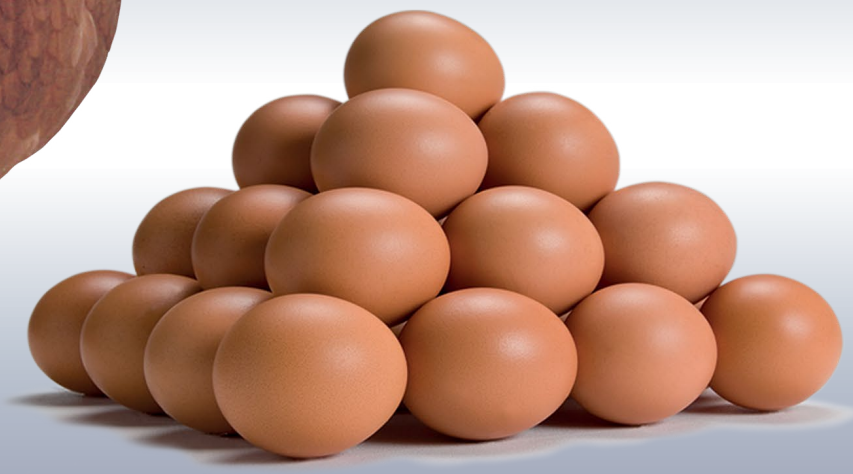
Hy-Line®

BROWN

Conventional Systems



Performance Guide

Hy-Line®

Use of the Performance Guide

The genetic potential of Hy-Line Brown Commercial can only be realized if good poultry husbandry practices and management are used. This management guide outlines successful flock management programmes for Hy-Line Variety Brown Commercial based on field experience compiled by Hy-Line International and using an extensive commercial layer flock database of Hy-Line flocks from all parts of the world. Hy-Line International Management Guides are periodically updated as new performance data and/or nutrition information become available.

The information and suggestions contained in this management guide should be used for guidance and educational purposes only, recognising that local environmental and disease conditions may vary and a guide cannot cover all possible circumstances. While every attempt has been made to ensure that the information presented is accurate and reliable at the time of publication, Hy-Line International cannot accept responsibility for any errors, omissions or inaccuracies in such information or management suggestions. Further, Hy-Line International does not warrant or make any representations or guarantees regarding the use, validity, accuracy, or reliability of, or flock performance or productivity resulting from the use of, or otherwise respecting, such information or management suggestions. In no event shall Hy-Line International be liable for any special, indirect or consequential damages or special damages whatsoever arising out of or in connection with the use of the information or management suggestions contained in this management guide.

Always consult hyline.com for the latest performance, nutrition, and management information.

Hy-Line Brown
Online Management Guide

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Summary of Performance Standards

REARING PERIOD (TO 17 WEEKS):	
Livability	98%
Feed Consumed	6069 g
Body Weight at 17 Weeks	1580 g
LAYING PERIOD (TO 90 WEEKS):	
Percent Peak	94.8–96.6%
Hen-Day Eggs to 60 Weeks Hen-Day Eggs to 72 Weeks Hen-Day Eggs to 90 Weeks	257.5–269.0 328.9–343.4 425.5–445.2
Hen-Housed Eggs to 60 Weeks Hen-Housed Eggs to 72 Weeks Hen-Housed Eggs to 90 Weeks	254.1–265.5 323.3–337.7 415.0–434.2
Livability to 60 Weeks Livability to 80 Weeks Livability to 90 Weeks	97.4% 95.1% 93.5%
Days to 50% Production (from hatch)	144
Egg Weight at 26 Weeks Egg Weight at 32 Weeks Egg Weight at 72 Weeks	59.2 g 61.9 g 64.8 g
Total Egg Mass per Hen-Housed (18–90 weeks)	26.8 kg
Body Weight at 32 Weeks Body Weight at 72 Weeks	1.93–2.07 kg 1.96–2.10 kg
Freedom From Egg Inclusions	Excellent
Shell Strength	Excellent
Shell Color Score at 38 Weeks Shell Color Score at 56 Weeks Shell Color Score at 72 Weeks Shell Color Score at 90 Weeks	87 85 81 79
Haugh Units at 38 Weeks Haugh Units at 56 Weeks Haugh Units at 72 Weeks Haugh Units at 90 Weeks	90.0 84.0 81.0 79.7
Average Daily Feed Consumption (18–90 weeks)	110.7 g/day per bird
Feed Conversion Rate, kg Feed/kg Eggs (20–60 weeks) Feed Conversion Rate, kg Feed/kg Eggs (20–72 weeks) Feed Conversion Rate, kg Feed/kg Eggs (20–90 weeks)	1.90–2.06 1.91–2.08 1.98–2.15
Feed Utilization, kg Egg/kg Feed (20–60 weeks) Feed Utilization, kg Egg/kg Feed (20–72 weeks) Feed Utilization, kg Egg/kg Feed (20–90 weeks)	0.49–0.53 0.48–0.52 0.46–0.50
Feed Consumption per 10 Eggs (20–60 weeks) Feed Consumption per 10 Eggs (20–72 weeks) Feed Consumption per 10 Eggs (20–90 weeks)	1.19–1.23 kg 1.21–1.24 kg 1.26–1.29 kg
Feed Consumption per Dozen Eggs (20–60 weeks) Feed Consumption per Dozen Eggs (20–72 weeks) Feed Consumption per Dozen Eggs (20–90 weeks)	1.43–1.47 kg 1.45–1.49 kg 1.51–1.55 kg
Skin Color	Yellow
Condition of Droppings	Dry

Rearing Period Performance Table

AGE (weeks)	MORTALITY Cumulative (%)	BODY WEIGHT (g)	WATER INTAKE (ml/bird/day)	FEED INTAKE (g/bird/day)	CUMULATIVE FEED INTAKE (g/bird to date)	UNIFORMITY %
1	0.40	70 – 80	18 – 28	12 – 14	84 – 98	
2	0.55	115 – 145	25 – 42	17 – 21	201 – 244	>85%
3	0.65	190 – 220	30 – 50	20 – 25	343 – 418	
4	0.75	270 – 320	37 – 60	25 – 30	515 – 627	
5	**0.85**	**360 – 420**	**43 – 73**	**29 – 36**	**717 – 883**	>80%
6	0.95	470 – 520	52 – 89	35 – 44	960 – 1193	
7	1.05	570 – 640	62 – 98	41 – 49	1249 – 1537	
8	1.15	680 – 760	71 – 112	47 – 56	1580 – 1929	
9	1.25	780 – 880	78 – 122	52 – 61	1943 – 2355	
10	**1.35**	**885 – 995**	**84 – 129**	**56 – 64**	**2334 – 2806**	
11	1.45	995 – 1105	90 – 137	60 – 69	2754 – 3287	>85%
12	1.55	1095 – 1205	93 – 144	62 – 72	3189 – 3791	
13	1.63	1175 – 1295	96 – 148	64 – 74	3637 – 4308	
14	1.70	1265 – 1365	99 – 154	66 – 77	4099 – 4845	
15	**1.78**	**1345 – 1445**	**102 – 158**	**68 – 79**	**4575 – 5399**	
16	1.85	1410 – 1510	105 – 164	70 – 82	5066 – 5973	
17	2.00	1485 – 1590	108 – 170	72 – 85	5570 – 6568	>90%

Production Period Performance Table

AGE (weeks)	% HEN-DAY Current	HEN-DAY EGGS Cumulative	HEN-HOUSED EGGS Cumulative	MORT-ALITY Cumulative (%)	BODY WEIGHT (kg)	WATER INTAKE (ml/bird/day)	FEED INTAKE (g/bird/day)	HH EGG MASS Cumulative (kg)	AVG. EGG WT. (g/egg)
18	1.1–7.7	0.1–0.5	0.1 –0.5	0.05	1.55 – 1.67	110 – 176	73–88	–	46.5
19	8.2–27.1	0.7 – 2.4	0.7 – 2.4	0.08	1.62 – 1.74	127 – 188	85–94	0.1	49.3
20	**30.8–57.3**	**2.8 – 6.4**	**2.8 – 6.4**	**0.13**	**1.68 – 1.80**	**135 – 197**	**90–99**	**0.2**	**51.6**
21	61.4–80.5	7.1 – 12.1	7.1 – 12.1	0.20	1.73 – 1.85	142 – 205	95–103	0.5	53.5
22	82.4–90.6	12.9 – 18.4	12.8 – 18.4	0.27	1.77 – 1.89	148 – 215	99–107	0.8	55.0
23	90.6–94.1	19.2 – 25.0	19.2 – 25.0	0.34	1.80 – 1.92	154 – 222	102–111	1.2	56.4
24	93.2–95.5	25.7 – 31.7	25.7 – 31.6	0.40	1.82 – 1.95	159 – 228	106–114	1.6	57.5
25	**94.2–96.2**	**32.3 – 38.4**	**32.2 – 38.3**	**0.46**	**1.84 – 1.98**	**162 – 230**	**108–115**	**2.0**	**58.4**
26	94.6–96.4	39.0 – 45.2	38.8 – 45.0	0.50	1.86 – 2.00	163 – 231	109–116	2.4	59.2
27	94.8–96.6	45.6 – 51.9	45.4 – 51.8	0.55	1.88 – 2.01	164 – 232	109–116	2.8	59.9
28	94.8–96.6	52.2 – 58.7	52.0 – 58.5	0.61	1.89 – 2.03	164 – 233	109–116	3.2	60.4
29	94.8–96.6	58.9 – 65.5	58.6 – 65.2	0.66	1.90 – 2.04	164 – 233	109–117	3.6	60.9
30	**94.8–96.5**	**65.5 – 72.2**	**65.2 – 71.9**	**0.71**	**1.91 – 2.05**	**164 – 233**	**109–117**	**4.0**	**61.3**
31	94.7–96.5	72.1 – 79.0	71.8 – 78.6	0.76	1.92 – 2.06	164 – 233	109–117	4.4	61.7
32	94.7–96.5	78.8 – 85.7	78.4 – 85.3	0.80	1.93 – 2.07	164 – 234	109–117	4.8	62.0
33	94.6–96.3	85.4 – 92.5	84.9 – 92.0	0.86	1.93 – 2.07	164 – 233	109–117	5.2	62.3
34	94.4–96.1	92.0 – 99.2	91.5 – 98.7	0.92	1.94 – 2.08	164 – 233	109–117	5.6	62.5
35	**94.2–96.0**	**98.6 – 105.9**	**98.0 – 105.3**	**0.97**	**1.94 – 2.08**	**163 – 233**	**109–117**	**6.0**	**62.7**
36	94.0–95.8	105.2 – 112.6	104.5 – 111.9	1.02	1.95 – 2.08	163 – 233	109–116	6.4	62.9
37	93.7–95.7	111.7 – 119.3	111.0 – 118.6	1.08	1.95 – 2.09	163 – 233	109–116	6.9	63.1
38	93.5–95.5	118.3 – 126.0	117.5 – 125.2	1.12	1.95 – 2.09	163 – 232	109–116	7.3	63.2
39	93.3–95.3	124.8 – 132.7	123.9 – 131.8	1.18	1.95 – 2.09	163 – 232	109–116	7.7	63.3
40	**93.1–95.0**	**131.3 – 139.3**	**130.4 – 138.3**	**1.24**	**1.95 – 2.09**	**163 – 232**	**108–116**	**8.1**	**63.4**
41	92.8–94.9	137.8 – 146.0	136.8 – 144.9	1.30	1.96 – 2.09	163 – 232	108–116	8.5	63.5
42	92.5–94.6	144.3 – 152.6	143.2 – 151.4	1.35	1.96 – 2.10	163 – 232	108–116	8.9	63.6
43	92.1–94.4	150.8 – 159.2	149.5 – 157.9	1.41	1.96 – 2.10	163 – 232	108–116	9.3	63.7
44	91.8–94.1	157.2 – 165.8	155.9 – 164.4	1.47	1.96 – 2.10	163 – 232	108–116	9.7	63.8
45	**91.5–93.8**	**163.6 – 172.3**	**162.2 – 170.9**	**1.52**	**1.96 – 2.10**	**163 – 232**	**108–116**	**10.1**	**63.9**
46	91.2–93.5	170.0 – 178.9	168.4 – 177.3	1.59	1.96 – 2.10	163 – 232	108–116	10.5	63.9
47	90.9–93.3	176.3 – 185.4	174.7 – 183.8	1.64	1.96 – 2.10	163 – 232	108–116	10.9	64.0
48	90.7–93.1	182.7 – 191.9	181.0 – 190.2	1.70	1.96 – 2.10	163 – 232	108–116	11.4	64.0
49	90.4–92.8	189.0 – 198.4	187.2 – 196.5	1.76	1.96 – 2.10	163 – 232	108–116	11.8	64.1
50	**90.0–92.7**	**195.3 – 204.9**	**193.4 – 202.9**	**1.83**	**1.96 – 2.10**	**163 – 232**	**108–116**	**12.2**	**64.1**
51	89.8–92.4	201.6 – 211.4	199.5 – 209.3	1.89	1.96 – 2.10	163 – 232	108–116	12.6	64.2
52	89.6–92.2	207.9 – 217.8	205.7 – 215.6	1.95	1.96 – 2.10	163 – 232	108–116	13.0	64.2
53	89.4–91.9	214.1 – 224.3	211.8 – 221.9	2.01	1.96 – 2.10	163 – 232	108–116	13.4	64.3
54	89.3–91.7	220.4 – 230.7	217.9 – 228.2	2.09	1.96 – 2.10	163 – 232	108–116	13.8	64.3
55	**88.9–91.5**	**226.6 – 237.1**	**224.0 – 234.4**	**2.16**	**1.96 – 2.10**	**163 – 232**	**108–116**	**14.2**	**64.3**
56	88.7–91.4	232.8 – 243.5	230.1 – 240.7	2.24	1.96 – 2.10	163 – 232	108–116	14.5	64.4
57	88.4–91.2	239.0 – 249.9	236.1 – 246.9	2.33	1.96 – 2.10	163 – 232	108–116	14.9	64.4
58	88.2–91.0	245.2 – 256.3	242.2 – 253.2	2.40	1.96 – 2.10	163 – 232	108–116	15.3	64.4

