Hy-Line®

# W-36

# PERFORMANCE STANDARDS GUIDE

## COMMERCIAL LAYERS

*CONVENTIONAL SYSTEMS*

Hy-Line®

# Use of the Performance Guide

The genetic potential of Hy-Line W-36 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 W-36 Commercial based on field experience compiled by Hy-Line International and using an extensive commercial layer flock database of Hy-Line flocks from all parts of the world. Hy-Line International Management Guides are periodically updated as new performance data and/or nutrition information become available.

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

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

**W-36 Online Management Guide**

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# Summary of Performance Standards

| REARING PERIOD (TO 17 WEEKS): | |
|---|---|
| Livability | 97% |
| Feed Consumed | 5.36–5.94 kg |
| Body Weight at 17 Weeks | 1190–1250 g |
| **LAYING PERIOD (TO 100 WEEKS):** | |
| Percent Peak | 95–97% |
| Hen-Day Eggs to 60 Weeks<br>Hen-Day Eggs to 100 Weeks | 256–264<br>471–487 |
| Hen-Housed Eggs to 60 Weeks<br>Hen-Housed Eggs to 100 Weeks | 252–260<br>456–472 |
| Livability to 60 Weeks<br>Livability to 100 Weeks | 97.1%<br>92.0% |
| Days to 50% Production (from hatch) | 143 |
| Egg Weight at 26 Weeks<br>Egg Weight at 32 Weeks<br>Egg Weight at 70 Weeks<br>Egg Weight at 100 Weeks | 54.7 g<br>58.5 g<br>63.3 g<br>63.8 g |
| Total Egg Mass per Hen-Housed (18–100 weeks) | 27.4–29.4 kg |
| Body Weight at 26 Weeks<br>Body Weight at 32 Weeks<br>Body Weight at 70 Weeks<br>Body Weight at 100 Weeks | 1480–1540 g<br>1510–1570 g<br>1550–1610 g<br>1550–1610 g |
| Freedom From Egg Inclusions | Excellent |
| Shell Strength | Excellent |
| Haugh Units at 38 Weeks<br>Haugh Units at 56 Weeks<br>Haugh Units at 70 Weeks<br>Haugh Units at 100 Weeks | 91.4<br>87.5<br>86.0<br>85.0 |
| Average Daily Feed Consumption (18–100 weeks) | 99.6 g/day per bird |
| Feed Conversion Rate, kg Feed/kg Eggs (20–60 weeks)<br>Feed Conversion Rate, kg Feed/kg Eggs (20–100 weeks) | 1.81–1.94<br>1.93–2.08 |
| Feed Utilization, kg Egg/kg Feed (20–60 weeks)<br>Feed Utilization, kg Egg/kg Feed (20–100 weeks) | 0.52–0.55<br>0.48–0.52 |
| Feed Consumption per 10 Eggs (20–60 weeks)<br>Feed Consumption per 10 Eggs (20–100 weeks) | 1.04–1.14 kg<br>1.13–1.24 kg |
| Feed Consumption per Dozen Eggs (20–60 weeks)<br>Feed Consumption per Dozen Eggs (20–100 weeks) | 1.25–1.37 kg<br>1.36–1.49 kg |
| Condition of Droppings | Dry |

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# Rearing Period Performance Table

| AGE (weeks) | MORTALITY Cumulative (%) | BODY WEIGHT (g) | | FEED INTAKE (g/bird/day) | | WATER INTAKE (ml/bird/day) | | CUMULATIVE FEED INTAKE (g/bird to date) | | UNIFORMITY % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | Low | High | Low | High | |
| 1 | 0.75 | 60 | 73 | 13 | 16 | 20 | 32 | 60 | 111 | >85% |
| 2 | 1.30 | 100 | 118 | 17 | 20 | 25 | 41 | 209 | 253 | |
| 3 | 1.55 | 150 | 181 | 22 | 26 | 33 | 53 | 360 | 438 | |
| 4 | 1.66 | 200 | 259 | 29 | 34 | 43 | 67 | 560 | 673 | >80% |
| **5** | **1.77** | **290** | **349** | **34** | **38** | **51** | **76** | **798** | **940** | |
| 6 | 1.88 | 372 | 440 | 39 | 43 | 59 | 86 | 1074 | 1242 | |
| 7 | 1.99 | 472 | 531 | 43 | 47 | 64 | 93 | 1373 | 1569 | >85% |
| 8 | 2.10 | 549 | 621 | 46 | 51 | 69 | 102 | 1695 | 1927 | |
| 9 | 2.15 | 649 | 721 | 50 | 55 | 76 | 110 | 2047 | 2311 | |
| **10** | **2.20** | **739** | **812** | **54** | **58** | **80** | **116** | **2423** | **2717** | |
| 11 | 2.25 | 830 | 894 | 55 | 60 | 83 | 119 | 2810 | 3135 | |
| 12 | 2.30 | 921 | 971 | 56 | 61 | 84 | 123 | 3204 | 3564 | |
| 13 | 2.35 | 980 | 1039 | 58 | 64 | 87 | 128 | 3613 | 4013 | |
| 14 | 2.40 | 1039 | 1111 | 59 | 66 | 89 | 132 | 4027 | 4475 | |
| **15** | **2.45** | **1102** | **1161** | **61** | **68** | **91** | **135** | **4453** | **4948** | |
| 16 | 2.50 | 1152 | 1211 | 64 | 69 | 95 | 138 | 4898 | 5431 | |
| 17 | 2.55 | 1188 | 1252 | 67 | 72 | 100 | 144 | 5366 | 5936 | >90% |

