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Preconditioning Calves Using Co-products[1]

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Introduction

Preconditioning cattle may be one potential management option for cow-calf producers looking to add value to their calf crop. The process of preconditioning cattle involves weaning, vaccination, and acclimating cattle to eating from feed bunks. Most often calves are preconditioned on a forage or roughage-based diet with supplemental feeds offered to achieve the desired level of performance. Like many management scenarios associated with beef cattle production, the greatest cost associated with preconditioning programs is the feed cost. In some cases, beef cow-calf producers who wish to precondition their calves may only have the capacity to store/handle one or two co-product commodities. Selection of the co-product(s) to be used should be based upon optimizing the nutrients supplied to compliment the basal forage, co-product palatability, and per unit price of energy and protein. Supplement feeds high in fermentable fiber and low in starch provide effective sources of energy for cattle on high-roughage diets, as starch may interfere with fiber digestion within the rumen (Richards et al. 2006). This publication will focus on the nutrition, feedstuff considerations, and performance potential for different co-product options in preconditioning management.

Performance Expectation

Bodyweight gains during the preconditioning period can be difficult to predict because many factors affect calf bodyweight gain (Lalman et al. 2002). These factors include health status, resumption of feed intake after weaning, amount of forage and supplement consumed, energy and protein concentration of diet, length of the feeding period, and previous plane of nutrition. Weighing conditions can have a large effect on the bodyweight gain observed; calves are capable of consuming between 0 and 4% of their bodyweight in feed, which may result in large differences in bodyweight among weigh periods. Likewise, because the preconditioning period utilizes lightweight calves and short feeding durations, the bodyweight gains may be relatively small. However, even small bodyweight gains can have positive effects on subsequent calf performance because of a successful preconditioning phase. If the producer wants to retain the calves and move them into an accelerated growth phase, then moderate bodyweight gains may be appropriate. In contrast, if the calves will be sold after the preconditioning period, then greater bodyweight gain may be desirable to increase the pounds of calves marketed, optimizing feed efficiency use and positioning the calves to enter any variety of subsequent management phases.

Feedstuff Selection

Generally, the preconditioning period is the calf's first introduction to dry feed; thus, selection of feedstuffs to compliment the forage base deserves some consideration for a successful preconditioning program. In order for the calf to get any nutritional value from the feeds, the feedstuff must be consumed, so a palatable feedstuff is an important consideration for starting calves. Using a highly palatable feedstuff minimizes the length of time that calves go without feed, potentially decreasing transition stress and the resulting bodyweight loss (Lalman et al. 2002). Co-products

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generally considered palatable are soybean hulls (SBH), soybean meal (SBM), citrus pulp, dried distiller's grains (DDG), wet brewer's grains (WBG), and whole cottonseed (WCS). All of these will be covered in this publication.

An important consideration when working with co-products is the variability of the product itself. The variability of feedstuffs will affect both its acceptability to the cattle and the nutrient concentrations of the feed. The next consideration is the supply of nutrients that a co-product will provide to the overall diet. Because young growing calves have limited dry matter intake potential, co-product nutrient concentrations need to be great enough to supply nutrients to meet calf nutrient requirements.

Preconditioning Outcomes

Research conducted at the University of Florida evaluated available feedstuffs and forages including bahiagrass and bermudagrass hay and pastures. Following are brief summaries of research that utilized a number of different co-products to background calves.

Liquid molasses is a high-energy, palatable co-product often utilized as a supplement in Florida. However, blackstrap molasses is deficient in crude protein (CP) relative to the requirements of growing cattle. Therefore, nitrogen- or protein-containing feeds or products are added to liquid molasses to create slurries that better meet the nutrient requirements of growing cattle. Austin and Thrift (2007) examined the effect of CP concentration supplied by urea or the addition of synthetic methionine in liquid molasses on calf bodyweight gain when preconditioned on bahiagrass pasture (Table 1). Liquid molasses was supplied via lick tanks for ad libitum consumption. Methionine is considered the first-limiting amino acid to growth in beef cattle; therefore, the use of a synthetic methionine source to augment the protein content of liquid molasses was of interest. This experiment demonstrates the variability and difficulty in making preconditioning programs work. Bodyweight gains of the calves from all treatments were negative, indicating moderate bodyweight loss during the first week of the preconditioning phase. In many cases, the shrink associated with weaning, stress, and diet changes is manifest in large bodyweight losses early in the preconditioning period. In comparison, the bodyweight changes during the remaining days on feed were more moderate. As a rule, the incorporation of urea as the sole or major source of nitrogen/protein should be avoided in growing calf diets. Growing cattle have requirements for amino acids that cannot be met by using urea; rather, sources of natural protein are a better choice for growing preconditioned cattle.

