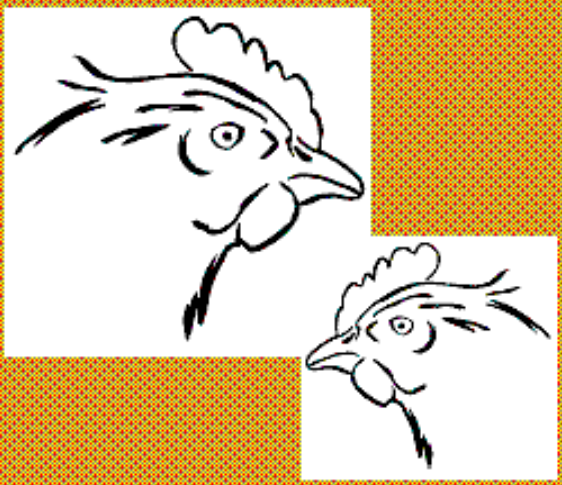
CVB Table Booklet Feeding of Poultry



Feeding standards, feeding advices and nutritional values of feeding ingredients

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CVB *for valuable feeding values*

Preface

CVB already for decades publishes a comprehensive booklet with feeding standards, feeding advices and nutritional values of feed ingredients for all farm animals.
Since 2000 this publication is entitled 'CVB Tabellenboek Veevoeding'.
In The Netherlands this publication is particularly used by people involved in the practical nutrition of productive livestock. The major target groups are livestock farmers, feed industry information officers, agricultural training students and veterinary surgeons.

In 2007 the Product Board Animal Feed (PDV, the organisation that nowadays is responsible for the CVB activities) started to publish separate tables for the individual animal species. These tables were published simultaneously in Dutch and in English.
In relation with this PDV decided to split up the 'CVB Tabellenboek Veevoeding' in separate booklets for each species and to publish these in English.
Before you lies the 'CVB Table Booklet Feeding of Poultry'.

Probably this publication is your first acquaintance with the CVB. If you are interested in more information about the CVB, you are kindly referred to our website.

In this second edition some errors in the dry matter contents of the ingredients and corresponding nutrient contents and feeding values have been corrected.

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Dr. M.C. Blok
Head of the CVB

Content

1 Energy evaluation for poultry

In the past, the Metabolizable Energy (ME; in Dutch 'Omzetbare Energie', ME) as determined with adult cocks (MEpo) was the only energy value for poultry. From 1990, the ME value for broilers (MEbr) is based on digestibility trials with young animals fed *ad libitum*. From 2004, the MEbr evaluation has been based on digestibility trials with broilers according to the standard CVB protocol. The ME for laying hens (MEla) is still based on research with adult cocks, even though he ME from digestible fat is upgraded with 15%, because of a better fat utilization by laying hens.
The MEbr is also often used for other types of growing poultry (e.g., young turkeys, ducks and rearing hens), while MEla is often applied also to other poultry in lay. Further, MEpo is also used for growing and laying poultry.

2 Broilers

2.1 Feed intake

Table 1 gives the average course of body weight, feed intake and feed conversion at different ages. The course is given based on average technical results (LEI, 2007), and for the top 25% of broiler farms in The Netherlands. The breed of the broilers has a large influence on the course of the growth curve. Therefore, it is increasingly difficult to give a broadly applicable reference growth curve.

Table 1 Average course of body weight and ME intake and corresponding feed intake and cumulative feed conversion for a feed with a MEbr content of 12.3 MJ/kg.

Average performance, LEI-reference 2007							
Age (days)	**BW [a] (g)**	**Weekly growth (g)**	**ME intake [b] (MJ.pa.p.d)**	**Feed intake [c] (g.p.a.p.d)**	**Feed conversion (FC) [d]**	**Cumulative feed intake (g)**	**LEI 2007 FC-1500 g**
0	40						
7	150	110	0.32 - 0.37	26 - 30	0.933	140	
14	375	225	0.68 - 0.75	55 - 61	1.200	450	
21	725	350	1.08 - 1.16	87 - 94	1.352	980	
28	1155	430	1.41 - 1.48	115 - 120	1.498	1730	
35	1640	485	1.80 - 1.89	147 - 154	1.631	2675	
42	2150	510	2.00 - 2.08	162 - 169	1.756	3775	1.496
49	2660	510	2.20 - 2.31	179 - 188	1.898	5050	1.434

Top 25% performance							
Age (days)	**BW [a] (g)**	**Weekly growth (g)**	**ME intake [b] (MJ.pa.p.d)**	**Feed intake [c] (g.p.a.p.d)**	**Feed conversion (FC) [d]**	**Cumulative feed intake (g)**	**LEI 2007 FC-1500 g**
0	40						
7	165	125	0.36 - 0.41	29 - 33	0.939	155	
14	415	250	0.76 - 0.84	62 - 68	1.217	505	
21	815	400	1.22 - 1.32	99 - 107	1.362	1110	
28	1300	485	1.60 - 1.67	130 - 136	1.508	1960	
35	1845	545	2.04 - 2.14	166 - 174	1.642	3030	
42	2425	580	2.28 - 2.37	185 - 193	1.773	4300	1.400
49	3025	600	2.51 - 2.63	204 - 214	1.904	5760	1.290

a) BW = body weight in grams.

b) Unless the MEbr value of the feed is so low that the given ME intake is not realized, the ME intake and the MEbr value for any specific feed may be used to estimate feed intake. The MEbr value in broiler feed usually lies between 11.8 and 12.5 MJ per kg. In the table the range in ME intake is given for a feed with 12.3 MJ/kg for the respective day.

c) This feed intake applies for a feed with 12.3 MJ MEbr per kg. The range in feed intake for the respective day is given.

d) The cumulative feed conversion is stated (kg of feed / kg animal live weight).

