FINAL REPORT

To: Poultry Protein and Fat Council

PPFC project #R69: Effect of feather meal inclusion on supplement intake behavior and performance in stocker cattle; a summary of two experiments.

R. Reuter and B. Wilson

Dept. of Animal & Food Sciences, Oklahoma State Univ.

November 1, 2018

Figure 1. SmartFeed Pro trailers

SUMMARY

Overall, the cattle in this study ate the supplements and gained weight as expected. We did not observe any deleterious effects or palatability issues in the feather meal-containing supplements. The proposal involved use of novel, precision supplementation units (SmartFeed Pro trailers, Figure 1). These units proved to be useful, however manufacturing issues and animal adaptation issues prevented us from collecting all data as originally designed. Further, the complexity of the data collected at this scale generates new questions as to how to interpret the findings.

OBJECTIVES

- Determine the effects of feather meal inclusion on supplement intake behavior and performance in stocker cattle
- Formulate a self-limiting free-choice supplement using feather meal that is cost effective

METHODS

Experiments

Two experiments were conducted. Experiment 1 used 84 stocker steers grazing dormant native range in late winter for 28 days. Experiment 2 used 74 stocker heifers grazing bermudagrass and Johnsongrass pasture in late summer for 42 days. In both experiments, supplements were fed via automatic self-feeders (SmartFeed Pro, C-Lock, Inc., Rapid City, SD). Forage mass was not limiting for intake or animal performance in either study. In both studies, cattle were weighed individually on validated scales at the beginning and end of the experiment. In both experiments, it proved difficult to train/entice a large percentage of the cattle to consume supplement consistently from the automatic feeders despite the best efforts of the researchers.

Supplements

The supplement specifications were similar, but technically different in each experiment. The overall goal was to formulate a supplement containing feather meal and test the palatability and ADG promoting potential of feather meal supplement against industry-standard supplements, including a salt-limited supplement.

Supplements (Table 1) were formulated to provide supplemental crude protein and

minerals. The supplements were not intended to be isonitrogenous but rather to mimic traditional commercial supplementation programs (Cottonseed meal and salt-limited cottonseed meal) to compare to the feather meal supplement under investigation. Supplements were fortified with trace minerals so that added trace mineral intake would match what is commonly used in commercial receiving cattle diets (Samuelson et al., 2016), when animals consumed 2.5 lb (as-fed) of supplement per day. Intake of these trace minerals would still meet NASEM (2016) requirements even at lower supplement intakes.

Table 1 - Supplement specifications.

Item	Feather meal	Salt-limited cottonseed meal	Plain cottonseed meal
Experiment 1			
Cottonseed meal		63.0	86.0
Feather meal	40.0		
Wheat middlings	53.0		7.0
Molasses	4.0	4.0	4.0
Salt		30.0	
Vitamin / mineral pack	3.0	3.0	3.0
CP%	46%	26%	36%
Experiment 2			
Cottonseed meal		68.0	86.0
Feather meal	50.0		
Wheat middlings	43.0		7.0
Molasses	4.0	4.0	4.0
Salt		25.0	
Vitamin / mineral pack	3.0	3.0	3.0
CP%	54%	28%	36%

Supplements were initially pelleted into ½" pellets, but the salt supplement proved too hard for cattle to eat, and they were remanufactured and fed in meal form.

Analysis

Data from both experiments were combined and analyzed together. Animal was the experimental unit. Animals were randomly assigned to receive one of the supplements. Total supplement intake during the experiment was summed within animal, and divided by the length of the trial to obtain mean supplement intake (mean therefore included days with zero intake). As mentioned, many animals never visited the self-feeders despite multiple attempts to adapt animals to the units. As a result, all animals that exhibited essentially no supplement intake (< 0.01 kg/d) were reassigned to the control treatment, because they did not actually consume any of their assigned treatment. Mean intake was predicted with ANOVA with post-hoc treatment and experiment in the model as fixed effects. Average daily gain was predicted with a linear model with mean supplement intake, post-hoc treatment and experiment as fixed effects. Least squares means of the post-hoc treatments were calculated. All analyses were conducted in R (v. 3.3.3, R Core Team, 2017).

RESULTS & DISCUSSION

The large amount of variation that was observed with individual animal voluntary intake warrants caution in interpreting the results.

However, mean intake of the feather meal-containing supplement was greater than the other supplements (3.09 lb/d vs. 0.80 or 2.06 lb/d, $P < 0.001$, Table 2). This result would seem to indicate that the "palatability" concerns associated with feather meal-containing supplements (Murphy et al., 1992) may not be warranted.

Average daily gain was not affected by the type of supplement, in a model that included supplement intake and experiment ($P = 0.39$). Stated alternatively, ADG was not different in the two experiments, and the more supplement cattle ate, the more weight they gained. These are expected effects. However, after those effects were accounted for, feather meal-containing supplements performed no different than cottonseed-meal containing supplements, and no different than their chemical nutrient analysis would predict. Again, a cautious interpretation would be that there is evidence that beef producers could incorporate feather meal into supplements for beef cattle when feather

meal is priced competitively based on nutrient value, and they should not expect palatability problems.

