhibited for this STEEP level appears lower than others within this three-way combination, it is unreason-

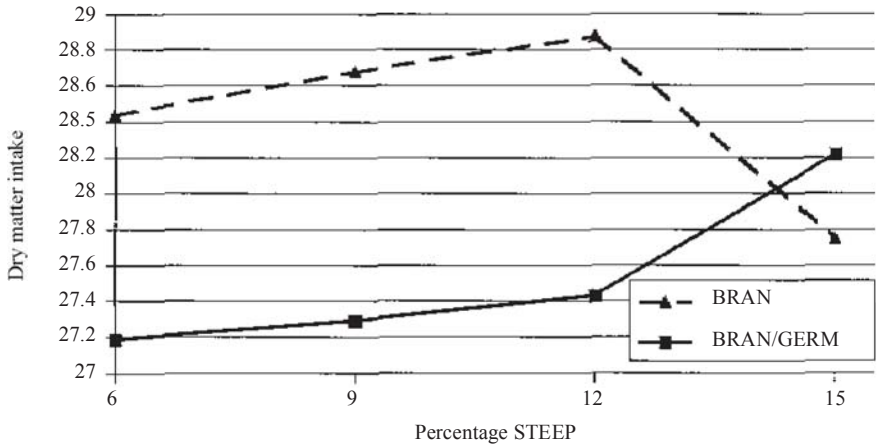

Figure 1. BRAN and BRAN/GERM by STEEP level interaction for dry matter intake.

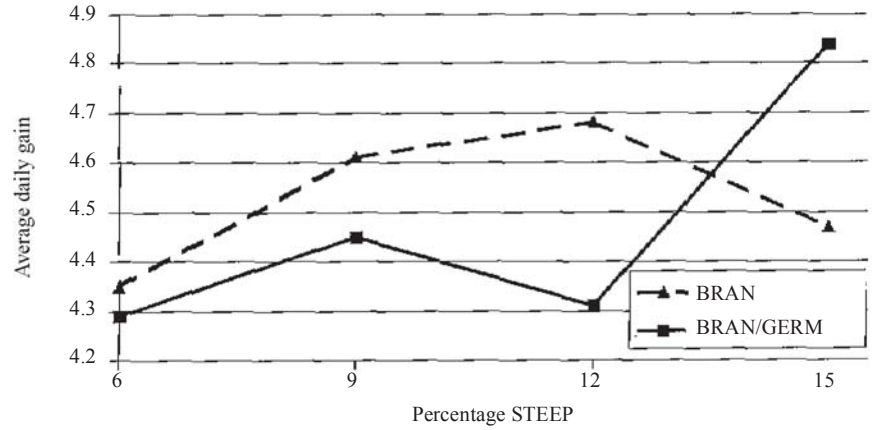

Figure 2. BRAN and BRAN/GERM by STEEP level interaction for average daily gain.

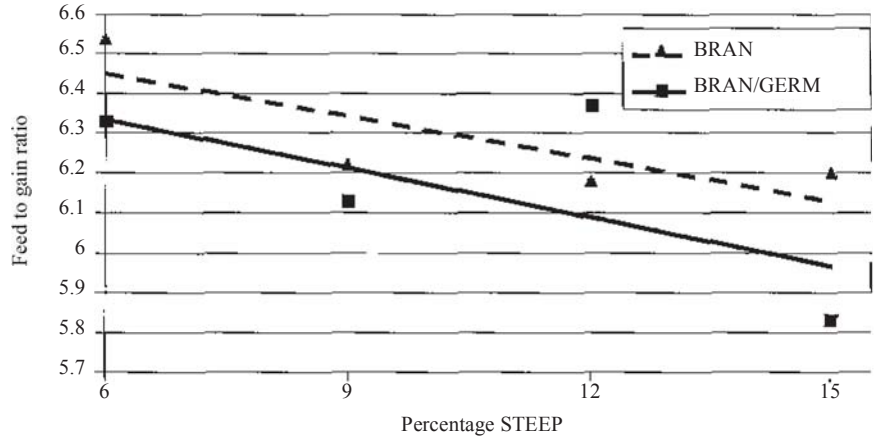

Figure 3. BRAN and BRAN/GERM by STEEP level interaction for feed to gain ratio. Points define actual means, whereas lines represent estimates obtained through linear regression.

