Hy-Line®

BROWN MAX PRO

PERFORMANCE STANDARDS GUIDE

COMMERCIAL LAYERS

ALTERNATIVE SYSTEMS

Hy-Line®

Use of the Performance Guide

The genetic potential of Hy-Line Brown Max Pro 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 Max Pro 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.

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Alternative Systems
Online Management Guide

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Summary of Performance Standards

REARING PERIOD (TO 17 WEEKS):	
Livability	97.63%
Feed Consumed	6.57 kg
Body Weight at 17 Weeks	1384–1449 g
LAYING PERIOD (TO 100 WEEKS):	
Percent Peak	94.1–97.9%
Hen-Day Eggs to 60 Weeks Hen-Day Eggs to 100 Weeks	261.4–273.6 487.1–510.3
Hen-Housed Eggs to 60 Weeks Hen-Housed Eggs to 100 Weeks	256.8–268.8 468.1–490.3
Livability to 60 Weeks Livability to 80 Weeks Livability to 100 Weeks	96.7% 93.8% 89.2%
Days to 50% Production (from hatch)	140
Egg Weight at 26 Weeks Egg Weight at 32 Weeks Egg Weight at 70 Weeks Egg Weight at 100 Weeks	54.0–56.5 g 58.2–61.0 g 61.0–63.9 g 61.6–64.7 g
Total Egg Mass per Hen-Housed (18–80 weeks) Total Egg Mass per Hen-Housed (18–100 weeks)	23.8 kg 30.3 kg
Body Weight at 26 Weeks Body Weight at 32 Weeks Body Weight at 70 Weeks Body Weight at 100 Weeks	1847–1930 g 1917–1996 g 2022–2115 g 2059–2161 g
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	91 88 84 81
Haugh Units at 38 Weeks Haugh Units at 56 Weeks Haugh Units at 72 Weeks Haugh Units at 90 Weeks	90 84 81 80
Average Daily Feed Consumption (19–100 weeks)	115.5–122.7 g/day per bird
Feed Conversion Rate, kg Feed/kg Eggs (20–60 weeks) Feed Conversion Rate, kg Feed/kg Eggs (20–100 weeks)	2.12–2.21 2.23–2.33
Feed Utilization, kg Egg/kg Feed (20–60 weeks) Feed Utilization, kg Egg/kg Feed (20–100 weeks)	0.45–0.47 0.43–0.45
Feed Consumption per 10 Eggs (20–60 weeks) Feed Consumption per 10 Eggs (20–100 weeks)	1.30–1.35 kg 1.36–1.41 kg
Feed Consumption per Dozen Eggs (20–60 weeks) Feed Consumption per Dozen Eggs (20–100 weeks)	1.56–1.62 kg 1.63–1.69 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 (kg/bird to date)		UNIFORMITY %
		Low	High	Low	High	Low	High	Low	High	
1	0.40	66	78	26	29	18	20	0.12	0.14	
2	0.56	115	134	29	32	20	22	0.26	0.29	>85%
3	0.67	180	209	35	38	23	26	0.42	0.47	
4	0.79	259	297	43	47	29	31	0.62	0.69	
5	**0.92**	**349**	**398**	**52**	**57**	**35**	**38**	**0.87**	**0.95**	>80%
6	1.04	447	507	62	68	41	45	1.16	1.27	
7	1.18	552	621	71	78	48	52	1.49	1.63	
8	1.31	660	736	80	87	53	58	1.86	2.04	
9	1.44	766	849	87	95	58	63	2.27	2.48	
10	**1.57**	**867**	**954**	**94**	**101**	**62**	**67**	**2.71**	**2.95**	
11	1.69	961	1051	100	107	66	72	3.17	3.45	
12	1.81	1048	1137	103	111	69	74	3.65	3.97	>85%
13	1.91	1126	1213	107	114	71	76	4.15	4.50	
14	1.99	1197	1281	110	118	74	79	4.67	5.06	
15	**2.09**	**1263**	**1341**	**113**	**121**	**75**	**81**	**5.20**	**5.62**	
16	2.18	1324	1396	118	125	78	84	5.75	6.20	
17	2.37	1384	1449	124	131	82	88	6.32	6.82	>90%

Rearing Period Space Recommendations

(check local regulations concerning space requirements)

- Useable space is calculated as litter floor and raised slat areas, not including perch space.
- Rearing density depends on age of transfer to the laying facility. Use the approximation at right.

Week of Transfer	Birds/m² of Useable Space
15	15
16	14
17	13
18	12

	MULTI-TIER	FLOOR
Floor space	< 20 kg live weight per m² of useable space at 16 weeks when transferred to the laying facility. Adjust stocking density if birds are transferred at other ages.	< 20 kg live weight per m² floor space at end of rearing period
Feeder space	2.5 cm/bird with access on both sides; 5 cm/bird with side access; 2.0 cm/bird with circular feeders	2.5 cm/bird with access on both sides; 5 cm/bird with side access; 2.0 cm/bird with circular feeders
Drinking systems, cups or nipples	12.5 birds per nipple drinker; 20 birds per cup	12.5 birds per nipple drinker; 20 birds per cup; 125 birds per bell drinker
Perch space	10–15 cm/bird	10–15 cm/bird

Production Period Performance Table

AGE (weeks)	% HEN-DAY Current		HEN-DAY EGGS Cumulative		HEN-HOUSED EGGS Cumulative		MORT-ALITY Cumulative (%)	BODY WEIGHT (g)		FEED INTAKE (g/bird/day)		WATER INTAKE (ml/bird/day)		HH EGG MASS Cumulative (kg)		AVG. EGG WT. (g/egg)	
	Low	High	Low	High	Low	High		Low	High	Low	High	Low	High	Low	High	Low	High
18	5.9	7.2	0.4	0.5	0.4	0.5	0.28	1440	1508	87	92	130	138	0.02	0.02	40.6	42.6
19	21.7	25.6	1.9	2.3	1.9	2.3	0.33	1494	1569	93	98	139	148	0.09	0.10	43.2	45.2
20	**48.6**	**55.1**	**5.3**	**6.1**	**5.3**	**6.1**	**0.39**	**1549**	**1633**	**98**	**104**	**147**	**156**	**0.26**	**0.27**	**45.6**	**47.8**
21	71.9	78.5	10.4	11.6	10.3	11.6	0.45	1604	1698	103	109	154	164	0.52	0.54	47.3	49.5
22	84.5	88.8	16.3	17.9	16.2	17.8	0.51	1658	1761	108	114	162	172	0.83	0.87	48.9	51.2
23	88.8	93.1	22.5	24.4	22.4	24.3	0.58	1716	1814	111	118	167	177	1.17	1.23	50.4	52.7
24	90.7	94.9	28.8	31.0	28.7	30.9	0.64	1767	1862	113	120	170	181	1.54	1.61	51.7	54.1
25	**91.8**	**95.9**	**35.3**	**37.7**	**35.1**	**37.5**	**0.70**	**1811**	**1900**	**115**	**122**	**172**	**183**	**1.92**	**2.01**	**52.9**	**55.4**
26	92.4	96.4	41.7	44.5	41.5	44.2	0.76	1847	1930	116	123	173	184	2.31	2.42	54.0	56.5
27	93.0	96.8	48.3	51.3	48.0	51.0	0.83	1873	1949	116	123	174	185	2.72	2.85	55.0	57.6
28	93.6	97.4	54.8	58.1	54.4	57.7	0.89	1888	1965	117	124	175	186	3.13	3.28	55.8	58.4
29	93.8	97.7	61.4	64.9	60.9	64.5	0.96	1898	1976	117	124	175	186	3.55	3.71	56.6	59.2
30	**94.1**	**97.9**	**68.0**	**71.8**	**67.5**	**71.3**	**1.03**	**1905**	**1983**	**117**	**124**	**175**	**186**	**3.97**	**4.15**	**57.2**	**59.9**
31	94.0	97.9	74.5	78.6	74.0	78.0	1.08	1911	1989	117	124	175	186	4.39	4.60	57.7	60.5
32	93.9	97.8	81.1	85.5	80.5	84.8	1.15	1917	1996	117	124	175	186	4.81	5.04	58.2	61.0
33	93.8	97.7	87.7	92.3	87.0	91.6	1.22	1923	2002	117	124	175	186	5.23	5.48	58.6	61.4
34	93.8	97.7	94.2	99.2	93.4	98.3	1.29	1929	2010	117	124	175	186	5.65	5.92	58.9	61.7
35	**93.7**	**97.6**	**100.8**	**106.0**	**99.9**	**105.1**	**1.37**	**1936**	**2017**	**117**	**124**	**175**	**186**	**6.06**	**6.35**	**59.2**	**62.0**
36	93.6	97.5	107.3	112.8	106.4	111.8	1.43	1943	2025	117	124	175	186	6.48	6.79	59.4	62.2
37	93.5	97.4	113.9	119.6	112.8	118.5	1.51	1950	2031	117	124	175	186	6.89	7.22	59.6	62.4
38	93.4	97.3	120.4	126.4	119.2	125.2	1.59	1954	2037	117	124	175	186	7.30	7.65	59.7	62.6
39	93.3	97.2	127.0	133.3	125.7	131.9	1.65	1959	2042	117	124	175	186	7.70	8.07	59.8	62.7
40	**93.2**	**97.1**	**133.5**	**140.1**	**132.1**	**138.6**	**1.73**	**1962**	**2046**	**117**	**124**	**175**	**186**	**8.10**	**8.48**	**59.8**	**62.7**
41	93.0	97.0	140.0	146.8	138.5	145.3	1.80	1966	2049	117	124	175	186	8.50	8.91	59.9	62.8
42	92.9	96.9	146.5	153.6	144.8	151.9	1.87	1970	2054	117	124	175	186	8.90	9.33	60.0	62.9
43	92.8	96.8	153.0	160.4	151.2	158.6	1.93	1973	2058	117	124	175	186	9.30	9.75	60.1	62.9
44	92.6	96.6	159.5	167.2	157.6	165.2	2.01	1977	2062	117	124	175	186	9.70	10.17	60.1	63.0
45	**92.5**	**96.5**	**165.9**	**173.9**	**163.9**	**171.8**	**2.07**	**1979**	**2064**	**117**	**124**	**175**	**186**	**10.10**	**10.59**	**60.2**	**63.1**
46	92.3	96.3	172.4	180.7	170.2	178.4	2.15	1982	2067	117	124	175	186	10.49	11.00	60.2	63.1
47	92.2	96.2	178.9	187.4	176.5	185.0	2.20	1983	2069	117	124	175	186	10.89	11.41	60.3	63.1
48	92.0	96.0	185.3	194.1	182.8	191.5	2.28	1986	2071	116	124	175	186	11.29	11.83	60.3	63.2
49	91.8	95.8	191.7	200.8	189.1	198.1	2.35	1987	2074	116	124	175	186	11.69	12.25	60.4	63.3
50	**91.6**	**95.7**	**198.1**	**207.5**	**195.4**	**204.6**	**2.41**	**1989**	**2075**	**116**	**124**	**175**	**186**	**12.09**	**12.66**	**60.4**	**63.3**
51	91.4	95.5	204.5	214.2	201.6	211.1	2.50	1991	2078	116	124	175	186	12.48	13.08	60.5	63.4
52	91.2	95.3	210.9	220.9	207.8	217.6	2.56	1993	2080	116	124	175	186	12.88	13.49	60.5	63.4
53	91.0	95.0	217.3	227.5	214.0	224.1	2.64	1994	2082	116	124	175	186	13.26	13.90	60.5	63.4
54	90.8	94.8	223.6	234.2	220.2	230.6	2.74	1997	2084	116	124	175	186	13.65	14.31	60.6	63.5
55	**90.5**	**94.6**	**230.0**	**240.8**	**226.4**	**237.0**	**2.82**	**1998**	**2086**	**116**	**124**	**175**	**186**	**14.05**	**14.72**	**60.6**	**63.5**
56	90.3	94.3	236.3	247.4	232.5	243.4	2.90	1999	2088	116	124	175	186	14.44	15.13	60.7	63.6
57	90.0	94.1	242.6	254.0	238.6	249.8	3.01	2002	2091	116	124	175	186	14.83	15.54	60.7	63.6
58	89.7	93.8	248.9	260.5	244.7	256.2	3.11	2003	2092	116	124	175	186	15.20	15.93	60.7	63.6

