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# Dried Corn Germ in Natural Finishing Programs Reduces Incidence of Liver Abscess

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## Introduction

Changes in consumer preference for beef produced without growth promotants, ionophores, or antibiotics and consumers' willingness to pay price premiums for such products have led some producers to begin raising beef under "natural" feeding regimens. Some natural programs prohibit use of injectable antibiotics, feed additive drugs, or growth promoting implants throughout the life of the animal. This creates challenges for maintaining efficient growth and preventing disease or metabolic disorders.

A key problem facing producers who feed cattle under a natural regimen, without use of antibiotics such as tylosin and ionophores, is ruminal acidosis, which is commonly linked with liver abscesses. Abscesses are the primary cause for condemnation of livers, and severe abscesses have been shown to decrease daily gains (ADG) and efficiency of gain (F:G). In addition, severely abscessed livers can lead to greater carcass trim, ultimately reducing hot carcass weight (HCW) and dressing percentages. *Fusobacterium necrophrum* and *Actinomyces pyogenes*, normal inhabitants of the bovine rumen, are believed to be the primary and secondary bacteria that cause liver abscesses. Acidosis frequently causes ruminitis, which allows these bacteria to enter the portal circulation and migrate to the liver. The bacteria then colonize in the liver, ultimately creating abscesses.

We previously observed a decrease in number of abscessed livers of approximately 5 to 7%, compared with controls, when dried, full-fat corn germ (GERM) was included in diets of finishing steers and heifers at rates ranging from 5 to 15%. These diets also included tylosin, which is commonly used to control liver abscesses. We speculated that adding GERM to the diet may decrease starch or alter intake patterns, resulting in decreased bouts of acidosis and subsequent ruminitis, or may suppress growth of *F. necrophorum*. Both scenarios could lead to decreased liver abscesses. The latter hypothesis was refuted in a previous study when we observed a tendency for increased concentrations of *F. necrophorum* when feeding supplemental fat at a rate of 4%.

Objectives of this experiment were to assess the effect of GERM on growth performance, carcass yield and quality grades, and incidence of liver abscesses when fed to finishing cattle as part of a natural feeding regimen applied under commercial feeding conditions.

## Experimental Procedures

Yearling Angus and Angus-cross steers and heifers (n = 4,199; initial body weight = 703 lb) were used to characterize feedlot performance, health, incidence of liver abscess, and carcass traits of feedlot cattle produced under a "natural" feeding regimen with and without GERM added to the finishing diet. Cattle were housed at a commercial feedlot in central Kansas. Prior to initiation of the experiment, cattle were grazing ryegrass or grass pasture. At processing, cattle were vaccinated for viral and clostridial diseases (Titanium IBR, AgriLabs, St. Joseph, MO, and Vision 7, Intervet Inc., Millsboro, DE), given an ex-

ternal parasiticide (Ivermax, RX Veterinary Products, Memphis, TN), tagged with color coded pen tags, and sorted into treatments on an every-other-head basis. After processing, cattle were pen weighed and placed in their respective pens.

Following a step-up period of 2 to 3 weeks, cattle were placed on one of two finishing diets (Table 1) primarily composed of corn: (1) traditional finishing diet containing no corn germ (Control) or (2) traditional finishing diet with 5% of the corn replaced with 5% dried corn germ on a dry-matter basis (5% GERM).

Samples were taken from each load of GERM delivered to the feedlot and analyzed for dry matter. Neutral detergent fiber of feed samples was analyzed by using the Ankom method (Ankom 200, Fairport, NY; AOAC, 2002). Samples were also analyzed for crude protein by using the combustion method (Leco FP2000, Leco Corp., St. Joseph, MI) and crude fat. Composition of the germ is shown in Table 2.

Prior to shipment to a commercial abattoir in Lexington, NE, cattle were visually sorted by feedlot personnel, and cattle being shipped were weighed. Days on feed, dry-matter intake, ADG, F:G, morbidity, and death loss were calculated for each pen of cattle. Slaughter data collected included HCW, incidence and severity of liver abscess, and dressing percentage. Additionally, USDA yield grade and USDA quality grades were determined by USDA graders.

Growth performance and carcass data were analyzed by using the GLM procedure of SAS. Pen was the experimental unit, and model effects included sex and treatment. Initial head count was included as a covariate to account for differences in pen size. Values were determined to be statistically different when $P \leq 0.05$.

