

Appendix 1. Basic nutrient composition

Ingredient	Crude protein (%)	Digestible protein (%)	Metabolizable energy (kcal/kg)	Crude fat (%)	Crude fiber (%)	Calcium (%)	Available phosphorus (%)	Linoleic acid (%)
Yellow Corn	8.5	7.8	3300	3.8	2.5	0.01	0.13	1.9
Wheat	13.0	11.6	3150	1.5	2.7	0.05	0.20	0.5
Oats	12.0	9.9	2756	4.0	12.0	0.10	0.20	1.5
Barley	11.5	9.3	2780	2.1	7.5	0.10	0.20	0.8
Milo	9.0	7.9	3250	2.5	2.7	0.05	0.14	1.0
Rye	12.5	8.4	2734	1.7	2.4	0.05	0.18	0.4
Triticale	15.4	13.2	3110	1.0	4.5	0.05	0.19	0.4
Rice (rough)	7.3	5.5	2680	1.7	10.0	0.04	0.13	0.6
Wheat bran	15.8	11.7	1580	4.8	10.4	0.10	0.65	1.7
Wheat shorts	15.1	14.3	2200	4.0	5.0	0.07	0.30	1.6
Wheat screenings #1	15.0	11.7	3000	4.1	3.0	0.05	0.20	0.7
Rice bran	13.0	7.7	1900	5.0	12.0	0.06	0.80	3.4
Rice polishings	11.0	8.5	2750	15.0	2.5	0.06	0.18	6.2
Bakery by-product	10.5	9.8	3500	9.5	2.5	0.05	0.13	3.0
Molasses (cane)	3.0	2.1	1962	-	-	0.50	0.03	-
Dehydrated alfalfa meal	17.0	9.5	1647	2.0	26.0	1.40	0.10	0.3
Canola meal	37.5	34.0	2000	1.5	12.0	0.65	0.45	0.5
Full-fat canola seed	22.0	19.7	4620	40.0	6.0	0.38	0.27	8.0
Soybean meal (48%)	48.0	44.0	2550	0.5	3.0	0.20	0.33	0.4
Full-fat soybeans	38.0	33.4	3880	20.0	2.0	0.15	0.37	0.3
Corn gluten meal	60.0	54.4	3750	2.51	2.48	0.10	0.28	9.0
Corn gluten feed	22.0	14.3	1830	2.5	10.0	0.40	0.21	1.22
Cotton seed meal	41.0	33.2	2350	0.5	14.5	0.15	0.40	1.0
Peanut meal	47.0	35.7	2205	1.0	13.0	0.20	0.45	0.21
Peas	23.5	20.7	2550	1.3	5.5	0.10	0.30	0.3
Safflower meal	42.0	32.9	1630	1.1	14.5	0.37	0.20	0.9
Sesame meal	44.0	30.6	1984	5.0	5.0	0.20	0.63	0.5
Sunflower meal	46.8	35.6	2205	2.9	11.0	0.30	0.75	2.0
Lupins	34.5	29.8	3000	6.3	16.0	0.20	0.50	1.8
Flax	22.0	18.1	3500	34.0	6.0	0.25	0.20	3.0
Meat Meal	50.0	45.0	2500	11.5	2.5	8.00	0.17	5.2
Fish meal (60%)	60.0	55.4	2750	2.0	1.0	6.50	4.00	1.82
Poultry by-product meal	60.0	52.5	2950	8.5	1.9	3.60	3.50	0.3
Blood meal	80.0	71.2	2690	1.0	1.0	0.28	2.10	2.5
Feather meal	85.0	75.7	3000	2.5	1.5	0.20	0.28	0.1
Dried Whey	13.0	12.4	1918	0.5	-	0.80	0.70	0.1

