

Hy-Line[®]

BROWN

Alternative Systems



Performance Guide



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.

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**Alternative Systems
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	1.49 kg
LAYING PERIOD (TO 90 WEEKS):	
Percent Peak	95–97%
Hen-Day Eggs to 60 Weeks	257.5–269.0
Hen-Day Eggs to 72 Weeks	328.9–343.4
Hen-Day Eggs to 90 Weeks	425.5–445.2
Hen-Housed Eggs to 60 Weeks	254.1–265.5
Hen-Housed Eggs to 72 Weeks	323.3–337.7
Hen-Housed Eggs to 90 Weeks	415.0–434.2
Livability to 60 Weeks	97%
Livability to 80 Weeks	95%
Livability to 90 Weeks	93%
Days to 50% Production (from hatch)	144
Egg Weight at 26 Weeks	58.4–61.8 g
Egg Weight at 32 Weeks	61.1–63.5 g
Egg Weight at 72 Weeks	63.9–66.6 g
Total Egg Mass per Hen-Housed (18–90 weeks)	27.0 kg
Body Weight at 32 Weeks	1.88–1.99 kg
Body Weight at 72 Weeks	1.93–2.04 kg
Freedom From Egg Inclusions	Excellent
Shell Strength	Excellent
Shell Color Score at 38 Weeks	87
Shell Color Score at 56 Weeks	85
Shell Color Score at 72 Weeks	81
Shell Color Score at 90 Weeks	79
Haugh Units at 38 Weeks	90
Haugh Units at 56 Weeks	84
Haugh Units at 72 Weeks	81
Haugh Units at 90 Weeks	80
Average Daily Feed Consumption (18–90 weeks)	117.9 g/day per bird
Feed Conversion Rate, kg Feed/kg Eggs (20–60 weeks)	1.93–2.24
Feed Conversion Rate, kg Feed/kg Eggs (20–72 weeks)	1.96–2.27
Feed Conversion Rate, kg Feed/kg Eggs (20–90 weeks)	2.03–2.36
Feed Utilization, kg Egg/kg Feed (20–60 weeks)	0.45–0.52
Feed Utilization, kg Egg/kg Feed (20–72 weeks)	0.44–0.51
Feed Utilization, kg Egg/kg Feed (20–90 weeks)	0.42–0.49
Feed Consumption per 10 Eggs (20–60 weeks)	1.23–1.37 kg
Feed Consumption per 10 Eggs (20–72 weeks)	1.26–1.40 kg
Feed Consumption per 10 Eggs (20–90 weeks)	1.31–1.47 kg
Feed Consumption per Dozen Eggs (20–60 weeks)	1.48–1.65 kg
Feed Consumption per Dozen Eggs (20–72 weeks)	1.51–1.68 kg
Feed Consumption per Dozen Eggs (20–90 weeks)	1.58–1.76 kg
Skin Color	Yellow
Condition of Droppings	Dry

Performance Summary data is based on results obtained from customers around the world. Please send your results to info@hyline.com. An easy to use record-keeping program, Hy-Line International EggCel, can be found at hyline.com.

Rearing Period Performance Table

AGE (weeks)	MORTALITY Cumulative (%)	BODY WEIGHT (kg)	WATER INTAKE (ml/bird/day)	FEED INTAKE (g/bird/day)	CUMULATIVE FEED INTAKE (g/bird to date)	UNIFORMITY %
1	0.40	0.06 – 0.07	18–28	12 – 14	84 – 98	>85%
2	0.55	0.12 – 0.13	25–42	17 – 21	201 – 244	
3	0.65	0.18 – 0.20	30–50	20 – 25	343 – 418	
4	0.75	0.26 – 0.29	37–60	25 – 30	515–627	>80%
5	0.85	0.35 – 0.38	43–73	29 – 36	717 – 883	
6	0.95	0.46 – 0.48	52–89	35 – 44	960 – 1193	
7	1.05	0.55 – 0.59	62–98	41 – 49	1249 – 1537	>85%
8	1.15	0.66 – 0.71	71–112	47 – 56	1580 – 1929	
9	1.25	0.77 – 0.82	78–122	52 – 61	1943 – 2355	
10	1.35	0.87 – 0.93	84–129	56 – 64	2334 – 2806	
11	1.45	0.98 – 1.04	90–137	60 – 69	2754 – 3287	
12	1.55	1.07 – 1.13	93–144	62 – 72	3189 – 3791	
13	1.63	1.15 – 1.22	96–148	64 – 74	3637 – 4308	
14	1.70	1.22 – 1.29	99–154	66 – 77	4099 – 4845	
15	1.78	1.29 – 1.36	102–158	68 – 79	4575 – 5399	
16	1.85	1.36 – 1.43	105–164	70 – 82	5066 – 5973	
17	2.00	1.42 – 1.50	108–170	72 – 85	5570 – 6568	>90%

Rearing Period Space Recommendations

(check local regulations concerning space requirements)

- Useable space is calculated as litter floor and raised slat areas, not including nest space or perch space.
- If the veranda (winter porch) floor space is considered as useable space when calculating stocking density, then the birds must be able to always access this area.
- Rearing density depends on age of transfer to the laying facility. Use the approximation at right.

Week of Transfer	Birds/m ² of Useable Space
15	15
16	14
17	13
18	12

	MULTI-TIER	FLOOR
Floor space	< 20 kg live weight per m ² 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 m ² 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

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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 WEIGHT (g/egg)
18	1.1–7.7	0.1–0.5	0.1–0.5	0.05	1.49–1.61	110–176	73–88	0.0	45.4–49.9
19	8.2–27.1	0.7–2.4	0.7–2.4	0.08	1.59–1.70	128–188	85–94	0.1	48.3–51.7
20	30.8–57.3	2.8–6.4	2.8–6.4	0.13	1.65–1.77	135–198	90–99	0.2	50.7–53.7
21	61.4–80.5	7.1–12.1	7.1–12.1	0.20	1.70–1.81	146–206	97–103	0.5	52.6–55.8
22	82.4–90.6	12.9–18.4	12.8–18.4	0.27	1.75–1.85	150–214	100–107	0.8	54.2–57.8
23	90.6–94.1	19.2–25.0	19.2–25.0	0.34	1.78–1.88	156–222	104–111	1.2	55.6–59.0
24	93.2–95.5	25.7–31.7	25.7–31.6	0.40	1.81–1.91	164–228	109–114	1.6	56.7–60.1
25	94.2–96.2	32.3–38.4	32.2–38.3	0.46	1.82–1.93	168–238	112–119	2.0	57.6–61.1
26	94.6–96.4	39.0–45.2	38.8–45.0	0.50	1.83–1.94	171–242	114–121	2.4	58.4–61.8
27	94.8–96.6	45.6–51.9	45.4–51.8	0.55	1.85–1.95	173–244	115–122	2.8	59.1–62.2
28	94.8–96.6	52.2–58.7	52.0–58.5	0.61	1.86–1.97	174–246	116–123	3.2	59.6–62.4
29	94.8–96.6	58.9–65.5	58.6–65.2	0.66	1.87–1.98	176–248	117–124	3.6	60.1–62.7
30	94.8–96.5	65.5–72.2	65.2–71.9	0.71	1.87–1.98	176–250	117–125	4.0	60.5–63.0
31	94.7–96.5	72.1–79.0	71.8–78.6	0.76	1.87–1.98	176–250	117–125	4.4	60.9–63.3
32	94.7–96.5	78.8–85.7	78.4–85.3	0.80	1.88–1.99	176–250	117–125	4.9	61.1–63.5
33	94.6–96.3	85.4–92.5	84.9–92.0	0.86	1.88–1.99	176–250	117–125	5.3	61.4–63.8
34	94.4–96.1	92.0–99.2	91.5–98.7	0.92	1.89–2.00	176–250	117–125	5.7	61.6–64.0
35	94.2–96.0	98.6–105.9	98.0–105.3	0.97	1.89–2.00	176–250	117–125	6.1	61.8–64.2
36	94.0–95.8	105.2–112.6	104.5–111.9	1.02	1.89–2.00	174–248	116–124	6.5	62.0–64.4
37	93.7–95.7	111.7–119.3	111.0–118.6	1.08	1.89–2.00	174–248	116–124	6.9	62.1–64.6
38	93.5–95.5	118.3–126.0	117.5–125.2	1.12	1.89–2.01	174–248	116–124	7.3	62.3–64.7
39	93.3–95.3	124.8–132.7	123.9–131.8	1.18	1.90–2.01	174–248	116–124	7.8	62.4–64.9
40	93.1–95.0	131.3–139.3	130.4–138.3	1.24	1.90–2.01	174–248	116–124	8.2	62.5–65.0
41	92.8–94.9	137.8–146.0	136.8–144.9	1.30	1.90–2.02	174–248	116–124	8.6	62.6–65.1
42	92.5–94.6	144.3–152.6	143.2–151.4	1.35	1.91–2.02	174–248	116–124	9.0	62.7–65.1
43	92.1–94.4	150.8–159.2	149.5–157.9	1.41	1.91–2.02	174–248	116–124	9.4	62.8–65.2
44	91.8–94.1	157.2–165.8	155.9–164.4	1.47	1.91–2.02	174–248	116–124	9.8	62.9–65.2
45	91.5–93.8	163.6–172.3	162.2–170.9	1.52	1.92–2.03	174–248	116–124	10.2	62.9–65.3
46	91.2–93.5	170.0–178.9	168.4–177.3	1.59	1.92–2.03	174–248	116–124	10.6	63.0–65.3
47	90.9–93.3	176.3–185.4	174.7–183.8	1.64	1.92–2.03	174–248	116–124	11.0	63.1–65.4
48	90.7–93.1	182.7–191.9	181.0–190.2	1.70	1.92–2.03	174–248	116–124	11.5	63.1–65.4
49	90.4–92.8	189.0–198.4	187.2–196.5	1.76	1.92–2.03	174–248	116–124	11.9	63.2–65.5
50	90.0–92.7	195.3–204.9	193.4–202.9	1.83	1.92–2.03	174–248	116–124	12.3	63.2–65.5
51	89.8–92.4	201.6–211.4	199.5–209.3	1.89	1.92–2.03	174–248	116–124	12.7	63.3–65.6
52	89.6–92.2	207.9–217.8	205.7–215.6	1.95	1.92–2.03	174–248	116–124	13.1	63.3–65.6
53	89.4–91.9	214.1–224.3	211.8–221.9	2.01	1.92–2.03	174–248	116–124	13.5	63.4–65.7
54	89.3–91.7	220.4–230.7	217.9–228.2	2.09	1.92–2.03	174–248	116–124	13.9	63.4–65.7
55	88.9–91.5	226.6–237.1	224.0–234.4	2.16	1.93–2.04	174–248	116–124	14.3	63.4–65.8
56	88.7–91.4	232.8–243.5	230.1–240.7	2.24	1.93–2.04	174–248	116–124	14.7	63.5–65.8
57	88.4–91.2	239.0–249.9	236.1–246.9	2.33	1.93–2.04	174–248	116–124	15.1	63.5–65.9
58	88.2–91.0	245.2–256.3	242.2–253.2	2.40	1.93–2.04	174–248	116–124	15.5	63.5–65.9
59	87.9–90.8	251.3–262.6	248.2–259.4	2.49	1.93–2.04	174–248	116–124	15.9	63.6–66.0
60	87.6–90.5	257.5–269.0	254.1–265.5	2.57	1.93–2.04	174–248	116–124	16.3	63.6–66.0

