DEFINING THE OPTIMUM DOSE AND TIMING OF PAYLEAN® APPLICATION IN FINISHING FEMALE PIGS
2H-110

Report prepared for the Co-operative Research Centre for an Internationally Competitive Pork Industry

By

A.C. Edwards

ACE Livestock Consulting Pty Ltd
Po Box 108 Cockatoo Valley SA 5351

In conjunction with

Australian Pork Farms Group
PO Box 742 Stirling SA 5152>

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Executive Summary

Paylean® has been identified as an effective feed additive for improving the growth performance and carcass value of finisher pigs. The response to Paylean® is known to cause an initial spike followed by a subsequent rate of decline. Optimising the application and dosage of Paylean® can help improve the economic gains Australian pig producers can obtain from feed additives such as Paylean®.

Two trial were conducted in a attempt to evaluate a series of exposure times (2,3 or 4 weeks) and doses (5, 7.5 and combination of 5+10ppm of Paylean®) with a view of achieving a clearer definition of the optimum commercial application of Paylean® in finishing pigs.

The initial trial did not produce the expected improvements in growth performance and carcass lean and no significant improvements were observed. The reasoning for the muted response remains obscure and may have been related to either erratic dispensing of the diets and/or health issues within the herd. Consequently, a second trial was conducted. The second trial was compromised by what appears to be a mechanical error in the feed dispensing system.

The limited conclusions which were able to be drawn from the outcomes were;

1. Paylean® increases carcass weight and improves feed conversion efficiency.
2. Carcass weight improvement was greatest after 3-4 weeks of application despite the spike in growth rate during the first week of application.
3. Response to Paylean® can be variable due to health or other interfering factors.

The optimal commercial duration of treatment and dosage of Paylean® could not be quantitatively determined from these trials. Based on the limited data from these trials and that of previous work, it is likely that the optimal dose may be at least 5ppm and probably 7.5ppm, and that the benefits are best expressed over 3-4 weeks exposure. However these points will require further work before more definite recommendations can be made.

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1. Introduction

Numerous trials have been conducted with Paylean® which for the most part have shown positive responses. However, these have involved different dosages at different periods of exposure, resulting in variable responses. This project set out to evaluate a series of exposure times and doses with a view to achieving a clearer definition of the optimum commercial application of Paylean®.

A secondary aim was to record the week by week response to Paylean® to quantify the reported initial spike in growth and subsequent rate of decline. This would then allow the economics of 2 versus 3 versus 4 weeks exposure.

The experiment was conducted twice. The first run failed to produce the marked response previously observed to feeding Paylean® for unknown reasons and prompted a repeat of the trial. Results from both experiments will be reported here.

2. Methodology

Project 2H-110:A (1st Trial)

Location: Brinkley Research and Development unit utilising 28 double pens in essentially commercial facilities but with the control of a Big Dutchman feed blending and metering system to accurately dispense multiple feed combinations to an array of treatment groups.

Animals: 1120 females in 28 double pens (56 pens of 20 pigs with each pair of pens sharing a common feeder valve) were selected from commercial grow out stock. These pigs were grown from approximately 25kg liveweight to 60kg liveweight on standard commercial diets before commencing the experiment.

Duration: The pigs were monitored for 6 weeks from approximately 60kg liveweight to 100kg liveweight. The first two weeks of this period involved a common feeding of the Paylean® base diet (no Paylean®) to record base line performance before the Paylean® treatments were applied over the subsequent four weeks.

Treatments: The trial involved two levels of Paylean® application (5 and 7.5ppm) and 3 periods of exposure (14, 21 and 28 days). Including a negative control, there were 7 treatment groups. For feed conversion evaluation there were four replicates (of 40 pigs) in each treatment group. For growth performance and carcass response evaluation there were eight replicates (of 20 pigs) in each treatment group.

Aiming for a final liveweight of about 105kg liveweight at 22 weeks of age the pigs were placed on test at around 16 weeks of age with the timing phases for the application of Paylean® shown in Table 1.