# Production Period Performance Table

| AGE (weeks) | % HEN-DAY Current | | HEN-DAY EGGS Cumulative | | HEN-HOUSED EGGS Cumulative | | MORT-ALITY Cumulative (%) | BODY WEIGHT (g) | | FEED INTAKE (g/bird/day) | | WATER INTAKE (ml/bird/day) | | HH EGG MASS Cumulative (kg) | | AVG. EGG WT. (g/egg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | | Low | High | Low | High | Low | High | Low | High | |
| 18 | 2 | 3 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 1.23 | 1.30 | 63 | 74 | 95 | 148 | 0.01 | 0.01 | 44.2 |
| 19 | 15 | 22 | 1.2 | 1.8 | 1.2 | 1.7 | 0.1 | 1.27 | 1.37 | 68 | 77 | 102 | 155 | 0.06 | 0.09 | 45.0 |
| **20** | **35** | **50** | **3.6** | **5.3** | **3.6** | **5.2** | **0.1** | **1.32** | **1.43** | **73** | **80** | **109** | **161** | **0.2** | **0.3** | **45.9** |
| 21 | 60 | 67 | 7.8 | 9.9 | 7.8 | 9.9 | 0.2 | 1.38 | 1.47 | 76 | 84 | 114 | 169 | 0.4 | 0.5 | 48.0 |
| 22 | 80 | 84 | 13.4 | 15.8 | 13.4 | 15.8 | 0.2 | 1.41 | 1.49 | 80 | 88 | 120 | 177 | 0.6 | 0.8 | 49.8 |
| 23 | 88 | 92 | 19.6 | 22.3 | 19.6 | 22.2 | 0.3 | 1.43 | 1.50 | 85 | 93 | 128 | 186 | 0.9 | 1.1 | 51.3 |
| 24 | 91 | 94 | 26.0 | 28.9 | 25.9 | 28.8 | 0.4 | 1.45 | 1.51 | 89 | 96 | 134 | 192 | 1.3 | 1.5 | 52.6 |
| **25** | **93** | **95** | **32.5** | **35.5** | **32.4** | **35.4** | **0.5** | **1.47** | **1.53** | **93** | **99** | **139** | **197** | **1.6** | **1.8** | **53.7** |
| 26 | 94 | 96 | 39.1 | 42.2 | 39.0 | 42.1 | 0.5 | 1.48 | 1.54 | 94 | 101 | 142 | 202 | 2.0 | 2.2 | 54.7 |
| 27 | 95 | 96 | 45.7 | 49.0 | 45.6 | 48.8 | 0.6 | 1.48 | 1.55 | 96 | 102 | 143 | 205 | 2.3 | 2.6 | 55.5 |
| 28 | 95 | 96 | 52.4 | 55.7 | 52.1 | 55.5 | 0.6 | 1.49 | 1.55 | 96 | 103 | 144 | 205 | 2.7 | 3.0 | 56.3 |
| 29 | 95 | 97 | 59.0 | 62.5 | 58.7 | 62.2 | 0.7 | 1.50 | 1.56 | 97 | 103 | 145 | 206 | 3.1 | 3.4 | 57.0 |
| **30** | **95** | **97** | **65.6** | **69.2** | **65.3** | **68.9** | **0.7** | **1.50** | **1.56** | **97** | **103** | **146** | **206** | **3.4** | **3.8** | **57.6** |
| 31 | 95 | 97 | 72.3 | 76.0 | 71.9 | 75.6 | 0.8 | 1.51 | 1.57 | 97 | 103 | 146 | 207 | 3.8 | 4.1 | 58.1 |
| 32 | 95 | 96 | 78.9 | 82.7 | 78.5 | 82.3 | 0.9 | 1.51 | 1.57 | 98 | 104 | 146 | 207 | 4.2 | 4.5 | 58.5 |
| 33 | 94 | 96 | 85.5 | 89.5 | 85.0 | 89.0 | 0.9 | 1.52 | 1.58 | 98 | 104 | 147 | 208 | 4.6 | 4.9 | 59.0 |
| 34 | 94 | 96 | 92.1 | 96.2 | 91.5 | 95.6 | 1.0 | 1.52 | 1.58 | 98 | 104 | 147 | 208 | 4.9 | 5.4 | 59.3 |
| **35** | **94** | **95** | **98.7** | **102.9** | **98.1** | **102.2** | **1.0** | **1.53** | **1.59** | **98** | **104** | **147** | **209** | **5.3** | **5.8** | **59.7** |
| 36 | 94 | 95 | 105.2 | 109.5 | 104.6 | 108.8 | 1.1 | 1.53 | 1.59 | 98 | 105 | 147 | 209 | 5.7 | 6.2 | 60.0 |
| 37 | 93 | 95 | 111.8 | 116.2 | 111.0 | 115.4 | 1.1 | 1.53 | 1.59 | 98 | 105 | 147 | 209 | 6.1 | 6.6 | 60.3 |
| 38 | 93 | 95 | 118.3 | 122.8 | 117.5 | 122.0 | 1.2 | 1.54 | 1.60 | 98 | 105 | 147 | 209 | 6.5 | 7.0 | 60.5 |
| 39 | 93 | 95 | 124.8 | 129.5 | 123.9 | 128.5 | 1.3 | 1.54 | 1.60 | 98 | 105 | 148 | 209 | 6.8 | 7.4 | 60.7 |
| **40** | **93** | **94** | **131.3** | **136.1** | **130.3** | **135.0** | **1.3** | **1.54** | **1.60** | **99** | **105** | **148** | **209** | **7.2** | **7.8** | **60.9** |
| 41 | 92 | 94 | 137.7 | 142.7 | 136.6 | 141.5 | 1.4 | 1.54 | 1.60 | 99 | 105 | 148 | 209 | 7.6 | 8.2 | 61.1 |
| 42 | 92 | 94 | 144.2 | 149.2 | 143.0 | 148.0 | 1.5 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 8.0 | 8.6 | 61.3 |
| 43 | 92 | 93 | 150.6 | 155.8 | 149.3 | 154.4 | 1.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 8.4 | 9.0 | 61.5 |
| 44 | 91 | 93 | 156.9 | 162.3 | 155.5 | 160.9 | 1.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 8.7 | 9.4 | 61.6 |
| **45** | **91** | **93** | **163.3** | **168.8** | **161.8** | **167.2** | **1.7** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **9.1** | **9.8** | **61.8** |
| 46 | 90 | 92 | 169.6 | 175.2 | 168.0 | 173.6 | 1.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 9.5 | 10.2 | 61.9 |
| 47 | 90 | 92 | 175.9 | 181.7 | 174.2 | 179.9 | 1.9 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 9.9 | 10.6 | 62.0 |
| 48 | 90 | 92 | 182.2 | 188.1 | 180.4 | 186.2 | 1.9 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 10.3 | 11.0 | 62.1 |
| 49 | 90 | 92 | 188.5 | 194.5 | 186.5 | 192.5 | 2.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 10.6 | 11.4 | 62.2 |
| **50** | **89** | **91** | **194.7** | **200.9** | **192.6** | **198.8** | **2.1** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **11.0** | **11.8** | **62.3** |
| 51 | 89 | 91 | 200.9 | 207.3 | 198.7 | 205.0 | 2.2 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 11.4 | 12.2 | 62.4 |
| 52 | 89 | 91 | 207.2 | 213.7 | 204.8 | 211.2 | 2.2 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 11.7 | 12.6 | 62.5 |
| 53 | 88 | 91 | 213.4 | 220.0 | 210.8 | 217.4 | 2.3 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 12.1 | 13.0 | 62.5 |
| 54 | 88 | 90 | 219.5 | 226.3 | 216.8 | 223.6 | 2.4 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 12.5 | 13.4 | 62.6 |
| **55** | **88** | **90** | **225.6** | **232.6** | **222.8** | **229.8** | **2.5** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **12.9** | **13.8** | **62.7** |
| 56 | 87 | 90 | 231.8 | 238.9 | 228.8 | 235.9 | 2.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 13.2 | 14.2 | 62.7 |
| 57 | 87 | 89 | 237.8 | 245.1 | 234.7 | 241.9 | 2.7 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 13.6 | 14.6 | 62.8 |
| 58 | 87 | 89 | 243.9 | 251.3 | 240.6 | 248.0 | 2.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 13.9 | 14.9 | 62.9 |

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# Production Period Performance Table (cont.)

