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Evaluation of AviPlus on Growth Performance of Nursery and Growing-Finishing Pigs

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Evaluation of AviPlus on Growth Performance of Nursery and Growing-Finishing Pigs

Abstract

This experiment was conducted to determine the effect of AviPlus (a combination of micro-encapsulated sorbic and citric acids and synthetic thymol and vanillin botanicals; Vetagro Inc., Chicago, IL) on growth performance during the wean-to-finish period in a commercial research environment. A total of 1,215 pigs (L337 × 1050; PIC, Hendersonville, TN) were used in a 156-d wean-to-finish experiment. Pigs were weaned at approximately 21 d of age and placed in pens based on initial body weight (BW) with 27 pigs per pen in a randomized complete block design. During the 42-day nursery period, pigs were allotted to 1 of 2 treatments in an unbalanced treatment structure with 15 pens (replications) fed the control diet and 30 pens (replications) fed diets containing AviPlus at 6 lb/ton from d 0 to 21 and 2 lb/ton from d 21 to 42. On d 42, pigs were transported as intact pens from the nursery to the commercial finishing facility. During the finishing period 3 treatments were applied, which included: 1) pigs on the control diet in nursery remained on control diets; 2) 50% of pigs in nursery provided AviPlus were then fed 1 lb AviPlus throughout finishing; and 3) 50% of pigs in nursery provided AviPlus were then fed the control diet throughout finishing. All pens on finishing treatments 2 and 3 were allotted based on ending nursery BW to the finishing treatment. There were 15 replications per treatment in the finishing period. From d 0 to 21, pigs fed diets with AviPlus had a tendency for improved ($P < 0.058$) F/G when compared to pigs fed the control diet; however, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, or d 21 BW. From d 21 to 42, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, or F/G. For the overall nursery period (d 0 to 42), pigs fed diets with AviPlus had improved ($P < 0.05$) F/G when compared to pigs fed the control diet, but there was no evidence of difference ($P > 0.05$) for d 42 BW, ADG, or ADFI between treatments. From d 42 to 106, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, and F/G. However, from d 106 to 156, pigs fed diets containing AviPlus in both the nursery and finishing periods had decreased ($P < 0.05$) ADG when compared to pigs fed the control diet and pigs receiving AviPlus only in the nursery, with no evidence of difference ($P > 0.05$) for other growth responses. For the overall finishing period (d 42 to 156) and overall experimental period (d 0 to 156), there was no evidence of difference ($P > 0.05$) for BW, ADG, ADFI, or F/G. For mortality and removals, there was no evidence of difference ($P > 0.05$) observed during the nursery, finishing or overall. In summary, providing AviPlus during the nursery phase improved early and overall nursery F/G, but there was no effect on overall wean-to-finish performance.

Keywords

AviPlus, Nursery Pigs, Finishing Pigs, Growth Performance

Cover Page Footnote

The authors would like to thank Vetagro Inc. (Chicago, IL) for partial financial support.

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K-STATE Research and Extension

Swine Day 2020

KANSAS STATE UNIVERSITY SWINE INDUSTRY DAY 2020

Evaluation of AviPlus on Growth Performance of Nursery and Growing-Finishing Pigs[1]

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Summary

This experiment was conducted to determine the effect of AviPlus (a combination of micro-encapsulated sorbic and citric acids and synthetic thymol and vanillin botanicals; Vetagro Inc., Chicago, IL) on growth performance during the wean-to-finish period in a commercial research environment. A total of 1,215 pigs (L337 × 1050; PIC, Hendersonville, TN) were used in a 156-d wean-to-finish experiment. Pigs were weaned at approximately 21 d of age and placed in pens based on initial body weight (BW) with 27 pigs per pen in a randomized complete block design. During the 42-day nursery period, pigs were allotted to 1 of 2 treatments in an unbalanced treatment structure with 15 pens (replications) fed the control diet and 30 pens (replications) fed diets containing AviPlus at 6 lb/ton from d 0 to 21 and 2 lb/ton from d 21 to 42. On d 42, pigs were transported as intact pens from the nursery to the commercial finishing facility. During the finishing period 3 treatments were applied, which included: 1) pigs on the control diet in nursery remained on control diets; 2) 50% of pigs in nursery provided AviPlus were then fed 1 lb AviPlus throughout finishing; and 3) 50% of pigs in nursery provided AviPlus were then fed the control diet throughout finishing. All pens on finishing treatments 2 and 3 were allotted based on ending nursery BW to the finishing treatment. There were 15 replications per treatment in the finishing period. From d 0 to 21, pigs fed diets with AviPlus had a tendency for improved ($P < 0.058$) F/G when compared to pigs fed the control diet; however, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, or d 21 BW. From d 21 to 42, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, or F/G. For the overall nursery period (d 0 to 42), pigs fed diets with AviPlus had improved ($P < 0.05$) F/G when compared to pigs fed the control diet, but there was no evidence of difference ($P > 0.05$) for d 42 BW, ADG, or ADFI between treatments. From d 42 to 106, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, and F/G. However, from d 106 to 156, pigs fed diets containing AviPlus in both the nursery and finishing periods had decreased ($P < 0.05$) ADG when compared to pigs fed the control diet and

