Deschambault Swine Testing Station

Trials 29 and 30

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Commercial hog performance data Final Report

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Introduction

Following the change in the swine grading grid in September 2009 which favoured pigs with lower lean yield than in the past, several commercial pig producers wondered about the type of feeding programs to use with regards to genetics (high lean yield breeding scheme compared to low lean yield breeding scheme). To answer this question, feed cost and pork price fluctuations over time as well as the effects of a feeding program (rich or poor in nutrients) and breeding schemes (high or low lean yield) on performance need to be considered.

In these two trials, four different treatment groups were evaluated by entering commercial pigs from low and high lean yield breeding schemes and using a richer feeding program (high protein and amino acid rich diet), generally used at the Deschambault swine research station and a second more affordable feeding program which had lower nutrient content (lower cost ration).

To better understand interactions between feeding and genetics as well as their economic impact, it is important to determine feed conversion accurately. This is why the Deschambault testing station offers an interesting option because it is equipped with a feeding system which allows obtaining this information for each station-tested pig. In addition, the station is fitted with a second feeding line in order to test two feeding treatments simultaneously. Thus, growth and feeding performance, carcass yield, and carcass and meat quality will be measured for the four treatments (2 x 2 factorial):

(High lean yield breeding scheme) X (Nutrient rich feed formulation)
(High lean yield breeding scheme) X (Lower nutrient content feed formulation)
(Low lean yield breeding scheme) X (Nutrient rich feed formulation)
(Low lean yield breeding scheme) X (Lower nutrient content feed formulation)

Ultimately, this project focuses primarily on identifying strategies to optimize returns to producers based on feed costs, pork prices, breeding schemes and grading grid.

The more specific objectives are:

1. Measure the effect of two feeding strategies (richer feed formulation compared to a feed supply with a lower nutritional content) and two breeding schemes (high lean yield compared to low lean yield) on performance (e.g. growth, feed conversion, etc.), economics and product quality.

2. Assess the economic impact of four combinations (two feeding strategies X two breeding schemes) based on different production parameters (grading grid, feed costs and pork prices).
3. Develop a decision-making tool for commercial producers in order to choose the best economic strategy based on different production parameters (breeding scheme, feeding strategy, grading grid, pork prices, feed costs).

This first report explains the results of both station trials, that is to say the performance evaluation of commercial hogs based on two feeding programs and two breeding schemes. A second report will present the economic impact of different scenarios considering various breeding schemes and feeding programs. These scenarios will be tested in the context of evolving production parameters such as feed costs and pork prices.

Description of the trials

Two consecutive trials were carried out at the Deschambault testing station, the second (30) being a repetition of the first trial (29). Trials 29 and 30 took place from November 2010 to November 2011. The acclimation phase, which took place mainly in the nursery, paralleled the post-weaning period where pigs' weights increased from 4.9 to 30.2 kg. For both trials, the trial phase paralleled the growth phase for which pigs' weights increased from 30.2kg to a targeted slaughter weight of 120kg. Growth, carcass and meat quality performance data were measured. During each trial, individual feed intake was measured using a computerized feeding system (IVOG). The time and exact duration of each visit to the feeder as well as quantity of feed consumed were also recorded. This data, recorded continuously, allows to determine the actual feed intake of pigs but also to study their feeding behaviour.

Animals originated from commercial herds for these two trials. In total, seven farms provided piglets for Trial 29 and ten farms provided piglets for Trial 30. No farm provided piglets for both trials.

For more details and to obtain the complete description of the experimental protocol, the document "Trials 29-30 Protoco" is available at the following address: http://www.cdpq.ca/recherche-et-developpement/epreuves-en-station.aspx.

Results

1. Acclimation period

The acclimation period (nursery) data found in the current report are on performance data from all piglets at the station. Raw data are presented across treatments and trials.

1.1 Feeding program

During the acclimation phase, only one feeding program was used for all piglets. The feeding program used during the acclimation phase was proposed by the feed supplier selected in previous trials (Trials 27-28). The feeding program was composed of four cube-textured medicated feed (four phases). The feeding program, nutritional guidelines and the composition of the fourth feed are described in Appendix 1.

The quantity of feed distributed per day was noted for each pen. Feed intake was calculated for all piglets and not on an individual basis. Feed leftovers were weighed and dead animals were considered in feed intake calculations. The piglets were fed *via* a feeding-trough during the first twelve days and using a dry feeder for the remainder of the acclimation period.

1.2 Health information

All piglets from Trials 29 and 30 received a combination of medications in feed, water and by injection to prevent health problems (Table 1 and Table 2). Additionally, piglets showing clinical signs of disease were treated with injectable medications according to the dosages outlined in Table 3. In circumstances where several piglets needed treatment, medications were administered in the water for all animals (Table 3).

The main causes for treatment are presented in Table 5. Medication use is presented as three indicators which are defined below (Table 6):

1. Intensity of use (IU) which represents the ratio between number of administered therapeutic doses (DT) and number of animal-days (AD);
2. Quantity of medication used per pig;
3. Cost of medication per pig.

The main causes of mortality or euthanasia are presented in Table 7.

At the beginning of Trial 30, during the acclimation phase, piglets were infected with the PRRS virus, which explains why there were seven times as many treatments administered to piglets in Trial 30 compared to Trial 29. During Trial 29, the main reasons for treatment were locomotion and respiratory problems, whereas in Trial 30, respiratory problems were much more prominent followed by overall poor condition, locomotion and digestive problems (Table 5). Incidentally, during the acclimation phase of Trial 30, *Trimethoprim sulfa* was given in the water to all piglets because of respiratory problems that were linked to PRRS.

Moreover, in Trial 29, 5 out of 326 piglets died, which represents a mortality rate of 1.5% whereas in Trial 30, 12 piglets out of 352 died, representing a mortality rate of 3.4% (Table 7). In Trial 29, the majority of these deaths occurred during the 7^{th} week in the nursery whereas in Trial 30, the majority of deaths occurred during the 5^{th}, 6^{th} and 7^{th} weeks in the nursery. In these two trials, most deaths occurred suddenly (Table 7).

1.3 Performance

Table 4 shows piglet growth and feed intake performance data during the acclimation period. The average acclimation period lasted 54.5 days, with piglets weighing 4.9 kg on entry and 30.2 kg at the end of the phase. For this period, an ADG of 460 grams/day was obtained. Feed conversion was not calculated for the entire acclimation phase because the individual feeding system did not collect the distribution data of the fourth feed during Trial 30. Feed conversion for phases 1, 2 and 3 was calculated with overall feed intake and gains and is not based on individual records.

2. Test period

Data collected during the test period are shown in Tables 11 to 14. The averages are adjusted to take into account various factors (e.g.: weight, sex, slaughter date, etc.) for different traits (see protocol to find out about variables considered in adjusted averages). Results of breeding schemes (low or high lean yield) and feeding treatments (test feed or control) are all presented as simple effects because interaction effects between these two factors were not significant ($p > 0.1$) except for ultimate loin pH.

2.1 Sampling

For the factors under study, a total of 659 animals began the testing phase, including 321 for Trial 29 and 338 for Trial 30. From this number, data on 623 animals were retained for analyses (303 for Trial 29 and 320 for Trial 30).

Table 9 shows the distribution of pigs kept for analyses. An equal number of litters, herds, barrows and females are found in both breeding schemes. The number of sires used was not available because pooled semen was used for inseminations.

2.2 Data exclusion

Of the 36 animals that started the trials but were excluded from analyses: 20 died during the trial (8 during Trial 29 and 12 during Trial 30), 7 were excluded for health reasons, 4 due to ID problems and 5 because they were not properly castrated.

2.3 Health information

No growth factors were used during the trials. Only pigs that showed clinical signs of disease were treated with injectable medications (Table 3).

It was found that the number and proportion of treated animals during the testing period of Trial 29 (29 out of 326 animals; 96 TD (injectable) was almost two times lower than for Trial 30 (49 animals out of 352; 162 TD (injectable) (Tables 5 and 6). The high number of treatments during Trial 30 was a result of a PRRS break that began early in the acclimation phase of Trial 30.

During the test period, the mortality rate was 2.5% in Trial 29 and deaths were mainly due to sudden death (3 cases), followed by locomotion problems (2 cases), other conditions (2 cases) and one case of meningitis. In Trial 30, the mortality rate during the test period was 3.5%. These deaths were related to cases of sudden death (7 cases), locomotion problems (2 cases) and respiratory problems (2 cases) (Table 7). These deaths, which were 1.5 times higher in Trial 30 than in Trial 29, were as a result of the PRRS break that started in the acclimation phase of Trial 30.

Finally, results from serological tests carried out at the end of trials are presented in Table 8. These controls allow determining the health status of the batches of pigs with regards to PRRS, pleuropneumonia (*Actinobacillus pleuropneumoniae*) and *Mycoplasma hyopneumoniae*. The two batches of pigs were positive regarding *Mycoplasma hyopneumoniae* . Whereas the batch from Trial 29 was tested negative for both pleuropnemonia and PRRS, the batch from Trial 30 was considered positive for both diseases.

