

Dilger, R.N., Adedokun, S.A., Jendza, J.A., **Sands, J.S., Simmins, P.H.** and Adeola, L. Efficacy of microbial phytase in swine diets. Abstract T86, Journal of Animal Science, **81** (supple 1), p 257.

### **Efficacy of microbial phytase in swine diets**

**R. N. Dilger<sup>1</sup>, S. A. Adedokun<sup>1</sup>, J. A. Jendza<sup>1</sup>, J. S. Sands<sup>2</sup>, P. H. Simmins<sup>2</sup> and O. Adeola<sup>1</sup>**

<sup>1</sup>Purdue University, West Lafayette, IN

<sup>2</sup>Danisco Animal Nutrition, Marlborough, UK

Three experiments were designed to assess both nutrient metabolism and growth performance of young swine fed microbial phytase-supplemented diets. Dietary treatments were similar between experiments and consisted of a positive control, basal, and basal plus either 500 or 1000 g/kg microbial phytase. In the first study, twenty four 15-kg crossbred barrows were assigned to crates according to a RCBD resulting in 6 pigs per diet to characterize the effect of phytase on apparent fecal digestibilities of DM and P. Diets were formulated at 165 g/kg CP with the positive control and basal diets containing 5.5 and 3.3 g/kg total P, respectively. A positive phytase effect was observed for apparent fecal digestibilities of DM (quadratic,  $P < 0.05$ ) and P (linear,  $P < 0.05$ ) fecal digestibility. The second study utilized 48 pigs in a 21-d growth performance trial arranged as a RCBD with 12 pigs (6 barrows, 6 gilts) assigned to the 4 dietary treatments. The positive control and basal diets (209 g/kg CP) contained 5.7 and 4.0 g/kg total P, respectively. A linear phytase effect ( $P < 0.05$ ) was observed for average daily gain and feed efficiency at week 1 and overall. Final plasma P concentrations were also shown to be positively affected by phytase addition (linear,  $P < 0.05$ ). In the third study, 128 crossbred were assigned to the 4 dietary treatments with 4 pens of gilts and 4 pens of barrows per diet according to a RCBD. The positive control and basal diets were formulated at 170 g/kg CP and contained 5.3 and 3.6 g/kg total P, respectively. ADG, ADFI, and G:F exhibited a linear phytase response ( $P < 0.01$ ) at weeks 4 and 6 as well as overall. In conclusion, pigs fed phytase-supplemented diets gave results comparable to those fed phosphorus-adequate diets in both nutrient utilization and growth performance.

**Key words: Microbial phytase, Growth performance, Pigs**

Dilger, R.N., Adedokun, S.A., Jendza, J.A., **Sands, J.S., Simmins, P.H.** and Adeola, L. Efficacy of microbial phytase in swine diets. Abstract T86, Journal of Animal Science, **81** (supple 1), p 257.

**Table 1.** Composition (g/kg) of control and basal diets (as-fed basis)

Experiment:	1	1	2	2	3	3
Diet:	Control	Basal	Control	Basal	Control	Basal
<i>Ingredient</i>						
Corn	710.0	710.0	620.0	620.0	719.0	719.0
Soybean meal	226.0	226.0	331.0	331.0	232.0	232.0
Corn oil	10.0	10.0	10.0	10.0	10.0	10.0
Salt	3.0	3.0	3.0	3.0	3.0	3.0
Dicalcium phosphate	9.0	0.0	9.0	0.0	9.0	0.0
Limestone	11.0	16.0	11.0	16.0	10.0	15.0
Vitamin premix <sup>a</sup>	2.0	2.0	1.5	1.5	1.5	1.5
Mineral premix <sup>b</sup>	1.0	1.0	1.0	1.0	1.0	1.0
Selenium premix <sup>c</sup>	1.0	1.0	0.5	0.5	0.5	0.5
Lysine HCl	1.0	1.0	1.0	1.0	1.0	1.0
Corn starch	12.0	16.0	12.0	16.0	13.0	17.0
Chromic oxide premix <sup>d</sup>	15.0	15.0	15.0	15.0	15.0	15.0
<i>Calculated Composition, g/kg</i>						
Crude protein	165	165	209	209	170	170
Ca	6.6	6.6	7.1	7.1	6.4	6.4
Total P	5.0	3.3	5.7	4.0	5.3	3.6

<sup>a</sup>Contains per g of premix: Vit. A, 2440 IU; Vit. D3, 243 IU; Vit E, 9.3 IU; Vit. K activity, 1.9 mg; Menadione, 600 ug; Vit B12, 12.4 mg; Riboflavin, 2.4 mg; d-pantothenic acid, 9 mg; Niacin, 14 mg.

