

ANNEX

Layer Management guide



ISA WARREN

by  ISA

2005

CONTENTS

FEEDING PROGRAMME FOR ISA WARREN IN REARING AT 20 ° C	2
FEEDING PROGRAMME FOR ISA WARREN IN REARING AT 28 ° C	3
LIGHTING PROGRAMME FOR ISA WARREN IN REARING	4
GROWTH CURVE OF ISA WARREN DURING REARING	6
SPECIFICATIONS FOR GROWING DIETS	7
DAILY NUTRIENT REQUIREMENTS IN LAY	8
NUTRITIONAL RECOMMENDATIONS FOR THE LAYING PERIOD	9

Note: The performance data contained in this document was obtained from results and experience from our own research flocks and flocks of our customers. In no way does the data contained in this document constitute a warranty or guarantee of the same performance under different conditions of nutrition, density or physical or biological environment.

**Warren is a registered trade mark of the ISA group in the European area.*

FEEDING PROGRAMME FOR ISA WARREN IN REARING AT 20 °C

Dietary suggestions for general guidance :

- Starter 2.950 kcal (12.3 MJ) as crumbs
- Grower 2 850 kcal (11.9 MJ) as mash or crumbs
- Pullet 2.750 kcal (11.5 MJ) as mash
- Pre – lay 2.750 kcal (11.5 MJ) as mash

Diet		Mean Bodyweight (1)	Kcal/day		Ration g/d		Cumul cons.	
Week	Day		Cages	Floor	Cages	Floor	Cages	Floor
Starter – 2 950 kcal (12.3 MJ)/kg 20.5 % crude protein		From day old to 300 g of BODYWEIGHT						
1	1 – 7	65	30	30	11	11	77	77
2	8 – 14	120	50	50	17	17	196	196
3	15 – 21	205 – 215	76	76	26	26	381	381
4	22 – 28	290 – 305	97	100	33	34	610	617
Grower – 2 850 kcal (11.9 MJ)/kg 19 % crude protein		From 300 g to 850 g of BODYWEIGHT						
5	29 – 35	390 – 410	108	114	38	40	876	897
6	36 – 42	485 – 510	123	129	43	45	1177	1213
7	43 – 49	580 – 610	134	140	47	49	1508	1558
8	50 – 56	670 – 710	146	152	51	53	1867	1931
9	57 – 63	760 – 800	155	164	54	57	2247	2333
10	64 - 70	850 – 895	167	175	58	62	2656	2764
Pullet – 2 750 kcal (11.5 MJ)/kg 16 % crude protein		After 875 g of BODYWEIGHT						
11	71 – 77	935 – 990	172	183	63	67	3094	3231
12	78 – 84	1025 – 1085	181	192	66	70	3554	3719
13	85 – 91	1115 – 1180	189	200	69	73	3035	4229
14	92 – 98	1205 – 1280	197	209	72	76	4537	4760
15	99 – 105	1290 – 1365	203	217	74	79	5054	5313
16	106 - 112	1375 – 1460	212	226	77	82	5593	5887
Pre-lay – 2 750 kcal (11.5 MJ)/kg 17 % crude protein (2)		Transfer between 15 and 17 weeks						
17	113 - 119	1460 - 1550	220	234	80	85	6153	6483

(1): Bodyweights above refer to weighings carried out in the rearing house in the afternoon. We stress that during transport, the pullet can lose 5 to 10 % of its bodyweight, depending on the time without food and in transport, and on the temperature. It is very difficult to make an accurate estimate of bodyweight after transfer.

(2): To avoid falls in food consumption, 50 % of the calcium should be supplied in granular form (diameter: 2 to 4 mm).

Note: The ration should be adjusted so as to control bodyweight.

FEEDING PROGRAMME FOR ISA WARREN IN REARING AT 28 °C

Dietary suggestions for general guidance :

- Starter 2.950 kcal (12.3 MJ) as crumbs
- Grower 2 850 kcal (11.9 MJ) as mash or crumbs
- Pullet 2.750 kcal (11.5 MJ) as mash
- Pre – lay 2.750 kcal (11.5 MJ) as mash