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 WEIGHT (g/egg)
61	87.3–90.2	263.6–275.3	260.1 –271.7	2.65	1.93 – 2.04	174–248	116–124	16.6	63.6–66.1
62	87.0–90.0	269.7–281.6	266.0 –277.8	2.77	1.93 – 2.04	174–248	116–124	17.0	63.7–66.1
63	86.7–89.8	275.7–287.9	271.9 –283.9	2.85	1.93 – 2.04	174–248	116–124	17.4	63.7–66.2
64	86.4–89.6	281.8–294.1	277.8 –290.0	2.92	1.93 – 2.04	174–248	116–124	17.8	63.7–66.2
65	86.1–89.3	287.8–300.4	283.6 –296.1	2.97	1.93 – 2.04	174–248	116–124	18.2	63.8–66.3
66	85.6–89.0	293.8–306.6	289.4 –302.1	3.08	1.93 – 2.04	174–248	116–124	18.6	63.8–66.3
67	85.1–88.6	299.7–312.8	295.2 –308.1	3.14	1.93 – 2.04	174–248	116–124	19.0	63.8–66.4
68	84.5–88.3	305.7–319.0	300.9 –314.1	3.20	1.93 – 2.04	174–248	116–124	19.4	63.8–66.4
69	83.8–88.0	311.5–325.2	306.6 –320.1	3.30	1.93 – 2.04	174–248	116–124	19.7	63.8–66.4
70	83.2–87.6	317.4–331.3	312.2 –326.0	3.43	1.93 – 2.04	174–248	116–124	20.1	63.9–66.5
71	82.7–87.0	323.1–337.4	317.8 –331.9	3.58	1.93 – 2.04	174–248	116–124	20.5	63.9–66.5
72	82.0–86.4	328.9–343.4	323.3 –337.7	3.73	1.93 – 2.04	174–248	116–124	20.8	63.9–66.6
73	81.4–85.8	334.6–349.4	328.8 –343.5	3.88	1.93 – 2.04	174–248	116–124	21.2	63.9–66.6
74	80.7–85.2	340.2–355.4	334.2 –349.2	4.03	1.93 – 2.04	174–248	116–124	21.6	63.9–66.7
75	80.1–84.6	345.8–361.3	339.6 –354.9	4.18	1.93 – 2.04	174–248	116–124	21.9	64.0–66.7
76	79.5–84.0	351.4–367.2	344.9 –360.5	4.33	1.93 – 2.04	174–248	116–124	22.3	64.0–66.8
77	78.9–83.4	356.9–373.1	350.2 –366.1	4.48	1.93 – 2.04	174–248	116–124	22.7	64.0–66.8
78	78.3–82.8	362.4–378.8	355.4 –371.6	4.63	1.93 – 2.04	174–248	116–124	23.0	64.0–66.9
79	77.7–82.2	367.8–384.6	360.6 –377.1	4.78	1.93 – 2.04	174–248	116–124	23.4	64.0–66.9
80	77.1–81.6	373.2–390.3	365.7 –382.5	4.93	1.93 – 2.04	174–248	116–124	23.7	64.0–67.0
81	76.6–81.0	378.6–396.0	370.8 –387.9	5.08	1.93 – 2.04	174–248	116–124	24.0	64.0–67.0
82	76.1–80.4	383.9–401.6	375.8 –393.2	5.23	1.93 – 2.04	174–248	116–124	24.4	64.1–67.1
83	75.6–79.8	389.2–407.2	380.9 –398.5	5.38	1.93 – 2.04	174–248	116–124	24.7	64.1–67.1
84	75.2–79.2	394.5–412.7	385.8 –403.7	5.53	1.93 – 2.04	174–248	116–124	25.1	64.1–67.2
85	74.8–78.6	399.7–418.2	390.8 –408.9	5.68	1.93 – 2.04	174–248	116–124	25.4	64.1–67.2
86	74.4–78.0	404.9–423.7	395.7 –414.1	5.83	1.93 – 2.04	174–248	116–124	25.7	64.1–67.3
87	74.0–77.4	410.1–429.1	400.5 –419.2	5.98	1.93 – 2.04	174–248	116–124	26.1	64.1–67.3
88	73.6–76.8	415.2–434.5	405.4 –424.2	6.13	1.93 – 2.04	174–248	116–124	26.4	64.1–67.4
89	73.3–76.3	420.4–439.8	410.2 –429.2	6.28	1.93 – 2.04	174–248	116–124	26.7	64.1–67.4
90	73.0–75.8	425.5–445.2	415.0 –434.2	6.45	1.93 – 2.04	174–248	116–124	27.0	64.1–67.5
91	72.7–75.3	430.6–450.4	419.7 –439.1	6.65	1.94 – 2.05	174–248	116–124	27.3	64.2–67.5
92	72.4–74.9	435.6–455.7	424.4 –444.0	6.85	1.94 – 2.05	174–248	116–124	27.7	64.2–67.6
93	72.1–74.5	440.7–460.9	429.1 –448.8	7.10	1.94 – 2.05	174–248	116–124	28.0	64.2–67.6
94	71.8–74.1	445.7–466.1	433.8 –453.6	7.30	1.94 – 2.05	174–248	116–124	28.3	64.2–67.7
95	71.5–73.7	450.7–471.2	438.4 –458.4	7.50	1.94 – 2.05	174–248	116–124	28.6	64.2–67.7
96	71.2–73.3	455.7–476.4	443.0 –463.2	7.60	1.94 – 2.05	174–248	116–124	28.9	64.2–67.8
97	70.9–72.9	460.7–481.5	447.6 –467.9	7.80	1.94 – 2.05	174–248	116–124	29.2	64.2–67.8
98	70.6–72.5	465.6–486.5	452.1 –472.5	8.00	1.94 – 2.05	174–248	116–124	29.5	64.2–67.9
99	70.3–72.1	470.5–491.6	456.7 –477.2	8.20	1.94 – 2.05	174–248	116–124	29.8	64.2–67.9
100	70.0–71.7	475.4–496.6	461.2 –481.8	8.40	1.94 – 2.05	174–248	116–124	30.1	64.2–68.0

