Effects of Feeding Citrus Pulp Supplements on the Performance of Calves in a Preconditioning Program

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Citrus pulp with added undegradable intake protein produced greater wt gains than CP alone during a 42 d preconditioning program.

Summary

Dehydrated citrus pulp and citrus pulp-protein supplements were evaluated as potential supplements for a preconditioning program. The supplements compared were no supplement, citrus pulp alone, citrus pulp with urea, and citrus pulp with added UIP. Supplemented cattle produced greater gains than unsupplemented cattle. Citrus pulp with added UIP produced the greatest ADG (0.95 lb/hd/d) whereas citrus pulp with added urea produced the lowest ADG (0.53 lb/hd/d). An economic evaluation of the costs associated with preconditioning using citrus pulp based supplements was conducted. Citrus pulp with added UIP was the most economical and citrus pulp with added urea was the least economical, of the supplements fed. Although BW gains were low to moderate and profit was minimal, citrus pulp shows potential as a supplement for preconditioning calves in Florida.

Increased performance of preconditioned calves in the feedlot has led to premiums offered for preconditioned calves. These premiums, as well as weight gain, the cost of preconditioning, market price, and marketing method will affect the profitability of preconditioning programs.

Introduction

Preconditioning calves is a process that involves weaning, vaccinating, and training calves to eat from feed bunks. It is well documented that preconditioned calves are healthier than non-preconditioned calves resulting in improved performance in the feedlot (Cole, 1985). Sound preconditioning programs are particularly important when trying to establish a reputation for quality calves or when considering retained ownership and was not accounted for in this economic evaluation.

Typically, the highest cost associated with preconditioning programs is feed. Preconditioning feeds should be highly palatable in order to encourage consumption and limit BW loss during the first week of weaning. After this "walk and bawl" period, calves can be returned to high quality pasture and in some cases this is the most economical solution. Higher BW gains may be obtained if calves are supplemented. Feedstuffs utilized for preconditioning calves vary greatly. These supplements can be expensive and therefore, feed costs will most likely dictate if a preconditioning program is economically feasible. However, if cheaper feedstuffs can be utilized, it may be possible to increase profits for producers.

Dehydrated citrus pulp is a byproduct of the citrus processing industry that is readily available to Florida cattle producers and recent declines in export opportunities have made it affordable. Citrus pulp is a good source of energy (82 % TDN) but a poor source of protein (6.7 % CP; NRC, 1996). Therefore, in order to evaluate the potential of citrus pulp as an affordable feedstuff for preconditioning cattle, additional protein is needed. Previous research with growing calves indicated that citrus pulp with added UIP produced similar gains to corn with the same level of added UIP. This research demonstrated that 0.48 lb of added UIP/hd/d resulted in the greatest gains. The current experiment was conducted to evaluate the effects of citrus pulp with added UIP as a supplement in a preconditioning program.

Procedure

This study was conducted at the BRU, located in Alachua County, Florida from September 2002 thru October 2002.

One hundred fifty Angus x Brahman crossbred calves (69 steers and 81 heifers, mean BW 530 ± 145 lbs) were utilized in a 42 day preconditioning program. Calves ranged in breed type from nearly all Angus to nearly all Brahman and had received two shots of a 4-way respiratory vaccination and two clostridial vaccines prior to weaning on September 11, 2002.

Calves were stratified by BW at weaning, sex, and breed type then randomly assigned to one of four supplemental treatments. Initial BW were similar across treatments (P = 0.99). Treatments consisted of control (CONTROL; no supplement), citrus pulp (CITR), citrus pulp with 0.48 lb of added UIP (CITR+UIP), or citrus pulp with added urea (CITR+UREA). The CITR+UREA treatment was formulated to be isonitrogenous to the CITR+UIP treatment. A complete summary of supplement composition and amount of supplement offered is available in Table 1.

At weaning, calves were separated into treatment groups, weighed, ear tagged, and placed in drylot pens with adequate shade. During this period, calves were offered access to their respective supplement starting at 3 lbs/hd/d and gradually increased to 5 lbs/hd/d. Bahia grass hay, water, and mineral were offered ad libitum. All hay used for this trial was harvested as small square bales from a pasture of Argentine Bahia grass with minimal infestation of common bermuda grass. Hay quality was analyzed and was 7.5 % CP (DM basis) and had an IVOMD concentration of 27 percent. After 7 days, animals were treated with one 500-lb dose of Eprinex® (Merial Limited, Iselin, New Jersey) pour-on at weighing. Each treatment group was then moved to one of four 7.5 acre pastures with adequate shade where they remained until the end of the trial (35 d.). Pastures were a mixture of Bahia grass and common bermuda grass and were created by cross-fencing one large pasture. While

on pasture, calves were offered 5 lb/hd/d of their respective treatment each morning in portable feed troughs. Body weights were recorded at 7 d intervals throughout the trial, prior to feeding.

