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Do Crowded Pigs Respond to Paylean®?

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Summary and Implications

Paylean® is a feed additive that improves feed efficiency, daily gain and carcass merit in finishing pigs. Restrictions in space allocation are known to reduce daily feed intake and daily gain. Thus, pigs may not respond as expected to dietary additions of Paylean® if feed intake is reduced due to crowding. A 2 x 2 factorial design was used to examine the potential interaction of Paylean® and space allocation. Experimental treatments were: 1) 14 or 19 pigs per pen (8.0 vs 5.9 ft²/pig); and 2) Paylean® for four weeks prior to slaughter (0 or 9 g/T). In this experiment, there were no interactions between space allocation and dietary Paylean® additions for overall daily gain, daily feed intake, feed conversion, carcass weight, carcass yield, carcass merit, carcass fat free lean, or daily fat free lean gain. Crowded pigs grew slower with no difference in feed conversion efficiency versus the uncrowded treatment. Pigs fed 9 g/T Paylean® for four weeks prior to slaughter had no difference in daily gain or final weight, but did have an increase in carcass yield (75.3 vs 74.6%), loin depth (2.71 vs 2.64 in.), carcass percent lean (56.0 vs 55.5%), and carcass premium (\$5.99 vs \$5.54/cwt) versus those fed 0 g/T. Incidence of and severity of tail biting were recorded on day 86 and there were no differences due to space allocation or Paylean® addition. These results suggest the response to dietary Paylean® additions is independent of

the response to space allocation. In addition, the lack of treatment effects on tail biting score on day 86 suggests neither space allocations nor dietary Paylean® addition were the cause of the tail biting observed in this experiment.

Introduction

The response to Paylean® by finishing pigs is dose dependent. At low inclusion levels (4.5 g/T), Paylean® impacts pig performance by improving gain, feed efficiency and carcass leanness. As the amount of Paylean® in the diet is increased (4.5 to 18 g/T), there generally is an improvement in carcass leanness and further improvements in feed efficiency. While diets are formulated with a specific amount of Paylean® (g/T), management factors can alter the daily feed intake of finishing pigs, influencing the intake of Paylean®. One management factor that alters feed intake is space allocation. When pigs are given less space per pig, feed intake almost always declines, with a resultant decrease in daily gain. Feed conversion efficiency may or may not be impacted by a reduction in space allocation. The following experiment was conducted to investigate the interaction of space allocation and Paylean® on pig performance and carcass characteristics.

Methods

The experiment was conducted at the University of Nebraska's Haskell Ag Lab Swine Research Unit near Concord, Neb. Pigs were housed in a double curtain, naturally ventilated, fully slatted confinement facility with 16 pens and daily fresh water, under slat flush-

ing for manure removal. Each pen measured 8 ft x 14 ft and contained one two-hole wean-to-finish feeder and one wean-to-finish cup drinker.

There were four replications of each combination of the following experimental treatments:

- 1) Space allocation from arrival
 - a) 5.9 ft²/pig (19 pigs/pen)
 - b) 8.0 ft²/pig (14 pigs/pen)
- 2) Paylean® in the diet for 4 weeks prior to slaughter
 - a) 0 g/T
 - b) 9 g/T

Crossbred barrows (Danbred USA, Seward, NE) were vaccinated for *H. parasuis*, *M. hyopneumoniae*, and erysipelas. All pigs that died during the experiment were examined for cause of death by a consulting veterinarian. Pen size was not adjusted in the event of pig removal or death. Feed disappearance was adjusted for dead and removed pigs prior to data analysis.

The experimental diets are listed in Table 1. Diets were switched on the week individual pens achieved target weights. All diets contained 100g/T Tylan from arrival to 80 lb, 40 g/T from 80 to approximately 180 lb, and 0 g/T thereafter.

Pigs were weighed every three weeks for the first nine weeks of the experiment. Pigs were weighed biweekly or weekly thereafter as necessary to determine the starting time for Paylean® treatments and to determine when to market pigs. The target slaughter weight for pigs fed Paylean® was 240 pounds and pigs were fed 0 or 9 g/T Paylean® diets for a four-week period prior to slaughter. Pigs on the uncrowded treatment were switched to the Paylean®

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treatments on day 58 while pigs on the crowded treatment were switched on day 65 of the experiment based on projected daily gain prior to slaughter.

