DEVELOPMENT AND EVALUATION OF FEEDING STRATEGIES TO IMPROVE FEED CONVERSION EFFICIENCY IN GROWING PIGS.

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

By

Mr Robert Hewitt & Dr Robert van Barneveld

CHM Alliance Pty Ltd
C/- Barneveld Nutrition Pty Ltd
Level 1, Suite 11, Plaza Chambers
3-15 Dennis Rd, Springwood, QLD, 4127

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Executive Summary

This research project was undertaken to:

- Hasten the rate of commercial adoption of outcomes from the Pork CRC research program.
- Significantly reduce the costs associated with commercial evaluation experiments and applied research experiments using large numbers of pigs in a commercial environment.
- Increase the level of accuracy associated with commercial grow-out experiments.
- Increase the number and scope of commercial grow-out experiments possible within the life of the Pork CRC.
- Enhance the available research infrastructure available in Australia.

The conduct of the project resulted in the installation of a FEEDLOGIC feeding system into a commercial 1000 head pig shed and infrastructure modifications to facilitate 20 group pens with single feeders for up to 50 pigs per pen and efficient individual pig weighing equipment. Once installed, three experiments were completed.

Experiment 1 sought to improve the definition of the nutrient requirements required by the modern lean genotype. Curvilinear responses in average daily gain and feed conversion to increasing lysine level were somewhat unexpected, and the lack of a plateau suggested that further improvements in performance could be achieved with higher lysine levels. In response to Experiment 1, Experiment 2 was conducted to again investigate the lysine requirements of a modern lean genotype but with a greater range of dietary lysine levels. Resultant feed conversion ratios suggest that production improvements are achieved at lysine levels that are some 20 per cent higher than current recommendations. Based on an urgent need to reduce the cost of production in times of high feed costs and low pig prices, Experiment 3 was a commercial validation of a fundamental experiment looking at the interaction of ractopamine and porcine somatotropin. Whilst substantial improvements in growth rate were seen with the inclusion of ractopamine in finisher diets, the use of porcine somatotropin during the final two weeks of growth resulted in significant improvements in feed conversion, primarily as a result of dramatic reductions in daily feed intake. This experiment was also the first to show that pST in oil could be injected twice weekly when used in conjunction with ractopamine to generate results comparable to those achieved with daily pST injections.

Outcomes from this research represent potential savings of at least 5c/kg to pig producers.

This project has delivered:

- A commercial research facility for on-going use by the Pork CRC.
- Substantial volumes of data that can be used for the on-going development of production models.
- Nutritional strategies for adoption by nutritionists and pig producers enabling them to improve production efficiency and reduce herd FCR.

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1. Introduction

The CHM Alliance represents 23,000 sows and includes the Cameron Pastoral Company, DA Hall and Company, McLean Farms, PIC (Australia) Pty Ltd, PIC (NZ) Pty Ltd and Tong Park Piggeries. In 2001, the CHM Alliance established a Science and Technology Program to ensure the group had access to the latest industry technologies and a means of assessing new innovations prior to incorporation into their commercial production systems. While the CHM Alliance Science and Technology Program has paid considerable dividends to its participants since inception, it became clear that a primary limitation to the adoption and assessment of useful technologies was the capacity to routinely and cost-effectively undertake structured research experiments in a commercial production environment. Auditing existing commercial grow-out facilities available in Australia, including those within the CHM Alliance, very few had the capacity to conduct research with pigs between 20 and 110 kg live weight without a significant requirement for additional labour inputs, bagged feed storage and logistics to run the experiment without interrupting commercial imperatives. This of course excludes liquid feeding systems, but our experience with these suggested they could not be regarded as representative of the bulk of Australian systems feeding mash or pelleted diets. There were also constraints within these systems in terms of the types of diets that could be fed and the number of combinations.

To meet the need described above, it was proposed to install a FEEDLOGIC Feeding System in existing facilities available at McLean Farms in Pittsworth, Queensland. The facility comprised two 1000 head grow-out units that had been constructed in the last 24 months.

FEEDLOGIC is a fully integrated feed dispensing and management system developed in the United States. The system comprises a self-contained feed delivery unit suspended from an overhead rail, a charging and loading station, and a wireless network connected to an off-board PC computer in a nearby office. The system has the ability to automatically deliver multiple diets to specific feeders and provide real-time data on feed disappearance. Data reporting software allows on-demand reports to be generated.

Once installed, some examples of commercial evaluations possible over time include:

- Commercial evaluation of different phase feeding systems, feeders or diet forms in the growing and finishing herd.
- Commercial evaluation of metabolic modifiers or other feed additives.
- Assessment of potential for fortification of pork products under commercial conditions.
- Evaluation of new grain types, feed processing treatments or alternative protein sources under commercial conditions.
- Whole of life growth and feed intake studies following pre and post weaning interventions.
- Feed intake and feed intake manipulation experiments under commercial conditions.
- Quantification of the influence of feeding regime on variation in the growing and finishing herd.

Access to a facility of this nature will allow the Pork CRC and the CHM Alliance to:

- Hasten the rate of commercial adoption of outcomes from the Pork CRC research program.

- Significantly reduce the costs associated with commercial evaluation experiments and applied research experiments using large numbers of pigs in a commercial environment.
- Increase the level of accuracy associated with commercial grow-out experiments.
- Increase the number and scope of commercial grow-out experiments possible within the life of the Pork CRC.
- Enhance the available research infrastructure available in Australia.
- Ensure the CHM Alliance has an active and prominent role in the Pork CRC research program.

2. Methodology

The first phase of this project involved the installation of a FEEDLOGIC feeding system within a commercial facility.

Figure 1. FEEDLOGIC FDU in operation.

The installation involved retrofitting the shed to allow for a continuous rail system to be installed, with significant structural changes undertaken, additional fences were installed to move from large pens (120 pigs per pen, 3 feeders per pen) to single feeder pens. Two additional silos were also installed allowing for four base diets to be stored and bringing total storage capacity to 56t.

Figure 2. FEEDLOGIC FDU showing running rail.


Figure 3. Loading station for the FDU showing the four delivery augers.

The FEEDLOGIC feed delivery unit (FDU) was installed by Drew Ryder (FEEDLOGIC Corporation) and Doug Pearson (Feedworks) and was operational within a week of arrival in Australia. The establishment of telecommunications to enable remote administration of the system proved the most difficult part of the installation, due to the limited infrastructure in regional Australia a Satellite system was installed.

Figure 4. Holding yards for Prattley Auto-sorter.

A Prattley Auto-sorter was also installed within a set of round yards to enable the easy weighing of pigs. This set-up allows the individual weighing of 500 pigs in two hours.

Figure 5. Prattley Auto-sorter in operation.

3. Initial Experiments

The three initial experiments undertaken within this new facility are reported as follows:

4. FEEDLOGIC Project 1: Review of nutritional requirements of a modern lean genotype - I

Introduction

Genetic selection for lean tissue growth rate and lean tissue feed efficiency has changed the metabolic status of modern pigs. These genetic improvements have made modern genotypes more sensitive to nutrition than their predecessors. In addition, selection for lean tissue feed efficiency has inadvertently resulted in animals with lower voluntary feed intake. Despite these genetic advancements, current nutritional recommendations for the PIC and other genotypes are conservative and reflect research undertaken more than 20 years ago on far less efficient genotypes. Improvement in efficiencies could be gained by assessing alternative feeding strategies designed to suit modern lean genotypes.

Methods

Diets

To investigate the effect of available lysine to energy ratio on pig performance four basal diets consisting of high energy:low protein, high energy:high protein, low energy:low protein and low energy:high protein combinations were formulated (Table 1) and subsequently blended to produce ten dietary treatments – 5 lysine levels at each of 2 energy levels (Table 2.) Full dietary formulations can be viewed in Appendix 1. Each dietary treatment was replicated on 2 pens, 1 one on each side of the shed.

Table 1. Specifications of four basal diets.

Diet	Name	MJ DE/kg	Total Avail Lys g/kg
1	McLean Farms Grower 1 FEEDLOGIC 19-10-07	13.8	0.70
2	McLean Farms Grower 2 FEEDLOGIC 19-10-07	13.8	1.10
3	McLean Farms Grower 3 FEEDLOGIC 19-10-07	14.6	0.70
4	McLean Farms Grower 4 FEEDLOGIC 19-10-07	14.6	1.10

Table 2. Blend ratios of four basal diets to produce 10 dietary treatments (2 energy levels x 4 lysine levels).

Treatment	Diet 1	Diet 2	Diet 3	Diet 4	MJ DE/kg	Total Avail Lys g/kg
1	100				13.8	0.70
2	75	25			13.8	0.80
3	50	50			13.8	0.90
4	25	75			13.8	1.00
5		100			13.8	1.10
6			100		14.6	0.70
7			75	25	14.6	0.80
8			50	50	14.6	0.90
9			25	75	14.6	1.00
10				100	14.6	1.10

Pigs and feeding

The experiment utilised approximately 1000 pigs grouped on the basis of age at entry (the two sides of the shed were filled a week apart, with one weeks age difference between sides) and size (pigs were boxed by size). The FEEDLOGIC delivery system was used for feeding. Feeders were filled to capacity on the first day of the experiment (Tuesday, 30th October) with the allocated dietary treatment and an attempt was made to maintain the feeders at full capacity for the duration of the trial so that daily feed consumption could be recorded, however the capability of this system prevented this occurring on a daily basis. At the trials completion, on the 11th of December (6 weeks after its commencement), the pens were reweighed. Any residual feed left in feeders on the final day of the trial were removed and weighed. Responses measured included average daily gain, feed intake and FCR.