Diet		Mean Bodyweight (1)	Kcal/day Floor	Ration g/d Floor	Cumul cons. Floor
Week	Day				
Starter – 2 950 kcal (12.3 MJ)/kg 20.5 % crude protein		From day old to 400 g of BODYWEIGHT			
1	1 – 7	65	30	11	77
2	8 – 14	120	50	17	196
3	15 – 21	205 – 215	76	26	381
4	22 – 28	290 – 305	94	32	603
5	29 – 35	390 – 410	105	37	862
Grower – 2 850 kcal (11.9 MJ)/kg 20.0 % crude protein		From 400 g to 850 g of BODYWEIGHT			
6	36 – 42	485 – 510	120	42	1156
7	43 – 49	580 – 610	132	46	1479
8	50 – 56	670 – 710	143	50	1831
9	57 – 63	760 – 800	152	53	2204
10	64 - 70	850 – 895	161	56	2599
Pullet – 2 750 kcal (11.5 MJ)/kg 16.8 % crude protein		After 875 g of BODYWEIGHT			
11	71 – 77	935 – 990	166	61	3023
12	78 – 84	1025 – 1085	175	64	3468
13	85 – 91	1115 – 1180	183	67	3934
14	92 – 98	1205 – 1280	189	69	4415
15	99 – 105	1390 – 1365	195	71	4911
16	106 - 112	1375 – 1460	203	74	5428
Pre-lay – 2 750 kcal (11.5 MJ)/kg 17.5 % crude protein (2)		Transfer between 15 and 17 weeks			
17	113 - 119	1460 - 1550	212	77	5966

(1): Bodyweights above refer to weighings carried out in the rearing house in the afternoon. We stress that during transport, the pullet can lose 5 to 10 % of its bodyweight, depending on the time without food and in transport, and on the temperature. It is very difficult to make an accurate estimate of bodyweight after transfer.

(2): To avoid falls in food consumption, 50 % of the calcium should be supplied in granular form (diameter: 2 to 4 mm).

Note: The ration should be adjusted so as to control bodyweight.

LIGHTING PROGRAMME IN TEMPERATE CLIMATE

The programmes suggested are only guides. They should be modified according to results previously obtained.

PRODUCTION IN DARK LAYING HOUSES

Age and/or Bodyweight	Duration of lit period		Intensity Lux
	Temperate season	Hot season	
1 – 3 days	22 h	22 h	20 – 40
4 – 7 days	20 h	20 h	15 – 30
8 – 14 days	18 h	18 h	10 – 20
15 – 21 days	16 h	16 h	5 – 10
22 – 28 days	15 h	15 h	5 – 10
29 – 35 days	13 h 30	14 h	5 – 10
36 – 42 days	12 h	13 h	5 – 10
43 – 49 days	11 h	12 h 30	5 – 10
After 49 days	10 h	12 h	5 – 10
1 300 g	12 h	14 h	5 – 15
1 375 g	12 h 30	14 h 30	5 – 15
1 450 g	13 h	15 h	5 – 15
1 525 g	13 h 30	15 h 30	5 – 15
After 1 525 g			

Increase by 30 min/week
So as to have 15 to 16 h at 50 % production

PRODUCTION IN NATURALLY LIT OR SEMI-DARK HOUSES

Age and/or Bodyweight	Duration of light at 14 weeks				
	≤ 10 h	11 h	12 h	13 h	≥ 14 h
1 – 3 days	22 h	22 h	22 h	22 h	22 h
4 – 7 days	20 h	20 h	20 h	20 h	20 h
8 – 14 days	18 h	18 h	18 h	18 h	18 h
15 – 21 days	16 h	16 h	16 h	16 h	16 h
22 – 28 days	15 h	15 h	15 h	15 h	15 h
29 – 35 days	13 h 30	14 h	14 h	14 h	14 h 30
36 – 42 days	12 h	13 h	13 h	13 h 30	14 h
43 – 49 days	11 h	12 h	12 h 30	13 h	14 h
Decreasing daylengths:					
After 49 days	10 h	NL	NL	NL	NL
1 300 g	12 h	13 h	14 h	15 h	16 h
1 375 g	13 h	14 h	14 h 30	15 h 30	16 h 30
1 450 g	13 h 30	14 h 30	15 h	16 h	16 h 30
Increasing daylengths:					
After 49 days	10 h	11 h	12 h	13 h	14 h
1 300 g	11 h	12 h	13 h	14 h	15 h
1 375 g	12 h	13 h	14 h	14 h 30	15 h 30
1 450 g	13 h	14 h	14 h 30	15 h	16 h
After 1 450 g	Increase by 30 min/week in order to have 15 to 16 h at 50 % production				

