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DEKALB AMBERLINK PRODUCT GUIDE

CAGE PRODUCTION SYSTEM

Achieving the full genetic potential of the Dekalb Amberlink

The DEKALB Story

Dekalb and The American Dream

The Dekalb story is a classic example of American pioneering and entrepreneurial thinking. Success in developing and commercializing hybrid seed corn in the 1930's and early 1940's prompted Dekalb Agricultural Association to explore whether hybridization could be applied to poultry.

President Tom Roberts Sr. and Ray C. Nelson, v.p. of the newly-formed poultry division, set out to develop hens with superior egg-laying performance for the nation's farmers and layer producers.

Dr. E. E. Schnetzler of Purdue was hired in 1945 as Dekalb's director of poultry research. A research farm was established and in the 1950's and research concentrated on further improving the efficient white egg layers.

By purchasing the J.J. Warren company in 1971 Dekalb gained access to an excellent brown egg layer that was color sexable. As a result, by the 1980's Dekalb white and brown layers were being distributed in over 25 countries and the poultry operation was named Dekalb Poultry Research, Inc. (DPRI).

Today, as part of Hendrix Genetics, Dekalb layers continue to be a dominant force in the major layer markets of the U.S., Europe and Japan.

The DEKALB Amberlink Today

Dekalb Amberlink is a well balanced, all round performance bird. A champion egg layer with very strong and very brown eggs.

The result is a predictable and proven profit. The ideal bird for nice, medium size table eggs.

- A reverse-cross white layer breed
- Exceptional feathering qualities
- Extended laying period

CONTENTS

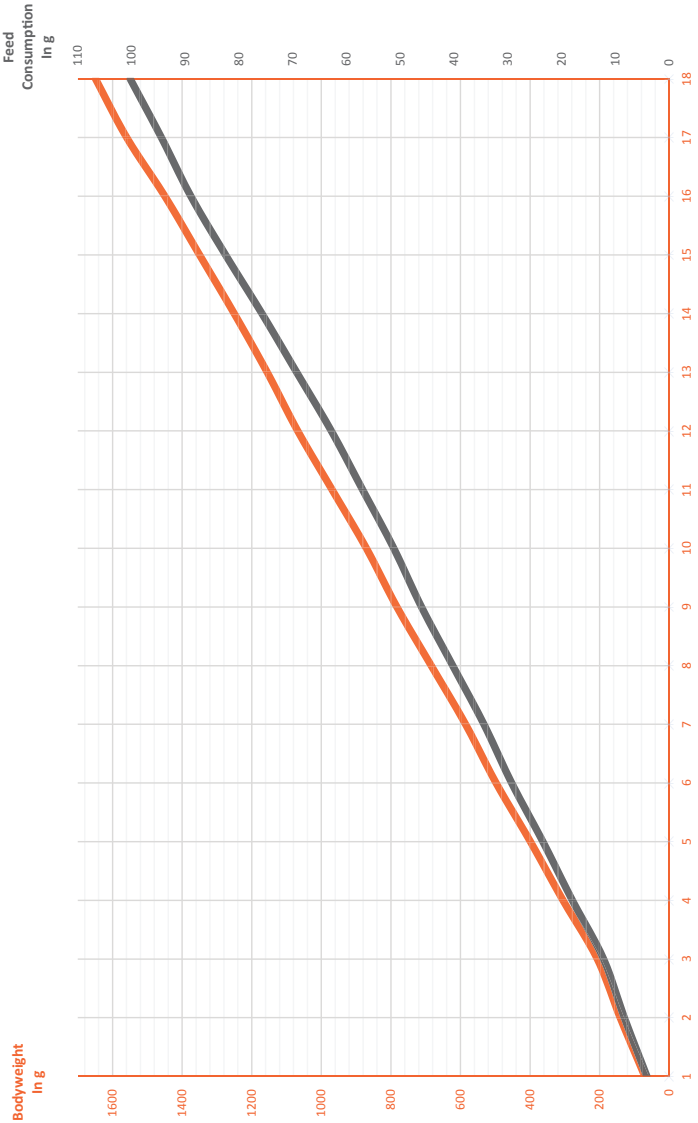
DEKALB AMBERLINK

REARING TABLE

Weeks	Age (days)	Feed intake per bird per day (g)		Feed intake per bird cum. (g)		Body weight (g)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	0-7	**13**	15	91	105	60	66
2	8-14	**26**	28	273	301	125	137
3	15-21	**32**	34	497	539	185	203
4	22-28	**35**	37	742	798	275	302
5	29-35	**38**	40	1008	1078	360	396
6	36-42	**42**	44	1302	1386	450	495
7	43-49	**47**	49	1631	1729	530	583
8	50-56	**51**	53	1988	2100	620	682
9	57-63	**54**	56	2366	2492	710	781
10	64-70	**57**	59	2765	2905	790	869
11	71-77	**60**	62	3185	3339	880	968
12	78-84	**62**	64	3619	3787	970	1067
13	85-91	**64**	66	4067	4249	1070	1155
14	92-98	**65**	67	4522	4718	1170	1250
15	99-105	**67**	69	4991	5201	1275	1350
16	106-112	**69**	71	5474	5698	1375	1450
17	113-119	**71**	73	5971	6209	1460	1560
18	120-126	**74**	76	6489	6741	1550	1650

The information supplied in this guide is based on many actual flock results obtained under good environment and managing conditions. It is presented as a service to our customers and should be used as a guide only. It does not constitute a guarantee or warranty of performance in any way.

REARING GRAPH



NOTES

PRODUCTION SUMMARY

Laying Period	(18-90 Weeks)	
Liveability	94.8	%
Age at 50% production	142	days
Peak of production	95.5	%
Average egg weight	60.7	g
Eggs hen housed	424	
Egg mass hen housed	25.8	kg
Average feed intake	114	g/day
Cum. feed conversion rate	2.19	kg/kg
Body weight	2020	g
Shell strength	4100	g
Shell Color	29	
Haugh units	83	

DEKALB AMBERLINK
PRODUCTION TABLE 1

PER HEN DAY

Weeks	% Lay	Egg weight (g)	Egg mass per day (g)	Feed intake per day (g)	Feed conversion per week
18	2.0	44.0	0.9	75	85.23
19	24.0	47.0	11.3	80	7.09
20	63.0	49.0	30.9	85	2.75
21	80.0	50.6	40.5	90	2.22
22	90.0	52.5	47.3	95	2.01
23	93.4	53.9	50.3	100	1.99
24	95.0	55.4	52.6	105	2.00
25	95.3	56.5	53.8	108	2.01
26	95.5	57.5	54.9	111	2.02
27	95.5	58.0	55.4	113	2.04
28	95.4	58.5	55.8	115	2.06
29	95.2	58.8	56.0	116	2.07
30	95.1	59.2	56.3	117	2.08
31	94.9	59.8	56.8	118	2.08
32	94.8	60.0	56.9	119	2.09
33	94.6	60.1	56.9	119	2.09
34	94.5	60.2	56.9	119	2.09
35	94.3	60.3	56.9	119	2.09
36	94.1	60.4	56.8	119	2.09
37	93.9	60.5	56.8	119	2.09
38	93.7	60.6	56.8	119	2.10
39	93.5	60.7	56.8	119	2.10
40	93.3	60.8	56.7	118	2.08
41	93.1	60.9	56.7	118	2.08
42	92.9	61.0	56.7	118	2.08
43	92.7	61.1	56.6	118	2.08
44	92.5	61.1	56.5	118	2.09
45	92.3	61.2	56.5	118	2.09
46	92.0	61.2	56.3	118	2.10
47	91.8	61.3	56.3	118	2.10
48	91.5	61.3	56.1	118	2.10
49	91.3	61.4	56.1	118	2.10
50	91.0	61.4	55.9	118	2.11
51	90.8	61.5	55.8	117	2.10
52	90.5	61.5	55.7	117	2.10
53	90.2	61.6	55.6	117	2.11
54	89.9	61.6	55.4	117	2.11

PER HEN HOUSED

Age in weeks	Eggs per bird cum.	Egg mass cum.	Feed intake cum. (kg)	Feed conversion cum.	% Liveability	Body weight (g)
18	0.1	0.5	85.23	99.9	1600	1500
19	1.8	0.1	1.1	12.75	99.8	1630
20	6.2	0.3	1.7	5.58	99.8	1700
21	11.8	0.6	2.3	3.95	99.7	1740
22	18.1	0.9	3.0	3.25	99.6	1780
23	24.6	1.3	3.7	2.90	99.5	1800
24	31.2	1.6	4.4	2.70	99.5	1815
25	37.8	2.0	5.1	2.57	99.4	1830
26	44.5	2.4	5.9	2.48	99.3	1840
27	51.1	2.8	6.7	2.42	99.3	1850
28	57.7	3.2	7.5	2.38	99.2	1860
29	64.3	3.5	8.3	2.34	99.1	1870
30	70.9	3.9	9.1	2.32	99.0	1875
31	77.5	4.3	9.9	2.29	99.0	1880
32	84.1	4.7	10.8	2.28	98.9	1885
33	90.6	5.1	11.6	2.26	98.8	1890
34	97.1	5.5	12.4	2.25	98.8	1895
35	103.7	5.9	13.2	2.24	98.7	1900
36	110.1	6.3	14.0	2.23	98.6	1905
37	116.6	6.7	14.9	2.22	98.5	1910
38	123.1	7.1	15.7	2.22	98.5	1915
39	129.5	7.5	16.5	2.21	98.4	1920
40	135.9	7.9	17.3	2.20	98.3	1925
41	142.4	8.3	18.1	2.20	98.3	1930
42	148.7	8.6	18.9	2.19	98.2	1935
43	155.1	9.0	19.8	2.19	98.1	1940
44	161.5	9.4	20.6	2.18	98.0	1940
45	167.8	9.8	21.4	2.18	98.0	1940
46	174.1	10.2	22.2	2.18	97.9	1945
47	180.4	10.6	23.0	2.17	97.8	1945
48	186.6	11.0	23.8	2.17	97.8	1950
49	192.9	11.3	24.6	2.17	97.7	1950
50	199.1	11.7	25.4	2.17	97.6	1950
51	205.3	12.1	26.2	2.17	97.5	1955
52	211.5	12.5	27.0	2.16	97.5	1955
53	217.6	12.9	27.8	2.16	97.4	1955
54	223.7	13.2	28.6	2.16	97.3	1960