Individually identified pigs were slaughtered at IBP, Inc., Madison, Neb. for determination of carcass composition and premiums. All pigs within a space allocation treatment (crowded vs uncrowded) were marketed on the same day. Fat free lean (FFL) and daily FFL gain were estimated on individual pigs using the loin and muscle depth values reported by IBP for individual pigs and the equations for FFL as published in Composition and Quality Assessment Procedures (National Pork Producers Council, 2000).

Either 10 or seven predetermined pigs per pen (5.9 or 8.0 ft²/pig) were bled via vena puncture on the same day as weighing and scanning. Plasma was harvested and frozen for analysis for plasma urea by the Non-Ruminant Nutrition Laboratory in the Animal Science Department at the University of Nebraska.

On day 86, all pigs were individually rated for injury due to tail biting using a 1 to 4 scale, with 1 being no injury evident and 4 being severe tail biting injury.

Results were analyzed using the ProcMixed procedure of SAS (SAS Institute, Cary, N.C.). The model included space, Paylean[®] addition and their interaction as fixed effects, and replication as a random effect. The pen of pigs was the experimental unit for all statistical comparisons. Death loss and pig removal was examined by Chi-square analysis.

Results and Discussion

Table 2 presents pig deaths and removal by pen, and experimental treatment. Because pen size was not adjusted in the event of pig death or removal, space allocation increased with death or removal. Two of the crowded pens had a space allocation at slaughter of 7.0 ft²/pig, two were at 6.2, and four were the original 5.9. In no instance did the space allocation of a crowded treatment pen become

Table 1. Experimental diets.

Ingredient, %	Period				
	65- 80 lb	80-130 lb	130- Paylean [®]	0 g/T Paylean [®]	9 g/T Paylean [®]
Ingredient, %					
Corn	67.13	72.68	80.38	74.73	74.68
Soybean meal, 46.5% CP	27.75	22.75	15.25	21.00	21.00
Fat ^a	2.00	2.00	2.00	2.00	2.00
Dicalcium PO ₄ , 18.5%	1.20	0.85	0.70	0.70	0.70
Limestone	0.80	0.75	0.80	0.75	0.75
Salt	0.30	0.30	0.30	0.30	0.30
Vitamin premix	0.30	0.275	0.2125	0.2125	0.2125
Trace mineral premix	0.25	0.20	0.1625	0.1625	0.1625
L-lysine	0.15	0.15	0.15	0.15	0.15
Tylan 40	0.125	0.05	0.05	0	0
Paylean [®] premix	0	0	0	0	0.05
Calculated composition					
ME, kcal/lb	1545	1553	1557	1557	1557
Crude protein, %	18.6	16.8	13.9	16.1	16.1
Lysine, %	1.10	0.97	0.77	0.92	0.92
Avail P, %	0.29	0.22	0.19	0.19	0.19
Total P, %	0.60	0.52	0.46	0.48	0.48
Ca, %	0.77	0.64	0.59	0.59	0.59
Laboratory Analysis^b					
Crude protein, %	18.8	18.2	16.7	17.1	17.1
Lysine, %		1.00	0.93	0.98	0.97
Ca, %	0.79	0.42	0.66	0.60	0.55
P, %	0.55	0.44	0.51	0.46	0.51
Particle size, microns		985	771	877	896

^aCW-3800, Feed Energy Co., Des Moines, IA

^bWard Laboratories, Kearney, Neb.

Table 2. Effect of experimental treatments on pig death, removal, and final stocking density.

Pen no.	Density, ft ² /pig		Paylean [®] , g/T	Day of death/removal	Cause	
	Initial	Final			Death	Removal
23	8.0	8.0	0			
28	8.0	9.3	0	29	Ulcer	
32	8.0	10.2	0	64		Tail bitten
				57		Failure to gain
				64		Injury
34	8.0	8.6	0	72	Streptococcus infection	
				47	Gastric torsion	
21	8.0	8.0	9			
25	8.0	8.0	9			
33	8.0	8.6	9	43	PRRS/pneumonia	
38	8.0	8.6	9	43		Tail bitten
22	5.9	5.9	0			
24	5.9	5.9	0			
35	5.9	6.2	0	72	PRRS	
36	5.9	7.0	0	39	Unknown	
				43	PRRS/pneumonia	
				71		Tail bitten
26	5.9	7.0	9	2	Gastric torsion	
				8	PRRS/pneumonia	
				86		Tail bitten
27	5.9	5.9	9			
31	5.9	5.9	9			
37	5.9	6.2	9	57		Tail bitten



Table 3. Effect of experimental treatments on pig performance.

