Performance and Digestibilities of Beef Cattle Fed Diets Supplemented with Either Soybean Meal or Roasted Soybeans and Implanted with Synovex[1,2]

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ABSTRACT: Two 160-d feedlot experiments, each consisting of 20 Angus-Hereford steers (216 ± 5 kg BW, Exp. 1; 258 ± 5 kg BW, Exp. 2) and 20 Angus-Hereford heifers (208 ± 5 kg BW, Exp. 1; 236 ± 5 kg BW, Exp. 2), were used to investigate the effects of supplementing diets with either roasted soybeans (RSB, roasted at 127°C for 10 min) or soybean meal (SBM) and implanting or not implanting with an estrogenic growth promoter (SYN; Synovex-S, 20 mg of estradiol benzoate plus 200 mg of progesterone or Synovex-H, 20 mg of estradiol benzoate plus 200 mg of testosterone) on performance. The cattle were fed a basal diet of 15% orchardgrass silage, 15% corn silage, and 70% corn-based concentrate. Treatments were 1) no SYN and fed a SBM-supplemented diet, 2) no SYN and fed a RSB-supplemented diet, 3) SYN and SBM, and 4) SYN and RSB. Cattle in the SYN groups were reimplanted at 80 d. Four additional Angus-Hereford steers were used in a digestion and nitrogen balance experiment conducted during the first half of Exp. 1. For the total 160-d feedlot experiments, DMI for RSB compared with SBM was lower ($P < .01$; 8.5 vs 9.2 kg/d, SEM = .07) and ADG/DMI tended to be higher ($P < .10$; 165 vs 157 g/kg, SEM = 1.3). Final BW of steers fed RSB was similar ($P > .10$) to that of steers fed SBM (473 vs 478 kg, SEM = 5.6), as was ADG (1.39 vs 1.43 kg/d, SEM = .02). Dry matter intake for SYN-implanted steers was higher ($P < .01$) than for steers not implanted (9.2 vs 8.5 kg/d). Likewise, final BW (491 vs 460 kg) and ADG (1.49 vs 1.33 kg/d) were higher ($P < .01$), and ADG/DMI (166 vs 157 g/kg) tended to be higher ($P < .10$), for SYN-implanted steers than for steers not implanted. During the more rapid muscle growth period (0 to 80 d), DMI for RSB compared with SBM was lower ($P < .01$; 7.8 vs 8.6 kg/d, SEM = .07) and ADG/DMI was similar ($P > .10$; 181 vs 172 g/kg, SEM = 1.8). Dry matter intake for SYN-implanted steers was higher ($P < .05$) than for steers not implanted (8.4 vs 8.0 kg/d), as was ADG/DMI ($P < .01$, 182 vs 171 g/kg). During this more rapid growth period, the supplement × implant interaction for ADG was significant ($P < .05$; 1.35, 1.36, 1.59, and 1.44 kg/d for Treatments 1, 2, 3, and 4, respectively, SEM = .04). There were no differences in digestibilities or N balance. The results suggest that there is no improvement in performance under feedlot conditions when RSB replaces SBM in the diet of beef cattle, and, in young cattle, RSB may reduce the response expected by an estrogenic growth promoter.

Key Words: Feedlots, Beef Cattle, Soybean Oil Meal, Soybeans, Estrogens, Progesterone

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Introduction

Fats and oils are an important option for producers to increase the energy density of animal diets. The use of these supplements in beef feedlot diets is recommended at levels of approximately 3 to 4% of dietary DM (NRC, 1984) without negatively influencing ruminal fermentation. Oilseeds have been used, particularly in lactating dairy cow diets, to both increase dietary energy content and to supply protein. However, Casper and Schingoethe (1989) have pointed out numerous studies that demonstrate reduced milk protein production from cows sup-

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plemented with oilseeds and hypothesized that added dietary oils may reduce the release of ST from the pituitary and, thus, interfere with the uptake of amino acids. Reduced ST release in humans (Imaki et al., 1985), rats (Imaki et al., 1986; Alvarez et al., 1991), lambs (Estienne et al., 1990), pigs (Barb et al., 1991), and lactating dairy cows (Romo, 1995) has been related to increased dietary fatty acids. Rumsey et al. (1996) reported that young growing beef steers under limited intake conditions and supplemented with roasted soybeans (**RSB**) had reduced growth rate and ST release, but the negative effect of RSB was alleviated by the estrogenic growth promoter Synovex-S (**SYN**). There are no data in the literature concerning the effect of diets supplemented with RSB with and without an estrogenic growth promoter on performance of growing beef cattle with ad libitum intake, which is typical of feedlot conditions.