Production Period Performance Table (cont.)

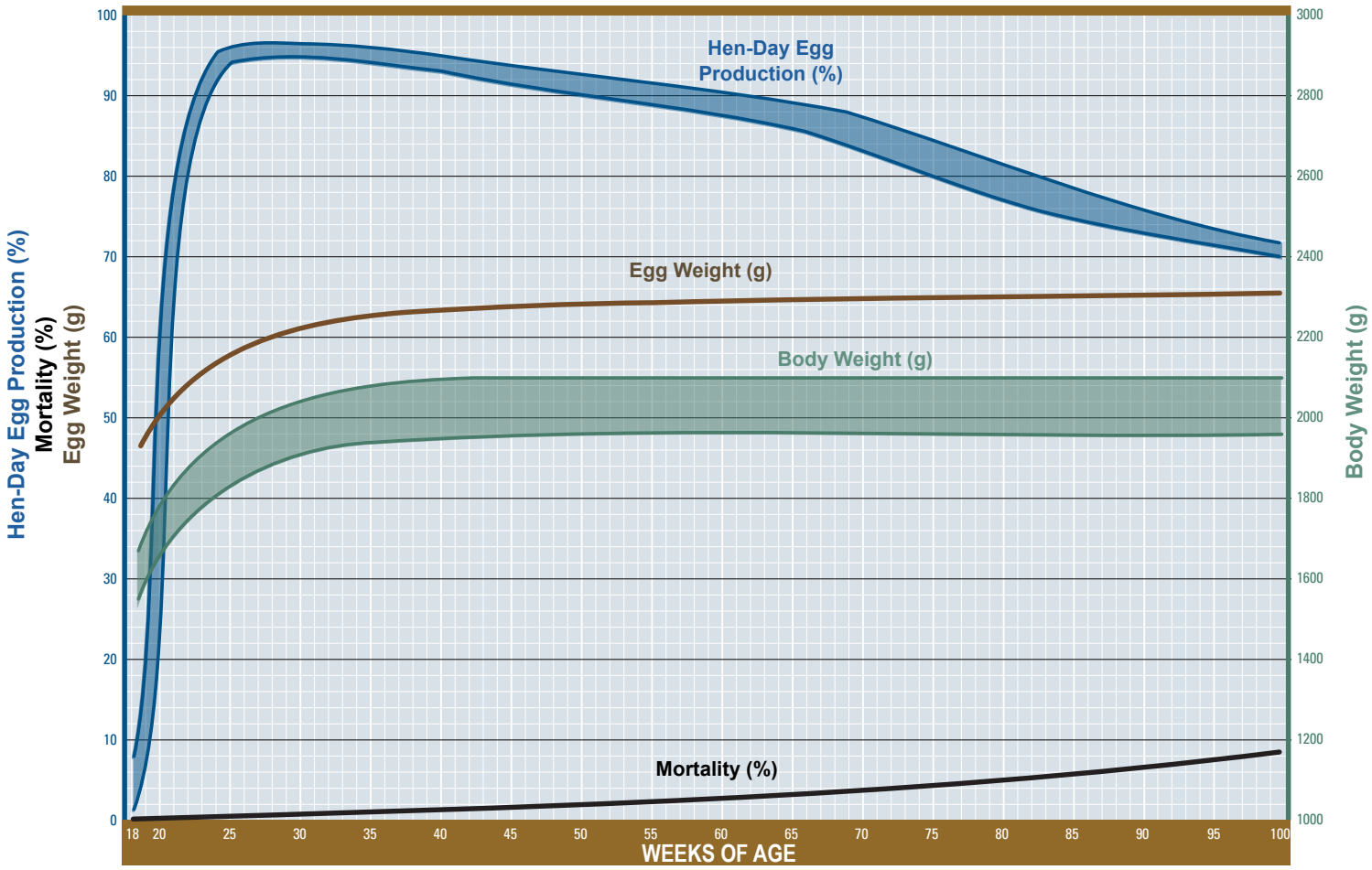
AGE (weeks)	% HEN-DAY Current	HEN-DAY EGGS Cumulative	HEN-HOUSED EGGS Cumulative	MORT-ALITY Cumulative (%)	BODY WEIGHT (kg)	WATER INTAKE (ml/bird/day)	FEED INTAKE (g/bird/day)	HH EGG MASS Cumulative (kg)	AVG. EGG WT. (g/egg)
59	87.9–90.8	251.3 – 262.6	248.2 – 259.4	2.49	1.96 – 2.10	163 – 232	108–116	15.7	64.5
60	**87.6–90.5**	**257.5 – 269.0**	**254.1 – 265.5**	**2.57**	**1.96 – 2.10**	**163 – 232**	**108–116**	**16.1**	**64.5**
61	87.3–90.2	263.6 – 275.3	260.1 – 271.7	2.65	1.96 – 2.10	163 – 232	108–116	16.5	64.6
62	87.0–90.0	269.7 – 281.6	266.0 – 277.8	2.77	1.96 – 2.10	163 – 232	108–116	16.9	64.6
63	86.7–89.8	275.7 – 287.9	271.9 – 283.9	2.85	1.96 – 2.10	163 – 232	108–116	17.3	64.6
64	86.4–89.6	281.8 – 294.1	277.8 – 290.0	2.92	1.96 – 2.10	163 – 232	108–116	17.7	64.6
65	**86.1–89.3**	**287.8 – 300.4**	**283.6 – 296.1**	**2.97**	**1.96 – 2.10**	**163 – 232**	**108–116**	**18.1**	**64.7**
66	85.6–89.0	293.8 – 306.6	289.4 – 302.1	3.08	1.96 – 2.10	163 – 232	108–116	18.4	64.7
67	85.1–88.6	299.7 – 312.8	295.2 – 308.1	3.14	1.96 – 2.10	163 – 232	108–116	18.8	64.7
68	84.5–88.3	305.7 – 319.0	300.9 – 314.1	3.20	1.96 – 2.10	163 – 232	108–116	19.2	64.7
69	83.8–88.0	311.5 – 325.2	306.6 – 320.1	3.30	1.96 – 2.10	163 – 232	108–116	19.6	64.8
70	**83.2–87.6**	**317.4 – 331.3**	**312.2 – 326.0**	**3.43**	**1.96 – 2.10**	**163 – 232**	**108–116**	**20.0**	**64.8**
71	82.7–87.0	323.1 – 337.4	317.8 – 331.9	3.58	1.96 – 2.10	163 – 232	108–116	20.3	64.8
72	82.0–86.4	328.9 – 343.4	323.3 – 337.7	3.73	1.96 – 2.10	163 – 232	108–116	20.7	64.9
73	81.4–85.8	334.6 – 349.4	328.8 – 343.5	3.88	1.96 – 2.10	163 – 232	108–116	21.1	64.9
74	80.7–85.2	340.2 – 355.4	334.2 – 349.2	4.03	1.96 – 2.10	163 – 232	108–116	21.4	64.9
75	**80.1–84.6**	**345.8 – 361.3**	**339.6 – 354.9**	**4.18**	**1.96 – 2.10**	**163 – 232**	**108–116**	**21.8**	**64.9**
76	79.5–84.0	351.4 – 367.2	344.9 – 360.5	4.33	1.96 – 2.10	163 – 232	108–116	22.1	64.9
77	78.9–83.4	356.9 – 373.1	350.2 – 366.1	4.48	1.96 – 2.10	163 – 232	108–116	22.5	65.0
78	78.3–82.8	362.4 – 378.8	355.4 – 371.6	4.63	1.96 – 2.10	163 – 232	108–116	22.8	65.0
79	77.7–82.2	367.8 – 384.6	360.6 – 377.1	4.78	1.96 – 2.10	163 – 232	108–116	23.2	65.0
80	**77.1–81.6**	**373.2 – 390.3**	**365.7 – 382.5**	**4.93**	**1.96 – 2.10**	**163 – 232**	**108–116**	**23.5**	**65.0**
81	76.6–81.0	378.6 – 396.0	370.8 – 387.9	5.08	1.96 – 2.10	163 – 232	108–116	23.9	65.0
82	76.1–80.4	383.9 – 401.6	375.8 – 393.2	5.23	1.96 – 2.10	163 – 232	108–116	24.2	65.1
83	75.6–79.8	389.2 – 407.2	380.9 – 398.5	5.38	1.96 – 2.10	163 – 232	108–116	24.5	65.1
84	75.2–79.2	394.5 – 412.7	385.8 – 403.7	5.53	1.96 – 2.10	163 – 232	108–116	24.9	65.1
85	**74.8–78.6**	**399.7 – 418.2**	**390.8 – 408.9**	**5.68**	**1.96 – 2.10**	**163 – 232**	**108–116**	**25.2**	**65.1**
86	74.4–78.0	404.9 – 423.7	395.7 – 414.1	5.83	1.96 – 2.10	163 – 232	108–116	25.5	65.2
87	74.0–77.4	410.1 – 429.1	400.5 – 419.2	5.98	1.96 – 2.10	163 – 232	108–116	25.9	65.2
88	73.6–76.8	415.2 – 434.5	405.4 – 424.2	6.13	1.96 – 2.10	163 – 232	108–116	26.2	65.2
89	73.3–76.3	420.4 – 439.8	410.2 – 429.2	6.28	1.96 – 2.10	163 – 232	108–116	26.5	65.2
90	**73.0–75.8**	**425.5 – 445.2**	**415.0 – 434.2**	**6.45**	**1.96 – 2.10**	**163 – 232**	**108–116**	**26.8**	**65.3**
91	72.7–75.3	430.6 – 450.4	419.7 – 439.1	6.65	1.96 – 2.10	163 – 232	108–116	27.1	65.3
92	72.4–74.9	435.6 – 455.7	424.4 – 444.0	6.85	1.96 – 2.10	163 – 232	108–116	27.4	65.3
93	72.1–74.5	440.7 – 460.9	429.1 – 448.8	7.10	1.96 – 2.10	163 – 232	108–116	27.8	65.3
94	71.8–74.1	445.7 – 466.1	433.8 – 453.6	7.30	1.96 – 2.10	163 – 232	108–116	28.1	65.3
95	**71.5–73.7**	**450.7 – 471.2**	**438.4 – 458.4**	**7.50**	**1.96 – 2.10**	**163 – 232**	**108–116**	**28.4**	**65.4**
96	71.2–73.3	455.7 – 476.4	443.0 – 463.2	7.60	1.96 – 2.10	163 – 232	108–116	28.7	65.4
97	70.9–72.9	460.7 – 481.5	447.6 – 467.9	7.80	1.96 – 2.10	163 – 232	108–116	29.0	65.4
98	70.6–72.5	465.6 – 486.5	452.1 – 472.5	8.00	1.96 – 2.10	163 – 232	108–116	29.3	65.4
99	70.3–72.1	470.5 – 491.6	456.7 – 477.2	8.20	1.96 – 2.10	163 – 232	108–116	29.6	65.4
100	**70.0–71.7**	**475.4 – 496.6**	**461.2 – 481.8**	**8.40**	**1.96 – 2.10**	**163 – 232**	**108–116**	**29.9**	**65.5**

