INCREASING PERFORMANCE OF GROWING CATTLE AFTER WEANING USING COTTONSEED AND COTTONSEED MEAL SUPPLEMENTS

G. M. Hill, J. F. Baker, B.C. Hand, G. W. Stone, M. Keeler and T. Ingram
Univ. of Georgia, Dept. of Animal & Dairy Sci.[1], PO Box 748, Tifton, GA 31793-0748

Introduction

During the autumn, 2003, weaned calves and stocker cattle were sold for record high prices. This event reduced the number of calves kept on farms and increased short-term profits. Georgia had 700,000 cows and heifers and 580,000 calves produced in 2001. Most calves are still marketed at weaning, with approximately 150,000 retained in the state on stocker programs. Numbers of retained calves should increase if more crop land is returned to temporary winter annual grazing programs. The opportunity exists for farmers who have cotton, peanuts or other crops to include cattle to graze winter annual pastures (oat/rye/ryegrass/wheat) from January to April. Many farms in the region have irrigated fields that can greatly increase early survival and production of winter annuals grown when row crops are not in production.

Cottonseed meal and whole cottonseed can be efficiently utilized in cattle diets after weaning during the transition from grazing summer perennial to winter annual pastures following cotton harvests. Cottonseed meal provides high quality protein (41 % CP, 72 % ruminant TDN, Feedstuffs, 2001) and whole cottonseed may provide both energy and protein (96 % TDN and 23% CP, Feedstuffs, 2001). Research has indicated that cottonseed has a value similar to a 20% protein mixture of corn and soybean meal, making it worth around $150/ton (Poore and Green, 1998). Cottonseed meal has a slower N degradation rate than corn (Hill et al.,1989), and it can be effectively utilized as a natural protein supplement for growing beef calves to balance protein requirements when grazing low quality forages or when fed hay (Kunkle, 2001; NRC, 1984). In recent research (Hill and Gates, 2003) growing steers were reluctant to consume whole cottonseed when late season green bermudagrass forage was available before frost. Our objectives included research to improve cotton by-product supplement consumption during the autumn transition periods from summer forages to winter annual pastures for autumn-weaned calves. Supplements with flavor enhancing additives might increase cotton by-product consumption, dietary digestion, and performance of these calves.

Materials and Methods

Steer Growth Trial. Beef calves were weaned in September from University herds, and adjusted to various supplemental treatments involving cottonseed meal (CSM) and/or

[1]Research was conducted at the Animal and Dairy Science Research Farm, Coastal Plain Experiment Station, Tifton, GA.

whole cottonseed (WCS), with or without molasses. Steers (n=84; Initial wt. 581.7 +/- 80.8 lb**)** were ranked by initial weight and randomly assigned to six dietary treatments in a 2 X 3 factorial experiment for 85 days (October 14, 2003 to January 7, 2004). Dietary supplements included: **1)** Corn with CSM (CCSM; 84.5% corn, 14% CSM); **2)** corn with CSM and 4% molasses(CCSM+M; 80.5% corn, 14% CSM. 4% molasses); **3)** corn with WCS (CWCS; 40% corn, 60% WCS); **4)** corn with WCS and 4% molasses (CWCS+M; 36% corn, 60%WCS, 4% molasses) **5)** CS (100% WCS); **6)** WCS with 4% molasses (CS+M; (96% WCS, 4% molasses). Trace mineralized salt and calcium carbonate (each at 0.75% of supplement mixture) were mixed with Supplements 1 and 2; a vitamin/mineral supplement was fed free-choice in pastures for Supplements 3–6. Supplements were fed at 4.4 lb/steer daily, with Tifton 85 bermudagrass hay in round bales with hay rings fed free-choice. Diets were balanced for crude protein, and energy (TDN), adjusted to meet dietary requirements of growing beef steers (NRC,1984) to support average daily gains (ADG) of approximately 2.0 lb. Steers were fed on bermudagrass pastures (12 pastures; 2-acres each; 2 pens of 7 steers/treatment). Initial and final weights were means of two consecutive daily unshrunk weights. Hay intake was monitored and recorded. Periodic hay and supplement samples are being analyzed for crude protein and fiber components. Steer weights and ADG were analyzed as a 2 X 3 factorial, with kind of supplement and molasses addition as main effects. Data were adjusted using initial weight as a covariate.

