Effects of Supplemental SoyPass in Forage-Based Diets Containing Distillers Grains on Performance of Growing Steers

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Summary with Implications

SoyPass was supplemented in two grass hay diets containing 20% or 35% wet distillers grains with solubles (WDGS) to analyze the effects on growing cattle performance. The SoyPass supplement replaced 0, 30, or 60% of dietary WDGS for a total of 6 treatments with a factorial design. Substituting SoyPass into the diet did not affect average daily gain (ADG) of calves; however, calves consuming the 35% WDGS diet gained 31% more than the 20% WDGS treatment calves. Dry matter intake (DMI) and feed to gain (F:G) increased linearly in the 35% WDGS diet with the inclusion of SoyPass. In the 20% WDGS diet, DMI and F:G were maximized when SoyPass replaced 30% of the WDGS and lowest when SoyPass replaced 60% of WDGS. Therefore, SoyPass can replace up to 60% of the WDGS in forage based diets containing 20% WDGS with no adverse effects on performance by appearing to supply needed lysine.

Introduction

Growing cattle require increased quality and quantity of metabolizable protein compared to older more mature animals in order to meet the animal's demand for amino acids used for muscle growth. Typically, diets formulated for growing cattle contain large amounts of forage and smaller amounts of grain and by-products. While forage CP can be high, the majority of that protein is rumen degradable protein, which is fermented to meet the requirements of the ruminal microbial population. In many cases, microbes cannot provide enough protein and more cannot be made as dietary energy limits production. Corn distillers grains (DGS) is often used as a bypass protein supplement as a large portion (63%) of its protein is not ruminally degraded and is available for utilization by the animal.

Methionine and lysine are two of the first-limiting amino acids in most growing cattle diets. Corn and its by-products contain large amounts of methionine but are lower in lysine. Conversely, soybean products contain low-levels of methionine but concentrated amounts of lysine. The purpose of this study was to replace DGS with SoyPass (a bypass soybean meal product) in a forage-based growing diet to evaluate response to bypass lysine for growing calves.

Table 1. Experimental diets

	Wet distillers grains with solubles (WDGS) supplement					
	20%			35%		
	SoyPass replacing WDGS, %					
Ingredient, %DM	0	30	60	0	30	60
Brome hay	77	77	77	62	62	62
Supplement[1]	3	3	3	3	3	3
WDGS	20	14	8	35	25	15
SoyPass	0	6	12	0	10	20
Nutrient						
CP, % DM	13	14	15	16	18	23
RUP, % of CP	31	36	41	43	48	53
Lysine, % DM	0.40	0.48	0.57	0.53	0.67	0.90

[1]Supplement formulated to provide 1.22% fine ground corn, 1.34% limestone, 0.08% tallow, 0.3% salt, 0.05% beef trace mineral, and 0.02% vitamins A-D-E on DM basis

Procedure

Two groups of 60 growing steers (initial BW 582 ± 30 lb and 664 ± 75 lb) were utilized to study the effects of replacing DGS with SoyPass (0%, 30%, or 60% of DGS) in grass hay diets containing 35% or 20% DGS (Table 1). The study was arranged as a 2 × 3 factorial design and the feeding period was 84 d. Two separate groups of animals were utilized to observe the effect of stage of growth on metabolizable protein requirements. Steers were individually fed to ensure ad libitum intakes utilizing the Calan gate system at the Eastern Nebraska Research and Extension Center (ENREC) located near Mead, NE.

Steers were limit-fed a common diet containing 50% Sweet Bran (Cargill Corn Milling, Blair, NE) and 50% alfalfa hay at 2% of BW for 5 d followed by 3 d of weighing. The average of the 3-d weight served as initial BW and this procedure was replicated at the end of the study to measure ending BW. Additionally, all steers were implanted on d 1 with Synovex S (Zoetis, Parsippany, NJ). On d 43 for both groups of cattle, a blood sample was collected and analyzed for serum urea nitrogen for the first group and plasma urea nitrogen for the second group.