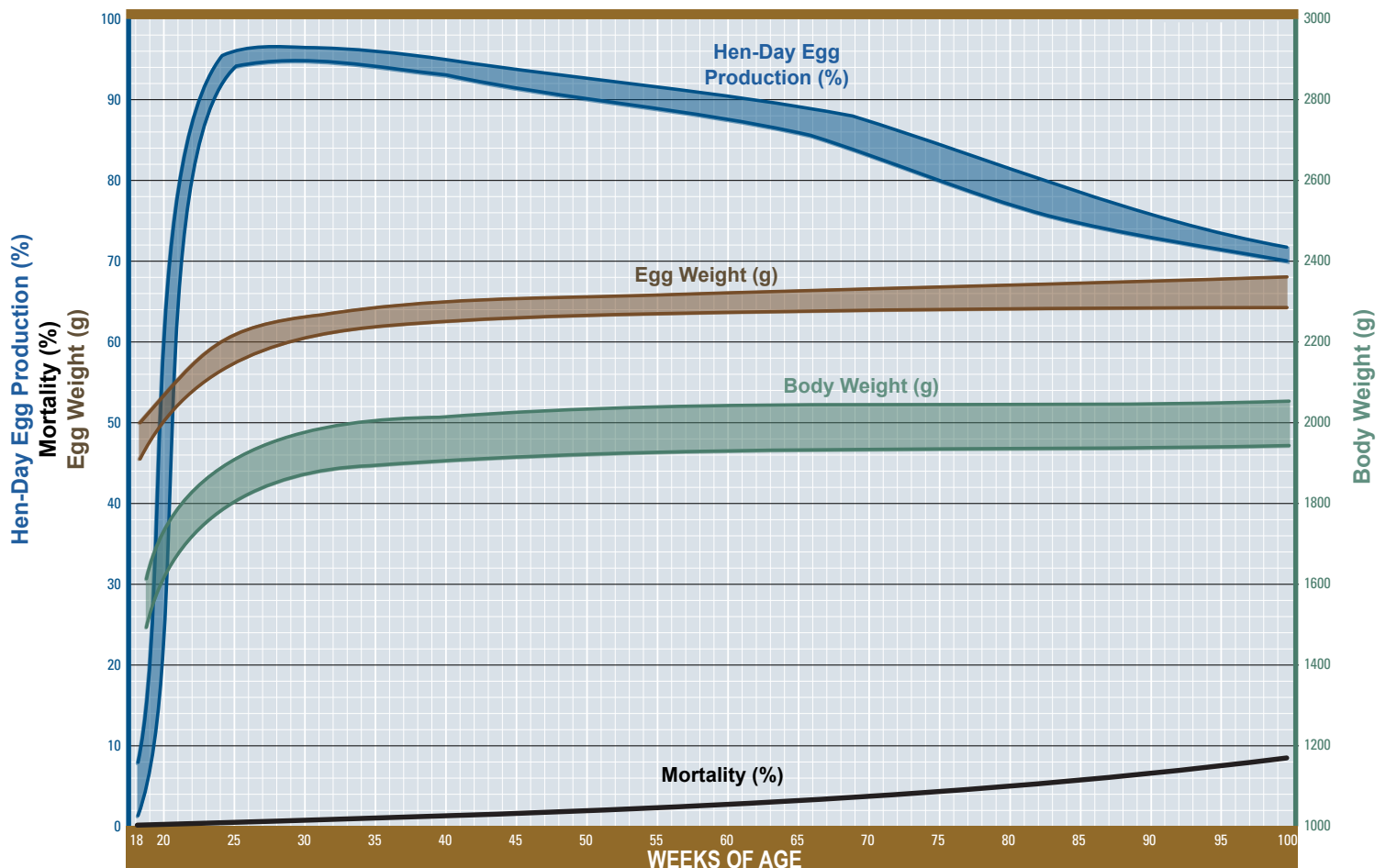
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Production Period Space Recommendations

check local regulations concerning space requirements)

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

E.U. Standards–Weekly*

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

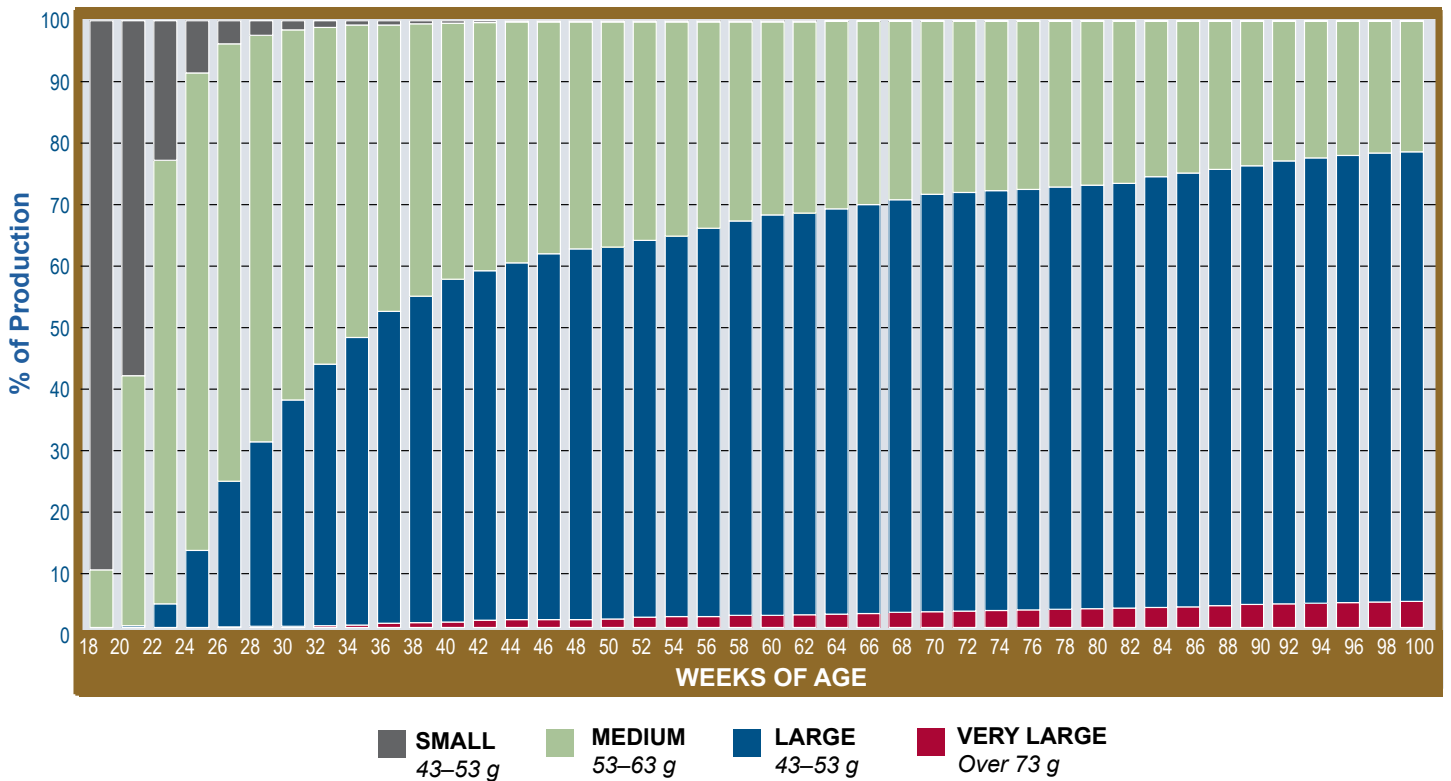
AGE (weeks)	AVG. EGG WEIGHT (g)	% SMALL 43–53 g	% MEDIUM 53–63 g	% LARGE 63–73 g	% VERY LARGE Over 73 g
18	47.7	90.5	9.5	0.0	0.0
20	52.2	58.5	41.2	0.3	0.0
22	56.0	23.0	73.1	3.9	0.0
24	58.4	8.6	78.7	12.7	0.0
26	60.1	3.8	72.1	24.0	0.1
28	61.0	2.4	67.0	30.4	0.2
30	61.8	1.5	61.0	37.3	0.2
32	62.3	1.1	55.5	43.1	0.3
34	62.8	0.7	51.5	47.4	0.4
36	63.2	0.7	47.2	51.4	0.7
38	63.5	0.5	44.9	53.8	0.8
40	63.8	0.4	42.2	56.5	0.9
42	63.9	0.3	40.9	57.6	1.2
44	64.0	0.2	39.7	58.8	1.3
46	64.1	0.2	38.2	60.3	1.3
48	64.3	0.2	37.4	61.1	1.3
50	64.4	0.2	37.1	61.3	1.4
52	64.5	0.2	36.0	62.1	1.7
54	64.5	0.2	35.3	62.7	1.8
56	64.6	0.2	34.0	64.0	1.8
58	64.7	0.2	32.8	65.0	2.0
60	64.8	0.2	31.8	66.0	2.0
62	64.9	0.2	31.5	66.2	2.1
64	65.0	0.1	30.9	66.8	2.2
66	65.0	0.1	30.2	67.4	2.3
68	65.1	0.1	29.4	68.0	2.5
70	65.2	0.1	28.5	68.8	2.6
72	65.3	0.1	28.2	69.0	2.7
74	65.3	0.1	27.9	69.2	2.8
76	65.4	0.1	27.7	69.3	2.9
78	65.5	0.1	27.3	69.6	3.0
80	65.5	0.1	27.0	69.8	3.1
82	65.6	0.1	26.7	70.0	3.2
84	65.6	0.1	25.6	71.0	3.3
86	65.7	0.1	25.0	71.5	3.4
88	65.8	0.1	24.4	71.9	3.6
90	65.8	0.1	23.8	72.3	3.8
92	65.9	0.1	23.0	73.0	3.9
94	65.9	0.1	22.5	73.4	4.0
96	66.0	0.1	22.1	73.7	4.1
98	66.1	0.1	21.7	74.0	4.2
100	66.1	0.1	21.5	74.1	4.3

