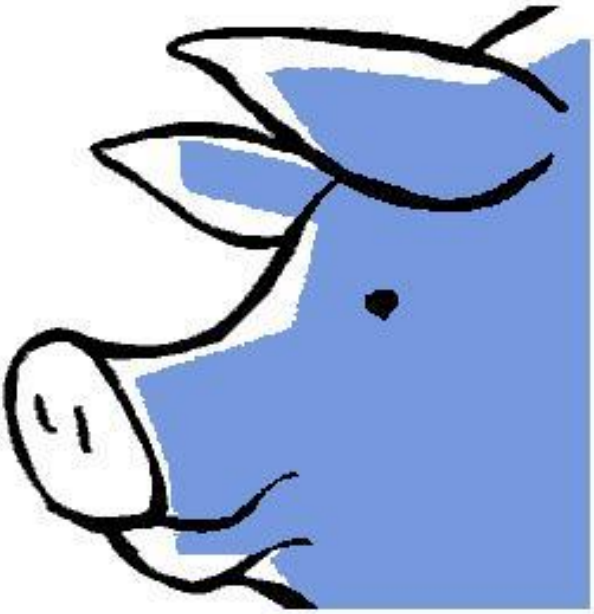
Booklet of Feeding Tables for Pigs

Nutrient requirements and feed ingredient composition for pigs



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Preface

This is the English translation of the Dutch publication “CVB Tabellenboek Voeding Varkens 2023”. The booklet is an update of the 2020 version. In the period between 2020 and 2023 a substantial amount of effort was put in updating the standardized ileal digestible amino acid coefficients of feedstuffs for pigs. Also, the amino acid requirements for weaned piglets have been analyzed and updated. In this updated version of the CVB Booklet of Feeding Tables for Pigs the results of this work are incorporated.

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WLR and ILVO

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Introduction

- In different parts of this publication the word 'requirement' is used. With this term the need for a certain nutrient is meant, *including* a safety margin.
- Many requirements are expressed as a ratio to a EW_{2015} value. For diets with a deviating EW_{2015} level recommended nutrient concentration can be easily recalculated by multiplying the Table with the (EW_{2015} level deviating diet) : (EW_{2015} of diet in table) ratio.
- 1 EW_{2015}= 8,8 MJ NE_{2015}.

1. Piglets

It is advised to offer creep feed to suckling piglets. The suckling piglets should consume as much solid feed as possible. A high intake can be obtained by supplying a milk-based pelleted feed from 10 days of age onwards. From one week before until two weeks after weaning, a weaner diet can be provided. This feed may also be fed from two weeks of age in case no creep feed is used. Dietary changes at weaning should be avoided.

1.1 Protein/amino acid requirements

From the age of 5 to 6 weeks, a piglet diet can be provided. Results from a meta-analysis on lysine dose response studies reported in the scientific literature it was observed that the requirement for standardized ileal digestible (SID) lysine was higher than 1,3 g per JM NE (~ 11,4 g SID-lysine/EW_{2015}) and that for most studies the lysine requirement was higher than the second highest tested SID-lysine treatment. A high lysine level combined with a low protein content in the diet could result in a situation that not lysine is limiting body weight gain but other non-essential amino acids. Therefore is was chosen to express the SID-lysine recommendation relative to the dietary protein level and the SID of this dietary protein. Based on a number of assumptions (a lysine concentration of 6.96% in body protein, a maximum efficiency of, respectively, 72 and 81% for the deposition of SID-lysine and SID-CP, and a dietary energy content of 1.14 EW_{2015}/kg), the optimal SID-lysine content can be calculated as a function of dietary protein content. The in this manner estimated SID-LYS recommendations are shown in Table 1.

Table 1. Recommended levels of standardized ileal digestible lysine (SID-LYS) in diets for weaned piglets from 5 - 6 weeks of age depending on the dietary CP-content and the percentage of standardized ileal digestible CP (SIDC-CP).

	SIDC-CP = 90%	**SIDC-CP = 85%**	**SIDC-CP = 80%**
CP (g/kg)	**SID-LYS (g/kg)**	**SID-LYS (g/kg)**	**SID-LYS (g/kg)**
160	11,3	10,6	10,0
170	12,0	11,3	10,6
180	12,7	12,0	11,3
190	13,4	12,6	11,9
200	14,1	13,3	12,6
210	14,8	14,0	13,2
220	15,5	14,6	13,8

Based on a literature review on recent studies (2003 – 2021) consisting of both dose response studies, literature reviews and amino acid recommendations from various organizations, the requirements for essential amino acids other than lysine have been established. These established requirements are shown in Table 2.

Table 2. Advised levels of standardized ileal digestible (SID) essential amino acids relative to SID lysine including dietary SID essential amino acid concentrations (g/kg) for a diet with a CP-content of 180 g/kg, a percentage of standardized ileal digestible CP (SIDC-CP) of 90% and a dietary EW_{2015} content of 1.14 per kg.

Amino Acid	SID amino acid requirement relative to SID lysine (%)	g SID amino acid/kg at a CP-content of 180 g/kg and a SIDC-CP of 90%
Lysine	100	12,7
Methionine[3]	33	4,2
Methionine+cystine[1, 3]	60	7,6
Threonine[3]	65	8,3
Tryptophan[3]	20	2,5
Isoleucine[2]	52	6,6
Valine	67	8,5
Leucine	100	12,7
Histidine	30	3,8
Tyrosine	40	5,1
Phenylalanine	54	6,9

1) It is advised to maintain a methionine percentage of 55% in the combined methionine + cystine content.
2) This advice is valid for diets without blood products. In diets with blood products a percentage of SID isoleucine relative to SID lysine of 55% is adviced.
3) During increased pathogen pressure of reduced hygiene status, the requirements of these amino acids may be higher.

1.2 Minerals and trace elements

1.2.1 Standardized digestible phosphorus, standardized digestible and (gross) calcium

Table 3 summarizes the standardized total tract digestible phosphorus (STTD P), standardized total tract digestible calcium (STTD Ca) and (gross) calcium (Ca) requirement per EW_{2015} for piglets.

Table 3. Recommended levels of standardized total tract digestible phosphorus (STTD P), standardized total tract digestible calcium (STTD Ca) and (gross) calcium (Ca) in diets for young piglets.

Diet	BW (kg)	STTD P (g/EW_{2015})	STTD Ca (g/EW_{2015})	Ca (g/EW_{2015})
Weaning diet	7 – 11	3,8	5,9	9,8
Piglet diet	11 – 25	3,2	5,0	8,4

The recommended STTD Ca content mentioned above is based on a Ca digestibility of 60%. The Ca-levels in weaning diets can (to reduce the buffer capacity) be lower than 9,8 g/EW in practice by, on the one hand, applying Ca-sources (e.g. Ca-formate) for which a 100% Ca availability is maintained and, on the other hand, by applying phytase which releases phytate-bound Ca. For health reasons it is also possible to choose to lower dietary Ca-levels and to also lower the dietary STTD P content. This choice will result in a a reduced P-retention in the

animal. When, for example, one choses to temporally reduce P retention with 15% (i.e. from 5,32 to 4,52 g/kg empty body weight), in order to get the Ca content and buffer capacity of the ration for weaned piglets at a desired low level, the following dietary levels can be used:

- Weaning diet (piglets of 7-11 kg): 3,4 g STTD P and 8,4 g Ca (or 5,0 g STTD Ca) per EW.

1.2.2 Other minerals and trace elements

In 2015 a desk study was performed with respect to the requirements of minerals and trace elements for pigs (CVB Documentation report no 58) (in Dutch). The requirements for minerals and trace elements of piglets are presented in Table 4.

Table 4. Mineral and trace element requirements of piglets.

	5 - 11 kg BW	**11 - 25 kg BW**
Minerals (g/kg)		
Mg	1,1	1,1
Na	2,4	2,4
Cl	3,2	3,2
K	3,3	2,9
Trace elements (mg/kg)		
Fe	110	110
I	0,15	0,15
Mn	22	22
Se	0,28	0,24

For copper and zinc no nutritional standards are given. In the EU, the following maximum legal levels of copper and zinc in piglet rations apply:

Copper (see Regulation EU 2018/1039):

- Until 4 weeks after weaning: 150 mg/kg (total);
- From the 5th week after weaning until 8 weeks after weaning: 100 mg/kg (total).

Zinc (see Regulation EU 2016/1095):

- Piglets: 150 mg/kg (total)
  Remark: In the EU Regulation there is no explanation on the definition of piglets. Often, 'animals are considered piglets until 12 weeks of age.

Clean drinking water should be continuously available to the piglets, irrespective of weaning age. For hygienic reasons (adjustable) nipple drinkers are recommended.

2. Replacement gilts

2.1 Feeding and growth of replacement gilts

Replacement gilts require sufficient energy and amino acids for a good development. The requirement of essential nutrients, like amino acids and minerals, is comparable to the needs for fattening pigs with a comparable weight. In contrast, a well-developed skeleton is more important in replacement gilts compared to fattening pigs due to the longevity of the gilt and the mobilization of calcium and phosphorus during lactation. This requires higher levels of digestible phosphorus and calcium in the diet of replacement gilts compared to fattening pigs. In addition, replacement gilts receive a feed that is relatively low in energy, to develop a good feed intake capacity.
It is advised to feed replacement gilts using a 3 phase feeding strategy in order to better feed the animal according to requirement. The first 6 weeks of the grower period a start diet for replacement gilts is advised. After that, from 15 weeks of age, one can gradually switch over to a replacement gilt diet, adapted to the needs of replacement gilts. First a replacement gilt diet 1 is given, second a replacement gilt diet 2. It is also possible to feed a low energy lactating sow diet. However, this lactating sow diet is less adapted to the needs of replacement gilts.

With the feeding schedule in Table 5 the aim is to establish an average growth of about 700 grams per day.

Feed intake of gilts in the period around mating influences the size of the first litter.
To increase the number of ovulated eggs it is recommended to raise the daily amount of feed by 0,5 to 1,0 kg (depending on the condition of the gilt) 10 - 14 days before mating.

Table 5. Feeding schedule for replacement gilts. EW_{2015} values presented in bold are only applicable when gilts are flushed.

Days after moving	BW [1] (kg)	EW_{2015} [2] (per day)
0	25	1,22
7	29	1,40
14	34	1,62
21	39	1,83
28	44	2,02
35	49	2,19
42	55	2,34
49	61	2,40
56	67	2,52
63	73	2,62
70	79	2,70
77	85	2,77
84	91	2,81
91	97	2,88
98	102	2,92
105	108	2,84
112	114	2,91
119	119	2,93
126	124	2,96
133	129	2,97
140	134	2,98
147	139	2,49
154	143	3,00
161	147	3,01
168	151	3,02
175	155	**3,02**
182	159	**3,02**
189	162	**3,03**

[1] BW = body weight in kg.

[2] The amount of feed in kg per day can be calculated by dividing the recommended amount of EW_{2015} by the EW_{2015} content of the feed.

Source: derived from Topigs Norsvin TN70 sow, 2016.

2.2 Requirement for standardized ileal digestible lysine

It is advised to use the dietary levels of standardized ileal digestible (SID) lysine levels given in Table 6. Requirements for of other amino acids are presented in Table 20.

