MANAGEMENT GUIDE

ALTERNATIVE SYSTEMS

MANAGEMENT RECOMMENDATIONS

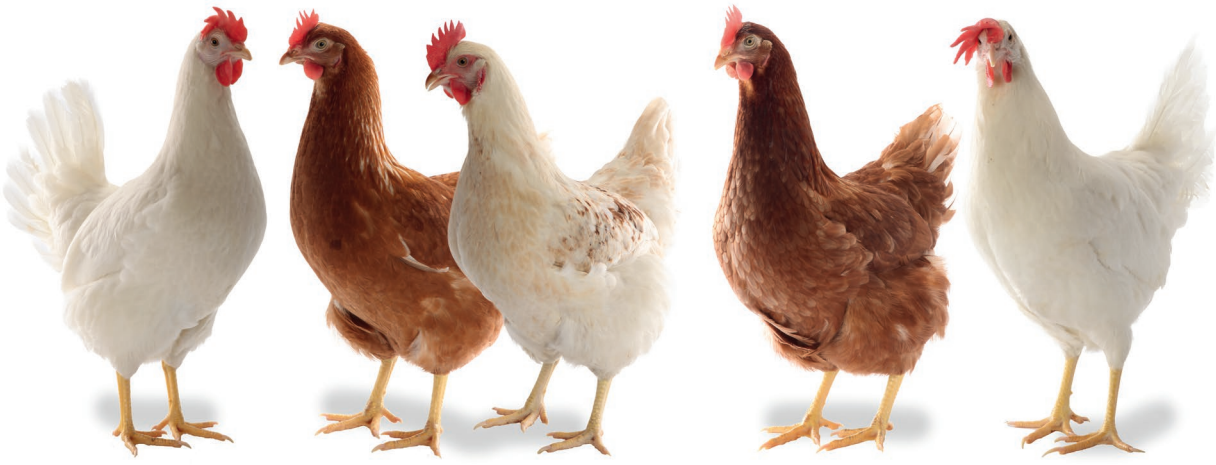
FOR DEEP LITTER, PERCHERY AND
FREE-RANGE SYSTEMS

BREEDING FOR SUCCESS … TOGETHER

LOHMANN
TIERZUCHT

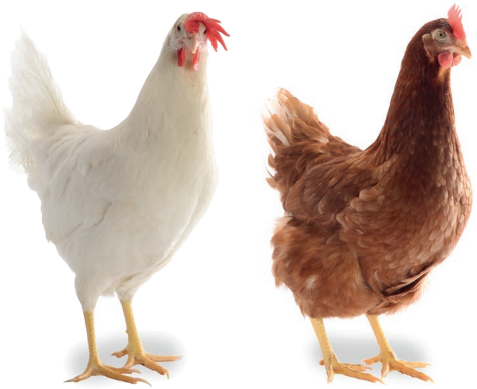
LOHMANN TIERZUCHT PRODUCTS

The growing global population and increasing competition in the poultry industry require efficient layers to satisfy specific market requirements. LOHMANN TIERZUCHT offers a wide range of high quality layer strains "bred in Germany" to meet these demands. The intensive monitoring program of all breeding farms and hatcheries by our Veterinary Laboratory assures the highest possible health status of chicks supplied by LOHMANN TIERZUCHT.

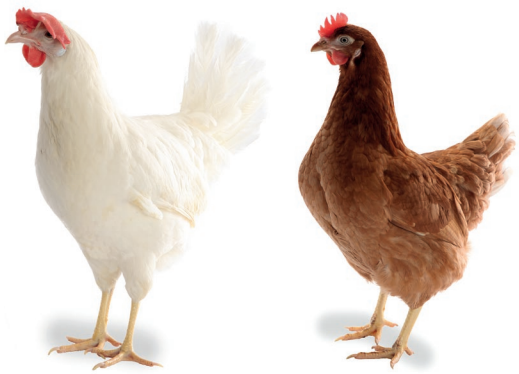


LOHMANN TIERZUCHT OFFERS A WIDE RANGE OF COMPETITIVE BIRDS.

- LOHMANN LSL-CLASSIC
- LOHMANN BROWN-CLASSIC
- LOHMANN LSL-LITE
- LOHMANN BROWN-LITE
- LOHMANN BRWON-PLUS
- LOHMANN BROWN-EXTRA
- LOHMANN TRADITION



The mainstream products are **LOHMANN LSL-CLASSIC** and **LOHMANN BROWN-CLASSIC,** well known for their efficient production of quality white and brown eggs, respectively.



LOHMANN LSL-LITE and **LOHMANN BROWN-LITE** are two products which have been designed for markets which prefer smaller eggs and measure efficiency in g feed per egg.

For markets requiring more XL-size eggs **LOHMANN BROWN-EXTRA** is the ideal brown layer.

LOHMANN BROWN-PLUS is a brown egg layer with an higher body weight and higher feed intake capacity, designed for lower density feed ratios especially for organic egg production.

LOHMANN TRADITION, a brown egg layer with high early egg weight was developed mainly for markets requiring an even larger egg size.

CONTENT

INTRODUCTION

Since December 2011, all conventional cages are banned in the European Union. Therefore, the trend to change from conventional battery cages towards deep litter, aviary and free range housing systems for laying hens has intensified in recent years. Particularly in West European countries, laying hens are being increasingly kept in production systems which are in line with the ethical and moral principles of these societies.

Organic farms managed in accordance with specific guidelines for organic farming have also gained market shares. The rearing of laying hens for deep litter, aviary and free range systems requires considerably more expertise and time, which should be invested in caring for the birds unlike in conventional cage rearing. Any farmer who decides to rear pullets or to keep layers in these alternative production systems should first acquire a basic knowledge of management practice in alternative systems. Before starting on production himself, he should have preferably gained some practical insight into what is involved by taking a good look around a well-managed and successful operation.

These management recommendations for rearing pullets for deep litter, aviary and free range systems are intended to provide basic information and help poultry farmers to fully exploit the genetic performance potential of LOHMANN breeding products in alternative systems.

The recommendations are based on results of scientific studies and most importantly, practical experience as gained in the field. This management program is intended to be used as a guide for newcomers and at the same time, assist experienced poultry farmers in optimizing their work with LOHMANN breeding products in alternative systems.

Source: Fienhage

PERFORMANCE DATA

LOHMANN BROWN-CLASSIC

Egg Production	Age at 50 % production	150 – 160 days
	Peak production	92 – 94 %
	Eggs per Hen Housed	
	in 72 weeks of age	311 – 316 (315)
	in 80 weeks of age	353 – 358 (356)
	in 85 weeks of age	378 – 383 (380)
	Eggs Mass per Hen Housed	
	in 72 weeks of age	19.5 – 20.5 kg (19.96 kg)
	in 80 weeks of age	22.0 – 23.0 kg (22.77 kg)
	in 85 weeks of age	24.0 – 25.0 kg (24.40 kg)
	Average Egg Weight	
	in 72 weeks of age	63.0 – 64.0 g (63.5 g)
	in 80 weeks of age	63.5 – 64.5 g (64.0 g)
	in 85 weeks of age	64.0 – 65.0 g (64.2 g)
Egg Characteristics	Shell colour	attractive brown
	Shell breaking strength	> 40 Newton
Feed Consumption	1st – 20th week	7.4 – 7.8 kg
	Production	115 – 125 g / day
	Feed conversion	2.1 – 2.15 kg / kg egg mass
Body Weight	at 20 weeks	1.6 – 1.7 kg
	at the end of production	1.9 – 2.2 kg
Liveability	Rearing	97 – 98 %
	Laying period	90 – 92 %

LOHMANN LSL-CLASSIC

Egg Production	Age at 50 % production	150 – 160 days
	Peak production	94 – 96 %
	Eggs per Hen Housed	
	in 72 weeks of age	318 – 323 (321)
	in 80 weeks of age	360 – 365 (363)
	in 85 weeks of age	385 – 390 (387)
	Eggs Mass per Hen Housed	
	in 72 weeks of age	19.5 – 20.5 kg (19.97 kg)
	in 80 weeks of age	22.0 – 23.0 kg (22.75 kg)
	in 85 weeks of age	24.0 – 25.0 kg (24.34 kg)
	Average Egg Weight	
	in 72 weeks of age	61.8 – 62.8 g (62.2 g)
	in 80 weeks of age	62.0 – 63.0 g (62.7 g)
	in 85 weeks of age	62.5 – 63.5 g (62.9 g)
Egg Characteristics	Shell colour	attractive white
	Shell breaking strength	> 40 Newton
Feed Consumption	1st – 20th week	7.0 – 7.5 kg
	Production	110 – 120 g / day
	Feed conversion	2.0 – 2.1 kg / kg Egg mass
Body Weight	at 20 weeks	1.33 – 1.44 kg
	at the end of production	1.72 – 1.87 kg
Liveability	Rearing	97 – 98 %
	Laying period	90 – 92 %

PERFORMANCE DATA

LOHMANN BROWN-LITE

Egg Production	Age at 50 % production Peak production	150 – 160 days 92 – 95 %
	Eggs per Hen Housed	
	in 72 weeks of age in 80 weeks of age in 85 weeks of age	315 – 320 (318) 357 – 362 (360) 382 – 387 (385)
	Eggs Mass per Hen Housed	
	in 72 weeks of age in 80 weeks of age in 85 weeks of age	19.3 – 20.3 kg (19.73 kg) 22.0 – 23.0 kg (22.53 kg) 24.0 – 25.0 kg (24.17 kg)
	Average Egg Weight	
	in 72 weeks of age in 80 weeks of age in 85 weeks of age	62.0 – 63.0 g (62.0 g) 62.5 – 63.5 g (62.6 g) 63.0 – 64.0 g (62.8 g)
Egg Characteristics	Shell colour Shell breaking strength	attractive brown > 40 Newton
Feed Consumption	1st – 20th week Production Feed conversion	7.4 – 7.8 kg 115 – 125 g / day 2.1 – 2.2 kg / kg Egg mass
Body Weight	at 20 weeks at the end of production	1.55 – 1.65 kg 1.91 – 2.11 kg
Liveability	Rearing Laying period	97 – 98 % 90 – 93 %

LOHMANN LSL-LITE

Egg Production	Age at 50 % production Peak production	150 – 160 days 94 – 97 %
	Eggs per Hen Housed	
	in 72 weeks of age in 80 weeks of age in 85 weeks of age	322 – 327 (324) 365 – 370 (367) 390 – 395 (392)
	Eggs Mass per Hen Housed	
	in 72 weeks of age in 80 weeks of age in 85 weeks of age	19.3 – 20.3 kg (19.68 kg) 22.0 – 23.0 kg (22.44 kg) 23.5 – 24.5 kg (24.03 kg)
	Average Egg Weight	
	in 72 weeks of age in 80 weeks of age in 85 weeks of age	60.2 – 61.2 g (60.7 g) 60.6 – 61.6 g (61.1 g) 61.0 – 62.0 g (61.3 g)
Egg Characteristics	Shell colour Shell breaking strength	attractive white > 40 Newton
Feed Consumption	1st – 20th week Production Feed conversion	7.0 – 7.5 kg 108 – 118 g / day 2.0 – 2.1 kg / kg Egg mass
Body Weight	at 20 weeks at the end of production	1.3 – 1.4 kg 1.7 – 1.8 kg
Liveability	Rearing Laying period	97 – 98 % 90 – 92 %