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

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Egg Size Distribution (cont.)

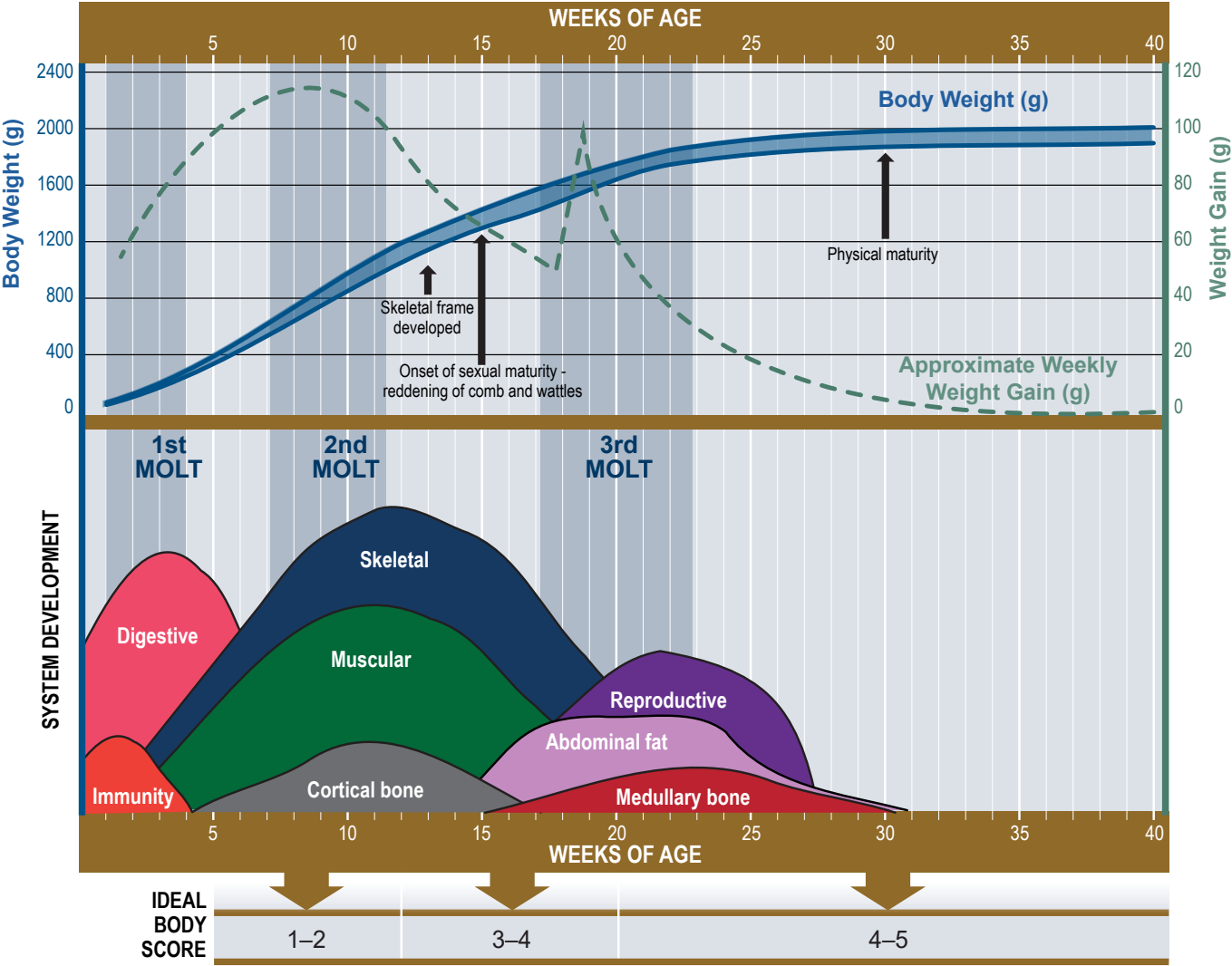
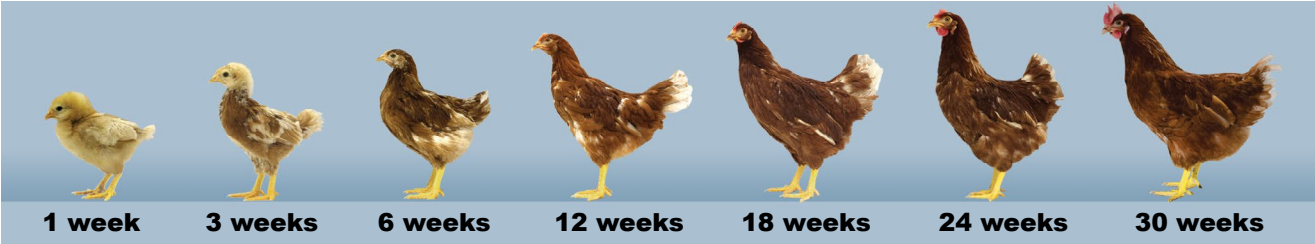
E.U. Standards–Weekly*



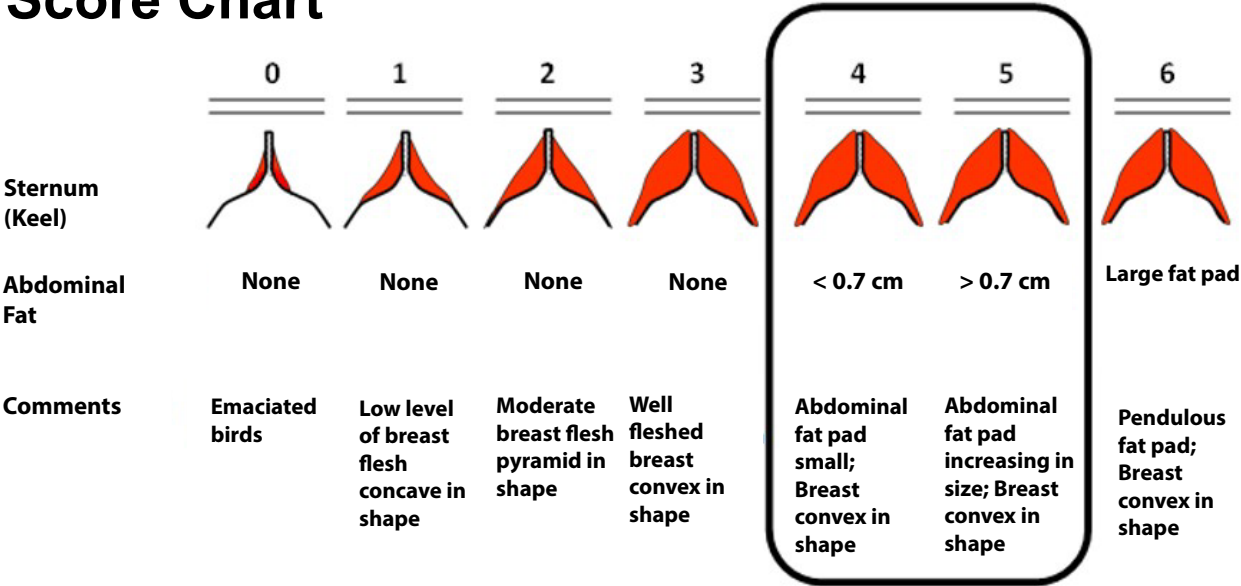
Brooding Temperature and Lighting Recommendations