Table 2 - Results from two experiments in which feather meal-containing supplements were compared to cottonseed meal-containing supplements.

Item	Control	Feather meal	Salt-limited cottonseed meal	Plain cottonseed meal
Number of experiments	2	2	2	2
Number of animals[1]	95	19	25	12
Initial BW, lb	738	757	752	774
ADG[2], lb	0.46	0.66	0.72	0.58
Supplement intake, lb/hd/d	0	3.09	0.80	2.06

[1]A minimum of 25 animals were randomly assigned to each each feed treatment at the beginning of the studies. However, some of these animals did not consume a measurable amount of supplement at any point during the experiment and were re-assigned to Control. The table reflects animals that consumed < 0.01 kg of supplement per day (Control) and animals that consumed > 0.01 kg of supplement per day (Feather meal, etc.)

[2]28 d in Experiment 1 and 42 d in Experiment 2. This ADG is the least squares mean from a model including experiment and supplement intake. R-squared of the model was 0.81, treatments do not differ ($P > 0.08$).

NEXT STEPS

The equipment and approach used in these studies is exciting for the potential it offers in precision supplementation research. We are currently conducting research with a newer precision supplementation equipment that offers easier training for stocker cattle. The current equipment has been modified to provide more reliable data in brood cows, and to improve cattle training procedures. Likely, additional research is warranted with feather meal before the results presented herein are deemed reliable and repeatable, based on the limited number of animals that actually consumed the supplements and the

difficulty in adapting the animals to the self-feeders. Please contact the authors of this study prior to using this information in any marketing materials. Thank you for your support of OSU Animal & Food Sciences and our precision supplementation research program.

Literature Cited

Murphy, T. M., K. S. Lusby, G. W. Horn, and F. T. Mccollum. 1992. The Value of Feather Meal as a Protein Supplement Source in Winter Supplements for Beef Cows. Prof. Anim. Sci. 8:21–27. Available from: http://linkinghub.elsevier.com/retrieve/pii/S1080744615321197

NASEM. (National Academies of Sciences, Engineering, and Medicine). 2016. Nutrient Requirements of Beef Cattle, 8th Revised ed. Washington, DC: The National Academies Press.

R Core Team. 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Samuelson, K. L., M. E. Hubbert, M. L. Galyean, and C. A. Löest. 2016. Nutritional recommendations of feedlot consulting nutritionists: The 2015 New Mexico State and Texas Tech University survey. J. Anim. Sci. 94:2648. Available from: https://www.animalsciencepublications.org/publications/jas/abstracts/94/6/2648

APPENDIX Reference Data

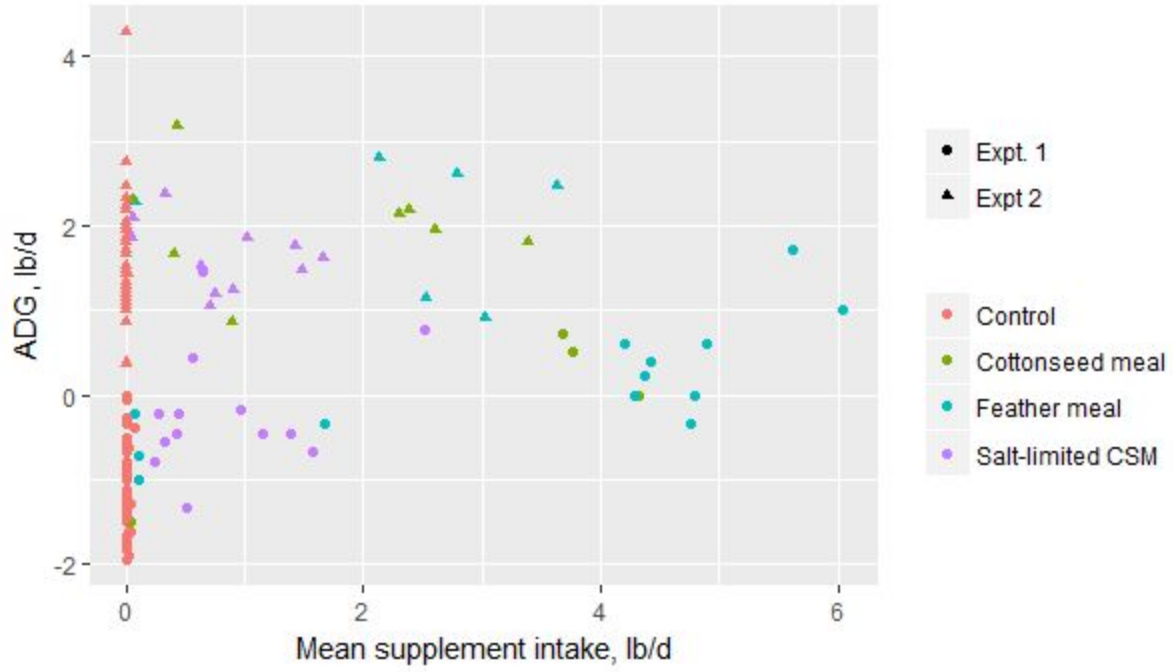

Figure 2. Data for each animal in both experiments.