



Hy-Line.

W-80 PLUS COMMERCIAL LAYERS

Management Guide



Hy-Line®

W-80 PLUS

USE OF THE MANAGEMENT GUIDE

The genetic potential of Hy-Line W-80 Plus Commercial can only be realized if good poultry husbandry practices and management are used. This management guide outlines successful flock management programs for Hy-Line Variety W-80 Plus 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, recognizing 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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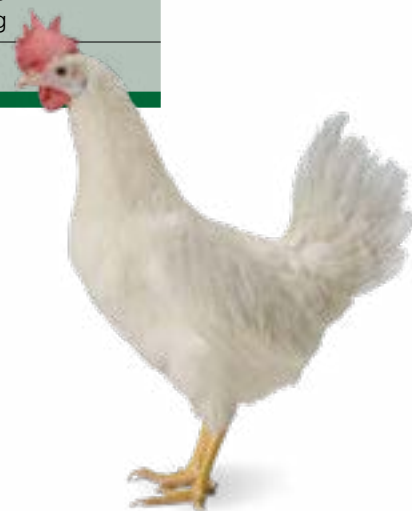
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Summary of Performance Standards

REARING PERIOD (TO 17 WEEKS):	
Livability	97%
Feed Consumed	5.12–5.66 kg
Body Weight at 17 Weeks	1.17–1.25 kg
LAYING PERIOD (TO 100 WEEKS):	
Percent Peak	95–97%
Hen-Day Eggs to 60 Weeks	258.4–264.9
Hen-Day Eggs to 100 Weeks	473.7–491.5
Hen-Housed Eggs to 60 Weeks	252.1–258.5
Hen-Housed Eggs to 100 Weeks	456.2–473.2
Livability to 60 Weeks	96.5%
Livability to 100 Weeks	93.0%
Days to 50% Production (from hatch)	141 days
Average Egg Weight at 26 Weeks	57.0 g / egg
Average Egg Weight at 32 Weeks	60.0 g / egg
Average Egg Weight at 70 Weeks	66.0 g / egg
Average Egg Weight at 100 Weeks	67.2 g / egg
Total Egg Mass per Hen-Housed (18–100 weeks)	28.3–30.1 kg
Body Weight at 26 Weeks	1.52–1.61 kg
Body Weight at 32 Weeks	1.59–1.71 kg
Body Weight at 70 Weeks	1.62–1.74 kg
Body Weight at 100 Weeks	1.66–1.76 kg
Freedom From Egg Inclusions	Excellent
Shell Strength	Excellent
Haugh Units at 38 Weeks	88.1
Haugh Units at 56 Weeks	85.6
Haugh Units at 70 Weeks	83.7
Haugh Units at 100 Weeks	80.0
Average Daily Feed Consumption (18–100 weeks)	101–108 g / day per bird
Feed Conversion Rate, kg Feed/kg Eggs (20–60 weeks)	1.91–2.06
Feed Conversion Rate, kg Feed/kg Eggs (20–100 weeks)	1.96–2.11
Feed Utilization, kg Egg/kg Feed (20–60 weeks)	0.49–0.53
Feed Utilization, kg Egg/kg Feed (20–100 weeks)	0.47–0.51
Feed Consumption per Dozen Eggs (20–60 weeks)	1.39–1.49 kg
Feed Consumption per Dozen Eggs (20–100 weeks)	1.49–1.60 kg
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 www.hylineeggcel.com.



Performance Tables

Rearing Period

AGE (weeks)	MORTALITY Cumulative (%)	BODY WEIGHT (kg)	FEED INTAKE (g / bird / day)	CUMULATIVE FEED INTAKE (g to date)	WATER CONSUMPTION (ml / bird / day)	UNIFORMITY (Cage)
1	1.0	0.07 – 0.08	12 – 14	80 – 100	18 – 28	>85%
2	1.3	0.12 – 0.13	15 – 19	190 – 230	23 – 38	
3	1.5	0.18 – 0.19	21 – 25	340 – 410	32 – 50	
4	1.6	0.25 – 0.26	27 – 31	530 – 620	41 – 62	>80%
5	1.7	0.32 – 0.35	31 – 35	740 – 870	47 – 70	
6	1.8	0.41 – 0.44	35 – 39	990 – 1140	53 – 78	
7	1.9	0.51 – 0.55	39 – 43	1260 – 1440	59 – 86	
8	2.0	0.60 – 0.65	42 – 46	1550 – 1760	63 – 92	
9	2.1	0.70 – 0.74	44 – 50	1860 – 2110	66 – 100	
10	2.2	0.78 – 0.84	48 – 53	2190 – 2480	71 – 105	
11	2.3	0.86 – 0.91	51 – 56	2550 – 2870	76 – 111	
12	2.4	0.92 – 0.99	54 – 59	2920 – 3280	80 – 117	>85%
13	2.5	0.98 – 1.05	57 – 62	3320 – 3710	85 – 123	
14	2.6	1.03 – 1.11	60 – 65	3730 – 4160	89 – 129	
15	2.7	1.08 – 1.16	63 – 68	4170 – 4630	94 – 135	
16	2.8	1.13 – 1.21	67 – 72	4640 – 5130	100 – 143	>90%
17	3.0	1.17 – 1.25	70 – 75	5120 – 5660	104 – 149	

Laying Period

AGE (weeks)	% HEN- DAY Current	HEN-DAY EGGS Cumulative	HEN-HOUSED EGGS Cumulative	MORT- ALITY Cumulative (%)	BODY WEIGHT (kg)	FEED INTAKE (g / bird / day)	WATER CONSUMPTION ¹ (ml / bird / day)	HEN- HOUSED EGG MASS Cumulative (kg)	AVG. EGG WEIGHT ² (g / egg)
18	–	–	–	0.1	1.25 – 1.27	74 – 81	111 – 162	–	–
19	9 – 12	0.6 – 0.8	0.6 – 0.8	0.3	1.31 – 1.33	79 – 86	119 – 172	0.03 – 0.04	43.0
20	34 – 37	3.0 – 3.4	3.0 – 3.4	0.5	1.37 – 1.39	82 – 89	123 – 178	0.1 – 0.1	44.0
21	54 – 57	6.8 – 7.4	6.8 – 7.4	0.7	1.39 – 1.44	87 – 94	131 – 188	0.3 – 0.3	46.0
22	78 – 81	12.3 – 13.1	12.2 – 13.0	0.9	1.43 – 1.46	89 – 96	134 – 192	0.6 – 0.6	48.0
23	86 – 89	18.3 – 19.3	18.1 – 19.2	1.0	1.46 – 1.50	91 – 99	137 – 198	0.8 – 0.9	51.0
24	90 – 92	24.6 – 25.8	24.3 – 25.5	1.2	1.48 – 1.54	92 – 102	138 – 204	1.2 – 1.3	53.0
25	92 – 94	31.0 – 32.3	30.7 – 32.0	1.4	1.50 – 1.58	94 – 103	141 – 206	1.5 – 1.6	55.0
26	93 – 95	37.5 – 39.0	37.1 – 38.6	1.5	1.52 – 1.61	95 – 105	143 – 210	1.9 – 2.0	57.0
27	94 – 96	44.1 – 45.7	43.6 – 45.2	1.6	1.54 – 1.62	96 – 106	144 – 212	2.2 – 2.4	58.0
28	94 – 96	50.7 – 52.4	50.1 – 51.8	1.7	1.55 – 1.66	97 – 107	146 – 214	2.6 – 2.8	59.0
29	94 – 96	57.3 – 59.2	56.5 – 58.4	1.8	1.56 – 1.67	98 – 108	147 – 216	3.0 – 3.1	59.0
30	94 – 96	63.8 – 65.9	63.0 – 65.0	1.9	1.57 – 1.69	99 – 108	149 – 216	3.4 – 3.5	60.0
31	94 – 96	70.4 – 72.6	69.4 – 71.6	2.0	1.58 – 1.70	100 – 109	150 – 218	3.8 – 3.9	60.0
32	95 – 97	77.1 – 79.4	76.0 – 78.2	2.0	1.59 – 1.71	101 – 109	152 – 218	4.1 – 4.3	60.0
33	95 – 97	83.7 – 86.2	82.5 – 84.9	2.2	1.59 – 1.71	101 – 110	152 – 220	4.5 – 4.7	61.0
34	95 – 97	90.4 – 93.0	89.0 – 91.5	2.2	1.59 – 1.71	102 – 110	153 – 220	4.9 – 5.1	61.0
35	94 – 96	97.0 – 99.7	95.4 – 98.1	2.3	1.59 – 1.71	103 – 110	155 – 220	5.3 – 5.5	61.0
36	94 – 96	103.5 – 106.4	101.8 – 104.7	2.3	1.59 – 1.71	103 – 110	155 – 220	5.7 – 6.0	62.0
37	94 – 96	110.1 – 113.1	108.3 – 111.2	2.4	1.59 – 1.71	103 – 110	155 – 220	6.1 – 6.4	62.0
38	94 – 96	116.7 – 119.8	114.7 – 117.8	2.4	1.59 – 1.71	103 – 110	155 – 220	6.5 – 6.8	62.0
39	94 – 96	123.3 – 126.6	121.1 – 124.3	2.5	1.59 – 1.71	103 – 110	155 – 220	6.9 – 7.2	62.0
40	94 – 96	129.9 – 133.3	127.5 – 130.9	2.5	1.59 – 1.71	103 – 110	155 – 220	7.3 – 7.6	63.0
41	94 – 96	136.4 – 140.0	133.9 – 137.4	2.6	1.59 – 1.71	103 – 110	155 – 220	7.7 – 8.0	63.0
42	94 – 96	143.0 – 146.7	140.3 – 144.0	2.6	1.59 – 1.71	103 – 110	155 – 220	8.1 – 8.4	63.0
43	94 – 96	149.6 – 153.4	146.7 – 150.5	2.7	1.60 – 1.71	103 – 110	155 – 220	8.5 – 8.8	63.0
44	94 – 96	156.2 – 160.2	153.1 – 157.1	2.7	1.60 – 1.71	103 – 110	155 – 220	8.9 – 9.2	63.0
45	94 – 96	162.8 – 166.9	159.5 – 163.6	2.8	1.60 – 1.71	103 – 110	155 – 220	9.3 – 9.7	64.0
46	93 – 95	169.3 – 173.5	165.9 – 170.1	2.8	1.60 – 1.72	103 – 110	155 – 220	9.7 – 10.1	64.0

¹ The chart shows an expected range of feed and water consumption at normal environmental temperatures of 21–27°C. As the environmental temperature increases above this range, water consumption may increase up to double the amounts shown.

² Egg weights after 40 weeks of age assume phase feeding of protein to limit egg size.

Performance Tables *(continued)*

AGE (weeks)	% HEN- DAY Current	HEN-DAY EGGS Cumulative	HEN-HOUSED EGGS Cumulative	MORT- ALITY Cumulative (%)	BODY WEIGHT (kg)	FEED INTAKE (g / bird / day)	WATER CONSUMP- TION ¹ (ml / bird / day)	HEN- HOUSED EGG MASS Cumulative (kg)	AVG. EGG WEIGHT ² (g / egg)
47	93 – 95	175.8 – 180.2	172.2 – 176.5	2.9	1.60 – 1.72	103 – 110	155 – 220	10.1 – 10.5	64.0
48	93 – 95	182.3 – 186.8	178.5 – 183.0	2.9	1.60 – 1.72	103 – 110	155 – 220	10.4 – 10.9	64.0
49	93 – 95	188.8 – 193.5	184.8 – 189.4	3.0	1.60 – 1.72	103 – 110	155 – 220	10.8 – 11.3	64.0
50	93 – 95	195.3 – 200.1	191.2 – 195.9	3.0	1.60 – 1.72	103 – 110	155 – 220	11.2 – 11.7	64.0
51	93 – 95	201.8 – 206.8	197.5 – 202.3	3.1	1.60 – 1.72	104 – 111	156 – 222	11.6 – 12.1	64.0
52	92 – 94	208.3 – 213.4	203.7 – 208.7	3.1	1.60 – 1.72	104 – 111	156 – 222	12.0 – 12.5	64.0
53	92 – 94	214.7 – 219.9	210.0 – 215.1	3.2	1.61 – 1.72	104 – 111	156 – 222	12.4 – 13.0	64.0
54	91 – 94	221.1 – 226.5	216.1 – 221.5	3.2	1.61 – 1.72	104 – 111	156 – 222	12.8 – 13.4	64.0
55	90 – 93	227.4 – 233.0	222.2 – 227.8	3.3	1.61 – 1.72	104 – 111	156 – 222	13.2 – 13.8	65.0
56	90 – 92	233.7 – 239.5	228.3 – 234.0	3.3	1.61 – 1.72	104 – 111	156 – 222	13.6 – 14.2	65.0
57	89 – 91	239.9 – 245.8	234.3 – 240.2	3.4	1.61 – 1.72	104 – 111	156 – 222	13.9 – 14.6	65.0
58	89 – 91	246.1 – 252.2	240.4 – 246.3	3.4	1.61 – 1.72	104 – 111	156 – 222	14.3 – 15.0	65.0
59	88 – 90	252.3 – 258.5	246.3 – 252.4	3.5	1.61 – 1.72	104 – 111	156 – 222	14.7 – 15.4	65.0
60	87 – 90	258.4 – 264.8	252.2 – 258.5	3.5	1.61 – 1.73	104 – 111	156 – 222	15.1 – 15.8	65.0
61	87 – 90	264.5 – 271.1	258.1 – 264.6	3.6	1.61 – 1.73	104 – 111	156 – 222	15.4 – 16.2	65.0
62	86 – 90	270.5 – 277.4	263.9 – 270.6	3.7	1.61 – 1.73	104 – 111	156 – 222	15.8 – 16.6	65.0
63	85 – 90	276.4 – 283.7	269.6 – 276.7	3.8	1.62 – 1.73	104 – 111	156 – 222	16.2 – 16.9	65.0
64	85 – 89	282.4 – 290.0	275.3 – 282.7	3.9	1.62 – 1.73	104 – 111	156 – 222	16.5 – 17.3	65.0
65	85 – 89	288.3 – 296.2	281.0 – 288.7	4.0	1.62 – 1.73	105 – 112	158 – 224	16.9 – 17.7	66.0
66	84 – 88	294.2 – 302.4	286.6 – 294.6	4.1	1.62 – 1.73	105 – 112	158 – 224	17.3 – 18.1	66.0
67	83 – 87	300.0 – 308.5	292.2 – 300.5	4.2	1.62 – 1.73	105 – 112	158 – 224	17.6 – 18.5	66.0
68	83 – 87	305.8 – 314.6	297.8 – 306.3	4.3	1.62 – 1.73	105 – 112	158 – 224	18.0 – 18.9	66.0
69	82 – 86	311.6 – 320.6	303.3 – 312.0	4.4	1.62 – 1.73	105 – 112	158 – 224	18.3 – 19.3	66.0
70	82 – 86	317.3 – 326.6	308.7 – 317.8	4.5	1.62 – 1.74	104 – 111	156 – 222	18.7 – 19.7	66.0
71	82 – 86	323.1 – 332.6	314.2 – 323.5	4.6	1.62 – 1.74	104 – 111	156 – 222	19.0 – 20.0	66.0
72	81 – 85	328.7 – 338.6	319.6 – 329.2	4.7	1.62 – 1.74	104 – 111	156 – 222	19.4 – 20.4	66.0
73	81 – 85	334.4 – 344.5	325.0 – 334.9	4.8	1.63 – 1.74	104 – 111	156 – 222	19.7 – 20.8	66.0
74	80 – 84	340.0 – 350.4	330.4 – 340.5	4.9	1.63 – 1.74	104 – 111	156 – 222	20.1 – 21.2	66.0
75	80 – 84	345.6 – 356.3	335.7 – 346.1	5.0	1.63 – 1.74	103 – 110	155 – 220	20.4 – 21.5	67.0
76	79 – 83	351.1 – 362.1	340.9 – 351.6	5.1	1.63 – 1.74	103 – 110	155 – 220	20.8 – 21.9	67.0
77	78 – 83	356.6 – 367.9	346.1 – 357.1	5.2	1.63 – 1.74	103 – 110	155 – 220	21.1 – 22.3	67.0
78	78 – 82	362.0 – 373.7	351.3 – 362.5	5.3	1.63 – 1.74	103 – 110	155 – 220	21.4 – 22.6	67.0
79	78 – 82	367.5 – 379.4	356.4 – 368.0	5.4	1.63 – 1.74	103 – 110	155 – 220	21.8 – 23.0	67.0
80	77 – 81	372.9 – 385.1	361.5 – 373.3	5.5	1.63 – 1.74	103 – 110	155 – 220	22.1 – 23.4	67.0
81	77 – 81	378.3 – 390.7	366.6 – 378.7	5.6	1.63 – 1.74	103 – 110	155 – 220	22.4 – 23.7	67.0
82	76 – 80	383.6 – 396.3	371.7 – 384.0	5.6	1.63 – 1.74	103 – 110	155 – 220	22.8 – 24.1	67.0
83	76 – 80	388.9 – 401.9	376.7 – 389.2	5.7	1.64 – 1.74	103 – 110	155 – 220	23.1 – 24.4	67.0
84	75 – 79	394.2 – 407.5	381.6 – 394.5	5.7	1.64 – 1.74	103 – 110	155 – 220	23.4 – 24.8	67.0
85	75 – 79	399.4 – 413.0	386.6 – 399.7	5.8	1.64 – 1.74	103 – 110	155 – 220	23.7 – 25.1	67.0
86	74 – 78	404.6 – 418.5	391.5 – 404.8	5.8	1.64 – 1.74	103 – 110	155 – 220	24.0 – 25.5	67.0
87	74 – 78	409.8 – 423.9	396.3 – 410.0	5.9	1.64 – 1.74	103 – 110	155 – 220	24.4 – 25.8	67.0
88	73 – 77	414.9 – 429.3	401.1 – 415.0	5.9	1.64 – 1.74	103 – 110	155 – 220	24.7 – 26.1	67.0
89	73 – 77	420.0 – 434.7	405.9 – 420.1	6.0	1.64 – 1.74	103 – 110	155 – 220	25.0 – 26.5	67.0
90	72 – 76	425.0 – 440.0	410.7 – 425.1	6.0	1.64 – 1.74	103 – 110	155 – 220	25.3 – 26.8	67.0
91	72 – 76	430.1 – 445.3	415.4 – 430.1	6.1	1.65 – 1.75	102 – 109	153 – 218	25.6 – 27.2	67.1
92	71 – 75	435.1 – 450.6	420.1 – 435.0	6.2	1.65 – 1.75	102 – 109	153 – 218	25.9 – 27.5	67.1
93	71 – 75	440.0 – 455.8	424.7 – 439.9	6.3	1.65 – 1.75	102 – 109	153 – 218	26.2 – 27.8	67.1
94	70 – 74	444.9 – 461.0	429.3 – 444.8	6.4	1.65 – 1.75	102 – 109	153 – 218	26.5 – 28.1	67.1
95	70 – 74	449.8 – 466.2	433.9 – 449.6	6.5	1.65 – 1.75	102 – 109	153 – 218	26.8 – 28.5	67.1
96	69 – 73	454.7 – 471.3	438.4 – 454.4	6.6	1.66 – 1.76	102 – 109	153 – 218	27.1 – 28.8	67.2
97	69 – 73	459.5 – 476.4	442.9 – 459.2	6.7	1.66 – 1.76	102 – 109	153 – 218	27.4 – 29.1	67.2
98	68 – 72	464.2 – 481.5	447.4 – 463.9	6.8	1.66 – 1.76	102 – 109	153 – 218	27.7 – 29.4	67.2
99	68 – 72	469.0 – 486.5	451.8 – 468.6	6.9	1.66 – 1.76	102 – 109	153 – 218	28.0 – 29.7	67.2
100	67 – 71	473.7 – 491.5	456.2 – 473.2	7.0	1.66 – 1.76	102 – 109	153 – 218	28.3 – 30.1	67.2