Table 1 - Paylean® exposure schedule and dosage (Trial 1)

			Week					
TRT		**Paylean® Exposure**	**17**	**18**	**19**	**20**	**21**	**22**
A	Control	0 weeks	-	-	-	-	-	-
B	5ppm	2 weeks	-	-	-	-	Paylean	Paylean
C		3 weeks	-	-	-	Paylean	Paylean	Paylean
D		4 weeks	-	-	Paylean	Paylean	Paylean	Paylean
E	7.5ppm	2 weeks	-	-	-	-	Paylean	Paylean

			Week					
TRT		**Paylean® Exposure**	**17**	**18**	**19**	**20**	**21**	**22**
F		3 weeks	-	-	-	Paylean	Paylean	Paylean
G		4 weeks	-	-	Paylean	Paylean	Paylean	Paylean

Base diet: The base diet was common to all treatments and was set at 14.0 MJ DE/kg and 0.58gm available lysine/MJ DE (see appendix 1 – Table 8).

Measurements: The pigs were weighed weekly from week 17 to 22 and feed disappearance recorded over the same interval with all pens within a replicate group being processed at the Big River abattoir on the same day following the final weighing. The replicate groups were graded for weight, each starting in a staggered manner to be close to the nominated 60kg start weight. They then had a common 6 week period on trial and were presented to the abattoir in the same staggered patterned. At slaughter individual carcass weights and backfat (at the P2 position) were recorded.

Statistics: All statistical analyses were conducted using the multi-factorial analysis of variance (MANOVA) procedure in Statsgraphic Plus 5.1 (Statistical Graphics Corp., Warrenton, VA). The pens were used as the experimental unit for ADG, body weight, and carcass data whilst the feeder was used as the experimental unit for the feed intake and feed conversion data.

Project 2H-110 :B (Second trial)

All aspects of the trial were the same as 2H:110:A except for a minor change in the treatments applied. In this trial the 3 week exposure to 7.5ppm Paylean® was replaced with a step up program of 5ppm for 2 weeks followed by 10ppm for 2 weeks. Treatments applied are shown in Table 2.

Table 2 - Paylean® exposure period and dosage (Trial 2)

			Week					
TRT		Paylean® Exposure	17	18	19	20	21	22
A	Control	0 weeks	-	-	-	-	-	-
B	5ppm	2 weeks	-	-	-	-	5ppm	5ppm
C		3 weeks	-	-	-	5ppm	5ppm	5ppm
D		4 weeks	-	-	5ppm	5ppm	5ppm	5ppm
E	7.5ppm	2 weeks	-	-	-	-	7.5ppm	7.5ppm
F		4 weeks	-	-	-	7.5ppm	7.5ppm	7.5ppm
G	5/10ppm	2/2weeks	-	-	5ppm	5ppm	10ppm	10ppm

3. Outcomes

Project 2H-110: A

A total of 9 pigs were removed throughout the trial due to mortality or morbidity. These 9 removals occurred across 6 of the 7 treatments. Paylean® dosage and application period did not influence survivability.

The growth performance results from week 19 to 22 are illustrated below in Figures 1, 2 and 3. The addition of Paylean® (at both 5 and 7.5ppm) did not improve growth performance of pigs relative to the control pigs ($P>0.05$). Neither Paylean® concentration nor length of exposure influenced the average daily gain of pigs from week 19 to week 22 (Figure 1, $P>0.05$).