2.4 Feeding behaviour

Computerized equipment used in the trials for the distribution of feed collects data which allows studying the feeding behaviour of pigs. Results were analyzed for all barrows and female pigs for each of the trial periods. Results from Trial 30 were excluded from the overall and 30-50 kg period compilation because the individual feeding system was not functional at the beginning of the grow-finish phase of Trial 30. Data from the 50-75 kg and 75-120 kg periods were combined for both trials. Feeding behaviour during the acclimation phase was not investigated. Table 10 presents the feeding behaviour parameters that were studied. Only descriptive statistics are shown, and the differences between test periods have not been statistically analyzed. Every pig spent an average of 61 minutes per day at the feeder, which led to an overall occupation rate of about 51%. This rate varied little during the growth of pigs. It then seems that the availability of the feeder in the pen was sufficient considering the number of pigs by pen. This is also confirmed by the fact that 84% of the time spent at the feeder took place during the day (from 4:45 am to 9:00 pm), which still left plenty of time for feeding during the night.

Figures 1 and 2 show the average daily feed intake trend for Trials 29 and 30, respectively. Trend curves for the average temperature inside the building for each trial were added to each graph respectively. The graphs show that pig feed intake recovered very quickly after weigh-ins or after feed changes during grow-finish.

2.5 Overall, carcass and meat quality performance

Average performance data are shown in Tables 11 and 12 (see “Overall” column) for all pigs. The average initial weight was 30.3 kg whereas the final weight was 120.0 kg. The average daily gain was 1,044 g/day and feed conversion was 2.45 kg/kg. Performance data are considered excellent for commercial pigs originating from several herds, especially since no growth factor was administered as a preventive measure during the test period. The conditions in the testing station therefore allowed pigs to adequately express their genetic potential.

The results pertaining to carcass quality are presented in Table 13. The carcass cutout is standardized and follows primal pork cuts presented in the Canadian Pork Buyers Manual. Carcasses were cut into four primal cuts: ham, loin, shoulder and belly. Average weight and average weight ratio of each cut with respect to the reconstituted half carcass weight are based on all station-tested pigs.

Meat quality results are presented for the loin and the ham in Table 14. The different measures are described in CDPQ’s manual on the methods to evaluate meat quality.

2.6 Performance by sex

Tables 15 and 16 show the performance data for barrows and females. Sex significant differences were observed for several performance traits with the expected magnitude and direction for 21 of the 31 parameters. Yet, during the first two measures or phases, no differences were observed with regards to initial and final weights, hot carcass weight, carcass yield, Destron lean depth, index, lean depth measured *via* ultrasound technology and feed conversion. These results are similar to those observed in previous trials except for carcass yield and hot carcass weight which showed significant differences during the last three commercial trials. No significant sex differences were observed for Trials 29 and 30 for carcass yield and hot carcass weight. It is interesting to note that the difference in backfat thickness did not result in an index difference. The explanation lies in the fact that with the grading grid used (Fall 2009), both sexes have a similar proportion of carcasses in the good yield class (class 3) and the proportion of barrow carcasses that were too lean (compared to class 3) was roughly equal to the proportion of female pigs that were too fat.

Carcass and meat quality results by sex are presented in Tables 17 and 18. Significant differences were observed with regards to the half-carcass weight, loin eye area, carcass length, ham and shoulder weights and yields as well as texture, fat firmness and loin marbling. These differences in performance are comparable to those seen in previous trials.

2.7 Performance by breeding scheme

Tables 11 to 14 present the performance, carcass and meat quality of both breeding schemes. The results in the “Yield –” correspond to the lower lean yield breeding scheme while the results of the column "Yield +" correspond to the higher lean yield breeding scheme. The two breeding schemes of Trial 29 are from Pen Ar Lan. For the high lean yield breeding scheme, piglets were born from a cross between Naïma sows and P76 boars. For the low lean yield breeding scheme, piglets were born from a cross between Naïma sows and Huron boars. Trial 30 piglets originated from three groups of herds: *Nucléus porcin du Québec*, *la Société des éleveurs de porcs du Québec* and *Sogeporc* (*La Coop fédérée*). Piglets from both breeding schemes were born from a crossbred Yorkshire-Landrace sow inseminated with Duroc semen. The difference between both breeding schemes pertains to the sires used during services. To produce high lean yield piglets, inseminations were carried out using semen from Duroc boars with high estimated breeding values (EBVs) for lean yield. With regards to the low lean yield breeding scheme, piglets were sired by a group of Duroc boars that had a low EBV for lean yield. The average lean yield EBV (weighted average) of boars in the high group was +0.46% whereas the average lean yield EBV from the low group of boars was -1.09% (Purebred genetic evaluation program and promotion of the hybrid female, July 2012). Thus, a lean yield difference of about 0.75% was expected between the two breeding schemes for Trial 30.

Performance differences between both breeding schemes were only observed for five traits linked to growth rate; a higher initial weight (+0.92 kg) and lower 50-75 kg ADG (-23.24g/d) were observed for the "Yield –" group. Additionally, the "Yield –" group had lower Destron lean depth (-1.46 mm) and drip loss (-0.57%) whereas marbling scores were higher in low lean yield pigs (+0.17%) than in high lean yield pigs (Yield +). According to published studies and results from previous trials carried out at the Deschambault testing station, a lower lean yield breeding scheme is often associated with lower lean depth and higher marbling score and belly weight. However, the difference in performance between both breeding schemes with regards to growth rate and drip loss cannot be directly associated with these high or low lean yield breeding schemes. These performance differences could have arisen from more specific characteristics of the studied lines.

The results are a little surprising and disappointing because no differences in lean yield were observed between both breeding schemes. Some factors, however, can explain the small difference in lean yield observed between both breeding schemes.

Firstly, the choice of breeding schemes was not optimal. Participants of these trials support the project financially and participate in them on a voluntary basis. Consequently, we were concerned about getting significant lean yield differences between breeding schemes from the beginning at the registration of participants for the trials. On one hand, the expected lean yield difference between both breeding schemes used in Trial 29 (between progeny sired by Huron and P76 boars) was 0.75% (Raphaël Bertinotti, personal communication). On the other hand, expected lean yield difference between the two schemes used in Trial 30, considering the breeding values of both groups of boars, was also 0.75%. The experimental design used was able to detect an actual difference of 0.54% with 80% power and an actual difference of 0.38 with a power of 50%. To detect a significant difference, an absolute numerical difference greater than 0.38% would have been required. In this case, the observed difference in lean yield was 0.20%. The observed difference in performance between the two diverging groups with regards to genetic values is often less than expected performance. Among possible explanations, there are that the environment differs between the testing station and nucleus herds, EBVs are predicted and not true breeding values, and the crossbreeding system affects the expression of genetic potential.

Secondly, a fire at the CIPQ boar stud in December 2010 had two negative effects. For one, several boars chosen for services were lost in the fire. Some participants had a very limited list of available boars and the lean yield differences between groups were smaller than expected. Secondly, lean yield is an unconventional trait because it is calculated from two other measures (lean depth and backfat). Thus, to obtain lean yield differences between breeding schemes, two traits need to be considered instead of just one, which reduces chances of success. For example, the choice of extreme boars for one trait, such as backfat or lean depth, would have increased our chances of finding differences in the progeny's performance for these two traits because the difference in genetic values would have been greater.

2.8 Performance of feeding programs

Tables 11 to 14 show adjusted values for production, carcass and meat quality performance for both feeding programs. The “Control” feeding program was the diet that was richer in protein and amino acid content. It meets more than 100% of the daily requirements of commercial hogs and it is the feeding program that was used during previous trials at the Deschambault testing station. The “Test” feeding program was the diet with reduced nutritional content. This feeding program had lower protein and amino acid content than the “Control” feeding program. Appendix 1 presents the nutritional specifications and formulation of both feeding programs as defined in the protocol, before carrying out both trials.

Performance differences between both feeding treatments were observed for seven traits. The pigs fed the “Test” diet had a lower lean yield (-0.31%) and loin eye area (-1.17cm^2) whereas Destron backfat thickness (+0.62mm), ultrasound backfat thickness (0.44mm) at 75kg, feed conversion for the 50-75kg period (+0.068kg/kg), fat firmness (+2.50) and marbling score (+0.22points) were higher.

The comparison of both feeding programs has allowed obtaining lean yield differences between both groups. These results are below expectations and information found in the literature. Appendix 2 presents certain nutritional analysis results of both feeding programs, which were done at the end of both trials. Nutritional analyses were carried out by the *Centre de recherche en sciences animales de Deschambault* (CRSAD) laboratory and by the Evonik company.

Analysis results show that the differences between the diets did not respect the original protocol. The protocol aimed for an average reduction of 29% in the lysine content between the "Control" and "Test" groups for the entire rearing period. Analysis results show that there was a reduction of 15.9 and 17.9% in lysine content for Trials 29 and 30, respectively, twice lower than expected. These analytical results explain the sometimes weak or non-significant difference in performance that was observed between the two feeding programs for traits of interest such as lean yield, backfat thickness, lean depth, loin eye area, growth rate and feed conversion.