Table 6. Recommended standardized ileal digestible (SID) lysine levels (g/EW_{2015}) for replacement gilts.

Day after moving	BW (kg)	SID lysine (g/EW_{2015})
0 – 42	25 – 50	8,8
42 – 90	50 – 90	7,5
90 – 147	90 – 128	6,2
147 – insemination	128 – 140	5,6

Source: derived from Topigs Norsvin TN70 sow, 2016.

2.3 Minerals and trace elements

2.3.1 Standardized digestible phosphorus and gross calcium

In Table 7 the requirements for standardized digestible phosphorus (STTD P), standardized digestible calcium (STTD Ca) and gross calcium (Ca) for replacement gilts are presented, based on the calculations of a feeding schedule aiming at an average daily gain of 700 g per day. In view of the optimal development of the skeleton a wider safety margin has been maintained then estimated by model based calculations.

Table 7. Recommended levels of standardized digestible phosphorus (STTD P), standardized digestible calcium (STTD Ca) and gross calcium (Ca) per EW_{2015}.

Days after relocation	BW (kg)	STTD P (g/EW_{2015})	STTD Ca (g/EW_{2015})	Ca (g/EW_{2015})
0 – 49	25 – 55	2,8	4,4	7,6
49 – 133	55 – 102	2,4	3,8	6,5
133 – 210	102 – 155	2,0	3,2	5,6
210 – insemination	155 – 162	2,0	3,2	5,6

2.3.2 Other minerals and trace elements

In 2015, a desk study was performed on the mineral and trace element requirements of pigs (Documentation report nr. 58; in Dutch). For growing replacement gilts the feeding standards are similar as for growing pigs (see Table 27). The same applies for the EU maximum legal levels of copper and zinc (see section 5.3.b).

3. Sows

3.1 Basis for recommended feeding schedules

In 2019 the energy- and amino acid requirements for gestating and lactating sows were updated by Wageningen Livestock Research, department animal nutrition (rapport 1190; Van der Peet-Schwering and Bikker, 2019). The energy- and amino acid requirements are based on the assumptions (weight- and back fat development of sows and litter size) presented in Table 8.

3.2 Dry sows

From weaning to first mating, it is recommended to supply dry sows with 3,6 EW_{2015} per day during maximal 10 days. It is advised to feed dry sows a lactating sow diet to stimulate feed intake and, due to high levels of starch and sugar, also stimulate insulin production.

3.3 Gestating sows

During gestation, sows need energy and amino acids for maintenance, maternal growth and growth of the unborn piglets, the uterus and the mammary gland.

3.3.1 Energy requirement

The energy requirement for sows is calculated:

1) Based on a constant maternal growth during gestation. This results in a feeding schedule that gradually increases. Calculation example for a parity 2 sow (Table 8):
    a. Real maternal gain: 20 kg /115 days = 174 gram growth per day from day 1 until day 115.

b. Recovery body condition loss previous lactation: 30 kg / 115 days = 260 gram growth per day from day 1 to day 115.
c. Total: 174 + 260 = 434 gram growth per day

Table 8. Starting-points for the calculation of energy- and amino acids requirements of gestating and lactating sows.

	Parity				
	1	**2**	**3**	**4**	**5**
Body weight of sow on day 0 of gestation (kg)	140	165	185	205	220
Back fat sow, early gestation (mm)	13	12	13	13	13
Maternal growth during gestation, excluding the uterus and its content (kg)	55	50	45	40	35
- "Real" maternal growth	55	20	15	15	10
- Recovery of weight loss from the previous lactation	0	30	30	25	25
Growth of sow during gestation, including the uterus and its content (kg)	82	79	74	69	64
Weight of sow at farrowing, excluding the uterus and its content (kg)	195	215	230	245	255
Back fat thickness at farrowing (mm)	17	17	17	17	17
Weight loss during lactation and interval weaning-estrus (kg)	30	30	25	25	20
Litter size (number of piglets, born alive and dead)	15	16	16	16	16
Weight piglet (kg)	1,25	1,40	1,40	1,40	1,40
Number of weaned piglets	12	13	13	13	13

Source: The model calculations are based on Van der Peet-Schwering and Bikker (2019) (Rapport 1190, Wageningen Livestock Research), adjusted to assumptions for a high productive sow of 140 kg and a back fat thickness of 13 mm at first mating. Mobilization during lactation of 30 kg body weight and 5 mm of back fat thickness taking into account a loss of 5 to 10 kg body weight and 0,5 to 1 mm of back fat between weaning and estrus.

2) Starting from 60 % 'extra' or 'accelerated' body condition recovery during the first 6 weeks of gestation on top of a (remaining) body condition recovery during the whole gestation period. The aim is to, largely, restore the weight- and back fat thickness losses from previous lactation during early gestation. This results in a high-low-high feeding schedule. Calculation example for a second parity sow:
   a. Real maternal growth: 20 kg / 115 days = 174 gram growth per day from day 1 until day 115.
   b. 60 % extra body condition recovery during the first 42 days of gestation: (30 kg x 0,6 / 42 days) + (30 kg x 0,4 / 115 days) = 429 + 104 = 533 gram growth per day from day 1 until day 42. From day 43 until day 115 the daily growth is 104 gram.
   c. Total: 174 + 533 = 707 gram growth per day from day 1 until day 42 and 174 + 104 = 288 gram growth per day from day 43 until day 115.
   Extra body condition recovery from 60% during the first 6 weeks means that a total body condition recovery of ca. 75% can be achieved.

The energy requirement of gestating sows increases gradually during gestation. For practical reasons it is not feasible to frequently adjust the amount of feed according to the requirements.

Therefore, the amount of feed during gestation is increased stepwise. This implies that immediately after an increase in feed supply, the animals are fed above the requirements and shortly before an adjustment the animals are fed slightly below the requirements.
Table 9 shows the feeding schedule starting from a constant maternal growth during gestation. Table 10 shows the calculated feeding schedule starting from 60% extra body condition recovery during the first 6 weeks of gestation. The EW_{2015} requirements given in Table 9 and 10 should be considered as a general guidelines and may be adjusted to specific farm conditions. The following adjustments are possible:

Adjustment to different live weights
When the bodyweight of the sows differs from the weights mentioned in Table 9, the energy supply should be increased or decreased by 0,07 EW_{2015} per 10 kg live weight deviation. If a parity 1 sow weighs e.g. 160 kg instead of 140 kg at day 0, this sow will receive daily 0,14 EW_{2015} more in contrast to the recommended energy supply in Table 9 and 10, due to higher maintenance requirements.

Table 9. Recommended energy supply for gestating sows in EW_{2015} per day, based on a constant maternal growth during gestation.

Days in gestation	EW_{2015} [1,2)] per day				
	Parity 1	Parity 2	Parity 3	Parity 4	Parity 5 and >
0 – 27	2,30	2,45	2,48	2,56	2,60
28 – 55	2,46	2,62	2,64	2,71	2,74
56 – 83	2,73	2,90	2,91	2,97	2,99
84 – 97	2,96	3,15	3,16	3,20	3,22
98 – 115	3,12	3,32	3,32	3,36	3,37
Total EW	305	324	326	333	336

1) The amount of compound feed in kg can be calculated by dividing the recommended supply of EW_{2015} by the EW_{2015} value of the feed (expressed per kg product).
2) In practice, **adjusted energy values** for gestating sows are used (instead of the EW_{2015}). Unfortunately, the EW_{2015} cannot easily be recalculated to these other energy values for gestating sows, as the conversion factor strongly depends on the diet composition. This means that the contents of digestible amino acids (Table 12 and 13) and the STTD P, STTD Ca and Ca (see paragraph 3.3.3.) in the gestation diet are not (directly) applicable when adjusted energy values are used.

Table 10. Recommended energy supply for gestating sows in EW_{2015} per day, based on 60% extra body condition recovery during the first 6 weeks of gestation.

Days in gestation	EW_{2015} [1)] per day				
	Parity 1[2)]	Parity 2	Parity 3	Parity 4	Parity 5 and >
0 – 27	2,30	3,03	3,03	3,04	3,08
28 – 41	2,40	3,18	3,16	3,16	3,19
42 – 55	2,52	2,41	2,46	2,55	2,58
56 – 83	2,73	2,62	2,66	2,74	2,76
84 – 97	2,96	2,85	2,88	2,96	2,97
98 – 115	3,12	3,01	3,03	3,11	3,12
Total EW	305	328	330	336	339

1) The amount of compound feed in kg can be calculated by dividing the recommended supply of EW_{2015} by the EW_{2015} value of the feed (expressed per kg product).
2) With parity 1 sows, there is no additional requirement for recovery of weight loss.

Adjustments for deviating ambient temperatures

If the ambient temperature is lower than the lower critical temperature for dry or gestating sows, extra feed should be provided to prevent body condition losses. For individually housed sows, 0,1 EW_{2015} extra should be given daily for each degree Celsius below an average temperature of 18 °C over 24 hours. For group-housed sows, 0,05 EW_{2015} extra should be provided for each degree Celsius below an average temperature of 16 °C over 24 hours.
In practice, it is difficult to determine the daily average temperature over 24 hours and to adjust the feed allowance accordingly. Therefore, it is advised to supply an extra amount of feed during winter (from October until March). This additional winter allowance is indicated in Table 11.

Table 11. Additional energy allowance for dry and gestating sows during the winter period (October-March).

Months	Extra energy (EW_{2015}/animal/day)	
	Individual housing	Group housing
October and March	0,10	-
November and February	0,25	0,10
December and January	0,40	0,20

Adjustments for abnormal behavior
The maintenance requirement of sows is increased in case of stereotypic behavior (e.g. biting bars and sham-chewing). When sows display this type of behavior, it is recommended to increase the EW_{2015} allowance by 0,25 EW_{2015} per day.
In case of excessive water intake, EW_{2015} allowance should also be adjusted (see the paragraph on “water intake”).

Adjustments to increase the birth weight of the piglets
If an increase in birth weight of the piglets is desired, the EW_{2015} provided may be increased with 0,1 EW_{2015} per day from day 84 onward (Table 9 and 10). This increase in EW_{2015} is generally sufficient to increase the birth weight of the piglets with approximately 100 gram per piglet.

Adjustment for larger litters
When the expected litter size is larger than stated in Table 8, the EW_{2015} allowance may be increased with 0,1 EW_{2015} per day per extra piglet from day 84 of gestation onwards.

Adjustment to improve the body condition of the sow
When the body condition of the sow is too low, the feeding level may be raised. As a general guideline, at least 4 EW_{2015} are required to increase the body weight of the sow by 1 kg.

Water intake in general
When sows (especially when individually housed) have *ad libitum* access to drinking water, and consume - for whatever reason - excessive amounts of water, extra energy is needed to warm up the ingested water to body temperature. For each additional 10 L of water ingested (at a temperature of 12 °C) above the normal water intake of 10 L per day, 0.1 extra EW_{2015} is needed. More detailed information on water intake of dry and gestating sows is given in CVB Documentation Report nr 25 (1999) (in Dutch).