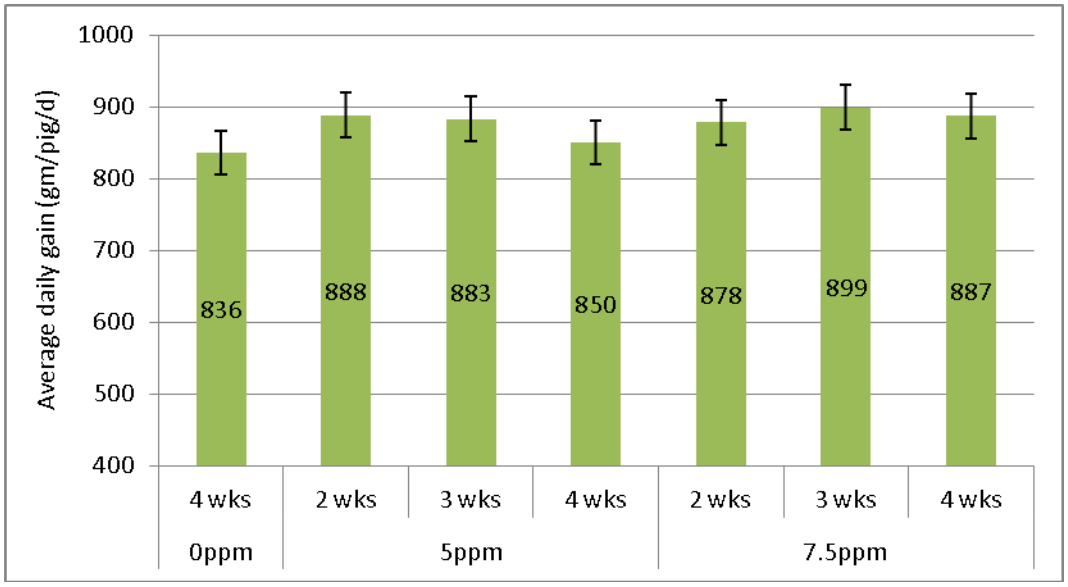

Figure 1 - Average Daily Gain of pigs from week 19 to week 22 (Trial 1)

Neither Paylean® concentration nor length of exposure influenced the feed intake of pigs from week 19 to week 22 (Figure 2, P>0.05)

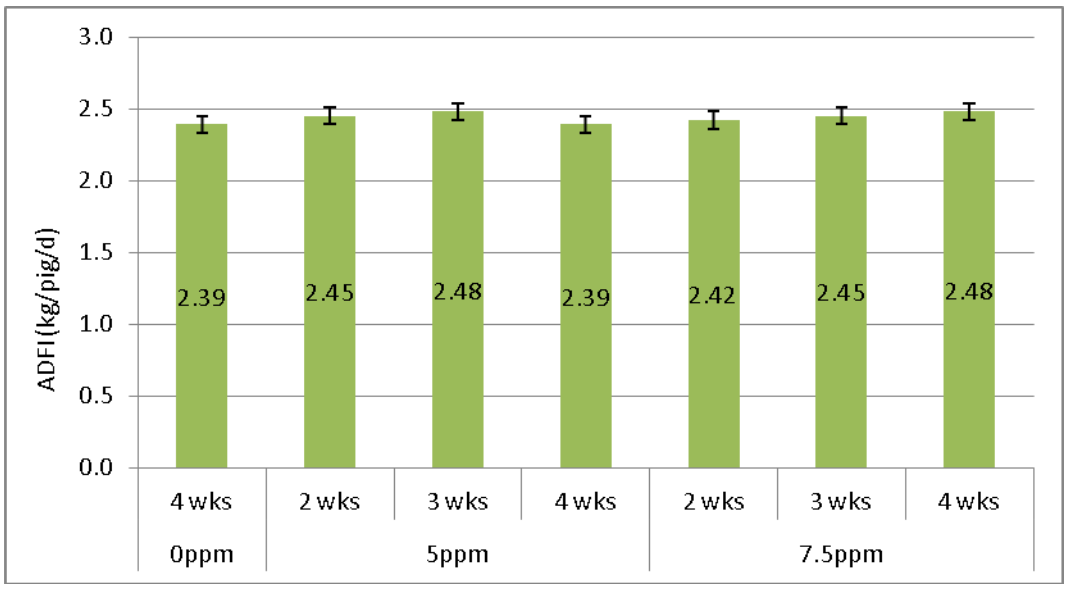

Figure 2 - Average daily feed intake (ADFI) of pigs from week 19 to week 22 (Trial 1)

Neither Paylean® concentration nor length of exposure influenced the feed conversion efficiency of pigs from week 19 to week 22 (Figure 3, P>0.05)