Item	Space, ft ² /pig		Paylean [®] , g/T ^a		SE	P Values		
	5.9	8.0	0	9		Space x Paylean [®]	Space	Paylean [®]
No. pens	8	8	8	8				
Pig weight, lb								
Initial	65.0	65.5	65.3	65.2				
Paylean [®] initiation ^a	183.5	176.8	179.7	180.5	1.6	0.273	0.014	0.715
Final ^b	239.0	235.6	236.2	238.3	2.0	0.895	0.257	0.429
Coefficient of variation for within pen weight, %								
Initial	10.2	10.8						
Final	9.0	9.0	8.2	9.8	0.6	0.073	0.981	0.073
Average daily gain, lb								
Day 0 to Paylean [®] initiation	1.85	1.95	1.90	1.91	0.03	0.374	0.025	0.739
Paylean [®] to final	2.02	2.13	2.05	2.10	0.06	0.821	0.108	0.480
Day 0 to final	1.89	2.00	1.93	1.96	0.02	0.971	0.010	0.496
Average daily feed, lb								
Day 0 to Paylean [®] initiation	4.72	4.80	4.74	4.78	0.08	0.266	0.461	0.718
Paylean [®] to final	6.00	6.30	6.35	5.95	0.07	0.465	0.020	0.004
Day 0 to final	5.11	5.30	5.25	5.11	0.07	0.481	0.071	0.340
Feed: gain								
Day 0 to Paylean [®] initiation	2.55	2.46	2.51	2.51	0.03	0.623	0.063	0.939
Paylean [®] to final	2.99	2.97	3.10	2.85	0.07	0.675	0.697	0.001
Day 0 to final	2.70	2.65	2.72	2.64	0.03	0.452	0.208	0.069
Tail biting score on day 86 ^c	1.4	1.3	1.3	1.5	0.1	0.485	0.729	0.303

^aInitiated on day 65 for 5.9 ft²/pig treatment and day 58 for 8.0 ft²/pig treatment.

^bDay 93 for 5.9 ft²/pig treatment and day 86 for 8.0 ft²/pig treatment.

^c1 = none; 4 = severe.

Table 4. Effect of experimental treatments on carcass measurements.

Item	Space, ft ² /pig		Paylean [®] , g/T ^a		SE	P Values		
	5.9	8.0	0	9		Space x Paylean [®]	Space	Paylean [®]
IBP ^b measures								
Carcass wt., lb	179.9	178.7	177.2	181.4	2.0	0.663	0.659	0.134
Carcass yield, %	74.8	75.1	74.6	75.3	0.3	0.389	0.459	0.097
Backfat, in.	0.59	0.62	0.61	0.60	0.02	0.253	0.080	0.536
Loin depth, in	2.644	2.705	2.639	2.710	0.021	0.506	0.011	0.005
Lean, %	55.70	55.80	55.50	56.00	0.07	0.060	0.682	0.001
Carcass premium, \$/cwt	5.72	5.82	5.54	5.99	0.13	0.449	0.543	0.017
NPPC Standardized Fat Free Lean (FFL)								
% FFL	51.6	51.5	51.4	51.6	0.2	0.380	0.470	0.406
FFL daily gain, lb	0.750	0.798	0.760	0.788	0.009	0.505	0.003	0.046

^aInitiated on day 65 for 5.9 ft²/pig treatment and day 58 for 8.0 ft²/pig treatment.

^bIBP Inc., Madison, Neb.

equal to the uncrowded allocation of 8.0 ft²/pig.

Table 3 presents the main effects of space and Paylean[®] on pig performance. There were no interactions between space allocation and Paylean[®] addition to the diet for final weight, daily gain, daily feed intake, feed conversion efficiency, or tail biting score. The interaction between space allocation and Paylean[®] for the coefficient of

variation of within pen weight at time of sale for slaughter is due to an increase in within pen CV for pigs fed 9 g/T Paylean[®] and given 5.9 ft²/pig versus 0 g/T Paylean[®] (10.5 vs 7.5 %) and no difference in within pen CV for either Paylean[®] treatment at 8 ft²/pig (9.0 vs 9.0%).

Pigs given 5.9 ft²/pig grew slower from the time of arrival to the beginning of the Paylean[®] treatments.

Unlike previous research results, there was no effect of space allocation on feed intake prior to the initiation of the Paylean[®] treatments. However, crowded pigs had a reduction in feed intake during the four week Paylean[®] treatment period. This resulted in a tendency for a reduction in feed intake due to a restriction in space allocation from arrival to slaughter.

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There was a tendency for crowded pigs to have a poorer feed conversion efficiency from arrival to the initiation of the Paylean® treatments. However, there was no effect of space allocation on feed efficiency during the Paylean® treatment period or overall.