Single feedstuffs
When (partly) substituting a sow diet by single feedstuffs it is necessary to meet the requirements of amino acids, vitamins and minerals. The contents of amino acids, vitamins and minerals must be at least equal to the contents of the gestation diet.

3.3.2 Standardized ileal digestible lysine requirements

The requirement for standardized ileal digestible (SID) lysine in grams per EW_{2015}, assuming constant maternal growth during gestation, is given in Table 12. The requirements for other SID amino acids –relative to SID lysine– are given in section 3.5.

Table 12. Advised standardized ileal digestible (SID) lysine (g/EW_{2015}) levels for gestating sows; assuming constant maternal growth during gestation.

Days in gestation	Standardized ileal lysine (g/EW_{2015})				
	Parity 1	Parity 2	Parity 3	Parity 4	Parity 5 and >
0 – 27	3,83	3,24	3,08	2,74	2,45
28 – 55	4,01	3,49	3,35	3,03	2,75
56 – 83	4,45	4,02	3,90	3,61	3,35
84 – 97	4,94	4,60	4,50	4,22	3,99
98 – 115	5,34	5,06	4,97	4,71	4,48

If during gestation one gestation sow diet is provided to all parity sows, a SID lysine level of 4,85 g/EW 2015 is advised. This level is based on the SID lysine requirement of parity 3 sows on day 98 of gestation. These levels are too low for parity 1 and 2 sows during the last weeks of gestation. If one opts for meeting the requirements of parity 1 and 2 sows during the last weeks of gestation the SID lysine levels should be increased with 8 and 2 %, for parity 1 and 2 sows, respectively.

In Table 13 the requirements for standardized ileal (SID) lysine per EW $_{2015}$ is provided, assuming 60% extra body condition recovery during the first 6 weeks of gestation. The requirements for other SID amino acids –relative to SID lysine– are given in section 3.5.

Table 13. Advised levels of standardized ileal (SID) lysine (g/EW_{2015}) levels for gestating sows; assuming 60% body condition recovery during the first 6 weeks of gestation.

Days in gestation	Advised SID lysine levels in g/EW_{2015}				
	Parity 1[1)]	Parity 2	Parity 3	Parity 4	Parity 5 and >
0 – 27	3,83	3,45	3,49	3,00	2,75
28 – 41	3,92	3,53	3,58	3,12	2,87
42 – 55	4,11	3,44	3,17	3,00	2,70
56 – 83	4,45	3,92	3,67	3,50	3,22
84 – 97	4,94	4,59	4,36	4,18	3,93
98 – 115	5,34	5,11	4,89	4,71	4,48

[1)] With parity 1 sows, there is no additional requirement for recovery of weight loss.

If during gestation one gestation sow diet is provided to all parity sows, a SID lysine level of 4,85 g/EW 2015 is advised. This level is based on the SID lysine requirement of parity 3 sows on day 100 of gestation. These levels are too low for parity 1 and 2 sows during the last weeks of gestation. In order to satisfy the requirements of parity 1 and 2 sows during the last weeks of gestation the SID lysine levels should be increased with 8 and 3% for parity 1 and 2 sows, respectively.

3.3.3 Requirement of minerals and trace elements

a. Standardized total tract digestible phosphorus, standardized total tract digestible calcium and (gross) calcium.

Gestating gilts have a higher STTD P and STTD Ca (or Ca) requirement per EW_{2015} than multiparous sows, mainly due to higher bone growth. Since gilts and multiparous sows are

usually given the same diet, it is recommended to use for dry and gestating sows the requirements that are valid for gilts as shown in Table 14.

Table 14. Recommended STTD P-, STTD Ca and gross Ca-levels (in g per EW_{2015}) for gestating sows.

Days in gestation	STTD P (g/EW_{2015})	STTD Ca (g/EW_{2015})	Ca (g/EW_{2015})
0 – 70	1,8	2,7	5,4
70 – 115	2,4	3,9	7,8
0 – 115	2,2	3,5	7,0

b. Other minerals and trace elements

In 2015, a desk study was performed with respect to mineral and trace element requirements of pigs (Documentation report nr. 58). The requirements for gestating sows are presented in Table 15.

Table 15. Recommended mineral and trace elements content for gestating sows.

Minerals	**Mg**	**Na**	**Cl**	**K**
(g/kg)	1,4	1,6	1,3	1,4
Trace elements	**Fe**	**I**	**Mn**	**Se**
(mg/kg)	90	0,58	26	0,16

For copper and zinc no requirements are provided. In the EU, legally allowed maximum copper and zinc levels in diets of gestating sows are:

- a total copper content of 25 mg/kg (see Regulation EU 2018/1039):
- a total zinc content of 150 mg/kg (see Regulation EU 2016/1095):

3.4 Lactating sows

During lactation, sows need energy and amino acids for maintenance and milk production.

3.4.1 Energy requirement

The energy requirements of the lactating sow is largely dependent on the milk production of the sow. The growth of the suckling piglets depends on the milk production. Therefore, a clear relationship exists between the daily EW_{2015} requirement of the sow and the daily gain of the litter. Table 16 shows the EW_{2015} requirements of a lactating sow with parity 1-5, assuming a daily litter growth of 2,5 kg and 3 kg. The lactation period lasts 28 days in this example. For parity 1 sows, 12 sucking piglets were assumed, and for parity 2 sows 13 sucking piglets (see Table 8).

In the calculation of the EW_{2015}-requirement, it is assumed that mobilization of body reserves of the sow occurs, as also assumed in Table 8. For sows with a body weight other than given in Table 8, the correct EW_{2015} allowance may be calculated by adjusting the EW_{2015} allowance with 0,07 EW_{2015} for each 10 kg deviation from live weight.

In the first week of lactation the feed allowance should be gradually increased up to the advised allowance.

Table 16. Recommended energy allowance for a lactating sow in EW_{2015} per day, for a lactation period of 28 days and a litter growth of 2,5 kg/d and 3,0 kg/d (parity 1 sows have 12 sucking piglets; parity 2-5 sows have 13-14 sucking piglets).

	EW_{2015} [1] per day									
Parity	**1**		**2**		**3**		**4**		**≥ 5**	
Litter growth (kg/d)	**2,5**	**3,0**	**2,5**	**3,0**	**2,5**	**3,0**	**2,5**	**3,0**	**2,5**	**3,0**
Days in lactation										
1 – 7	4,40	5,18	4,84	5,61	5,17	5,94	5,27	6,04	5,56	6,33
8 – 14	5,97	7,11	6,39	7,52	6,73	7,86	6,84	7,96	7,14	8,26
15 – 21	6,46	7,69	6,89	8,10	7,23	8,45	7,34	8,55	7,65	8,86
22 – 28	6,22	7,36	6,66	7,79	7,02	8,14	7,12	8,25	7,44	8,57
1 – 28	5,76	6,84	6,19	7,25	6,54	7,59	6,64	7,70	6,95	8,00

[1] The amount of concentrates may be calculated by dividing the EW_{2015} allowance by the EW_{2015} content of the feed.

In Table 17, a simplified schedule is presented for the EW_{2015} requirement of lactating sows, based on the number of suckling piglets.

Table 17. Recommended energy allowance for a lactating sow (in EW_{2015} per day).

	EW_{2015} [1] per day for a sow with a body weight of:	
	200 kg	**250 kg**
First week gradually increase to 1% body weight (2,0 - 2,5 EW_{2015}), plus 0,5 EW_{2015} per piglet per day, e.g., in total:		
- for 12 piglets	8,0	8,5
- for 14 piglets	9,0	9,5
- for 16 piglets	10,0	10,5

[1] The amount of concentrates can be calculated by dividing the EW_{2015} allowance by the EW_{2015} content of the feed.

The EW_{2015}-requierements in Tables 16 and 17 are general guidelines and may be adjusted according to farm circumstances. The nutritional requirements of the lactating sow may vary from one farm to another because of several management- and farm-related factors.

Temperature in the farrowing room

The lactating sow produces a considerable amount of heat because of the high milk production level. The farrowing room temperature is usually kept high to account for the high temperature requirement of the piglets. At a high ambient temperature, it is difficult for the sow to lose her body heat. The sow will respond to this by decreasing her feed intake. However, the room temperature in the farrowing stable may be reduced rather rapidly to 20°C, as long as the piglets are dry after birth, have access to a warm nest and the floor is a solid concrete floor with bedding. In case of a solid floor or fully slatted floor without bedding, a temperature of 22°C is recommended.

Water intake

In case of insufficient water intake, the feed intake of the sow will decrease. The water requirement of lactating sows is high (minimum 20 L/day). Therefore, nipple drinkers should provide at least 1,5 to 2,5 L per minute.

Body Condition
High feed intake during gestation not only increases the body condition of the sow at farrowing but also seems to reduce the feed intake during lactation. On the other hand, insufficient body condition development of first parity sows may lead to failure to come in heat after the first lactation.
Therefore, a proper body condition of first parity sows at farrowing is desired, though excessive body condition may clearly have negative consequences.

Consequences of too low or too high feed intake during lactation
Sub-optimal feed intake during lactation leads to mobilization of body reserves which may have a negative impact on subsequent reproductive performance, especially of first parity sows: the interval between weaning and estrus may be prolonged, embryonic deaths may increase, leading to returns after insemination (failure to conceive) and disappointing litter sizes at the next farrowing.
Sub-optimal feed intake during lactation may be caused by:

- excessive body condition at farrowing, caused by excessive feed intake during gestation,
- too high ambient temperature in the farrowing room,
- insufficient water intake in the farrowing room.

When feed intake during lactation is too high, sows may come into estrus too early (in the farrowing room). On farms with a sow management system, analyzing the interval between weaning and estrus may shed light on this. Estrus during lactation will mainly occur in older sows, due to a larger feed intake capacity. With these older sows, prolonged intervals between weaning and estrus may indicate that the sows were in estrus during lactation, especially when these sows do not respond to a PG600 injection. An injection with PG600 does not induce estrus when given during the luteal phase.

3.4.2 Requirement of standardized ileal digestible lysine

In Table 18, the recommended standardized ileal digestible (SID) lysine is shown, in grams per EW_{2015}, for lactating sows parity 1-5, assuming a daily litter growth of 2,5 kg and 3,0 kg. The lactation period lasts 28 days. For parity 1 sows, 12 sucking piglets were assumed, and for parity 2-5 sows 13-14 sucking piglets (see Table 8). The requirements for other SID amino acids –relative to SID lysine– are given in section 3.5.

If during lactation a single lactating sow diet is fed to all parity sows, it is advised to give 8,00 g SID lysine/EW_{2015}. For parity 1 sows, this amount will probably be too low and should be increased with 5%.

Table 18. Recommended standardized ileal digestible (SID) lysine levels (g/EW_{2015}) for lactating sows with a lactation period of 28 days and a litter growth of 2,5 kg/d and 3,0 kg/d (parity 1 sows have 12 sucking piglets, parity 2-5 sows have 13-14 sucking piglets).