<sup>b</sup>Contains per g premix: Fe, 179 mg; Mn, 60 mg; Zn, 150 mg; Cu, 17.5 mg; I, 3mg.

<sup>c</sup>600 ug Se per g of premix.

<sup>d</sup>Contains 4 parts corn to 1 part Cr<sub>2</sub>O<sub>3</sub>.

Dilger, R.N., Adedokun, S.A., Jendza, J.A., **Sands, J.S., Simmins, P.H.** and Adeola, L. Efficacy of microbial phytase in swine diets. Abstract T86, Journal of Animal Science, **81** (supple 1), p 257.

**Table 2.** Efficacy of phytase on apparent ileal digestibilities of dry matter, phosphorus, and amino acids in growing swine.

Item	Diet <sup>1</sup>			SD
	Basal	Basal + 500 FTU/kg DAN	Basal + 1000 FTU/kg DAN	
Dry matter	57.6	62.5	50.4	15.3
Phosphorus	24.6	45.4	44.0	25.3
Amino acids		%		
Indispensable				
Arginine	83.3	80.5	83.8	9.9
Histidine	76.8	72.8	74.6	11.5
Isoleucine	71.4	68.2	72.8	12.5
Leucine	72.8	69.5	71.6	12.6
Lysine	79.1	71.6	76.7	15.1
Methionine	74.9	70.3	71.2	11.7
Phenylalanine	76.2	70.4	74.7	11.6
Threonine	63.6	54.8	58.1	16.6
Tryptophan	69.6	60.0	70.1	16.2
Valine	67.7	63.3	68.2	14.6
Dispensable				
Alanine	64.0	60.3	61.8	15.4
Aspartic acid	77.3	72.9	74.5	9.1
Cysteine	62.6	54.2	54.3	17.9
Glutamic acid	78.8	71.8	76.6	13.4
Glycine	55.0	37.3	46.3	31.0
Proline	67.3	64.5	65.2	14.5
Serine	76.1	69.4	72.3	10.0
Tyrosine	75.3	67.0	73.1	13.2
N	9	8	7	

<sup>1</sup>DAN = Danisco Animal Nutrition phytase; FTU = phytase units.

Dilger, R.N., Adedokun, S.A., Jendza, J.A., **Sands, J.S., Simmins, P.H.** and Adeola, L. Efficacy of microbial phytase in swine diets. Abstract T86, Journal of Animal Science, **81** (supple 1), p 257.

**Table 3.** Efficacy of phytase on apparent fecal digestibilities of dry matter, phosphorus, and amino acids in growing swine.

Item	Diet <sup>1</sup>				SD
	Control	Basal	Basal + 500 FTU/kg DAN	Basal + 1000 FTU/kg DAN	
Dry matter <sup>bc</sup>	87.3	88.9	88.6	89.5	0.2
Phosphorus <sup>ac</sup>	37.5	24.0	32.1	49.5	1.8
Amino acids					
Indispensable					
Arginine <sup>a</sup>	90.8	90.7	91.7	92.2	0.5
Histidine	89.5	89.7	90.5	90.9	0.5
Isoleucine <sup>ac</sup>	79.1	75.2	81.6	84.2	1.0
Leucine	82.5	83.4	84.2	85.3	0.7
Lysine	80.2	82.7	83.4	84.8	1.0
Methionine	74.3	77.5	77.7	78.9	1.1
Phenylalanine <sup>a</sup>	83.2	82.7	84.7	85.5	0.7
Threonine	77.0	79.2	80.2	80.6	0.8
Tryptophan <sup>c</sup>	86.9	89.7	90.1	91.1	0.8
Valine <sup>ac</sup>	78.5	74.9	80.7	82.8	1.0
Dispensable					
Alanine <sup>c</sup>	74.7	78.2	78.1	80.0	1.1
Aspartic acid <sup>c</sup>	83.1	85.7	86.3	86.7	0.7
Cysteine <sup>c</sup>	84.4	88.3	88.4	88.4	0.6
Glutamic acid <sup>c</sup>	87.8	89.4	89.9	90.6	0.5
Glycine <sup>c</sup>	77.9	80.9	80.6	82.0	0.8
Proline	87.6	88.8	88.7	89.0	0.5
Serine <sup>c</sup>	85.2	87.3	87.5	87.5	0.6
Tyrosine	81.9	82.9	83.5	84.3	0.8
N	6	6	6	6	

<sup>1</sup>DAN = Danisco Animal Nutrition phytase; FTU = phytase units.

