Effects of increasing sugar beets on steer backgrounding performance

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ABSTRACT

The objective of this study was to evaluate the effects of sugar beets on steer backgrounding performance. Forty-eight Angus steers (260.7 ± 3.43 kg) were used in a completely randomized design for a 50 d study. On d -1, steers were weighed and assigned to 1 of 8 pens (6 steers per pen) equipped with GrowSafe units and one of four dietary treatments on d 0 (n = 12 steers/treatment; 2 pens/treatment: Table 1): 1) 0SB: control diet with no sugar beets; 2) 15SB: 15% sugar beets substituted for barley on a DM basis; 3) 30SB: 30% sugar beets substituted for barley on a DM basis; and 4) 45SB: 45% sugar beets substituted for barley on a DM basis. Sugar beets directly replaced rolled barley on a DM basis. All dietary treatments were formulated to meet or exceed the nutrient requirements of a 295 kg steer gaining 0.91 kg/d (NRC, 1996). The MIXED procedure of SAS was used for statistical analysis. Initial BW, mid-BW, final BW, period 1 and 2 ADG, and period 1 and 2 G:F were not different ($P \geq 0.33$) due to dietary treatment. There was also significant treatment × day interaction ($P < 0.001$) for DMI. On d 3, 19, 21, 23, 33, 44, and 45, 0SB DMI was reduced ($P \leq 0.05$), and increased ($P \leq 0.05$) on d 12, 20, and 47 compared with 15SB. On d 3, 19, 21, 33, 35, and 50, 0SB DMI was reduced ($P \leq 0.03$), and increased ($P \leq 0.01$) on d 9, 12, and 20 when compared with 30SB. On d 19, 21, 27, 33, 37, 38, and 45, 0SB DMI was reduced ($P \leq 0.05$), and increased ($P \leq 0.04$) on d 9, 24, and 35 when compared to 45SB. On d 35 and 37, 15SB DMI was reduced ($P \leq 0.002$), and increased ($P \leq 0.05$) on d 9 and 36 when compared with 30SB. On d 37 and 47, 15SB DMI was reduced ($P \leq 0.02$), and increased ($P \leq 0.03$) on d 1, 9, 44, and 46, when compared to 45SB. On d 45, 30SB DMI was reduced ($P \leq 0.03$), and increased ($P \leq 0.04$) on d 24 when compared to 45SB. These data suggest that backgrounding steers can be fed diets up to 45% sugar beets on a DM basis without negatively impacting performance.

INTRODUCTION

- Approximately 700 acres (or ~45.2 million lbs.) of sugar beet fields not harvested during the 2014-15 Montana sugar beet harvest. (USDA, 2015b)
- Whole sugar beets are an excellent energy source (81% TDN; Lardy and Schafer, 2008)
  - Potential replacement for barley or corn.
- Whole sugar beet require processing before feeding as they are a potential choking hazard.

HYPOTHESIS

- Feeding increasing levels of sugar beets (0, 15, 30, and 45% of DM) would have no deleterious effects on steer feedlot growth, but would have improved palatability indicated by increased DMI as sugar beets increased in the diet.

OBJECTIVE

- To evaluate the effects of sugar beets on steer backgrounding performance.