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PRODUCTION TABLE 2

PER HEN DAY

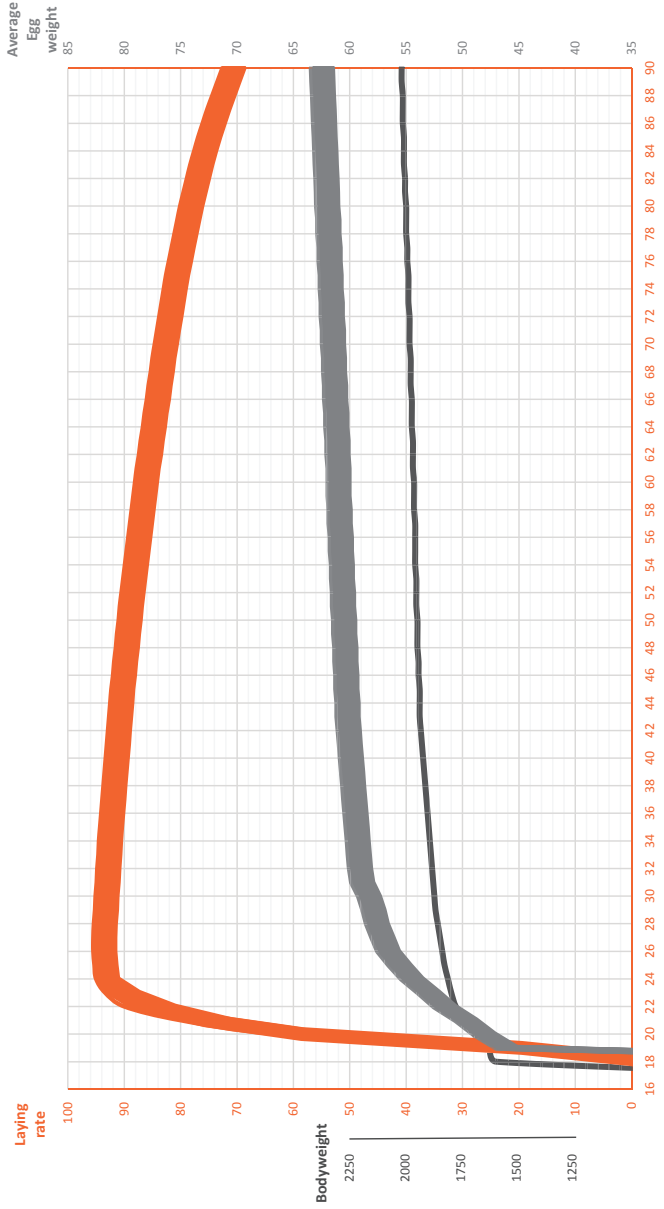
Weeks	% Lay	Egg weight (g)	Egg mass per day (g)	Feed intake per day (g)	Feed conversion per week
55	89.6	61.7	55.3	117	2.12
56	89.3	61.7	55.1	117	2.12
57	89.0	61.8	55.0	117	2.13
58	88.7	61.8	54.8	117	2.13
59	88.4	61.9	54.7	117	2.13
60	88.1	61.9	54.5	116	2.13
61	87.8	61.9	54.3	116	2.13
62	87.4	62.0	54.2	116	2.14
63	87.1	62.0	54.0	116	2.15
64	86.7	62.1	53.8	116	2.15
65	86.4	62.1	53.7	116	2.16
66	86.0	62.2	53.5	115	2.15
67	85.7	62.2	53.3	115	2.16
68	85.3	62.3	53.1	115	2.16
69	85.0	62.3	53.0	115	2.17
70	84.6	62.4	52.8	115	2.18
71	84.2	62.4	52.5	115	2.19
72	83.8	62.5	52.4	115	2.20
73	83.4	62.5	52.1	115	2.21
74	83.0	62.6	52.0	115	2.21
75	82.6	62.6	51.7	114	2.20
76	82.1	62.7	51.5	114	2.21
77	81.6	62.7	51.2	114	2.23
78	81.1	62.8	50.9	114	2.24
79	80.6	62.8	50.6	114	2.25
80	80.1	62.9	50.4	114	2.26
81	79.5	62.9	50.0	114	2.28
82	78.9	63.0	49.7	114	2.29
83	78.3	63.0	49.4	114	2.31
84	77.6	63.1	48.9	114	2.33
85	76.9	63.1	48.5	114	2.35
86	76.1	63.2	48.1	114	2.37
87	75.3	63.2	47.6	114	2.39
88	74.4	63.3	47.1	114	2.42
89	73.5	63.3	46.5	114	2.45
90	72.6	63.4	46.0	114	2.48

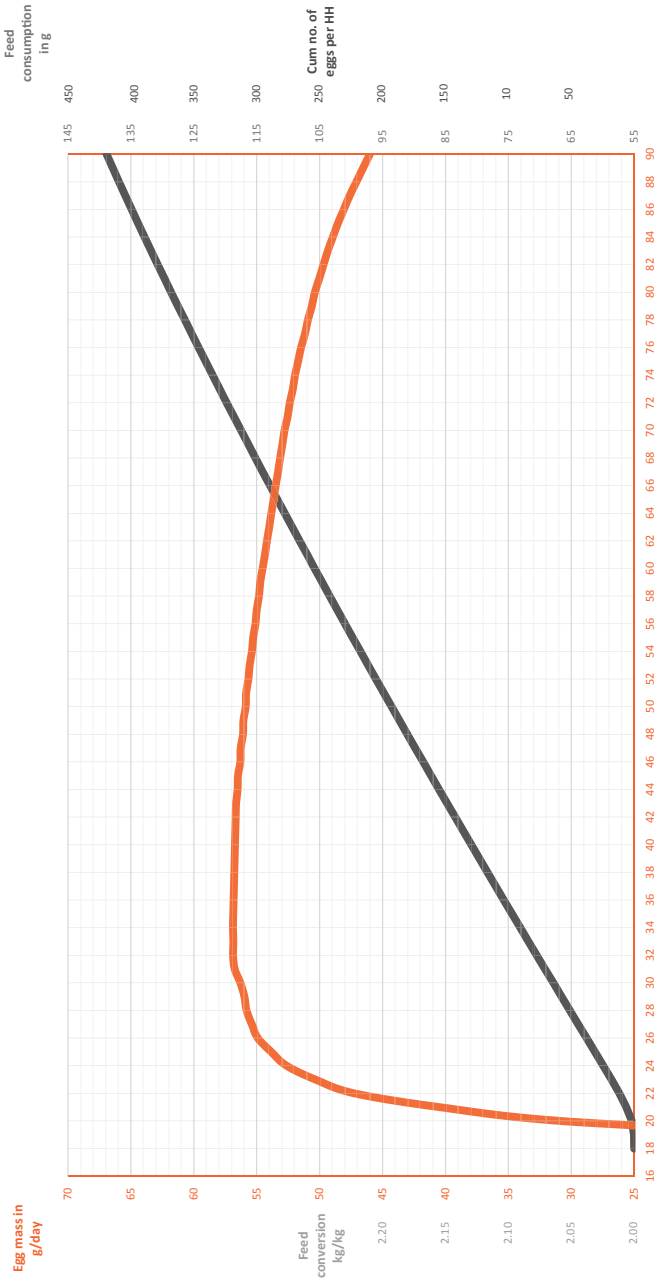
PER HEN HOUSED

Age in weeks	Eggs per bird cum.	Egg mass cum.	Feed intake cum. (kg)	Feed conversion cum.	% Liveability	Body weight (g)
55	229.8	13.6	29.4	2.16	97.3	1960
56	235.9	14.0	30.2	2.16	97.2	1960
57	242.0	14.4	31.0	2.16	97.1	1960
58	248.0	14.7	31.8	2.16	97.0	1965
59	254.0	15.1	32.6	2.16	97.0	1965
60	260.0	15.5	33.4	2.16	96.9	1965
61	265.9	15.8	34.2	2.15	96.8	1970
62	271.8	16.2	34.9	2.15	96.8	1970
63	277.7	16.6	35.7	2.15	96.7	1970
64	283.6	16.9	36.5	2.15	96.6	1975
65	289.4	17.3	37.3	2.15	96.5	1975
66	295.2	17.7	38.1	2.15	96.5	1975
67	301.0	18.0	38.8	2.15	96.4	1980
68	306.8	18.4	39.6	2.15	96.3	1980
69	312.5	18.7	40.4	2.15	96.3	1980
70	318.2	19.1	41.2	2.16	96.2	1985
71	323.9	19.5	41.9	2.16	96.1	1985
72	329.5	19.8	42.7	2.16	96.0	1985
73	335.1	20.2	43.5	2.16	96.0	1990
74	340.7	20.5	44.3	2.16	95.9	1990
75	346.2	20.9	45.0	2.16	95.8	1990
76	351.7	21.2	45.8	2.16	95.8	1995
77	357.2	21.5	46.6	2.16	95.7	1995
78	362.6	21.9	47.3	2.16	95.6	2000
79	368.0	22.2	48.1	2.16	95.5	2000
80	373.4	22.6	48.8	2.17	95.5	2000
81	378.7	22.9	49.6	2.17	95.4	2005
82	383.9	23.2	50.4	2.17	95.3	2005
83	389.1	23.5	51.1	2.17	95.3	2010
84	394.3	23.9	51.9	2.17	95.2	2010
85	399.4	24.2	52.6	2.18	95.1	2010
86	404.5	24.5	53.4	2.18	95.0	2015
87	409.5	24.8	54.2	2.18	95.0	2015
88	414.4	25.1	54.9	2.18	94.9	2015
89	419.3	25.5	55.7	2.19	94.8	2020
90	424.1	25.8	56.4	2.19	94.8	2020