Results

Diets

Supplement formulations and actual chemical composition of supplements and pasture are listed in Table 1. The pastures utilized in this experiment were similar in OM, CP, NDF, and IVOMD across all treatments ($P>0.05$). There was a quadratic ($P\leq .01$) decline in CP and IVOMD across all treatments from 0 to 42 d, with the greatest depression observed between weeks one and two (Table 2). The decline in pasture quality is probably due to calves selectively grazing the best quality forage during the early weeks of the experiment.

The CP content was different ($P=0.05$) between supplements by design, because not all supplements were formulated to be isonitrogenous. The IVOMD differed ($P=0.05$) between supplements because of the supplement formulation including the addition of urea and UIP. The CP content of CITR+UREA was similar ($P=0.45$) compared to CITR+UIP indicating they were isonitrogenous, as formulated.

Animal Response

There was a treatment effect ($P<0.01$) on 42-d ADG. Supplemented calves had greater 42-d ADG than unsupplemented calves ($P<0.01$). The CITR+UIP treatment produced the greatest 42-d ADG (0.95 lb/hd/d), while CITR and CITR+UREA had an intermediate 42-d ADG (0.73 and 0.53 lb/hd/d, respectively). Animals on the control treatment (no supplement) had the lowest 42-d ADG (0.31 lb/hd/d). Across all treatments, calves lost approximately 11 lb during the first week. This corresponds to the stress from weaning compounded by the drylot environment and poor quality hay offered. Calves then gained steadily throughout the remainder on the trial except for week five where very little gain was observed for any treatment.

Animal sex tended ($P=0.09$) to have an effect on 42-d ADG (Figure 1). Across all treatments, 42-d ADG was 1.47 lb for steers compared to 1.30 lb for heifers. Animal breed type also tended ($P=0.06$) to have an effect on 42-d ADG (Figure 2). Crossbred cattle with more than 20% *Bos indicus* breeding had greater ADG than those with less than 20% *Bos indicus*. Brangus (3/8 B, 5/8 A) calves had intermediate ADG.

Economic Evaluation

A summary of the costs associated with preconditioning calves in this trial is given in Table 3. Costs of vaccines, anthelmintic, hay, mineral, supplement, pasture fertilizer and pesticide, and labor were included in the total cost of preconditioning calves. Also included were the opportunity costs of pasture (based on lease rate) and interest (based on selling calves at weaning). Total cost of preconditioning was similar for all supplemented calves ($30/hd), with supplement being the largest percent of cost.

Profitability of the different preconditioning treatments was calculated by comparing them to non-preconditioned calves sold at weaning (Table 4). In this evaluation, it was assumed that non-preconditioned calves would weigh 530 lb and would sell for $0.80/lb. Based on this, a breakeven price was calculated for each preconditioning treatment by adding the cost of preconditioning to the income received if the calves had been sold at weaning ($424) and dividing by the market weight or weight at weaning (530 lb) plus the gain realized over the preconditioning period. The breakeven price for the Control, CITR, CITR+UREA, and CITR+UIP treatments is $0.82/lb, $0.80/lb, $0.82/lb, and $0.80/lb, respectively.

Assuming that preconditioned calves would sell for the same price as non-preconditioned calves ($0.80/lb, assumption = additional weight is offset by added perceived value of preconditioning calves), the profit from each preconditioning treatment was calculated. At the $0.80/lb selling price, the only supplement that would return a profit over cost was CITR+UIP. This supplement produced a $1.91 profit/hd.

If the preconditioned calves brought a premium at the time of sale ($0.85/lb, which is not uncommon if they are marketed correctly), then all treatments would produce a profit compared with calves sold at weaning for a market price of $0.80/lb. At these market prices, the profit per head from CITR+UIP was $30.41, CITR was $25.32, CITR+UREA was $18.95, and Control was $18.21. This evaluation does not account for differences in shrink when marketing fresh weaned compared to preconditioned calves.

Although the ADG of the calves supplemented in this experiment was low to moderate, it was better than unsupplemented animals. Of the supplemented calves, those fed the CITR+UIP supplement had the highest 42-d ADG (0.95 lb/hd/d), and those supplemented with CITR+UREA had the lowest (0.53 lb/hd/d). Based on the assumptions mentioned above, the most profitable treatment was CITR+UIP and the least profitable was the Control.

References

Alkire, D.O., Thrift, T.A., and Kunkle, W.E. Effects of Feeding Citrus Pulp or Corn Supplements With Increasing Levels of Added Undegraded Intake Protein on the Performance of Growing Cattle. 2004 Florida Beef Report: 71-76.

