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Effect of corn silage inclusion with different corn processing on finishing steer performance and carcass characteristics

Jessica L. Miller, Nolan R. Meier, Karla H. Wilke, Galen E. Erickson, and Pablo L. Loza[1]

Department of Animal Science, University of Nebraska-Lincoln, Lincoln, NE 68583, USA

[1]Corresponding author: ploza2@unl.edu

Abstract

Objectives were to determine the effect of corn silage inclusion within dry-rolled corn (DRC) or steam-flaked corn (SFC) finishing diets on cattle growth performance and carcass characteristics. The experiment used British and continental crossbred steers ($n = 480$; initial body weight [BW] = 389 ± 17 kg) in a 4 × 2 factorial arrangement of treatments with six replications per treatment. Treatments consist of four inclusions of corn silage (0%, 15%, 30%, or 45%; dry matter [DM] basis) within either a DRC or SFC diet. A corn silage by corn processing interaction was observed for dry-matter intake (DMI; $P = 0.05$). As corn silage inclusion increased in the diet, DMI increased linearly ($P < 0.01$) for both corn processing methods. DM intake was not different between SFC and DRC-fed cattle at 0% ($P = 0.33$), 30% ($P = 0.90$), or 45% ($P = 0.31$) corn silage inclusion. The interaction was due to the DMI of cattle fed 15% silage, as cattle-fed DRC consumed 0.5 kg/d less ($P < 0.01$) than cattle on the SFC diet. Quadratic effects were observed for final BW, hot carcass weight (HCW), average daily gain (ADG), feed efficiency (G:F), marbling, and fat depth ($P < 0.01$), regardless of corn processing. Cattle fed 15% or 30% corn silage gained faster ($P < 0.01$) than those fed 0% or 45% corn silage. Feed efficiency decreased quadratically ($P < 0.01$) as silage inclusion increased in the diet with G:F similar for cattle fed 0% and 15% silage and decreased curvilinearly for cattle fed 30% and 45% silage. The incidence of liver abscesses was greater ($P = 0.03$) in cattle fed 0% corn silage than for steers fed 15%, 30%, or 45% corn silage. Corn processing method, independent of silage, had no effect ($P = 0.42$) on liver abscess incidence. Feeding SFC increased ($P < 0.01$) steer final BW and HCW when compared to cattle-fed DRC, regardless of silage inclusion. Corn silage inclusion had similar effects on performance in both DRC diets and SFC diets except for DMI. As corn silage inclusion increased in the diet, feed efficiency decreased linearly ($P < 0.01$). Cattle-fed SFC gained 7.9% more ($P < 0.01$) and were 6.7% more efficient ($P < 0.01$) than cattle-fed DRC. In diets containing either DRC or SFC, corn silage can be included at up to 30% of the diet without negative impacts on ADG or HCW.

Lay Summary

This experiment evaluated the effect of corn silage inclusion within dry-rolled corn (DRC) or steam-flaked corn (SFC) diets on growth performance and carcass characteristics. Corn silage was included in the diet at 0%, 15%, 30%, or 45% (DM basis) within DRC or steam-flaked diets. Feeding SFC increased final body weight (BW) and improved feed efficiency when compared to cattle-fed DRC, illustrating that flaking corn results in greater energy provided to finishing cattle. Final BW, average daily gain, and hot carcass weight were greatest for cattle fed 15% and 30% corn silage, regardless of corn processing. Feed efficiency was similar between cattle fed 0% and 15% corn silage but declined as corn silage inclusion increased to 30% and 45%, following a typical roughage response. The occurrence of liver abscesses was greatest for cattle fed 0% corn silage, but was similar between cattle fed 15%, 30%, and 45% corn silage.