DEKALB AMBERLINK

PRODUCTION GRAPHS





EGG WEIGHT CLASSIFICATION

% Eggs per Class at Given Age

Weight Class	Weight in grams	Age in Weeks						
		30	40	50	60	70	80	90
Jumbo	>66	8	14	17	20	24	27	30
XL	61-66	28	34	36	37	38	38	38
Large	51-61	61	49	45	41	38	34	31
Medium	43-61	4	2	2	1	1	1	0
Small	<43	0	0	0	0	0	0	0
Weekly Egg Weight (g)		**59.2**	**60.8**	**61.4**	**61.9**	**62.4**	**62.9**	**63.4**

Cumulative Number of Eggs (HH) per Class

Weight Class	Weight in grams	Age in Weeks				
		60	72	76	80	90
Jumbo	>66	32	47	53	58	73
XL	61-66	75	101	110	118	137
Large	51-61	134	161	169	177	193
Medium	43-61	18	19	19	19	20
Small	<43	1	1	1	1	1
Total Number		**260**	**329**	**252**	**313**	**424**

STANDARD CLASSIFICATION PER 1000 EGGS

Age	Av. Egg weight	Small <43	Medium 43-51	Large 51-61	XL 61-66	Jumbo >66g
18	44.0	388.2	588.5	23.4	0.0	0.0
19	47.0	143.7	712.6	143.6	0.1	0.0
20	49.0	62.9	632.1	303.9	1.1	0.0
21	50.6	30.2	509.1	455.5	5.0	0.1
22	52.5	11.9	348.6	618.0	20.8	0.7
23	53.9	5.7	244.9	699.6	47.3	2.5
24	55.4	2.6	157.8	736.4	94.8	8.4
25	56.5	1.4	110.4	728.4	141.9	17.8
26	57.5	0.8	78.0	697.8	191.1	32.3
27	58.0	0.6	65.1	675.3	216.6	42.3
28	58.5	0.5	54.1	648.9	242.1	54.5
29	58.8	0.4	48.3	631.4	257.1	62.9
30	59.2	0.3	41.4	606.4	276.4	75.5
31	59.8	0.2	32.7	566.1	303.5	97.5
32	60.0	0.2	30.2	552.1	311.8	105.6
33	60.1	0.2	29.0	545.0	315.9	109.9
34	60.2	0.2	27.9	537.9	319.8	114.2
35	60.3	0.2	26.8	530.8	323.6	118.7
36	60.4	0.2	25.7	523.5	327.3	123.2
37	60.5	0.1	24.7	516.3	331.0	127.9
38	60.6	0.1	23.7	509.0	334.5	132.7
39	60.7	0.1	22.8	501.7	337.8	137.5
40	60.8	0.1	21.8	494.4	341.1	142.5
41	60.9	0.1	21.0	487.1	344.2	147.6
42	61.0	0.1	20.1	479.8	347.2	152.8
43	61.1	0.1	19.3	472.4	350.1	158.1
44	61.1	0.1	19.3	472.4	350.1	158.1
45	61.2	0.1	18.5	465.1	352.8	163.4
46	61.2	0.1	18.5	465.1	352.8	163.4
47	61.3	0.1	17.8	457.8	355.5	168.9
48	61.3	0.1	17.8	457.8	355.5	168.9
49	61.4	0.1	17.0	450.4	357.9	174.5
50	61.4	0.1	17.0	450.4	357.9	174.5
51	61.5	0.1	16.3	443.1	360.3	180.2
52	61.5	0.1	16.3	443.1	360.3	180.2
53	61.6	0.1	15.7	435.8	362.5	186.0
54	61.6	0.1	15.7	435.8	362.5	186.0
55	61.7	0.1	15.0	428.5	364.6	191.8
56	61.7	0.1	15.0	428.5	364.6	191.8
57	61.8	0.1	14.4	421.3	366.5	197.8
58	61.8	0.1	14.4	421.3	366.5	197.8
59	61.9	0.1	13.8	414.0	368.3	203.8
60	61.9	0.1	13.8	414.0	368.3	203.8
61	61.9	0.1	13.8	414.0	368.3	203.8
62	62.0	0.1	13.2	406.8	369.9	210.0
63	62.0	0.1	13.2	406.8	369.9	210.0
64	62.1	0.1	12.7	399.7	371.4	216.2
65	62.1	0.1	12.7	399.7	371.4	216.2
66	62.2	0.1	12.1	392.5	372.8	222.5
67	62.2	0.1	12.1	392.5	372.8	222.5
68	62.3	0.1	11.6	385.4	374.0	228.9
69	62.3	0.1	11.6	385.4	374.0	228.9
70	62.4	0.1	11.1	378.4	375.0	235.4
71	62.4	0.1	11.1	378.4	375.0	235.4
72	62.5	0.0	10.7	371.4	375.9	242.0
73	62.5	0.0	10.7	371.4	375.9	242.0
74	62.6	0.0	10.2	364.4	376.7	248.6
75	62.6	0.0	10.2	364.4	376.7	248.6
76	62.7	0.0	9.8	357.5	377.4	255.3
77	62.7	0.0	9.8	357.5	377.4	255.3
78	62.8	0.0	9.4	350.6	377.9	262.1
79	62.8	0.0	9.4	350.6	377.9	262.1
80	62.9	0.0	9.0	343.9	378.2	268.9
81	62.9	0.0	8.9	342.0	378.3	270.8
82	63.0	0.0	8.7	338.6	378.4	274.3
83	63.0	0.0	8.5	335.3	378.4	277.7
84	63.1	0.0	8.3	331.9	378.5	281.2
85	63.1	0.0	8.1	328.6	378.5	284.7
86	63.2	0.0	8.0	325.3	378.4	288.3
87	63.2	0.0	7.8	322.0	378.4	291.8
88	63.3	0.0	7.6	318.8	378.3	295.3
89	63.3	0.0	7.5	315.5	378.1	298.9
90	63.4	0.0	7.3	312.3	377.9	302.5

REARING PERIOD

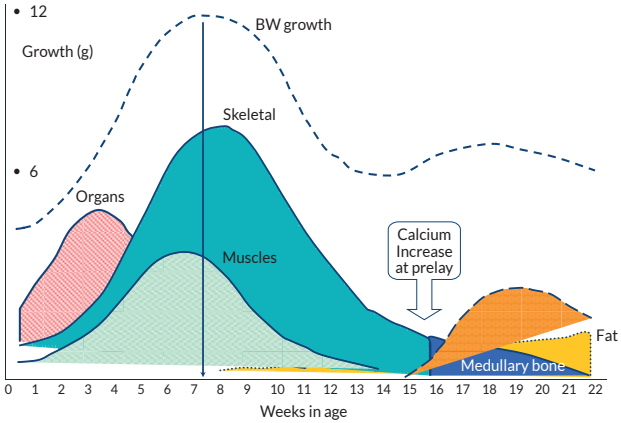
Good brooding conditions are vital to give the chicks the best possible start.

The period from one day old to the point of first egg production is a critical time in the life of the laying hen. It is during this time that the physiological capability of the hen is developed.

Success in the rearing period leads to success in the laying house and this starts with chick arrival. All the standards and programmes set out in this section have been proven to give excellent performance in the production stages.

Any delay in growth at 4-5 weeks will be reflected in a reduction in bodyweight at 16 weeks and then in performance. This is particularly true for mean egg weight in temperate climates and may cause a delay in start of lay in hot climates near the equator.

Figure 1: Bodyweight development



Equipment and Environment

Age (weeks)		Floor		Cages	
		0 – 2	2 – 5	0 – 3	3 – 5
Ventilation	Minimum per hour / kg	0,7 m^3	0,7 m^3	0,7 m^3	0,7 m^3
Stocking densities	Birds / m^2	30	20	80	45
	cm^2 / Bird			125	220
Water supply	Chicks / Chick drinker	75		80 (1)	
	Birds / drinker	75	75		
	Birds / nipple	10	10	10 (2)	10 (2)
Feed supply	Birds / Starting pan	50		(3)	
	cm of trough feeders	4	4	2	4
	Birds / Round feeder	35	35		

(1): Place one additional drinker per cage for the first week
(2): Make sure that all the birds have access to at least 2 nipples
(3): Spread sheets of paper over the cage bottom to last for 7 days, remove the top sheet every day

Notes:

- The removal of the supplementary starter drinkers should be done gradually, making sure that the chicks have acquired the habit of using the regular drinkers.
- It is useful to monitor water consumption. To maintain litter quality, it is necessary to avoid water spillage, by carefully regulating the drinkers or the nipples.
- The drinkers should be cleaned daily for the first 2 weeks. From the third week they should be cleaned each week.
- Check that all the birds, even the smaller ones have access to feed and water.
- It is important to use 360° nipples, especially for infra-red beak treated birds.