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	10–15 lux	10–15 lux						
LIGHT HOURS	Intermittent Program or 20 hours	Intermittent Program or 20 hours	Intermittent Program or 20 hours	18 hours	18.5 hours	15 hours	13.5 hours						

Development of the Organ Systems in Pullets

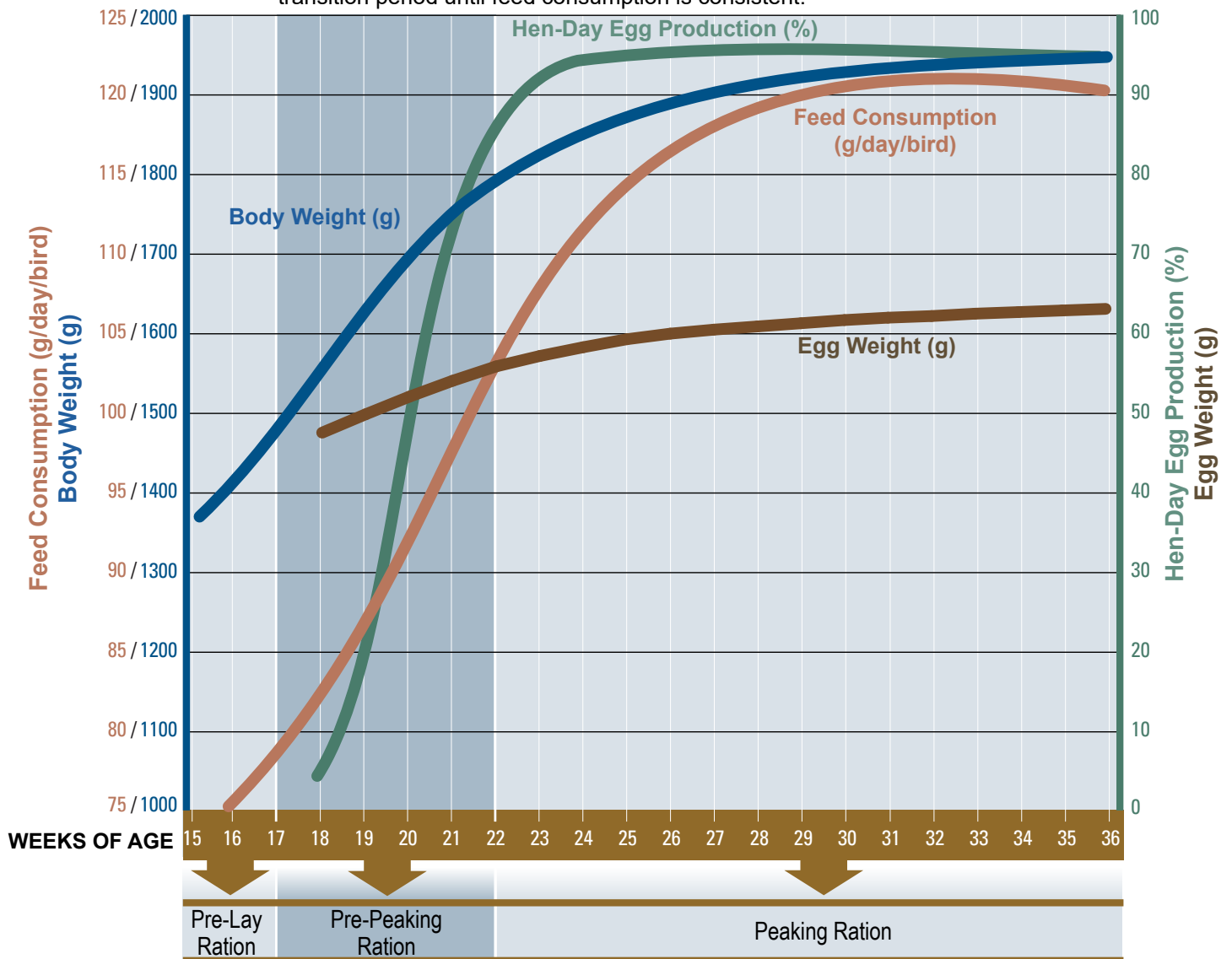


Body Score Chart



Transition Period from Rear to Peak Egg Production

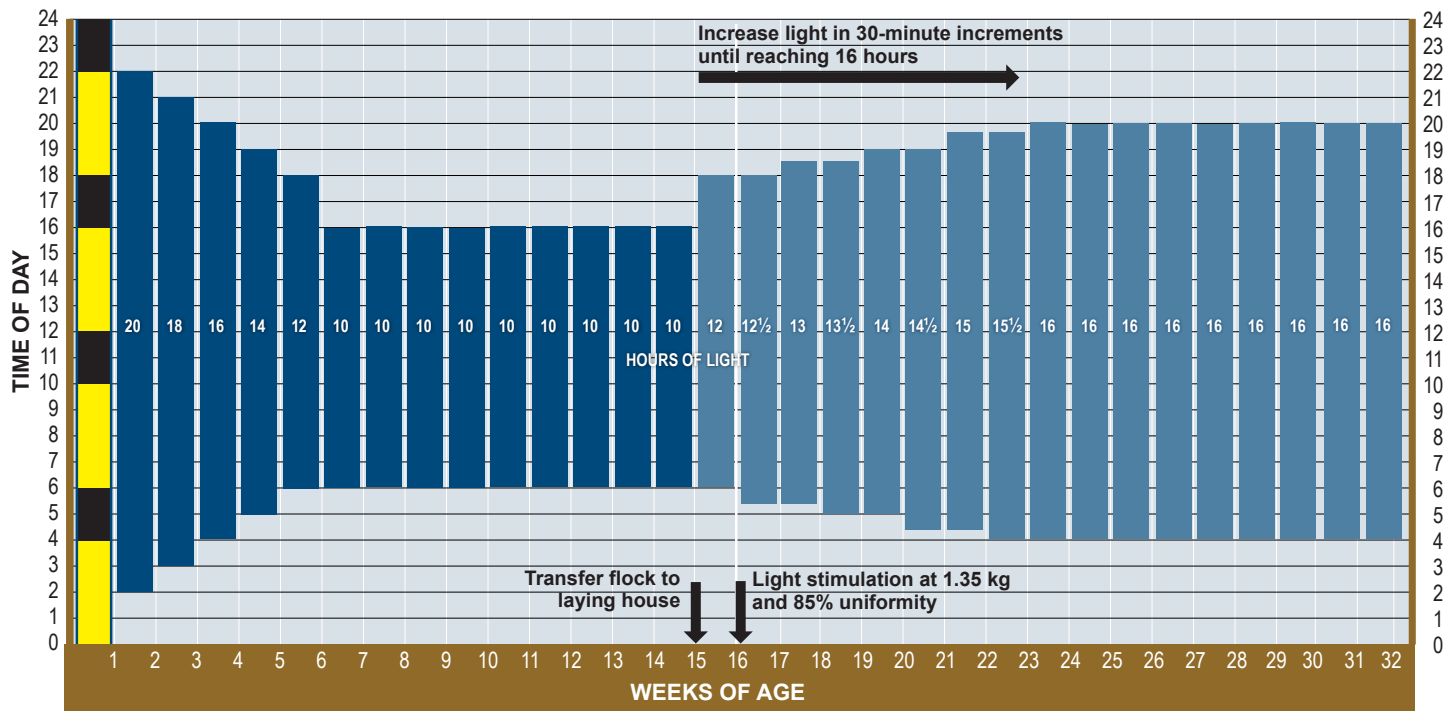
Frequently formulate to changing feed consumption during transition period until feed consumption is consistent.



