Evaluating growth performance trends as a result of combined use of production enhancement technologies in beef heifers during adaptation to high-concentrate finishing diets

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Introduction

- Domestic beef supply is maintained by the presence of roughly 10 million head of cattle fed in feedlots each day
- Gradual adaptation of grazing cattle to conventional feedlot diets is necessary to reduce occurrence of ruminal acidosis
- Direct-fed microbials provide a source of live, naturally-occurring organisms to cattle and may improve gain performance (Krehbiel et al., 2003)
- Metaphylaxis is timely mass application of a group of animals to minimize potential outbreaks.
- Use of the antibiotic florfenicol may reduce initial feed intake of cattle (Mosely et al., 2004)
- Use of anabolic growth promotants such as Revalor-G have in consistently improved stocker cattle performance (Kuhl, 1997)
- Though modes of action differ, influence of combined use on animal growth performance across an adaptation regimen should be evaluated.

Objectives

Describe potential influences of commonly employed production enhancement technologies on performance of growing beef heifers during adaptation a to high-energy, concentrate-based diet

Methodology

Animals

- 96 beef heifers (initial shrunk BW = 147±17 kg)
- Stratified by BW and randomly assigned to treatment
- Received in the fall of 2016 by Angelo State University and managed identically until trial initiation

Treatments

- 0g or 15g of a commercially available direct-fed microbial (Probios, Chr. Hansen, Milwaukee, WI) administered orally at intervals coinciding with diet change
- Either no injection or a single injection of florfenicol (Nuflor, Merck Animal Health, Madison, NJ) administered according to label directions on d 0
- Either no implant or a single anabolic implant (40mg trenbolone acetate, 8mg estradiol; Revalor-G, Merck Animal Health, Madison, NJ)

Treatment group	Direct-fed microbial	Metaphylaxis	Implant
1	--	--	●
2	●	--	●
3	●	--	--
4	--	●	●
5	●	●	●
6	--	●	--
7	●	●	--
8	--	--	--

- Treatment group randomly assigned to pen
- In order account for any potential differences in feed intake between treatment groups, individual heifers were not randomly assigned – thus treatment group and pen were purposefully confounded

Diets and feed intake allowance

- Heifers were limit-fed each day
- Diets and allowance in each period were based on predicted weight gain
- Rates of projected weight gain were 0.00 (Rate 1), 0.27 (Rate 2), 0.54 (Rate 3), and 1.09 (Rate 4) kg per d for during periods 1, 2, 3, and 4, respectively

Dietary and nutrient composition

Item	Period[1] 1	2	3	4
Ingredient, % as-fed				
Dry-rolled corn	27.58	33.49	40.99	48.39
Dried distillers grains	18.38	22.33	27.32	18.73
Alfalfa pellets	9.19	3.99	0.00	5.20
Cottonseed hulls	36.76	31.90	23.91	13.01
Corn gluten pellets	0.00	0.00	0.00	10.41
Molasses	2.57	3.19	3.42	1.04
Trace mineral	4.60	3.99	3.42	2.60
Urea	0.92	1.04	0.89	0.62
Nutrient composition[2]				
Dry matter, %	89.45	89.37	89.12	89.60
Crude protein, %DM	13.87	15.87	17.72	17.13
NDF, %DM	38.79	39.91	33.19	28.36
ADF, %DM	28.11	27.17	19.81	19.41
DE, Mcal/lb	1.32	1.34	1.44	1.43
ME, Mcal/lb	1.08	1.10	1.18	1.17
NE_m, Mcal/lb	0.73	0.75	0.81	0.80
NE_g, Mcal/lb	0.41	0.42	0.49	0.48
Total starch, %DM	24.90	22.80	25.60	31.10
Feed allowance				
Predicted, kg DM $hd^{-1}{\cdot}d^{-1}$	3.75	3.79	3.87	4.05
Provided, kg DM $hd^{-1}{\cdot}d^{-1}$	2.28	2.64	2.98	3.58