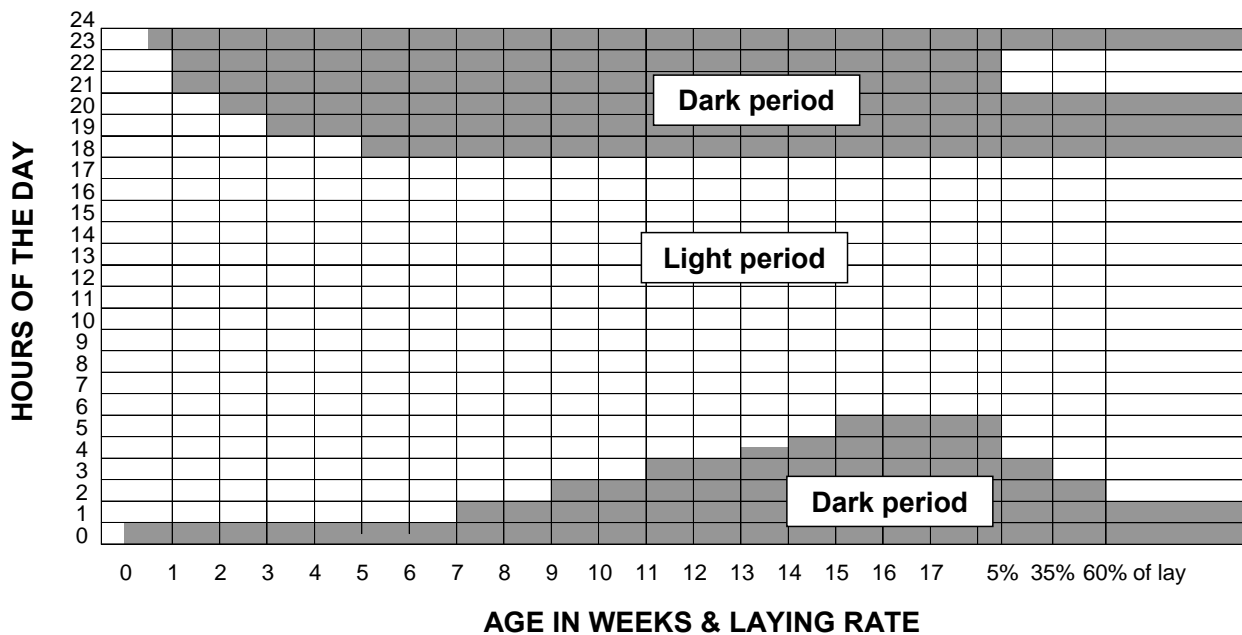
LIGHTING PROGRAMME IN HOT CLIMATE

The programmes suggested are only guides. They should be modified according to results previously obtained.

LIGHTING PROGRAMME FOR HOT CLIMATES BETWEEN LATITUDES 20° NORTH AND 20° SOUTH

1 – 3 days	23 or 24 h	40
4 – 7 days	22 h	40
8 – 14 days	20 h	40
15 – 21 days	19 h	40
22 – 35 days	18 h	40
36 – 49 days	17 h	40
50 – 63 days	16 h	40
64 – 77 days	15 h	40
78 – 91 days	14 h	40
92 – 98 days	13 h	40
99 – 105 days	13 h	40
106 – 112 days	Natural light	40
113 – 126 days	Natural light	40
After 127 days	Natural light	40
5 % lay	14 h (+ 2 h)	40
After 35 % lay	15 h (+ 2 h)	40
After 60 % lay	16 h (+ 2 h)	40

