# AXIOM SIRE LINES GUIDE

## TECHNICAL AND NUTRITIONAL

AXIOM

# FOREWORD
# ENSURING SUSTAINABLE PERFORMANCE

**Driven by our passion for swine genetics, we at AXIOM have an unwavering commitment to supporting your pig production activities, and strive to meet your daily requirements.**

This technical and nutritional guide aims to support you in managing AXIOM lines and to help you express the full potential of our boars. Optimum performance is closely correlated with suitable nutrition: accurately meeting nutritional requirements is key to fully developing our lines' genetic potential.

The recommendations provided in this guide are derived from extensive work conducted by our engineering and R&D teams. They have based their work on reliable scientific data and on feedback from breeders.

We wish to consolidate our commitment to combining scientific rigor, on-site performance, and engage all the players in the pig farming industry.

Guillaume Naveau
General Manager - AXIOM

**To help you with the management of pigs sired by AXIOM boars**, this technical and nutritional guide serves as a comprehensive and practical reference tool.

Depending on the markets and production target objectives, AXIOM offers a wide boar range – Pietrain Valens, Thor, Duroc, to name only a few – that meet various requirements:
- Improved meat quality and intramuscular fat rate,
- Carcass quality driven by outstanding lean meat percentage and muscle yield,
- High growth rates with profiles in line with production rates,
- Livestock strength and independence from birth to sale,
- Feed efficiency promoting low Feed Conversion Ratios and reduced feed waste and nutrient output.

To meet these objectives, it is key to suitably characterize the nutritional requirements of pigs sired by AXIOM boars. This guide presents the necessary recommendations to use their full potential on each market, while considering the local particulars and raw materials.

As each farm is unique, we provide a customized approach, with regular contact between our engineering and nutrition teams and yours, to tailor the strategies to your performance and target objectives.

Laurent ROGER
Technical and Marketing Director – AXIOM



**> Flash the code for feedback and reviews from breeders on Axiom genetics via our media library**

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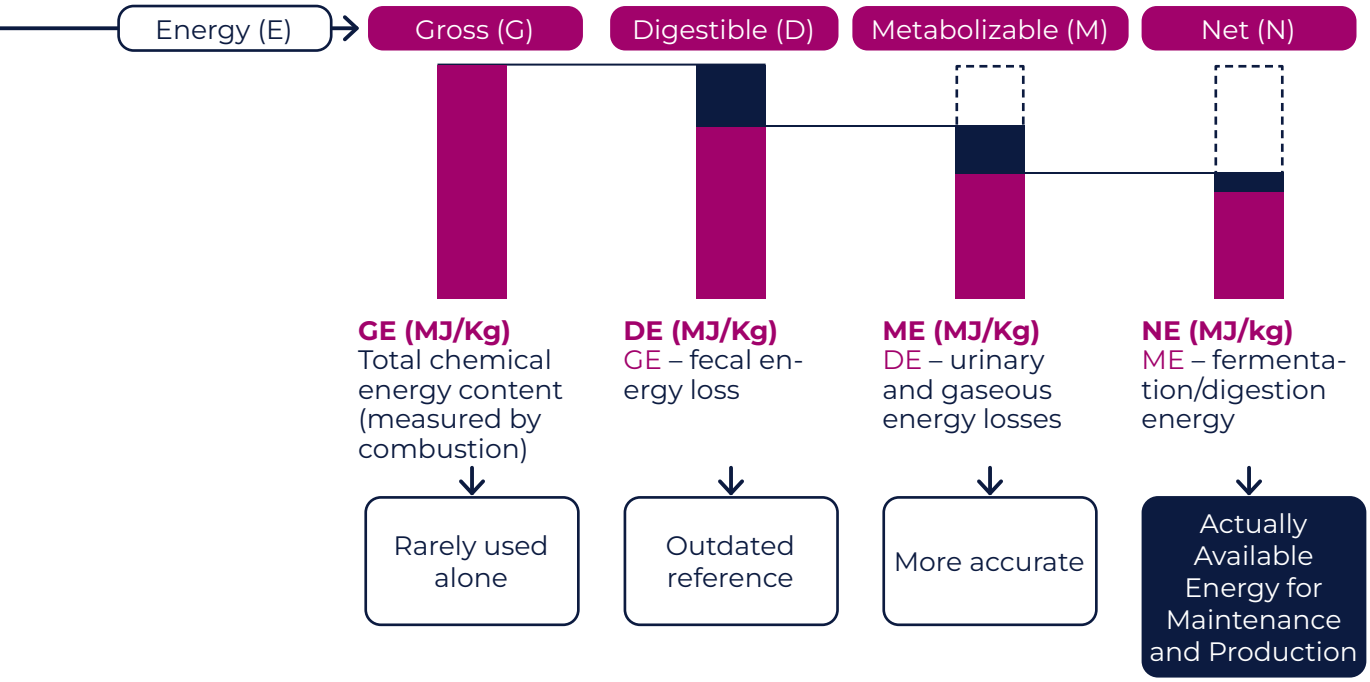
# 1.NUTRITIONAL PRINCIPLES OF FORMULATION
## ENERGY

### > Energy

The net energy requirement is a key factor in pig nutrition, as it directly affects growth, body condition, feed intake and efficiency. AXIOM's nutritional recommendations are provided as Net Energy (MJ/Kg of feed).




A number of energy systems and formulation tables are available.
AXIOM's baseline values are provided according to INRAE tables, whose raw material values are available via the Evapig platform, version 2.0.3.2 of 2020.

Values are also expressed as ME (Metabolizable Energy) and Net Energy, according to the Dutch and Danish system.

Refer to AXIOM's engineering and nutrition teams to adjust the Net Energy values provided in the recommendations tables, according to local production conditions (Immunocastration, uncastrated males, ad libitum or restricted feeding, health conditions and thermal environment, etc.), raw material availability and production objectives.



# 1.NUTRITIONAL PRINCIPLES OF FORMULATION
## PROTEINS AND AMINO ACIDS

### > Proteins and Amino Acids

The digestible amino acid requirements in pigs are key for securing optimum growth, a good Feed Conversion Ratio, and satisfactory carcass quality. They should be expressed as Standardized Ileal Digestible (SID) amino acids, i.e. a fraction that the animal can actually use following intestinal digestion. To optimize feed costs and minimize nitrogen releases into the environment, AXIOM has developed a formulation based on 9 key SID amino acids.

Managing this formulation using these 9 amino acids lowers the feed's total protein content and requires no minimum protein content value in the formulas.

| AA | Grower pig (kg) | Finisher pig (mm) |
|---|---|---|
| SiD Lysine | 100% | 100% |
| SiD M+C | 58% | 58% |
| SiD M | 30% | 29% |
| SiD Threo | 60% | 63% |
| SiD Trp | 18% | 17% |
| SiD Val | 66% | 66% |
| SiD Ile | 50% | 50% |
| SiD Leu | 100% | 100% |
| SiD His | 32% | 32% |

*Formulation minimum value, lysine is set at 100.*

In some geographical areas, using all 9 SID amino acids may not always be possible. As a result, the formulation will need to include a higher total protein content than AXIOM's recommendations.



## > Phosphorus and Calcium

Grower and finisher pigs' phosphorus (P) and calcium (Ca) requirements are key for:

- Bone development
- Energy metabolism
- Feed efficiency
- Welfare (prevention of lameness, locomotion issues)

As with amino acids, requirements should be expressed as digestible forms.

In pigs; several formulation and mineral supplementation systems are available.
Recent studies have enabled a transition from the Digestible Phosphorus formulation (Ingested P - fecal P/ingested P) to STTD P (Standard total tract digestibility): this criterion takes into account endogenous Phosphorous loss.

**Standardized Total Tract Digestibility** (STTD):

- Assesses the amount of actually absorbed minerals (in particular phosphorus (P) and calcium (Ca)
- Corrects apparent digestibility, taking into account basal endogenous losses (non feed-related internal secretions)
- Is cumulative, which promotes rational diet formulation

As opposed to apparent digestibility, STTD is more reliable and accurate.

Likewise, recent research work has made it possible to transition from total calcium to STTD Ca (Standard total tract digestibility).



# 1.NUTRITIONAL PRINCIPLES OF FORMULATION
## PHOSPHORUS AND CALCIUM

**What is calcium STTD?**
**STTD Ca** is the fraction of **calcium that is actually absorbed by pigs**, taking the following into account:

- Digestive losses (fecal)
- Basal endogenous losses (non feed-related, such as intestinal secretions)

STTD Ca is additive, allowing for a more accurate formulation.

**STTD Ca = ingested Ca - fecal Ca + basal endogenous Ca**

STTD Ca is additive, allowing for a more accurate formulation.

Accurate control of these 2 minerals is key for achieving successful pig performance.
In fact, excess calcium in relation to phosphorus induces a drop in phosphorous digestibility, which can generate subdeficiencies, leading to performance loss, and in particular, decreased Feed Conversion Ratios.

AXIOM recommends conducting routine tests on growing-finishing feeds, in order to prevent excess calcium intake: carbonate is often used as a carrier for premixes and various nutritional solutions, which are not taken into account in the formulation, leading to excess calcium content of up to 15 to 25%.

Therefore, AXIOM recommends a maximum analytical calcium content throughout the growing-finishing period (analytical calcium is the total actual calcium that does not take into account any phytase-induced enzymatic valorization).