PERFORMANCE DATA

LOHMANN BROWN-EXTRA

Egg Production	Age at 50 % production	150 – 160 days
	Peak production	88 – 93 %
	Eggs per Hen Housed	
	in 72 weeks of age	310 – 315 (312)
	in 80 weeks of age	350 – 355 (352)
	in 85 weeks of age	372 – 377 (375)
	Eggs Mass per Hen Housed	
	in 72 weeks of age	19.5 – 20.5 kg (19.97 kg)
	in 80 weeks of age	22.5 – 23.5 kg (22.72 kg)
	in 85 weeks of age	24.0 – 25.0 kg (24.30 kg)
	Average Egg Weight	
	in 72 weeks of age	63.5 – 64.5 g (64.0 g)
	in 80 weeks of age	64.0 – 65.0 g (64.5 g)
	in 85 weeks of age	64.5 – 65.5 g (64.8 g)
Egg Characteristics	Shell colour	attractive brown
	Shell breaking strength	> 40 Newton
Feed Consumption	1st – 20th week	7.4 – 7.8 kg
	Production	115 – 125 g / day
	Feed conversion	2.1 – 2.2 kg / kg Egg mass
Body Weight	at 20 weeks	1.58 – 1.70 kg
	at the end of production	1.95 – 2.16 kg
Liveability	Rearing	97 – 98 %
	Laying period	90 – 92 %

LOHMANN BROWN-PLUS

Egg Production	Age at 50 % production	150 – 160 days
	Peak production	93 – 95 %
	Eggs per Hen Housed	
	in 72 weeks of age	312 – 317 (316)
	in 80 weeks of age	355 – 360 (358)
	in 85 weeks of age	378 – 383 (381)
	Eggs Mass per Hen Housed	
	in 72 weeks of age	19.5 – 20.5 kg (19.85 kg)
	in 80 weeks of age	22.3 – 23.3 kg (22.65 kg)
	in 85 weeks of age	24.0 – 25.0 kg (24.26 kg)
	Average Egg Weight	
	in 72 weeks of age	62.0 – 63.0 g (62.8 g)
	in 80 weeks of age	63.0 – 64.0 g (63.3 g)
	in 85 weeks of age	63.0 – 64.0 g (63.6 g)
Egg Characteristics	Shell colour	attractive brown
	Shell breaking strength	> 40 Newton
Feed Consumption	1st – 20th week	7.4 – 7.8 kg
	Production	120 – 130 g / day
	Feed conversion	2.3 – 2.4 kg / kg Egg mass
Body Weight	at 20 weeks	1.69 – 1.79 kg
	at the end of production	2.16 – 2.30 kg
Liveability	Rearing	97 – 98 %
	Laying period	90 – 93 %

PERFORMANCE DATA

LOHMANN TRADITION

Egg Production	Age at 50 % production	145 – 155 days
	Peak production	90 – 93 %
	Eggs per Hen Housed	
	in 72 weeks of age	308 – 312 (310)
	in 80 weeks of age	345 – 350 (349)
	in 85 weeks of age	367 – 373 (370)
	Eggs Mass per Hen Housed	
	in 72 weeks of age	19.5 – 20.5 kg (20.06 kg)
	in 80 weeks of age	22.0 – 23.0 kg (22.72 kg)
	in 85 weeks of age	24.0 – 25.0 kg (24.24 kg)
	Average Egg Weight	
	in 72 weeks of age	64.0 – 65.0 g (64.6 g)
	in 80 weeks of age	65.0 – 66.0 g (65.2 g)
	in 85 weeks of age	66.0 – 67.0 g (66.4 g)
Egg Characteristics	Shell colour	attractive brown
	Shell breaking strength	> 40 Newton
Feed Consumption	1st – 20th week	7.5 – 7.9 kg
	Production	115 – 125 g / day
	Feed conversion	2.2 – 2.3 kg / kg Egg mass
Body Weight	at 20 weeks	1.61 – 1.73 kg
	at the end of production	1.95 – 2.15 kg
Liveability	Rearing	97 – 98 %
	Laying period	92 – 94 %

REARING OF PULLETS

HOUSING SYSTEMS

Pullets destined for alternative housing systems should also be reared in deep litter and aviary systems. The more closely the growing facility resembles the future production system, the easier it will be for the pullets to settle down in their new environment after being transferred to the laying house.

Barn systems

Floor rearing systems for chicks and pullets should consist of a well littered, climate controlled, illuminated shed which in addition to feeders and drinkers, also provide slightly raised roosting places. Chicks learn and want to fly up to rails or perches at an early age. If perching or flying is learnt too late, it can result in reduced mobility of individual hens in the future laying house. Rails or perches should therefore be available to chicks before 6 weeks of age.

Mounting feeders and drinkers on or alongside the perches is a very effective preparation for the production phase. Floor rearing systems which have dropping pits onto which feeders and drinkers are mounted, are particularly effective for familiarising the birds with the design of the laying house.

Aviary system

Aviary systems can accommodate more birds per m^2 of floor area than deep litter systems as the total amount of usable space is greater. Multi-tiered aviary systems of different designs are currently offered by several manufacturers with appropriate management recommendations.

The levels are furnished with plastic or metal slats and feature manure belt ventilation. Feeders and drinkers are usually located only on the bottom and middle levels. The top level is used by the pullets at night as a roosting area. This natural behaviour can be reinforced by using the lighting system to simulate sunset. This involves turning off the light in a step-wise sequence starting with the bottom and middle levels and finally, the top level. In the morning, the birds should go to the two lower levels for feeding. By moving between the resting zone and the other levels, the pullets get physical exercise and familiarize themselves with the aviary system. Staggered feeding on the lower tiers promotes flexibility of movement.

PLACEMENT OF CHICKS

Already in the truck that delivers the chicks from the hatchery to the rearing farm, the conditions for the day old chicks must be ideal so as to ensure a good development of the chicks from the very beginning. The loading space must have a temperature of 25 – 26 °C (77.0 – 78.8 °F). During transport, the live weight of the chicks can be reduced by 0.3 % per hour. Therefore, it is very important to transfer them very quickly so that the day old chicks can be placed at the rearing facility as fast as possible.

Key Points

- Before the placement of the chicks, check all equipment for functionality (feeders, drinkers, heaters).
- Ensure that before the chicks arrive, feed and water are already distributed in the house.
- The height of the drinkers must fit to the size of the chicks so that they can easily find the water. Reduce the water pressure of the nipple-drinkers. Through the reduced water pressure, water droplets will appear at the nipple-drinker which will help the chicks to find the water easily.
- Regulate the water temperature between 20 – 25 °C (68 – 77 °F). In order to do so, change the water in the round drinker and flush the line of the nipple drinkers frequently.
- **Heat the facility in time to 35 – 36 °C (95 – 96.8 °F).** In summer, start with this 24 hours beforehand and in winter, 48 hours before the chicks arrive. After achieving the desired temperature, let the ventilation work at minimum. These prevents temperature differences in the rearing house.
- Keep the room temperature of 35 – 36 °C (95 – 96.8 °F) for the first 48 – 72 hours.
- Air humidity should be at a minimum of 60 %.
- Follow the recommended lighting program.
- Familiarise the chicks to the presence of humans from the beginning on. Visit the chicks at least 1 – 2 times per day.

Placement – barn system

It is advisable to place the chicks close to the drinkers and feeders in the building. If uniform distribution of temperature within the house cannot be guaranteed or if radiant heaters are used, the use of chick guards or similar devices to keep the chicks together has proven to be an effective method. These restrict the chicks to the areas of the building where the climate is optimal and where feeders and drinkers are located.

The shed can also be furnished with chick feeding bowls to ensure a better feed intake in the first few days. Both standard feeders and these additional chick bowls should be filled with a layer of about 1 cm of coarse starter feed. As soon as the chicks are able to eat from standard feeders, the bowls should be removed gradually.

If radiant heaters are used, chick guards or similar devices for keeping the chicks in the warm area should be installed underneath. This provides a draught-free and comfortable microclimate for the chicks during the first two to three days after hatching. If the chicks are housed in sheds equipped with dropping pits, it is advisable to place narrow strips of thin, corrugated cardboard over the slats (40 – 50 cm wide) on which drinkers, feeders and the chick bowls used for the first week are placed. Chick guards or similar devices are again very useful for keeping the chicks closed to water, feed and heat sources during the first few days of life.

Key Points

- After arrival of the chicks, place them closed to the heater, water and feed.
- Measure temperature in the chick guards at the height of the chicks.
- Dip the beak of some chicks into the water and activate the nipple-drinkers. This motivates the birds to drink. After finding the water, chicks will soon start to eat. This takes at least 2 – 3 hours.
- Place some extra feeders to achieve better feed consumption during the first days.
- Do not distribute the litter until the floor reaches the recommended temperature. As suitable litter, one can use wood shavings, cellulose pellets or straw.
- The chicks should be fully feathered before removing the heater out of the barn.

Placement – aviary

Depending on the system, the chicks are placed either on the middle or bottom level of the aviary where they remain up to about day 14/21. Feed and water are close by so that the birds become fully accustomed to their environment. From 3 to 4 weeks of age, the „training tiers" will be opened. Now the birds can move freely throughout the building and learn to jump and fly.

Aviaries which provide feed and water on all tiers and can be operated similar to a battery system by confining the chicks during their first few weeks of life, may be very convenient for the pullet producer but are less suitable for training the chicks to move around the system. In these systems, the tiers should also be opened as early as possible to encourage chick movement within the house by means of staggered feeding on the different tiers. Even here, it is essential that take-off, landing and flying should be mastered by 6 weeks of age.

During the first few days of having access to all parts of the house, the chicks should be closely watched. Disorientated birds have to be moved manually and trained by the attendants. Pullets which will later be moved to aviaries where they have to fly onto perches for feeding should preferably be familiarised with this type of perch while still in the growing facility. The pullets should be moved to the laying house well before the proposed start of production. They are then better able to find their way around the different areas (feeding, scratching, roosting).

By eliminating stress during the period of adaptation to aviary systems, existing nest boxes are more readily accepted and the daily feed intake is more likely to keep up with the bird's growing requirements at the onset of production.

REARING OF PULLETS

Stocking density

The stocking density depends on the housing system. In deep litter systems, stocking densities of up to 15 birds / m^2 of usable floor space are acceptable.

Stocking densities in aviary systems should be according to the recommendations of the manufacturer of the system. Densities of up to 30 pullets / m^2 house area are possible.*

**The stocking density has to be adjusted in accordance to the animal welfare regulations valid for the country where the chicks / pullets are housed.*

Rearing equipment

The type of drinker which is used during rearing should be comparable to those used in the production facilities. Do not train pullets to drink out of a nipple drinker which can be used vertically and horizontally if in the production facilities there are nipple drinkers which can only work vertically.