The use of different protein sources, including natural protein added to liquid molasses, was examined by Stateler et al. (2001). Liquid molasses supplementation improved calf bodyweight gains compared with pasture/hay-fed control cattle (Table 2). There was no difference in bodyweight gain between molasses or molasses containing urea. In contrast, the incorporation of SBM or a natural rumen undegradable protein source increased calf bodyweight compared with control, molasses, or molasses containing urea. The results of Stateler et al. (2001) highlight the requirement of growing cattle to obtain adequate levels of rumen undegradable protein, which supplies amino acids to support growth.

A number of commodity co-products available to beef cattle producers have been examined as potential feedstuffs. Savell et al. (2007) conducted two experiments that compared the use of SBH or WCS to SBM (Table 3). In both experiments, the supplements were fed to supply 0.6 lb/day of CP; therefore, actual amounts of supplement offered and consumed were different between treatments as a result of the different CP concentration of the feedstuffs. The first experiment compared feeding SBH to SBM to background calves grazing bahiagrass-bermudagrass pastures. Because the supplements were fed to supply similar CP, nearly 3.0 lbs more SBH were fed compared to SBM. As a result, approximately 2.2 lb/d more total digestible nutrients (TDN) was offered in the SBH group compared to the SBM-supplemented calves. The greater amount of TDN supplied by the SBH resulted in greater bodyweight gain during the first and second 21-day periods and across the entire 42-day trial. These results highlight the critical importance of an adequate energy supply in promoting an acceptable level of bodyweight gain during preconditioning.

In the second experiment, SBM (1.40 lb/day as fed) was compared to WCS (2.78 lb/day as fed). A similar amount of CP was offered to the calves, but because of differences in CP concentration of the feedstuffs, different amounts of supplement were offered. The amount of TDN offered was much more similar than in the first trial, but bodyweight gain in the first 21 days was greater for WCS than SBM. However, during the second 21 days of the trial, bodyweight gain of the WCS-supplemented calves was decreased dramatically, resulting in nearly a 10 lb difference in gain during that period and nearly a 10 lb difference across the 42-day preconditioning period. The likely cause of the decreased bodyweight gain for WCS-fed calves was the cumulative effect of dietary fat intake by the calves offered the WCS supplement. While the WCS resulted in 0.73 lb/day more TDN intake, that energy was being supplied in the form of fat from the WCS. The high intake of fat supplied by the WCS likely resulted in an eventual feed refusal by these growing calves. Figure 1 shows the pattern of supplement intake of the SBM and WCS supplements. During week 1, supplement intake was stepped-up to acclimate calves to the feedstuffs. However, the WCS calves never consumed the desired amount of WCS (2.78 lb/day, as fed) and consumption began to fall during week 4, ending at approximately 65% of the desired level of consumption. In this case, WCS presents an acceptable nutritional profile (adequate TDN and CP), but consideration needs to be given to the feeding characteristics associated with the WCS product and its overall acceptability as a sole co-product supplement for preconditioning calves.

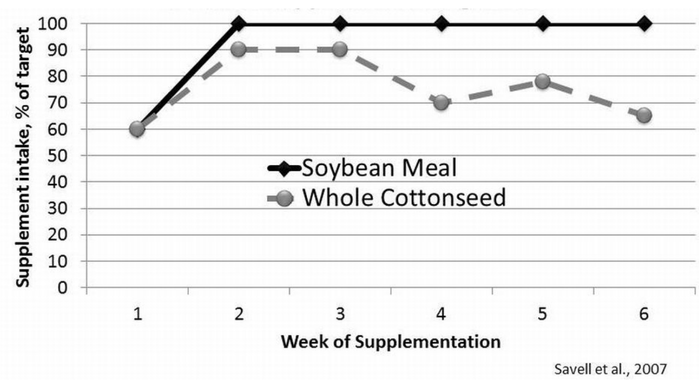

Figure 1. Supplement intake of soybean meal and whole cottonseed by preconditioning steers

Co-products including SBH, DDG, and WBG can be utilized as low starch feed resources for preconditioning cattle. However, little data exists that directly compares these as co-products or in proportional combinations as supplements to high forage diets for preconditioning cattle. Even less data exists when utilizing these co-products with subtropical forages in the Gulf Coast region. Recent work has compared SBH, DDG, and WBG alone or in combination as supplements for preconditioning steers on high forage diets.

