FEEDING MANUAL

TN Tempo progeny

Topigs Norsvin Global Nutrition Service
Updated: 02-04-2020

www.topigsnorsvin.com

Topigs Norsvin

6 Appendix

1. Example of diet calculations Wheat-Barley market

2. Example of diet calculations for Corn-Soy Market

3. Amino acid/ Lysine ratio used to estimate amino acid requirements

4. Standardized ileal digestible (SID) vs. apparent ileal digestible (AID) lysine

5. Vitamin and mineral recommendations

6. Phosphorus

1. INTRODUCTION

Progress in Pigs. That is what Topigs Norsvin stands for. We are continuously improving our genetics to enable our clients to stay ahead. Our goal is to unlock the maximum potential of our genetics for all customers, to enable them to achieve the best possible performance results. Nutrition is a factor to unlock this potential, therefore our nutrition team gives advice and develops protocols, tools and manuals.

This manual was developed by the Global Nutrition team to be used in professional pig production. We want to thank Agrifim, De Heus and Zoetis for their contribution to this manual.

2. THE AIM OF THE MANUAL

The aim of this manual is to provide a feeding guide based on the nutritional requirements of the TN Tempo progeny to achieve an optimum genetic performance, calculated in terms of daily gain. Daily gain is described in this manual as the sum of protein and fat deposition. Use of maximum genetic performance will result in optimal growth and minimal feed conversion ratio. Maximum lean growth can be achieved only when the nutrients, specifically amino acids and energy, are supplied in the diet at the appropriate amount.

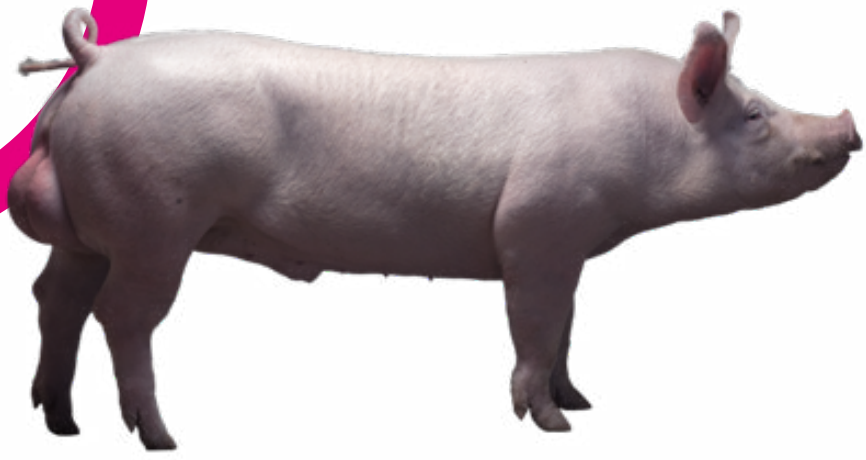
The recommendations in this manual are based on protein and fat deposition. Protein and fat deposition is influenced by factors like sex, age, feed intake, health status and genetic line. Body protein and lipid mass and their deposition in the body are most often used to describe compositional pig growth models and can be estimated separately. The results in the tables are derived from our own Pig Growth Model developed by Topigs Norsvin Research Center (TNRC Pig Growth Model®, 2019) and from the analysis of field data under various environments. This manual can only be used for Topigs Norsvin genetics.

3. TYPOLOGY, CHARACTERISTICS OF TN TEMPO

TN Tempo boar is known as the Topigs Norsvin E-line. Progeny of TN Tempo boars differentiate themselves in the market through:

- More full value pigs
- Increased survival from birth to market
- Uniform and very fast growing pigs
- Sustained feed intake and high performance under challenging conditions
- The highest belly yields for highly valued bacon production

TN Tempo is the industry's no. 1 robust boar with an inherent tolerance to feed and disease challenges. Compared with the competition, TN Tempo gives 10% more Full Value Pigs, allows you to empty your barns 1 week earlier, and produces carcasses with 4% higher belly value.



4. DAILY NUTRITIONAL REQUIREMENTS

4.1 Basic assumptions

TN Tempo finishers are capable of high protein deposition and high growth rates. High performance is achieved with the right diets which need to cover the daily requirements of the animals. The daily requirements given in this manual are based on TNRC Pig Growth Model®, 2019 and the validation data was collected on Topigs Norsvin nucleus and test farms.

The daily requirments in this manual are based on:

- Multi-phase feeding
- Castrates, gilts and boars fed *ad libitum*
- Dry pelleted diet, with dry matter of 88% (using pelleted feed improves the digestibility of the diet and the daily intake)
- Conventional/high health
- Sexes separately housed and fed
- Ideal ambient temperatures

4.2 Daily nutritional requirements TN Tempo finishers

Due to relatively low feed intake in the starter/grower phase (or early finishing), and their high capacity for protein deposition, diet formulation and management strategies should focus on increasing feed intake during this stage.