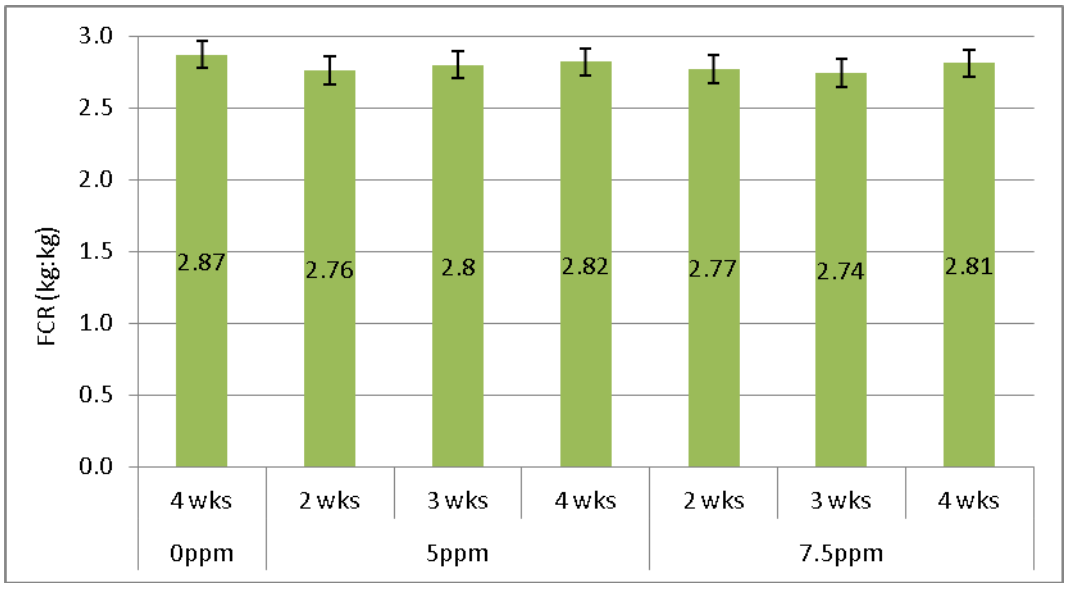

Figure 3 - Feed conversion (FCR) of pigs from week 19 to week 22 (Trial 1)

Neither Paylean® concentration nor length of exposure influenced the carcass weight, backfat thickness or dressing percentage of pigs at slaughter (Table 3, P>0.05).

Table 3 - Carcass data (Trial 1)

Paylean® Dose	Paylean® Period	Carcass weight (kg)	Backfat (P2, mm)	Dressing Percentage
0.0ppm	4 wks	79.35	11.53	77.28
5.0ppm	2 wks	80.84	11.75	77.63
	3 wks	81.12	11.57	77.88
	4 wks	80.98	12.09	77.68
7.5ppm	2 wks	80.28	11.44	77.29
	3 wks	81.53	11.69	77.85
	4 wks	81.19	11.28	77.75
	Std Error	1.353	0.313	0.357
P-values	Dose	0.239	0.386	0.274
	Period	0.894	0.971	0.645
	Dose x Period	0.992	0.687	0.937

Increases in the carcass weight were calculated from week 19 to week 22 based on the following formula.

Δ carcass weight = (Actual carcass weight – (initial weight * 0.76))

The relative increase in carcass weight from week 19 to week 22 is shown in Figure 4. There were numerical increases in carcass weight gain for all pigs offered Paylean®. The greatest increase was observed in those animals offered Paylean® for 3 weeks prior to slaughter.

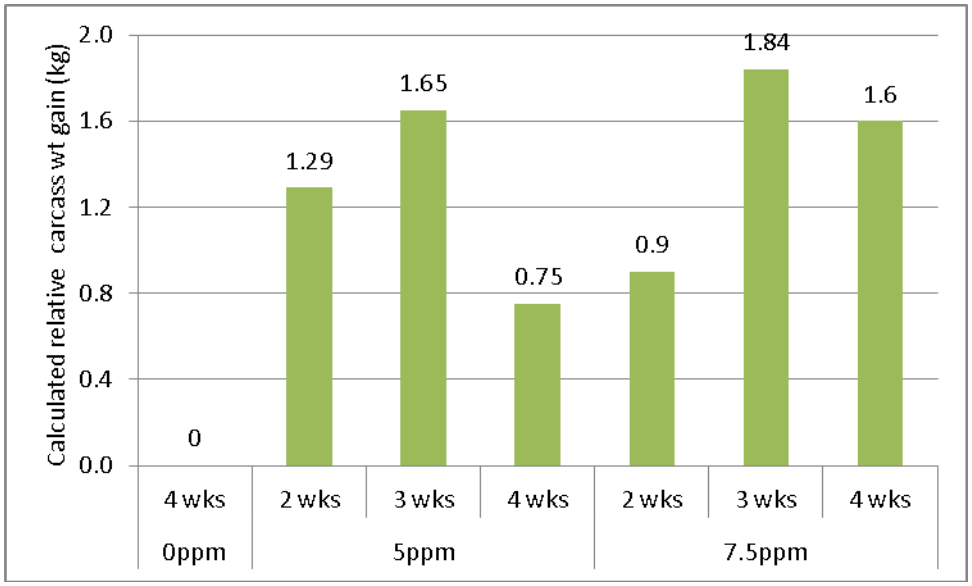

Figure 4 - Relative increase in carcass weight gain of pigs from week 19 to week 22 (Trial 1).

