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The Effect of Delayed Corn Silage Harvest on Corn Silage Yield and Finishing Performance in Yearling Steers

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Summary

A finishing experiment evaluated the effects of harvesting drier corn silage on performance. Factors were corn silage DM (37 or 43%) and inclusion in the finishing diet (15 or 45%). As corn silage inclusion increased, DMI did not differ, ADG decreased, and F:G increased. As DM of corn silage was increased, no differences in DMI, ADG, or F:G were observed at either 15 or 45% inclusion. Ensiling drier silage increased tonnage with no negative impact on performance.

Introduction

Increased corn silage inclusion during times of increased corn prices can be an economical alternative compared to corn, although ADG and F:G are not as favorable (2015 Nebraska Beef Cattle Report, pp. 66–67). Feeding corn silage allows cattle feeders to take advantage of the entire corn plant at a time of maximum quality (approximately 35% DM) and tonnage as well as secure substantial quantities of roughage/grain inventory (2013 Nebraska Beef Cattle Report, pp. 74–75). Inclusion of distillers grains with elevated concentrations of corn silage has been shown to be an economical alternative compared to corn in times of high prices, with less depression in performance compared to adding greater concentrations of silage without distillers grains (2014 Nebraska Beef Cattle Report, pp. 88–89). Additionally, as corn harvest was delayed to black layer formation, corn and whole plant yield were maximized with little effect on nutritive quality based on hand harvested plot work (*2013 Nebraska Beef Report, pp. 42–43*; 2016 *Nebraska Beef Report*, pp. 79–80). Therefore the objectives of this experiment were to determine the effects of delaying corn silage harvest on yearling steer feedlot performance and carcass characteristics when feeding traditional levels and elevated concentrations of corn silage in diets containing 40% distillers grains.

Procedure

Corn silage was harvested at the Agricultural Research and Development Center (ARDC) near Mead, Neb. Harvest DM was targeted to mimic traditional corn silage harvest at 37% DM or a delayed harvest at 43% DM. Corn silage harvest initiation was determined when the field was at approximately ¾ milkline for the 37% DM corn silage (9/4/2014), and delayed two wks coinciding with black layer formation for the 43% DM corn silage (9/16/14). Corn silage was harvested in 4 replications within a single field and green chop samples were taken for DM determination on a Koster tester prior to bagging. Additionally, high moisture corn and dry corn yield strips were harvested within the same field on 9/18/14 and 11/4/14, respectively. Both, 37% DM and 43% DM silages were stored in sealed AgBags® and after 28 d, silage was sampled for fermentation analysis and DM (forced air oven at 140°F) were collected weekly (Table 1).

Crossbred yearling steers (n=180; initial BW = 943 lb ± 86 lb) were sorted into 3 BW blocks and assigned randomly to one of 20 pens (9 steers/pen). Treatments were designed as a 2 × 2 factorial arrangement that consisted of harvested corn silage DM (37% DM or 43% DM) and inclusion of corn silage in the finishing diet (15% or 45% DM basis; Table 2). Corn silage fed at 45% of diet DM in the finishing diet replaced high moisture corn compared to 15% silage treatments. All steers were fed a supplement formulated for 30 g/ton Rumensin® (DM basis) and a targeted intake of 90 mg/steer daily of Tylan®. Steers were implanted with Revalor-200® on d 1. Steers were fed for an average of 108 d before harvest. Prior to shipping to a commercial abattoir, pens of steers were weighed on

Table 1. Nutrient and fermentation analysis of 37 and 43% DM silage

Item	37% DM		43% DM	
	Mean	C.V.[a]	Mean	C.V.[a]
DM[b]	37.3	(3.2)	42.7	(3.9)
CP	7.51	(3.6)	7.50	(1.2)
NDF,%	31.6	(17.5)	28.9	(5.7)
ADF,%	21.4	(15.8)	18.6	(17.9)
Starch,%	35.4	(16.7)	40.8	(5.0)
Sugar,%	2.6	(19.6)	2.5	(8.7)
pH	3.88	(1.3)	3.85	(1.5)
Lactic acid,%	3.11	(26.9)	4.14	(28.1)
Acetic acid,%	3.98	(21.5)	2.81	(27.1)
Propionic acid,%	0.51	(26.8)	0.28	(54.3)
Butyric acid,%	< 0.01	(0.0)	< 0.01	(0.0)
Total acids,%	7.61	(10.5)	7.22	(3.3)

[a]C.V. = coefficient of variation and is calculated by dividing the standard deviation by the mean and is expressed as a percentage.
[b]DM was calculated using weekly samples and oven dried for 48 h at 60° C.
Note: All other samples are based on monthly composites of weekly samples taken during the finishing trial, and analyzed at Dairyland Labs (St. Cloud, MN) and Ward Labs (Kearney, NE).

a platform scale. A 4% pencil shrink was applied to this weight for final live BW and calculation of dressing percentage. Steers were weighed the afternoon prior to evening shipping, and harvested the following morning. The day of harvest, HCW were recorded, and carcass adjusted final BW were calculated from HCW adjusted to a common dressing percentage (63%), and used to determine ADG and F:G. Marbling score, 12th rib fat thickness, and LM area were recorded after a 48-h chill.

Data were analyzed using the GLIMMIX procedure of SAS as a randomized block design with pen as the experimental unit and block as a fixed effect. Silage harvest data were analyzed as a completely randomized block with field as block and silage strips serving as the experimental unit. Feedlot performance data were analyzed as a randomized block design with BW sort as block and pen serving as the experimental unit. Initial BW was significantly different between silage DM treatments, therefore initial BW was included as a covariate.

