Impact of Corn Silage Inclusion on Finishing Cattle Performance

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Summary with Implications

Cattle fed high grain diets with little to no roughage are typically at greater risk for acidosis and reduced dry matter intake and average daily gain. An individual feeding study was conducted to compare different inclusions of corn silage used as a roughage source on finishing performance and liver abscess rate. Treatments consisted of 3 inclusions of corn silage at 0, 7.5 and 15% of the diet DM and a control treatment with 7.5% alfalfa. There were no differences for live animal performance or carcass characteristics. There were also no differences in liver abscess incidence. Feeding corn silage at 15% gave similar performance responses compared to 7.5% alfalfa. These data suggest that roughage is not required in a finishing diet when feeding individual animals.

Introduction

Cattle fed all-concentrate diets may suffer from rumenitis, acidosis, and liver abscesses when fed for an extended period of time. Including roughage in a feedlot ration promotes rumen health and buffers rumen pH to mitigate risk of acidosis and digestive upset from highly fermentable carbohydrates. In the US, most cattle feeders include roughage in finishing diets at an inclusion of 0 to 13% (Dry matter basis; DM basis) averaging 8.3 to 9%, depending on season, with the most common roughage sources as alfalfa or corn silage. However, traditional inclusion of roughages can be subjective based on corn processing, inclusion of byproducts, and forage type.

Table 1. Composition (% of diet DM) of dietary treatments fed to calf-fed steers.

	Treatment[1]			
Ingredient	Alf	CS0	CS7.5	CS15
Dry-rolled corn	33.75	37.5	33.75	30
High-moisture corn	33.75	37.5	33.75	30
Alfalfa	7.5	-	-	-
Corn Silage	-	-	7.5	15
WDGS[2]	20	20	20	20
Supplement[3]				
Fine Ground Corn	2.27	2.27	2.27	2.27
Limestone	1.71	1.71	1.71	1.71
Tallow	0.125	0.125	0.125	0.125
Urea	0.5	0.5	0.5	0.5
Salt	0.3	0.3	0.3	0.3
Vitamin A-D-E Premix	0.05	0.05	0.05	0.05
Beef Trace Minerals Premix	0.015	0.015	0.015	0.015
Rumensin[4] Premix (g/ton)	0.17	0.17	0.17	0.17
Tylosin[5] Premix (mg/d)	0.009	0.009	0.009	0.009
Analyzed Nutrient Composition, % of DM				
Organic Matter	93.3	93.5	92.6	91.8
Neutral Detergent Fiber	23.8	19.8	22.3	24.7
Acid Detergent Fiber	10.8	7.15	9.30	11.5
Crude Protein	12.3	11.8	11.8	11.8

[1]Treatments included Alf: Alfalfa included at 7.5% of diet DM; CS0: contained no corn silage or alfalfa; CS7.5: corn silage included at 7.5% of diet DM; CS15: corn silage included at 15% of diet DM.

[2]WDGS: wet distillers grains.

[3]Supplement fed at 5% of dietary DM for all treatments.

[4]Formulated to supply Rumensin-90 (Elanco Animal Health) at 30 g per ton DM.

[5]Formulated to supply Tylan-40 (Elanco Animal Health) at 90 mg per steer daily.

Corn silage, on a DM basis, is approximately 50% concentrate (corn grain) and 50% roughage from leaves, stalk, and husk. Currently, it is common for producers to include corn silage at 7.5% of the diet DM as a roughage source. However, because of grain content, it may be beneficial to include corn silage at greater inclusions. It is logical that if silage is included at 15% of the diet DM, 7.5% of that would be corn grain and 7.5 % would be roughage. The objective of this study was to determine the effects of feeding no roughage, 7.5% or 15% corn silage, compared to traditional alfalfa hay at common inclusions of 7.5% DM basis.

Procedure

A finishing experiment conducted at the Eastern Nebraska Research and Extension Center utilized 60 individually fed crossbred steers (initial shrunk body weight 952 lbs ± 47 lbs). Steers were limit-fed a diet of 50% alfalfa and 50% Sweet Bran at 2% of body weight (BW) for 5 days prior to start of trial to reduce variation in gut fill, then 3 consecutive day weights were collected, utilizing the average as initial BW. Steers were stratified by body weight and assigned randomly to one of four treatments. Treatments consisted of 3 inclusions of corn

Table 2. Live performance and carcass characteristics of finished steers fed corn silage at two levels as a roughage source compared to no roughage or an alfalfa control.