Supplements containing DDG, DDG/SBH, SBH/DDG, and SBH were formulated to supply approximately 5.0 lb/steer/day of TDN to calves that were consuming bahiagrass hay free choice. During the first 14 days of the feeding period, steers in the DDG treatment had ADG that was 55% less compared to steers in the SBH/DDG or SBH treatments (Table 4). From day 14 to 42, steer ADG did not differ among supplement treatments. However, it is noteworthy that SBH treatment steers gained 0.57 lb/day less compared to the mean of the other treatments from day 14 to 42. Across the 42-day feeding period, ADG of SBH-supplemented steers was less compared to DDG/SBH- and SBH/DDG-supplemented steers; DDG-supplemented steers were intermediate. Estimated mean hay intake for DDG steers was potentially depressed by the level of total fat in the diet (7.7%) as a result of the amount of DDG offered. Regardless, there appears to be an economic advantage for utilizing a combination of DDG and SBH supplements rather than feeding DDG or SBH alone as supplements for subtropical forage. The delivered price of each co-product should determine the most economically desirable proportions of DDG and SBH for preconditioning steers on high forage diets.

In another experiment, growing steers consuming bermudagrass hay were offered WBG, WBG/SBH, or SBH to supply 3.0 lb of TDN (Thomas et al. 2011; Table 5). As-fed feed amounts offered to steers differed between treatments because of the relative differences in TDN and dry matter. During the first 17 days, steer ADG was similar between treatments (mean = 1.77 lb/d). Steer ADG from day 0 to 34 was greater for WBG and WBG/SBH (mean = 2.19 lb/d) compared to SBH-supplemented steers. Across the total 51-day preconditioning period, steers offered WBG/SBH had greater ADG compared to SBH, and ADG of steers offered WBG was intermediate. It would appear that some amount of adaptation to WBG during the first 17 days was necessary for young growing cattle. After 17 days, steers offered any amount of WBG had better growth performance than steers consuming SBH alone.

Work utilizing dried citrus pulp to background calves has also been examined. Alkire et al. (2005) compared citrus pulp to cracked corn with increasing levels (0 to 0.48 lb/day) of rumen undegradable protein (RUP). The supplements supplied the same amount of TDN (4.5 lb/day) and CP (1.34 lb/day) to calves offered bermudagrass hay for 84 days. Calf ADG was similar between citrus pulp and corn, but ADG increased with increasing levels of RUP supplementation. The need for RUP sources to augment the CP deficiency in citrus pulp and subtropical grass hay was confirmed in a follow-up trial in which calves were preconditioning for 42 days (Alkire and Thrift 2005). Calves were grazed only on bahiagrass-bermudagrass pasture or were offered 5.0 lb/day of citrus pulp, citrus pulp+urea, or citrus pulp+RUP (0.48 lb). Calf ADG during the 42-day period was 0.31, 0.53, 0.73, and 0.95 lb/day for pasture, citrus pulp, citrus pulp+urea, and citrus pulp+RUP. This work underscores the need to closely examine the nutrients supplied by a single co-product or feedstuff compared to the calf's nutrient requirements. When using citrus pulp or corn as a supplement to low-quality hay, the protein supplied from the hay, citrus pulp, and urea in the supplement was not sufficient to support the metabolizable protein requirements associated with an acceptable level of ADG in the growing calves.