Production Period Space Recommendations

check local regulations concerning space requirements)

WEEKS OF AGE	3	17	20 30 40 50 60 70 80
CONVENTIONAL AND COLONY CAGES			
Floor Space			
	100–200 cm^2 (50–100 birds / m^2)	310 cm^2 (32 birds / m^2)	490 cm^2 (20 birds / m^2) – 750 cm^2 (13 birds / m^2)
Nipple/Cup			
	1 / 12 birds	1 / 8 birds	1 / 12 birds or access to 2 drinkers
Feeders			
	5 cm / bird	8 cm / bird	7–12 cm / bird

Performance Graph



Egg Quality and Egg Size Distribution

AGE (weeks)	HAUGH UNITS	BREAKING STRENGTH	SHELL COLOR
20	**97.8**	**4605**	**89**
22	97.0	4590	89
24	96.0	4580	89
26	95.1	4570	88
28	94.2	4560	88
30	**93.3**	**4540**	**88**
32	92.2	4515	88
34	91.5	4490	88
36	90.6	4450	87
38	90.0	4425	87
40	**89.3**	**4405**	**87**
42	88.5	4375	87
44	87.8	4355	87
46	87.1	4320	87
48	86.4	4305	87
50	**85.6**	**4280**	**86**
52	85.0	4250	86
54	84.6	4225	86
56	84.0	4190	85
58	83.1	4170	85
60	**82.6**	**4150**	**85**
62	82.2	4130	84
64	81.9	4110	83
66	81.6	4095	83
68	81.5	4085	82
70	**81.1**	**4075**	**81**
72	81.0	4065	81
74	80.8	4055	80
76	80.5	4040	80
78	80.2	4020	80
80	**80.1**	**3995**	**80**
82	80.0	3985	79
84	79.9	3975	79
86	79.8	3965	79
88	79.7	3960	79
90	**79.7**	**3955**	**79**

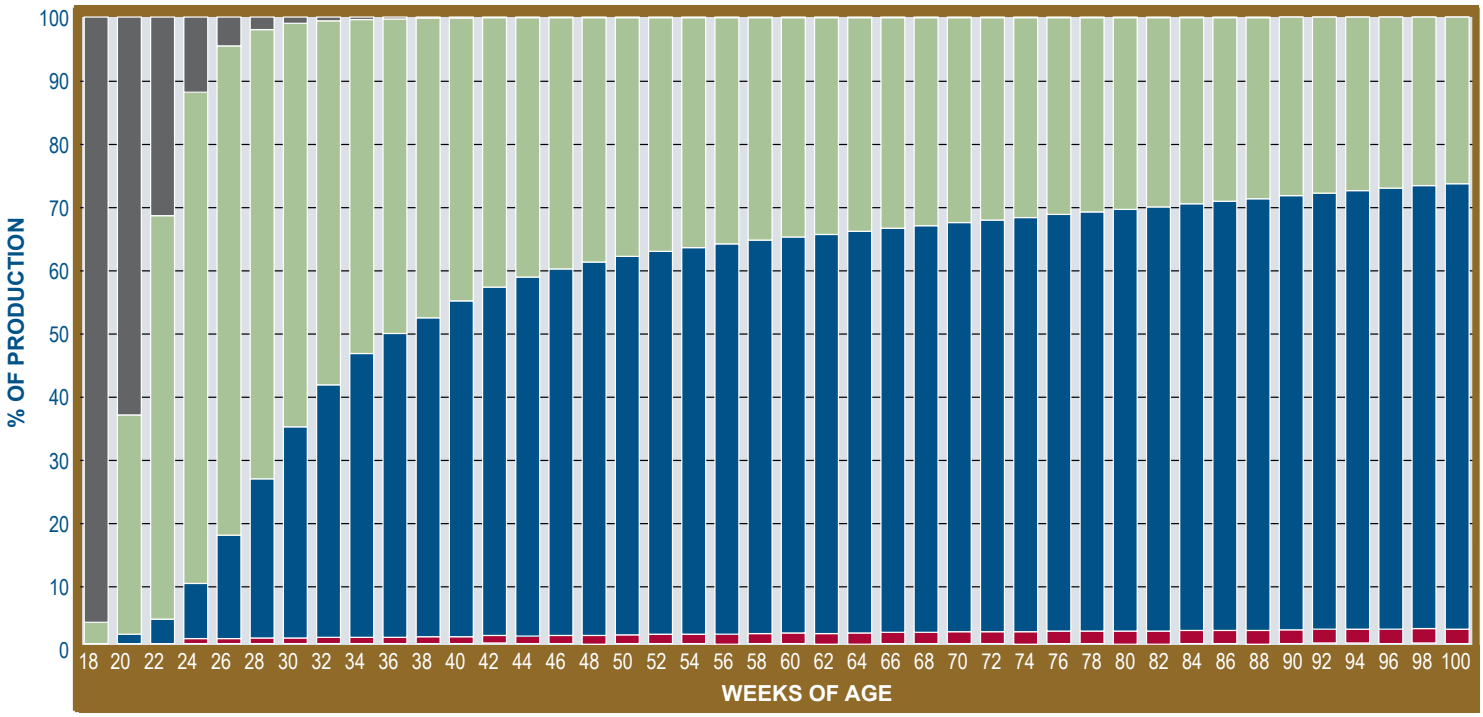
E.U. Standards–Weekly*

AGE (weeks)	AVERAGE EGG WEIGHT (g)	WEEKLY % SMALL 43–53 g	WEEKLY % MEDIUM 53–63 g	WEEKLY % LARGE 63–73 g	WEEKLY % VERY LARGE Over 73 g
18	46.5	96.6	3.4	0.0	0.0
20	**51.6**	**63.5**	**35.0**	1.5	**0.0**
22	55.0	31.7	64.4	3.9	0.0
24	57.5	12.0	78.4	8.8	0.8
26	59.2	4.6	78.1	16.5	0.8
28	60.4	2.0	71.7	25.4	0.9
30	**61.3**	**1.0**	**64.4**	33.7	**0.9**
32	62.0	0.6	58.1	40.3	1.0
34	62.5	0.4	53.3	45.3	1.0
36	62.9	0.3	50.2	48.5	1.0
38	63.2	0.2	47.8	50.9	1.1
40	**63.4**	**0.2**	**45.1**	53.6	**1.1**
42	63.6	0.1	43.0	55.6	1.2
44	63.8	0.1	41.4	57.3	1.2
46	63.9	0.1	40.1	58.5	1.3
48	64.0	0.1	39.0	59.6	1.4
50	**64.1**	**0.1**	**38.1**	60.4	**1.4**
52	64.2	0.1	37.3	61.1	1.5
54	64.3	0.1	36.7	61.7	1.5
56	64.4	0.1	36.1	62.3	1.6
58	64.4	0.1	35.5	62.8	1.6
60	**64.5**	**0.1**	**35.0**	63.2	**1.7**
62	64.6	0.1	34.6	63.7	1.7
64	64.6	0.1	34.1	64.1	1.8
66	64.7	0.1	33.6	64.5	1.8
68	64.7	0.1	33.2	64.9	1.8
70	**64.8**	**0.1**	**32.7**	65.3	**1.9**
72	64.9	0.1	32.3	65.7	1.9
74	64.9	0.1	31.9	66.1	2.0
76	64.9	0.1	31.4	66.5	2.0
78	65.0	0.1	31.0	66.9	2.0
80	**65.0**	**0.1**	**30.6**	67.3	**2.1**
82	65.1	0.1	30.2	67.7	2.1
84	65.1	0.1	29.7	68.1	2.1
86	65.2	0.1	29.3	68.5	2.1
88	65.2	0.1	28.9	68.9	2.2
90	**65.3**	**0.0**	**28.5**	69.3	**2.2**
92	65.3	0.0	28.1	69.6	2.2
94	65.3	0.0	27.7	70.0	2.2
96	65.4	0.0	27.3	70.4	2.3
98	65.4	0.0	26.9	70.7	2.3
100	**65.5**	**0.0**	**26.6**	71.1	**2.3**

** Distribution of egg sizes based on weekly (not cumulative) average egg weights.*

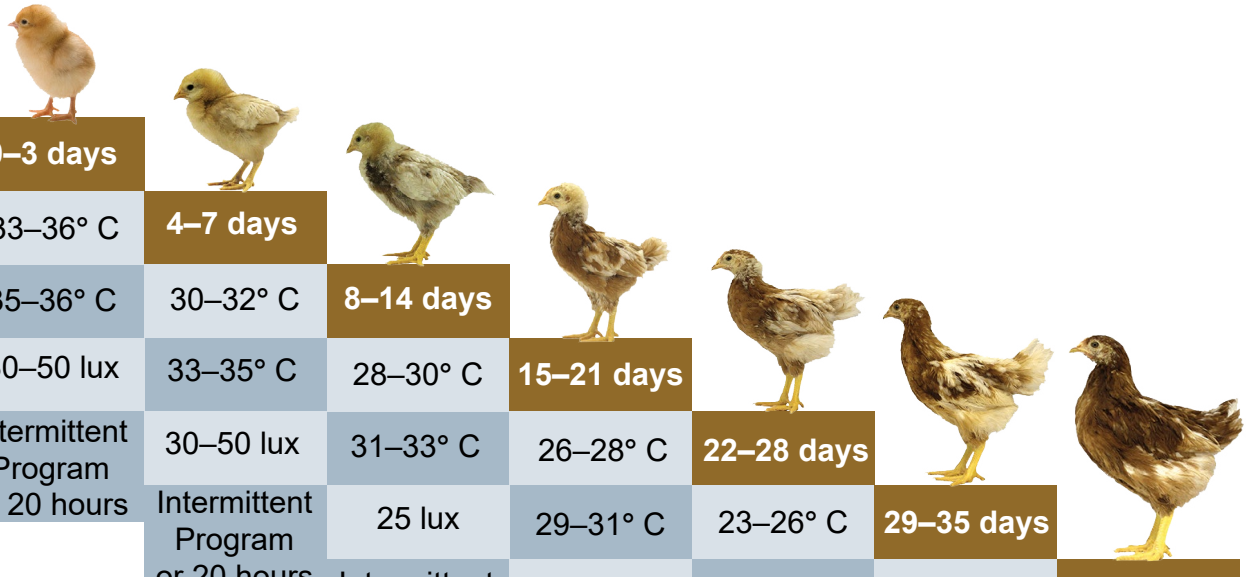
Egg Size Distribution (cont.)