Standards of Temperature and Humidity

In order to ensure that the equipment and the litter are warm for chick arrival, we advise starting to raise the house temperature at least 36 hours before chick arrival so that it reaches a house temperature of 28 to 31°C. The concrete floor must be at 28°C and litter at 30°C.

The best way to check if the house temperature is correct during the first days after arrival is to measure cloacal temperature of the chicks (40°C/104°F).

Standards for Temperature and Humidity

Age in days	Brooding temperature at the edge of the brooders	Brooding temperature at 2-3m from the brooders	Room temperature	Relative humidity optimum-maximum in%
0 – 3	35 °C	29 – 28 °C	33 – 31 °C	55 – 60
4 – 7	34 °C	28 – 27 °C	32 – 31 °C	55 – 60
8 – 14	32 °C	27 – 26 °C	30 – 28 °C	55 – 60
15 – 21	29 °C	26 – 25 °C	28 – 26 °C	55 – 60
22 – 24		25 – 23 °C	25 – 23 °C	55 – 65
25 – 28		23 – 21 °C	23 – 21 °C	55 – 65
29 – 35		21 – 19 °C	21 – 19 °C	60 – 70
After 35		19 – 17 °C	19 – 17 °C	60 – 70

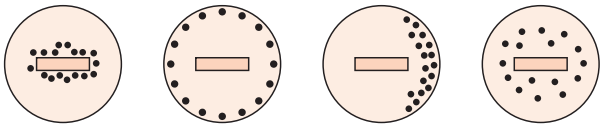
Notes:

- The heat losses incurred from contact with the litter are very important during the first days.
- Provision of two gas brooders or 2 radiant heaters of 1450 Kcal is advised for 1000 birds.
- Temperature and relative humidity should be uniform throughout the building.

The distribution behaviour of chicks is the best indicator of temperature

- On floor system, the distribution of chicks in each pen or throughout the building will help you to manage the correct temperature of the house.
- If the chicks crowd together under the brooder -> temperature is too low.
- If the chicks are close to the surroundings -> the temperature is too high.

Distribution behaviour according to temperature



Too cold Too warm Draught Ideal

Lighting programme to enclosure feed intake and growth

During the first few days, it is important to maintain the chicks under a maximumw light regime (22 to 23 hours) with a high intensity (30-40 lux) to encourage intake of water and feed. Afterwards, the light intensity should be gradually reduced to reach a level of about 10 lux at 15 days of age in dark houses. Light intensity will also depend on bird behaviour.

Note: a cyclical programme could be applied for the first 2 weeks (4hours of light /2hours of dark, repeated 4 times to equal 24hours) and then follow recommended lighting programme, which is 18 hours of light on third week.

Lighting programme according to age and rearing housing system

	Rearing in dark or semi dark house		Rearing in hot climate (open houses)	
	Light duration	Light intensity	Light duration	Light intensity
1 – 3 days	23 hours	20 – 40 lux	23 hours	40 lux
4 – 7 days	22 hours	15 – 30 lux	22 hours	40 lux
8 – 14 days	20 hours	10 – 20 lux	20 hours	40 lux
15 – 21 days	18 hours	5 – 10 lux	19 hours	40 lux
22 – 24 days	16 hours	5 – 10 lux	18 hours	40 lux
25 – 28 days	14 hours	5 – 10 lux	17 hours	40 lux

Below are some key-points to provide day old chicks with a good start.

Key points:

- Flush the water lines prior to arrival, and make sure that no disinfectant is left in the water lines when the chicks arrive.
- Make sure that the nipples and round drinkers are on the correct height - nipples at chick eye level and round drinkers on the floor.
- Put paper under the nipples to attract the chicks and extra feed over the chick paper or paper trays.
- Check the nipples / round drinkers to ensure the water supply is sufficient. When nipples are used the chicks must see the water drop on the nipple.
- The feed should be distributed when the chicks have drunk enough water to restore their body fluid (about 2 hours after being placed in the brooding pens), especially when the birds have travelled for a long time.
- In hot climate environments, flush the line just before chicks arrived to provide them fresh water.

All these recommendations will help to:

- Get a good start and a low mortality level during the first 2 weeks
- A good frame and immune system
- A good uniformity from the start

From 4 to 16 weeks - building the potential of the future layer

After a good start, the objective of the 4-16 week period is to prepare the birds for egg production with the best development of:

- The frame
- The bodyweight
- The uniformity
- The digestive tract

These objectives can be achieved by providing:

- A correct stocking density and housing conditions
- A lighting programme adapted to rearing conditions
- Beak trimming performed by trained people
- Good management of the feeding programme and feeding techniques
- Good bio - security

Housing and Equipment

Age (weeks)		Floor		Cages	
		5 – 10	10 – 17	5 – 10	10 – 17
Ventilation	Minimum per hour / kg	4 m^3	4 m^3	4 m^3	4 m^3
Stocking densities	Birds / m^2	15	10	15	10
	Birds / m^2 (hot climate)	12	9	12	9
	cm^2 / Bird			220	350
Water supply	Birds / drinker	100	100		
	Birds / drinker (hot climate)	75	75		
	Birds / nipple	9	8	10 (1)	10 (1)
Feed supply	cm of trough feeders	5	7	4	6
	Birds / Round feeder	25	23	25	23

(1): Make sure that all the birds have access to at least 2 nipples

A good follow up with a weekly check of the development

A weekly control of the growth is a must to check the real evolution of the flock: the earlier you know the earlier you can correct.

Targets in Rearing

- To produce a uniform flock with a bodyweight in accordance with the target age at sexual maturity
- To obtain the correct bodyweight at 4 weeks to secure frame development
- To achieve steady growth between 4 and 16

Targets in Production

- To make sure that between 5% lay and peak of production the bodyweight increase is at least 300 g for brown layers and 200 g for white layers. For these reasons it is essential to exercise control over bodyweight on a weekly basis from 0 to 30 weeks of age, and after that, at least once every month.
- Controlling the quantity of feed distributed will not on it's own ensure good growth because the requirements vary according to:
  - the energy level of the diet
  - the house temperature
  - the health status of the flock

Beak trimming: A delicate operation

This operation is normally carried out for two main reasons:

- To prevent feather pecking and cannibalism
- To reduce feed wastage

Beak trimming is a delicate operation and only specially trained personnel should perform it. If improperly done, it may result in birds having difficulty eating and drinking and lead to a non-uniform flock as a consequence.

Age of Beak Trimming

In addition to technical recommendations, any local codes and regulations concerned with animal welfare should be observed.

The decision about the age of beak trimming depends mostly on the housing system and local regulations:

- In cage productions, in dark houses, when the intensity of artificial light is low, beaks should be trimmed at one day old or at 7 to 10 days.
- Production in open-sided houses, giving exposure to high natural light intensity, one single beak tipping at 7 to 10 days will not prevent pecking entirely. Under these conditions, beak trimming should be carried out twice: a light tipping at 10 days and then a second operation between 8 and 10 weeks of age, where local regulations allow it.

During Beak Trimming: Attention Points

The operator should be seated comfortably so that each beak is cut in the same manner

- Do not rush the process: too high a rate (number of birds/ minute) could lead to a higher chance of errors and poor uniformity.
- Change blades when required: maximum recommended usage for a blade is 5.000 birds.
- Make sure the tongue of the bird does not get burned.

After Beak Trimming: Attention Points

- Increase the water level in the drinkers and decrease the water pressure in the pipes to make it easy for the birds to drink.
- Make sure that the depth of the feed is adequate, do not empty the feeders for a week after beak trimming.

Beak trimming is a very delicate operation and it is important enough to be done correctly. Improper beak trimming can damage bird liveability and uniformity and consequently affect negatively the overall flock performances.

General principles of the lighting programmes in rearing period

Chickens are sensitive to changes in the duration of illumination, and this will influence the age of sexual maturity. In addition, feed consumption is greatly influenced by the duration of day length. Lighting programmes have, therefore, different objectives.

During rearing, they allow us to encourage growth and to control the birds' sexual maturity. For this reason, we consider lighting programmes to be essential to achieve;

- The recommended bodyweight at 5% lay.
- In order to obtain an egg weight which conforms to the target from start of lay.
- To achieve high overall production.

Lighting programme and growth

In addition to the influence on growth, the lighting programme plays a determinant role for 3 essential reasons:

- Progressive growth of the digestive system.
- Gradual adaptation to a body clock (above all, anticipation of a dark period).
- Lack of night time energy supply when dark periods are too long.

Observations of the feeding and drinking behaviour show a first peak of feed intake in the 2 to 3 hours that precede a dark period, and a second peak shortly after lights come on. The crop is used during these peaks of consumption as a storage organ.

The introduction of a dark period from the start of the rearing period is important to progressively develop the crop capacity, which plays the role of feed reserve. However the amount of feed stocked remains insufficient for the nocturnal energy needs.

Control of sexual maturity

The purpose of lighting programmes is to control the age at point of lay and above all to avoid the influence of the variations in natural day length. Do not underestimate the effect of even the slightest variations in day length.