Project 2H-110: B

Neither Paylean® concentration nor length of exposure influenced the average daily gain of pigs from week 19 to week 22 (Figure 5, P>0.05).

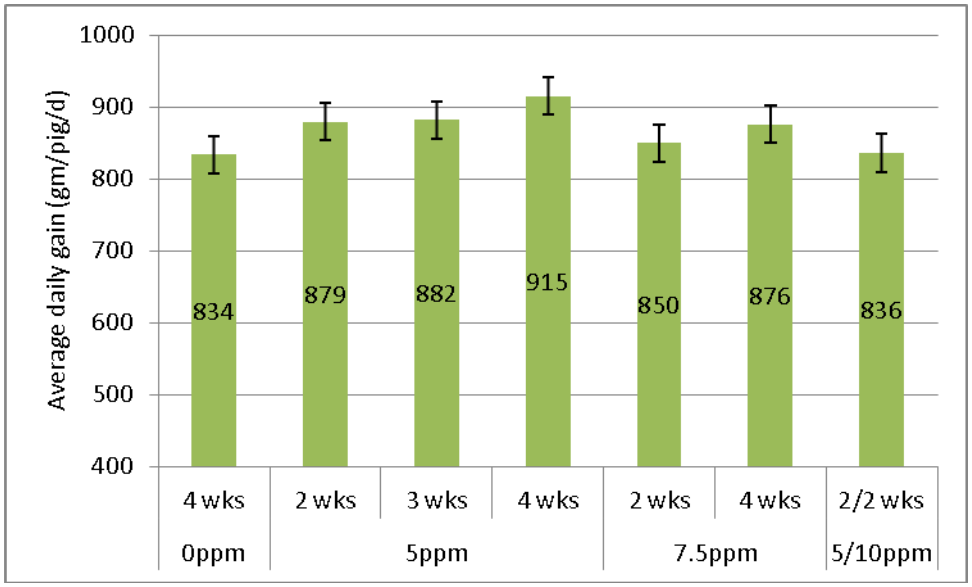

Figure 5 - Average daily gain of pigs from week 19 to week 22 (Trial 2)

Neither Paylean® concentration nor length of exposure influenced the average daily feed intake of pigs from week 19 to week 22 (Figure 6, P>0.05).

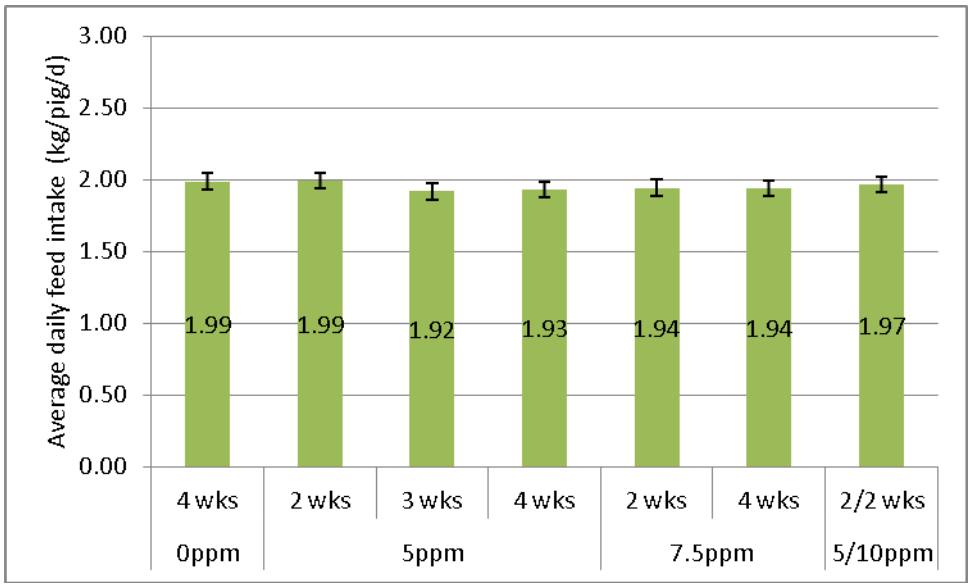

Figure 6 - Average daily feed intake of pigs from week 19 to week 22 (Trial 2)

Feed conversion efficiecny tended to be influence by Paylean® supplementation (Figure 7). Pigs offered diets contain 5ppm of Paylean® for 3 or 4 weeks had superior feed conversion compared to control pigs (P=0.10).