E.U. Standards–Weekly*



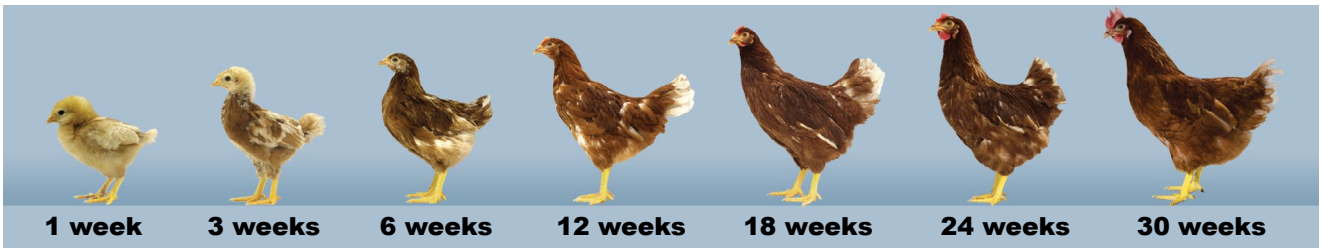
** Distribution of egg sizes based on weekly (not cumulative) average egg weights.*

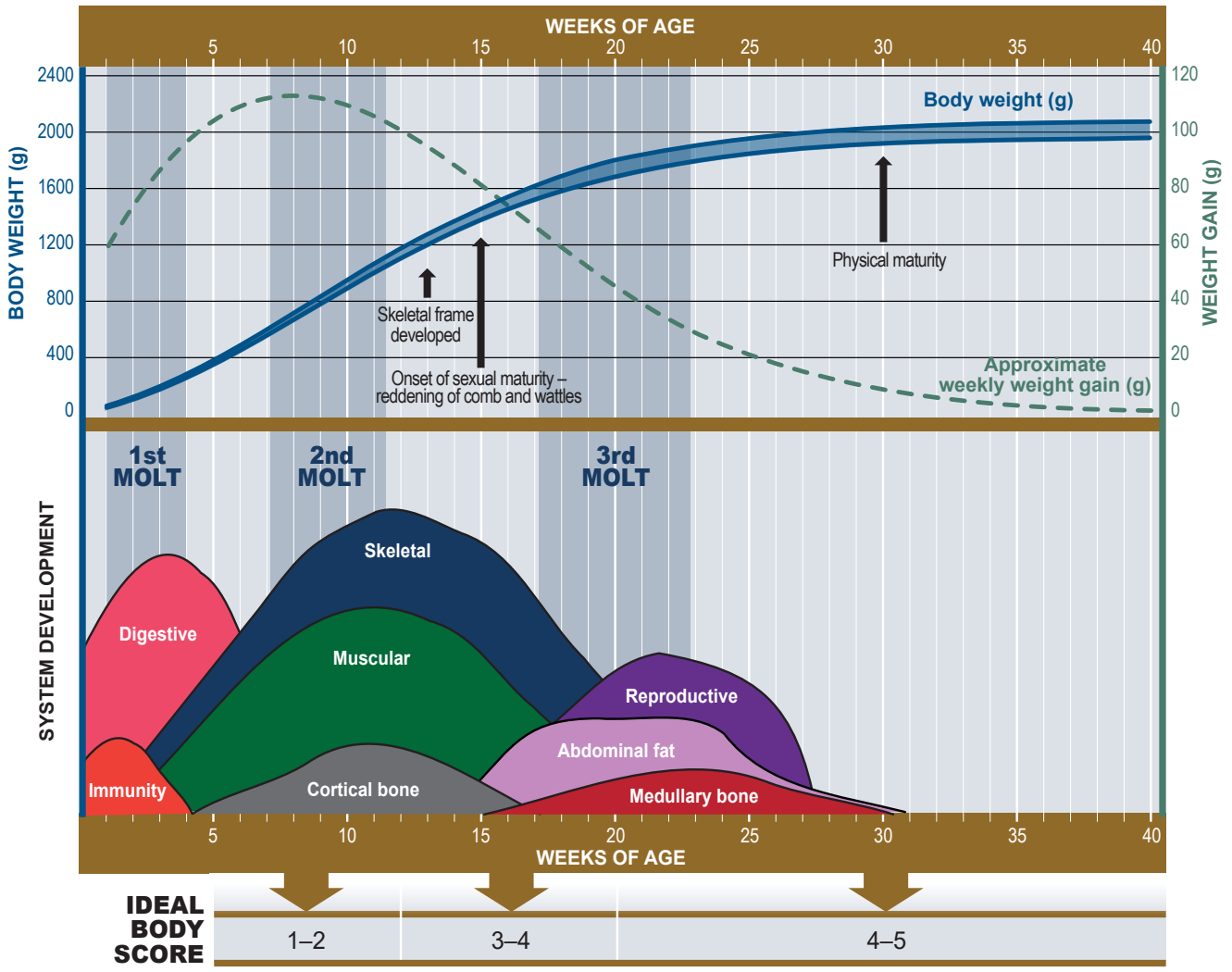
Brooding Temperature and Lighting Recommendations



AGE	0–3 days	4–7 days	8–14 days	15–21 days	22–28 days	29–35 days	36–42 days
AIR TEMP. (CAGE)	33–36° C	30–32° C	28–30° C	26–28° C	23–26° C	21–23° C	21° C
AIR TEMP. (FLOOR)	35–36° C	33–35° C	31–33° C	29–31° C	26–27° C	23–25° C	21° C
LIGHT INTENSITY	30–50 lux	30–50 lux	25 lux	25 lux	25 lux	10–15 lux	10–15 lux
LIGHT HOURS	Intermittent Program or 20 hours	Intermittent Program or 20 hours	Intermittent Program or 20 hours	18 hours	16.5 hours	15 hours	13.5 hours

Development of the Organ Systems in Pullets



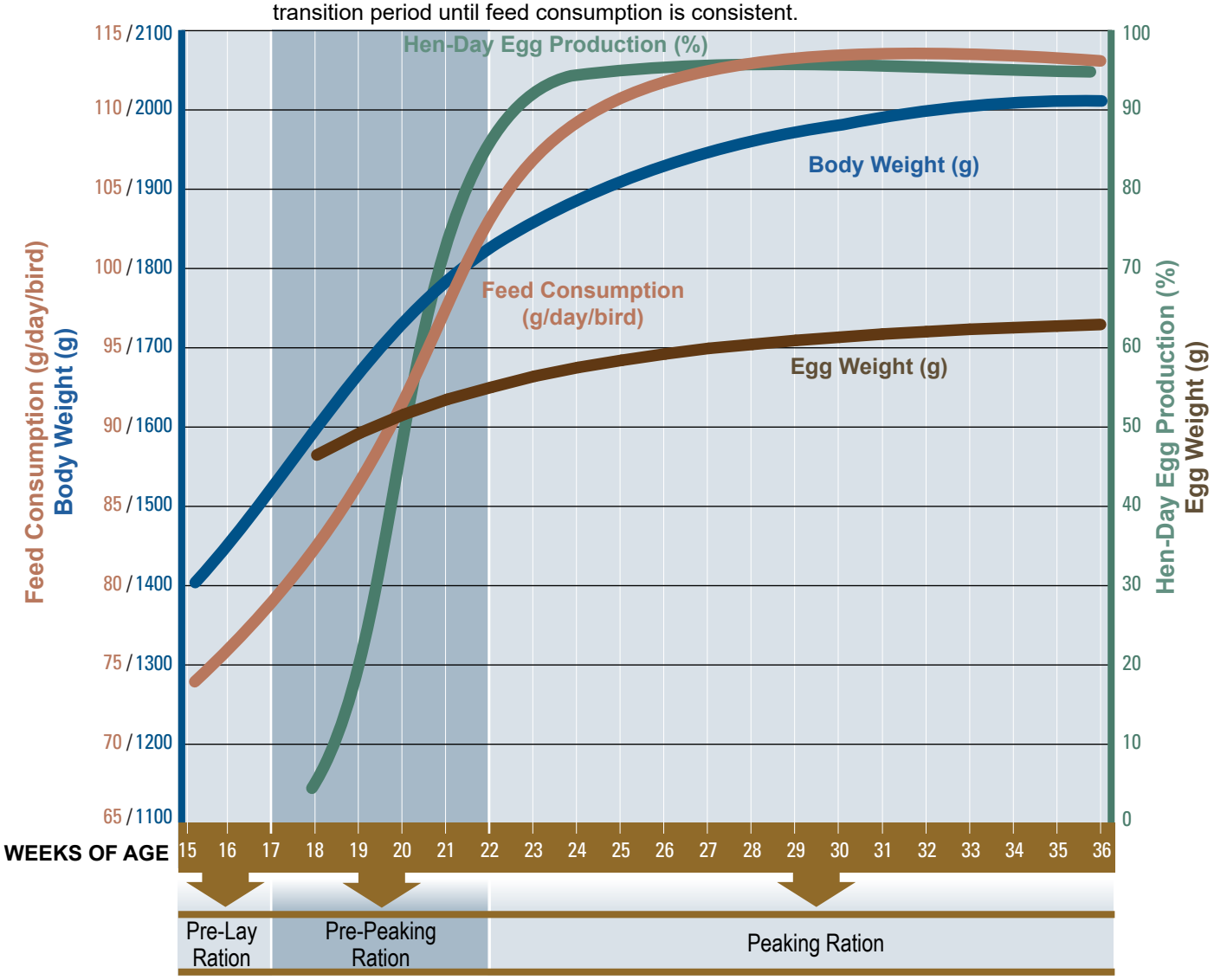


Body Score Chart

	0	1	2	3	4	5	6
Sternum (Keel)							
Abdominal Fat	None	None	None	None	< 0.7 cm	> 0.7 cm	Large fat pad
Comments	Emaciated birds	Low level of breast flesh concave in shape	Moderate breast flesh pyramid in shape	Well fleshed breast convex in shape	Abdominal fat pad small; Breast convex in shape	Abdominal fat pad increasing in size; Breast convex in shape	Pendulous fat pad; Breast convex in shape

Transition Period from Rear to Peak Egg Production

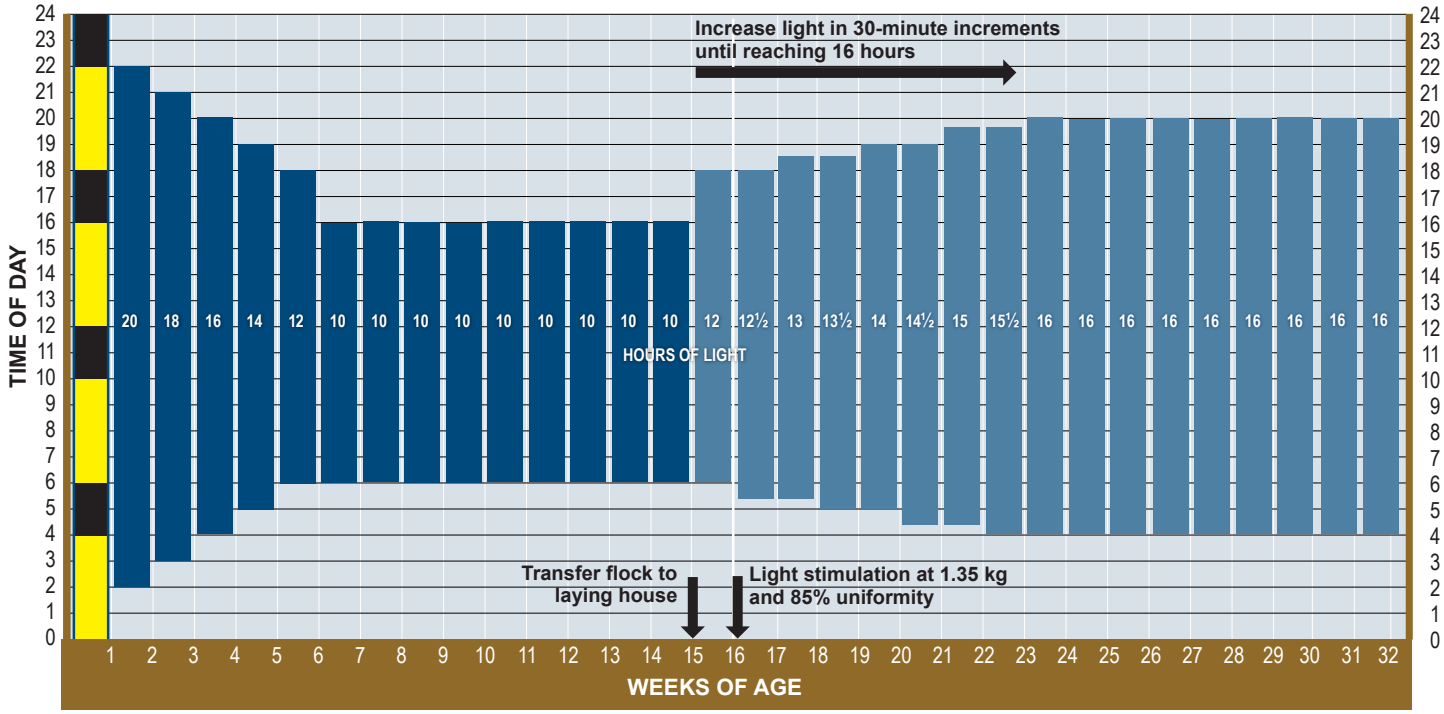
Frequently formulate to changing feed consumption during transition period until feed consumption is consistent.