Digestion Trial. A digestion trial was conducted in October and November, 2003, utilizing beef steers fed the same six dietary treatments described for the steer performance trial. The six supplements were fed at rates similar to those fed in the steer growth trial, with free-choice Tifton 85 hay in square bales. In the 18-day study, steers (n=36; 548 lb initial weight) were ranked by weight, and randomly assigned to six supplement and hay treatments (6 steers/treatment; individually-fed). Chromic oxide (10 g/steer daily) was fed as in indigestible marker to allow determination of apparent diet digestibility. Daily intake of hay and supplements were determined, and apparent digestion of organic matter crude protein, and fiber components (ADF, NDF and ADL) are being determined through laboratory procedures. Determination of negative associative effects on fiber digestion will be documented.

Results and Discussion

In the current steer growth trial, pastures continued to grow at reduced rates during autumn, before the first killing frost occurred in late November. Steers continued grazing these pastures, although hay was available in all pastures, which reduced the amount of hay consumed on all treatments. Unfortunately, hay quality was not as good as we anticipated for this experiment, although we had attempted to use our highest quality hays for these young growing cattle. This impacted hay intake, and reduced ADG of steers on all treatments, which resulted in lower overall performance of these steers compared with steers grazing similar diets on the same pastures in 2002 (Hill and Gates, 2003). Low hay intake in autumn, 2003, was also recorded for growing heifers on another experiment. Hay samples are currently being analyzed to document low quality we encountered.

In the current experiment, steers readily consumed all supplements, including the whole cottonseed, with or without molasses. However, in the 2002 experiments, supplement intake was reduced, especially on WCS diets, because of the unusually high bermudagrass pasture growth rate in September, October, and November (Hill and Gates, 2003). Addition of molasses apparently assisted young calves in adapting to the WCS diet, but in the present experiment daily feeding observations indicated both WCS and WCS+M supplements were consumed without hesitation. In Table 1, hay intake was highest for steers fed CCSM, and lowest for CS. Apparently, hay intake was increased slightly for steers fed 4% molasses with supplements. All hay intake data in this experiment was approximately half the values observed in the 2002 study (Hill and Gates, 2003). Hay in that study was excellent quality, and steers consumed more of it, regardless of grazing additional autumn pasture forages. Steer ADG was reduced on treatments containing WCS in the present study, just as they were in the 2002 study (Hill and Gates, 2003), and molasses feeding had little effect on ADG. Main effect means were presented in Table 1, because there were no supplement X molasses feeding interactions ($P > 0.10$) for performance data. Steer final weight and ADG at 56 and 85 days were lower ($P < 0.05$) for CCS and CS than CCSM, primarily because of low hay intake. Results of this experiment were affected by the low hay intake, however, when both the 2002 study (Hill and Gates, 2003) and the present study are considered, a strong trend emerges for reduced weaned calf performance when WCS is included as the supplement or as a major part of the supplement fed with hay. These results suggest that WCS may not be meeting protein and energy requirements of young growing cattle. The digestion experiment conducted in October, 2003, in which higher quality Tifton 85 hay was individually-fed to 36 steers with the same six dietary supplements as in the growth study, will indicate dietary digestibility. This data will indicate whether or not these supplements with WCS are meeting steer requirements for adequate growth rates. Complete laboratory analyses on hays, supplements and digestion samples are currently being processed.

