Protein Sources for Steers Fed Steam Flaked, High Moisture or Whole Shelled Corn Grain

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Story in Brief

One hundred ninety-two steers were fed cottonseed meal, soybean meal or urea supplemented rations in which the corn grain was fed whole (with 5 percent corn silage) or in the high moisture or steam flaked form (with 14 percent corn silage dry matter added). Rates of gain and feed efficiencies were approximately equal for steers fed soybean meal and cottonseed meal and slightly superior to those fed urea (3.9 and 5.6 percent, respectively). Performance depression with urea was approximately three times as great during the last 63 days than during the initial 70 days of the trial. Composition of feces and carcass characteristics was largely unchanged by source of supplemental protein, although marbling tended to be greater for steers fed soybean than those fed cottonseed meal. Rate of gain and feed efficiency were excellent with whole shelled corn rations, being 6 and 11 percent superior to the other corn types. Results of 10 past comparisons of soybean meal with urea supplementation revealed that soybean meal always produced more rapid and efficient steer gains with high moisture corn. With dry corn rations, urea supplements generally gave greater feed intake, rate of gain and efficiency of feed use.

Introduction

Many trials over the past years have compared soybean meal with urea as a source of supplemental protein for corn grain rations. Advantages for soybean meal in daily gain of steers have ranged from minus 12 to plus 7 percent, and in feed efficiency from minus 8 to plus 4 percent. Such inconsistencies often have been attributed to protein level and steer weight with little concern for grain processing method. The objective of this trial was to determine the rate of gain, feed efficiency and fecal starch response of feedlot steers to soybean meal, cottonseed meal or urea supplementation of whole shelled, steam flaked and high moisture corn rations.

Materials and Methods

One hundred ninety-two steers averaging 692 lb were allotted to 24 pens of eight steers each. Four Angus, two Herefords and two exotic breed crossbred steers were in each pen. The procedures followed that described for the "Corn Processing" trial described elsewhere in this publication. Supplement composition is shown in Table 1.

Results and Discussion

Performance by periods across grain processing methods is shown in Table 2. Gain and feed efficiency were approximately equal for cottonseed- and soybean meal-fed steers, but urea-fed steers lagged behind by 4 and 5 percent with the difference much greater during the last half of the finishing period. Divided by corn type (Table 3), urea-fed cattle lagged behind soybean-fed cattle more in both gain and feed efficiency with high moisture than with dry grain. For dry grains, rate of gain and feed efficiency were greater with cottonseed meal than with soybean meal supplementation. Marbling score and federal grade favored soybean meal supplements, but other carcass

Table 1. Composition of protein supplements, %.

	For whole corn[a]			For processed corn		
	SBM[b]	CSM[b]	Urea	SBM	CSM	Urea
Soybean meal	68.4	0	0	79.1	0	0
Cottonseed meal	0	74.8	0	0	79.6	0
Urea	0	0	9.2	0	0	9.8
Ground corn	8.2	0	63.5	0	0	66.4
Limestone	12.4	15.0	12.2	11.8	12.0	10.8
KC1	5.05	6.00	7.45	3.50	4.30	5.65
Salt	3.5	3.5	3.5	3.3	3.3	3.3
Dicalcium phosphate	1.65	0	3.35	1.55	0	3.25
Minerals	0.29	0.29	0.29	0.28	0.28	0.28
Monensin	0.37	0.37	0.37	0.37	0.37	0.37
Vitamin A	0.08	0.08	0.08	0.08	0.08	0.08

[a]Pelleted.
[b]SBM = soybean meal; CSM = cottonseed meal.

Table 2. Performance across grain processing method.

	CSM	SBM	Urea
Pens	9	9	6
Days 0-70			
ADG*, lb	4.00	3.93	3.88
ADF*, lb	21.6	22.0	21.1
F/G*	5.45	5.64	5.71
Days 70-133			
ADG, lb	2.82	2.83	2.63
ADF, lb	20.2	19.6	20.2
F/G	7.22[ab]	7.03[a]	7.77[b]
Days 0-133			
ADG, lb	3.44	3.41	3.29
ADF, lb	21.0	20.9	21.2
F/G	6.13	6.14	6.48

[ab]Means in a row with different superscripts differ significantly ($P<.05$).
*ADG = average daily gain; ADF = average daily feed; F/G = feed/gain.

characteristics were similar among steers fed all supplements (Table 4). Composition of feces indicated a trend toward slightly increased starch in feces of steers fed urea, but dry matter and pH differences were small.

Soybean meal has been directly compared with urea as a source of supplemental protein for corn grain rations in 10 trials at OSU over the past 5 years. A summary of results from these trials is presented in Table 5.