Results

There was a significant increase ($P < 0.01$) in yield of DM tons per acre comparing 37% DM to 43% DM corn silage with yields of 9.55 and 10.07 t/ac (DM), respectively. There was no difference in yield between high moisture corn and dry corn grain with 259 and 263 bu/acre yields, respectively. These data suggest that grain and silage yield was maximized when delaying corn silage harvest until black layer formation as high-moisture corn was harvested 3 d after the 43% DM silage was harvested. No further yield increase for grain was observed between this time point and dry grain harvest.

There were no interactions between corn silage DM and concentration of corn silage inclusion ($P \geq 0.47$) for feedlot performance or carcass characteristics, therefore, main effects will be discussed (Table 3). As concentration of corn silage in the finishing diet increased from 15 to 45%, ADG decreased ($P = 0.04$), while DMI did not differ ($P = 0.17$) and this in turn led to an increase in F:G ($P < 0.01$). Carcass-adjusted final BW and HCW were lower ($P \leq 0.04$) for steers fed 45% corn silage compared to 15%. Dressing percentage

Table 2. Diet composition (% of diet DM) of finishing diets fed to yearlings with varying silage DM and varying inclusion.

	Treatment[a]			
	15% corn silage		45% corn silage	
	37% DM	43% DM	37% DM	43% DM
High moisture corn	41.0	41.0	11.0	11.0
Modified distillers grains plus solubles	40.0	40.0	40.0	40.0
37% DM corn silage	15.0	—	45.0	—
43% DM corn silage	—	15.0	—	45.0
Supplement[b]	4.0	4.0	4.0	4.0

[a]Treatments: 15% silage 37% DM = 15% inclusion of 37% DM silage, 15% silage 43% DM = 15% inclusion of 43% DM silage, 45% silage 37% DM = 45% inclusion of 37% DM silage, 45% silage 43% DM = 45% inclusion of 43% DM silage; all diets contained 40% MDGS.
[b]Supplement consisted of 1.8% Fine ground corn, 1.71% limestone, 0.10% tallow, 0.30% salt, 0.05% trace mineral package, 0.015% Vitamin A-D-E package as percentages of the final diet. It was also formulated for 30 g/ton Rumensin® (DM basis) and a targeted intake of 90 mg/steer daily of Tylan®.

Table 3. The effects of delayed silage harvest and increased inclusion concentrations of silage on feedlot performance and carcass characteristics on cross bred yearling steers

Variable	Treatments[a]					*P*-value		
	15% corn silage		45% corn silage					
	37% DM	43% DM	37% DM	43% DM	SEM	Int.[b]	Concentration[c]	DM[d]
Feedlot performance								
Initial BW, lb	938	942	938	942	1.1	0.77	0.87	< 0.01
Final BW[e], lb	1353	1375	1325	1334	17.4	0.69	0.04	0.49
DMI, lbs	27.8	29.0	28.7	29.6	0.8	0.77	0.17	0.19
ADG, lb	3.89	4.05	3.61	3.69	0.21	0.75	0.04	0.55
Feed:Gain[f]	7.16	7.15	7.96	8.02	—	0.76	< 0.01	0.94
Live Final BW, lb	1393	1425	1387	1405	24.4	0.75	0.54	0.41
Carcass characteristics								
HCW, lb	853	866	835	841	14.5	0.69	0.04	0.49
Dressing percentage,%	61.1	60.8	60.2	59.8	0.56	0.93	0.06	0.62
LM area, in^2	13.07	12.81	13.14	12.92	0.21	0.86	0.54	0.23
12th-rib fat, in	0.52	0.55	0.51	0.51	0.04	0.51	0.28	0.65
Marbling score[g]	516	498	491	493	21.4	0.49	0.31	0.70

[a]Treatments: 15% silage 37% DM = 15% inclusion of 37% DM silage, 15% silage 43% DM = 15% inclusion of 43% DM silage, 45% silage 37% DM = 45% inclusion of 37% DM silage, 45% silage 43% DM = 45% inclusion of 43% DM silage; all diets contained 40% MDGS
[b] Silage Concentration × Silage DM interaction
[c] Fixed effect of silage concentration
[d] Fixed effect of silage DM
[e] Final BW, were calculated based on HCW / common dressing percent of 63%
[f] F:G was analyzed as gain to feed.
[g] Marbling score 400 = small[00], 500 = modest[00]
[h,i,j]Means with different superscripts differ ($P < 0.05$).

tended to decrease ($P = 0.06$) as concentration of corn silage was increased from 15 to 45% in the finishing diet. There were no differences ($P \geq 0.31$) in LM area, 12th rib fat, and marbling score as concentration of corn silage inclusion increased.

As DM of corn silage increased from 37 to 43% due to delaying harvest, there were no differences ($P = 0.94$) in F:G. While not significant, DMI ($P = 0.19$) and ADG ($P = 0.55$) did increase numerically as DM of corn silage was increased from 37 to 43%. Additionally, there were no differences ($P \geq 0.68$) in carcass adjusted final BW or HCW as corn silage DM was increased. No differences ($P \geq 0.23$) in dressing percent, LM area, 12th rib fat, or marbling scores were observed as DM of corn silage was increased. While increasing the concentration of corn silage from 15 to 45% in place of corn in finishing diets reduces performance, delaying corn harvest and ensiling drier silage may be economical due to increased corn silage tonnage, cheaper handling costs, and no negative impact on performance when fed at either 15 or 45% of finishing diets.

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