## Results and Discussion

Finishing performance, carcass characteristics, and liver abscesses of cattle fed 0 or 5% GERM are presented in Tables 3 through 5. No sex × treatment interactions ($P \geq 0.11$) were observed; therefore, only main effects of finishing treatment are presented. Days on feed were not different between the two treatments ($P=0.39$); however, they were numerically higher for the Control treatment. There is little research concerning fat supplementation to finishing cattle that examines days on feed. Theoretically, adding moderate levels of fat to finishing diets would increase energy density of the diet, allowing animals to finish quicker and reduce days on feed.

Adding GERM to the diet resulted in no differences in ADG on a live basis ($P=0.63$); however, when adjusted HCW were used as the final weight, ADG was improved for cattle receiving GERM ($P=0.04$). Adding GERM to the diet did not affect F:G ($P \geq 0.21$).

The percentage of cattle that fell out of the natural program because of being treated for illness was not affected by treatment ($P=0.47$). Percentage of death loss tended ($P=0.06$) to increase for cattle receiving 5% GERM; however, death loss in both treatments was minimal and affected fewer than 1% of the animals.

All carcass traits measured except liver abscesses were unaffected by finishing treatment ($P \geq 0.15$). We previously observed linear increases in fat thickness and kidney, pelvic,

and heart fat and a quadratic increase in USDA yield grade 4 carcasses when increasing amounts of GERM were added to steam-flaked corn diets.

Incidence of liver abscess was reduced by 12% when GERM was added to the diet (P=0.01). The percentage of mild abscesses was unaffected by treatment (P=0.97). The percentage of moderate abscesses tended (P=0.11) to be reduced, and severe abscesses were reduced by 8.2% when GERM was added to the diet. We previously observed a linear decrease in incidence of liver abscesses in two experiments in which cattle were fed increasing levels of GERM. The decrease in incidence of liver abscesses could also be the result of some component of the GERM altering rumen fermentation or inhibiting some portion of the pathway in which liver abscesses are developed.

## Implications

Results of this experiment indicate that GERM can be used as a replacement for steam-rolled corn in finishing diets for naturally raised cattle. Growth performance and carcass characteristics were neither improved nor negatively affected by adding 5% GERM to diet. In addition, adding GERM to the diet may help control incidence of liver abscess in naturally raised cattle, a problem incurred by many producers who raise beef naturally, without use of tylosin.

**Table 1. Experimental diets and nutrient composition (formulated) for cattle fed 0 or 5% full-fat corn germ during the finishing period (dry-matter basis)**

| | | | | Finishing treatment | | | |
|---|---|---|---|---|---|---|---|
| | | | | Control | | 5% Germ | |
| Item, % | Step 1 | Step 2 | Step 3 | Step 4 | Finish | Step 4 | Finish |
| Steam-rolled corn | 45.1 | 55.2 | 64.2 | 72.8 | 78.5 | 70.3 | 73.5 |
| Corn germ | – | – | – | – | – | 2.6 | 5.1 |
| Alfalfa hay | 41.3 | 31.5 | 21.2 | 11.9 | 4.7 | 11.8 | 5.9 |
| Sorghum silage | 2.6 | 2.6 | 2.6 | 2.6 | 2.3 | 2.6 | 2.2 |
| Soybean straw | 2.4 | 2.4 | 2.4 | 2.4 | 3.6 | 2.4 | 2.4 |
| Wet distillers grains | 6.1 | 4.5 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 |
| Mineral supplement | 2.5 | 3.8 | 5.0 | 5.7 | 6.3 | 5.7 | 6.3 |
| Nutrient composition | | | | | | | |
| Crude protein, % | 14.73 | 14.23 | 14.05 | 13.63 | 13.32 | 13.69 | 13.59 |
| Crude fat, % | 3.73 | 3.76 | 3.90 | 4.03 | 4.11 | 5.08 | 6.20 |
| Calcium, % | 0.90 | 0.87 | 0.85 | 0.78 | 0.76 | 0.78 | 0.75 |
| Phosphorus, % | 0.32 | 0.32 | 0.32 | 0.33 | 0.33 | 0.33 | 0.34 |
| Potassium, % | 1.08 | 0.97 | 0.86 | 0.76 | 0.68 | 0.76 | 0.69 |
| $NE_m$, Mcal/kg | 36.16 | 38.15 | 40.07 | 41.95 | 43.11 | 42.71 | 44.70 |
| $NE_g$, Mcal/kg | 23.32 | 25.09 | 26.83 | 28.49 | 29.54 | 28.98 | 30.58 |

