Effect of increasing levels of soy hulls in finishing diets of cattle fed free-choice hay on performance, roughage intake and carcass characteristics

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INTRODUCTION

- In feedlot finishing diets, roughage inclusion represents in average 8 to 10% , in a dry matter (DM) basis.
- Roughage helps mitigate digestive disorders. Yet, increases feed costs per unit of metabolizable energy and complicates diet handling and management at commercial feedlots.
- Soybean hulls (SH), a by-product obtained after removing the seed coats from whole soybeans, contains more than 60% of readily fermentable neutral detergent fiber (NDF).
- The potential of SH inclusion as a mean to reduce roughage utilization in high grain diets of feedlot cattle has been given little attention.

Objective and Hypothesis

Our objective was to evaluate roughage intake, growth performance and carcass characteristics of feedlot cattle offered the roughage and a mix of concentrates with incremental levels of SH separately.

We hypothesized that offering cattle diets with greater concentration of SH in replacement of cracked corn (CC) will decrease roughage intake without negatively affecting feedlot performance and carcass characteristics

METHODS

- Sixty Angus × SimAngus-crossbred heifers (BW= 302 ± 29 kg; 20/treatment) and 54 steers (BW= 316 ± 29 kg ; 18/treatment) were fed for an average of 167 d.
- 5%SH= 5% SH, 70% cracked corn (CC), 15% DDGS and 10% supplement; 10%SH and 15%SH included an additional 5% and 10% SH in place of CC, respectively. Grass hay was offered ad libitum and separate from the concentrates.

- Yield and quality grade were provided by a USDA grader.
- Data were analyzed as a randomized complete block design using PROC MIXED in SAS. If there was no treatment × sex interaction, mean treatment differences were separated using polynomial (lineal and quadratic) contrast procedures. The effects of treatment, sex, and their interaction were included in the model as fixed, and block and animal within pen as random variables. Significant differences were determined at $P \leq 0.05$.
- Multiple linear regression analysis were evaluated for finishing performance and carcass characteristics considering the effect of sex, NDF intake, forage NDF intake and the standard deviation of forage intake. All factors included in the multiple linear regression analysis represented average values.

RESULTS

Table 1. Effects of increasing levels of soy hulls in finishing diets of steers and heifers fed free-choice hay on finishing performance and carcass characteristics.

	Treatment[1]							P-values[4]			
	Heifers			Steers				Treatment			
Item	5%SH	10%SH	15%SH	5%SH	10%SH	15%SH	SEM	L	Q	Sex	Trt*sex
IBW[2], Kg	299	297	299	317	310	314	2.59	0.47	0.06	<0.01	0.53
FBW, Kg	575^{d}	555^{e}	577^{d}	608^{a}	599^{b}	591^{c}	2.54	<0.01	<0.01	<0.01	<0.01
ADG, Kg/d	1.61^{a}	1.49^{b}	1.66^{a}	1.71^{a}	1.67^{a}	1.64^{a}	0.05	0.79	0.10	0.03	0.13
DMI, Kg/d	10.24^{b}	9.76^{c}	10.71^{a}	11.0^{a}	10.77^{a}	10.93^{a}	0.13	0.16	<0.01	<0.01	<0.01
FDMI g/d	579.8^{b}	604.1^{ab}	518.4^{c}	639.5^{a}	584.9^{ab}	604.5^{ab}	21.8	0.02	0.62	0.01	0.03
G:F	0.159^{a}	0.159^{a}	0.158^{a}	0.158^{a}	0.156^{a}	0.150^{a}	0.004	0.30	0.69	0.27	0.67
NEm,[3] Mcal/d	21.1^{b}	19.5^{c}	20.7^{b}	22.7^{a}	21.6^{b}	21.2^{b}	0.27	<0.01	<0.01	<0.01	0.01
HCW, Kg	344	331	344	376	365	361	5.9	0.22	0.10	<0.01	0.27
YG	3.5	3.2	3.4	3.5	3.5	3.3	0.22	0.45	0.69	0.67	0.54
LM area, cm^2	87.4	86.3	88.3	91.2	89.5	90.8	1.8	0.90	0.26	0.02	0.92
Backfat, cm	1.32	1.30	1.65	1.51	1.28	1.49	0.17	0.37	0.14	0.94	0.60
MS	753	768	677	751	748	728	30.6	0.10	0.23	0.68	0.46
KPH, %	2.55	2.54	2.25	2.73	2.69	2.50	0.128	0.03	0.30	0.06	0.91
QG	7.05	7.1	6.3	7.05	7.16	6.88	0.30	0.14	0.24	0.40	0.61

$^{a-e}$ Within a row, means without a common superscript differ ($P \leq 0.05$).
[1] 5%SH = finishing diet with 5% of soy hulls; 10%SH = finishing diet with 10% of soy hulls; 15%SH = finishing diet with 15% of soy hulls.
[2] BW of steers and heifers was registered on d 0 of the trial.
[3] NEm = Net energy for maintenance. Calculated as concentrate mix and hay intake multiplied by their respective NEm content.
[4] Trt = main effect of treatment; sex = main effect of sex; Trt × sex = interaction between treatment and sex. If the treatment*sex interaction P value was ≤ 0.05 the main effect of treatments linear (L), cubic (Q), and sex are not reported.

- There were treatment × sex interactions for dry matter intake (DMI), final body weight (FBW), forage dry mater intake (FDMI) and net energy of maintenance (NEm) intake. Heifers on the 15%SH treatment consumed less roughage but more total DM. Among steers, NEm intake was lower for the 15%SH treatment, which resulted in lighter FBW and HCW. Regardless of sex and treatment, cattle opted for a diet with no more than 6% of roughage. Total NDF and forage NDF were negatively associated with DMI, FBW, and ADG. Forage NDF intake was positively and negatively related with BF and MS, respectively, whereas total NDF intake was positively related to BF but did not relate to MS.

Table 2. Multiple linear regression on finishing performance and carcass characteristics.

Item	Intercept	Sex	Total NDF	Forage NDF	SD FDMI
DMI	11.12**	-0.5766*	-0.6004**	-0.1213**	0.0089**
FBW	633.68**	-31.4753**	-1.8156*	-3.4130*	0.2108*
ADG[1]	1.9914**	-0.1115*	-0.00945*	-0.02050*	0.000735*
G:F	0.1784**	-0.00208	-0.00006	-0.00031	-0.00005
HCW	737.08**	-75.2666**	-0.4183	-0.8704**	0.2863**
BF	0.7310**	0.04031	0.006744*	0.01652**	-0.00164**
MS	702.71**	-7.7455	-1.1936	-0.8692**	0.2337

* 0.0001 < P-value ≤ 0.05; ** P-value < 0.0001
[1] Average daily gain

CONCLUSIONS

- Despite differential responses to dietary treatments between steers and heifers, replacing a small portion of corn with SH could be cost-effective when considering the lower price of SH relative to corn and roughage.