Studies on this topic show that amino acid requirements (lysine) of pigs vary with age, genetics, environmental conditions (crowding and temperature) and herd health status. In several trials, at a constant energy level, performance improves with increasing lysine content until it reaches a plateau (quadratic effect). Given that the ‘Control’ ration used at the centre is rich in protein and amino acids to maximize pig performance, the differences between both diets was not as large (lysine content reduction of 15.9 (Trial 29) and 17.9% (Trial 30) compared to the targeted reduction of 29%) and that the pigs were raised in rearing conditions that were not very restrictive, the results are partly explainable.

However, in commercial herds, where the composition of diets is at times different and the crowding and immune challenges are greater, it is possible that the reduction in lysine content of rations as seen in these two trials may have had no impact on the pig performance. Pastorelli *et al.* (2011), showed in a meta-analysis that pigs exposed to the following health challenges: bacterial infection, poor housing conditions, mycotoxicoses, parasites or respiratory infections had rapidly deteriorating performance (reduced feed intake and average daily gain of 8 to 23% and 16 to 29%, respectively, depending on the nature of the health challenge). In fact, environmental stressors and immune challenges have a negative effect on feed intake and alter the use of nutrients that are no longer used for growth and protein deposition.

In a commercial setting, the reduced protein and amino acid content can significantly affect pig performance based on the conditions that are prevalent in the herd.

Thereby, in light of the obtained results, the hypotheses with regards to the feeding program of these two trials could not be addressed because rations that were distributed to the pigs did not meet the targeted lysine content required in the protocol.

Conclusions

Overall, the mortality rates in Trials 29 and 30 were comparable to previous commercial trials. During the test phase, the mortality rate was low (< 5 %) in both trials, with the mortality rate in Trial 29 being lower than in Trial 30.

During these two trials, pigs had excellent growth performance which indicates that the conditions in the station allowed the animals to adequately express their genetic potential. Performance data for several traits (i.e. growth rate, meat quality, etc.) were comparable to those observed in previous trials.

Although we observed very little differences in performance data for lean yield and for other correlated traits between feeding treatments and between breeding schemes, we can retain the following positive aspects: these trials have generated individual data with variations in lean yield and performance data between station-tested pigs which can be used for the development of a simulation tool. The participating producers in these trials have obtained performance results on their genetics to the different treatments that were applied. These results can help producers define the selection objectives of their lines, for example, to determine their targets with regards to lean yield.

It is important to underline that the objective of both trials was to draw general conclusions on all tested lines with low or high lean yield submitted to two different feeding programs. The study provided ambivalent results. For both feeding treatments under study, these trials showed that a 15% reduction in lysine has little effect on the performance of station-tested pigs.

A second report presenting the economic impact of different scenarios considering different breeding schemes and feeding programs is also available. These scenarios will be checked against different production parameters such as feed costs and pork prices.

References

Pastorelli H. et al. 2011, Meta-analysis of feed intake and growth responses of growing pigs after a sanitary challenge. Animal 6: 952-961.

Raphaël Bertinotti, Pen Ar Lan Canada Director, personal communication.

Table 1 **Program of preventive medication in feed during the acclimation period (Trial 29 and 30)**

Feed	Medication	Antibiotic content	Duration (d)	Medications (g/pig)	Costs ($/pig[5])
Phase 1	Chlortetracycline[1] Tiamulin[2]	110 mg/kg 31 mg/kg	9	0.19	0.028463 $
Phase 2	Non medicated	---	9	---	---
Phase 3	Trimethoprim sulfa[3]	450 mg/kg	9	4.09	0.65 $
Phase 4	Tylosin[4]	44 mg/kg	27	0.82	0.19 $
		Trial 29 total	**54**	**5,10**	**0.87 $**
Phase 1	Chlortetracycline[1] Tiamulin[2]	110 mg/kg 31 mg/kg	11	0.23	$0.034789
Phase 2	Non medicated	---	7	---	---
Phase 3	Trimethoprim sulfa[3]	450 mg/kg	10	4.55	$0.73
Phase 4	Tylosin[4]	44 mg/kg	27	0.82	$0.16
		Trial 30 total	**55**	**5.60**	**$0.92**

[1] Aureomycin 220® by Alpharma
[2] Denagard® by Novartis
[3] Uniprim® by Bio-Agri-Mix
[4] Tylan 40® by Elanco
[5] CDMV price excluding taxes

Table 2 **Program of preventive medication in water (H_2O) and by injection (Inj.) during the acclimation period (Trials 29 and 30)**

Pathway	Medication	Antibiotic content	Weight (kg)	Dosage (mg/kg)	Duration (d)	Medication (g/pig)	Cost ($/pig[6])
H_2O	Tiamulin[1]	100 mg/L	4.82	31.1	5	0.75	0.53
Inj.	Circovirus vaccine[2]	1 dose	6.72	---	1	1.00	1.80
Inj.	Doramectin[3]	10 mg/ml	7.88	0.6	1	0.01	0.17
Inj.	Mycoplasma vaccine[5]	1 dose	23.6	---	1	2.00	0.36
H_2O	Proliferative enteropathy vaccine[6]	1 dose	40.7	---	1	1.00	2.12
	Trial 29 total				**9**	**4.76**	**4.98**
H_2O	Tiamulin[1]	100 mg/L	4.96	30.24	7	1.05	0.74
Inj.	Circovirus vaccine[2]	1 dose	8.04	---	1	1.00	1.80
Inj.	Doramectin[3]	10 mg/ml	15.1	0.4	1	0.01	0.20
Inj.	Mycoplasma vaccine[4]	1 dose	23.7	---	1	2.00	0.36
H_2O	Proliferative enteropathy vaccine[5]	1 dose	28.2	---	1	1.00	2.12
	Trial 30 total				**11**	**5.06**	**5.22**

[1] Denagard® by Novartis
[2] Circoflex® by Boehringer
[3] Dectomax® by Pfizer
[4] M+Pac® by Boehringer
[5] Enterisol Ileitis by Boehringer
[6] CDMV price excluding taxes

Table 3 Curative medication used in pigs from Trials 29 and 30

Pathway	Medication	Posology	Weight (kg)	Dosage (mg/kg)	Length (d)	Medication (g/10 kg)	Costs ($/10 kg[13])
Inj.	Ketoprofen (100)[1]	100 mg/ml	10	3	3	0.09	1.30
Inj.	Ceftiofur (RTU)[2]	50 mg/ml	10	7.5	3	0.225	4.05
Inj.	Tylosin[3]	200 mg/ml	10	8	3	0.24	0.18
Inj.	Penicillin[4]	300 mg/ml	10	45	4	1.8	0.52
Inj.	Trimethoprim sulfa[5]	240 mg/ml	10	16	4	0.64	0.34
Inj.	Dexamethasone[6]	2 mg/ml	10	0.133	5	0.007	0.49
Inj.	Tulathromycin[7]	100 mg/ml	10	25	1	0.025	1.08
Inj.	Ceftiofur[8]	100 mg/ml	10	5	1	0.05	0.47
Inj.	Lincomycin hydrochloride[9]	100 mg/ml	10	10	3	0.3	0.91
Inj.	Trimethoprim sulfa[10]	240 mg/ml	10	16	4	0.64	0.34
Inj.	Trimethoprim sulfa[11]	240 mg/ml	10	16	4	0.64	0.34
H_2O	Trimethoprim sulfa[12]	240 mg/ml	19	52.74	5	0.501	0.02

[1] Anafen® by Merial
[2] Excenel RTU® by Pfizer
[3] Tylan 200® by Elanco
[4] Depocillin® by Intervet
[5] Borgal® by Hoechst
[6] Dexamethasone 2® by Vétoquinol
[7] Draxxin® by Pfizer
[8] Excede 100® by Pfizer
[9] Lincomix 100® by Pfizer
[10] Dofatrim-Ject® by Rafter 8
[11] Trimidox® by Vétoquinol
[12] 200-130 330G Formula by Bond and Beaulac
[13] CDMV price excluding taxes

Table 4 Piglet performance during the acclimation period of Trials 29-30

Feeding phase	Number of piglets	Age (days)	Duration (days)	Weight (kg)	ADG (g/jour)	Feed (kg)	Feed intake (kg)		Feed conversion
							/day	/piglet	
1	678	13.2 to 23.2	10.0	4.9 to 5.9	96	757	0.111	1.12	1.16
2	677	23.2 to 31.2	8.0	5.9 to 8.0	265	1 672	0.310	2.47	1.17
3	677	31.2 to 40.7	9.5	8.0 to 13.1	532	4 628	0.720	6.84	1.35
4	673	40.7 to 67.7	27.0	13.1 to 30.2	630				
Overall	678	13.2 to 67.7	54.5	4.9 to 30.2	460				