Broilers are often given three or four kinds of feeds, according to their age: I (0 - ca. 2 weeks of age), II and III (also refer to Table 7). Feed III is a feed without coccidiostat that legally must be fed from at least one to five days before slaughter. In The Netherlands, often (more than 2/3 of the broilers farms) at least 15% of the animals is delivered at least five days before the final delivery. In such a system, an average growth cycle of 42

days therefore lasts from about 38 to 45 days of age. Over 70% of broilers is delivered at a final weight of 2100 grams or more.

2.2 Controlled feeding

Some 15 years ago, the losses among broilers had increased considerably. These higher losses could be partially prevented by applying a controlled feeding schedule. The chicks were then fed restrictedly, based on a growth schedule. The somewhat lower daily gain caused by this system was abundantly compensated for by an improvement in feed conversion. Genetic improvement plays a major role, also in this area. The modern chick is more able to handle a high daily growth than chicks in the past. Therefore, the need for feed restriction has diminished and *ad libitum* feeding systems are increasing.

2.3 Adding whole wheat to the diet

Over the last 10 to 15 years, the use of whole wheat in broiler rations has gained interest in The Netherlands, for both economical and nutrition-technical reasons. Whole and/or broken wheat stimulates the development of the gizzard and therefore improves intestinal health. Whole wheat is often offered next to a compound feed. The proportion of whole wheat in the broiler ration is gradually increased from about ten days of age, up to a maximum of 40%. It is experimentally determined that the use of whole wheat leads to an increase in the weight of the digestive tract. This results in increased losses at slaughter.

2.4 Protein value

For broilers (and for laying hens) the protein requirement is expressed as the requirement for faecal digestible amino acids. Based on a literature review by CVB (CVB Documentation Report nr 18, 1996) (in Dutch), the requirements for the first limiting amino acids as given in Table 2 can be applied to obtain maximal growth in broilers fed *ad libitum*. When (e.g., for economical reasons) a lower content is used for one of the amino acids, the other amino acids contents may, in principal, also be lowered; however, the content of apparent faecal digestible amino acids (as a proportion of the first limiting amino acid) should at least comply with the proportions given in the last column of Table 2.

Table 2 Estimated requirement for apparent faecal digestible amino acids for broilers fed ad libitum (in g/kg of feed) [c].

Amino acid [a] [b]	0-2 weeks	2-4 weeks	4-6 week	Proportion [d]
Lysine	10.5	10.2	9.9	100
Methionine	4.0	3.9	3.8	38
Methionine +Cystine	7.7	7.4	7.2	73
Valine	8.4	8.2	7.9	80
Arginine	11.0	10.7	10.4	105
Isoleucine	6.9	6.7	6.5	66
Threonine	6.8	6.6	6.4	65
Tryptophan	1.7	1.6	1.6	16
Glycine + Serine [e]	15.0			
MEbr (MJ/kg)	11.9	12.6	12.6	

[a] Only the requirements for the first limiting amino acids, based on faecal digestibility, are given. For reaching a minimal feed conversion and a maximal percentage of

breast meat, the contents of Methionine and Lysine should be set a little higher for the age range of 2 to 6 weeks. In that case, the proportions in the last column are, of course, not entirely correct anymore.

b) Applying a feeding schedule where the animals are fed restrictedly - at least during a certain period - may lead to different requirements.

c) The contents are attuned to the stated energy content of the feed. When formulating diets with another MEbr value, the contents should be adjusted accordingly.

d) Although there are indications that this may not be entirely correct, it is assumed that during the growth period no changes occur in the amino acids requirements relative to lysine.

e) Probably, the synthesis capacity of the chick is only insufficient from 0 to 2 weeks of age to attend fully to the needs; therefore, the feed should contain a certain minimal amount of these amino acids in this period.

Due to the continuous developments in genetic growth potential of broilers, and the contents in practical feeds (Table 7), the values in Table 2 are probably on the low side, especially for the starter phase.

2.5 Digestible phosphorus and calcium

In October 1997, the system “Digestible Phosphorus Poultry” has officially been implemented. For the contents of digestible phosphorus (Dig P po) in feedstuffs the reader is referred to the Table in paragraph 6.2. The P requirement, expressed in g Dig P po/kg of feed, depends on the growing rate of the broilers and their feed intake. Table 3 gives the advised contents of Dig P po/kg of feed, and the growth rate and feed intake they apply to. For further information on the standards, one is referred to CVB Documentation report no 20 “Final system Digestible Phosphorus Poultry” (1997) (in Dutch).

Table 3 P and Ca requirements of broilers, expressed as g digestible phosphorus (Dig P po) and g calcium per kg of feed.

Age	Growth rate (g/period)	Feed intake (g/period)	Advised contents [a]	
			Dig P po	Ca [b]
0 - 10 days	195	255	4.0	8.8 - 9.2
10 - 30 days	1065	1715	3.1	6.8 - 7.1
30 - 40 days	730	1455	2.8	6.2 - 6.4
40 - 50 days	840	1850	2.7	5.9 - 6.2

a) contents in g/kg feed.

b) the optimal calcium / digestible phosphorus ratio is 2.2 to 2.3.