[1] The authors would like to thank Vetagro Inc. (Chicago, IL) for partial financial support.

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pigs receiving AviPlus only in the nursery, with no evidence of difference ($P > 0.05$) for other growth responses. For the overall finishing period (d 42 to 156) and overall experimental period (d 0 to 156), there was no evidence of difference ($P > 0.05$) for BW, ADG, ADFI, or F/G. For mortality and removals, there was no evidence of difference ($P > 0.05$) observed during the nursery, finishing or overall. In summary, providing AviPlus during the nursery phase improved early and overall nursery F/G, but there was no effect on overall wean-to-finish performance.

Introduction

Due to growing public concerns related to antibiotic resistance for antibiotic use and other growth promoters used in swine diets, there is an increased interest to identify alternative ingredients that elicit similar health and performance responses. The ability to raise healthy pigs with minimal medication and to achieve optimal growth performance is still the desirable goal to be successful from a food safety and economic position. Organic acids have been reported to reduce potential pathogens along the gastrointestinal tract, reduce the pH of the gastrointestinal tract, and improve growth performance of growing pigs.[4] Microencapsulation of nutrients and organic acids has the potential to distribute those nutrients along the gastrointestinal tract, thus providing a benefit to the animal.[5] Due to their broad spectrum of antimicrobial activity, essential oils, such as thymol and vanillin, extracted from edible plants are also emerging as a substitute for antibiotics.[6] Recent research has shown that a commercial product (AviPlus, Vetagro Inc., Chicago, IL) that is a combination of micro-encapsulated sorbic and citric acids and synthetic thymol and vanillin botanicals improved the growth performance during the wean-to-finish period.[7] Research is needed to verify this response under commercial conditions. Therefore, the objective of this study was to evaluate the effect of AviPlus during the wean-to-finish period in a commercial research environment.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment. This experiment was conducted at New Horizon Farms research nursery and finishing facilities located in Pipestone, Minnesota. In the nursery, each pen (12 × 8 ft) had plastic slatted floors and was equipped with a six-hole stainless steel dry feeder and a pan waterer allowing *ad libitum* access to feed and water. Phase 1 diets were manufactured at Hubbard Feeds and all other diets were manu-

[4] Canibe, N., HØjberg, O., HØjsgaard, S., and Jensen, B.B. 2005. Feed physical form and formic acid addition to the feed affect the gastrointestinal ecology and growth performance of growing pigs. J. Anim. Sci. 83: 1287-1302. doi: 10.2527/2005.8361287x.

[5] Piva, A., Pizzamiglio, V., Morlacchini, M., Tedeschi, M., and Piva, G. 2007. Lipid microencapsulation allows slow release of organic acids and natural identical flavors along the swine intestine. J. Anim. Sci. 85: 486-493. doi:10.2527/jas.2006-323.

[6] Falcone, P., Speranza, B., Del Nobile, M.A., Corbo, M.R., and Sinigaglia, M. 2005 A study of the antimicrobial activity of thymol intended as a natural preservative. J. Food. Prot. 68: 1664-1670. doi:10.4315/0362-028X-68.8.1664.