Table 2. Performance data and carcass characteristics for yearling steers.

	Treatment							
	STEEP : BRAN ratio				STEEP : BRAN : GERM ratio			
Item	6:24	9:21	12:18	15:15	6:12:12	9:10.5:10.5	12:9:9	15:7.5:7.5
DM intake, lb/day[ab]	28.4	28.7	28.9	27.7	27.2	27.3	27.4	28.2
Daily gain, lb[ac]	4.35	4.61	4.68	4.47	4.30	4.45	4.31	4.84
Feed to gain[ad]	6.54	6.22	6.18	6.20	6.33	6.13	6.36	5.83
Hot carcass wt,lb[a]	797	816	819	807	789	801	796	829
Fat depth, in.	.53	.56	.53	.50	.49	.46	.51	.54
Quality grade[e]	18.6	18.8	18.9	19.0	18.9	18.7	19.3	18.9
Yield grade	2.6	2.7	2.8	2.8	2.4	2.6	2.6	2.7

[a]Corn bran and corn bran with solvent-extracted germ meal by steep liquor level interaction ($P<.05$).
[b]Corn bran, quadratic ($P=.06$); corn bran with solvent-extracted germ meal, linear ($P=.05$).
[c]Corn bran, quadratic ($P=.01$); corn bran with solvent-extracted germ meal, linear ($P<.01$).
[d]Corn bran, linear ($P<.05$); corn bran with solvent-extracted germ meal, linear ($P<.05$).
[e]High Select = 18, low Choice = 19.

able to conclude this depression is nutritionally based. We believe this mean was influenced by variation in gain potential of the yearlings, causing the noticeable departure from the linear nature of the response. Within the BRAN treatments, a quadratic response was observed for ADG ($P=.01$) with diets containing 9 and 12 percent STEEP exhibiting the highest daily gains.

A linear decrease ($P<.05$) in feed to gain was noted when BRAN or BRAN/GERM was replaced by STEEP. Within the BRAN/GERM treatments, the increased feed to gain associated with the 18 percent BRAN/GERM and 12 percent STEEP level (Table 2) is likely a function of the ADG for this treatment. A direct comparison of means for feed to gain between BRAN and BRAN/GERM treatments was not possible due to the significant interaction. However, linear regression analysis plotting feed efficiencies across STEEP levels (Figure 3) illustrated combining BRAN with GERM enhanced feed efficiency relative to BRAN alone.

A BRAN and BRAN/GERM by STEEP level interaction was observed for hot carcass weight which reflected the ADG data. Means for fat depth, quality grade and yield grade did not indicate a similar interaction, nor did carcass measures differ due to treatment (Table 2).

Dry matter intakes with corn bran finishing diets are typically higher than those encountered when less fibrous energy sources, such as dry-rolled corn, are used (1998 Nebraska Beef Report, pp. 50-53). Cattle consuming corn bran are less prone to experience subacute acidosis due to the slower nature of fiber fermentation compared with starch fermentation, whereas the high digestibility of corn bran allows for favorable gains. However, corn bran is lower in energy than corn, which may result in lower feed efficiency.

Results from this trial showed as BRAN replaced dietary STEEP, intakes generally increased and feed conversion diminished. A similar effect on efficiency was exhibited for the BRAN/GERM combinations, although intake increased as the BRAN/GERM blend was replaced by STEEP. Feed efficiency was enhanced when higher STEEP levels were fed in both the BRAN and BRAN/GERM treatments. Based on the regression analysis, STEEP had 155 percent the apparent energy value of BRAN and 173 percent the apparent energy value of BRAN/GERM. It is more likely STEEP influenced overall diet utilization rather than having an actual energy value this high. Responses in feed efficiency suggests solvent-extracted germ meal may have a higher energy value than corn bran. Based on the regression analysis, BRAN/GERM had 119.9 percent the energy of BRAN. Altering the ratio of corn bran and solvent-extracted germ meal in the production of corn gluten feed resulted in small changes in animal performance, whereas altering the level of steep liquor/distillers solubles had a greater impact on daily gain and efficiency.

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