Role of Bodyweight

Photo stimulation is not necessary to stimulate production even when the pullets are reared under very short day lengths.

- A trial carried out by Lewis (1996) shows that with a day length greater or equal to 10 hours, the age at 50% lay does not vary, or only a little. On the other hand, a day length kept at 8 hours appears to delay sexual maturity by one week. This delay of maturity with 8 hours at the plateau is explained by the lower growth obtained compared to 10 or more hours of lighting programme.
- These observations are confirmed in latitudes close to the Equator. With very little change in day length, we have seen that sexual maturity is mainly activated by obtaining adequate bodyweight.

The higher the latitude is the higher the differences in sexual maturity between summer and winter flocks are.

Light Stimulation

- The variation of light duration greatly influences sexual maturity. Under certain conditions, we can observe a response to a light stimulation from 6 weeks of age. However, the more sensitive period is between 10 and 12 weeks of age.
- According to the programme being used, the age at 50% can vary by up to 6 weeks

Light stimulation will change the bird`s weight at sexual maturity, its adult weight and as a consequence, the egg weight, which is directly related to the bodyweight of the bird at first egg.

Bird weight at sexual maturity will be 75 g lower when light stimulation is advanced one week. Egg numbers will be greater but egg weight will be reduced by about 1 g. Total egg mass produced does not seem to be affected by reasonable variations in the age of sexual maturity (Lewis 1997).

For this reason, it is preferable to determine the time of light stimulation according to bodyweight rather than the of age of the bird.

Light Intensity in Rearing

Little information is available. However some work has shown that light intensity can be very low. Morris (1996) showed that an intensity greater than 1 lux did not modify sexual maturity.

Ideal light intensity will be determined in practice by the following needs:

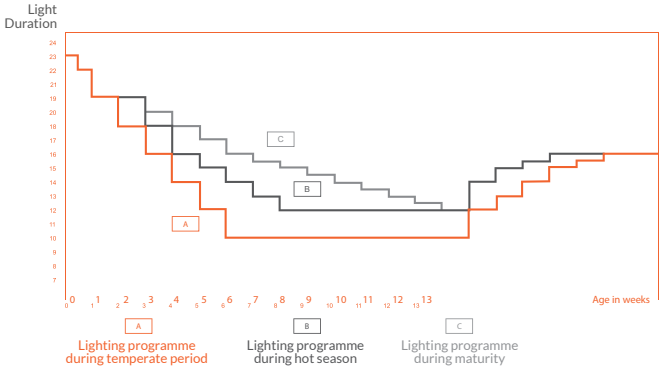
- Light required to inspect the birds well.
- The degree of darkness of the building (light leaking in)
- The intensity to be used during laying period.

Lighting programmes have to be adapted to the rearing facilities (dark or open house systems), to the conditions of production, to the climate and to the egg weight profile demanded by the market. In order to get an efficient light stimulation, the day length increase has to be done in the morning.

For rearing in dark house systems and production in an open house system, it is necessary to maintain a high light intensity throughout all the rearing period in order to avoid a sudden increase of light intensity.

The lighting programmes suggested below are only guides. They have to be adapted to the real circumstances of the rearing farm and according to performances previously obtained.

Guide line for lighting programme for rearing in a dark poultry house



We consider essential to achieve the recommended bodyweight at light stimulation and at 5% lay, in order to obtain an egg weight which conforms to the target, and to achieve high overall production.

PRODUCTION PERIOD

The transfer from the rearing farm to the laying facilities is a major stress, accompanied by changes in environment (temperature, humidity...) and equipment. It should be carried out as fast as possible, ideally being completed within a day. Be sure the production house is clean, disinfected and temperature is minimum 17°C.

Then, between transfer and the peak of production, a rapid increase in feed intake is necessary since the bird has to cover:

- Its requirements to grow to the adult bodyweight
- Its requirements to achieve peak of production
- Its requirements to get a rapid egg weight increase

Age of transfer

We advise transferring the birds at 16 weeks, maybe even at 15 weeks, but never after 17 weeks.

Because of the stress to which birds are subjected during transfer and immediately afterwards:

- It is extremely important that transfer is completed before the appearance of the first eggs: most development of reproductive organs (ovary and oviduct) occurs during the 10 days prior to the first egg.
- We advice that vaccinations are given at least a week before transfer, so as to obtain a good vaccine response.
- De-worming of the flock, if necessary, is best done in the last days before moving, depending on the de worming product used.
- A late transfer or too long a transfer often leads to delayed start of lay and higher mortality and increases the risk of floor laying in non-cage systems.

Points of attention at loading and transport

The following rules should minimise stress at handling of the birds at loading and during later transport:

- The birds should have an empty digestive tract at the moment of loading, but they must have access to fresh drinking water up to the time of being loaded.
- Choose the best time for transport during the day or night, depending on the weather circumstances.
- Crates or containers, equipment, trucks etc. must be thoroughly cleaned and disinfected.
- Make sure that air can circulate freely around the crates, but protect pullets from direct air flow. Containers or crates should not be overloaded, particularly in hot weather on long distance hauls.
- Avoid unnecessary stops during transit of the birds.

Lighting as a tool for encouraging a rapid adaptation to a new environment

Immediately after the birds arrive at the laying unit, it is very important to put into practice the following techniques to help the birds adapt to the new environment, particularly to cages and nipple systems.

- Apply 22 hours of light the first day.
- Light duration should be decided according to what has been used during rearing.
- Increase the light intensity for 4 to 7 days to help the birds in the darkest cages to find nipples.
- Then reduce light intensity gradually while ensuring that normal water intake continues. A high light intensity for longer than 7 days can increase the risks of pecking.

Encouraging water consumption

Birds can become dehydrated during transfer. The water loss rate ranges between 0.3% and 0.5% per hour according to atmospheric conditions.

- Pullets should drink before feeding: the absence of feed helps them find the nipple drinkers more easily.
- Make sure that the water pipes have been rinsed before pullets arrival.
- Wait for 3 or 4 hours before distributing feed and check if drinking system is working properly.
- If the pullets have not been reared on nipples, decrease the pressure and allow some leakage of water during the first few days.
- If nipples are planned for production, it is helpful to add at least one nipple for 200 birds to the other drinking equipment used in rearing, as a “nipples school”.
- A daily water consumption control is of paramount importance.

Feeding for Physiological Needs

- About 2 weeks before the first egg is laid, the medullary bone, which acts as a reservoir of calcium for eggshell formation, develops. Therefore a pre-lay diet needs to be used, containing enough calcium and phosphorus, for this bone formation. This diet should be switched to a layer diet as soon as production reaches 2% to avoid any demineralization.
- Then, an early lay feed with a high content of amino acids (about 7% higher than after peak diet) should be used. This feed needs to satisfy requirements for early production, growth and reproductive development.

Encouraging Feed Consumption

From the start of lay to the peak of production, feed consumption should increase by about 40% to allow the birds to meet their requirements for egg production and growth.

To encourage bird appetite and feed intake, the following advice should be put into practice:

- Maintain the temperature at point of lay as close as possible to the temperature to which the birds became acclimatised during rearing. Growth at the point of lay is reduced above 24°C, and is extremely low above 28°C.
- Minimize house temperature variations and avoid draughts.
- Use an adapted light duration, achieving 15 hours of light at 50% of production.
- Providing 1hour 30 minutes to 2 hours of supplementary light in the middle of the dark period will help to attain the correct bodyweight by allowing an extra feed intake ("midnight feeding").
- Limit the number of feed distributions according to equipment to avoid selective feeding and competition for large particles which could lead to lack of uniformity.
- Adapt the feeding times as to achieve 60% of feed consumed in the last 6 hours of the day and to have empty feeders for 2 to 3 hours in the middle of the day. This technique avoids a build up of fine particles and its consequent negative effect on feed intake.
- Use a layer feed with the correct grist (80% of particles between 0.5 and 3.2 of diameter).

Monitoring environmental and production parameters

A close control of the following parameters will help you to check the real evolution of the flock during this critical period for the future performances:

- Feed consumption (daily).
- Water consumption (daily) and water/feed ratio.
- Temperature (min-max) and relative humidity (daily).
- Evolution of bodyweight (weekly until peak of lay), by weighing the birds up to 35 weeks of age.
- Evolution of egg weight (daily for the first weeks of lay).

General principles of lighting programmes during the production period

In production as well as in rearing, the lighting programme greatly influences feed consumption. In addition, during all its life, a chicken remains sensitive to changes in the duration of illumination.

The objective of the lighting programmes during the production period is:

- To encourage growth at start of lay.
- To counteract the harmful effects of decreases in natural day length.
- To control the liveability through the light intensity management.
- To improve eggshell quality.

Other lighting programmes can also be introduced during the production period to adapt the egg weight to market demand, to improve eggshell quality or to control feed intake for some breeds.

Light intensity in production

The light intensity required is low. No significant differences have been found in the different trials with today's breeds. But as stated for the rearing period, we encourage an increase in light intensity for a few days from the transfer time in order to help the bird to discover its new environment and to find easily water and feed systems.

Thereafter, the light intensity can be reduced step by step to a minimum of 0.5 lux at the feeder level in the dimmest areas of the laying house as long as during the rearing stage light intensity doesn't exceed 10 lux.

There is a strong relation between bird activity, stocking density and feather loss during production.