Statistical analyses

To determine whether energy level had an effect on response to the different lysine levels a two way ANOVA was conducted. Regression analyses were then applied to determine the model that best described response of average daily gain to lysine. All analyses were conducted using Genstat 10th Edition.

Results

Energy content did not have an effect on the average daily gain (Figure 6), average daily intake (Figure 7) or FCR (Figure 8) response to dietary lysine level, nor was there any energy level x lysine level interaction effect ($p > 0.05$). A power analysis of the data revealed that the power to detect an effect of energy level was less than 23 % for any of the parameters measured at the 0.05 % significance level.

However, as no effect of energy was observed on any of the parameters the data was pooled to produce four replicate values per lysine level and a 1 way ANOVA conducted to determine if lysine level had any effect on average daily feed intake and FCR. No

significant difference was found for either parameter among the lysine levels investigated (p >0.05).

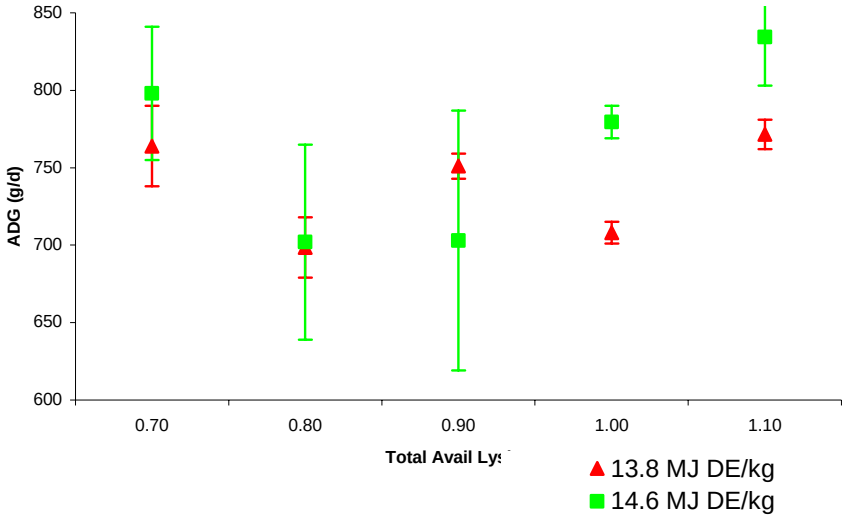

Figure 6. Average daily gain (g/day) ± SE.

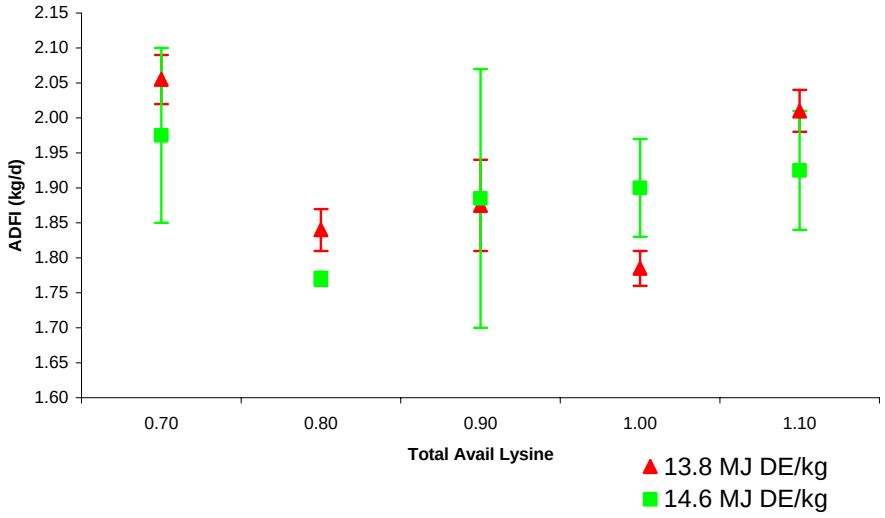

Figure 7. Average feed intake (ADFI) (kg/day) ± SE.

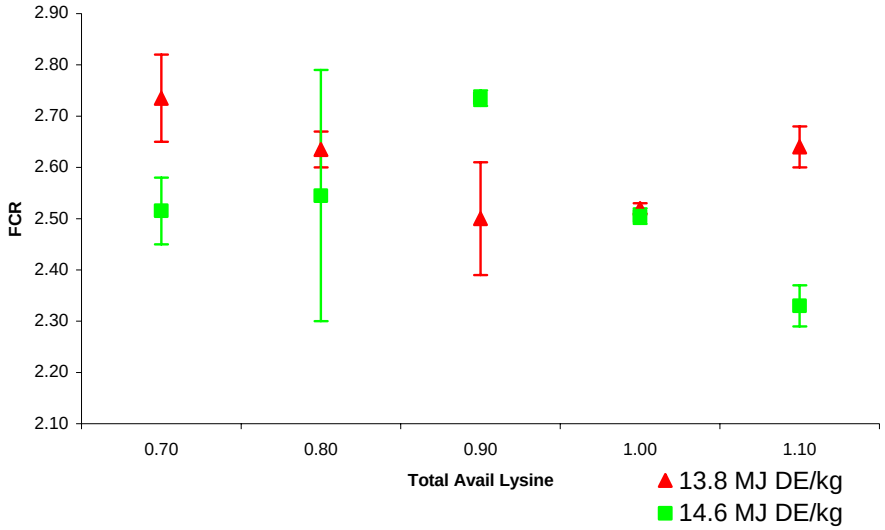

Figure 8. Feed conversion ratio (FCR) ± SE.

Average daily gain

Owing to the lack of significant effect of energy level regression analysis was also conducted on the pooled data. A quadratic model (Figure 9) significantly explained the variation in average daily gain with increasing lysine level ($p = 0.031$; $r2 = 0.88$).

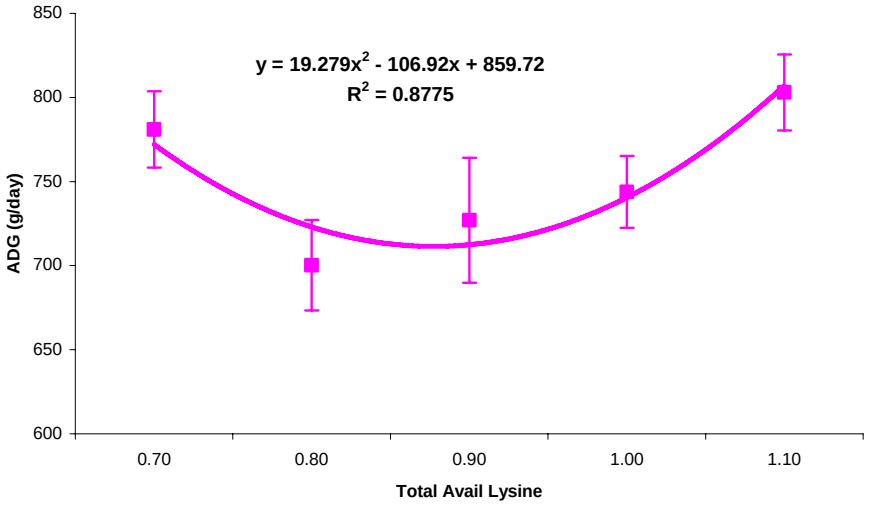

Figure 9. Average daily gain (ADG) ± SE. High and low energy data for each level of lysine was pooled to produce means.

Discussion

None of the parameters investigated – average daily gain, average daily feed intake or FCR were affected by energy level. It is possible the difference between the two energy levels

was not great enough for there to be an effect of energy, although the experiment did have low power.

The U-shaped response in average daily gain to increasing lysine level is unusual. It would be expected that a linear plateau response should be observed whereby daily weight gain increases with increasing lysine content up to a genetically determined level above which it then remains constant. Based on the response observed it appears that maximum daily gain achievable for the genotype studied was not reached and that further improvements in daily weight gains could have been made with higher lysine levels.

Recommendations for future experiments include increasing the number of replicate pens, having a greater range between the two energy levels and investigating higher dietary lysine levels than used in this study.

5. FEEDLOGIC Project 2: Review of nutritional requirements of a modern lean genotype – II

Introduction

Genetic selection for lean tissue growth rate and lean tissue feed efficiency has changed the metabolic status of modern pigs. These genetic improvements have made modern genotypes more sensitive to nutrition than their predecessors. In addition, selection for lean tissue feed efficiency has inadvertently resulted in animals with lower voluntary feed intake. Despite these genetic advancements, current nutritional recommendations for the PIC and other genotypes are conservative and reflect research undertaken more than 20 years ago on far less efficient genotypes. Improvement in efficiencies could be gained by assessing alternative feeding strategies designed to suit modern lean genotypes.

The first experiment in this program investigated the effect of available lysine to energy ratio on pig performance. Basal diets were blended to produce ten dietary treatments – five lysine levels (7 to 11g/kg) at each of two energy levels (13.8 vs 14.6 MJ DE/kg). Energy level did not affect any of the parameters investigated – average daily gain, average daily feed intake or FCR.

An unusual U-shaped response in average daily gain was observed in response to increasing lysine level - a linear plateau response would be expected whereby daily gain increases with increasing lysine content to a genetically determined level above which it remains constant. Based on the observed response it was concluded that the maximum daily gain achievable by that genotype was not reached and that further improvements could be made with higher lysine levels. These unusual results warranted a further investigation of this issue.

Methods

Diets

The investigation into the effect of available lysine to energy ratio on pig performance was based on the results from experiment 1. Two basal diets of equal energy level but differing in lysine level were formulated (Table 3) and subsequently blended to produce five dietary treatments (Table 4.) Full dietary formulations can be viewed in Appendix 2. Each dietary treatment was replicated on four pens, two on each side of the shed.