Body temperature of the chick

The body temperature of the chicks housed is a very useful indicator of how to adjust the house temperature in an optimum way. A simple tool to measure the body temperature of a day old chick is the use of modern ear thermometers, as known from human medicine. The correct and simple method of measuring the body temperature is to touch the cloaca gently with the thermometer probe.

The optimal body temperature of the chicks is about 40 to 41 °C (104 – 105.8 °F). Obtain temperatures of various chicks which are distributed in the different parts of the house in order to have reliable results. Proceed in a way you normally do while weighing chicks / pullets to check their uniformity. Collect the information, calculate the average and adjust the house temperature accordingly to achieve optimal chick temperatures. For example, increase the house temperature by 0.5 °C (0.9 °F) if the average body temperature of the chicks is 39.5 °C (103.1 °F). In the first days after hatch, the chicks are not able to regulate their body temperature on their own. They are dependent on an external heat source. Chicks of young parent stock flocks generally need a longer time until they are able to regulate their body temperature independently.

Besides house temperature, there are other factors which could affect the body temperature of the chicks negatively:

- Insufficient air distribution in the house
- Low humidity level (low heat transfer capacity of the air)
- Failing to pre-warm the house at the right time

After a few hours, check whether the chicks have settled down well. The chicks' behaviour is the best indicator of their well being:

- If the chicks are evenly spread out and moving freely, temperature and ventilation are all right.
- If the chicks are crowding together or avoiding certain areas within the house, temperature is too low or there is a draft.
- If the chicks are laying on the floor with their wings spread out and gasping for air, temperature is too high.

At first signs that the chicks are not feeling well determine the reason, correct the situation and check more frequently.

Rough estimates of the equipment needed for barn / aviary systems are as follows:

Table 1: Equipment Requirement for Rearing Period:

Equipment	Age (Weeks)	Requirement*
Bell-type drinkers	1	1 drinker (4 – 5 l) per 100 chicks
Round drinkers	up to 20	1 drinker (ø 46 cm) per 125 birds
Linear drinking troughs	up to 20	1 m trough length per 100 birds
Nipple drinkers (with drip cups)	up to 20	6 – 8 birds per nipple
Chick feeding bowls	1 – 2	1 bowl per 60 chicks
Cut-off chick cartons	1 – 2	1 carton per 100 chicks
Round feeders	3 – 10 11 – 20	2 troughs (ø 40 cm) per 100 birds 3 troughs (ø 40 cm) per 100 birds
Chain feeders	3 – 10 11 – 20	2.5 – 3.5 m trough length per 100 birds 4.5 m trough length per 100 birds

**The stocking densities have to be adjusted in accordance to the animal welfare regulations valid for the country where the chicks / pullets are housed*

House climate

Environmental conditions have an effect on the well-being and performance of the birds. Important environmental factors are temperature, humidity and the level of toxic gases in the air.

Toxic gases and dust are especially harmful for young chicks and will affect their well-being and health.

Table 2: Minimum Air Quality Requirements

O_2	over	20 %
CO_2	under	0.3 %
CO	under	40 ppm
NH_3	under	20 ppm
H_2S	under	5 ppm

The optimal temperature depends on the age of the birds. The following table is a guide to the correct temperature at bird level. The best indicator for correct temperature is to observe the behaviour of the chicks!

The following temperatures should be reached at chick level.

Table 3: Desired Temperatures at Bird Level Dependent on Age

Age	Temperatur (°C)	Temperatur °F
Day 1 – 2*	35 – 36	95.0 – 96.8
Day 3 – 4	33 – 34	91.4 – 93.2
Day 5 – 7	31 – 32	87.8 – 89.6
Week 2	28 – 29	82.4 – 84.2
Week 3	26 – 27	78.8 – 80.6
Week 4	22 – 24	71.6 – 75.2
From week 5	18 – 20	64.4 – 68

** Body temperatures of 40–41 °C (104–15.8 °F) are the optimum for the chicks.*

The relative humidity level inside the house should be at about 60 – 70 %.

Set the temperature for chicks of young parent stock flocks at 1 °C (1.8 °F) higher than usual. The heater should be adapted to weather conditions in order to reach the optimal house temperature at setting. The right heating and ventilation should guarantee an uniform climate in the house.

Litter

Scratching and pecking in litter is scientifically classified as foraging behaviour. Foraging chicks will always consume some pieces of litter. Therefore, the type and quality of the litter is of significant importance.
Chicks must not ingest fine particles. When combined with water, they will swell up in the oesophagus, causing illness and reduced feed intake.

Straw must always be clean and free of mould. Wheat straw is preferable to barley or oat straw. Barley straw contains awn residues which can cause injury to chicks and oat straw does not absorb sufficient moisture. To reduce dust formation, the straw should not be chopped but also laid down as long straw. Splicing improves moisture absorbency.
Long straw has the added advantage of encouraging the chicks to forage. This stimulates the birds' natural investigative and feeding behaviour thus reducing the risk of feather pecking.

Wood shavings are good litter material provided that they are dust-free and come from softwood varieties which have not been chemically treated. A minimum particle size of 1 cm is recommended.

For several years now, the use of cellulose pellets has proven its worth. The pellets absorb moisture very efficiently and contain less dust particles.

Litter should be distributed after heating the shed, i.e. when the floor has reached the correct temperature. Significant differences between floor and room temperatures when litter is distributed too early change the dew point. The litter becomes wet from below and sticky.

LIGHTING PROGRAM

General

The lighting program controls the onset of lay and affects the performance during production. Within certain limits, performance can be adapted to farm specific requirements by adjusting the lighting program.

Easiest to follow are the lighting programs in closed houses without the effect of natural daylight. In these, the hours of light and light intensity can be adjusted according to changing needs.

Rearing birds in closed houses and producing eggs in light-tight houses enables the producers to maximize performance. Follow the lighting program which is recommended for this type of housing system and commercial variety.
As an example, please refer to figure 1 which shows lighting programs for white and brown layers. For open or brown out houses (houses translucent for natural daylight), a tailor made program has to be developed which reflects the season and geographical location where the pullets are being reared and stimulated to lay.

Rearing pullets in closed houses and keeping the latter in closed houses during production can optimize egg production. One should choose the lighting program which is recommended for the particular breed.

REARING OF PULLETS

In open house facilities where natural daylight has effects on the flock, a tailor made lighting program has to be developed which includes the hatch-date and geographical location where the pullets are being reared and stimulated to lay.

Please follow some basic principles concerning the lighting program:

- **Never increase the hours of light during the rearing period until the planned stimulation begins.**
- **Never decrease the hours of light during the production period.**

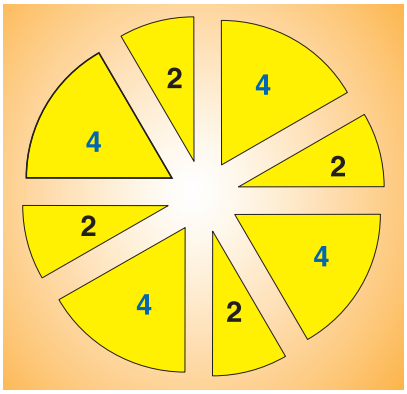
Intermittent lighting program for day old chicks

When the day old chicks arrive on the farm, they have already been intensively handled in the hatchery and often have had a long transport to their final destination. Common practice is to give them 24 hours of light to help them to recover in the first 2 to 3 days after arrival and to provide them enough time to eat and drink. It has been observed in practice that after arrival and housing, some chicks continue to sleep whereas others start to look for feed and water. The activity of the flock will always be irregular. Especially in this phase, poultry men have difficulties interpreting the chick's behaviour and their condition.

There is a practically proven principal in splitting the day into phases of resting and activity using a specially designed intermittent lighting program. The aim is to synchronize the chick's activities. The farmer gets a better impression of the flock's condition and the birds are encouraged by the group's behaviour to search for water and feed.

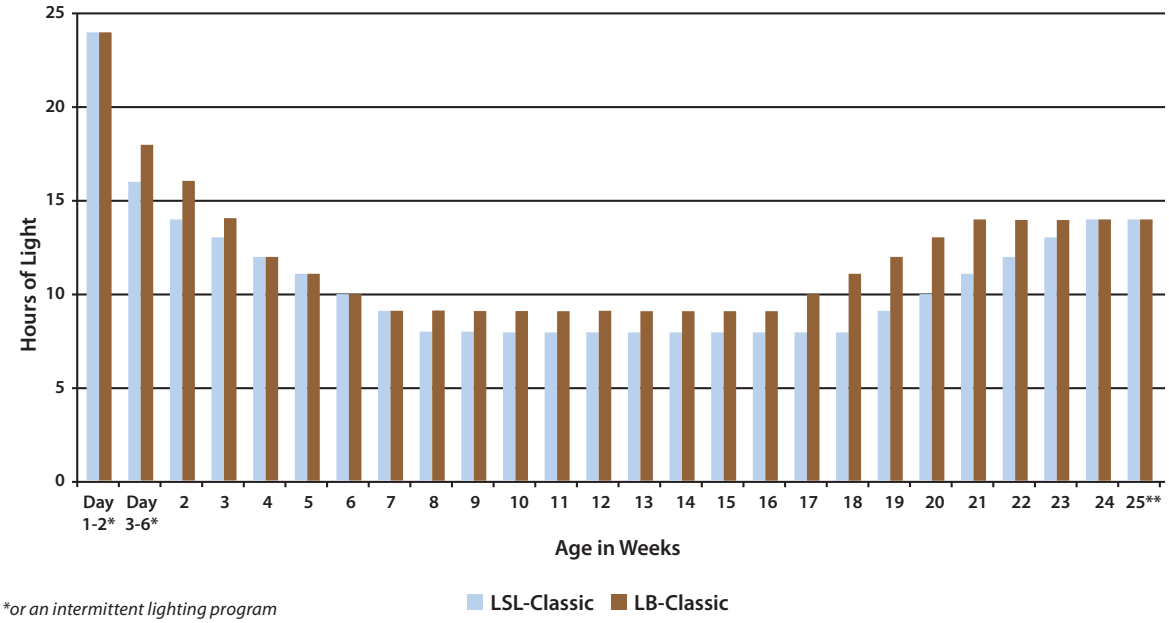
LOHMANN TIERZUCHT therefore advises to give chicks a rest after they arrive at the rearing farm and then start with four hours of light followed by two hours of darkness.

Lighting program after arrival of the chicks



This program can be used for up to 7 – 10 days after arrival and then switched to the regular step down lighting program. The usage of the following lighting program brings about the following advantages:

Figure 1: Example for a Lighting Program for LSL-CLASSIC and LB-CLASSIC (closed houses)



*or an intermittent lighting program
**until the end of production

› The chicks will rest and / or sleep at the same time. This means that the behaviour of the chicks will be synchronized.
› Weak chicks will be stimulated by stronger ones to move as well as to drink and eat.
› The behaviour of the flock is more uniform and monitoring the birds is made easier.
› Mortality will decrease.