Cage Brooding Recommendations

Transportation to the Farm

- Use a truck designed for transportation of chicks from hatchery to farm.
- Truck should be environmentally controlled, maintaining 26–29°C at 70% relative humidity (measured inside chick box); with a minimum air flow of 0.7 m³ per minute.
- Provide space between stacks of chick boxes for air flow.

Chick Placement

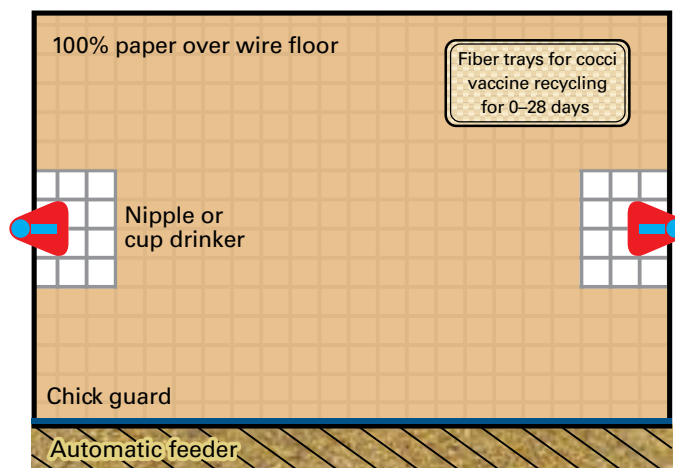
- Unload boxes quickly and gently place chicks in brooding area.
- Brood chicks in groups from similar aged breeder flocks.
- Start chicks in upper tiered cages which are usually warmer and brighter. Ensure there are no shadows on drinkers.
- Chicks from young breeder flocks should be placed in warmer and brighter areas of the house.

House Preparation before Arrival of Chicks

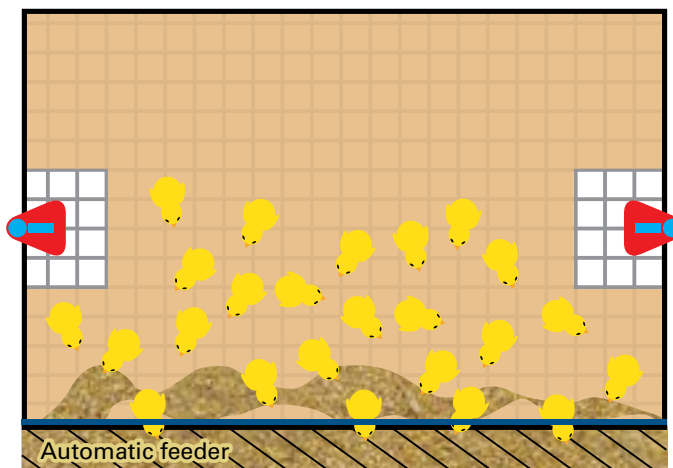
- Brooder house should be completely cleaned and disinfected well in advance of chick delivery. Confirm effectiveness of cleaning and disinfection with environmental swabs.
- Allow 2 weeks minimum downtime between flocks.
- For more information on house preparation and brooding management, see the “Growing Management of Commercial Pullets” technical update at www.hyline.com.
- Establish proper house temperature of 33–36°C (air temperature measured at chick level) and 60% humidity 24 hours before chick placement.
- Pre-heat brooding houses prior to chick placement: 24 hours in normal climates, 48 hours in cool climates and 72 hours in cold climates.
- Fill automatic feed line to its highest level and adjust chick guards. Allow access to the automatic feeder from the first day.
- Bright light (30–50 lux) during 0–7 days helps chicks quickly find feed and water and adapt to the new environment.

Brooding Management

- Place feed on cage paper 0–3 days to encourage consumption. For beak-treated chicks, feed on paper for 0–7 days.
- Place feed in front of permanent feeder to train chicks to move toward feeders.
- Remove paper at 7–14 days of age to avoid build-up of feces.
- Cage floors should not be slippery or sloped.
- Use vitamins and electrolytes in chicks’ water (avoid sugar-based products to prevent growth of microorganisms).
- Chicks’ body weight should double between arrival and 7 days of age.
- Brood chicks in groups from similar aged breeder flocks.
- Modify temperature as needed to meet chicks’ comfort needs.
- Adjust brooding temperature according to relative humidity. Lower temperature should be used with higher relative humidity.
- Find optimum balance of temperature, humidity and ventilation rate for chick comfort.
- For every 5 percentage point increase above 60% relative humidity, reduce brooding temperatures by 1°C.
- After the first week, reduce temperature weekly 2–3°C until reaching 21°C.
- Do not give cold water to chicks. Be careful when flushing water lines for chicks. Allow water time to warm up in the house so chicks are comfortable drinking.

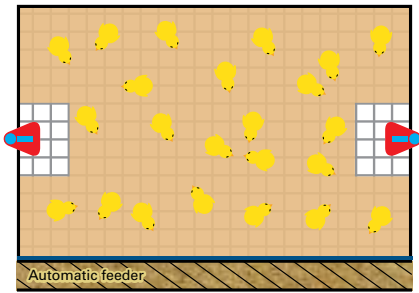


Chick guard adjusted to allow access to feeder from first day



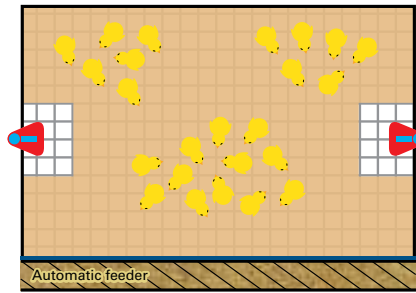
Place feed on paper near automatic feeder to train chicks

Cage Brooding Recommendations *(continued)*



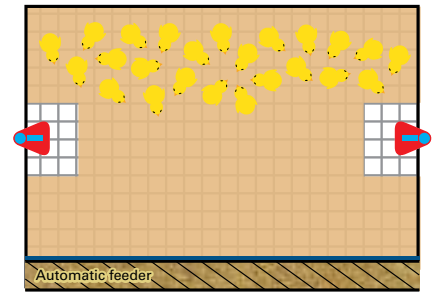
CORRECT

Chicks evenly distributed in cage,
active and sounding content



COLD

Chicks gathered into groups
sounding distressed

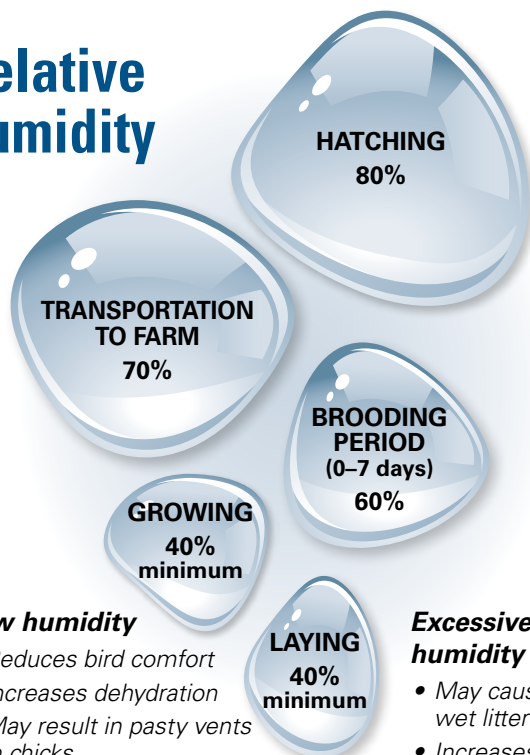


UNEVEN VENTILATION

Chicks congregated in one part
of cage, avoiding drafts, noise or
uneven light distribution

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	30-32°C	28-30°C	26-28°C	23-26°C	21-23°C	21°C
LIGHT INTENSITY	30-50 lux	33-35°C	28-30°C	26-28°C	23-26°C	21-23°C	21°C
LIGHT HOURS	22 hours or Intermittent Program	30-50 lux	31-33°C	26-28°C	23-26°C	21-23°C	21°C
		21 hours or Intermittent Program	25 lux	29-31°C	23-26°C	21-23°C	21°C
			20 hours	25 lux	26-27°C	21-23°C	21°C
				18.5 hours	25 lux	23-25°C	21°C
					17 hours	5-15 lux	21°C
						15.5 hours	5-15 lux
							14 hours

Relative humidity



Low humidity

- Reduces bird comfort
- Increases dehydration
- May result in pasty vents in chicks
- May increase agitation and possibility of pecking
- Adversely affects feather cover
- Increases dust

Excessive humidity

- May cause wet litter
- Increases ammonia
- Causes poor air quality

CROP FILL – ARE THE CHICKS EATING?

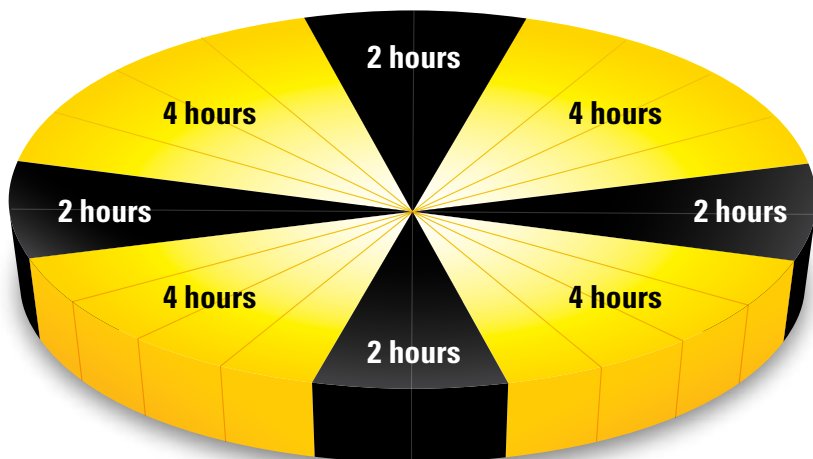
Hours after chick placement	Chicks with feed in crop	Chick with starter feed in crop	Chick without starter feed in crop
6	75%		
12	85%		
24	100%		

Brooding temperatures that are too low or too high will decrease the percentage of chicks with crop fill.

Lighting During Brooding Period

- An intermittent lighting program is preferred. If not using an intermittent lighting program from 0–7 days, then use 22 hours of light from 0–3 days and 21 hours of light from 4–7 days.
- Do not use 24 hours of light.
- Bright light (30–50 lux) during 0–7 days helps chicks quickly find feed and water and adapt to the new environment.
- After the first week, reduce light intensity and begin slow step-down lighting program (see Light Program for Light-Controlled Housing).

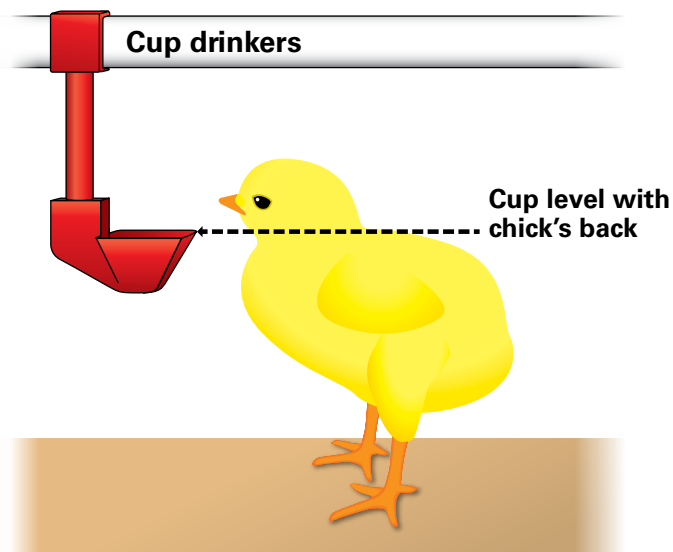
INTERMITTENT LIGHTING PROGRAM FOR CHICKS



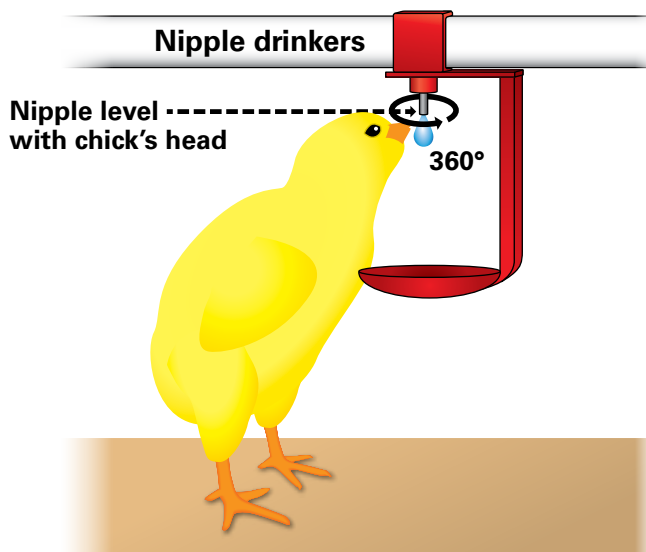
- Preferred lighting technique
- Use from 0–7 days (can be used up to 14 days of age)
- Intermittent dark periods provide rest periods for chicks
- Synchronizes chicks' activities and feedings
- Establishes more natural pattern of rest and activity
- May improve 7 day livability and pullet body weight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

Drinking Systems

- The type of drinkers used during rearing should be the same as in the layer house. Also use the same nipple type in rearing and laying house (vertical vs. 360° nipples).
- Drinking water should be tested periodically for quality and cleanliness from source and end of the water line.
- Flush water lines prior to chick arrival.
- Flush water lines weekly during rearing and production periods.
- Nipple drinkers should deliver minimum 60 ml per minute / nipple, with easy activation of the drinkers by chicks.
- Record daily flock water consumption. A drop in water consumption is often the first sign of a serious problem in the flock.