This study was conducted to determine whether reduced performance would occur under ad libitum intake feedlot conditions using similar RSB and estrogenic growth-promoter treatments as reported by Rumsey et al. (1996), who used limited intake conditions. Additionally, a digestion and nitrogen balance experiment was conducted to estimate possible differences in diet utilization.

Materials and Methods

Animal Care. The experiments described in this paper were conducted with the approval of the USDA Beltsville Area Institutional Animal Care and Use Committee.

Feedlot Experiments. Two experiments were conducted in two consecutive years, one experiment per year, with year serving as the replication. Each experiment was conducted during the same time period within year, and the calves averaged 7.5 mo of age when placed on each experiment. Each experiment included 20 beef steers (216 ± 5 kg BW, Exp. 1; 258 ± 5 kg BW, Exp. 2) and 20 beef heifers (208 ± 5 kg BW, Exp. 1; 236 ± 5 kg BW, Exp. 2) selected from calves born in the fall from the Angus × Hereford nutrition herd at the Beltsville Agricultural Research Center. For each experiment and within steers and heifers, animals were assigned to four treatments to equalize BW across treatment groups (eight groups of five animals per group, four groups per sex). Treatments were in a 2 × 2 factorial arrangement, and each experiment included two time periods (0 to 80 d and 80 to 160 d). All animals were fed a 30% silage-70% concentrate diet supplemented with either solvent-extracted soybean meal (**SBM**) as control or RSB as described in Table 1 and either not implanted or implanted with SYN (Synovex-S, 20 mg of estradiol benzoate and 200 mg of progesterone for steers, and Synovex-H, 20 mg of estradiol benzoate and 200 mg of testosterone for heifers, Fort Dodge Laboratories, Division of American Home Products, Fort Dodge, IA). The RSB were prepared commercially by heating soybeans to 127°C for 10 min (Melvin Z. Horst, Lincoln University, PA).

During a 6-wk adaptation period before each experiment, animals were assigned to eight group pens of either five steers or five heifers per pen with continuous access to water and were limit-fed for the first 4 wk the SBM diet to gain an estimated 1.3 kg/d (ME/kg $BW^{.75}$ basis; NRC, 1984). Animals were then fed either the SBM or RSB diets (two pens of steers and two pens of heifers per diet) and adjusted to an ad libitum level of intake (approximately 10% orts daily) for an additional 2 wk. The animals were then implanted as assigned (one pen per each diet × sex combination) and continued on feed for the 160-d experimental feeding period. The initial implanting was considered as d 0 for each experiment, and the implanted animals were reimplanted at 80 d.

The diets were mixed each morning and animals were fed daily at 0900. Feed intake of each pen was determined daily. Diet formulation was adjusted for changes in silage DM biweekly to maintain a consistent DM formulation. Diets and orts were sampled daily, composited weekly, and analyzed for DM (forced-air oven at 60°C) and Kjeldahl nitrogen (AOAC, 1990). The ME content of the diets was estimated from NRC (1984).

The feedlot facility consisted of eight 20.7- × 4.3-m side-by-side pens on a concrete surface. One-third of each pen was shaded to cover the feed bunk end of the pen. Animals were placed in adjacent dirt drylots approximately 10 times larger than each feedlot pen for at least 1 h daily to allow feedlot cleaning throughout each experiment. All animals were weighed weekly at approximately 0830 on the same day each week and on two consecutive days at the beginning and end of each time period during each experiment.

Digestion and N Balance Experiment. Four steers, selected from the same calf crop as the animals in the first feedlot experiment, were adapted to individual pens (1.6 × 9.1 m on a concrete surface with complete shade cover and automatic waterers) and trained to halters and to urine harnesses (a rubber funnel held in place over the penis with elastic straps fastened around the steer's body). Two 3-d periods before the balance experiment began were used to accustom the steers to the digestion stalls. The digestion stalls were floor-level adjustable-stanchion stalls that allowed access to a feeder and automatic waterer. Feces were collected in a pan set in a gutter at the rear of the stalls, and urine was collected via the rubber funnel with Tygon tubing attached to the rubber funnel and to a closed stainless steel carboy. Urine delivery to the carboy was aided by a vacuum hose attached to each carboy. The stanchion of each stall was adjusted to the length of each steer to optimize feces collection in the pan and animal comfort. Total 24-h feces and urine

were collected, mixed, and measured just before each morning feeding, and a 10% aliquot by weight of each was frozen. Hydrochloric acid was added to the urine collection vessel to reduce the pH to approximately 2.0.