Table 3. Specifications of two basal diets.

Diet	Name	MJ DE/kg	Total Avail Lys g/kg
1	McLean Farms Grower 1 FEEDLOGIC 08-02-08	14.2	8.0
2	McLean Farms Grower 2 FEEDLOGIC 08-02-08	14.2	14.0

Table 4. Blend ratios of two basal diets to produce five dietary treatments.

Treatment	Diet 1	Diet 2	MJ DE/kg	Total Avail Lys g/kg
1	100		14.2	8.0
2	75	25	14.2	9.5
3	50	50	14.2	11.0
4	25	75	14.2	12.5
5		100	14.2	14.0

Pigs and feeding

The experiment utilised approximately 1000 pigs grouped on the basis of age at entry (the two sides of the shed were filled a week apart, with one weeks age difference between sides) and size (pigs were boxed by size). The FEEDLOGIC delivery system was used for feeding. Feeders were filled to capacity on the first day of the experiment (Tuesday, 12th February) with the allocated dietary treatment and an attempt was made to maintain the feeders at full capacity for the duration of the trial so that daily feed consumption could be recorded. A periodic error with the delivery of feed on one side of the shed resulted in some interruptions to feed availability, however, total feed consumed over the period was not significantly different between sides ($p>0.05$). These feed interruptions may have been a contributing factor to ADG response. At the trials completion, on the 27th of March (44 days after its commencement), the pens were reweighed. Any residual feed left in feeders on the final day of the trial was removed and weighed. Responses measured included average daily gain, feed intake and FCR.

Statistical analyses

To determine whether shed side (as a result of feed interruptions) had an effect on response to the different lysine levels a two way ANOVA was conducted. Regression analyses were then applied to determine the model that best described response of average daily gain to lysine. All analyses were conducted using Genstat 10th Edition.

Results

Whilst differences occurred, shed side did not have an effect on the average daily gain (Figure 10), average daily intake (Figure 11) or FCR (Figure 12) response to dietary lysine level.

As no effect of shed side was observed on any of the parameters the data was pooled to produce four replicate values per lysine level and a 1 way ANOVA conducted to determine if lysine level had any effect on average daily gain, average daily feed intake or FCR. No significant difference was found for any parameter among the lysine levels investigated ($p >0.05$).

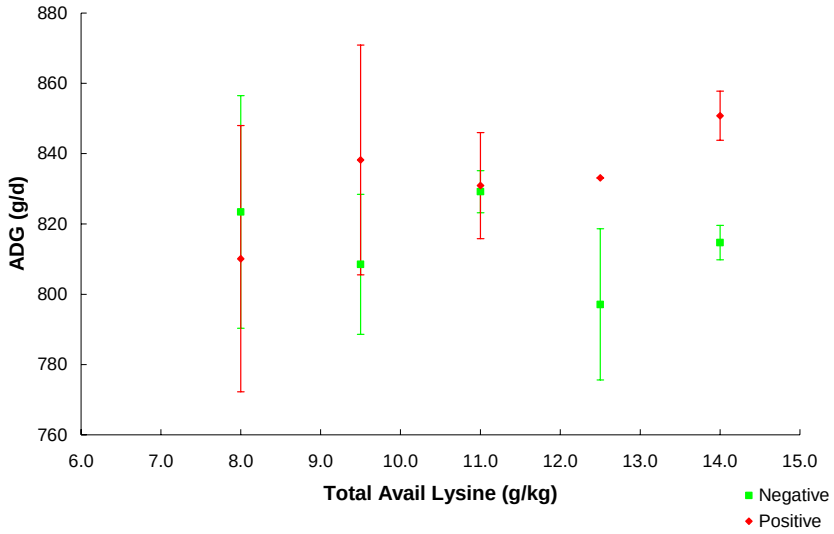

Figure 10. Average daily gain (g/day) ± SE.

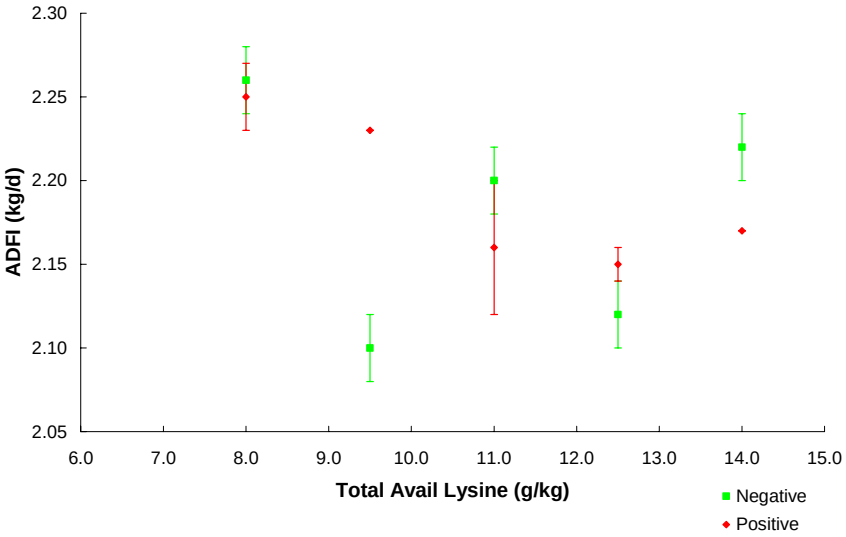

Figure 11. Average feed intake (ADFI) (kg/day) ± SE.

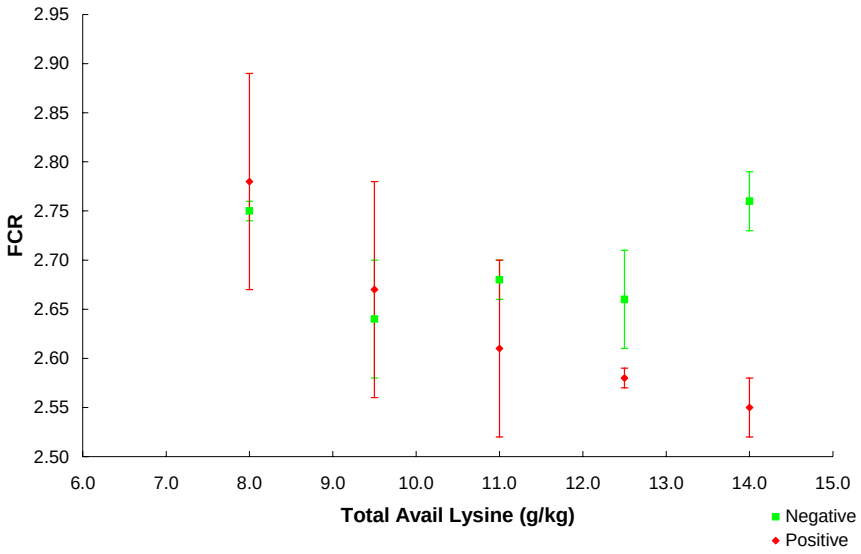

Figure 12. Feed conversion ratio (FCR) ± SE.

Pooled Data

Owing to the lack of significant effect of shed side, regression analysis was also conducted on the pooled data. A quadratic model (Figure 13) explained the variation in average daily feed intake with increasing lysine level (r2 = 0.85).

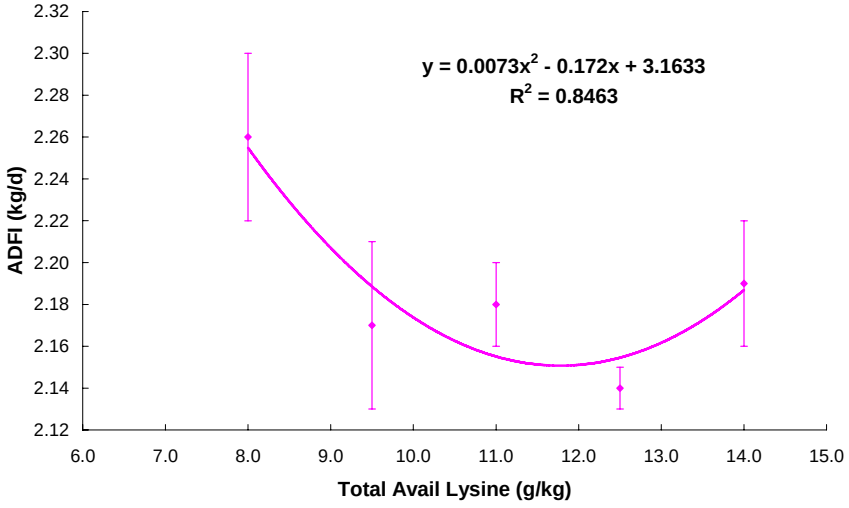

Figure 13. Average daily feed intake (ADFI) ± SE. Pooled data.

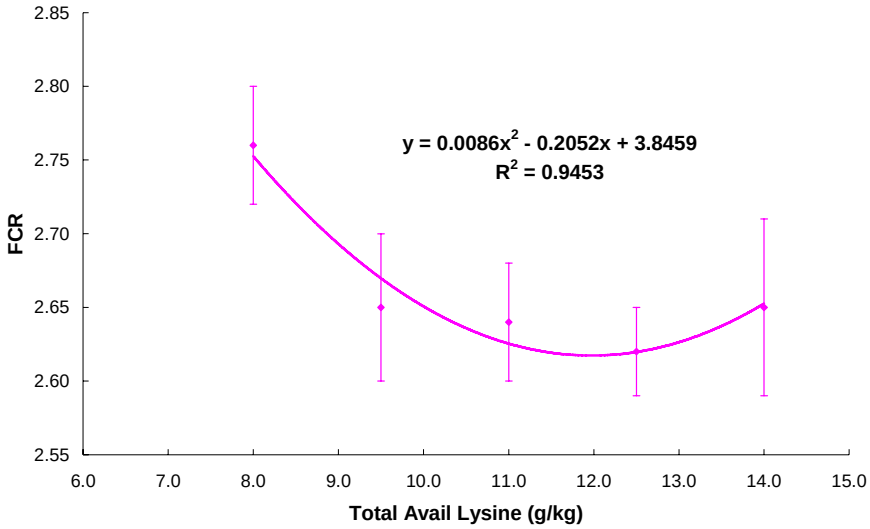

Figure 14. Feed conversion ratio (FCR) ± SE. Pooled data.

