Evaluation of Whole, In-shell Peanuts as a Supplement Feed for Beef Cows

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Results indicated that raw, whole in-shell peanuts may have potential as an energy and protein supplement feed for mature beef cows.

Summary

A cow feeding trial and a digestion trial were conducted to evaluate the suitability of using whole, in-shell raw peanuts (WP) as an energy and protein supplement feed for beef cattle. The digestion trial utilized 18 growing beef steers (584 lb avg. initial wt.). The steers were fed bermudagrass free choice plus one of three supplement treatments: 1) corn and cottonseed meal mix (50:50; CCSM; control), 2) corn and WP mix (50:50; CWP), or 3) WP. Hay and diet dry matter (DM) consumption, and apparent digestibility of DM, acid detergent fiber (ADF), and neutral detergent fiber NDF were slightly reduced (P<0.05) for steers on the WP treatment compared to CCSM and CWP treatments; CCSM and CWP were similar. Digestibility of crude protein (CP) of WP treatment was similar to CCSM. The cow feeding trial utilized 80 mature late gestating cows (1,210 lb avg. initial wt.). The cows were fed bermudagrass hay free choice and fed either CCSM (50:50) or WP as a supplement feed 3x weekly that provided an average of 2.5 lb/d per head. Supplement treatment did not affect cow body condition (BCS), but body weight (BW) gain over the 84 d trials tended to be lower for WP vs. CCSM supplement treatment (P=0.09). Subsequent calf birth wt, survival rate and weaning wt, and subsequent cow AI conception rate were not affected by supplement treatment. Results indicate that WP may be a suitable, easy to feed energy and protein supplement for wintering mature beef cows; however, as noted from the steer digestibility trial, some decrease in total diet digestibility may occur.

Introduction

Peanut (*Arachis hypogaea* L.) is a legume crop commonly grown in the southeastern USA for pod/seed production for human consumption. Changes in the U.S. peanut program have resulted in decreased peanut prices. Those peanuts not suitable for human consumption (i.e. "oil stock" peanuts) may offer a convenient, easy to use energy and protein supplement for beef cattle when fed whole. These peanuts, which are about 10 to 20% shell by weight, contain about 20% CP, 40% fat (oil) and 6% moisture. Previous research with other intact whole oil seeds, such as sunflower seeds (Banta et al., 2006), raw soybeans (Long et al., 2008) and whole cottonseed (Hill et al., 2008) have shown these oilseeds to be a simple, convenient way to provide supplemental energy and protein for beef cattle (Funston, 2004). The high oil content of raw, whole in-shell peanuts would be an effective way to increase diet energy density. We are not aware of any published reports on using whole in-shell peanuts in beef cattle feeding, but field observations have noted that mature beef cattle will consume in-shell peanuts. Thus, our objective was to evaluate raw whole, in-shell peanuts as a supplement feed for beef

cattle, in particular as a supplement feed for mature beef cows.

Procedures

Two experiments were conducted – a digestibility trial conducted at the University of Georgia, CPES Tifton located in south central Georgia, and a beef cow feeding trial conducted at the University of Florida, NFREC Marianna located in northwest Florida. Both trials were conducted in accordance with approvals of both universities animal use committees.

Digestion trial

The digestion trial utilized 18 growing beef steers (avg. initial weight of 584 ± 26 lb; 9 mo. of age) of Angus, Angus cross, or Polled Hereford breeding. The steers were randomly assigned to three supplement treatments (six per treatment). The supplement treatments were: 1) corn and cottonseed meal mix (50:50; CCSM; control), 2) corn and whole peanuts (50:50; CWP), and 3) whole peanuts (WP). All supplements were fed at 3 lb/head/d. Bermudagrass hay ('Tifton 85') was fed free-choice, and steers had free-choice access to both water and a mineral supplement.

The whole peanuts were processed (ground) before feeding using a hammer mill. The peanuts were only ground to the extent of breaking shells, leaving approximately 95% of the peanut kernels unbroken. Processing was done to insure intake of the peanuts by the growing steers. Previous experience at the Tifton station has noted that growing cattle will not readily consume whole peanuts. This is contrary to anecdotal evidence that suggests that mature cattle will readily consume whole peanuts.

The steers were fed treatment supplements once daily at 0800 hr. Digestibility was determined using chromic oxide. Chromic oxide (10 g/steer daily) was fed with supplements from d 8 to d 17. Fecal samples (12/steer) were collected 3 times daily from d 14 to d 18. Individual steer fecal samples were dried, ground (1 mm), and composited over time for each steer. Samples of hay, corn, peanuts, and fecal samples were chemically analyzed for DM, CP, ADF and NDF, and fecal samples were additionally analyzed for Cr. Apparent digestion coefficients were then computed for DM, CP, ADF and NDF. Individual steer DMI was computed as the difference between daily feed intake and refusals.