Appendix 2. Total amino acid composition

Ingredient	Methi-onine %	Cystine %	Lysine (%)	Hist-idine %	Trypt-ophan %	Thre-onine %	Arg-inine %	Iso-leucine %	Leu-cine %	Phenyl-alanine %	Val-inine %
Yellow Corn	0.2	0.11	0.2	0.2	0.1	0.41	0.4	0.5	1.0	0.5	0.4
Wheat	0.2	0.21	0.49	0.2	0.21	0.42	0.7	0.3	0.9	0.6	0.5
Oats	0.2	0.2	0.4	0.2	0.2	0.4	0.7	0.5	0.9	0.6	0.6
Barley	0.21	0.21	0.39	0.3	0.19	0.4	0.5	0.5	0.8	0.6	0.6
Milo	0.12	0.17	0.31	0.3	0.09	0.32	0.4	0.5	1.5	0.5	0.5
Rye	0.2	0.2	0.5	0.3	0.1	0.4	0.5	0.5	0.7	0.6	0.6
Triticale	0.2	0.2	0.4	0.3	0.1	0.3	0.8	0.5	1.0	0.7	0.7
Rice (rough)	0.12	0.11	0.22	0.2	0.11	0.34	0.6	0.3	0.7	0.3	0.5
Wheat bran	0.1	0.1	0.6	0.3	0.3	0.4	1.0	0.6	0.9	0.5	0.7
Wheat shorts	0.21	0.19	0.61	0.2	0.21	0.5	0.9	0.7	1.0	0.6	0.7
Wheat screenings #1	0.21	0.21	0.53	0.2	0.2	0.42	0.6	0.3	0.9	0.5	0.5
Rice bran	0.29	0.11	0.51	0.3	0.18	0.38	0.5	0.4	0.8	0.4	0.6
Rice polishings	0.21	0.29	0.50	0.2	0.12	0.32	0.6	0.3	0.7	0.4	0.7
Bakery by-product	0.21	0.19	0.29	0.3	0.13	0.3	0.5	0.4	0.8	0.6	0.5
Molasses (cane)	-	-	-	-	-	-	-	-	-	-	-
Dehydrated alfalfa meal	0.3	0.4	1.8	0.4	0.4	0.5	0.7	0.7	1.3	0.8	0.9
Canola meal	0.69	0.61	2.21	1.1	0.5	1.72	2.2	1.4	2.7	1.5	1.9
Full-fat canola seed	0.5	0.4	1.3	0.6	0.3	1.0	1.3	0.8	1.6	0.9	1.1
Soybean meal (48%)	0.72	0.79	3.22	1.3	0.71	1.96	3.6	2.6	3.7	2.5	2.5
Full-fat soybeans	0.49	0.63	2.41	0.9	0.49	1.53	2.7	2.0	2.8	1.9	1.9
Corn gluten meal	1.61	0.91	0.90	1.4	0.3	1.7	2.2	2.4	8.1	3.2	2.6
Corn gluten feed	0.4	0.5	0.6	0.7	0.2	0.9	1.0	0.6	2.4	0.7	1.0
Cotton seed meal	0.49	0.62	1.67	1.0	0.5	1.31	4.6	1.3	2.4	2.2	1.9
Peanut meal	0.4	0.7	1.6	1.2	0.5	1.5	4.9	2.0	3.0	2.7	2.8
Peas	0.3	0.2	1.6	0.7	0.2	0.9	1.4	1.1	1.8	1.9	1.3
Safflower meal	0.4	0.7	1.3	0.4	0.3	0.6	2.9	0.6	1.2	1.2	1.1
Sesame meal	1.5	0.6	1.4	1.2	0.8	1.7	5.1	2.3	3.2	2.3	2.5
Sunflower meal	0.8	0.7	1.6	1.0	0.9	1.6	3.3	1.8	2.4	1.9	2.2
Lupins	0.3	0.6	1.7	0.9	0.4	1.2	4.5	1.4	2.4	1.3	1.4
Flax	0.41	0.41	0.89	0.4	0.29	0.82	2.1	1.0	1.3	1.0	1.1
Meat Meal	0.71	0.61	2.68	0.7	0.36	1.52	3.0	1.3	3.3	1.6	2.4
Fish meal (60%)	1.82	1.1	5.28	1.6	0.58	3.01	4.0	4.1	5.0	2.7	3.6
Poultry by-product meal	1.3	2.0	3.4	1.0	0.4	2.2	3.5	2.1	4.5	1.8	3.0
Blood meal	1.0	1.4	6.9	4.2	1.1	3.7	3.5	1.0	10.0	6.0	7.0
Feather meal	0.6	5.5	1.72	0.5	0.6	4.51	6.4	4.3	6.5	4.3	7.4
Dried Whey	0.2	0.3	1.1	0.2	0.2	0.8	0.4	0.9	1.4	0.4	0.7