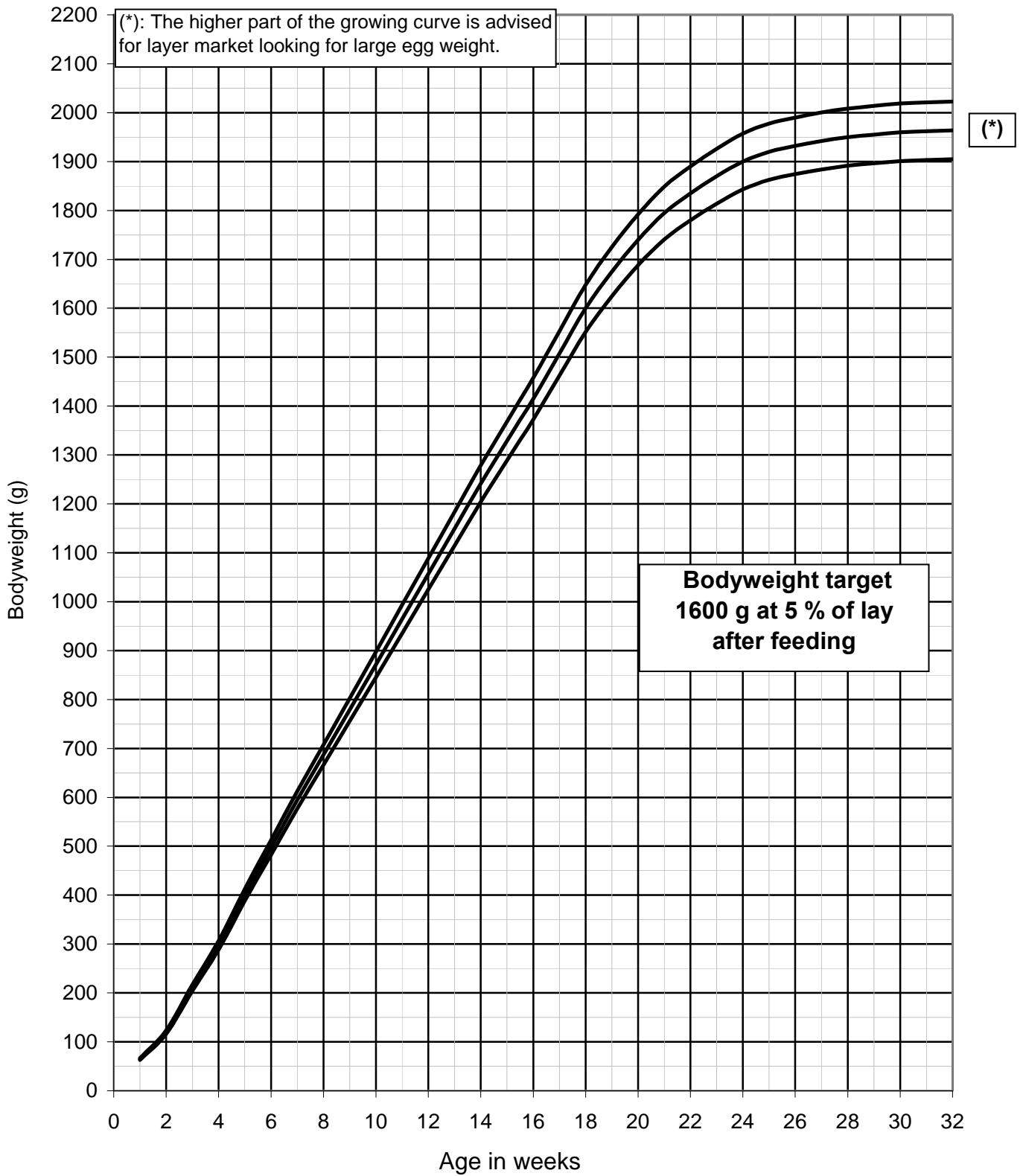
Note: (+ 2 h) refers to the period of artificial light given in the middle of the night to encourage feed consumption.



Example of a lighting programme which could be used in hot climates between latitudes 20° North and 20° South

GROWTH CURVE OF ISA WARREN DURING REARING

OPTIMUM GROWTH CURVE FOR ISA WARREN PULLETS IN REARING



ISA WARREN

NAME / COUNTRY:.....

NUMBER OF PULLETS:.....

DATE OF HATCH:.....