	Treatment[1]					*P*–value[2]		
Item	Alf	CS0	CS7.5	CS15	SEM	*Alf v CS15*	Linear	Quadratic
Carcass Adjusted Performance								
Initial BW, lb	953	953	953	951	12.8	0.93	0.92	0.95
Live final BW, lb[3]	1375	1389	1388	1383	18.5	0.75	0.82	0.92
Final BW, lb[4]	1380	1393	1382	1368	18.9	0.67	0.36	0.94
DMI, lb/d	25.8	24.6	25.3	25.2	0.57	0.50	0.42	0.54
ADG, lb	3.65	3.76	3.67	3.57	0.12	0.63	0.27	0.97
F:G	7.10	6.60	7.04	7.22	-	0.75	0.08	0.67
Carcass Characteristics								
HCW, lb	842	)850	843	835	11.5	0.67	0.36	0.94
Marbling[5]	430	426	440	408	16.7	0.36	0.43	0.27
LM area, in^2	12.9	13.3	13.2	13.2	0.38	0.53	0.84	0.95
12th rib fat, in	0.47	0.50	0.44	0.43	0.03	0.42	0.14	0.56
Dressing, %	61.3	61.1	60.5	60.3	0.39	0.10	0.16	0.60
Liver Abscesses, %[6]	7.1	13.3	0	0	0.08	0.96	0.98	0.99
Calculated Yield Grade[7]	3.25	3.20	3.02	3.03	0.15	0.32	0.43	0.61

[1]Treatments included Alf: Alfalfa included at 7.5% of diet DM; CS0: contained no corn silage or alfalfa; CS7.5: corn silage included at 7.5% of diet DM; CS15: corn silage included at 15% of diet DM.

[2]Alf v CS15: Orthogonal contrast comparing 7.5% alfaf and 15% corn silage. Orthogonal contrasts for linear and quadratic effects of silage inclusion.

[3]Live final BW is the average individual 2 day weight shrunk 4.0%, Subsequent ADG and G:F are calculated from 4.0% shrunk EBW.

[4]Final BW calculated based on HCW using a common dressing percent of 61.0%.

[5]Marbling Score 300 = Slight, 400 = Small, 500 = Modest, etc.

[6]Calculated as a percent of total animals

[7]Calculated as 2.5 + (2.5 × 12th rib fat) + (0.2 × 2.0 [KPH]) + (0.0038 × HCW)–(0.32 × LM area).

silage at 0 (CS0), 7.5 (CS7.5) or 15% (CS15) of the diet DM and a control treatment with 7.5% alfalfa (Alf; Table 1). Cattle fed Alf and CS15 were stepped up over 21 days in 5 steps. Cattle fed CS0 and CS7.5 were stepped up for 28 days over 6 steps. Cattle were fed individually, *ad libitum*, using a Calan Gate system. All steers were fed for 117 days and harvested at Greater Omaha to collect carcass data (hot carcass weight, HCW; marbling, longissimus muscle area, LM area; fat thickness, liver abscesses).

Carcass and performance data were analyzed using the MIXED procedure of SAS where animal was the experimental unit and treatment was a fixed effect. Orthogonal contrasts were used to test linear and quadratic effects of corn silage inclusion. Liver abscess incidence was analyzed using PROC GLIMMIX of SAS as binomial data with treatment as a fixed effect.

Results

When evaluating the effects of different silage levels against an alfalfa control there was no significant difference for ending BW, dry matter intake (DMI), average daily gain (ADG) or feed to gain (F:G) ($P \geq 0.75$; Table 2). Animals did not perform as expected. As observed in the digestion study (*2019 Nebraska Beef Cattle Report*, pp. 66–68) intake decreased with lesser roughage inclusion. Changes in DMI led to differences in ruminal pH and VFA concentration. If animals in this study had differences in DMI, it may have altered severity of acidosis and affected animal performance. There was no significant difference for HCW, marbling, LM area, 12th rib fat, liver abscesses or calculated yield grade ($P \geq 0.45$). Dressing percent was not statistically significant for all treatments ($P = 0.12$). However, there was a linear response ($P = 0.02$) for corn silage inclusion where dressing percentage was greatest for CS0 and linearly declined with increasing inclusions of silage. The distributions of calculated yield grade and quality grade were not different for treatment ($P \geq 0.30$). There were numerically greater ($P = 0.96$) number of liver abscesses for cattle fed no roughage (13%) compared to Alf (7%) or CS7.5 and CS15 (0%).

Conclusion

These results suggest that corn silage can be ed up to 15% of diet DM without adversely affecting animal performance or carcass characteristics. Steers did not have reduced DM intakes as expected when fed lower inclusions of roughage. This could change the severity of acidosis experienced by cattle fed lesser roughage resulting in

reduced effects on performance. It is important to note that animals were individually fed, and results may have been affected if animals were fed in a pen. When priced favorably, corn silage can be an economical roughage source in a feedlot and can be utilized without detrimentally affecting performance or carcass merit. However, this study shows no roughage is needed in a finishing diet when individually fed.

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