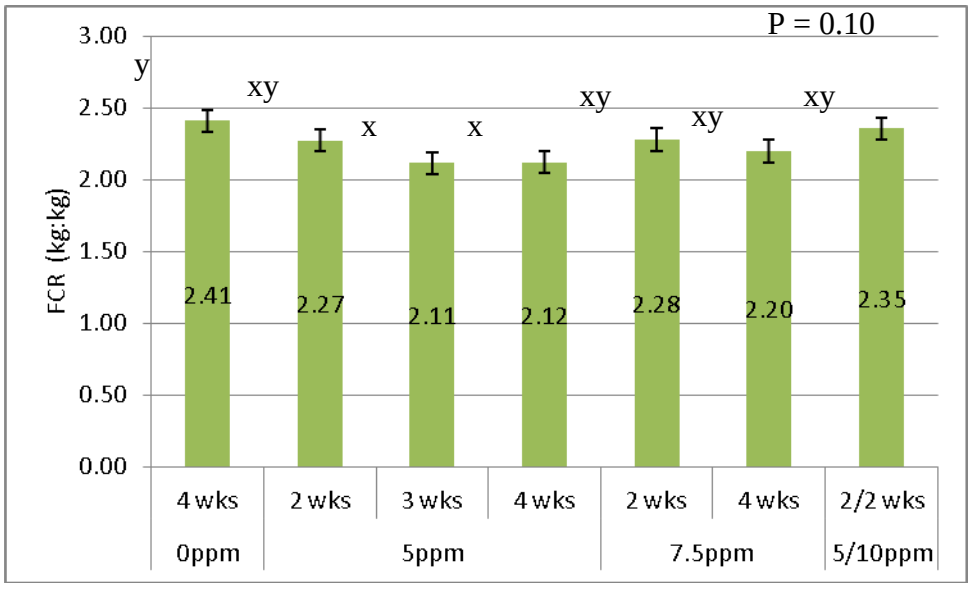

Figure 7 - Feed conversion ratio of pigs from week 19 to week 22 (Trial 2)

Neither Paylean® concentration nor length of exposure influenced the carcass weight, backfat thickness or dressing percentage of pigs at slaughter (Table 4, P>0.05).

Table 4 - Carcass data (Trial 2)

Paylean® Conc.	Paylean® Period	Carcass weight (kg)	Backfat (P2, mm)	Dressing Percentage
0ppm	4 wks	72.74	11.12	77.21
5ppm	2 wks	73.14	10.53	76.71
	3 wks	73.07	10.82	76.55
	4 wks	74.33	10.65	77.06
7.5ppm	2 wks	73.1	10.81	76.99
	4 wks	73.58	10.68	77.44
5/10ppm	2/2wks	71.81	10.89	77.29
	SE	1.048	0.225	0.342
	P-values	0.778	0.638	0.535

