Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 984

2003

Evaluation of hemicell® on growth performance of late nursery pigs

N A. Lenehan

C N. Groesbeck

C W. Hastad

See next page for additional authors

Recommended Citation

Lenehan, N A.; Groesbeck, C N.; Hastad, C W.; Keegan, T P.; Lawrence, K R.; Young, M G.; Tokach, Michael D.; Goodband, Robert D.; Nelssen, Jim L.; and Dritz, Steven S. (2003) "Evaluation of hemicell® on growth performance of late nursery pigs," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6824

Evaluation of hemicell® on growth performance of late nursery pigs

Abstract

A total of 276 pigs (initially 21.9 lb) was used to determine the effects of added HemicellÂ® on growth performance. HemicellÂ® is a patented fermentation product of Bacillus lentus. The active ingredient in the fermentation product is Î²-mannanase. However, other enzymes such as amylase, xylanase, cellulases, and Î±-galactosidase also are present. It is claimed that HemicellÂ® degrades Î²-mannan in feed, thus, removing its effects as an antinutritive factor in swine diets. Dietary treatments were arranged as a 2 x 3 factorial, with or without 0.05% HemicellÂ®, in diets with 3 levels of energy density (1,388, 1,488, 1,588 ME, kcal/lb). The 100 kcal increments were achieved by the addition of wheat bran or soy oil to a corn-soybean meal based diet. The addition of HemicellÂ® to the diets, regardless of energy level, did not lead to an improvement in growth performance in these late nursery pigs. Increasing energy density of the diet, however, resulted in an improved ADG and F/G.; Swine Day, 2003, Kansas State University, Manhattan, KS, 2003

Keywords

Swine day, 2003; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 920; Kansas Agricultural Experiment Station contribution; no. 04-120-S; Weanling pigs; HemicellÂ®; Enzyme; Swine

Authors

N A. Lenehan, C N. Groesbeck, C W. Hastad, T P. Keegan, K R. Lawrence, M G. Young, Michael D. Tokach, Robert D. Goodband, Jim L. Nelssen, and Steven S. Dritz

EVALUATION OF HEMICELL® ON GROWTH PERFORMANCE OF LATE NURSERY PIGS[1]

N.A. Lenehan, M.D. Tokach, R.D. Goodband, J.L. Nelssen, S.S. Dritz[2], C.N. Groesbeck, C.W. Hastad, T.P. Keegan, K.R. Lawrence, and M.G. Young

Summary

A total of 276 pigs (initially 21.9 lb) was used to determine the effects of added Hemicell® on growth performance. Hemicell® is a patented fermentation product of Bacillus lentus. The active ingredient in the fermentation product is β-mannanase. However, other enzymes such as amylase, xylanase, cellulases, and α-galactosidase also are present. It is claimed that Hemicell® degrades β-mannan in feed, thus, removing its effects as an anti-nutritive factor in swine diets. Dietary treatments were arranged as a 2 x 3 factorial, with or without 0.05% Hemicell®, in diets with 3 levels of energy density (1,388, 1,488, 1,588 ME, kcal/lb). The 100 kcal increments were achieved by the addition of wheat bran or soy oil to a corn-soybean meal based diet. The addition of Hemicell® to the diets, regardless of energy level, did not lead to an improvement in growth performance in these late nursery pigs. Increasing energy density of the diet, however, resulted in an improved ADG and F/G.

(Key Words: Weanling Pigs, Hemicell®, Enzyme)

Introduction

A variety of non-starch polysaccharides (NSP) are present in the cell wall structure of many feedstuffs. These NSPs have been shown to diminish growth performance and inhibit nutrient absorption in swine. One class of NSPs are commonly known as hemicelluloses and found in many ingredients used in swine diets, including soybean meal. Soybean meal can contain up to 22.7% NSP on a dry matter basis. Hemicelluloses in soybean meal, specifically galactomannans, are chemically composed of a d-mannose backbone with attached d-galactose molecules. Monogastrics, including pigs, lack the essential enzyme needed to degrade galactomannans. The enzyme, beta-d-mannanase is commercially available as the patented feed additive Hemicell®. Recent studies by Oklahoma State University have suggested that β-mannanase may improve growth performance in weanling and grow-finish pigs, but has minimal effect on nutrient digestibility. Other research has observed a trend for improvement in lean gain in grow-finish pigs fed Hemicell®. Thus, our objective in this study was to determine the effects of Hemicell® inclusion in the diet on

[1]Appreciation is expressed to Roger James of ChemGen Corp., Gaithersburg, Maryland, for providing the Hemicell® enzyme and chemical analysis of the diets.
[2]Food Animal Health and Management Center.

growth performance of late nursery pigs. Three levels of energy density were used in the trial to investigate if Hemicell® will improve energy utilization.