Beef cow trial

The cow feeding trial was a comparison of two supplement treatments: CCSM (50:50; control) and WP fed to mature, wintering beef cows fed grass hay. Trial was conducted during the 2004-2005 and 2005-2006 winter seasons. For each year, 40 mature beef cows (primarily Angus and Brangus), were divided into two blocks of 20 cows each based on body condition: a low BCS (avg. = 4.8) and a high BCS (avg. = 5.9) block. The cows averaged 1,158 ± 145 lb for the first year and 1,262 ± 145 kg for the second yr, and were 3 to 11 yr of age. Within the low and high blocks, the cows were further divided into treatment groups based on BW, age and genetic background, which resulted in four groups of 10 cows per yr (two groups of ten of low BCS and two groups of ten of high BCS cows per treatment per year). The cattle were divided into low and high BCS groups to better target nutritional needs of the cows. Within yr and within BSC group (block), supplement treatment was assigned at random. The assignment process was repeated for the second yr, thus, cows had an equal chance of being assigned to another treatment the second yr. The high BCS groups were fed 2 lb/d of supplement per head and the low groups, 3 lb/d per head. The supplements were fed three times weekly – Monday, Wednesday and Friday mornings (0730 to 0830 h). All cows received hay ('Tifton 85' bermudagrass) and a cattle mineral supplement free choice. The cows were maintained as four groups of ten on four 3.2 ac dormant warm season bahiagrass pastures. The cows had free access to water and shade. Although hay was provided, the cows had access to dormant bahiagrass. Ample feed bunk space was provided such that all cows in a group were able to consume supplement at one time. For each year, the trial lasted for 84 d from mid-November to early February.

Individual cow BW and BCS were determined at the start and end, and every 28 d during the trials. Weights were determined after a 16 hr

withdrawal from feed and water. Body condition scores (1 through 9; 1 = emaciated, 9 obese) were assigned by the same two individuals throughout the trials.

The peanuts used in the cow trial were "oil stock" peanuts obtained from the peanut breeding program at NFREC Marianna. The bermudagrass hay was grown and harvested at the center. Representative samples of the peanuts and hay used were analyzed for nutrient composition by a commercial feed analysis laboratory.

Subsequent calf data were collected which included birth wt, weaning wt and adjusted 210 d calf weaning wt. Calving was from early February to mid-April each year. All calves were weaned in early September.

Statistical

The steer intake and apparent digestibility data were statistically analyzed using Proc MIXED (SAS, 2002). Steer DMI and apparent digestion coefficients for DM, CP, ADF and NDF were analyzed as a completely random design, since steers were individually fed supplement treatments. Steer DMI and apparent digestion data were adjusted for initial BW as a covariate.

Data collected from the cow trial included cow body wt and BCS changes, and subsequent calf performance. Since the cows were group fed, the experimental unit was the group of ten cows. The data were analyzed as a RCB using Proc MIXED (SAS, 2002) with treatment as fixed and year as a random effect; BCS group was treated as a block.

Results

The nutritional analysis of the raw whole, in-shell peanuts indicated that peanuts can be a good source of energy and protein when used as a supplement feed for beef cattle (Tables 1 and 2). For example, when fed at 2 lb/d per head along with medium quality grass hay (~ 54% TDN, 8% CP), the resulting total daily diet for a 1,200 lb beef cow would be about 58% TDN and 9% CP, more than adequate for a mature gestating beef cow in good body condition (NRC, 2000).

In the steer digestion trial, the dietary supplements were formulated to mimic expected usage of the raw, whole, in-shell peanuts as a supplement feed for beef cattle. The CWP treatment was a simple 50:50 mixture which may be a logical choice for some producers. Dietary CP intake varied because of the varied CP of the supplements (total diet CP, including hay, was 17.8, 13.1 and 15.4% for the CCSM, CWP, and WP treatments, respectively). All diet CP levels exceed NRC (2000) recommended levels of CP for growing beef steers. Hay used in the digestibility trial would be considered good quality based on analyses (Table 1).

Hay DMI and total diet DMI were reduced ($P<0.02$) for steers receiving the WP supplement compared with the CCSM and CWP treatments (Table 3). Apparent digestibility coefficients obtained were relatively high, about 10% higher than anticipated. Differences due to supplement treatment were noted. Apparent digestibility of DM, ADF and NDF were reduced ($P<0.01$; Table 3) from steers on the WP treatment compared to the CCSM and CWP treatments. The lower intake and digestibility's may be the result of the peanut hulls and (or) relatively high fat (oil) concentration of the WP. Peanut hulls are high in fiber and lignin, and are poorly utilized by beef cattle (Hill, 2002). However, the hulls would only comprise about 5% of the total diet. On the other hand, the estimated ether extract (fat) level of the total diet (WP + hay) was 13% (DM basis). The estimated ether extract level of the CWP diet was 7%, just above the level (6 %) above which interference with fiber digestion and DM intake can be expected (Moore et al., 1986; Coppock and Wilks, 1991; Funston, 2004). In spite of the estimated 7% fat level, digestibility of DM, ADF and NDF of the CWP treatment were similar ($P>0.10$) to those of the control (CCSM).

