"Evaluation of distillers' grains from ethanol plants for feedlot cattle"

USING DISTILLERS' GRAINS IN FEEDLOT DIETS

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RESEARCH INSTITUTIONS: Agriculture and Agri-Food Canada, University of Saskatchewan
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Background: Distillers grains with solubles (DDGS) are the residue left over when grain is fermented to produce ethanol for biofuel. Combined with high feed barley and corn prices, increased production of DDGS has led to the widespread use of these byproducts in feedlot diets. Since the fermentation process removes only the starch from the grain, other nutrients (e.g. fat, protein, fiber and minerals) are concentrated in the byproducts. DDGS have been successfully used in backgrounding diets for many years, but they are now being used at higher levels as both an energy and protein source in feedlot finishing diets.

These researchers are analyzing the variability in nutrient content in samples of wheat- and corn-based DDGS from different ethanol plants. They are also looking at the impact of feeding higher levels of corn- vs. wheat-based DDGS on digestibility, animal performance, health, and carcass quality of feedlot cattle, as well as the effect on nitrogen and phosphorus content in the manure.

Objectives: Develop a database for the nutrient composition and fermentation of DDGS, determine nutrient digestibility and environmental impact when feeding DDGS derived from wheat vs. corn, develop nutritional strategies that incorporate wheat-based DDGS into finishing rations as a substitute for silage, determine the impact of wheat- vs. corn-based DDGS on acidosis, digestive upsets, finishing performance, eating behavior and carcass quality traits of cattle, and examine the incidence of E. coli O157:H7 shedding in cattle fed wheat-based DDGS.

What they did: This project encompassed a number of studies to meet the objectives.

Determination of nutrient composition: 110 DDGS samples that varied by grain source (wheat, corn, or a blend of the two) and processing (traditional or fractional) were collected from ethanol plants in western Canada. The DDGS samples were analyzed for moisture, ash, crude protein, neutral detergent fibre (NDF), acid detergent fibre (ADF), and ether extract content.

Nutrient digestibility and environmental impact of feeding DDGS: Eight ruminally cannulated heifers were fed 4 different treatment diets; a control diet containing no wheat DDGS, a low (25%) wheat DDGS diet, a medium (30%) wheat DDGS diet, or a high (35%) wheat DDGS diet. The diets were formulated so that wheat DDGS was substituted for both barley grain and barley silage to evaluate whether wheat DDGS can be fed as both an energy and fibre (replacement for barley silage) source in finishing diets. In a separate trial, an additional

five rumen cannulated heifers were fed diets where barley was replaced by DDGS from wheat or corn at 20% or 40% of the diet on a dry matter basis.

Finishing performance, eating behaviour and carcass quality: Two hundred crossbred steers were fed one of four diets (control, 25% wheat DDGS, 30% wheat DDGS, 35% wheat DDGS) to determine feed intake, average daily gain, carcass quality, eating behaviour and blood metabolites. An additional 275 crossbreed steers compared differences in feedlot performance and carcass quality when barley was replaced with both wheat and corn DDGS at two inclusion levels (20 or 40% of diet dry matter). Two more trials (396 steers and 288 steers) evaluated the feeding value of DDGS from wheat, corn, or a mixture of the two grains in backgrounding and finishing diets. The final study of 240 crossbred steers examined the fatty acid profile of beef from cattle fed wheat DDGS at varying levels.

Effect of DDGS on fecal shedding & persistence of E.coli O157:H7: Both corn and wheat DDGS were examined in this study. The effect of replacing barley grain with corn or wheat DDGS at the 20% and 40% levels on survival of E.coli O157:H7 in incubations of rumen digesta and feces, as well as the effect on fecal shedding and persistence of E.coli O157:H7 in live cattle (9000 head in 30 commercial feedlot pens) was examined.

What they learned: Determination of nutrient composition: Substantial variations existed between types of DDGS (wheat vs. corn) as well as milling process (traditional vs. fractional) in terms of protein and energy content, as well as fermentation characteristics.