Production Period Performance Table (cont.)

AGE (weeks)	% HEN-DAY Current		HEN-DAY EGGS Cumulative		HEN-HOUSED EGGS Cumulative		MORT-ALITY Cumulative (%)	BODY WEIGHT (g)		FEED INTAKE (g/bird/day)		WATER INTAKE (ml/bird/day)		HH EGG MASS Cumulative (kg)		AVG. EGG WT. (g/egg)	
	Low	High	Low	High	Low	High		Low	High	Low	High	Low	High	Low	High	Low	High
59	89.5	93.5	255.1	267.1	250.8	262.5	3.21	2005	2094	116	124	175	185	15.60	16.35	60.8	63.7
60	**89.1**	**93.2**	**261.4**	**273.6**	**256.8**	**268.8**	**3.32**	**2006**	**2096**	**116**	**124**	**175**	**185**	**15.97**	**16.74**	**60.8**	**63.7**
61	88.8	92.9	267.6	280.1	262.8	275.1	3.42	2008	2098	116	124	175	185	16.36	17.15	60.8	63.8
62	88.5	92.6	273.8	286.6	268.8	281.3	3.54	2010	2100	116	124	175	185	16.73	17.54	60.8	63.8
63	88.2	92.2	280.0	293.0	274.7	287.6	3.66	2012	2102	116	124	175	185	17.10	17.92	60.8	63.7
64	87.8	91.9	286.1	299.5	280.6	293.8	3.77	2013	2104	116	124	175	185	17.49	18.33	60.9	63.8
65	**87.5**	**91.5**	**292.2**	**305.9**	**286.5**	**299.9**	**3.90**	**2014**	**2106**	**116**	**124**	**175**	**185**	**17.85**	**18.71**	**60.9**	**63.8**
66	87.1	91.2	298.3	312.3	292.4	306.0	4.03	2016	2108	116	124	175	185	18.23	19.12	60.9	63.9
67	86.7	90.8	304.4	318.6	298.2	312.1	4.15	2018	2110	116	124	175	185	18.59	19.49	60.9	63.9
68	86.3	90.4	310.4	324.9	304.0	318.2	4.29	2019	2111	116	124	175	185	18.96	19.88	61.0	63.9
69	86.0	90.0	316.5	331.2	309.7	324.2	4.43	2021	2113	116	124	175	185	19.33	20.26	61.0	63.9
70	**85.5**	**89.6**	**322.5**	**337.5**	**315.4**	**330.2**	**4.57**	**2022**	**2115**	**116**	**124**	**175**	**185**	**19.68**	**20.63**	**61.0**	**63.9**
71	85.1	89.1	328.4	343.7	321.1	336.1	4.71	2024	2117	116	124	175	185	20.06	21.03	61.0	64.0
72	84.7	88.7	334.3	350.0	326.8	342.0	4.85	2025	2118	116	124	175	185	20.41	21.39	61.0	64.0
73	84.2	88.2	340.2	356.1	332.4	347.9	5.01	2026	2120	116	124	175	185	20.78	21.79	61.1	64.1
74	83.8	87.8	346.1	362.3	337.9	353.7	5.16	2028	2122	116	124	175	185	21.12	22.15	61.1	64.0
75	**83.3**	**87.3**	**351.9**	**368.4**	**343.4**	**359.5**	**5.32**	**2029**	**2124**	**116**	**124**	**175**	**185**	**21.48**	**22.52**	**61.1**	**64.1**
76	82.9	86.8	357.7	374.5	348.9	365.3	5.48	2031	2125	116	124	175	185	21.83	22.89	61.1	64.1
77	82.4	86.3	363.5	380.5	354.4	371.0	5.64	2032	2127	116	124	175	185	22.17	23.24	61.1	64.1
78	81.9	85.8	369.2	386.5	359.8	376.6	5.81	2034	2129	116	124	175	185	22.53	23.63	61.2	64.2
79	81.4	85.4	374.9	392.5	365.1	382.2	5.99	2035	2130	116	124	175	185	22.86	23.97	61.2	64.2
80	**81.0**	**84.9**	**380.6**	**398.4**	**370.4**	**387.8**	**6.17**	**2036**	**2132**	**116**	**124**	**175**	**185**	**23.21**	**24.34**	**61.2**	**64.2**
81	80.5	84.4	386.2	404.3	375.7	393.3	6.35	2037	2133	116	124	175	185	23.55	24.69	61.2	64.2
82	80.0	83.9	391.8	410.2	381.0	398.8	6.54	2038	2135	116	124	175	185	23.89	25.05	61.3	64.3
83	79.5	83.4	397.4	416.0	386.1	404.3	6.73	2040	2137	116	124	175	185	24.23	25.41	61.3	64.3
84	79.0	82.9	402.9	421.8	391.3	409.7	6.94	2041	2138	116	124	175	185	24.54	25.74	61.3	64.3
85	**78.6**	**82.4**	**408.4**	**427.6**	**396.4**	**415.0**	**7.14**	**2042**	**2140**	**116**	**124**	**175**	**185**	**24.87**	**26.09**	**61.3**	**64.3**
86	78.1	81.9	413.9	433.4	401.5	420.3	7.34	2043	2141	116	124	175	185	25.20	26.43	61.3	64.3
87	77.6	81.4	419.3	439.1	406.5	425.6	7.55	2045	2143	116	124	175	185	25.53	26.78	61.4	64.4
88	77.1	80.9	424.7	444.7	411.5	430.8	7.76	2046	2144	116	124	175	185	25.86	27.12	61.4	64.4
89	76.6	80.4	430.1	450.3	416.4	436.0	7.97	2047	2146	116	124	175	185	26.18	27.46	61.4	64.4
90	**76.2**	**80.0**	**435.4**	**455.9**	**421.3**	**441.2**	**8.21**	**2049**	**2148**	**116**	**124**	**175**	**185**	**26.48**	**27.77**	**61.4**	**64.4**
91	75.8	79.5	440.7	461.5	426.1	446.3	8.43	2049	2148	116	124	175	185	26.82	28.13	61.5	64.5
92	75.3	79.1	446.0	467.1	431.0	451.3	8.67	2050	2150	116	124	175	185	27.11	28.44	61.5	64.5
93	74.9	78.6	451.2	472.6	435.7	456.3	8.91	2051	2151	116	124	175	185	27.43	28.77	61.5	64.5
94	74.4	78.2	456.4	478.0	440.5	461.3	9.15	2052	2152	116	124	175	185	27.74	29.10	61.5	64.5
95	**74.0**	**77.8**	**461.6**	**483.5**	**445.2**	**466.2**	**9.43**	**2054**	**2154**	**116**	**124**	**175**	**185**	**28.05**	**29.42**	**61.5**	**64.6**
96	73.6	77.4	466.8	488.9	449.8	471.1	9.67	2054	2155	116	124	175	185	28.35	29.75	61.6	64.6
97	73.2	77.0	471.9	494.3	454.4	476.0	9.94	2056	2157	116	124	175	185	28.64	30.04	61.6	64.6
98	72.8	76.6	477.0	499.6	459.0	480.8	10.21	2056	2157	116	124	175	185	28.96	30.38	61.6	64.7
99	72.5	76.2	482.1	505.0	463.6	485.6	10.48	2058	2159	116	124	174	185	29.24	30.68	61.6	64.6
100	**72.1**	**75.8**	**487.1**	**510.3**	**468.1**	**490.3**	**10.76**	**2059**	**2161**	**116**	**124**	**174**	**185**	**29.54**	**30.99**	**61.6**	**64.7**