How to Improve Shell Quality

All methods that help to increase the quantity of calcium stored in the gizzard before lights off and to ingest a soluble form of calcium after lights on, have a positive effect on shell quality. According after transfer we advise:

For Brown Layers:

- Encourage maximum feed intake during the last 6 hours of the day (distribute 6 - 7 hours before lights out).
- Arrange to have feeders empty in the middle of the day to encourage feed intake in the afternoon.
- Distribute feed during the night in the light period of 1-2 hours, 4 hours after "lights off" if midnight light is used or at lights on.
- Ensure that the calcium content of the feed has at least 70% in particles of 2 to 4 mm to encourage retention in the gizzard and storage for the night period.
- Provide 30% of the calcium in easily soluble powder form for quick availability at lights on.

Important Note:

During the hot season or in summer, heat stress can delay the oviposition time, mainly when birds are panting. Panting provokes a loss of carbon dioxide and bicarbonate in blood plasma. As a consequence, oviposition times are delayed. In these circumstances the maximum feed possible has to be given during midnight lighting and early in the morning to maintain production and shell quality.

Adjusting egg weight to meet market requirements

Egg producers want to produce eggs of a size which matches market demand and in the end satisfies the needs of their customers and optimises margins.

The principal factors affecting egg weight are:

- Genetic aspects
- Bodyweight at sexual maturity (so at the time of the first egg is laid)
- Feed consumption and growth from first egg till achieving of adult bodyweight
- Nutritional factors

WATER: THE MOST CRITICAL NUTRIENT

The water is the most critical nutrient for the poultry. The daily control of water consumption is essential. If an animal does not drink, it will not eat and can not produce.

Water quality

Good quality drinking water is very important for (production) animals. Birds must always have easy access to the drinking water, the water must be fresh and bright. Taste and smell seem to be of less importance to the birds but are indicators for the water quality.

Parameter	Poultry	
	Good quality	Do not use
pH	5 – 8,5	<4 and >9
Ammonium mg/l	<2,0	>10
Nitrite mg/l	<0,1	>1,0
Nitrate mg/l	<100	>200
Chloride mg/l	<250	>2000
Sodium mg/l	<800	>1500
Sulfate mg/l	<150	>250
Iron mg/l	<0,5	>2,5
Mangane mg/l	<1,0	>2,0
Lime/chulk content	<20	>25
Oxidizable organic matter mg/l	<50	>200
H_2S	non detectable	non detectable
Coliform bacteria's cfu/ml	<100	>100
Total bacteria count cfu/ml	<100.000	>100.000

Monitoring water quality

The value of any analysis depends on when, where, and how the sample has been taken, (where it enters the house or at the end of the system). One should not forget that an analysis only refers to the quality of the water at the time when the sample was taken, and is never a guarantee of its quality at another time. Where farms have their own water supply, it is necessary to take a sample at least twice a year (one at the end of winter, the other at the end of summer). On farms using the mains supply an annual measurement should be adequate. It is important to realise that the sodium thiosulphate, contained in the flasks supplied by the laboratories carrying out bacteriological tests on water, only neutralises chlorine or bleach. It has no action on quaternary ammonium compounds.

Water Consumption

Water consumption depends on ambient temperature. Above 20°C, consumption increases to enable the bird to maintain body temperature (respiratory evaporation).

The actual consumption depends on temperature and humidity of the ambient air. The following table shows the relationship between water and feed consumption according to house temperature:

Water to feed ratio according to temperature in rearing and laying period

Temperature	Rearing	Production
15 °C	1.6	1.70 (210 ml)
20 °C	1.7	1.80 (205 ml)
25 °C	2.3	2.10 (230 ml)
30 °C	3.0	3.10 (320 ml)

In hot periods it is essential to provide cool water for the birds. In a hot climate, cool water will improve productivity. It is extremely important to protect the water tanks from the direct sunlight.

NUTRITION

Feed specifications during rearing period

The requirements are based on the "European Amino acids Table" (WPSA, 1992) of raw materials composition and expressed as digestible amino acids by using the digestibility coefficients mentioned in the "Tables de composition et de valeur nutritive des matières premières destinées aux animaux d'élevage" (INRA editions 2002).

Energy Level

During the first few weeks of life, meat type chickens just like young pullets are incapable of regulating their energy intake according to the energy concentration of the diet. It takes weeks to develop the digestive tract. During the first 8-10 weeks, any increase in the energy level is accompanied by an increase in growth. When given the feed in a crumb form, young pullets are able to increase their feed intake.

Between 18 & 24°C	Diet units	Starter 0-4 weeks 1-28 Days	Grower 4-10 weeks 28-70 days	Pullet 10 - 16 weeks 70 - 112 days	Pre- lay 112 days to 2 % lay
Metabolisable energy	kcal/kg	2950-2975	2850-2875	2750	2750
	Mj/kg	12.3-12.4	11.9-12.0	11.5	11.5
Crude protein	%	20.5	19	16	16.8
Methionine	%	0.52	0.45	0.33	0.40
Methionine + cystine	%	0.86	0.76	0.60	0.67
Lysine	%	1.16	0.98	0.74	0.80
Threonine	%	0.78	0.66	0.50	0.56
Tryptophan	%	0.217	0.194	0.168	0.181
Digestible amino acids					
Dig. Methionine	%	0.48	0.41	0.30	0.38
Dig. Meth. + Cystine	%	0.78	0.66	0.53	0.60
Dig. Lysine	%	1.00	0.85	0.64	0.71
Dig. Threonine.	%	0.67	0.57	0.43	0.48
Dig. Tryptophan	%	0.186	0.166	0.145	0.155
Major minerals					
Calcium	%	1.05-1.10	0.90 - 1.10	0.90-1.00 (1)	2-2.10 (1)
Available phosphorus	%	0.48	0.42	0.36	0.42
Chlorine minimum	%	0.15	0.15	0.14	0.14
Sodium minimum	%	0.16	0.16	0.15	0.15

Above 24°C	Diet units	Starter 0-4 weeks 1-28 Days	Grower 4-10 weeks 28-70 days	Pullet 10 - 16 weeks 70 - 112 days	Pre- lay 112 days to 2 % lay
Metabolisable energy	kcal/kg	2950-2975	2850-2875	2750	2750
	Mj/kg	12.3-12.4	11.9-12.0	11.5	11.5
Crude protein	%	20.5	20	16.8	17.5
Methionine	%	0.52	0.47	0.35	0.42
Methionine + cystine	%	0.86	0.80	0.63	0.70
Lysine	%	1.16	1.03	0.78	0.84
Threonine	%	0.78	0.69	0.53	0.59
Tryptophan	%	0.217	0.207	0.175	0.19
Digestible amino acids					
Dig. Methionine	%	0.48	0.43	0.32	0.40
Dig. Meth. + Cystine	%	0.78	0.69	0.56	0.63
Dig. Lysine	%	1.00	0.89	0.67	0.74
Dig. Threonine.	%	0.67	0.61	0.45	0.50
Dig. Tryptophan	%	0.195	0.175	0.152	0.163
Major minerals					
Calcium	%	1.05-1.10	0.95-1.10	0.95-1.05 (1)	2.1-2.2 (1)
Available phosphorus	%	0.48	0.44	0.38	0.44
Chlorine minimum	%	0.16	0.16	0.15	0.15
Sodium minimum	%	0.17	0.17	0.16	0.16

(1): To avoid falls in food consumption, 50% of the calcium should be supplied in granular form (diameter = 2 to 4 mm)

Feeding program during production period

Protein Requirements

The amino acid requirements are to a large extent dependent on the feed conversion ratio and, therefore on age; that is why, when young the requirements expressed in mg of amino-acids per g of growth are the same as a broiler. Any delay in growth during the first few weeks will be reflected in a reduced bodyweight at 17 weeks and in later performance. It is, therefore, extremely important to use a starter diet for the first 4 or 5 weeks, which has an amino acid/protein ratio similar to that of the broiler. In hot climates, the amino acids and minerals concentrations should be slightly higher than in temperate climates. That results in a reduction in the maintenance requirement, and, therefore in the feed conversion ratio.

Feed Presentation

Feed consumption is determined to a large extent by the form of presentation and the stage to which the digestive tract has developed. Presenting feed in crumb form makes it easier for the chicken to eat it, reduces the time taken in eating, and encourages growth. The energy cost of eating, thus saved, gives an improvement in feed conversion ratio.

Form of Dietary Presentation	Mash	Crumbs	Difference
Weight at 70 day (g)	984	1016	+ 32 g
Weight at 99 day (g)	1344	1405	+ 61 g
Weight at 123 day (g)	1589	1664	+ 75 g

Source: ISA/CNEVA, 1996

This benefit of feeding crumbs will only be obtained when the birds have access to good quality crumbs in the feeders. A poor quality crumb can lead to a buildup of fine particles in the feeders and, therefore have the opposite effect to that sought.

From 0 to 4/5 weeks, we recommend using a crumbed diet, after which mash, with a good particle size, should be used. It is, however, possible to use a granular feed later, where the grinding is coarser, or even as crumbs, if need be. However, we recommend using a mash diet from 12 weeks to avoid a risk of under consumption at the beginning of the sexual maturity if the change is made later.

Basic rules of our Feeding Program

Feeding the birds has to be simple, to reduce the risk of errors at varying levels in the manufacturing and delivery process. There are also additional reasons which are related to the birds directly. For example, birds are very sensitive to the feed presentation and the introduction of new raw materials, for this reason we recommend a limited number of feed changes.