**Table 2. Laboratory analysis of dried full-fat corn germ samples taken from each load of corn germ delivered to the feedlot (dry-matter basis)**

| Sample date | Dry matter | Crude protein | Crude fat | Neutral detergent fiber |
|---|---|---|---|---|
| 03/19/2007 | 96.19 | 12.13 | 41.84 | 37.45 |
| 05/03/2007 | 96.55 | 12.88 | 45.16 | 34.61 |
| 06/14/2007 | 98.17 | 12.23 | 45.87 | 31.90 |
| 08/06/2007 | 98.08 | 12.16 | 45.61 | 34.34 |
| 09/05/2007 | 99.03 | 11.89 | 42.92 | 39.03 |
| 10/02/2007 | 97.12 | 12.49 | 45.70 | 34.39 |
| 10/23/2007 | 97.27 | 12.44 | 45.52 | 33.33 |
| 11/20/2007 | 97.32 | 12.50 | 46.71 | 36.56 |
| 12/17/2007 | 97.32 | 12.79 | 44.91 | 34.19 |
| 01/19/2008 | 98.13 | 12.40 | 45.11 | 31.42 |
| Mean | 97.52 | 12.39 | 44.94 | 34.72 |
| Standard deviation | 0.843 | 0.302 | 1.458 | 2.374 |

**Table 3. Feedlot performance of cattle fed 0 or 5% full-fat corn germ during the finishing period**

| | Treatment | | | |
|---|---|---|---|---|
| Item | Control | 5% Germ | SEM | P-value |
| No. of head | 2,102 | 2,097 | | |
| No. of pens | 13 | 13 | | |
| Days on feed | 173 | 168 | 4.76 | 0.41 |
| Initial wt, lb | 703 | 702 | 5.78 | 0.95 |
| Final wt, lb[1] | 1232 | 1226 | 11.5 | 0.61 |
| DMI, lb/day | 21.7 | 21.9 | 0.31 | 0.60 |
| ADG, lb/day | 2.71 | 2.73 | 0.044 | 0.63 |
| F:G | 8.05 | 8.01 | 0.13 | 0.85 |
| Carcass adjusted | | | | |
| Final wt, lb[2] | 1206 | 1215 | 10.9 | 0.58 |
| ADG, lb/d | 2.54 | 2.69 | 0.044 | 0.04 |
| F:G | 8.59 | 8.22 | 0.21 | 0.21 |
| Fallouts, %[3] | 0.21 | 0.32 | 0.11 | 0.44 |
| Death loss, % | 0.07 | 0.73 | 0.24 | 0.06 |

[1] Calculated as final body weight × 0.96.
[2] Calculated as HCW/0.635.
[3] Fallouts were cattle removed from the natural program because of being treated for illness with a medication that is not allowed to be given to cattle in the natural program.

**Table 4. Carcass characteristics of cattle fed 0 or 5% full-fat corn germ during the finishing period**

| | Treatment | | | |
|---|---|---|---|---|
| Item | Control | 5% Germ | SEM | P-value |
| Carcass wt, lb | 767 | 772 | 6.9 | 0.61 |
| Dressing percentage[1] | 61.9 | 62.6 | 0.430 | 0.23 |
| USDA quality grade, % | | | | |
| Prime | 2.4 | 3.4 | 0.794 | 0.39 |
| Premium choice | 39.6 | 36.5 | 2.952 | 0.44 |
| Low choice | 44.3 | 47.1 | 2.716 | 0.47 |
| Select | 12.6 | 12.6 | 1.768 | 1.00 |
| Standard | 0.9 | 0.4 | 0.223 | 0.15 |
| USDA yield grade, % | | | | |
| YG 1 | 0.5 | 0.8 | 0.242 | 0.37 |
| YG 2 | 23.5 | 19.7 | 3.637 | 0.45 |
| YG 3 | 59.6 | 60.8 | 3.055 | 0.77 |
| YG 4 | 15.3 | 17.3 | 2.356 | 0.55 |
| YG 5 | 1.1 | 1.4 | 0.386 | 0.57 |

[1] Calculated as HCW/final weight × 0.96.

**Table 5. Liver abscesses in cattle fed 0 or 5% full-fat corn germ during the finishing period**

| | Treatment | | | |
|---|---|---|---|---|
| Item, % | Control | 5% Germ | SEM | P-value |
| Total liver abscesses | 67.9 | 55.9 | 2.97 | 0.01 |
| Mild abscesses[1] | 27.3 | 27.2 | 1.34 | 0.97 |
| Moderate abscesses[2] | 18.6 | 14.9 | 1.58 | 0.11 |
| Severe abscesses[3] | 21.9 | 13.7 | 2.38 | 0.02 |

1 Mild = livers with one or two small abscesses.
2 Moderate = livers with two to four well organized abscesses less than 1 in. in diameter.
3 Severe = livers with one or more large abscesses.