[7] Oh, H. J., In, K. H., Song, M. H., Kwak, G., Yun, W., Lee, J. H., Lee, C. H., Oh, S. Y., Liu, S., An, J. S., Kim, H. B., and Cho, J. H. 2018. Effects of microencapsulated complex of organic acids and essential oils on growth performance, nutrient retention, blood profiles, fecal microflora, and lean meat percentage in weaning to finishing pigs. Canadian J Ani Sci 99(1), 41-49, (13 June 2018). https://doi.org/10.1139/cjas-2018-0006.

factured at the New Horizon Farms feed mill in Pipestone, MN. In the grow-finish phase of the study, each pen (18 × 9 ft) was equipped with a 4-hole stainless steel dry self-feeder and a waterer cup for *ad libitum* access to feed and water. Feed additions for the nursery and finishing phases to each pen were delivered and recorded by a robotic feeding system (FeedPro, Feedlogic Corp., Wilmar, MN). Pens of pigs were weighed, and feed delivery and disappearance were determined weekly during the nursery phase and approximately every 2 weeks during the finisher phase. Weights and feed measurements were used to determine growth performance (ADG, ADFI, and F/G). If a pig died, it was weighed and recorded. Pigs that were unable to overcome sickness or injury during the trial were removed and recorded.

A total of 1,215 pigs (L337 × 1050; PIC, Hendersonville, TN) were placed in 45 pens with 27 pigs per pen. Pigs were weaned at approximately 21 d of age and placed in pens based on initial body weight (BW). During the 42-day nursery period, pigs were allotted to 1 of 2 dietary treatments in an unbalanced treatment structure with 15 pens (replications) fed the control and 30 pens (replications) fed diets containing AviPlus (a combination of micro-encapsulated sorbic and citric acids and synthetic thymol and vanillin botanicals; Vetagro Inc., Chicago, IL) at the expense of corn in the diet at 6 lb/ton from d 0 to 21 and 2 lb/ton from d 21 to 42. Nursery diets were fed in 3 phases, with pharmacological levels of Zn in phase 1 and 2 (3,000 ppm added from zinc oxide in phase 1 and 2,000 ppm in phase 2). Diets were formulated to meet or exceed requirements recommended by the NRC.[8]

On d 42, pigs were transported as intact pens from the nursery to a commercial finishing facility. During the finishing period 3 treatments were applied, which included: 1) pigs fed the control diet in nursery remained on control diets; 2) 50% of pigs in nursery fed AviPlus were then fed 1 lb AviPlus throughout finishing; and 3) 50% of pigs in nursery fed AviPlus were then fed the control diet throughout finishing. All pens on finishing treatments 2 and 3 were allotted based on ending nursery BW to the finishing treatment. There were 15 replications per treatment in the finishing period.

Data were analyzed using R Studio (Version 4.0, R Core Team. Vienna, Austria) with pen serving as the experimental unit. The study was a randomized complete block design with weight block included in the model as a random effect. Pre-planned contrast statements were used to evaluate the treatment effects on ADG, ADFI, BW, F/G, removals, and mortality. Nursery data were analyzed as a 1-way treatment structure with 2 levels. Grow-finish data were analyzed as a 1-way treatment structure with 3 levels. Statistical models were fitted using NLME package in R. Results were considered significant at $P < 0.05$ and marginally significant at $0.05 > P < 0.10$.

Results and Discussion

From d 0 to 21, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, or d 21 BW. However, pigs fed diets with AviPlus had showed a trend for improved ($P < 0.058$) F/G compared to pigs provided the control diet. From d 21 to 42, there was no evidence of difference ($P > 0.05$) for ADG, ADFI, F/G, or d 42 BW.

[8] National Research Council. 2012. Nutrient Requirements of Swine: Eleventh Revised Edition. Washington, DC: The National Academies Press. https://doi.org/10.17226/13298.

For the overall nursery period (d 0 to 42) pigs fed diets with AviPlus had improved ($P < 0.05$) F/G compared to pigs fed the control diet, but there was no evidence of difference ($P > 0.05$) for ADG or ADFI.

For the finishing period, from d 42 to 106, there was no evidence of difference ($P > 0.05$) between treatments for ADG, ADFI, and F/G. From d 106 to 156, pigs fed diets containing AviPlus both in the nursery and finishing periods had decreased ($P < 0.05$) ADG when compared to pigs on the control diet and pigs receiving AviPlus only in the nursery, with no evidence of difference ($P > 0.05$) for other growth responses. For the overall finishing period (d 42 to 156), there was no evidence of difference ($P > 0.05$) for d 156 BW, ADG, ADFI, or F/G.

For the overall wean-finish period (d 0 to 156), no evidence for difference ($P > 0.05$) was observed for ADG, ADFI, or F/G between the different treatments.

For mortality and removals, there was no evidence of difference ($P > 0.05$) observed for nursery mortality, removals, or total nursery mortality and removals. Similarly, in finishing and overall, no evidence of difference ($P > 0.05$) was observed for mortality, removals, or total mortality and removals.