[1]Durations: period 1 = 14 d; period 2 = 15 d; period 3 = 14 d; period 4 = 15 d

[2]Analyzed

Statistical analysis

- Effect of increasing predicted rate of gain on observed ADG was evaluated using regression procedures of SAS 9.4
- Predicted rate and predicted rate squared were included as predictor variables
- Treatment group means were compared to treatment group 8 using F-protected t-tests

Results

Statistical significanc indicators of fixed effects in determinating regression coefficients of observed rate of weight gain

Item	*P*-value Intercept	Linear	Quadratic
DFM	0.29	0.09[1]	0.04[2]
Met	0.89	0.87	0.74
Imp	0.32	0.29	0.33
DFM × Met	0.25	0.28	0.39
DFM × Imp	0.52	0.77	0.85
Met × Imp	0.82	0.73	0.72
DFM × Met × Imp	0.61	0.49	0.45

[1]Without DFM = 1.11; with DFM = 0.84 (SE=0.11)

[2]Without DFM = -0.15; with DFM = -0.09 (SE=0.02)

Influence of fixed effects

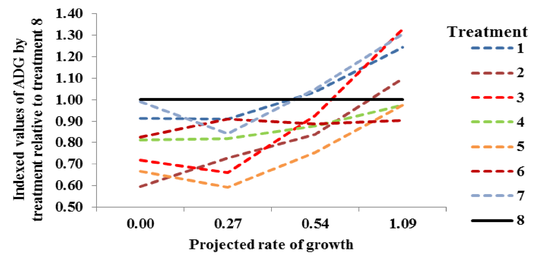
- No treatment interactions were observed
- Linearly, observed growth responses to increased feed energy an allowance tended to be lower when heifers received DFM
- Quadratic estimates indicated that DFM contributed to stability in gain responses attributed to increasing dietary growth potential
- No other treatments influenced observed growth rate measures

- Potential effects of florfenicol may only be manifested in the initial 10 to 14d. Here, analysis of initial period ADG indicated no associated response (*P* = 0.92).
- Limit-feeding may have masked potential effects of implants as cumulative ADG did not reflect differences with use (*P* = 0.73).

Regression coefficients of ADG by treatment group

Trt	β_0	SE	β_1	SE	β_2	SE
1	-1.26	± 0.26	1.09	± 0.22	-0.13	± 0.04
2	-0.82	± 0.26	0.71	± 0.22	-0.07	± 0.04
3	-0.99	± 0.26	0.76	± 0.22	-0.06	± 0.04
4	-1.12	± 0.26	1.00	± 0.22	-0.13	± 0.04
5	-0.92	± 0.26	0.75	± 0.22	-0.08	± 0.04
6	-1.14	± 0.26	1.07	± 0.22	-0.15	± 0.04
7	-1.37	± 0.27	1.13	± 0.23	-0.13	± 0.04
8	-1.38	± 0.27	1.27	± 0.23	-0.18	± 0.04

Cells highlighted in gold indicate a tendency (*P* ≤ 0.15) to differ from treatment group 8



Evaluation of treatment combinations

- Using derived regressions equations, treatment group 8 daily weight gain by period (and measure relative to projected) was as follows: Period 1 = -0.29 kg (-0.29 kg); Period 2 = 0.44 kg (+0.17 kg); Period 3 = 0.81 kg (+0.27 kg); and Period 4 = 0.82 kg (-0.27 kg)
- In support of fixed effect analysis, DFM tended to reduce linear responses of ADG to increasing feed energy and allowance relative to heifers in treatment group 8 in all instances in which it was applied except for when provided in unison with florfenicol in the absence of an implant
- Quadratic measures associated of this response were consistent with fixed effect observations

Implications

When adapting beef heifers to high-concentrate finishing diets, projected weight gain may be predictably reduced when direct-fed microbials are administered. Combinations of florfenicol in a metaphylaxis and use of an anabolic growth promotant will likely not influence growth responses relative projections.

Literature cited

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