Table 1. Daily nutritional requirements and weight development curves of TN Tempo finishers

Days in	Castrates			Gilts			Boars		
	BW, kg	NE, MJ/day[1]	Lys. SID, g/day[1]	BW, kg	NE, MJ/day[1]	Lys. SID, g/day[1]	BW, kg	NE, MJ/day[1]	Lys. SID, g/day[1]
1	25,0	10,84	12,74	25,0	10,53	12,75	25,0	9,67	12,49
8	29,6	12,86	14,35	29,6	12,45	14,35	29,3	11,42	14,09
15	35,2	14,94	15,86	35,1	14,42	15,86	34,7	13,24	15,65
22	41,3	16,98	17,24	41,2	16,34	17,24	40,7	15,05	17,13
29	47,9	18,92	18,46	47,8	18,15	18,46	47,1	16,79	18,50
36	54,9	20,68	19,49	54,7	19,78	19,49	54,0	18,40	19,73
43	62,3	22,21	20,33	62,0	21,18	20,33	61,3	20,22	20,81
50	69,9	23,49	20,96	69,5	22,34	20,96	68,9	22,00	21,72
57	77,8	24,91	21,35	77,2	23,61	21,39	76,9	23,67	22,46
64	85,9	26,48	21,54	85,1	25,02	21,63	85,1	25,21	23,01
71	94,0	28,34	21,55	93,1	26,71	21,68	93,6	27,04	23,39
78	102,2	29,59	21,40	101,2	27,80	21,57	102,2	28,27	23,61
85	110,4	30,65	21,09	109,1	28,72	21,31	110,9	29,31	23,66
92	118,6	31,54	20,66	117,1	29,47	20,92	119,6	30,17	23,57
99	126,6	32,27	20,13	124,9	30,06	20,42	128,4	30,86	23,34
106	134,5	32,84	19,51	132,5	30,50	19,83	137,1	31,37	23,00
113	142,2	33,29	18,82	139,9	30,83	19,17	145,7	31,73	22,56
120	149,7	33,61	18,09	147,2	31,04	18,46	154,2	31,95	22,04

[1] Net energy (NE) and standardized ileal digestible (SID) lysine requirements are expressed as the amount required per day to achieve optimal performance. Based on the TNRC Pig Growth Model® (2019).

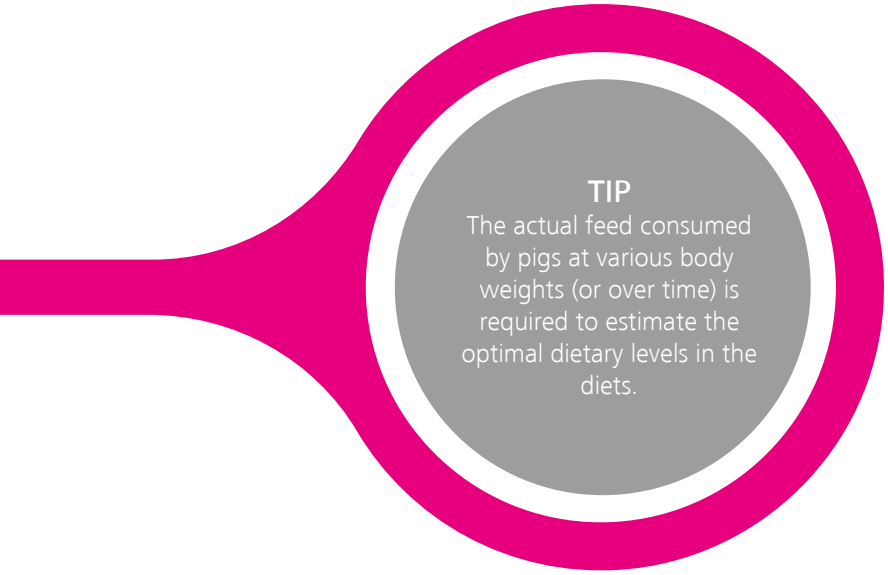
5. FEEDING AND MANAGEMENT

5.1 Introduction

In order to achieve the highest performance possible Topigs Norsvin provides in this manual the daily requirements for genetic potential. However the genetic potential is influenced by different environmental factors. In this chapter we will describe the most important factors which will affect the performance during the finisher phase.

5.2 Feed intake: Ad libitum vs. restricted feeding

The daily feed intake of a finisher will be the key determinant for the feed industry to design a proper feed program, which will give the farmer the highest economic return. Due to the variation in feed intake, Topigs Norsvin presents the requirements to their clients as energy and digestible lysine per day, as given in this manual.



In the event of pigs being given feed *ad libitum* the estimation of actual intake may also be indicative of the appetite prevailing under the particular circumstances of feed type, management quality, herd health and housing environment.

TN Tempo finishers have a high feed intake capacity and can easily overeat from 75 kg body weight onwards, if fed *ad libitum*. As the genetic potential to deposit protein reduces, fat deposition increases. Consequently back fat thickness will increase and lean meat percentage will decrease. Therefore controlling the feed intake of TN Tempo finishers will lead to better lean meat percentages and feed conversion ratio's, as compared to *ad libitum* feed systems.

5.3 Health conditions

The efficiency of nutrient utilization in pigs is optimized under high health environments. A high health status not only increases productivity and efficiency, but also leads to an increased nutrient demand. When pigs are immunologically challenged, nutrients are diverted away from productive functions (i.e., lean tissue growth) towards the activated immune system. Therefore under conventional health situations (most farms in the world), the immune system of the animal has to cope with all kinds of pathogens. This can have an influence on the amino acid profile requirements of the challenged animals especially for Met + Cys, Thr and Trp (Kampman - van de Hoek E, 2015).

Under SPF conditions the animals can increase their feed intake with ±10 -15%, reduce maintenance with some 10% and increase protein deposition capacity with around 25g/d.