In summary, diets with AviPlus improved F/G in the early and overall nursery phases. However, no benefit was found in the finishing period or for the overall wean-to-finish period. This is in contrast to previous research when pigs fed AviPlus had improved growth performance in the wean-to-finish period.[7] The discrepancy in studies warrants further investigation.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

Table 1. Composition of nursery diets (as-fed basis)[1]

Item	Phase 1[2]	Phase 2[3]	Phase 3[4]
Ingredient, %			
Corn	42.20	47.05	48.35
Soybean meal	15.05	24.95	27.30
Dried whey	17.50	9.00	---
Enzymatically treated soybean meal[5]	6.65	---	---
Distillers dried grains with solubles	5.00	10.00	20.00
Fish meal	5.00	5.00	---
Beef tallow	---	1.00	1.00
Corn oil	3.00	---	---
Spray-dried blood plasma	2.50	---	---
Limestone	0.73	0.80	1.25
Monocalcium P	0.45	0.30	0.50
Sodium chloride	0.30	0.50	0.55
L-Lysine-HCl	0.40	0.48	0.50
DL-Methionine	0.20	0.19	0.10
L-Threonine	0.20	0.19	0.13
L-Tryptophan	0.02	0.03	0.02
L-Valine	0.10	0.10	0.05
Zinc oxide	0.42	0.27	---
Phytase[6,7]	0.02	0.05	0.05
Vitamin premix[8]	0.05	---	---
Trace mineral premix[9]	0.13	---	---
Selenium premix	0.05	---	---
Vitamin and trace mineral premix[10]	---	0.15	0.15
Tri-basic copper chloride	---	---	0.02
AviPlus[11]	(+/-)	(+/-)	(+/-)
Total	100	100	100

continued

Table 1. Composition of nursery diets (as-fed basis)[1]

Item	Phase 1[2]	Phase 2[3]	Phase 3[4]
Calculated analysis			
Standardized ileal digestible (SID) amino acids			
Lysine	1.40	1.38	1.30
Isoleucine:lysine	55	57	61
Leucine:lysine	115	121	140
Methionine:lysine	37	38	33
Methionine and cysteine:lysine	58	58	57
Threonine:lysine	64	63	62
Tryptophan:lysine	18.2	18.3	18.3
Valine:lysine	71	70	72
Total lysine, %	1.57	1.56	1.48
ME,[12] kcal/lb	1,602	1,523	1,491
NE,[12] kcal/lb	1,209	1,134	1,105
SID Lys:NE, g/Mcal	5.25	5.52	5.34
CP, %	22.2	22.8	23.3
Ca, %	0.70	0.70	0.68
P, %	0.65	0.63	0.60
STTD P, %	0.56	0.51	0.47
Na, %	0.42	0.36	0.29
Cl, %	0.74	0.67	0.50

[1] Nursery diets were provided in 3 phases from d 0 to 42.
[2] Phase 1 diets were provided as a 4 lb/pig feed budget.
[3] Phase 2 diets were provided after phase 1 until d 21.
[4] Phase 3 diets were provided from d 21 to 42.
[5] HP 300 (Hamlet Protein, Findlay, OH).
[6] Quantum Blue 5G (AB Vista, Plantation, FL) provided 1,959 FTU/kg that was used in phase 1 in diets provided from Hubbard Feeds.
[7] Optiphos 2000, (Huvepharma Inc., Peachtree City, GA) provided 227 phytase units (FTU)/lb of diet, for an estimated release of 0.14% available P that was used in phases 2 and 3 in diets provided from the mill at New Horizon Farms.
[8] Provided per kg of premix: 11,100,196 IU vitamin A; 2,000,360 IU vitamin D; 59,996 IU vitamin E; 6000 mg vitamin K; 50 mg vitamin B12; 8,001 mg riboflavin; 41,000 mg pantothenic acid; 45,002 mg niacin; 1,200 mg folic acid; and 200 mg biotin.
[9] Provided per kg of premix: 160,090 mg Zn from zinc sulfate; 134,000 mg Fe from ferrous sulfate; 40,000 mg Mn from manganese oxide; 13,340 mg Cu from copper sulfate; and 666 mg I from calcium iodate.
[10] Each kg of premix contained 66,700 mg Fe from ferrous sulfate, 73,300 mg Zn from zinc oxide, 26,700 mg Mn from manganese oxide, 10,000 mg Cu from copper sulfate, 500 mg I from calcium iodate, 200 mg Se, 5,344,484 IU vitamin A, 100,210 IU vitamin E, 21 mg vitamin B12, 4,007 mg riboflavin, 15,366 mg pantothenic acid, 29,061 mg niacin, 668 mg folic acid, 1,201 mg vitamin B6, 67 mg biotin, 1,336,122 IU vitamin D3, and 1,671 mg vitamin K.
[11] AviPlus (Vetagro Inc., Chicago, IL) was provided at 6 lb/ton from d 0 to 21 and 2 lb/ton from d 21 to 42.
[12] ME = metabolizable energy. NE = net energy. CP = crude protein.