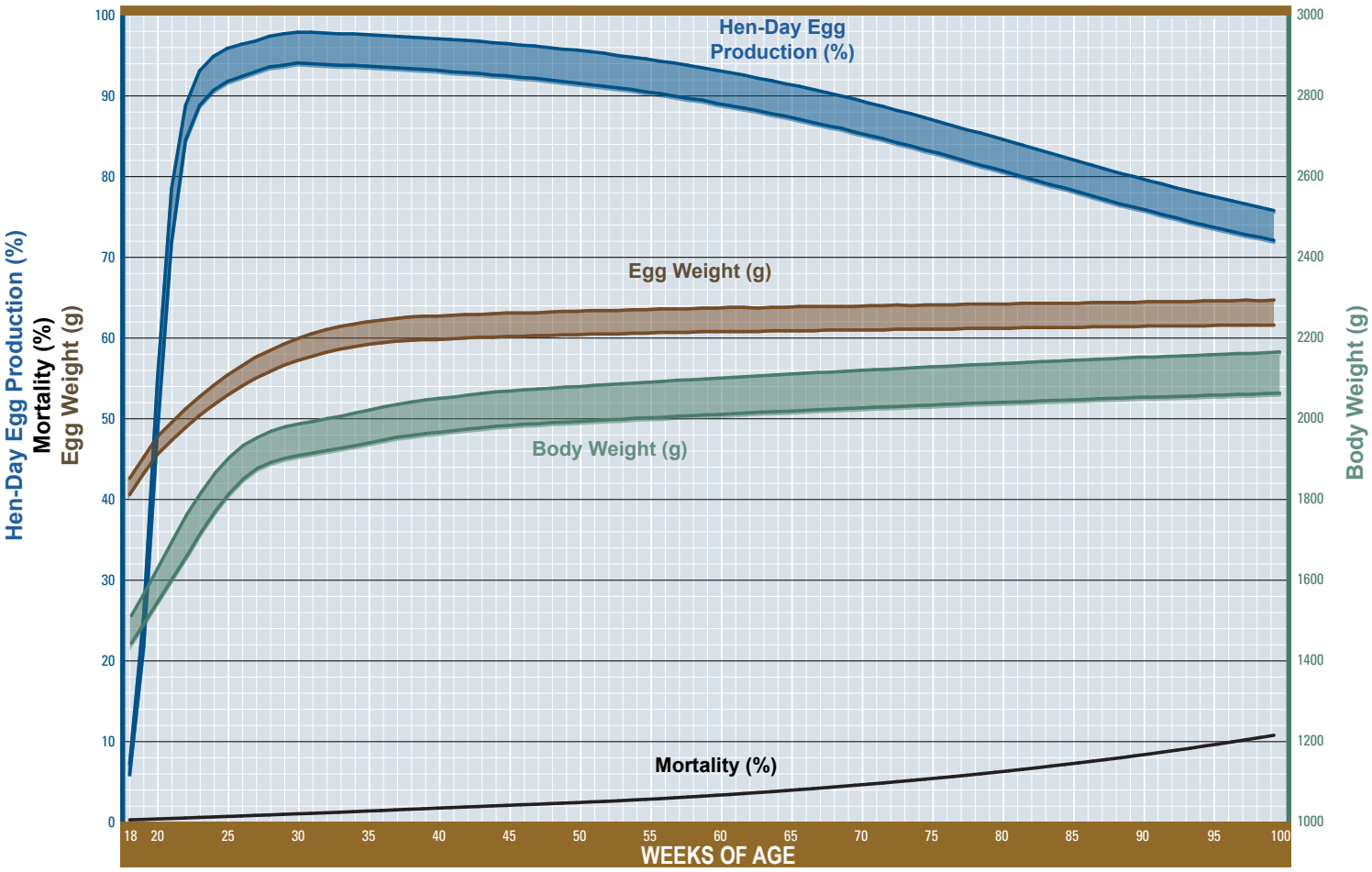
Production Period Space Recommendations

(check local regulations concerning space requirements)

- Useable space is calculated as litter floor and raised slat areas, not including perch space.
- Rearing density depends on age of transfer to the laying facility.

Floor	7–9 birds/m^2 of useable space. Higher stocking densities can be used in aviary systems. Consult equipment manufacturers.
Feeders	5cm/bird (with access on both sides); 10 cm/bird (with access on one side); 4 cm/bird with circular feeders
Drinkers	Nipples/cups: 1 per 10 birds; circular drinkers: 1 cm/bird; linear drinker: 2.5 cm per bird
Perches	10–15 cm/bird
Nests	5 birds/nest or 120 birds per m^2 in colony nests

Performance Graph



Egg Quality and Egg Size Distribution

AGE (weeks)	HAUGH UNITS	BREAKING STRENGTH	SHELL COLOR
20	**97.8**	**4605**	**93**
22	97.0	4590	93
24	96.0	4580	93
26	95.1	4570	92
28	94.2	4560	92
30	**93.3**	**4540**	**92**
32	92.2	4515	92
34	91.5	4490	92
36	90.6	4450	91
38	90.0	4425	91
40	**89.3**	**4405**	**91**
42	88.5	4375	91
44	87.8	4355	91
46	87.1	4320	91
48	86.4	4305	91
50	**85.6**	**4280**	**90**
52	85.0	4250	89
54	84.6	4225	89
56	84.0	4190	88
58	83.1	4170	88
60	**82.6**	**4150**	**88**
62	82.2	4130	87
64	81.9	4110	86
66	81.6	4095	86
68	81.5	4085	85
70	**81.1**	**4075**	**84**
72	81.0	4065	84
74	80.8	4055	83
76	80.5	4040	83
78	80.2	4020	83
80	**80.1**	**3995**	**83**
82	80.0	3985	82
84	79.9	3975	81
86	79.8	3965	81
88	79.7	3960	81
90	**79.7**	**3955**	**81**

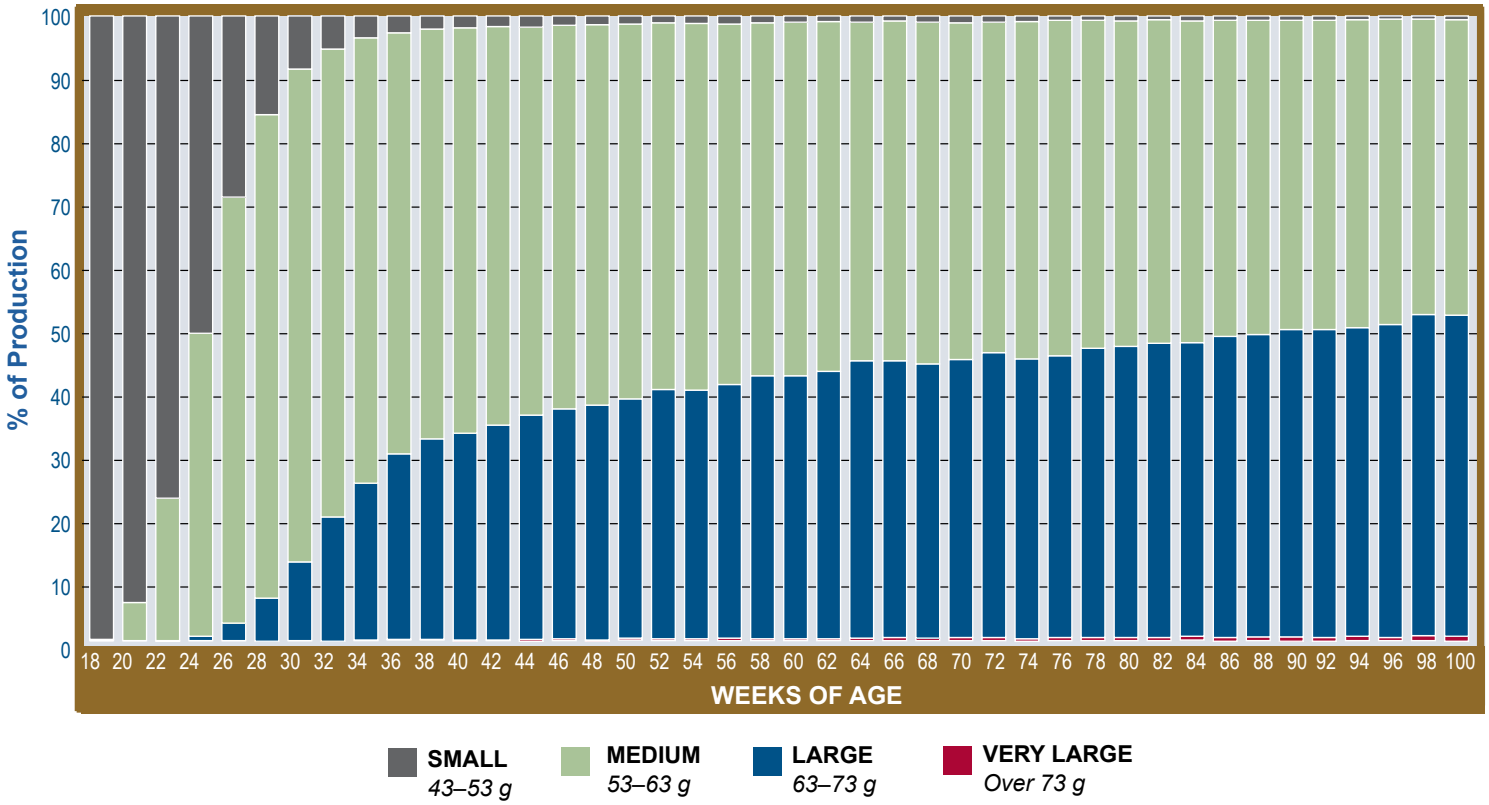
EU Standards–Weekly*

AGE (weeks)	AVG.EGG WT. (g)	% SMALL 43–53 g	% MEDIUM 53–63 g	% LARGE 63–73 g	% VERY LARGE Over 73 g
18	41.6	99.8	0.2	0.0	0.0
20	**46.7**	**93.9**	**6.1**	**0.0**	**0.0**
22	50.0	77.2	22.8	0.1	0.0
24	52.9	50.8	48.5	0.7	0.0
26	55.3	29.0	68.2	2.8	0.0
28	57.1	15.8	77.4	6.9	0.0
30	**58.5**	**8.5**	**78.9**	**12.6**	**0.0**
32	59.6	5.3	74.9	19.9	0.0
34	60.3	3.5	71.3	25.1	0.1
36	60.8	2.7	67.4	29.7	0.1
38	61.2	2.1	65.6	32.1	0.1
40	**61.3**	**1.9**	**64.9**	**33.1**	**0.2**
42	61.4	1.7	63.8	34.4	0.1
44	61.6	1.8	62.1	35.9	0.3
46	61.6	1.5	61.4	36.8	0.3
48	61.8	1.4	60.9	37.6	0.2
50	**61.9**	**1.3**	**60.0**	**38.3**	**0.3**
52	62.0	1.1	58.7	39.9	0.3
54	62.0	1.2	58.7	39.8	0.3
56	62.1	1.3	57.7	40.6	0.4
58	62.2	1.1	56.5	42.1	0.3
60	**62.2**	**1.0**	**56.6**	**42.1**	**0.3**
62	62.3	0.9	56.0	42.8	0.3
64	62.4	1.0	54.2	44.4	0.4
66	62.4	0.8	54.4	44.3	0.5
68	62.4	1.0	54.7	43.9	0.4
70	**62.4**	**1.1**	**53.9**	**44.5**	**0.5**
72	62.5	1.0	52.9	45.6	0.5
74	62.6	0.9	54.0	44.8	0.4
76	62.6	0.7	53.7	45.1	0.5
78	62.7	0.7	52.5	46.3	0.5
80	**62.7**	**0.8**	**52.1**	**46.6**	**0.5**
82	62.8	0.6	51.8	47.1	0.5
84	62.8	0.8	51.5	47.0	0.6
86	62.8	0.7	50.6	48.2	0.6
88	62.9	0.7	50.3	48.4	0.6
90	**62.9**	**0.7**	**49.5**	**49.2**	**0.7**
92	63.0	0.7	49.5	49.3	0.6
94	63.0	0.6	49.3	49.4	0.7
96	63.1	0.5	48.9	50.1	0.5
98	63.1	0.5	47.3	51.4	0.8
100	**63.2**	**0.6**	**47.3**	**51.4**	**0.8**