3 Laying hens and broiler breeders

3.1 Energy value

When fed *ad libitum*, laying hens regulate their feed intake according to their energy requirement. The requirement is then determined by the body weight (maintenance), the growth rate, the production level, and the ambient temperature.

Calculation of the energy requirement proceeds from the amounts of energy needed for:
- maintenance: at 25 °C 435 kJ MEla per kg metabolic body weight ($BW^{0,75}$) and 9.5 kJ MEla per kg BW for each °C temperature difference,
- growth: 21.5 kJ MEla per gram body weight gain,
- production: 12.1 kJ MEla per gram of egg.

Table 4a Dietary requirement for laying hens in g/animal/day (based on a feed with 11.80 MJ MEla/kg. [a])

	Laying percentage at an egg weight of 55 and 60 g, respectively				
BW (g)	**0%**	**60%**	**75%**	**85%**	**95%**
1400	54	87 - 94	96 - 104	101 - 110	107 - 117
1500	56	90 - 96	99 - 106	104 - 113	110 - 120
1600	59	93 - 99	101 - 109	107 - 116	113 - 122
1700	62	96 -102	104 - 112	110 - 118	115 - 125
1800	64	98 -104	107 - 114	112 - 121	118 - 128
1900	67	101 -107	109 - 117	115 - 124	121 - 130
2000	70	103 -110	112 - 120	118 - 126	123 - 133

Table 4b Dietary requirement for broiler breeders in g/animal/day (based on a feed with 11.50 MJ MEla/kg. [a])

	Laying percentage at an egg weight of 55 and 60 g, respectively				
BW (g)	**0%**	**50%**	**65%**	**75%**	**85%**
3000	106	138 -143	147 - 154	153 - 161	160 - 169
3200	111	143 -148	152 - 159	159 - 166	165 - 174
3400	116	148 -153	157 - 164	164 - 171	170 - 179
3600	121	153 -158	162 - 169	169 - 176	175 - 184
3800	126	158 -163	167 - 174	173 - 181	180 - 189
4000	131	163 -168	172 - 179	178 - 186	185 - 194

[a] With a deviating MEla value of the feed, the feed requirement may simply be calculated by multiplying the given requirement by 11.8/(deviating MEla value) for laying hens or 11.5/(deviating MEla value) for broiler breeders.

In Table 4a (laying hens) a growth rate of 1,5 gram per day is assumed at an ambient temperature of 22 °C. Table 4b (broiler breeders) assumes a growth rate of 4.0 gram per day at an ambient temperature of 20 °C.

During the production period, phase feeding is often applied. Three important phases are: before, during and after the maximum egg mass.

3.2 Protein value

To reach maximum production levels (egg production and feed conversion), for laying hens in the age range of 20 to 76 weeks the standard requirements for first limiting amino acids as given in Table 5 apply. Research shows that the requirements hardly change between 24 and 76 weeks of age. For the present, it is assumed that the requirements in the period between 20 and 24 weeks of age (low egg production level, but still juvenile growth) do not significantly deviate from the requirements between 24 and 76 weeks. For more information, one is referred to CVB Documentation report no 18 (1996) (in Dutch).

Table 5 Estimated requirement for apparent faecal digestible amino acids for white laying hens [a] to reach maximum production results (egg production and feed conversion).

Amino acid [b]	mg/animal/day	Content in diet (g/kg) [c]	Corresponding protein level (g/kg) [d]
Lysine	700	6.4 - 6.1	-
Methionine	350	3.2 - 3.0	-
Methionine + Cystine	650	5.9 - 5.7	-
Threonine	460	4.2 - 4.0	135 – 140
Tryptophan	130	1.2 - 1.1	135 – 140
Valine	600	5.5 - 5.2	135 – 140
Isoleucine	550	5.0 - 4.8	130 – 135

a) For the (somewhat heavier) brown laying hens the protein and amino acids requirements for maintenance are a little higher. The differences in egg production between white and brown layers are decreasing. The recommendation of the American NRC to maintain a 10% higher daily requirement (expressed as mg per animal per day) for brown layers seems to be rather high.

b) Only the requirements for the first limiting amino acids, based on faecal digestibility, are presented.

c) Based on a daily feed intake of 110 and 115 g/animal, respectively.

d) Based on a maize-wheat-soy diet; at crude protein levels below the stated values, these amino acids may become limiting.

3.3 Digestible phosphorus and calcium

The system “Digestible Phosphorus Poultry”, as valid since October 1997, also applies to laying poultry. The P requirements given below apply under the conditions given in Table 6.

Table 6 Conditions for which the given P requirements for laying hens are valid.

Age	White hens			Brown hens		
	growth (g)*	feed intake (g/a/d)	egg mass (g)	growth (g)*	feed intake (g/a/d)	egg mass (g)
20 - 28 wks	280	105	57	290	112	59
28 - 35 wks	50	110	60	80	115	62
35 - 55 wks	50	115	64	40	120	65
from wk 55	40	115	66	40	120	67

* The P content of the carcass is 6 g per kg live weight.

A dark period of eight hours is assumed, during which the animals do not ingest feed. Under these conditions, the P requirements are met when the feed contains the following Dig P po contents:

- Feed for week 20 - 28: 3.2 g Dig P po/kg.
- Feed for week 28 - 35: 3.0 g Dig P po/kg.
- Feed for week 35 - 55: 3.0 g Dig P po/kg.
- Feed from week 55: 2.8 g Dig P po/kg.