Table 5 Individual treatment reasons during acclimation and test periods

	Trial 29		Trial 30	
Reasons for treatment[1]	**Acclimation**	**Test**	**Acclimation**	**Test**
Overall poor condition	1	4	18	16
Locomotion problems	4	13	13	13
Digestive problems	0	2	10	0
Respiratory problems	4	5	33	2
Nervous system problems	1	0	4	0
Other conditions	1	5	0	18
Total number of piglets treated	**11**	**29**	**78**	**49**

[1] A piglet may have been treated several times for different causes

Table 6 **Treatments administered to pigs from Trials 29 (n = 326) and 30 (n = 352) during the acclimation period (A) and the test period (T)**

Local	Administration (justification)	AD[1] (n)	DT[2] (n)	IU[3] (%)	Medications[4] (g/pig)	Costs[5] ($/pig)
A	Feed (preventive)	17 521	14 634	83.52	5.13	0.85
A	Water (preventive)	17 521	1 630	9.30	0.76	0.53
A	Injectable (preventive)	17 521	974	5.56	3.01	2.36
A	Injectable (curative)	17 521	37	0.21	0.03	0.03
T	Water (preventive)	26 712	321	1.20	1.01	2.17
T	Water (curative)	26 712	96	0.36	0.57	0.42
A - T	**Total for Trial 29**	**44 233**	17 692	100.15	**10.51**	**6.36**
A	Feed (preventive)	19 140	16 815	87.85	5.70	0.98
A	Water (preventive)	19 140	2 464	12.87	1.07	0.77
A	Injectable (preventive)	30 425	1725	5.67	5.00	0.23
A	Injectable (curative)	19 140	1 040	5.43	3.00	2.44
A	Water (preventive)	19 140	288	1.50	0.29	0.25
T	Water (curative)	30 425	335	1.10	1.01	2.17
T	Injectable (curative)	30 425	162	0.53	0.56	0.57
A - T	**Total for Trial 30**	**49 565**	22 829	114.95	**16.63**	**7.41**

[1] Animal-days (AD). This indicator represents the cumulative number of animals present every day in the nursery and in the grow-finish phase (E.g. D1 = 50 animals, D2 = 50 animals, D3 = 49 animals, Total AD = 149 animals).

[2] Number of therapeutic doses administered (TD). This indicator is equivalent to the number of “AD in treatment.”

[3] Intensity of use (IU). This indicator represents the ratio between TD and AD.

[4] Sum of medication consumed in the premise / average number of pigs in the premise (for the acclimation phase or the testing period before the first batch of pigs was slaughtered).

[5] Sum of the costs of each treatment in the premise / Final number of pigs in the premise (for the acclimation phase or the test period before the first batch of pigs was slaughtered).

Table 7 Causes of death

	Trial 29		Trial 30	
	Acclimation	Test phase	Acclimation	Test phase
Poor condition[1]	0	0	0	0
Wasting	0	0	0	0
Locomotion problems	0	2	1	2
Nervous syst. problems	0	0	0	0
Respiratory problems	0	0	2	2
Sudden death	3	3	8	7
Meningitis	1	1	0	0
Other conditions	1	2	1	1
Total number (%)	**5/326 (1.5)**	**8/322 (2.5)**	**12/352 (3.4)**	**12/342 (3.5)**

1 Piglets in poor condition at the arrival to the testing station (0-3 day(s))

Table 8 Serological controls at the end of test periods

	Trial 29		Trial 30	
	Number of pigs tested	Number of positives	Number of pigs tested	Number of positives
PRRS virus[1]	20	0	20	20
Pleuropneumonia (multi)[2]	20	0	20	1
Mycoplasma hyopneumoniae[3]	20	5 (3 positives and 2 suspected)	20	12 (7 positives and 5 suspected)

1 Test ELISA IDEXX (Laboratoire FMV)

2 Test ELISA App multi (*Actinobacillus pleuropneumoniae*, all serotypes) (Laboratoire FMV)

3 Test ELISA IDEXX (Laboratoire FMV)

Table 9 Distribution of sires, litters, herds and sexes by breeding scheme[1]

	Yield -	Yield +
Number of sires used	N/A	N/A
Number of litters	78	82
Number of herds	11	12
Number of barrows	159	141
Number of females	163	160

1 For the number of piglets entered into the station and for which data were used in analyses

Table 10 Feeding behaviour data

	Total duration of visits/ pig/ day (min)	Number of visits/ pig/ day	Average meal size (g) of pigs	Rate of ingestion (g/min)	Average duration of visits (min)	% of time the feeder was busy prior to the first slaughter	% of total visit time occurring when light is on	% of total visit time occurring from 4:45am to 9:00pm
All								
Overall*	60.8	14.8	235.8	49.4	5.5	50.8	56.4	84.2
30-50 kg*	66.8	16.1	147.8	34.0	5.5	53.5	48.8	79.7
50-75 kg	65.3	16.9	187.2	43.4	5.2	52.6	51.2	82.5
75-120kg	56.4	13.1	291.5	57.8	5.7	47.8	60.8	86.2
Barrows								
Overall*	65.3	15.9	236.1	48.8	5.5	51.9	53.6	82.8
30-50 kg*	68.2	17.2	144.7	34.2	5.4	53.0	48.1	79.0
50-75 kg	70.2	18.2	190.5	42.9	5.2	54.2	49.0	81.4
75-120 kg	61.5	14.2	293.8	57.3	5.8	49.5	57.3	84.5
Females								
Overall*	57.2	13.8	235.5	50.0	5.5	49.8	58.8	85.5
30-50 kg*	65.4	15.1	150.7	33.9	5.6	54.1	49.5	80.3
50-75 kg	61.5	15.9	184.6	43.8	5.1	51.2	53.1	83.4
75-120 kg	52.3	12.2	289.6	58.3	5.6	46.0	63.7	87.7

* Includes only results from Trial 29

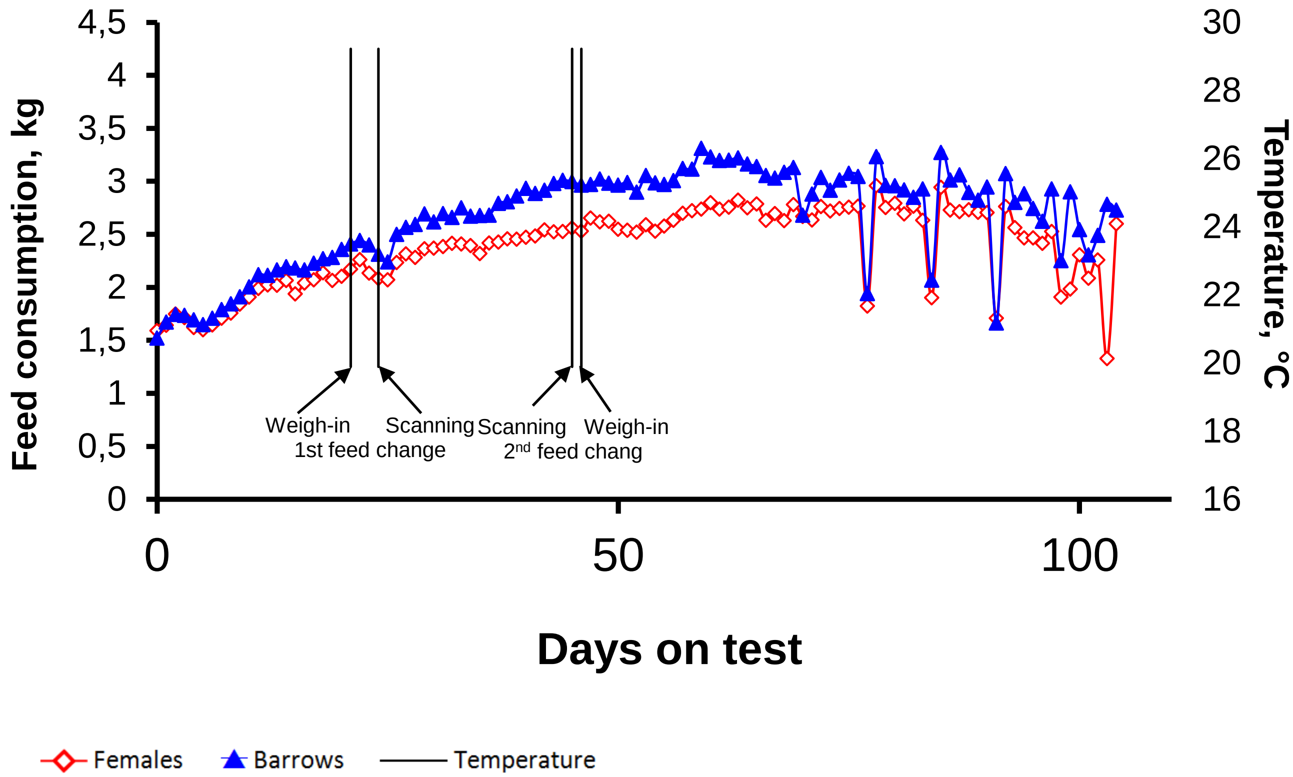
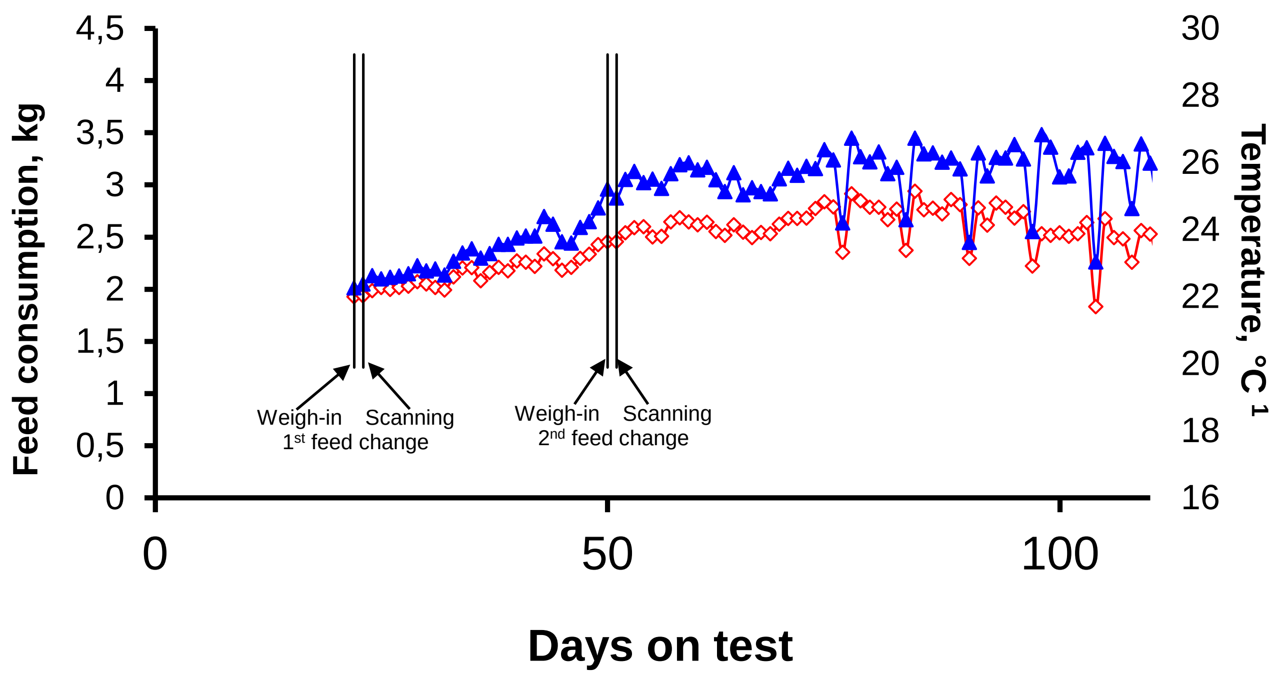