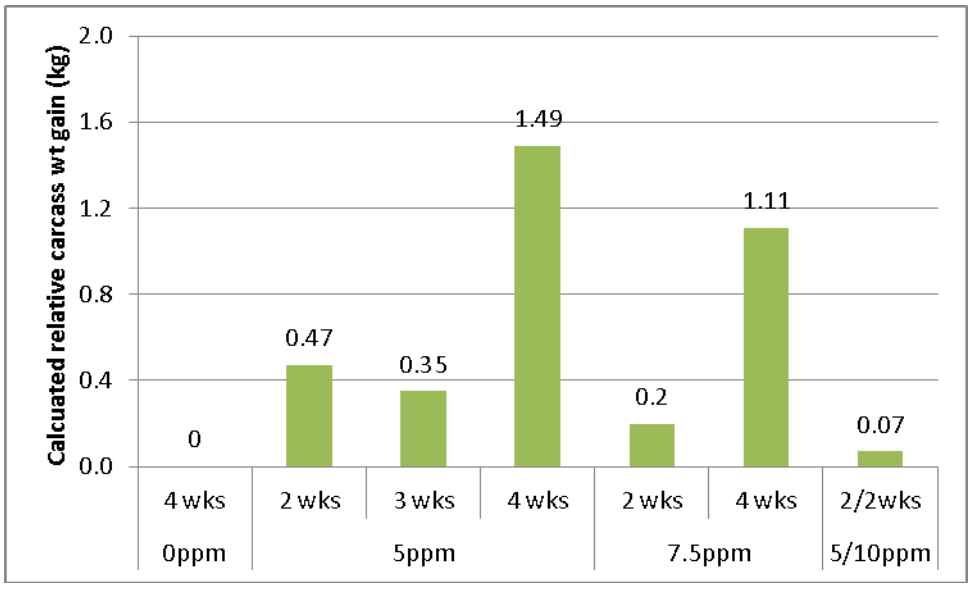

Figure 8 - Relative increase in carcass weight gain of pigs from week 19 to week 22 (Trial 2).

The relative increase in carcass weight from week 19 to week 22 is shown in Figure 8. There were numerical increases in carcass weight gain for all pigs offered Paylean®. The greatest increase was observed in those animals offered Paylean® for 4 weeks prior to slaughter.

In trial 1 the response to Paylean® appeared muted in terms of growth rate and feed efficiency, yet all Paylean® treatments did produce a positive numerical increase in carcass weight (when expressed as carcass weight increase over the 4 week test period, relative to the control). These responses were however of a lower order of magnitude than those recorded in the previous Paylean® evalutions (Edwards, 2011; Rikard-Bell et al., 2009).

This muted response prompted a query re the accuracy of the Paylean® dosing in the test diet. Samples of each diet were sent for analysis at Symbio Alliance Labs (Table 5).

Table 5 - Theoretical versus analysed concentrations of Paylean® in feed samples (Trial 1)

Valve	Treatment	Theoretical Conc. (ppm)	Analysed Conc. (ppm)
1	A	0	<2
58	A	0	<2
2	D	5	6
11	D	5	3
4	G	7.5	6
47	G	7.5	6
Concentrate	-	250	233

The precision of the assay at low levels of inclusion is not tight but the analyst considered these recovery rates satisfactory, implying the Paylean® was in fact delivered as planned.

Consequently the reason for the muted response to Paylean® remains obscure. Possible explanations may include erratic dispensing not detectable by the assays employed, or subclinical health issues.

Comparing a composite of the Paylean® treatments and the control with the comparable energy density diet in 2H:111 (14.2MJ DE/kg) the overall performance in these trials is not all that dissimilar (Table 6).

Table 6 - Comparison of growth Performance results for two CRC Paylean® trials

	2H:110A			2H:111	
	Control	5ppm Paylean®	7.5ppm Paylean®	Control	7.5ppm Paylean®
FI (kg/d)	2.39	2.44	2.45	2.53	2.57
ADG (g/d)	836	874	888	864	923
FCR (kg:kg)	2.87	2.79	2.77	2.93	2.79
Δ Carc. Wt (kg)	19.1	20.33	20.55	18.16	20.18

FI = Feed intake, ADG = Average daily gain, FCR = Feed conversion ratio, Δ Carc. Wt = Change in carcass weight over 4 week supplementation period (calculated as carcass wt – (initial weight X 0.76).

This suggests that if there were health effects they were minor, but this and/or variable dispensing may have introduced greater variance between replicates on the same treatment resulting in an erosion of the statistical power of the experimental design.

One objective of this project was to define the response to Paylean® over time to quantitatively determine the reported decline in the response with extended use. Unfortunately the weekly growth rate data was too erratic to extract any meaningful assessment of this aspect of the Paylean® response.

Table 7 shows a comparison of the responses in the first, second, third and four week of exposure to the average growth in all group x period combinations receiving no Paylean®.

Table 7 - Comparison of average daily gain in Trial 1 and Trial 2 in pigs receiving Paylean® relative to control pigs

	Trial 1	Trial 2
	Average daily gain (g/d)	
Control (0ppm)	871	862
Week 19	967 (+96)	897 (+35)
Week 20	736 (-135)	877 (+15)
Week 21	837 (-34)	818 (-44)
Week 22	776 (-95)	763 (-99)

( ) Change in average daily gain relative to control.