Conclusions

No one co-product is the single solution to preconditioning growing calves. All co-products have limitations to their use as sole ingredients for preconditioning cattle because they often do not have a complete compliment of nutrients or have excessive amounts of certain nutrients. Thus, during the preconditioning period, particular attention should be given to rapidly adapting cattle to feed consumption, beginning to regain lost bodyweight, and adding bodyweight during a limited feeding period. To accomplish the objectives, the feedstuffs need to be palatable, nutrient dense, and consumed in adequate amounts to achieve the desired level of performance. Energy supply and feed intake are generally the first limiting issues to calf bodyweight gain, so feedstuffs that supply adequate energy are of primary importance. An adequate supply of protein is also important for preconditioning calves. The incorporation of urea to meet protein requirements generally does not support calf gain potential compared to natural sources of protein. Growing cattle need some level of rumen undegradable protein to supply amino acids that support the greater lean tissue growth exhibited by young cattle. Ultimately, for preconditioning to be economical for the cow-calf operator, the evaluation of any potential feedstuff must be made on the following three criteria:

1. Will the calves consume the feed at the desired level?

2. Can the calves achieve adequate bodyweight gains during the feeding period?

3. Is the feedstuff economical to utilize to background calves?

Literature Cited

Alkire, D., T. Thrift, and W. Kunkle. "Effects of Feeding Citrus Pulp or Corn Supplements with Increasing Levels of Added Undegraded Intake Protein on the Performance of Growing Cattle." *2005 Florida Beef Report, University of Florida* (2005). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2005/Nutrition-Chap10.pdf.

Alkire, D., and T. Thrift. "Effects of Feeding Citrus Pulp Supplements on the Performance of Calves in a Preconditioning Program." *2005 Florida Beef Report, University of Florida* (2005). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2005/Nutrition-Chap11.pdf.

Austin, B., and T. Thrift. "Effect of Different Molasses Slurries on the Performance of Preconditioning Calves." *2007 Florida Beef Report, University of Florida* (2007). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2007/Nutrition2.pdf.

Austin, B., D. Alkire, T. Thrift, and W. Kunkle. "The Effect of Molasses Based Liquid Supplements Containing Fibrolytic Enzymes and Bypass Methionine on the Performance of Growing Calves." *2005 Florida Beef Report, University of Florida* (2005). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2005/Nutrition-Chap9.pdf.

Lalman, D, D. Gill, G. Highfill, J. Wallace, K. Barnes, C. Strasia, and B. LeValley. "Nutrition and Management Considerations for Preconditioning Home Raised Beef Calves." Oklahoma Cooperative Extension Service ANSI-3031 (2002). Accessed May 10, 2011. http://osufacts.okstate.edu/docushare/dsweb/Get/Document-1957/ANSI-3031web2010.pdf.

Richards, C. J., R. B. Pugh, and J. C. Waller. "Influence of Soybean Hull Supplementation on Rumen Fermentation and Digestibility in Steers Consuming Freshly Clipped, Endophyte-infected Tall Fescue." *J. Anim. Sci.* 84 (2006):678-85.

Savell, J., M. Hersom, and T. Thrift. "Effects of Feeding Soybean Hulls on Calf Performance during Preconditioning." *2007 Florida Beef Report, University of Florida* (2007). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2007/Nutrition9.pdf.

Savell, J., M. Hersom, and T. Thrift. "Effects of Feeding Whole Cottonseed on Calf Performance during Preconditioning." *2007 Florida Beef Report, University of Florida* (2007). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2007/Nutrition10.pdf.

Stateler, A., B. Kunkle, and A. Hammond. "Effect of Protein Level and Source in Molasses Slurries on Performance of Growing Cattle Fed Hay during the Winter." *2001 Florida Beef Report, University of Florida* (2001). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2001/Nutrition-chap3.pdf.

Thomas, M., M. Hersom, T. Thrift, and J. Yelich. "Effect of Soybean Hulls, Wet Brewer's Grains, or a Combination Supplement on the Performance of Forage-fed Steers during Backgrounding." *2011 Florida Beef Report, University of Florida* (2011). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/beef_cattle_report/2011/documents/nathomassoyhulls.pdf.

Wahrmund, J., and M. Hersom. "Dried Distillers Grains and(or) Soybean Hulls to Background Beef Calves Fed Bahiagrass Forage." *2009 Florida Beef Report, University of Florida* (2009). Accessed May 10, 2011. http://www.animal.ifas.ufl.edu/extension/beef/2009-beef-report/pdf/n-DriedGrains.pdf.

