SHAVER

Shaver Brown

Product Guide
Cage Production Systems

ISA
A Hendrix Genetics Company

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Introduction

Many years of investment in genetic research and development have resulted in layers with excellent performance traits such as liveability, production and egg quality.

These highly favourable genetic characteristics can only be fully realized when layers are supported with good management practices, which include, but are not limited to, good quality feed, housing and constant attention to the birds behaviour and welfare.

The purpose of this management guide is to help producers to gain the best possible results from their investment. This will be achieved by providing conditions in which the layers can thrive. The information supplied in this publication is based on the analysis of extensive research and field results, produced over time and with many years of experience.

We do recognize that many egg producers have developed their own management programmes, as a result of their experience with specific housing types, climate, feed, market conditions .Therefore do not hesitate to use your own experience in conjunction with the guidelines in this guide. And of course, do not hesitate to consult our distributors who will be happy to help in any way they can.

We are constantly seeking to develop our breeding programme and welcome feedback from the field. Please send your technical results to isa.technicalfieldresults@hendrix-genetics.com . Excel files are available on request to help our distributors to follow the flocks performance and record information.

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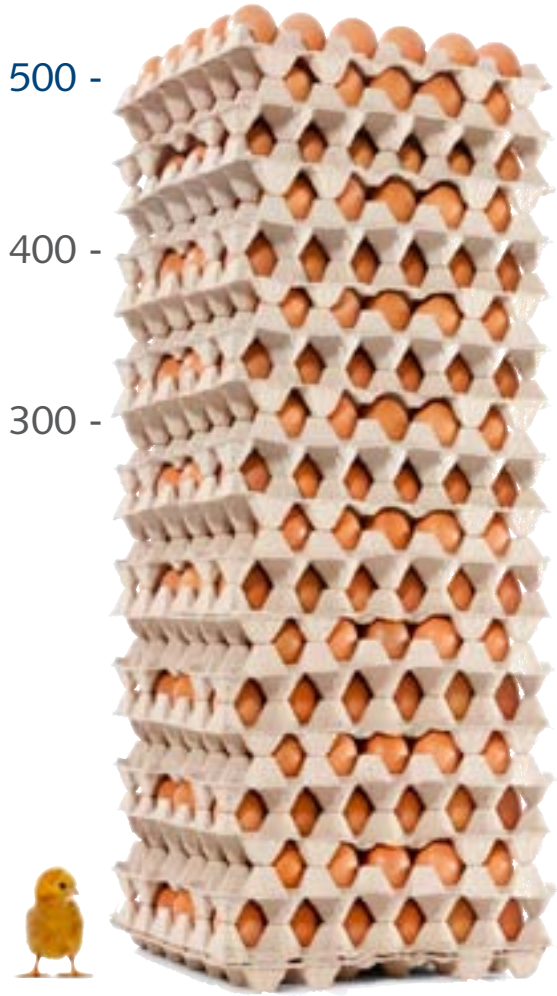
ISA Breeding

With roots dating back to the beginning of the 20th century, ISA has emerged as the world's leading breeder of brown and white laying hens, which thrive in both traditional and alternative production systems and in different climatic conditions.

Our mission is to contribute to profitable and sustainable egg production by improving the economic life of laying hens. This involves breeding hens that with each generation lay more eggs for a longer period of time, without compromising on egg quality, animal health & welfare. We own the largest gene pool of pedigreed pure lines in the world and collaborate closely with renowned academic and research institutes in numerous research projects in order to achieve our mission. The progress we are witnessing every year in our breeding program and in production results obtained by egg producers, gives us great confidence that our breeding objective of 500 first quality eggs by 2020 is well within reach.

Aside from breeding, we produce and supply parent stock to around 300 distributors around the world with whom we have built a strong business relationship over the years. Our hens are available on the market under the brand names Isa, Babcock, Shaver, Hisex, Bovans and Dekalb. ISA is part of multi-species breeding company Hendrix Genetics.



Breeding for 500 first quality Eggs !