Procedures

A total of 276 pigs (initial BW of 21.9 lb and 32 ± 2 d of age) were used in a 19-d growth assay. Pigs were blocked by weight and allotted to one of six dietary treatments on d 14 postweaning. There were eight pens per treatment. Six replications consisted of six pigs/pen and two replications consisted of five pigs/pen. Pigs were housed in the KSU nursery facility. Each pen was 4 × 5 ft and contained one self-feeder and one nipple waterer to provide ad libitum access to feed and water. Initial temperature was 90°F for the first 5 d after weaning, and was lowered approximately 3°F each week thereafter.

Experimental diets (Table 1) were fed in meal form and were corn-soybean meal based. The trial was conducted using three different energy levels (low, medium, and high), with and without the addition of Hemicell®. The control diets contained 1,488 kcal ME/lb. Wheat bran was added to reduce the dietary energy concentration to 1,388 kcal ME/lb, while energy was increased by the use of soy oil to give an energy content of 1,588 kcal ME/lb for the high energy diets (100 kcal increments). Pigs were allotted on d 14 postweaning. Average daily gain, ADFI and F/G were determined by weighing pigs and measuring feed disappearance on d 21, 28, and 33 postweaning.

Table 1. Composition of Experimental Diets

	Energy Level		
Ingredient, %	Low	Medium	High
Corn	42.95	60.00	55.11
Soybean meal, 46.5%	33.57	36.34	36.76
Soy oil	---	---	4.45
Wheat bran	20.00	---	---
Sand[a]	0.05	0.05	0.05
Monocalcium phosphate, 21% P	1.15	1.38	1.4
Limestone	1.00	0.95	0.95
Salt	0.35	0.35	0.35
Vitamin premix	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15
L-threonine	0.13	0.13	0.13
Lysine HCl	0.25	0.25	0.25
DL-methionine	0.15	0.15	0.15
TOTAL	100.00	100.00	100.00
Total lysine, %	1.45	1.45	1.45
Isoleucine:lysine ratio, %	65%	66%	65%
Leucine:lysine ratio, %	128%	133%	130%
Methionine:lysine ratio, %	34%	34%	34%
Met & Cys:lysine ratio, %	62%	61%	60%
Threonine:lysine ratio, %	67%	67%	66%
Tryptophan:lysine ratio, %	20%	19%	19%
Valine:lysine ratio, %	74%	73%	72%
ME, kcal/lb	1,388	1,488	1,588
Protein, %	22.4	22.0	21.8
Calcium, %	0.75	0.76	0.76
Available phosphorus, %	0.47	0.47	0.47

[a]Hemicell® replaced sand in each diet to provide the additional dietary treatments.

Chemical analyses of the experimental diets for Hemicell® concentrations was performed by ChemGen Corp. The Hemicell® assay results (mmunits/ton) for the diets with and without added Hemicell® are shown in Table 2.

Data were analyzed as a 2 × 3 factorial with or without 0.05% Hemicell® and three levels of energy density (1,388, 1,488, and 1,588 ME, kcal/lb), with pen as the experimental unit. Analysis of variance was performed using the MIXED procedure of SAS. The model included all main effects as well as two-way interactions.

Table 2. Chemical Analysis of Hemicell® in Diets

	Hemicell® (mmunits/ton)[a]	
Energy level	without[b]	With[b]
Low	17.5	107.3
Medium	10.1	104.1
High	9.7	90.2

[a]Hemicell® (mmunits/ton). The expected results at the 1 lb/ton inclusion rate is 100.0 with an assay range of 95.0 to 115.0.
[b]These results indicate normal background levels that are typical in untreated samples.