- Cup drinkers should be manually filled during 0–3 days to train chicks to drink.
- Open drinkers (bell, plasson, supplemental chick drinkers, trough) are easily contaminated and should be cleaned daily.



- Adjust nipple water system pressure to create hanging drop to help chicks find water for 0–3 days and in layer house at transfer.
- Splash cups are useful during brooding period and in hot climates.
- 360° activated nipples make drinking easy for chicks.
- Use only 360° activated nipples for hatchery beak-treated chicks.

Beak Treatment / Trimming

(Check local regulations concerning use of beak trimming)

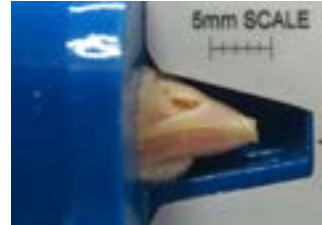
- Hy-Line W-80 Plus commercial layer should be beak trimmed at hatch by infrared beak treatment or between 7–10 days of age by precision beak trimming. If necessary, do corrective trimming at 6 weeks or 12–14 weeks of age.
- Hatchery beak treatment or 7–10-day beak trimming reduces feed wastage and leaves the beak less damaging to other birds.

HATCHERY INFRARED BEAK TREATMENT (IRBT)

- This provides efficient, uniform beak treatment.
- Beak remains intact until 21–28 days of age when treated portion separates.
- Use only 360° activated nipples for IRBT chicks, as well as supplemental chick drinkers.
- For IRBT chicks, feed on paper for 0–7 days.
- For more information, see the “Infrared Beak Treatment” technical update at www.hyline.com.
- In open housing, IRBT treated pullets may need retrimming at 6 or 12–14 weeks.



Infrared beak treatment can be modified according to local conditions.



Immediately following infrared beak treatment on day of hatch



7 days after infrared beak treatment

PRECISION BEAK TRIMMING

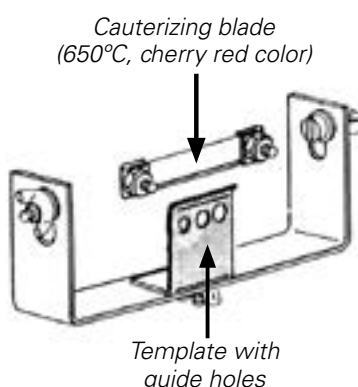
- Cauterize beak for 2 seconds at 650°C.
 - When cauterizing blade is not hot enough or cauterization time is < 2 seconds, beak will continue to grow unevenly.
 - If cauterizing blade is too hot or cauterization time is > 2 seconds, sensitive neuromas may form.
- Use a pyrometer to accurately measure blade temperature, which should be approximately 650°C.
- Cauterizing blade color may be used as an approximate indicator of temperature.

< 650°C

650°C

> 650°C

- Blade temperature variation of up to 40°C is common due to external influences and cannot be detected by the human eye.
- Use a template with guide plate holes for precision beak trim of different size chicks.
- Monitor beak trimming crews to ensure that beaks have been properly and evenly trimmed.



Guide holes correspond to different size and age of chicks

- 3.56 mm
- 4.00 mm
- 4.37 mm



Photo courtesy of Lyon Technologies, Inc.



Pyrometer indicating proper blade temperature of 650°C.



Properly trimmed beaks

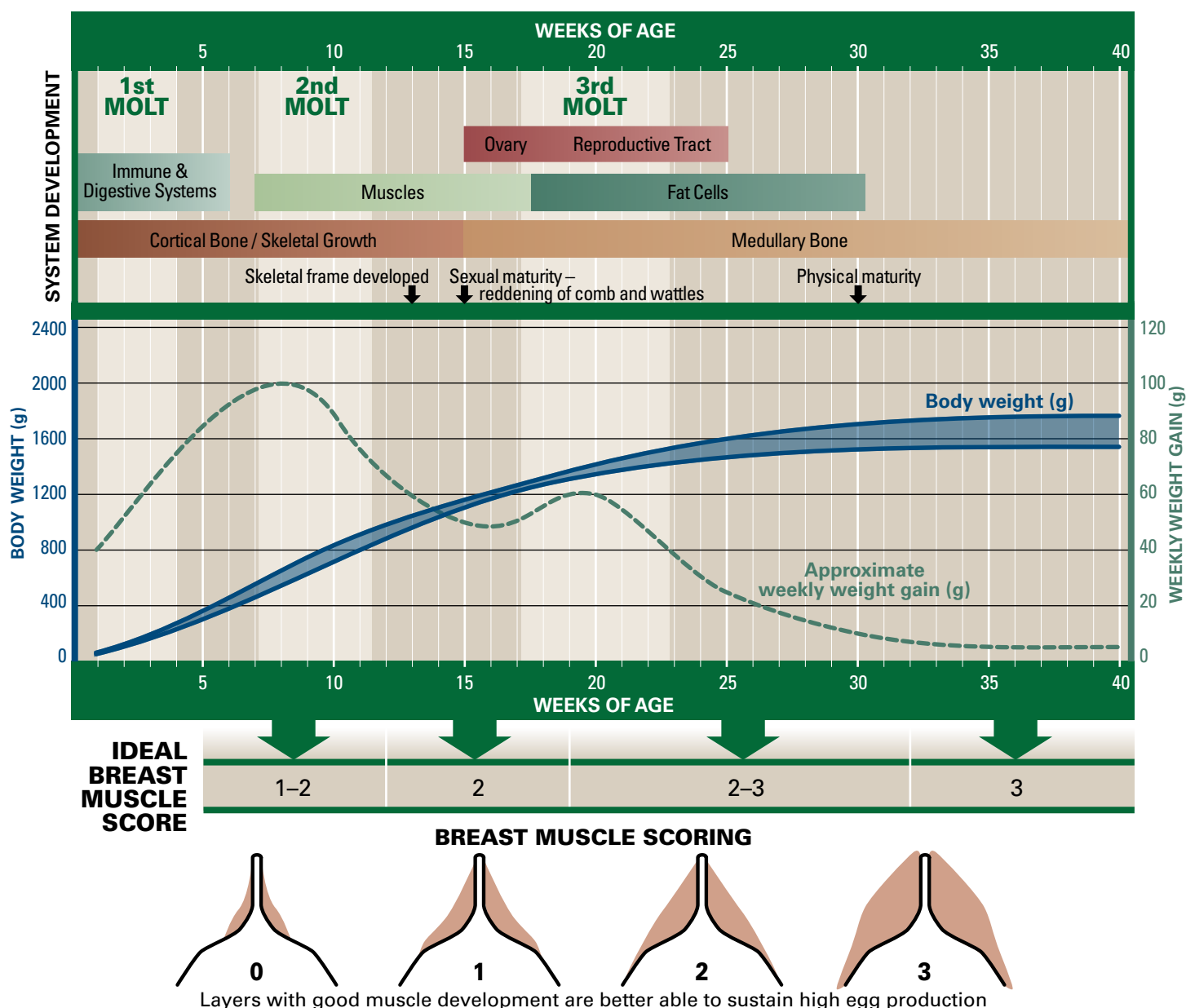


Precautions when using IRBT or beak trimming birds:

- Water intake is the most important factor in the success of IRBT/beak trimming. Chicks require immediate and easy access to water.
- Do not beak-trim sick or stressed birds.
- Do not hurry; handle chicks carefully.
- Provide vitamins and electrolytes containing vitamin K in drinking water 2 days before and 2 days after beak trimming.
- Watch chicks after beak trimming to assess stress. Raise ambient temperature until birds appear comfortable and active.
- Keep feed at the highest level for several days after beak trimming.
- Use only well-trained crews.
- Use 360° activated nipples, supplemental chick drinkers and splash cups to encourage drinking.

Growth and Development

- Focus on pullet rearing programs to optimize growth and development.
- The best predictor of future laying performance is the pullet's body weight and body type at the point of lay.
- A pullet flock entering into egg production at the correct body weight (1.17–1.25 kg) with uniformity higher than 90% performs best in the production period.
- It is important to achieve 6, 12, 18, 24, and 30 week body weight targets to ensure optimum development of the bird's body.
- **Manage feeding to achieve body weights 0–12 weeks in the upper range of the body weight standard. This will ensure good musculoskeletal and GIT development. Avoid high rates of body weight gains after 12 weeks to prevent excessive abdominal fat development.**
- Change rearing diets only when recommended body weight is attained. Suggested ages are a guide if target weights are achieved.
- Delay diet change if birds are underweight or have poor body weight uniformity.
- Anticipate rapid rise in ambient temperature and adjust bird's diet accordingly. Birds will eat less when exposed to a rapid temperature increase. (See the "Understanding Heat Stress in Layers" technical update at www.hyline.com.)
- Stress periods require a change in diet formulation to ensure proper nutrient intake.
- Increasing dietary fiber to 5–6% beginning with developer diet can increase crop, gizzard and intestine development and capacity.



Rearing Body Weights, Feed Consumption and Uniformity

AGE (weeks)	BODY WEIGHT (kg)	FEED INTAKE (g / bird / day)	WATER CONS. (ml / bird/ day)	UNIFORMITY (Cage)
1	0.07 – 0.08	12 – 14	18 – 28	>85%
2	0.12 – 0.13	15 – 19	23 – 38	
3	0.18 – 0.19	21 – 25	32 – 50	
4	0.25 – 0.26	27 – 31	41 – 62	
5	0.32 – 0.35	31 – 35	47 – 70	>80%
6	0.41 – 0.44	35 – 39	53 – 78	
7	0.51 – 0.55	39 – 43	59 – 86	
8	0.60 – 0.65	42 – 46	63 – 92	
9	0.70 – 0.74	44 – 50	66 – 100	
10	0.78 – 0.84	48 – 53	71 – 105	
11	0.86 – 0.91	51 – 56	76 – 111	
12	0.92 – 0.99	54 – 59	80 – 117	
13	0.98 – 1.05	57 – 62	85 – 123	>85%
14	1.03 – 1.11	60 – 65	89 – 129	
15	1.08 – 1.16	63 – 68	94 – 135	
16	1.13 – 1.21	67 – 72	100 – 143	
17	1.17 – 1.25	70 – 75	104 – 149	

- Monitor body weights weekly from 0–30 weeks and before scheduled diet changes.
- Body weight gains and uniformity may be negatively affected by inappropriate diet changes, bird handling, vaccination and transfer.
- Using multiple hatch dates, causing a range of chick ages, will negatively affect uniformity.
- Flocks should be at 90% uniformity at the time of transfer to the laying facility.
- During the transfer of birds from rearing to laying facilities, there will be some loss of body weight.

Weigh 100 birds weekly to 30 weeks of age



Weigh birds separately after 3 weeks using a digital scale that calculates uniformity.

Space Guidelines *(check local regulations)*

		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																													
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											

Requirements vary with type of equipment used and environmental conditions.

Transfer to Laying House

- **Transfer the flock to the production facility by 16 weeks of age or after administration of the last live vaccines.**
- **Delayed transfer results in overcrowding in rearing cages and loss of flock uniformity and body condition.**
- It is important that rearing and production cages use similar feed and water systems, to minimize stress.
- Any sex slips (males) should be removed around 7 weeks and at transfer.
- Supportive care to reduce stress, such as water-soluble vitamins, probiotics, vitamin C and increased dietary density, should be used 3 days before and 3 days after transfer.
- Weigh prior to transfer and monitor weight loss during transfer.
- Monitor flock water consumption frequently after transfer. Pre-transfer water consumption should be achieved within 6 hours after transfer to the laying house.
- Brighten the lights for three days after transfer until birds settle in their new environment.
- Inspect the flock and remove mortality daily.
- If mortality exceeds 0.1% per week, perform necropsies and other diagnostics to determine cause(s) of mortality.
- Transfer birds quickly to laying house. Transfer all birds the same day. Move early in the morning so birds can keep to a normal daily routine.

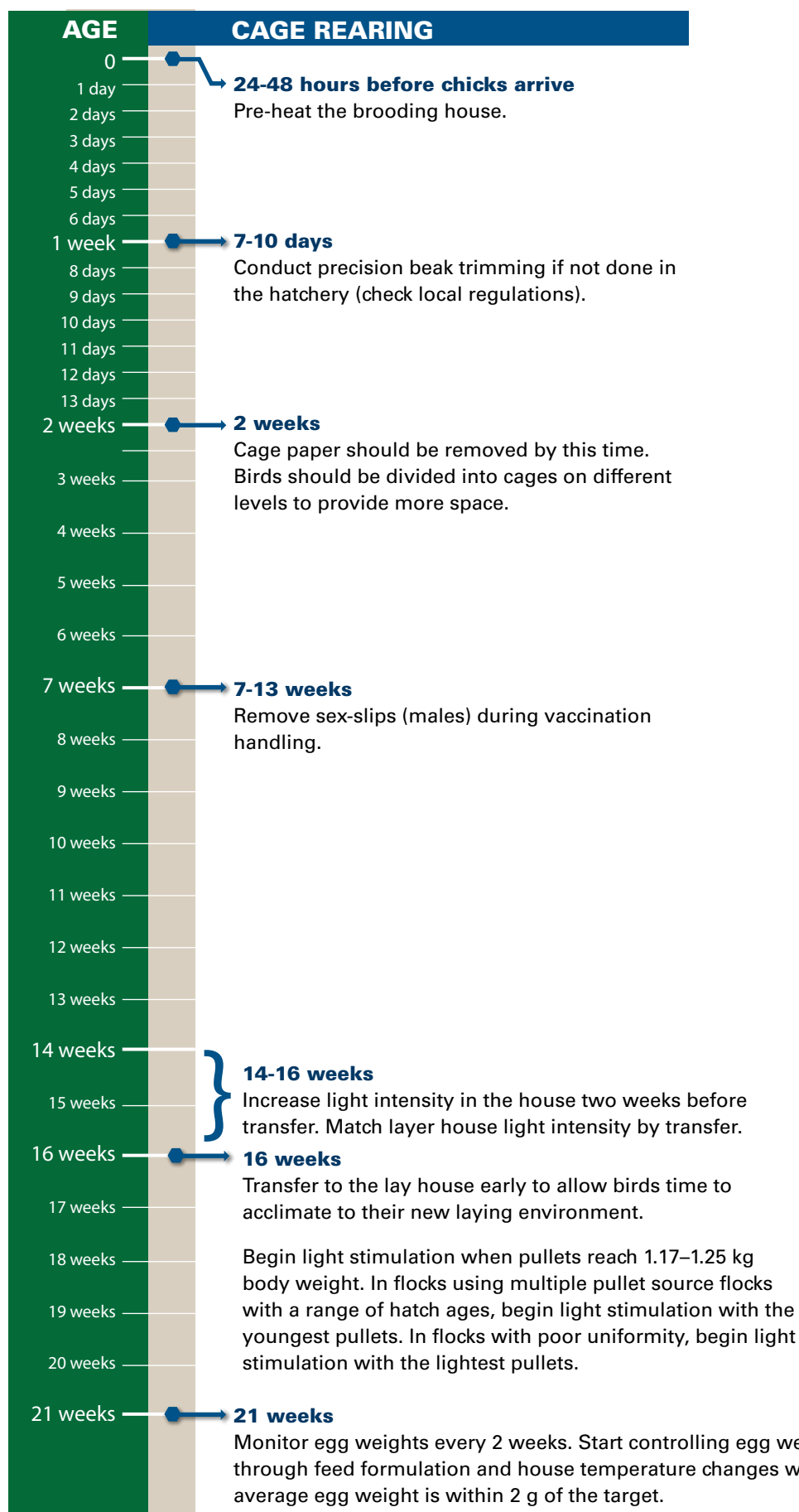
Enriched Cages

- Enriched cages address some of the welfare concerns of layers in cages by providing more space with environment enrichment devices, such as perches, nest boxes, scratch areas and abrasive pads for beak and toe shortening.
- Generally, bird group sizes range from 40–110 birds per cage.
- As group size increases, there is more competition for feed and water space and less stable social groups. This could lead to behavioral problems like feather pecking and piling. Cage enrichments help prevent these behavioral problems.

Alternative Systems

- W-80 Plus is an excellent choice for alternative management systems. For more information on managing the W-80 Plus in barn, aviary and free range systems, see the Alternative Systems Management Guide at www.hyline.com.

Management Events for Commercial Layers



Bird Handling—BE GENTLE

- Proper handling of birds during body weight measurements, blood collection, selection, vaccination, and transfer will reduce bird stress and prevent injuries.
- Hold birds by both legs or both wings.
- Return birds to cage or floor gently.
- Use experienced personnel that have been trained in proper procedures of bird handling.
- Continually observe crews for proper handling.