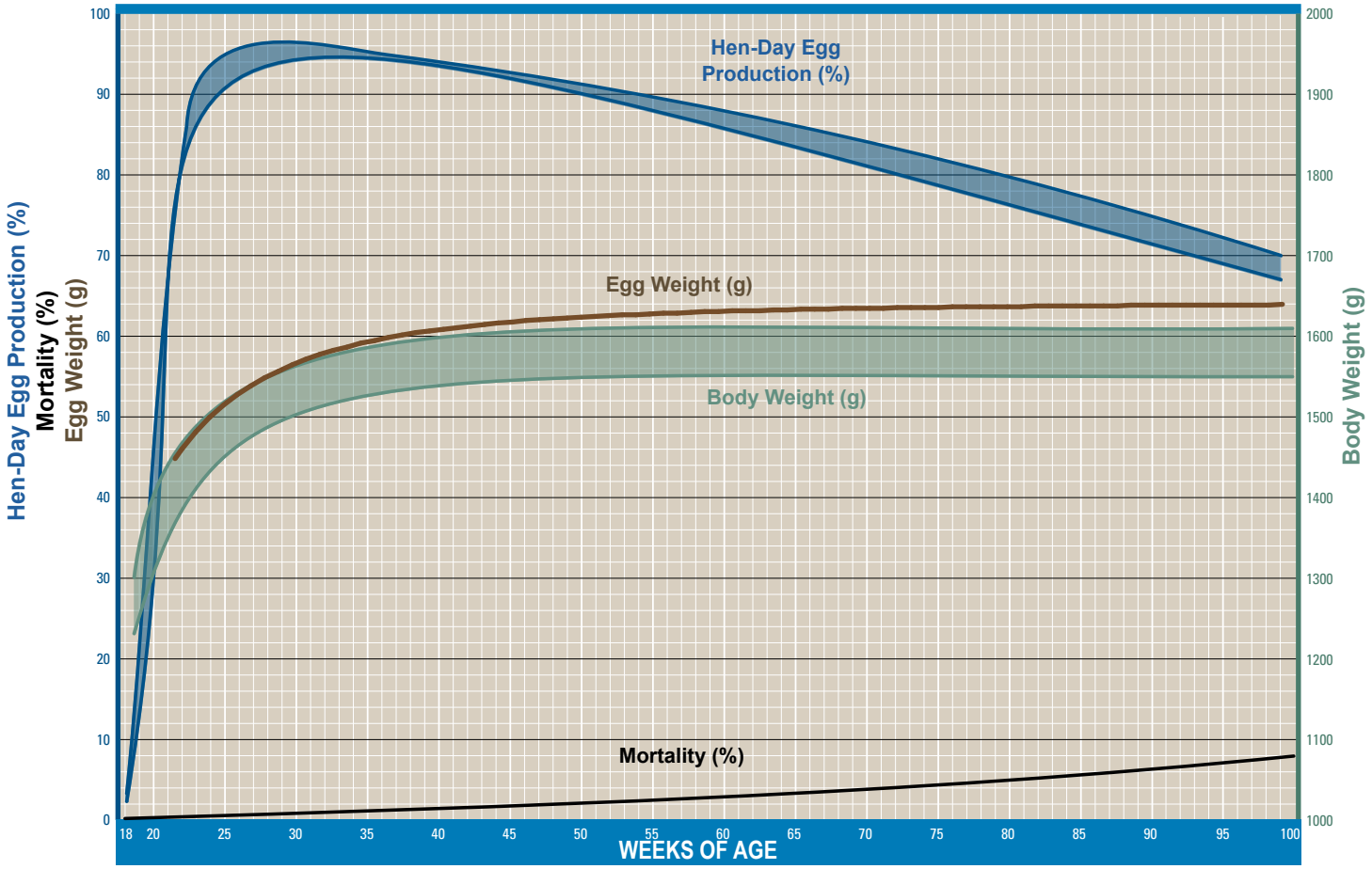
| AGE (weeks) | % HEN-DAY Current | | HEN-DAY EGGS Cumulative | | HEN-HOUSED EGGS Cumulative | | MORT-ALITY Cumulative (%) | BODY WEIGHT (g) | | FEED INTAKE (g/bird/day) | | WATER INTAKE (ml/bird/day) | | HH EGG MASS Cumulative (kg) | | AVG. EGG WT. (g/egg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | | Low | High | Low | High | Low | High | Low | High | |
| 59 | 86 | 88 | 249.9 | 257.5 | 246.5 | 254.0 | 2.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 14.3 | 15.3 | 62.9 |
| **60** | **86** | **88** | **256.0** | **263.7** | **252.3** | **259.9** | **2.9** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **14.7** | **15.7** | **63.0** |
| 61 | 86 | 88 | 261.9 | 269.8 | 258.1 | 265.9 | 3.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 15.0 | 16.1 | 63.0 |
| 62 | 85 | 88 | 267.9 | 276.0 | 263.9 | 271.9 | 3.1 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 15.4 | 16.5 | 63.0 |
| 63 | 85 | 87 | 273.9 | 282.1 | 269.6 | 277.8 | 3.2 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 15.7 | 16.9 | 63.1 |
| 64 | 85 | 87 | 279.8 | 288.1 | 275.4 | 283.6 | 3.3 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 16.1 | 17.2 | 63.1 |
| **65** | **84** | **86** | **285.7** | **294.2** | **281.1** | **289.5** | **3.4** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **16.4** | **17.6** | **63.2** |
| 66 | 84 | 86 | 291.5 | 300.2 | 286.7 | 295.3 | 3.5 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 16.8 | 18.0 | 63.2 |
| 67 | 83 | 85 | 297.3 | 306.2 | 292.3 | 301.0 | 3.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 17.1 | 18.4 | 63.2 |
| 68 | 83 | 85 | 303.1 | 312.1 | 297.9 | 306.8 | 3.7 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 17.5 | 18.7 | 63.3 |
| 69 | 82 | 85 | 308.9 | 318.1 | 303.4 | 312.5 | 3.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 17.8 | 19.1 | 63.3 |
| **70** | **82** | **84** | **314.6** | **324.0** | **308.9** | **318.1** | **3.9** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **18.2** | **19.5** | **63.3** |
| 71 | 81 | 84 | 320.3 | 329.8 | 314.4 | 323.8 | 4.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 18.5 | 19.8 | 63.3 |
| 72 | 81 | 83 | 325.9 | 335.7 | 319.8 | 329.4 | 4.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 18.8 | 20.2 | 63.4 |
| 73 | 80 | 83 | 331.6 | 341.5 | 325.2 | 335.0 | 4.1 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 19.2 | 20.5 | 63.4 |
| 74 | 80 | 83 | 337.2 | 347.3 | 330.6 | 340.5 | 4.2 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 19.5 | 20.9 | 63.4 |
| **75** | **80** | **82** | **342.7** | **353.0** | **335.9** | **346.0** | **4.3** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **19.8** | **21.3** | **63.4** |
| 76 | 79 | 82 | 348.3 | 358.8 | 341.2 | 351.5 | 4.3 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 20.2 | 21.6 | 63.5 |
| 77 | 79 | 81 | 353.8 | 364.5 | 346.5 | 357.0 | 4.4 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 20.5 | 22.0 | 63.5 |
| 78 | 78 | 81 | 359.3 | 370.2 | 351.7 | 362.4 | 4.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 20.8 | 22.3 | 63.5 |
| 79 | 78 | 81 | 364.7 | 375.8 | 356.9 | 367.8 | 4.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 21.2 | 22.7 | 63.5 |
| **80** | **77** | **80** | **370.1** | **381.4** | **362.0** | **373.1** | **4.7** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **21.5** | **23.0** | **63.5** |
| 81 | 77 | 80 | 375.5 | 387.0 | 367.1 | 378.4 | 4.9 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 21.8 | 23.4 | 63.5 |
| 82 | 76 | 79 | 380.8 | 392.6 | 372.2 | 383.7 | 5.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 22.1 | 23.7 | 63.6 |
| 83 | 76 | 79 | 386.1 | 398.1 | 377.2 | 388.9 | 5.2 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 22.4 | 24.0 | 63.6 |
| 84 | 75 | 78 | 391.4 | 403.6 | 382.2 | 394.1 | 5.3 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 22.7 | 24.4 | 63.6 |
| **85** | **75** | **78** | **396.6** | **409.0** | **387.1** | **399.3** | **5.5** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **23.0** | **24.7** | **63.6** |
| 86 | 74 | 77 | 401.8 | 414.4 | 392.0 | 404.4 | 5.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 23.3 | 25.0 | 63.6 |
| 87 | 74 | 77 | 406.9 | 419.8 | 396.9 | 409.4 | 5.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 23.6 | 25.4 | 63.6 |
| 88 | 73 | 76 | 412.1 | 425.1 | 401.7 | 414.5 | 6.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 23.9 | 25.7 | 63.6 |
| 89 | 73 | 76 | 417.1 | 430.4 | 406.5 | 419.5 | 6.1 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 24.2 | 26.0 | 63.7 |
| **90** | **72** | **75** | **422.2** | **435.7** | **411.2** | **424.4** | **6.3** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **24.5** | **26.3** | **63.7** |
| 91 | 72 | 75 | 427.2 | 440.9 | 415.9 | 429.3 | 6.5 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 24.8 | 26.7 | 63.7 |
| 92 | 71 | 74 | 432.2 | 446.1 | 420.6 | 434.1 | 6.7 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 25.1 | 27.0 | 63.7 |
| 93 | 71 | 74 | 437.1 | 451.3 | 425.2 | 439.0 | 6.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 25.4 | 27.3 | 63.7 |
| 94 | 70 | 73 | 442.0 | 456.4 | 429.7 | 443.7 | 7.0 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 25.7 | 27.6 | 63.7 |
| **95** | **70** | **73** | **446.9** | **461.5** | **434.3** | **448.5** | **7.2** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **26.0** | **27.9** | **63.7** |
| 96 | 69 | 72 | 451.8 | 466.6 | 438.7 | 453.1 | 7.4 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 26.3 | 28.2 | 63.7 |
| 97 | 69 | 72 | 456.6 | 471.6 | 443.2 | 457.8 | 7.6 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 26.5 | 28.5 | 63.7 |
| 98 | 68 | 71 | 461.3 | 476.6 | 447.6 | 462.4 | 7.8 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 26.8 | 28.8 | 63.7 |
| 99 | 68 | 71 | 466.1 | 481.6 | 451.9 | 466.9 | 7.9 | 1.55 | 1.61 | 99 | 105 | 148 | 209 | 27.1 | 29.1 | 63.7 |
| **100** | **67** | **70** | **470.8** | **486.5** | **456.3** | **471.5** | **8.0** | **1.55** | **1.61** | **99** | **105** | **148** | **209** | **27.4** | **29.4** | **63.8** |

# Production Period Space Recommendations

*check local regulations concerning space requirements)*

| WEEKS OF AGE | 4 | 15 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| **CONVENTIONAL AND COLONY CAGES** | | | | | | | | | |
| **Floor Space** | | | | | | | | | |
| 100–200 $cm^2$ (50–100 birds / $m^2$) | 360 $cm^2$ (28 birds / $m^2$) | | 490 $cm^2$ (20 birds / $m^2$) | | | | | | |
| **Nipple/Cup** | | | | | | | | | |
| 1 / 12 birds | 1 / 8 birds | | 1 / 12 birds or access to 2 drinkers | | | | | | |
| **Feeders** | | | | | | | | | |
| 4.5 cm / bird | 5–7 cm / bird | | 7–9 cm / bird | | | | | | |

# Performance Graph



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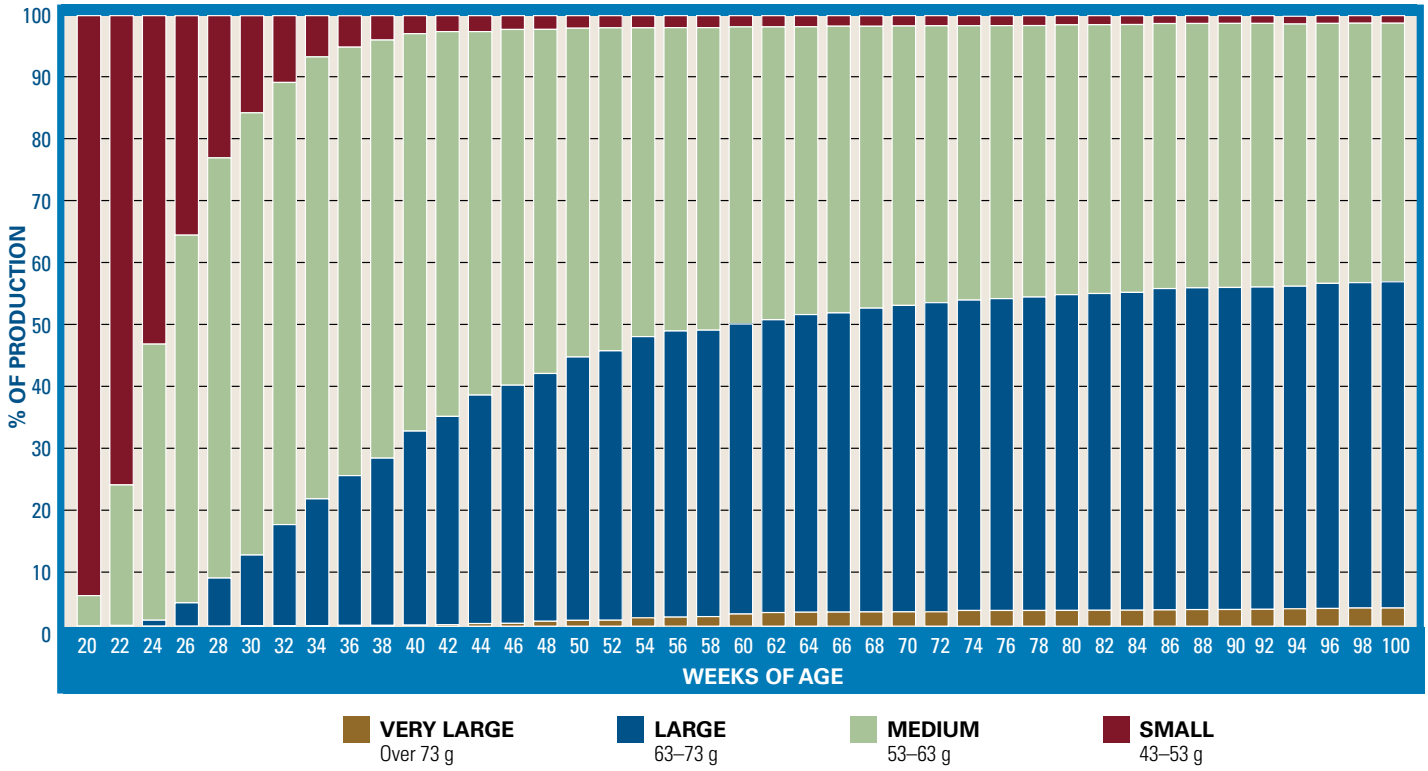
# Egg Quality and Egg Size Distribution