The Ca requirement is calculated by applying the factorial method, as indicated by the WPSA (1984). A decreasing Ca utilization during the laying period has been taken into account, from about 50% in young hens to about 40% at the end of the laying period. Under the conditions given in Table 6, the Ca requirement is covered with the following gross Ca contents in the feed:

- Feed for week 20 - 28: 37 g Ca/kg.
- Feed for week 28 - 35: 38-39 g Ca/kg.
- Feed for week 35 - 55: 41-43 g Ca/kg.
- Feed from week 55: 42-44 g Ca/kg.

3.4 Feed restriction laying hens

Feed restriction of laying hens should be combined with an accurate registration of:

- the amount of feed,
- the body weight,
- the laying percentage,
- the egg weight,
- the room temperature,
- the water consumption.

When feed restriction is applied in the laying period, this should start after the maximum egg mass production has been clearly passed (approximately 45-50 weeks). Good farming practices are of the essence. An often used rule of thumb is: for each gram egg mass less, offer one gram of feed less.
For broiler breeders, separate feeding systems for cocks and hens enables restricted feeding. An accurate restriction limits the body weight of especially cocks, resulting in better fertilization results.

4 Rearing period

During the rearing period, laying hens and broiler breeders are usually fed according to the body weight curve supplied by the rearing company. Nowadays, this implies that the animals are fed restrictedly. For rearing hens of laying breeds, this implies a moderate feed restriction (feeding level between 85 and 95% of *ad libitum* intake). On the other hand, young broiler breeders (female) are much stronger restricted. These animals are offered a feeding level between 25 and 50% of *ad libitum* intake. Lately, feeds that support the well-being of the animals gain special attention. A strong feed restriction in the rearing phase leads to hunger and frustration, which is expressed in deviant behaviour. By offering feed with a lower energy content and a lower protein content, the animals are allowed to consume more feed, so that the sensation of hunger decreases. Spending more time on feed intake will lead to more uniform flocks.
Some years ago, Dutch research on rearing hens of laying breeds has revealed that the growth occurs in bursts (short bouts of high growth rate), and that the animals should be fed accordingly. In practice, this means no restriction for these hens during the first 6 to 8 weeks of the rearing period, followed by a relatively strong restriction from 8 to 15 weeks (suppression of excessive fat accretion). Some weeks before the start of the laying period, an increasing feeding level should prepare the animals for an optimal egg production. Young broiler breeders should, however, be fed restrictedly until the start of the laying period. Excessive feed intake just before onset of lay causes too much useless breeding eggs (twin yolks, wind-eggs, et cetera). For both categories of rearing hens, the feeding schedule to be followed furthermore depends on vaccinations, beak-trimming and heat stress.
In the rearing period, often two types of feed, with adjusted nutrient contents, are given subsequently. The first phase is from 0 to approximately 6 weeks, and the second phase follows and runs up to the end of the rearing period. Three-phase-systems are also 8,5

5 Composition of feeds

Table 7 gives contents of digestible lysine (dLYS), digestible methionine + cystine (dM+C), calcium (Ca) and digestible phosphorus (Dig P po) for different feeds, as used in practical poultry feeding in The Netherlands.

Table 7 Average composition of practical compound feeds [a] for poultry.

	Per kg of feed				
	ME [b1) b2)] (MJ)	**dLYS (g)**	**dM+C (g)**	**Ca (g)**	**Dig P po (g)**
Broilers:					
• Broiler pre-starter, 0-8 days	11.85	12.0	8.5	9.0 - 10	4.2 - 4.4
• Broiler feed I, 0(8)-14 days	11.85	11.0	8.1	8.5 - 9.0	4.0 - 4.2
• Broiler feed II,14-30 days	12.25	10.2	7.5	7.0 - 7.5	3.1 - 3.3
• Broiler feed III, from 30 days	12.35	9.7	7.2	6.0 - 6.5	2.8 - 3.0
Rearing hens:					
• Rearing feed 0 – 6 weeks [c]	10.90	8.6	6.5	8.5	3.8
• Rearing feed 7 – 17 weeks	10.90	6.7	5.1	8.0	3.3
Laying hens [d]:					
• Pre-lay, 17-19 wks of age [e]	11.65	6.3	5.3	20 - 22	3.3
• 19-35 weeks of age	11.85	6.6	5.9	36 - 37	3.2
• 35-55/60 weeks of age	11.75	6.2	5.6	39 - 40	3.0
• from 55/60 weeks of age	11.65	5.9	5.3	42 - 43	2.8
Broiler breeders:					
• 23-35/40 weeks of age	11.50	6.1	5.3	29 - 31	3.1
• from 35/40 weeks of age	11.10	5.6	5.0	31 - 33	2.6

a) These averages are based on an inquiry amongst the Dutch compound feed industry in 2007. In practice, higher as well as lower contents may occur, as well as more phases, and/or other age ranges.

b1) In broiler feeds and rearing feeds, the MEbr is given. For the other feeds, MEla is stated. dLYS = faecal digestible Lysine; dM+C = faecal digestible Methionine + Cystine.

b2) The ME values of cereals and their by-products are often increased by approximately 6%, depending on type of cereal and animal category, due to the application of carbohydrate degrading enzymes.

c) In practice, two- and three-phase rearing feeds occur.

d) Feeds port-folio and age ranges also depend on management system (cage or free-range) and lay performance. Sometimes, starter feeds are given until peak production (approximately 28 weeks of age).

e) A pre-lay feed stimulates the feed intake of young hens and improves uniformity. Pre-lay feeds are given from 17 to 19 weeks of age (<5%.lay).

