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Introduction

High feed prices and abundant corn stalk residue have created growing interest in the utilization of corn stalk residue or corn stover as a component of beef feedlot rations. Corn stover is generally considered low-quality forage that is high in fiber but low in protein and energy. The high fiber content and coarseness of the product make it a very effective roughage source, and corn stover is often included in high-energy feedlot rations consisting mostly of corn and corn co-products. The stalk bales typically are ground and mixed into a total mixed ration (TMR) in the feedlot setting. A local company has created several pelleted feed products consisting of corn stover mixed and pelleted with corn co-products and various other commodities. Incorporation of corn co-products and other high protein commodities facilitate the production of a relatively high protein pellet that can be used in many ways as part of a beef ration. This study was conducted to examine the use of 15% DDG Mixer pelleted product as the primary source of roughage and protein in a feedlot ration.

Materials and Methods

A feeding trial was completed at the Armstrong Research Farm in Lewis, Iowa, using 160 cross-bred steers allocated in four pens of 40 head each. Cattle were blocked by source and randomly allotted to one of two dietary treatments to balance weight and body condition score across pens. Pens one and three (Control) received a control ration consisting of hay, modified distiller's grain (MDG), shelled corn, and mineral supplement. Pens two and four (Pellet) received a test ration consisting of the 15% DDG Mixer pelleted product, shelled corn, and mineral supplement. The 15% DDG Mixer is approximately 33 percent corn stover, 33 percent dry distiller's grains (DDG) with the balance comprised of various other commodities. Laboratory analysis revealed an NDF of approximately 42 percent for the 15% DDG Mixer and an NDF of approximately 59 percent for the ground hay of the control diet. Feedstuffs were analyzed for nutritional value and rations were balanced to provide approximately equal NEg values across all pens. The cattle were fed 160 days and marketed based on estimated carcass composition. Serial weights were collected by the Armstrong Research Farm staff and carcass data were collected by Tri-County Steer Carcass Futurity. Data were analyzed using the MIXED procedure of SAS.

Results and Discussion

Control cattle had greater dry matter intake (DMI) ($P=0.03$; 26.17 lb vs. 25.57 lb) and greater average daily gain (ADG) ($P=0.04$; 3.42 lb vs. 3.30 lb) than Pellet cattle. Control cattle also produced heavier hot carcass weights (HCW) ($P=0.01$; 819 lb vs. 802 lb) than Pellet cattle. When compared with Pellet cattle, Control cattle had greater yield grades (YG) ($P=0.02$; 3.40 vs. 3.16) and tended to have more back fat (BF) ($P=0.09$; 0.55 in. vs. 0.47 in.). There were no significant differences in final body weight, kidney pelvic heart fat (KPH), ribeye area (REA), marbling, quality grade (QG), or feed to gain ratio (F:G) ($P>0.1$). Data are summarized in Table 1.

In order to provide comparable NEg levels to both the control and the test cattle, Pellet cattle received a finishing ration that was over 60 percent corn on an as-fed basis. Consumption of this high starch diet, with only the pelleted corn stover as roughage, caused digestive issues in the Pellet cattle including ruminal acidosis and bloat. This was likely due to the small particle size and inadequate levels of effective fiber. In order to control ruminal acidosis and bloat, long-stem roughage was added to the test ration. Corn and overall energy density of the ration had been gradually increased using a series of four "step-ups." On day 53 of the feeding period, which was 8 days after the fourth and final step-up, ground hay was added at a rate of 8.9 percent on an as-fed basis for two days. Roughage rate was then reduced to 5.23 percent on an as-fed basis and was maintained at that level until day 128 of the feeding period. At that time, Pellet cattle began to demonstrate signs of digestive disturbances again and the ground hay inclusion rate was increased to 8.9 percent on an as-fed basis and maintained at that level for the remainder of the feeding period. While feeding the high corn finishing diet, the addition of ground hay into the diet helped to significantly minimize digestive disturbances and promote rumen health. Bunk management of the Pellet ration proved to be challenging and incorporation of ground hay into the ration also seemed to improve overall palatability and consumption.

Although Control cattle had greater DMI and ADG as compared with Pellet cattle, there was no statistical difference in feed efficiency. With no significant difference in feed efficiency, depending on feed prices and yardage prices, it may be economically feasible to feed the Pellet ration to feedlot beef cattle. With a TDN of approximately 65 percent and NEg of approximately 40 percent, the 15% DDG Mixer pellet requires mixing with energy dense feedstuffs, such as corn, to provide adequate NEg for a finishing ration. Using exclusively corn and the 15% DDG Mixer pellet required high inclusion rates of corn, predisposing the cattle to digestive disturbances. When using the pelleted feed at the levels used in this study, it would be advisable to offer long-stem roughage and enough particle size to ensure adequate effective NDF in the ration. This will help to stimulate rumen function and minimize the digestive disturbances often associated with high-starch rations. Given the nutritional profile of the 15% DDG Mixer, further research may be warranted to elucidate its potential effectiveness in other segments of the industry including cow-calf supplementation and backgrounding rations.

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Table 1. Effects of using pelleted corn stover/DDG feed as a primary source of roughage and protein in beef feedlot rations.

	Classification			
Item	**Control**	**Pellet**	**SEM[1]**	**P-value**
Final weight, lb	1,323	1,314	2.89	0.15
Days on feed	160	160		
Avg. daily gain, lb	3.42	3.30	0.02	0.04
Dry matter intake, lb	26.17	25.57	0.08	0.03
Feed:Gain ratio	7.66	7.75	0.02	0.14
Carcass characteristics				
Hot carcass wt, lb	819	802	1.41	0.01
12th rib back fat, in.	0.55	0.47	0.02	0.09
Ribeye area, in.	12.63	12.53	0.13	0.51
KPH, %	2.30	2.29	0.04	0.83
Yield grade	3.40	3.16	0.03	0.02
Marbling score[2]	1,056	1,057	15.83	0.98
Quality grade	16.91	16.87	0.19	0.90

[1]n=2.
[2]Marbling score: 900=slight 0, 1,000=small 0, 1,100=modest 0, etc.
[3]Quality grade: 15=select^{-}, 16=select^{+}, 17=choice^{-}, 18=choice^{0}, 19=choice^{+}, etc.