	Recommended SID lysine level in g/EW_{2015}									
Litter	**1**		**2**		**3**		**4**		**≥ 5**	
Litter growth (kg/d)	**2,5**	**3,0**	**2,5**	**3,0**	**2,5**	**3,0**	**2,5**	**3,0**	**2,5**	**3,0**
Days in lactation										
1 – 7	8,52	8,70	7,78	8,04	7,76	8,01	7,62	7,89	7,66	7,91
8 – 14	8,16	8,29	7,61	7,81	7,59	7,79	7,49	7,70	7,52	7,71
15 – 21	8,35	8,46	7,82	8,01	7,79	7,97	7,69	7,88	7,70	7,88
22 – 28	8,59	8,69	8,03	8,21	7,98	8,15	7,88	8,06	7,87	8,05
1 – 28	8,40	8,50	7,80	8,00	7,80	8,00	7,70	7,90	7,70	7,90

3.4.3 Minerals and trace elements

a. Recommended standardized digestible phosphorus, standardized digestible calcium, and gross calcium levels.

Diets for lactating sows are recommended to contain 2,8 g STTD P and 4,2 g STTD Ca (or 8,4 g Ca) per EW_{2015}. This advice assumes a litter of 14 piglets and a litter growth of 2,5 kg/d for primiparous and 3,0 kg/d for multiparous sows.

b. Other minerals and trace elements

In 2015, a desk study was performed with respect to mineral and trace element requirements of pigs (Documentation report nr. 58; in Dutch). The requirements for lactating sows are presented in Table 19.

Table 19. Recommended mineral and trace elements content for lactating sows.

Minerals	**Mg**	**Na**	**Cl**	**K**
(g/kg)	1,8	2,2	2,7	2,9
Trace elements	**Fe**	**I**	**Mn**	**Se**
(mg/kg)	90	1,50	26	0,17

For copper and zinc no requirements are provided. In the EU, legally allowed maximum copper and zinc levels in diets of lactating sows are:

- a total copper content of 25 mg/kg (see Regulation EU 2018/1039)
- a total zinc content of 150 mg/kg (see Regulation EU 2016/1095)

3.5 Requirement of other essential amino acids for gestating and lactating sows

For the SID amino acids other than lysine, it is recommended to use the values, given in Table 20.

Table 20. Recommended ratios of standardized ileal digestible (SID) amino acids, relative to SID Lysine and the accompanying SID levels (g/EW_{2015}) by providing a single gestating sow diet and a single lactating sow diet.

Amino acid	Ratio of SID amino acid requirements to SID Lysine		Levels of SID amino acid (g/EW_{2015})	
	Gestating sows	Lactating sows	Sow diet gestation[1)]	Sow diet lactation[2)]
Lysine	100	100	4,85	8,00
Methionine+cystine[3]	68	60	3,30	4,80
Threonine	75	63	3,64	5,04
Tryptophan	19	19	0,92	1,52
Isoleucine	65	58	3,15	4,64
Valine	78	82	3,78	6,56
Leucine	102	114	4,95	9,12
Histidine	32	38	1,55	3,04
Phenylalanine	61	56	2,96	4,48

1) The levels can be too low for parity 1 and 2 sows during the last few weeks of gestation. In order to meet the need for parity 1 and 2 sows during the last few weeks of gestation, the amino acid levels should be increased by 8 and 3% for parity 1 and 2 sows, respectively.

2) The levels may be too low for parity 1 sows. For parity 1 sows, the amino acid levels should be increased by 5%.

3) it is recommended that at least 55% of the total methionine+cysteine supply originates from methionine.

Source: Van der Peet-Schwering and Bikker (2019), rapport 1190, Wageningen Livestock Research.

3.6 Diet types for gestating and lactating sows

Amongst others for environmental reasons it is advised to provide dry and gestating sows a special gestating sow feed. From one week before farrowing and during the lactation period, a lactation feed should be offered.

4. Breeding boars

Table 21. Energy requirements of breeding boars.

BW[1)] (kg)	Age (days)	EW_{2015} [2)] (per day)
150 – 200	270 – 400	2,7 – 3,0
200 – 300	400 – 800	3,0 – 3,3
300 – 400	800 – older	3,3 – 3,5

1) BW = Body Weight

2) The amount of compound feed may be calculated by dividing the EW_{2015} allowance by the EW_{2015} content of the feed.

It is important that breeding boars have sufficient energy, amino acids, vitamins and minerals without gaining weight. In AI-stations, a special boar diet is fed. However, on a sow farm, only a few breeding boars are present, which receive the diets present on the farm. A gestation diet meets the standards of a fully-grown breeding boar (800 days or older). Feeding solely a gestation feed to young, growing breeding boars is not recommended, because it will lead to a shortage of amino acids and minerals (leg problems), as they grow fast with a relative low feed intake. Therefore, a diet for replacement gilts or a mixture of a gestation diet and a lactation diet is recommended for young breeding boars. A lactation diet amply satisfies the

needs of young breeding boars, but the high phosphorus and calcium content can result in the occurrence of urinary gravel or bladder crystals. This problem can be solved by temporarily adding acidifying (dEB lowering) ingredients in the feed, such as calcium chloride or ammonium chloride.
More feed should be given when the average ambient temperature over 24 hours drops below 18 °C. An additional energy allowance of 0.1 EW_{2015} is recommended for each degree Celsius below 18 °C. For breeding boars, the same additional winter allowance should be provided as is advised for individually housed dry and gestating sows (see Table 11).

5. Grower and finisher pigs

5.1 Feeding schedules

In 2018, the amino acid requirements for growing pigs were updated by Wageningen Livestock Research (rapport 1101; Van der Peet-Schwering and Bikker, 2018). In this update the feeding schedule and growth as shown in table 22 was assumed.

*Table 22. Feeding schedules (in EW_{2015}/day) for boars, barrows and gilts, as used for the calculation of standardized ileal digestible (SID) amino acid requirements (starting body weight 25 kg).**

	Boars		Barrows		Gilts	
Day	**BW (kg)**	**EW_{2015}**	**BW (kg)**	**EW_{2015}**	**BW (kg)**	**EW_{2015}**
1	25,0	1,29	25,0	1,40	25,0	1,35
8	29,6	1,45	29,8	1,57	29,5	1,52
15	34,6	1,62	35,0	1,75	34,4	1,68
22	40,0	1,76	40,5	1,90	39,7	1,84
29	45,7	1,90	46,3	2,05	45,3	1,99
36	51,7	2,04	52,3	2,19	51,2	2,12
43	58,0	2,16	58,5	2,30	57,3	2,24
50	64,4	2,27	64,7	2,41	63,5	2,35
57	70,9	2,37	71,0	2,50	69,8	2,46
64	77,5	2,44	77,3	2,57	76,2	2,55
71	84,1	2,52	83,5	2,64	82,6	2,63
78	90,7	2,59	89,6	2,71	89,0	2,70
85	97,2	2,64	95,5	2,75	95,3	2,75
92	103,6	2,68	101,3	2,79	101,5	2,81
99	109,9	2,72	106,9	2,83	107,6	2,85
106	116,0	2,75	112,3	2,86	113,5	2,88
113	122,0		117,6		119,2	
120						
Growth (g/day)		869		826		841
EW_{2015} intake/day		2,19		2,32		2,29
EW_{2015}-conversion		2,52		2,82		2,72

* Based on starter diet (25-50 kg; EW_{2015}: 1,10), grower diet (50-80 kg; EW_{2015}: 1,10) and finisher diet (80-120 kg; EW_{2015}: 1,10).

Source: Van der Peet-Schwering and Bikker (2018), rapport 1101, Wageningen Livestock Research.

The growth and protein intake of fattening pigs in Table 22 is based on research by Van der Peet-Schwering et al. (2012), in which boars, barrows and sows were weighed every two weeks and in which feed intake was recorded every two weeks. The growth of these fattening pigs was about 5% higher than the average growth of the fattening pigs as published in the Kengetallenspiegel 2016 (Agrovision, 2017). The optimal feeding schedule for fattening pigs depends on many factors, like feed intake capacity as well as the genetic capacity for protein deposition. The Handboek Varkenshouderij (2015) is based on recommended feeding schedules of Topigs Norsvin (2012). In order to be consistent with the Handboek Varkenshouderij (2015), these advisory feeding schedules are also included in this Table Booklet (Tables 23a and 23b). In principle, the recommended feeding schemes apply to a uniform group of growing pigs. Within a pen the variation between the animals should be as small as possible. In that case it is obvious to house gilts and barrows separately.

*Table 23a. Recommended feeding schedules (in EW_{2015}[1]/day) for Topigs Norsvin Tempo boars, barrows and gilts (starting body weight 25 kg).**

	Boars		Barrows		Gilts	
Day	**BW (kg)**	**EW_{2015}**	**BW (kg)**	**Day**	**BW (kg)**	**EW_{2015}**
1	25,0	1,50	25,0	1,57	25,0	1,54
8	31,9	1,67	31,9	1,83	31,8	1,77
15	38,8	1,83	39,0	2,04	38,8	1,97
22	45,8	1,96	46,3	2,23	45,9	2,13
29	52,8	2,12	53,7	2,38	53,1	2,26
36	59,9	2,26	61,3	2,52	60,3	2,39
43	67,0	2,41	68,9	2,66	67,6	2,50
50	74,2	2,53	76,7	2,77	74,9	2,60
57	81,3	2,64	84,3	2,83	82,1	2,67
64	88,2	2,70	91,4	2,92	89,0	2,75
71	94,7	2,81	98,0	3,00	95,4	2,82
78	100,9	2,87	104,0	3,06	101,4	2,90
85	106,7	2,93	109,5	3,12	107,0	2,93
92	112,1	2,99	114,6	3,18	112,3	2,98
99	117,3	3,05	119,3	3,22	117,2	3,02
106	122,2	3,06	123,6	3,26	121,8	3,09
113	126,8	3,08	127,6	3,28	126,1	3,14
120	131,1	3,11	131,3	3,34	130,2	3,16
Growth (g/day)		890		890		880
EW_{2015} intake/day		2,50		2,70		2,56
EW_{2015}-conversion		2,81		3,04		2,91

* Based on starter diet (25-40 kg; EW_{2015}: 1,14), grower diet (40-70 kg; EW_{2015}: 1,12) and finisher diet (70-110 kg; EW_{2015}: 1,10). Source: Topigs Norsvin, 2012.

Adjustments to farm specific circumstances

1. When barrows and gilts are housed together, it is advised to maintain the mean values for the feeding schedules that are applicable to the gilts and barrows in question.
2. According to the recommended feeding schedules, the piglets are fed *ad libitum* right from the start, to achieve the highest protein deposition. In some cases (e.g., under stress) it is advised to feed prudently during the first two weeks and to start with a lower schedule that, subsequently, is gradually increased.

3. Sometimes the expected growth rate is not achieved. This may be caused by sub-optimal circumstances on the farm. To a large extent, the health status of the animals determines the preferred feeding schedule and the realized growth.