6 Feed ingredients

6.1 General explanation

The contents and values, presented in the tables in the next paragraphs, are mean values calculated from the data of analyses in the CVB database.

For more information on the analysis methods used, the contents of other chemical parameters, the contents of digestible nutrients and the calculation of the feeding values the reader is referred to the CVB Table Poultry 2007 or to the CVB Feed Table 2007.

Unless otherwise stated, in this table ‘dry matter’ is the total content of dry matter, so inclusive soil/sand that may be present in some ingredients.

6.2 Ingredients for compound feeds of poultry

	DM	Chemical composition (g/kg)			
		ASH	CP	CFAT	CFIBRE
Alfalfa meal, dehydrated, CP 140-160 g/kg	911	102	152	23	292
Alfalfa meal, dehydrated, CP 160-180 g/kg	910	109	168	25	271
Alfalfa meal, dehydrated, CP >180 g/kg	904	115	189	30	234
Barley	869	21	104	17	46
Barley feed, high grade	875	53	138	47	106
Barley mill byproduct	887	60	119	39	138
Beans (phaseolus), heat treated	862	52	229	16	45
Biscuits, ground CFAT < 120 g/kg	939	19	84	111	5
Biscuits, ground CFAT > 120 g/kg	919	18	80	162	7
Blood meal, spray dried	937	17	927	7	-
Bread meal	900	29	122	37	11
Brewers' yeast, dehydrated	936	69	468	26	22
Coconut expeller, CFAT < 100 g/kg	909	61	204	84	126
Coconut expeller, CFAT > 100 g/kg	939	62	208	121	125
Coconut extracted	898	65	214	22	134
Cottonseed without huks, CFIBRE < 100 g/kg	935	44	403	308	28
Cottonseed expeller, without husk, CFIBRE< 140 g/kg	928	61	412	110	122
Cottonseed expeller, partly with husk, CFIBRE 140-200 g/kg	941	57	349	70	177
Cottonseed expeller, with husk, CFIBRE 140-200 g/kg	921	52	307	61	219
Cottonseed extracted, without husk, CFIBRE < 140 g/kg	897	66	422	32	120
Cottonseed extracted, partly with husk, CFIBRE 140-200 g/kg	892	64	350	31	171
Fat, from Animals	994	1	-	993	-
Fats/oils, vegetable	995	-	-	995	-
Fats/oils, vegetable, (Soybean, maize,safflower)	995	-	-	995	-
Feather meal, hydrolized	934	23	830	91	12
Fish meal, CP < 580 g/kg	927	154	567	158	-
Fish meal, CP 580 - 630 g/kg	913	167	629	112	-
Fish meal, CP 630 - 680 g/kg	913	158	657	107	-
Fish meal, CP > 680 g/kg	922	133	711	101	-
Grass meal CP < 140 g/kg	928	105	120	27	246

Chemical composition (g/kg)						Feeding values poultry (per kg)			
STA	**SUG**	**N**	**P**	**K**	**Ca**	**MEbr**	**MEpo**	**MEla**	**Dig P po**
11	23	24,3	2,6	25,7	15,4	-	2,95	3,00	1,9
12	36	26,9	2,7	27,1	17,3	-	3,84	3,90	2,0
11	26	30,2	2,8	29,3	15,6	-	4,69	4,77	2,1
496	25	16,6	3,5	4,9	0,6	9,89	11,67	11,74	1,3
199	49	22,1	7,0	8,7	2,0	-	8,12	8,32	1,9
217	23	19,0	4,1	7,7	2,6	-	7,10	7,27	1,1
326	39	36,6	4,6	15,2	1,6	-	10,30	10,36	2,3
439	268	13,4	1,5	2,6	1,0	-	16,06	16,59	0,6
460	74	12,8	1,4	2,3	0,7	-	16,56	17,33	0,6
-	-	148,3	1,7	2,8	0,5	-	13,18	13,18	1,4
529	69	19,5	2,1	2,6	1,0	-	13,99	14,16	0,8
52	12	74,9	12,6	19,8	3,2	-	10,92	11,01	-
5	85	32,6	5,6	21,3	0,8	-	7,39	7,83	2,7
9	84	33,3	5,4	21,0	1,0	-	8,72	9,36	2,6
15	90	34,2	5,6	20,7	1,4	-	5,47	5,56	2,7
-	41	69,0	7,5	9,4	1,2	-	14,03	15,43	2,3
11	39	65,9	11,2	14,7	2,4	-	8,85	9,33	3,4
11	39	55,8	10,3	14,5	2,3	-	7,47	7,79	3,1
11	39	53,3	10,3	14,5	2,3	-	6,57	6,85	3,1
20	28	67,5	10,7	15,7	2,2	-	7,06	7,18	3,2
20	45	56,0	10,2	15,2	2,0	-	6,34	6,45	3,1
-	-	-	-	0,2	-	31,26	35,47	40,79	-
-	-	-	-	-	-	34,64	35,54	40,88	-
-	-	-	-	-	-	34,64	37,48	43,10	-
-	-	132,8	2,7	1,0	5,0	11,81	13,42	13,75	1,9
-	-	90,7	21,3	9,6	40,9	13,27	14,88	15,65	15,8
-	-	100,6	25,6	8,0	40,2	12,01	13,71	14,26	18,9
-	-	105,1	24,0	9,9	35,9	12,02	13,78	14,30	17,8
-	-	113,8	21,9	14,1	28,2	12,35	14,22	14,72	16,2
11	96	19,2	2,7	22,1	5,8	-	3,10	3,17	2,0