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

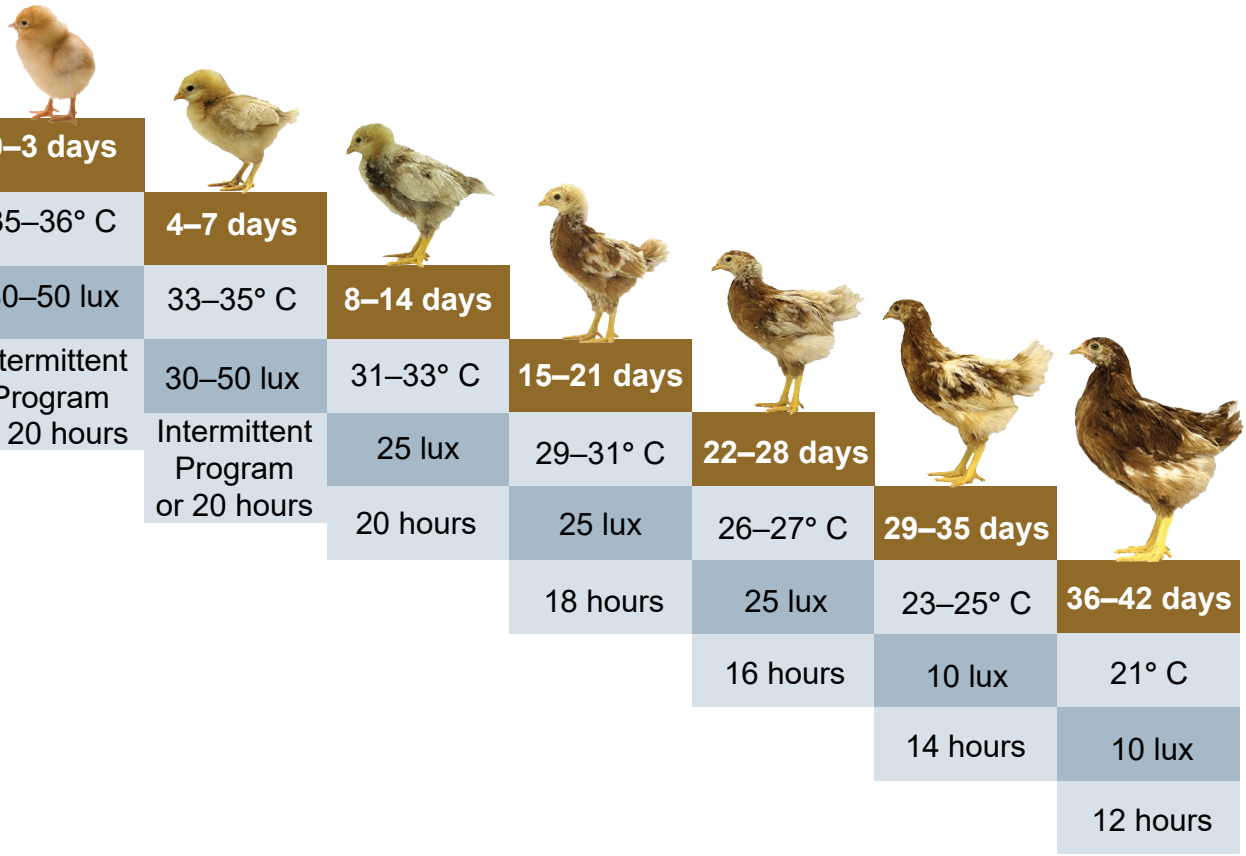
Egg Size Distribution (cont.)

EU Standards–Weekly*



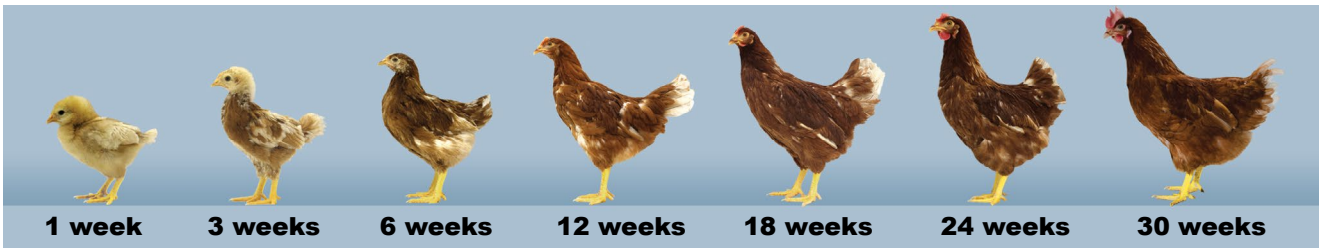
** Distribution of egg sizes based on weekly (not cumulative) average egg weights.*

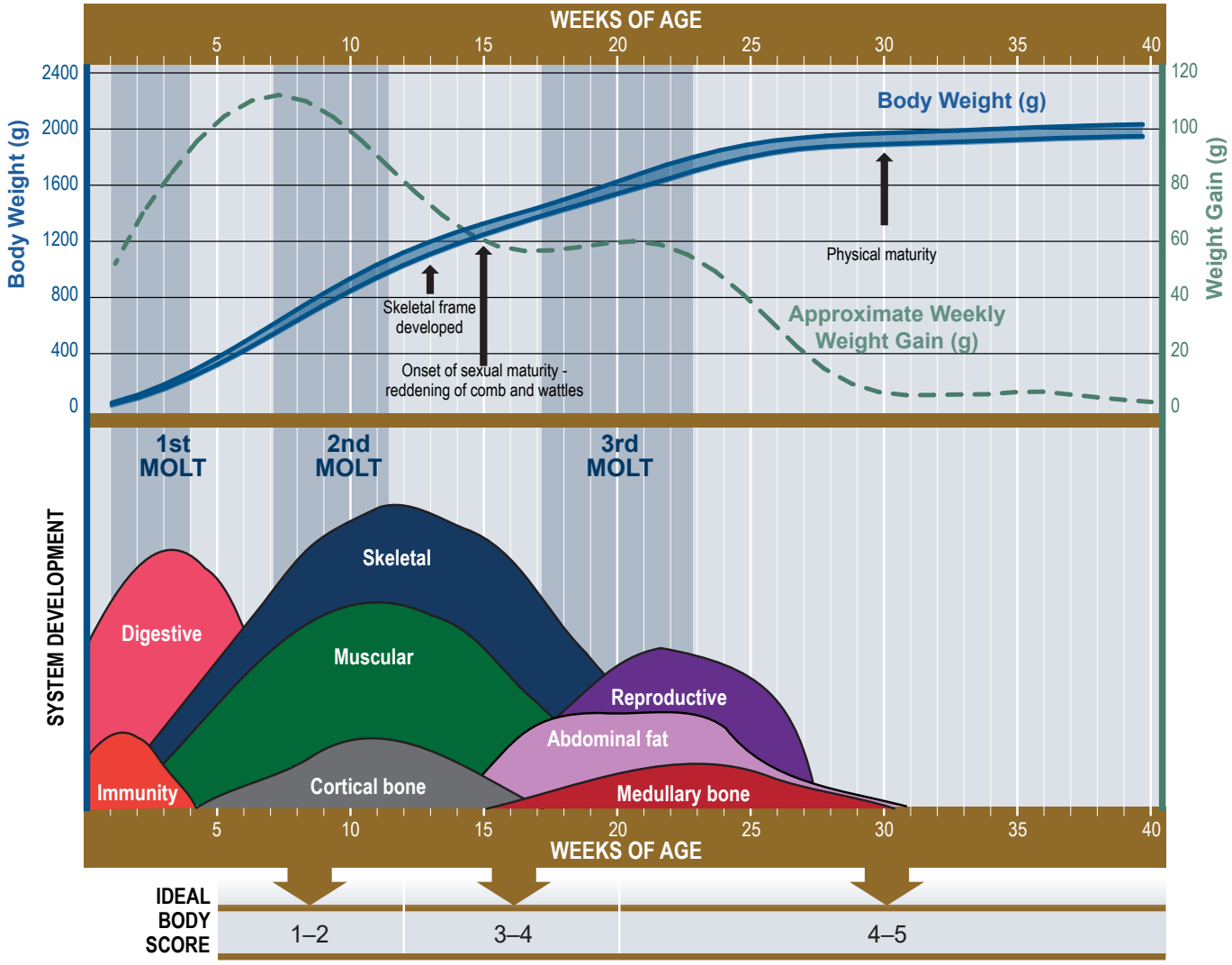
Brooding Temperature and Lighting Recommendations



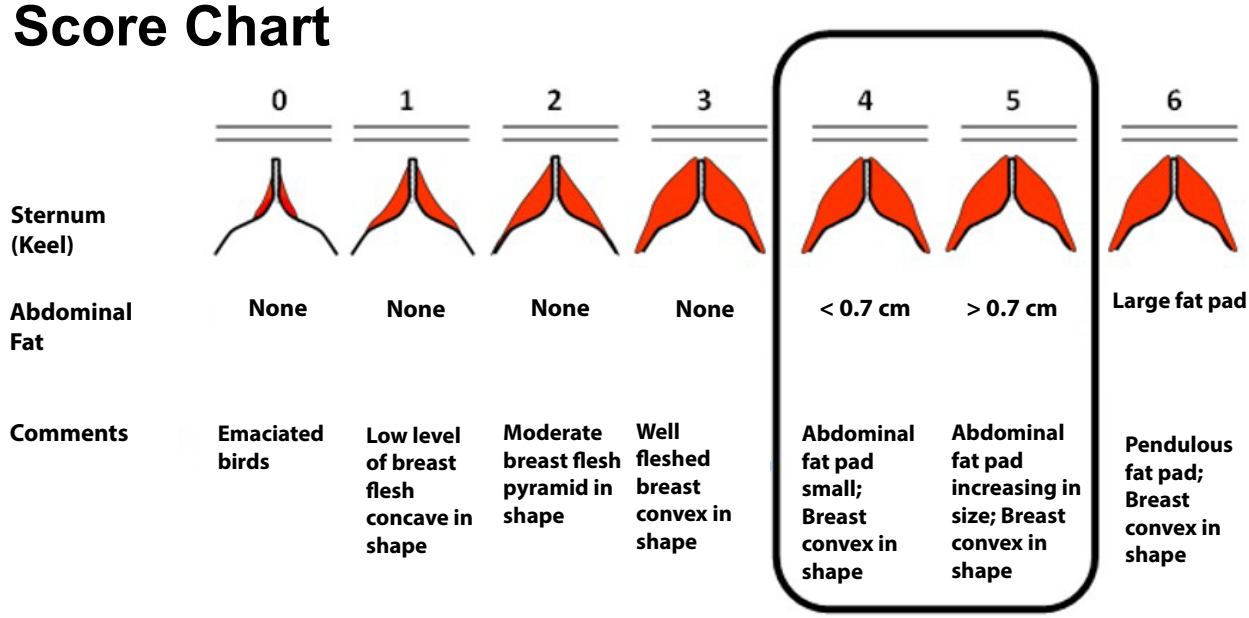
AGE	0–3 days	4–7 days	8–14 days	15–21 days	22–28 days	29–35 days	36–42 days
AIR TEMP. (FLOOR)	35–36° C	33–35° C	31–33° C	29–31° C	26–27° C	23–25° C	21° C
LIGHT INTENSITY	30–50 lux	30–50 lux	25 lux	25 lux	25 lux	10 lux	10 lux
LIGHT HOURS	Intermittent Program or 20 hours	Intermittent Program or 20 hours	20 hours	18 hours	16 hours	14 hours	12 hours