The following points need to be taken under consideration for SPF animals :

- SPF animals grow faster; therefore have the capacity to reach higher protein deposition rates.
- The higher feed intake capacity in SPF animals does not reflect in an increased protein deposition level, if the ratio lysine to energy ratio's in the diet is limited.

5.4 Paylean® (Ractopamine)

Ractopamine-HCl, is an adrenergic agonist, and is labelled for use in swine diets during the final growth stages. Dietary inclusion has shown consistent improvement in pig growth performance and has led to its widespread use in the swine industry. When fed, it promotes lean growth rather than fat deposition by directing nutrients away from the fat depots towards muscle development.

Fat tissue deposition requires more energy than lean growth, thus increasing lean deposition leads to improved feed efficiency prior to market and a leaner carcass. Because of the increased protein accretion, pigs that are fed Ractopamine have an increased dietary amino acid requirement.

Beside the advantages of using Ractopamine, there are some attention points which should be considered. Topigs Norsvin recommends to strictly follow the nutritional guidelines of the specific manufacturer, when using these additives.

5.5 Vaccination against boar taint (Zoetis)

A vaccine against gonadotropin-releasing hormone (GnRH) for controlling boar taint and sexual boar behaviour has been introduced to the global market as an animal-welfare-friendly alternative to surgical castration. The vaccine is licensed globally. The first dose of the injection primes the pig's immune system but does not alter testes functionality. The second dose stimulates the protective immune response resulting in a temporary inhibition of testicular development.

Until the second injection the animal remains a boar. After the second vaccination the testicular hormone release is blocked (for about 10 weeks) inducing a physiological transition to a castrate-type animal.

After a 10 to 14 day transition period following the second injection, the ADFI of the vaccinated animals increases dramatically. Because of the significant increase in ADFI that occurs starting two weeks after the second Injection, **feeder space and feed availability must be prioritized for these vaccinated animals.**

This increase in feed consumption results in a significant increase in lipid deposition rate, and the overall F/G advantage of IC barrows begins to decline (by 1.5 to 2.0% per week with each additional week after the second dose. (Puls, 2013)). However, the vaccinated animals continue to be more efficient than physically castrated barrows up to at least seven weeks after the second dose. At the same time, belly yield and bacon slicing characteristics improve as time after the second injection increases (Boler et al, 2012). Therefore, it will be imperative for each production system to balance live performance and carcass characteristic goals to maximize the profit potential from this technology.

Nutritional guidance

To optimize ADG and F/G, it is recommended that lysine-eq levels for boars vaccinated against boar taint be increased to the same requirement for non-vaccinated entire boars until 10 days after the second dose and to the same requirement for physically castrated animals from 10 days after the second dose to market. Energy-density before and after the 2nd vaccination needs to be adapted in a way that animals do not limit themselves in intake and can be fed *ad libitum*.

How to feed immunocastrates:

5.6 Pellet vs. Mash feed

The feeding behaviour and performance of pigs can also be influenced by the feed type (pellet vs. mash). Feeding pelleted diets to pigs has been shown to increase nutrient digestibility and improve FCR from 5% to 8% in finishing pigs. Improvements in animal performance have also been attributed to decreased feed wastage, reduced selective feeding, decreased ingredient segregation, less time and energy expended for prehension, destruction of pathogens, thermal modification of starch and protein, and improved palatability.

The improvements in FCR are highly depended on pellet quality, percentage fines and pellet size. Another advantage to use pelleted diets is the ability to grind grains to smaller micron sizes and to use a higher percentage of alternative ingredients in the diets and still maintain good feed flowability.

5.7 Hot climates

The environment can serve as a significant factor affecting both the voluntary feed intake level and the overall nutrient requirements of pigs. Temperature, probably more than any other environmental factor, can be used to explain a majority of the variations associated with differences in feed intake and performance among groups of pigs. Given the fact that animals tend to eat less when temperature rises, feed intake capacity can be a limiting factor for optimal performance. Swine diet formulations should be adjusted to account for the variations in feed intake associated with environmental temperature changes.
Some alternatives can be used to optimize the performance in hot climates. Under heat stress, pigs reduce their feed intake in order to reduce their heat production due to the thermal effect of feed (TEF). The reduction of feed consumption results in a decrease of growth of pigs which affects the profitability of the swine producers. Nutritional solutions can mainly be described according to their ability to reduce dietary heat increment or to increase dietary nutrient density. The increase of crude protein supply is associated with a higher protein turn over which enhances heat production.

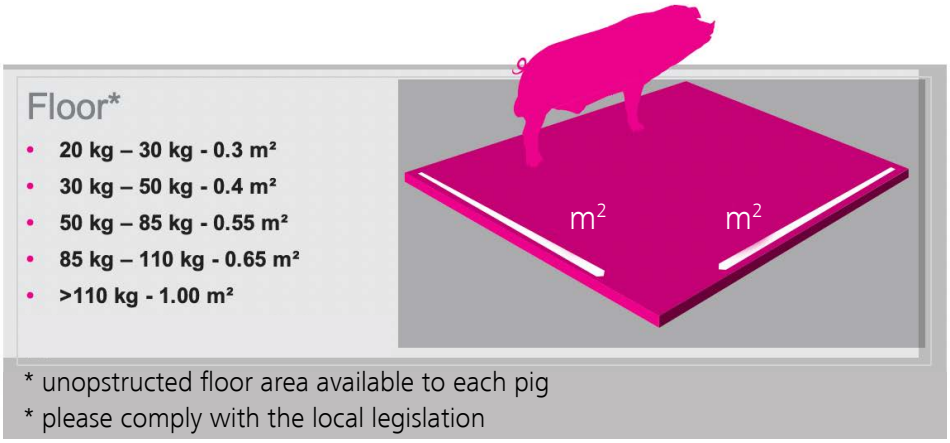
What might be beneficial is:

(1) Low crude protein diets. Practically, crude protein is partially replaced by starch and/or fat and industrial amino acids in order to meet the protein requirement for optimal performance.
(2) Offer the feed during cooler phases of the day/night.
(3) Feed more times per day. Feed will be less per meal and have a lower influence on the energy needed to digest/internal heat etc.
(4) Ensure the availability of fresh clean water. Water should be available *ad libitum*. Ensure a minimum flow rate of 1.5 litre water per minute.

5.8 Stocking Density

The stocking density is very important for the overall performance and the welfare of the herd. Not complying with the minimum stocking densities could have an effect on overall performance.

- Average daily gain and feed conversion
- Less sociable pigs with damaging behavior towards pen mates
- Increased losses



* unopstructed floor area available to each pig
* please comply with the local legislation

5.9 Liquid feeding

Working with liquid feeding systems requires certain precautions. For each type of diet there is an ideal dilution, which depends on the ingredients used and on how each one was included. There can be decomposition into sub products which do not have proper time to be incorporated to the liquid diet, losses of vitamins and essential nutrients can also occur. When considering the type of grain used to elaborate the feed, it is important to consider the chemical composition and the effects that the raw materials can have on the pigs feed digestibility. Therefore, Topigs Norsvin advise regular laboratory analyses of the feed to guarantee that the pigs are not fed diets that can limit their performance and/ or affect the carcass quality negatively.

5.10 Split sex feeding

In general, gilts will consume less feed and are about 4% more efficient in converting feed to body weight gain during the finishing period as compared to castrates. To offset the reduction in feed intake, diets for gilts need to contain higher nutrient levels (namely protein or amino acids) to achieve adequate daily intakes of these nutrients. Boars will even be more efficient than gilts.
The differences in feed intake, together with the differences in performance and carcass parameters, provide the basis for split-sex feeding.

5.11 Topigs Norsvin Feed Monitor

The Topigs Norsvin Feed Monitor is an online tool that offers the possibility to compare your current feeding program, growth rates and feed conversion ratios with the Topigs Norsvin feeding advice and performance indicators. The aim of the Feed Monitor is to give insight in the way your finishers are fed compared to the feeding advice of Topigs Norsvin. It is a simple tool that compares basal requirements for energy and lysine intake. The tool is available online at https://feedmonitor.topigsnorsvin.com, please request access online or contact your local Topigs Norsvin office for the login information.