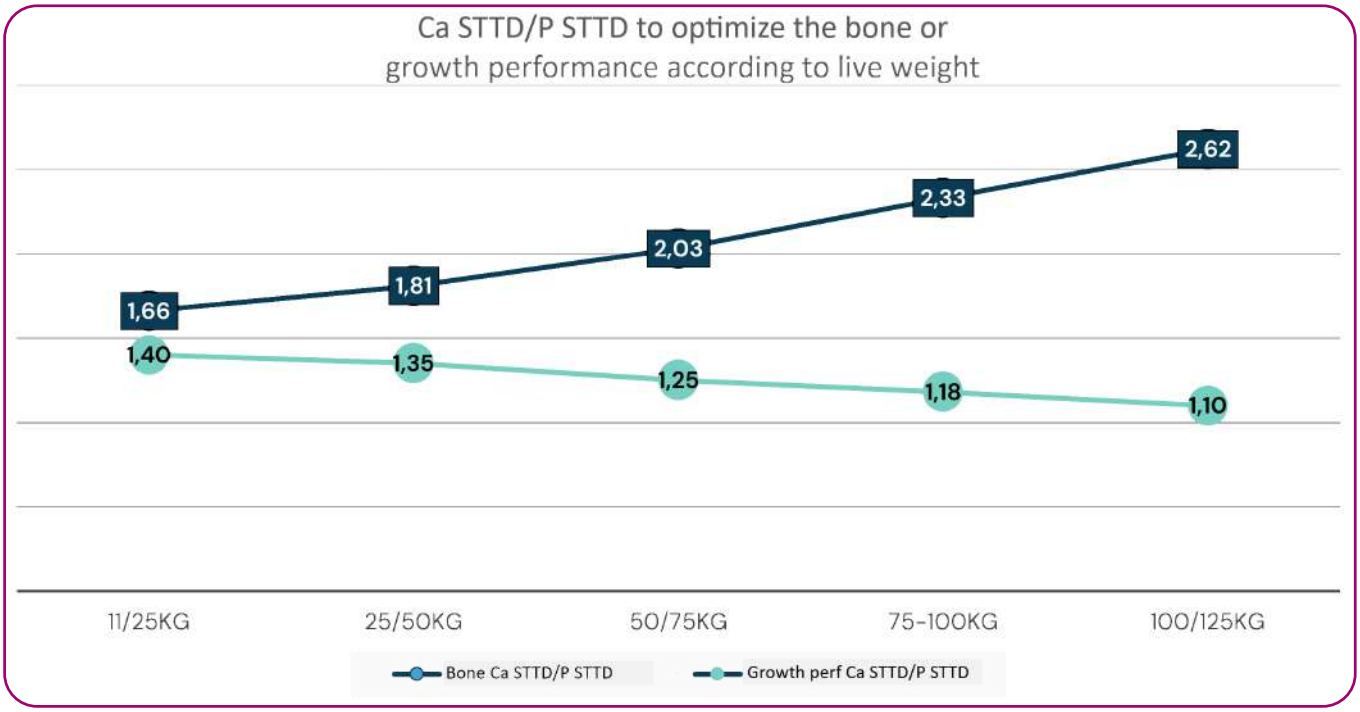
## > Swine Calcium and Phosphorus Requirements

| Live Weights | 5-7 Kg | 7-11 Kg | 11-25 Kg | 25-50 Kg | 50-75 Kg | 75-100 Kg | 100-135 Kg |
|---|---|---|---|---|---|---|---|
| Total Ca | 0.85 | 0.80 | 0.70 | 0.66 | 0.59 | 0.52 | 0.46 |
| Total P | 0.70 | 0.65 | 0.60 | 0.56 | 0.52 | 0.47 | 0.43 |
| STTD P for growth optimization[1] | 0.45 | 0.40 | 0.33 | 0.31 | 0.27 | 0.24 | 0.21 |
| STTD P for P retention optimization[2] | 0.53 | 0.47 | 0.39 | 0.36 | 0.32 | 0.28 | 0.25 |

*[1] Growth performance optimization requirements (NRC, 2012), equivalent to 0.85 of P requirements for maximum P retention throughout the body (primarily P retention in the bones)*

*[2] Requirements to maximize P retention throughout the body, calculated by dividing the requirements to maximize growth requirements by 0.85 (NRC, 2012)*

According to NRC 2012 data, the STTD P/STTD Ca ratio to maximize protein and muscle depositions is very different to that used to optimize bone depositions.

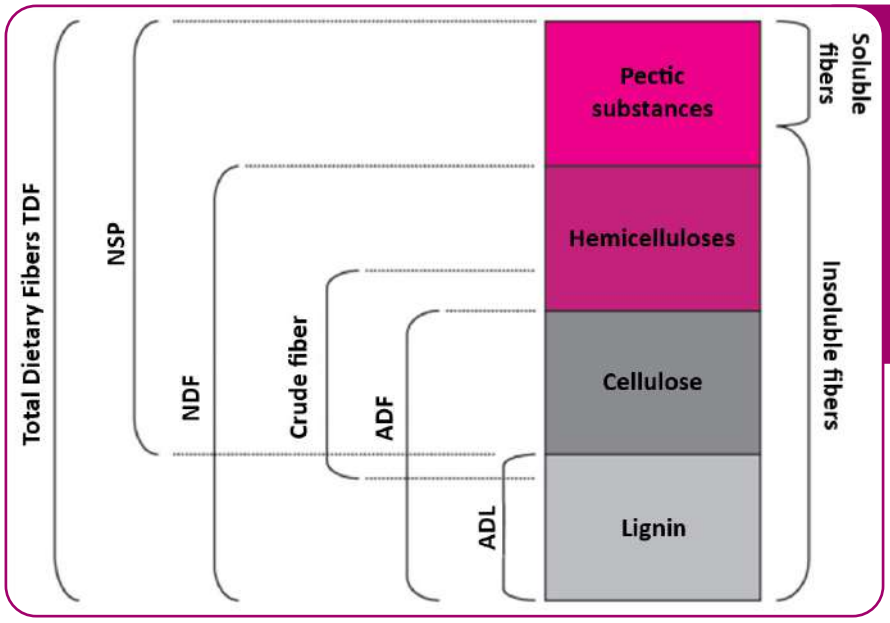



This diagram shows the importance of good Calcium/Phosphorus ratio management. Excess calcium intake promotes bone retention and health, which is advantageous for the boars to be, but leads to a drop in protein and muscle depositions, which is key for carcass quality and for achieving low Feed Conversion Ratios.

To optimize the use of phytic phosphorous in raw materials and minimize phosphorous releases, AXIOM recommends using Phytase across all pig production stages (Refer to AXIOM's document on enzyme use, including phytases).

## > Fibers and Non-Starch Polysaccharides

Non-Starch Polysaccharides (NSPs) are dietary fiber compounds, and their role in growing-finishing pig nutrition is the subject of a growing number of studies, in particular to improve intestinal health and feed efficiency.
NSPs constitute about 90% of the plant cell wall material and are therefore a good indicator of this material.




**Fiber Type Distribution According to Solubility and Analytical Process**

*(TDF, total dietary fiber; NSP, non-starch polysaccharides; NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignine), according to Le Goff (2001).*

The results of tests conducted in pigs have shown that NSPs (non-starch polysaccharides) adversely affect the apparent digestion of proteins, fats and certain minerals.
Moreover, large amounts of fermented NSPs increase the empty hindgut weight.

Considering that organ tissue like the digestive tract is metabolically very active, further energy may be required for maintenance, thus allowing less energy for growth.

Despite all the adverse effects listed above, adding ingredients with a high NSP content to the pigs' diet also has a number of benefits. Their energy value can cover maintenance energy requirements.

Furthermore, the positive effects on pig welfare and health, as well as on ammonia excretion, have been identified and studied. Feeding growing pigs with high total soluble fiber diets (e.g. beet pulp) significantly increases daily enteric methane production.

# 1.NUTRITIONAL PRINCIPLES OF FORMULATION
## FIBERS AND NON-STARCH POLYSACCHARIDES

Feeding growing pigs with high total insoluble fiber diets (e.g. wheat bran) causes a significant drop in the apparent total digestibility of dry matter, organic matter and gross energy.

These results show that strategic ingredient selection according to total fiber type and fiber content can serve as a nutritional strategy to reduce greenhouse gas emissions derived from pig production (E Satarova et al., animal Science technology-2024).
A number of tables characterizing the carbohydrate fraction and NSP content of raw materials are available.

Dietary fiber quantification and characterization is essential to understand the functional benefits (satiety, water retention capacity, pig behavior, effects on the digestive microflora, digestive transit time, etc.) as well as the anti-nutritional effects (cage effect, reduced protein and energy digestibility, etc.).

Moreover, the use of fibrous raw materials can also be associated with other anti-nutritional factors, e.g. mycotoxin contamination (see Appendix).

AXIOM's engineering and nutrition department recommends adding NSPs (xylanase, beta-glucanase, hemicellulase, mannanase, enzyme combination, etc.) to the diet of piglets and growing-finishing pigs (Refer to AXIOM's document on enzyme use, including NSPs).



## > NSP types and content in certain cereals (dry matter %)

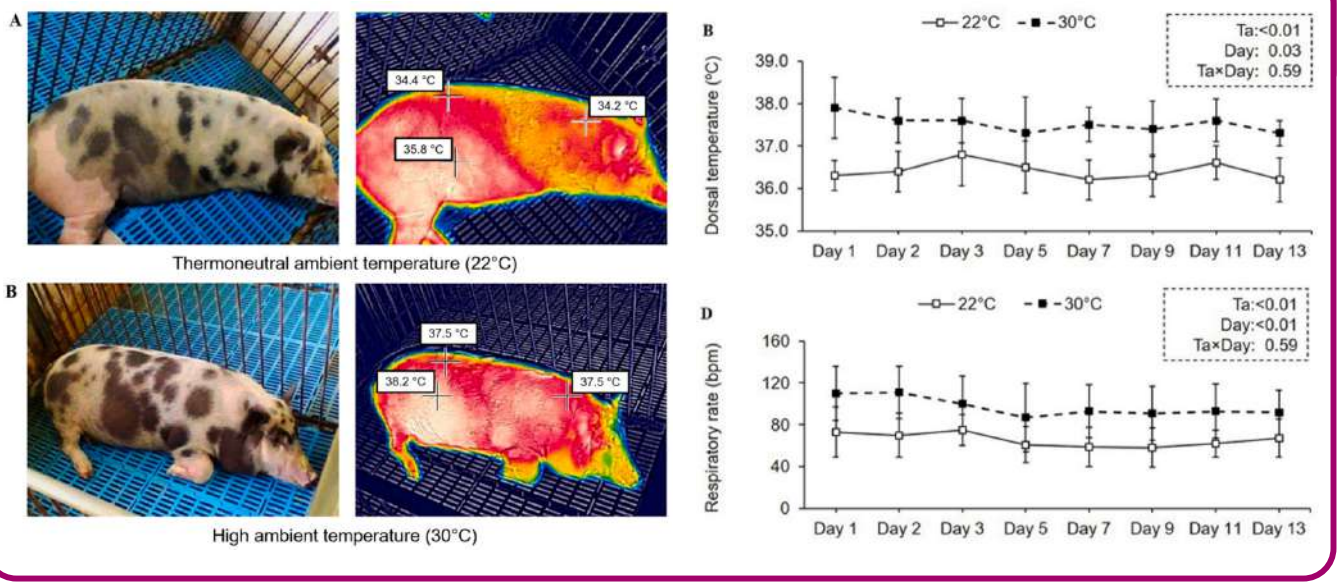
| Cereal | | Arabinoxylan | Beta-glucans | Cellulose | Man | Gal | Uronic Acid | Total |
|---|---|---|---|---|---|---|---|---|
| Wheat[a] | Soluble | 1.8 | 0.4 | - | T | 0.2 | T | 2.4 |
| | Insoluble | 6.3 | 0.4 | 2.0 | T | 0.1 | 0.2 | 9.0 |
| Barley[a] | Soluble | 0.8 | 3.6 | - | T | 0.1 | T | 4.5 |
| | Insoluble | 7.1 | 0.7 | 3.9 | 0.2 | 0.1 | 0.2 | 12.2 |
| Rye[a] | Soluble | 3.4 | 0.9 | - | 0.1 | 0.1 | 0.1 | 4.6 |
| | Insoluble | 5.5 | 1.1 | 1.5 | 0.2 | 0.2 | 0.1 | 8.6 |
| Corn[b] | Soluble | 1.3 | 0.2 | - | 0.02 | 0.1 | 0.1 | 1.7 |
| | Insoluble | 9.5 | 1.5 | 2.5 | 0.6 | 0.4 | 0.1 | 14.6 |
| Triticale[b] | Soluble | 0.1 | 0.1 | - | T | T | T | 0.2 |
| | Insoluble | 2.0 | 0.1 | 2-2 | 0.15 | 0.15 | T | 4.6 |
| Sorghum[b] | Soluble | 0.1 | T | - | T | T | T | 0.1 |
| | Insoluble | 5.1 | - | 2.0 | 0.6 | 0.6 | T | 8.0 |
| Rice (pearled)[b] | Soluble | T | 0.1 | - | T | 0.1 | 0.1 | 0.3 |
| | Insoluble | 0.2 | - | 0.3 | T | T | T | 0.5 |