The variation in feed conversion ratio with increasing lysine level was also well explained by a quadratic model (Figure 14; r2 = 0.95). However, the explanation of the variation in average daily gain was less well explained (Figure 15). A cubic model (r2 = 0.64) explained the variation better than a quadratic model (r2 = 0.48), however, there appears to be an external factor influencing average daily gain.

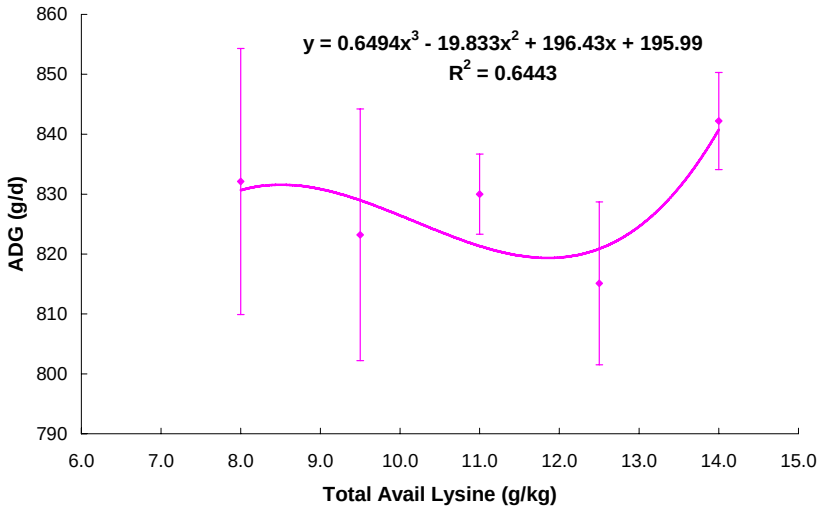

Figure 15. Average daily gain (ADG) ± SE. Pooled data.

Discussion

Whilst interruptions in feed availability occurred, none of the parameters investigated – average daily gain, average daily feed intake or FCR were affected by these interruptions.

The U-shaped response in average daily feed intake and FCR are consistent with earlier findings and indicate some degree of "break-point" in lysine level at an approximate total available lysine level of 11.5 g/kg, almost two grams higher than current feeding recommendations.

Whilst the response of average daily gain to increasing lysine level is less elegant than either average daily feed intake or FCR there is still a response at this 11.5 g/kg "break-point". However, it is at the bottom of the curve, with better ADG being achieved as we move away from this point to either lower or higher lysine levels.

6. FEEDLOGIC Project 3: Efficacy of ractopamine and pST under commercial conditions.

Introduction

Ractopamine is an approved feed ingredient for pigs that repartitions nutrients toward increased lean deposition and has been shown to improve growth performance and carcass characteristics. Porcine somatotropin (pST) is a protein naturally produced by the pig and is a major factor controlling growth and metabolism, administering exogenous sources of pST during the finishing phase enables the animal to continue to deposit muscle tissue and reduce the amount of fat in the carcass. Recent experimental work has shown that combining ractopamine and pST in the last two weeks of production improved feed efficiency by about 40% and resulted in overall feed:gain for females between 65 and 100kg of only 2.31. If we can achieve these levels within commercial operations, production will be at world best level.

Hypothesis

The use of ractopamine and pST in combination results in increased feed efficiency in finisher gilts.

Methods

Treatments

To test the efficacy of ractopamine and pST under commercial conditions five treatments were investigated (table 5).

Table 5. Treatment descriptions.

Treatment	Diet	Ractopamine	pST
1	Standard finisher	-	-
2	Hi-spec finisher	-	-
3	Hi-spec finisher	5 ppm	-
4	Hi-spec finisher	5 ppm	5 mg daily
5	Hi-spec finisher	5 ppm	35 mg per week#

pST was delivered on Tuesday and Friday, receiving a 3-day dose of 15mg on the Tuesday and a 4-day dose of 20mg on the Friday.

Treatment 1 was a control diet using the current specifications of the finisher diet (normally containing 5ppm of ractopamine) used in this facility. Treatment 2 was a positive control utilizing the high specification finisher that is "required" to allow pST to fully express its benefits. Treatments 3, 4 and 5 all contained ractopamine at an inclusion rate of 5ppm, but differing in pST treatment. Treatment 3 pigs did not receive any pST, nor a placebo solution. Treatment 4 pigs received 5mg of pST administered daily, as a 1ml solution, and treatment 5 pigs received 20mg of pST administered as an oil emulsion delivered as a 1ml solution.

Diets

Three diets were formulated to meet the treatment requirements (table 6). The hi-spec finisher diets had both higher energy and lysine contents than the standard diet, and in accordance with specifications for pST use, and some debate, the ratios of threonine and methionine plus cysteine to lysine were lifted. Full dietary formulations can be viewed in Appendix 3.

Table 6. Specifications of treatment diets.

Diet	Name	MJ DE/kg	Total Avail Lys g/kg	Thr:Lys	Met+Cys:Lys
1	Standard finisher	13.4	7.4	0.67	0.63
2	Hi-spec finisher	14.0	9.8	0.70	0.67
3	Hi-spec finisher + ractopamine	14.0	9.8	0.70	0.67

Pigs and feeding

The experiment utilised 20 pens of pigs blocked on shed side (the two sides of the shed were filled a week apart, with one weeks age difference between sides) and average pen weight. Sides were run as experimental blocks, with events on the younger side occurring one week after the older side.

The FEEDLOGIC delivery system was used for feeding. Feeders were filled to capacity on the first day of the experiment with the allocated dietary treatment and an attempt was made to maintain the feeders at full capacity for the duration of the trial so that daily feed consumption could be recorded. At the completion of the trial (28 days after its commencement) the pens were reweighed. Any residual feed left in feeders on the final day of the trial was removed and weighed. Responses measured included average daily gain, feed intake and feed:gain ratio.

pST treatment

The administration of pST was conducted by an experienced operator using a gas-powered auto-injector.

Statistical analyses

As there was no significant effect of shed side (block), differences between treatments were assessed using a simple on-way ANOVA. All analyses were conducted using Genstat 10th Edition.

Results

There was no significant difference in average daily gain ($p=0.212$), average daily feed intake ($p=0.292$) or feed:gain ratio ($p=0.567$) between each side of the shed (table 7), nor any difference in starting weight (Weight in) of each treatment ($p=1.000$).

Whilst there were no significant differences in weight out at the end of the trial (Weight out, $p=0.504$), there was a difference in weight gain, with ractopamine treated pigs gaining significantly more than non-ractopamine treated pigs ($p<0.001$). Pigs treated with

pST grew, on average, 41 to 50g per day faster than those receiving only ractopamine and up to 180g per day faster than the standard diet (table 7 and figure 16).

When pST was administered on a daily basis (treatment 4) pigs consumed significantly less than the non-pST treated pigs, although when administered twice per week this effect became non-significant. As a result of this improved rate of average daily gain and decreased feed intake, pigs treated with pST had a significantly lower feed:gain ratio than other treatments ($p<0.001$), those pigs that received only ractopamine had a significantly better feed:gain ratio than the two control treatments (1 & 2).

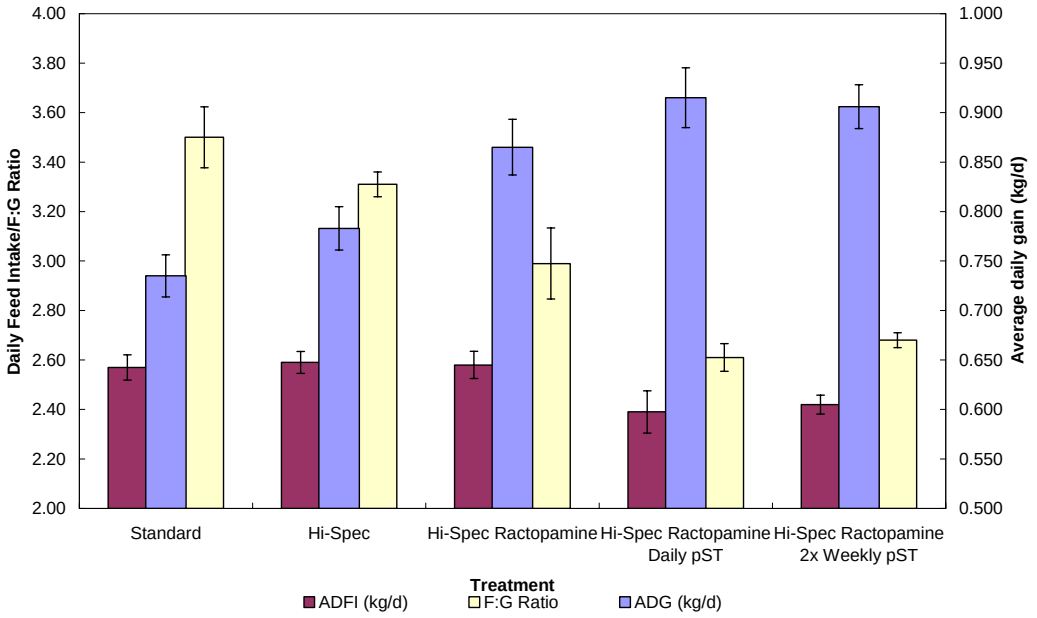

Figure 16. Average daily feed intake (ADFI), average daily gain (ADG) and feed:gain ratio (F:G Ratio) for each treatment group (mean ± SE).