SPECIFICATIONS FOR GROWING DIETS

Between 18 & 24 °C	Units	Starter 0 - 4 weeks 1 - 28 days	Grower 4 - 10 weeks 28 - 70 days	Pullet 10 - 16 weeks 70 - 112 days	Pre - lay 112 days to 2 % lay
Forecast quantity / bird	g	600	2100	3000	
Metabolisable energy	kcal/kg	2950	2850	2750	2750
	MJ/kg	12.3	11.9	11.5	11.5
Crude protein	%	20.5	19	16	17
Methionine	%	0.52	0.45	0.33	0.36
Methionine + Cystine	%	0.86	0.76	0.60	0.65
Lysine	%	1.16	0.98	0.74	0.80
Threonine	%	0.78	0.66	0.50	0.54
Tryptophan	%	0.21	0.19	0.16	0.17
Digestible amino acids (1)					
Dig. Methionine	%	0.48	0.41	0.30	0.33
Dig. Meth.+ Cystine	%	0.78	0.66	0.53	0.57
Dig. Lysine	%	1.00	0.85	0.64	0.69
Dig. Threonine.	%	0.67	0.57	0.43	0.46
Dig. Tryptophan	%	0.18	0.16	0.14	0.15
Major minerals					
Calcium	%	1.05 - 1.10	0.90 - 1.10	0.90 - 1.00 (2)	2 - 2.10 (2)
Available Phosphorus	%	0.48	0.42	0.36	0.45
Chlorine minimum	%	0.15	0.15	0.15	0.15
Sodium minimum	%	0.16	0.16	0.16	0.16
Above 24 °C	Units	Starter 0 - 5 weeks 1 - 35 days	Grower 5 - 10 weeks 35 - 70 days	Pullet 10 - 16 weeks 70 - 112 days	Pre - lay 112 days to 2 % lay
Forecast quantity / bird	g	850	1700	2800	
Metabolisable energy	kcal/kg	2950	2850	2750	2750
	MJ/kg	12.3	11.9	11.5	11.5
Crude protein	%	20.5	20.0	16.8	17.5
Methionine	%	0.52	0.47	0.35	0.38
Methionine + Cystine	%	0.86	0.80	0.63	0.68
Lysine	%	1.16	1.03	0.78	0.87
Threonine	%	0.78	0.69	0.53	0.56
Tryptophan	%	0.21	0.20	0.17	0.18
Digestible amino acids (1)					
Dig. Methionine	%	0.48	0.43	0.32	0.35
Dig. Meth. + Cystine	%	0.78	0.69	0.56	0.60
Dig. Lysine	%	1.00	0.89	0.67	0.72
Dig. Threonine.	%	0.67	0.61	0.45	0.48
Dig. Tryptophan	%	0.18	0.17	0.15	0.16
Major minerals					
Calcium	%	1.05 - 1.10	0.90 - 1.10	0.90 - 1.00 (2)	2 - 2.10 (2)
Available Phosphorus	%	0.48	0.44	0.38	0.47
Chlorine minimum	%	0.15	0.16	0.16	0.16
Sodium minimum	%	0.16	0.17	0.17	0.17

(1): These recommendations are based on the digestibility tables of RHONE POULENC ANIMAL NUTRITION (nutrition guide – Ed. 1993).

(2): To avoid falls in food consumption, 50 % of the calcium should be supplied in granular form (diameter = 2 to 4 mm).

DAILY NUTRIENT REQUIREMENTS IN LAY

NUTRIENTS IN RAW MATERIALS	Unit	Requirements			
		Daily in mg per day		In mg per g of egg	
		RPAN (93)	NRC (94)	RPAN (93)	NRC (94)
Crude protein (1)	g/d	(19.5)	(19.5)		
Crude Lysine	mg/d	900	900	15,25	15,25
Crude Methionine	mg/d	455	455	7,6	7,6
Crude Methionine + Cystine	mg/d	770	770	13,0	13,0
Crude Tryptophan	mg/d	200	208	3,35	3,5
Crude Isoleucine	mg/d	820	775	13,9	13,0
Crude Threonine	mg/d	655	655	11,0	11,0
Crude Valine	mg/d	900	840	15,0	14,2
Crude Arginine	mg/d	1160	1130	19,5	18,9
DIGESTIBLE AMINO ACIDS (2)					
Digestible Lysine	mg/d	810	810	13,50	13,50
Digestible Methionine	mg/d	430	430	7,2	7,2
Digestible Methionine + Cystine	mg/d	690	690	11,45	11,45
Digestible Tryptophan	mg/d	171	180	2,85	3,00
Digestible Isoleucine	mg/d	740	690	12,3	11,5
Digestible Threonine	mg/d	565	565	9,4	9,4
Digestible Valine	mg/d	800	760	13,4	12,6
Digestible Arginine	mg/d	1050	1020	17,5	17,0