Enzyme selection is contingent upon the substrate present and its inclusion rate within the diet formulations (xylanase, beta-glucanase, etc.).

## > Thermal Environment

The thermal environment of finisher pigs significantly affects their eating behavior. A higher ambient temperature leads to hyperthermia and increased respiratory rate.

**Effects of Ambient Temperature on Feeding Behavior**
*Alípio dos Reis Teixeira and coll, Journal of Thermal Biology 99 (2021)*

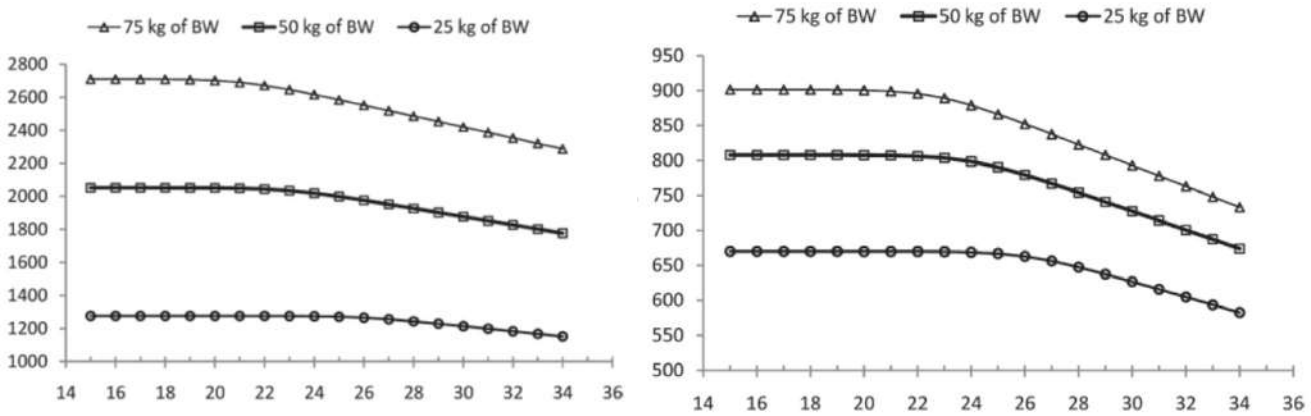


# NUTRITIONAL PRINCIPLES OF FORMULATION- FOCUS ON DIET AND HEAT STRESS

## > Focus on Diet and Heat Stress

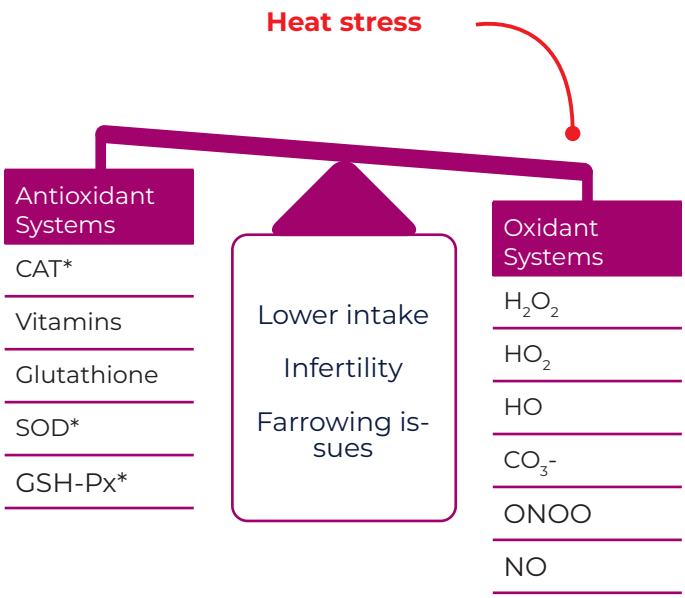
Above 22°C (71-72°F), each degree induces **a drop in voluntary feed intake by 190g/d**, leading to a growth rate drop.

**Feed Intake and Average Daily Gain (ADG) in g/d**




Heat inside the building (heat stress) causes the animals to hyperventilate to release body heat, as pigs do not perspire.
This leads to higher CO2 output through breathing and lower CO2 concentration in the blood: the blood pH increases, the pig is in respiratory alcalosis.

Furthermore, **heat stress** leads to **oxidative stress** (Yan Zhao and coll., Asian-Australas J Anim Sci 2020) in pigs, affecting their health.




**Impact of heat stress on sow health and reproductive performance**

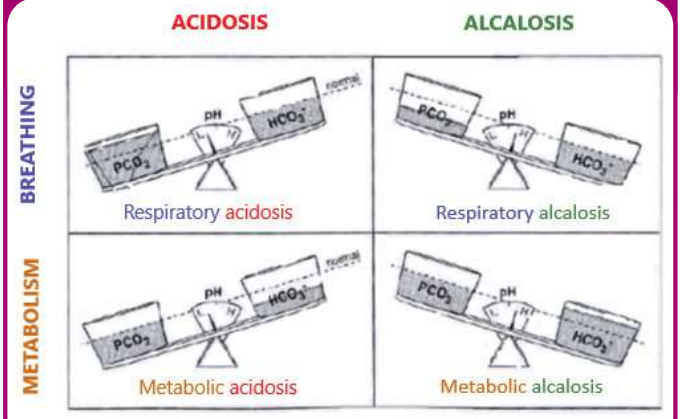
*Qihui Li and Coll., Animal Nutrition 2022*

# 1.NUTRITIONAL PRINCIPLES OF FORMULATION
## FOCUS ON DIET AND HEAT STRESS

As a result, during warm periods, AXIOM recommends adjusting the feed formulation.

1. **Reduce metabolic heat production:** use net energy sources as **fat** rather than as starch: 1 to 1.5% fat increase.
2. **Reduce the feed's protein content** and use pure amino acids: 0.5 to 1% protein content decrease.
3. **Compensate respiratory alcalosis** with metabolic acidosis: **the increase in electrolyte balance** (EB, in Meq/Kg) during warm periods induces metabolic acidosis. Using sodium bicarbonate will help, as the EB must be at least 200 Meq/Kg. The intake of 5 Kg/Tonne of sodium bicarbonate increases EB by +60 Meq/Kg. Increased EB also improves feed digestibility.

**3. Respiratory Alcalosis Compensation**




| EB, meq/Kg | | -50 | 100 | 250 | 400 |
|---|---|---|---|---|---|
| Ideal digestibility % | Nitrogen | 68.9 | 72.8 | **75.4** | 76.1 |
| | Energy | 63.3 | 68.4 | **69.6** | 72.3 |
| | Lysine | 79.4 | 82.2 | **83.6** | 83.6 |
| | Threonine | 66.9 | 70.3 | **72.3** | 72.4 |

*Qihui Li and Coll., Animal Nutrition 2022*

4. **Fight oxidative stress** by heightening the feed's antioxidant effect: increased antioxidant vitamins such as vitamin E (150-200 mg/Kg), use of vitamin C (100-150 mg/Kg). Using organic selenium (0.1-0.15 mg/Kg) also improves the antioxidant status. A number of plant extracts and polyphenols are available on the market, some of which can be useful.
5. **AXIOM's Nutrition teams recommend using a hepatoprotector** during the lactation period: 750 mg/Kg Choline. During hot periods, adding 2 kg/T of Betaine feed improves the feed intake of lactating sows.