Figure 1 Evolution of the average daily consumption and temperature during Trial 29



[1] Average calculated temperature = the average of minimum and maximum temperatures

Figure 2 Evolution of the average daily consumption and temperature during Trial 30

Table 11 **Effect of breeding scheme and feeding treatment on performance**

Variables	N	Overall	Breeding scheme				Feeding program			
			Yield +	Yield -	Diff.	Prob.	Test	Control	Diff.	Prob.
Growth performance										
Off test age, d	623	154.57	153.73	155.40	1.67	0.058	154.64	154.50	-0.14	0.839
Trial duration, d	623	86.96	86.31	87.61	1.30	0.105	87.09	86.83	-0.26	0.703
On-test weight, kg	623	30.29	29.83	30.76	0.92	0.000	30.58	30.01	-0.58	0.598
Off-test weight, kg	623	119.97	120.16	119.78	-0.39	0.114	119.75	120.19	0.43	0.052
ADG, g/d	623	1043.62	1053.40	1033.84	-19.56	0.101	1 039.85	1 047.39	7.54	0.376
Pre-slaughter backfat (Ultrasound), mm	622	15.72	15.52	15.93	0.42	0.399	16.10	15.36	-0.74	0.113
Pre-slaughter lean depth (Ultrasound), mm	622	67.11	67.25	66.96	-0.30	0.548	67.07	67.14	0.06	0.859
Feed intake performance										
Total feed intake, kg	303	212.12	211.00	213.25	2.25	0.549	212.42	211.83	-0.59	0.765
Daily feed intake, kg/d	303	2.55	2.57	2.52	-0.05	0.219	2.55	2.54	-0.01	0.690
Feed conversion	303	2.45	2.44	2.47	0.03	0.488	2.46	2.45	-0.01	0.667
Carcass yield										
Hot carcass weight, kg	618	96.29	96.13	96.46	0.33	0.136	96.38	96.20	-0.18	0.338
Carcass yield, %	618	80.33	80.19	80.47	0.29	0.113	80.42	80.24	-0.18	0.242
Backfat (Destron) (mm)	597	18.31	18.22	18.40	0.18	0.664	18.62	18.00	-0.62	0.015
Lean depth (Destron) (mm)	597	65.20	65.93	64.47	-1.46	0.012	64.94	65.47	0.53	0.767
Lean yield, %	597	60.81	60.89	60.74	-0.15	0.422	60.66	60.97	0.31	0.008
Index (Quebec grading grid)	564	112.47	112.29	112.65	0.37	0.175	112.33	112.62	0.29	0.275

Table 12 Effect of breeding scheme and feeding treatment on performance by phase

Variables	N	Overall	Breeding scheme				Feeding program			
			Yield +	Yield -	Diff.	Prob.	Test	Control	Diff.	Prob.
Growth performance										
On-test weight (kg)	623	30.29	29.83	30.76	0.922	0.000	30.583	30.005	-0.578	0.598
Weight at first feed change (kg)	623	50.61	50.66	50.56	-0.099	0.721	50.370	50.846	0.476	0.120
Weight at second feed change (kg)	623	77.94	78.32	77.57	-0.748	0.069	77.568	78.318	0.750	0.146
Off-test weight (kg)	623	119.97	120.16	119.78	-0.386	0.114	119.752	120.186	0.434	0.052
Backfat 50 kg (mm)	623	9.12	9.03	9.21	0.177	0.251	9.226	9.021	-0.205	0.315
Backfat 75 kg (mm)	623	11.17	11.12	11.22	0.095	0.637	11.389	10.953	-0.436	0.005
Pre-slaughter backfat (mm)	622	15.72	15.52	15.93	0.417	0.399	16.100	15.358	-0.743	0.113
Lean depth 50 kg (mm)	623	44.34	44.43	44.25	-0.185	0.725	44.253	44.424	0.171	0.721
Lean depth 75 kg (mm)	623	54.84	55.02	54.67	-0.357	0.358	54.666	55.021	0.356	0.264
Pre-slaughter lean depth (mm)	622	67.11	67.25	66.96	-0.296	0.548	67.075	67.137	0.062	0.859
Performance by period										
Daily feed intake 30-50 kg (kg/day)	303	1.95	1.97	1.92	-0.049	0.198	1.946	1.951	0.005	0.869
Daily feed intake 50-75 kg (kg/day)	578	2.41	2.44	2.39	-0.047	0.100	2.431	2.397	-0.034	0.211
Daily feed intake 75 kg to the end (kg/day)	621	2.88	2.90	2.86	-0.042	0.189	2.876	2.887	0.011	0.660
ADG 30-50 kg (g/day)	623	992.07	991.18	992.95	1.762	0.920	980.072	1 004.059	23.987	0.139
ADG 50-75 kg (g/day)	619	1036.68	1048.31	1025.06	-23.246	0.042	1 032.493	1 040.872	8.379	0.437
ADG 75 kg to the end (g/day)	623	1071.39	1084.92	1057.87	-27.048	0.097	1 073.759	1 069.029	-4.730	0.698
Feed conversion 30-50 kg	303	1.86	1.85	1.87	0.016	0.687	1.884	1.838	-0.046	0.067
Feed conversion 50-75 kg	578	2.32	2.30	2.34	0.035	0.506	2.357	2.288	-0.068	0.005
Feed conversion 75 kg to the end	623	2.78	2.76	2.80	0.037	0.291	2.770	2.792	0.022	0.539

Table 13 Effect of breeding scheme and feeding treatment on carcass quality

Variables	N	Overall	Breeding scheme				Feeding program			
			Yield +	Yield -	Diff.	Prob.	Test	Control	Diff.	Prob.
Primal cuts										
Reconstituted half carc. (kg)	607	41.91	41.85	41.97	0.12	0.420	41.92	41.90	-0.01	0.912
Loin eye area (cm²)	603	48.83	49.13	48.54	-0.59	0.369	48.25	49.42	1.17	0.003
Carcass length (cm)	617	83.28	83.13	83.44	0.31	0.191	83.25	83.31	0.06	0.669
Leg weight (kg)	614	11.07	11.09	11.06	-0.03	0.630	11.08	11.07	-0.01	0.852
Loin weight (kg)	613	11.14	11.15	11.13	-0.02	0.810	11.15	11.13	-0.02	0.700
Shoulder weight (kg)	607	11.74	11.71	11.77	0.07	0.216	11.73	11.75	0.02	0.689
Belly weight (kg)	613	7.93	7.89	7.98	0.10	0.068	7.93	7.94	0.01	0.911
Leg yield (%)	607	26.46	26.55	26.37	-0.18	0.149	26.46	26.45	-0.01	0.941
Loin yield (%)	607	26.60	26.67	26.53	-0.14	0.281	26.62	26.57	-0.05	0.672
Shoulder yield (%)	607	28.00	27.95	28.05	0.10	0.383	27.97	28.02	0.05	0.665
Belly yield (%)	607	18.93	18.84	19.02	0.18	0.154	18.92	18.95	0.03	0.762