Cole, N. A. 1985. Preconditioning calves for the feedlot. Vet. Clin. of North Am. Food Anim. Pract. 1: 401.

National Research Council (NRC). 1996. Nutrient Requirements of Beef Cattle (7th Revised Ed.). National Academy Press, Washington, DC.

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Table 1. Feeding rate, formulation, and nutrient composition of pasture and supplements fed to preconditioned calves.

	Pasture	Control[a]	CITR	CITR+UREA	CITR+UIP
Feeding rate lb/hd/d	Ad libitum	--	5.00	5.08	5.48
Ingredient (%)					
Citrus pulp (#605)		--	100.00	98.00	91.00
Soy Plus (42.5 % CP, 60 % UIP)		--	0.00	0.00	9.00
Urea (#522)		--	0.00	2.00	0.00
Formulated					
TDN lb/hd/d	--	--	3.74	3.74	4.09
CP lb/hd/d	--	--	0.35	0.59	0.59
DIP lb/hd/d	--	--	0.24	0.46	0.33
UIP lb/hd/d	--	--	0.13	0.13	0.26
Actual Analysis					
DM (%)	38.92	--	91.04	90.74	90.88
OM (%)	95.99	--	94.18	94.39	94.28
CP (%)	14.06	--	7.24[a]	11.93[b]	10.38[ab]
IVOMD (%)	30.11	--	87.05[a]	86.73[b]	86.80[b]
NDF (%)	68.86	--	20.11	19.74	20.32

LS means within a row with different superscripts are different $P<0.05$.
[a]Pasture only.

Table 2. Pasture quality (± SE) by week for preconditioned calves fed citrus pulp supplements.

	Analysis (%)			
Wk	OM	CP	IVOMD	NDF
1	95.94 ± 0.06[ab]	17.69 ± 0.33[c]	32.40 ± 0.21[d]	67.03 ± 0.26[c]
2	96.24 ± 0.06[b]	13.72 ± 0.33[b]	30.86 ± 0.21[c]	68.34 ± 0.26[b]
3	95.94 ± 0.06[ab]	13.89 ± 0.33[b]	29.85 ± 0.21[b]	68.50 ± 0.26[b]
4	95.93 ± 0.06[ab]	13.85 ± 0.33[b]	29.49 ± 0.21[ab]	69.66 ± 0.26[a]
5	96.10 ± 0.06[b]	12.79 ± 0.33[a]	29.05 ± 0.21[a]	69.85 ± 0.26[a]
6	95.80 ± 0.06[a]	12.43 ± 0.33[a]	29.04 ± 0.21[a]	69.81 ± 0.26[a]

LS means within a column with different superscripts are different $P<0.05$.

Table 3. Economic evaluation of preconditioning costs.

	Cost/hd ($)				
	Non-preconditioned	Control	CITR	CITR+UREA	CITR+UIP
Vaccines (all were given preweaning) 2 clostridial vaccine @ $0.529/dose 2 chemically altered MLV @ $1.10/dose	--	$3.26	$3.26	$3.26	$3.26
Anthelmintic (500 lb dose given at d 7) Eprinex® pour-on (eprinomectin)	--	$1.94	$1.94	$1.94	$1.94
Hay (42 lb/bale) 28 bales/treatment @ $3.00/bale	--	$2.24	$2.24	$2.24	$2.24
Pasture (opportunity cost) 30 acres @ $150/ac lease rate x 42 d	--	$3.45	$3.45	$3.45	$3.45
Fertilizer @ 60 lb/ac (19 % N)	--	$3.38	$3.38	$3.38	$3.38
Pasture pesticide (army worm)	--	$1.00	$1.00	$1.00	$1.00
Mineral (150 lb/treatment @ $6.50/50 lb)	--	$0.53	$0.53	$0.53	$0.53
Supplement (total trial)	--	--	$8.19	$8.61	$10.75
Labor (15 min/d @ $6.00/hr)	--	$1.68	$1.68	$1.68	$1.68
Interest (opportunity cost) 5% interest if calves sold for $0.80/lb @ 530 lb	--	$2.43	$2.43	$2.43	$2.43
Total costs	--	$19.34	$27.53	$27.95	$30.09

Table 4. Economic evaluation of preconditioning income and expenses.