| EGG QUALITY | | | |
|---|---|---|---|
| AGE (weeks) | HAUGH UNITS | % SOLIDS | BREAKING STRENGTH |
| 18 | 98.0 | 22.4 | 4280 |
| 20 | 97.6 | 22.9 | 4260 |
| 22 | 96.8 | 23.2 | 4250 |
| 24 | 96.0 | 23.5 | 4240 |
| 26 | 95.3 | 23.7 | 4220 |
| 28 | 94.6 | 23.9 | 4200 |
| 30 | 93.9 | 24.1 | 4180 |
| 32 | 93.2 | 24.3 | 4160 |
| 34 | 92.6 | 24.4 | 4140 |
| 36 | 92.0 | 24.5 | 4120 |
| 38 | 91.4 | 24.6 | 4110 |
| 40 | 90.8 | 24.6 | 4100 |
| 42 | 90.3 | 24.7 | 4090 |
| 44 | 89.7 | 24.7 | 4085 |
| 46 | 89.2 | 24.7 | 4080 |
| 48 | 88.9 | 24.7 | 4075 |
| 50 | 88.5 | 24.7 | 4070 |
| 52 | 88.1 | 24.7 | 4065 |
| 54 | 87.7 | 24.7 | 4060 |
| 56 | 87.5 | 24.7 | 4050 |
| 58 | 87.2 | 24.7 | 4045 |
| 60 | 87.0 | 24.7 | 4040 |
| 62 | 86.8 | 24.7 | 4030 |
| 64 | 86.6 | 24.7 | 4010 |
| 66 | 86.4 | 24.7 | 3990 |
| 68 | 86.2 | 24.7 | 3970 |
| 70 | 86.0 | 24.7 | 3955 |
| 72 | 85.8 | 24.7 | 3945 |
| 74 | 85.6 | 24.7 | 3940 |
| 76 | 85.4 | 24.7 | 3930 |
| 78 | 85.2 | 24.7 | 3920 |
| 80 | 85.0 | 24.7 | 3910 |
| 82 | 84.8 | 24.8 | 3900 |
| 84 | 84.6 | 24.8 | 3890 |
| 86 | 84.4 | 24.8 | 3880 |
| 88 | 84.2 | 24.8 | 3870 |
| 90 | 84.0 | 24.8 | 3860 |
| 92 | 83.8 | 24.8 | 3850 |
| 94 | 83.6 | 24.8 | 3840 |
| 96 | 83.4 | 24.8 | 3830 |
| 98 | 83.2 | 24.8 | 3820 |
| 100 | 83.0 | 24.8 | 3810 |

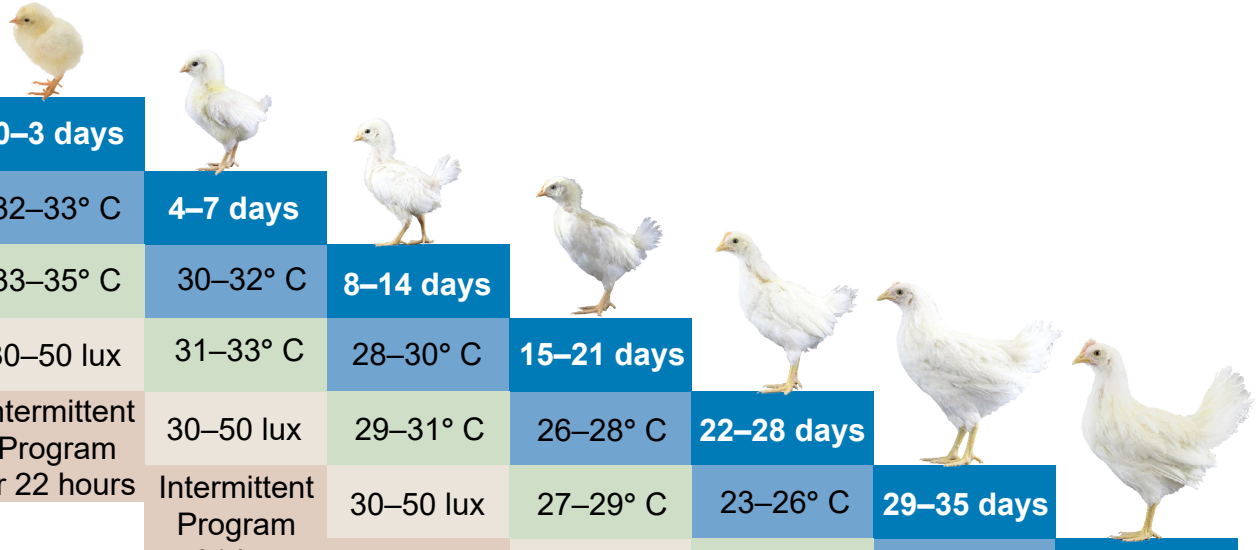
| EGG SIZE DISTRIBUTION—E.U. STANDARDS | | | | | |
|---|---|---|---|---|---|
| AGE (weeks) | AVERAGE EGG WEIGHT (g) | % VERY LARGE Over 73 g | % LARGE 63–73 g | % MEDIUM 53–63 g | % SMALL 43–53 g |
| 20 | 45.9 | 0.00 | 0.00 | 5.00 | 95.00 |
| 22 | 49.8 | 0.00 | 0.12 | 23.02 | 76.86 |
| 24 | 52.6 | 0.00 | 0.97 | 45.23 | 53.80 |
| 26 | 54.7 | 0.00 | 3.82 | 60.23 | 35.94 |
| 28 | 56.3 | 0.00 | 7.88 | 68.83 | 23.29 |
| 30 | 57.6 | 0.04 | 11.61 | 72.44 | 15.90 |
| 32 | 58.5 | 0.06 | 16.58 | 72.42 | 10.94 |
| 34 | 59.3 | 0.09 | 20.76 | 72.40 | 6.75 |
| 36 | 60.0 | 0.13 | 24.53 | 70.18 | 5.15 |
| 38 | 60.5 | 0.13 | 27.39 | 68.49 | 3.99 |
| 40 | 60.9 | 0.17 | 31.78 | 65.10 | 2.95 |
| 42 | 61.3 | 0.25 | 34.11 | 63.03 | 2.61 |
| 44 | 61.6 | 0.43 | 37.42 | 59.54 | 2.61 |
| 46 | 61.9 | 0.46 | 39.01 | 58.27 | 2.26 |
| 48 | 62.1 | 0.80 | 40.59 | 56.36 | 2.25 |
| 50 | 62.3 | 0.95 | 43.14 | 53.85 | 2.06 |
| 52 | 62.5 | 0.97 | 44.13 | 52.91 | 1.99 |
| 54 | 62.6 | 1.37 | 46.06 | 50.58 | 1.99 |
| 56 | 62.7 | 1.48 | 46.87 | 49.69 | 1.96 |
| 58 | 62.9 | 1.57 | 46.91 | 49.56 | 1.96 |
| 60 | 63.0 | 1.99 | 47.51 | 48.66 | 1.84 |
| 62 | 63.0 | 2.23 | 47.96 | 47.97 | 1.84 |
| 64 | 63.1 | 2.28 | 48.76 | 47.14 | 1.82 |
| 66 | 63.2 | 2.30 | 49.01 | 46.96 | 1.73 |
| 68 | 63.3 | 2.33 | 49.76 | 46.17 | 1.73 |
| 70 | 63.3 | 2.34 | 50.20 | 45.77 | 1.69 |
| 72 | 63.4 | 2.35 | 50.64 | 45.35 | 1.66 |
| 74 | 63.4 | 2.57 | 50.84 | 44.94 | 1.65 |
| 76 | 63.5 | 2.57 | 51.08 | 44.72 | 1.62 |
| 78 | 63.5 | 2.57 | 51.34 | 44.47 | 1.61 |
| 80 | 63.5 | 2.58 | 51.72 | 44.20 | 1.50 |
| 82 | 63.6 | 2.60 | 51.89 | 44.03 | 1.48 |
| 84 | 63.6 | 2.61 | 52.06 | 43.88 | 1.44 |
| 86 | 63.6 | 2.66 | 52.64 | 43.41 | 1.29 |
| 88 | 63.6 | 2.72 | 52.70 | 43.30 | 1.28 |
| 90 | 63.7 | 2.73 | 52.75 | 43.25 | 1.27 |
| 92 | 63.7 | 2.76 | 52.79 | 43.18 | 1.27 |
| 94 | 63.7 | 2.85 | 52.83 | 42.95 | 1.27 |
| 96 | 63.7 | 2.90 | 53.25 | 42.58 | 1.27 |
| 98 | 63.7 | 2.97 | 53.30 | 42.49 | 1.24 |
| 100 | 63.8 | 2.97 | 53.44 | 42.35 | 1.24 |

# Egg Size Distribution (cont.)

## E.U. Standards




# Brooding Temperature and Lighting Recommendations



| AGE | 0–3 days | 4–7 days | 8–14 days | 15–21 days | 22–28 days | 29–35 days | 36–42 days |
|---|---|---|---|---|---|---|---|
| AIR TEMP. (CAGE) | 32–33° C | 30–32° C | 28–30° C | 26–28° C | 23–26° C | 21–23° C | 21° C |
| AIR TEMP. (FLOOR) | 33–35° C | 31–33° C | 29–31° C | 27–29° C | 24–27° C | 22–24° C | 21° C |
| LIGHT INTENSITY | 30–50 lux | 30–50 lux | 30–50 lux | 25 lux | 25 lux | 10 lux | 10 lux |
| LIGHT HOURS | Intermittent Program or 22 hours | Intermittent Program or 21 hours | 20 hours | 19 hours | 18 hours | 17 hours | 16 hours |

