

EFFICACY OF RACTOPAMINE AND PST COMBINATIONS ON FINISHER PIG PERFORMANCE

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

By

Dr Robert van Barneveld
Consultant Research Scientist (Nutrition)
Barneveld Nutrition Pty Ltd/BECAN Consulting Group
Springwood QLD 4127

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FEEDLOGIC Experiment 3

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 1).

Table 1 Treatments

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	20 mg twice weekly

Treatment 1 was a control diet using the current specifications of the finisher diet (13.4 MJ/kg; 0.55 g available lysine/MJ DE; normally containing 5ppm of ractopamine) used in this facility. Treatment 2 was a positive control utilizing the high specification finisher with elevated levels of energy, available lysine, calcium and essential amino acids relative to lysine 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. Treatment 5 pigs received 20mg or 15 mg of pST administered as an oil emulsion delivered as a 1ml solution twice weekly. All pigs on treatment five received the same daily pST equivalent as those on the daily treatment.

Diets

Three diets were formulated to meet the treatment requirements (Table 2). The hi-specification finisher diets had both higher energy and available lysine contents compared to the standard diet and in accordance with specifications for pST use the ratios of threonine and methionine plus cystine to lysine were lifted.

Table 2 Specifications of treatment diets

Di et	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 a one week 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 one-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 3), 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 Paylean and up to 180g per day faster than pigs on the standard diet (table 3 and figure 1).

When pST was administered on a daily basis (treatment 4) pigs consumed significantly less than their non-pST treated counterparts, 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 better feed: gain ratio than other treatments ($p<0.001$). Pigs that received only ractopamine had a significantly better feed: gain ratio than the two control treatments (1 & 2).

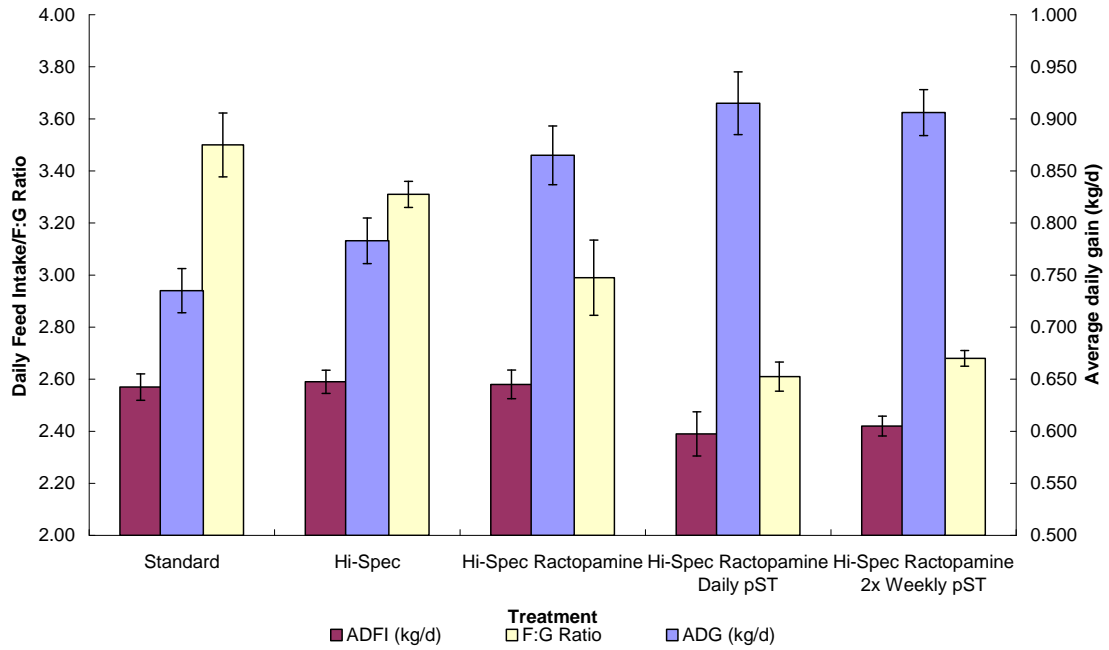


Figure 1. Average daily feed intake (ADFI), average daily gain (ADG) and feed: gain ratio (F: G Ratio) for each treatment group (mean \pm SE) measured over the entire 28 days of the study.