Development of the Organ Systems in Pullets

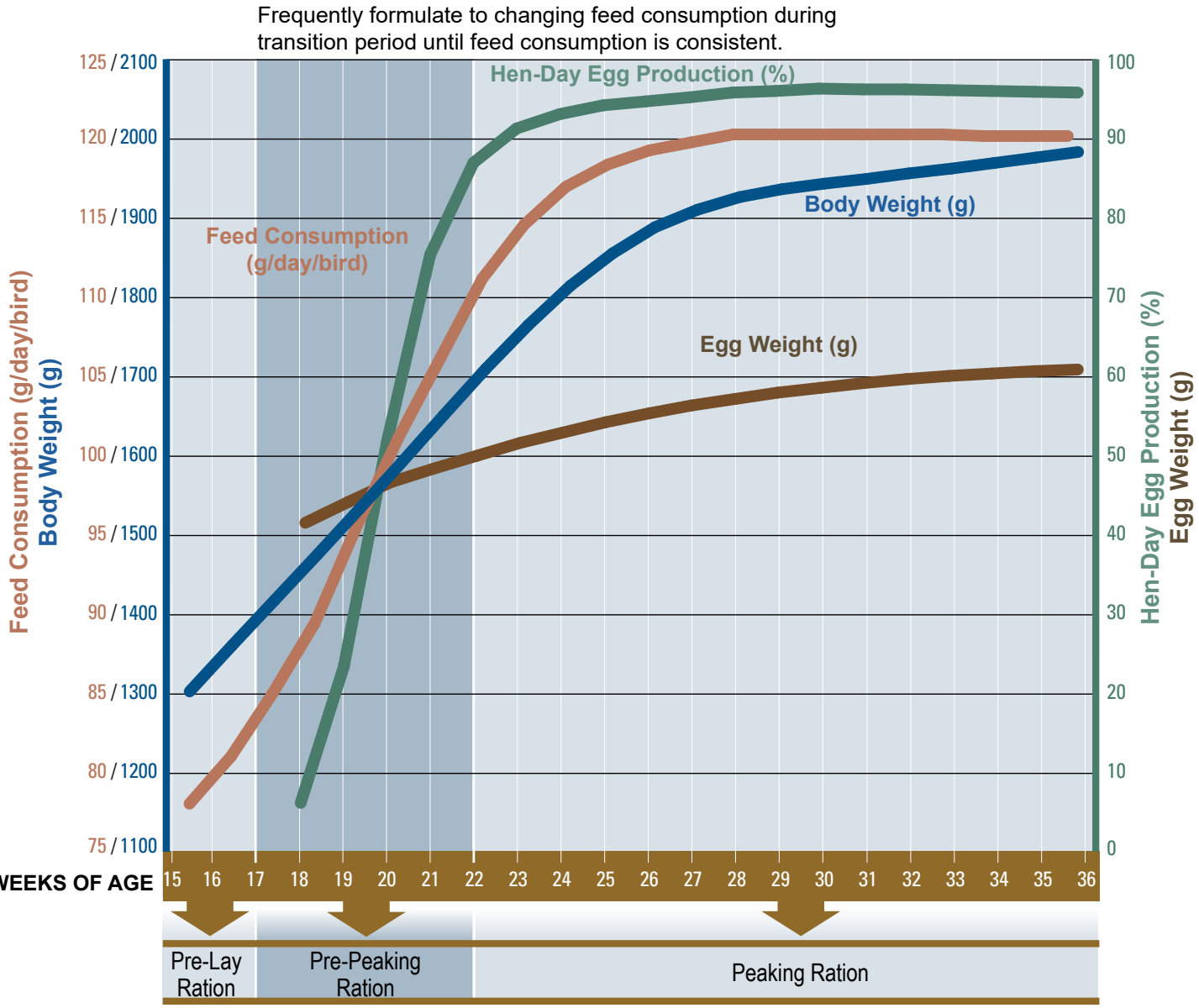




Body Score Chart



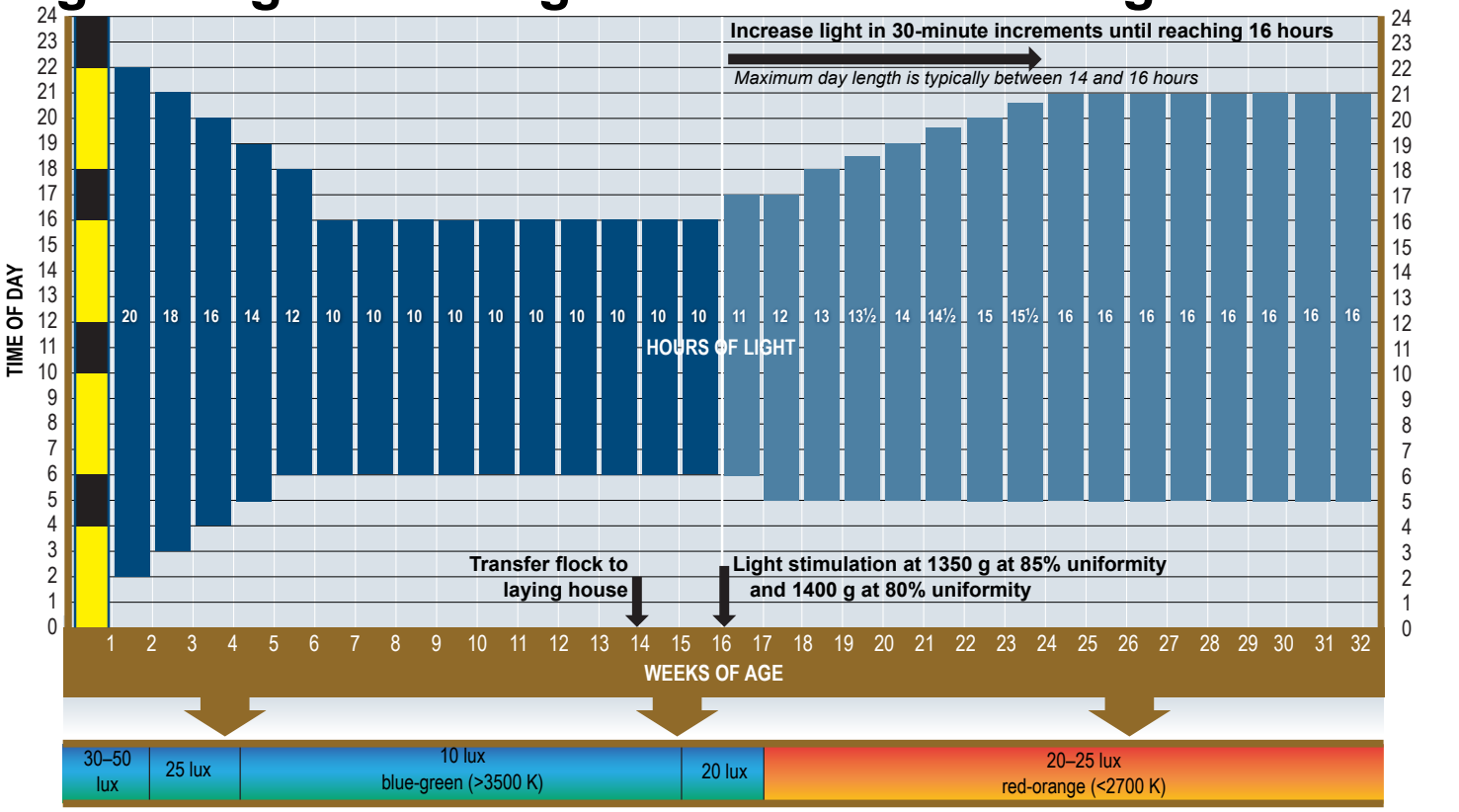
Transition Period from Rear to Peak Egg Production