There was no significant difference in average daily feed intake (ADFI) between treatments during the first two weeks of the trial (table 7 and figure 17). However, when pST was administered for the final two weeks, it resulted in a significant reduction in the ADFI during this period ($p<0.001$).

The ADFI of pigs that were not treated with pST increased by 80 to 200g per day from the first to the second period, whereas those treated with pST reduced their intake by 110 to 200g per day.

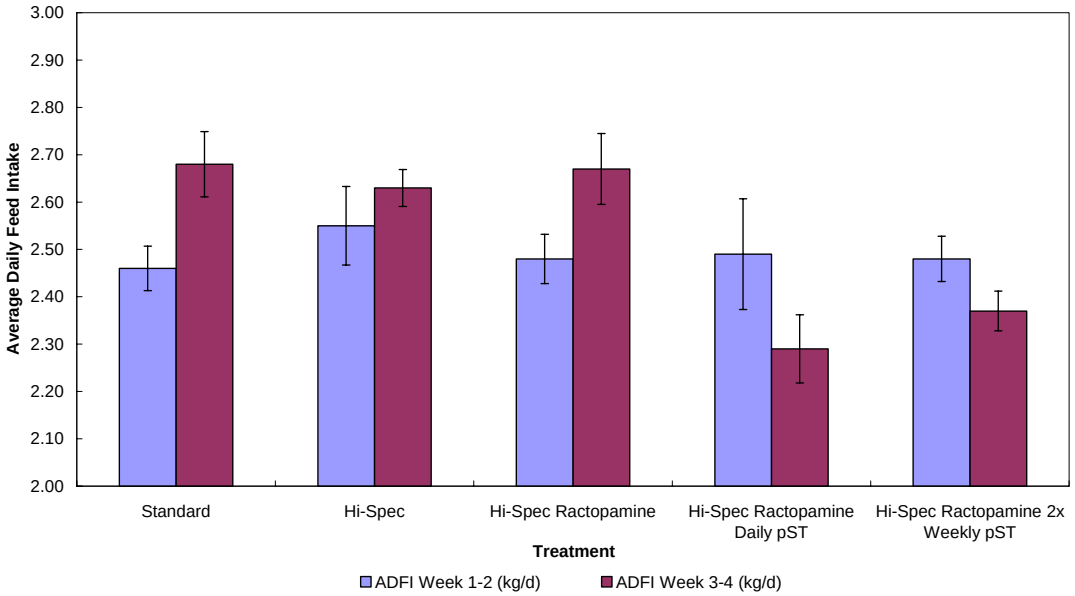

Figure 17. Average daily feed intake during the first two weeks (ADFI Week 1-2) and second two weeks (ADFI Week 3-4), showing the response to pST (mean ± SE).

Backfat depth (P2) was captured at slaughter, unfortunately due to an outbreak of Erysipelas four days post-trial pigs over 107kg in live weight were not sold until after they had been treated, consequently the data for backfat depth contains only pigs in the 84-107kg live weight range. Differences in carcase weights (HSCW) were not significant between treatments, so backfat depths were linearly adjusted to a common carcase weight (75.1kg HSCW).

There were significant differences between treatments (table 7 & figure 18, $p<0.001$). The treatment group that only received the hi-spec diet was significantly fatter than all other groups, and whilst the administration of pST did show a response it was not significant when compared with the standard treatment and only marginally significant compared to the ractopamine only treatment group.

Table 7. Parameter values showing treatment means and p-values for treatment and block factors and their interaction.

	Treatment						p-value		
Parameter	Standard	Hi-Spec	Hi-Spec Ractopamine	Hi-Spec Ractopamine Daily pST	Hi-Spec Ractopamine 2x Weekly pST	SED	Treatment	Block	Treatment x Block
N. (Pens)	4	4	4	4	4				
N. (Pigs)	177	181	182	181	180				
Days on trial	28	28	28	28	28				
Weight in (kg)	75.7	75.5	75.5	75.2	75.4	2.64	1.000	0.210	0.995
Weight out (kg)	96.3	97.4	99.7	100.8	100.8	3.10	0.504	0.093	0.995
Weight gain (kg)	20.6a	21.9a	24.2b	25.6b	25.4b	0.99	<0.001	0.212	0.383
ADG (kg/d)	0.735a	0.783a	0.865b	0.915b	0.906b	0.04	<0.001	0.212	0.383
ADFI (kg/d)	2.57b	2.59b	2.58b	2.39a	2.42ab	0.08	0.069	0.087	0.321
F:G Ratio	3.50c	3.31c	2.99b	2.61a	2.68a	0.13	<0.001	0.738	0.162
ADFI Week 1-2 (kg/d)	2.46	2.55	2.48	2.49	2.48	0.11	0.937	0.010	0.425
ADFI Week 3-4 (kg/d)	2.68b	2.63b	2.67b	2.29a	2.37a	0.09	<0.001	0.558	0.118
N. (Pigs)	128	131	132	126	89				
Adj. P2 (mm)	9.7a	10.4c	9.8b	9.1a	9.4ab	0.32	<0.001	0.890	0.381

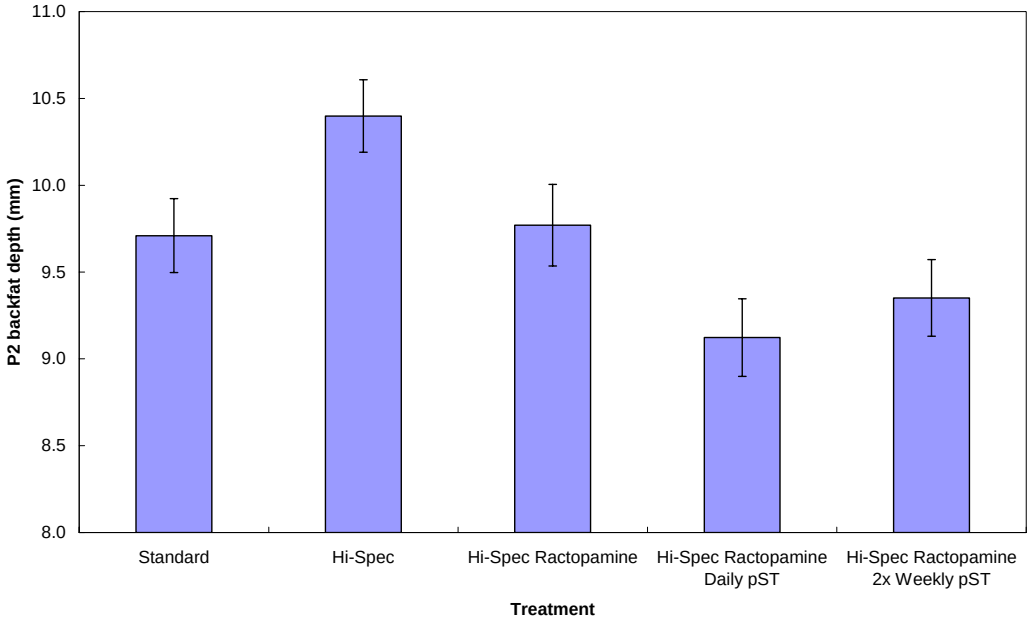

Figure 18. Adjusted backfat depths showing treatment effects (mean ± SE). Backfat depths were adjusted to a common slaughter weight of 75.1kg.

Discussion

The use of ractopamine and pST in combinations results in increased feed efficiency in finisher gilts. Whilst the use of ractopamine on its own significantly improved the growth rate of finisher pigs during the last four weeks of growth it had little effect on daily feed intake.

However, when pST was administered either daily or twice a week in combination with ractopamine in the last two weeks of production a significant reduction in daily feed intake occurred, which resulted in further improvements in feed efficiency.

Despite the extra costs involved in preparing a higher specification diet (~$40/t) and the administration of pST (~$3/treatment period), the increased slaughter weight or reduced time to slaughter and the improvements in feed efficiency can result in a benefit to the producer of up to $3/pig.

Acknowledgements

Thanks to Mr Mark Mingay, OzBioPharm for the supply of pST and it's administration.

7. Outcomes

This project has seen the establishment of a research facility within a commercial production unit that is being utilized to undertake large-scale discovery and validation experiments on behalf of the Pork CRC for the benefit of Australian pig producers. The facility has the ability to conduct large experiments (n=20 pens, 1,000 pigs), feeding multiple nutritional regimes without requiring small individual batches of feed to be manufactured or considerable additional labour expenses to deliver this feed, whilst reducing the risk of feeding the wrong diet.

Changing priorities in the Australian pig industry and consultation within the R&D committee, resulted in changes in the experiments conducted within this initial period. Consequently, that has resulted in changes to the project outcomes.

Experiment 1 sought to improve the definition of the nutrient requirements required by the modern lean genotype. Curvilinear responses in average daily gain and feed conversion to increasing lysine level were somewhat unexpected, and the lack of a plateau suggested that further improvements in performance could be achieved with higher lysine levels.

In response to Experiment 1, Experiment 2 was conducted to again investigate the lysine requirements of a modern lean genotype but with a greater range of dietary lysine levels. Resultant feed conversion ratios suggest that production improvements are achieved at lysine levels that are some 20 per cent higher than current recommendations.

