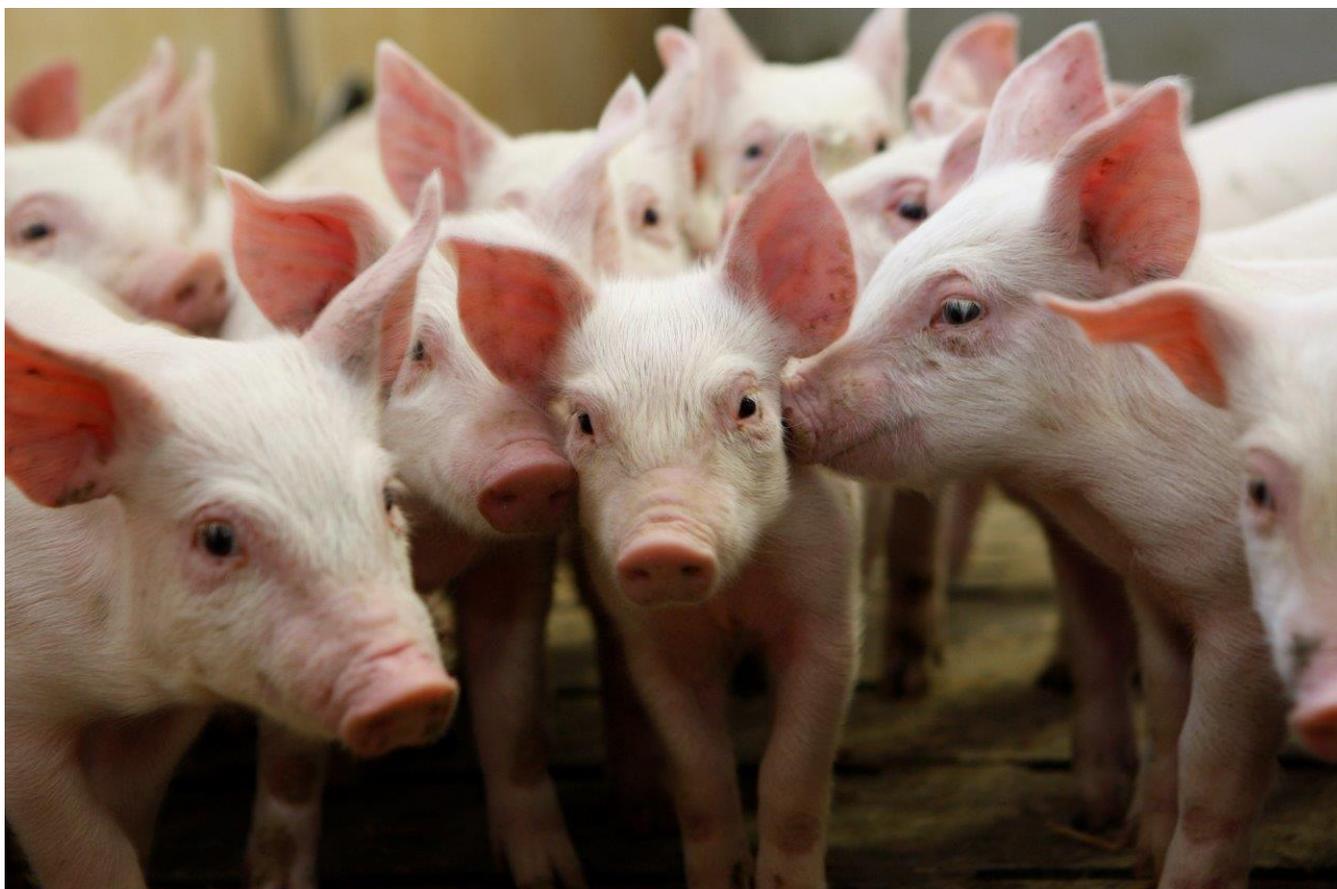


Skjoldborg test station

# TestGris\*\*\*

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Birk Centerpark 24, 7400 Herning  
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Performance effects of four weaning diets in nursery pigs (V)

Test conducted on request from Hamlet Protein  
Authors: Dorthe Carlson and Niels Ove Nielsen

June 2020

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## Summary

This test aimed to test the effect of 4 different diets (HPA, HPB, HPC and HPD) fed in the period from 2-6 weeks after weaning on piglet performance. The piglets were followed until 6 weeks after weaning. The main differences between the diets were the type and level of soy protein concentrate.