Key words: corn silage, corn processing, finishing steers, inclusion

Introduction

Corn silage is a cost-effective roughage source that is commonly fed to cattle throughout the United States (Samuelson et al., 2016; Wilson et al., 2023). While it is common for producers to include roughage at 8% to 10% of diet dry matter (DM) for feedlot cattle (Samuelson et al., 2016), previous studies have shown that feeding corn silage at 12.26% of diet DM to feedlot cattle results in similar growth performance as steers fed alfalfa hay at 8.0% of diet DM (Benton et al., 2015). However, increasing corn grain price may make it more economical to increase corn silage and replace grain in the diet (DiCostanzo et al., 1998). Increasing corn silage inclusion in dry-rolled corn (DRC) and high-moisture corn blend diets from 15% to 45% of diet DM in previous studies has resulted in reductions in average daily gain (ADG) and feed efficiency (Burken et al., 2017a; Hilscher et al., 2022). Burken et al. (2017b) studied the effect of corn silage inclusion with corn silage at 15%, 30%, 45%, and 55% of diet DM in a DRC and high-moisture corn blend diet. Burken et al. (2017b) observed that DM intake increased linearly as corn silage inclusion increased but ADG and feed efficiency decreased linearly. While previous research has documented the effect of increasing corn silage inclusion in DRC diets, there is limited research on the effect of corn silage inclusion within steam-flaked corn (SFC) diets. In addition, previous research did not include diets with 0% corn silage

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when testing increasing inclusion above traditional roughage inclusions. We hypothesized that increasing corn silage inclusion would reduce ADG and feed efficiency in DRC and SFC diets, but the response would be different whereby less corn silage would optimize intake and gain in diets with DRC and more roughage would be beneficial for diets based on SFC. Therefore, the objective of this study was to evaluate the effect of increasing corn silage inclusion from 0% to 45% in finishing diets in DRC and SFC diets on finishing performance and carcass characteristics.

Materials and Methods

All animal care and management protocols were approved by the University of Nebraska-Lincoln's Institutional Animal Care and Use Committee protocol #7260.

Four hundred and eighty British and continental crossbred yearling steers (initial body weight [BW] = 389 ± 17 kg) were fed to evaluate the effect of corn silage inclusion within DRC or SFC diets on growth performance and carcass characteristics. Treatments were arranged in a 4 × 2 factorial design with corn silage inclusions of 0%, 15%, 30%, and 45% (DM basis) within either DRC or SFC-based diets. The corn silage was grown at the UNL Mitchell Experimental Farm (Mitchell, NE). At harvest, the corn silage was harvested at 32% DM, kernel processed, and ensiled in a covered pile. SFC was sourced from Scottsbluff County Feeders (Scottsbluff, NE) with 59.93% being retained on a 6,300 µm screen (Table 1). Fresh flakes were delivered weekly over the duration of the trial. DRC was sourced from the UNL Mitchell Experimental Farm (Mitchell, NE) and local elevators as whole corn and processed using Roshkamp's Grain Roler Milll 1958 set at a 3.6 mm roller gap at University of Nebraska Panhandle Research, Extension, and Education Center Feedlot.

The cattle were received at the University of Nebraska Panhandle Research, Extension, and Education Center Feedlot in May 2021 and were fed from May 2021 to September 2021. Cattle were processed on day 0. Initial processing included treatment for internal parasites (Valbazen, Zoetis, Parsippany-Troy Hills, NJ), external parasites (Dectomax, Zoetis), infectious bovine rhinotracheitis virus, bovine viral diarrhea virus, parainfluenza three viruses, bovine respiratory syncytial virus (Bovi-Shield Gold 5, Zoetis), and *Haemophilus somnus* (Somubac, Zoetis). Cattle were also implanted with a combination implant containing 200 mg of trenbolone acetate and 40 mg of estradiol (Revalor XS, Merck Animal Health, Summit, NJ) on day 0. Cattle were limit-fed at approximately 2% of BW for 5 d before trial initiation to reduce variation in gut fill (Watson et al., 2013). The limit-fed diet contained 40% alfalfa hay, 40% corn silage, 14% wet distillers grains plus solubles (WDGS), and 6% supplement (DM basis). Cattle were individually weighed on days 0 and 1 using a hydraulic chute (Silencer, Moly Manufacturing Inc., Lorraine KS: scale accuracy ± 0.454 kg) and averaged to determine initial BW. Cattle were stratified and blocked by BW with four weight blocks. Cattle were assigned randomly to pens (10 steers/pen) within weight block for a total of 48 pens and six replications per treatment.