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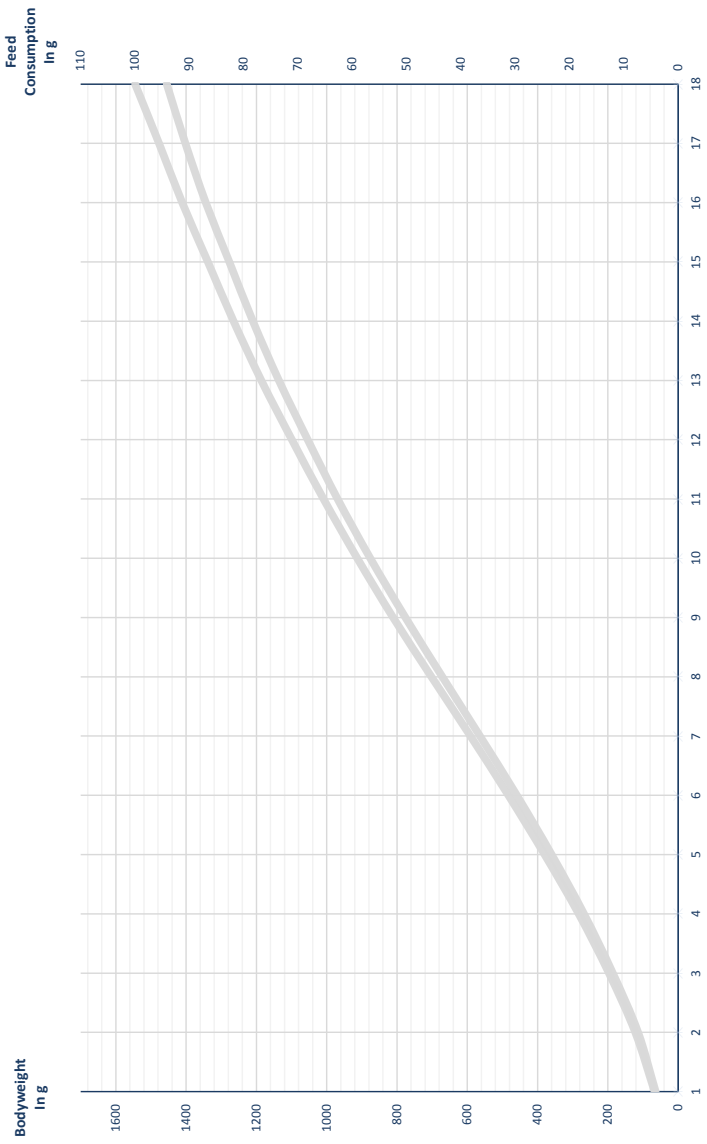
Rearing table

Weeks	Age in days	Feed intake per bird per day (g)		Feed intake per bird cum. (kg)		Body weight (g)	
		minimum	maximum	minimum	maximum	minimum	maximum
1	0-7	10	12	70	84	64	67
2	8-14	16	18	182	210	114	122
3	15-21	24	26	350	392	186	197
4	22-28	31	33	567	623	268	283
5	29-35	36	38	819	889	360	380
6	36-42	41	43	1106	1190	459	483
7	43-49	45	47	1421	1519	564	591
8	50-56	49	51	1764	1876	671	702
9	57-63	53	55	2135	2261	776	811
10	64-70	57	59	2534	2674	876	913
11	71-77	60	62	2954	3108	969	1009
12	78-84	63	65	3395	3563	1054	1099
13	85-91	66	68	3857	4039	1136	1186
14	92-98	69	71	4340	4536	1210	1265
15	99-105	72	74	4844	5054	1277	1338
16	106-112	75	77	5369	5593	1344	1411
17	113-119	83	85	5950	6188	1402	1477
18	120-126	84	86	6538	6790	1455	1545

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	%
Age at 50% production	143	days
Peak percentage	97	%
Average egg weight	62.1	g
Egg number hen housed	405	
Egg mass hen housed	25.1	kg
Average feed consumption	110	g/day
Feed conversion	2.17	kg/kg
Body weight	1975	g
Shell strength	4150	g
Shell color	32.0	
Haugh units	83	