Piglet performance was measured as average daily gain (ADG), feed intake (FI) and feed conversion ratio (FCR; kg feed per kg gain) under practical pig production conditions.

When piglets showed signs of diarrhoea or were unthriving they were removed to a disease pen (where necessary medical treatment was given).

No significant differences between the 4 diets in any of the feeding phases were observed. The ADG during the 43-day long test period was 450 to 458 g/d, the average FI was in the range 665-685 g/day and the FCR was 1.46 to 1.51 kg/kg.

## Introduction

This study was conducted on request from Hamlet Protein in the period March 16 (2020) to May 26 (2020) at Skjoldborg test station.

The test aimed to test the effect of 4 different diets fed the first 4 weeks after weaning on performance during the first 6 weeks after weaning.

The 4 diets were designated “HPA”, “HPB”, “HPC” and “HPD”.

The test was designed to test the effect of the diets on average daily gain (ADG), feed intake (FI) and feed conversion ratio (FCR; kg feed per kg gain) in weaned piglets under practical pig production conditions.

## Materials and methods

### Animals, diets and protocol

The test station is a conventional (Health status: Blue Spf + myc + AP6 +AP12+Vac.) integrated production, which runs weekly operation in the sow unit.

The test included a total of 2804 Danbred crossbred (Landrace/Yorkshire x Duroc) female and castrated male piglets with approximately the same number of both genders. The piglets were weaned at  $25 \pm 3$  days of age.

Housing conditions for piglets complied fully with EU and Danish legislation. Five similar rooms of 12 double-pens were used. Rooms were cleaned and disinfected before insertion of piglets. The double-pens were traditionally structured sharing two dry feed dispensers integrated in the mid-pen wall partitioning the double-pen in two pens. Of the 12 double-pens per room only 8 were used for this trial. The piglets were group housed in pens and allocated randomly; females and castrated males mixed on both sides of the feed dispensers. Thus, two pens around 2 feeders constitute one observation (photo of pen design in Appendix A). Around 35 piglets were inserted in every pen after weaning resulting in 702, 702, 698 and 702 pigs in the HPA, HPB, HPC and HPD group, respectively. Pens are designed as 2-climate pens with an insulated piglet nest and a slatted activity area.

At the day of weaning, all piglets were distributed in pens according to size (small, small/medium, large/medium and Large). The average body weight of piglets in the pens was in the range of 5.1 to 7.5 kg. The double-pens were allocated to one of four diets i.e. two dry feed dispensers for each diet per room. The average initial body weight of the piglets was 6.25, 6.24, 6.24 and 6.26 kg for diet HPA, HPB, HPC and HPD, respectively

The test period was initiated at the day of weaning and was divided into three phases (Phase A, B and C). Phase A was from day 0 to day 14 (15 days), phase B was from day 14 to day 28 (14 days) and phase C was from day 28 to 42 (14 days), resulting in a total test period of 43 days.

In Phase A all pigs were fed the same diet and in Phase B and Phase C the test diets were provided to the four experimental groups.

Prior to weaning, piglets received a pre-starter diet containing corn, wheat, oat, whey powder, soy protein concentrate, plasma and potato protein.

The diets fed in phase A and phase B were formulated and produced by Hamlet Protein. In phase A all piglets received the same diet and in phase B, 4 different diets were fed to the 4 experimental groups, respectively. The composition of the test diets was unknown for the personnel at the test station and only limited information was available for the personnel at TestPig<sup>\*\*\*</sup>. The diets fed in phase C were formulated by TestPig<sup>\*\*\*</sup> and optimized to provide nutrients according to the Danish feeding standards for piglets in the weight intervals of 15-30 kg, respectively. Each of the 4 phase C diets were supplemented with 4% of 4 different test mixes (HP A, HP B, HP C and HP D, respectively). The exact composition of the test mixes was unknown to TestPig<sup>\*\*\*</sup>. The phase C diet was produced on farm under the supervision of TestPig<sup>\*\*\*</sup>. The composition of the diets is given in Appendix B. None of the diets contained antibiotics or therapeutic levels of veterinary ZnO in phase A.

