Effects of long-term feeding of corn byproducts in Southeastern beef cattle production systems

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INTRODUCTION

- Recent volatility of feed prices and economic instability has forced beef cattle producers to reevaluate nutritional programs
- Increased availability of distiller's grains plus solubles (DDGS) lead to increased interest in utilization of corn byproducts
- Possibly the largest contributing factor to the value of DDGS as protein supplement in growing animals is the increased availability of rumen undegradeable protein (RUP) (Klopfenstein et al. 2007)
- Information is limited on Southeastern feedlot systems due to climate and cost-limiting nutritional resources
- Limited research on meat quality from cattle fed DDGS and corn gluten feed (CGF) from weaning to slaughter

OBJECTIVES:

- Evaluate performance and compositional development of steers fed one of two corn by-products from weaning through slaughter
- Compare carcass characteristics, meat quality, and shelf-life stability of strip steaks from the aforementioned steers

MATERIALS AND METHODS

STOCKER TRIAL

- Steers (n=81) were randomly assigned to 9 pens in 3 replicates of 3 different protein supplements at the Georgia Mtn. Education and Research Center.
- Diets were 75% corn silage, 25% supplement: DDGS, CGF, soybean meal (SBM) and corn (10% and 15% respectively)
- Body weight (BW), hip height (HH), body condition score (BCS), and compositional development via ultrasound were measured at 28 d intervals for a 84 d stocker trial

FEEDLOT TRIAL

- A subset of the above steers (n=36) were transported to a feedlot at the UGA Wilkins Beef Unit
- Individual intake measured using a Calan© gate system.
- Feedlot diets were formulated identically with protein supplement accounting for 25% of the diet (same protein supplements as above)
- Body weight was measured at 25 d intervals
- Compositional ultrasound measurements, rumen fluid, and blood serum and plasma samples were taken at d 1, 50, and 100

CARCASS CHARACTERISTICS

- After the 100 d feeding trial steers (n=36) were slaughtered at the UGA Meat Science Technology Center.
- Carcass data was collected 24 h post-mortem by trained personnel
- At 48 h post-mortem a single strip loin was removed and fabricated into 2.54 cm steaks.
- Steaks were used to determine differences in shelf-life, and lipid oxidation over a 9 d aging period as well as tenderness over 21 d.

RESULTS

Stocker Trial

Table 1. Performance and Efficiency of beef steers stockered on corn silage with differing protein supplements

	Treatment			
Item	CGF	DDGS	SBM	SEM
BW, kg				
0	304	304	303	5.80
84	387	399	401	5.80
ADG[1], kg/d	2.23	2.57	2.64	0.15
F:G, kg	6.5[a]	5.8[b]	6.4[a]	0.16
COG[2], $/kg	0.33	0.28	0.35	0.06

[1]cumulative ADG
[2]cost of gain – silage = $50/ton, CGF = $160/ton, DDGS = $140/ton, soybean meal = $410/ton, corn = $110
[3] 1-2 = very thin, 3-4 = thin,5-6 = average, 7-8 = fleshy, 9 = fat
[abc] Within a row means without a common superscript differ (P<0.05).

Table 2. Ultrasound data from beef steers stockered on corn silage with differing protein supplements

	Treatment			
Item[1]	CGF	DDGS	SBM	SEM
REA, cm^2				
0	47.92	47.32	50.19	1.13
84	59.12[b]	58.85[b]	63.60[a]	1.15
FT, cm				
0	0.31	0.27	0.31	0.02
84	0.44	0.39	0.48	0.03
IMF, %				
0	3.8	3.4	3.6	0.10
84	4.3[a]	3.9[b]	4.2[a]	0.10
RF, cm				
0	0.39	0.35	0.36	0.02
84	0.57	0.55	0.65	0.04

[1]REA=ribeye area, FT=12th rib fat thickness, IMF=intramuscular fat, RF=rump fat thickness.
[ab] Within a row means without a common superscript differ (*P<0.05*).