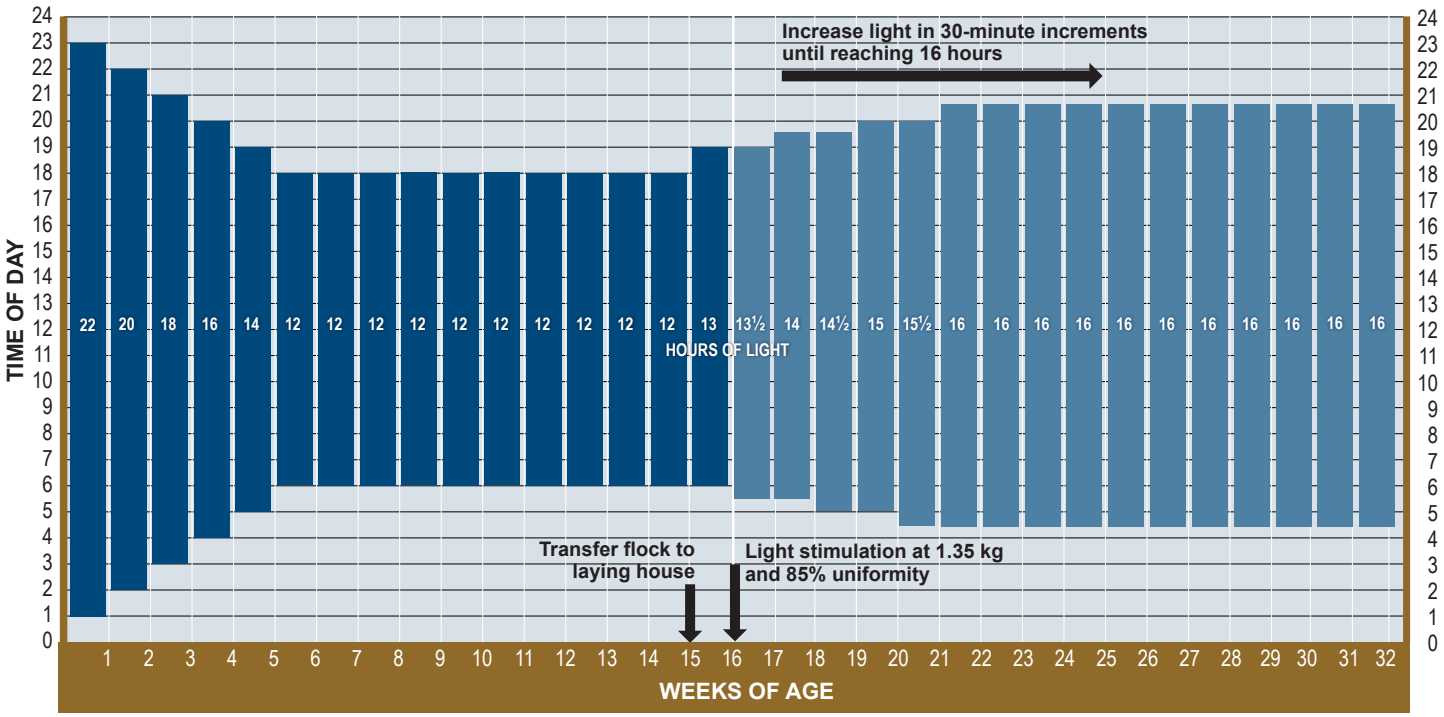
Pre-Peak

- Pre-Peak diets are intended for flocks with low feed intake and are fed for a limited period from first egg to the beginning of peak production. The nutrient specification of the Pre-Peak diet should be dense enough to allow for lower feed intake and also cater to the increased nutritional needs of the bird entering egg production. Continue to feed the Pre-Peak until feed intake has developed sufficiently to allow transition to the Peak diet.
- If utilized until no more than 50–70% HD, a Pre-Peak diet with reduced energy concentration can be beneficial to stimulate feed intake. Pre-Peaking diets are useful in situations where local conditions may result in reduced feed intake, such as hot climates where feed intake may be depressed.
- Increasing the vitamins and trace mineral inclusion to 30% can be useful to cope with the lower feed intake during the Pre-Peak phase.

Light Program for Light-Controlled Housing

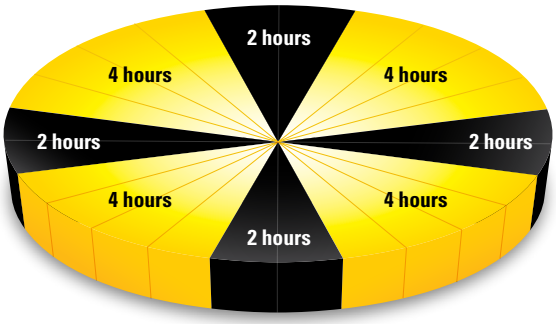


Light Program for Open-Sided Housing

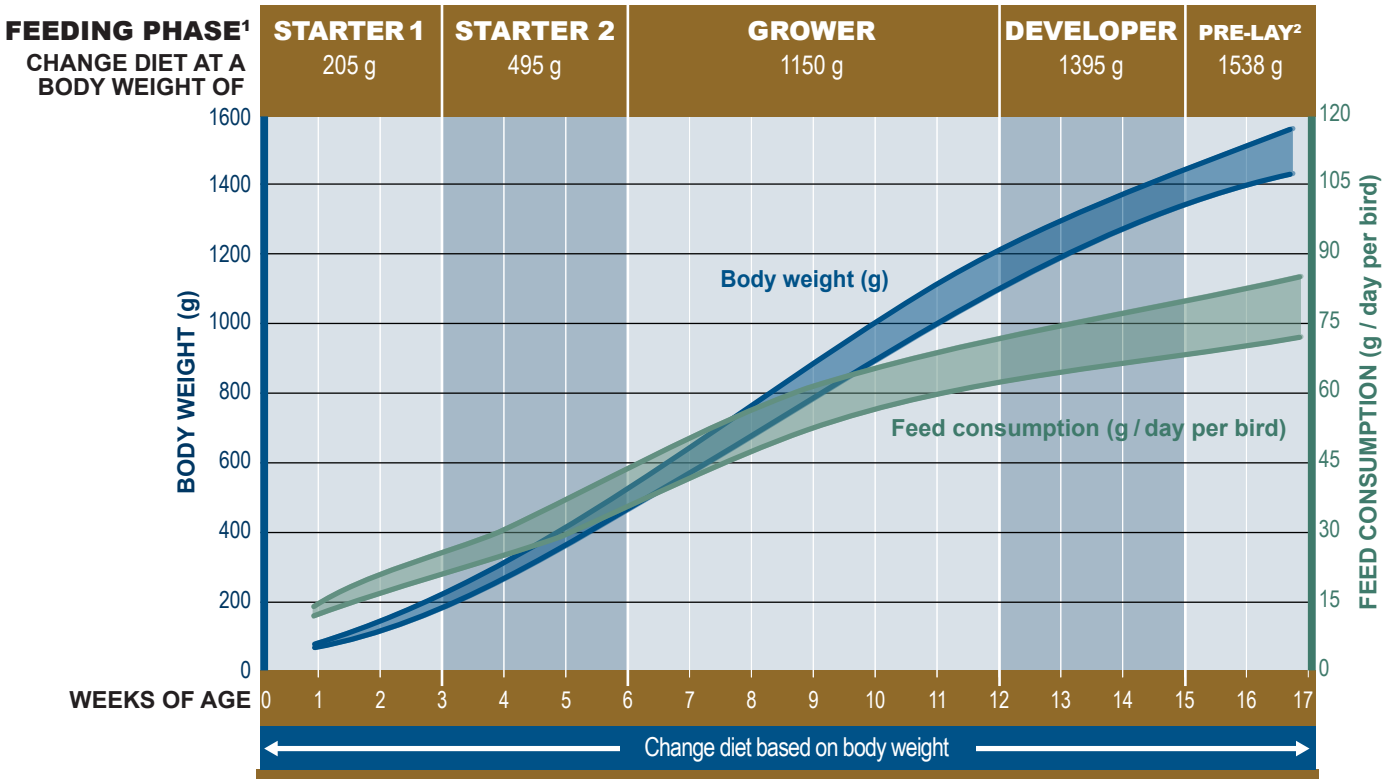


Intermittent Lighting Program for Chicks

- Preferred lighting technique.
- Use from 0–7 days (can be used up to 14 days of age).
- Intermittent dark periods provide rest periods for chicks.
- Synchronises chicks' activities and feedings.
- Establishes more natural behaviour of rest and activity.
- May improve 7-day livability and pullet body weight.
- Some dark periods may be shortened or removed to accommodate work schedules.



Rearing Period Nutritional Recommendations



NUTRITION	RECOMMENDED NUTRIENT CONCENTRATION				
Metabolizable energy[3], kcal/kg	2900–3100	2850–3050	2800–3000	2700–3000	2750–3000
Metabolizable energy[3], MJ/kg	12.13–12.97	11.92–12.76	11.72–12.55	11.30–12.55	11.51–12.55
	Standardized Ileal Digestible Amino Acids / Total Amino Acids[4]				
Lysine, %	**1.07** / 1.17	**0.92** / 1.00	**0.82** / 0.89	**0.60** / 0.66	**0.72** / 0.78
Methionine, %	**0.48** / 0.52	**0.42** / 0.45	**0.39** / 0.43	**0.28** / 0.30	**0.35** / 0.38
Methionine+Cystine,%	**0.82** / 0.91	**0.72** / 0.81	**0.66** / 0.74	**0.50** / 0.57	**0.62** / 0.70
Threonine, %	**0.69** / 0.82	**0.60** / 0.70	**0.55** / 0.64	**0.41** / 0.49	**0.50** / 0.58
Tryptophan, %	**0.19** / 0.22	**0.17** / 0.20	**0.17** / 0.20	**0.13** / 0.16	**0.16** / 0.20
Arginine, %	**1.11** / 1.20	**0.96** / 1.03	**0.85** / 0.91	**0.63** / 0.68	**0.75** / 0.81
Isoleucine, %	**0.75** / 0.80	**0.66** / 0.71	**0.61** / 0.66	**0.45** / 0.48	**0.56** / 0.61
Valine, %	**0.77** / 0.84	**0.68** / 0.75	**0.64** / 0.70	**0.48** / 0.53	**0.61** / 0.67
Crude protein[5], %	20.00	18.00	17.00	15.50	16.50
Calcium[6], %	1.05	1.00	0.95	0.90	2.50
Phosphorus (available)[7], %	0.45	0.44	0.43	0.38	0.42
Phosphorus (digestible), %	0.41	0.40	0.39	0.34	0.38
Sodium, %	0.18	0.18	0.18	0.18	0.18
Chloride, %	0.18	0.18	0.18	0.18	0.18
Linoleic acid (C18:2 n-6), %	1.20	1.20	1.20	1.20	1.20
Choline, mg/kg	2,000	1,800	1,800	1,500	1,800

[1] Body weights are approximate. Ages shown are a guide only. Please note that at time of transfer, there will be some loss in body weight (normally 10–12%) due to reduced water intake.

[2] Do not feed Pre-Lay Diet earlier than 15 weeks of age. Do not feed Pre-Lay later than first egg as it contains insufficient calcium to support egg production. Implementing a pre-lay diet can be challenging in mixed-age flocks. If it's not possible to use the Pre-Lay diet, the calcium content of the last stage rearing diet (developer) must be increased to 1.4%.

[3] Recommended energy range is based on raw material energy values shown in feed ingredient table at back of this guide. It is important that target concentrations of dietary energy are adjusted according to energy system applied to raw material matrix.