*Table 23b. Recommended feeding schedules (in EW_{2015}[1]/dag) for Topigs Norsvin Pietrain boars, barrows and gilts (starting body weight 25 kg).**

	Boars		Barrows		Gilts	
Day	BW (kg)	EW_{2015}	BW (kg)	Day	BW (kg)	EW_{2015}
1	25,0	1,35	25,0	1,41	25,0	1,37
8	31,4	1,49	31,5	1,62	31,3	1,56
15	37,9	1,63	38,3	1,84	37,8	1,76
22	44,4	1,76	45,2	2,01	44,5	1,89
29	50,9	1,88	52,2	2,15	51,2	2,03
36	57,5	2,00	59,4	2,29	58,0	2,15
43	64,2	2,09	66,7	2,41	64,8	2,26
50	70,9	2,20	74,0	2,52	71,7	2,35
57	77,6	2,30	81,4	2,62	78,5	2,41
64	84,3	2,38	88,4	2,68	85,2	2,50
71	90,7	2,46	95,0	2,76	91,6	2,57
78	96,7	2,52	101,1	2,83	97,7	2,62
85	102,5	2,58	106,8	2,89	103,3	2,67
92	108,0	2,64	112,2	2,93	108,7	2,73
99	113,3	2,70	117,1	2,98	113,8	2,77
106	118,3	2,72	121,7	3,02	118,7	2,81
113	123,0	2,75	126,0	3,05	123,3	2,85
120	127,5	2,75	130,1	3,08	127,5	2,87
Growth (g/day)		860		880		860
EW_{2015} intake/day		2,21		2,48		2,32
EW_{2015}-conversion		2,57		2,81		2,69

* Based on starter diet (25-40 kg; EW_{2015}: 1,14), grower diet (40-70 kg; EW_{2015}: 1,12) and finisher diet (70-110 kg; EW_{2015}: 1,10). Source: Topigs Norsvin, 2012.

5.2 Protein and amino acid requirements

In 2018, the amino acid recommendations for fattening pigs were updated by Wageningen Livestock Research (rapport 1101; Van der Peet-Schwering and Bikker, 2018) with the help of the InraPorc model (Van Milgen et al., 2008) and based on recent literature. De amino acids requirements were:

- estimated for barrows, gilts and boars separately;
- estimated for all essential amino acids;
- based on 105% of the needs of the average pig, so that approximately 95% of animals in a group always receives sufficient amino acids.
- expressed in grams of standardized ileal digestible (SID) amino acids per EW_{2015}.

The estimated SID amino acid requirements for barrows, gilts and boars, based on the above feeding schedule and growth (Table 22), are given in Tables 24-26.

Table 24. Recommended standardized ileal digestible (SID) amino acid levels (g/EW_{2015}) in diets for fattening pigs (boars) (the ratios relative to lysine are presented between brackets).

Amino acid	Fattening pigs (boars) (in g SID amino acid/EW_{2015}) Type of diet per weight range					
	Starter diet (25-50 kg)		Grower diet (50–80 kg)		Finisher diet (80-120 kg)	
Lysine	9,1	(100)	8,0	(100)	7,1	(100)
Methionine+cystine[1]	5,5	(60)	4,9	(61)	4,4	(62)
Threonine	6,0	(66)	5,4	(67)	4,8	(68)
Tryptophan	1,8	(20)	1,6	(20)	1,4	(20)
Isoleucine[2]	4,8	(53)	4,2	(53)	3,8	(53)
Valine	6,1	(67)	5,4	(67)	4,8	(67)
Leucine	9,1	(100)	8,0	(100)	7,1	(100)
Histidine	2,9	(32)	2,6	(32)	2,3	(32)
Phenylalanine+tyrosine[3]	8,6	(95)	7,6	(95)	6,8	(95)

1 At least 55% of the (MET+CYS) content should be covered by MET.
2 This advice is for feed without blood products. For diets with blood products, the ratio between SID isoleucine and SID lysine is recommended to be 55%.
3 At least 57% of the (PHE+TYR) content should be covered by phenylalanine.
Source: Van der Peet-Schwering and Bikker (2018), rapport 1101, Tables 8 and 9, Wageningen Livestock Research.

Table 25 Recommended standardized ileal digestible (SID) amino acid levels (g/EW_{2015}) in feed for fattening pigs (barrows) (the ratios relative to lysine are presented between brackets).

Amino acid	Fattening pigs (barrows) (in g SID amino acid/EW_{2015}) Type of diet per weight range					
	Starter diet (25-50 kg)		Grower diet (50–80 kg)		Finisher diet (25-50 kg)	
Lysine	8,7 (100)		7,5	(100)	6,1	(100)
Methionine+cystine[1]	5,2	(60)	4,6	(61)	3,8	(62)
Threonine	5,7	(66)	5,0	(67)	4,2	(68)
Tryptophan	1,7	(20)	1,5	(20)	1,2	(20)
Isoleucine[2]	4,6	(53)	4,0	(53)	3,2	(53)
Valine	5,8	(67)	5,0	(67)	4,1	(67)
Leucine	8,7 (100)		7,5	(100)	6,1	(100)
Histidine	2,8	(32)	2,4	(32)	2,0	(32)
Phenylalanine+tyrosine[3]	8,3	(95)	7,1	(95)	5,8	(95)

1 At least 55% of the (MET+CYS) content should be covered by MET.
2 This advice is for feed without blood products. For diets with blood products, the ratio between SID isoleucine and SID lysine is recommended to be 55%.
3 At least 57% of the (PHE+TYR) content should be covered by phenylalanine.
Source: Van der Peet-Schwering and Bikker (2018), rapport 1101, Tables 8 and 9, Wageningen Livestock Research.

In practice, no lack of SID amino acids will occur for pigs with a growth and feed intake, as shown in Table 22, when the levels of each of the amino acids in the feed will not be lower than the values given in Tables 24-26.

Because there are no updated amino acid standards for piglets, the amino acid standards in piglet feed and in starter feed for fattening pigs may no longer be entirely compatible. This will be studied in the near future.
The recommended SID amino acid levels can also be used if the fattening pigs are fed through the recommended feeding schemes of Topigs Norsvin (2012). The animals have a higher growth rate, but this is the result of a higher EW intake and not the result of a more favorable EW conversion. This means that the effect of the higher growth on the advised SID amino-acid levels in g/EW_{2015} is low.

Table 26. Recommended standardized ileal digestible (SID) amino acids levels (g/EW_{2015}) in diets for fattening pigs (gilts) (the ratios relative to lysine are presented between brackets).

Amino acid	**Fattening pigs (sows) (in g SID amino acid/EW_{2015}) Type of diet per weight range**					
	Starter diet (25-50 kg)		Grower diet (50–80 kg)		Finisher diet (25-50 kg)	
Lysine	8,7	(100)	7,5	(100)	6,4	(100)
Methionine+cystine[1]	5,2	(60)	4,6	(61)	4,0	(62)
Threonine	5,7	(66)	5,0	(67)	4,4	(68)
Tryptophan	1,7	(20)	1,5	(20)	1,3	(20)
Isoleucine[2]	4,6	(53)	4,0	(53)	3,4	(53)
Valine	5,8	(67)	5,0	(67)	4,3	(67)
Leucine	8,7	(100)	7,5	(100)	6,4	(100)
Histidine	2,8	(32)	2,4	(32)	2,1	(32)
Phenylalanine+tyrosine[3]	8,3 (95)		7,1	(95)	6,1	(95)

[1] At least 55% of the (MET+CYS) content should be covered by MET.
[2] This advice is for feed without blood products. For diets with blood products, the ratio between SID isoleucine and SID lysine is recommended to be 55%.
[3] At least 57% of the (PHE+TYR) content should be covered by phenylalanine.
Source: Van der Peet-Schwering and Bikker (2018), rapport 1101, Tables 8 and 9, Wageningen Livestock Research.

5.3 Minerals and trace elements

5.3.1 Standardized total tract digestible phosphorus, standardized digestible calcium, and gross calcium

In Table 27 requirements for standardized total tract digestible P-value (STTD P), standardized total tract digestible (STTD Ca) calcium and gross calcium (Ca) are provided for barrows, boars and gilts. The advice is based on a high rate of bone mineralization and applies to fattening pigs growing according the feeding schedule presented in Table 22.
The CVB Documentation Report No. 59 (2017) can be used for calculation of STTD P, STTD Ca and Ca requirements for animals with different growth rates and protein conversion (see Table 23a and 23b).

Table 27. Recommended STTD P, STTD Ca, and (gross) Ca levels (in g per EW_{2015}) for various growth ranges of fattening pigs (boars, barrows and gilts) growing according the feeding schedule presented in Table 22.

Type of animal	(digestible) mineral	Weight range (with corresponding diet type)		
		Starter diet 25 – 50 kg	Grower diet 50 – 80 kg	Finisher diet 80 – 120 kg
Boars	STTD P	2,9	2,4	2,0
	STTD Ca	4,5	3,7	3,2
	Ca	7,7	6,4	5,5
Barrows	STTD P	2,8	2,1	1,9
	STTD Ca	4,4	3,3	3,0
	Ca	7,6	5,7	5,2
Gilts	STTD P	2,8	2,2	2,0
	STTD Ca	4,4	3,5	3,2
	Ca	7,6	6,0	5,5

5.3.2 Other minerals and trace elements

In 2015, a desk study was performed with respect to mineral and trace element requirements of pigs (Documentation report nr. 58). The requirements for fattening pigs are presented in Table 28.

Table 28. Recommended mineral and trace elements content for different body weight ranges for growing pigs.

Contents in the diet	Weight range		
	25 – 50 kg	50 – 75 kg	75 – 135 kg
Minerals (g/kg)			
Mg	1,1	1,1	1,1
Na	1,1	1,1	1,1
Cl	1,1	1,1	1,1
K	2,5	2,1	1,9
Trace elements (mg/kg)			
Fe	60	55	50
I	0,15	0,15	0,15
Mn	22	22	22
Se	0,20	0,16	0,16

For copper and zinc no requirements are given. In the EU, legally allowed maximum copper and zinc levels in the diet for growing pigs are:

- a total copper content of 25 mg/kg (see Regulation EU 2018/1039)
- a total zinc content of 120 mg/kg (see Regulation EU 2018/1039).

5.4 Water requirement

Drinking water should be *ad-libitum* available.

5.5 Separate housing of barrows and gilts and of boars and gilts

It may be financially interesting to accommodate gilts and barrows in separate pens when the difference in lean meat percentage between barrows and gilts amounts to 2,5% or more. Gilts may be fed *ad libitum* during the whole fattening period.
When the barrows receive 3 to 5% more energy compared to gilts during the whole growing and fattening period, the growth of barrows is similar to gilts. As the deposition of fat in barrows

occurs especially in the last phase of the fattening period, it is recommended to restrictive feeding of barrows from 70 kg onward. When preparing a feeding schedule for barrows from 70 kg live weight it is advised to take into account the difference in energy intake between barrows and gilts until 70 kg body weight. If the barrows up to 70 kg live weight, consume approximately 10% more energy than the gilts, barrows should receive the same amount of feed as the gilts, from 70 kg live weight up to slaughter. Barrows and gilts will then reach their final weight and slaughter age simultaneously. When the barrows up to 70 kg live weight consume 6% more feed than the gilts, they should receive 2 to 3% more feed from 70 kg live weight, to realize the same growth rate as the gilts. Continuous evaluation of results is needed to adjust the feeding schedules accordingly.