Table 14 **Effect of breeding scheme and feeding treatment on meat quality**

Variables	N	Overall	Breeding scheme				Feeding program			
			Yield +	Yield -	Diff.	Prob.	Test	Control	Diff.	Prob.
Loin										
Ultimate pH	612	5.57	5.56	5.57	0.01	0.546	5.56	5.57	0.00	0.448
Luminosity	614	52.61	52.74	52.48	-0.26	0.646	52.80	52.43	-0.37	0.203
Color	615	3.49	3.47	3.52	0.05	0.359	3.49	3.50	0.01	0.747
Texture (1=soft, 3=firm)	618	2.47	2.44	2.49	0.06	0.448	2.49	2.44	-0.05	0.314
Muscle firmness (durometer)	599	8.91	8.38	9.44	1.07	0.064	9.06	8.77	-0.29	0.553
Fat firmness (durometer)	616	61.59	60.94	62.23	1.29	0.278	62.83	60.33	-2.50	0.008
Marbling (NPPC)	615	2.48	2.40	2.57	0.17	0.020	2.59	2.37	-0.22	0.000
Drip loss (%)	619	4.39	4.68	4.11	-0.57	0.035	4.52	4.26	-0.25	0.197
Ham										
Ultimate pH	615	5.58	5.57	5.58	0.01	0.460	5.58	5.57	0.00	0.544
Luminosity	618	52.90	53.14	52.65	-0.49	0.103	52.99	52.81	-0.18	0.398
Color	619	3.65	3.61	3.68	0.07	0.089	3.64	3.65	0.01	0.785
Bicolour index	619	1.72	1.72	1.71	-0.02	0.679	1.70	1.73	0.02	0.525
Technical yield (%)	616	127.84	127.68	128.00	0.32	0.583	127.91	127.76	-0.16	0.342

Table 15 Effect of sex and main effect interactions on performance

Variables	N	Overall	Sex				Main effect interactions			
			Barrows	Females	Diff.	Prob.	Line x treatment	Line x sex	Sex x treatment	Sex x line x treatment
Growth performance										
Off-test age, d	623	154.57	151.32	157.81	6.49	0.000	0.804	0.928	0.044	0.181
Trial duration, d	623	86.96	83.74	90.18	6.44	0.000	0.770	0.804	0.044	0.170
On-test weight, kg	623	30.29	30.44	30.15	-0.29	0.788	0.382	0.771	0.834	0.076
Off-test weight, kg	623	119.97	120.44	119.50	-0.93	0.537	0.505	0.297	0.301	0.379
ADG, g/d	623	1043.62	1 086.30	1 000.94	-85.36	0.000	0.755	0.304	0.215	0.224
Pre-slaughter backfat (Ultrasound), mm	622	15.72	17.10	14.46	-2.64	0.000	0.940	0.311	0.713	0.392
Pre-slaughter lean depth (Ultrasound), mm	622	67.11	66.51	67.70	1.19	0.001	0.710	0.925	0.777	0.489
Feed intake performance										
Total feed intake, kg	303	212.12	215.45	208.80	-6.64	0.002	0.350	0.594	0.212	0.136
Daily feed intake, kg/day	303	2.55	2.69	2.41	-0.28	0.000	0.390	0.737	0.582	0.097
Feed conversion	303	2.45	2.49	2.42	-0.08	0.002	0.435	0.556	0.258	0.136
Carcass yield										
Hot carcass weight, kg	618	96.29	96.10	96.48	0.38	0.310	0.760	0.797	0.846	0.250
Carcass yield, %	618	80.33	80.16	80.50	0.34	0.393	0.746	0.692	0.805	0.210
Backfat (Destron) (mm)	597	18.31	19.78	16.94	-2.84	0.000	0.714	0.434	0.617	0.443
Lean depth (Destron) (mm)	597	65.20	63.86	66.55	2.69	0.077	0.511	0.678	0.728	0.517
Lean yield, %	597	60.81	60.11	61.51	1.40	0.000	0.922	0.728	0.768	0.390
Index (Quebec slaughter grid)	564	112.47	112.49	112.45	-0.04	0.875	0.841	0.187	0.115	0.242

Table 16 Effect of sex and main effect interactions on performance by phase

Variable	N	Overall	Sex				Main effect interactions			
			Barrows	Females	Diff.	Prob.	Line x treatment	Line x sex	Sex x treatment	Sex x line x treatment
Growth performance										
On-test weight (kg)	623	30.29	30.442	30.147	-0.295	0.788	0.382	0.771	0.834	0.076
Weight at first feed change (kg)	623	50.61	51.125	50.090	-1.035	0.001	0.892	0.534	0.590	0.805
Weight at second feed change (kg)	623	77.94	79.774	76.112	-3.662	0.000	0.328	0.627	0.295	0.492
Off-test weight (kg)	623	119.97	120.435	119.503	-0.932	0.537	0.505	0.297	0.301	0.379
Backfat 50 kg (mm)	623	9.12	9.404	8.851	-0.553	0.008	0.713	0.361	0.031	0.183
Backfat 75 kg (mm)	623	11.17	11.817	10.557	-1.260	0.000	0.901	0.298	0.151	0.691
Pre-slaughter backfat (mm)	622	15.72	17.099	14.460	-2.639	0.000	0.940	0.311	0.713	0.392
Lean depth 50 kg (mm)	623	44.34	43.965	44.712	0.748	0.215	0.937	0.348	0.969	0.610
Lean depth 75 kg (mm)	623	54.84	54.617	55.070	0.453	0.147	0.494	0.723	0.593	0.528
Pre-slaughter lean depth (mm)	622	67.11	66.513	67.699	1.185	0.001	0.710	0.925	0.777	0.489
Performance by period										
Daily feed intake 30-50 kg (kg/day)	303	1.95	2.007	1.890	-0.118	0.001	0.114	0.754	0.639	0.696
Daily feed intake 50-75 kg (kg/day)	578	2.41	2.559	2.269	-0.290	0.000	0.169	0.070	0.511	0.725
Daily feed intake 75 kg to the end (kg/day)	621	2.88	3.086	2.677	-0.409	0.000	0.869	0.145	0.957	0.070
ADG 30-50 kg (g/day)	623	992.07	1 017.079	967.053	-50.026	0.000	0.533	0.239	0.401	0.717
ADG 50-75 kg (g/day)	619	1036.68	1 086.955	986.411	-100.544	0.000	0.181	0.151	0.798	0.669
ADG 75 kg to the end (g/day)	623	1071.39	1 117.825	1 024.964	-92.861	0.000	0.306	0.183	0.156	0.031
Feed conversion 30-50 kg	303	1.86	1.851	1.872	0.021	0.387	0.184	0.510	0.558	0.659
Feed conversion 50-75 kg	578	2.32	2.340	2.304	-0.036	0.128	0.763	0.885	0.684	0.828
Feed conversion 75 kg to the end	623	2.78	2.865	2.698	-0.166	0.000	0.212	0.653	0.144	0.127

Table 17 **Effect of sex and main interaction effects on carcass quality**

Variables	N	Overall	Sex				Main effects interactions			
			Barrows	Females	Diff.	Prob.	Line x treatment	Line x sex	Sex x treatment	Sex x line x treatment
Primal cuts										
Reconstituted half carc. (kg)	607	41.91	41.71	42.11	0.40	0.013	0.903	0.925	0.638	0.505
Loin eye area (cm²)	603	48.83	47.05	50.69	3.64	0.000	0.942	0.808	0.071	0.355
Carcass length (cm)	617	83.28	82.83	83.73	0.90	0.000	0.703	0.193	0.106	0.837
Leg weight (kg)	614	11.07	10.89	11.26	0.37	0.000	0.696	0.329	0.328	0.050
Loin weight (kg)	613	11.14	11.07	11.21	0.14	0.406	0.713	0.300	0.865	0.222
Shoulder weight (kg)	607	11.74	11.81	11.67	-0.14	0.006	0.796	0.594	0.599	0.323
Belly weight (kg)	613	7.93	7.92	7.95	0.04	0.388	0.078	0.646	0.526	0.423
Leg yield (%)	607	26.46	26.13	26.79	0.67	0.000	0.833	0.265	0.405	0.005
Loin yield (%)	607	26.60	26.57	26.63	0.06	0.629	0.403	0.495	0.678	0.053
Shoulder yield (%)	607	28.00	28.29	27.71	-0.58	0.000	0.798	0.529	0.366	0.625
Belly yield (%)	607	18.93	18.99	18.87	(0.12)	0.212	0.141	0.401	0.575	0.099