Production table 1

PER HEN DAY

Age in weeks	% Lay	Egg weight (g)	Egg mass per day (g)	Feed intake per day (g)	Feed conversion per week
18				85	#DIV/0!
19	12.0	43.9	5.3	88	16.70
20	32.0	46.8	15.0	97	6.48
21	62.0	49.9	30.9	104	3.36
22	85.0	53.1	45.1	107	2.37
23	92.0	55.3	50.9	108	2.12
24	94.0	56.8	53.4	109	2.04
25	95.3	57.7	55.0	110	2.00
26	96.0	58.5	56.2	110	1.96
27	96.5	59.2	57.1	110	1.93
28	96.3	59.8	57.6	110	1.91
29	96.0	60.3	57.9	110	1.90
30	95.7	60.7	58.1	110	1.89
31	95.5	61.1	58.4	110	1.89
32	95.3	61.4	58.5	110	1.88
33	94.5	61.7	58.3	111	1.90
34	94.0	61.9	58.2	111	1.91
35	93.5	62.1	58.1	111	1.91
36	93.2	62.3	58.1	111	1.91
37	93.0	62.4	58.0	111	1.91
38	93.0	62.5	58.1	111	1.91
39	92.8	62.5	58.0	111	1.91
40	92.5	62.6	57.9	111	1.92
41	92.3	62.6	57.8	111	1.92
42	92.0	62.7	57.7	111	1.92
43	91.8	62.7	57.6	111	1.93
44	91.5	62.8	57.5	111	1.93
45	91.2	62.8	57.3	111	1.94
46	91.0	62.9	57.2	111	1.94
47	90.7	62.9	57.1	111	1.95
48	90.4	63.0	57.0	111	1.95
49	90.2	63.0	56.8	111	1.95
50	90.0	63.1	56.8	111	1.95
51	89.5	63.1	56.5	111	1.97
52	89.0	63.2	56.2	111	1.97
53	88.2	63.2	55.7	111	1.99
54	87.6	63.2	55.4	111	2.00

PER HEN HOUSED

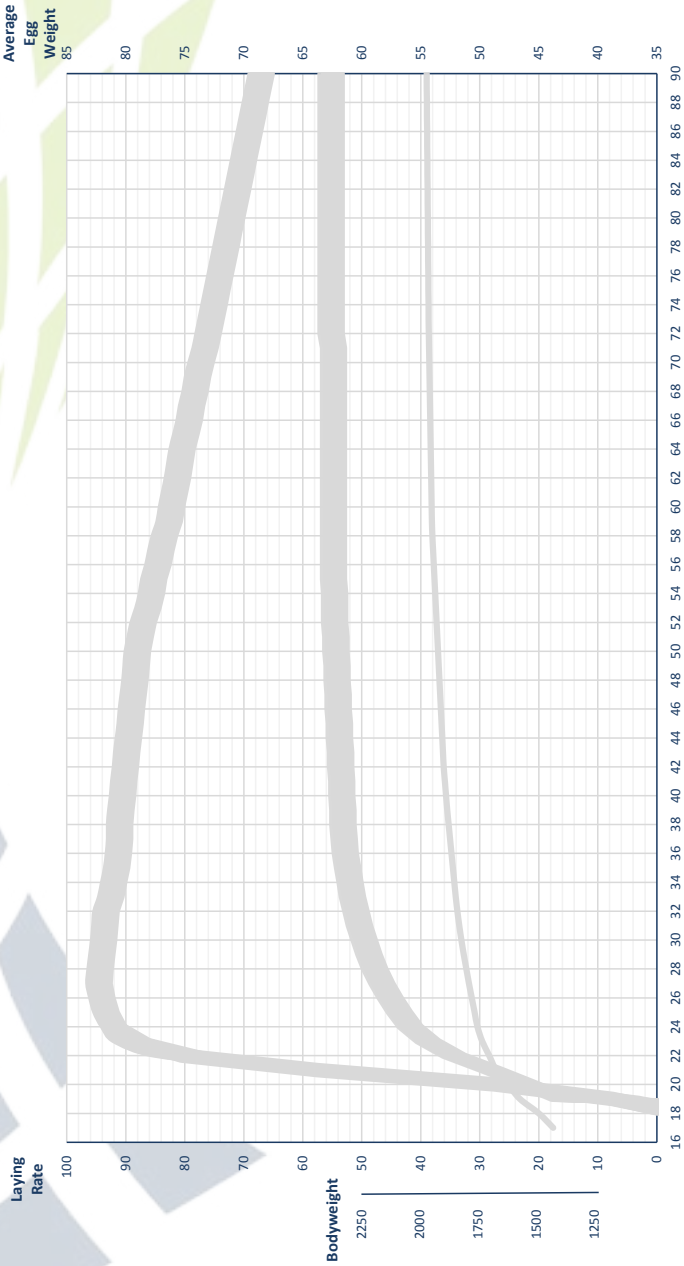