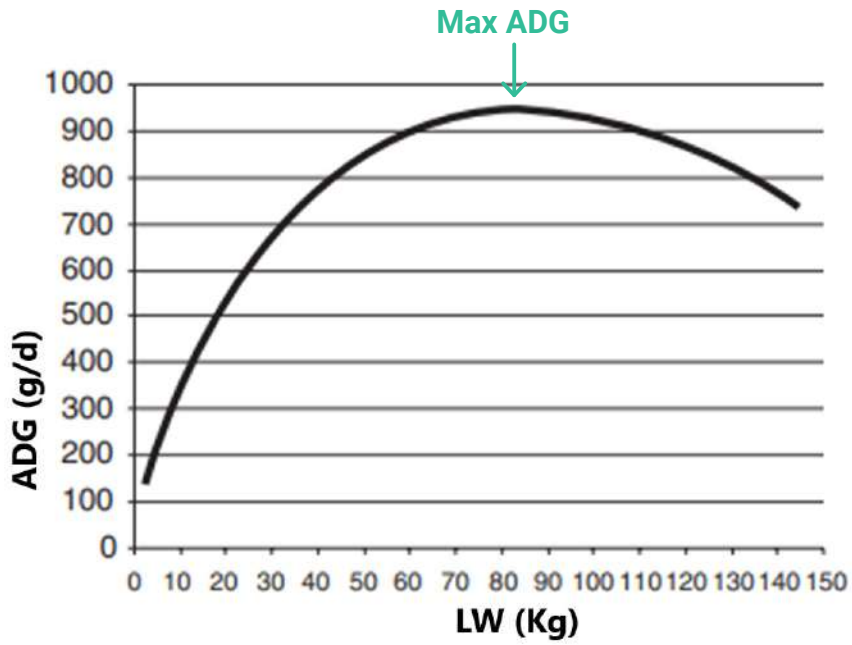
## > Terminal Growth Profiles and Nutritional Recommendations

The growth curve of growing-finishing pigs corresponds to the evolution of their production performance (weight, average daily gain, feed intake, Feed Conversion Ratio, etc.) throughout the growing-finishing phase.

The Gompertz model is very often used to describe pig growth as it reflects the biological evolution.

$$P(t) = A \cdot e^{-e^{-k(t-t_i)}}$$

- **P(t)**: live weight at age ttt (in days)
- **A**: asymptotic weight (maximum theoretical weight, often 130-150 Kg)
- **k**: growth rate (growth coefficient)
- **t**: age (in days)
- **ti**: age at inflection point (maximum growth)

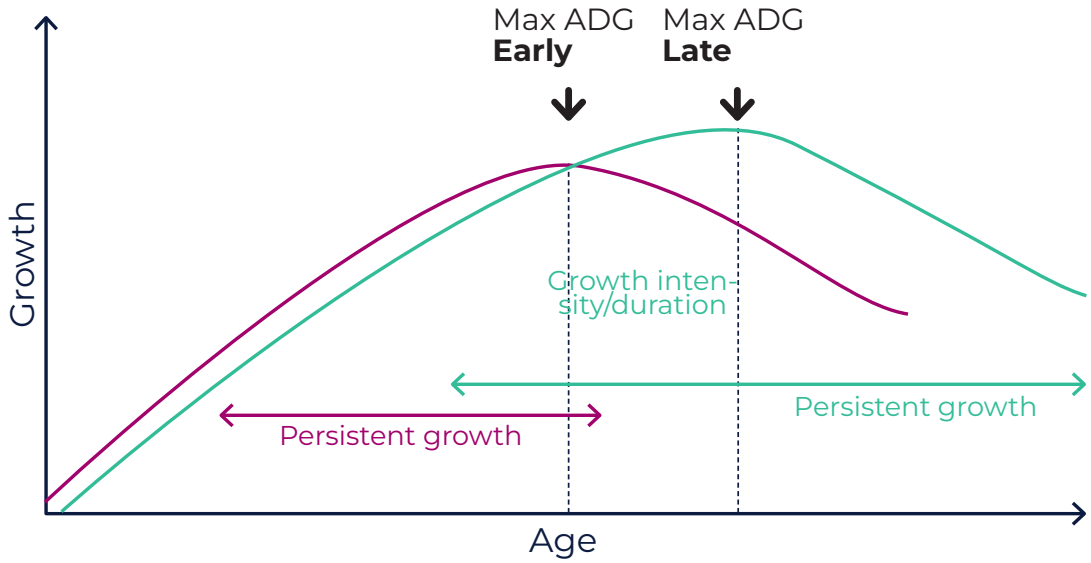



**ADG Evolution Relative To Live Weight**

*Alexia AUBRY et al, JRP 2004*

With AXIOM'S individual data collection devices for growing-finishing pigs used in its sire line selection units, the Engineering and Nutrition teams were able to determine growth and consumption dynamics for each line, thereby fine-tuning the pigs' nutritional requirements.

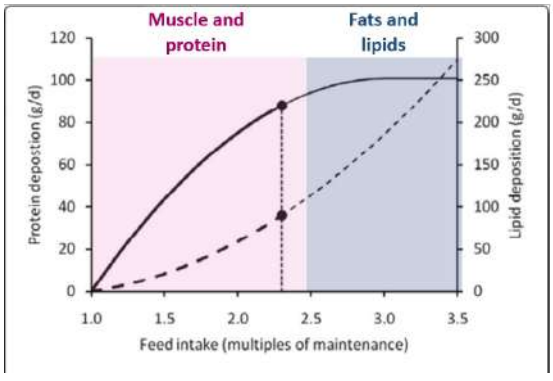
# 1.NUTRITIONAL PRINCIPLES OF FORMULATION
## TERMINAL GROWTH PROFILES AND NUTRITIONAL RECOMMENDATIONS

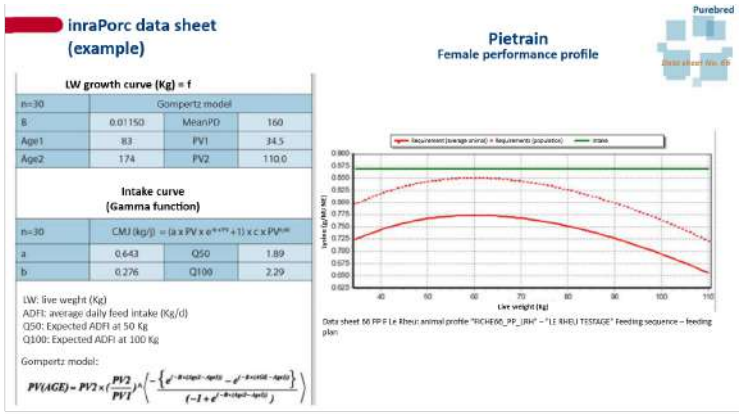



AXIOM lines reach their full growth potential at different ages. Likewise, line growth persistence varies from one line to the next, which allows AXIOM lines to adapt to the various markets according to the various production and performance objectives.

The growth profiles help determine growing-finishing pigs' nutritional requirements, and optimize amino acid and phosphorus supplementation to maximize protein and muscle depositions, therefore maximizing Feed Conversion Ratios.

**Growth Profile and Nutritional Requirement Modeling Example.**

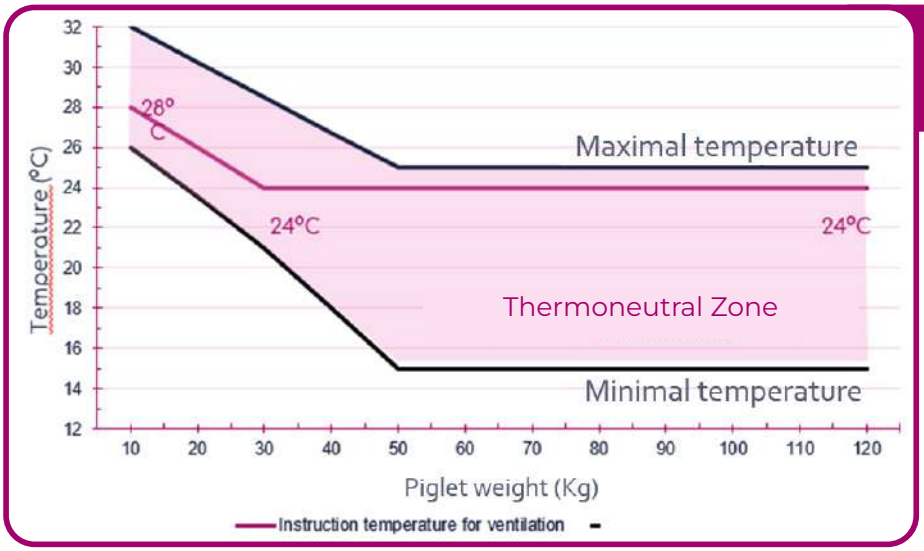


# 2. FOCUS ON GROWTH STAGES
## GENERAL PARTICULARS & RECOMMENDATIONS

### > General Particulars

Piglet weaning is a critical phase in pig production. It is a transition from a milk-based diet (sow milk) to a solid diet.
Poor weaning management can lead to stress, slower growth, digestive disorders and diseases (such as post-weaning scours).




**Nursery Piglets' Thermal Comfort**

### > Recommendations for successful piglet weaning

Piglet housing conditions, and thermal comfort, is key:

- pre-weaning: Introduce a milk replacement (starter) or creep feed 7–10 days after farrowing to allow the digestive tract to adjust to the diet
- nutrition: Introduce pre-starter feed in portions of 4 to 7 Kg/piglet (refer to AXIOM recommendations), transition to the starter feed over 2-4 days, until the piglets reach a live weight of 28-30 Kg (refer to AXIOM recommendations)
- temperature: Keep the ambient temperature to 28–30°C during the early days of the post weaning phase
- water: Free access to fresh water
- litter grouping: Avoid mixing too many different litters for health purposes and to reduce piglet stress (3 to 4 litters maximum)
- monitoring: Check on the piglets at least 2-3 times daily, in particular in the first 5 days



# 2. FOCUS ON GROWTH STAGES
## GENERAL PARTICULARS & RECOMMENDATIONS

The weaning phase involves an initial drop in feed intake (acute weaning phase): it is important to ensure suitable feed intake as any discontinuation leads to fast deterioration of the gut lining, which, due to its permeability, allows potential pathogens to cross (leaky gut), leading to an increased risk of digestive upsets.

AXIOM recommends wetting the feed in additional troughs, when possible, to stimulate feed intake as much as possible and at an early stage.

The second weaning phase is a period of resilience - acclimatization, during which the piglets resume a steady feed intake.

The feeders must therefore be properly set (no excess feed with excessively open feeders) to prevent slug feeding and overconsumption, which can cause scours.

AXIOM recommends a 2 to 4 day transition period between the starter and post-starter diet. Piglet weaning can vary according to husbandry type, production objectives and applicable regulations.
Weaning at 21 days:

- Piglets are more sensitive (less developed digestive and immune system).
- Heightened risk of post-weaning scours.
- Need for a milk replacement that is suitable for the piglet's digestive physiology.

Following the European ban of the use of zinc oxide at therapeutic doses, the market is adopting a later weaning age, which is advantageous for the piglets' digestive and immune maturity. Except under special health conditions, European regulations enforce a minimum weaning age of 21 days.