The adaptation period included four steps over 28 d for cattle fed the 0% and 15% corn silage treatments and three steps over 13 d for cattle fed the 30% and 45% corn silage treatments. Step-up diets are presented in Table 2. Finishing diets are presented in Table 3.

Nutrient requirements (NASEM, 2016) were met or exceeded when formulating diets. Assessment of feed bunks occurred daily at 0700 hours with a target for feed bunks to be clean at the time of feeding. This bunk assessment was only done in the mornings which prevented an assessment of target clean-up time. Cattle were fed at approximately 0800 hours daily and had ad libitum access to water. A Roto-Mix 354-128 was used to mix and deliver diets once daily. Weekly samples of dietary ingredients were collected for DM analysis to adjust as-fed ingredient inclusions. The formulation dispensed through the micromachine provided 33.0 mg/kg monensin (Elanco Animal Health, Greenfield, IN, DM Basis) and 9.7 mg/kg tylosin (Elanco Animal Health, DM Basis).

Cattle were harvested at a commercial abattoir (Greater Omaha, Omaha, NE) after 125 days of feed. Hot carcass weight (HCW) and liver abscess scores were recorded on the day of slaughter. After a 46-h chill, USDA marbling score, longissimus muscle (LM) area, and 12th rib fat depth were recorded. Carcass-adjusted final BW (Adj. final BW), ADG, and feed efficiency (G:F) were calculated from final BW based on HCW adjusted to a 63% dress. The USDA YG equation: YG = 2.5 + (6.35 [fat thickness, cm]) − (2.06 [LM area, cm^2]) + (0.2 [KPH fat, %]) + (0.0017 [HCW, kg]; USDA,1997) was used to calculate yield grade.

Samples of dietary ingredients were collected weekly (200), dried in a forced-air oven at 60 °C for 48 h, and composited by month. Monthly ingredient composites were analyzed at

Table 1. Corn particle size distribution of dry-rolled corn and steam-flaked corn

	DRC		SFC	
Screen size, µm	Percent retained	CV	Percent retained	CV
6,300	4.79	13.08	59.93	9.74
4,750	28.82	14.66	13.77	35.04
3,350	46.08	5.73	11.17	19.86
1,700	15.25	22.79	8.77	47.83
1,410	1.34	70.77	1.08	54.05
850	1.73	77.61	1.71	85.98
600	0.67	70.77	0.73	76.49
<600	1.34	94.32	2.83	57.90

DRC, dry-rolled corn; SFC, steam-flaked corn.

Table 2. Step-up diet composition on a DM basis fed to finishing steers

	Step 1[*]				Step 2[†]				Step 3[‡]		Step 4[ǁ]
Corn silage inclusion, %	0	15	30	45	0	15	30	45	0	15	0
Corn[§]	19.0	19.0	19.0	19.0	39.0	39.0	39.0	24.0	59.0	59.0	69.0
Corn silage	40.0	40.0	40.0	40.0	30.0	30.0	30.0	45.0	20.0	20.0	10.0
Alfalfa hay	20.0	20.0	20.0	20.0	10.0	10.0	10.0	10.0	0.0	0.0	0.0
WDGS	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Supplement[¶,**,††]	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0