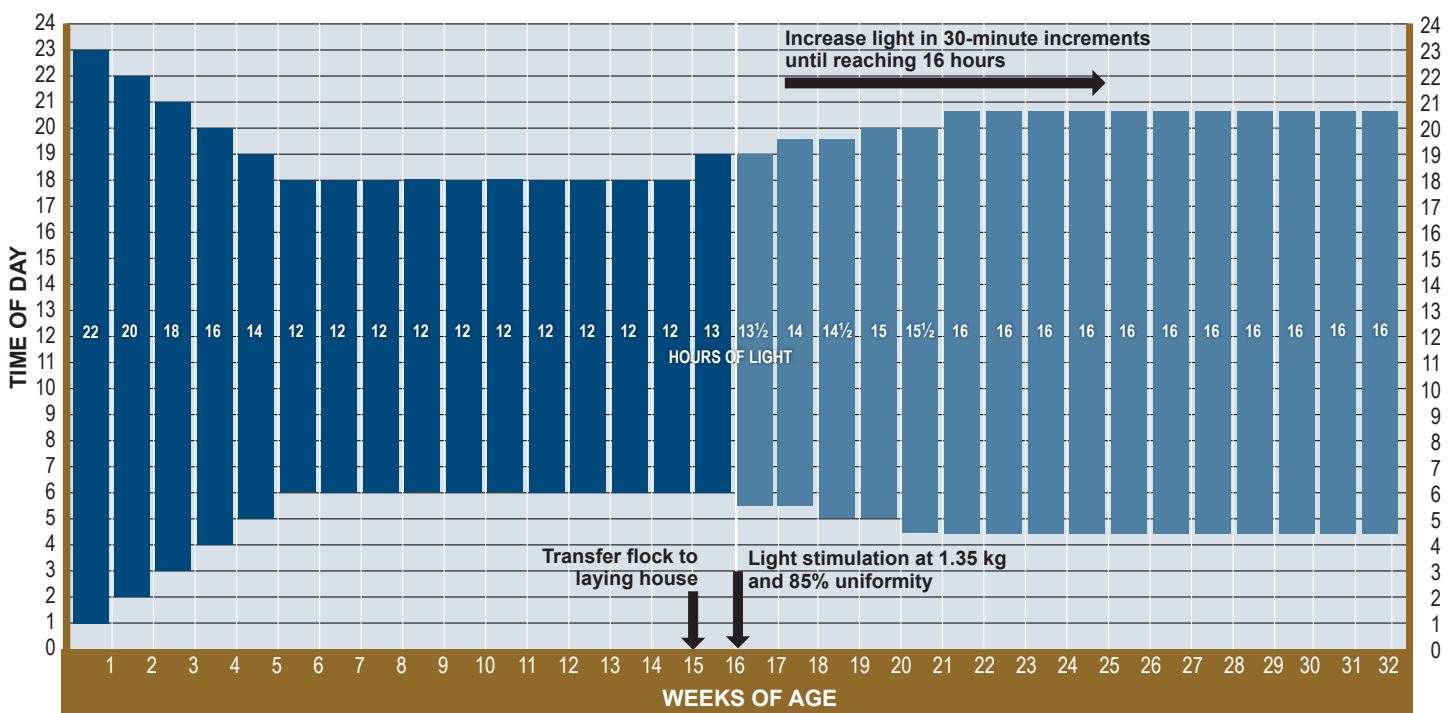
Pre-Peak

- 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 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

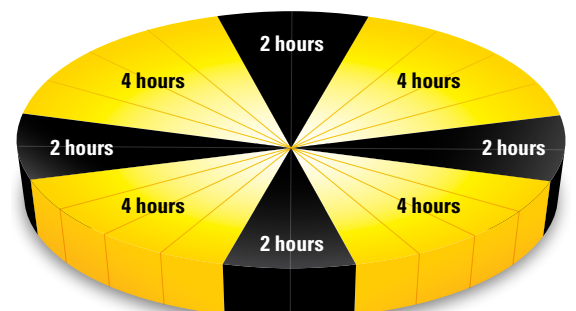


Light Program for Open-Sided Housing



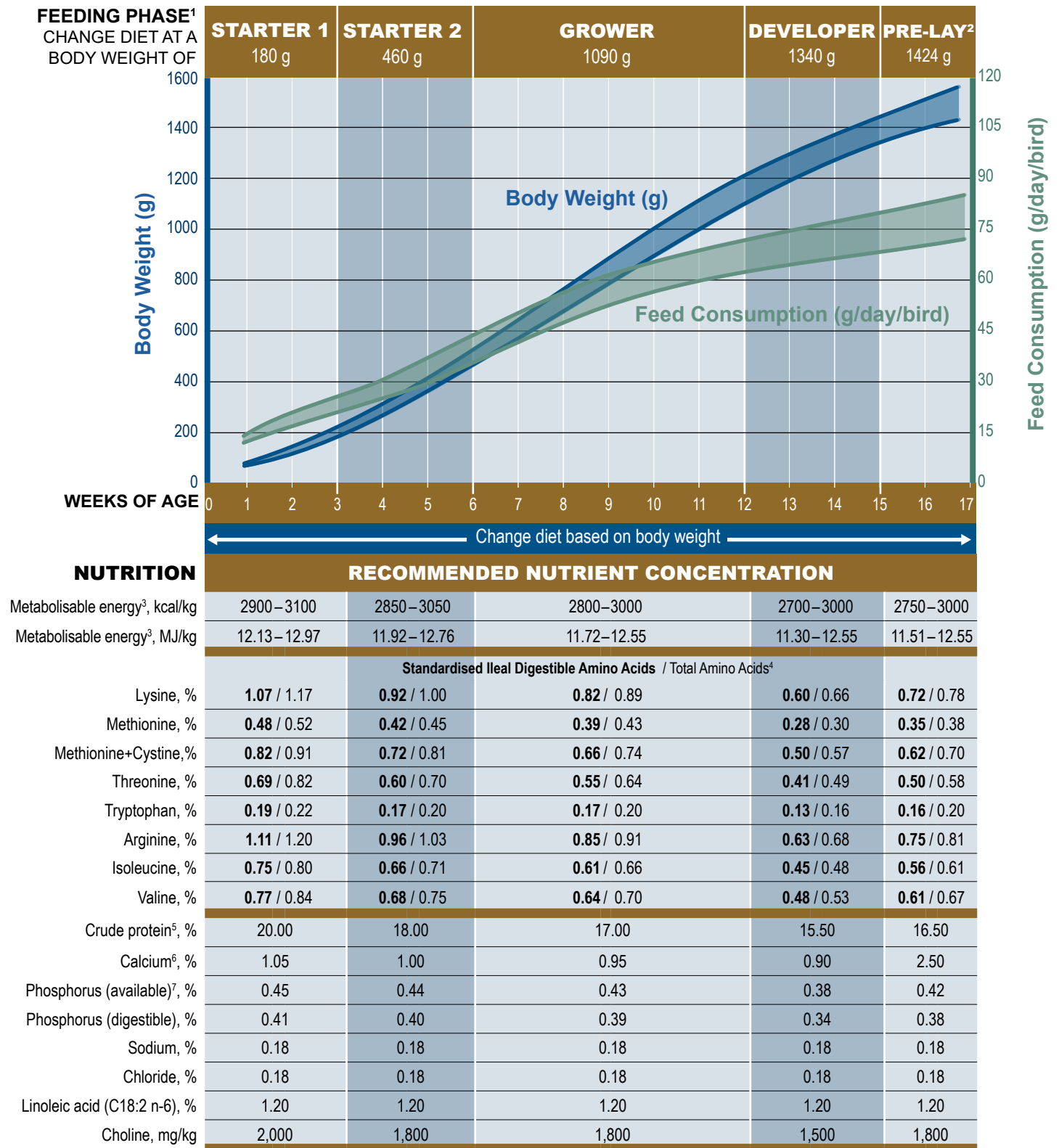
Intermittent Lighting Program for Chicks

- 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.



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Rearing Period Nutritional Recommendations



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.