There was no significant difference in average daily feed intake (ADFI) between treatments during the first two weeks of the trial (table 3 and figure 2). 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.

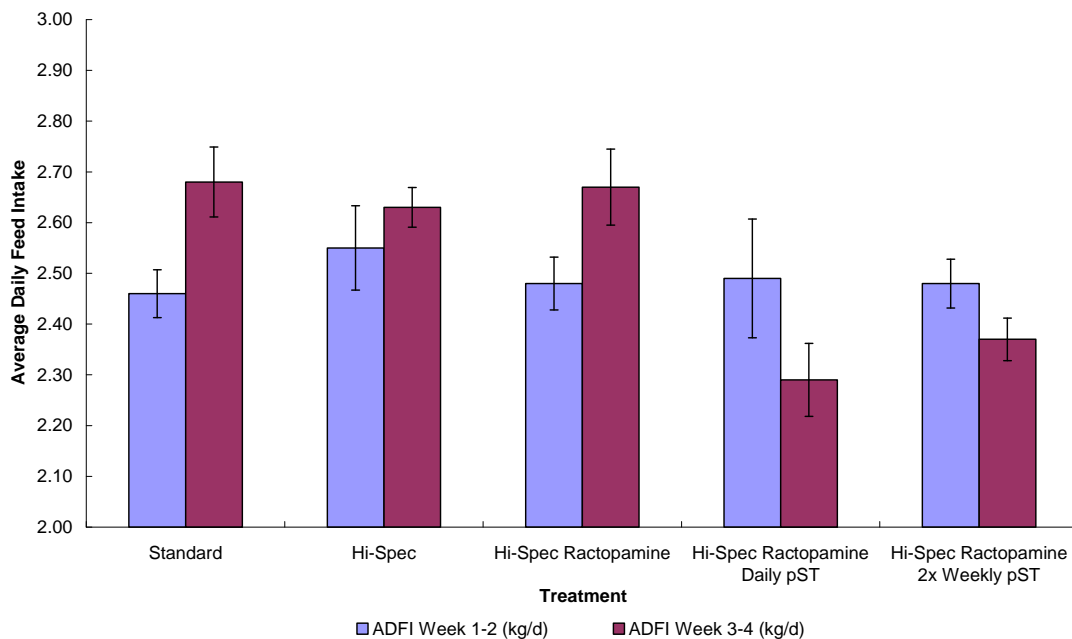


Figure 2. Average daily feed intake during the first two weeks (ADFI Week 1-2) and second two weeks (ADFI Week 3-4), showing the response to pST (mean \pm SE).

Table 3. Parameter values showing treatment means and p-values for treatment and block factors and their interaction.

Parameter	Treatment						p-value		
	Standard	Hi-Spec	Hi-Spec Paylean	Hi-Spec Paylean Daily pST	Hi-Spec Paylean 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

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 carcass weights (HSCW) were not significant between treatments, so backfat depths were linearly adjusted to a common carcass weight (75.1kg HSCW).

There were significant differences between treatments (table 3 & figure 3, $p < 0.001$). 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.