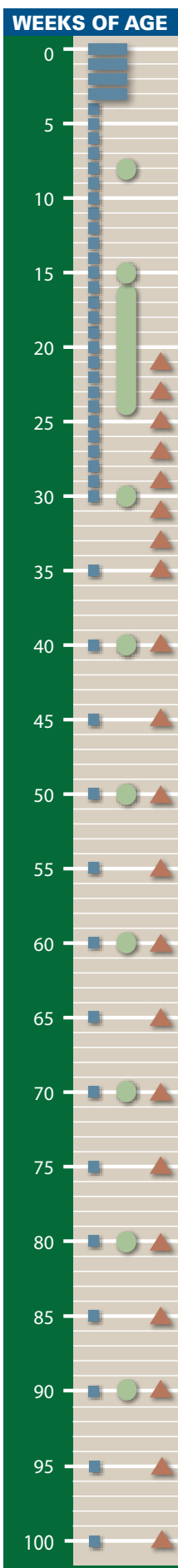


Hold no more than three birds in one hand.



Correct way to hold birds when placing or removing from cage.

Management Events for Commercial Layers



AGES OF BODY WEIGHT MEASUREMENTS

- Weigh separate groups of birds on each cage level due to temperature and environmental differences.
- Identify cages from the beginning and end of feed lines.
- Mark cages and use the same cage every time body weight is monitored.
- Weigh birds on the same day of the week and the same time of day.

0–3 weeks

- Bulk weigh 10 boxes of 10 chicks.

4–29 weeks

- Weigh 100 birds individually every week.
- Weigh birds in the same cages each time for best accuracy.
- Calculate uniformity.

30–100 weeks

- Weigh 100 birds individually every 5 weeks.
- Weigh birds in the same cages each time for best accuracy.
- Calculate uniformity.

When handling birds for body weights, assess:

- Keel bone—straightness and firmness
- Breast muscle score
- Body fat
- External parasites
- Clinical symptoms of disease

CALCULATING UNIFORMITY

- Use individual bird weights.
- Uniformity calculation tool is available at www.hylinebodyweight.com.

AGES OF SERA COLLECTION

For more information, see the “Proper Collection and Handling of Diagnostic Samples” technical update at www.hyline.com.

Collect 10–20 sera samples per flock for titer determination.

8 weeks

- Assess early vaccination technique and disease exposure.

15 weeks

- Collect sera before transfer to lay house to assess possible change in disease exposure.
- It is common to not send sera to the laboratory and freeze for future analysis in event of disease outbreak on lay farm.

16–24 weeks

- Collect sera at least 4 weeks after final inactivated vaccination to measure post-vaccination antibody response.
- It is useful to assess disease challenge after transfer to lay farm.

30–90 weeks

- Collect sera every 10 weeks.
- It is useful for assessing disease exposure during the laying period.

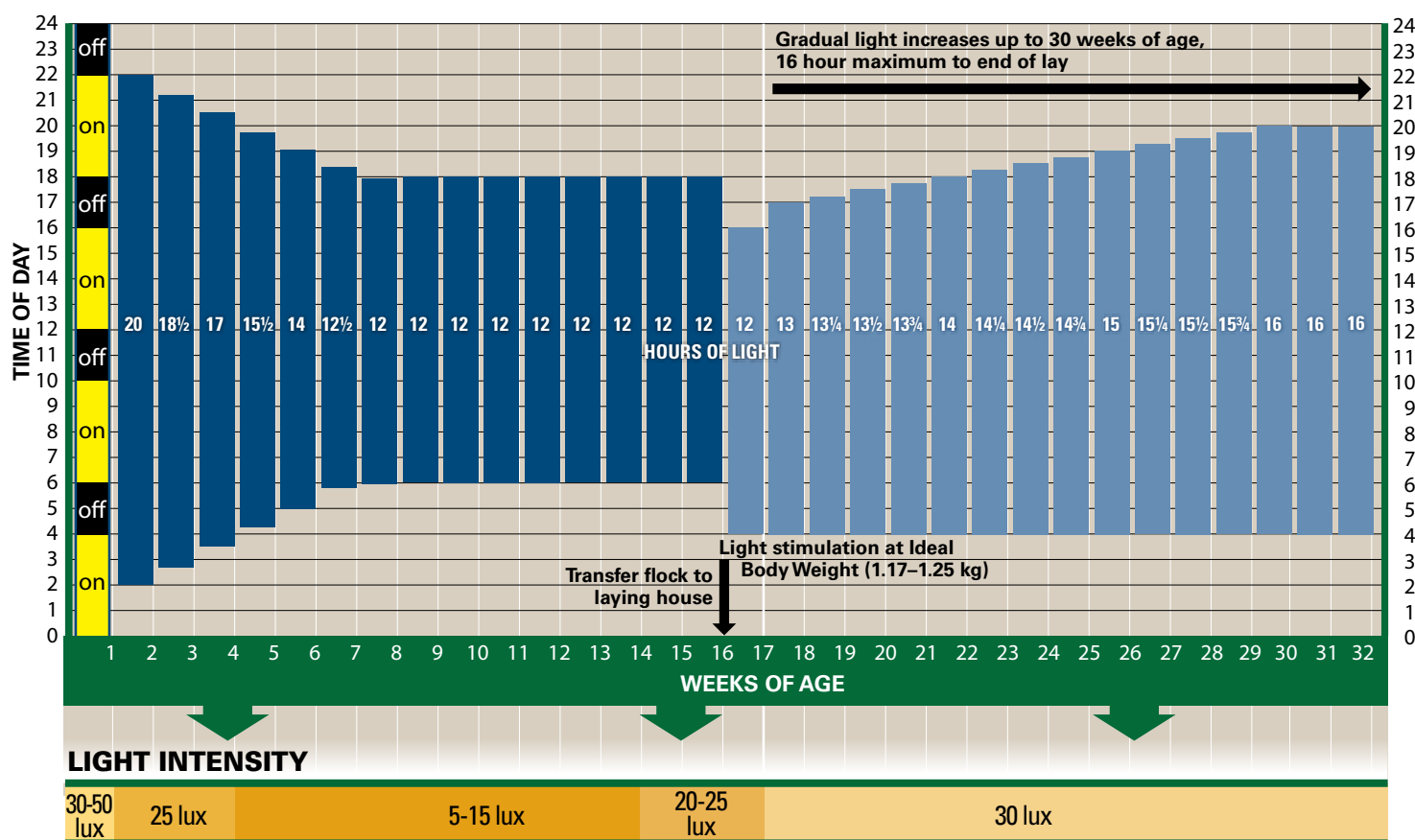
AGES TO MONITOR EGG WEIGHTS

Weigh 100 eggs collected from egg belts in front of randomly selected cages (may be the same cages used for body weight monitoring) to ensure even distribution of egg samples. Monitor egg weights on a specific day of the week within the same 3-hour time frame.

Good Lighting Practices

- Measure minimum light intensity at feeder on bottom tier cages, mid-way between lights.
- Keep light bulbs clean to prevent loss of light intensity.
- Prevent dark areas caused by too much distance between lights or burned-out light bulbs.
- Position lights to minimize bright and dark areas in the house.
- Shiny or white surfaces reflect light and increase light intensity.
- Take local conditions into account which may require adaptations of lighting programs.
- Light hours of rearing and production houses should be matched at transfer.
- Light intensity should gradually increase 2 weeks before flock is transferred to the laying house (but not prior to 14 weeks of age). Final rearing house light intensity should match the laying house intensity.
- Begin light stimulation when flock reaches the body weight target (1.17–1.25 kg). Delay light stimulation if the flock is underweight or has poor uniformity.
- Light stimulation period should extend into the peaking period. Achieve 16 hours of light at approximately 30 weeks.
- Alternating the height of lights improves light distribution to all cage levels.

Light Program for Light-Controlled Housing



- Light-controlled houses are those which use light traps around fans and air inlets and complete prevent the ingress of light from the outside. Houses that are not light controlled should use lighting programs for open-sided housing.
- An intermittent lighting program for chicks is preferred. If not using an intermittent lighting program from 0–7 days, then use 22 hours of light from 0–3 days and 21 hours of light from 4–7 days.
- “Lights on” time can be varied between houses in laying flocks to facilitate egg collection on multiple flock complexes.
- If the laying flock has a large spread in hatch ages and/or poor uniformity, light stimulate the flock based on the youngest hatch date or lightest birds.
- Use warm lights (2700–3500 K) in laying flocks to ensure sufficient red spectrum light.
- For more information on poultry lighting, see the “Understanding Poultry Lighting” and “Impact of Tarp Color on Poultry Lighting” technical updates at www.hyline.com.

Customized Lighting Programs for Open-Sided Housing (www.hyline.com)

The Hy-Line International Lighting Program can create custom lighting programs for your location, hatch date, and variety.

- On the first screen—enter e-mail address and select language.
- On the second screen, use dropdowns for “Select Location of Flock,” “Hatch Date,” “Varying Standards” and “Housing Style.”
- Click on “Create Lighting Spreadsheet.”
- Results will be e-mailed to you.

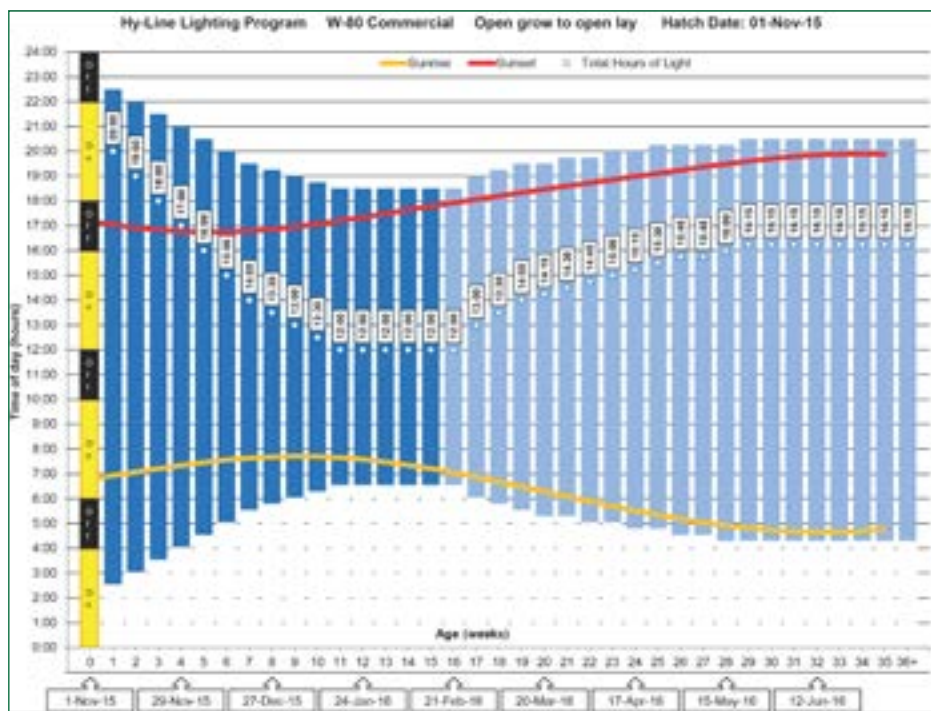
Lighting Program for : IOWA / DALLAS CENTER 93° 56' W 41° 43' N

Variety: W-80 Commercial
Hatch Date: 01-Nov-15
Standard daylight time

Age to stopdown to floor level: 10
Hours of constant light to grow after stopdown: 10
Hours of constant light to lay after stopdown: 10

Weeks of Age	Date	Sunrise	Sunset	Light on	Light off	Break	Light on	Light off	Total hours of light
0	1-Nov-15	6:43	17:00	17:00	17:00	17:00	17:00	17:00	10:17
1	8-Nov-15	6:38	17:30	17:30	17:30	17:30	17:30	17:30	10:52
2	15-Nov-15	6:34	18:00	18:00	18:00	18:00	18:00	18:00	11:27
3	22-Nov-15	6:30	18:30	18:30	18:30	18:30	18:30	18:30	12:02
4	29-Nov-15	6:26	19:00	19:00	19:00	19:00	19:00	19:00	12:37
5	6-Dec-15	6:22	19:30	19:30	19:30	19:30	19:30	19:30	13:12
6	13-Dec-15	6:18	20:00	20:00	20:00	20:00	20:00	20:00	13:47
7	20-Dec-15	6:14	20:30	20:30	20:30	20:30	20:30	20:30	14:22
8	27-Dec-15	6:10	21:00	21:00	21:00	21:00	21:00	21:00	14:57
9	3-Jan-16	6:06	21:30	21:30	21:30	21:30	21:30	21:30	15:32
10	10-Jan-16	6:02	22:00	22:00	22:00	22:00	22:00	22:00	16:07
11	17-Jan-16	5:58	22:30	22:30	22:30	22:30	22:30	22:30	16:42
12	24-Jan-16	5:54	23:00	23:00	23:00	23:00	23:00	23:00	17:17
13	31-Jan-16	5:50	23:30	23:30	23:30	23:30	23:30	23:30	17:52
14	7-Feb-16	5:46	24:00	24:00	24:00	24:00	24:00	24:00	18:27
15	14-Feb-16	5:42	24:30	24:30	24:30	24:30	24:30	24:30	19:02
16	21-Feb-16	5:38	25:00	25:00	25:00	25:00	25:00	25:00	19:37
17	28-Feb-16	5:34	25:30	25:30	25:30	25:30	25:30	25:30	20:12
18	6-Mar-16	5:30	26:00	26:00	26:00	26:00	26:00	26:00	20:47
19	13-Mar-16	5:26	26:30	26:30	26:30	26:30	26:30	26:30	21:22
20	20-Mar-16	5:22	27:00	27:00	27:00	27:00	27:00	27:00	21:57
21	27-Mar-16	5:18	27:30	27:30	27:30	27:30	27:30	27:30	22:32
22	3-Apr-16	5:14	28:00	28:00	28:00	28:00	28:00	28:00	23:07
23	10-Apr-16	5:10	28:30	28:30	28:30	28:30	28:30	28:30	23:42
24	17-Apr-16	5:06	29:00	29:00	29:00	29:00	29:00	29:00	24:17
25	24-Apr-16	5:02	29:30	29:30	29:30	29:30	29:30	29:30	24:52
26	1-May-16	4:58	30:00	30:00	30:00	30:00	30:00	30:00	25:27
27	8-May-16	4:54	30:30	30:30	30:30	30:30	30:30	30:30	26:02
28	15-May-16	4:50	31:00	31:00	31:00	31:00	31:00	31:00	26:37
29	22-May-16	4:46	31:30	31:30	31:30	31:30	31:30	31:30	27:12
30	29-May-16	4:42	32:00	32:00	32:00	32:00	32:00	32:00	27:47
31	5-Jun-16	4:38	32:30	32:30	32:30	32:30	32:30	32:30	28:22
32	12-Jun-16	4:34	33:00	33:00	33:00	33:00	33:00	33:00	28:57
33	19-Jun-16	4:30	33:30	33:30	33:30	33:30	33:30	33:30	29:32
34	26-Jun-16	4:26	34:00	34:00	34:00	34:00	34:00	34:00	30:07
35	3-Jul-16	4:22	34:30	34:30	34:30	34:30	34:30	34:30	30:42
36+		4:18	35:00	35:00	35:00	35:00	35:00	35:00	31:17

Same lighting program with sunrise and sunset represented by yellow and red lines and suggested artificial day length indicated by blue bars



Use of Shades in Open-Sided Housing



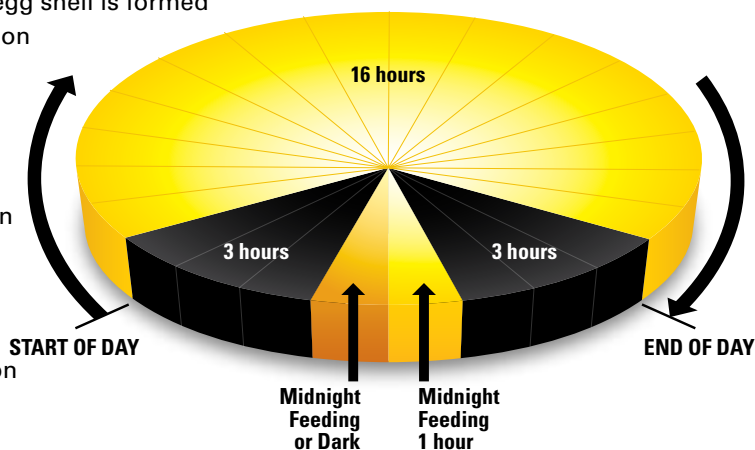
- Shades are an effective way to decrease light intensity in an open-sided house.
- Shades must be porous to allow air flow through the curtain.
- Keep shades clean and free of dust to allow air flow.
- Use stir fans when using shades.
- Avoid direct sunlight on birds by using shades or roof overhangs.
- Black shades are preferred.