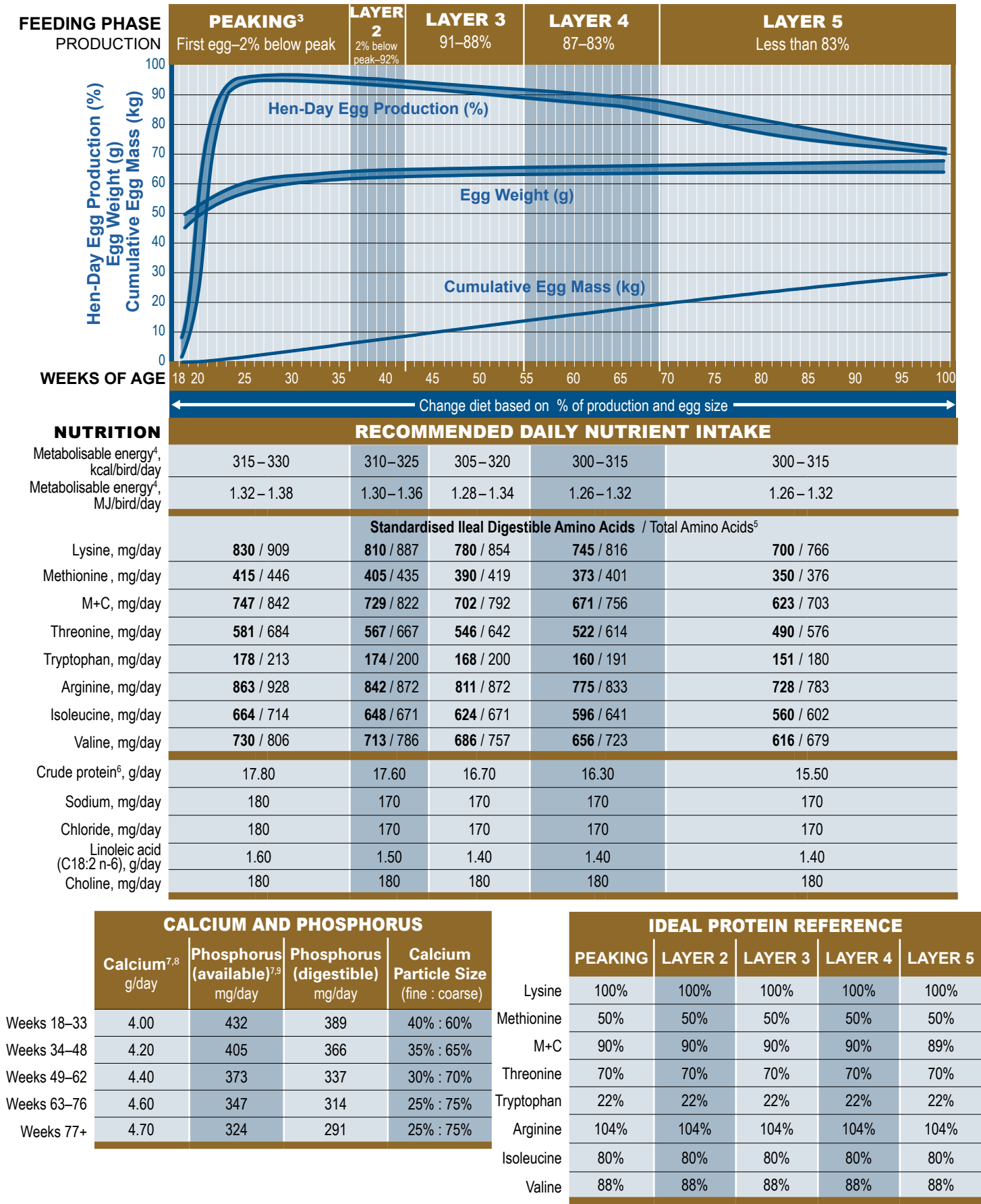
⁴ Recommendation for Total Amino Acids is only appropriate to corn and soybean meal diet. Where diets utilise other ingredients, recommendations for Standardised Ileal Digestible Amino Acids must be followed.

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.

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}



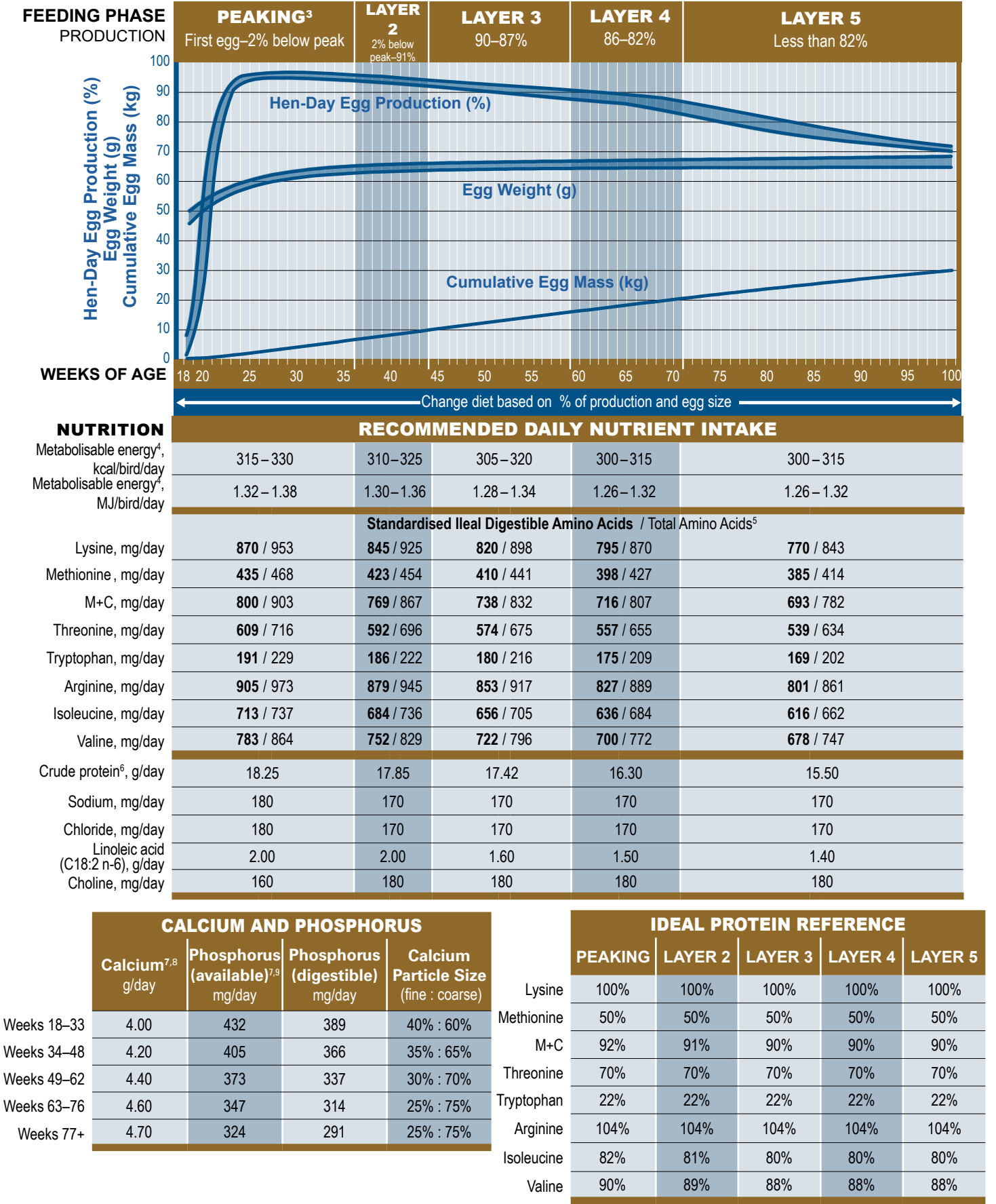
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Production Period Dietary Nutrient Concentrations for Economical Performance^{1,2}