Age in weeks	Eggs per bird cum.	Egg mass cum.	Feed intake cum. (kg)	Feed conversion cum.	% Liveability	Body weight (g)
18			0.6		99.9	1500
19	1		1.2	32.85	99.8	1580
20	3	0.1	1.9	13.34	99.8	1630
21	7	0.4	2.6	7.31	99.7	1681
22	13	0.7	3.4	5.00	99.6	1710
23	20	1.0	4.1	4.01	99.5	1740
24	26	1.4	4.9	3.48	99.4	1760
25	33	1.8	5.6	3.16	99.3	1772
26	40	2.2	6.4	2.95	99.3	1784
27	46	2.6	7.2	2.79	99.2	1796
28	53	3.0	7.9	2.67	99.1	1807
29	60	3.4	8.7	2.58	99.0	1818
30	66	3.8	9.4	2.51	98.9	1828
31	73	4.2	10.2	2.45	98.8	1837
32	79	4.6	11.0	2.40	98.8	1845
33	86	5.0	11.7	2.36	98.7	1852
34	92	5.4	12.5	2.32	98.6	1858
35	99	5.8	13.3	2.29	98.5	1864
36	105	6.2	14.0	2.27	98.4	1870
37	112	6.6	14.8	2.25	98.3	1876
38	118	7.0	15.6	2.23	98.3	1882
39	124	7.4	16.3	2.21	98.2	1888
40	131	7.8	17.1	2.20	98.1	1893
41	137	8.2	17.8	2.18	98.0	1898
42	143	8.6	18.6	2.17	97.9	1903
43	150	9.0	19.4	2.16	97.8	1906
44	156	9.4	20.1	2.15	97.8	1909
45	162	9.7	20.9	2.14	97.7	1912
46	168	10.1	21.6	2.13	97.6	1915
47	175	10.5	22.4	2.13	97.5	1918
48	181	10.9	23.2	2.12	97.4	1921
49	187	11.3	23.9	2.12	97.3	1924
50	193	11.7	24.7	2.11	97.3	1927
51	199	12.1	25.4	2.11	97.2	1930
52	205	12.5	26.2	2.10	97.1	1933
53	211	12.8	26.9	2.10	97.0	1936
54	217	13.2	27.7	2.10	96.9	1939