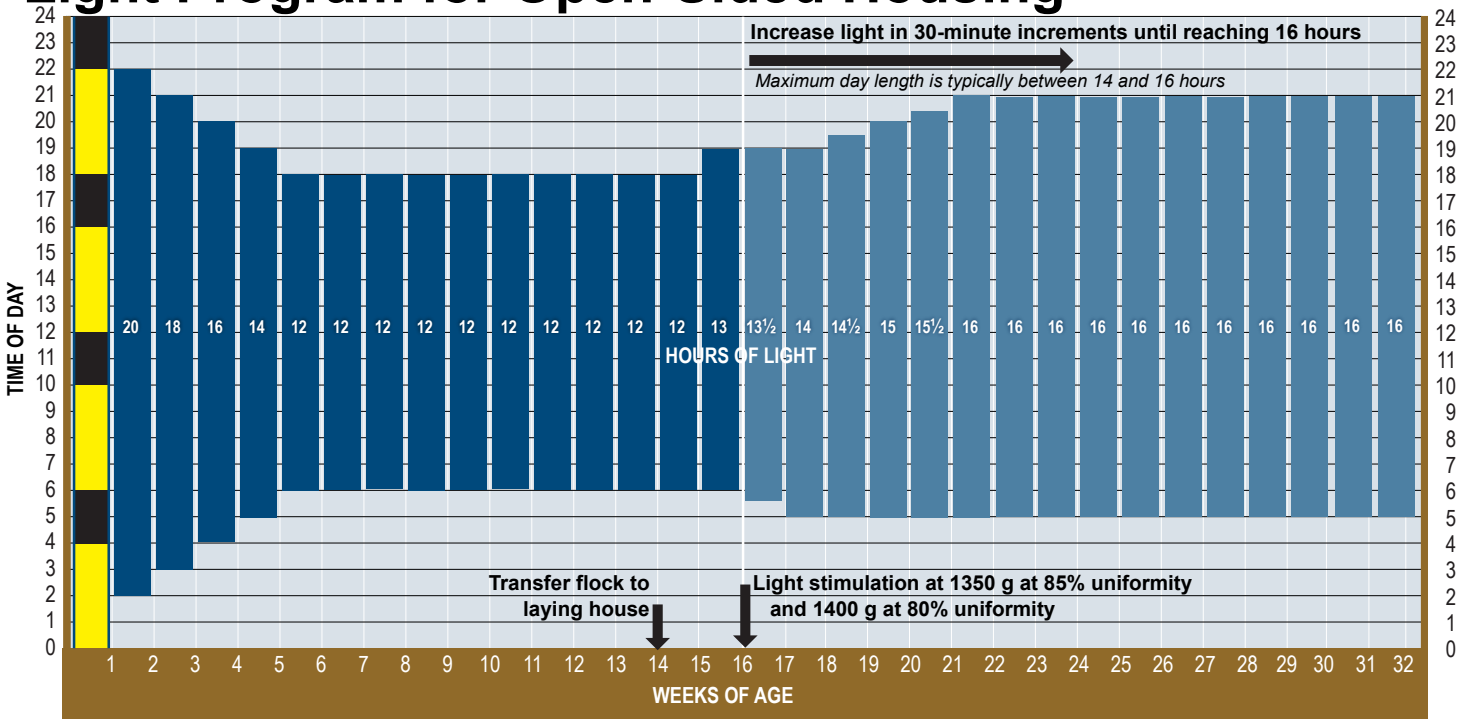
Pre-Peak

- 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 utilised 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



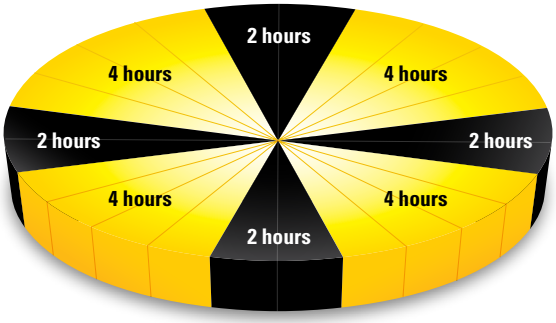
Light Program for Open-Sided Housing



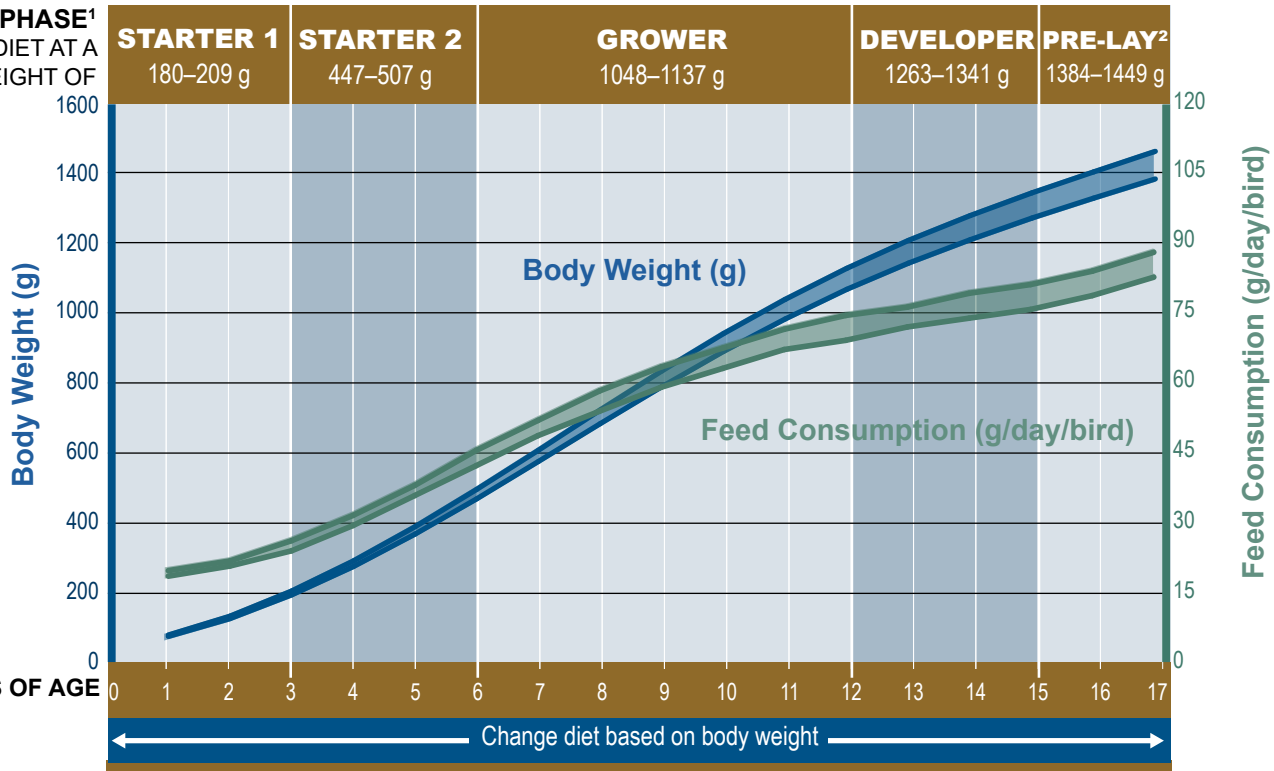
Note: You can achieve 12 hours or more of constant light by 6 weeks of age, depending on the total day length planned at 16 weeks.

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				
Metabolisable energy[3], kcal/kg	2935 / 3085	2885 / 3035	2733 / 2883	2632 / 2782	2683 / 2833
Metabolisable energy[3], MJ/kg	12.28 / 12.91	12.07 / 12.70	11.43 / 12.06	11.01 / 11.64	11.23 / 11.85
	Standardised Ileal Digestible Amino Acids / Total Amino Acids[4]				
Lysine, %	1.05 / 1.15	0.91 / 1.00	0.80 / 0.87	0.65 / 0.71	0.79 / 0.86
Methionine, %	0.47 / 0.51	0.42 / 0.45	0.38 / 0.42	0.30 / 0.32	0.38 / 0.41
Methionine+Cystine,%	0.80 / 0.90	0.71 / 0.80	0.64 / 0.72	0.54 / 0.62	0.68 / 0.76
Threonine, %	0.68 / 0.80	0.60 / 0.70	0.54 / 0.62	0.44 / 0.53	0.55 / 0.64
Tryptophan, %	0.19 / 0.22	0.17 / 0.20	0.17 / 0.19	0.14 / 0.17	0.18 / 0.22
Arginine, %	1.09 / 1.18	0.95 / 1.03	0.83 / 0.89	0.68 / 0.73	0.82 / 0.89
Isoleucine, %	0.74 / 0.79	0.66 / 0.70	0.59 / 0.64	0.49 / 0.52	0.61 / 0.66
Valine, %	0.76 / 0.83	0.68 / 0.74	0.62 / 0.69	0.52 / 0.57	0.67 / 0.74
Crude protein[5], %	19.44	17.57	16.29	15.00	17.12
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. Ration changes through rear must be based on body weight rather than age.

[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.

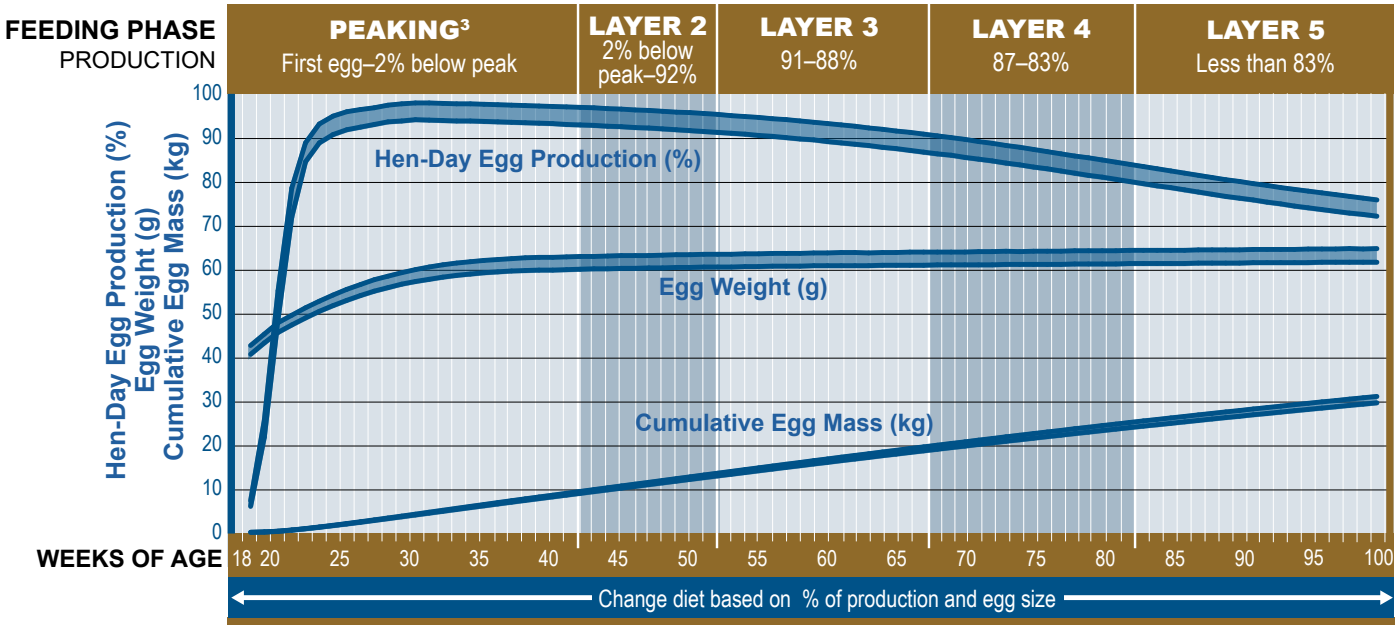
[4] Recommendation for Total Amino Acids is only appropriate to corn and soybean meal diet. Where diets utilise other ingredients, recommendations for Standardised Ileal Digestible Amino Acids must be followed.

[5] Diets should always be formulated to provide required intake of amino acid. Concentration of crude protein in diet will vary with raw material 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. Introduction of up to 50% coarse limestone of the pre-lay diet can help familiarize the bird to a coarser form of limestone and help support positive behaviour.