There was no effect of 9 g/T Paylean® addition in the diet for four weeks prior to slaughter on final weight compared to 0 g/T Paylean® in the diet. There was no effect of Paylean® addition on daily gain, either during the four-week period it was in the experimental diets or overall. The addition of 9 g/T Paylean® to the diet did result in a decrease in daily feed intake during the four-week inclusion period and a significant improvement in feed:gain for the four-week treatment period. This improvement was large enough to result in an overall improvement in feed:gain compared with the 0 g/T treatment.

There was no effect of experimental treatments on death loss or the number of pigs removed for tail biting or poor performance. Tail biting scores on day 86 (Table 3) suggest no effect of experimental treatments on tail biting. In general, the incidence of tail biting was not considered severe in this experiment.

Similar to the live performance data, there were minimal interactions between space allocation and Paylean® treatments for any of the IBP carcass traits reported (Table 4). There was no effect of experimental treatments on carcass weight, similar to the lack of treatment effect on live weight at slaughter. However, carcass yield was increased slightly for pigs fed 9 g/T Paylean® versus 0 g/T. Crowded pigs had a slight reduction in carcass backfat depth when compared to uncrowded pigs. Loin muscle depth was decreased for the crowded versus the uncrowded pigs. However, there was no effect of space allocation on carcass percentage lean, carcass premium or fat free lean percentage. Because of the slower daily live weight gain, there was a decrease in daily FFL gain for the crowded versus uncrowded pigs.

Table 5. Effect of experimental treatments on plasma urea, mg/100 ml.

Day	Space, ft ² /pig		Paylean®, g/T ^a			P Values		
	5.9	8.0	0	9	SE	Space x		
						Paylean®	Space	Paylean®
2	22.3	23.4	23.5	22.2		0.133	0.341	0.238
23	24.6	25.0	25.0	24.6		0.996	0.713	0.708
44	22.2	24.2	23.4	23.0		0.306	0.068	0.691
65	20.5	27.2	23.3	24.3		<0.001	<0.001	0.365
86	24.9	26.1	26.4	24.6	0.8	0.184	0.279	0.105

^aInitiated on day 65 for 5.9 ft²/pig treatment and day 58 for 8.0 ft²/pig treatment.

Table 6. Experimental treatment interactions on plasma urea, day 65, mg/100 ml.

Paylean®, g/T ^a	Space, ft ² /pig				SE	P Values		
	5.9		8.0			Space x	Space	Paylean®
	0	9	0	9				
Plasma urea	20.3	20.7	26.4	28.0	0.8	<0.001	<0.001	0.365

^aInitiated on day 65 for 5.9 ft²/pig treatment and day 58 for 8.0 ft²/pig treatment.

Pigs fed 9 g/T Paylean® for four weeks prior to slaughter had an increase in loin muscle depth, carcass lean percentage and carcass premium compared to pigs fed 0 g/T Paylean®. There was no effect of Paylean® treatment on FFL percentage, but there was an increase in daily FFL gain for the 9 g/T Paylean® treatment.

On day 44, pigs given 5.9 ft²/pig had a lower plasma urea concentration compared with pigs given 8.0 ft²/pig (Table 5). The interaction between space and Paylean® treatments for plasma urea on day 65 (Table 6) is due to the day Paylean® treatments began. Pigs on the 8.0 ft²/pig treatment had been on the .92% lysine diet associated with the Paylean® treatments for 7 days while pigs on the 5.9 ft²/pig treatment were switched to the higher lysine diet following sampling on day 65. The trend toward an increase in plasma urea on day 86 for the 0 g/T Paylean® treatment versus the 9 g/T Paylean® treatment suggests the dietary lysine level was in excess of the pigs needs for lean tissue deposition for the 0 g/T Paylean® treatment.

Conclusion

In this experiment, there were no interactions between space allocation and dietary Paylean® additions for overall daily gain, daily feed intake, feed conversion, carcass weight, carcass yield, carcass premium, carcass fat free lean, or daily fat free lean gain. The interactions between space allocation and Paylean® treatments on days 65 and 86 were most likely due to the seven-day difference in when Paylean® treatments were applied to the 5.9 vs 8.0 ft²/pig treatments.

These results suggest the response to dietary Paylean® additions is independent of the response to space allocation. In addition, the lack of treatment effects on tail biting score on day 86 suggests neither space allocations nor dietary Paylean® addition were the cause of the tail biting observed in this experiment.

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