Midnight Feeding / Lighting Program

- Optional lighting technique that promotes greater feed consumption
- Used whenever more feed intake is desired in rearing or laying flocks
- Increases calcium absorption during night when most egg shell is formed
- Useful to increase feed intake during peak egg production
- Helps maintain feed consumption in hot climates
- Midnight feeding may increase feed intake 2–5 g / day per bird

Good Practices

- Initiate the program by turning lights on for 1–2 hours in the middle of the dark period.
- Fill feeders before lights are turned on.
- There must be at least 3 hours of dark before and after the midnight feeding.
- Light provided during the midnight feeding is in addition to regular day length (i.e. 16 hours + midnight feeding).
- If midnight feeding is removed, reduce light gradually at a rate of 15 minutes per week.



Heat Stress

For information on management of layers in heat stress conditions, see the “Understanding Heat Stress in Layers” technical update at www.hyline.com.

Water Quality

- Good quality water must be available to birds at all times.
- Water and feed consumption are directly related—when birds drink less, they consume less feed and production quickly declines.
- As a general rule, healthy birds will consume 1.5–2.0 times more water than feed. This ratio increases in high ambient temperatures.
- Test water quality at least 1 time per year. The water source will determine the regularity of water testing.
 - Surface water requires more frequent testing, as it is more affected by season and rainfall patterns.
 - Closed wells taking water from aquifers or deep artesian basins will be more consistent in water quality, but are generally higher in dissolved mineral content.
- The presence of coliform bacteria is an indicator that the water source has been contaminated with animal or human waste.
- When collecting a well water sample, let the water run for 2 minutes prior to collecting the sample. Water samples should be kept below 10°C and submitted to the lab in less than 24 hours.
- Some water sources contain high levels of dissolved minerals such as calcium, sodium and magnesium. When this occurs, amounts of these minerals in water have to be considered when formulating feed.
- Ideal water pH is 5–7 to promote good water sanitation, increase feed consumption and improve upper gastrointestinal health.
- Less than optimum water quality can have a significant impact on intestinal health, which will lead to under utilization of nutrients in feed.
- A decrease in flock water consumption is often the first sign of health problems and production drops.

ITEM	MAXIMUM CONCENTRATION (ppm or mg/L)*	
Nitrate NO_3^- ¹	25	Older birds will tolerate higher levels up to 20 ppm. Stressed or diseased 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.
Sulfate (SO_4^{2-}) ¹	250	Higher levels may be laxative.
Iron (Fe) ¹	<0.3	Higher levels result in bad odor 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	
Aluminum (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	6.3–7.5	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	Likely to indicate dirty water.
Total Coliform bacteria ³	50 CFU/ml	
Fecal 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 sanitize water at a favorable 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

Air Quality

Air Movement (m³ / hour per 1000 birds)

AMBIENT TEMP. (°C)	WEEKS OF AGE					
	1	3	6	12	18	19+
32	340	510	1020	2550	5950	4650–9350
21	170	255	510	1275	2550	4250–5100
10	120	170	340	680	1870	2550–3400
0	70	130	230	465	1260	850–1300
-12	70	100	170	340	500	600–850
-23	70	100	170	340	500	600–680

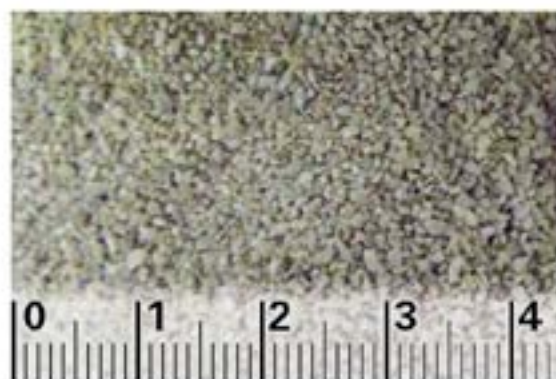
Acknowledgment: Dr. Hongwei Xin, Professor, Department of Agriculture and Biosystems Engineering and Department of Animal Science, Iowa State University, Ames, Iowa, USA

- Production house should be at 18–25°C and 40–60% humidity.
- The general rule for determining required fan capacity—4 m³ of air movement / kilogram of body weight per hour.
- Ventilation is essential to:
 - Remove moisture from house
 - Remove excessive heat
 - Provide each bird with an adequate supply of oxygen
 - Remove carbon dioxide produced by birds
 - Remove dust particles
 - Dilute aerosolized pathogenic organisms
- Allowable levels of gases at floor level in the house are: ammonia (NH₃) < 25 ppm; carbon dioxide (CO₂) < 5000 ppm; carbon monoxide (CO) < 50 ppm.

Calcium Particle Size

PARTICLE SIZE	STARTER, GROWER, DEVELOPER	PRE-LAY	WEEKS 17–37	WEEKS 38–48	WEEKS 49–62	WEEKS 63–76	WEEKS 77+
Fine (0–2 mm)	100%	50%	40%	35%	30%	25%	25%
Coarse (2–4 mm)	–	50%	60%	65%	70%	75%	75%

- The appropriate particle size depends on the solubility of limestone.
- Dietary calcium levels may need to be adjusted based on limestone solubility.
- Limestone dark in color is geologically older, containing more impurities (typically magnesium) and is generally lower in solubility and calcium availability.
- Oyster shell and other marine shells are good sources of soluble calcium.



Fine calcium (0–2 mm)



Coarse calcium (2–4 mm)

Photos courtesy of Longcliff Quarries Ltd.

Feed Particle Size (Grist)

A sieve shaker separates a feed sample into categories based on particle size.

- Use on the farm to check feed particle size from the feed mill—sample taken on delivery or from feed bins.
- Use to assess the uniformity of feed particle size throughout the feeding system—samples are taken from various points.

Too many fine feed particles:

- Feed intake and nutrient absorption decreases
- Dust in house increases

Too many coarse feed particles:

- Birds selectively eat large particles
- Risk of feed separation increases



OPTIMAL FEED PARTICLE PROFILES

Hy-Line Sieve Shaker

PARTICLE SIZE	STARTER	GROWER	DEVELOPER	PRODUCTION
< 1 mm	1–3 mm diameter, crumble feed should contain < 10% fine feed particles	< 15%	< 15%	< 15%
1–2 mm		45–60%	25–35%	20–30%
2–3 mm		10–25%	25–40%	30–40%
> 3 mm		–	5–10%	10–15%

For more information, see the “Feed Granulometry” technical update at www.hyline.com.

Best Practices

- A 3–4 hour gap between mid-day feedings allows birds to consume fine particles. Daily consumption of fine feed particles is important for a balanced nutrient intake.
- Add a minimum of 0.5% liquid oil / fat in mash diets to incorporate and retain small particles in feed.
- Use larger particle size mash or crumble to increase intakes in hot climates.

Vitamins and Trace Minerals

- As the vitamin / trace mineral premix is often found in fine feed particles, a minimum level of 0.5% added liquid oil / fat in diets binds small particles in feed.

ITEM ^{1,2,3,4}	IN 1000 KG COMPLETE DIET	
	Rearing Period	Laying Period
Vitamin A, IU	10,000,000	8,000,000
Vitamin D ₃ ⁵ , IU	3,300,000	3,300,000
Vitamin E, g	25	20
Vitamin K (menadione), g	3.5	2.5
Thiamin (B ₁), g	2.2	2.5
Riboflavin (B ₂), g	6.6	5.5
Niacin (B ₃) ⁶ , g	40	30
Pantothenic acid (B ₅), g	10	8
Pyridoxine (B ₆), g	4.5	4
Biotin (B ₇), mg	100	75
Folic acid (B ₉), g	1	0.9
Cobalamine (B ₁₂), mg	23	23
Manganese ⁷ , g	90	90
Zinc ⁷ , g	85	80
Iron ⁷ , g	30	40
Copper ⁷ , g	15	8
Iodine, g	1.5	1.2
Selenium ⁷ , g	0.25	0.22

¹ Minimum recommendations for rearing and laying periods. Local regulations may limit dietary content of individual vitamins or minerals.

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.

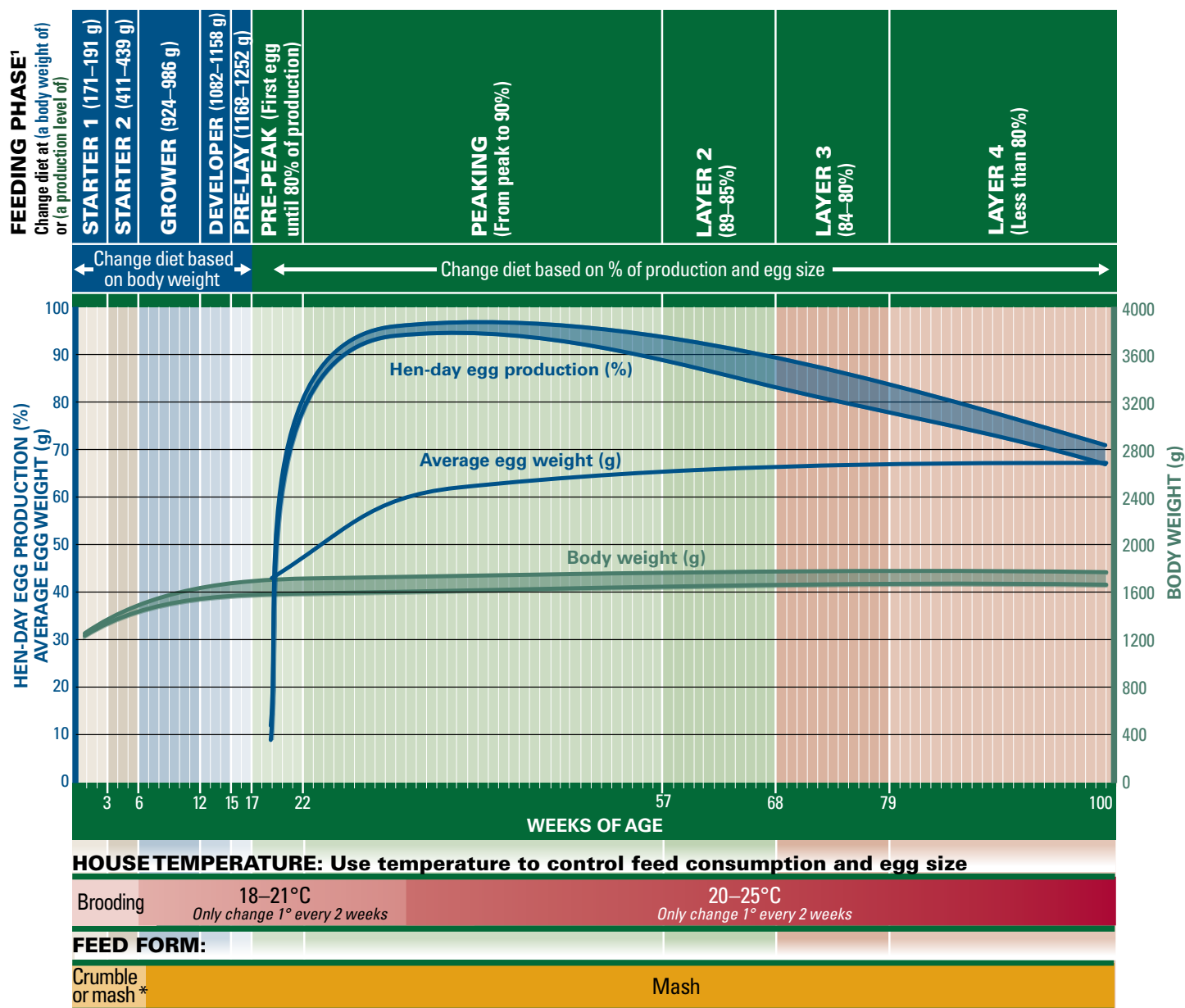
⁴ Where heat treatment is applied to diet, higher levels of vitamins may be required. Consult with vitamin supplier regarding stability through individual production processes.

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.

Phase Feeding to Meet the W-80's Nutritional Needs



* Crumble may be fed longer to encourage body weight gain

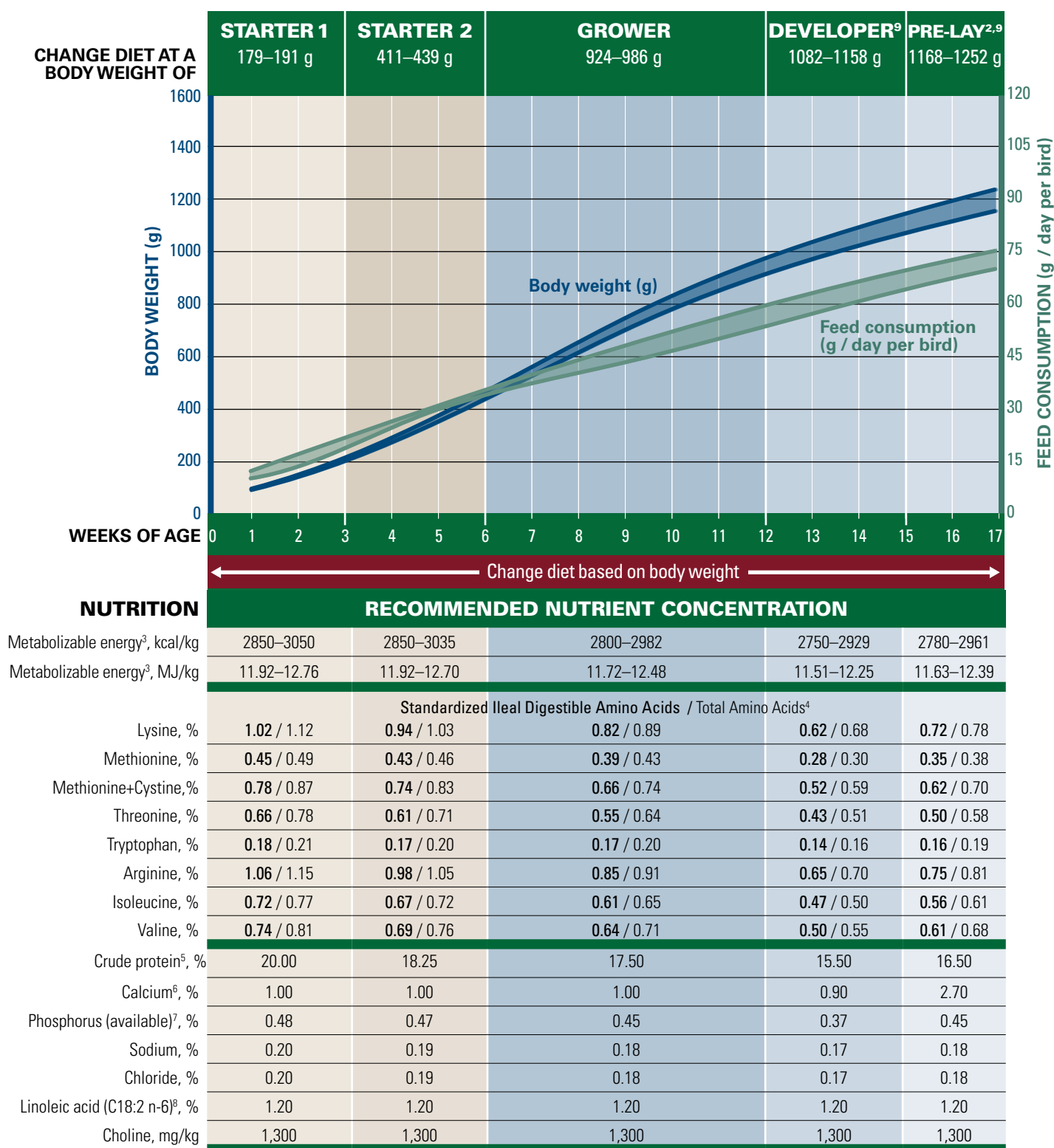
Control of Ambient House Temperature

- At housing, an ambient temperature of 18–20°C is desired. Increase house temperature about 1°C every 2 weeks until reaching 25°C, assuming ventilation systems are able to maintain adequate air quality at these temperatures.
- Lower (colder) house temperatures after peak will lead to greater feed intakes and may be counterproductive to egg-weight control, as well as optimal feed efficiency and adult hen body weights.
- Place temperature sensors to measure temperature inside of cage. The temperature in walkways is significantly colder than the temperature inside cages, especially in stack deck belted house systems.
- High environmental temperatures have a depressing effect on feed intake.