The diets fed in phase A and phase B were pelleted and crumbled and the diet in phase C were fed as meal feed. All diets were fed *ad libitum*. The diets were supplied when requested by a sensor in one of the 2 feed dispensers up to several times per day. When delivered to the individual feed dispensers, the amount of diet dropped into the feeders was registered by weight. The pigs had permanent access to fresh water from 2 types of nipple drinkers; one separate and one that was built into the feed dispensers.

If pigs showed signs of diarrhoea, they were moved to a disease pen (taken out of test) where medical treatment was given.

## Registrations

The piglets were weighed when allocated to the pens at the day of insertion. Subsequently, they were weighed when changing to phase B and phase C diets and at the end of test. All pigs in one pen were weighed as a unit. Whenever a pig was taken out of the study due to death or disease the weight was recorded.

Before change to the next feeding phase any feed residues in the feed dispenser was weighed and subtracted from the amount supplied in the previous phase

The amount of feed produced per feed dispenser per day was recorded by the feeding computer.

The normal procedure was followed in respect of registration of any medical treatment (including treatment days) against diarrhoea and infections.

## Calculations and statistics

Average daily gain per piglet was calculated as the difference in weight at insertion and exit of each feeding phase (A, B and C) as well as the overall period from weaning to end of trial at day 43. The body weight used was an average of the piglets in the double pen sharing the two dry feed dispensers.

Feed intake (FI) was calculated as the amount of feed provided per feed dispenser minus the remaining feed residues and feed taken out for chemical analyses in the feeding periods.

In all calculations, data were adjusted for number and weight of piglets taken out of trial.

Pigs taken out of study (PTO) were calculated as percentage of the initial number of piglets in each phase (A, B and C) as well as the total period (A-C).

All statistical analyses were done in cooperation with the Danish Technological Institute, Department of field trials, technology and analysis, Aarhus, Denmark. Animal performance data were statistically analysed by the GLMM procedure of R (R Core Team, 2014).

ADG, FI and FCR in phase A, phase B, phase C and the total test period were analysed in a Gaussian mixed effect model including “initial body weight at day 0”, “weekly batch” and “diet” (HPA, HPB, HPC and HPD). “weekly batch” was included in the model as a random parameter and “diet” was included in the model as a fixed parameter. Statistical significance was accepted at  $P < 0.05$ .

Standard model control for all outcome variables were performed to assure that the normality assumptions for the models were met. This was not true for FI and FCR in phase B and therefore the test statistics were not accurate. To obtain a more accurate test of treatment effect, bootstrapping was applied to the analysis of FI and FCR in phase B.

Data on PTO were not statistically analysed and hence these data are only presented in a descriptive way.

## Results and comments

In general, piglets maintained good health during the experiment. Based on veterinary diagnosis (lung disease), all pigs in test received treatment with Doxycyclin (Doxx-Sol®) in the drinking water for the first 5 days after weaning. There were no other treatment days against any specific diseases for pigs that stayed in test.

The results on performance in terms of ADG, FI and FCR for the different feeding phases is presented in Table 1. No significant differences between the 4 diets in any of the feeding phases were observed. The ADG during the 43-day long test period was 450 to 458 g/d, the average FI was in the range 665-685 g/day and the FCR was 1.46 to 1.51 kg/kg.

Table 1. Average daily gain (ADG), feed intake (FI) and feed conversion ratio (FCR) in phase A (6-9 kg) phase B (9-15 kg), phase C (15-30 Kg) and the whole test period (A-C) of pigs fed the four experimental diets.

|          | Phase | Diet |      |      |      | P-value | LSD  |
|----------|-------|------|------|------|------|---------|------|
|          |       | HPA  | HPB  | HPC  | HPD  |         |      |
| ADG, g/d | A     | 181  | 180  | 182  | 189  | 0.52    | 13   |
|          | B     | 488  | 489  | 492  | 499  | 0.79    | 24   |
|          | C     | 714  | 723  | 694  | 695  | 0.53    | 49   |
|          | A-C   | 455  | 458  | 450  | 455  | 0.87    | 18   |
| FI, g/d  | A     | 239  | 240  | 239  | 252  | 0.15    | 13   |
|          | B     | 681  | 680  | 692  | 706  | 0.26    | 29   |
|          | C     | 1132 | 1104 | 1097 | 1128 | 0.23    | 42   |
|          | A-C   | 674  | 665  | 666  | 685  | 0.16    | 20   |
| FCR,     | A     | 1.33 | 1.34 | 1.32 | 1.34 | 0.73    | 0.06 |
|          | B     | 1.40 | 1.40 | 1.41 | 1.42 | 0.35    | 0.03 |

|         |     |      |      |      |      |      |      |
|---------|-----|------|------|------|------|------|------|
| kg      | C   | 1.59 | 1.55 | 1.59 | 1.63 | 0.55 | 0.12 |
| feed/kg | A-C | 1.48 | 1.46 | 1.48 | 1.51 | 0.29 | 0.06 |
| gain    |     |      |      |      |      |      |      |

<sup>x</sup> Values are LS-means (n=16).