		Cost/hd ($)			
	Non-preconditioned	Control	CITR	CITR+UREA	CITR+UIP
Supplement (total trial)	--	--	$8.19	$8.61	$10.75
Total costs	--	$19.34	$27.53	$27.95	$30.09
Calf wt at weaning	530	530	530	530	530
Total wt gain (lb)	--	13.18	30.84	23.23	39.93
Calf weight at marketing (lb)	530	543	561	554	570
Cost of gain ($/lb)[b]	--	$1.47	$0.89	$1.20	$0.75
Breakeven @ $0.80/lb ($/lb)[c]	--	$0.82	$0.80	$0.82	$0.80
Income/hd @ $0.80/lb[d]	$424.00 [a]	$434.40	$448.80	$443.20	$456.00
Profit over non-preconditioned calves[e]	--	-$8.94	-$2.73	-$8.75	$1.91
Income/hd @ $0.85/lb[f]	--	$461.55	$476.85	$470.90	$484.50
Profit over non-preconditioned calves[g]	--	$18.21	$25.32	$18.95	$30.41

[a]Assuming non-preconditioned calves weighed the same as preconditioned calves at weaning (530 lb).
[b]The cost of preconditioning divided by the gain realized from preconditioning.
[c]The cost of preconditioning plus the income received if calves were marketed at weaning ($424.00) divided by the total of the market weight plus the gain realized from preconditioning.
[d]The income received if calves were marketed at $0.80/lb multiplied by the market weight.
[e]The income received if calves were marketed at $0.80/lb multiplied by the market weight minus the total of income received if calves were marketed at weaning ($424.00) and the cost of preconditioning.
[f]The income received if calves were marketed at $0.85/lb multiplied by the market weight.
[g]The income received if calves were marketed at $0.85/lb multiplied by the market weight minus the total of income received if calves were marketed at weaning ($424.00) and the cost of preconditioning.

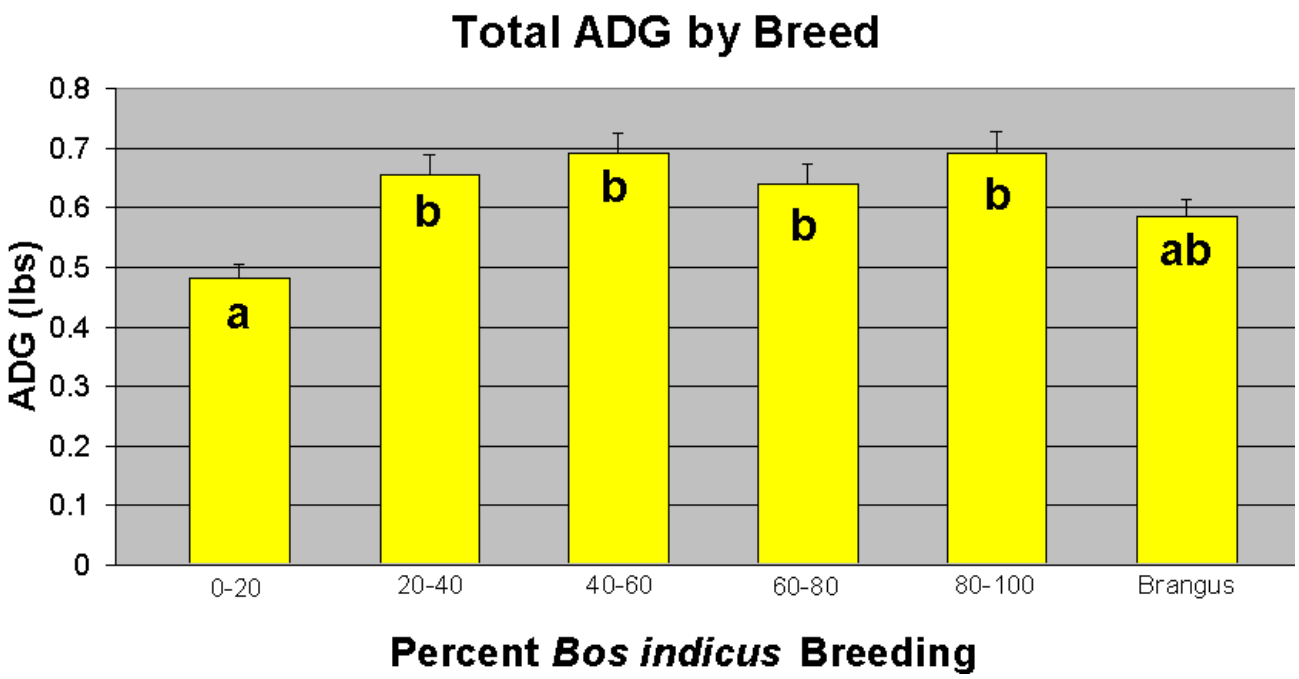

Figure 1. Effect of *Bos indicus* breeding on total ADG of preconditioned calves. Breed effect P=0.06.
[a,b]LS means within a column with different superscripts are different P<0.05.