The steers were initially fed the SBM diet for 4 wk at a level of intake to achieve 1.3 kg of gain daily (NRC, 1984). During this initial period and throughout the digestibility and N balance experiment, the steers were fed half their daily allotment of feed at 0800 and half at 1600. The initial level of intake, adjusted weekly, was maintained throughout the experiment for steers on each diet. At the end of the initial 4 wk, the steers were randomly assigned to the SBM or RSB diets (Table 1; two steers per diet) and fed the experimental diets for 5 wk before the first collection period. The collection periods were 7 d in duration: 2-d adjustment to stalls and 5-d total collection. Following the first collection period, the experimental diet fed to each steer was switched, fed for an additional 5 wk, and then followed by a second collection period. During the collection periods, intake was measured daily, and diets were sampled daily (equal sample sizes) and stored in a freezer. At the end of each collection period, the daily feed, feces, and urine samples for each steer were thawed, composited, and analyzed for DM and Kjeldahl N as described for the feedlot trials.

The steers were weighed weekly, diet formulation was adjusted weekly for changes in silage DM, and the amount of total diet offered was adjusted weekly except for the week before each collection period.

Statistical Analysis. For the feedlot experiments, ADG for each steer was calculated from the regression of BW on days. Individual animal ADG measurements allowed the estimation of within-animal variation and the testing of sex and experiment (year as replication) as main effects on ADG. Average daily gain was analyzed using the GLM procedure of SAS (1988) with SYN, RSB, sex, and experiment (replication) as main effects and their interactions in the model, and animal as the experimental unit. Replication interactions were not significant ($P > .10$) and, thus, were removed from the model. Dry matter intake and feed efficiency (ADG averaged per pen divided by daily DMI per pen) were analyzed using pen as the experimental unit with main effects and two-way interactions included in the model. If a treatment interaction occurred ($P \leq .05$), differences among means were evaluated using Duncan's new multiple range test. Data from the digestion and N balance experiment were analyzed as a single reversal with period and treatment as main effects.

Results

Feedlot Experiments. All animals except two steers completed the feedlot experiments. In Exp. 1, one steer was removed because of a respiratory infection,

Table 1. Ingredient and chemical composition of the diets supplemented with soybean meal (SBM) or roasted soybean (RSB) fed to beef cattle in feedlot and digestion experiments (DM basis)

	Experiment			
	Feedlot		Digestion	
Item	SBM	RSB	SBM	RSB
	%			
Ingredient				
Silage				
Corn	15.0	15.0	15.0	15.0
Orchardgrass	15.0	15.0	15.0	15.0
Concentrate				
Cracked corn	50.0	46.5	47.0	43.5
Soybean meal[a]	18.0	2.0	21.0	5.0
Roasted soybeans[b]	—	19.5	—	19.5
Dicalcium phosphate	1.0	1.0	1.0	1.0
Trace mineral salt[c]	1.0	1.0	1.0	1.0
Chemical composition				
Crude protein[d]	17.8	17.9	18.3	18.7
Ether extract[d]	3.2	6.5	3.2	6.5
ME, Mcal/kg[e]	2.87	2.86	2.91	2.90

[a]Solvent-extracted, 44% CP.
[b]Commercially roasted at 127°C for 10 min (Melvin Z. Horst, Lincoln University, PA).
[c]Trace mineral content (g/kg): Mn, 2.00; Fe, 1.60; Cu, .33; S, .11; Co, .10; Zn, .10; I, .07.
[d]Laboratory analysis.
[e]Estimated for this study based on NRC (1984). Using more recent NRC (1996) values published after this study was initiated would increase the estimated ME content of RSB diets by approximately .02 Mcal/kg.

and, in Exp. 2, one steer was removed because of a kidney infection. The performance of heifers vs steers is summarized for 0 to 80 d (Period 1), 80 to 160 d (Period 2), and the total feeding period in Table 2. Steers were heavier ($P < .01$) at the beginning and end of the experiments than heifers, and steers gained weight more rapidly and efficiently ($P < .01$) than heifers. Variation among treatments was similar for heifers and steers.