Summary

Beef calves were weaned in September, 2003, and adjusted to various supplemental treatments involving cottonseed meal (CSM) and/or whole cottonseed (WCS), with or without molasses. Steers (n=84; Initial wt. 581.7) were assigned to six dietary treatments in a 2 X 3 factorial experiment on October 14, 2003, for 85 days. Dietary supplements included: 1) Corn with CSM (CCSM 84.5% corn, 14% CSM); 2) corn with CSM and 4% molasses(CCSM+M; 80.5% corn, 14% CSM. 4% molasses); 3) corn with WCS (CWCS; 40% corn, 60% WCS); 4) corn with WCS and 4% molasses (CWCS+M; 36% corn, 60%WCS, 4% molasses); 5) CS (100% WCS); 6) WCS with 4% molasses (CS+M; (96% WCS, 4% molasses). Trace mineralized salt, calcium carbonate, and vitamin -mineral mixtures were fed. Supplements were fed at 4.4 lb/steer daily with Tifton 85 bermudagrass hay. Supplement treatments were fed on bermudagrass pastures (12 pastures; 2-acres each; 2 pens of 7 steers/treatment). Steer weights and ADG were analyzed as a 2 X 3 factorial, with kind of supplement and molasses addition as main effects. Data were adjusted using initial weight as a covariate. Hay quality was lower than anticipated, resulting in low hay intake on all treatments, which severely reduced steer gains. Steers

fed the control supplement of corn with cottonseed meal had higher ($P < 0.05$) 56-day and 85-day ADG, and final weights, than steers fed supplements with WCS. Although hay intake was substantially higher in a 2002 study, there is a trend for reduced performance when weaned steers are fed cottonseed in various supplements. A digestion study (36 steers; hay and 6 supplements) was conducted in October 2003, which may indicate reasons for the reduced performance non cotton seed treatments when laboratory analyses are completed.

References

Feedstuffs. 2001. Reference Issue. Feedstuffs . Vol. 73, No. 29. The Miller Publishing Co., Minnetonka, MN.

Hill, G. M. and R. N. Gates. 2003. Cottonseed and cottonseed meal utilization by growing beef cattle grazing perennial forages in Georgia. 2002 Georgia Cotton Research and Extension Reports, Univ. of Georgia CAES and USDA-ARS, Athens, GA. Pp.3-8.

Hill, G. M. and P. R. Utley. 1989. Digestibility, protein metabolism and ruminal degradation of Beagle 82 triticale and Kline barley fed in corn-based cattle diets. J. Anim. Sci. 67:1793.

Kunkle, W. E. 2001. Strategies for cost effective supplementation of beef cattle. SS-ANS-14. Univ. of Florida Cooperative Extension Service, IFAS, University of Florida, Gainesville.

National Cattleman. 2001. Statistics: USDA/Cattle-Fax. National Cattlemen's Beef Association, Englewood, CO. Vol.16, No. 4.

NRC. 1984. Nutrient Requirements of beef cattle. (6th Rev. Ed.). National Academy Press, Washington, DC.

Poore, M.H. and G. M. Rogers. 1998. Alternative feed resources for beef cattle in the Southern region of th US. J. Anim. Sci.76(Suppl. 1):21.(Abstr.).

Table 1. Performance of steers fed dietary supplements with or without molasses

Item[a]	Corn-CSM **CCSM**	Corn-WCS **CWCS**	WCS **CS**	SE	4% Molasses No	4% Molasses Yes	SE
Initial wt, lb	582.3	575.1	575.0	11.9	581.0	573.9	14.0
Final wt, lb[bc]	686.3	655.4	639.0	13.2	661.3	659.2	10.6
ADG, 28d lb[b]	1.89	1.24	1.47	.27	1.56	1.50	.24
ADG, 56d lb[bc]	1.28	.71	.34	.17	.85	.72	.16
ADG, 85d lb[bc]	1.23	.87	.67	.14	.94	.91	.12
Hay, lb/d	5.61	4.48	4.81		4.75	5.18	

[a]Special Abbreviations: CSM = Cottonseed meal; WCS=whole cottonseed; CCSM, CWCS, CS = Supplement treatments; SE=standard error.
[b]Initial weight used as a covariate to adjust means.
[c]Supplement main effect means differ ($P < 0.05$).