[*]Cattle received the step 1 treatment diet for 7 d.
[†]Cattle received the step 2 treatment diet for 7 d.
[‡]Cattle received the step 3 treatment diet for 7 d.
[ǁ]Cattle received the step 4 treatment diet for 7 d.
[§]Cattle received diets containing their respective corn treatment, either dry-rolled corn or steam-flaked corn.
[¶]Diets were formulated to include Rumensin (Elanco Animal Health) at 33 mg/kg of DM and Tylan (Elanco Animal Health) at 9.7 mg/kg of DM and supplement included urea at 1% of diet DM.
[**]Supplement contained 38.8 IU of vitamin A, 4.8 IU of vitamin D, and 0.1 IU of vitamin E/g.
[††]Supplement contained 0.052% Zn, 0.007% Fe, 0.031% Mn, 0.019% Cu, 0.210% Mg, and 0.002% I.
WDGS, wet distillers grains plus solubles.

a commercial laboratory (WARD Labs, NE) for CP (AOAC International, 2000; Method 990.03), NDF (ANKOM, 2006), ADF (ANKOM, 2006), total starch (Megazyme International, 2011, AOAC International, 2000; Method 996.11; AOAC Method 76.13), Ca, P, S, K, and Mg (Mills and Jones, 1996). Monthly composites of DRC and SFC were analyzed for corn particle size using the sieve method (American Society of Agricultural Engineers, 1969). Subsamples of corn were shaken through a series of seven sieves (U.S. Standard Sieve Series; W.S. Tyler Company, Cleveland OH; 6,300, 4,750, 3,350, 1,700, 1,410, 850, and 600 µm) on the sieve shaker (Mode RX-86; W.S. Tyler Incorporated, Gastonia, NC) for 10 min to determine the particle size distribution of each sample. The distribution was then quantified as percent retained on each sieve.

Performance and carcass characteristics were analyzed using the MIXED procedure of SAS (SAS Institute Inc., Carry, NC) with pen as the experimental unit and block as a fixed effect. Performance data were analyzed for the corn processing method × corn silage inclusion interaction. When interactions were not detected main effects of the corn processing method and corn silage inclusion were presented. Orthogonal contrasts were used to analyze linear, quadratic, and cubic trends of corn silage inclusion. Regression equations for ADG and HCW were calculated using the REG procedure of SAS (SAS Institute Inc.). The occurrence of liver abscesses was analyzed using the GLIMMIX procedure of SAS with pen as the experimental unit. For binomial analysis, data were analyzed by pen with the number of animals with liver abscesses and the number of animals without liver abscesses in the pen. Liver abscess severity was analyzed using the GLIMMIX procedure of SAS with pen as the experimental unit for multinomial analysis. Data were analyzed by pen with the number of animals without liver abscesses, the number of animals with A−, A, and A + liver abscess severity scores in the pen. Significance was deemed at $P \leq 0.05$ and tendencies at $0.05 > P \leq 0.10$.

Results and Discussion

Effect of the Interaction of Corn Processing Method and Silage Inclusion

An interaction between the corn processing method and corn silage inclusion was observed for dry-matter intake (DMI; $P = 0.05$). DM intake did not differ between SFC or DRC at 0% ($P = 0.33$), 30% ($P = 0.90$), or 45% ($P = 0.31$) corn silage inclusion. Cattle fed 15% corn silage and DRC consumed 10.6 kg/d which was less ($P < 0.01$) than cattle fed SFC that consumed 11.1 kg/d. In two studies, Scott et al. (2003) observed no differences in intakes of cattle-fed SFC or DRC in finishing diets that contained no byproducts. However, studies by Scott et al. (2003) and Macken et al. (2006) observed that feeding SFC decreased DMI by 8.3% and 3.8% when compared to feeding DRC in diets that contained wet corn gluten feed (WCGF; Sweet Bran; Cargill, Blair, NE). No other significant corn processing by corn silage inclusion interactions were observed for performance, carcass characteristics, or liver abscess rate or severity ($P \geq 0.15$).