Lighting Program for closed houses

To which extent lighting hours have to be reduced during the growing period and the time when stimulation begins by increasing the lighting hours are means by which performance can be adjusted to specific farm requirements. The following standard lighting programs has been designed as an example for a quick start into production.

The light intensity measured in lux depends on the used source of light. Giving advice concerning this measurement would confuse rather than help layer farmers.

Light intensity is therefore just given in lux in the following table.

Table 4: Lighting Program for white and brown hens in closed houses

Age (Weeks)	Product			
	LSL-CLASSIC, LSL-LITE		LB-CLASSIC, LB-LITE, LB-EXTRA, LB-PLUS, Lohmann Tradition	
	Light (hours)	Light intensity (Lux)***	Light (hours)	Light intensity (Lux)***
Day 1 – 2 *	24	20 – 40	24	20 – 40
Day 3 – 6 *	16	20 – 30	18	20 – 30
2	14	10 – 20	16	10 – 20
3	13	10 – 20	14	10 – 20
4	12	4 – 6	12	4 – 6
5	11	4 – 6	11	4 – 6
6	10	4 – 6	10	4 – 6
7	9	4 – 6	9	4 – 6
8	8	4 – 6	9	4 – 6
9	8	4 – 6	9	4 – 6
10	8	4 – 6	9	4 – 6
11	8	4 – 6	9	4 – 6
12	8	4 – 6	9	4 – 6
13	8	4 – 6	9	4 – 6
14	8	4 – 6	9	4 – 6
15	8	4 – 6	9	4 – 6
16	8	4 – 6	9	4 – 6
17	8	4 – 6	10	10 – 15
18	8	10 – 15	11	10 – 15
19	9	10 – 15	12	10 – 15
20	10	10 – 15	13	10 – 15
21	11	10 – 15	14	10 – 15
22	12	10 – 15	14	10 – 15
23	13	10 – 15	14	10 – 15
24	14	10 – 15	14	10 – 15
25**	14	10 – 15	14	10 – 15

** or run an intermittent lighting program*
*** until the end of production*
**** minimum*

REARING OF PULLETS

Lighting Programs for open or brown out houses

There is a possibility to adjust the lighting program to reach the optimum, even in houses which are influenced by natural daylight.

In houses where hens have access to winter gardens or a free range area, or if windows, ventilation shafts and other openings cannot be blacked out sufficiently to protect the birds completely from the effects of natural daylight, the lighting program must be adjusted to the natural day length at the time of rehousing.
Do bear in mind that in Central Europe, the natural length of day increases during the course of the calendar year to about 17 hours by late June and then shortens to about 8 hours by late December.

We distinguish between two variants:
1. Production starts as the natural day length decreases.
2. Production starts as the natural day length increases.

In both variations, taking the natural day length into account, the lighting program should be set to a lighting period of at least 10 hours at 17 weeks of age for LOHMANN BROWN-CLASSIC, LOHMANN BROWN-LITE, LOHMANN BROWN-EXTRA and LOHMANN TRADITION. These have to be increased by 1 hour every week to 14 hours until 21 weeks of age. For the LSL varieties, the lighting program should be set to a lighting period of at least 8 hours at 18 weeks of age and be increased by 1 hour every week to 14 hours until 23 weeks of age.
Never switch on the artificial light before 04.00 o'clock in the morning (CE time).

During the spring months, the lighting program will be affected by the increase in the natural day length and gradually extends to about 17 hours. When the natural day length begins to decrease in Central Europe i.e. from July onwards, the 17-hour light period should be kept constant until the end of the production period.
This example can be very simply accomplished in Central Europe by

- 04.00* hours in the morning: lights on – dimmer switch off at ≥ 50 – 60 Lux.
- Dimmer switch on at ≤ 50 – 60 Lux – 21.00 * o'clock in the evening lights off.

**Central European time*

These times should be varied depending on the condition of the flocks, the start of lay (production, egg size) and the facilities in the building.

If for operational reasons a different diurnal rhythm from the one described above is applied, it should not differ too much from the dawn / dusk times stated above considering the diurnal rhythm of the hens.

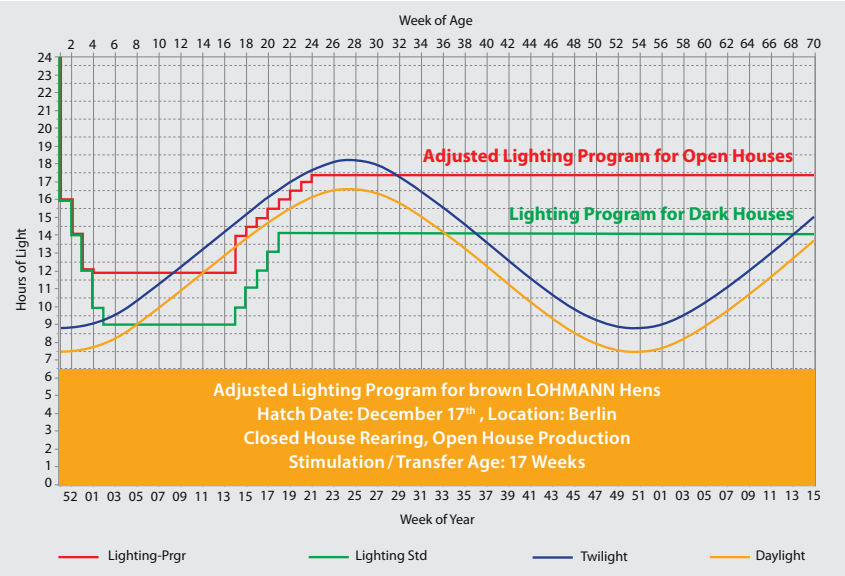
If the birds are driven indoors before the end of the natural day and if the building can be darkened completely, the lighting program for windowless laying houses should be applied. The times for darkening the room or opening the windows are determined by the lighting program.

It is important to follow the correct sequence:

- In the evening: close the windows first and then switch off the light;
- In the morning: switch on the light first and then open the windows.

Contact your LOHMANN TIERZUCHT specialists for specific lighting programs adjusted to your location, conditions and requirements.

An Example of a lighting program for brown LOHMANN Hens adjusted to location, condition and requirements by LOHMANN TIERZUCHT lighting program tool



HYGIENE

To prevent diseases and epidemics, it's important to follow practical hygiene management. Single measures are often less effective – there is a need for an overall concept. Please contact your veterinarian or the LOHMANN TIERZUCHT Veterinary Laboratory for more information on a hygiene concept.

Key Points

- Build the farm at a safe distance from other poultry houses and fence it.
- Keep birds of only one age group and no other poultry on the farm.
- Don't allow visitors to enter the farm.
- Wear only the farm's own protective clothing within the farm area and also provide clothes for veterinarians, service, maintenance workers and consultants.
- Disinfect boots before entering the houses.
- Use bulk feed if possible. Do not allow the truck driver to enter the houses.
- Safeguard the houses against wild birds and vermins. Keep rats and mice under constant control.
- Dispose dead birds hygienically. Follow local laws and regulations.

VACCINATION PROGRAM

General Recommendations

Vaccinations are preventive measures against infectious diseases and help to keep flocks healthy and productive.

The success of vaccinations is determined essentially by the following factors:

1. Selection of suitable vaccines
2. Selection of appropriate vaccination times
3. Selection of suitable vaccination methods
4. Condition of birds to be vaccinated

Vaccines are veterinary medicinal products that are available on prescription from the veterinarian attending your flock. The manufacturer's directions for use must be strictly observed.

Depending on the region, hens kept in alternative systems should also be vaccinated against fowl pox and especially in the case of free-range hens, against EDS (Egg Drop Syndrome) as wild waterfowl are reservoirs for the EDS virus. A combined vaccination against IB, ND, EDS and sometimes also ART should be carried out.
Regular blood tests to monitor the success of vaccination measures are recommended.

Keep records of all vaccinations and vaccine serial numbers.

Supplementary Vaccinations

The infection pressure in deep litter systems is far greater than for cage birds. Moreover, strains of coliform bacteria and Pasteurella can occur and develop in a very narrow geographical area. In such cases, it may be necessary to design autogeneous vaccines for use in the rearing facility.

Mycoplasmosis Vaccination is only advisable if the farm cannot be kept free of mycoplasmosis. Infections with virulent mycoplasma species during the production period lead to a depression in performance. The best performance is achieved by flocks which are kept free of mycoplasmosis and are not vaccinated.

Vaccination against Coccidiosis is the most reliable method in floor rearing to develop immunity against this disease. The vaccine will multiply in the bird's digestive tract and be excreted and reconsumed via pecking. The immune system will be gradually strengthened with this process. As birds have to periodically re-consume the vaccine within the first 3 to 4 weeks of life, it's important that they stay in contact with their own manure. In aviary systems where the manure drops onto the manure belt, chick paper has to be placed on the wire mash to collect the manure. This way, chicks can develop a sufficient immunity against coccidiosis. When opening the aviary system, the chick paper should be moved into the litter area.
As the vaccine contains weakened coccidia strains, which react very sensitively to coccidiostats, do not use them when the chicks have been vaccinated.

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Table 5: Example of a Vaccination Program for LOHMANN Layers

Disease	Occurrence		Application Methods	Remarks
	World-wide	Locally		
Marek	●		SC – IM	Day 1 – Hatchery
Newcastle*	●		DW – SP – SC – IM	Number of vaccinations according to disease pressure
Gumboro	●		DW	2 live vaccinations recommended
Infectious Bronchitis*	●		DW – SP – SC – IM	Number of vaccinations according to disease pressure
AE	●		DW – SC – WW	Vaccination of PS and Commercials is recommended
Mycoplasmosis		●	SP – ED – SC – IM	Vaccination before transfer
Fowl Pox		●	WW	Vaccination before transfer
Pasteurellosis		●	SC	2 vaccinations approx. at week 8 and 14
Infectious Coryza		●	SC	2 vaccinations approx. at week 8 and 14
Salmonella		●	DW – SP – IM	Vaccination before transfer
ILT		●	DW – ED	2 vaccinations between 6 and 14 weeks
EDS		●	SC – IM	Vaccination before transfer
Coccidiosis	●		SP – DW	1. Vaccination between day 1 – 9

DW: Drinking Water SP: Spray ED: Eye Drop WW: Wing Web IM: Intramuscular Injection SC: Subcutaneous Injection

** An implementation of early live vaccination for Newcastle Disease (ND) and Infectious Bronchitis (IB) is of high value in order to induce local protection in the respiratory system of the chicks (priming effect). The right choice of vaccine is crucial. Never vaccinate very young birds with high-virulence live vaccine. Revaccination with live ND and/or IB every 6–8 weeks during production period is beneficial in order to improve the local immunity.*

The use of inactivated ND/IB/IBD vaccine before onset of lay is recommended.

A severe vaccination program especially intramuscular injections may depress the body weight development.