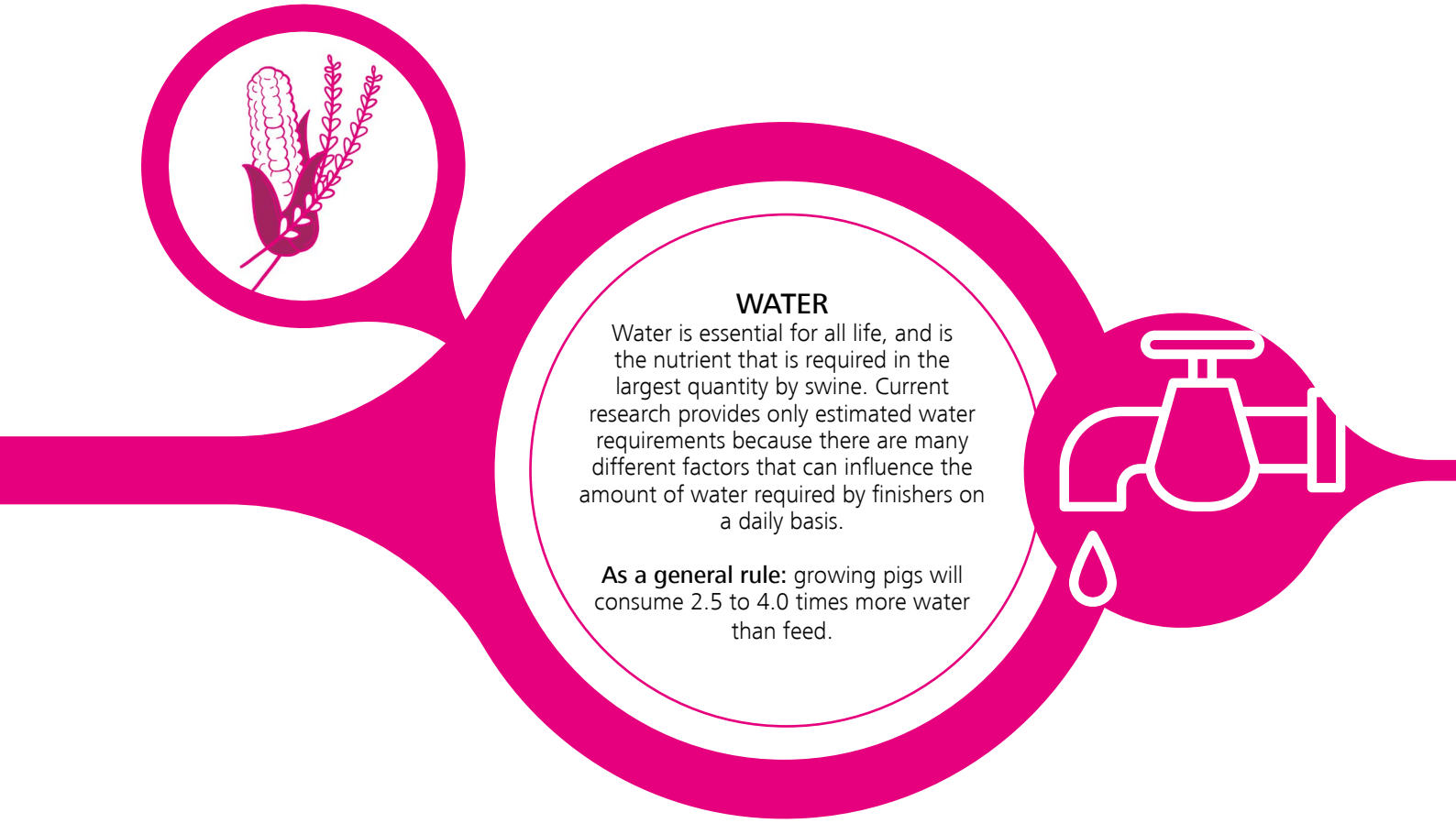
5.12 The advantages of using fibres

Extra added fiber like soy hulls, wheat middlings, or others can help to increase satiety, help digestion and limit negative impact of rapid hind gut fermentation in older finishing pigs. It is also important to use different type of fibers, fermentable and unfermentable. The right combination is essential for good results. Inclusion examples might be:

- Soy hulls - 2% beginning at 70 kg live weight and increasing to 5 to 7% by market
- Wheat middlings - up to 5%

5.13 Temperature and ventilation

Ensure proper ventilation rates. TN Tempo sired pigs are high performing with high feed intake levels. Therefore, take also into consideration that the increased body heat production also affects stocking densities. From research, it is known that at higher temperatures the density of pigs per m^2 should be adjusted as this is also correlated with the behavior of animals in terms of laying pattern and activity (Spoolder et al., 2012). Depending on the farm and the systems used temperature should be adjusted in order to keep the animals in a comfort zone.



WATER

Water is essential for all life, and is the nutrient that is required in the largest quantity by swine. Current research provides only estimated water requirements because there are many different factors that can influence the amount of water required by finishers on a daily basis.

As a general rule: growing pigs will consume 2.5 to 4.0 times more water than feed.

6. APPENDIX

1. Example of diet calculations Wheat-Barley market

Corn-soybean and wheat-barley are the two main feed markets in the world. Pigs fed well-balanced wheat-barley based diets can perform as well as those fed corn-soybean diets. The minimal energy levels reachable when using these two different feed sources is what differentiates these two markets. Therefore, the feed schedules and calculations will be different for these two markets. Nevertheless, the daily nutrient requirements of TN Tempo finishers are the same.

Table 2. Nutritional requirement (g/kg) for TN Tempo finishers, based on a 5 phase feeding program

Sex	Body Weight (kg)	Starter	Grower 1	Grower 2	Finisher	Final
		25 - 35	35 - 55	55 - 75	75 - 100	100 - 130
Castrates	**Ave Daily feed intake, kg/day [1]**	**1,3**	**1,9**	**2,4**	**3,0**	**3,4**
	NE, MJ/kg [2, 3]	9,8	9,5	9,3	9,2	9,1
	ME, Mcal/kg [2, 3]	3,13	3,04	2,98	2,93	2,90
	Lys. SID, g/kg [2]	10,9	9,5	8,4	7,2	6,1
	SID Lys/NE, g/MJ	1,11	0,99	0,90	0,79	0,67
	Ca, g/kg	8,4	7,7	7,0	6,1	5,4
	Available P, g/kg [4, 5]	4,3	4,0	3,7	3,4	3,1
	Digestible P, g/kg [4, 5]	3,2	2,9	2,6	2,3	2,0
Gilts	**Ave Daily feed intake, kg/day [1]**	**1,3**	**1,8**	**2,3**	**2,8**	**3,3**
	NE, MJ/kg [2, 3]	10,0	9,6	9,3	9,1	8,9
	ME, Mcal/kg [2, 3]	3,18	3,06	2,97	2,91	2,85
	Lys. SID, g/kg [2]	11,5	10,0	8,9	7,8	6,4
	SID Lys/NE, g/MJ	1,16	1,04	0,95	0,85	0,72
	Ca, g/kg	8,6	7,8	7,2	6,4	5,5
	Available P, g/kg [4, 5]	4,4	4,1	3,8	3,6	3,2
	Digestible P, g/kg [4, 5]	3,3	3,0	2,7	2,4	2,0
Boars	**Ave Daily feed intake, kg/day [1]**	**1,2**	**1,7**	**2,3**	**2,8**	**3,3**
	NE, MJ/kg [2, 3]	10,0	9,6	9,3	9,1	8,9
	ME, Mcal/kg [2, 3]	3,21	3,08	2,98	2,91	2,85
	Lys. SID, g/kg [2]	12,4	10,8	9,5	8,2	7,1
	SID Lys/NE, g/MJ	1,24	1,12	1,01	0,90	0,80
	Ca, g/kg	9,1	8,4	7,6	6,7	5,9
	Available P, g/kg [4, 5]	4,7	4,4	4,0	3,7	3,5
	Digestible P, g/kg [4, 5]	3,5	3,2	2,8	2,5	2,2