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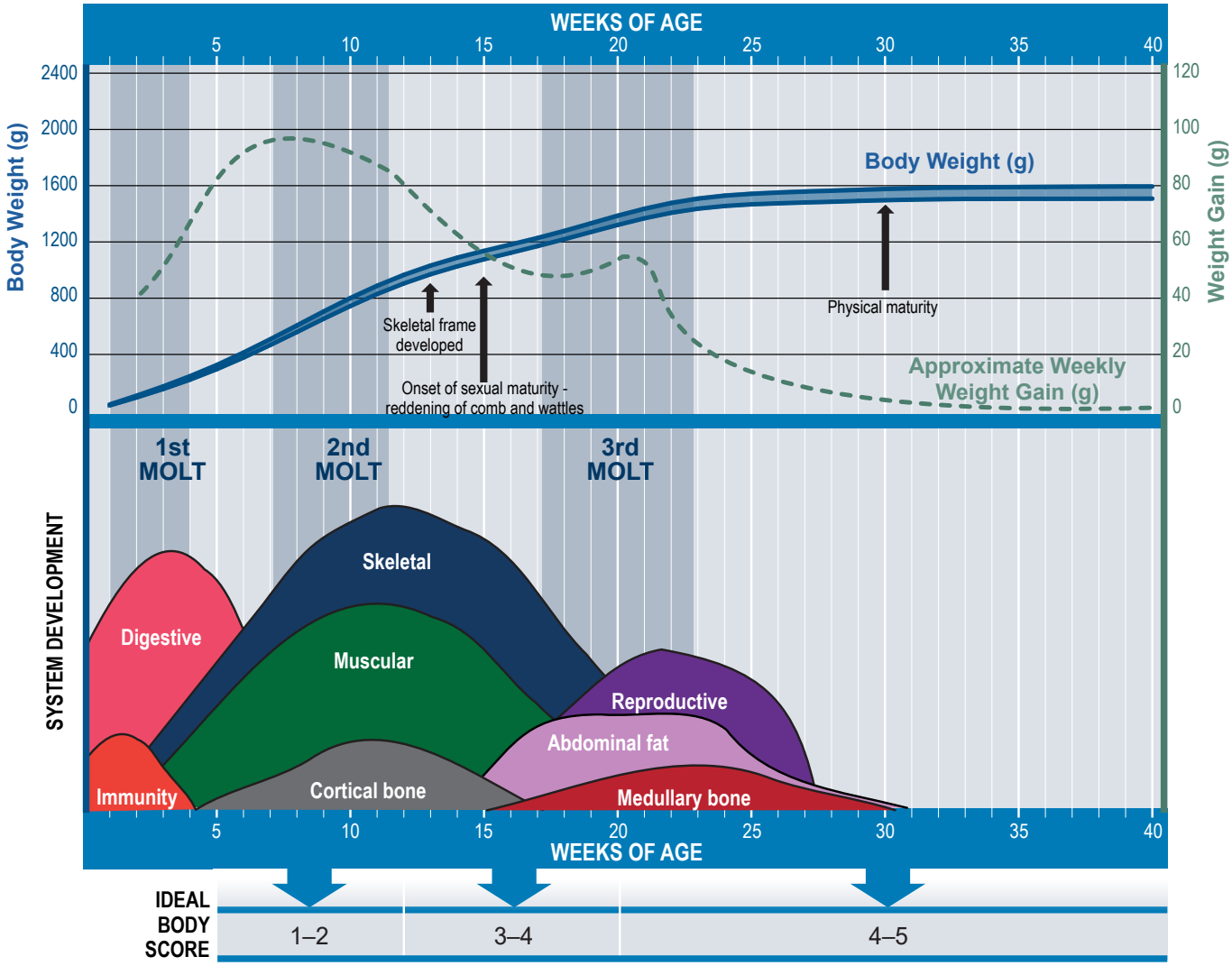
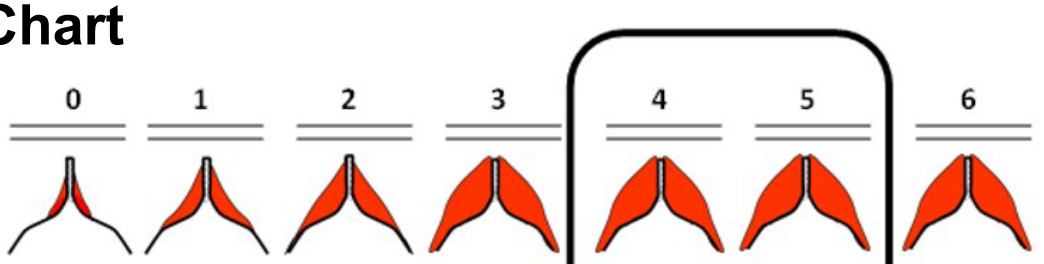
# Development of the Organ Systems in Pullets