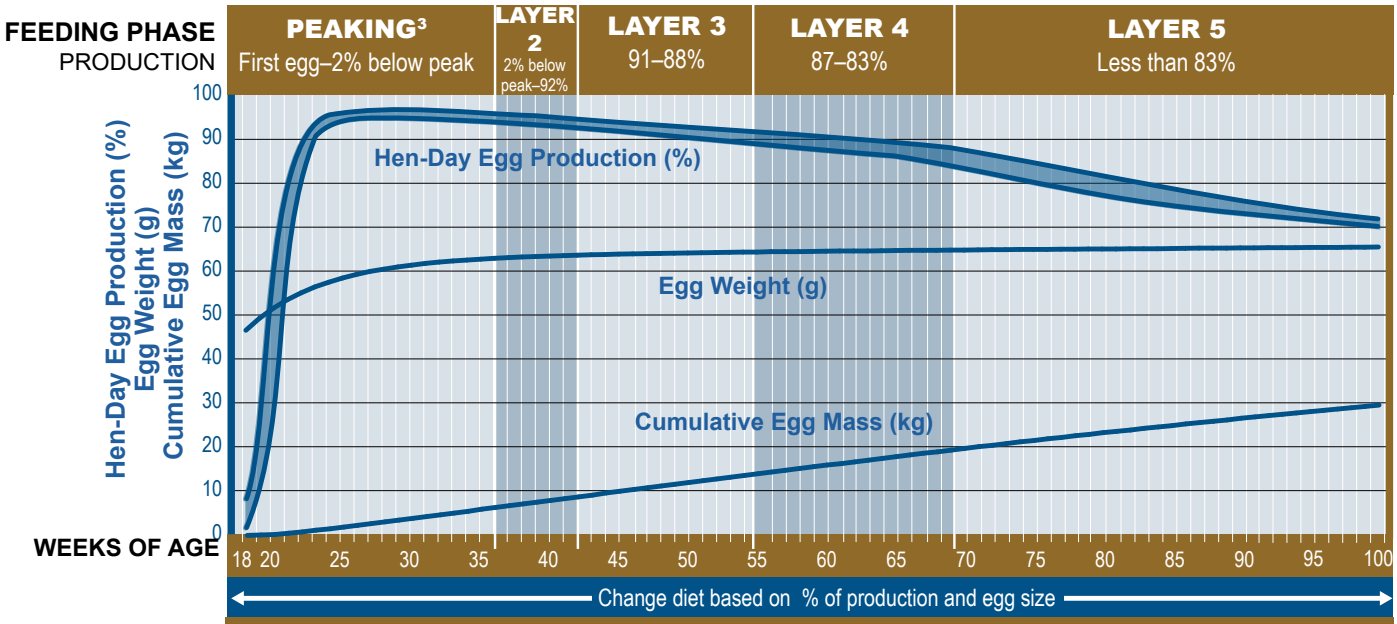
[4] Recommendation for Total Amino Acids is only appropriate to corn and soybean meal diet. Where diets utilize other ingredients, recommendations for Standardized Ileal Digestible Amino Acids must be followed.

[5] Diets should always be formulated to provide required intake of amino acid. Concentration of crude protein in diet will vary with raw materials used. Crude protein value provided is an estimated typical value only.

[6] Calcium should be supplied as fine calcium carbonate (mean particle size less than 2 mm). Coarse limestone (2–4 mm) can be introduced in Pre-Lay Diet at up to 50% of total limestone.

[7] Where other phosphorus systems are used, diets should contain recommended minimum level of available phosphorus.

Production Period Nutritional Recommendations for Economical Performance[1,2]



NUTRITION	RECOMMENDED DAILY NUTRIENT INTAKE				
Metabolizable energy[4], kcal/bird/day	315–330	310–325	305–320	300–315	300–315
Metabolizable energy[4], MJ/bird/day	1.32–1.38	1.30–1.36	1.28–1.34	1.26–1.32	1.26–1.32
	Standardized Ileal Digestible Amino Acids / Total Amino Acids[5]				
Lysine, mg/day	**830** / 909	**810** / 887	**780** / 854	**745** / 816	**700** / 766
Methionine , mg/day	**415** / 446	**405** / 435	**390** / 419	**373** / 401	**350** / 376
Methionine+Cystine, mg/day	**747** / 842	**729** / 822	**702** / 792	**671** / 756	**630** / 711
Threonine, mg/day	**581** / 684	**567** / 667	**546** / 642	**522** / 614	**490** / 576
Tryptophan, mg/day	**178** / 213	**174** / 208	**168** / 200	**160** / 191	**151** / 180
Arginine, mg/day	**863** / 928	**842** / 906	**811** / 872	**775** / 833	**728** / 783
Isoleucine, mg/day	**664** / 714	**648** / 697	**624** / 671	**596** / 641	**560** / 602
Valine, mg/day	**730** / 806	**713** / 786	**686** / 757	**656** / 723	**616** / 679
Crude protein[6], g/day	17.80	17.60	16.70	16.30	15.50
Sodium, mg/day	180	170	170	170	170
Chloride, mg/day	180	170	170	170	170
Linoleic acid (C18:2 n-6), g/day	1.60	1.50	1.40	1.40	1.40
Choline, mg/day	180	180	180	180	180

	CALCIUM AND PHOSPHORUS			
	Calcium[7,8] g/day	Phosphorus (available)[7,9] mg/day	Phosphorus (digestible) mg/day	Calcium Particle Size (fine : coarse)
Weeks 18–33	4.00	432	389	40% : 60%
Weeks 34–48	4.20	405	366	35% : 65%
Weeks 49–62	4.40	373	337	30% : 70%
Weeks 63–76	4.60	347	314	25% : 75%
Weeks 77+	4.70	324	291	25% : 75%

	IDEAL PROTEIN REFERENCE				
	PEAKING	LAYER 2	LAYER 3	LAYER 4	LAYER 5
Lysine	100%	100%	100%	100%	100%
Methionine	50%	50%	50%	50%	50%
M+C	90%	90%	90%	90%	89%
Threonine	70%	70%	70%	70%	70%
Tryptophan	22%	22%	22%	22%	22%
Arginine	104%	104%	104%	104%	104%
Isoleucine	80%	80%	80%	80%	80%
Valine	88%	88%	88%	88%	88%

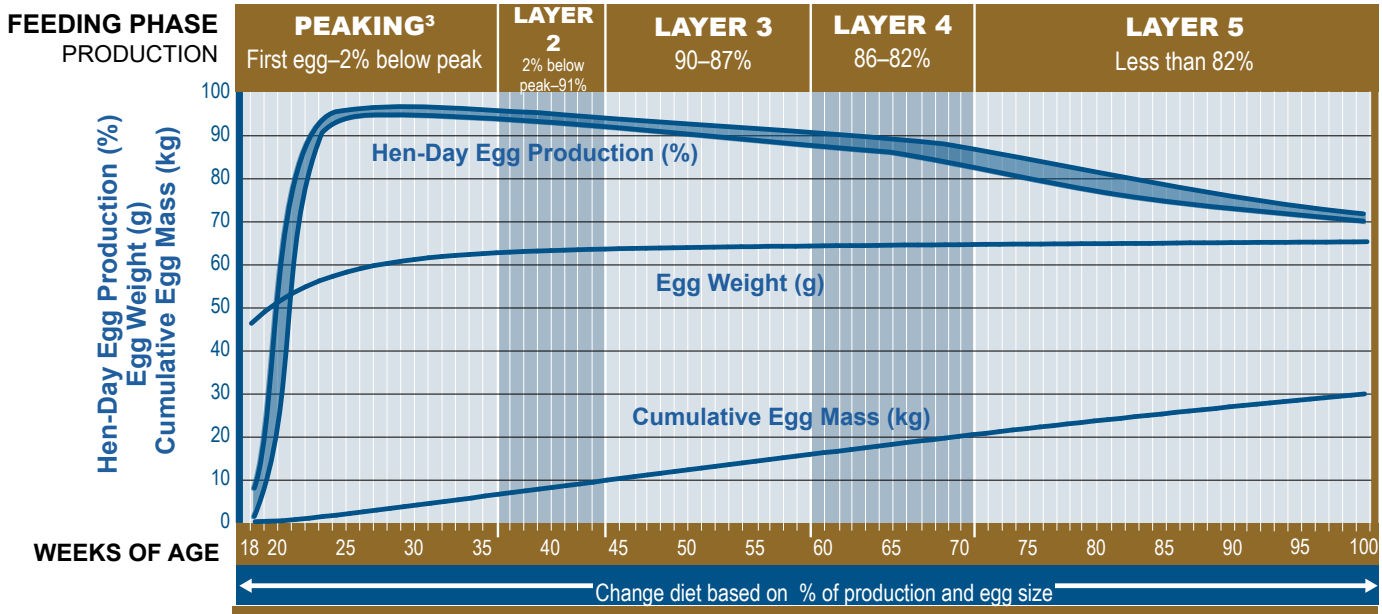
Production Period Dietary Nutrient Concentrations for Economical Performance[1,2]

FEEDING PHASE	PEAKING[3] First egg until production drops 2% below peak					LAYER 2 2% below peak to 92%					LAYER 3 91–88%					LAYER 4 87–83%					LAYER 5 Less than 83%				
PRODUCTION NUTRITION	RECOMMENDED CONCENTRATION																								
Metabolizable energy[4], kcal/bird/day	315–330					310–325					305–320					300–315					300–315				
Metabolizable energy[4], MJ/bird/day	1.32–1.38					1.30–1.36					1.28–1.34					1.26–1.32					1.26–1.32				
	FEED CONSUMPTION (*Typical Feed Consumption)																								
g/day per bird	90	95	**100***	105	110	100	105	**110***	115	120	100	105	**110***	115	120	100	105	**110***	115	120	100	105	**110***	115	120
	Standardized Ileal Digestible Amino Acids																								
Lysine, %	0.92	0.87	**0.83**	0.79	0.75	0.81	0.77	**0.74**	0.70	0.68	0.78	0.74	**0.71**	0.68	0.65	0.75	0.71	**0.68**	0.65	0.62	0.70	0.67	**0.64**	0.61	0.58
Methionine, %	0.46	0.44	**0.42**	0.40	0.38	0.41	0.39	**0.37**	0.35	0.34	0.39	0.37	**0.35**	0.34	0.33	0.37	0.36	**0.34**	0.32	0.31	0.35	0.33	**0.32**	0.30	0.29
Methionine+Cystine, %	0.83	0.79	**0.75**	0.71	0.68	0.73	0.69	**0.66**	0.63	0.61	0.70	0.67	**0.64**	0.61	0.59	0.67	0.64	**0.61**	0.58	0.56	0.63	0.60	**0.57**	0.55	0.53
Threonine, %	0.65	0.61	**0.58**	0.55	0.53	0.57	0.54	**0.52**	0.49	0.47	0.55	0.52	**0.50**	0.47	0.46	0.52	0.50	**0.47**	0.45	0.44	0.49	0.47	**0.45**	0.43	0.41
Tryptophan, %	0.20	0.19	**0.18**	0.17	0.16	0.17	0.17	**0.16**	0.15	0.15	0.17	0.16	**0.15**	0.15	0.14	0.16	0.15	**0.15**	0.14	0.13	0.15	0.14	**0.14**	0.13	0.13
Arginine, %	0.96	0.91	**0.86**	0.82	0.78	0.84	0.80	**0.77**	0.73	0.70	0.81	0.77	**0.74**	0.71	0.68	0.78	0.74	**0.70**	0.67	0.65	0.73	0.69	**0.66**	0.63	0.61
Isoleucine, %	0.74	0.70	**0.66**	0.63	0.60	0.65	0.62	**0.59**	0.56	0.54	0.62	0.59	**0.57**	0.54	0.52	0.60	0.57	**0.54**	0.52	0.50	0.56	0.53	**0.51**	0.49	0.47
Valine, %	0.81	0.77	**0.73**	0.70	0.66	0.71	0.68	**0.65**	0.62	0.59	0.69	0.65	**0.62**	0.60	0.57	0.66	0.62	**0.60**	0.57	0.55	0.62	0.59	**0.56**	0.54	0.51
	Total Amino Acids[5]																								
Lysine, %	1.01	0.96	**0.91**	0.87	0.83	0.89	0.84	**0.81**	0.77	0.74	0.85	0.81	**0.78**	0.74	0.71	0.82	0.78	**0.74**	0.71	0.68	0.77	0.73	**0.70**	0.67	0.64
Methionine, %	0.50	0.47	**0.45**	0.42	0.41	0.44	0.41	**0.40**	0.38	0.36	0.42	0.40	**0.38**	0.36	0.35	0.40	0.38	**0.36**	0.35	0.33	0.38	0.36	**0.34**	0.33	0.31
Methionine+Cystine, %	0.94	0.89	**0.84**	0.80	0.77	0.82	0.78	**0.75**	0.71	0.69	0.79	0.75	**0.72**	0.69	0.66	0.76	0.72	**0.69**	0.66	0.63	0.71	0.68	**0.65**	0.62	0.59
Threonine, %	0.76	0.72	**0.68**	0.65	0.62	0.67	0.64	**0.61**	0.58	0.56	0.64	0.61	**0.58**	0.56	0.54	0.61	0.58	**0.56**	0.53	0.51	0.58	0.55	**0.52**	0.50	0.48
Tryptophan, %	0.24	0.22	**0.21**	0.20	0.19	0.21	0.20	**0.19**	0.18	0.17	0.20	0.19	**0.18**	0.17	0.17	0.19	0.18	**0.17**	0.17	0.16	0.18	0.17	**0.16**	0.16	0.15
Arginine, %	1.03	0.98	**0.93**	0.88	0.84	0.91	0.86	**0.82**	0.79	0.76	0.87	0.83	**0.79**	0.76	0.73	0.83	0.79	**0.76**	0.72	0.69	0.78	0.75	**0.71**	0.68	0.65
Isoleucine, %	0.79	0.75	**0.71**	0.68	0.65	0.70	0.66	**0.63**	0.61	0.58	0.67	0.64	**0.61**	0.58	0.56	0.64	0.61	**0.58**	0.56	0.53	0.60	0.57	**0.55**	0.52	0.50
Valine, %	0.90	0.85	**0.81**	0.77	0.73	0.79	0.75	**0.71**	0.68	0.66	0.76	0.72	**0.69**	0.66	0.63	0.72	0.69	**0.66**	0.63	0.60	0.68	0.65	**0.62**	0.59	0.57
Crude protein[6], %	19.78	18.74	**17.80**	16.95	16.18	17.60	16.76	**16.00**	15.30	14.67	16.70	15.90	**15.18**	14.52	13.92	16.30	15.52	**14.82**	14.17	13.58	15.50	14.76	**14.09**	13.48	12.92
Sodium, %	0.20	0.19	**0.18**	0.17	0.16	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14
Chloride, %	0.20	0.19	**0.18**	0.17	0.16	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14
Linoleic acid (C18:2 n-6), %	1.78	1.68	**1.60**	1.52	1.45	1.50	1.43	**1.36**	1.30	1.25	1.40	1.33	**1.27**	1.22	1.17	1.40	1.33	**1.27**	1.22	1.17	1.40	1.33	**1.27**	1.22	1.17
Choline, mg/kg	2000	1895	**1800**	1714	1636	1800	1714	**1636**	1565	1500	1800	1714	**1636**	1565	1500	1800	1714	**1636**	1565	1500	1800	1714	**1636**	1565	1500