Main Effect of Corn Processing Method

Feeding SFC improved cattle ADG, feed efficiency, and HCW when compared to feeding cattle DRC ($P < 0.01$; Table 4). Carcass-adjusted final BWs of cattle fed the SFC diets were

Table 3. Diet composition on a DM basis fed to finishing steers

Corn processing method	DRC[*]				SFC[†]			
Corn silage inclusion, %	0	15	30	45	0	15	30	45
Dry-rolled corn	79.0	64.0	49.0	34.0	—	—	—	—
Steam-flaked corn	—	—	—	—	79.0	64.0	49.0	34.0
Corn silage	0.0	15.0	30.0	45.0	0.0	15.0	30.0	45.0
WDGS	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Supplement[‡,‖,§]	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Chemical composition[¶], %								
Neutral detergent fiber	12.0	17.6	23.3	28.9	12.5	18.0	23.6	29.2
Acid detergent fiber	7.51	12.5	17.4	22.3	6.5	11.6	16.8	21.9
Crude protein	14.4	14.4	14.4	14.4	15.1	15.0	14.9	14.7
Calcium	0.69	0.73	0.76	0.79	0.71	0.74	0.77	0.80
Phosphorus	0.34	0.33	0.33	0.32	0.35	0.34	0.33	0.32

[*]Treatment diets contained dry-rolled corn.
[†]Treatment diets contained steam-flaked corn.
[‡]Diets were formulated to include Rumensin (Elanco Animal Health) at 33 mg/kg of DM and Tylan (Elanco Animal Health) at 9.7 mg/kg of DM and the supplement included urea at 1% of diet DM.
[‖]Supplement contained 38.8 IU of vitamin A, 4.8 IU of vitamin D, and 0.1 IU of vitamin E/g.
[§]Supplement contained 0.052% Zn, 0.007% Fe, 0.031% Mn, 0.019% Cu, 0.210% Mg, and 0.002% I.
[¶]Chemical composition was determined by averaging analyses of monthly ingredient composites.
WDGS, wet distillers grains plus solubles.

Table 4. Main effect of corn processing method on steer performance and carcass characteristics

	Corn processing method			
	DRC	SFC	SEM	*P*-value
Pens	24	24		
Performance				
Initial BW, kg	390	390	0.4	0.40
Adj. final BW[*], kg	595	612	2.1	<0.01
ADG, kg	1.65	1.78	0.016	<0.01
Gain:Feed	0.149	0.159	0.0011	<0.01
Carcass characteristics				
HCW, kg	375	385	1.3	<0.01
LM area, cm^2	84.5	85.2	4.84	0.33
Marbling score[†]	530	547	8.7	0.18
12th rib fat, cm	1.45	1.57	0.025	<0.01
Liver abscess[‡], %	7.5	10.0	—	0.42
No abscesses[‖], %	92.9	90.0	—	0.37
A–[4], %	3.3	2.9	—	
A[4], %	2.9	5.0	—	
A+[‖], %	0.8	2.1	—	

[*]Adjusted final body weight was calculated using hot carcass weight with a 63% dressing percentage adjustment.
[†]Marbling score 500 = Modest00, 600 = Moderate00.
[‡]Liver abscesses were analyzed in SAS as a binomial distribution.
[‖]Liver abscess severity data were analyzed in SAS as a multinomial distribution.

17 kg heavier than cattle fed the DRC diets ($P < 0.01$). Cattle-fed SFC gained 7.9% faster ($P < 0.01$) than cattle-fed DRC. Feeding cattle SFC improved ($P < 0.01$) feed efficiency by 11.9% on a corn inclusion basis when compared to cattle-fed DRC. Although Macken et al. (2006) observed no differences in final BW or ADG when feeding diets containing WCGF at 30% of diet DM, Scott et el. (2003) observed a 14 kg improvement in final BW and a 6.1% increase in ADG when comparing cattle-fed SFC to cattle-fed DRC in diets that contained 30% WCGF (DM basis). Similar to the current study, Corrigan et al. (2009) observed a 13.0% improvement in efficiency on a corn inclusion basis when cattle were fed SFC in diets containing 15% WDGS. Improvements in feed efficiency observed when diets containing WCGF were fed were slightly larger, with efficiency being improved by 17.3% in the study by Scott et al. (2003) and 19.4% in Macken et al. (2006) on a corn inclusion basis. Variability in feed efficiency improvement across studies, for cattle-fed SFC when