ADDED VITAMINS AND MINERALS				
Added trace elements	Unit	REARING PERIOD		LAYING PERIOD
		0 – 10 weeks	10 – 2 % LAY	
Manganese (Mn)	PPM	60	60	60
Zinc (Zn)	PPM	60	60	60
Iron (Fe)	PPM	60	60	60
Iodine (I)	PPM	1	1	1
Copper (Cu)	PPM	5	5	5
Selenium (Se)	PPM	0.2	0.2	0.2
Cobalt (Co)	PPM	0.5	0.5	0.15
Added vitamins per kg of diet in IU or mg				
Vitamin A	IU	13.000	10.000	10.000
Vitamin D3	IU	3.000	2.000	2.000
Vitamin E	mg	25	25	20
Vitamin K3	mg	2	2	2
Vitamin B1 (Thianine)	mg	2	2	2
Vitamin B2 (Riboflavin)	mg	5	5	5
Vitamin B6 (Pyridoxine)	mg	5	5	5
Vitamin B12	mg	0.02	0.01	0.01
Nicotinic Acid (Niacin)	mg	60	30	30
Calcium Pantothenate	mg	15	10	10
Folic Acid	mg	0.75	0.75	0.75
Biotin	mg	0.2	0.1	
Choline	mg	600	500	500

(1): Not needed if the feed formulation is made with all these amino acids mainly Isoleucine and Valine.

(2): These recommendations have been derived from tables of the composition of raw materials RPAN (1993) and NRC (1994). The recommendations on digestible amino acids are based on the digestibility coefficients presented in tables in RPAN (1993).

Note: A minimum of fibre or lignin is required to prevent feather pecking.

NUTRITIONAL RECOMMENDATIONS FOR THE LAYING PERIOD (1)

Recommended energy : 2 750 kcal/kg 11.5 MJ/kg	FROM 2 % LAY TO 28 WEEKS OLD				
	Average food intake in g/day	95	100	105	110
Crude Protein	(20.5)	(19.5)	(18.6)	(17.7)	(17.0)
Crude amino acids % :					
Lysine	0.95	0.90	0.86	0.82	0.78
Methionine	0.48	0.46	0.43	0.41	0.40
Methionine + Cystine	0.81	0.77	0.73	0.70	0.67
Tryptophan *	0.210 / 0.219	0.200 / 0.208	0.190 / 0.198	0.182 / 0.189	0.174 / 0.181
Threonine	0.69	0.66	0.62	0.60	0.57
Isoleucine *	0.86 / 0.82	0.82 / 0.78	0.78 / 0.74	0.75 / 0.70	0.71 / 0.67
Valine *	0.95 / 0.88	0.90 / 0.84	0.86 / 0.80	0.82 / 0.76	0.78 / 0.73
Arginine *	1.22 / 1.19	1.16 / 1.13	1.10 / 1.08	1.05 / 1.03	1.03 / 1.00
Digestible amino acids % :					
Lysine	0.85	0.81	0.77	0.74	0.70
Methionine	0.45	0.43	0.41	0.39	0.37
Methionine + Cystine	0.73	0.69	0.66	0.63	0.60
Tryptophan *	0.180 / 0.189	0.171 / 0.180	0.163 / 0.171	0.155 / 0.164	0.149 / 0.156
Threonine	0.59	0.56	0.54	0.51	0.49
Isoleucine *	0.78 / 0.73	0.74 / 0.69	0.70 / 0.66	0.67 / 0.63	0.64 / 0.60
Valine *	0.84 / 0.80	0.80 / 0.76	0.76 / 0.72	0.73 / 0.69	0.70 / 0.66
Arginine *	1.11 / 1.07	1.05 / 1.02	1.00 / 0.97	0.95 / 0.93	0.91 / 0.89

From 2 % lay up to 28 weeks, one should base it on a level of consumption, which is 7 g lower than the intake observed after 28 weeks.