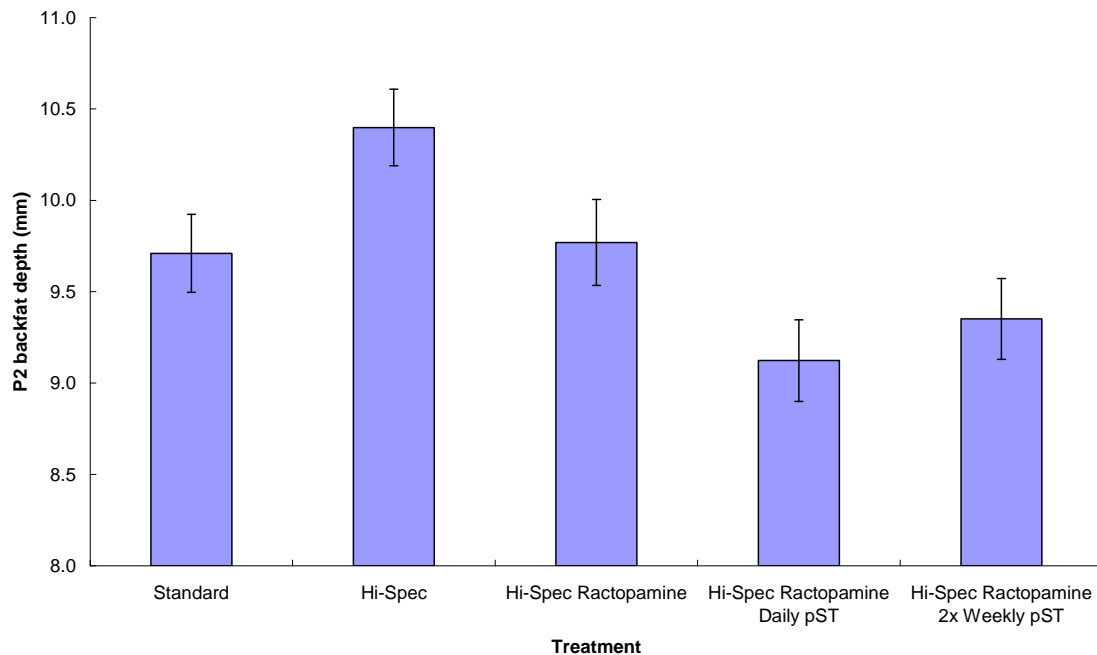


Figure 3. Adjusted backfat depths showing treatment effects (mean \pm SE). Backfat depths were adjusted to a common slaughter weight of 75.1kg.

Discussion

The use of ractopamine and pST in combination results in markedly 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 (less than \$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 at least \$3/pig. Modelling of the outcomes by the Pork CRC predicted an improvement in profitability of some \$7/pig for animals offered the diet containing 5 ppm Paylean and treated with pST during the final two weeks of production. The improvement in profitability predicted for pigs treated with Paylean only was lower however; these pigs would not likely require the higher specification and more costly diet to elicit the improvements in growth performance reported here.

Overall the results demonstrate the levels of improvement in growth performance able to be achieved in late finishing using Paylean and Paylean and pST in combination. The improvement in feed efficiency elicited by the combination treatments was in the order of 30% which would improve overall herd feed conversion 9%-10% and reduce the latter from 4.05 to only 3.65. These results confirm the importance of understanding what pigs are doing in late finishing and offer practical means for enhancing performance during this critical and relatively costly period of pork production.

Acknowledgements

Thanks to Mr Mark Mingay, OzBioPharm for the supply of pST and its administration.

APPENDIX 1 – DIET FORMULATIONS

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:
: 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      EM 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	ALLYSPIG % :	0.738944	W6_FA % :	1.13706
NITROGEN % :	2.790304	CALCIUM % :	1.092261	W3+W6_FA % :	1.284065
C FIBRE % :	4.24074	PHOSPHORUS % :	0.720959	#ALLY/DEP % :	0.055132
DE_PIG_MJ MJ/KG :	13.403213	AV_PHOS % :	0.420304	#MET/LYS % :	0.30044
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


```

:
: Single-Mix Tools (FM) MCLEAN FARMS {16} JUNE 2008 FULL PRINT 10:51 27/06/08 0002 :
: 27-October-2006/643.5r ( 29) Plant=0088 Rob :

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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      EM 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	#AILYSD/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 EM 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