Animal performance by treatment is summarized for Periods 1 and 2 and the total feeding period in Table 3. Among treatments for Period 1, initial BW was similar ($P > .10$). Dry matter intake was lower ($P < .01$) for animals supplemented with RSB than for animals supplemented with SBM. Dry matter intake was higher ($P < .05$) for SYN-implanted animals than for animals not implanted. Average daily gain was influenced by a significant supplement × implant interaction ($P < .05$). A significant growth response to estrogenic implants was obtained when animals were fed the SBM-supplemented diet but not when animals were fed the RSB-supplemented diet. Efficiency of gain was similar ($P > .10$) between SBM and RSB animals and higher ($P < .01$) for implanted animals than for animals not implanted. Implanted animals were 10% more efficient than animals not implanted when fed SBM and were 3% more efficient than animals not implanted when fed RSB. As in Period 1, DMI for Period 2 was lower ($P < .05$) for animals fed the RSB-supplemented diet than for animals fed the SBM-supplemented diet and was higher ($P < .01$) for implanted animals than for animals not implanted. Average daily gain for Period 2 was higher ($P < .01$) for SYN-implanted animals than for animals not implanted and was not different ($P > .10$) between SBM and RSB animals. There was no SYN × RSB interaction observed for these older animals like that seen when the animals were younger (Period 1). Efficiency of gain tended to be higher ($P < .10$) for animals supplemented with RSB than for animals receiving SBM and higher for SYN-implanted animals than for animals not implanted.

For the total experiment, DMI was lower (8%, $P < .01$) for animals supplemented with RSB than for animals receiving soybean meal. Dry matter intake was higher (8%, $P < .01$) for SYN-implanted animals than for animals not implanted. Average daily gain was higher (12%, $P < .01$) for SYN-implanted animals than for animals not implanted. Although the supplement × implant interaction for ADG was not significant ($P > .10$), the means numerically reflected the significant interaction observed in Period 1. Thus, ADG for the total period was 14% higher for SYN-implanted animals than for animals not implanted when fed the SBM diet and was 10% higher for SYN-implanted animals than for animals not implanted when fed the RSB diet. Efficiency of gain for the total feeding period tended to be higher (5%, $P < .10$) for animals fed the RSB-supplemented diet than for animals fed the SBM-supplemented diet and tended to be higher (6%, $P < .10$) for SYN-implanted animals than for animals not implanted.

Digestion and N Balance Experiment. Results of the digestion and N balance experiment are summarized in Table 4. There were no differences obtained for treatment. Mean digestibility of DM and N varied between treatments by only 1.7 and .1 percentage units, respectively. Numerically, N balance was reduced by 7.6% when steers were fed RSB compared with soybean meal, a value that is comparable to the

Table 2. Effect of period and sex on feedlot performance of heifers and steers fed for 160 d

	Sex			
Item	Heifers	Steers	SEM[a]	$P <$
No. of animals	40	38	—	—
Period 1 (0–80 d)				
Initial BW, kg	222	237	3.7	.01
DMI, kg	8.1	8.3	.10	NS[b]
ADG, kg	1.36	1.51	.03	.01
ADG/DMI, g/kg	169	183	3.8	.05
Period 2 (80–160 d)				
Initial BW, kg	341	369	6.8	.01
DMI, kg	9.2	9.8	.10	.05
ADG, kg	1.30	1.47	.03	.01
ADG/DMI, g/kg	142	153	3.0	.05
Total experiment (0–160 d)				
Final BW, kg	452	499	5.5	.01
DMI, kg	8.6	9.0	.06	.05
ADG, kg	1.33	1.49	.02	.01
ADG/DMI, g/kg	155	167	2.7	.01

[a]n = 39 for final BW and ADG, and n = 8 for DMI and ADG/DMI.
[b]Not significant.