# 2. FOCUS ON GROWTH STAGES
# NURSERY NUTRITIONAL RECOMMENDATIONS

## > Stage 1 – Pre-starter

| | | | Pre-Starter Performance** | | Secure Pre-Starter** | |
|---|---|---|---|---|---|---|
| **Energy*** | **Unit** | % | MIN | MAX | MIN | MAX |
| Net Energy | MJ/Kg | | 10.5 | - | 10.5 | - |
| ME<br>Energy Value (Netherlands)<br>Energy Value (Denmark) | MJ/Kg<br>EV<br>NE | | 14.6<br>1.19<br>1.18 | - | 14.3<br>1.17<br>1.16 | - |
| Net Energy | Kcal/Kg | | 2,510 | - | 2,462 | - |
| Fats | % | | 5 | - | 4.5 | - |
| Total sugar | % | | 12 | 15 | 8 | 10 |
| Lactose | % | | 6 | - | 4 | - |
| Cooked Starch | % | | 12 | - | 10 | - |
| LysDP/NE ratio | | | 0.125 | | 0.115 | |

| **Protein** | | % | MIN | MAX | MIN | MAX |
|---|---|---|---|---|---|---|
| Crude Protein | % | | - | 18.5 | - | 16.5 |
| SiD Lysine | % | | 1.31 | - | 1.18 | - |
| SiD M+C | % | 60% | 0.79 | - | 0.71 | - |
| SiD M | % | 30% | 0.39 | - | 0.36 | - |
| SiD Threo | % | 65% | 0.85 | - | 0.77 | - |
| SiD Trp | % | 19% | 0.25 | - | 0.23 | - |
| SiD Val | % | 68% | 0.89 | - | 0.81 | - |
| SiD Ile | % | 50% | 0.66 | | 0.59 | |
| SiD Leu | % | 100% | 1.31 | | 1.18 | |
| SiD His | % | 32% | 0.42 | | 0.38 | |

| **Minerals** | | % | MIN | MAX | MIN | MAX |
|---|---|---|---|---|---|---|
| STTD P | % | | 0.44 | - | 0.43 | - |
| Dig P | % | | 0.40 | - | 0.39 | - |
| Na | % | | 0.25 | 0.30 | 0.25 | 0.30 |
| STTD Ca | % | | - | - | - | - |
| STTD Ca / STTD P | | | - | - | - | - |
| Total Calcium (analytical) | % | | 0.65 | 0.75 | 0.55 | 0.60 |

| **Fiber** | | % | MIN | MAX | MIN | MAX |
|---|---|---|---|---|---|---|
| ADL | % | | - | 0.8 | - | - |
| Crude Fiber | g/Kg | | 30 | - | 30 | 0.85 |

*Energy recommendations do not take into account the potential use of NSPs in the diet. Axiom recommends against the use of an energy matrix and amino acids for phytase, sepiolite and clays.

** For pre-starter feeds, the nutritional values are given for information only.
For further details regarding formulation, raw material selection and specifications (quality), feed additives and solutions, please contact Axiom's engineering team.

## > Stage 2 – Starter

| | | | Pre-Starter Performance | | Secure Pre-Starter | | 25-40 Kg | |
|---|---|---|---|---|---|---|---|---|
| **Energy*** | **Unit** | % | MIN | MAX | MIN | MAX | MIN | MAX |
| Net Energy | MJ/Kg | | 9.8 | - | 9.8 | - | 9.8 | - |
| ME<br>Energy Value (Netherlands)<br>Energy Value (Denmark) | MJ/Kg<br>EV<br>NE | | 13.6<br>1.11<br>1.10 | - | 13.6<br>1.11<br>1.10 | - | 13.6<br>1.11<br>1.10 | - |
| Net Energy | Kcal/Kg | | 2,342 | - | 2,342 | - | 2,342 | - |
| Fats | % | | 2.5 | - | 2.0 | - | 1.5 | - |
| Total sugar | % | | - | - | - | - | - | - |
| Lactose | % | | - | - | - | - | - | - |
| Cooked starch | % | | - | - | - | - | - | - |
| LysDP/NE ratio | | | 0.109 | | 0.106 | | 0.098 | |
| **Protein** | | % | MIN | MAX | MIN | MAX | MIN | MAX |
| Crude Protein | % | | - | 18 | - | 16.5 | - | 15.5 |
| SiD Lysine | % | | 1.07 | - | 1.04 | - | 0.96 | - |
| SiD M+C | % | 60% | 0.43 | - | 0.62 | - | 0.58 | - |
| SiD M | % | 30% | 0.21 | - | 0.31 | - | 0.29 | - |
| SiD Threo | % | 65% | 0.46 | - | 0.68 | - | 0.62 | - |
| SiD Trp | % | 19% | 0.13 | - | 0.20 | - | 0.18 | - |
| SiD Val | % | 68% | 0.49 | - | 0.71 | - | 0.65 | - |
| SiD Ile | % | 50% | 0.37 | - | 0.52 | - | 0.48 | - |
| SiD Leu | % | 100% | 0.74 | - | 1.04 | - | 0.96 | - |
| SiD His | % | 32% | 0.24 | - | 0.33 | - | 0.31 | - |
| **Minerals** | | % | MIN | MAX | MIN | MAX | MIN | MAX |
| STTD P | % | | 0.36 | - | 0.36 | - | 0.34 | - |
| Dig P | % | | 0.32 | - | 0.31 | - | 0.28 | - |
| Na | % | | 0.20 | 0.25 | 0.20 | 0.25 | 0.20 | 0.25 |
| STTD Ca | % | | 0.40 | 0.45 | 0.40 | 0.45 | 0.40 | 0.45 |
| STTD Ca / STTD P | | | 1.10 | 1.25 | 1.10 | 1.25 | 1.20 | 1.30 |
| Total Calcium (analytical) | % | | - | 0.60 | - | 0.60 | - | 0.60 |
| Electrolytical Balance | Meq/Kg | | 170 | - | 170 | - | 170 | - |
| **Fiber** | | % | MIN | MAX | MIN | MAX | | |
| ADL | % | | - | 1.40 | - | 1.40 | - | 1.50 |
| Crude Fiber | g/Kg | | 35 | - | 35 | - | 40 | - |

*Energy recommendations do not take into account the potential use of NSPs in the diet. Axiom recommends against the use of an energy matrix and amino acids for phytase, sepiolite and clays.

**Pre-starter dietary safety:** to ensure dietary safety, some nutritional solutions such as acidifiers, probiotics, post-biotics, can be advantageous and efficient: contact AXIOM's Engineering and Nutrition Department for further information. A specific precision nutrition approach can also be deployed to support the immune system, according to AXIOM recommendations.

Some formulation matrices provide maximum limit values for indigestible and fermentable protein, and a fiber and carbohydrate nutrition approach: contact AXIOM's Engineering and Nutrition Department for advice on these specific matters.

## > Growing pigs

| | | | Late maturity 40-75 Kg | | Early maturity 40-75 Kg | |
|---|---|---|---|---|---|---|
| **Energy*** | **Unit** | % | MIN | MAX | MIN | MAX |
| Net Energy | MJ/Kg | | 9.7 | - | 9.8 | - |
| ME<br>Energy Value (Netherlands)<br>Energy Value (Denmark) | MJ/Kg<br>EV<br>NE | | 13.5<br>1.10<br>1.09 | - | 13.6<br>1.11<br>1.10 | - |
| Net Energy | Kcal/Kg | | 2,318 | - | 2,342 | - |
| Fats | % | | - | - | | - |
| LysDP/NE ratio | | | 0.084 | | 0.088 | |

| **Protein** | | % | MIN | MAX | MIN | MAX |
|---|---|---|---|---|---|---|
| Crude Protein | % | | - | 16 | - | 16 |
| SiD Lysine | % | | 0.81 | - | 0.86 | - |
| SiD M+C | % | 58% | 0.47 | - | 0.50 | - |
| SiD M | % | 30% | 0.24 | - | 0.26 | - |
| SiD Threo | % | 60% | 0.49 | - | 0.52 | - |
| SiD Trp | % | 18% | 0.15 | - | 0.16 | - |
| SiD Val | % | 66% | 0.54 | - | 0.57 | - |
| SiD Ile | % | 50% | 0.41 | - | 0.43 | - |
| SiD Leu | % | 100% | 0.81 | - | 0.86 | - |
| SiD His | % | 32% | 0.26 | - | 0.28 | - |

| **Minerals** | | % | MIN | MAX | MIN | MAX |
|---|---|---|---|---|---|---|
| STTD P | % | | 0.28 | - | 0.28 | - |
| Dig P | % | | 0.23 | - | 0.24 | - |
| Na | % | | 0.20 | 0.25 | 0.20 | 0.25 |
| STTD Ca | % | | 0.30 | 0.35 | 0.30 | 0.35 |
| STTD Ca / STTD P | | | 1.10 | 1.30 | 1.70 | 1.30 |
| Total Calcium (analytical) | % | | - | 0.60 | - | 0.60 |
| Electrolytical Balance | Meq/Kg | | 170 | - | 170 | - |

| **Fiber** | | % | MIN | MAX | MIN | MAX |
|---|---|---|---|---|---|---|
| ADL | % | | - | 1.70 | - | 1.70 |
| Crude Fiber | g/Kg | | 40 | - | 40 | - |

*Energy recommendations do not take into account the potential use of NSPs in the diet. Axiom recommends against the use of an energy matrix and amino acids for phytase, sepiolite and clays.