Recommended energy: 2 750 kcal/kg 11.5 MJ/kg	FROM 28 WEEKS TO THE END OF LAY				
	Average food intake in g/day	105	110	115	120
Crude Protein	(18.6)	(17.7)	(17.0)	(16.3)	(15.6)
Crude amino acids %:					
Lysine	0.86	0.82	0.78	0.75	0.72
Methionine	0.43	0.41	0.40	0.38	0.36
Methionine + Cystine	0.73	0.70	0.67	0.64	0.62
Tryptophan *	0.190 / 0.198	0.182 / 0.189	0.174 / 0.181	0.167 / 0.173	0.160 / 0.166
Threonine	0.62	0.60	0.57	0.55	0.52
Isoleucine *	0.78 / 0.74	0.75 / 0.70	0.71 / 0.67	0.68 / 0.65	0.66 / 0.62
Valine *	0.86 / 0.80	0.82 / 0.76	0.78 / 0.73	0.75 / 0.70	0.72 / 0.67
Arginine *	1.10 / 1.08	1.05 / 1.03	1.03 / 1.00	0.97 / 0.94	0.93 / 0.90
Digestible amino acids %:					
Lysine	0.77	0.74	0.70	0.67	0.65
Methionine	0.41	0.39	0.37	0.36	0.34
Methionine + Cystine	0.66	0.63	0.60	0.58	0.55
Tryptophan *	0.163 / 0.171	0.155 / 0.164	0.149 / 0.156	0.142 / 0.150	0.137 / 0.144
Threonine	0.54	0.51	0.49	0.47	0.45
Isoleucine *	0.70 / 0.66	0.67 / 0.63	0.64 / 0.60	0.62 / 0.58	0.59 / 0.55
Valine *	0.76 / 0.72	0.73 / 0.69	0.70 / 0.66	0.67 / 0.63	0.64 / 0.61
Arginine *	1.00 / 0.97	0.95 / 0.93	0.91 / 0.89	0.88 / 0.85	0.84 / 0.82

(*) These recommendations are based on the tables in RPAN (Nutrition guide 1993) and NRC. When the values differ, those of NRC are printed in Italics.

NUTRITIONAL RECOMMENDATIONS FOR THE LAYING PERIOD (2)

PERIOD OF USE		FROM 17 TO 28 WEEKS	FROM 28 TO 50 WEEKS	AFTER 50 WEEKS
Available Phosphorus (1)	g/d	0.44	0.42	0.38
Available Phosphorus (2)	g/d	0.40	0.38	0.34
Calcium	g/d	3.9 – 4.1	4.1 – 4.3	4.3 – 4.6
Sodium minimum	mg/d	180	180	180
Chlorine minimum / maximum	mg/d	170 / 260	170 / 260	170 / 230
Linoleic acid	g/d	1.6 mini	1.4 mini	1 mini – 1.25 maxi

FROM 2 % LAY TO 28 WEEKS						
Average food intake recorded g/day		95	100	105	110	115
Available Phosphorus (1)	%	0.46	0.44	0.42	0.40	0.38
Available Phosphorus (2)	%	0.42	0.40	0.38	0.36	0.34
Calcium	%	4.1 – 4.3	3.9 – 4.1	3.7 – 3.9	3.5 – 3.7	3.4 – 3.6
Sodium minimum	%	0.19	0.18	0.17	0.16	0.16
Chlorine minimum / maximum	%	0.18 – 0.26	0.17 – 0.26	0.16 – 0.25	0.15 – 0.24	0.14 – 0.23
Linoleic acid minimum	%	1.70	1.60	1.50	1.40	1.30