Results and Discussion

From d 0 to 7, there was no interaction observed between Hemicell® and dietary energy density. Pigs fed diets with added Hemicell® performed similarly to those pigs fed diets without Hemicell® (Table 3). Feed efficiency improved as ME concentration increased from 1,388 to 1,488 Kcal ME, but did not continue to improve in pigs fed diets with 1,588 Kcal ME/lb (quadratic, P<0.05).

From d 7 to 14, there was a tendency for a Hemicell® × energy interaction for ADFI (P<0.06). Pigs fed diets with added Hemicell® showed had decreased ADFI as energy density of the diet increased, whereas ADFI of pigs fed diets without Hemicell® were unaffected by increasing energy density. Average daily gain and F/G was similar for those pigs fed diets with and without Hemicell®. There was a linear improvement in F/G (P<0.01) as energy density of the diet increased.

From d 14 to 19 of the trial, results were similar to those observed d 0 to 14. There was no Hemicell® × energy interaction observed. The effect of Hemicell® was again not shown to be significant (Table 3). A linear increase in ADG and F/G was observed as dietary energy density increased (P<0.01).

Overall, from d 0 to 19, there were no Hemicell® × energy interactions observed. In addition, no effect of Hemicell® was observed. Increasing the energy density of the diet improved (quadratic, P<0.05) ADG and F/G. The greatest improvement in performance occurred as dietary energy density was increased from 1,388 to 1,488 ME, kcal/lb. Similarly, ADFI decreased (quadratic, P<0.05) as energy density of the diet increased.

In summary, addition of Hemicell® did not improve ADG, ADFI, or F/G in this experiment. As the energy density of the diet increased from 1,388 to 1,588 kcal/lb ME, there was a quadratic (P<0.05) improvement in ADG and F/G. The greatest response occurred as dietary energy density increased from 1,388 to 1,488 kcal/lb ME. Increasing energy density of the diet resulted in a reduction in feed intake (quadratic, P<0.05). This trial does not support data from other studies where an improvement in growth performance, due to the addition of Hemicell® in nursery diets, has been observed.

Table 3. Evaluation of Hemicell® on Growth Performance of Late Nursery Pigs[a]

		Treatments							P <			
	Hemicell®:	Without			With[b]							
Item	ME Kcal/lb:	1,388	1,488	1,588	1,388	1,488	1,588	SE	Hemicell	Hemicell × Energy	Energy Linear	Energy Quadratic
Day 0 to 7												
ADG, lb		0.81	0.89	0.82	0.82	0.86	0.83	0.06	0.931	0.808	0.783	0.064
ADFI, lb		1.25	1.26	1.24	1.25	1.28	1.25	0.06	0.826	0.947	0.770	0.514
F/G		1.56	1.41	1.55	1.55	1.48	1.51	0.06	0.917	0.571	0.575	0.038
Day 7 to 14												
ADG, lb		1.06	1.18	1.12	1.16	1.14	1.14	0.06	0.349	0.165	0.586	0.255
ADFI, lb		1.56	1.63	1.58	1.67	1.60	1.53	0.06	0.733	0.060	0.075	0.362
F/G		1.47	1.38	1.41	1.44	1.41	1.34	0.06	0.282	0.252	0.007	0.359
Day 14 to 19												
ADG, lb		1.06	1.27	1.21	1.11	1.18	1.23	0.06	0.944	0.335	0.008	0.095
ADFI, lb		1.63	1.82	1.66	1.70	1.69	1.67	0.06	0.717	0.199	0.884	0.078
F/G		1.55	1.43	1.38	1.53	1.43	1.36	0.06	0.716	0.926	<.0001	0.415
Day 0 to 19												
ADG, lb		0.98	1.11	1.05	1.03	1.06	1.07	0.03	0.733	0.125	0.035	0.014
ADFI, lb		1.48	1.57	1.49	1.53	1.52	1.48	0.04	0.988	0.136	0.307	0.048
F/G		1.53	1.41	1.44	1.51	1.44	1.41	0.02	0.602	0.282	0.000	0.022

[a]A total of 276 pigs (six replications consisted of six pigs per pen and two replications consisted of five pigs per pen) with an average initial BW of 21.9 lb. Treatment diets were fed from d 0 to 19 of the experiment.

[b]Hemicell® was added at 0.05% of the diet.