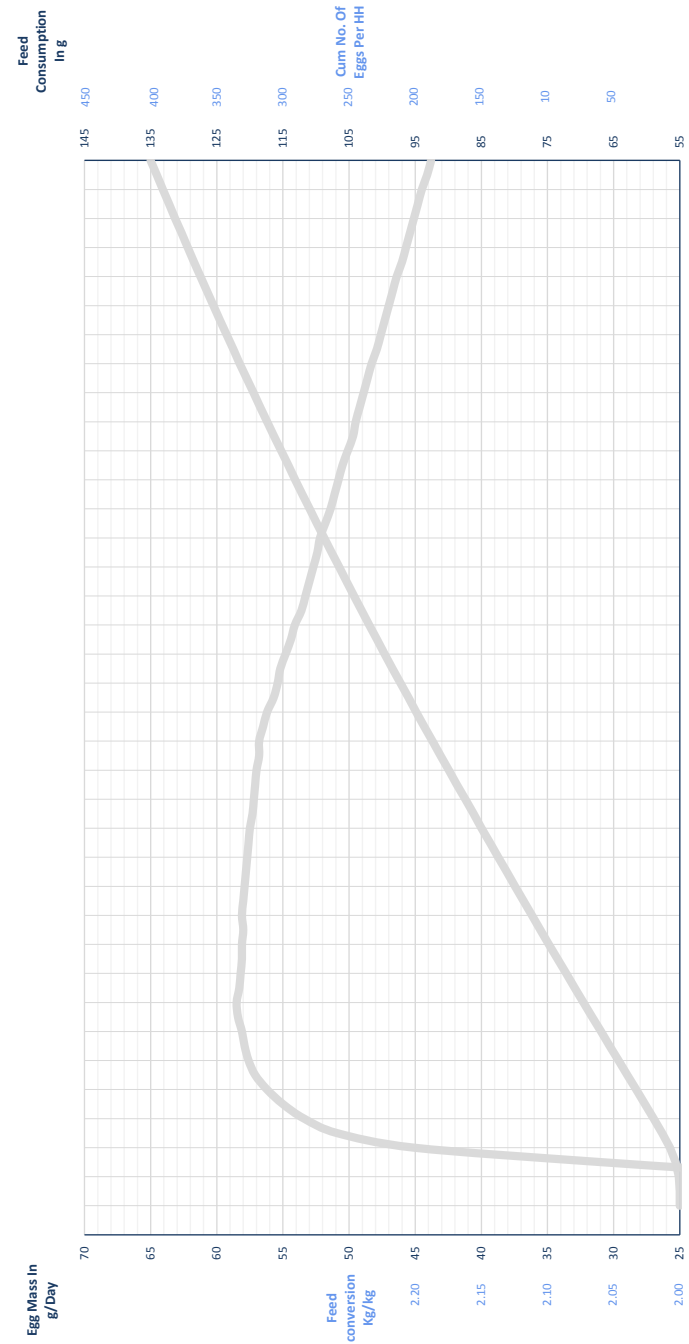
Production table 2

PER HEN DAY					
Age in weeks	% Lay	Egg weight (g)	Egg mass per day (g)	Feed intake per day (g)	Feed conversion per week
55	87.2	63.3	55.2	111	2.01
56	86.5	63.3	54.8	111	2.03
57	86.0	63.3	54.4	111	2.04
58	85.4	63.3	54.1	111	2.05
59	84.6	63.3	53.6	111	2.07
60	84.2	63.3	53.3	111	2.08
61	83.7	63.3	53.0	111	2.10
62	83.2	63.3	52.7	111	2.11
63	82.8	63.3	52.4	111	2.12
64	82.4	63.3	52.2	111	2.13
65	81.8	63.3	51.8	111	2.14
66	81.2	63.3	51.4	111	2.16
67	80.8	63.3	51.1	111	2.17
68	80.2	63.3	50.8	112	2.21
69	79.8	63.3	50.5	112	2.22
70	79.2	63.3	50.1	112	2.23
71	78.5	63.3	49.7	112	2.25
72	78.0	63.5	49.5	112	2.26
73	77.5	63.5	49.2	112	2.28
74	77.0	63.5	48.9	112	2.29
75	76.5	63.5	48.6	112	2.31
76	76.0	63.5	48.3	112	2.32
77	75.5	63.5	47.9	112	2.34
78	75.0	63.5	47.6	112	2.35
79	74.5	63.5	47.3	112	2.37
80	74.0	63.5	47.0	112	2.38
81	73.5	63.5	46.7	112	2.40
82	73.0	63.5	46.4	112	2.42
83	72.5	63.5	46.0	112	2.43
84	72.0	63.5	45.7	112	2.45
85	71.5	63.5	45.4	112	2.47
86	71.0	63.5	45.1	112	2.48
87	70.5	63.5	44.8	112	2.50
88	70.0	63.5	44.5	112	2.52
89	69.5	63.5	44.1	112	2.54
90	69.0	63.5	43.8	112	2.56

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	223	13.6	28.4	2.09	96.8	1942
56	229	14.0	29.2	2.09	96.8	1945
57	235	14.3	29.9	2.09	96.7	1948
58	241	14.7	30.7	2.09	96.6	1951
59	246	15.1	31.4	2.09	96.5	1953
60	252	15.4	32.2	2.09	96.4	1954
61	258	15.8	32.9	2.09	96.3	1955
62	263	16.1	33.7	2.09	96.3	1956
63	269	16.5	34.4	2.09	96.2	1957
64	274	16.8	35.2	2.09	96.1	1958
65	280	17.2	35.9	2.09	96.0	1959
66	285	17.5	36.7	2.09	95.9	1960
67	291	17.9	37.4	2.09	95.9	1961
68	296	18.2	38.2	2.10	95.8	1962
69	301	18.5	38.9	2.10	95.7	1963
70	307	18.9	39.7	2.10	95.6	1964
71	312	19.2	40.4	2.10	95.5	1965
72	317	19.5	41.2	2.11	95.4	1966
73	322	19.9	41.9	2.11	95.4	1967
74	327	20.2	42.7	2.11	95.3	1967
75	333	20.5	43.4	2.12	95.2	1968
76	338	20.8	44.2	2.12	95.1	1968
77	343	21.2	44.9	2.12	95.0	1969
78	348	21.5	45.6	2.13	94.9	1969
79	353	21.8	46.4	2.13	94.9	1970
80	357	22.1	47.1	2.13	94.8	1970
81	362	22.4	47.9	2.14	94.7	1971
82	367	22.7	48.6	2.14	94.6	1971
83	372	23.0	49.4	2.14	94.5	1972
84	377	23.3	50.1	2.15	94.4	1972
85	381	23.6	50.8	2.15	94.4	1973
86	386	23.9	51.6	2.16	94.3	1973
87	391	24.2	52.3	2.16	94.2	1974
88	395	24.5	53.1	2.16	94.1	1974
89	400	24.8	53.8	2.17	94.0	1975
90	405	25.1	54.5	2.17	93.9	1975