Early maturity: Max ADG reached before 120 days
Late maturity: Max ADG reached after 120 days



## > Finisher pig

| | | | Non persistent growth | | Persistent growth | | Uncastrated male finishing | |
|---|---|---|---|---|---|---|---|---|
| **Energy*** | **Unit** | % | MIN | MAX | MIN | MAX | MIN | MAX |
| Net Energy | MJ/Kg | | 9.7 | - | 9.8 | - | 9.8 | |
| ME<br>Energy Value (Netherlands)<br>Energy Value (Denmark) | MJ/Kg<br>EV<br>NE | | 13.5<br>1.10<br>1.09 | - | 13.6<br>1.11<br>1.10 | - | 13.6<br>1.11<br>1.10 | |
| Net Energy | Kcal/Kg | | 2,318 | - | 2,342 | - | 2,342 | |
| Fats | % | | - | - | 1.5 | - | 2 | |
| LysDP/NE ratio | | | 0.080 | | 0.083 | | 0.085 | |

| **Protein** | | % | MIN | MAX | MIN | MAX | | |
|---|---|---|---|---|---|---|---|---|
| Crude Protein | % | | - | 15 | - | 15 | - | 15 |
| SiD Lysine | % | | 0.78 | - | 0.81 | - | 0.83 | - |
| SiD M+C | % | 58% | 0.45 | - | 0.47 | - | 0.48 | - |
| SiD M | % | 29% | 0.23 | - | 0.24 | - | 0.24 | - |
| SiD Threo | % | 63% | 0.49 | - | 0.51 | - | 0.52 | - |
| SiD Trp | % | 17% | 0.13 | - | 0.14 | - | 0.14 | - |
| SiD Val | % | 66% | 0.51 | - | 0.54 | - | 0.55 | - |
| SiD Ile | % | 50% | 0.39 | - | 0.41 | - | 0.42 | - |
| SiD Leu | % | 100% | 0.78 | - | 0.81 | - | 0.83 | - |
| SiD His | % | 32% | 0.25 | - | 0.26 | - | 0.27 | - |

| **Minerals** | | % | MIN | MAX | MIN | MAX | | |
|---|---|---|---|---|---|---|---|---|
| STTD P | % | | 0.25 | - | 0.25 | - | 0.26 | - |
| Dig P | % | | 0.20 | - | 0.21 | - | 0.22 | - |
| Na | % | | 0.20 | 0.25 | 0.20 | 0.25 | 0.20 | 0.25 |
| STTD Ca | % | | 0.30 | 0.35 | 0.30 | 0.35 | 0.30 | 0.35 |
| STTD Ca / STTD P | | | 1.20 | 1.40 | 1.20 | 1.40 | 1.20 | 1.30 |
| Total Calcium (analytical) | % | | - | 0.55 | - | 0.55 | - | 0.55 |
| Electrolytical Balance | Meq/Kg | | 170 | - | 170 | - | 170 | - |

| **Fiber** | | % | MIN | MAX | MIN | MAX | | |
|---|---|---|---|---|---|---|---|---|
| ADL | % | | - | 1.70 | - | 1.70 | - | 1.70 |
| Crude Fiber | g/Kg | | 50 | - | 45 | - | 45 | - |

## > Finisher Pigs if Sexing Possible

| | | Heavy Gilt (Italian type > 150 Kg) | | | Finisher Uncastrated Male | | | Finisher Sow | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Energy*** | **Unit** | % | MIN | MAX | % | MIN | MAX | % | MIN | MAX |
| Net Energy | MJ/Kg | | 9.5 | - | | 9.7 | - | | 9.8 | - |
| ME<br>Energy Value (Netherlands)<br>Energy Value (Denmark) | MJ/Kg<br>EV<br>NE | | 13.2<br>1.08<br>1.07 | - | | 13.5<br>1.10<br>1.09 | - | | 13.6<br>1.11<br>1.10 | - |
| Net Energy | Kcal/Kg | | 2,271 | | | 2,318 | | | 2,342 | |
| Fats | % | | - | - | | - | - | | - | - |
| LysDP/NE ratio | | | 0.072 | | | 0.077 | | | 0.080 | |

| **Protein** | | % | MIN | MAX | % | MIN | MAX | % | MIN | MAX |
|---|---|---|---|---|---|---|---|---|---|---|
| Crude Protein | % | | - | 16.5 | | - | 15 | | - | 15 |
| SiD Lysine | % | | 0.68 | - | | 0.75 | - | | 0.78 | - |
| SiD M+C | % | 58% | 0.46 | - | 58% | 0.46 | - | 58% | 0.46 | - |
| SiD M | % | 28% | 0.22 | - | 29% | 0.23 | - | 29% | 0.23 | - |
| SiD Threo | % | 63% | 0.50 | - | 63% | 0.50 | - | 63% | 0.50 | - |
| SiD Trp | % | 18% | 0.14 | - | 18% | 0.14 | - | 18% | 0.14 | - |
| SiD Val | % | 66% | 0.52 | - | 66% | 0.52 | - | 66% | 0.52 | - |
| SiD Ile | % | 50% | 0.40 | - | 50% | 0.40 | - | 50% | 0.40 | - |
| SiD Leu | % | 100% | 0.80 | - | 100% | 0.80 | - | 100% | 0.80 | - |
| SiD His | % | 32% | 0.25 | - | 32% | 0.25 | - | 32% | 0.25 | - |

| **Minerals** | | % | MIN | MAX | % | MIN | MAX | % | MIN | MAX |
|---|---|---|---|---|---|---|---|---|---|---|
| STTD P | % | | 0.27 | - | | 0.25 | - | | 0.25 | - |
| Dig P | % | | 0.23 | - | | 0.21 | - | | 0.21 | - |
| Na | % | | 0.20 | 0.25 | | 0.20 | 0.25 | | 0.20 | 0.25 |
| STTD Ca | % | | 0.40 | - | | 0.35 | - | | 0.35 | - |
| STTD Ca / STTD P | | | - | - | | - | - | | - | - |
| Total Calcium (analytical) | % | | - | 0.55 | | - | 0.55 | | - | 0.55 |
| Electrolytical Balance | Meq/Kg | | 170 | - | | 170 | - | | 170 | - |

| **Fiber** | | % | MIN | MAX | % | MIN | MAX | % | MIN | MAX |
|---|---|---|---|---|---|---|---|---|---|---|
| ADL | % | | - | 1.7 | | - | 1.7 | | - | 1.7 |
| Crude Fiber | g/Kg | | 55 | - | | 50 | - | | 50 | - |

## > Dietary Specifications for Growing-Finishing Pigs

| | | Growers 40-80 Kg | | | Finishers 80-125 Kg | | |
|---|---|---|---|---|---|---|---|
| **Energy*** | **Unit** | % | MIN | MAX | % | MIN | MAX |
| Net Energy | MJ/Kg | | 10.7 | - | | 10.7 | - |
| ME<br>Energy Value (Netherlands)<br>Energy Value (Denmark) | MJ/Kg<br>EV<br>NE | | 14.9<br>1.22<br>1.20 | - | | 14.9<br>1.22<br>1.20 | - |
| Net Energy | Kcal/Kg | | 2,557 | | | 2,557 | |
| Fats | % | | - | - | | 1.5 | - |
| LysDP/NE ratio | | | 0.100 | | | 0.095 | |

| **Protein** | | % | MIN | MAX | % | MIN | MAX |
|---|---|---|---|---|---|---|---|
| Crude Protein | % | | - | 17 | | - | 16 |
| SiD Lysine | % | | 1.07 | - | | 1.02 | - |
| SiD M+C | % | 58% | 0.62 | - | 58% | 0.59 | - |
| SiD M | % | 30% | 0.32 | - | 29% | 0.29 | - |
| SiD Threo | % | 60% | 0.64 | - | 63% | 0.64 | - |
| SiD Trp | % | 18% | 0.19 | - | 17% | 0.17 | - |
| SiD Val | % | 66% | 0.71 | - | 66% | 0.67 | - |
| SiD Ile | % | 50% | 0.54 | - | 50% | 0.51 | - |
| SiD Leu | % | 100% | 1.07 | - | 100% | 1.02 | - |
| SiD His | % | 32% | 0.34 | - | 32% | 0.33 | - |

| **Minerals** | | % | MIN | MAX | % | MIN | MAX |
|---|---|---|---|---|---|---|---|
| STTD P | % | | 0.31 | - | | 0.28 | - |
| Dig P | % | | 0.27 | - | | 0.24 | - |
| Na | % | | 0.20 | 0.25 | | 0.20 | 0.25 |
| STTD Ca | % | | 0.30 | 0.35 | | 0.30 | 0.35 |
| STTD Ca / STTD P | | | 1.70 | 1.10 | | 1.10 | 1.25 |
| Total Calcium (analytical) | % | | - | 0.60 | | - | 0.55 |
| Electrolytical Balance | Meq/Kg | | 180 | - | | 180 | - |

| **Fiber** | | % | MIN | MAX | % | MIN | MAX |
|---|---|---|---|---|---|---|---|
| ADL | % | | - | 1.7 | | - | 1.7 |
| Crude Fiber | g/Kg | | 40 | - | | 45 | - |

# 2. FOCUS ON GROWTH STAGES
# VITAMINS AND MINERALS RECOMMANDATIONS

## > Post-Weaning and Growing-Finishing Vitamins and Trace Elements

| **Vitamins** | Pre-Starter Piglets (weaning + 2 weeks) | Starter Piglet (<30 Kg) | Fattening (Single) | Fattening Growth (<80 Kg) | Fattening Finishing |
|---|---|---|---|---|---|
| Vitamin A | 15,000 | 12,000 | 6,000 | 6,000 | 5,000 |
| Vitamin D | 2,000 | 2,000 | 1,500 | 1,500 | 1,200 |
| Vitamin E | 150 | 80 | 10 | 10 | 5 |
| Vitamin B1 | 2.5 | 1.5 | 1 | 1.5 | 0.5 |
| Vitamin K3 | 3 | 3 | | | |
| Vitamin C | 200 | | | | |
| Vitamin B2 riboflavin | 8 | 5 | 2 | 2 | 1 |
| Vitamin B5 pantothenic acid | 20 | 12 | 15 | 20 | 10 |
| Vitamin B6 pyridoxine | 5 | 4 | 2 | 0.7 | 0.7 |
| Vitamin B9 folic acid | 1 | 0.5 | | | |
| Vitamin B12 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 |
| Vitamin B3 PP, niacin | 20 | 15 | 12 | 15 | 8 |
| Biotin | 0.2 | 0.1 | | | |
| Choline Chloride | 500 | 250 | 50 | 50 | 50 |
| HyD (25 OHD3)* | | | | | |
| **Element Trace** | | | | | |
| Cu (mg) | 150 | 100 | 15 | 15 | 15 |
| Fe (mg) | 180 | 120 | 100 | 120 | 80 |
| Zn (mg) | 100 | 100 | 100 | 100 | 100 |
| Mn (mg) | 70 | 60 | 40 | 40 | 40 |
| I (mg) | 2.5 | 1.5 | 1.5 | 1.5 | 1 |
| Mg (%) | 0.3 | 0.25 | 0.25 | 0.25 | 0.25 |
| Se (mg)** | 0.4 | 0.3 | 0.3 | 0.3 | 0.15 |
| Na (%) | 0.25 | 0.2 | 0.2 | 0.2 | 0.15 |
| Cl (%) | 0.25 | 0.2 | 0.2 | 0.2 | 0.15 |