Table 3. Feedlot performance of beef cattle[a] fed diets supplemented with either soybean meal (SBM) or roasted soybeans (RSB) and implanted with an estrogenic growth promoter (SYN)

	Treatment[b]							
						$P <$		
Item	SBM −SYN	RSB −SYN	SBM +SYN	RSB +SYN	SEM[c]	SYN	RSB	×[d]
No. of animals	19	20	19	20	—	—	—	—
Period 1 (0–80 d)								
Initial BW, kg	229	230	231	229	5.2	NS[e]	NS	NS
DMI, kg	8.3	7.7	8.9	7.9	.10	.05	.01	NS
ADG, kg	1.35[x]	1.36[x]	1.59[y]	1.44[x]	.04	.01	.10	.05
ADG/DMI, g/kg	164	178	180	183	2.5	.01	NS	NS
Period 2 (80–160 d)								
Initial BW, kg	347	349	369	355	6.9	.05	NS	NS
DMI, kg	9.2	8.8	10.4	9.6	.10	.01	.05	NS
ADG, kg	1.33	1.29	1.48	1.49	.05	.01	NS	NS
ADG/DMI, g/kg	139	147	147	156	1.9	.10	.10	NS
Total experiment (0–160 d)								
Final BW, kg	459	461	497	485	7.9	.01	NS	NS
DMI, kg	8.7	8.2	9.6	8.7	.10	.01	.01	NS
ADG, kg	1.33	1.32	1.52	1.46	.03	.01	NS	NS
ADG/DMI, g/kg	152	161	162	169	1.8	.10	.10	NS

[a]The study included steers and heifers, and the variation among treatments was similar with steers and heifers. Differences between steers and heifers are presented in Table 2.
[b]Animals were either implanted or not with a Synovex (SYN) ear implant (20 mg estradiol benzoate and 200 mg protesterone for steers or 20 mg estradiol benzoate and 200 mg testosterone for heifers; Fort Dodge Laboratories, Division of American Home Products, Fort Dodge, IA) and fed either supplemental SBM or RSB (commercially roasted at 127°C for 10 min; Melvin Z. Horst, Lincoln University, PA).
[c]n = 19 for final BW and ADG, and n = 4 for DMI and ADG/DMI.
[d]Supplement × implant interaction.
[e]NS = not significant.
[x,y]Means in the same row with different superscript differ ($P < .05$).

reduction of 10.4% in performance observed between similar treatments at the same intake levels reported by Rumsey et al. (1996).

Discussion

Fats and oils represent energy supplements that typically can be added at levels up to 3 to 4% of ruminant diets without negatively affecting ruminal fermentation. Oilseeds supply both a fat and a protein supplement to the diet, and roasting has been used to increase the amount of ruminal escape protein of a diet. Both of these factors are important to support high production in lactating dairy cattle and in feedlot cattle. However, Casper and Schingoethe (1989) have reviewed numerous studies that demonstrated reduced milk protein from lactating cows supplemented with oilseeds and hypothesized that added dietary fat reduces the release of ST from the pituitary and, thus, interferes with the uptake of amino acids for milk production. A recent study reported by Madison-Anderson et al. (1997) showed a 4.2% lower milk protein concentration in cows supplemented with RSB than in those fed SBM. Production studies for growing beef cattle are not available. However, in a controlled study and under conditions of equalized metabolizable energy and protein intake across treatments, Rumsey et al. (1996) obtained both lower daily gain and less release of ST when RSB were used as a dietary supplement compared with SBM as a supplement. Furthermore, this response was alleviated when steers were implanted with an estrogenic growth promoter, and the effect seemed to be diminished or eliminated in older steers. In their study, RSB was found to reduce the release of both ST and thyroid-stimulating hormone (**TSH**; Rumsey et al., 1997), and SYN was found to increase the release of these hormones when RSB were fed.

The current study was designed to examine the effects of feeding RSB to beef steers under feedlot conditions of ad libitum levels of feed intake and to

Table 4. Diet digestibility and nitrogen balance in beef steers fed diets supplemented with soybean meal (SBM) or roasted soybeans (RSB)

	Diet supplement		
Item	SBM	RSB[a]	SEM[b]
DMI, g/d	7,905	8,033	192.3
DM digestibility, %	71.7	70.0	1.56
Nitrogen intake, g/d	241.4	245.8	5.30
Nitrogen digestibility, %	70.5	70.6	1.49
Nitrogen balance, g/d	96.9	89.5	14.00

[a]Commercially roasted at 127°C for 10 min (Melvin Z. Horst, Lincoln University, PA).
[b]n = 4.

again compare animals at two stages of feedlot growth. This was accomplished by using diets similar to those used earlier by Rumsey et al. (1996). Dietary protein was maintained in excess to ensure adequate protein to match those diets fed in earlier studies. The current study indicated there was no difference in DM and N digestibilities between the RSB- and SBM-supplemented diets at near ad libitum levels of intake. An evaluation of the RSB indicated that ruminal undegradable protein was 50.4% for the RSB and 32.5% for the SBM, and acid detergent insoluble nitrogen was not increased due to roasting (Casper and Varga, personal communication).

