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Post-Weaning Feed Intake and Performance of Bulls Developed in an Automated Feed Intake Management System

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KANSAS STATE UNIVERSITY CATTLEMEN'S DAY

Post-Weaning Feed Intake and Performance of Bulls Developed in an Automated Feed Intake Management System

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Abstract

Three years of feed intake and performance data from spring-born growing bulls (n = 115) developed in an automated feed intake system were analyzed and compared to predicted values generated by the Beef Ration and Nutrition Decision Software (BRaNDS) feed formulation tool (Iowa State University, Ames, IA). Each year, bulls were weaned in the fall and entered the Kansas State University Precision Intake facility, where they were fed a total mixed ration during development prior to initial service. Feed intake data were recorded by the Insentec system for 64, 72, and 64 days in years one, two, and three, respectively. Across the three years, a moderate, statistically significant correlation (r = 0.61, $P < 0.01$) was observed between predicted and actual dry matter intake (DMI). A slightly stronger correlation (r = 0.65, $P < 0.01$) was found between predicted and actual average daily gain (ADG). However, actual ADG of bulls consistently exceeded the predicted values. These findings suggest that while the BRaNDS program appears to reasonably predict DMI, it underestimates ADG, likely due to current established nutrient requirement models for bulls and energy balance prediction equations.

Introduction

Post-weaning intake and its relationship to average daily gain (ADG) are critical given the significant impact feed costs have on developing virgin bulls. In typical production systems, bulls upon weaning are often managed in pen settings in which the overall intake of the contemporary group is measured, yet significant variation on an individual animal basis may occur. Individual feed consumption data can be recorded by existing systems, but much of the previous work in this area with growing beef cattle has been with steers. Likewise, the performance of growing cattle can be predicted from nutrient requirements if feed intake is measured and dietary composition is known, and research evaluating this with pre- and peri-pubertal bulls post-weaning is limited. The Beef Ration and Nutrition Decision Software (BRaNDS) formulation program is used by Kansas State University Research and Extension as well as by other Extension services, nutritionists, and veterinarians. Data sets using individual feed intake and performance data to validate performance predictions are limited and valuable for improving accuracy of the BRaNDS program. Our objectives were to: 1) report observed intake and performance data, and 2) compare expected and observed dry matter intake (DMI) and ADG of bulls in a multi-year analysis using modeled nutrient requirement equations in the BRaNDS program.

Experimental Procedures

Feed intake and performance data from purebred Angus, Hereford, and Simmental bull calves across three calf crops (birth years 2021 [n = 40], 2022 [n = 37], and 2023 [n = 41]) were used for this ongoing multi-year analysis. The first two years of this analysis were previously reported (Banks et al., 2024). All calves were born at the Kansas State University Purebred Beef Unit in the spring and raised at the dam's side, grazing native Flint Hills range until weaning in September each year. At weaning, bulls initially had access to native prairie hay and a commercial creep feed for *ad libitum* consumption for approximately 2 weeks before being transitioned to a total mixed ration, which was subsequently fed for 5-6 weeks. Following the weaning and diet transition period, bulls entered the Kansas State University Precision Feed Intake Facility in mid-November each year. Intake test periods were November 11, 2021, through February 2, 2022 (83 days), November 19, 2022, through January 30, 2023 (72 days), and December 2, 2023, through February 4, 2024 (64 days), for years 1, 2, and 3, respectively. During the 2021-2022 test year, feed intake data were recorded for 64 days. In all years, bulls were managed as a common group in earthen partially covered pens and fed using Insentec bunk module units allowing for individual feed intake data to be recorded while on test. The third-year bulls were divided into diet treatment groups consisting of a 0 lb (control), 0.5 lb, and 1.0 lb per head per day equivalent intake (as-is basis) of an omega 3-based fatty acid supplement top-dressed onto the basal diet. Treatment groups were randomly assigned to bunk module units throughout the pen and individual feed intake data were recorded, but bulls were managed in a single pen. Ingredient composition of diets fed differed among years (Table 1). Bulls were individually weighed without feed or water restriction at both the beginning and end of the test period to calculate ADG, with feed to gain ratio (F:G) subsequently calculated for each bull from average individual DMI. In year 3, bulls were weighed for three consecutive days at both the beginning and end of the test period and averaged to determine initial and ending weight.