Production graphs





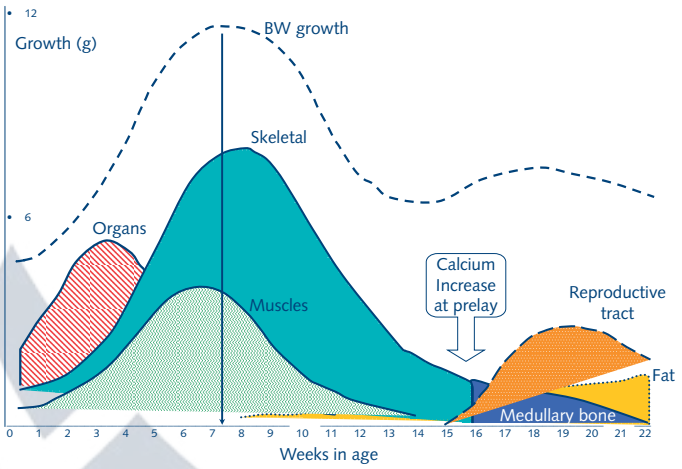
Rearing period

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

		Floor		Cages	
Age (weeks)		0 – 2	2 – 5	0 – 3	3 – 5
Ventilation	Minimum per hour / kg	0,7 m³	0,7 m³	0,7 m³	0,7 m³
Stocking densities	Birds / m²	30	20	80	45
	cm² / 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 2-3 m 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

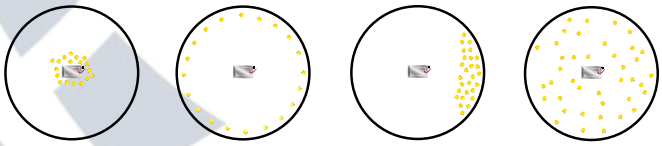
Notes:

- 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 encourage 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 – 28 days	16 hours	5 – 10 lux	18 hours	40 lux
29 – 35 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 (wks)		Floor 5 – 10	Floor 10 – 17	Cages 5 – 10	Cages 10 – 17
Ventilation	Minimum per hour / kg	4 m³	4 m³	4 m³	4 m³
Stocking densities	Birds / m²	15	10	15	10
	Birds / m² (hot climate)	12	9	12	9
	cm² / 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 weeks with a good development of the digestive tract

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.

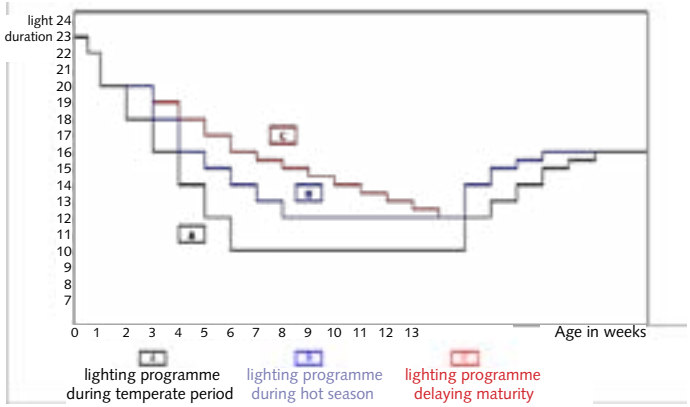
Lighting programmes have to be adapted to the rearing facilities (dark or open house systems), to the conditions of production, to the climate and to the egg weight profile demanded by the market.

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.

In detail:

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
Manganese mg/l	<1,0	>2,0
"lime/chulk content"	<20	>25
"oxidizable organic matter" mg/l	<50	>200
H2S	non detectable	non detectable
Coliform bacterials cfu/ml	<100	>100
Total germ 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.

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 meter	=10.76 squate feet per bird
3 bird per square meter	=3.59 squate feet per bird
4 bird per square meter	=2.69 squate feet per bird
5 bird per square meter	=2.15 squate feet per bird
7 bird per square meter	=1.54 squate feet per bird
11 bird per square meter	=0.98 squate feet per bird
13 bird per square meter	=0.83 squate 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		

Warranty disclaimer

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Notes