Applying Vitamins in the first two to three days after vaccination can help to reduce stress and prevent undesired reactions. To what extent this need to be done depends on the specific situation on each farm.

Vaccination Methods

Individual Vaccination – such as injections and eye-drops are very effective and generally well tolerated but also very labour intensive.

Drinking Water Vaccination is not laborious but must be carried out with the greatest care in order to be effective. The water used for preparing the vaccine solution must not contain any disinfectants. It must be of very good quality (see table 14, page 28). During the growing period, the birds should be without water for approximately 2 hours prior to vaccination. Reduce this time accordingly during hot weather. The amount of vaccine solutions should be calculated for complete consumption within 2 – 4 hours.

When vaccinating with live vaccines, add 2 g of skim milk powder per litre of water, canned milk or a vaccine stabiliser in order to protect the virus titre.

Spray Vaccinations are not labour intensive and are highly effective, but may occasionally have side effects. For chicks up to the age of 3 weeks, apply only coarse spray. Use distilled water for vaccination with temperatures ranging between 8 – 20 °C.

Serological Monitoring

To evaluate the immune status of the pullets towards the end of rearing, it is advisable to take a minimum of 25 blood samples from different birds of a flock and have these analysed in a veterinary laboratory. Based on these samples, the titres and the success of the vaccination can be evaluated. Take the blood samples at least 2 to 3 weeks prior to transfer.

BEAK TREATMENT

Birds reared on the floor and in aviaries can roam freely around the barn. These housing systems do not promote the formation of stable social structures like those found in smaller flocks. Scientific studies have shown that hens who do not know each other, first meet in the barn, explore their flock mates by pecking. This behaviour referred to as exploratory pecking, forms part of the natural repertoire of fowls.

Situations such as high dust levels, poor house climate, very high stocking densities in selected areas of the poultry house, reaction to vaccinations and other disruptive factors which, despite the very best efforts, cannot always be avoided in floor and aviary systems, often lead to a state of frustration in hens.
Aggressive feather pecking which occurs as a consequence of such stress situations have been observed to be a natural reaction by hens.

Beak treatment is recommended for hens in deep litter systems and aviaries in order to limit the adverse effects of both types of feather pecking and to minimize the risk of cannibalism.

If feather pecking occurs in a flock, please check the following parameters:

- **Nutritional condition and health status of the flock** – body weight, uniformity, signs of diseases.
- **Stocking density** – overcrowding or insufficient feeders and drinkers cause anxiety in the flock.
- **House climate** – temperature, humidity, air exchange rate or pollution by dust and / or harmful gases.
- **Light intensity / light source** – excessive light intensity, flickering light (low frequency fluorescent tubes or energy-saving bulbs emitting light at a very low frequency).
- **Ecto- and endoparasites** – infested birds are restless and develop diarrhea.
- **Feed consistency** – do not feed very finely ground meal-type rations or pelleted feed. Both encourage abnormal behaviour.
- **Amino acid content of the ration** – deficiencies of sulphur-containing amino acids cause problems.
- **Supply of calcium and sodium** – deficiency makes the birds irritable.

The EU directive on the management of laying hens (Council Regulation 74 / 1999 of 19.07.99) stipulates that the treatment of the beak tips may be performed up to the age of 10 days. In Germany, beak treatment is subject to authorization by a government veterinary officer.*

A very gentle and highly recommended method of beak treatment is the infrared treatment of the upper and lower beak by means of a special technique, performed shortly after chicks hatch. This procedure can already be done in the hatchery under very hygienic conditions by specially trained personnel. Even when done carefully, beak treatment is stressful for the chicks.

Subject to national regulations, beak treatment must be performed with utmost care! A poorly treated flock grows unevenly, resulting in lack of uniformity at the end of rearing.

** The treatment has to be done in accordance to the animal welfare regulations valid for the country where the chicks, pullets and layers are housed.*

MOLTING

Growing pullets change their plumage several times. The growing chick replaces the down of the day-old with a first full feather coat. This process is almost completed at 5 weeks of age. The bird's growth slows down during molting. Especially white layers are very sensitive during this time. Bad air quality can make a flock susceptible to feather pecking and cannibalism. If this misbehaviour during this critical phase occurs, light intensity should be reduced.

At 8 to 9 weeks of age, another slight but incomplete molt takes place. At this age, more feathers than usual can be found in the litter of floor-reared or aviary hens. An ntensive and complete change of plumage will be observed at 13 / 14 weeks of age. This molt also involves successively changing of flight feathers.
At 15 weeks, numerous feathers can be found on the floor of the poultry house of a well-developed flock.
The absence of molting at 13 weeks indicates poor weight development or lack of flock uniformity. Body weight and uniformity should then be determined as a matter of urgency. If the flock is found to be underweight, it is advisable to check for viral or bacterial infections (coccidiosis is a common cause of growth depres-

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sions) and to examine whether the feed quality is satisfactory.
If necessary, the feed can temporarily be enriched with 1 kg lysine per ton to balance out deficits in the growth immediately.

Only when the final molt is almost complete (normally at 15 to 16 weeks of age), light intensity and the length of illumination will increase in readiness for the impending start of lay. Practical experience has shown that the best time for moving the birds is in week 17 or 18.

BODY WEIGHT DEVELOPMENT AND UNIFORMITY

The uniformity of a flock is an important criteria to assess the quality of rearing. Uniformity can be used as a tool to find out whether all birds of a flock have been supplied with an equal amount of good quality feed. Uniformity is calculated based on the number of birds which are within a 10 % range of the average body weight. In order to determine this, 1 % of the entire flock has to be weighed individually. Please find below an example of how this can be calculated:

Example:

- 95 pullets weighed a total of 86.260 g
- 86.260 g divided by 95 birds = 908 g / Bird
- 908 g x 10 % = 91 g
- 908 g + 91 g = 999 g –> upper value
- 908 g – 91 g = 817 g –> lower value
- 81 birds weighed within the 817 g – 999 g range
- 81 divided by 95 times 100 = 85 % uniformity

Uniformity helps to predict the laying performance of a reared flock.

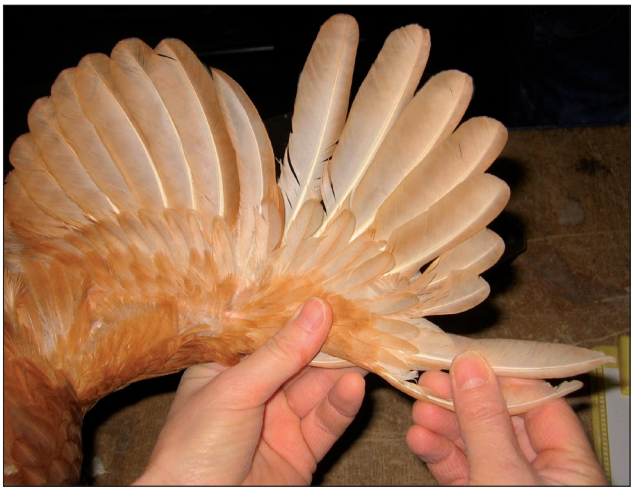
The highest uniformity can be observed at the age of 15 – 16 weeks. Afterwards, the birds develop sexual maturity. Sexual maturity starts unevenly and decreases the uniformity of a flock. Healthy flocks which are reared according to recommendations by breeders are very uniform.

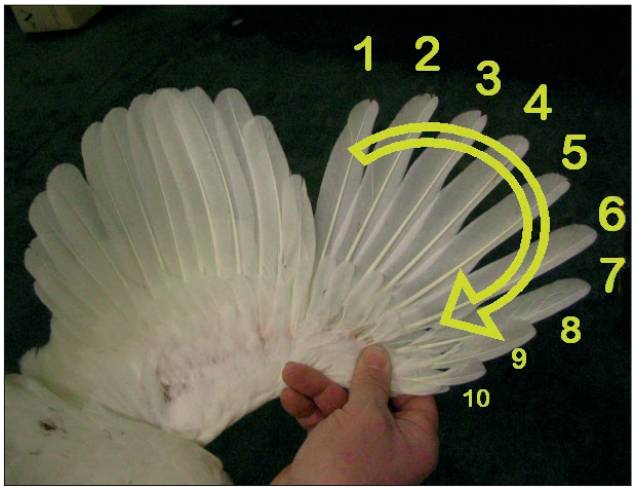
Table 6: Evaluating flock uniformity

very good	> 85 %
good	80 – 85 %
fair	70 – 80 %
poor	< 70 %

Factors which influence flock uniformity:
- Stocking density
- Feed structure (avoid selective feed intake)
- Trough length and height
- Availability of water
- Quality of beak treatment
- Stress factors (diseases, vaccination)
- Age of the flock when uniformity is measured
- Product variety
- Weighing method: the more birds you weigh, the more accurate the calculated uniformity will be

Wings of pullets at about 18 weeks of age:





We recommend weighing the chicks/pullets every week or fortnightly from 4 weeks of age until transfer to the layer facility, to obtain the average body weight and uniformity. By doing so, one can control if a flock is growing on target. These body weight figures are important in determining when an age dependent feed change has to be done.

Very low average body weights which are not in line with breeder's targets as well as bad uniformity are early symptoms for a performance drop in egg production and impending health problems. Bad uniformity in rearing can be a hint for an unbalanced relation in terms of feeding capacities or an uneven distribution of feed within the barn. It's advisable to check if lighter birds are found mainly in certain parts of the barn (e.g. in the lower tier). If this is the case, the lower feed chain has to be operated with a higher feed supply to enable these birds to catch up.

LOHMANN TIERZUCHT recommends a variety of specific body weight standards for each product. These include an average, minimum and maximum value for the rearing and production period. An evaluation of the average body weight development of a flock should be done by using only the average. By only taking the minimum or maximum value into account for evaluation, many birds might either be considered to be too heavy or too light.

Key Points

- Due to starvation before and during transport, weight losses of up to 15 % of body weight may occur.
- The basis for switching between diet types is the hens' body weight development. The correct time for changing the diet is not determined by age but rather body weight. Chicks and pullets should therefore be weighed at regular intervals.
- Very heavy pullets should be prevented. A slight overweight of up to 100 g can be tolerated and possibly be an advantage.

Body weight of flocks which are above target at an early age could be indications of early maturing. The body weight of these pullets might be considerably influenced by water stored in the pullets' body.

The body weight of matured birds is often used to predict the egg size for the production period. Practical experiences at LOHMANN TIERZUCHT have shown that the body weight at 12 – 13 weeks of age has a much higher influence on the later egg weight when compared to the mature body weight. Up to that age, 95 % of the frame size will be developed (see figure 2). A small frame size in combination with an insufficient body weight negatively influences the later egg weight.

Supplying very dense feed from 12 to 13 weeks onwards in order to catch up with the body weight will fatten the birds and the frame size will remain underdeveloped.