Table 2. Composition of finishing diets (as-fed basis)[1]

Item	Phase 1	Phase 2	Phase 3	Phase 4
Ingredient, %				
Corn	52.70	59.95	66.15	69.50
Soybean meal	23.95	16.60	10.50	7.20
Distillers dried grains with solubles	20.00	20.00	20.00	20.00
Limestone	1.20	1.30	1.25	1.25
Beef tallow	1.00	1.00	1.00	1.00
Sodium chloride	0.35	0.35	0.35	0.35
L-Lysine-HCl	0.45	0.45	0.45	0.40
DL-Methionine	0.04	0.03	---	---
L-Threonine	0.09	0.08	0.08	0.08
L-Tryptophan	0.02	0.03	0.04	0.03
Phytase[2]	0.04	0.04	0.04	0.04
Vitamin and trace mineral premix[3]	0.15	0.15	0.15	0.15
AviPlus[4]	(+/-)	(+/-)	(+/-)	(+/-)
Total	100	100	100	100

continued

Table 2. Composition of finishing diets (as-fed basis)[1]

Item	Phase 1	Phase 2	Phase 3	Phase 4
Calculated analysis				
Standardized ileal digestible (SID) amino acids				
Lysine	1.18	1.00	0.85	0.73
Isoleucine:lysine	62	61	60	63
Leucine:lysine	148	157	168	185
Methionine:lysine	30	31	30	33
Methionine and cysteine:lysine	55	57	58	64
Threonine:lysine	61	61	62	66
Tryptophan:lysine	18.6	18.9	18.8	18.7
Valine:lysine	71	72	73	77
Total lysine, %	1.35	1.15	0.99	0.86
ME,[5] kcal/lb	1,503	1,505	1,509	1,510
NE,[5] kcal/lb	1,123	1,141	1,158	1,166
SID Lys:NE, g/Mcal	4.77	3.98	3.33	2.84
CP, %	21.90	19.00	16.60	15.20
Ca, %	0.54	0.55	0.51	0.50
P, %	0.48	0.45	0.42	0.41
STTD P, %	0.36	0.34	0.33	0.32
Na, %	0.21	0.21	0.20	0.20
Cl, %	0.37	0.37	0.37	0.36

[1] Diets were provided in 4 phases: Phase 1 diet was fed from 50 to 85 lb, Phase 2 diet was fed from 85 to 140 lb, Phase 3 diet was fed from 140 to 200 lb, and Phase 4 diet was fed from 200 lb to the end of the trial.
[2] Optiphos 2000, (Huvepharma Inc., Peachtree City, GA) provided 227 phytase units (FTU)/lb of diet, for an estimated release of 0.14% available P.
[3] Provided per kg of premix: 3,527,360 IU vitamin A; 881,840 IU vitamin D; 17,637 IU vitamin E; 1,764 mg vitamin K; 15.4 mg vitamin B12; 33,069 mg niacin; 11,023 mg pantothenic acid; 3,307 mg riboflavin; 74 g Zn from zinc sulfate; 74 g Fe from iron sulfate; 22 g Mn from manganese oxide; 11 g Cu from copper sulfate; 0.22 g I from calcium iodate; 0.20 g Se from sodium selenite; and 500,000 FTU phytase from OptiPhos 2000 (Huvepharma Inc., Peachtree City, GA).
[4] AviPlus (Vetagro Inc., Chicago, IL) inclusion rate of 1 lb/ton was used from the start of the finishing period to the end of the experiment.
[5] ME = metabolizable energy. NE = net energy. CP = crude protein.