		Chemical composition (g/kg)			
	DM	ASH	CP	CFAT	CFIBRE
Grass meal CP 140-160 g/kg	921	117	151	30	224
Grass meal CP 160-200 g/kg	917	117	178	39	210
Grass meal CP > 200 g/kg	913	127	208	35	200
Horsebeans	863	34	251	14	79
Horsebeans, white	872	35	275	14	79
Linseed expeller	901	55	310	85	96
Linseed extracted	870	54	318	30	96
Lupins, CP < 335 g/kg	913	27	314	52	153
Lupins, CP > 335 g/kg	888	39	372	48	137
Maize	872	12	82	38	22
Maize, chemical/heat treated	879	13	88	42	21
Maize bran	873	14	94	34	99
Maize feedflour	881	6	72	12	8
Maize feed meal	872	22	94	61	51
Maize germ meal, solvent extracted	887	37	185	17	71
Maize germ meal feed expeller	897	44	134	56	59
Maize germ meal feed solvent extracted	875	39	138	24	63
Maize glutenfeed CP < 200 g/kg	892	60	187	36	73
Maize glutenfeed CP 200-230 g/kg	893	60	212	39	74
Maize glutenfeed CP > 230 g/kg	890	62	240	41	74
Maize gluten meal	901	17	610	56	10
Maize starch	876	1	6	5	2
Meat meal, Dutch	946	175	585	144	28
Meat meal CFAT < 100 g/kg	950	221	580	89	22
Meat meal CFAT > 100 g/kg	946	210	572	136	23
Meat-and-bone meal, CFATh < 100 g/kg	957	401	461	88	15
Meat-and-bone meal, CFATh > 100 g/kg	938	355	450	131	14
Millet	881	32	111	40	99
Millet (pearlmillet)	912	25	122	45	20
Milk powder, skimmed	945	79	350	16	-
Oats grain	889	26	104	49	105
Oats grain, peeled	884	19	131	66	16
Peanuts without shell,CFIBRE <85 g/kg	932	22	287	490	23
Peanut expeller, without shell, CFIBRE < 80 g/kg	914	68	451	79	60
Peanut expeller, partly with shell, CFIBRE 80-150 g/kg	915	64	418	78	82
Peanut expeller with shell, CFIBRE > 150 g/kg	933	34	312	122	162

Chemical composition (g/kg)						Feeding values poultry (per kg)			
STA	SUG	N	P	K	Ca	MEbr	MEpo	MEla	Dig P po
11	104	24,2	3,4	27,6	5,3	-	3,29	3,36	2,6
11	111	28,5	3,7	29,4	5,5	-	4,49	4,58	2,8
11	115	33,3	4,2	31,9	5,0	-	5,21	5,30	3,1
326	28	40,2	5,2	12,2	1,0	10,19	10,33	10,37	2,3
338	39	44,0	3,7	13,3	1,8	10,30	11,11	11,15	1,6
26	43	49,6	8,1	11,7	3,4	-	7,16	7,56	2,0
35	43	50,9	9,4	11,9	3,6	-	5,58	5,71	2,4
12	53	50,2	2,8	7,7	2,4	8,01	7,53	7,73	1,4
21	49	59,5	2,9	8,5	2,4	8,39	8,32	8,50	1,4
606	12	13,1	2,7	3,4	0,2	13,46	13,78	13,97	0,8
612	15	14,1	2,8	3,5	0,3	13,52	13,94	14,14	0,8
280	17	15,1	4,7	-	0,3	12,20	7,50	7,61	1,7
729	10	11,5	0,7	1,2	0,2	13,49	14,40	14,45	0,3
436	28	15,0	4,8	4,9	1,4	13,24	11,40	11,69	1,7
299	3	29,6	6,2	4,5	0,5	-	8,45	8,51	2,5
336	51	21,4	8,3	9,0	1,0	-	10,46	10,67	3,3
326	10	22,1	5,7	7,0	0,8	-	9,28	9,36	2,3
158	26	29,9	8,6	12,4	0,7	7,21	8,29	8,44	3,4
127	27	33,9	9,0	12,1	1,6	6,98	8,10	8,26	3,6
102	26	38,4	8,6	11,2	2,1	6,75	7,83	8,00	3,4
177	1	97,6	4,5	1,6	0,1	13,31	15,16	15,43	1,8
836	-	1,0	0,4	-	-	-	14,93	14,93	0,2
-	-	93,6	23,1	6,3	45,7	11,67	13,70	14,44	14,3
-	-	92,8	35,3	7,0	70,6	9,84	11,49	11,93	21,9
-	-	91,5	36,4	5,1	73,2	11,23	12,83	13,51	22,6
-	-	73,8	69,7	3,2	145,6	7,94	8,12	8,44	42,5
-	-	72,0	60,6	3,2	125,6	9,28	9,81	10,42	37,0
497	8	17,8	2,8	3,0	0,1	-	12,18	12,36	1,1
607	14	19,5	3,3	3,5	0,2	-	14,19	14,39	1,3
-	502	56,0	10,1	16,3	12,4	-	12,58	12,66	8,1
400	13	16,6	3,3	4,7	0,7	10,89	10,92	11,16	1,6
564	14	21,0	4,3	4,0	0,6	-	14,55	14,88	2,2
62	30	49,3	4,4	5,4	1,0	-	23,48	26,17	1,7
62	91	72,2	5,6	12,0	1,7	9,43	11,84	12,24	2,1
60	91	66,9	5,3	11,8	1,9	9,04	11,26	11,66	2,0
62	91	53,5	5,7	12,2	1,9	-	10,57	11,22	2,2