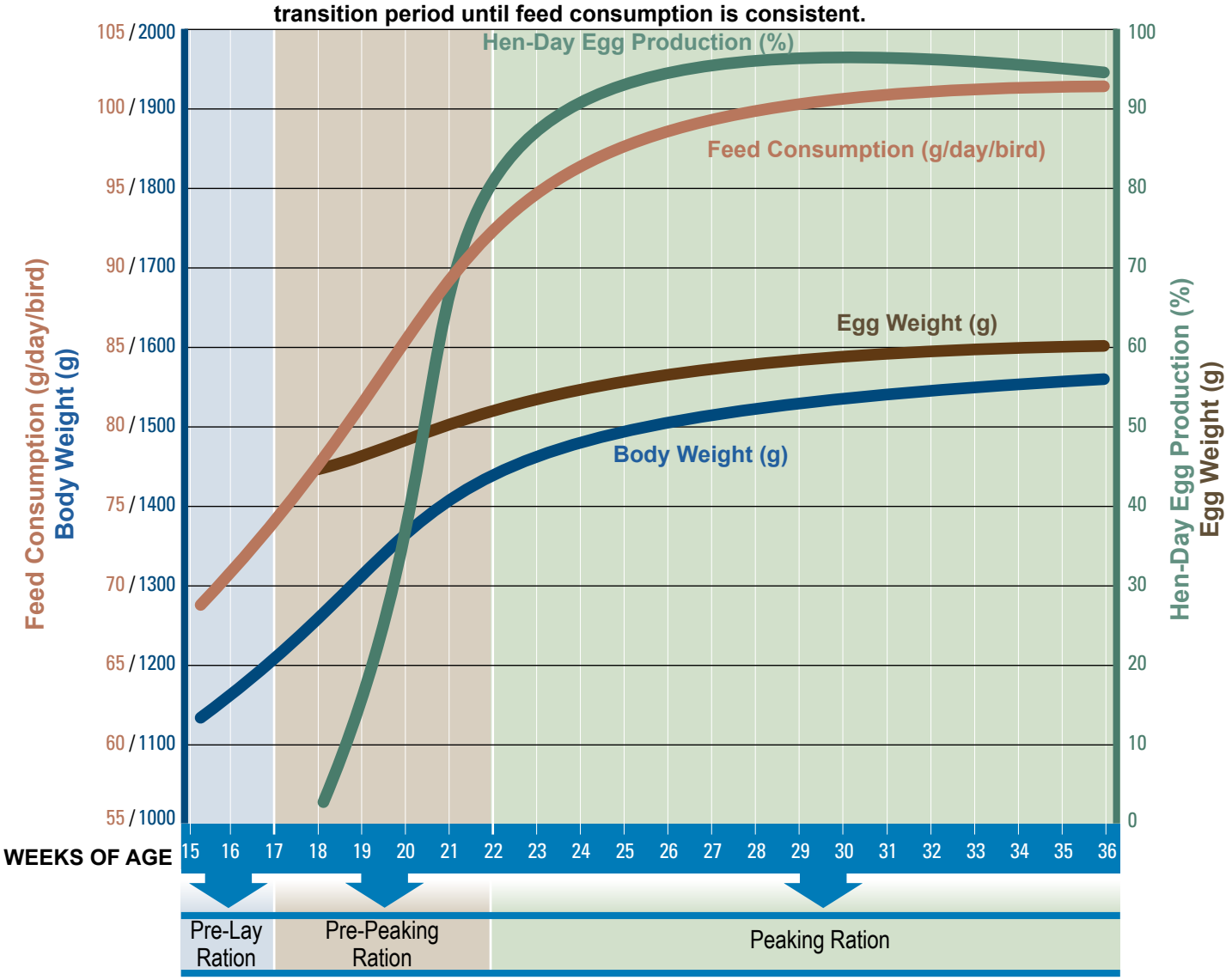

# Body Score Chart



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

# Transition Period from Rear to Peak Egg Production

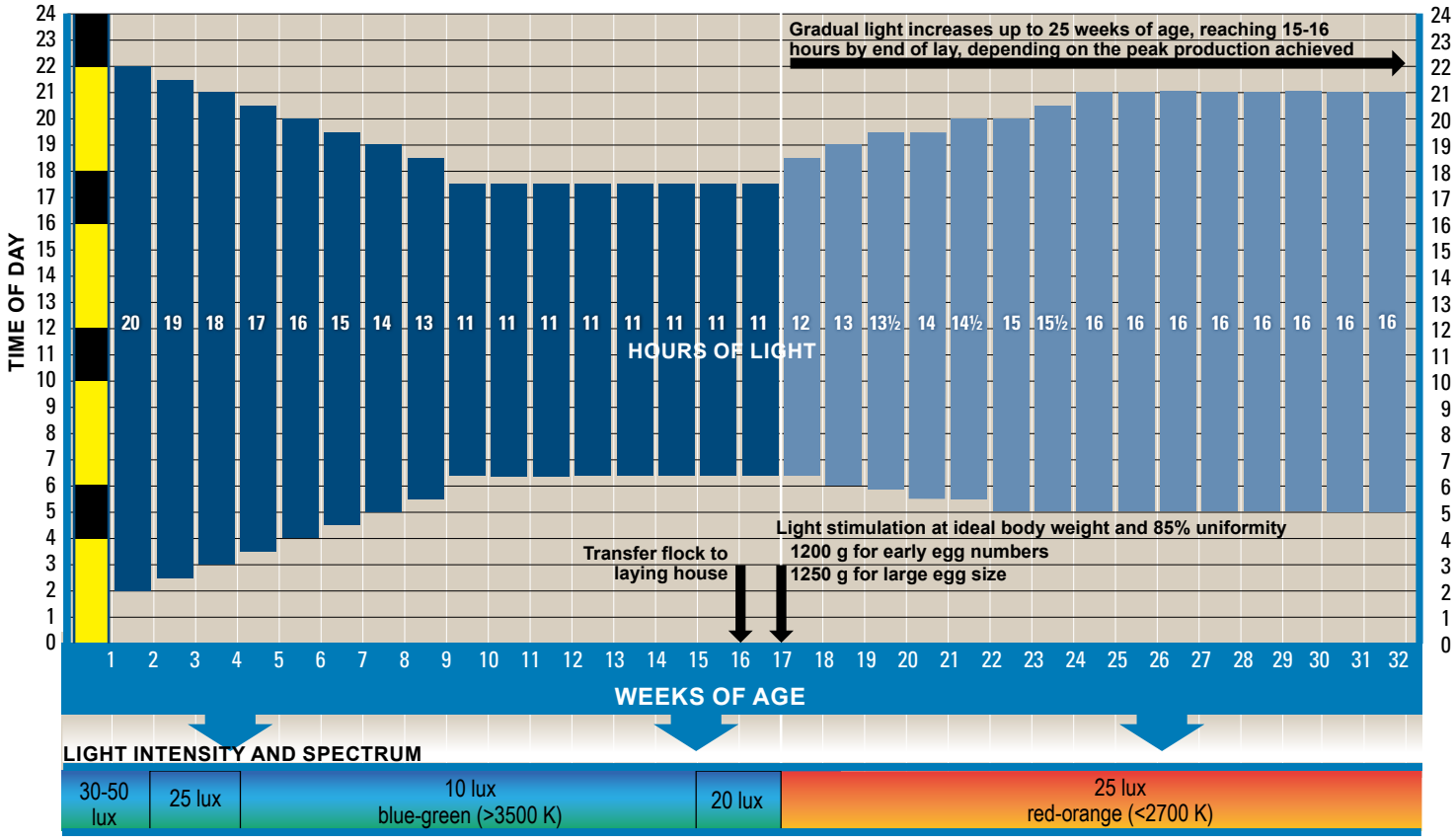
**Frequently formulate to changing feed consumption during transition period until feed consumption is consistent.**




## Pre-Peak

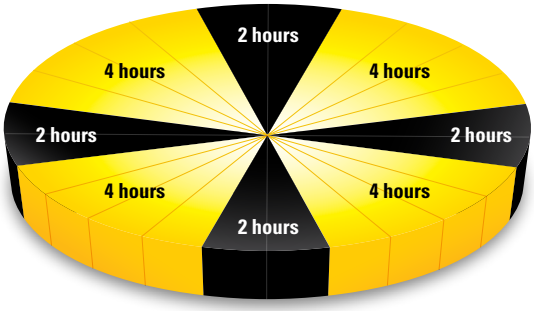
- Pre-Peak diets are intended for flocks with low feed intake and are fed for a limited period from first egg to the beginning of peak production. The nutrient specification of the Pre-Peak diet should be dense enough to allow for lower feed intake and also cater to the increased nutritional needs of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

# Light Program for Light-Controlled Housing

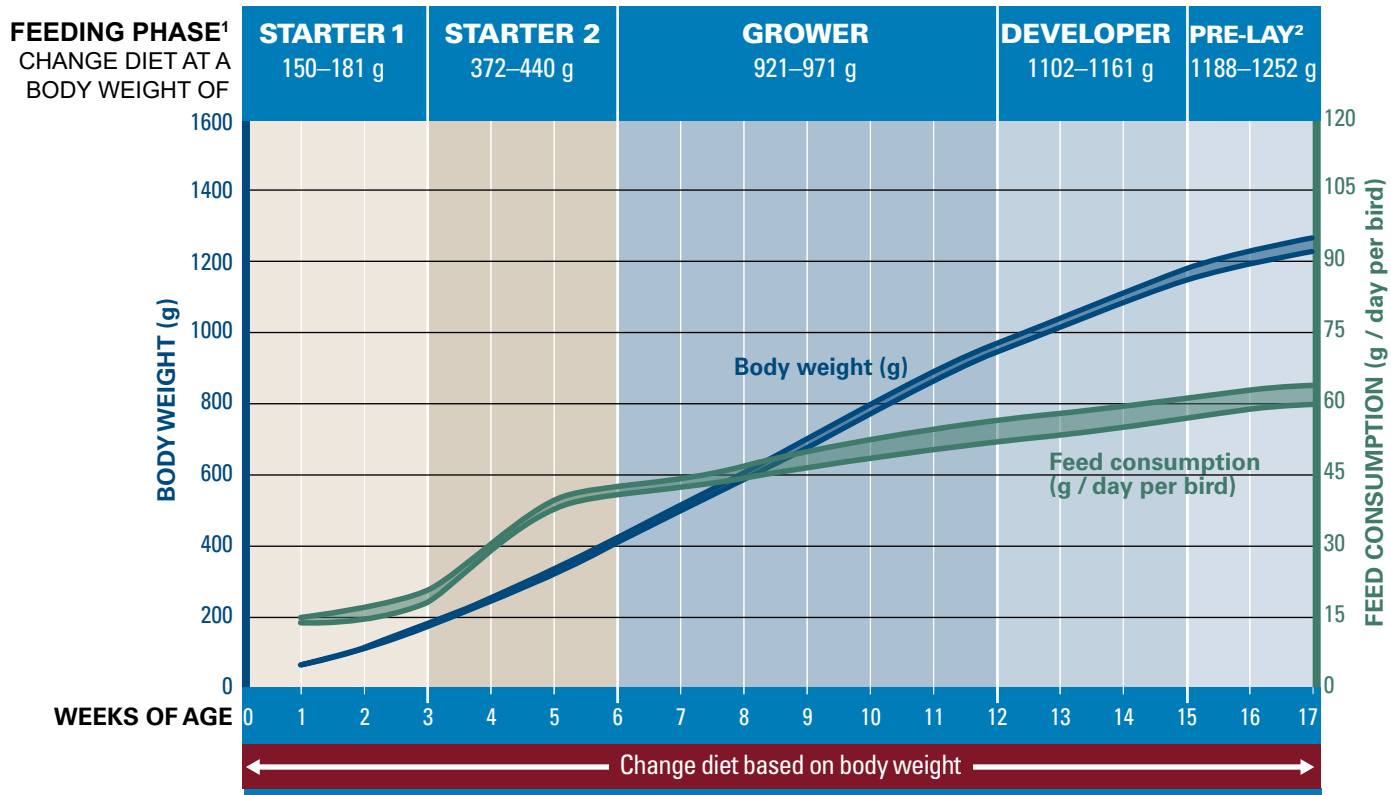



# Intermittent Lighting Program for Chicks

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



# Rearing Period Nutritional Recommendations




| NUTRITION | RECOMMENDED NUTRIENT CONCENTRATION | | | | |
|---|---|---|---|---|---|
| Metabolizable energy[3], kcal/kg | 2977–3087 | 2977–3087 | 2930–3087 | 2880–3050 | 2911–3087 |
| Metabolizable energy[3], MJ/kg | 12.45–12.82 | 12.45–12.82 | 12.25–12.62 | 12.04–12.41 | 12.17–12.54 |
| | **Standardized Ileal Digestible Amino Acids** / Total Amino Acids[4] | | | | |
| Lysine, % | 1.05 / 1.15 | 0.98 / 1.07 | 0.88 / 0.96 | 0.76 / 0.83 | 0.78 / 0.85 |
| Methionine, % | 0.47 / 0.51 | 0.44 / 0.47 | 0.40 / 0.44 | 0.36 / 0.38 | 0.38 / 0.41 |
| Methionine+Cystine,% | 0.74 / 0.83 | 0.74 / 0.83 | 0.67 / 0.75 | 0.59 / 0.67 | 0.66 / 0.74 |
| Threonine, % | 0.69 / 0.82 | 0.66 / 0.77 | 0.60 / 0.70 | 0.52 / 0.62 | 0.55 / 0.64 |
| Tryptophan, % | 0.18 / 0.21 | 0.18 / 0.21 | 0.17 / 0.20 | 0.15 / 0.18 | 0.16 / 0.20 |
| Arginine, % | 1.12 / 1.21 | 1.05 / 1.13 | 0.94 / 1.01 | 0.81 / 0.87 | 0.83 / 0.90 |
| Isoleucine, % | 0.74 / 0.79 | 0.71 / 0.76 | 0.65 / 0.70 | 0.57 / 0.61 | 0.62 / 0.67 |
| Valine, % | 0.76 / 0.83 | 0.73 / 0.80 | 0.69 / 0.76 | 0.61 / 0.67 | 0.66 / 0.73 |
| Crude protein[5], % | 20.00 | 18.25 | 17.50 | 16.00 | 16.50 |
| Calcium[6], % | 1.05 | 1.00 | 0.95 | 0.90 | 2.50 |
| Phosphorus (available)[7], % | 0.48 | 0.47 | 0.45 | 0.40 | 0.43 |
| Phosphorus (digestible), % | 0.44 | 0.43 | 0.41 | 0.35 | 0.38 |
| Sodium, % | 0.18 | 0.17 | 0.17 | 0.18 | 0.18 |
| Chloride, % | 0.18 | 0.17 | 0.17 | 0.18 | 0.18 |
| Linoleic acid (C18:2 n-6), % | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| Choline, mg/kg | 2,000 | 1,800 | 1,800 | 1,500 | 1,500 |

[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.