Amino acids requirements depend of the productivity of the flocks and from the uniformity of the productivity. Our amino acids recommendations are based on an average productivity of 60 g per day. At 50 weeks, the egg mass produced is around 58 g. A lot of birds are able to produce more than 60g of egg mass over a period of 50 – 65 weeks. This is the reason why is difficult to reduce the amino acids levels after 50 weeks without affecting the productivity

A deficiency in amino acids reduces in a first time egg weight and in a second time the persistency, around 4 or 5 weeks later.

Pre-lay Feed or Layer 1

Medullary bone is developed in long bone before the first ovulation. The total calcium contained in this medullary is around 1.5 to 2 grams. A pre-layer feed with a higher calcium level is needed to establish this bone reserve. It has to be used from approximately 16 weeks. Its characteristics are similar to the layer 1, but with a level of calcium of 2 – 2.2%.

Don't forget to use the Layer 1 before 2% lay. If the change is realized later, the earliest birds ingest around 1,8g of calcium and need to produce a shell with 2g of calcium. They will stop or reduce laying for some days and will produce eggs without shell. These birds will exhibit cage layer fatigue later and osteoporosis at end of lay.

We think that the risk will be reduced by using a layer 1 instead of a pre-lay feed. However, if the limestone is in 2-4 mm particles form, it is possible to use the layer 1 at 16 weeks. The main reason for the use of pre-lay feed was the risk of under consumption when the limestone used was in powder form. Don't forget to use the Layer 1 before 2% lay.

Layer 1

Layer 1 has to be satisfying the amino acids requirements for growth and production at a moment where the feed consumption is lower. At start of lay feed consumption is lower because the birds have not yet reached their adult body weight. Growth is not completely finished by 28 weeks. With regard to protein, a requirement for growth is added to the requirement for production.

From a practical point of view, we have estimated that it is necessary to increase the concentration of amino acids by about 6 % during the 18-28 week period in relation to the feed consumption observed after 28 weeks. This feed has to be used until the moment that the feed consumption is normal or an average egg size of 60-61g is obtained or around 26-28 weeks. At the onset of lay, it is desirable to encourage feed consumption and quickly to obtain eggs of marketable size.

For this, a feed enriched in fat allows to improve the presentation of diet which gives an increase in feed consumption. Oils rich in polyunsaturated fatty acids are responsible for a large increase in egg weight.

Layer 2

This feed has to be used from 26-28 weeks until 50 weeks or end of lay. If it is possible, it will be good to increase the limestone level at 50 weeks to reduce the percentage of seconds. Birds have daily requirements for amino-acids and minerals, consequently, the percentage of nutrients has to be defined according to the feed consumption observed. The feed consumption depends mainly of the energy requirement and of the temperature.

Layer 3

Amino acids requirement: Taking into account persistency in lay, individual variability and egg weight, the requirement for amino acids does not fall throughout the laying period. In an economic context, it may be worth reducing the safety margins slightly. However, the best results, in terms of productivity and feed conversion ratio, are obtained, when one maintains the intake level of amino acids.

Any deficiency of amino acids, no matter, which type of amino acid, shows up as a reduction in performance, of which 2/3 is due to a reduction in rate of lay and the remaining 1/3 is a decrease in mean egg weight. It is, therefore, not possible to reduce egg weight towards the end of lay by reducing the amino acid concentration without bringing about a reduction in rate of lay. Persistency in lay has improved considerably (30 to 35 weeks above 90% lay). An analysis of the individual performance over the period 40-66 weeks shows that 66 % of the birds had performance above average. The 40 % best layers had laid 177 eggs in 182 days and /or 63.2 g of egg mass per day.

Average feed intake observed after 28 wks in g/day	105	110	115	120	125
	FROM 2% LAY TO 28 WEEKS OLD (1)				
Protein w/o MBM %	(18.2-18.7)	(17.7-18.2)	(17.2-17.6)	(16.7-17.2)	(16.2-16.7)
Protein with MBM %	(19.5-20.0)	(18.9-19.4)	(18.2-18.8)	(17.9-18.4)	(17.4-17.9)
Total amino acids %:					
Lysine	0.91	0.87	0.83	0.8	0.77
Methionine	0.46	0.44	0.42	0.41	0.39
Methionine + Cystine	0.77	0.74	0.71	0.68	0.65
Tryoptophan	0.21	0.2	0.192	0.184	0.176
Threonine	0.66	0.63	0.6	0.58	0.56
Isoleucine	0.8	0.77	0.73	0.7	0.67
Valine	0.86	0.82	0.79	0.76	0.73
Digestible amino acids % :					
Lysine	0.81	0.78	0.74	0.71	0.68
Methionine	0.44	0.42	0.4	0.38	0.37
Methionine + Cystine	0.7	0.66	0.64	0.61	0.59
Tryoptophan	0.182	0.173	0.166	0.159	0.153
Threonine	0.57	0.54	0.52	0.49	0.47
Isoleucine	0.73	0.7	0.67	0.64	0.61
Valine	0.78	0.75	0.71	0.68	0.66
	FROM 28 WEEKS TO THE END OF LAY				
Prot w/o MBM %	(17.4-17.9)	(16.9-17.4)	(16.4-16.9)	(15.9-16.4)	(15.4-15.9)
Prot with MBM %	(18.7-19.2)	(18.1-18.6)	(17.6-18.1)	(17.1-17.6)	(16.6-17.1)
Total amino acids % :					
Lysine	0.86	0.82	0.79	0.75	0.72
Methionine	0.44	0.42	0.4	0.38	0.37
Methionine + Cystine	0.73	0.7	0.63	0.64	0.61
Tryoptophan	0.198	0.189	0.181	0.173	0.166
Threonine	0.62	0.6	0.57	0.55	0.52
Isoleucine	0.76	0.72	0.69	0.66	0.64
Valine	0.81	0.78	0.74	0.71	0.68
Digestible amino acids % :					
Lysine	0.77	0.73	0.7	0.67	0.64
Methionine	0.41	0.4	0.38	0.36	0.35
Methionine + Cystine	0.66	0.63	0.6	0.58	0.55
Tryoptophan	0.17	0.162	0.155	0.148	0.142
Threonine	0.53	0.51	0.49	0.47	0.45
Isoleucine	0.69	0.66	0.63	0.6	0.58
Valine	0.74	0.7	0.67	0.65	0.62

Those requirements are based on the “European Amino acids Table” (WPSA, 1992) of raw materials composition and expressed as digestible amino acids by using the digestibility coefficients mentioned in the “Tables de composition et de valeur nutritive des matières premières destinées aux animaux d’élevage” (INRA editions 2002).

Calcium nutrition and particle size

Recommendations

Brown layers: Around 40% of birds have finished their eggshell at the time the lights are on, consequently 65% of the calcium have to be in particles of 2 to 4 mm and 35% in a powder form.

Mineral and oil level recommendations

(1): When coarse limestone is supplied as particles of 2 to 4 mm, it is possible to use these values.

(2): We advise using these values when the calcium is supplied in powder form.

(3): Vegetable oil rich in unsaturated fatty acid improve egg weight, according to the requirement of the market and the appetence a level of 2 to 3% is required. To avoid egg size becoming too large at the end of lay, we advise reducing the quantity of vegetable oil being used.

DAILY REQUIREMENT	From 17 to 28 WEEKS	From 28 to 50 WEEKS	From after 50 WEEKS
Available phosphorus (1) mg	400	380	340
Available phosphorus (2) mg	440	420	380
Total Calcium g	3.9 – 4.1	4.1 – 4.3	4.3 – 4.6
White birds			
Coarse Calcium (2 to 4mm) g	2.0	2.1	2.2
Brown birds			
Coarse Calcium (2 to 4mm) g	2.6	2.7	2.9
Sodium minimum mg	180	180	180
Chlorine mini-maxi mg	170 - 260	170 - 260	170 - 260
Oil Mini-maxi (3) %	2 - 3	1 - 2	0.5 – 1.5
Fibre	A minimum of coarse fibre or lignin is required to prevent feather pecking and improve the feed digestibility		

Average feed intake observed after 28 wks in g/day	105	110	115	120	125
	FROM 2% LAY TO 28 WEEKS OLD (1)				
Available phosphorus (1) %	0.41	0.39	0.37	0.35	0.34
Available phosphorus (2) %	0.45	0.43	0.41	0.39	0.37
Total Calcium %	3.9 - 4.1	3.8 - 4.0	3.6 - 3.8	3.4 - 3.6	3.3 - 3.5
Sodium minimum %	0.18	0.17	0.16	0.16	0.15
Chlorine mini-maxi %	0.17 - 0.26	0.16 - 0.25	0.16 - 0.24	0.15 - 0.23	0.15 - 0.22
	FROM 28 WEEKS TO 50 WEEKS				
Available phosphorus (1) %	0.36	0.34	0.33	0.32	0.31
Available phosphorus (2) %	0.4	0.38	0.37	0.35	0.34
Total Calcium %	3.9 - 4.1	3.7 - 3.9	3.6 - 3.8	3.4 - 3.6	3.3 - 3.5
Sodium minimum %	0.17	0.16	0.16	0.15	0.14
Chlorine mini-maxi %	0.16 - 0.25	0.16 - 0.24	0.15 - 0.23	0.14 - 0.22	0.14 - 0.21
	FROM 50 WEEKS TO END OF LAY				
Available phosphorus (1) %	0.32	0.30	0.29	0.28	0.27
Available phosphorus (2) %	0.36	0.34	0.33	0.32	0.30
Total Calcium %	4.1 - 4.3	3.9 - 4.1	3.8 - 4.0	3.6 - 3.8	3.5 - 3.7
Sodium minimum %	0.17	0.16	0.16	0.15	0.14
Chlorine mini-maxi %	0.16 - 0.25	0.16 - 0.24	0.15 - 0.23	0.14 - 0.22	0.14 - 0.21

Feed presentation for commercial layers

Importance of the feed particle size

Mixing difficulties, inappropriate particle size and separation problems have been resolved by milling the raw materials relatively fine. However, diets, which are too finely ground, often seriously reduce feed intake. Low consumption has been avoided by using diets presented as crumbs or pellets. In effect, the ease of eating and the reduction in feeding time, due to pelleting, leads to an increase in the number of feeds taken by the birds and in their growth. This effect is observed in both laying hens and broiler chickens. Birds are grain eaters and their feed consumption depends on feed presentation.