FEEDING PHASE PRODUCTION NUTRITION	PEAKING ³ First egg until production drops 2% below peak					LAYER 2 2% below peak to 92%					LAYER 3 91–88%					LAYER 4 87–82%					LAYER 5 Less than 83%									
	RECOMMENDED CONCENTRATION																													
	ME ⁴ , kcal/bird/day					315–330					310–325					305–320					300–315					300–315				
	ME 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/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, %	0.92	0.87	0.83	0.79	0.75	0.77	0.74	0.70	0.68	0.65	0.74	0.70	0.67	0.63	0.60	0.71	0.67	0.64	0.61	0.58	0.67	0.63	0.60	0.57	0.54					
Methionine, %	0.46	0.44	0.42	0.40	0.38	0.39	0.37	0.35	0.34	0.32	0.37	0.35	0.33	0.32	0.30	0.36	0.34	0.32	0.30	0.29	0.33	0.32	0.30	0.28	0.27					
M+C, %	0.83	0.79	0.75	0.71	0.68	0.69	0.66	0.63	0.61	0.58	0.67	0.63	0.60	0.57	0.54	0.64	0.60	0.57	0.55	0.52	0.60	0.57	0.54	0.51	0.49					
Threonine, %	0.65	0.61	0.58	0.55	0.53	0.54	0.52	0.49	0.47	0.45	0.52	0.49	0.47	0.44	0.42	0.50	0.47	0.45	0.42	0.40	0.47	0.44	0.42	0.40	0.38					
Tryptophan, %	0.20	0.19	0.18	0.17	0.16	0.17	0.16	0.15	0.15	0.14	0.16	0.15	0.14	0.14	0.13	0.15	0.14	0.14	0.13	0.12	0.14	0.14	0.13	0.12	0.12					
Arginine, %	0.96	0.91	0.86	0.82	0.78	0.80	0.77	0.73	0.70	0.67	0.77	0.73	0.69	0.66	0.63	0.74	0.70	0.66	0.63	0.60	0.69	0.66	0.62	0.59	0.56					
Isoleucine, %	0.74	0.70	0.66	0.63	0.60	0.62	0.59	0.56	0.54	0.52	0.59	0.56	0.53	0.51	0.48	0.57	0.54	0.51	0.48	0.46	0.53	0.50	0.48	0.46	0.43					
Valine, %	0.81	0.77	0.73	0.70	0.66	0.68	0.65	0.62	0.59	0.57	0.65	0.62	0.59	0.56	0.53	0.62	0.59	0.56	0.53	0.51	0.59	0.55	0.53	0.50	0.48					
Total Amino Acids ⁵																														
Lysine, %	1.01	0.96	0.91	0.87	0.83	0.84	0.81	0.77	0.74	0.71	0.81	0.77	0.73	0.69	0.66	0.78	0.74	0.70	0.66	0.63	0.73	0.69	0.65	0.62	0.59					
Methionine, %	0.50	0.47	0.45	0.42	0.41	0.41	0.40	0.38	0.36	0.35	0.40	0.38	0.36	0.34	0.32	0.38	0.36	0.34	0.33	0.31	0.36	0.34	0.32	0.31	0.29					
M+C, %	0.94	0.89	0.84	0.80	0.77	0.78	0.75	0.71	0.69	0.66	0.75	0.71	0.68	0.64	0.61	0.72	0.68	0.65	0.61	0.59	0.68	0.64	0.61	0.58	0.55					
Threonine, %	0.76	0.72	0.68	0.65	0.62	0.64	0.61	0.58	0.56	0.53	0.61	0.58	0.55	0.52	0.50	0.58	0.55	0.52	0.50	0.48	0.55	0.52	0.49	0.47	0.45					
Tryptophan, %	0.24	0.22	0.21	0.20	0.19	0.20	0.19	0.18	0.17	0.17	0.19	0.18	0.17	0.16	0.16	0.18	0.17	0.16	0.16	0.15	0.17	0.16	0.15	0.15	0.14					
Arginine, %	1.03	0.98	0.93	0.88	0.84	0.86	0.82	0.79	0.76	0.72	0.83	0.79	0.75	0.71	0.68	0.79	0.75	0.71	0.68	0.65	0.75	0.71	0.67	0.64	0.61					
Isoleucine, %	0.79	0.75	0.71	0.68	0.65	0.66	0.63	0.61	0.58	0.56	0.64	0.60	0.57	0.55	0.52	0.61	0.58	0.55	0.52	0.50	0.57	0.54	0.51	0.49	0.47					
Valine, %	0.90	0.85	0.81	0.77	0.73	0.75	0.71	0.68	0.66	0.63	0.72	0.68	0.65	0.62	0.59	0.69	0.65	0.62	0.59	0.56	0.65	0.61	0.58	0.55	0.53					
Cr. protein ⁶ , %	19.78	18.74	17.80	16.95	16.18	16.76	16.00	15.30	14.67	14.08	15.90	15.05	14.27	13.58	12.95	15.52	14.68	13.93	13.25	12.64	14.76	13.96	13.25	12.60	12.02					
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), %	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																														
Feed Consumption, g/day per bird	Weeks 18–33					Weeks 34–48					Weeks 49–62					Weeks 63–76					Weeks 77+									
	90	95	100	106	112	118	124	100	106	112	118	124	100	106	112	118	124	100	106	112	118	124	100	106	112	118	124			
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 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 Optimal Performance^{1,2}



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Production Period Dietary Nutrient Concentrations for Optimal Performance^{1,2}

FEEDING PHASE PRODUCTION NUTRITION	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%				
	RECOMMENDED CONCENTRATION																								
ME ⁴ , kcal/bird/day	315–330					310–325					305–320					300–315					300–315				
ME 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/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, %	0.97	0.92	0.87	0.83	0.79	0.80	0.77	0.73	0.70	0.68	0.78	0.74	0.70	0.67	0.64	0.76	0.72	0.68	0.65	0.62	0.73	0.69	0.66	0.63	0.60
Methionine, %	0.48	0.46	0.44	0.41	0.40	0.40	0.38	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	0.37	0.35	0.33	0.31	0.30
M+C, %	0.89	0.84	0.80	0.76	0.73	0.73	0.70	0.67	0.64	0.62	0.70	0.66	0.63	0.60	0.57	0.68	0.65	0.61	0.58	0.56	0.66	0.62	0.59	0.56	0.54
Threonine, %	0.68	0.64	0.61	0.58	0.55	0.56	0.54	0.51	0.49	0.47	0.55	0.52	0.49	0.47	0.44	0.53	0.50	0.48	0.45	0.43	0.51	0.49	0.46	0.44	0.42
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	0.14	0.16	0.15	0.14	0.14	0.13
Arginine, %	1.01	0.95	0.91	0.86	0.82	0.84	0.80	0.76	0.73	0.70	0.81	0.77	0.73	0.69	0.66	0.79	0.75	0.71	0.67	0.64	0.76	0.72	0.68	0.65	0.62
Isoleucine, %	0.79	0.75	0.71	0.68	0.65	0.65	0.62	0.59	0.57	0.55	0.62	0.59	0.56	0.53	0.51	0.61	0.57	0.54	0.52	0.49	0.59	0.55	0.53	0.50	0.48
Valine, %	0.87	0.82	0.78	0.75	0.71	0.72	0.68	0.65	0.63	0.60	0.69	0.65	0.62	0.59	0.56	0.67	0.63	0.60	0.57	0.54	0.65	0.61	0.58	0.55	0.53
Total Amino Acids ⁵																									
Lysine, %	1.06	1.00	0.95	0.91	0.87	0.88	0.84	0.80	0.77	0.74	0.86	0.81	0.77	0.73	0.70	0.83	0.78	0.74	0.71	0.67	0.80	0.76	0.72	0.69	0.65
Methionine, %	0.52	0.49	0.47	0.45	0.43	0.43	0.41	0.39	0.38	0.36	0.42	0.40	0.38	0.36	0.34	0.41	0.38	0.36	0.35	0.33	0.39	0.37	0.35	0.34	0.32
M+C, %	1.00	0.95	0.90	0.86	0.82	0.83	0.79	0.75	0.72	0.69	0.79	0.75	0.71	0.68	0.64	0.77	0.73	0.69	0.66	0.63	0.74	0.70	0.67	0.64	0.61
Threonine, %	0.80	0.75	0.72	0.68	0.65	0.66	0.63	0.61	0.58	0.56	0.64	0.61	0.58	0.55	0.52	0.62	0.59	0.56	0.53	0.51	0.60	0.57	0.54	0.52	0.49
Tryptophan, %	0.25	0.24	0.23	0.22	0.21	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, %	1.08	1.02	0.97	0.93	0.88	0.90	0.86	0.82	0.79	0.76	0.87	0.83	0.78	0.75	0.71	0.85	0.80	0.76	0.72	0.69	0.82	0.78	0.74	0.70	0.67
Isoleucine, %	0.85	0.81	0.77	0.73	0.70	0.70	0.67	0.64	0.61	0.59	0.67	0.64	0.60	0.57	0.55	0.65	0.62	0.58	0.56	0.53	0.63	0.60	0.57	0.54	0.51
Valine, %	0.96	0.91	0.86	0.82	0.79	0.79	0.75	0.72	0.69	0.66	0.76	0.72	0.68	0.65	0.62	0.74	0.70	0.66	0.63	0.60	0.71	0.67	0.64	0.61	0.58
Cr. protein ⁶ , %	20.28	19.21	18.25	17.38	16.59	17.00	16.23	15.52	14.88	14.28	16.59	15.69	14.89	14.16	13.50	15.52	14.68	13.93	13.25	12.64	14.76	13.96	13.25	12.60	12.02
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+					
		90	95	100	106	112	118	124	100	106	112	118	124	100	106	112	118	124	100	106	112	118	124	100	106	112	118	124			
Feed Consumption, g/day per bird																															
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 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
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 D₃ can be supplemented as 25-hydroxy D₃ 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 ($\text{NO}_3\text{-N}$) 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 ($\text{NO}_2\text{-N}$) 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

PRODUCT UPDATES

Hy-Line Brown – Selecting for Superior Egg Quality
Feeding Rapeseed Meal or Canola Meal to Hy-Line Brown and Hy-Line Silver Brown Hens

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