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Evaluation of Corn Bran and Corn Steep Liquor for Finishing Steers

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Corn steep liquor has a higher energy value than bran and there is an associative effect between steep and bran when fed in combination.

Summary

Sixty yearling Hereford steers were used to evaluate the effect of replacing of dry rolled corn with various levels of corn bran and/or corn steep liquor in finishing diets. Steers fed 15% bran, 15 or 30% steep liquor or any combination of bran and steep gained faster than steers fed the dry rolled corn diet or the 30% bran diet. A product type x level interaction was observed for feed/gain. The first increment (15%) of bran or steep liquor added to the diet appears to be the most beneficial; steep liquor has a higher energy value than bran and there is an associative effect between steep liquor and bran.

Introduction

The increased production of fructose in Nebraska has resulted in various byproduct feedstuffs from the corn wet milling industry. Many of these byproduct feedstuffs are potential economic alternatives to corn. Corn bran and corn steep liquor are the main byproducts of corn sweetener and ethanol production and are the two major ingredients blended to produce wet corn gluten feed. Previous research has shown that wet corn byproducts are equal to or higher in energy than corn grain. The higher energy value of the byproducts has the potential to increase efficiency. The longer storage life of corn bran and corn steep liquor versus that of wet corn gluten feed may serve as a way to further expand the area to which byproduct feeding is an economically viable alternative to corn grain. Therefore, the objectives of this trial were to determine the feeding values of corn bran and corn steep liquor in finishing diets.

Procedure

Sixty yearling Hereford steers (722 lb) were used in a finishing trial from August 4 to December 15, 1995 (132 days). Steers were assigned randomly to one of nine dietary treatments based on the replacement of dry rolled corn (DRC) with corn bran (B) and/or steep liquor (S). The product referred to as steep liquor in this trial was actually a blend of steep and distiller's solubles. The distillers solubles is the liquid byproduct of alcohol production using yeast fermentation in the wet milling

Table 1. Diet composition (% DM basis).

	Diet[a]								
Item	DRC	15%B	30%B	15%S	30%S	15%B-15%S	15%B-30%S	30%B-15%S	30%B-30%S
Dry rolled corn	85.00	70.00	55.00	70.00	55.00	55.00	40.00	40.00	25.00
Corn bran	——	15.00	30.00	——	——	15.00	15.00	30.00	30.00
Steep liquor	——	——	——	15.00	30.00	15.00	30.00	15.00	30.00
Alfalfa silage	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Supplement[b]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

[a]DRC = dry rolled corn; B = corn bran; S = steep liquor.
[b,c]Includes vitamins, minerals, and feed additives.

Table 2. Effect of corn bran and steep liquor on performance.

	Diet[a]								
Item	DRC	15%B	30%B	15%S	30%S	15%B-15%S	15%B-30%S	30%B-15%S	30%B-30%S
Daily gain, lb	3.24[b]	4.26[c]	3.64[b]	4.35[c]	3.99[c]	4.37[c]	4.37[c]	4.33[c]	4.23[c]
DM intake, lb/day	22.7[d]	25.46[e]	25.99[e]	25.01[e]	23.94[d]	27.54[e]	28.37[e]	27.60[e]	27.23[e]
Feed/gain[hi]	6.99	5.99	7.14	5.75	5.99	6.29	6.49	6.37	6.45
Quality grade[j]	17.0[de]	17.8[defg]	16.9[de]	18.9[g]	17.7[def]	18.0[efg]	18.7[fg]	17.5[def]	16.7[d]
Yield grade	2.1[d]	2.8[ef]	2.6[def]	2.4[de]	2.6[def]	3.0[f]	3.5[g]	3.0[f]	3.0[f]
Fat thickness, in	.34[d]	.48[def]	.41[def]	.38[de]	.44[def]	.53[fg]	.63[g]	.49[efg]	.51[efg]

[a]DRC = dry rolled corn; B = corn bran; S = steep liquor.
[b,c]Means within a row with unlike superscripts differ (P<.01).
[d,e,f,g]Means within a row with unlike superscripts differ (P<.10).
[h]Feed/gain analyzed as gain/feed. Feed/gain is the reciprocal of gain/feed.
[i]Product type x level interaction (P<.01).
[j]17 = average select; 18 = high select; 19 = low choice.

plant. Steep liquor alone is the byproduct when corn sweetener is produced, but both steep liquor and distillers solubles are produced when alcohol is produced. Normally, steep liquor from wet milling plants contains some distillers solubles as does wet corn gluten feed. Corn bran and steep liquor were fed alone or in combination to replace 0, 15, 30, 45, or 60% of the DRC (DM basis). Diets were DRC control, 15% B, 30% B, 15% S, 30% S, 15% B-15% S, 15% B-30% S, 30% B-15% S, and 30% B-30% S.

Diets (Table 1) were formulated to contain (DM basis) a minimum of 13% CP, .70% Ca, and .30% P, and included 25 g/ton Rumensin and 10 g/ton Tylan. Steers were adapted by limit feeding finishing diets until ad libitum intake was reached. Steers were individually fed once daily using Calan gates. Steers were implanted with Revalor-S on day one and re-implanted with Revalor-S on day 69. Steers were housed in covered pens with 15 head per pen. Initial weights were the average of three consecutive weights taken before feeding. Final weights were calculated using hot carcass weight divided by a common dressing percentage (62). Hot carcass weights and liver abscess scores were recorded at slaughter. Fat thickness at the 12th rib, quality grade, and yield grade were recorded after a 48-hour chill.