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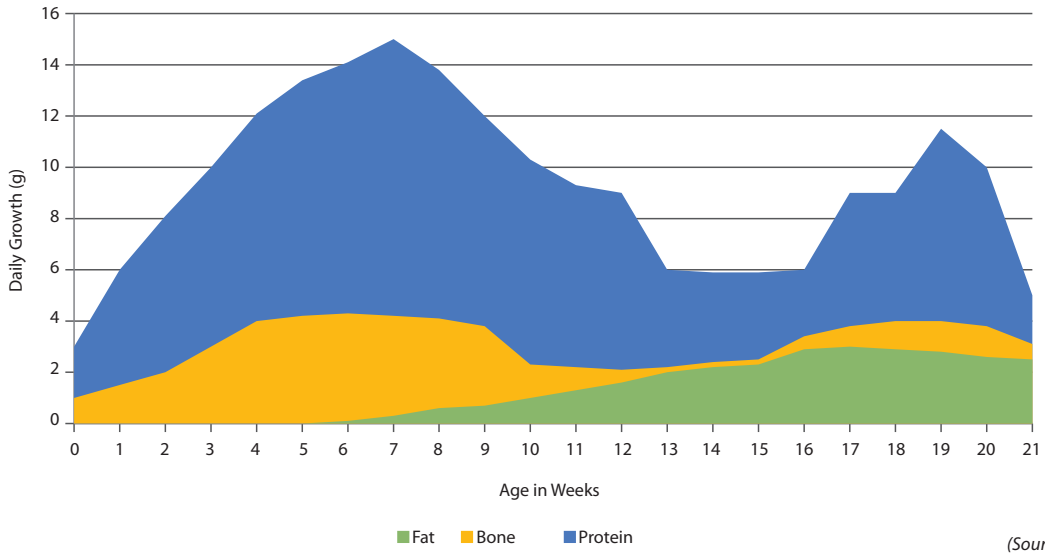
Figure 2: Development of Body Tissue



(Source: Ysilevitz, 2007)

Table 7: Body Weight Development of different LOHMANN Breeds

Age (Weeks)	Average Body Weight (g)							Feed
	Brown Hens					White Hens		
	LB-CLASSIC	LB-LITE	LB-EXTRA	LB-PLUS	Lohmann Tradition	LSL-CLASSIC	LSL-LITE	
1	75	75	75	75	76	75	70	Grower / Starter
2	130	125	130	130	132	125	120	
3	195	190	195	195	198	187	185	
4	275	270	275	275	280	257	255	
5	367	360	367	370	373	337	334	
6	475	465	475	480	483	429	425	
7	583	570	583	590	593	529	524	
8	685	670	685	695	697	624	618	
9	782	765	782	795	796	719	712	Developer
10	874	855	874	890	890	809	802	
11	961	940	961	980	978	887	880	
12	1043	1020	1043	1068	1062	957	950	
13	1123	1098	1123	1153	1143	1017	1010	
14	1197	1171	1197	1235	1219	1072	1065	
15	1264	1236	1264	1315	1287	1122	1115	
16	1330	1301	1330	1395	1354	1167	1160	
17	1400	1369	1400	1475	1426	1214	1207	
18	1475	1443	1475	1565	1502	1264	1257	Pre-Layer
19	1555	1521	1555	1655	1583	1322	1315	

NUTRITION

In addition to the lighting program and adequate body weight development, nutrition is the third key factor in reaching laying maturity.

Due to their higher activity levels, pullets which are kept on the floor or in aviary systems require more feed with the same nutrient density as caged birds. The nutrient requirements specified by the breeder for the product concerned should be taken into consideration when formulating diets for pullets. Generally, it remains true that all products of LOHMANN TIERZUCHT can utilise their full genetic potential with adequate nutrition. Fully nutritious feeding which match the performance potential of the birds has to be guaranteed by a compound feed.
Chicks and pullets should be fed a coarse diet of a meal type consistency (see table 8 for particle sizes). The feed should be homogeneous and should have a good structure. A high proportion of very fine components or a structure that is too coarse can lead to selective feed intake and an unbalanced nutrient supply.

A meal type feed should not contain whole grain. A diet with an extremely fine consistency reduces the feed intake of the birds and can result in a lacking supply of certain nutrients.
If pelletizing of feed is inevitable for hygienic reasons, the pellets should be crumbled to the recommended consistency.

During the different growing phases of chicks and pullets, qualitatively different feed varieties should be used in which the nutrient content meets the birds changing needs. Feed mills offer a four phase feeding program (Chick Starter, Grower, Developer, Pre-Layer).
The diets are matched to the nutrient requirements and weight development at each stage of growth. The switch to developer feed should only be made when the standard body weight has been reached. A reduced nutrient density and an increased content of crude fibre (5–6 %) during this phase are beneficial for improving nutrient intake.

Particularly for pullets reared in alternative housing systems which will be later transferred into non-cage facilities, the use of a pre-layer feed has to be recommended (see page 26: "The correct use of a pre-layer diet").

Pullets should already learn to empty the trough preferably once a day or at least several times per week. An even intake of coarse and fine feed particles will be assured and nutrient intake capacity can be improved. The birds should have the ability to eat bigger meals when trained at that time. This will be an advantage for the pullets reared under these regimes as they enter the laying period when feed intake has to be sufficient enough.

A good nutrient intake capacity is important especially at the start of lay. Layers need the nutrients consumed for egg production as well as to facilitate growth in body weight. If pullets are too heavy at this time, they won't eat enough and as such, mobilise nutrients from body reserves for egg production.

Table 8: Recommended Particle-Size Distribution for Chick's Starter, Grower, Developer and Layer Feed (Mash)

Sieve Size	Passing Part	Sieve Size Interval	Part of Interval
0.5 mm	19 %	0.0 – 0.5 mm	19 %
1.0 mm	40 %	0.51 – 1.0 mm	21 %
1.5 mm	75 %	1.01 – 1.5 mm	35 %
2.0 mm	90 %	1.51 – 2.0 mm	15 %
2.5 mm	100 %	> 2 mm	10 %*
			100 %

** Individual particles not bigger than*
3 mm in chick superstarter-/starter diets
5 mm in grower, developer and layer

Ad Libitum Feed Supply

LOHMANN Layers and their breeders are specialised birds selected for a high egg production. Because of their high turnover rates "feed into food", they have a big demand for nutrients. Layers in full production convert roughly one third of the consumed nutrients into eggs. There is no danger in wasting feed by supplying feed ad libitum, because the hens can adjust their intake to the nutrient density of the feed. But there is a real danger in restricting birds in feed intake. An undersupply of nutrients will harm the birds. They lose production and once exhausted, they easily can run into a health problem.

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Table 9: Average Feed Consumption of different LOHMANN Breeds

Age (Weeks)	Average feed consumption (g / Bird / day)*							Feed
	Brown hens					White hens		
	LB-CLASSIC	LB-LITE	LB-EXTRA	LSL-Plus	Lohmann Tradition	LSL-CLASSIC	LSL-LITE	
1	11	11	11	11	10	10	10	Grower / Starter
2	17	17	17	17	17	17	17	
3	22	22	22	25	22	23	23	
4	28	28	28	30	28	29	29	
5	35	35	35	40	35	34	34	
6	41	40	41	45	41	37	37	
7	47	46	47	50	48	41	41	
8	51	50	51	55	52	45	45	
9	55	54	55	60	56	49	49	Developer
10	58	57	58	65	59	53	53	
11	60	59	60	70	61	56	56	
12	64	63	64	75	64	60	60	
13	65	64	65	75	66	64	64	
14	68	67	68	75	68	67	67	
15	70	69	70	75	69	70	70	
16	71	70	71	80	72	73	73	
17	72	71	72	80	74	76	76	
18	75	74	75	90	77	79	79	Pre-Layer
19	81	80	81	95	83	84	84	

** by feeding the recommended feed qualities in table 10*

Table 10: Recommendations for Nutrient Levels in LOHMANN Breeds

Diet		Starter	Grower	Developer	Pre-Layer
Nutrient		Week 1 – 3	Week 4 – 8	Week 9 – 16	Week 17 – 5 % Production
Metabol. Energy	kcal	2900	2750 – 2800	2750 – 2800	2750 – 2800
	MJ	12.0	11.4	11.4	11.4
Crude Protein	%	20.0	18.5	14.5	17.5
Methionine	%	0.48	0.40	0.34	0.36
Dig. Methionine	%	0.39	0.33	0.28	0.29
Meth. / Cystine	%	0.83	0.70	0.60	0.68
Dig. M / C	%	0.68	0.57	0.50	0.56
Lysine	%	1.20	1.00	0.65	0.85
Dig. Lysine	%	0.98	0.82	0.53	0.70
Valine	%	0.89	0.75	0.53	0.64
Dig. Valine	%	0.76	0.64	0.46	0.55
Tryptophan	%	0.23	0.21	0.16	0.20
Dig. Tryptophan	%	0.19	0.17	0.13	0.16
Threonine	%	0.80	0.70	0.50	0.60
Dig. Threonine	%	0.65	0.57	0.40	0.49
Isoleucine	%	0.83	0.75	0.60	0.74
Dig. Isoleucine	%	0.68	0.62	0.50	0.61
Calcium	%	1.05	1.00	0.90	2.00
Phosphor, total	%	0.75	0.70	0.58	0.65
Phosphor, avail.	%	0.48	0.45	0.37	0.45
Sodium	%	0.18	0.17	0.16	0.16
Chloride	%	0.20	0.19	0.16	0.16
Linoleic Acid	%	2.00	1.40	1.00	1.00

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Correct Use of Pre-Layer Feed

Pre-layer feed should be used for a short period of time before a flock starts being supplied with phase 1 layer feed. This leads to a smooth transition from the developer feed (low calcium and low nutrient density) to a diet with high calcium and nutrient levels. It helps to prevent the often reduced appetite / daily feed intake during early production.

Typically, pre-layer feed contains about 2.0 – 2.5 % calcium. This is too much for a typical feed for rearing but not enough for a bird starting to produce eggs. From a nutritional point of view, this is considered as compromise and never as "optimal" feed. Nevertheless, it's worthwhile to use pre-layer feed for a short period of time. Correct use can enhance the uniformity of a pullet flock. It's especially beneficial for flocks with very low uniformity and also aids the development of Ca-metabolism in medullar bones.

Since pre-layer feed is a compromise feed for the short transition period, it cannot supply a bird which is in full lay sufficiently. Therefore, it cannot be used when feed logistics and correct timing do not work.

Key Points

- Start using pre-layer feed based on the birds' sexual maturity, age and their standard body weights.
- Use pre-layer feed for about 10 days with a maximum of 1 kg per bird.
- The wrong way to use pre-layer feed is either to start using it too early and / or using it too long.
- If onset of lay is scheduled for the 19th week of age, you may start feeding the birds with pre-layer feed only after they are 17 weeks of age. In case of an earlier or later production, adjust this schedule accordingly.
- **As soon as daily production reaches 5 %, change from the pre-layer to a layer diet.**

Crude Fibre

Crude fibre, sometimes described as insoluble NSP (Non-Starch Polysaccharides), may not have nutritional values for poultry, but it does have other benefits for a healthy and stable digestive physiology. Used in the second half of the rearing period, it can positively influence the development of the digestive tract, the crop size and the appetite of pullets. This is beneficial for young layers, especially at the start of production when the appetite of the birds is sometimes insufficient to meet their nutrient demands. The tool has been proven to be very beneficial under varying feeding situations in a lot of countries.