[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.

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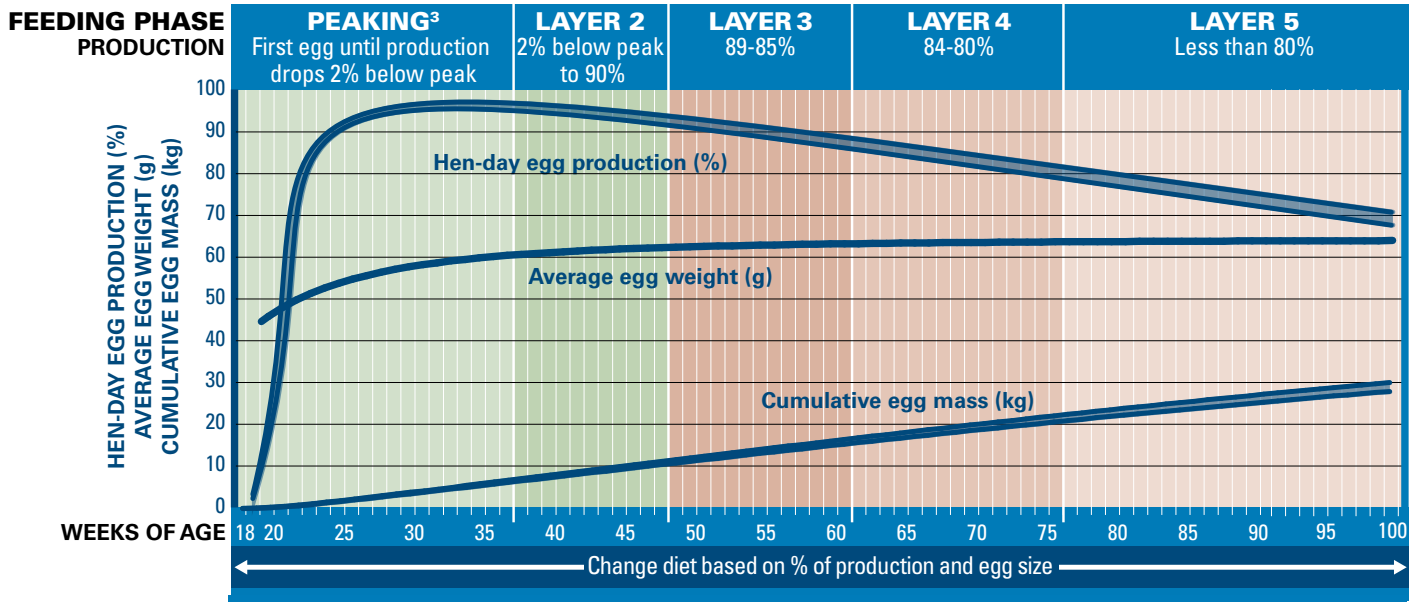
# Production Period Nutritional Recommendations[1,2]




| NUTRITION | RECOMMENDED DAILY NUTRIENT INTAKE | | | | |
|---|---|---|---|---|---|
| Metabolizable energy[4], kcal/bird/day | 290–305 | 285–300 | 280–295 | 280–295 | 280–295 |
| Metabolizable energy[4], MJ/bird/day | 1.21–1.28 | 1.19–1.26 | 1.17–1.23 | 1.17–1.23 | 1.17–1.23 |
| | Standardized Ileal Digestible Amino Acids / Total Amino Acids[5] | | | | |
| Lysine, mg/day | **800** / 876 | **770** / 843 | **740** / 810 | **700** / 766 | **660** / 723 |
| Methionine, mg/day | **418** / 449 | **393** / 422 | **369** / 397 | **341** / 367 | **314** / 338 |
| Methionine+Cystine, mg/day | **728**/ 822 | **693** / 782 | **666** / 752 | **623** / 703 | **581** / 655 |
| Threonine, mg/day | **560** / 658 | **539** / 634 | **518** / 610 | **490** / 576 | **462** / 544 |
| Tryptophan, mg/day | **168** / 201 | **162** / 193 | **155** / 186 | **147** / 175 | **139** / 166 |
| Arginine, mg/day | **856** / 920 | **824** / 886 | **792** / 852 | **749** / 805 | **706** / 759 |
| Isoleucine, mg/day | **640** / 688 | **616** / 662 | **585** / 628 | **546** / 587 | **515** / 554 |
| Valine, mg/day | **704** / 776 | **677** / 747 | **651** / 717 | **609** / 672 | **568** / 626 |
| Crude protein[6], g/day | 16.70 | 16.30 | 16.00 | 15.20 | 14.70 |
| Sodium, mg/day | 180 | 180 | 180 | 180 | 180 |
| Chloride, mg/day | 180 | 180 | 180 | 180 | 180 |
| Linoleic acid (C18:2 n-6), g/day | 2.00 | 1.80 | 1.60 | 1.40 | 1.20 |
| Choline, mg/day | 180 | 180 | 180 | 180 | 180 |

| | CALCIUM AND PHOSPHORUS | | | |
|---|---|---|---|---|
| | Calcium[7,8] g/day | Phosphorus (available)[7,9] mg/day | Phosphorus (digestible) mg/day | Calcium Particle Size (fine : coarse) |
| 18–32 Weeks | 4.00 | 447 | 401 | 40% : 60% |
| Weeks 33–55 | 4.15 | 421 | 381 | 35% : 65% |
| Weeks 56–72 | 4.30 | 395 | 356 | 30% : 70% |
| Weeks 73–85 | 4.45 | 369 | 334 | 25% : 75% |
| Weeks 86+ | 4.60 | 344 | 309 | 25% : 75% |