Table 18 Effect of sex and main effect interactions on meat quality

			Sex				Main effect interactions			
Variables	**N**	**Overall**	**Barrows**	**Females**	**Diff.**	**Prob.**	**Line x treatment**	**Line x sex**	**Sex x treatment**	**Sex x line x treatment**
Loin										
Ultimate pH	612	5.57	5.57	5.56	-0.01	0.438	0.023	0.563	0.355	0.330
Luminosity	614	52.61	52.84	52.38	-0.46	0.146	0.471	0.569	0.792	0.886
Color	615	3.49	3.47	3.52	0.05	0.195	0.160	0.668	0.461	0.891
Texture (1=soft, 3=firm)	618	2.47	2.54	2.40	-0.14	0.011	0.158	0.083	0.946	0.847
Muscle firmness (durometer)	599	8.91	9.02	8.80	-0.21	0.713	0.107	0.392	0.770	0.829
Fat firmness (durometer)	616	61.59	67.03	55.62	-11.41	0.000	0.801	0.429	0.923	0.722
Marbling (NPPC)	615	2.48	2.62	2.35	-0.27	0.000	0.543	0.056	0.512	0.570
Drip loss (%)	619	4.39	4.54	4.25	-0.29	0.150	0.143	0.184	0.269	0.772
Ham										
Ultimate pH	615	5.58	5.58	5.57	-0.01	0.478	0.191	0.799	0.178	0.508
Luminosity	618	52.90	53.06	52.73	-0.33	0.129	0.982	0.880	0.305	0.123
Color	619	3.65	3.65	3.65	0.00	0.894	0.760	0.703	0.660	0.764
Bicolour index	619	1.72	1.75	1.68	-0.06	0.620	0.252	0.377	0.594	0.814
Technical yield (%)	616	127.84	127.84	127.84	0.00	0.996	0.301	0.033	0.158	0.567

Appendix 1

Appendix 1

Guaranteed nutritional analysis of the first three feeds served during the acclimation period

Analysis		1st feed	2nd feed	3rd feed
Crude protein (minimum)	%	20.5	19.0	19.0
Crude fiber (maximum)	%	1.6	3.0	3.0
ADF fiber	%	3.1	3.8	3.8
Fat (minimum)	%	8.0	5.0	5.0
Calcium	%	1.1	1.0	1.0
Total phosphorus	%	0.8	0.8	0.8
Sodium	%	0.2	0.2	0.2
Added copper	mg/kg	125	125	125
Added zinc	mg/kg	500	500	500
Added selenium	mg/kg	0.3	0.3	0.3
Added vitamin A	UI/kg	18 000	10 000	10 000
Added vitamin D	UI/kg	1 800	1 000	1 000
Added vitamin E	UI/kg	50	46	46

*Changes are possible based on supplier

Formulations and nutritional specifications of control feeds

Acclimation period			Control feeds — Test period		
		4th feed	Start ~ 25 to 50 kg	Growth 50 to 75 kg	Finishing 75 to 120 kg
Ingredients by 1 000 kg.					
Corn	kg	478.88	520	600	625
Soybean meal (48,0 %)	kg	293.00	250	210	190
Wheat	kg	150.00	150	150	150
Fat (animal)	kg	37.00	35	5	0
Phytase (500 FTU/1000)	kg	0.50	0.50	-----	-----
Phytase (400 FTU/1000)	kg	-----	-----	0.40	-----
Phytase (300 FTU/1000)	kg	-----	-----	-----	0.30
	Total		**1 000**	**1 000**	**1 000**
Predicted nutritional values (as fed)					
Solids	%	88.63	88	88	88
Crude protein	%	20.65	19	17.5	17
Digestible energy per pig	kcal/kg	3 467	3 460	3 325	3 300
Net energy per pig	Kcal/kg	2 515	2 515	2 415	2 415
Crude fiber	%	3. 07	3.0	3.0	3.0
Fat (ether extract)	%	6.08	6.0	3.2	2.8
Calcium	%	0.89	0.80	0.75	0.68
Added copper	mg/kg		75	75	75
Total phosphorus	%	0.57	0.50	0.45	0.42
Digestible phosphorus	%		0.36	0.31	0.27
Total sodium	%	0.19	0.2	0.2	0.2
Added selenium	mg/kg	0.30	0.30	0.30	0.30
Total lysine	%	1.30	1.20	1.08	0.97
Meth. / total lysine ratio		0.35	0.30	0.30	0.30
Meth.+Cyst. / total lysine ratio		0.63	0.63	0.63	0.63
Threonine / total lysine ratio		0.67	0.68	0.68	0.68
Tryptophan / total lysine		0.18	0.18	0.18	0.18
Vomitoxin	mg/kg		Max. 0.5	Max. 0.5	Max. 0.5

Formulations and nutritional specifications of test feeds

		Acclimation period	Test feeds		
			Test period		
		4th feed	Start ~ 25 to 50 kg	Growth 50 to 75 kg	Finishing 75 to 120 kg
Ingredients by 1 000 kg.					
Corn	kg	478.88	Min. 500	Min. 500	Min. 500
Soybean meal (48,0 %)	kg	293.00	Min. 175	Min. 150	Min. 125
Wheat	kg	150.00	150	150	150
Fat (animal)	kg	37.00	35	5	0
Phytase (500 FTU/1000)	kg	0.50	0.50	-----	-----
Phytase (400 FTU/1000)	kg	-----	-----	0.40	-----
Phytase (300 FTU/1000)	kg	-----	-----	-----	0.30
	Total		**1 000**	**1 000**	**1 000**
Predicted nutritional values (as fed)					
Solids	%	88.63	88	88	88
Crude protein	%	20.65	17	15	14
Digestible energy per pig	kcal/kg	3 467	Same amount of energy as for control feed		
Net energy per pig	Kcal/kg	2 515			
Crude fiber	%	3. 07			
Fat (ether extract)	%	6.08			
Calcium	%	0.89	0.80	0.75	0.68
Added copper	mg/kg		75	75	75
Total phosphorus	%	0.57	0.50	0.45	0.42
Digestible phosphorus	%		0.36	0.31	0.27
Total sodium	%	0.19	0.2	0.2	0.2
Added selenium	mg/kg	0.30	0.30	0.30	0.30
Total lysine	%	1.30	1.00	0.75	0.65
Meth. / total lysine ratio		0.35	0.30	0.30	0.30
Meth.+Cyst. / total lysine ratio		0.63	0.63	0.63	0.63
Threonine / total lysine ratio		0.67	0.68	0.68	0.68
Tryptophan / total lysine		0.18	0.18	0.18	0.18
Vomitoxin	mg/kg		Max. 0.5	Max. 0.5	Max. 0.5

Appendix 2

Appendix 2

Bilan des analyses de moulées Épreuves #29

Chimie humide effectué chez Evonik

Type de moulées		Début Contrôle		écart	Début Test		écart
		Théorique	analyse	réel vs théo	Théorique	analyse	réel vs théo
Matière sèche	%	88	84,06		88	86,51	
Protéine Brute	%	18,95	20,17	106,44%	16,5	16,46	99,76%
Lysine totale	%	1,35	1,08	80,00%	1	0,99	99,00%
Méthionine totale	%	0,41	0,36	87,80%	0,32	0,3	93,75%
Cystine totale	%	0,28	0,32	114,29%	0,26	0,26	100,00%
M+C totale	%	0,71	0,69	97,18%	0,59	0,56	94,92%
Thréonine totale	%	0,81	0,82	101,23%	0,68	0,68	100,00%
Tryptophane	%	0,23			0,2		
Arginine Totale	%	1,13	1,36	120,35%	0,99	1,04	105,05%

Type de moulées		Croissance Contrôle		écart	Croissance test		écart
		Théorique	analyse	réel vs théo	Théorique	analyse	réel vs théo
Matière sèche	%	88	84,94		88	84,74	
Protéine Brute	%	17,5	17,89	102,23%	15	15,85	105,67%
Lysine totale	%	1,07	0,96	89,72%	0,75	0,72	96,00%
Méthionine totale	%	0,35	0,32	91,43%	0,23	0,25	108,70%
Cystine totale	%	0,27	0,28	103,70%	0,25	0,25	100,00%
M+C totale	%	0,63	0,61	96,83%	0,48	0,51	106,25%
Thréonine totale	%	0,73	0,73	100,00%	0,55	0,6	109,09%
Tryptophane	%	0,21			0,18		
Arginine Totale	%	1,06	1,14	107,55%	0,9	0,92	102,22%