# 2. FOCUS ON GROWTH STAGES
## RAW MATERIAL INCORPORATION LIMIT RECOMMENDATIONS

| | | Phase | Growth 1 25-50 Kg | | Growth 25-80 Kg | | Growth 2 25-100 Kg | | Finishing 1 80 - 100 Kg | | Finishing 100 - Slaughter | | Finishing 2 100 - Slaughter | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Raw materials** | **Unit** | | min | max | min | max | min | max | min | max | min | max | min | max |
| **Cereals and by-products** | | | | | | | | | | | | | | |
| Barley | g/Kg | | 200 | | 150 | | 80 | | | | | | | |
| Rolled oats | g/Kg | | | 50 | | 80 | | 150 | | 150 | | 150 | | 150 |
| Wheat | g/Kg | | | 450 | | 450 | | 450 | | 450 | | 450 | | 450 |
| Wheat bran + wheat middlings + food grade gluten | g/Kg | | | 100 | | 100 | | 175 | | 175 | | 200 | | 250 |
| Wheat gluten meal (80% CP) | g/Kg | | | 75 | | 100 | | 125 | | 125 | | 125 | | 150 |
| Wheat DDGS | g/Kg | | | 100 | | 100 | | 125 | | 125 | | 125 | | 150 |
| Corn | g/Kg | | | 500 | | 500 | | 500 | | 650 | | 650 | | 650 |
| Corn gluten meal (60% CP) | g/Kg | | | 50 | | 100 | | 125 | | 125 | | 125 | | 150 |
| Corn gluten based feeds | g/Kg | | | 50 | | 50 | | 75 | | 75 | | 75 | | 100 |
| Corn DDGS | g/Kg | | | 100 | | 100 | | 125 | | 125 | | 125 | | 150 |
| Triticale | g/Kg | | | 100 | | 150 | | 150 | | 200 | | 225 | | 250 |
| Rye | g/Kg | | | 80 | | 100 | | 150 | | 200 | | 225 | | 250 |
| Biscuit meal | g/Kg | | | 100 | | 150 | | | | | | | | |
| Sugar beet pulp | g/Kg | | | 50 | | 50 | | 80 | | 80 | | 80 | | 80 |
| Ground flaxseed/meal | g/Kg | | | 30 | | 30 | | 50 | | 50 | | 50 | | 50 |
| Copra meal | g/Kg | | | 30 | | 30 | | 50 | | 50 | | 50 | | 50 |
| Alfalfa | g/Kg | | | 20 | | 20 | | 30 | | 30 | | 30 | | 30 |
| Citrus pulp | g/Kg | | | 20 | | 20 | | 50 | | 50 | | 50 | | 80 |
| Molasses | g/Kg | | | 30 | | 30 | | 50 | | 60 | | 60 | | 70 |
| Sugar/Lactose/Dextrose | g/Kg | | | | | | | | | | | | | |
| **Plant-based Proteins** | | | | | | | | | | | | | | |
| Sunflower meal (low protein and high protein content) | g/Kg | | | 50 | | 80 | | 100 | | 150 | | 150 | | 180 |
| Hipro soybean meal >48% CP | g/Kg | | | | | | | | | | | | | |
| Lopro soybean meal <48% CP | g/Kg | | | | | | | | | | | | | |
| Extruded whole soybean | g/Kg | | | | | | | | | | | | | |
| Soybean hulls | g/Kg | | | 10 | | 20 | | 20 | | 40 | | 40 | | 50 |
| Peas | g/Kg | | | 100 | | 100 | | 100 | | 150 | | 150 | | 200 |
| Rapeseed extract (00 grade) | g/Kg | | | 50 | | 50 | | 75 | | 75 | | 100 | | 150 |
| Palm kernel meal | g/Kg | | | 30 | | 30 | | 50 | | 75 | | 75 | | 100 |
| **Animal protein** | | | | | | | | | | | | | | |
| Fish meal 70% | g/Kg | | | | | | | | | | | | | |
| **Oils and fats** | | | | | | | | | | | | | | |
| Fish oil | g/Kg | | | | | | | | | | | | | |
| Soybean oil | g/Kg | | | | | | | | | | | | | |
| Sunflower oil | g/Kg | | | | | | | | | | | | | |
| Corn germ oil | g/Kg | | | | | | | | | | | | | |
| Coconut oil | g/Kg | | | | | | | | | | | | | |
| Palm oil | g/Kg | | | | | | | | | | | | | |
| Rapeseed oil | g/Kg | | | | | | | | | | | | | |
| Animal fat > 5% free fatty acids (FFA) | g/Kg | | | 5 | | 5 | | 5 | | 5 | | 5 | | 5 |
| Lard | g/Kg | | | | | | | | | | | | | |


AXIOM

# APPENDIX #1
# FEED HEALTH QUALITY

## > Feed Health Quality

Besides nutritional balance considerations, focus should be placed on raw material quality control.

The control plan aims to check the main nutrients in the raw materials to take into account any deviation in the feed formulation. Thus, depending on processed raw material volumes, their source, AXIOM recommends humidity, ash, protein, starch, crude cellulose testing for all raw materials, according to a set sampling plan.
Testing the manufactured or purchased feed once a month will help identify any discrepancy between expected and measured values.

A key control criterion is the fungal quality control of raw materials and feeds as mycotoxins are endocrine disruptors that have multiple effects on sows: low feed intake, return to estrus, lower immunity, litter size drop, carry-over into the milk, etc.

Be mindful that mycotoxins can also be found in straw bedding, which is consumed by straw-reared animals on a daily basis: though the raw materials may contain little contamination, the straw could be contaminated.

With the effects of climate change and weather conditions, the risk of raw material contamination is heightened. Moreover, the regulatory limit values are reviewed on a regular basis as low concentration toxicity is better known. Finally, when analyzing the main mycotoxins, many so-called emerging mycotoxins are gradually being documented for their harmful effects on reproductive performance (e.g. beauvericin, enniatins). Recent studies have shown a negative interaction between mycotoxin contamination and bone health.

Finally, by affecting gut lining permeability, mycotoxins promote the transfer of endotoxins into the blood stream, which can lead to a number of inflammatory responses (necrosis, delayed lactation onset, impaired performance, etc.)

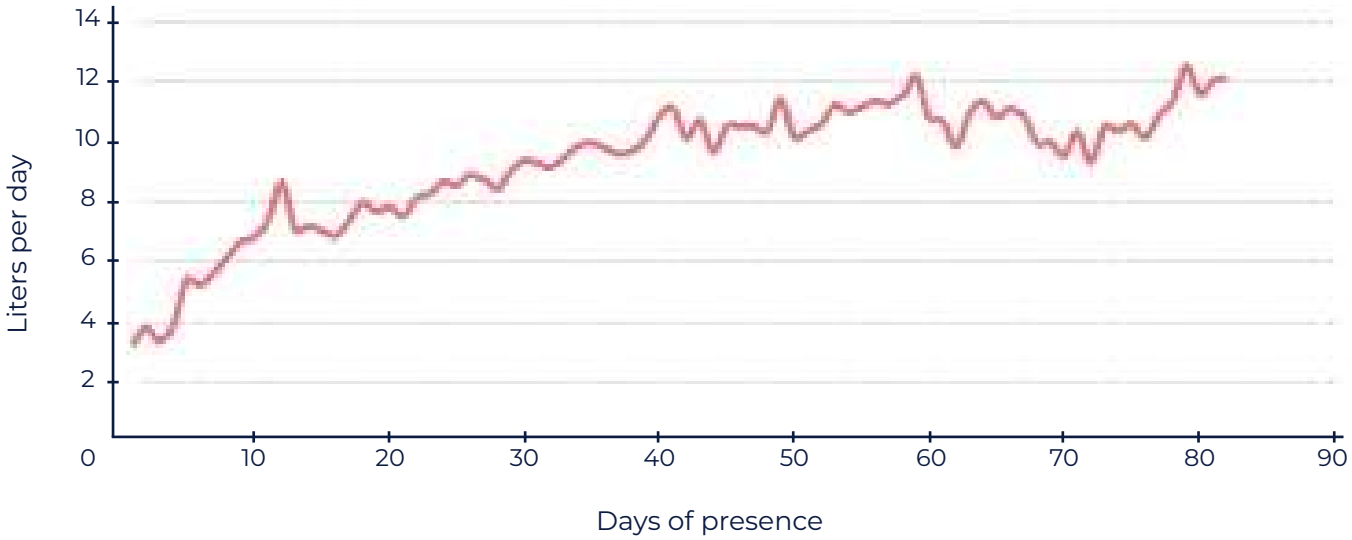
The effects of mycotoxins are often additive, and even at a low contamination level, the addition of several mycotoxins can have harmful effects. A number of surveys are published every year by solution developers, and the risks can be assessed according to geographical areas.
Important: there is no quick fix to eliminate the mycotoxin hazard. The first step is to conduct a risk assessment, ensure safe raw material storage, using antifungal agents if necessary, disposing of any contaminated raw material or reducing its use in the diet formula.

| Toxin | Limit Value |
|---|---|
| Diacetoxyscirpenol (DAS) | < 2 ppm |
| Toxin T-2 | < 1 ppm |
| Zearelenone (ZEN) | 1 to 3 ppm (young gilt diets) |
| Ochratoxin A | < 0.2 ppm (kidney lesions) / < 2 ppm (weight gain drop) |
| Ergot (Alkaloids) | 4 to 6 ppm |
| Vomitoxin (Deoxynivalenol, DON) | < 1 ppm (growing pigs) / 0 ppm (lactating or gestating sows) |
| Aflatoxin | < 0.02 ppm |

## > Water

Water intake is paramount to support livestock growth.
Water intake in the growing-finishing period (figure below) increases in line with the feed intake. It tends to stabilize due to a slower - or even plateauing - feed intake in the late finishing phase.

For a weight gain of 1 Kg, the average water intake is 8.4 liters. This can change from 6 to 11.9 liters depending on the season and according to the pigs' internal temperature regulation needs.




Regularly flushing (1 to 4 times daily) the water lines improves fresh water intake.

