Meta-Analysis Comparing Growth Performance, Carcass Characteristics, and Water Usage of Growing-Finishing Pigs Fed Using Conventional Dry and Wet-Dry Feeders

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Summary

Fifteen trials were used for meta-analyses comparing the effects of conventional dry (CD) and wet-dry (WD) feeders on growth performance, carcass traits, and water usage of growing-finishing pigs. The meta-analysis indicated that pigs fed with WD feeders consistently had greater ($P < 0.01$) ADG (0.09 lb/d) and ADFI compared with those fed with CD feeders; however, although highly variable, no overall difference ($P = 0.93$) was observed in F/G. As a result of improved growth rate, final BW and HCW of pigs fed with WD feeders was 3.2% greater ($P < 0.01$) than when fed with CD feeders. For carcass traits, backfat was greater ($P < 0.01$) and percentage lean was lower ($P < 0.01$) in pigs fed with WD feeders compared with those fed with CD feeders. Carcass yield and loin depth did not differ ($P > 0.14$) among feeder types. Water usage for pigs fed with WD feeders was 0.4 gal/pig/d less ($P = 0.02$) than for pigs using CD feeders. Growing-finishing pigs fed with WD feeders had increased growth rate, feed intake, final BW, and HCW, but deposited more fat as indicated by greater backfat and lower percentage lean.

Key words: conventional dry feeder, wet-dry feeder, finishing pig, meta-analysis

Introduction

Recent studies have demonstrated that finishing pigs fed using WD feeders had improved ADG, ADFI, and final BW; however, F/G responses are inconsistent among trials. Nitikanchana et al. (2011[2]) observed improved F/G in pigs fed with WD feeders; in contrast, studies in the same facility indicated poorer or no difference in F/G in pigs fed with a WD compared with a CD feeder.[3,4]

Wet-dry feeders also influence carcass characteristics and water usage of finishing pigs. Myers et al. (2011[3]) and Bergstorm et al. (2011[4]) found a greater backfat and lower lean percentage in pigs fed with a WD feeder compared with a CD feeder, which can reduce carcass price and the economic benefits of using a WD feeder. The inconsistency of feed efficiency responses and impact of WD feeders on carcass traits are major factors to

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[2] Nitikanchana et al., Swine Day 2011, Report of Progress 1038, pp. 257–261.
[3] Myers, A.J. 2011. Effect of diet form and feeder design on growth performance of finishing pigs. College of Agriculture, Kansas State University. Thesis.
[4] Bergstrom, J.R. 2011. The effect of feeder design, dietary level of dried distillers' grain with solubles, and gender on the performances and carcass characteristics of finishing pigs. College of Agriculture, Kansas State University. Dissertation.

consider when using WD feeders. Therefore, we conducted a meta-analysis of available studies to evaluate the influence of WD feeders on growth performance, carcass traits, and water usage of growing-finishing pigs.

Procedures

A comprehensive search via Kansas State University Libraries using the internet and the ISI Web of KnowledgeSM/CABI search engine was used to obtain published data including theses and university publications. The criteria for selection of data included experiments conducted with complete randomized design or randomized complete block design, replicated treatments, and a clear description or diagram of the WD feeder to confirm that the water source was indeed located within the feeder. The search resulted in 15 trials with growth performance data, 8 trials that measured carcass characteristics (carcass weight, backfat, loin depth, percentage carcass yield), 9 trials that reported lean percentage, 5 trials listing water disappearance, and 3 trials that included diet type (meal vs. pellet) in their comparison of feeder types. Data were analyzed using the PROC MIXED procedure of SAS (SAS Institute, Inc., Cary, NC). Means for feeder type (CD and WD) within trial and diet type (pellet or meal) were the experimental units for all data analysis. Thus, there were 2 observations per feeder type in the 3 trials that had both meal and pellet diet form. Pen replicates per observation ranged from 6 to 24. Backfat, loin depth, and lean percentage in each study were adjusted to using HCW as a covariate. Results were considered significant at $P \leq 0.05$.

From the meta-analysis results, the growth performances and carcass characteristics were used to calculate an income over feed cost (IOFC) of feeding with WD and CD feeders. Income over feed cost is a method to measure an economic value by assuming that other costs, such as utility and labor, are equal. Feed cost was valued at $278/ton, carcass price at $0.88/lb, and $1.50 for 1% of reduction in lean percentage. The advantage or disadvantage of feeding with a WD vs. a CD feeder was evaluated by the difference in IOFC.