1 Average daily feed intake was used to calculate the nutrients per kg feed.
2 Net energy (MJ/kg), Metabolizable energy (Mcal/kg) and SID-lysine (g/kg) are calculated on an ADFI (kg/d).
3 NE = ME X 0.74 (The conversion factor could be different for each country); MJ = Mcal X 4.184
4 The level of digestible phosphorous (g/kg) is expressed as STTD P (standard total tract digestibility) and is calculated by dividing daily requirements by daily feed intake of the animals. We recommend utilization of Phytase in order to reduce Phosphorous excretions and environmental impact.
5 Definitions of Available and Digestible phosphorus are indicated in Appendix 5.

2. Example of diet calculations for Corn-Soy Market

Corn-soybean and wheat-barley are the two main feed markets in the world. Pigs fed well-balanced wheat-barley based diets can perform as well as those fed corn-soybean diets. The minimal energy levels reachable when using these two different feed sources is what differentiates these two markets. Therefore, the feed schedules and calculations will be different for these two markets. Nevertheless, the daily nutrient requirements of TN Tempo finishers are the same.

Table 3. Nutritional requirement (g/kg) for TN Tempo finishers, based on a 5 phase feeding program

Sex	Body Weight (kg)	Starter	Grower 1	Grower 2	Finisher	Final
		25 - 35	35 - 55	55 - 75	75 - 100	100 - 130
Castrates	**Ave Daily feed intake, kg/day [1]**	**1,3**	**1,8**	**2,4**	**2,8**	**3,1**
	NE, MJ/kg [2, 3]	9,8	9,7	9,7	9,8	9,9
	ME, Mcal/kg [2, 3]	3,13	3,10	3,10	3,12	3,15
	Lys. SID, g/kg [2]	10,9	9,6	8,7	7,7	6,6
	SID Lys/NE, g/MJ	1,11	0,99	0,90	0,79	0,67
	Ca, g/kg	8,4	7,8	7,3	6,5	5,9
	Available P, g/kg [4, 5]	4,3	4,1	3,8	3,6	3,3
	Digestible P, g/kg [4, 5]	3,2	3,0	2,7	2,4	2,2
Gilts	**Ave Daily feed intake, kg/day [1]**	**1,3**	**1,8**	**2,2**	**2,6**	**3,0**
	NE, MJ/kg [2, 3]	10,0	9,8	9,7	9,7	9,7
	ME, Mcal/kg [2, 3]	3,18	3,12	3,09	3,10	3,10
	Lys. SID, g/kg [2]	11,5	10,2	9,2	8,3	7,0
	SID Lys/NE, g/MJ	1,16	1,04	0,95	0,85	0,72
	Ca, g/kg	8,6	7,9	7,5	6,8	6,0
	Available P, g/kg [4, 5]	4,4	4,2	4,0	3,8	3,5
	Digestible P, g/kg [4, 5]	3,3	3,1	2,8	2,5	2,2
Boars	**Ave Daily feed intake, kg/day [1]**	**1,2**	**1,7**	**2,2**	**2,7**	**3,1**
	NE, MJ/kg [2, 3]	10,0	9,8	9,7	9,7	9,7
	ME, Mcal/kg [2, 3]	3,21	3,14	3,11	3,10	3,10
	Lys. SID, g/kg [2]	12,4	11,0	9,9	8,7	7,7
	SID Lys/NE, g/MJ	1,24	1,12	1,01	0,90	0,80
	Ca, g/kg	9,1	8,5	7,9	7,1	6,5
	Available P, g/kg [4, 5]	4,7	4,5	4,2	4,0	3,8
	Digestible P, g/kg [4, 5]	3,5	3,3	2,9	2,6	2.4

1 Average daily feed intake was used to calculate the nutrients per kg feed.
2 Net energy (MJ/kg), Metabolizable energy (Mcal/kg) and SID-lysine (g/kg) are calculated on an ADFI (kg/d).
3 NE = ME X 0.74 (The conversion factor could be different for each country); MJ = Mcal X 4.184
4 The level of digestible phosphorous (g/kg) is expressed as STTD P (standard total tract digestibility) and is calculated by dividing daily requirements by daily feed intake of the animals. We recommend utilization of Phytase in order to reduce Phosphorous excretions and environmental impact.
5 Definitions of available and digestible phosphorus are indicated in Appendix 5.

3. Amino acid/ Lysine ratio used to estimate amino acid requirements

Lysine is the first limiting amino acid in most practical swine diets. It is common practice to first define the adequate lysine level in the diet and then derive the required level of other essential amino acids from lysine on the basis of an ideal protein ratio, thus giving a balanced protein diet. A balanced protein diet contains sufficient levels of each essential amino acid to meet the biological needs of the animal while minimizing the amounts of excess amino acids. The latest review by Peet-Schwering and Bikker (2018) has defined the ideal balance of amino acids for each phase of production based on the concept of Ideal Protein. This serves as basis for Topigs Norsvin recommendations. Feed ingredients have different amino acid digestibility coefficients. Therefore, when formulating diets that are more complex, it is recommended that standardized ileal digestible values are used in the formulation process.