When boars and gilts are housed separately, they can be fed *ad libitum* during the whole growing period. Due to a higher amino acid requirement of boars (and to a lesser extent the STTD P, STTD Ca and gross Ca requirements),in case of separate housing, it is advised to provide different diets tailored to their requirements.

6. Feed ingredients

6.1 General explanation

The nutrient contents presented in the tables in the next paragraph are mean values calculated from feed analyses stored in the CVB database.
The chemical contents and feeding values of compound feedstuffs are expressed on product base. For high moisture ingredients, the values are expressed on dry matter basis (except the DM content; this is presented in the second column as g/kg product).

More information on methods of analysis, the composition, digestible nutrient contents and the calculation of feeding values of feed ingredients and forages can be found in the 2023 edition of the CVB Feed Table (free for download via: http://www.cvbdiervoeding.nl).

Unless otherwise mentioned, 'dry matter' is the total content of dry matter, so inclusive soil/sand that may be present in certain ingredients.

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STA am	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Potato crisps	962	35	59	300	11	444	28	98	1,40	0,35	2,02	1,6	0,8	0,8
Potato protein, ASH < 10 g/kg	908	5	797	20	6	1	9	76	1,57	0,44	1,13	55,6	25,8	0,9
Potato protein, ASH > 10 g/kg	904	20	773	20	9	1	5	85	2,03	0,52	1,11	54,0	25,0	1,2
Potatoes, dried	897	42	93	4	25	599	31	129	2,40	0,50	0,98	3,1	1,8	1,4
Potato pulp, dried, CP < 90 g/kg	876	47	61	2	164	251	12	503	1,02	2,72	0,77	1,5	0,8	0,6
Potato pulp, dried, CP 90 - 130 g/kg	880	69	96	4	151	244	12	456	1,30	2,60	0,76	3,0	1,5	0,8
Potato starch, heat treated, dried	875	45	39		3	728	35	29	1,60	0,20	1,21			1,0
Sweet potatoes, dried	878	38	40	6	27	592	68	136	1,30	1,70	1,18	0,9	0,7	0,8
Brewer's grains, dried	915	46	248	70	132	40	9	503	4,56	3,45	0,65	7,2	7,4	1,6
Brewer's yeast, dried	924	65	459	26	18	68	27	282	10,60	2,03	0,89	27,2	9,5	5,3
Sugarbeet pulp, dried, SUG < 100 g/kg	893	61	75	14	175	7	68	671	0,78	9,85	1,02	2,3	1,2	0,5
Sugarbeet pulp, dried, SUG > 200 g/kg	912	76	102	14	130	7	219	500	0,71	7,85	1,05	2,0	1,1	0,4
Sugarbeet pulp, dried, SUG 100 - 150 g/kg	901	67	88	14	166	7	123	606	0,70	8,98	1,03	2,4	1,2	0,4
Sugarbeet pulp, dried, SUG 150 - 200 g/kg	906	77	97	13	137	7	182	535	0,69	7,89	1,04	2,2	1,2	0,4
Biscuits, ground CFATh < 120 g/kg	930	24	91	113	7	399	115	165	1,48	0,89	1,54	2,1	3,0	0,7
Biscuits, ground CFATh > 120 g/kg	921	18	82	163	7	408	199	31	1,38	0,73	1,69	1,9	2,7	0,7
Bloodmeal, dried	919	17	903	5	7			-6	1,65	0,49	1,02	75,3	19,1	1,2
Feed beans, heat treated	862	52	229	16	45	326	40	201	4,61	1,60	1,00	9,8	2,5	1,8
Bread (remains)	897	27	124	54	11	499	68	99	1,89	0,70	1,36	2,8	4,0	0,9
Casein	916	32	872	11				2	5,32	1,80	1,13	68,7	29,0	4,5
Citrus pulp	912	66	64	23	127	10	178	577	0,98	14,89	0,83	0,6	0,6	0,3
DDGS, Maize	903	44	268	129	67	29	17	314	8,20	0,20	1,05	3,7	5,5	4,8
DDGS, Wheat	916	46	324	68	71	11	49	358	8,39	0,00	0,84	3,9	8,3	4,9

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Peas	866	29	201	17	53	416	43	162	3,84	0,93	1,14	11,6	3,5	1,8
Barley	873	21	102	27	47	502	22	201	3,25	0,53	1,12	2,8	3,2	1,1
Barley feed, high grade	884	55	133	45	108	234	50	370	6,26	1,68	0,82	3,9	3,5	1,9
Barley, mill by-product	886	64	118	38	138	202	23	442	4,08	2,57	0,71	3,3	3,0	1,2
Grass meal, CP < 140 g/kg	929	108	122	25	235	13	122	543	3,19	5,33	0,58	2,3	1,5	1,0
Grass meal, CP > 200 g/kg	917	126	208	40	201	13	88	445	3,88	5,26	0,66	3,9	2,6	1,2
Grass meal, CP 140 - 160 g/kg	928	123	151	32	212	13	106	507	3,56	5,33	0,62	2,8	1,9	1,1
Grass meal, CP 160 - 200 g/kg	929	121	177	38	211	13	90	495	3,81	5,33	0,64	3,3	2,2	1,1
Groundnut expeller, partly dehulled, CF 75 - 145 g/kg	920	51	423	99	95	61	92	198	4,73	2,24	1,14	11,3	8,9	1,2
Groundnut expeller, dehulled, CF < 75 g/kg	932	64	476	94	61	62	93	147	4,79	2,27	1,21	12,7	10,1	1,2
Groundnut meal, partly dehulled, CF 75 - 145 g/kg	926	56	529	21	116	61	76	185	6,49	1,81	0,93	14,1	11,2	1,6
Groundnut meal, dehulled, CF < 75 g/kg	913	60	456	24	64	60	75	241	6,40	1,78	0,97	12,1	9,6	1,6
Oats	879	24	100	49	106	374	9	323	3,03	0,65	0,95	3,3	3,7	0,9
Oats, peeled	888	20	129	69	13	545	14	111	4,30	0,62	1,33	4,6	5,1	1,3
Oats husk meal	910	42	48	18	268	182	11	609	1,43	2,27	0,39	0,8	0,9	0,4
Oats mill feed, high grade	886	24	91	44	118	269	10	448	3,63	0,70	0,86	2,2	2,6	1,1
Carob pods	897	30	42	8	67		421	411	0,54	4,03	0,78			0,3
Canary seed	874	55	150	56	68	405	13	195	4,46	0,41	1,05			1,6
Greaves meal	964	48	817	138				-40	6,77	6,34	1,40			5,4
Cotton seed expeller, partly dehulled, CF 140 - 210 g/kg	933	60	363	74	170	11	38	388	10,17	2,24	0,76	10,4	9,6	3,0
Cotton seed expeller, dehulled, CF < 140 g/kg	932	63	416	105	129	11	39	300	11,18	2,42	0,94	11,9	11,0	3,4
Cottonseed meal, solvent extracted, partly dehulled, CF 140 - 200 g/kg	896	63	364	25	166	20	45	381	10,21	1,97	0,59	10,4	9,6	3,1

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Cottonseed meal, solvent extracted, dehulled, CF < 140 g/kg	898	65	437	31	120	20	28	319	10,68	2,24	0,68	12,5	11,5	3,2
Copra cake, CFAT < 100 g/kg	907	61	204	89	113	11	100	445	5,52	0,83	1,03	2,9	3,5	1,5
Copra cake, CFAT > 100 g/kg	941	63	210	126	127	11	75	458	5,42	0,96	1,14	3,0	3,7	1,5
Copra meal	910	69	227	27	129	9	77	503	5,68	1,46	0,84	3,3	4,0	1,5
Linseed	922	39	212	410	95	14	22	225	5,29	2,41	1,85	6,5	6,8	0,5
Linseed expeller	922	58	340	89	90	23	38	375	8,25	3,52	0,98	10,3	10,7	0,8
Linseed meal	872	55	320	39	96	35	43	383	8,37	3,14	0,75	9,7	10,0	0,8
Lentils	873	30	230	13	45	413	48	141	3,76	0,79	1,10	13,8	2,8	1,5
Lupins, CP < 335 g/kg	895	28	303	62	153	12	50	442	3,42	2,33	1,02	12,9	5,7	2,1
Lupins, CP > 335 g/kg	878	38	360	55	137	21	48	357	3,51	2,28	0,99	15,3	6,8	2,1
Lucerne (alfalfa) meal, CP > 180 g/kg	906	115	191	37	233	11	26	527	2,76	15,49	0,56	3,8	2,2	0,8
Lucerne (alfalfa) meal, CP 140 - 160 g/kg	913	103	152	30	286	11	38	579	2,52	15,75	0,52	3,0	1,8	0,8
Lucerne (alfalfa) meal, CP 160 - 180 g/kg	914	110	168	32	276	11	40	554	2,72	16,06	0,53	3,3	2,0	0,8
Maize	863	12	75	38	24	596	13	131	2,47	0,04	1,26	1,6	2,7	0,7
Maize, chemical/heat treated	876	13	78	40	18	610	15	122	2,94	0,32	1,30	1,7	2,8	0,8
Maize gluten meal	899	17	604	60	10	176	2	40	4,63	0,27	1,27	9,0	23,6	0,9
Maize gluten feed, CP < 200 g/kg	882	54	185	35	72	161	16	376	9,45	0,67	0,78	3,6	4,9	2,4
Maize gluten feed, CP > 230 g/kg	889	62	240	41	74	97	26	369	9,53	1,95	0,77	4,7	6,3	2,4
Maize gluten feed, CP 200 - 230 g/kg	893	56	205	40	76	121	17	398	9,57	2,09	0,77	4,0	5,4	2,4
Maize germs, STAew < 200 g/kg	970	15	137	458	73	122		238	3,98	0,14	2,14			
Maize germs, STAew > 200 g/kg	885	54	134	199	49	297	50	153	11,24	0,50	1,50			
Maize germs expeller	900	58	194	51	81	308	7	282	4,23	1,85	1,07	3,7	5,9	0,8
Maize germ meal, solvent extracted	876	25	226	33	89	213	3	377	5,21	0,53	0,94	4,3	6,9	1,0
Maize, distillers solubles, dried	894	50	260	98	71	54	18	415	7,96	1,07	0,86	4,0	7,3	4,6