<sup>ab</sup> LS-Means within rows without a common superscript differ (P<0.05).

The average piglet weight ( $\pm$  standard deviations) on day 43 was 25.5 ( $\pm$  1.5), 25.7 ( $\pm$  2.2), 25.3 ( $\pm$  1.9) and 25.6 ( $\pm$  1.5) kg for HPA, HPB, HPC and HPD, respectively.

In Table 3, Table 4 and Table 5 the number of pigs taken out in percentage of the number of pigs inserted in each phase of the study is presented. The reason for taking the pigs out included different kinds of veterinary observations e.g. diarrhoea, hernia, arthritis etc. The health data were not statistical analysed. The descriptive data indicate that there was no effect of diet on number of pigs taken out or on the reasons for taking the pigs out.

Table 3. Pigs taken out of study (PTO, number of pigs) in phase A (day 0-14) divided on the experimental diets and the reason for taking it out and PTO in % of total number of experimental pigs.

| Reason                    | HPA  | HPB  | HPC  | HPD  |
|---------------------------|------|------|------|------|
| <b>PTO:</b>               |      |      |      |      |
| Disease pen               | 12   | 10   | 7    | 7    |
| Dead                      | 1    | 1    | 0    | 0    |
| Euthanized                | 1    | 0    | 0    | 0    |
| <b>Reason:</b>            |      |      |      |      |
| Diarrhoea and un-thriving | 12   | 9    | 6    | 6    |
| Arthritis                 | 2    | 1    | 1    | 1    |
| Cerebrospinal Meningitis  | 0    | 0    | 0    | 0    |
| Blood ear                 | 0    | 0    | 0    | 0    |
| Hernia                    | 0    | 0    | 0    | 0    |
| Other                     | 0    | 1    | 0    | 0    |
| <b>PTO (% of total):</b>  |      |      |      |      |
| Disease pen (%)           | 1.71 | 1.42 | 1.00 | 1.00 |
| Dead (%)                  | 0.28 | 0.14 | 0.00 | 0.00 |

Table 4. Pigs taken out of study (PTO, number of pigs) in phase B (day 15-28) divided on the experimental diets and the reason for taking it out and PTO in % of total number of experimental pigs.

| Reason                    | HPA  | HPB  | HPC  | HPD  |
|---------------------------|------|------|------|------|
| <b>PTO:</b>               |      |      |      |      |
| Disease pen               | 8    | 8    | 9    | 17   |
| Dead                      | 2    | 0    | 0    | 0    |
| Euthanized                | 1    | 1    | 2    | 2    |
| <b>Reason:</b>            |      |      |      |      |
| Diarrhoea and un-thriving | 6    | 7    | 6    | 10   |
| Arthritis                 | 2    | 0    | 3    | 3    |
| Cerebrospinal Meningitis  | 0    | 0    | 0    | 0    |
| Blood ear                 | 1    | 0    | 0    | 0    |
| Hernia                    | 1    | 1    | 2    | 2    |
| Tail biting               | 0    | 0    | 0    | 4    |
| Other                     | 1    | 0    | 0    | 0    |
| <b>PTO (% of total):</b>  |      |      |      |      |
| Disease pen (%)           | 1.16 | 1.16 | 1.30 | 2.45 |
| Dead (%)                  | 0.44 | 0.14 | 0.29 | 0.29 |

Table 5. Pigs taken out of study (PTO, number of pigs) in phase C (day 19-42) divided on the experimental diets and the reason for taking it out and PTO in % of total number of experimental pigs.