Table 4. Recommendations for SID essential amino acids other than lysine in starter, grower and finisher pig diets (expressed as % of SID lysine) for current and future1 growing and finishing pigs and the variation in the SID essential amino acid to lysine ratios in the reviewed literature (Peet-Schwering and Bikker, 2018).

Amino Acids[1]	Starter	Grower	Finisher	Variation
Lysine	100	100	100	-
Met + Cys[2]	60	61	62	58-63
Tryptophan	20	20	20	17-23
Threonine	66	67	68	61-74
Valine	67	67	67	64-72
Isoleucine[3]	53	53	53	50-54
Leucine	100	100	100	100-102
Histidine	32	32	32	32-32
Phenylalanine+Tyrosine[4,5]	95	95	95	94-100

1 The daily gain of the future growing and finishing pigs is 10% higher than the daily gain of the current growing and finishing pigs and is realized by a 10% higher feed intake or a 10% improved feed conversion ratio;
2 A minimum ratio of methionine to methionine+cystine of 55% is advised;
3 Recommendation in diets without blood products (non-excess level of leucine);
4 Based on experiments with weaned piglets;
5 A minimum SID phenylalanine to lysine of 54 % and a maximum SID tyrosine to lysine ratio of 40% to support maximal growth is advised

4. Standardized ileal digestible (SID) vs. apparent ileal digestible (AID) lysine

The terminology used to describe the bioavailability and ileal digestibility of amino acids in pig feed ingredients are explained in this appendix. Ileal digestibility values may be expressed as apparent ileal digestibility (AID), standardized ileal digestibility (SID), or true ileal digestibility (TID). These terms are used to specify how ileal endogenous AA losses are reflected in digestibility values. Ileal endogenous AA losses may be separated into basal losses, which are not influenced by feed ingredient composition, and specific losses, which are induced by feed ingredient characteristics such as levels and types of fiber and anti-nutritional factors. Values for AID are established when total ileal outflow of AA (i.e., the sum of endogenous losses and no digested dietary AA) is related to dietary AA intake. A concern with the use of AID values is that these are not additive in mixtures of feed ingredients. This concern may be overcome by correcting AID values for defined basal endogenous losses of AA, which yields SID values. Furthermore, if the AID values are corrected for basal and specific endogenous losses, then values for TID are calculated. However, reliable procedures to routinely measure specific endogenous losses are not yet available. It is suggested that SID values should be used for feed formulation, at least until more information on TID values becomes available.

Table 5. Example of the differences between SID and AID Lys for TN Tempo Castrates

SID Lysine and AID Lysine	Basal (g/kg DM)	25 - 50 kg	
		SID Lysine	AID Lysine
Lysine	0.040	1.000	0.964
Methionine	0.011	0.280	0.270
Methionine + Cysteine	0.021	0.600	0.581
Threonine	0.061	0.650	0.596
Tryptophan	0.014	0.180	0.167

5. Vitamin and mineral recommendations

Table 6. Vitamins recommendations

VITAMINS	Units	25 - 45 kg		45 - 75 kg		75 - End	
FAT SOLUBLE VITAMINS		Min	Max	Min	Max	Min	Max
VIT. A	i.u	6500	10000	6500	10000	5000	7500
VIT. D^3	i.u	1500	2000	1500	2000	1000	1500
VIT. E	i.u	60	100	60	100	40	75
VIT. K^3	mg	2	3	2	3	2	3
WATER SOLUBLE VITAMINS							
VIT. B_1 (Thiamine)	mg	2	3	2	3	2	3
VIT. B_2 (Riboflavin)	mg	7	10	7	10	5	8
VIT. B_3 (Nicotinic acid)	mg	20	40	20	40	20	30
VIT. B_5 (Pantothenic acid)	mg	25	45	25	45	25	45
VIT. B_6 (Pyridoxine)	mg	2	4	2	4	2	3
VIT. B_{12} (Cobalamin)	mcg	30	50	30	50	20	40
VIT. B_9 (Folic acid)	mg	1	1,5	1	1,5	0,5	1
VIT. B_7 (Biotin)	mg	0,05		0,05		0,05	
Choline	mg	150	300	150	300	100	200

Notes:

- Vitamin requirements are based on the latest recommendations and were derived from various sources.
- Comply with the local legislation given per country.
- The levels can be adjusted depending on the objectives (i.e. meat quality, heat stress, etc.)

Table 7. Minerals recommendations

MINERALS	Units	25 - 45 kg		45 - 75 kg		75 - End	
		Min	Max	Min	Max	Min	Max
Na	%	0,2	0,25	0,15	0,25	0,15	0,25
K	%		1,1		1,3		1,3
Mg	%		0,25		0,3		0,3
Fe	ppm	120		120		80	
I	ppm	1,5	4	1,5	4	1	3
Se	ppm	0,3	0,5	0,3	0,5	0,3	0,5
Cu	ppm	25		25		25	
Zn	ppm	120		120		100	
Mn	ppm	75		75		50	
Cl	%	0,15		0,15		0,15	

Notes:
- Mineral requirements are based on the latest recommendations and were derived from various sources.
- Comply with the local legislation given per country.
- The levels can be adjusted depending on the objectives (i.e. meat quality, heat stress, etc.)

6. Phosphorus

Phosphorus is one of the most significant minerals in swine nutrition. It is essential for bone development, plays a key role in metabolic processes such as the formation of cellular membranes and is vital for enzymatic systems involved in protein and carbohydrate metabolism. The ratio between Calcium and Phosphorus is of importance because these minerals are antagonists of each other which mean that an oversupply of calcium can work negatively for the digestibility of Phosphorus.