In the mature beef cow trial, the feeding of WP did not ($P>0.10$) influence BCS at the end of the 84 d feeding phases during late gestation when compared to control CCSM supplement treatment (Table 4). Cow body wt gain, however, tended to be lower for WP vs. CCSM ($P = 0.09$; Table 4). Subsequent calf birth wt,

calf wt gain and weaning wt were not affected (P>0.10) by supplement treatment. Subsequent

AI conception rate was not affected by treatment, however, only a total of 40 cows were used per treatment.

Results indicated that whole in-shell peanuts can be a suitable feed supplement for mature beef cows. These peanuts were readily consumed by the mature cows. However, it took nearly all day for the peanuts to be consumed. As noted in the steer digestibility trial, some decrease in DMI and total diet digestibility may occur if WP is fed to cows. The slightly lowered weight gain noted for the WP treatment in the cow trial may be a reflection of these effects. Banta et al. (2006) also noted some decrease in cow weight change upon interval feeding of whole sunflower seeds which contain about 40% fat (oil) that were fed at 3.6 lb/d per head.

Implications

Results indicated that raw, whole in-shell peanuts could be an easy to use energy and protein supplement feed for mature beef cows. However, poor intakes have been noted with growing beef cattle (Hill, unpublished results). Some processing (i.e. coarse grinding) and blending with another feedstuff (i.e. corn) would be needed to insure intake by growing cattle. Also, like any high fat feed, caution should be taken to insure that total diet fat content is not excessive (i.e. above 6 to 8%).

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Table 1. Composition (%) of supplements and hay fed to steers in the digestion trial[a].

Item	DM	CP	ADF	NDF
CCSM[b]	89	33	6	9
CWP[c]	90	16	15	26
WP[d]	92	23	28	41
Corn	89	9	2	10
Hay[e]	92	12	39	79

[a]Percent DM basis.

[b]Corn and cottonseed meal (50:50 mix).

[c]Corn and whole, raw peanuts (50:50 mix).

[d]Whole, raw in-shell peanuts.

[e]Tifton 85' bermudagrass.

Table 2. Nutritional composition of raw whole, in-shell peanuts and hay used in the mature beef cow trial[a].

	Whole peanuts		Hay[b]	
Item	Year 1	Year 2	Year 1	Year 2
Moisture	4.2	7.1	13.9	12.9
Crude protein	23.0	20.6	7.8	7.8
Crude fat	45	40	ND[c]	ND
Crude fiber	22	33	31	36
ADF	24	26	40	46
NDF	32	37	72	79
TDN	121	109	57	56
Ash	2.8	2.8	5.5	6.1
Ca	0.28	0.18	0.32	0.34
P	0.36	0.34	0.25	0.26

[a]Analyses done by a commercial laboratory; values are on an as-fed basis.

[b]Tifton 85' bermudagrass.

[c]Not determined.

Table 3. Dietary intake of hay and apparent digestibility coefficients of total diet (supplement + hay) for the growing steer digestion trial.

	Hay DMI,[a]	% digestibility			
Supplement	lb/d	DM	CP	ADF	NDF
CCSM[b]	7.7[f]	86.8[h]	86.7[h]	85.3[h]	87.2[f]
CWP[c]	7.9[f]	85.6[h]	82.7[i]	84.0[h]	86.4[f]
WP[d]	6.6[g]	81.6[i]	84.9[h]	79.4[i]	83.2[g]
SE[e]	0.31	0.68	0.77	0.81	0.81

[a]Dry matter intake.
[b]Corn and cottonseed meal (50:50 mix).
[c]Corn and whole peanuts (50:50 mix).
[d]Whole peanuts.
[e]Standard error; n = 6.
[f,g]P<0.02.
[h,i]P<0.01.

Table 4. Mean performance parameters of wintering mature gestating beef cows fed hay and supplement, and effects on subsequent calf crop and cow reproduction[a].

	Supplement treatment			
Item	CCSM[b]	WP[c]	SE[d]	P-value
Body condition score[e]:				
Start	5.5	5.5	0.05	NS
End	5.5	5.5	0.06	NS
Cow body wt. change, lb	+108	+79	7.9	0.09
Calf birth wt., lb	79	79	0.3	NS
Calf weaning wt., 1b	515	542	12.8	0.23
Calf wt. gain, lb	436	468	12.3	0.16
Calf survival rate, %	100	95	1.8	0.18
Cow conception rate[f], %	70	68	6.2	NS

[a]Two year study, 40 cows per yr (10 cows per paddock).
[b]Rolled corn-cottonseed meal mix (50:50).
[c]Whole peanuts.
[d]n = 4.
[e]Scores of 1 to 9 with 1 = very thin and 9 = obese.
[f]Subsequent breeding via AI.