RESULTS

- Mid-point and final BW were not affected (P ≥ 0.63)
- ADG was not affected (P ≥ 0.55) by treatment
- G:F values were not effected (P ≥ 0.33) by treatment.
- Average daily DMI for the second period (P = 0.10) and overall (P = 0.06) tended to be effected quadratically by dietary treatment.
- There was also significant treatment x day interaction (P < 0.001; **Figure 1**) for DMI.
  - 0SB DMI was reduced (P ≤ 0.05) on d 3, 19, 21, 23, 33, 44, and 45, and increased (P ≤ 0.05) on d 12, 20, and 47 relative to 15SB.
  - On d 3, 19, 21, 33, 35, and 50, 0SB DMI was reduced ($P \leq 0.03$), and increased ($P \leq 0.01$) on d 9, 12, and 20 when compared with 30SB.
  - On d 19, 21, 27, 33, 37, 38, and 45, 0SB DMI was reduced (P ≤ 0.05), and increased ($P \leq 0.04$) on d 9, 24, and 35 when compared to 45SB.
  - On d 35 and 37, 15SB DMI was reduced ($P \leq 0.002$), and increased ($P \leq 0.05$) on d 9 and 36 when compared with 30SB
  - On d 37 and 47, 15SB DMI was reduced ($P \leq 0.02$), and increased ($P \leq 0.03$) on d 1, 9, 44, and 46, when compared to 45SB
  - On d 45, 30SB DMI was reduced ($P \leq 0.03$), and increased ($P \leq 0.04$) on d 24 when compared to 45SB.

Table 2. Effects of increasing sugar beets on backgrounding performance of steer calves.

	Dietary Treatment[1]						Contrasts[2]		
Item	0SB	15SB	30SB	45SB	SEM	*P* – value	Linear	Quadratic	Cubic
BW, lb									
d 1	571.56	575.52	572.66	574.42	15.576	1.00	0.94	0.95	0.87
d 28	659.34	666.38	666.16	670.78	18.744	0.98	0.68	0.95	0.88
d 50	712.8	736.56	746.46	751.74	23.188	0.63	0.27	0.67	0.92
ADG, lb/d									
d 1 to 27	3.124	3.256	3.344	3.454	0.308	0.89	0.44	0.99	0.98
d 28 to 50	3.124	3.058	3.498	3.52	0.374	0.72	0.36	0.92	0.59
d 1 to 50	3.036	3.168	3.41	3.476	0.264	0.55	0.16	0.90	0.78
DMI, lb/d									
d 1 to 27	13.728	14.63	13.068	12.54	0.924	0.25	0.11	0.36	0.34
d 28 to 50	18.326	20.064	21.23	19.624	1.144	0.18	0.21	0.10	0.62
d 1 to 50	15.708	16.94	16.72	15.95	0.616	0.16	0.80	0.06	0.69
G:F									
d 1 to 27	0.23	0.22	0.24	0.27	0.02	0.41	0.20	0.27	0.79
d 28 to 50	0.16	0.15	0.17	0.18	0.02	0.72	0.43	0.59	0.64
d 1 to 50	0.19	0.18	0.20	0.22	0.02	0.33	0.12	0.41	0.71

[1]Diets will be formulated to meet or exceed nutrient requirements of a 295 kg steer gaining 0.91 kg/d (NRC, 1996). Treatments were 0SB: 45% barley and 45% chopped hay; 15SB: 15% sugar beets substituted for barley on a % DM basis; 30SB: 30% sugar beets substituted for barley; and 45SB: 45% sugar beets substituted for barley

[2]n = 12

[3]*P* -value for the *F*-test of the mean.

[4]*P*-value for linear, quadratic, and cubic effects of increasing sugar beets in the diet.

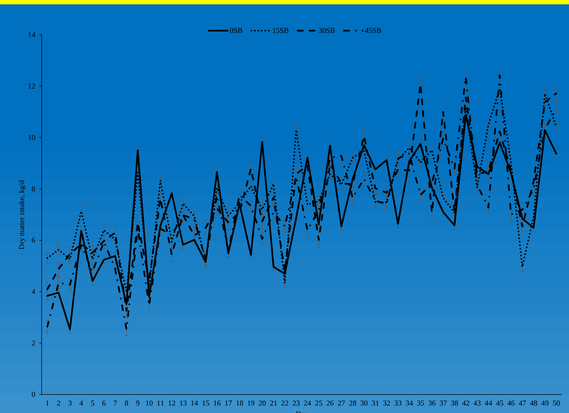

Figure 1. Effects of increasing sugar beets on steer dry matter intake. Diets were formulated to meet or exceed nutrient requirements of a 295 kg steer gaining 0.91 kg/d (NRC, 1996). Treatments were 0SB: 45% barley and 45% chopped hay; 15SB: 15% sugar beets substituted for barley on a % DM basis; 30SB: 30% sugar beets substituted for barley; and 45SB: 45% sugar beets substituted for barley. Dietary treatment: $P = 0.16$; day: $P = 0.14$; and dietary treatment × day: $P < 0.001$.