Results

Steers fed B and/or S gained faster (P<.01) than steers fed DRC except for 30% B fed alone (Table 2). Steers fed 15% B or 30% B consumed more feed (P<.05) than steers fed DRC. Steers fed 15% S consumed more feed (P<.10) than steers fed DRC. Steers fed B and S in combination consumed more feed (P<.01) than steers fed DRC. A product type x level interaction (P<.01) was observed (Figure 1) for feed/gain. While some statistical differences in carcass characteristics were obtained, these differences were likely due to the limited number of observations per treatment and the inherent variation among animals rather than biological differences due to the dietary treatments.

The first increment of B (15%) markedly increased DM intake, daily gain, and efficiency (Figure 1), likely due to reduced acidosis. Steers fed the DRC diet may have experienced mild subacute acidosis. These cattle performed typically for grain fed cattle and it is likely that cattle fed these high grain diets experience some degree of acidosis in the feedlot. Wet milling byproducts have much lower starch content than DRC. Therefore, the inclusion of these byproducts reduces the starch content of the diet and as a result reduces acidosis. This has been clearly demonstrated with the feeding of wet corn gluten feed. The next increment of B (30%) reduced efficiency versus 15% B, suggesting that bran has less energy than the DRC that it replaced and that 15% B was sufficient to reduce acidosis. Feed efficiency for the 30% B diet was still equal to the control diet, likely because of the combination of acidosis control and energy content.

Both 15 and 30% S improved efficiency compared to cattle fed DRC, suggesting a higher energy value for S than for DRC. The first increment of S

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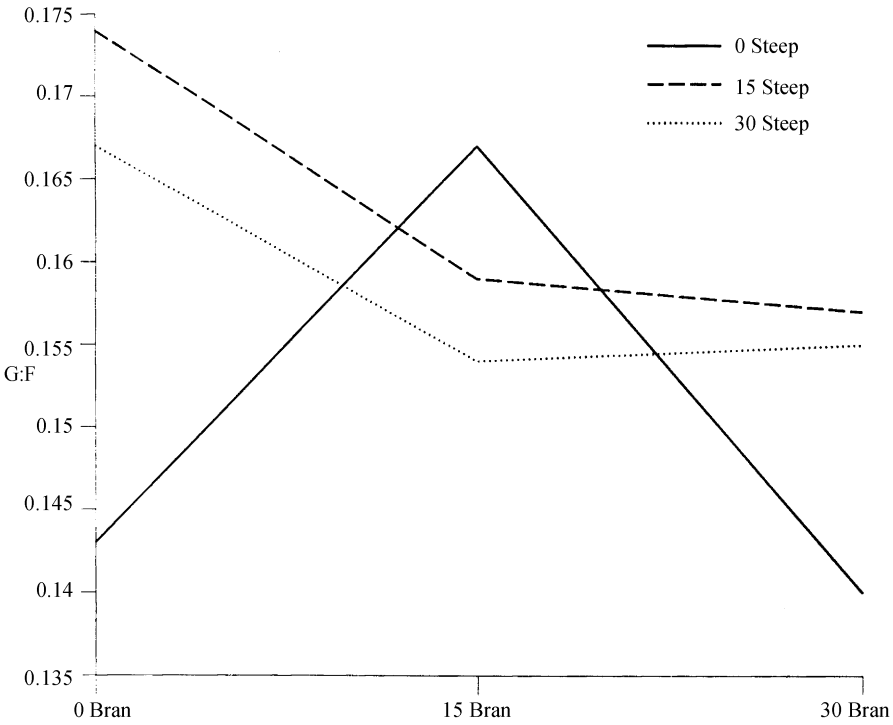

Figure 1. Interaction of level of bran and level of steep on feed efficiency.

(15%) gave as much response in efficiency and daily gain as 30% S, suggesting an effect other than energy content alone. Previous research at the University of Nebraska (1995 Nebraska Beef Report, pp 30-33) has shown increased lactate utilization by rumen microbes in steers fed distiller's solubles. The steep liquor used in this trial contained some distiller's solubles resulting from alcohol production. Thus, S would have reduced the starch content of the diet and may have enhanced lactate utilization by rumen microbes. The resulting net effect may have been reduced subacute acidosis.

Addition of B to diets containing both 15 and 30% S decreased efficiency suggesting lower energy content in B compared to S. The combinations of 15 or 30% S with 15 or 30 percent B resulted in diets similar to those containing 30-60% wet corn gluten feed. These ratios of S to B are probably representative of the range of values seen in the wet milling industry. Efficiencies were better than the control for all combinations of S and B. This is consistent with previous research with wet corn gluten feed especially where subacute acidosis is a factor in the high grain control diet. It is of interest to note that addition of 15% S to 30% B increased efficiency 12% when compared to 30% B fed alone, suggesting an associative effect between the S and B.

Results of this research indicate that replacement of dry rolled corn with corn bran (15 percent of diet DM), corn steep liquor, and corn bran and corn steep liquor in combination improved daily gain. Addition of corn bran, corn steep liquor (15% of diet DM), or corn bran and corn steep liquor in combination also increased DM intake. It appears the greatest efficiency response occurs with the first increment of B or S included in the diet. There may be an associative effect between B and S when fed in combination. This research also suggests that S is higher in energy than the dry-rolled corn it replaced.

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