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

Production Period Nutritional Recommendations for Egg Numbers[1,2]



NUTRITION	RECOMMENDED DAILY NUTRIENT INTAKE				
Metabolisable energy[4], kcal/bird/day	325 / 335	325 / 335	323 / 333	320 / 330	317 / 327
Metabolisable energy[4], MJ/bird/day	1.36 / 1.40	1.36 / 1.40	1.35 / 1.39	1.34 / 1.38	1.33 / 1.37
	Standardised Ileal Digestible Amino Acids / Total Amino Acids[5]				
Lysine, mg/day	850 / 931	850 / 931	820 / 898	790 / 865	760 / 832
Methionine , mg/day	425 / 457	425 / 457	410 / 441	395 / 425	380 / 409
M+C, mg/day	765 / 863	765 / 863	738 / 832	711 / 802	684 / 771
Threonine, mg/day	621 / 730	621 / 730	599 / 704	577 / 678	555 / 653
Tryptophan, mg/day	187 / 224	187 / 224	180 / 216	174 / 208	167 / 200
Arginine, mg/day	884 / 950	884 / 950	853 / 917	822 / 883	790 / 850
Isoleucine, mg/day	680 / 731	680 / 731	656 / 705	632 / 680	608 / 654
Valine, mg/day	748 / 825	748 / 825	722 / 796	695 / 767	669 / 738
Crude protein[6], g/day	18.10	18.10	17.45	16.80	16.10
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%	90%
Threonine	73%	73%	73%	73%	73%
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 Egg Numbers[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**																								
ME[4], kcal/bird/day	325 / 335					325 / 335					323 / 333					320 / 330					317 / 327				
ME[4], MJ/bird/day	1.36 / 1.40					1.36 / 1.40					1.35 / 1.39					1.34 / 1.38					1.33 / 1.37				
FEED CONSUMPTION (*Typical Feed Consumption)																									
g/day/bird	90	95	**100**	105	110	105	110	**115**	120	125	105	111	**117**	123	129	105	111	**117**	123	129	105	111	**117**	123	129
Standardised Ileal Digestible Amino Acids																									
Lysine, %	0.94	0.89	**0.85**	0.81	0.77	0.81	0.77	**0.74**	0.71	0.68	0.78	0.74	**0.70**	0.67	0.64	0.75	0.71	**0.68**	0.64	0.61	0.72	0.68	**0.65**	0.62	0.59
Methionine, %	0.47	0.45	**0.43**	0.40	0.39	0.40	0.39	**0.37**	0.35	0.34	0.39	0.37	**0.35**	0.33	0.32	0.38	0.36	**0.34**	0.32	0.31	0.36	0.34	**0.32**	0.31	0.29
M+C, %	0.85	0.81	**0.77**	0.73	0.70	0.73	0.70	**0.67**	0.64	0.61	0.70	0.66	**0.63**	0.60	0.57	0.68	0.64	**0.61**	0.58	0.55	0.65	0.62	**0.58**	0.56	0.53
Threonine, %	0.69	0.65	**0.62**	0.59	0.56	0.59	0.56	**0.54**	0.52	0.50	0.57	0.54	**0.51**	0.49	0.46	0.55	0.52	**0.49**	0.47	0.45	0.53	0.50	**0.47**	0.45	0.43
Tryptophan, %	0.21	0.20	**0.19**	0.18	0.17	0.18	0.17	**0.16**	0.16	0.15	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.14	0.13	0.16	0.15	**0.14**	0.14	0.13
Arginine, %	0.98	0.93	**0.88**	0.84	0.80	0.84	0.80	**0.77**	0.74	0.71	0.81	0.77	**0.73**	0.69	0.66	0.78	0.74	**0.70**	0.67	0.64	0.75	0.71	**0.68**	0.64	0.61
Isoleucine, %	0.76	0.72	**0.68**	0.65	0.62	0.65	0.62	**0.59**	0.57	0.54	0.62	0.59	**0.56**	0.53	0.51	0.60	0.57	**0.54**	0.51	0.49	0.58	0.55	**0.52**	0.49	0.47
Valine, %	0.83	0.79	**0.75**	0.71	0.68	0.71	0.68	**0.65**	0.62	0.60	0.69	0.65	**0.62**	0.59	0.56	0.66	0.63	**0.59**	0.57	0.54	0.64	0.60	**0.57**	0.54	0.52
Total Amino Acids[5]																									
Lysine, %	1.03	0.98	**0.93**	0.89	0.85	0.89	0.85	**0.81**	0.78	0.74	0.86	0.81	**0.77**	0.73	0.70	0.82	0.78	**0.74**	0.70	0.67	0.79	0.75	**0.71**	0.68	0.64
Methionine, %	0.51	0.48	**0.46**	0.44	0.42	0.44	0.42	**0.40**	0.38	0.37	0.42	0.40	**0.38**	0.36	0.34	0.40	0.38	**0.36**	0.35	0.33	0.39	0.37	**0.35**	0.33	0.32
M+C, %	0.96	0.91	**0.86**	0.82	0.78	0.82	0.78	**0.75**	0.72	0.69	0.79	0.75	**0.71**	0.68	0.64	0.76	0.72	**0.69**	0.65	0.62	0.73	0.69	**0.66**	0.63	0.60
Threonine, %	0.81	0.77	**0.73**	0.70	0.66	0.70	0.66	**0.63**	0.61	0.58	0.67	0.63	**0.60**	0.57	0.55	0.65	0.61	**0.58**	0.55	0.53	0.62	0.59	**0.56**	0.53	0.51
Tryptophan, %	0.25	0.24	**0.22**	0.21	0.20	0.21	0.20	**0.19**	0.19	0.18	0.21	0.19	**0.18**	0.18	0.17	0.20	0.19	**0.18**	0.17	0.16	0.19	0.18	**0.17**	0.16	0.16
Arginine, %	1.06	1.00	**0.95**	0.90	0.86	0.90	0.86	**0.83**	0.79	0.76	0.87	0.83	**0.78**	0.75	0.71	0.84	0.80	**0.75**	0.72	0.68	0.81	0.77	**0.73**	0.69	0.66
Isoleucine, %	0.81	0.77	**0.73**	0.70	0.66	0.70	0.66	**0.64**	0.61	0.58	0.67	0.64	**0.60**	0.57	0.55	0.65	0.61	**0.58**	0.55	0.53	0.62	0.59	**0.56**	0.53	0.51
Valine, %	0.92	0.87	**0.83**	0.79	0.75	0.79	0.75	**0.72**	0.69	0.66	0.76	0.72	**0.68**	0.65	0.62	0.73	0.69	**0.66**	0.62	0.59	0.70	0.66	**0.63**	0.60	0.57
Crude protein[6], %	20.11	19.05	**18.10**	17.24	16.45	17.24	16.45	**15.74**	15.08	14.48	16.62	15.72	**14.91**	14.19	13.53	16.00	15.14	**14.36**	13.66	13.02	15.33	14.50	**13.76**	13.09	12.48
Sodium, %	0.20	0.19	**0.18**	0.17	0.16	0.16	0.15	**0.15**	0.14	0.14	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13
Chloride, %	0.20	0.19	**0.18**	0.17	0.16	0.16	0.15	**0.15**	0.14	0.14	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13
Linoleic acid (C18:2 n-6), %	1.78	1.68	**1.60**	1.52	1.45	1.43	1.36	**1.30**	1.25	1.20	1.33	1.26	**1.20**	1.14	1.09	1.33	1.26	**1.20**	1.14	1.09	1.33	1.26	**1.20**	1.14	1.09
Choline, mg/kg	2000	1895	**1800**	1714	1636	1714	1636	**1565**	1500	1440	1714	1622	**1538**	1463	1395	1714	1622	**1538**	1463	1395	1714	1622	**1538**	1463	1395

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	111	117	100	105	111	117	123	129	100	105	111	117	123	129	100	105	111	117	123	129	100	105	111	117	123	129
Calcium[7,8], %	4.44	4.21	4.00	3.81	3.60	3.42	4.20	4.00	3.78	3.59	3.41	3.26	4.40	4.19	3.96	3.76	3.58	3.41	4.60	4.38	4.14	3.93	3.74	3.57	4.70	4.48	4.23	4.02	3.82	3.64
Phosphorus (available)[7,9], %	0.48	0.46	0.43	0.41	0.39	0.37	0.41	0.39	0.37	0.35	0.33	0.31	0.37	0.36	0.34	0.32	0.30	0.29	0.35	0.33	0.31	0.30	0.28	0.27	0.32	0.31	0.29	0.28	0.26	0.25
Phosphorus (digestible), %	0.43	0.41	0.39	0.37	0.35	0.33	0.37	0.35	0.33	0.31	0.30	0.28	0.34	0.32	0.30	0.29	0.27	0.26	0.31	0.30	0.28	0.27	0.25	0.24	0.29	0.28	0.26	0.25	0.24	0.23

[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 optimise 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 utilise other ingredients, recommendations for Standardised Ileal Digestible Amino Acids must be followed.

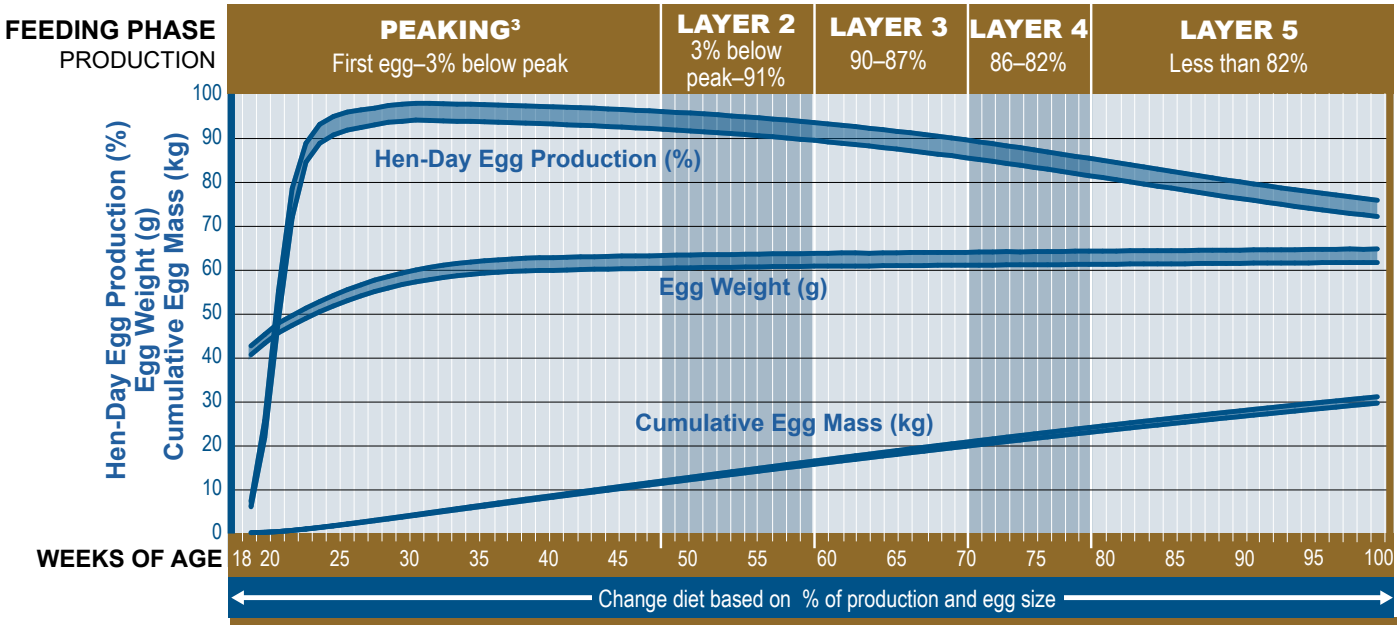
[6] Diets should always be formulated to provide required intake of amino acid. Concentration of crude protein in diet will vary with raw material used. Crude protein value provided is an estimated typical value only.