Table 1. Effect of liquid molasses supplement protein content on calf bodyweight gain.[1]

	Co-product supplement			
Item	Control (Pasture)	16% CP [2] Molasses	16% CP Molasses + Alimet [3]	32% CP Molasses
Suppl. intake, lb/d[4]	--	2.62	2.59	2.37
Days on feed	Average daily gain, lb/d			
1 to 7	-1.39	-1.02	-0.58	-1.50
1 to 21	-0.15[ab]	-0.24[a]	0.04[b]	-0.24[a]
22 to 42	-0.11[b]	0.35[a]	-0.07[b]	0.20[a]
1 to 42	-0.13[b]	0.04[a]	-0.11[b]	-0.01[ab]

[1] Austin and Thrift (2007).
[2] Crude protein.[3] Synthetic source of methionine amino acid.[4] As-fed basis.[a,b] Means with different superscripts differ $P < 0.05$.

Table 2. Effect of protein source in liquid molasses supplement on calf performance.[1]

	Co-product and protein source supplement				
Item	Control	Molasses	Molasses+Urea	Molasses+SBM[2]	Molasses+Bypass[3]
Supplement intake, lb/d[4]	--	6.0	5.7	6.0	6.0
Days on feed	Average daily gain, lb/d				
0 to 27	0.51[a]	0.91[b]	0.90[b]	1.37[c]	1.37[c]
27 to 55	-0.18[a]	1.04[b]	1.10[b]	1.30[b]	1.12[b]
56 to 101	0.26[a]	0.93[b]	0.75[b]	0.83[b]	1.02[b]
0 to 101	0.21[a]	0.96[b]	0.90[b]	1.11[c]	1.15[c]
Hay intake, lb/d	10.0[a]	8.8[b]	8.7[b]	8.5[b]	9.3[b]

[1] Stateler et al. (2001).
[2] Soybean meal.[3] Bypass source of protein.[4] As-fed basis.[a,b,c] Means with different superscripts differ P< 0.05.

Table 3. Effect of co-product supplement on backgrounding calf performance.[1]

	Co-product supplement			
Item	Soybean Hulls	Soybean Meal-1	Soybean Meal-2	Whole Cottonseed
Supplement intake, lb/day[2]	4.00	1.13	1.16	1.94
Crude protein intake, lb/day	0.56	0.56	0.58	0.47
TDN[3] intake, lb/day	3.20	0.98	1.01	1.74
Bodyweight gain, lb				
Day 1 to 21	19.3[a]	11.1[b]	23.0[x]	24.5[y]
Day 22 to 42	15.5[a]	11.2[b]	17.1[x]	6.2[y]
Total bodyweight gain, lbs	34.8[a]	22.3[b]	40.1[x]	30.7[y]

[1] Savell et al. (2007).
[2] As-fed basis.[3]Total digestible nutrients.[a,b] or [x,y] Means with different superscripts differ $P < 0.05$.

Table 4. Comparison of dried distiller's grains and soybean hulls as supplements for backgrounding calves.[1]

	Co-product supplement[2]			
Item	DDG	DDG/SBH	SBH/DDG	SBH
Suppl. intake, lb[3]	6.17	4.19/2.16	4.52/2.11	6.87
Days on feed	Average daily gain, lb/day[4]			
0 to 14	0.73[a]	1.19[ab]	1.37[b]	1.39[b]
14 to 28	1.98	2.07	1.78	1.48
28 to 42	2.05	2.07	2.36	1.50
0 to 42	1.59[ab]	1.76[a]	1.83[a]	1.45[b]

[1] Wahrmund and Hersom (2009).
[2] Formulated to supply 5.0 lb total digestible nutrients. DDG = dried distiller's grains, SBH = soybean hulls.[3] As-fed basis.[4] Mean initial bodyweight was 605 lb for Angus steers.[a,b] Means with different superscripts differ P< 0.05.

Table 5. Comparison of wet brewer's grains (WBG) and soybean hulls (SBH) as supplements for backgrounding calves.

	Co-product supplement[1]		
Item	WBG	WBG/SBH	SBH
As-fed suppl. intake, lb/day	20	10/2.1	4.1
Days on feed	Average daily gain, lb/day[2]		
0 to 17	1.55	1.70	2.06
0 to 34	2.04[a]	2.33[b]	1.97[a]
0 to 51	1.66[ab]	1.82[b]	1.54[a]

[1] Formulated to supply 3.0 lb total digestible nutrients. WBG = wet brewer's grains, SBH = soybean hulls.
[2] Mean initial bodyweight was 554 lb for Angus and Brangus steers.[a,b] Means with different superscripts differ $P < 0.05$.