Results of the current feedlot experiments are not totally consistent with the effects of feeding RSB reported earlier by Rumsey et al. (1996) in a controlled intake study. Consistent with the earlier study of Rumsey et al. (1996) is the apparent difference in treatment effects between Periods 1 and 2. There were no performance effects associated with RSB in Period 2 except for lower DMI of RSB compared with SBM diets, a consistent effect in both periods. Inconsistent with the study of Rumsey et al. (1996) are the treatment effects observed during Period 1. Although the N balance experiment resulted in a 7% lower N balance, which is consistent with the results expected from the study of Rumsey et al. (1996), this effect was not seen in the present feedlot study with an ad libitum intake level. For Period 1, average performance was not different between animals that were not implanted and fed either RSB or SMB diets. Under limited intake (Rumsey et al., 1996), the RSB diet reduced performance compared to the SBM diet when steers were not implanted. When animals were implanted with SYN in the current study, performance of RSB-fed animals was lower than that of SBM-fed animals. This is consistent with the results for younger steers in the earlier study reported by Rumsey et al. (1996) under limited intake. Two differences between the earlier study by Rumsey et al. (1996) and the current feedlot experiment are that the RSB-fed animals ate less feed than the SBM-fed animals and ruminal escape protein may have been greater with ad libitum intake.

The differences observed in feed intake may suggest that, at an ad libitum level of intake, the animals fed RSB reached satiety sooner; thus, other endocrine or metabolic controls affecting growth-related mechanisms may have been important in regulating nutrient use. Unfortunately, an assessment of specific tissue deposition is not available to determine the composition of gain that would directly influence overall weight gain. Studies on the carcass merit and composition of the steers from this study and the earlier study of Rumsey et al. (1996) indicated that fat deposition in the carcasses of RSB-fed steers was greater than that in SBM-fed steers (Rumsey et al., 1999). Because RSB was shown to reduce TSH release (Rumsey et al., 1997), additional fat gain may have occurred in the RSB-fed animals as a result of depressed thyroid status (Rumsey et al., 1992). This could also explain the apparent antagonism between SYN and RSB in the current experiment, because one effect of SYN is a stimulation of TSH (Rumsey et al., 1997). Thus, under feedlot conditions, an improvement in performance from the added oil in RSB when animals are implanted may not be realized, particularly for young feedlot cattle. This study also points out the limitations in extrapolating results from controlled intake studies to production situations.

It can be speculated that the additional dietary oil causes reduced ST and TSH release, which has a negative effect on growth in RSB-fed cattle. Rumsey et al. (1996) reported a significant increase in plasma NEFA in steers fed an RSB-supplemented diet, as was fed in the current study. Increases in dietary fatty acids have been reported to reduce ST release in humans (Imaki et al., 1985), rats (Imaki et al., 1986; Alvarez et al., 1991), lambs (Estienne et al., 1990), pigs (Barb et al., 1991), and lactating dairy cows (Romo, 1995). Others have reported an antiestrogenic effect of soybeans when fed to male mice (Makela et al., 1995), which seemed to be greater in 9-mo-old than in 12-mo-old mice. More research is needed to delineate the biological effects of soybeans compared to soybean meal when fed to growing ruminants.

Implications

In an earlier controlled intake experiment with young beef steers, supplementing with roasted soybeans reduced average daily gain and depressed the release of somatotropin, suggesting that additional oil from soybeans may negatively influence growth via endocrine effects. The current study determined whether the same performance effects of feeding roasted soybeans occur in cattle under feedlot conditions. There were no differences in performance under feedlot conditions when roasted soybeans replaced soybean meal in the diet of beef cattle not implanted. However, with an estrogenic growth promoter, performance was reduced when roasted soybeans replaced soybean meal during the first 80 d of a 160-d feedlot period when protein deposition would be expected to be greater, compared with the second 80 d when fat deposition would be expected to be greater. Thus, the full benefit of an estrogenic implant may not be realized when roasted soybeans are fed to young feedlot cattle.

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