An interaction between grain moisture and protein supplement was evident in rate of gain, feed intake and feed efficiency. Soybean meal in each trial proved superior to urea for supplementing high moisture corn. With dry grain, results were less consistent, but generally, urea supplementation produced greater feed intake and rate of gain than soybean meal supplementation. With whole shelled corn, benefit from urea supplementation may be less than with processed corn. How the two protein supplements influence site of energy digestion and intestinal supply of feed protein and bacterial protein with the two corn types is under study.

Table 3. Corn type and protein supplement.

		Overall performance			
Corn	Supplement	ADG	ADF	F/G	NE_G
HMC*	CSM	3.37^{abc}	21.9^{bc}	6.52^{cde}	57.0^{ab}
	SBM	3.55^{c}	21.7^{abc}	6.11^{abcd}	60.5^{abc}
	Urea	3.26^{abc}	22.2^{c}	6.83^{e}	56.3^{a}
SFC*	CSM	3.33^{abc}	20.8^{abc}	6.27^{bcde}	59.7^{ab}
	SBM	3.13^{a}	20.5^{ab}	6.55^{cde}	58.5^{ab}
	Urea	3.19^{ab}	21.2^{a}	6.66^{de}	56.1^{a}
WSC*	CSM	3.60^{c}	20.2^{a}	5.61^{a}	66.2^{c}
	SBM	3.54^{bc}	20.4^{a}	5.77^{ab}	64.3^{bc}
	Urea	3.40^{abc}	20.3^{a}	5.95^{abc}	61.2^{abc}

[abcde]Means in a column with different superscripts differ significantly ($P<.05$).
*HMC = high moisture corn; SF = steam flaked corn; WSC = whole shelled corn.

Table 4. Protein supplements and carcass characteristics.

Corn	Supplement	Dressing percentage	Rib eye area in^2	Marbling score	Cutability %	Fat thickness, in
HMC	CSM	61.2^{ab}	12.4	13.3^{ab}	49.6	.50
	SBM	61.8^{b}	12.6	13.4^{ab}	49.7	.49
	Urea	60.3^{a}	12.1	13.8^{ab}	48.9	.57
SF	CSM	61.0^{ab}	12.6	13.6^{ab}	50.0	.46
	SBM	60.5^{ab}	12.4	14.9^{b}	49.6	.50
	Urea	60.2^{a}	12.1	13.9^{ab}	49.4	.52
WSC	CSM	60.5^{ab}	12.4	12.3^{a}	49.3	.54
	SBM	60.7^{ab}	12.4	14.2^{b}	49.3	.54
	Urea	60.4^{ab}	12.3	12.5^{a}	50.2	.43

[ab]Means in a column with different superscripts differ significantly ($P<.05$).

Table 5. Summary of protein supplement comparison trials 1976-1980.

Corn[a] source	Year	Initial weight	Protein level	Daily gain		Daily feed		Feed/gain		SBM advantage		
				SBM	Urea	SBM	Urea	SBM	Urea	ADG	ADF	F/G
		lb	%	lb	lb	lb	lb			%	%	%
HMC	1980	692	10.4	3.55	3.26	21.7	22.3	6.11	6.83	8.2	−2.7	11.8
HMC	1976	754	12.4	3.81	3.54	19.8	19.2	5.20	5.42	7.1	3.2	4.2
HMC	1979	698	11.5	3.51	3.30	19.9	19.4	5.67	5.89	6.0	2.3	3.9
HMC	1976	754	11.0	3.86	3.72	20.1	19.8	5.22	5.31	3.6	2.0	1.7
HMC	1979	698	11.5	3.42	3.38	19.2	19.7	5.61	5.84	1.2	−2.9	4.1
HMC	Mean	719	11.2	3.63	3.44	20.1	20.1	5.56	5.84	5.2	0.4	5.1
WSC	1980	692	10.4	3.54	3.40	20.4	20.2	5.77	5.95	4.0	1.0	3.1
SF	1980	692	10.4	3.13	3.19	20.5	21.2	6.55	6.66	−1.9	−3.6	1.7
WSC	1977	564	11.3	3.27	3.44	17.5	18.5	5.34	5.37	−5.2	−5.8	0.6
RC	1979	698	11.5	3.08	3.37	19.1	20.2	6.20	5.99	−9.4	−5.7	−3.4
RC	1979	698	11.5	3.04	3.42	18.8	19.5	6.17	5.70	−12.5	−3.9	−7.6
DRY	Mean	669	10.8	3.21	3.36	19.2	19.9	6.01	5.93	−5.0	−3.6	−1.1

[a]HMC = high moisture corn; WSC = whole shelled corn; SF = steam flaked corn; RC = rolled dry corn grain.