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Maize feed flour	875	6	76	17	8	685	10	83	0,70	0,18	1,31	1,9	2,9	0,4
Maize feed meal	879	22	89	74	41	463	23	209	4,03	0,57	1,22	2,2	3,3	1,0
Maize feed meal, solvent extracted	867	13	86	33	26	489	26	220	3,85	0,48	1,16	2,1	3,2	1,0
Maize starch	892	1	6	5	2	851		29	0,45		1,37			0,3
Molasses, sugarbeet	787	90	98	2			512	100	0,54	0,70	0,83	0,5	0,6	0,3
Molasses, sugarcane, SUG < 475 g/kg	724	112	51	4	6		454	117	0,65	7,94	0,73	0,2	0,5	0,4
Molasses, sugarcane, SUG > 475 g/kg	721	91	41	4	6		488	112	0,65	6,77	0,77	0,1	0,4	0,4
Milkpowder, skimmed	951	79	356	10			489	41	10,18	12,55	1,22	26,9	11,9	9,2
Milk powder, whole	949	59	267	243			367	31	7,59	9,40	1,86	20,0	8,9	6,8
Millet	881	32	111	40	99	497	8	194	2,82	0,09	1,15	1,6	4,0	0,8
Millet, (pearl millet)	912	25	122	45	20	606	14	100	3,28	0,18	1,34	1,8	4,4	0,9
Malt culms, CP < 200 g/kg	918	46	186	27	128	121	106	435	4,98	1,84	0,63	5,7	3,9	1,7
Malt culms, CP > 200 g/kg	914	54	218	27	123	101	98	420	5,62	1,83	0,61	6,7	4,6	2,0
Niger seed	916	47	203	409	145	8	35	215	6,87	4,03	1,49	5,3	6,6	0,7
Horse beans, coloured flowering	869	33	254	18	77	328	29	207	5,07	1,05	1,00	13,1	3,3	2,0
Horsebeans, white flowering	867	33	264	16	82	336	39	181	5,12	1,47	1,04	14,8	4,3	2,0
Palm kernel expeller, CF < 180 g/kg	919	42	159	87	167	3	15	614	5,86	2,88	0,83	3,1	3,8	2,3
Palm kernel expeller, CF > 180 g/kg	927	43	152	87	198	2	15	629	5,73	2,91	0,79	3,0	3,6	2,3
Palm kernel, solvent extracted, CF < 190 g/kg	893	39	158	25	173	2	12	656	5,98	2,77	0,63	3,1	3,8	2,4
Palm kernel, solvent extracted, CF > 190 g/kg	876	40	150	17	204	2	12	655	5,87	2,71	0,56	2,9	3,6	2,3
Palm kernels	938	20	92	480	97	2	15	330	3,09	1,22	1,75	1,8	2,2	1,2
Rape seed	925	38	192	434	114	15	29	219	6,29	4,34	1,96	7,7	6,5	1,8
Rape seed expeller	902	62	315	113	122	7	77	331	10,20	6,86	1,00	12,8	10,6	2,9
Rape seed meal, solvent extracted, CP < 370 g/kg	882	69	339	39	125	8	85	346	10,52	7,48	0,76	13,8	11,4	2,9

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Rape seed meal, solvent extracted, CP > 370 g/kg	897	80	383	30	115	11	88	310	10,63	7,09	0,77	15,6	12,9	3,0
Rice, dehulled	885	7	78	12	7	715	9	64	0,88	0,09	1,30	3,1	3,1	0,1
Rice, with hulls	886	44	73	22	102	463	13	271	2,57	0,44	0,96	2,4	2,5	0,3
Rice husk	912	152	68	52	265	127	9	503	11,03	3,65	0,47	1,1	1,2	1,4
Rice feed meal, ASH < 90 g/kg	901	75	139	167	56	264	48	208	15,09	4,66	1,30	3,6	3,7	2,0
Rice feed meal, ASH > 90 g/kg	912	121	137	183	60	215	31	226	17,02	24,93	1,26	3,6	3,6	2,2
Rice bran meal, solvent extracted	901	108	143	15	113	270	26	339	16,51	1,05	0,72	3,7	3,8	2,1
Rye	870	16	93	17	21	514	55	176	3,07	0,40	1,13	2,7	3,1	0,9
Rye feed	872	50	141	32	60	129	10	511	4,36	0,78	0,61	3,7	4,1	1,1
Sesame seed expeller	943	132	451	116	62		25	221	9,79	19,10	1,10	9,2	17,4	1,0
Sesame seed meal, solvent extracted	893	60	430	16	117		63	326	12,86	23,04	0,83	8,8	16,6	1,3
Soya beans, heat treated	899	50	362	208	49	7	67	208	5,07	2,20	1,43	18,6	8,2	2,8
Soya bean hulls, CF < 320 g/kg	883	48	129	32	306	9	17	649	1,68	5,83	0,61	4,8	2,4	0,8
Soya bean hulls, CF > 360 g/kg	887	45	101	21	360	6	12	702	1,06	5,18	0,60	3,7	1,9	0,5
Soya bean hulls, CF 320 - 360 g/kg	886	46	105	25	344	7	16	688	1,21	5,33	0,61	3,9	2,0	0,6
Soya bean expeller	916	64	439	90	63	8	84	234	6,32	2,75	1,17	24,2	11,0	2,7
Soya bean meal, solvent extracted, HiPro CF < 45 g/kg, CP < 485 g/kg	882	65	469	24	37	11	92	224	6,72	2,89	0,94	26,1	11,9	2,8
Soya bean meal, solvent extracted, HiPro CF < 45 g/kg, CP > 485 g/kg	878	65	489	24	36	8	90	206	6,52	2,88	0,94	27,2	12,4	2,7
Soya bean meal, solvent extracted, CF > 70 g/kg	878	65	421	24	75	13	80	280	5,79	2,88	0,92	22,9	10,5	2,4
Soya bean meal, solvent extracted, CF 45 - 70 g/kg, CP < 450 g/kg	880	63	436	24	63	9	86	266	5,91	2,89	0,93	23,7	10,8	2,5
Soya bean meal, solvent extracted, CF 45 - 70 g/kg, CP > 450 g/kg	877	64	467	26	48	5	84	235	6,39	2,88	0,93	25,7	11,7	2,7
Sorghum	872	15	87	35	23	606	8	122	2,66	0,26	1,27	1,7	2,8	0,7
Sorghum gluten meal	900	32	430	54	36	246		138	2,97		1,23	8,1	13,5	0,6

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Sugar	1000	0	0	0	0	0	1053	0	0,00	0,00	1,52	0,0	0,0	0,0
Tapioca, dried, STAew < 630 g/kg	883	58	23	9	62	593	9	192	0,72	4,07	1,09	0,5	0,3	0,4
Tapioca, dried, STAew 630 - 680 g/kg	879	58	23	8	53	620	8	162	0,74	2,48	1,12	0,5	0,3	0,4
Tapioca, dried, STAew 680 - 730 g/kg	873	51	23	7	48	653	7	132	0,88	2,00	1,14	0,5	0,3	0,5
Tapioca starch	880	1	11	2	2	855		11	0,35	0,18	1,37			0,2
Wheat	867	15	110	21	23	561	26	135	2,96	0,34	1,19	2,6	3,8	0,9
Wheat gluten meal	911	9	781	56	5	29	28	8	1,82	0,73	1,25	13,1	29,4	0,9
Wheat gluten feed, dried, ASH < 40 g/kg	888	36	144	38	55	294	82	296	6,35	1,05	0,98	3,7	4,0	1,9
Wheat gluten feed, dried, ASH > 60 g/kg	911	65	160	46	65	190	120	333	10,13	1,08	0,91	4,1	4,5	5,6
Wheat gluten feed, dried, ASH 40 - 50 g/kg	901	48	156	50	81	196	77	378	8,80	1,06	0,87	4,0	4,4	2,6
Wheat gluten feed, dried, ASH 50 - 60 g/kg	901	52	167	51	82	184	84	366	9,64	1,06	0,86	4,2	4,7	5,3
Wheat germs	872	41	264	0	35	204	109	174	7,89	0,52	1,16	12,7	7,0	2,2
Wheat germ feed	866	40	179	53	52	257	65	276	9,09	0,87	1,01	5,8	5,5	2,0
Wheat milling by-products, Wheat flour	871	16	141	30	11	562	47	77	4,00	0,42	1,27	4,1	4,7	1,0
Wheat milling by-products, Wheat middlings	871	47	152	47	88	182	56	389	9,55	0,91	0,78	4,8	4,4	1,9
Wheat milling by-products, Wheat feed flour	872	29	153	44	45	334	63	252	5,50	0,79	1,07	5,1	4,8	1,3
Wheat milling by-products, Wheat feed meal	870	43	154	45	72	230	63	337	8,60	1,00	0,88	4,7	4,5	1,9
Wheat milling by-products, Wheat bran CF > 125 g/kg	874	61	142	43	126	102	47	481	12,33	1,05	0,55	3,9	3,8	2,2
Wheat milling by-products, Wheat bran CF < 125 g/kg	869	53	149	44	109	138	58	430	10,63	0,96	0,66	4,1	4,0	1,9
Triticale	867	17	103	19	22	546	29	155	3,22	0,43	1,15	2,8	3,7	1,0
Feather meal, hydrolysed	938	24	833	93	13			-12	2,76	4,95	1,15	10,2	30,0	2,3

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STA am	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Processed animal protein, poultry origin, ASH < 145 g/kg	956	100	710	116	7			30	17,11	23,90	1,16	35,0	16,4	15,4
Processed animal protein, poultry origin, ASH > 335 g/kg	973	379	493	92	7			8	64,51	134,66	0,84	18,9	8,7	45,2
Processed animal protein, poultry origin, ASH 145 - 240 g/kg	962	192	639	108	7			23	32,71	60,41	1,06	29,1	13,6	26,2
Processed animal protein, poultry origin, ASH 240 - 335 g/kg	968	286	566	101	7			15	48,59	97,38	0,95	23,7	11,0	34,0
Fat/oil, Animal fat, 6% linolzuur	994	1		993							3,62			
Fat/oil, Animal fat, 9% linolzuur	994	1		993							3,65			
Fat/oil, Groundnut oil	995			995							3,84			
Fat/oil, Poultry fat	999	1		998							3,77			
Fat/oil, Coconut oil	995			995							3,84			
Fat/oil, Linseed oil	995			995							3,85			
Fat/oil, Maize oil	995			995							3,84			
Fat/oil, Olive oil	995			995							3,84			
Fat/oil, Palm oil, chemically refined	995			995							3,61			
Fat/oil, Palmkernel oil, chemically refined	995			995							3,85			
Fat/oil, Rapeseed oil	995			995							3,85			
Fat/oil, Tallow	994	1		993							3,61			
Fat/oil, Safflower oil	995			995							3,85			
Fat/oil, Soya oil	995			995							3,84			
Fat/oil, Lard	994	1		993							3,63			
Fat/oil, Fish oil	994	1		993							3,73			
Fat/oil, Sunflower oil, refined	995			995							3,85			
Vinasse, beet, CP < 240 g/kg	652	176	206	0	1		40	232	1,19	4,06	0,40	1,6	4,7	0,8
Vinasse, beet, CP > 240 g/kg	657	98	270	2			44	243	1,65	2,30	0,45	2,0	6,2	1,1

6.2 Ingredients for compound feeds for pigs (EW_{2015} per product; other nutrients in g/kg product)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Fish meal, treated, CP < 600 g/kg	911	194	561	142				13	26,41	40,07	1,19	38,1	17,7	20,3
Fish meal, treated, CP > 690 g/kg	917	132	707	101				-24	21,93	27,17	1,17	48,0	22,3	16,9
Fish meal, treated, CP 600 - 650 g/kg	913	168	629	112				4	26,02	40,27	1,15	42,7	19,8	20,0
Fish meal, treated, CP 650 - 690 g/kg	911	164	654	105			0	-13	24,85	38,00	1,14	44,4	20,6	19,1
Whey powder	982	81	130	8			702	96	6,10	5,39	1,28	8,9	4,1	5,2
Whey powder, low lactose, ASH < 210 g/kg	956	177	252	53			467	31	14,71	17,62	1,18	17,7	8,0	12,5
Whey powder, low lactose, ASH > 210 g/kg	962	230	217	41			444	52	19,64	33,85	1,08	15,1	6,9	16,7
Sunflower seed expeller, partly de-hulled, CF 200 - 315	923	58	298	105	227	4	47	414	10,03	2,92	0,90	8,3	9,6	1,7
Sunflower seed expeller, dehulled, CF < 200 g/kg	926	63	335	103	180	5	56	367	11,25	2,93	0,95	9,3	10,9	1,9
Sunflower seed meal, solvent ex-tracted, partly dehulled, CF 150 - 195 g/kg	901	66	368	21	176	8	63	378	11,57	3,57	0,68	10,2	11,9	2,0
Sunflower seed meal, solvent ex-tracted, partly dehulled, CF 195 - 245 g/kg	891	66	308	25	224	3	50	441	10,56	3,53	0,61	8,5	10,0	1,8
Sunflower seed meal, solvent ex-tracted, non-dehulled, CF > 245 g/kg	885	62	272	22	268	8	36	487	9,65	3,51	0,54	7,5	8,8	1,6

- In case only an average value for CFAT was available and no value for CFATh, the CFAT values was used. In general, STAam is analyzed with amyloglucosidase.
- The EW_{2015} of vegetable fats/oils depends on the fatty acid composition.