Results and Discussion

The meta-analysis indicated that pigs fed with WD feeders had greater ($P < 0.01$; Table 1) ADG and ADFI compared with those fed with CD feeders, but no difference ($P = 0.93$) was observed in F/G. As a result of improved growth rate, final BW and HCW of pigs fed with WD feeders were 3.2% greater ($P < 0.01$) than when pigs were fed with a CD feeder. For carcass traits, backfat was greater ($P < 0.01$) and percentage lean was lower ($P < 0.01$) in pigs fed with WD feeders compared with those fed with CD feeders. Carcass yield and loin depth did not differ ($P > 0.14$) among feeder types. Water usage for pigs fed with WD feeders was 0.4 gal/pig/d less ($P = 0.02$) than for pigs using CD feeders.

Economic analysis using the result of this meta-analysis shows that WD feeders would provide an advantage of $0.74/pig. If the reduction in lean percentage were not discounted by the processor, the economic advantage would increase to $1.60 per pig. Notably, some experiments have found a negative impact on F/G (0.03 to 4.60%) for pigs fed from WD feeders. This response is a concern, because it was highly variable among the studies and any negative change in F/G would eliminate any economic advantage. Feeder adjustment and stocking rate have been reported to be important

variables in influencing F/G of pigs fed with WD feeders. The difference in water usage was not included in this economic analysis; however, the smaller volume of water usage with WD feeder may provide an economic benefit by reducing waste water.

This meta-analysis accounted for both types of feed (meal and pellet), but because of the limited data on pelleted feed (3 experiments), no interaction was observed between diet type and feeder design. Some data[5] suggest a possible interaction between diet type (meal vs. pellet) and feeder design. Researchers have speculated that with CD feeders, pigs fed a pelleted diet have improved F/G compared with those fed a meal diet, but no differences in F/G between diet types when fed with WD feeders. Providing both wet feed and pelleting decreases eating time, but it is speculated that the interaction occurs because these two factors are not additive.

Meta-analysis is a great method to provide quantification of biological difference among different feeder types and allow economic analysis in different circumstances. Pigs fed with WD feeders consistently had increased growth rate, feed intake, final BW, and HCW, but deposited more fat as indicated by greater backfat and lower percentage of lean. The economic return of using WD feeders depends on the feed efficiency response with an economic advantage when feed efficiency is similar among feeder types. However, the F/G response was highly variable; hence, if feed efficiency were poorer due to stocking density or feeder adjustment, any economic value to using WD feeders would be lost.

Table 1. Meta-analysis of growth performance, carcass traits, and water usage in pigs fed with conventional dry (CD) or wet-dry (WD) feeders[1]

Item	No. of observations[2]	Dry	Wet-dry	SEM	Probability, *P*<
ADG, lb	19	1.91	2.00	0.046	0.01
ADFI, lb	19	5.09	5.35	0.222	0.01
F/G	19	2.65	2.65	0.101	0.91
Carcass wt, lb	10	201.6	208.0	2.04	0.01
Backfat, in.[3]	10	0.67	0.71	0.009	0.01
Loin depth, in.	10	2.45	2.42	0.027	0.14
Lean, %	12	51.4	50.8	0.85	0.01
Carcass yield, %	10	75.8	75.6	0.26	0.57
Water disappearance, gal/pig/d	6	1.7	1.3	0.09	0.02
Initial wt, lb	19	74.2	74.1	5.90	0.27
Final wt, lb	19	228.4	235.7	13.80	0.01

[1] Growth performance was evaluated from 15 trials, carcass characteristics (carcass weight, backfat, loin depth, percentage carcass yield) from 8 trials, lean percentage from 9 trials, water disappearance from 5 trials, and response due to diet type (meal vs. pellet) were analyzed from 3 trials.
[2] Numbers of means for feeder type (CD and WD) within experiment and diet types (pellet or meal) that were used in the meta-analysis.
[3] Backfat, loin depth, and lean percentage in each study were adjusted using HCW as a covariate.

[5] Rantanen et al., Swine Day 1995, Report of Progress, pp. 199–120.