Appendix Table 2
Total amino acid composition

Appendix 3. Available amino acid composition

Ingredient	Methi -onine %	Cystine %	Lysine (%)	Hist -idine %	Trypt -ophan %	Thre -onine %	Arg -inine %	Iso -leucine %	Leu -cine %	Phenyl -alanine %	Val -ine %
Yellow corn	0.18	0.09	0.16	0.18	0.07	0.33	0.35	0.44	0.8	0.42	0.33
Wheat	0.16	0.17	0.40	0.18	0.17	0.32	0.56	0.26	0.81	0.54	0.42
Oats	0.18	0.18	0.37	0.18	0.18	0.34	0.64	0.45	0.81	0.55	0.50
Barley	0.16	0.16	0.31	0.26	0.15	0.29	0.41	0.41	0.73	0.53	0.48
Milo	0.09	0.15	0.23	0.26	0.06	0.24	0.28	0.42	1.30	0.40	0.40
Rice (rough)	0.09	0.06	0.17	0.17	0.11	0.27	0.50	0.26	0.56	0.28	0.41
Wheat bran	0.08	0.07	0.42	0.24	0.24	0.28	0.79	0.48	0.72	0.41	0.55
Wheat shorts	0.16	0.14	0.48	0.16	0.15	0.41	0.71	0.56	0.84	0.49	0.57
Rice bran	0.15	0.07	0.39	0.24	0.13	0.28	0.40	0.31	0.54	0.30	0.46
Rice polishings	0.16	0.08	0.41	0.18	0.08	0.25	0.48	0.27	0.57	0.31	0.52
Bakery by-product	0.18	0.16	0.19	0.24	0.08	0.21	0.40	0.32	0.71	0.51	0.40
Dehydrated alfalfa meal	0.21	0.16	1.00	0.29	0.28	0.35	0.56	0.51	1.00	0.55	0.70
Canola meal	0.61	0.47	1.76	0.93	0.38	1.30	1.92	1.04	2.40	1.30	1.55
Full-fat canola seed	0.40	0.26	1.00	0.48	0.24	0.81	0.98	0.62	1.28	0.72	0.81
Soybean meal (48%)	0.64	0.63	2.87	1.07	0.53	1.75	3.20	2.30	3.20	2.10	2.20
Full-fat soybeans	0.41	0.52	2.00	0.74	0.39	1.27	2.31	1.72	2.20	1.70	1.70
Corn gluten meal	1.44	0.78	0.81	1.14	0.21	1.58	2.07	2.30	7.90	3.10	2.40
Corn gluten feed	0.33	0.35	0.42	0.56	0.14	0.65	0.87	0.48	2.12	0.63	0.83
Cotton seed meal	0.35	0.40	1.18	0.69	0.35	0.90	3.68	0.95	1.72	2.00	1.70
Peanut meal	0.33	0.55	1.28	0.96	0.38	1.20	4.00	1.80	2.70	2.30	2.40
Sesame meal	1.30	0.54	1.30	1.00	0.60	1.43	4.60	2.00	2.80	2.10	2.30
Sunflower meal	0.72	0.55	1.30	0.80	0.65	1.20	2.64	1.28	1.90	1.55	1.75
Lupins	0.27	0.54	1.40	0.81	0.26	1.00	4.10	1.20	2.20	1.10	1.20
Flax	0.33	0.30	0.72	0.32	0.26	0.65	1.76	0.72	1.10	0.76	0.95
Meat meal	0.62	0.33	2.09	0.56	0.26	1.17	2.78	1.00	2.60	1.30	1.90
Fish meal (60%)	1.62	0.80	4.72	1.40	0.48	2.50	3.62	3.70	4.50	2.30	3.20
Poultry by-product meal	1.1	1.20	2.70	0.80	0.3	1.8	3.00	1.70	3.80	1.40	2.40
Blood meal	0.90	1.10	5.90	3.40	0.80	2.80	2.90	0.78	8.90	5.30	6.10
Feather meal	0.47	2.38	1.10	0.35	0.41	3.15	5.05	3.60	5.00	3.50	6.10