There are two expressions used for the phosphorus calculation by nutritionists: Available Phosphorus and digestible Phosphorus. The definition is as follows:

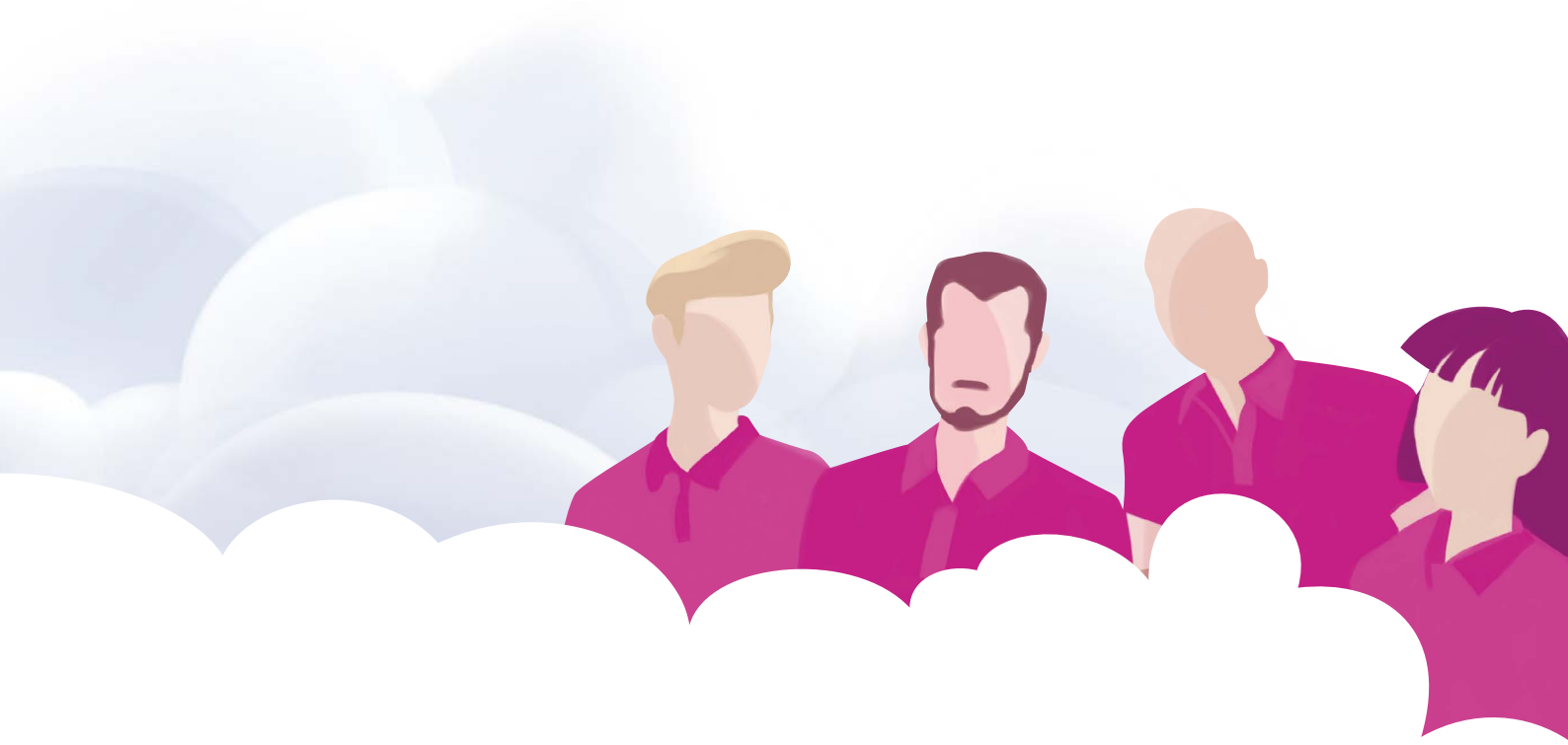
AVAILABLE PHOSPHORUS =
TOTAL PHOSPHORUS – INNOSITOL PHOSPHORUS

DIGESTIBLE PHOSPHORUS =
P INTAKE – FAECAL P / P INTAKE

In raw materials, a large amount of Phosphorus is in the form of Phytic acid (myo-inositol hexaphosphate). The Phosphorus in Phytic acid is largely unavailable to the pig. Thus, a phytase enzyme is added to diets to enhance the pig's ability to use Phosphorus from Phytic acid. Because manufacturers have their own individual analytical techniques, it is often confusing to compare phytase sources by a single analytical method. To avoid this confusion, Topigs Norsvin indicate the Phosphorus requirements without any influences of the Phytase enzymes.

The level of digestible and available Phosphorus for maintenance and gain were estimated using the following equations Bikker and Blok (2017) and NRC (2012) **considering the extra gain achieved by the latest genetics.**

The requirements provided by Topigs Norsvin in the appendix for calcium and digestible phosphorous were determined with the objective to unlock the genetic potential but also on bone development. The diets should be formulated in such a way to comply with the local legislation.



If you have any questions about the manual,
please contact the Topigs Norsvin Global Nutrition Service
feed.group@topigsnorsvin.com

www.topigsnorsvin.com

Topigs Norsvin