Controlling Egg Weight

- Closely monitor egg weight of each flock and make nutritional changes as needed to ensure optimal egg weight.
- If smaller eggs are desired, egg weight should be controlled at an early age.
- Egg-weight control is achieved by limiting amino acid consumption and ensuring that feed intake is not too high.
- Monitor egg weight every 2 weeks until 35 weeks of age, then every 5 weeks. Start controlling egg weight when average egg weight is within 2 g of target.
- For more information, see the “Optimizing Egg Size in Layers” technical update at www.hyline.com.

Rearing Period Nutritional Recommendations



¹ All nutrient requirements are based on the feed ingredient table at the back of this guide.

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. Use Pre-Lay Diet to introduce large particle calcium.

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.

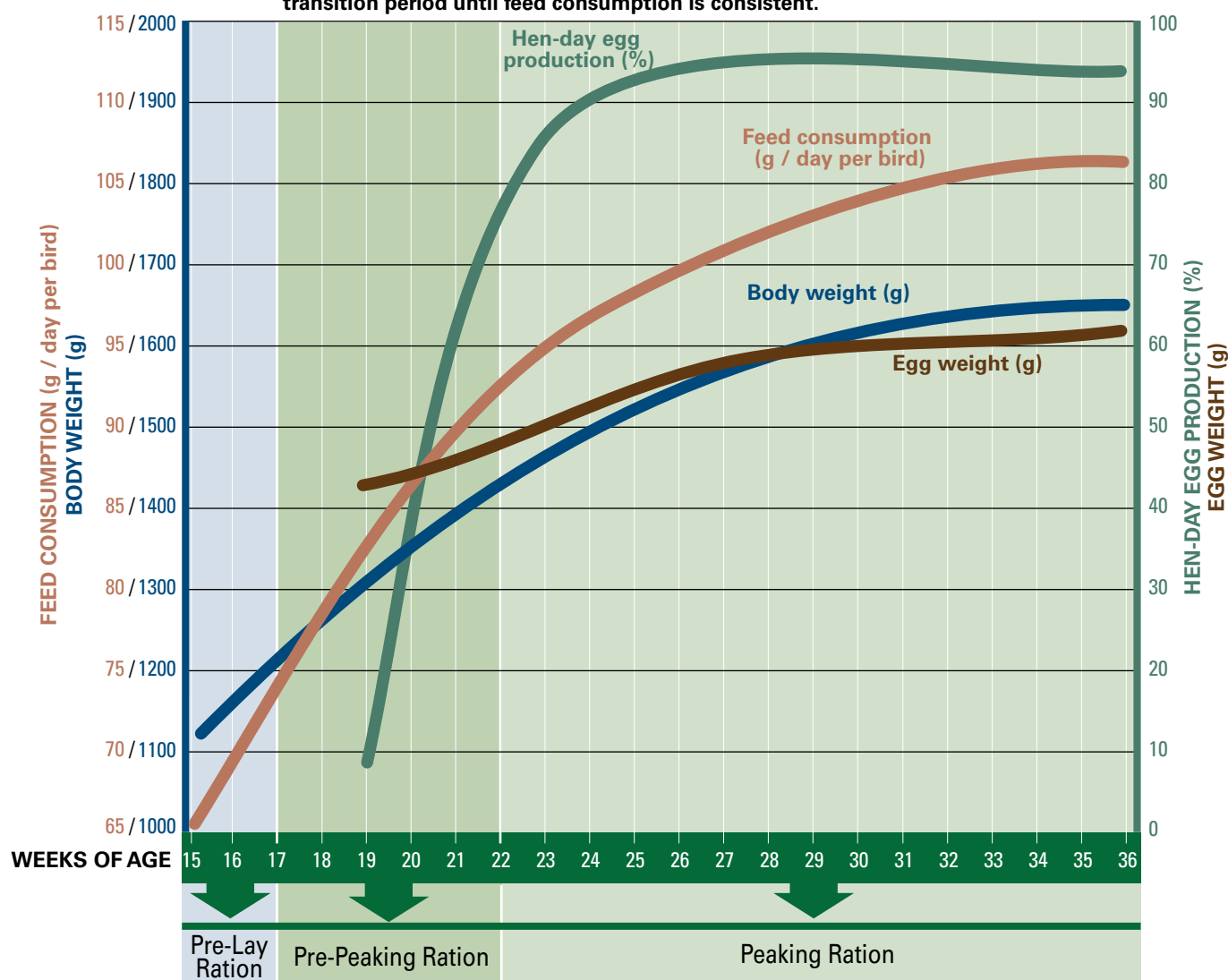
⁷ Where other phosphorus systems are used, diets should contain recommended minimum level of available phosphorus.

⁸ Oil levels can be increased to 2.0% in starter diets when given as a mash to control dust and increase feed palatability.

⁹ Avoid excessive body weight gain after 12 weeks.

Transition Period from Rear to Peak Egg Production

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



Pre-Lay Ration

- Plan to feed for a maximum of 10–14 days before point of lay.
- Feed when most pullets show reddening of combs.
- It is important to increase medullary bone reserves.
- Begin introducing large particle calcium in Pre-Lay Diet.
- Discontinue pre-lay feeding with the commencement of egg production.

Transition Period

- **Avoid excessive weight gain during the transition period.**
- **Body weight gain from 18–25 weeks should not exceed 20%.**
- Occurring during the transition period:
 - Rapidly increasing egg production
 - Increasing egg size
 - Increasing body weight
- Feed consumption may increase slowly during transition:
 - In underweight birds
 - In flocks lacking uniformity
 - During high environmental temperatures
- Poor uniformity prolongs the transition period and may result in low peak and poor persistency of egg production.
- Monitor feed intake carefully during transition and adjust dietary nutrient concentration according to actual feed intakes.

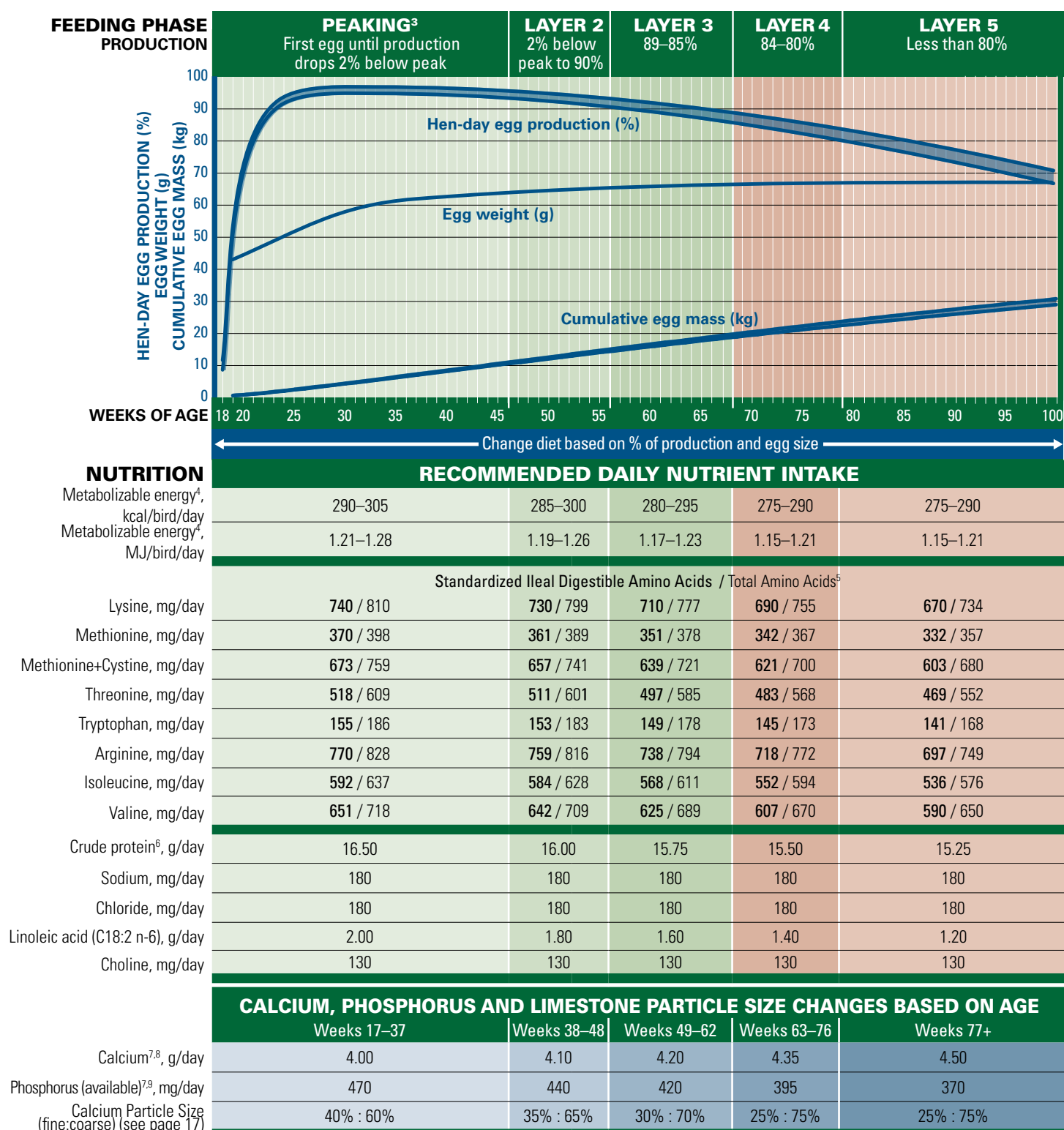
Pre-Peaking Ration

- Formulations for low feed intakes (80–85 g/day/bird) should be given as the flock enters egg production to better meet nutrient requirements.
- Begin Pre-Peaking Diet with onset of lay (1% egg production).
- Pre-Peaking Diet is given until average feed consumption reaches 95 g/day/bird.

Peaking Ration

- Birds should continue to grow during peaking period. Poor nutrition during this period can lead to loss of body weight and soft bones.
- Feed intake may be reduced if birds are not accustomed to extra large particle calcium (i.e. not using a Pre-Lay Diet).
- Monitor keel bone development during the peaking period. For more information on keel bone scoring, see the “Understanding the Role of the Skeleton in Egg Production” technical update at www.hyline.com.

Production Period Nutritional Recommendations



¹ All nutrient requirements are based on the feed ingredient table at the back of this guide.

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 1.8 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 Table. Dietary calcium levels 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.

Dietary Nutrient Concentrations for Production Period *(According to Phase and Feed Intake)*

FEEDING PHASE PRODUCTION	PEAKING ³ First egg until production drops 2% below peak					LAYER 2 2% below peak to 90%					LAYER 3 89–85%					LAYER 4 84–80%					LAYER 5 Less than 80%				
	RECOMMENDED CONCENTRATION																								
NUTRITION Metabolizable energy ⁴ , kcal/bird/day Metabolizable energy ⁷ , MJ/bird/day	290–305					285–300					280–295					275–290					275–290				
	1.21–1.28					1.19–1.26					1.17–1.23					1.15–1.21					1.15–1.21				
g/day per bird	FEED CONSUMPTION (*Typical Feed Consumption)																								
	90	95	100*	105	110	95	100	105*	110	115	100	105	110*	115	120	98	103	108*	113	118	97	102	107*	112	117
	Standardized Ileal Digestible Amino Acids																								
Lysine, %	0.82	0.78	0.74	0.70	0.67	0.77	0.73	0.70	0.66	0.63	0.71	0.68	0.65	0.62	0.59	0.70	0.67	0.64	0.61	0.58	0.69	0.66	0.63	0.60	0.57
Methionine, %	0.41	0.39	0.37	0.35	0.34	0.38	0.36	0.34	0.33	0.31	0.35	0.33	0.32	0.31	0.29	0.35	0.33	0.32	0.30	0.29	0.34	0.33	0.31	0.30	0.28
Methionine+Cystine, %	0.75	0.71	0.67	0.64	0.61	0.69	0.66	0.63	0.60	0.57	0.64	0.61	0.58	0.56	0.53	0.63	0.60	0.58	0.55	0.53	0.62	0.59	0.56	0.54	0.52
Threonine, %	0.58	0.55	0.52	0.49	0.47	0.54	0.51	0.49	0.46	0.44	0.50	0.47	0.45	0.43	0.41	0.49	0.47	0.45	0.43	0.41	0.48	0.46	0.44	0.42	0.40
Tryptophan, %	0.17	0.16	0.16	0.15	0.14	0.16	0.15	0.15	0.14	0.13	0.15	0.14	0.14	0.13	0.12	0.15	0.14	0.13	0.13	0.12	0.15	0.14	0.13	0.13	0.12
Arginine, %	0.86	0.81	0.77	0.73	0.70	0.80	0.76	0.72	0.69	0.66	0.74	0.70	0.67	0.64	0.62	0.73	0.70	0.66	0.64	0.61	0.72	0.68	0.65	0.62	0.60
Isoleucine, %	0.66	0.62	0.59	0.56	0.54	0.61	0.58	0.56	0.53	0.51	0.57	0.54	0.52	0.49	0.47	0.56	0.54	0.51	0.49	0.47	0.55	0.53	0.50	0.48	0.46
Valine, %	0.72	0.69	0.65	0.62	0.59	0.68	0.64	0.61	0.58	0.56	0.63	0.60	0.57	0.54	0.52	0.62	0.59	0.56	0.54	0.51	0.61	0.58	0.55	0.53	0.50
	Total Amino Acids ⁵																								
Lysine, %	0.90	0.85	0.81	0.77	0.74	0.84	0.80	0.76	0.73	0.69	0.78	0.74	0.71	0.68	0.65	0.77	0.73	0.70	0.67	0.64	0.76	0.72	0.69	0.66	0.63
Methionine, %	0.44	0.42	0.40	0.38	0.36	0.41	0.39	0.37	0.35	0.34	0.38	0.36	0.34	0.33	0.32	0.37	0.36	0.34	0.32	0.31	0.37	0.35	0.33	0.32	0.31
Methionine+Cystine, %	0.84	0.80	0.76	0.72	0.69	0.78	0.74	0.71	0.67	0.64	0.72	0.69	0.66	0.63	0.60	0.71	0.68	0.65	0.62	0.59	0.70	0.67	0.64	0.61	0.58
Threonine, %	0.68	0.64	0.61	0.58	0.55	0.63	0.60	0.57	0.55	0.52	0.59	0.56	0.53	0.51	0.49	0.58	0.55	0.53	0.50	0.48	0.57	0.54	0.52	0.49	0.47
Tryptophan, %	0.21	0.20	0.19	0.18	0.17	0.19	0.18	0.17	0.17	0.16	0.18	0.17	0.16	0.15	0.15	0.18	0.17	0.16	0.15	0.15	0.17	0.16	0.16	0.15	0.14
Arginine, %	0.92	0.87	0.83	0.79	0.75	0.86	0.82	0.78	0.74	0.71	0.79	0.76	0.72	0.69	0.66	0.79	0.75	0.71	0.68	0.65	0.77	0.73	0.70	0.67	0.64
Isoleucine, %	0.71	0.67	0.64	0.61	0.58	0.66	0.63	0.60	0.57	0.55	0.61	0.58	0.56	0.53	0.51	0.61	0.58	0.55	0.53	0.50	0.59	0.56	0.54	0.51	0.49
Valine, %	0.80	0.76	0.72	0.68	0.65	0.75	0.71	0.68	0.64	0.62	0.69	0.66	0.63	0.60	0.57	0.68	0.65	0.62	0.59	0.57	0.67	0.64	0.61	0.58	0.56
Crude protein ⁶ , %	18.33	17.37	16.50	15.71	15.00	16.84	16.00	15.24	14.55	13.91	15.75	15.00	14.32	13.70	13.13	15.82	15.05	14.35	13.72	13.14	15.72	14.95	14.25	13.62	13.03
Sodium, %	0.20	0.19	0.18	0.17	0.16	0.19	0.18	0.17	0.16	0.16	0.18	0.17	0.16	0.16	0.15	0.18	0.17	0.17	0.16	0.15	0.19	0.18	0.17	0.16	0.15
Chloride, %	0.20	0.19	0.18	0.17	0.16	0.19	0.18	0.17	0.16	0.16	0.18	0.17	0.16	0.16	0.15	0.18	0.17	0.17	0.16	0.15	0.19	0.18	0.17	0.16	0.15
Linoleic acid (C18:2 n-6), %	2.22	2.11	2.00	1.90	1.82	1.89	1.80	1.71	1.64	1.57	1.60	1.52	1.45	1.39	1.33	1.43	1.36	1.30	1.24	1.19	1.24	1.18	1.12	1.07	1.03
Choline, mg/kg	1444	1368	1300	1238	1182	1368	1300	1238	1182	1130	1300	1238	1182	1130	1083	1327	1262	1204	1150	1102	1340	1275	1215	1161	1111
Feed Consumption, g/day per bird	CALCIUM, PHOSPHORUS AND LIMESTONE PARTICLE SIZE CHANGES BASED ON AGE																								
	Weeks 17–37					Weeks 38–48					Weeks 49–62					Weeks 63–76					Weeks 77+				
	90	95	100	105	110	95	100	105	110	115	100	105	110	115	120	98	103	108	113	118	97	102	107	112	117
Calcium ^{7,8} , %	4.44	4.21	4.00	3.81	3.64	4.32	4.10	3.90	3.73	3.57	4.20	4.00	3.82	3.65	3.50	4.44	4.22	4.03	3.85	3.69	4.64	4.41	4.21	4.02	3.85
Phosphorus (available) ^{7,9} , %	0.52	0.49	0.47	0.45	0.43	0.46	0.44	0.42	0.40	0.38	0.42	0.40	0.38	0.37	0.35	0.40	0.38	0.37	0.35	0.33	0.38	0.36	0.35	0.33	0.32
Calcium Particle Size (fine:coarse) (see page 17)	40% : 60%					35% : 65%					30% : 70%					25% : 75%					25% : 75%				

¹ All nutrient requirements are based on the feed ingredient table at the back of this guide.