Table 5. Main effect of corn silage inclusion on steer performance and carcass characteristics

	Corn silage inclusion, %					*P*-value		
	0	15	30	45	SEM	Linear	Quad.	Cubic
Pens	12	12	12	12				
Performance								
Initial BW, kg	390	390	390	390	0.55	0.98	0.67	0.24
Adj. final BW[*], kg	597[a]	609[b]	610[b]	599[a]	2.9	0.61	<0.01	0.90
ADG, kg	1.66[a]	1.75[b]	1.76[b]	1.68[a]	0.050	0.59	<0.01	0.74
Gain:Feed	0.164[a]	0.160[a]	0.151[b]	0.139[c]	0.0015	<0.01	<0.01	0.97
Carcass characteristics								
HCW, kg	376[a]	383[b]	384[b]	378[a]	1.9	0.61	<0.01	0.91
LM area, cm^2	85.8[a]	85.2[a]	84.2[b]	83.9[b]	0.65	0.02	0.63	0.85
Marbling score[†]	520[a]	560[b]	558[b]	515[a]	17.1	0.73	<0.01	0.99
Fat thickness, cm	1.42[a]	1.60[c]	1.55[c]	1.47[b]	0.04	0.53	<0.01	0.28
Liver abscess[‡], %	15.8[a]	5.8[b]	7.5[b]	5.8[b]	—	0.04	0.28	0.27
No abscesses[ǁ], %	84.0	94.2	93.3	94.2	—	0.03	0.25	0.37
A–[ǁ], %	5.0	3.3	3.3	0.8	—			
A[ǁ], %	6.7	1.7	3.3	4.2	—			
A+[ǁ], %	4.2	0.8	0.0	0.8	—			

[*]Adjusted final body weight was calculated using hot carcass weight with a 63% dressing percentage adjustment.
[†]Marbling score 500 = Modest00, 600 = Moderate00.
[‡]Liver abscesses were analyzed in SAS as a binomial distribution.
[ǁ]Liver abscess severity data were analyzed in SAS as a multinomial distribution.
[ab]Means in a row with different superscripts are different ($P<0.05$).

compared to cattle-fed DRC, may be due to differences in byproduct inclusion in the diet. Corrigan et al. (2009) reported that the improvement in feed efficiency when feeding SFC over DRC decreased as WDGS inclusion increased in the diet.

HCWs of cattle-fed SFC were 10 kg heavier ($P < 0.01$) than HCWs of cattle-fed DRC. LM area and marbling scores were similar ($P \geq 0.18$) between cattle-fed SFC and cattle-fed DRC. Backfat thickness was 0.12 cm greater ($P < 0.01$) in cattle-fed SFC compared to cattle-fed DRC. Similar responses in LM area, marbling, and backfat thickness were also observed by Scott et al. (2003) and Macken et al. (2006) with the backfat thickness being greater in cattle-fed SFC when compared to cattle-fed DRC. Additionally, the occurrence of liver abscesses was not impacted by the corn processing method ($P = 0.42$) with 7.5% of cattle-fed DRC and 10.0% of cattle-fed SFC having liver abscesses.

Main Effect of Corn Silage Inclusion

Increasing corn silage inclusion resulted in similar gain and weight responses regardless of corn processing method. Quadratic responses were observed for adj. final BW, ADG, G:F, HCW, marbling, and backfat thickness ($P < 0.01$; Table 5). LM area decreased linearly ($P = 0.02$) as corn silage inclusion increased. Carcass-adjusted final BWs of cattle fed 15% or 30% corn silage were 11.5 kg heavier ($P < 0.01$) than adj. final BWs of cattle fed 0% or 45% corn silage. Cattle fed 15% or 30% corn silage gained faster ($P < 0.01$) than cattle fed 0% or 45% corn silage with ADG being maximized at 23.4% corn silage inclusion. Maximum ADG was determined using the first derivative of the ADG quadratic equation; ADG (kg) $= -0.00019 \times {}^{2} + 0.008889x + 1.6608$ (Standard error around constants 0.000069, 0.003241, and 0.03028, respectively) with × being corn silage inclusion.