This is the reason for the implementation of minimum recommendation of crude fibre (5 – 6 %) in the developer feed for LOHMANN layers.

Cereals and their by-products (e.g. bran) or oil seed by-products (e.g. meal of sunflower or rapeseed), can be used as a source of crude fibre. DDGS (Dried Distillers Grains with Solubles) can be used as a source of crude fibre as well. Other raw materials, which are rich of crude fibre, may be used if available but only as long as their inclusion does not reduce the energy level of the diet. With the classical corn-soya diet, the recommended crude fibre content can hardly be achieved. In such cases, other feed ingredients must be used. For advice, please contact the technical service department at LOHMANN TIERZUCHT.

Grit

Grit stimulates the development of the crop and the gizzard during the rearing period, which in turn has a positive effect on feed intake capacity.

Table 11: Amount and Granulation of Grit Dependent on Age

Week 1 – 2	weekly 1 g / bird (size 1 – 2 mm)
Week 3 – 8	weekly 2 g / bird (size 3 – 4 mm)
from Week 9	monthly 3 g / bird (size 3 – 4 mm)

Supplements

Supplements ensure the necessary supply of essential vitamins, trace elements and substances such as anti-oxidants or carotenoids.

Suitable supplementation can compensate for the varying contents of raw materials and safeguard the supply of all necessary nutrients (see Table 12).

Table 12: Recommended Micro-Nutrient Specification for Chicken and Pullets

Supplements per kg Feed		Starter / Grower	Developer
Vitamin A	I.U.	10000	10000
Vitamin D_3	I.U.	2000	2000
Vitamin E	mg	20 – 30**	20 – 30**
Vitamin K_3	mg	3***	3***
Vitamin B_1	mg	1	1
Vitamin B_2	mg	6	6
Vitamin B_6	mg	3	3
Vitamin B_{12}	mcg	20	20
Pantothenic Acid	mg	8	8
Nicotinic Acid	mg	30	30
Folic Acid	mg	1	1
Biotin	mcg	50	50
Cholin	mg	300	300
Antioxydant	mg	100 –150**	100 –150**
Manganese*	mg	100	100
Zinc*	mg	60	60
Iron	mg	25	25
Copper*	mg	5	5
Iodine	mg	0.5	0.5
Selenium*	mg	0.2	0.2

** So called "organic sources" should be considered with higher bioavailability.*
*** according to fat addition*
**** double in case of heat treated feed*

Water

To ensure health and optimum egg quality, the water supplied to the hens should be of potable standard. The poultry farmer should therefore always ask himself if he would be prepared to drink the water offered to his birds. Feed and water intake are closely correlated. Chicks and pullets which do not drink enough water have an inadequate feed intake. Regular checks to ensure that drinkers are working properly are therefore recommended.
It's especially necessary to check even if the last nipple in the drinker line gets enough water.

When ambient temperatures are high or if birds have health problems, they consume more water. Under normal conditions, the ration of feed and water intake is at around 1:2. During hot weather, water serves to regulate the birds' body temperature. Cool drinking water is best for this purpose and water temperatures above 20 °C should therefore be avoided. During extremely hot weather with temperatures of over 30 °C, the feed to water intake ratio can shift to 1:5. In such situations, cooling of the drinking water is beneficial.

The water consumption during the first days of a chick's life is relatively low. In a brooding barn where temperatures of 35 – 36 °C in the first days are optimal, water temperature will increase. It is important to flush the water lines and change the water of the round drinkers regularly. Good brooding temperatures and the low water consumption of the young chicks in their first days of life promote the multiplication of bugs in the drinker lines and chick founds. When water is flushed / substituted temporarily, the build-up of the so-called biofilm in the drinkers can be avoided.

Table 13: Water consumption dependent from age of the flock (at 18–22 °C house temperature)

Age (Weeks)	Water Consumption (Feed : Water)
1 – 8	1 : 1.2
8 – 18	1 : 1.2 – 1.4
from 18	1 : 1.6 – 1.8

Water meters allow regular monitoring of the hens' water consumption. They are inexpensive and easy to install. A reduction or increase in water intake can be regarded as a first warning sign of problems in the flock or with the technology. Minimising water wastage reduces costs and improves the house climate.

Key Points

- Regular cleaning of the water lines in poultry buildings is essential and special attention should be paid whilst checking the supply tanks.
- If water from wells on the farm is used, regular tests of the water should be conducted (minimum once a year). The assessment of water quality should be based on the standards laid down in the Drinking Water Ordinance.
- Birds which have access to range areas should never be able to drink water out of puddles.

REARING OF PULLETS

The quality of water has to be as follows:

Table 14: Recommendations for water quality (German Drinking Water Ordinance)

Parameter	Limiting Value
pH Value	≥ 6,5 and ≤ 9,5 pH-Units
Ammonia	0.50 mg / l
Nitrite	0.50 mg / l
Nitrate	50 mg / l
Chloride	250 mg / l
Sodium	200 mg / l
Iron	0.200 mg / l
Lead	0.010 mg / l
Copper	2 mg / l
Manganese	0.050 mg / l
Sulphate	250 mg / l
E. Coli	0 / 100 ml
Enterococcus	0 / 100 ml

Do bear in mind that sour water or water containing iron, harms vaccines and drugs.

The water consumption of the birds will clearly increase at roughly 10 – 14 days prior to the onset of lay. During this time, the ovary and laying organs will develop and water will be stored especially in the follicles of the ovary.

TRANSFER TO THE LAYING HOUSE

The move from the growing facility to the laying house should be done gently but quickly. Catching and transporting is stressful for the birds. They also have to adapt to a strange environment. A stress-free transfer and careful acclimatisation of the flock to the new management system are crucial and ensure good production results.

The development from a pullet to a mature laying hen is characterised by a basic change of all vital physiological and hormone regulations. The phase of the juvenile and body tissue growth is nearly completed and is followed by the onset of lay. At the start of egg production, however, hens' bodies are not fully developed. The growth curve will only flatten after 30 weeks of age when weekly body weight gain stays lower than 5 g.

It is advisable to move pullets from alternative rearing systems in good time before the proposed onset of lay. This ensures that the pullets become familiar with their new surroundings before they start to lay. We recommend transferring pullets at an age of 16 to 18 weeks. Pullets have to be placed in a layer barn evenly near feeders and drinkers. **Water and feed have to be available immediately.**

Keep the water pressure inside the drinker lines low during the first days after transfer. The water drops hanging on the nipples motivate the birds to drink. As soon as the birds start to use the nipples, the pressure inside the drinker lines can be set to normal.

It is normal for pullets to lose weight after transport and housing. It is therefore important that the birds are quickly able to find feed and water to ensure sufficient feed intake. Effective ways of encouraging pullets to eat include moistening the feed, running the feeding lines more frequently, the use of skim milk powder or whey fat concentrate and vitamin supplements. Pullets must not lose weight after being transferred. They should continue to gain weight, or at least maintain their body weight.

If the housing system permits it and provided stocking densities are not exceeded by doing so, the pullets should be confined to the grid above the dropping pit or in the aviary.

Partially closing the scratching area (leaving the birds a minimum scratching area) and manually moving disorientated birds back into the system have also proved effective.

Upon arrival in the new barns, the light should be left on so that the hens can find their way around. In extreme cases, the light should not be switched off for up to 24 hours whilst observing the day / night rhythm. However, if the pullets are extremely tired on arrival, it may be recommendable to turn the light off for a short period of rest.

The layer barn should be warmed up before the flocks' arrival. Cold barns can be the reason for inactive birds which don't drink and eat. House temperatures of between 18 – 20 °C should be achieved.

MANAGEMENT OF LAYING HENS

HOUSING SYSTEMS

Design of laying houses

This manual does not propose to describe the technical construction of alternative laying hen housing in detail. It merely outlines the basic requirements for laying houses. Before planning and executing any building work on new housing or converting existing buildings to deep litter houses and aviary systems, it is essential to consult experts.

The construction of barn systems and aviaries with winter gardens, eventually with additional range areas, must meet different and often higher standards than cage housing. As the birds spend at least some of their time directly on the barn floor, this should be heat-insulated. A lower stocking density per m^2 of floor space compared with conventional cages and the associated reduction in the amount of heat generated by the hens in the room must be taken into consideration when designing ventilation and air-conditioning.
The dispersion of the hens within the building depends on its size, compartments within the shed and in particular, air flow and house climate. If the latter two factors are relatively uniform, the hens will disperse evenly within the shed and feel comfortable. Otherwise, the birds will crowd together in areas of the shed they find suitable. The litter in such overused areas can become heavily soiled, the proportion of harmful gases can rise and in the worst case scenario, the hens could suffocate to death.

Nests must be easily accessible to all hens and preferably positioned in a central location in the laying house. As the hens can choose whether or not to use the nests for egg laying and since not every hen would have learnt to lay eggs in the nest, some eggs will be laid in the scratching area, on the dropping pit or in the aviary system. It is therefore crucial to get the hens used to the nests.
Eggs laid outside the nest are hygienically undesirable and have to be marketed at discounts.

In barn systems or aviaries, a large quantity of dust is generated by hens using the littered scratching area and moving about. This can pose a health hazard for the birds.
If barns are combined with a range area, the building should be aligned in a north-south direction. This prevents the walls from heating up at different rates and differences in the amount of light entering the two halves of the building when the pop holes are open.
The design of the building and its installations should be user-friendly to allow easy servicing.

Barn systems

Barn systems for laying hens can vary considerably in design and layout depending on the type of building. The classic form consists of 60 – 80 cm high dropping pits covered with wooden, wire mesh or plastic slats. These take up two-thirds of the floor space.

Feeders, drinkers and laying nests should be positioned on top of the dropping pit and the drinkers should be mounted at a distance of 30 to 50 cm directly in front of the entrance to the nest.

A littered scratching area of sand, straw, wood shavings or other materials which occupies one-third of the floor space, gives the hens room to move, scratching and dust-bathing. The littered scratching area takes up about one-third of the total floor space, but can be replaced completely with perforated flooring in a modified variant. In this case, it is recommended to provide an additional winter garden where the birds can express their natural behaviours such as scratching and dust-bathing.
Stocking densities should not exceed 9 hens per m^2 (of usable floor space)*.
Rails or other elevated perching facilities should be provided as resting places for the hens.

Aviary systems

Aviaries are systems in which birds can roam on several levels. The levels are covered with wire mesh, plastic slats or are made out of wood. Manure belt ventilation can also be installed if desired. Feeding and drinking equipment are usually located on the lower tiers. The upper tiers usually serve as resting areas for the birds. Depending on the aviary system, the laying nests are either within the system or outside. **A stocking density of up to 18 hens per m^2 of floor area can be used in this housing system.*** Controlled lighting and staggered feeding times encourage the birds to move around the different levels.