		Chemical composition (g/kg)			
	DM	**ASH**	**CP**	**CFAT**	**CFIBRE**
Peanut extracted, without shell, CFIBRE > 80 g/kg	913	60	457	11	64
Peanut extracted, with shell, CFIBRE 80-150 g/kg	893	54	501	10	126
Peas	867	28	211	10	53
Potato protein, ASH < 10 g/kg	907	6	795	32	6
Potato protein, ASH > 10 g/kg	905	22	768	34	7
Potato starch, heat treated, dehydrated	875	45	39	-	3
Potatoes, sweet, dehydrated	878	38	40	6	27
Rapeseed	923	39	198	415	97
Rapeseed, expeller	894	70	324	75	116
Rapeseed, solvent extracted, CP < 380 g/kg	873	67	335	26	120
Rapeseed, solvent extracted, CP > 380 g/kg	906	84	388	16	115
Rice without hulls	872	7	77	8	7
Rice with hulls	886	44	73	19	102
Rice bran meal, solvent extracted	899	119	151	32	102
Rice feed meal, ASH < 90 g/kg	897	70	135	141	53
Rice feed meal, ASH > 90 g/kg	908	117	133	162	55
Rye	872	16	98	13	21
Sesameseed expeller	946	126	449	116	61
Semameseed meal, solvent extracted	929	62	429	17	122
Sorghum	882	15	94	29	22
Sorghum gluten meal	900	32	430	54	36
Soybeans, heat treated	885	49	351	192	56
Soybean expeller	888	64	435	81	64
Soybean meal, solvent extracted HP, CFIBRE < 45 g/kg, CP<480 g/kg	873	65	464	19	37
Soybean meal, solvent extracted HP, CFIBRE < 45 g/kg, CP>480 g/kg	874	65	487	18	35
Soybean meal, solvent extracted, CFIBRE 45-70 g/kg, CP < 450 g/kg	876	62	430	22	61
Soybean meal, solvent extracted, CFIBRE 45-70 g/kg, CP > 450 g/kg	875	60	460	18	60
Soybean meal, solvent extracted, CFIBRE > 70 g/kg	874	62	425	19	74
Sugar	1000	-	-	-	-
Sugarbeet molasses	723	60	100	2	-
Sugarcane molasses SUG < 475 g/kg	734	106	44	1	1

Chemical composition (g/kg)						Feeding values poultry (per kg)			
STA	SUG	N	P	K	Ca	MEbr	MEpo	MEla	Dig P po
51	75	73,1	6,4	12,5	1,8	7,32	9,99	10,03	2,4
51	75	80,2	6,4	12,3	1,8	7,35	8,14	8,14	2,4
387	43	33,8	4,0	10,0	1,0	10,55	11,33	11,36	1,7
5	9	127,2	1,5	0,2	0,4	-	14,45	14,56	1,0
5	9	122,9	2,1	6,7	0,4	-	14,13	14,24	1,4
745	35	6,2	1,6	0,4	0,2	-	12,83	12,83	0,9
596	68	6,4	1,3	5,9	1,7	-	12,23	12,23	1,0
15	56	31,7	6,7	7,9	4,2	15,92	15,22	16,94	2,2
20	102	51,8	10,8	11,8	6,3	8,15	8,54	8,90	3,6
8	90	53,6	10,9	12,5	7,4	5,79	6,99	7,09	3,6
11	89	62,1	10,7	12,6	7,2	6,08	7,37	7,42	3,5
703	8	12,3	0,9	0,9	0,1	14,38	14,57	14,59	0,1
463	13	11,7	2,6	3,4	0,4	-	11,17	11,25	0,4
270	23	24,2	17,6	12,2	1,5	-	7,92	8,03	2,8
307	41	21,6	13,6	9,9	4,6	11,36	12,95	13,67	2,2
255	38	21,3	14,7	10,3	22,2	11,34	12,61	13,44	2,4
522	64	15,7	3,2	4,4	0,4	-	11,50	11,53	1,2
-	25	71,8	9,1	9,5	17,3	9,73	10,85	11,32	2,7
-	66	68,6	13,4	10,9	24,0	-	8,40	8,43	4,0
618	8	15,0	2,9	3,6	0,3	13,09	13,44	13,58	0,9
245	-	68,8	3,0	-	-	-	12,01	12,26	0,9
4	78	56,2	5,3	17,5	2,1	12,34	13,61	14,55	2,2
8	82	69,6	6,5	21,9	3,0	9,51	10,50	10,88	2,7
8	107	74,3	6,5	22,4	2,7	7,93	9,19	9,23	2,7
8	103	77,9	6,5	22,2	2,9	8,15	9,35	9,38	2,7
8	102	68,8	6,5	21,9	2,7	7,38	8,70	8,73	2,7
8	96	73,6	6,5	22,1	2,8	7,63	8,82	8,85	2,7
8	95	68,0	6,0	20,6	3,2	7,13	8,36	8,39	2,5
-	1053	-	-	-	-	16,41	16,41	16,41	-
-	430	16,0	0,3	36,6	4,9	-	7,07	7,07	0,2
-	444	7,0	0,5	41,1	6,9	6,39	7,30	7,30	0,2