Appendix 4. Mineral composition

Ingredients	Chloride (%)	Magnesium (%)	Sodium (%)	Potassium (%)	Iron (%)	Manganese (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)	Selenium (mg/kg)
Yellow Corn	0.05	0.15	0.05	0.38	0.01	4	3	29	0.04
Wheat	0.08	0.16	0.09	0.52	0.01	48	7	40	0.50
Oats	0.10	0.17	0.06	0.37	0.01	38	5	31	0.30
Barley	0.18	0.12	0.08	0.48	0.01	16	7	40	0.30
Milo	0.07	0.17	0.05	0.32	0.01	14	9	26	0.04
Rye	0.37	0.12	0.02	0.26	0.01	66	7	30	0.45
Triticale	0.41	0.15	0.04	0.41	0.01	51	6	35	0.43
Rice (rough)	0.28	0.14	0.03	0.34	0.01	15	3	10	0.17
Wheat bran	0.30	0.15	0.06	1.24	0.02	115	12	89	0.95
Wheat shorts	0.10	0.26	0.07	0.84	0.01	104	9	99	0.80
Wheat screenings #1	0.05	0.15	0.08	0.55	0.01	48	7	40	0.57
Rice bran	0.17	0.85	0.10	1.30	0.02	425	14	30	0.19
Rice polishings	0.17	0.65	0.10	1.17	0.02	310	8	30	0.17
Bakery by-product	0.48	0.20	0.53	0.62	0.02	30	7	41	0.30
Molasses (cane)	0.65	0.40	0.30	3.50	0.02	50	20	35	0.08
Dehydrated alfalfa meal	0.45	0.34	0.16	2.40	0.03	50	9	41	0.06
Canola meal	0.05	0.51	0.09	1.45	0.02	61	7	44	0.90
Full-fat canola seed	0.03	0.31	0.01	0.81	0.02	35	6	26	0.52
Soybean meal (44%)	0.05	0.25	0.05	2.61	0.02	32	35	54	0.12
Soybean meal (48%)	0.05	0.27	0.05	2.55	0.01	27	36	52	0.11
Full-fat soybeans	0.04	0.21	0.05	1.50	0.01	20	27	41	0.10
Corn gluten meal	0.06	0.05	0.10	0.04	0.04	7	28	66	0.30
Corn gluten feed	0.20	0.29	0.95	0.60	0.05	5	47	45	0.17
Cotton seed meal	0.03	0.39	0.05	1.10	0.01	18	16	40	0.06
Peanut meal	0.55	0.04	0.07	1.10	0.03	29	6	80	0.12
Peas	0.06	0.12	0.03	1.10	0.01	18	16	20	0.05
Safflower meal	0.03	0.27	0.10	0.69	0.03	24	9	80	0.13
Sesame meal	0.05	0.50	0.04	1.20	0.04	48	4	27	0.06
Sunflower meal	0.03	0.75	0.02	1.00	0.10	15	3	100	0.25
Lupins	0.01	0.13	0.10	1.00	0.01	70	4	30	0.18
Flax	0.05	0.30	0.08	1.20	0.02	74	17	91	0.11
Meat meal	0.90	1.00	0.50	1.25	0.04	18	8	98	0.40
Fish meal (60%)	0.55	0.21	0.47	0.32	0.06	25	8	119	1.85
Poultry by-product meal	0.40	0.18	0.36	0.28	0.05	20	6	79	0.90
Blood meal	0.26	0.14	0.33	0.21	0.03	6	8	80	0.60
Feather meal	0.40	0.20	0.70	0.30	0.05	15	12	7	0.72
Dried Whey	0.07	0.13	0.43	0.19	0.02	4	43	105	0.06

Appendix Table 4
Mineral composition