| Reason                   | HPA  | HPB  | HPC  | HPD  |
|--------------------------|------|------|------|------|
| <b>PTO:</b>              |      |      |      |      |
| Disease pen              | 1    | 7    | 4    | 3    |
| Dead                     | 0    | 0    | 1    | 0    |
| Euthanized               | 0    | 0    | 1    | 1    |
| <b>Reason:</b>           |      |      |      |      |
| Diarrhoea and unthriving | 1    | 1    | 3    | 1    |
| Arthritis                | 0    | 2    | 0    | 0    |
| Cerebrospinal Meningitis | 0    | 0    | 1    | 0    |
| Blood ear                | 0    | 0    | 1    | 2    |
| Hernia                   | 0    | 1    | 1    | 1    |
| Tail biting              | 0    | 3    | 0    | 0    |
| Other                    | 0    | 0    | 0    | 0    |
| <b>PTO (% of total):</b> |      |      |      |      |
| Disease pen (%)          | 0.15 | 1.03 | 0.59 | 0.44 |
| Dead (%)                 | 0.00 | 0.00 | 0.29 | 0.15 |

To sum up the data in table 3 to 5 the percentage of pigs moved to a disease pen and the percentage of pigs that died during the 6-week test period is presented in Table 1.

Table 6. Pigs taken out of study (PTO, %) in the total test period (day 0-42)

| Reason          | HPA  | HPB  | HPC  | HPD  |
|-----------------|------|------|------|------|
| Disease pen (%) | 2,99 | 3,56 | 2,87 | 3,85 |
| Dead (%)        | 0,71 | 0,28 | 0,57 | 0,57 |

## Conclusion

It is concluded that the 4 diets fed in phase B and phase C provided the same level of pig performance in this trial.

Appendix A. Photo of the pens used for test



## Appendix B. Feed ingredients in test diets

Table 1. Feed ingredients (%) in the diet provided to all experimental pigs in phase A (6-9 kg).

|                             | Content (%) |
|-----------------------------|-------------|
| Wheat                       | 49.7        |
| Barley                      | 15.0        |
| Milk powder                 | 13.8        |
| Soybean concentrate (HP300) | 11.9        |
| Potato protein              | 2.0         |
| Leci E                      | 2.7         |
| Premix <sup>1</sup>         | 4.9         |

<sup>1</sup>Containing vitamins, minerals, amino acids, phytase, Ronozyme and benzoic acid

Table 2. Feed ingredients (%) in the test diets used in phase B (9-15 kg).

|                     | HPA  | HPB  | HPC  | HPD  |
|---------------------|------|------|------|------|
| Wheat               | 59.2 | 59.0 | 60.5 | 59.4 |
| Corn                | 9.9  | 10.0 | 8.5  | 9.5  |
| Soybean meal        | 5.0  | 5.0  | 5.0  | 5.0  |
| HP300               | 12.4 | 12.4 | 12.3 | 12.4 |
| HP A <sup>1</sup>   | 4.0  |      |      |      |
| HP B <sup>1</sup>   |      | 4.0  |      |      |
| HP C <sup>1</sup>   |      |      | 4.0  |      |
| HP D <sup>1</sup>   |      |      |      | 4.0  |
| Potato protein      | 2.2  | 2.0  | 2.0  | 2.0  |
| Palm oil            | 1.2  | 1.3  | 1.3  | 1.3  |
| Leci E              | 1.5  | 1.5  | 1.5  | 1.5  |
| Premix <sup>2</sup> | 4.8  | 4.8  | 4.9  |      |

<sup>1</sup>Unknown to TestPig

<sup>2</sup>Containing vitamins, minerals, amino acids, phytase, Ronozyme and benzoic acid

Table 3. Feed ingredients (%) in the test diets used in phase C (15-30 kg)

|                     | HPA  | HPB  | HPC  | HPD  |
|---------------------|------|------|------|------|
| Wheat               | 64.6 | 64.5 | 64.6 | 64.6 |
| Soybean meal        | 24.7 | 24.8 | 24.7 | 24.7 |
| HP A <sup>1</sup>   | 4.0  |      |      |      |
| HP B <sup>1</sup>   |      | 4.0  |      |      |
| HP C <sup>1</sup>   |      |      | 4.0  |      |
| HP D <sup>1</sup>   |      |      |      | 4.0  |
| Soy oil             | 1.8  | 1.8  | 1.8  | 1.8  |
| Premix <sup>2</sup> | 4.9  | 4.9  | 4.9  | 4.9  |

<sup>1</sup>Unknown to TestPig

<sup>2</sup>Containing vitamins, minerals, amino acids, phytase, enzymes and benzoic acid