Pelleted or crumbled diets for layers

In theory, presenting a diet in crumb or pellet form will give higher feed consumption. That presupposes that the feeding systems in operation and the raw materials used are providing the laying hen with a good quality pellet or crumb.

Very often, the difficulties in obtaining a good quality crumb are responsible for under consumption and some technical problems because of:

- The breaking down of the crumb in the feed distribution system.
- The build up of fine feed particles in the feeders.
- More shell quality problem related to the difficulties to use a granular limestone nutritional factors.
- More feather pecking due to a shorter feeding time.
- The increased cost of manufacture.

To develop a good digestive system it is necessary to have coarsely milled feed. With the intention of keeping good shell quality one can:

- Use granular limestone if the diameter of the diet is adapted.
- Add some of the limestone after pelleting more shell quality p- - add some of the limestone after pelleting.
- Distribute 3 to 4 g per bird of granular limestone (2 to 4mm) in the poultry house each afternoon.

Suggested premix composition for commercial layers

FOR COMMERCIAL LAYERS		REARING PERIOD		LAYING PERIOD
		6 - 10 weeks	10 wks - 2% Lay	
Added trace elements mg per kg of diet				
Maganese (Mn)	ppm	60	60	70
Zinc (Zn)	ppm	60	60	60
Iron (Fe)	ppm	60	60	60
Iodine (I)	ppm	1	1	1
Copper (Cu)	ppm	8	6	8
Selenium (Se)	ppm	0.25	0.25	0.25
Cobalt (Co)	ppm	0.25	0.15	0.15
Added vitamins per kg of diet in IU or mg				
Vitamin A	mg	13	10	10
Vitamin D3	mg	3	2	2.5
Vitamin E	mg	25	25	20
Vitamin K3	mg	3	3	3
Vitamin B1 (Thiamine)	mg	2	2	2
Vitamin B2 (Riboflavin)	mg	5	5	5
Vitamin B6 (Pyridoxine)	mg	5	5	5
Vitamin B12	mg	0.02	0.01	0.015
Nicotinic Acid (Niacin)	mg	60	40	40
Pantothenic acid	mg	15	12	12
Folic Acid	mg	0.75	0.75	0.75
Biotin	mg	0.2	0.1	0.05
Vitamin C in hot climate or during summer time	mg			100
Total Choline requirement per kg of diet (raw materials included) mg				
Choline	mg/kg	1600	1400	1400
Choline	mg/day	-	-	160

Add antioxidant

Warranty Disclaimer

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CONVERSION TABLE

1 mtr.	=3.282 feet	1 foot	=0.305 mtr.
1 sq. mtr.	=10.76 sq. feet	1 sq. foot	=0.093 sq. mtr.
1 cub. mtr.	=35.316 cub. feet	1 cub. foot	=0.028317 cub. m.
1 cm.	=0.394 inches	1 inch	=2.54 cm.
1 sq. cm.	=0.155 sq. inch	1 sq. inch	=6.45 sq.cm.
1 kg.	=2.205 lbs.	1 lb.	=0.454 kg.
1 g.	=0.035 ozs.	1 oz.	=28.35 g.
1 ltr.	=0.22 gallons	1 gallon	=4.54 ltr.

1 bird per square metre	=10.76 square feet per bird
3 birds per square metre	=3.59 square feet per bird
4 birds per square metre	=2.69 square feet per bird
5 birds per square metre	=2.15 square feet per bird
7 birds per square metre	=1.54 square feet per bird
11 birds per square metre	=0.98 square feet per bird
13 birds per square metre	=0.83 square feet per bird

1 cubic meter/kilogram/hour	=16.016 cubic feet/lb./hour
1 cubic foot/lb./hour	=0.0624 cubic meter/kilogram/hour

F °	=9/5 °C+32	°C	=5/9 (°F-32)		
45 °C	=113 °F	22 °C	=72 °F	10 °C	=50 °F
40 °C	=104 °F	20 °C	=68 °F	8 °C	=46 °F
35 °C	=95 °F	18 °C	=64 °F	6 °C	=43 °F
30 °C	=86 °F	16 °C	=61 °F	4 °C	=39 °F
27 °C	=81 °F	14 °C	=57 °F	2 °C	=36 °F
24 °C	=75 °F	12 °C	=54 °F	0 °C	=32 °F

1 Joule per second = 1 Watt = Volt x Ampere

1 KJ	=1000J	Ex. large	=63.8-70.9
1 MJ	=1000KJ	Large	=56.7-63.8
1 MJ	=239 Kcal	Medium	=49.6-56.7
1 Kcal	=4.2 KJ	Small	=42.5-49.6
1 KWh	=3.6MJ - 860 Kcal		
1 BTU	=1055 J		

ADDITIONAL INFORMATION

Lighting program in rearing for the Dekalb Amberlink

Age in weeks	Hours of light	Remarks
1	cyclic program (4hr light/ 2h dark)	Period of dark could be adjusted according to working hours (i.e. 1h dark instead of 2h could be applied at lunch time to facilitate the work the houses)
2		
3	18	**Speed of the light decrease could be modulated according to the growth and the egg size targets:** • fast step down decreases the growth and the egg size • slow step down: promote the growth and increase egg size
4	16	
5	15	
6	14	
7	13	
8	12	
9	11	
10	10	
11	10	
12	10	
13	10	
14	10	

			Body weight reference (BWR)	Sexual maturity	Egg size
BWR	11	**BWR = Bodyweight reference.** To obtained the target egg size, increase the light by 1h/week when birds have reached the target bodyweight.	1400g	+++	+
BWR + 1 week	12		1450g	++	++
BWR + 2 week	13		1500g	+	+++
BWR + 3 week	14				

ADDITIONAL INFORMATION

Dekalb Amberlink feed specifications during rearing

Nutrients	Age			
	Starter 0-5 weeks	Grower 5-10 weeks	Developer 10-16* weeks	Pre- lay 16-18* weeks
Energy Mj/Kg	12.3 - 12.4	11.9 - 12.0	11.5	11.6
Crude protein % **	20.5	18.5	16.	16.8
Digestible Methionine %	0.48	0.43	0.32	0.40
Digestible Methionine + Cystine %	0.78	0.69	0.56	0.63
Digestible Lysine %	1	0.89	0.67	0.74
Digestible Threonine %	0.67	0.61	0.45	0.50
Digestible Tryptophan %	0.195	0.18	0.152	0.16
Calcium %	1	1.0	1.5	2.1
Available Phosphorus %	0.48	0.44	0.38	0.44
Chlorin minimum %	0.16	0.16	0.15	0.15
Sodium minimum %	0.17	0.17	0.16	0.16
Calcium powder	100%	100%	50 - 100%	50%
Coarse calcium form (2-4mm)	-	-	0 - 50%	50%

* Pre-lay must be used 2 weeks before start of lay until 2%

** Crude protein is given as an indication, formulation with digestible amino acids in recommended, if Lysine, Methionine, Threonine and Tryptophane specifications are used, total Protein concentration could be slightly higher.

ADDITIONAL INFORMATION

Dekalb Amberlink feed specifications from 2% lay to 90 weeks

Nutrients	Age in weeks: 18 - 25	25 - 35	35 - 55	55 - 75	75 - 90	Remarks
Metabolisable Energy kcal/kg	2800	2750	2700	2650	2650	To be adjusted according to bodyweight (increase it if bodyweight to low/decrease it if bodyweight too high)
Protein %	17.5	17.0	16.0	16.0	15.0	Protein % is given as indication, lower level could be used if all digestible amino acids specifications are used.
LYS dig %	0.80	0.76	0.68	0.68	0.66	
MET dig %	0.42	0.40	0.36	0.36	0.33	
MET + CYS dig %	0.66	0.62	0.58	0.58	0.56	Amino acids concentration have been calculated according to DKA standard egg mass. If the daily egg mass is higher than standard, then amino acids levels must be adjusted (cf nutrition guide)
TRY dig %	0.18	0.16	0.15	0.15	0.14	
ILE dig %	0.70	0.67	0.62	0.62	0.57	
VAL dig %	0.72	0.70	0.66	0.66	0.62	
THR dig %	0.56	0.53	0.48	0.48	0.46	
Calcium %	3.8	3.8	3.8	4	4.2	1/3 provided as powder; 2/3 provided as coarse particle (2-4mm)
Available Phosphorus %	0.4	0.36	0.33	0.3	0.27	If 60% of the feed is not distributed in the afternoon and/ or if birds are feed with calcium powder only, Phosphorous requirement is higher. We recommend to increase these values by 0.04%
Total fat %	4%	(4% if EW too small)	-	-	-	4% of total fat could be maintained to maximise the egg size up to 6% of total fat could be used to strongly increase the EW

NOTES