MATERIALS AND METHODS

Animals & Diets

- 48 Angus steers (260.7 ± 3.43 kg) weighed and assigned to 1 of 8 pens on equipped with growsafe units on d 1.
  - Pens were assigned to 1 of the 4 treatments on d 0 (12 steers/treatment; 2 pens/treatment).
    - 1) **0SB:** control diet with no sugar beets. 2) **15SB:** 15% sugar beets 3) **30SB:** 30% sugar beets. 4) **45SB:** 45% sugar beets. (Table 1).
    - Sugar beets directly replaced rolled barley on a DM basis, and samples of the total mixed rations were collected weekly and dried in a forced air oven at 70 degrees Celsius for 48 h to determine DM.

Timeline

- Ration samples were collected weekly composited by period (period 1: d 0 to 27; period 2: d 28 to 56)
- Steers weighed on consecutive days on d 0 and 1, mid-point (d 26 and 27), and at the end (d 49 and 50) of the trial
- Blood samples collected via jugular venipuncture on d 0, 27, and 49 of the trial.

STATISTICAL ANALYSIS

- MIXED procedure of SAS
- Model: dietary treatment
- Experimental unit: individual animal
- DM intake data was analyzed utilizing repeated measures with the fixed effects of dietary treatment, day, and the interaction.
- Pre-planned comparisons of linear, quadratic, and cubic contrasts were utilized to partition treatment effects.
- Significance determined at P ≤ 0.05.
- To partition day effects and treatment x day interactions, LS Means was utilized (P ≤ 0.05).

Table 1. Ingredient and nutritional composition of diets fed to backgrounding steers (DM basis)

	Dietary Treatment[1]			
Item	0SB	15SB	30SB	45SB
Ingredient, %				
Sugar beets[2]	—	15.0	30.0	45.0
Rolled barley	45.0	30.0	15.0	—
Chopped hay	45.0	41.0	36.9	32.75
Soybean meal	6.25	10.40	14.75	19.0
Mineral premix[3]	0.90	0.90	0.90	0.90
Calcium carbonate	1.25	1.10	0.85	0.75
Salt	0.25	0.25	0.25	0.25
Deccox	1.35	1.35	1.35	1.35
Nutritional Composition[4]				
DM, %	87.4	74.4	64.7	57.3
TDN, %	66.6	65.5	64.5	63.4
CP, %	16.0	15.6	15.4	15.1
Ca:P	2.63	2.65	2.57	2.64

[1]Diets will be formulated to meet or exceed nutrient requirements of a 295 kg steer gaining 0.91 kg/d (NRC, 1996). Treatments were 0SB: 45% barley and 45% chopped hay; 15SB: 15% sugar beets substituted for barley on a % DM basis; 30SB: 30% sugar beets substituted for barley; and 45SB: 45% sugar beets substituted for barley.

[2]Sugar beets were processed through a wood chipper to reduce the particle size to reduce the risk of choking.

[3]Mineral premix: 13.6% Ca, 10% P, 15.6% salt, 1.0% Mg, 0.1% K, 2,500 mg/kg Cu, 35 mg/kg Se, 8,500 mg/kg Zn, 440,529 IU/kg vitamin A, 44,053 IU/kg vitamin D, and 881 IU/kg vitamin E.

[4]Calculated nutrient composition of the diets.

CONCLUSIONS

- Results from the current study suggests that whole sugar beets can replace barley up to 45% without negatively effecting performance.
- Further research is needed to find how increasing concentrations of sugar beets diets in backgrounding rations for steers effects meat quality.

**All procedures were approved by the animal care and use committee of Montana State University (#2015-AA09).

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