CALCIUM AND PHOSPHORUS CHANGES BASED ON FEED INTAKE																									
	Weeks 18–33							Weeks 34–48					Weeks 49–62					Weeks 63–76					Weeks 77+				
Feed Consumption, g/day per bird	90	95	100	**105**	110	115	120	100	105	**110**	115	120	100	105	**110**	115	120	100	105	**110**	115	120	100	105	**110**	115	120
Calcium[7,8], %	4.44	4.21	4.00	**3.81**	3.64	3.48	3.33	4.20	4.00	**3.82**	3.65	3.50	4.40	4.19	**4.00**	3.83	3.67	4.60	4.38	**4.18**	4.00	3.83	4.70	4.48	**4.27**	4.09	3.92
Phosphorus (available)[7,9], %	0.48	0.46	0.43	**0.41**	0.39	0.38	0.36	0.41	0.39	**0.37**	0.35	0.34	0.37	0.36	**0.34**	0.32	0.31	0.35	0.33	**0.32**	0.30	0.29	0.32	0.31	**0.29**	0.28	0.27
Phosphorus (digestible), %	0.43	0.41	0.39	**0.37**	0.35	0.34	0.32	0.37	0.35	**0.33**	0.32	0.31	0.34	0.32	**0.31**	0.29	0.28	0.31	0.30	**0.29**	0.27	0.26	0.29	0.28	**0.26**	0.25	0.24

[1] All nutrient requirements are based on the Feed Ingredient Tables.
[2] Crude protein, methionine+cystine, fat, linoleic acid, and / or energy may be changed to optimize egg size.
[3] Peaking nutrient levels are calculated for birds at peak egg production. Prior to achieving peak egg production, the nutrient requirements will be lower.
[4] A good approximation of the influence of temperature on energy needs is that for each 0.5°C change higher or lower than 22°C, subtract or add about 2 kcal /bird /day, respectively.
[5] Recommendation for Total Amino Acids is only appropriate to corn and soybean meal diet. Where diets utilize other ingredients, recommendations for Standardized Ileal Digestible Amino Acids must be followed.
[6] Diets should always be formulated to provide required intake of amino acid. Concentration of crude protein in diet will vary with raw material used. Crude protein value provided is an estimated typical value only.
[7] Calcium and available phosphorus requirements are determined by flock age. When production remains higher and diets are fed for longer than ages shown, it is recommended to increase to calcium and phosphorus concentrations of next feeding phase.
[8] Calcium carbonate particle size recommendation varies throughout lay. Refer to Calcium Particle Size. Dietary calcium levels and fine to coarse ratio may need to be adjusted based on limestone solubility.
[9] Where other phosphorus systems are used, diets should contain recommended minimum level of available phosphorus.

Production Period Nutritional Recommendations for Optimal Performance[1,2]



NUTRITION	RECOMMENDED DAILY NUTRIENT INTAKE				
Metabolizable energy[4], kcal/bird/day	315 – 330	310 – 325	305 – 320	300 – 315	300 – 315
Metabolizable energy[4], MJ/bird/day	1.32 – 1.38	1.30 – 1.36	1.28 – 1.34	1.26 – 1.32	1.26 – 1.32
	Standardized Ileal Digestible Amino Acids / Total Amino Acids[5]				
Lysine, mg/day	**870** / 953	**845** / 925	**820** / 898	**795** / 870	**770** / 843
Methionine , mg/day	**435** / 468	**423** / 454	**410** / 441	**398** / 427	**385** / 414
Methionine+Cystine, mg/day	**800** / 903	**769** / 867	**738** / 832	**716** / 807	**693** / 782
Threonine, mg/day	**609** / 716	**592** / 696	**574** / 675	**557** / 655	**539** / 634
Tryptophan, mg/day	**191** / 229	**186** / 222	**180** / 216	**175** / 209	**169** / 202
Arginine, mg/day	**905** / 973	**879** / 945	**853** / 917	**827** / 889	**801** / 861
Isoleucine, mg/day	**713** / 767	**684** / 736	**656** / 705	**636** / 684	**616** / 662
Valine, mg/day	**783** / 864	**752** / 829	**722** / 796	**700** / 772	**678** / 747
Crude protein[6], g/day	18.25	17.85	17.42	16.30	15.50
Sodium, mg/day	180	170	170	170	170
Chloride, mg/day	180	170	170	170	170
Linoleic acid (C18:2 n-6), g/day	2.00	2.00	1.60	1.50	1.40
Choline, mg/day	160	180	180	180	180

	CALCIUM AND PHOSPHORUS			
	Calcium[7,8] g/day	Phosphorus (available)[7,9] mg/day	Phosphorus (digestible) mg/day	Calcium Particle Size (fine : coarse)
Weeks 18–33	4.00	432	389	40% : 60%
Weeks 34–48	4.20	405	366	35% : 65%
Weeks 49–62	4.40	373	337	30% : 70%
Weeks 63–76	4.60	347	314	25% : 75%
Weeks 77+	4.70	324	291	25% : 75%

	IDEAL PROTEIN REFERENCE				
	PEAKING	LAYER 2	LAYER 3	LAYER 4	LAYER 5
Lysine	100%	100%	100%	100%	100%
Methionine	50%	50%	50%	50%	50%
M+C	92%	91%	90%	90%	90%
Threonine	70%	70%	70%	70%	70%
Tryptophan	22%	22%	22%	22%	22%
Arginine	104%	104%	104%	104%	104%
Isoleucine	82%	81%	80%	80%	80%
Valine	90%	89%	88%	88%	88%

Production Period Dietary Nutrient Concentrations for Optimal Performance[1,2]

FEEDING PHASE	PEAKING[3] First egg until production drops 2% below peak					LAYER 2 2% below peak to 91%					LAYER 3 90–87%					LAYER 4 86–82%					LAYER 5 Less than 82%				
PRODUCTION NUTRITION	**RECOMMENDED CONCENTRATION**																								
Metabolizable energy[4], kcal/bird/day	315–330					310–325					305–320					300–315					300–315				
Metabolizable energy[4], MJ/bird/day	1.32–1.38					1.30–1.36					1.28–1.34					1.26–1.32					1.26–1.32				
FEED CONSUMPTION (*Typical Feed Consumption)																									
g/day per bird	90	95	**100***	105	110	100	105	**110***	115	120	100	105	**110***	115	120	100	105	**110***	115	120	100	105	**110***	115	120
Standardized Ileal Digestible Amino Acids																									
Lysine, %	0.97	0.92	**0.87**	0.83	0.79	0.85	0.80	**0.77**	0.73	0.70	0.82	0.78	**0.75**	0.71	0.68	0.80	0.76	**0.72**	0.69	0.66	0.77	0.73	**0.70**	0.67	0.64
Methionine, %	0.48	0.46	**0.44**	0.41	0.40	0.42	0.40	**0.38**	0.37	0.35	0.41	0.39	**0.37**	0.36	0.34	0.40	0.38	**0.36**	0.35	0.33	0.39	0.37	**0.35**	0.33	0.32
Methionine+Cystine, %	0.89	0.84	**0.80**	0.76	0.73	0.77	0.73	**0.70**	0.67	0.64	0.74	0.70	**0.67**	0.64	0.62	0.72	0.68	**0.65**	0.62	0.60	0.69	0.66	**0.63**	0.60	0.58
Threonine, %	0.68	0.64	**0.61**	0.58	0.55	0.59	0.56	**0.54**	0.51	0.49	0.57	0.55	**0.52**	0.50	0.48	0.56	0.53	**0.51**	0.48	0.46	0.54	0.51	**0.49**	0.47	0.45
Tryptophan, %	0.21	0.20	**0.19**	0.18	0.17	0.19	0.18	**0.17**	0.16	0.16	0.18	0.17	**0.16**	0.16	0.15	0.18	0.17	**0.16**	0.15	0.15	0.17	0.16	**0.15**	0.15	0.14
Arginine, %	1.01	0.95	**0.91**	0.86	0.82	0.88	0.84	**0.80**	0.76	0.73	0.85	0.81	**0.78**	0.74	0.71	0.83	0.79	**0.75**	0.72	0.69	0.80	0.76	**0.73**	0.70	0.67
Isoleucine, %	0.79	0.75	**0.71**	0.68	0.65	0.68	0.65	**0.62**	0.59	0.57	0.66	0.62	**0.60**	0.57	0.55	0.64	0.61	**0.58**	0.55	0.53	0.62	0.59	**0.56**	0.54	0.51
Valine, %	0.87	0.82	**0.78**	0.75	0.71	0.75	0.72	**0.68**	0.65	0.63	0.72	0.69	**0.66**	0.63	0.60	0.70	0.67	**0.64**	0.61	0.58	0.68	0.65	**0.62**	0.59	0.57
Total Amino Acids[5]																									
Lysine, %	1.06	1.00	**0.95**	0.91	0.87	0.93	0.88	**0.84**	0.80	0.77	0.90	0.86	**0.82**	0.78	0.75	0.87	0.83	**0.79**	0.76	0.73	0.84	0.80	**0.77**	0.73	0.70
Methionine, %	0.52	0.49	**0.47**	0.45	0.43	0.45	0.43	**0.41**	0.39	0.38	0.44	0.42	**0.40**	0.38	0.37	0.43	0.41	**0.39**	0.37	0.36	0.41	0.39	**0.38**	0.36	0.35
Methionine+Cystine, %	1.00	0.95	**0.90**	0.86	0.82	0.87	0.83	**0.79**	0.75	0.72	0.83	0.79	**0.76**	0.72	0.69	0.81	0.77	**0.73**	0.70	0.67	0.78	0.74	**0.71**	0.68	0.65
Threonine, %	0.80	0.75	**0.72**	0.68	0.65	0.70	0.66	**0.63**	0.61	0.58	0.68	0.64	**0.61**	0.59	0.56	0.66	0.62	**0.60**	0.57	0.55	0.63	0.60	**0.58**	0.55	0.53
Tryptophan, %	0.25	0.24	**0.23**	0.22	0.21	0.22	0.21	**0.20**	0.19	0.19	0.22	0.21	**0.20**	0.19	0.18	0.21	0.20	**0.19**	0.18	0.17	0.20	0.19	**0.18**	0.18	0.17
Arginine, %	1.08	1.02	**0.97**	0.93	0.88	0.95	0.90	**0.86**	0.82	0.79	0.92	0.87	**0.83**	0.80	0.76	0.89	0.85	**0.81**	0.77	0.74	0.86	0.82	**0.78**	0.75	0.72
Isoleucine, %	0.85	0.81	**0.77**	0.73	0.70	0.74	0.70	**0.67**	0.64	0.61	0.71	0.67	**0.64**	0.61	0.59	0.68	0.65	**0.62**	0.59	0.57	0.66	0.63	**0.60**	0.58	0.55
Valine, %	0.96	0.91	**0.86**	0.82	0.79	0.83	0.79	**0.75**	0.72	0.69	0.80	0.76	**0.72**	0.69	0.66	0.77	0.74	**0.70**	0.67	0.64	0.75	0.71	**0.68**	0.65	0.62
Crude protein[6], %	20.28	19.21	**18.25**	17.38	16.59	17.85	17.00	**16.23**	15.52	14.88	17.42	16.59	**15.84**	15.15	14.52	16.30	15.52	**14.82**	14.17	13.58	15.50	14.76	**14.09**	13.48	12.92
Sodium, %	0.20	0.19	**0.18**	0.17	0.16	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14
Chloride, %	0.20	0.19	**0.18**	0.17	0.16	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14
Linoleic acid (C18:2 n-6), %	2.22	2.11	**2.00**	1.90	1.82	2.00	1.90	**1.82**	1.74	1.67	1.60	1.52	**1.45**	1.39	1.33	1.50	1.43	**1.36**	1.30	1.25	1.40	1.33	**1.27**	1.22	1.17
Choline, mg/kg	1778	1684	**1600**	1524	1455	1800	1714	**1636**	1565	1500	1800	1714	**1636**	1565	1500	1800	1714	**1636**	1565	1500	1800	1714	**1636**	1565	1500