Based on an urgent need to reduce the cost of production in times of high feed costs and low pig prices, Experiment 3 was a commercial validation of a fundamental experiment looking at the interaction of ractopamine and porcine somatotropin. Whilst substantial improvements in growth rate were seen with the inclusion of ractopamine in finisher diets, the use of porcine somatotropin during the final two weeks of growth resulted in significant improvements in feed conversion, primarily as a result of dramatic reductions in daily feed intake. This experiment was also the first to show that pST in oil could be injected twice weekly when used in conjunction with ractopamine to generate results comparable to those achieved with daily pST injections.

8. Application of Research

- Outcomes from this research represent potential savings of at least 5c/kg to pig producers.
- All results generated through the course of this research can be directly applied without further experimentation by pig producers in consultation with their nutritionist.
- This is high impact research with direct and immediate outcomes for the pork industry.
- There is no basis for the protection of intellectual property arising from this research and the results should be demonstrated as widely as possible.
- Formalised commercialization strategies are not required.
- A range of additional experimental opportunities exist within the CHM Feedlogic System and have been detailed below.

9. Conclusion

This project has delivered:

- A commercial research facility for on-going use by the Pork CRC.
- Substantial volumes of data that can be used for the on-going development of production models.
- Nutritional strategies for adoption by nutritionists and pig producers enabling them to improve production efficiency and reduce herd FCR.

10. Limitations/Risks

There are no limitations or risks to the application of the results generated from this research if they are applied exactly as detailed in the experimental protocols.

11. Recommendations

A range of additional experimental opportunities exist for this facility. In the first instance, a fourth experiment has commenced as follows, and an extension to the existing project will be sought.

FEEDLOGIC Project 4: Efficacy of cysteamine as an in-feed growth promoter under commercial conditions.

Introduction

Cysteamine is an orally active compound that increases the secretion of somatotropin in rats, sheep and fish, and is thought to work through the inhibition of somatostatin secretion, thus it is analogous to using exogenous sources of porcine somatotropin such as Reporcin. Ractopamine is an approved feed ingredient for pigs that repartitions nutrients toward increased lean deposition and has been shown to improve growth performance and carcass characteristics. Recent commercial validation work has shown that combining ractopamine and pST in the last two weeks of production increased average daily gain and improved feed efficiency by about 25% and resulted in overall feed:gain for females between 75 and 100kg of only 2.3:1. With cysteamine having a similar course of action to pST if we can achieve these levels within commercial operations the negative animal welfare and OH&S issues associated with pST may be resolved

Hypothesis

The sole use of cysteamine and/or in combination with ractopamine results in increased feed efficiency in finisher gilts.

Materials and Methods

Design:	Randomised block design
Site:	McLean Farms Grower Unit – Shed 11
Animals Required:	20 pens of finishers (~50 pigs/pen; 4 pens per treatment). Total of ~200 pigs per treatment.
Age:	Commencing 7 weeks prior to slaughter
Duration:	49 days. Trial will end with final weight and abattoir P2.
Diets:	1. Standard grower 2. Standard grower + ractopamine 5ppm 3. Standard finisher 4. Standard finisher + ractopamine 10ppm 5. Standard finisher + cysteamine 1200ppm *note – finisher feed inclusion levels at double treatment doses to

	allow for blending to occur.
Feeding protocol:	FEEDLOGIC, grower treatment diets to be fed for 3 weeks, followed by 1 week of standard finisher, followed by 3 weeks of finisher treatment diets. Pigs to remain on current feed until trial commences.
Feed supply:	McLean Farms Mill
Treatments:	Treatment A: Control – Standard grower & standard finisher. Treatment B: Positive control – Standard grower & standard finisher + ractopamine. Treatment C: Disrupted ractopamine – Standard grower + ractopamine & standard finisher + ractopamine. Treatment D: Cysteamine – Standard grower & standard finisher + cysteamine. Treatment E: Combination – Standard grower & standard finisher + ractopamine + cysteamine *note – all treatments will receive standard finisher for 1 week between grower and finisher treatments.
Replicates:	4 replicates/treatment.
Start/Finish Date:	Start: 23rd September 2008 Finish: 18th November 2008
Feed Required:	• Standard grower – 38t • Standard grower + ractopamine 5ppm – 10t • Standard finisher – 45.5t • Standard finisher + ractopamine 10ppm – 16.5t • Standard finisher + cysteamine 1200ppm – 11t
Feed Analysis:	Sample from each batch to be retained.
Additional medication:	Nil
Measurements:	1. Start weight (individual pig measurement). 2. Interim weight (21 days), at end of grower treatments. 3. Final weight (49 days) (individual pig measurement). 4. Daily feed consumption during both grower and finisher periods. 5. Mortality and incidence of disease.
Treatment structure:	• 2 pens/treatment/side. • Pens will be blocked on weight.
Ethical Considerations:	N/A
Other experimental considerations:	• Sides will be started and finished one week apart. • Cysteamine supply courtesy of CountryVet
Special Considerations and Liability:	Nil

Subsequent to the conduct of this experiment, it is suggested that a Management Committee be assembled to review the research undertaken within the Feedlogic Systems located in Queensland and Western Australia. Some possible avenues for further investigation include:

- As a result of anecdotal evidence on a CHM farm where use of pST in oil with twice weekly injections without ractopamine resulted in a significant increase in pig backfat, it is suggested that the FEEDLOGIC system be used to investigate the response of finishing pigs to i) a pST finisher diet without pST injections, ii) pST finisher plus daily pST injections for 3 weeks, iii) pST finisher plus daily PST injections with ractopamine for 3 weeks, iv) pST finisher plus twice weekly pST in oil injections for 3 weeks, and v) pST finisher plus twice weekly pST in oil injections plus ractopamine for 3 weeks.
- There is clear evidence that increasing the growth rate of piglets prior to weaning has a marked effect on their lifetime performance and the profitability of the pig enterprise (Mahan and Lepine, 1991). This improvement in lifetime performance is thought to be due to enhanced development of the gastro-intestinal tract, immune system and hormonal axis of the piglet. Hence, it is reasonable to assume that pigs grouped on the basis of weaning weight will respond differently to different nutritional regimes during the 20-100kg growth phase. An experiment is suggested that will utilise 1000 pigs grouped on the basis of weaning weight and then fed to theoretical growth curves based on modeled performance and nutrient requirements. Pigs would be selected at weaning (23 days) and individually identified. They would then be fed a standard diet from 5-25 kg within a liquid feeding facility. They would be sorted on the basis of sex (males and females) and weaning weight (3 groups based on <4 kg, 4-5kg and >5kg) on entry into the FEEDLOGIC facility. Feeding regimes would be developed based on AUSPIG simulations of growth performance and nutrient requirements for pigs with varying weaning weights. Pigs would be weighed at weekly intervals. The FEEDLOGIC system would monitor feed delivery on a daily basis.
- Progeny modeling is an important component of production models such as e-Piggery. At present, the progeny modeling is based on assumed coefficients of variation for groups of pigs based on their liveweight. In addition, the models do not account for the potential impact of different feeding regimes and feed interruption during the production cycle on these CV's. Apart from providing robust data for further development of these models, an experiment is suggested to help quantify the negative impacts of feed interruption on production efficiency. This experiment would utilise 1000 pigs grouped on the basis of sex (males and females) and weaning weight (<5 kg and >5 kg). The FEEDLOGIC system would be used to deliver up to four feeding regimes including a regular feed interruption for one regime and the influence on feed consumption, growth performance and group variation quantified.

12. References

Nil.

Appendix 1: FEEDLOGIC Project 1 Diets

Formula basic data

Code : 6000 Name : MCLEAN FARMS GROWER 1 FEEDLOGIC 19-10-07

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 330.523 Created : 17/10/07 Version :
Margin : -330.493 Updated : 19/10/07 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

	Raw material	%	[Kg]	Tonnes
13240	SORGHUM 11.0	42.226667	633.4	0.0
14320	WHEAT 15.0	39.0	585.0	0.0
33170	CANOLA MEAL 38.0 [EXP]	9.866667	148.0	0.0
40660	MEAT MEAL 50.0	7.466667	112.0	0.0
49005	SALT (FINE)	0.2	3.0	0.0
52810	CHOLINE CHLORIDE 60%	0.026667	0.4	0.0
53150	L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
60000	BENTONITE (FINE)	0.56	8.4	0.0
PCP4007	CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0
		100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.612951	CHOLINE	MG/KG	:	1001.493333
DRYMATTER	%	:	88.679133	TRYPTOPHAN	%	:	0.177738	FAT/EE	%	:	3.338347
MOISTURE	%	:	11.067533	M+C	%	:	0.64209	W3_FA	%	:	0.153572
PROTEIN	%	:	18.2776	AILYSPIG	%	:	0.69934	W6_FA	%	:	0.910413
NITROGEN	%	:	2.876416	CALCIUM	%	:	0.996912	W3+W6_FA	%	:	1.063985
C_FIBRE	%	:	3.154427	PHOSPHORUS	%	:	0.733824	#AILYS/DEP		:	0.050678
DE_PIG_MJ	MJ/KG	:	13.799653	AV_PHOS	%	:	0.418963	#MET/LYS		:	0.328658
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.358516	#M+C/LYS		:	0.720096
ISOLEUCINE	%	:	0.647025	#CAL/AVPHO		:	2.379477	#TRY/LYS		:	0.199331
LYSINE	%	:	0.891673	SODIUM	%	:	0.162504	#THR/LYS		:	0.687417
METHION	%	:	0.293055	SALT	%	:	0.409739	#ISO/LYS		:	0.72563

Formula basic data

Code : 7000 Name : MCLEAN FARMS GROWER 2 FEEDLOGIC 19-10-07

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 353.143 Created : 17/10/07 Version :
Margin : -352.999 Updated : 19/10/07 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