## > Water Quality Requirements

| Category | Weight | Water flow rate | Daily water intake |
|---|---|---|---|
| Post-weaning piglet | 7-30 kg | 0.5 to 1 liter/minute | 4 to 6 liters/day/pig |
| Growing pigs | 30-60 kg | 1.0 to 1.5 liters/minute | 4 to 6 liters/day/pig |
| Grower and finisher pigs (fattening) | 60-100 kg | 1.5 to 2 liters/minute | 6 to 10 liters/day/pig |
| | > 100 Kg | 1.5 to 2 liters/minute | 10 to 12 liters/day/pig |

There is not enough focus on water quality testing on pig farms, which has a major impact on the sows' health (uro-genital infection) and the feed intake level.
AXIOM recommends testing the drinking water quality at least twice yearly and cleaning the lines at least once yearly. Water treatment is also essential (disinfection, acidification, etc.)

The water line can be flushed between batches or every day in the nursery, especially after weaning, to optimize fresh water supply.

# APPENDIX #2
# WATER

**Water that is drinkable for pigs should also be drinkable for humans: focus on water quality criteria.**

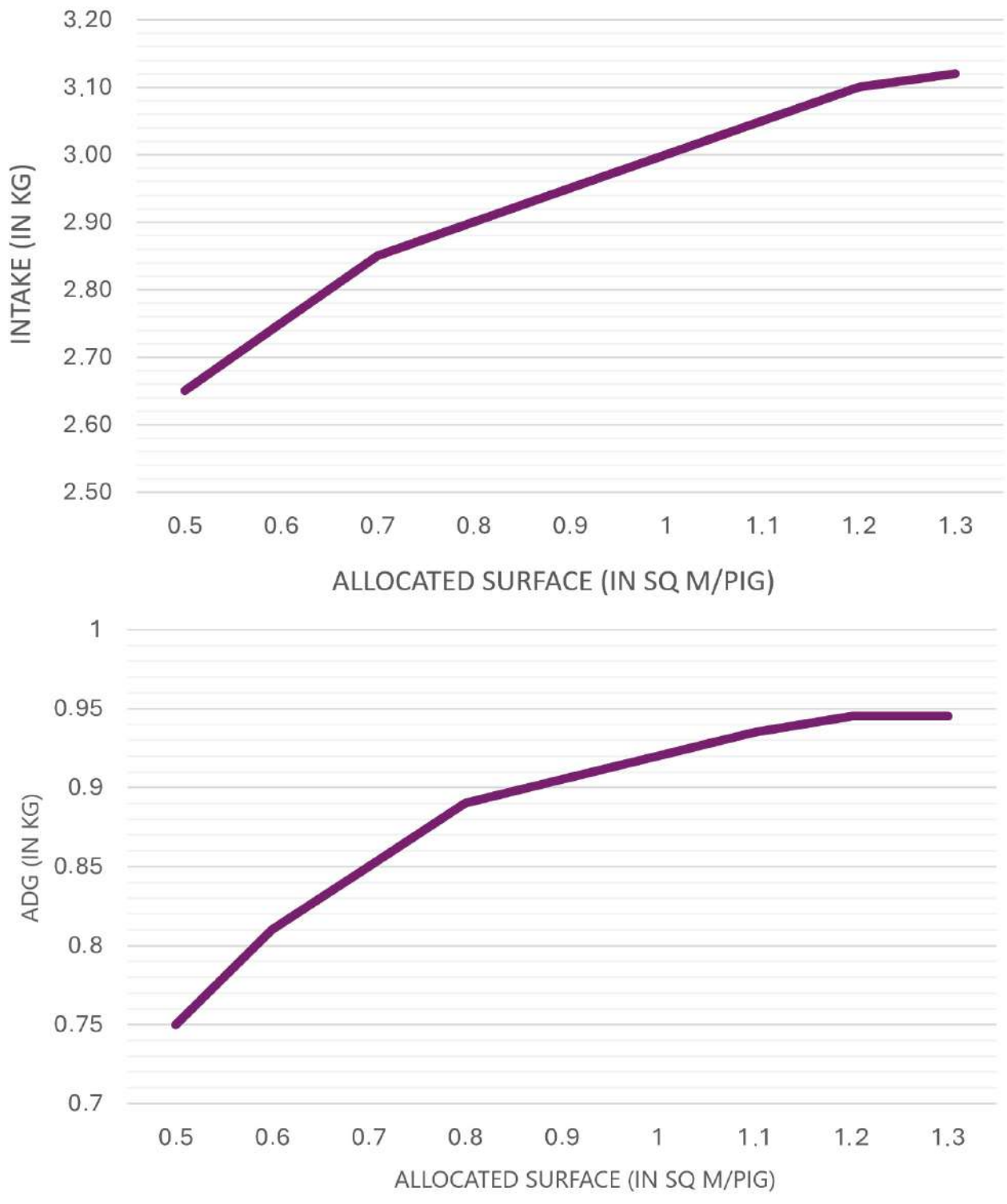
| Water Physico-Chemical Criteria | | |
|---|---|---|
| Criterion | Recommended Limit Value | Possible Actions |
| pH at 20°C | 5.5 to 6.5 | Acidification |
| Total water hardness TH (°F) | 10 to 25 | Neutralization if TH < 10<br>Softener if TH > 30 |
| Conductivity (micro siemens/cm) | 200-1000 at 25°C (mineralization deficiency risk if < 333, gilts PC) | Addition of calcium chlorides |
| Organic matter, Potassium permanganate oxidizability (mgO2/L) | < 2 | Line filtration and cleaning |
| Iron (mg/L) | < 0.02 | Iron removal with oxidation then filtration |
| Manganese (mg/L) | < 0.05 | Manganese removal with oxidation then filtration |
| Nitrates (mg/L) | < 50 | Denitration |
| Nitrites (mg/L) | < 0.1 | Denitrification |
| NH4 (mg/L) | < 1 | |
| Chlorides (mg/L) | < 250 | |
| Sulfates (mg/L) | < 150 | |
| Sodium (mg/L) | < 400 | |

| Water Microbiological Quality Criteria | | |
|---|---|---|
| Criterion | Recommended Limit Value | Possible Actions |
| Total germs per mL at 22°C for 72 h | <100 | |
| Total germs per mL at 37°C for 24 h | <10 | If only the microbiological deviation criterion is retained, suspected contamination at the time of sample collection |
| Total coliforms per 100 mL at 37°C for 24 h | 0 | If only the microbiological criterion deviates (<5 germs/100 mL), suspected contamination at the time of sample collection<br>Runoff-related contamination signs from a contaminated source |
| Thermotolerant coliforms (including E. coli) per 100 mL at 44°C for 24 h | 0 | Fecal contamination<br>Bacterial infection risk |
| Enterococci (group D fecal streptococci) per 100 mL at 37°C for 48 h | 0 | Fecal contamination<br>Bacterial infection risk |
| Sulfate reducing anaerobic bacteria (bacteria and spores) per 100 mL at 37°C for 48 h | 0 | Former fecal water contamination or poor water line maintenance (biofilm) |
| Salmonella in 5 liters | 0 | |



## > Feed Management in Finishing Pigs: Impact of Stocking Density

**Stocking Density Impact Curve In Feed Management**
*Thomas et al., 2017 and Flohr, J. R. et al., 2015*



# APPENDIX #3
# DENSITY RECOMMENDATIONS

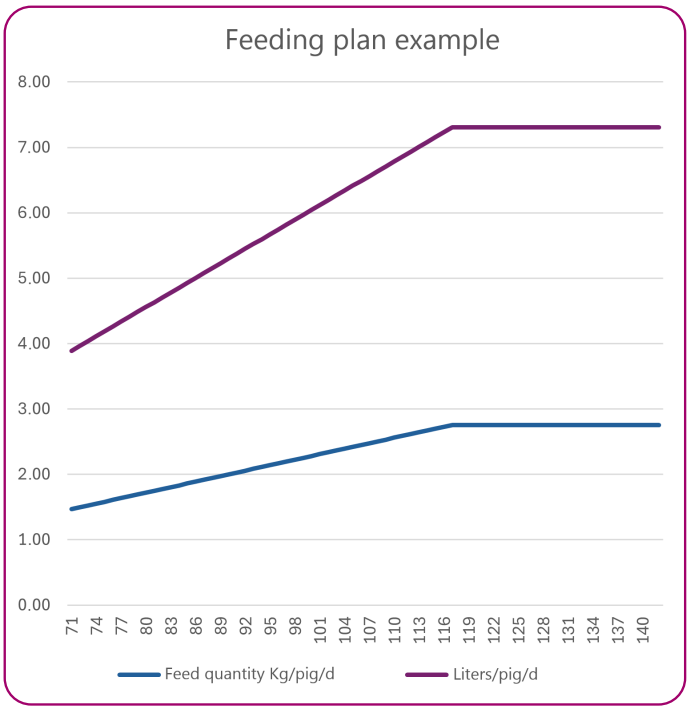
Stocking density affects intake and growth in a linear manner, up to an inflection point of 0.75-0.80 sq.m/pig

**Do not exceed 140 Kg/sq. m**

## > Restricted feeding curves

**Recommendations to be adjusted based on production objectives and country:**

- 2,750 g/pig/d as feed intake cap for 9.7/9.8 MJ NE finishing diets.
- Initially, introduce 45-47 g feed/Kg of live weight
  - Gradually increase the daily intake per pig by 28-30g, until the feed intake cap is reached.
- If a liquid diet is used, supply 2.5 to 2.6 liters water/Kg of feed, i.e. about 23.5% of DM/liter of liquid feed.




| Phase | Weight (Kg) | Dry Matter % | | | Feed (Kg/day) | Water (Kg/day) | Total Feed (Kg/day) |
|---|---|---|---|---|---|---|---|
| | | Min | Ideal | Max | | | |
| Farrowing or Post-weaning | 15-25 | 23 | 25 | 28 | 1.32 | 3.22 | 4.54 |
| Fattening (Pre-growth) | 25-40 | 23 | 23.5 | 25 | 1.60 | 4.32 | 5.92 |
| Fattening (Growth) | 40-70 | 22 | 23 | 25 | 2.30 | 6.40 | 8.70 |
| Fattening (Finishing) | 70-120 | 21 | 22-23 | 24 | 2.70 | 7.74 | 10.44 |

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