CALCIUM AND PHOSPHORUS CHANGES BASED ON FEED INTAKE																									
	Weeks 18–33							Weeks 34–48					Weeks 49–62					Weeks 63–76					Weeks 77+				
Feed Consumption, g/day per bird	90	95	100	**105**	110	115	120	100	105	**110**	115	120	100	105	**110**	115	120	100	105	**110**	115	120	100	105	**110**	115	120
Calcium[7,8], %	4.44	4.21	4.00	**3.81**	3.64	3.48	3.33	4.20	4.00	**3.82**	3.65	3.50	4.40	4.19	**4.00**	3.83	3.67	4.60	4.38	**4.18**	4.00	3.83	4.70	4.48	**4.27**	4.09	3.92
Phosphorus (available)[7,9], %	0.48	0.46	0.43	**0.41**	0.39	0.38	0.36	0.41	0.39	**0.37**	0.35	0.34	0.37	0.36	**0.34**	0.32	0.31	0.35	0.33	**0.32**	0.30	0.29	0.32	0.31	**0.29**	0.28	0.27
Phosphorus (digestible), %	0.43	0.41	0.39	**0.37**	0.35	0.34	0.32	0.37	0.35	**0.33**	0.32	0.31	0.34	0.32	**0.31**	0.29	0.28	0.31	0.30	**0.29**	0.27	0.26	0.29	0.28	**0.26**	0.25	0.24

[1] All nutrient requirements are based on the Feed Ingredient Tables.
[2] Crude protein, methionine+cystine, fat, linoleic acid, and / or energy may be changed to optimize egg size.
[3] Peaking nutrient levels are calculated for birds at peak egg production. Prior to achieving peak egg production, the nutrient requirements will be lower.
[4] A good approximation of the influence of temperature on energy needs is that for each 0.5°C change higher or lower than 22°C, subtract or add about 2 kcal /bird /day, respectively.
[5] Recommendation for Total Amino Acids is only appropriate to corn and soybean meal diet. Where diets utilize other ingredients, recommendations for Standardized Ileal Digestible Amino Acids must be followed.
[6] Diets should always be formulated to provide required intake of amino acid. Concentration of crude protein in diet will vary with raw material used. Crude protein value provided is an estimated typical value only.
[7] Calcium and available phosphorus requirements are determined by flock age. When production remains higher and diets are fed for longer than ages shown, it is recommended to increase to calcium and phosphorus concentrations of next feeding phase.
[8] Calcium carbonate particle size recommendation varies throughout lay. Refer to Calcium Particle Size. Dietary calcium levels and fine to coarse ratio may need to be adjusted based on limestone solubility.
[9] Where other phosphorus systems are used, diets should contain recommended minimum level of available phosphorus.

Vitamins and Trace Minerals

ITEM [1,2,3,4]	IN 1000 KG COMPLETE DIET	
	Rearing Period	Production Period
Vitamin A, IU	10,000,000	8,000,000
Vitamin D_3[5], IU	3,300,000	3,300,000
Vitamin E, g	30.00	25.00
Vitamin K (menadione), g	3.50	3.00
Thiamin (B_1), g	2.20	2.50
Riboflavin (B_2), g	6.60	5.50
Niacin (B_3)[6], g	40.00	30.00
Pantothenic acid (B_5), g	10.00	10.00
Pyridoxine (B_6), g	4.50	5.00
Biotin (B_7), mg	100.00	75.00
Folic acid (B_9), g	1.00	0.90
Cobalamine (B_{12}), mg	23.00	23.00
Manganese[7], g	100.00	100.00
Zinc[7], g	85.00	80.00
Iron[7], g	30.00	40.00
Copper[7], g	15.00	8.00
Magnesium[7], g	600.00	500.00
Iodine, g	1.50	1.20
Selenium[7], g	0.25	0.25

[1] Minimum recommendations for rearing and laying periods. Local regulations may limit dietary content of individual vitamins or minerals. Levels of 150-200mg/kg of Vitamin C can be beneficial during periods of stress.

[2] Store premixes according to supplier's recommendations and observe 'use by' dates to ensure vitamin activity is maintained. Inclusion of antioxidant may improve premix stability.

[3] Vitamin and mineral recommendations vary according to activity.

[4] Where heat treatment is applied to diet, higher levels of vitamins may be required. Consult with vitamin supplier regarding stability through individual production processes.

[5] A proportion of Vitamin D_3 can be supplemented as 25-hydroxy D_3 according to supplier's recommendations and applicable limits.

[6] Higher levels of Niacin are recommended in non-cage systems.

[7] Greater bioavailability and productivity may be possible with use of chelated mineral sources.

Drinking Water Quality for Poultry

ITEM	MAXIMUM CONCENTRATION (ppm or mg/L)*	
Nitrate NO_3^- [1]	25	Older birds will tolerate higher levels up to 20 ppm. Stressed or disease challenged birds may be more sensitive to effects of Nitrate.
Nitrate Nitrogen (NO_3-N) [1]	6	
Nitrite NO_2^- [1]	4	Nitrite is considerably more toxic than Nitrate, especially for young birds, where 1 ppm Nitrite may be considered toxic.
Nitrite Nitrogen (NO_2-N) [1]	1	
Total dissolved solids [2]	1000	Levels up to 3000 ppm may not affect performance but could increase manure moisture.
Chloride (Cl^-) [1]	250	Levels as low as 14 mg may be problematic if sodium is higher than 50 ppm.
Sulphate (SO_4^-) [1]	250	Higher levels may be laxative.
Iron (Fe) [1]	<0.3	Higher levels result in bad odour and taste.
Magnesium (Mg) [1]	125	Higher levels may be laxative. Levels above 50 ppm may be problematic if sulphate levels are high.
Potassium (K) [2]	20	Higher levels may be acceptable depending on sodium level, alkalinity, and pH.
Sodium (Na) [1,2]	50	Higher concentration is acceptable but concentrations above 50 ppm should be avoided if high levels of chloride, sulphate, or potassium exist.
Manganese (Mn) [3]	0.05	Higher levels may be laxative.
Arsenic (As) [2]	0.5	
Fluoride (F^-) [2]	2	
Aluminium (Al) [2]	5	
Boron (B) [2]	5	
Cadmium (Cd) [2]	0.02	
Cobalt (Co) [2]	1	
Copper (Cu) [1]	0.6	Higher levels result in bitter taste.
Lead (Pb) [1]	0.02	Higher levels are toxic.
Mercury (Hg) [2]	0.003	Higher levels are toxic.
Zinc (Zn) [1]	1.5	Higher levels are toxic.
pH [1]	5–7	Birds may adapt to lower pH. Below pH 5 may reduce water intake and corrode metal fittings. Above pH 8 may reduce intake and reduce effectiveness of water sanitation.
Total bacteria counts [3]	1000 CFU/ml	This is likely to indicate dirty water.
Total Coliform bacteria [3]	50 CFU/ml	
Faecal Coliform bacteria [3]	0 CFU/ml	
Oxygen Reduction Potential (ORP) [3]	650–750 mEq	The ORP range at which 2–4 ppm of free chlorine will effectively sanitise water at a favourable pH range of 5–7.

* Limits may be lower as interactions exist between magnesium and sulphate; and between sodium, potassium, chloride, and sulphate.

[1] Carter & Sneed, 1996. Drinking Water Quality for Poultry, Poultry Science and Technology Guide, North Carolina State University Poultry Extension Service. Guide no. 42

[2] Marx and Jaikaran, 2007. Water Analysis Interpretation. Agri-Facts, Alberta Ag-Info Centre. Refer to http://www.agric.gov.ab.ca/app84/rwqit for online Water Analysis Tool

[3] Watkins, 2008. Water: Identifying and Correcting Challenges. Avian Advice 10(3): 10–15 University of Arkansas Cooperative Extension Service, Fayetteville

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TECHNICAL UPDATES

Diseases

An Overview of Focal Duodenal Necrosis (FDN)
MG Control in Commercial Layers
Colibacillosis in Layers: An Overview
Fowl Pox in Layers
Avian Urolithiasis (Visceral Gout)
Infectious Bursal Disease (IBD, Gumboro)
Fatty Liver Hemorrhagic Syndrome
Infectious Laryngotracheitis (ILT)
Intestinal Dilation Syndrome (IDS)
Newcastle Disease
Mycoplasma Synoviae (MS)
Low Pathogenic Avian Influenza (LPAI)

Diagnostic Samples and Breeder Flock Monitoring

Salmonella, *Mycoplasma*, and Avian Influenza Monitoring in Parent Breeder Flocks
Proper Collection and Handling of Diagnostic Samples

Management

Growing Management of Commercial Pullets
Understanding the Role of the Skeleton in Egg Production
The Science of Egg Quality
Understanding Poultry Lighting
Understanding Heat Stress in Layers
Infrared Beak Treatment
Feed Granulometry and the Importance of Feed Particle Size in Layers
Impact of Tarp Colour on Poultry Lighting
SPIDES (Short Period Incubation During Egg Storage)
Fly Management: Surveillance and Control
Optimising Egg Size in Commercial Layers
Vaccination Recommendations
Egg Drop Syndrome (EDS)
Managing Fully Beaked Flocks
Thiamin Deficiency in Pullets
Understanding Nesting Behaviour

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