So although there appears to be a definite growth spike in the first week of application the responses in the subsequent weeks are too variable to quantify a trend.

In the second trial there appeared to be a malfunction in the feed dispensing equipment resulting in the under recording of feed dispensed. This inference is based on the observation of normal growth rates (average 867 g/d over all treatments for the 4 week test period) but apparent feed intakes of only 1.95kg/d (average of all treatments) which is approximately 20% below that recoded in 2H:111A (2.44 kg/d) or 24% below that recorded in 2H:110 (2.55 kg/d). The FCR values were therefore unrealistically low as well.

An intense review of the feed recording software failed to reveal any anomalies, and hence the problem was assumed to be mechanical (e.g. leakage from the weight hopper prior to dispatch). This could have resulted in a dilution of the Paylean® dosage by approximately 20%, but may have also been variable in nature.

Whatever the cause, the data set with regard to feed intake and feed conversion efficiency has been compromised and should be disregarded.

With regard to the dose of Paylean® there was no clear differentiation between 5 and 7.5ppm. The response to the 5 and 10 ppm step-up was negligible, almost as if they received no Paylean® at all. The diets in the second experiment were not assayed for Paylean®.

4. Application of Research

Due to the compromised nature of the data there are no clear conclusions that can be extracted to assist in defining the optimal use of Paylean®. The responses recorded are generally consistent with previous observations and hence current recommendations regarding the application of Paylean® are endorsed, but not clarified to the extent intended.

5. Conclusion

Due to the somewhat muted response in the first trial and the dubious feed intake data in the second trial, the primary objective of this project to define the optimal dose and timing for the application of Paylean® has not been achieved. The limited conclusions that can be drawn are:

1. Paylean® increases carcass weight and improves feed conversion efficiency.
2. Carcass weight improvement was greatest after 3-4 weeks of application despite the spike in growth rate during the first week of application.
3. Response to Paylean® can be variable due to health or other interfering factors.

6. Limitations/Risks

The compromised response to Paylean® in this trial is inconsistent with the positive responses recorded in previous trials and therefore the current results should not be taken as indications of Paylean®'s potential value.

7. Recommendations

We would have hoped to have been able to define whether 5 or 7.5ppm gave the best economic response, and what was the optimal duration of treatment, but this outcome was not achieved.

Based on the limited data from these trials and that of previous work, it is likely that the optimal dose may be at least 5ppm and probably 7.5ppm, and that the benefits are best expressed over 3-4 weeks exposure. However these points will require further work before more definite recommendations can be made.

8. References

Edwards, A.C. (2011) The effect of dietary energy density on Paylean® response in finishing pigs, *Pork Co-operative Research Centre Project Final Report: 2H:111.*

Rikard-Bell, C.V., Pluske, J.R., van Barneveld, R.J., Mullan, B.P., Edwards, A.C., Gannon, N.J., Henman, D.J. and Dunshea, F.R. (2009) Response of finisher boar and gilts to dietary lysine and ractopamine. *In 'Manipulating Pig Production XII'* Eds R.J. van Barneveld, pp 71.

Appendix 1 - Composition and theoretical analysis of base diet

Table 8 - 14 MJ Paylean® base diet

	Raw material inclusion (%)
Wheat 11.5%	47.75
Triticale 11%	25.00
Peas	12.00
Canola Expeller 36%	10.00
Soya bean meal 48%	1.00
Tallow	1.10
Salt	0.20
Limestone	1.70
Biofos-MDCP	0.50
DL-Methionine	0.05
Threonine	0.11
Lysine-HCl	0.30
Grower Vitamin/Mineral Premix	0.20
Biofix Plus	0.10
Antioxidant blend	0.02
	100.03
Digestible Energy (MJ/kg)	14.05
Protein (%)	15.47
Fat (%)	3.67
Fibre (%)	3.90
Calcium (%)	0.91
Available Phosphorous (%)	0.36
Lysine (%)	0.95
Methionine (%)	0.26
Meth + Cysteine (%)	0.64
Threonine (%)	0.67
Isoleucine (%)	0.59
Tryptophan (%)	0.17
Avail. Lys/ DE (gm/MJ)	0.58