Table 3. Evaluation of AviPlus on growth performance of nursery and growing-finishing pigs[1]

	Nursery performance			
Trait[2]	Control	Added AviPlus[3]	SEM	*P*-value
d 0 to 21				
d 0 BW	11.1	11.1	0.10	0.986
ADG, lb	0.45	0.46	0.010	0.428
ADFI, lb	0.78	0.76	0.010	0.331
F/G	1.74	1.66	0.030	0.058
d 21 BW	21.2	21.5	0.30	0.429
d 21 to 42				
ADG, lb	1.20	1.19	0.010	0.732
ADFI, lb	1.74	1.72	0.030	0.652
F/G	1.44	1.44	0.010	0.603
d 42 BW	50.7	51.0	0.51	0.797
d 0 to 42				
ADG, lb	0.85	0.85	0.016	0.983
ADFI, lb	1.28	1.26	0.024	0.813
F/G	1.52	1.49	0.010	0.049

continued

Table 3. Evaluation of AviPlus on growth performance of nursery and growing-finishing pigs[1]

	Grow-finish performance				
		Added AviPlus[3]			
Trait[2]	Control	Nursery and finisher[4]	Only in nursery[5]	SEM	*P*-value
d 42 to 106					
d 42 BW	50.7	50.9	51.0	0.717	0.963
ADG, lb	1.92	1.91	1.93	0.015	0.678
ADFI, lb	4.09	4.11	4.11	0.046	0.961
F/G	2.13	2.15	2.13	0.017	0.663
d 106 BW	174.4	174.1	175.4	1.290	0.719
d 106 to 156					
ADG, lb	2.17	2.12	2.17	0.015	0.040
ADFI, lb	6.60	6.57	6.63	0.058	0.753
F/G	3.05	3.09	3.06	0.023	0.331
d 156 BW	281.4	278.6	282.5	1.621	0.236
d 42 to 156					
ADG, lb	2.03	2.00	2.03	0.012	0.187
ADFI, lb	5.17	5.16	5.19	0.047	0.917
F/G	2.55	2.58	2.55	0.017	0.477
d 0 to 156					
ADG, lb	1.67	1.65	1.67	0.009	0.142
ADFI, lb	3.99	3.96	3.98	0.038	0.876
F/G	2.39	2.41	2.39	0.014	0.591
Mortality, %					
Nursery	0.5	1.0	0.7	0.50	0.710
Finishing	0.7	0.2	0.7	0.40	0.515
Total nursery and finishing	1.1	1.1	1.3	0.60	0.939
Removals, %[6]					
Nursery	10.0	8.6	8.8	1.60	0.739
Finishing	5.4	7.9	6.7	1.30	0.369
Total nursery and finishing	15.6	16.5	15.6	1.80	0.907
Mortality and removals, %					
Nursery	10.6	9.6	9.6	1.30	0.865
Finishing	6.2	8.1	7.4	1.40	0.544
Total nursery and finishing	16.8	17.7	17.0	1.90	0.928

[1] A total of 1,215 pigs (initial BW of 11.1 ± 0.1 lb) were used in a 156-d growth study with 27 pigs per pen. In the nursery, there were 15 pens (replications) fed the control diet and 30 pens (replications) fed diets containing AviPlus. In the finishing period of the experiment, 3 treatments were applied which included: 1) pigs on the control diet in nursery remaining on control diets; 2) ½ of pigs in nursery fed AviPlus were then fed 1 lb AviPlus throughout finishing, and 3) ½ of pigs in nursery fed AviPlus were then fed the control diets throughout finishing. Pens on treatments 2 and 3 were allotted based on ending nursery BW to the finishing treatment making 15 pens (replications) per treatment in the finishing phase.

[2] BW = body weight. ADG = average daily gain. ADFI = average daily feed intake. F/G = feed efficiency.

[3] A combination of micro-encapsulated sorbic and citric acids and synthetic thymol and vanillin botanicals (Vetagro Inc., Chicago, IL).

[4] AviPlus inclusion rate of 6 lb/ton in phase 1 (4 lb/pig) and phase 2 (ended at d 21) and 2 lb/ton from d 21 to 42 of the nursery period. Pigs were then placed on diets that provided an inclusion rate of 1 lb/ton of AviPlus throughout the grow-finish period.

[5] Pigs were fed diets with AviPlus at 6 lb/ton in phase 1 (4 lb/pig) and phase 2 (ended at d 21) and 2 lb/ton from d 21 to 42 during the nursery period and then switched to the control diet from d 42 to 156.

[6] Pigs that were unable to overcome sickness or injury during the trial were removed and marked as a removal.