	Raw material	%	[Kg]	Tonnes
13240	SORGHUM 11.0	24.2	363.0	0.0
14320	WHEAT 15.0	41.506667	622.6	0.0
33170	CANOLA MEAL 38.0 [EXP]	10.0	150.0	0.0
34630	SOYBEAN MEAL 47.5	15.0	225.0	0.0
40100	BLOOD MEAL 90.0	0.666667	10.0	0.0
40660	MEAT MEAL 50.0	7.133333	107.0	0.0
49005	SALT (FINE)	0.2	3.0	0.0
53000	DL METHIONINE	0.033333	0.5	0.0
53150	L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
60000	BENTONITE (FINE)	0.606667	9.1	0.0
PCP4007	CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0
		100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.864599	CHOLINE	MG/KG	:	1182.12
DRYMATTER	%	:	89.0946	TRYPTOPHAN	%	:	0.266957	FAT/EE	%	:	3.0884
MOISTURE	%	:	10.652067	M+C	%	:	0.840896	W3_FA	%	:	0.160932
PROTEIN	%	:	24.299033	AILYSPIG	%	:	1.100167	W6_FA	%	:	0.792507
NITROGEN	%	:	3.836747	CALCIUM	%	:	1.000911	W3+W6_FA	%	:	0.953439
C_FIBRE	%	:	3.747853	PHOSPHORUS	%	:	0.769285	#AILYS/DEP		:	0.079726
DE_PIG_MJ	MJ/KG	:	13.79928	AV_PHOS	%	:	0.420297	#MET/LYS		:	0.300995
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.301092	#M+C/LYS		:	0.621292
ISOLEUCINE	%	:	0.941723	#CAL/AVPHO		:	2.381435	#TRY/LYS		:	0.19724
LYSINE	%	:	1.353464	SODIUM	%	:	0.162189	#THR/LYS		:	0.638805
METHION	%	:	0.407386	SALT	%	:	0.402907	#ISO/LYS		:	0.695788

Formula basic data

Code	8000	Name	MCLEAN FARMS GROWER 3 FEEDLOGIC 19-10-07		
Sell price:	0.0	Batch [Kg]:	1500.0	Group code:	
Cost	350.839	Created	17/10/07	Version	
Margin	-350.845	Updated	19/10/07	FM origin	KPE 60
Tonnes	0.0	User name	Rob	VM key	KPE 60

External reference:
Script file name :

Raw material	%	[Kg]	Tonnes
13240 SORGHUM 11.0	35.533333	533.0	0.0
14320 WHEAT 15.0	47.053333	705.8	0.0
34630 SOYBEAN MEAL 47.5	5.466667	82.0	0.0
40660 MEAT MEAL 50.0	7.933333	119.0	0.0
45100 TALLOW	3.133333	47.0	0.0
49005 SALT (FINE)	0.2	3.0	0.0
52810 CHOLINE CHLORIDE 60%	0.026667	0.4	0.0
53150 L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
PCP4007 CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0
	100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.572433	CHOLINE	MG/KG	:	987.493333
DRYMATTER	%	:	89.0386	TRYPTOPHAN	%	:	0.174143	FAT/EE	%	:	5.953
MOISTURE	%	:	10.708067	M+C	%	:	0.579155	W3_FA	%	:	0.151129
PROTEIN	%	:	17.83	AILYSPIG	%	:	0.700972	W6_FA	%	:	0.9728
NITROGEN	%	:	2.8048	CALCIUM	%	:	1.003192	W3+W6_FA	%	:	1.123929
C_FIBRE	%	:	2.35476	PHOSPHORUS	%	:	0.689683	#AILYS/DEP		:	0.048026
DE_PIG_MJ	MJ/KG	:	14.59564	AV_PHOS	%	:	0.421045	#MET/LYS		:	0.299427
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.45457	#M+C/LYS		:	0.663789
ISOLEUCINE	%	:	0.64893	#CAL/AVPHO		:	2.382622	#TRY/LYS		:	0.199592
LYSINE	%	:	0.872497	SODIUM	%	:	0.161595	#THR/LYS		:	0.656085
METHION	%	:	0.261249	SALT	%	:	0.399147	#ISO/LYS		:	0.743762

Formula basic data

Code : 9000 Name : MCLEAN FARMS GROWER 4 FEEDLOGIC 19-10-07

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 374.181 Created : 17/10/07 Version :
Margin : -374.237 Updated : 19/10/07 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

	Raw material	%	[Kg]	Tonnes
13240	SORGHUM 11.0	17.8	267.0	0.0
14320	WHEAT 15.0	44.913333	673.7	0.0
33170	CANOLA MEAL 38.0 [EXP]	10.0	150.0	0.0
34630	SOYBEAN MEAL 47.5	15.0	225.0	0.0
40100	BLOOD MEAL 90.0	0.666667	10.0	0.0
40660	MEAT MEAL 50.0	7.133333	107.0	0.0
45100	TALLOW	3.6	54.0	0.0
49005	SALT (FINE)	0.2	3.0	0.0
53000	DL METHIONINE	0.033333	0.5	0.0
53150	L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
PCP4007	CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0
		100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.856697	CHOLINE	MG/KG	:	1170.973333
DRYMATTER	%	:	89.5142	TRYPTOPHAN	%	:	0.265922	FAT/EE	%	:	6.541333
MOISTURE	%	:	10.232467	M+C	%	:	0.837093	W3_FA	%	:	0.198584
PROTEIN	%	:	24.106033	AILYSPIG	%	:	1.100363	W6_FA	%	:	0.92936
NITROGEN	%	:	3.805867	CALCIUM	%	:	1.001675	W3+W6_FA	%	:	1.127944
C_FIBRE	%	:	3.691807	PHOSPHORUS	%	:	0.761967	#AILYS/DEP		:	0.075395
DE_PIG_MJ	MJ/KG	:	14.594627	AV_PHOS	%	:	0.421908	#MET/LYS		:	0.299269
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.31459	#M+C/LYS		:	0.618554
ISOLEUCINE	%	:	0.931448	#CAL/AVPHO		:	2.374154	#TRY/LYS		:	0.196498
LYSINE	%	:	1.353306	SODIUM	%	:	0.160992	#THR/LYS		:	0.63304
METHION	%	:	0.405002	SALT	%	:	0.398633	#ISO/LYS		:	0.688276

Appendix 2: FEEDLOGIC Project 2 Diets

Formula basic data

Code : 10000 Name : MCLEAN FARMS GROWER 1 FEEDLOGIC 08-02-08

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 403.433 Created : 07/02/08 Version :
Margin : -403.34 Updated : 08/02/08 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

	Raw material	%	[Kg]	Tonnes
13240	SORGHUM 11.0	77.68	1165.2	0.0
33160	CANOLA MEAL 38.0	10.0	150.0	0.0
40100	BLOOD MEAL 90.0	2.733333	41.0	0.0
40660	MEAT MEAL 50.0	5.866667	88.0	0.0
45100	TALLOW	2.333333	35.0	0.0
48250	KYNOPHOS 21	0.466667	7.0	0.0
49005	SALT (FINE)	0.2	3.0	0.0
52810	CHOLINE CHLORIDE 60%	0.046667	0.7	0.0
53000	DL METHIONINE	0.02	0.3	0.0
53150	L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
PCP4007	CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0
		100.0	1500.0	0.0

Analysis

[VOLUME]	%	100.0	THREONINE	%	0.653199	CHOLINE	MG/KG	1007.313333
DRYMATTER	%	88.341533	TRYPTOPHAN	%	0.176676	FAT/EE	%	5.378373
MOISTURE	%	11.3958	M+C	%	0.606662	W3_FA	%	0.101229
PROTEIN	%	18.049753	AILYSPIG	%	0.799239	W6_FA	%	1.051093
NITROGEN	%	2.838101	CALCIUM	%	0.885036	W3+W6_FA	%	1.152323
C_FIBRE	%	3.09528	PHOSPHORUS	%	0.735872	#AILYS/DEP		0.056262
DE_PIG_MJ	MJ/KG	14.205627	AV_PHOS	%	0.413895	#MET/LYS		0.303118
ME_PIG_MJ	MJ/KG	0.066	#CAL/PHO		1.202704	#M+C/LYS		0.618942
ISOLEUCINE	%	0.604555	#CAL/AVPHO		2.138312	#TRY/LYS		0.180252
LYSINE	%	0.98016	SODIUM	%	0.158912	#THR/LYS		0.666421
METHION	%	0.297104	SALT	%	0.410216	#ISO/LYS		0.616792

Formula basic data

Code : 11000 Name : MCLEAN FARMS GROWER 2 FEEDLOGIC 08-02-08

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 490.025 Created : 07/02/08 Version :
Margin : -489.962 Updated : 08/02/08 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

Raw material	%	[Kg]	Tonnes
13240 SORGHUM 11.0	57.253333	858.8	0.0
33160 CANOLA MEAL 38.0	10.0	150.0	0.0
34630 SOYBEAN MEAL 47.5	15.0	225.0	0.0
34750 SOYCOMIL R (ADM)	5.6	84.0	0.0
40100 BLOOD MEAL 90.0	3.0	45.0	0.0
40660 MEAT MEAL 50.0	6.733333	101.0	0.0
45100 TALLOW	1.266667	19.0	0.0
48250 KYNOPHOS 21	0.2	3.0	0.0
49005 SALT (FINE)	0.2	3.0	0.0
53000 DL METHIONINE	0.093333	1.4	0.0
53150 L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
PCP4007 CHM PIG GROWER PMX (McLEAN)	0.253333	3.8	0.0
	100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	1.038573	CHOLINE	MG/KG	:	1060.286667
DRYMATTER	%	:	89.0524	TRYPTOPHAN	%	:	0.301263	FAT/EE	%	:	4.102693
MOISTURE	%	:	10.690267	M+C	%	:	0.930164	W3_FA	%	:	0.091784
PROTEIN	%	:	27.28376	AILYSPIG	%	:	1.400689	W6_FA	%	:	0.836013
NITROGEN	%	:	3.726325	CALCIUM	%	:	0.998051	W3+W6_FA	%	:	0.927797
C_FIBRE	%	:	3.696653	PHOSPHORUS	%	:	0.801501	#AILYS/DEP		:	0.098616
DE_PIG_MJ	MJ/KG	:	14.20344	AV_PHOS	%	:	0.416525	#MET/LYS		:	0.298296
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.245226	#M+C/LYS		:	0.560879
ISOLEUCINE	%	:	1.065361	#CAL/AVPHO		:	2.396134	#TRY/LYS		:	0.181659
LYSINE	%	:	1.658403	SODIUM	%	:	0.163555	#THR/LYS		:	0.626249
METHION	%	:	0.494695	SALT	%	:	0.412104	#ISO/LYS		:	0.642402