Type de moulées		Finition Contrôle		écart	Finition test		écart
		Théorique	analyse	réel vs théo	Théorique	analyse	réel vs théo
Matière sèche	%	88	86,7		88	85,81	
Protéine Brute	%	16,1	15,96	99,13%	13,1	14,29	109,08%
Lysine totale	%	0,97	0,8	82,47%	0,64	0,69	107,81%
Méthionine totale	%	0,3	0,25	83,33%	0,21	0,23	109,52%
Cystine totale	%	0,26	0,26	100,00%	0,22	0,25	113,64%
M+C totale	%	0,56	0,51	91,07%	0,43	0,47	109,30%
Thréonine totale	%	0,65	0,58	89,23%	0,47	0,52	110,64%
Tryptophane	%	0,19			0,15		
Arginine Totale	%	0,96	0,96	100,00%	0,75	0,83	110,67%

Bilan des analyses de moulées Épreuves #30

Chimie humide effectué chez Evonik

Type de moulées		Début Contrôle		écart	Début Test		écart
		Théorique	analyse	réel vs théo	Théorique	analyse	réel vs théo
Matière sèche	%	88	87,41		88	88,15	
Protéine Brute	%	18,95	19,17	101,16%	16,5	18,02	109,21%
Lysine totale	%	1,35	1,14	84,44%	1	1,19	119,00%
Méthionine totale	%	0,41	0,37	90,24%	0,32	0,35	109,38%
Cystine totale	%	0,28	0,29	103,57%	0,26	0,28	107,69%
M+C totale	%	0,71	0,67	94,37%	0,59	0,62	105,08%
Thréonine totale	%	0,81	0,74	91,36%	0,68	0,74	108,82%
Tryptophane	%	0,23			0,2		
Arginine Totale	%	1,13	1,25	110,62%	0,99	1,14	115,15%

Type de moulées		Croissance Contrôle		écart	Croissance test		écart
		Théorique	analyse	réel vs théo	Théorique	analyse	réel vs théo
Matière sèche	%	88	88		88	87,88	
Protéine Brute	%	17,5	18,65	106,57%	15	16,3	108,67%
Lysine totale	%	1,07	1,16	108,41%	0,75	0,82	109,33%
Méthionine totale	%	0,35	0,35	100,00%	0,23	0,25	108,70%
Cystine totale	%	0,27	0,3	111,11%	0,25	0,27	108,00%
M+C totale	%	0,63	0,65	103,17%	0,48	0,52	108,33%
Thréonine totale	%	0,73	0,75	102,74%	0,55	0,59	107,27%
Tryptophane	%	0,21			0,18		
Arginine Totale	%	1,06	1,18	111,32%	0,9	0,99	110,00%

Type de moulées		Finition Contrôle		écart	Finition test		écart
		Théorique	analyse	réel vs théo	Théorique	analyse	réel vs théo
Matière sèche	%	88	87,47		88	87,38	
Protéine Brute	%	16,1	16,6	103,11%	13,1	14,93	113,97%
Lysine totale	%	0,97	0,98	101,03%	0,64	0,79	123,44%
Méthionine totale	%	0,3	0,3	100,00%	0,21	0,24	114,29%
Cystine totale	%	0,26	0,28	107,69%	0,22	0,26	118,18%
M+C totale	%	0,56	0,58	103,57%	0,43	0,5	116,28%
Thréonine totale	%	0,65	0,65	100,00%	0,47	0,55	117,02%
Tryptophane	%	0,19			0,15		
Arginine Totale	%	0,96	1,02	106,25%	0,75	0,89	118,67%

Appendix 3

Appendix 3

Definition of variables

Variables	Abbreviations (units)	Description
Nursery-Growth Performance		
Age	Age (d)	Age at the beginning and at the end of the period.
Duration	Duration (d)	End date – start date of the period.
Weight	Weight (kg)	Weight at the beginning and at the end of the period.
Average daily gain	ADG (g/d)	Final weight – initial weight/number of piglet days. For the overall period and for each of the feeding phases.
Total feed consumption	Feed(kg)	Total quantity of feed consumed for all piglets during the period. For the overall period and for each of the feeding phases.
Daily feed intake*	Feed intake/day (kg/d)	Feed intake per piglet per day. For the overall period and for each of the feeding phases.
Feed intake per piglet*	Feed intake/piglet (kg/piglet)	Total feed intake per piglet. For the overall period and for each of the feeding phases.
Feed conversion on live weight gain*	F.C. live weight gain	Overall feed intake for all pens/live weight gain for all piglets. For the overall period and for each of the feeding phases.

* Feed intake in the nursery was measured for all piglets and not on an individual basis.

Test-Growth performance		
Age at the beginning of the trial	Initial age (d)	Age at the beginning of the trial
Age at the end of the trial	Final age (d)	Age on the day of shipment to the slaughterhouse prior to fasting
Duration of trial	Trial duration (d)	Date at the end of the test- date at the beginning of the test
Weight at the beginning of the trial	Initial weight (kg)	Weight at the beginning of the trial
Weight at the end of the trial	Final weight (kg)	Weight on the day of shipment to the slaughterhouse prior to fasting
Average daily gain	ADG (g/d)	Final weight – initial weight / number of days For the overall period and for each of the feeding phases.
Repeated measures		
Backfat thickess	Backfat (mm)	Backfat thickness measurement between 3rd and 4th last ribs on the live animal Frequency: at 50kg, 75kg, every two weeks thereafter and prior to shipment to the slaughterhouse. Ultrasound machine in B mode
Lean depth	Lean depth (mm)	Loin depth measurement between 3rd and 4th last ribs on the live animal Frequency: at 50kg, 75kg, every two weeks thereafter and prior to shipment to the slaughterhouse. Ultrasound machine in B mode

Feed efficiency performance		
Total feed intake per pig	Total feed intake (kg)	Total feed intake during the trial
Daily feed intake per pig	Feed intake/day (kg)	Total feed intake per pig / duration of the trial For the overall period and for each of the feeding phases
Feed conversion on live weight gain	F.C. live weight gain	Feed intake per pig/live weight gain. For the overall period and for each of the feeding phases.

Variables	Abbreviations (units)	Description
Carcass yield		
Hot carcass weight	Hot weight (kg)	Hot carcass weight after exsanguination and evisceration with head, tongue, leaf fat, kidneys, jowl, feed and no trimmings
Carcass yield	Carcass yield (%)	(Hot carcass weight/Live weight at the end of the trial) x 100
Grading index (good stratum)	Average index	Average index of carcasses that are in the good stratum of defined weight according to the grading grid that is in effect
Lean yield	Lean yield (%)	Carcass lean yield calculated from the prediction equation established by Agriculture and Agri-Food Canada
Half-carcass length	Length (cm)	Measure on the head side of the first rib to the anterior part of the pubic bone (Foster's rule)

Primal cut		
Half-carcass weight	½ carcass weight recons. (kg)	Half carcass weight reconstituted from the 4 primal cuts: ham, loin, shoulder and belly; does not include legs.
Loin eye area	Loin eye area (cm2)	Area measured from a digital photo and image J software
Ham weight	Ham weight (kg)	Cut perpendicular to the inferior part of the leg. Cut line at 4.5 cm (1 ¾ inch) from the anterior part of the pubic bone. Without the hind feet and tail.
Loin weight	Loin weight (kg)	The loin is separated from the belly by a cut which being at the extremity of the shoulder, starts at 4.5 cm (1 ¾ inch) from the base of the ribs, extends to 10cm (4 in) to the center of the loin and ends at the ham extremity by running alongside the tenderloin at 2 cm (3/4 inch)
Shoulder weight	Shoulder weight (kg)	The shoulder is separated from the loin and the belly by a cut that is perpendicular to the back and which passes through the centre of the 3rd rib.
Belly weight	Belly weight (kg)	See the description for the loin weight.
Short hip and ½ carcass ratio	Short hip yield (%)	(Ham weight / Half carcass weight) x 100
Loin and ½ carcass ratio	Loin Yield (%)	(Loin weight / Half carcass weight) x 100
Shoulder and ½ carcass ratio	Shoulder Yield (%)	(Shoulder weight / Half carcass weight) x 100
Belly and ½ carcass ratio	Belly yield (%)	(Belly weight / Half carcass weight) x 100

Variables	Abbreviations (units)	Description
Meat quality		
Loin: Measurse taken on the Longissimus dorsi muscle between the 3rd and the 4th last ribs, 24 hours after slaughter		
Ham : Measures taken on theGluteus medius muscle 24 hours after slaughter		
24hr pH (loin and ham)	24hr pH	pH measurement at two (2) locations in the loin muscle using a pH meter One measure is taken in the *gluteus medius* muscle of the ham.
Luminosity (loin and ham)	Luminosity	Reflectance measure taken at 2 spots on the loin muscle using a Minolta CR300 apparatus. One measure only is recorded on the ham in the *gluteus superficialis* muscle..
Visual colour score (loin and ham)	Colour	Scores determined by comparison to Meat Colour Samples from the Japanese Colour Scale (1 to 6). In the ham, scoring is made on the *gluteus superficialis* muscle
Visual Intramuscular Fat Score measured on the loin	Marbling	Measure of the marbling level according to the NPPC scale (1 to 10)
Loin drip loss	Drip loss (%)	Measure performed on a muscle tissue sample collected from the anterior portion of the loin and drip dried for 48 hours. (Water loss of muscle / fresh muscle weight) x 100

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