[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 at hyline.com. 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 Egg Weight[1,2]



NUTRITION	RECOMMENDED DAILY NUTRIENT INTAKE				
Metabolisable energy[4], kcal/bird/day	330 / 340	330 / 340	326 / 336	323 / 333	320 / 330
Metabolisable energy[4], MJ/bird/day	1.38 / 1.42	1.38 / 1.42	1.36 / 1.41	1.35 / 1.39	1.34 / 1.38
	Standardised Ileal Digestible Amino Acids / Total Amino Acids[5]				
Lysine, mg/day	890 / 974	890 / 974	850 / 931	820 / 898	790 / 865
Methionine , mg/day	445 / 478	445 / 478	425 / 457	410 / 441	395 / 425
M+C, mg/day	819 / 923	810 / 913	765 / 863	738 / 832	711 / 802
Threonine, mg/day	623 / 733	623 / 733	595 / 700	574 / 675	553 / 651
Tryptophan, mg/day	196 / 234	196 / 234	187 / 224	180 / 216	174 / 208
Arginine, mg/day	925 / 995	926 / 995	884 / 950	853 / 917	822 / 883
Isoleucine, mg/day	730 / 785	721 / 775	680 / 731	656 / 705	632 / 680
Valine, mg/day	801 / 883	792 / 874	748 / 825	722 / 796	695 / 767
Crude protein[6], g/day	19.00	19.00	18.00	17.45	16.80
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 Egg Weight[1,2]

FEEDING PHASE	PEAKING[3] First egg until production drops 3% below peak					LAYER 2 3% below peak to 91%					LAYER 3 90–87%					LAYER 4 86–82%					LAYER 5 Less than 82%				
PRODUCTION NUTRITION	**RECOMMENDED CONCENTRATION**																								
ME[4], kcal/bird/day	330 / 340					330 / 340					326 / 336					323 / 333					320 / 330				
ME[4], MJ/bird/day	1.38 / 1.42					1.38 / 1.42					1.36 / 1.41					1.35 / 1.39					1.34 / 1.38				
FEED CONSUMPTION (*Typical Feed Consumption)																									
g/day/bird	90	95	**100**	105	110	105	110	**115**	120	125	105	111	**117**	123	129	105	111	**117**	123	129	105	111	**117**	123	129
Standardised Ileal Digestible Amino Acids																									
Lysine, %	0.99	0.94	**0.89**	0.85	0.81	0.85	0.81	**0.77**	0.74	0.71	0.81	0.77	**0.73**	0.69	0.66	0.78	0.74	**0.70**	0.67	0.64	0.75	0.71	**0.68**	0.64	0.61
Methionine, %	0.49	0.47	**0.45**	0.42	0.40	0.42	0.40	**0.39**	0.37	0.36	0.40	0.38	**0.36**	0.35	0.33	0.39	0.37	**0.35**	0.33	0.32	0.38	0.36	**0.34**	0.32	0.31
M+C, %	0.91	0.86	**0.82**	0.78	0.74	0.77	0.74	**0.70**	0.68	0.65	0.73	0.69	**0.65**	0.62	0.59	0.70	0.66	**0.63**	0.60	0.57	0.68	0.64	**0.61**	0.58	0.55
Threonine, %	0.69	0.66	**0.62**	0.59	0.57	0.59	0.57	**0.54**	0.52	0.50	0.57	0.54	**0.51**	0.48	0.46	0.55	0.52	**0.49**	0.47	0.44	0.53	0.50	**0.47**	0.45	0.43
Tryptophan, %	0.22	0.21	**0.20**	0.19	0.18	0.19	0.18	**0.17**	0.16	0.16	0.18	0.17	**0.16**	0.15	0.14	0.17	0.16	**0.15**	0.15	0.14	0.17	0.16	**0.15**	0.14	0.13
Arginine, %	1.03	0.97	**0.93**	0.88	0.84	0.88	0.84	**0.81**	0.77	0.74	0.84	0.80	**0.76**	0.72	0.69	0.81	0.77	**0.73**	0.69	0.66	0.78	0.74	**0.70**	0.67	0.64
Isoleucine, %	0.81	0.77	**0.73**	0.70	0.66	0.69	0.66	**0.63**	0.60	0.58	0.65	0.61	**0.58**	0.55	0.53	0.62	0.59	**0.56**	0.53	0.51	0.60	0.57	**0.54**	0.51	0.49
Valine, %	0.89	0.84	**0.80**	0.76	0.73	0.75	0.72	**0.69**	0.66	0.63	0.71	0.67	**0.64**	0.61	0.58	0.69	0.65	**0.62**	0.59	0.56	0.66	0.63	**0.59**	0.57	0.54
Total Amino Acids[5]																									
Lysine, %	1.08	1.03	**0.97**	0.93	0.89	0.93	0.89	**0.85**	0.81	0.78	0.89	0.84	**0.80**	0.76	0.72	0.86	0.81	**0.77**	0.73	0.70	0.82	0.78	**0.74**	0.70	0.67
Methionine, %	0.53	0.50	**0.48**	0.46	0.43	0.46	0.43	**0.42**	0.40	0.38	0.44	0.41	**0.39**	0.37	0.35	0.42	0.40	**0.38**	0.36	0.34	0.40	0.38	**0.36**	0.35	0.33
M+C, %	1.03	0.97	**0.92**	0.88	0.84	0.87	0.83	**0.79**	0.76	0.73	0.82	0.78	**0.74**	0.70	0.67	0.79	0.75	**0.71**	0.68	0.64	0.76	0.72	**0.69**	0.65	0.62
Threonine, %	0.81	0.77	**0.73**	0.70	0.67	0.70	0.67	**0.64**	0.61	0.59	0.67	0.63	**0.60**	0.57	0.54	0.64	0.61	**0.58**	0.55	0.52	0.62	0.59	**0.56**	0.53	0.50
Tryptophan, %	0.26	0.25	**0.23**	0.22	0.21	0.22	0.21	**0.20**	0.20	0.19	0.21	0.20	**0.19**	0.18	0.17	0.21	0.19	**0.18**	0.18	0.17	0.20	0.19	**0.18**	0.17	0.16
Arginine, %	1.11	1.05	**1.00**	0.95	0.90	0.95	0.90	**0.87**	0.83	0.80	0.90	0.86	**0.81**	0.77	0.74	0.87	0.83	**0.78**	0.75	0.71	0.84	0.80	**0.75**	0.72	0.68
Isoleucine, %	0.87	0.83	**0.79**	0.75	0.71	0.74	0.70	**0.67**	0.65	0.62	0.70	0.66	**0.62**	0.59	0.57	0.67	0.64	**0.60**	0.57	0.55	0.65	0.61	**0.58**	0.55	0.53
Valine, %	0.98	0.93	**0.88**	0.84	0.80	0.83	0.79	**0.76**	0.73	0.70	0.79	0.74	**0.71**	0.67	0.64	0.76	0.72	**0.68**	0.65	0.62	0.73	0.69	**0.66**	0.62	0.59
Cr. protein[6], %	21.11	20.00	**19.00**	18.10	17.27	18.10	17.27	**16.52**	15.83	15.20	17.14	16.22	**15.38**	14.63	13.95	16.62	15.72	**14.91**	14.19	13.53	16.00	15.14	**14.36**	13.66	13.02
Sodium, %	0.20	0.19	**0.18**	0.17	0.16	0.16	0.15	**0.15**	0.14	0.14	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13
Chloride, %	0.20	0.19	**0.18**	0.17	0.16	0.16	0.15	**0.15**	0.14	0.14	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13	0.16	0.15	**0.15**	0.14	0.13
Linoleic acid (C18:2 n-6), %	2.22	2.11	**2.00**	1.90	1.82	1.90	1.82	**1.74**	1.67	1.60	1.52	1.44	**1.37**	1.30	1.24	1.43	1.35	**1.28**	1.22	1.16	1.33	1.26	**1.20**	1.14	1.09
Choline, mg/kg	1778	1684	**1600**	1524	1455	1714	1636	**1565**	1500	1440	1714	1622	**1538**	1463	1395	1714	1622	**1538**	1463	1395	1714	1622	**1538**	1463	1395

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	111	117	100	105	111	117	123	129	100	105	111	117	123	129	100	105	111	117	123	129	100	105	111	117	123	129
Calcium[7,8], %	4.44	4.21	4.00	3.81	3.60	3.42	4.20	4.00	3.78	3.59	3.41	3.26	4.40	4.19	3.96	3.76	3.58	3.41	4.60	4.38	4.14	3.93	3.74	3.57	4.70	4.48	4.23	4.02	3.82	3.64
Phosphorus (available)[7,9], %	0.48	0.46	0.43	0.41	0.39	0.37	0.41	0.39	0.37	0.35	0.33	0.31	0.37	0.36	0.34	0.32	0.30	0.29	0.35	0.33	0.31	0.30	0.28	0.27	0.32	0.31	0.29	0.28	0.26	0.25
Phosphorus (digestible), %	0.43	0.41	0.39	0.37	0.35	0.33	0.37	0.35	0.33	0.31	0.30	0.28	0.34	0.32	0.30	0.29	0.27	0.26	0.31	0.30	0.28	0.27	0.25	0.24	0.29	0.28	0.26	0.25	0.24	0.23

[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 optimise 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 utilise other ingredients, recommendations for Standardised 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 at hyline.com. 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
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 150-200 mg/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.

[8] Supplementing with up to 500 ppm of magnesium may be beneficial to support eggshell quality, particularly in aged hens or during periods of increased metabolic demand.

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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