Projected DMI and ADG were calculated for each group of bulls by year on an individual basis using the Growing Bull module of the Excel-based BRaNDS formulation program. Intake and performance equations incorporated into BRaNDS are from the Nutrient Requirements of Beef Cattle 7th and 8th editions. Using actual initial and ending body weight (BW) for each bull, actual DMI of individual feedstuffs based on diet composition, and assumed average feedstuff composition values, projected DMI and ADG were retrospectively calculated to determine the accuracy of the program in predicting performance. In the 2021-2022 test year, two different diets were fed but only one diet was used in the analysis as it was fed for the majority of the total days. All data were analyzed using SAS (SAS Institute Inc., Cary, NC), and correlation procedures were used to evaluate the relationship between observed and projected DMI and ADG. *P*-values less than or equal to 0.05 were declared significant.

Results and Discussion

Initial BW averaged 793 lb with an ending weight of 1,056 lb across the three-year study (Table 2). Actual DMI was similar to predicted values, with a mean of 20.2 lb/day compared to the predicted 20.7 lb/day, and a standard deviation of 3.9 (Table 1). Actual ADG was consistently higher than predicted, with a mean ADG of 3.63 lb/day compared to the predicted 2.26 lb/day.

For the combined 2021-2023 dataset, a moderate positive correlation ($r = 0.61$, $P < 0.01$) was found between actual and predicted DMI, indicating that the BRaNDS

formulation program accurately models DMI across varying diet compositions (Table 3). A stronger positive correlation (r = 0.65, $P < 0.01$) was observed between actual and predicted ADG, although the actual ADG consistently exceeded the predicted values (Table 3). This consistent underestimation of ADG may reflect how BRaNDS handles metabolizable protein and energy balances in relation to different diets and suggests the current performance models underpredict performance of young growing bulls.

Implications

These results indicate that while BRaNDS accurately predicts DMI, further refinement of energy equations with additional individual performance data is needed to improve its ability to predict ADG.

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References

Banks, J., L Wyatt, K.E. Fike, and J.M. Warner. 2024. Post-weaning feed intake and performance of bulls developed in an automated feed intake management system. Kansas Agricultural Experiment Station Research Reports 10(1).

Table 1. Ingredient composition of diets by year, percent dry matter basis

Item	2021-2022[1]	2021-2022[2]	2022-2023	2023-2024[3]	2023-2024[4]	2023-2024[5]
Corn silage	43.50	35.70	60.00	30.50	31.10	30.80
Wet corn gluten feed	21.75	25.00	25.00	29.20	27.50	26.10
Steam flaked corn	---	---	7.98	---	---	---
Dry rolled corn	23.00	10.00	---	20.30	17.80	16.40
Brome hay	9.46	22.15	---	12.50	14.10	14.70
supplement	2.29	2.15	1.74	7.50	7.30	7.60
Omega 3 fatty acid supplement	---	5.00	5.28	---	2.20	4.50

[1]Fed from November 11 to December 29, 2021.
[2]Fed from December 30, 2021, to February 2, 2022.
[3]Control diet.
[4]0.5 lb Omega 3 fatty acid supplement inclusion diet.
[5]1.0 lb Omega 3 fatty acid supplement inclusion diet.

Table 2. Actual and predicted bull performance means

	2021-2023		
Item	**Actual**	**SD[1]**	**Predicted**
Initial BW,[2] lb	793	114	---
Ending BW,[2] lb	1,056	137	---
DMI,[2] lb/day	20.2	3.9	20.7
ADG,[2] lb	3.63	0.79	2.26
F:G[2]	5.76	1.28	---

[1] Standard deviation.
[2] BW = body weight; DMI = dry matter intake; ADG = average daily gain; F:G = feed to gain ratio.

Table 3. Correlation coefficients for actual and predicted intake and gain of bulls

	2021-2023			
Item	**Actual**	**Predicted**	**r**	***P*-value**
DMI,[1] lb/day	20.2	20.7	0.61	< 0.01
ADG,[1] lb	3.63	2.26	0.65	< 0.01

[1] DMI = dry matter intake; ADG = average daily gain.