		Chemical composition (g/kg)			
	DM	**ASH**	**CP**	**CFAT**	**CFIBRE**
Sugarcane molasses SUG > 475 g/kg	730	96	42	-	-
Sunflowerseed expeller, dehulled, CFIBRE < 210 g/kg	906	54	383	71	167
Sunflowerseed expeller, partly dehulled, CFIBRE 210-325 g/kg	921	62	286	99	247
Sunflowerseed meal, solvent extracted, CFIBRE < 160 g/kg	891	66	382	18	148
Sunflowerseed meal, solvent extracted, CFIBRE 160 - 200 g/kg	890	69	347	19	181
Sunflowerseed meal, solvent extracted, CFIBRE 200 - 240 g/kg	890	66	313	19	223
Sunflowerseed meal, solvent extracted, CFIBRE > 240 g/kg	887	60	277	19	268
Tapioca STARCH 575-625 g/kg	883	60	23	5	62
Tapioca STARCH 625-675 g/kg	881	57	23	5	53
Tapioca STARCH 675-725 g/kg	874	51	23	4	47
Tapioca starch	880	1	11	2	2
Triticale	877	17	112	15	22
Wheat	868	15	111	13	24
Wheat bran	883	55	156	35	107
Wheat feedflour, CFIBRE < 35 g/kg	865	22	152	32	19
Wheat feedflour, CFIBRE 35 - 55 g/kg	869	29	152	37	44
Wheat feed meal	868	45	154	34	70
Wheat germfeed	868	39	177	46	54
Wheat middlings	865	50	153	34	86
Whey powder	980	80	130	9	-
Whey powder, low lactose, ASH < 210 g/kg	956	177	254	53	-
Whey powder, low lactose, ASH > 210 g/kg	959	225	213	41	-

Chemical composition (g/kg)						Feeding values poultry (per kg)			
STA	**SUG**	**N**	**P**	**K**	**Ca**	**MEbr**	**MEpo**	**MEla**	**Dig P po**
-	490	6,7	0,6	34,6	6,5	7,05	8,06	8,06	0,3
5	59	61,3	7,5	12,8	2,9	-	8,16	8,43	2,0
4	47	45,8	7,6	13,0	2,9	7,42	7,90	8,28	2,1
8	53	61,1	11,6	15,0	3,5	5,74	6,69	6,75	3,1
8	51	55,5	11,8	16,0	3,5	5,27	6,34	6,40	3,2
8	53	50,1	10,8	15,1	3,5	4,82	5,99	6,04	2,9
8	45	44,3	10,0	14,3	3,4	4,37	5,30	5,36	2,7
595	9	3,7	1,0	5,9	2,6	11,07	11,33	11,33	0,7
620	8	3,7	0,7	5,8	2,6	11,47	11,66	11,66	0,5
653	7	3,7	1,0	5,9	2,6	11,81	11,85	11,85	0,7
851	-	1,8	0,3	-	0,2	14,51	14,81	14,81	0,2
565	40	17,9	3,3	4,7	0,3	10,90	-	-	-
557	27	17,8	3,1	4,2	0,4	12,00	12,91	12,96	1,2
146	62	25,0	12,0	13,7	1,8	5,34	6,49	6,58	3,2
468	46	24,3	4,0	7,2	0,5	10,61	12,83	12,98	1,1
348	65	24,3	6,9	7,2	0,9	8,97	11,05	11,22	1,9
229	66	24,6	8,7	12,4	1,0	7,21	8,97	9,10	2,3
259	65	28,3	9,1	10,4	0,9	8,35	10,17	10,38	2,5
179	60	24,5	10,6	13,3	1,0	5,99	7,72	7,85	2,9
-	700	20,8	6,3	26,4	5,5	-	11,63	11,67	5,0
-	467	40,6	15,0	43,1	16,7	-	11,57	11,83	12,0
-	443	34,1	19,6	48,6	33,8	-	10,61	10,81	15,7

7 Abbreviations used

Abbreviation	Unit	Description
ASH	g	Crude ash
BW	g or kg	Body weight
$BW^{0.75}$		Metabolic body weight
Ca	g	Calcium
CFIBRE	g	Crude fibre
CFAT	g	Crude fat
CFATh	g	Crude fat after acid hydrolysis
CP	g	Crude protein
CYS	g	Cystine
dLYS		Faecal digestible Lysine
DM	g	Dry matter
dM + C		Faecal digestible Methionine + Cystine
Dig P po	g	Digestible Phosphorus Poultry
FC		Feed conversion (g feed / g body weight
g		Gram
K	g	Potassium
kcal		Kilocalories
kg		Kilogram
kJ		Kilojoule
LYS	g	Lysine
ME	MJ / kcal	Metabolizable energy
MEbr	MJ / kcal	Metabolizable energy for broilers
MEla	MJ / kcal	Metabolizable energy for laying hens
MEpo	MJ / kcal	Metabolizable energy for poultry
MET	g	Methionine
MJ		Megajoule
N	g	Nitrogen
P	g	Phosphorus
p.a.p.d.		Per animal per day
PDV		Product Board Animal Feed
STA	g	Starch (enzymatically determined by amyloglucosidase)
SUG	g	Sugars