Nutrient digestibility and environmental impact of feeding DDGS: Replacing barley silage with increasing levels of wheat DDGS decreased intake of dry matter without changing crude protein intake. As wheat DDGS increased in the diet, mean ruminal pH tended to decrease as well. Replacing barley grain with wheat DDGS caused intake of crude protein and phosphorus levels to rise as the amount of DDGS in the diet increased. Feed intake was similar when barley grain was replaced by DDGS. Results demonstrated that wheat DDGS can be effectively used to replace both barley grain and silage at a moderate level in a finishing diet. However, if a diet contains less than 10% silage or other forage, wheat DDGS does not provide an effective fiber source, resulting in lower ruminal pH even though the rapidly fermentable starch content of the diet is much lower. Replacement of barley grain with up to 40% wheat or corn DDGS did not mitigate rumen pH conditions associated with mild to moderate acidosis. Feeding corn DDGS improved the apparent digestibility of all nutrients except ADF, compared to wheat DDGS. Inclusion of either 40% wheat or corn DDGS increased both nitrogen and phosphorus intakes as well as excretion, with wheat DDGS having the larger effect.

Finishing performance, eating behaviour and carcass quality: Feeding wheat DDGS at the 25% level increased dry matter intake without affecting final body weight, average daily gain or gain to feed ratio. Carcass characteristics were not affected, either. However, when wheat DDGS was increased to 30% of the diet, liver abscess scores increased and plasma urea nitrogen was doubled with the higher level of wheat DDGS. Corn DDGS decreased dry matter intake and improved gain to feed ratio when compared to similar levels of wheat DDGS in the diet. Replacing barley grain with either corn or wheat DDGS reduced days on feed and increased dressing percentage, without altering other carcass traits. Steers consuming higher levels of wheat DDGS spent less time eating, but consumed feed at a faster rate. Including wheat DDGS in the diet improved beef fatty acid profiles through increased total polyunsaturated fatty acids, as well as increased concentrations of linoleic acid.

Effect of DDGS on fecal shedding & persistence of E.coli O157:H7: Although the in vitro studies suggested that inclusion of high levels of corn or wheat DDGS may encourage the survival of E.coli O157:H7 in feces, the real world study, which included 9000 cattle in 30 commercial feedlot pens demonstrated that feeding corn or wheat DDGS in the finishing diets of cattle had no effect on the amount of E.coli O157:H7 present in feces, nor the ability of E.coli O157:H7 to survive in feces.

What it means: This research demonstrates the value of both wheat and corn DDGS in finishing diets in beef cattle. Replacing a portion of the barley grain with wheat or corn DDGS may be economical, but will depend on the relative price of the byproducts. It is also important to be aware of the type and source of DDGS you are purchasing. For example, processing such as fat removal can have a large effect on nutritional value. Feeding either wheat or corn DDGS as part of a finishing diet does not affect feedlot performance or carcass quality. While DDGS from corn is a superior energy source, when corn and wheat DDGS were blended together, the feeding value approached that of corn DDGS alone. In addition, including wheat DDGS in the diet improved fatty acid composition of beef by increasing total polyunsaturated fatty acids and linoleic acid in particular. Feeding corn DDGS has been linked to increased fecal shedding of E.coli O157:H7, however; this study found no association between fecal shedding or persistence of E.coli O157:H7 from 9000 cattle fed either corn or wheat DDGS, indicating no increased health risk. Although wheat DDGS can be used to replace both barley grain and silage at moderate levels in finishing diets, if the proportion of silage is less than 10%, wheat DDGS is not an effective fiber source, which may increase acidosis. In addition, when DDGS makes up 20% or more of a finishing ration, animals consume more nitrogen and phosphorous, leading to increased excretion of those nutrients. When feeding DDGS based diets, a proper manure utilization program is critical to control the increased excretion of nitrogen and phosphorous.

For more details on this project please visit:

http://www.beefresearch.ca/factsheet.cfm/effects-of-feeding-ethanol-byproducts-on-rumen-health-30

http://www.beefresearch.ca/factsheet.cfm/effects-of-feeding-ethanol-byproducts-on-manure-nutrient-levels-78

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