Appendix 3: FEEDLOGIC Project 3 Diets

```
:                                                                                :
:  Single-Mix Tools    (FM)     MCLEAN FARMS        {16} JUNE 2008            FULL PRINT          10:51 27/06/08  0001 :
: 27-October-2006/643.5r          (   29) Plant=0088     Rob                                                          :
```

Formula basic data

```
Code      :     20500         Name      : DIET 1 - STANDARD FINISHER

Sell price:       0.0         Batch [Kg]:     1500.0     Group code:
Cost      :     340.919       Created   : 26/06/08       Version   :
Margin    :    -340.586       Updated   : 27/06/08       FM origin : KPE 60
Tonnes    :       0.0         User name : Rob            VM key    : KPE 60
```

External reference:
Script file name :

Raw material	%	[Kg]	Tonnes	
13240 SORGHUM	11.0	65.606667	984.1	0.0
16020 MILLRUN	16.0	15.933333	239.0	0.0
33170 CANOLA MEAL 38.0 [EXP]		10.0	150.0	0.0
40100 BLOOD MEAL 90.0		1.266667	19.0	0.0
40660 MEAT MEAL 50.0		5.466667	82.0	0.0
47000 LIMESTONE (FINE)		0.733333	11.0	0.0
49005 SALT (FINE)		0.2	3.0	0.0
52810 CHOLINE CHLORIDE 60%		0.033333	0.5	0.0
53000 DL METHIONINE		0.006667	0.1	0.0
53150 L-LYSINE SULPHATE (51% LYSINE)		0.4	6.0	0.0
53810 ZNP 3801 PHYTASE (SORGHUM) - 60G/KG		0.1	1.5	0.0
PCP4005 CHM PIG GROWER PMX (McLEAN) - 2.5 KG/T	0.253333	3.8	0.0	
100.0	1500.0	0.0		

Analysis

[VOLUME]	%	100.0	THREONINE	%	0.624938	CHOLINE	MG/KG	1000.04
DRYMATTER	%	87.9911	TRYPTOPHAN	%	0.179495	FAT/EE	%	3.960987
MOISTURE	%	11.655567	M+C	%	0.593436	W3_FA	%	0.147005
PROTEIN	%	17.743273	AILYSPIG	%	0.738944	W6_FA	%	1.13706
NITROGEN	%	2.790304	CALCIUM	%	1.092261	W3+W6_FA	%	1.284065
C_FIBRE	%	4.24074	PHOSPHORUS	%	0.720959	#AILYS/DEP		0.655132
DE_PIG_MJ	MJ/KG	13.403213	AV_PHOS	%	0.420304	#MET/LYS		0.30944
ME_PIG_MJ	MJ/KG	0.066	#CAL/PHO		1.515011	#M+C/LYS		0.633941
ISOLEUCINE	%	0.616509	#CAL/AVPHO		2.598741	#TRY/LYS		0.191746
LYSINE	%	0.936106	SODIUM	%	0.154809	#THR/LYS		0.667593
METHION	%	0.281244	SALT	%	0.394408	#ISO/LYS		0.658588

Formula basic data

Code : 21500 Name : DIET 2 – HI-SPEC FINISHER

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 382.79 Created : 26/06/08 Version :
Margin : -382.793 Updated : 27/06/08 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

	Raw material	%	[Kg]	Tonnes
13240	SORGHUM 11.0	67.173333	1007.6	0.0
16020	MILLRUN 16.0	5.0	75.0	0.0
33170	CANOLA MEAL 38.0 [EXP]	7.533333	113.0	0.0
34580	SOYBEAN MEAL 45.0	7.533333	113.0	0.0
40100	BLOOD MEAL 90.0	3.0	45.0	0.0
40660	MEAT MEAL 50.0	7.0	105.0	0.0
45100	TALLOW	1.266667	19.0	0.0
47000	LIMESTONE (FINE)	0.266667	4.0	0.0
49005	SALT (FINE)	0.2	3.0	0.0
52810	CHOLINE CHLORIDE 60%	0.033333	0.5	0.0
53000	DL METHIONINE	0.16	2.4	0.0
53150	L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
53200	L-THREONINE	0.08	1.2	0.0
53810	ZNP 3801 PHYTASE (SORGHUM) - 60G/KG	0.1	1.5	0.0
PCP4005	CHM PIG GROWER PMX (McLEAN) - 2.5 KG/T	0.253333	3.8	0.0
		100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.841077	CHOLINE	MG/KG	: 1095.34
DRYMATTER	%	:	88.352933	TRYPTOPHAN	%	:	0.219336	FAT/EE	%	: 4.890853
MOISTURE	%	:	11.293733	M+C	%	:	0.806887	W3_FA	%	: 0.124088
PROTEIN	%	:	21.092293	AILYSPIG	%	:	0.980424	W6_FA	%	: 1.02904
NITROGEN	%	:	3.302677	CALCIUM	%	:	1.099848	W3+W6_FA	%	: 1.153128
C_FIBRE	%	:	3.44664	PHOSPHORUS	%	:	0.727676	#AILYS/DEP		: 0.070057
DE_PIG_MJ	MJ/KG	:	13.994747	AV_PHOS	%	:	0.448857	#MET/LYS		: 0.38995
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.511453	#M+C/LYS		: 0.671596
ISOLEUCINE	%	:	0.727307	#CAL/AVPHO		:	2.450329	#TRY/LYS		: 0.18256
LYSINE	%	:	1.201447	SODIUM	%	:	0.167256	#THR/LYS		: 0.700054
METHION	%	:	0.468504	SALT	%	:	0.421188	#ISO/LYS		: 0.605359

Formula basic data

Code : 22500 Name : DIET 3 – HI-SPEC FINISHER + PAYLEAN

Sell price: 0.0 Batch [Kg]: 1500.0 Group code:
Cost : 403.974 Created : 27/06/08 Version :
Margin : -403.974 Updated : 27/06/08 FM origin : KPE 60
Tonnes : 0.0 User name : Rob VM key : KPE 60

External reference:
Script file name :

	Raw material	%	[Kg]	Tonnes
13240	SORGHUM 11.0	67.148333	1007.225	0.0
16020	MILLRUN 16.0	5.0	75.0	0.0
33170	CANOLA MEAL 38.0 [EXP]	7.533333	113.0	0.0
34580	SOYBEAN MEAL 45.0	7.533333	113.0	0.0
40100	BLOOD MEAL 90.0	3.0	45.0	0.0
40660	MEAT MEAL 50.0	7.0	105.0	0.0
45100	TALLOW	1.266667	19.0	0.0
47000	LIMESTONE (FINE)	0.266667	4.0	0.0
49005	SALT (FINE)	0.2	3.0	0.0
52810	CHOLINE CHLORIDE 60%	0.033333	0.5	0.0
52960	PAYLEAN (RACTOPAMINE) ELANCO	0.025	0.375	0.0
53000	DL METHIONINE	0.16	2.4	0.0
53150	L-LYSINE SULPHATE (51% LYSINE)	0.4	6.0	0.0
53200	L-THREONINE	0.08	1.2	0.0
53810	ZNP 3801 PHYTASE (SORGHUM) - 60G/KG	0.1	1.5	0.0
PCP4005	CHM PIG GROWER PMX (McLEAN) - 2.5 KG/T	0.253333	3.8	0.0
		100.0	1500.0	0.0

Analysis

[VOLUME]	%	:	100.0	THREONINE	%	:	0.840986	CHOLINE	MG/KG	: 1095.19
DRYMATTER	%	:	88.355558	TRYPTOPHAN	%	:	0.21931	FAT/EE	%	: 4.890153
MOISTURE	%	:	11.291108	M+C	%	:	0.806793	W3_FA	%	: 0.124071
PROTEIN	%	:	21.089543	AILYSPIG	%	:	0.980382	W6_FA	%	: 1.028765
NITROGEN	%	:	3.302237	CALCIUM	%	:	1.099843	W3+W6_FA	%	: 1.152836
C_FIBRE	%	:	3.446115	PHOSPHORUS	%	:	0.727604	#AILYS/DEP		: 0.070071
DE_PIG_MJ	MJ/KG	:	13.991197	AV_PHOS	%	:	0.448842	#MET/LYS		: 0.389935
ME_PIG_MJ	MJ/KG	:	0.066	#CAL/PHO		:	1.511597	#M+C/LYS		: 0.671552
ISOLEUCINE	%	:	0.727197	#CAL/AVPHO		:	2.450399	#TRY/LYS		: 0.182547
LYSINE	%	:	1.201386	SODIUM	%	:	0.167246	#THR/LYS		: 0.700013
METHION	%	:	0.468463	SALT	%	:	0.421158	#ISO/LYS		: 0.605298