Performance results and blood urea nitrogen data were analyzed using the MIXED procedure of SAS. Initially, block of cattle, level of DGS, level of SoyPass supplement, and the interaction served as fixed effects in the model. Because there were no treatment × block interactions ($P \geq 0.10$), the interaction was removed from the final

Table 2. Performance of growing cattle on forage-based diets supplemented with SoyPass

	Wet distillers grains with solubles supplement									
	20%			35%						
	SoyPass replacing WDGS, %						SEM	*P*-value		
Item	0	30	60	0	30	60		Dist	SoyP	Int
IBW[1], lb	623	624	621	625	622	622	13	0.97	0.99	0.98
EBW[2], lb	787	778	781	836	830	829	14	<0.01	0.84	0.99
DMI, lb	17.7[bc]	18.4[ab]	16.9[c]	17.8[bc]	18.6[ab]	19.7[a]	0.47	0.01	0.30	0.01
ADG, lb	1.96	1.83	1.91	2.52	2.48	2.47	0.07	<0.01	0.49	0.76
F:G	9.1[ab]	10.2[a]	8.9[bc]	7.0[e]	7.4[de]	8.0[cd]	-	<0.01	0.17	0.03

[1]Initial body weight

[2]Ending body weight

[abcde]Means in a row with uncommon superscripts differ ($P \leq 0.05$)

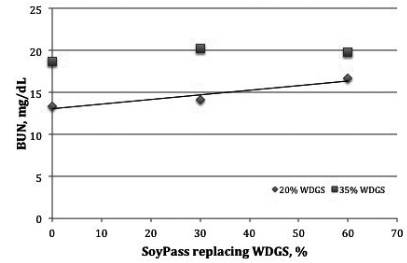

Figure 1. Blood urea nitrogen increased with increasing SoyPass in 20% distillers grains diets. SoyPass was supplemented to replace 0, 30, or 60% of distillers grains in grass hay diets formulated to contain 20 or 35% WDGS. Main effect of distillers grains inclusion ($P < 0.01$; SEM = 0.35), SoyPass inclusion ($P < 0.01$; SEM = 0.44), and the interaction ($P = 0.04$; SEM = 0.61).

analysis and data from both blocks of cattle were combined for analysis with block as a fixed effect. Additionally, where SoyPass × DGS interactions were detected, SoyPass inclusion was analyzed using covariate regression within DGS inclusion.

Results

There were no interactions detected for ADG between SoyPass supplementation and level of DGS in the diet ($P = 0.76$; Table 2). Additionally, SoyPass inclusion had no effect on ADG ($P = 0.49$). However, ADG was increased for steers consuming the 35% DGS diet compared to steers offered the 20% distillers ration (2.49 vs. 1.90 lb, respectively; $P < 0.01$).

A SoyPass × DGS interaction was detected ($P = 0.01$) for DMI. As SoyPass replaced DGS in the 35% diet, DMI increased linearly (linear $P = 0.01$). In the 20% DGS diet, DMI decreased as SoyPass replaced 60% of the DGS compared to 30% ($P = 0.02$). Therefore, there was also an interaction between SoyPass and DGS for F:G ($P = 0.03$) with a linear increase ($P = 0.01$) in F:G as SoyPass replaced DGS in the 35% treatment and a quadratic increase ($P = 0.02$) detected for the 20% WDGS treatment. On average, F:G was improved 20% for cattle consuming the 35% diet compared to 20% (7.5 vs. 9.4, $P < 0.01$).

Blood urea nitrogen increased linearly as SoyPass replaced distillers in the 20% diet ($P = 0.01$), which reflects the increased dietary CP and RUP content (Figure 1). Blood urea nitrogen was not affected by SoyPass substitution in the 35% diet, likely due to the animal's capacity to excrete urea being maximized under all 3 dietary conditions.

Performance results may be explained by both metabolizable protein and energy balance. In the 35% DGS diet, metabolizable protein was provided above requirements and may have supplied sufficient lysine. Likely because of the oil in DGS, DGS supplied more energy than the SoyPass. In the 20% DGS diet, F:G was not affected by SoyPass level, even though there is less energy in the SoyPass than in the distillers grains. This suggests metabolizable lysine may have been limiting with only DGS and the SoyPass supplied needed lysine.

Conclusion

Overall, forage-based growing diets formulated with low-levels of distillers grains (< 20%) may be deficient in metabolizable lysine, which could be corrected by the inclusion of SoyPass. Furthermore, cattle demonstrated increased performance when fed the 35% distillers diet compared to the 20% because both dietary energy and metabolizable protein balance were improved.

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