6.3 High moisture ingredients for pigs (EW_{2015} per kg DM; DM in g/kg product; other nutrients in g/kg DM)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Potato cuttings/chips, prefried, CFATh < 120 g/kg DM	309	34	72	102	19	668	10	115	2,30	0,33	1,62	2,3	1,2	1,4
Potato cuttings/chips, prefried, CFATh > 180 g/kg DM	352	28	63	212	16	576	10	111	2,10	0,34	1,89	2,0	1,0	1,3
Potato cuttings/chips, prefried, CFATh 120 - 180 g/kg DM	330	30	72	152	17	619	10	118	2,30	0,35	1,74	2,3	1,2	1,4
Potato peelings, steamed, STAam < 350 g/kg DM	119	81	155	13	71	257	35	248	2,70	2,10	1,21	5,6	2,5	0,9
Potato peelings, steamed, STAam > 600 g/kg DM	157	53	102	8	34	633	9	137	2,50	0,92	1,35	3,7	1,6	0,9
Potato peelings, steamed, STAam 350 - 475 g/kg DM	138	69	137	11	56	416	19	211	2,60	1,60	1,25	4,9	2,2	0,9
Potato peelings, steamed, STAam 475 - 600 g/kg DM	145	57	116	8	40	536	12	186	2,50	1,20	1,30	4,2	1,9	0,9
Potato starch, gelatinised, STAam < 400 g/kg DM	133	71	169	21	37	337	23	212	4,10	2,90	1,22			2,5
Potato starch, gelatinised, STAam > 625 g/kg DM	132	22	67	13	22	660	23	137	1,90	1,30	1,41			1,1
Potato starch, gelatinised, STAam 400 - 525 g/kg DM	132	51	155	25	39	467	23	160	3,00	2,50	1,30			1,8
Potato starch, gelatinised, STAam 525 - 625 g/kg DM	134	39	117	14	33	574	23	155	2,70	2,50	1,33			1,6
Brewer's grains, Meura filter process	258	42	260	103	182	16	23	503	5,57	4,87	0,85	7,6	7,8	3,6
Brewer's grains, traditional process, DM < 250 g/kg	222	43	243	106	176	21	6	515	6,67	4,60	0,82	7,1	7,3	4,3
Brewer's grains, traditional process, DM > 250 g/kg	265	43	247	104	179	20	15	506	6,50	4,10	0,82	7,2	7,4	4,2
Brewer's yeast, liquid, CP average	156	43	300	22	14	30	26	168	8,60	1,70	1,50	17,7	6,2	4,3
Brewer's yeast, liquid, CP high	173	46	353	25	14	30	26	109	9,60	1,30	1,52	20,8	7,3	4,8
Brewer's yeast, liquid, CP low	150	38	233	18	14	30	26	244	7,30	2,40	1,47	13,7	4,8	3,7
Sugarbeet pulp, pressed, ensiled	248	77	86	13	189	10	53	726	0,99	9,90	1,25	4,7	1,7	0,6
Corn cob mix (CCM), silage, partly with rachis, CF 40 - 60 g/kg DM	632	18	96	43	45	613	3	194	3,02	0,10	1,37	1,8	3,2	1,8
Corn cob mix (CCM), silage, with rachis, CF > 60 g/kg DM	525	21	99	43	72	588	3	214	3,02	0,10	1,34	1,8	3,2	1,8

6.3 High moisture ingredients for pigs (EW_{2015} per kg DM; DM in g/kg product; other nutrients in g/kg DM)

	DM	ASH	CP	CFATh	CF	STAam	SUG	NSPh	P	Ca	EW_{2015}	SID LYS	SID (M+C)	STTD P
Corn cob mix (CCM), silage, without rachis, CF < 40 g/kg DM	662	16	99	48	23	675	7	122	3,02	0,10	1,46	2,0	3,5	1,8
Pea creme	245	94	212	6	85	140	136	354	7,40	2,50	1,08	13,0	3,8	
Pea protein, liquid	241	149	340	11	2	14	215	153	10,80	1,80	1,08	21,6	6,4	
Pea fibre	197	26	89	7	225	267	7	492	1,00	3,30	1,16	4,1	1,3	
Cheese whey, fresh, CP < 175 g/kg DM	44	96	153	47			591	8	7,52	9,45	1,45	10,2	4,9	6,4
Cheese whey, fresh, CP > 275 g/kg DM	31	141	327	80			182	30	12,70	16,10	1,88	21,8	10,4	10,8
Cheese whey, fresh, CP 175 - 275 g/kg DM	38	106	210	72			468	12	9,10	12,09	1,55	14,0	6,6	7,7
Maize gluten feed, fresh and ensiled, STAew < 200 g/kg DM	414	57	198	38	134	88	17	539	9,90	0,30	0,82	3,8	5,0	2,5
Maize gluten feed, fresh and ensiled, STAew > 200 g/kg DM	418	39	166	38	86	308	12	382	6,80	0,30	1,02	3,2	4,2	1,7
Wheat yeast concentrate, CP < 275 g/kg DM	259	64	261	64	33	15	143	298	8,10	2,00	1,17	8,7	6,4	
Wheat yeast concentrate, CP > 325 g/kg DM	261	80	382	58	14	16	117	192	12,75	1,76	1,25	12,8	9,4	
Wheat yeast concentrate, CP 275 - 325 g/kg DM	256	62	296	63	29	11	124	273	8,40	1,90	1,20	9,9	7,3	
Wheat starch, STAam < 200 g/kg DM	244	30	136	37	22	154	279	172	3,37	0,84	1,39	5,8	5,0	2,0
Wheat starch, STAam > 600 g/kg DM	218	15	62	21	19	654	34	154	2,00	0,71	1,44	2,7	2,3	1,2
Wheat starch, STAam 200 - 400 g/kg DM	234	25	125	35	23	306	175	186	3,24	0,83	1,40	5,4	4,6	1,9
Wheat starch, STAam 400 - 600 g/kg DM	219	23	104	30	25	481	84	171	3,40	0,82	1,42	4,5	3,8	2,0

6.4 Mineral constituents

It is recommended to express the mineral contents as elements and not as oxides. To recalculate mineral contents expressed as oxides into elements the following factors can be used:

From	To	Multiply with
K_2O	K	0,830
Na_2O	Na	0,742
NaCl	Na	0,393
CaO	Ca	0,715
MgO	Mg	0,603
P_2O_5	P	0,437
SO_3	S	0,400
SO_4	S	0,334

Relevant CVB and other publications

Most data in the Booklet of Feeding Tables for Pigs concerning the feeding standards and feeding advices are derived from CVB documentation reports. Below an overview is given of the relevant CVB documentation reports and (recent) WLR reports:

CVB Documentation reports

Nr. 9: Normen voor de dragende zeugen (1994; in Dutch)
nr. 14: Aminozurenbehoefte van biggen en vleesvarkens (1996; in Dutch)
nr. 21: Antinutritionele factoren en de darmverteerbaarheid van eiwit en aminozuren bij varkens (1998; in Dutch)
nr. 25: Wateropname van zeugen (1999; in Dutch)
nr. 56: A new Dutch net energy formula for feed and feedstuffs for growing and fattening pigs (2015)
nr. 58: Behoefte aan Mg, Na, Cl, K, Fe, J, Mn en Se door varkens: een literatuurstudie voor het CVB (2015; in Dutch)
nr. 59: Phosphorus and calcium requirements of growing pigs and sows

WLR Reports

C.M.C. van der Peet-Schwering and P. Bikker (2018), Amino acid requirement of growing and finishing pigs, report 1101, Wageningen Livestock Research
C.M.C. van der Peet-Schwering and P. Bikker (2019), Energy and amino acid requirements of gestating and lactating sows, report 1190, Wageningen Livestock Research

For more detailed information on the CVB feed evaluation systems and detailed information about the composition and feeding values of feedstuffs the reader is referred to:

- CVB Feed Table 2023
- Online Feeding value calculator

The CVB products can be consulted via the CVB website: www.cvbdiervoeding.nl.

List with abbreviations

Abbreviation	Unit	Description
AA	g	Amino acid(s)
AID	g/kg	Apparent Ileal Digestible
ASH	g	Crude ash
BW	g or kg	Body weight
$BW^{0.75}$		Metabolic body weight
°C	-	Degrees Celsius
Ca	g/kg	Calcium
Cal	-	Calorie (1 cal = 4,184 Joules)
CF	g	Crude fiber
CFAT	g	Crude fat
CFATh	g	Crude fat after acid hydrolysis
Cl	g/kg	Chlorine
Co	mg/kg	Cobalt
CP	g/kg	Crude protein
Cu	mg/kg	Copper
DM	g	Dry matter
EW_{2015}	-	Energy value pigs = NE_{2015} / 8,8
EW-conv.	-	EW-conversion
Fe	mg/kg	Iron
g	-	Gram
GOS	g/kg	Glucose-oligosaccharide
I	mg	Iodine
J	-	Joule (1J = 0,239 cal)
K	g/kg	Potassium
Kg	-	Kilogram
mg	-	Milligram
Mg	g/kg	Magnesium
MJ	-	Mega joule (1 MJ = 1000 kJ = 1.000.000 J)
Mn	mg/kg	Manganese
Na	g/kg	Sodium
NE_{2015}	MJ	Net energy
NSPh	g/kg	Non starch polysaccharide (= Organic matter – crude protein – crude fat – starch - sugar)
P	g/kg	Phosphorus
S	g/kg	Sulphur
Se	mg/kg	Selenium
SID	g/kg	Standardized Ileal Digestible
STAam	g/kg	Starch analyzed using the amyloglucosidase method
SUG	g/kg	Sugar
STTD P	g/kg	Standardized total tract digestible phosphorus
STTD Ca	g/kg	Standardized total tract digestible calcium
Zn	mg/kg	Zinc