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 1.8 kcal/bird/day, respectively.

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⁸ Calcium carbonate particle size recommendation varies throughout lay. Refer to Calcium Particle Size Table. Dietary calcium levels 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.

Disease Control

A flock of pullets or layers can only perform up to its genetic potential when disease influence is minimized. The diseases of economic importance vary widely between locations, but in every case the challenge is to identify and control those diseases.

Biosecurity

Biosecurity is the best method of avoiding diseases. A good biosecurity program identifies and controls the most likely ways a disease could enter the farm.

- Human and equipment movement onto the farm should be strictly controlled.
- Visitors to the farm should be limited to those essential for its operation.
- Visits should be documented in a logbook.
- All visitors and workers should shower at a central location before entering.
- Clean boots, clothing and head cover should be provided for workers and visitors.
- Clean footbaths containing disinfectant should be placed outside entries to all poultry houses.
- If possible, avoid using outside crews or equipment for vaccination, moving, and beak trimming.
- Ideally, workers should be limited to a single house.
- For those visiting a number of flocks, flocks visited on one day should be limited. Always progress from younger to older and from healthy to sick flocks. After visiting a sick flock, no other houses should be entered.
- Removal of flocks from the farm is an opportunity for disease to be introduced, as trucks and crews have often been on other farms.
- A single-aged rearing farm using an all-in, all-out principle is best to prevent transmission of disease from older flocks to younger, susceptible flocks.
- Houses should be designed to prevent exposure to wild birds, insects and rodents.
- Quickly and properly dispose of dead chickens.

Rodents

Rodents are known carriers of many poultry diseases and the most common reason for re-contamination of a cleaned and disinfected poultry facility. They are also responsible for house-to-house spread of disease on a farm.

- The farm should be free of debris and tall grass that provide a hiding area for rodents.
- The perimeter of each house should have a 1 m wide area of crushed rock or concrete to prevent rodents from burrowing into the house.
- Feed and eggs should be stored in rodent-proof areas.
- Bait stations should be placed throughout the house and maintained with fresh rodenticide.

Cleaning and Disinfection

Cleaning and disinfection of the house between flocks reduces infection pressure for the next flock.

- Allow a minimum of 2 weeks downtime between flocks.
- All feed and manure should be removed from the house before cleaning.
- Thoroughly clean air inlets, fan housing, fan blades and fan louvers.
- Heating the house during washing improves the removal of organic matter.

- The house should be cleaned of organic matter with a high-pressure spray of warm water.
- Use foam / gel detergent to soak into organic matter and equipment.
- Wash the upper portion of the house before the pit.
- Use high pressure warm water to rinse.
- Allow the house to dry.
- After it is fully dry, apply foam / spray disinfectant followed by fumigation.
- Flush and sanitize water lines.
- The monitoring of poultry houses for the presence of Salmonella, particularly *Salmonella enteritidis*, by routine environmental testing is recommended.
- Allow the house to dry before repopulating.

Vertically Transmitted Diseases

- Some diseases are known to be transmitted from infected breeders to progeny.
- Disease-free breeders are the first step in control of these diseases for commercial layers.
- All breeders directly under Hy-Line International's control are free of lymphoid leukosis, *Mycoplasma gallisepticum*, *Mycoplasma synoviae*, *Salmonella pullorum*, *Salmonella gallinarum*, *Salmonella enteritidis*, *Salmonella typhimurium* and other Salmonella species.
- Due to the possibility of horizontal transmission of these diseases, later generations may not remain free.
- It is the responsibility of breeding and commercial flock owners to prevent horizontal transmission of these diseases and to continue testing to be assured of a negative status.

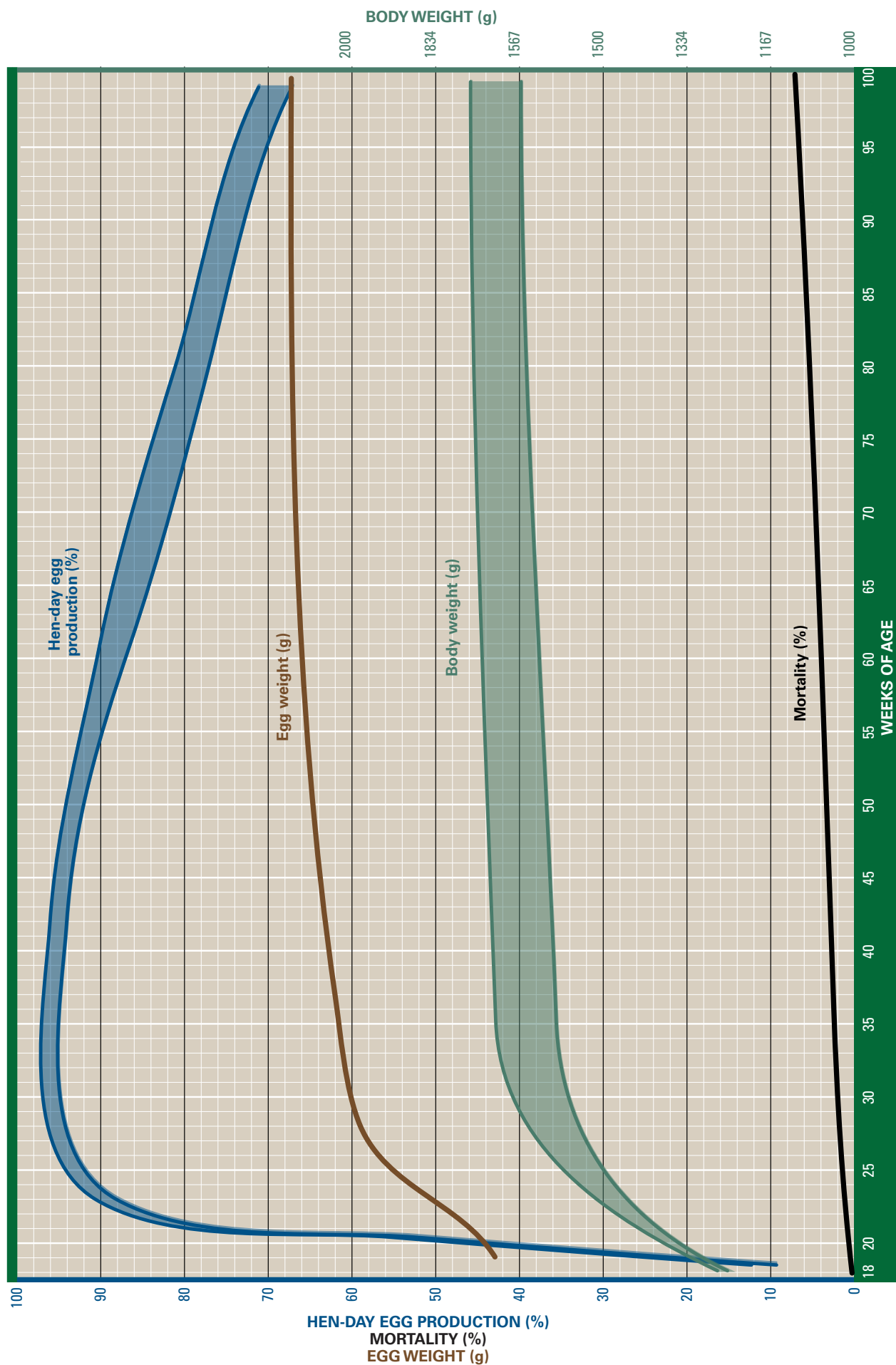


COCCIDIA

This parasitic infection of the intestines may lead to gut damage and, in severe infestations, death. More commonly, poor control of sub-clinical infection reduces feed conversion or leaves pullets with chronic, irreversible gut damage. Pullet flocks may be uneven or underweight at housing and not perform to their full potential in lay. Control of coccidia includes the following measures (check local regulations):

- Use ionophores or chemicals on a step-down program to ensure immunity in pullets.
- Live vaccine use is an alternative to anti-coccidial drug treatments.
- Live vaccines are available that can be administered by spray in the hatchery or by feed or water application during the first few days in the brooder house.
- Control of flies and beetles, which are vectors of coccidia spread.
- Thorough cleaning and disinfection of houses reduces challenge pressure.
- Limit bird access to manure belts.
- Cocco vaccines require cycling; discuss this with the vaccine manufacturer.

Performance Graph

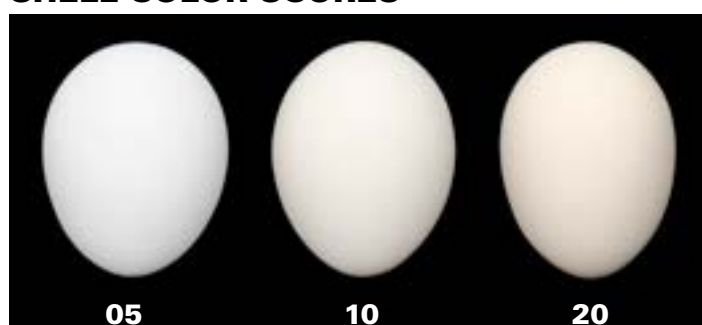


Egg Standards and Egg Size Distribution

EGG QUALITY		
AGE (weeks)	HAUGH UNITS	BREAKING STRENGTH
20	90.6	4490
22	90.3	4480
24	90.1	4470
26	89.8	4450
28	89.5	4430
30	89.2	4410
32	89.0	4390
34	88.7	4360
36	88.4	4340
38	88.1	4330
40	87.8	4320
42	87.6	4310
44	87.3	4300
46	87.0	4290
48	86.7	4280
50	86.5	4270
52	86.2	4260
54	85.9	4250
56	85.6	4240
58	85.4	4230
60	85.1	4220
62	84.8	4210
64	84.5	4200
66	84.3	4190
68	84.0	4170
70	83.7	4150
72	83.4	4130
74	83.2	4110
76	82.9	4090
78	82.6	4070
80	82.3	4050
82	82.1	4030
84	81.8	4010
86	81.5	4000
88	81.2	3980
90	81.0	3960
92	80.8	3950
94	80.6	3940
96	80.4	3930
98	80.2	3920
100	80.0	3910

EGG SIZE DISTRIBUTION—E.U. STANDARDS					
AGE (weeks)	AVERAGE EGG WEIGHT (g)	% VERY LARGE Over 73 g	% LARGE 63–73 g	% MEDIUM 53–63 g	% SMALL 43–53 g
20	44.0	0.00	0.00	1.22	98.78
22	48.0	0.00	0.01	10.56	89.44
24	53.0	0.00	0.62	49.38	50.00
26	57.0	0.00	7.16	76.38	16.46
28	59.0	0.03	16.43	76.37	7.17
30	60.0	0.08	23.14	72.39	4.39
32	60.0	0.08	23.14	72.39	4.39
34	61.0	0.21	31.78	65.46	2.55
36	62.0	0.44	40.15	57.80	1.61
38	62.0	0.44	40.15	57.80	1.61
40	63.0	0.86	49.14	49.14	0.86
42	63.0	0.86	49.14	49.14	0.86
44	63.0	0.86	49.14	49.14	0.86
46	64.0	1.61	57.80	40.15	0.44
48	64.0	1.61	57.80	40.15	0.44
50	64.0	1.61	57.80	40.15	0.44
52	64.0	1.61	57.80	40.15	0.44
54	64.0	1.61	57.80	40.15	0.44
56	65.0	2.84	65.46	31.49	0.21
58	65.0	2.84	65.46	31.49	0.21
60	65.0	2.84	65.46	31.49	0.21
62	65.0	2.84	65.46	31.49	0.21
64	65.0	2.90	66.16	30.77	0.17
66	66.0	4.39	72.30	23.23	0.08
68	66.0	4.39	72.30	23.23	0.08
70	66.0	4.39	72.30	23.23	0.08
72	66.0	5.01	72.33	22.61	0.05
74	66.0	5.01	72.33	22.61	0.05
76	67.0	5.68	78.45	15.84	0.03
78	67.0	6.20	78.55	15.24	0.01
80	67.0	6.20	78.55	15.24	0.01
82	67.0	6.20	78.55	15.24	0.01
84	67.0	5.73	79.66	14.61	0.00
86	67.0	5.73	79.66	14.61	0.00
88	67.0	5.73	79.66	14.61	0.00
90	67.0	5.73	79.66	14.61	0.00
92	67.1	5.55	81.07	13.38	0.00
94	67.1	5.55	81.07	13.38	0.00
96	67.2	5.56	81.33	13.11	0.00
98	67.2	5.37	82.47	12.16	0.00
100	67.2	5.37	82.47	12.16	0.00

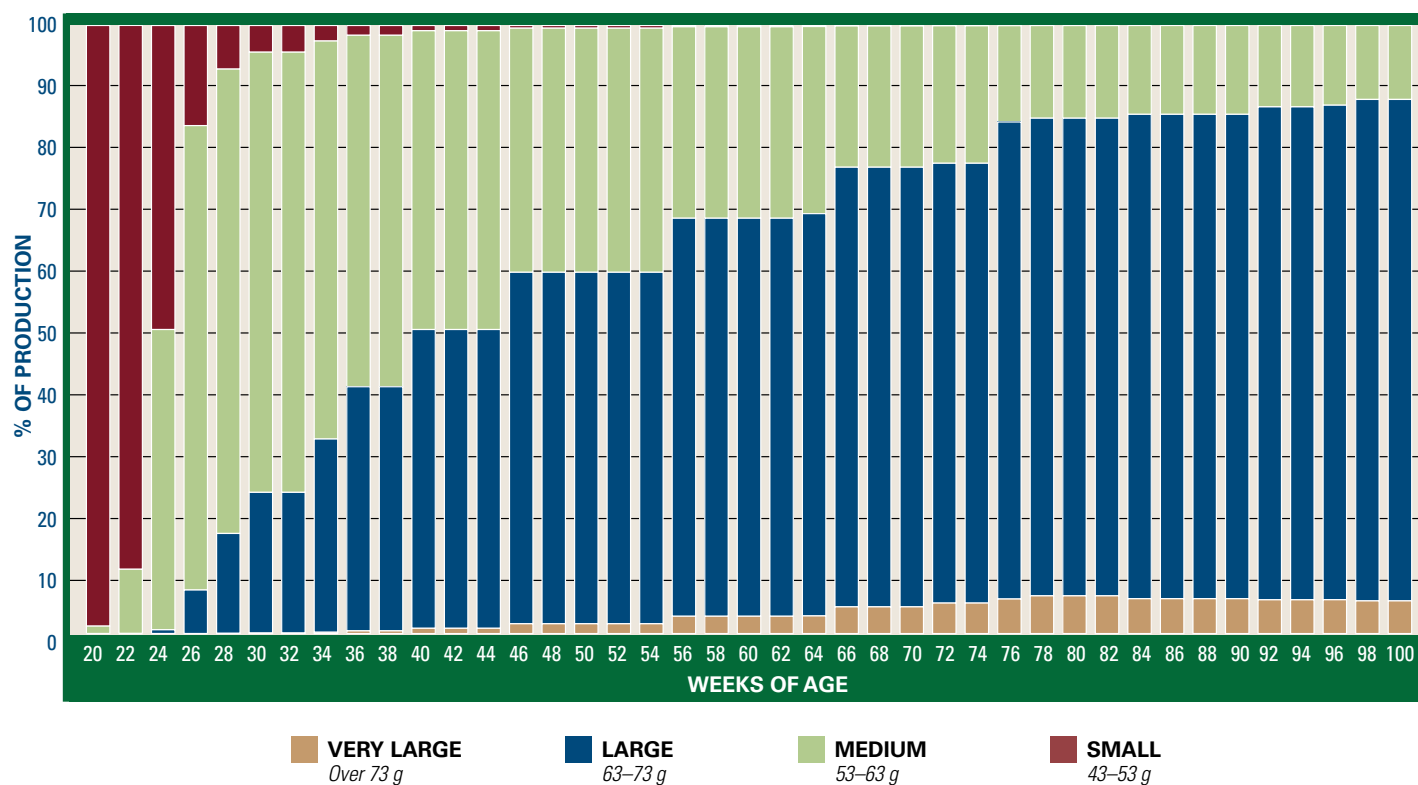
SHELL COLOR SCORES



- The W-80 Plus normally lays uniformly white colored eggs (05–10).
- Eggs laid the first week are typically darker (10–20) than subsequent eggs.
- For more information on egg quality, see the “The Science of Egg Quality” technical update at www.hyline.com.