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

# Production Period Dietary Nutrient Concentrations[1,2]

| FEEDING PHASE | 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% | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTION | | | | | | | | | | | | | | | | | | | | | | | | | |
| NUTRITION | RECOMMENDED CONCENTRATION | | | | | | | | | | | | | | | | | | | | | | | | |
| Metabolizable energy[4], kcal/bird/day | 290–305 | | | | | 285–300 | | | | | 280–295 | | | | | 280–295 | | | | | 280–295 | | | | |
| Metabolizable energy[4], MJ/bird/day | 1.21–1.28 | | | | | 1.19–1.26 | | | | | 1.17–1.23 | | | | | 1.17–1.23 | | | | | 1.17–1.23 | | | | |
| | FEED CONSUMPTION (*Typical Feed Consumption) | | | | | | | | | | | | | | | | | | | | | | | | |
| g/day per bird | 95 | 100 | **105*** | 110 | 115 | 95 | 100 | **105*** | 110 | 115 | 95 | 100 | **105*** | 110 | 115 | 95 | 100 | **105*** | 110 | 115 | 95 | 100 | **105*** | 110 | 115 |
| | Standardized Ileal Digestible Amino Acids | | | | | | | | | | | | | | | | | | | | | | | | |
| Lysine, % | 0.94 | 0.89 | **0.84** | 0.80 | 0.76 | 0.86 | 0.81 | **0.77** | 0.73 | 0.70 | 0.82 | 0.78 | **0.74** | 0.70 | 0.67 | 0.78 | 0.74 | **0.70** | 0.67 | 0.64 | 0.73 | 0.69 | **0.66** | 0.63 | 0.60 |
| Methionine, % | 0.49 | 0.46 | **0.44** | 0.42 | 0.40 | 0.44 | 0.41 | **0.39** | 0.37 | 0.36 | 0.41 | 0.39 | **0.37** | 0.35 | 0.34 | 0.38 | 0.36 | **0.34** | 0.32 | 0.31 | 0.35 | 0.33 | **0.31** | 0.30 | 0.29 |
| Methionine+Cystine,% | 0.86 | 0.81 | **0.77** | 0.73 | 0.69 | 0.77 | 0.73 | **0.69** | 0.66 | 0.63 | 0.74 | 0.70 | **0.67** | 0.63 | 0.61 | 0.69 | 0.66 | **0.62** | 0.59 | 0.57 | 0.65 | 0.61 | **0.58** | 0.55 | 0.53 |
| Threonine, % | 0.66 | 0.62 | **0.59** | 0.56 | 0.53 | 0.60 | 0.57 | **0.54** | 0.51 | 0.49 | 0.58 | 0.55 | **0.52** | 0.49 | 0.47 | 0.54 | 0.52 | **0.49** | 0.47 | 0.45 | 0.51 | 0.49 | **0.46** | 0.44 | 0.42 |
| Tryptophan, % | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.18 | 0.17 | **0.16** | 0.15 | 0.15 | 0.17 | 0.16 | **0.16** | 0.15 | 0.14 | 0.16 | 0.15 | **0.15** | 0.14 | 0.13 | 0.15 | 0.15 | **0.14** | 0.13 | 0.13 |
| Arginine, % | 1.01 | 0.95 | **0.90** | 0.86 | 0.82 | 0.92 | 0.87 | **0.82** | 0.78 | 0.75 | 0.88 | 0.83 | **0.79** | 0.75 | 0.72 | 0.83 | 0.79 | **0.75** | 0.71 | 0.68 | 0.78 | 0.74 | **0.71** | 0.67 | 0.64 |
| Isoleucine, % | 0.75 | 0.71 | **0.67** | 0.64 | 0.61 | 0.68 | 0.65 | **0.62** | 0.59 | 0.56 | 0.65 | 0.62 | **0.59** | 0.56 | 0.53 | 0.61 | 0.57 | **0.55** | 0.52 | 0.50 | 0.57 | 0.54 | **0.52** | 0.49 | 0.47 |
| Valine, % | 0.83 | 0.78 | **0.74** | 0.70 | 0.67 | 0.75 | 0.71 | **0.68** | 0.64 | 0.62 | 0.72 | 0.69 | **0.65** | 0.62 | 0.59 | 0.68 | 0.64 | **0.61** | 0.58 | 0.55 | 0.63 | 0.60 | **0.57** | 0.54 | 0.52 |
| | Total Amino Acids[5] | | | | | | | | | | | | | | | | | | | | | | | | |
| Lysine, % | 1.03 | 0.97 | **0.92** | 0.88 | 0.83 | 0.94 | 0.89 | **0.84** | 0.80 | 0.77 | 0.90 | 0.85 | **0.81** | 0.77 | 0.74 | 0.85 | 0.81 | **0.77** | 0.73 | 0.70 | 0.80 | 0.76 | **0.72** | 0.69 | 0.66 |
| Methionine, % | 0.53 | 0.50 | **0.47** | 0.45 | 0.43 | 0.47 | 0.44 | **0.42** | 0.40 | 0.38 | 0.44 | 0.42 | **0.40** | 0.38 | 0.36 | 0.41 | 0.39 | **0.37** | 0.35 | 0.33 | 0.38 | 0.36 | **0.34** | 0.32 | 0.31 |
| Methionine+Cystine,% | 0.97 | 0.91 | **0.87** | 0.82 | 0.78 | 0.87 | 0.82 | **0.78** | 0.74 | 0.71 | 0.84 | 0.79 | **0.75** | 0.72 | 0.68 | 0.78 | 0.74 | **0.70** | 0.67 | 0.64 | 0.73 | 0.69 | **0.66** | 0.62 | 0.60 |
| Threonine, % | 0.77 | 0.73 | **0.69** | 0.66 | 0.63 | 0.70 | 0.67 | **0.63** | 0.60 | 0.58 | 0.68 | 0.64 | **0.61** | 0.58 | 0.55 | 0.64 | 0.61 | **0.58** | 0.55 | 0.52 | 0.60 | 0.57 | **0.54** | 0.52 | 0.49 |
| Tryptophan, % | 0.24 | 0.22 | **0.21** | 0.20 | 0.19 | 0.21 | 0.20 | **0.19** | 0.18 | 0.18 | 0.21 | 0.20 | **0.19** | 0.18 | 0.17 | 0.19 | 0.18 | **0.18** | 0.17 | 0.16 | 0.18 | 0.17 | **0.17** | 0.16 | 0.15 |
| Arginine, % | 1.08 | 1.02 | **0.97** | 0.92 | 0.88 | 0.98 | 0.93 | **0.89** | 0.84 | 0.81 | 0.95 | 0.90 | **0.85** | 0.81 | 0.77 | 0.89 | 0.85 | **0.81** | 0.77 | 0.73 | 0.84 | 0.80 | **0.76** | 0.72 | 0.69 |
| Isoleucine, % | 0.81 | 0.76 | **0.72** | 0.69 | 0.66 | 0.74 | 0.70 | **0.66** | 0.63 | 0.60 | 0.70 | 0.66 | **0.63** | 0.60 | 0.57 | 0.65 | 0.62 | **0.59** | 0.56 | 0.53 | 0.62 | 0.58 | **0.55** | 0.53 | 0.50 |
| Valine, % | 0.91 | 0.86 | **0.82** | 0.78 | 0.74 | 0.83 | 0.79 | **0.75** | 0.71 | 0.68 | 0.80 | 0.75 | **0.72** | 0.68 | 0.65 | 0.75 | 0.71 | **0.67** | 0.64 | 0.61 | 0.70 | 0.66 | **0.63** | 0.60 | 0.57 |
| Crude protein[6], % | 19.65 | 18.56 | **17.58** | 16.70 | 15.90 | 18.11 | 17.16 | **16.30** | 15.52 | 14.82 | 17.78 | 16.84 | **16.00** | 15.24 | 14.55 | 16.89 | 16.00 | **15.20** | 14.48 | 13.82 | 16.33 | 15.47 | **14.70** | 14.00 | 13.36 |
| Sodium, % | 0.21 | 0.20 | **0.19** | 0.18 | 0.17 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 |
| Chloride, % | 0.21 | 0.20 | **0.19** | 0.18 | 0.17 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 | 0.20 | 0.19 | **0.18** | 0.17 | 0.16 |
| Linoleic acid (C18:2 n-6), % | 2.35 | 2.22 | **2.11** | 2.00 | 1.90 | 2.00 | 1.89 | **1.80** | 1.71 | 1.64 | 1.78 | 1.68 | **1.60** | 1.52 | 1.45 | 1.56 | 1.47 | **1.40** | 1.33 | 1.27 | 1.33 | 1.26 | **1.20** | 1.14 | 1.09 |
| Choline, mg/kg | 2118 | 2000 | **1895** | 1800 | 1714 | 2000 | 1895 | **1800** | 1714 | 1636 | 2000 | 1895 | **1800** | 1714 | 1636 | 2000 | 1895 | **1800** | 1714 | 1636 | 2000 | 1895 | **1800** | 1714 | 1636 |

| CALCIUM AND PHOSPHORUS CHANGES BASED ON FEED INTAKE | Weeks 18–32 | | | | | | | Weeks 33–55 | | | | | Weeks 56–72 | | | | | Weeks 73–85 | | | | | Weeks 86+ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feed Consumption, g/day per bird | 85 | 90 | 95 | **100** | 105 | 110 | 115 | 95 | 100 | **105** | 110 | 115 | 95 | 100 | **105** | 110 | 115 | 95 | 100 | **105** | 110 | 115 | 95 | 100 | **105** | 110 | 115 |
| Calcium[7,8], % | 4.71 | 4.44 | 4.21 | **4.00** | 3.81 | 3.64 | 3.48 | 4.37 | 4.15 | **3.95** | 3.77 | 3.61 | 4.53 | 4.30 | **4.10** | 3.91 | 3.74 | 4.68 | 4.45 | **4.24** | 4.05 | 3.87 | 4.84 | 4.60 | **4.38** | 4.18 | 4.00 |
| Phosphorus (available)[7,9], % | 0.53 | 0.50 | 0.47 | **0.45** | 0.43 | 0.41 | 0.39 | 0.44 | 0.42 | **0.40** | 0.38 | 0.37 | 0.42 | 0.39 | **0.38** | 0.36 | 0.34 | 0.39 | 0.37 | **0.35** | 0.34 | 0.32 | 0.36 | 0.34 | **0.33** | 0.31 | 0.30 |
| Phosphorus (digestible), % | 0.47 | 0.45 | 0.42 | **0.40** | 0.38 | 0.36 | 0.35 | 0.40 | 0.38 | **0.36** | 0.35 | 0.33 | 0.38 | 0.36 | **0.34** | 0.32 | 0.31 | 0.35 | 0.33 | **0.32** | 0.30 | 0.29 | 0.33 | 0.31 | **0.29** | 0.28 | 0.27 |

[1] All nutrient requirements are based on the Feed Ingredient Tables.
[2] Crude protein, methionine+cystine, fat, linoleic acid, and / or energy may be changed to optimize egg size.
[3] Peaking nutrient levels are calculated for birds at peak egg production. Prior to achieving peak egg production, the nutrient requirements will be lower.
[4] A good approximation of the influence of temperature on energy needs is that for each 0.5°C change higher or lower than 22°C, subtract or add about 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. 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.

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# Vitamins and Trace Minerals

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

[1] Minimum recommendations for rearing and laying periods. Local regulations may limit dietary content of individual vitamins or minerals. Levels of 150-200 mg/kg of Vitamin C can be beneficial during periods of stress.
[2] Store premixes according to supplier's recommendations and observe 'use by' dates to ensure vitamin activity is maintained. Inclusion of antioxidant may improve premix stability.
[3] Vitamin and mineral recommendations vary according to activity.
[4] Where heat treatment is applied to diet, higher levels of vitamins may be required. Consult with vitamin supplier regarding stability through individual production processes.
[5] A proportion of Vitamin $D_3$ can be supplemented as 25-hydroxy $D_3$ according to supplier's recommendations and applicable limits.
[6] Higher levels of Niacin are recommended in non-cage systems.
[7] Greater bioavailability and productivity may be possible with use of chelated mineral sources.
[8] Supplementing with up to 500 ppm of magnesium may be beneficial to support eggshell quality, particularly in aged hens or during periods of increased metabolic demand.

# Drinking Water Quality for Poultry

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

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

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

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

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

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