Meat Quality Trial

Table 5. Carcass traits for beef steers finished with differing protein supplements

	Treatment[1]			
Item	CGF	DDGS	SBM	SEM
HCW, kg	354	350	341	7.33
DP,%	63.8	62.9	63.5	0.59
REA,cm^2	77.65	77.68	79.23	3.25
Marbling[4]	494.2	432.5	457.5	23.44
FT, cm	1.20	1.11	1.20	0.07
KPH, %	2.3	2.2	2.2	0.11
OA Maturity	136	131	145	6.57
YG	3.10	3.11	3.05	0.18

[1] CGF = corn gluten feed, DDGS = dried distillers grains plus soluble, SBM = soybean meal

Feedlot Trial

Table 3. Efficiency data from feedlot steers fed differing protein supplements

	Treatment[1]			
Item	CGF	DDGS	SBM	SEM
ADG[2], kg/d	1.52	1.80	1.51	0.10
DMI, % BW	2.29	2.14	2.09	0.06
F:G	7.5[a]	6.01[b]	7.12[ab]	0.42
COG[3], $/kg	1.27[b]	1.08[b]	1.71[a]	0.09

[1] CGF = corn gluten feed, DDGS = dried distillers grains plus soluble, SBM = soybean meal
[2]cumulative ADG
[3]cost of gain – CGF diet = $151.95/ton, DDGS diet = $159.95/ton, SBM diet = $214.98/ton
[ab] Within a row means without a common superscript differ (*P < 0.05*)

Table 4. Ultrasound data from beef steers finished with differing protein supplements

	Treatment[1]			
Item	CGF	DDGS	SBM	SEM
REA, cm^2				
0	62.2	58.5	62.1	1.9
100	80.2	80.8	82.4	2.4
FT, cm				
0	0.54[a]	0.41[b]	0.61[a]	0.04
100	0.61	.88	1.11	0.05
IMF,%				
0	3.63	3.20	3.37	.14
100	3.70	3.44	3.56	.14
RF, cm				
0	0.67[a]	0.50[b]	0.75[a]	0.06
100	0.75	1.04	1.30	0.09

[1] CGF = corn gluten feed, DDGS = dried distillers grains plus soluble, SBM = soybean meal
[ab] Within a row means without a common superscript differ (*P < 0.05*)

SHELF LIFE TRIAL

Figure 5. Warner-Bratzler Shear force

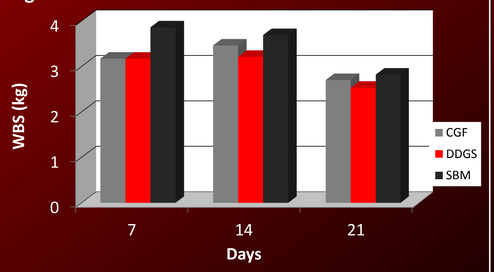
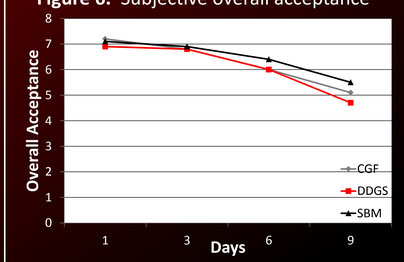
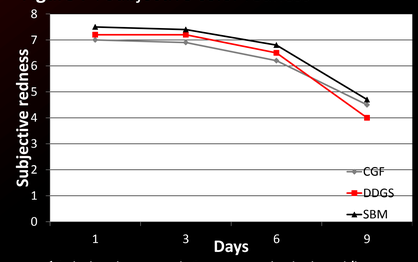


Figure 6. Subjective overall acceptance[1]



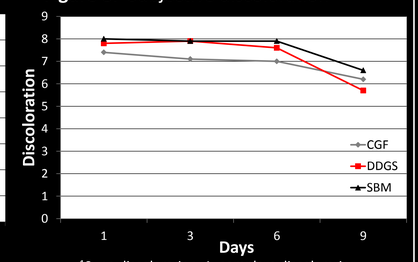
[1]8=extremely acceptable, 1=extremely unacceptable

Figure 7 . Subjective color redness[1]



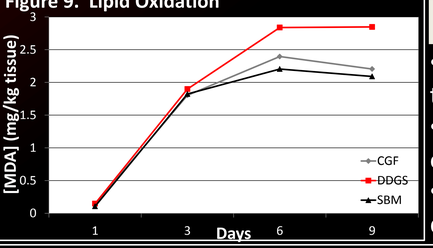
[1]8=light cherry red, 1=extremely dark red/brown

Figure 8. Subjective discoloration[1]



[1]8=no discoloration, 1=complete discoloration

Figure 9. Lipid Oxidation



CONCLUSIONS

- Cattle fed CGF and DDGS are comparable in terms of performance to those fed SBM.
- Steers fed DDGS were more efficient in the feedlot than those fed SBM or CGF
- Steers fed CGF and DDGS harvested with similar carcass yield and quality to those fed SBM