Burken et al. (2017b) observed that cattle gains were greatest at 15% corn silage inclusion and decreased linearly as inclusion increased to 30%, 45%, and 55% of diet DM replacing a blend of HMC:DRC. In the current study, G:F decreased quadratically ($P < 0.01$) as corn silage inclusion increased in the diet. Increasing corn silage inclusion from 15% to 45% decreased ($P < 0.01$) feed efficiency by 13.1%. The change in feed efficiency comparing 15% silage inclusion to 45% silage inclusion has been variable across studies, due to changes in intake and gain responses due to silage inclusion. Burken et al. (2017a; 2017b) observed 3.5% to 13.5% decreases in feed efficiency as corn silage increased from 15% to 45%of diet DM across five comparisons.

Carcasses of cattle fed 0% or 45% corn silage were 6.5 kg lighter ($P < 0.01$) than HCW of cattle fed 15% or 30% corn silage. Burken et al. (2017b) observed a linear decrease in HCW as corn silage inclusion increased. Burken et al. (2017a) and Hilsher et al. (2022) also observed a greater decrease in HCW (14 and 12 kg) than the current study when comparing cattle fed 15% corn silage to cattle fed 45% corn silage in HMC:DRC blend diets. As corn silage inclusion increased, LM area decreased linearly ($P = 0.02$) with the LM area of cattle fed 0% corn silage being 1.9 cm^2 greater than the LM area of cattle fed 45% corn silage. Marbling score and backfat thickness were greater ($P < 0.01$) for cattle fed 15% or 30% corn silage when compared to cattle fed 0% and 45% corn silage. Hilsher et al. (2022) observed no differences in LM area when comparing cattle fed 15% corn silage to cattle fed 45% corn silage, although they did find that cattle fed 15% corn silage had a greater 12th rib fat depth than cattle fed 45% corn silage. Burken et al. (2017b) reported that 12th rib fat depth decreased linearly as corn silage inclusion increased in the diet. The occurrence of liver abscesses was greatest for cattle fed 0% corn silage and decreased linearly ($P = 0.04$; Table 5) as corn silage increased in the diet with percent of cattle with liver abscesses being similar for cattle fed 15%, 30%, and 45% corn silage. A 63% reduction ($P = 0.04$) in abscess rate was observed for cattle fed 15% or more silage compared to the 0% silage; however, the study design with 10 head per pen is not ideal to test liver abscess incidence, as incidence overall was lower than the industry average of 20.3% (Herrick et al., 2022). Corn silage inclusion also had an effect on liver abscess severity with liver abscess severity decreasing linearly ($P = 0.03$; Table 5) as corn silage increased in the diet. Wilson et al. (2023) reported a 34.7% reduction in the incidence of abscessed livers when comparing cattle fed 15% corn silage (DM basis) to cattle fed 45% corn silage (DM basis) in diets that contained tylosin. Similarly, a pooled analysis of five research studies conducted by Wilson et al. (2023) reported a 47% reduction in the occurrence of abscessed livers from 7.80% abscessed livers at 15% corn silage (DM basis) to 4.12% abscessed livers at 45% corn silage (DM basis) in diets that contained tylosin.

Conclusion

Feeding SFC resulted in a 7.9% increase in ADG and a 6.7% improvement in feed efficiency. Increasing corn silage inclusion had similar effects on cattle performance in both DRC diets and SFC diets, except for DMI. Feed efficiency decreased as corn silage inclusion in the diet increased. However, HCW and ADG responded quadratically with cattle fed 15% and 30% corn silage gaining faster and being heavier than those fed 0% or 45% corn silage.

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