<sup>a</sup>Linear phytase effect ( $P < 0.05$ ).

<sup>b</sup>Quadratic phytase effect ( $P < 0.05$ ).

<sup>c</sup>Contrast of control vs. basal ( $P < 0.05$ ).

Dilger, R.N., Adedokun, S.A., Jendza, J.A., **Sands, J.S., Simmins, P.H.** and Adeola, L. Efficacy of microbial phytase in swine diets. Abstract T86, Journal of Animal Science, **81** (supple 1), p 257.

**Table 4.** Efficacy of phytase on growth performance of weanling pigs.

Item	Diet <sup>1</sup>				SD
	Control	Basal	Basal + 500 FTU/kg DAN	Basal + 1000 FTU/kg DAN	
Week 1					
ADG, g <sup>a</sup>	452	368	423	432	94.1
ADFI, g	774	831	827	772	151.8
G:F, g:kg <sup>a</sup>	578	462	517	564	108.4
Week 2					
ADG, g <sup>b</sup>	492	410	521	436	88.0
ADFI, g	1037	1110	1146	1027	179.4
G:F, g:kg	472	380	457	429	76.9
Week 3					
ADG, g	571	474	472	521	73.0
ADFI, g	1138	1186	1088	1100	232.0
G:F, g:kg	517	413	435	486	82.7
Overall					
ADG, g <sup>ab</sup>	505	417	472	463	56.9
ADFI, g	983	1042	1020	967	164.0
G:F, g:kg <sup>a</sup>	516	413	468	487	70.3
Plasma P, mg/L					
Initial	4.2	4.0	4.0	4.0	0.27
Final <sup>a</sup>	3.4	1.4	2.0	2.3	0.43
N	11	11	11	12	

Average initial weight was 9.9 kg

<sup>1</sup>DAN = Danisco Animal Nutrition phytase; FTU = phytase units.

<sup>a</sup>Linear phytase effect ( $P < 0.05$ ).

<sup>b</sup>Quadratic phytase effect ( $P < 0.05$ ).

Dilger, R.N., Adedokun, S.A., Jendza, J.A., **Sands, J.S., Simmins, P.H.** and Adeola, L. Efficacy of microbial phytase in swine diets. Abstract T86, Journal of Animal Science, **81** (supple 1), p 257.

**Table 5.** Efficacy of phytase on growth performance of pigs.

Item	Diet <sup>1</sup>				SD
	Control	Basal	Basal + 500 FTU/kg DAN	Basal + 1000 FTU/kg DAN	
Week 2					
ADG, g	718	523	579	580	64
ADFI, g	1442	1352	1316	1348	100
G:F, g:kg	497	386	427	431	48
Week 4					
ADG, g <sup>a</sup>	848	592	683	790	58
ADFI, g <sup>a</sup>	2022	1762	1764	1965	149
G:F, g:kg <sup>a</sup>	421	337	377	404	40
Week 6					
ADG, g <sup>a</sup>	912	575	726	817	84
ADFI, g <sup>a</sup>	2970	2335	2449	2683	283
G:F, g:kg <sup>a</sup>	312	246	288	305	39
Overall					
ADG, g <sup>a</sup>	826	563	663	729	49
ADFI, g <sup>a</sup>	2145	1816	1843	1999	156
G:F, g:kg <sup>ab</sup>	388	310	360	366	28
N	32	32	31	32	

Average initial weight was 20.1 kg

<sup>1</sup>DAN = Danisco Animal Nutrition phytase; FTU = phytase units.

<sup>a</sup>Linear phytase effect ( $P < 0.01$ ).

<sup>b</sup>Quadratic phytase effect ( $P < 0.05$ ).