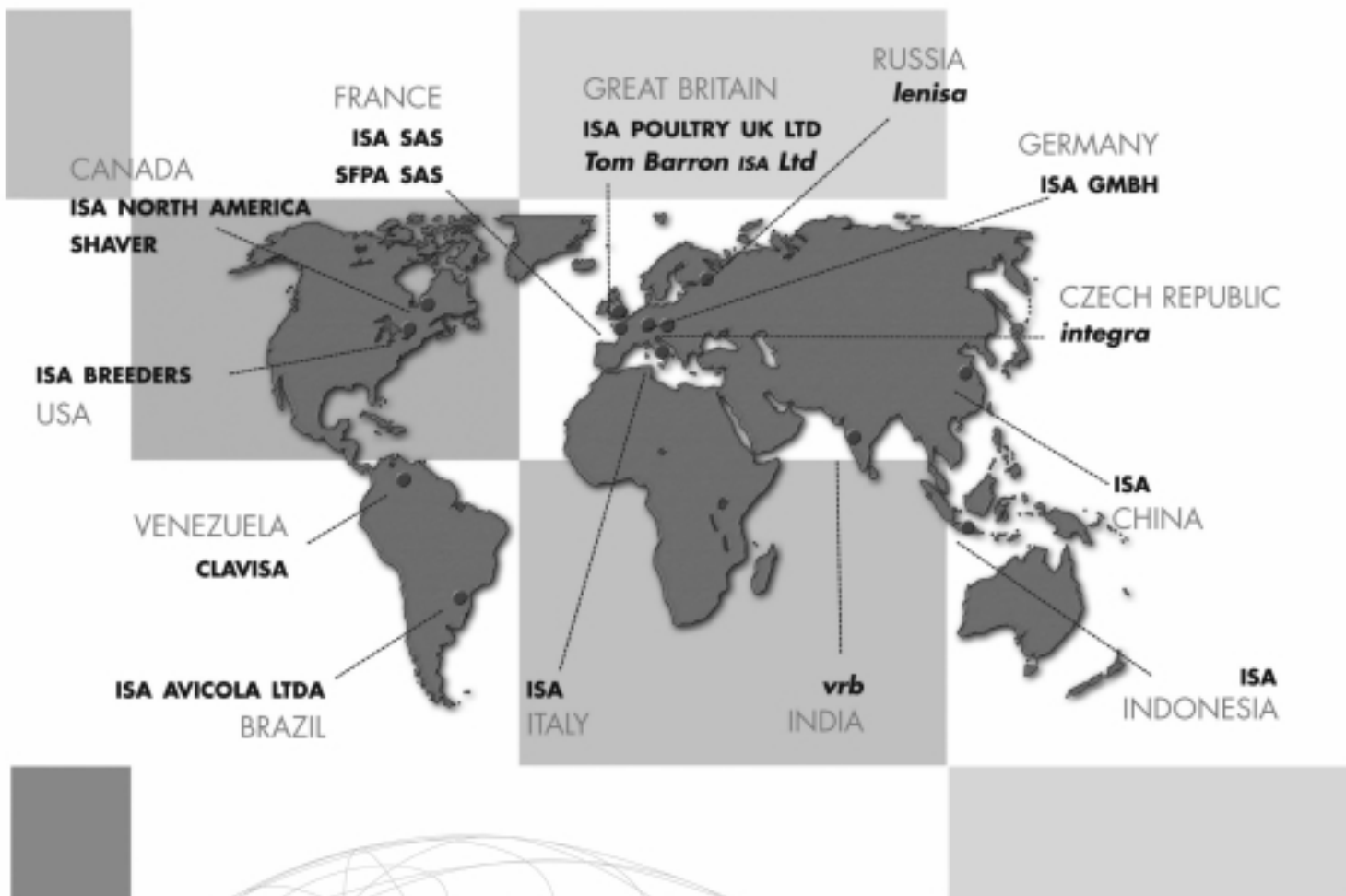
FROM 28 WEEKS TO 50 WEEKS						
Average food intake recorded g/day		105	110	115	120	125
Available Phosphorus (1)	%	0.40	0.38	0.37	0.35	0.34
Available Phosphorus (2)	%	0.36	0.34	0.33	0.32	0.31
Calcium	%	3.9 – 4.1	3.7 – 3.9	3.6 – 3.8	3.4 – 3.6	3.3 – 3.5
Sodium minimum	%	0.17	0.16	0.16	0.15	0.15
Chlorine minimum / maximum	%	0.16 – 0.25	0.15 – 0.24	0.15 – 0.23	0.14 – 0.22	0.14 – 0.21
Linoleic acid minimum	%	1.35	1.30	1.25	1.15	1.10

FROM 50 WEEKS TO THE END OF LAY						
Average food intake recorded g/day		105	110	115	120	125
Available Phosphorus (1)	%	0.36	0.34	0.33	0.32	0.30
Available Phosphorus (2)	%	0.32	0.30	0.29	0.28	0.27
Calcium	%	4.1 – 4.3	3.9 – 4.1	3.8 – 4.0	3.6 – 3.8	3.5 – 3.7
Sodium minimum	%	0.17	0.16	0.16	0.15	0.14
Chlorine minimum / maximum	%	0.16 – 0.22	0.15 – 0.21	0.15 – 0.20	0.14 – 0.19	0.14 – 0.18
Linoleic acid maximum	%	1.20	1.15	1.10	1.05	1.00

(1): We advise using these values when the calcium is supplied in powder form

(2): When 70 % of the calcium is supplied as particles of 2 to 4 mm, it is possible to use these values.

Note: To avoid egg size becoming too large at the end of lay, we advise reducing the quantity of vegetable oil being used. A minimum of fibre or lignin is required to prevent feather pecking.



ISA group in the world
at your service

www.isapoultry.com



It's time for ISA

Distributor :

Headoffice :
 ISA SAS
 5, rue Buffon BP 308
 22003 Saint-Brieuc Cedex 1
 France