Egg Size Distribution *(continued)*

EGG SIZE DISTRIBUTION—E.U. STANDARDS



Feed Ingredient Table 1

INGREDIENT (as-fed basis)	DRY MATTER (%)	CRUDE PROTEIN (%)	FAT-ether extract (%)	CRUDE FIBER (%)	CALCIUM (%)	PHOSPHORUS total (%)	PHOSPHORUS available (%)	SODIUM (%)	CHLORIDE (%)	POTASSIUM (%)	SULFUR (%)	ME (kcal/lb)	ME (kcal/kg)	ME (MJ/kg)	LINOLEIC ACID (%)	CHOLINE (mg/kg)
Barley, grain	89.0	11.5	1.9	5.0	0.08	0.42	0.15	0.03	0.14	0.56	0.15	1250	2750	11.51	1.1	1027
Beans, broad (vicia faba)	89.0	25.7	1.4	8.2	0.14	0.54	0.20	0.08	0.04	1.20	—	1100	2420	10.13	0.9	1670
Calcium carbonate (38%Ca)	99.0	—	—	—	38.00	—	—	0.06	—	0.06	—	—	—	—	—	—
Canola meal (38%)	91.0	38.0	3.8	11.1	0.68	1.20	0.40	—	—	1.29	1.00	960	2110	8.83	—	6700
Corn, yellow, grain	86.0	7.5	3.5	1.9	0.01	0.28	0.12	0.02	0.04	0.33	0.08	1530	3373	14.11	1.9	1100
Corn gluten meal (60%)	90.0	60.0	2.0	2.5	0.02	0.50	0.18	0.03	0.05	0.45	0.50	1700	3740	15.65	1.8	2200
Cottonseed meal (41%), mech. extd	91.0	41.0	3.9	12.6	0.17	0.97	0.32	0.04	0.04	1.20	0.40	955	2100	8.79	0.8	2807
Cottonseed meal (41%), direct solv.	90.0	41.0	2.1	11.3	0.16	1.00	0.32	0.04	0.04	1.16	0.30	915	2010	8.41	0.4	2706
Dicalcium phosphate (18.5% P)	99.0	—	—	—	22.00	18.50	18.50	0.08	—	0.07	—	—	—	—	—	—
DL-Methionine	99.0	58.1	—	—	—	—	—	—	—	—	—	2277	5020	21.00	—	—
Fat, animal	99.0	—	98.0	—	—	—	—	—	—	—	—	3600	7920	33.14	—	—
Fat, vegetable	99.0	—	99.0	—	—	—	—	—	—	—	—	4000	8800	36.82	40.0	—
Fish meal, anchovy, Peruvian	91.0	65.0	10.0	1.0	—	—	—	0.88	0.60	0.90	0.54	1280	2820	11.80	0.1	5100
Fish meal, white	91.0	61.0	4.0	1.0	—	—	—	0.97	0.50	1.10	0.22	1180	2600	10.88	0.1	4050
Flaxseed	92.0	22.0	34.0	6.5	—	—	—	0.08	—	1.50	—	1795	3957	16.56	54.0	3150
L-Lysine	99.0	93.4	—	—	—	—	—	—	—	—	—	1868	4120	17.24	—	—
L-Threonine	99.0	72.4	—	—	—	—	—	—	—	—	—	1619	3570	14.94	—	—
L-Tryptophan	99.0	84.0	—	—	—	—	—	—	—	—	—	2653	5850	24.48	—	—
Linseed meal flax, expeller	90.0	32.0	3.5	9.5	0.40	0.80	—	0.11	—	1.24	0.39	700	1540	6.44	0.5	672
Linseed meal flax, solvent	88.0	33.0	0.5	9.5	0.35	0.75	—	0.14	—	1.38	0.39	635	1400	5.86	0.1	1760
Meat and bone meal, 50%	93.0	50.0	8.5	2.8	9.20	4.70	4.70	0.80	0.75	1.40	0.40	1150	2530	10.59	0.5	2000
Millet, pearl grain	90.0	12.0	4.2	1.8	0.05	0.30	0.10	0.04	0.64	0.43	0.13	1470	3240	13.56	1.3	789
Mono-dicalcium phosphate (21% P)	99.0	—	—	—	16.00	21.00	—	0.05	—	0.06	—	—	—	—	—	—
Oats, grain	90.0	11.0	4.0	10.5	0.10	0.35	0.14	0.07	0.12	0.37	0.21	1160	2550	10.67	2.4	1070
Peanut meal, solvent	90.0	47.0	2.5	8.4	0.08	0.57	0.18	0.07	0.03	1.22	0.30	1217	2677	11.20	0.5	1948
Poultry byproduct meal (feed grade)	94.0	57.0	14.0	2.5	5.00	2.70	2.70	0.30	0.55	0.60	0.50	1406	3100	12.97	0.7	5980
Rice bran, unextracted	91.0	13.5	5.9	13.0	0.10	1.70	0.24	0.10	0.07	1.35	0.18	925	2040	8.54	5.2	1948
Rice, grain, rough	89.0	7.3	1.7	10.0	0.04	0.26	0.09	0.04	0.06	0.34	0.10	1335	2940	12.30	0.83	5980
Safflower seed meal, expeller	91.0	20.0	6.6	32.2	0.23	0.61	0.20	0.05	0.16	0.72	0.10	525	1160	4.85	—	800
Salt, NaCl	99.0	—	—	—	—	—	—	39.34	60.66	—	—	—	—	—	—	—
Sodium bicarbonate, NaHCO ₃	99.0	—	—	—	—	—	—	27.38	—	—	—	—	—	—	—	—
Sorghum, milo, grain	89.0	11.0	2.8	2.0	0.04	0.29	0.10	0.03	0.09	0.34	0.09	1505	3310	13.85	1.3	678
Soybeans, full-fat, cooked	90.0	38.0	18.0	5.0	0.25	0.59	0.20	0.04	0.03	1.70	0.30	1520	3350	14.02	9.9	2420
Soybean meal, expeller	89.0	42.0	3.5	6.5	0.20	0.60	0.20	0.04	0.02	1.71	0.33	1100	2420	10.13	1.8	2673
Soybean meal, solvent	90.0	44.0	0.5	7.0	0.25	0.60	0.20	0.04	0.02	1.97	0.43	1020	2240	9.37	0.3	2743
Sunflower meal, expeller	93.0	41.0	7.6	21.0	0.43	1.00	0.25	0.20	0.01	1.00	0.10	1050	2310	9.67	6.5	—
Sunflower meal, partially dehul, solv.	92.0	34.0	0.5	13.0	0.30	1.25	0.27	0.20	0.01	1.60	0.38	1025	2260	9.46	0.2	1909
Triticale	90.0	12.5	1.5	2.59	0.05	0.30	0.10	—	0.07	—	0.20	1430	3150	13.18	0.9	460
Wheat, hard grain	88.0	13.5	1.9	3.0	0.05	0.41	0.12	0.06	0.07	0.50	0.10	1440	3170	13.26	1.00	778
Wheat, soft grain	86.0	10.8	1.7	2.8	0.05	0.30	0.11	0.06	0.07	0.40	0.10	1460	3210	13.43	1.00	778
Wheat bran	89.0	14.8	4.0	10.0	0.14	1.17	0.38	0.06	0.14	1.20	0.22	590	1300	5.44	2.10	980
Wheat middlings	89.0	15.0	3.6	8.5	0.15	1.17	0.45	0.06	0.07	0.60	0.16	950	2090	8.74	1.90	110

Nutrient recommendations are based on calculations using these energy and nutrient values (source: 2018–2019 Feedstuffs Reference Issue and field data). Values provided are “typical” based on ingredient surveys. Nutrient values should be confirmed by analysis of the materials being used in order to maintain an accurate formulation matrix.

Feed Ingredient Table 2

INGREDIENT (as-fed basis)	CRUDE PROTEIN (%)	LYSINE (%)		METHIONINE (%)		CYSTINE (%)		THREONINE (%)		TRYPTOPHAN (%)		ARGININE (%)		ISOLEUCINE (%)		VALINE (%)	
		Total content	Digestible content	Total content	Digestible content	Total content	Digestible content	Total content	Digestible content	Total content	Digestible content	Total content	Digestible content	Total content	Digestible content	Total content	Digestible content
Barley, grain	11.50	0.53	0.41	0.18	0.14	0.25	0.20	0.36	0.28	0.17	0.12	0.50	0.43	0.42	0.34	0.62	0.50
Beans, broad (vicia faba)	25.70	1.52	1.29	0.25	0.18	0.14	0.09	0.98	0.77	0.24	0.16	2.20	1.91	1.00	0.73	1.22	0.88
Canola meal (38%)	91.0	2.02	1.60	0.77	0.69	0.97	0.71	1.50	1.17	0.46	0.38	2.30	2.07	1.51	1.25	1.94	1.59
Corn, yellow, grain	7.50	0.24	0.19	0.18	0.16	0.18	0.15	0.29	0.24	0.07	0.06	0.40	0.36	0.29	0.26	0.42	0.37
Corn gluten meal (60%)	60.00	1.00	0.88	1.90	1.84	1.10	0.95	2.00	1.84	0.30	0.25	1.90	1.82	2.30	2.19	2.70	2.57
Cottonseed meal (41%), mech. extd	41.00	1.52	0.99	0.55	0.40	0.59	0.44	1.30	0.88	0.50	0.39	4.33	3.81	1.31	0.93	1.84	1.36
Cottonseed meal (41%), direct solv.	41.00	1.70	1.11	0.51	0.37	0.62	0.46	1.31	0.89	0.52	0.41	4.66	4.10	1.33	0.95	1.82	1.34
DL-Methionine	58.10	—	—	99.00	99.00	—	—	—	—	—	—	—	—	—	—	—	—
Fish meal, anchovy, Peruvian	65.00	4.90	4.21	1.90	1.63	0.60	0.43	2.70	2.17	0.75	0.59	3.38	2.77	3.00	2.55	3.40	2.82
Fish meal, white	61.00	4.30	3.70	1.65	1.42	0.75	0.54	2.60	2.09	0.70	0.55	4.20	3.44	3.10	2.64	3.25	2.70
Flaxseed	22.00	0.92	0.79	0.35	0.30	0.42	0.30	0.77	0.62	0.22	0.17	2.05	1.68	0.95	0.81	1.17	0.97
L-Lysine	93.40	78.80	78.80	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L-Threonine	72.40	—	—	—	—	—	—	98.50	98.50	—	—	—	—	—	—	—	—
L-Tryptophan	84.00	—	—	—	—	—	—	—	—	98.00	98.00	—	—	—	—	—	—
Linseed meal flax, expeller	32.00	1.10	0.99	0.47	0.37	0.56	0.44	1.10	1.00	0.47	0.43	2.60	2.39	1.70	1.49	1.50	1.29
Linseed meal flax, solvent	33.00	1.10	0.99	0.48	0.38	0.58	0.45	1.20	1.10	0.48	0.44	2.70	2.48	1.80	1.58	1.60	1.38
Meat and bone meal, 50%	50.00	2.60	2.05	0.67	0.57	0.33	0.19	1.70	1.34	0.26	0.13	3.35	2.85	1.70	1.41	2.25	1.85
Millet, pearl grain	12.00	0.35	0.32	0.28	0.25	0.24	0.20	0.44	0.37	0.20	0.18	0.55	0.49	0.52	0.46	0.70	0.62
Oats, grain	11.00	0.40	0.35	0.20	0.17	0.21	0.18	0.28	0.24	0.18	0.14	0.80	0.75	0.53	0.47	0.62	0.55
Peanut meal, solvent	47.00	1.52	1.29	0.50	0.44	0.60	0.47	1.12	0.91	0.42	0.39	4.76	4.28	1.50	1.32	1.80	1.57
Poultry byproduct meal (feed grade)	57.00	2.25	1.80	0.91	0.78	0.90	0.55	1.88	1.50	0.50	0.26	3.50	3.08	2.10	1.79	2.32	1.93
Rice bran, unextracted	13.50	0.50	0.38	0.17	0.13	0.10	0.07	0.40	0.28	0.10	0.08	0.45	0.39	0.39	0.30	0.60	0.46
Rice, grain, rough	7.30	0.24	0.19	0.14	0.13	0.08	0.07	0.27	0.22	0.12	0.11	0.59	0.54	0.33	0.27	0.46	0.39
Safflower seed meal, expeller	20.00	0.70	0.58	0.40	0.35	0.58	0.45	0.47	0.34	0.30	0.24	1.20	1.01	0.28	0.22	1.00	0.87
Sorghum, milo, grain	11.00	0.27	0.21	0.10	0.09	0.20	0.17	0.27	0.22	0.09	0.08	0.40	0.30	0.60	0.53	0.53	0.46
Soybeans, full-fat, cooked	38.00	2.40	2.16	0.54	0.49	0.55	0.45	1.69	1.43	0.52	0.46	2.80	2.60	2.18	1.94	2.02	1.78
Soybean meal, expeller	42.00	2.70	2.43	0.60	0.54	0.62	0.51	1.70	1.44	0.58	0.52	3.20	2.97	2.80	2.49	2.20	1.94
Soybean meal, solvent	44.00	2.70	2.43	0.65	0.58	0.67	0.55	1.70	1.44	0.60	0.53	3.40	3.16	2.50	2.22	2.40	2.11
Sunflower meal, expeller	41.00	2.00	1.74	1.60	1.47	0.80	0.64	1.60	1.31	0.60	0.52	4.20	3.91	2.40	2.14	2.40	2.08
Sunflower meal, partially dehul, solv.	34.00	1.42	1.19	0.64	0.60	0.55	0.43	1.48	1.26	0.35	0.30	2.80	2.32	1.39	1.25	1.64	1.41
Triticale	12.50	0.39	0.35	0.26	0.23	0.26	0.22	0.36	0.31	0.14	0.12	0.48	0.39	0.76	0.70	0.51	0.44
Wheat, hard grain	13.50	0.40	0.32	0.25	0.22	0.30	0.26	0.35	0.29	0.18	0.16	0.60	0.53	0.69	0.61	0.69	0.59
Wheat, soft grain	10.80	0.30	0.24	0.14	0.12	0.20	0.17	0.28	0.23	0.12	0.11	0.40	0.35	0.43	0.38	0.48	0.41
Wheat bran	14.80	0.60	0.43	0.20	0.15	0.30	0.22	0.48	0.35	0.30	0.24	1.07	0.88	0.60	0.47	0.70	0.54
Wheat Middlings	15.00	0.70	0.56	0.12	0.10	0.19	0.14	0.50	0.36	0.20	0.16	1.00	0.80	0.70	0.58	0.80	0.61

Amino acid digestibility is standardized ileal digestibility. Amino acid values are standardized for 88% dry matter (source: 2018–2019 Feedstuffs Reference Issue and field data). Values provided are “typical” based on ingredient surveys. Nutrient values should be confirmed by analysis of the materials being used in order to maintain an accurate formulation matrix.

Hy-Line International Welfare Goals and Principles

To promote animal well-being and produce birds of the highest quality, we adhere to the following welfare goals and principles. These goals and principles are the essential building blocks for the humane and professional care of our birds:

- **Feed and Water**

Provide access to good quality water and nutritionally balanced diets at all times

- **Health and Veterinary Care**

Provide science-based health programs and prompt veterinary care

- **Environment**

Provide shelter that is designed, maintained and operated to meet the bird's needs and to facilitate daily inspection

- **Husbandry and Handling Practices**

Provide comprehensive care and handling procedures that ensure the bird's well-being throughout its life

- **Transportation**

Provide transportation that minimizes travel time and stress

RESOURCES AVAILABLE AT WWW.HYLINE.COM

Corporate Information | Technical Updates | Interactive Management Guides
Hy-Line International Lighting Program | Hy-Line EggCel | Body Weight Uniformity Calculator

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)

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 Color on Poultry Lighting
SPIDES (Short Period Incubation During Egg Storage)
Fly Management: Surveillance and Control
Optimizing Egg Size in Commercial Layers



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