Manufacturers now supply a wide range of aviary systems where laying hens can be kept successfully and achieve high production. Before deciding on which system to use, the egg producer should look at the existing construction and select an installation that can be readily adapted to the existing building. When constructing a new facility, the casing of the house and the aviary installation should preferably be designed to match. If the aviary system

** The stocking density has to be adjusted in accordance to the animal welfare regulations valid for the country where the layers are housed.*

MANAGEMENT OF LAYING HENS

where the pullets were raised is similar to the type installed in the subsequent laying house, familiarisation problems can be minimized. This aspect should also be considered when establishing an aviary system for laying hens.

Free range systems

In free range systems, a normal barn or aviary system is combined with a range area **(4 m² floor area per hen*)** for the hens. The range area must be available to the birds during the day. Pop holes spread along the entire length of the building provide access to the exterior. A winter garden attached to the poultry house has proven to be highly beneficial. The hens cross the winter garden to get to the range area. Winter gardens in front of the laying house have a positive effect on both litter quality and the climate of the house. Most of the dirt carried by the hens from outside remains in the winter garden. Since cold air cannot flow straight into the building when the pop holes are opened, the climate indoors would not be so greatly affected as it would be without a winter garden.

The egg producer should also bear in mind that in order to successfully adapt hens to alternative systems, other factors need to be considered which may have to be discussed with the pullet supplier. **The more closely the growing facility resembles the future production system, the easier it will be for the pullets to settle down in their new barn.**

Range

Range areas have to be offered to layers according to the weather conditions. Hens should be kept inside the barn three weeks after transfer. This ensures a complete adaptation to the equipment inside. Thereafter, the pop holes can be opened. If a winter garden is available, the birds should have access to the same one week prior to the opening of the pop holes to the range. During lay, pop holes should be opened after the main laying time. Rules concerning the availability of the ranges as stipulated in the marketing of "Free Range Eggs" have to be followed.

Young flocks going outside for the first time need to be trained in the use of the range. The route from the laying house to the outside and back must be easy to find. Food and water should only be available indoors.

** The stocking density has to be adjusted in accordance to the animal welfare regulations valid for the country where the layers are housed.*

Pasture ranges

Hens readily accept the range if the pasture area is surrounded by a few trees or bushes which provide protection from predators. The area closest to the laying house will be heavily used by the flock and the grass becomes worn.

The range area has to be well maintained. Hens tend to use the areas closest to the barn intensively, consume all the grass and the ground will get more condensed as a result of this. Water can't evaporate easily thereby resulting in undesirable puddles.

The range area is a real challenge for maintaining a high hygienic status. It is beneficial to carry out an annually dressing with lime for the range. The range has to be kept bird free after this disinfection for two weeks.

Depending on the condition of this part of the range, care of the grounds and disinfection measures should be carried out. Pasture rotation has proved effective in practice.

Young pullets ranging on pastures with good vegetation for the first time tend to ingest numerous plants, stones, etc. This can greatly reduce their feed intake capacity. Failure to consume sufficient feed, especially during the phase of peak egg production, will jeopardise the hens' nutrient supply. In practice, this often leads to weight loss, reduced production and increased susceptibility to disease.

Young flocks should therefore be gradually introduced to using the ranges. It is essential to ensure that the hens consume sufficient feed.

Perimeter fence

A solid perimeter fence for the range is a one-off investment that is definitely worthwhile. Range areas must be kept free from foxes, stray cats and dogs, polecats and martens. A two metre high fence provides protection from predators. An external electric fence can increase the level of protection.

MANAGEMENT

Management during the early days

During the first few days after housing, it is important to stimulate sufficient feed intake. The hens should be encouraged to increase their feed consumption as quickly as possible.

Some ways to achieve this are to:

- Provide an attractive type of feed with good structure
- Run the feeding lines more frequently
- Feed on an empty trough
- Illumination of the feeder lines
- Moistening the feed
- Use of skim milk powder or whey-fat concentrate
- Vitamin supplements

Pullets should not lose weight after being transferred. They should continue to gain weight, or at least maintain their body weight.

Lamps should be placed in such a way that the entire building and the entrance to the nests are well-lit. These should be programed so that only the light above the dropping pit or above the resting zones of the aviary system is on before the end of the lighting day. This will enable and motivate the hens to get back to the system at the end of the day.

Litter

The type and quality of the litter are of importance for the hens and the climate of the house. Different materials may be used:

- Wood shavings
- Cellulose pellets
- Coarse wood shavings
- Wheat, spelt, rye straw
- Bark mulch
- Sand or gravel up to 8 mm granule size

Regardless of the litter material used, it should be absolutely hygienic.
Wood shavings should be dust-free and not chemically pre-treated. Straw must be clean and free of mould. Sand and gravel should be dry when distributed. A litter depth of 1 – 2 cm is sufficient. Litter should preferably be distributed after the hens have been housed and be spread by the hens themselves if possible. This prevents the formation of condensed water between the floor and litter. Straw litter has the advantage of encouraging the hens to forage in the litter material. This stimulates their natural investigative and feeding behaviour and reduces vices. Removal and replacing of litter in heavily frequented areas of the building is often unavoidable during the laying period.

To prevent litter from sticking together, it is recommendable to distribute whole grain to critical areas in the barn once a day. Birds increase pecking and scratching in these areas and the litter will be slackened. Not more than 3 – 5 g grain per bird / day should be supplied to maintain a good feed intake. Winter gardens in front of the laying house have a positive effect on litter quality. When the pop holes are opened, cold air does not flow directly into the building. As such, the climate indoors will be less affected as it would be without a winter garden.

House climate

Room temperatures of 18 °C are considered optimal for laying hens in alternative systems. Especially at housing, temperatures between 18 – 20 °C should be achieved to get an optimal start of production. A relative humidity of between 60 and 70 % is tolerated by the hens. Lower temperatures during the winter months will also not pose a problem for the hens, i.e. if they have got used to them. High temperatures exceeding 30 °C are however, less well tolerated. During heat spells, when room temperatures above 30 °C are unavoidable, sufficient air circulation around the hens should be ensured to help the birds give off body heat into the atmosphere. The use of additional fans in the poultry house is highly effective in such situations.

Hens which have access to a winter garden or an outdoor enclosure should be adapted to colder winter temperatures. The quality of the plumage needs to be taken into consideration in temperature management programs for laying hens in alternative housing. Climate and room temperature are heavily influenced by the activity of the birds, stocking density and the presence of pop holes, if any.

Draughts are harmful for the birds. Draughty areas are avoided by the hens which prefer to congregate in poorly ventilated parts of the building. Mortalities due to smothering and the incidence of floor eggs are supported by poor ventilation. The ventilation system should ensure that warm air is extracted quickly from the birds' surroundings in summer and that the building does not become too cold in winter. High concentrations of noxious gases should be avoided. Ammonia reduces the bird's comfort and is also hazardous to health. A well designed winter garden and the use of a bird lock or a wind protection device like a strip curtain can prevent controlled airflow from being interrupted when the negative pressure system is active. If problems in the ventilation of the barn or aviary houses occur, it is advisable to consult a specialist. Recommendations on the concentration of single gases can be found in table 2 on page 13.

Equipment

The more closely the growing facility resembles the future production system, the easier it will be for the pullets to settle down in their new surroundings. Simple things like a difference in the colour or functionality of the nipple drinkers can hinder hens from easily adjusting themselves to the new environment.

Laying nests

Laying nests should be designed and positioned in such a way that they are easily accessible to the hens, preferably in a central location in the barn. It is recommended to keep the entrance to the nest well-lit whereas the interior should be darkened.

Pullets should not be allowed access to the nests too early, only just before the onset of lay. This enhances the attractiveness of the nest and improves nest acceptance.

MANAGEMENT OF LAYING HENS

During the laying period, the nests should be opened 2 – 3 hours before the start of the lighting day and closed 2 – 3 hours before the end of the lighting day.
Closing the nests at night prevents soiling and broodiness. Close-out prevents the hens from roosting in the nests overnight and also makes the nest less attractive to mites. Tilting floors have proven to be effective for close-out. They also help keep the nest box floor clean.

Important Remark:
Before eggs are laid every morning, the egg belt should be moved once in a complete circle. By doing so, dust and manure can be removed and laid eggs can roll down onto a clean belt. **Ensure that eggs which have been laid in the afternoon of the previous day, be collected in the evening so that this does not disrupt the cleaning process.**

Key Points
What makes nests attractive?
1. The right position: a calm place. Drinkers should be installed in front of the nests
2. Comfortable nest floor: Astro Turf, rubber floor, litter (chaff of grain or spelt straw).
3. The right intensity of light: Lit the entrance of the nest very well. The inside of the nest should however, be kept dark (1 Lux).
4. Sufficient number of nests.
5. Avoidance of draft in nests.

Lighting

The best source of light for laying hens is a high frequency bulb emitting light within the natural spectrum (frequency range above 2000 Hz). Low frequency Fluorescent tubes or energy-saving bulbs (50 – 100 Hz) have a disco effect on hens and encourage feather pecking and cannibalism (this does not happen with incandescent bulbs).
Lamps should have a dimmer switch.
LEDs (**l**ight **e**mitting **d**iodes) can also be used in non-cage rearing and production systems for laying hens. LEDs emitting white light are preferable, especially those which can be used underneath and within the systems. One should use high frequency lamps for the ceiling and the walls. There are no LEDs available until today which can be used as stand-alone lamps for non-cage systems.

Lighting programs

Bear in mind that a flock should never have to experience an increasing day length until the stimulation has been planned. Furthermore, the day length should never be decreased during the production period. In barns which can be darkened, this should not be a problem if air inlets and exhausting fans are trapped by light. In this case, optimal lighting program for the respective variety of products can be used.

Table 15: Equipment Requirement for Production Period

Equipment / Adjustment	Requirement
Darkness	At least 8 hours or natural dark phase
Distances	Max. 8 m to feeder / drinker
Feeder Space	Feeding trough: 5 m / 100 hens Round feeder: 4 feeders (ø 40 cm) for 100 hens
Drinkers	Chain drinkers: 1 running meter for 80 – 100 hens Bell drinker: 1 drinker (ø 46 cm) for 125 hens Nipple: 1 Nipple for 6 – 8 hens
Nests	Single nests: 1 Nest (26 x 30 cm) / 4 hens Group nests: 120 hens / m^2
Perches	15 cm / hen; distance between perches 30 cm
Dropping Pit	80 – 90 cm deep to hold the droppings from one batch if manure scraper is available; 7° gradient up to the nest
Proprotion of Litter Area	At least 33 % of the floor area
Pop Holes	Minimum size: 45 cm in height for 500 hens per running m. Pop holes from barn to winter garden and those from winter garden to range should spread out

The stocking densities have to be adjusted in accordance to the animal welfare regulations valid for the country where the hicks / pullets are housed. Organic egg producers might have to follow different or specific regulations.

Special considerations for hens kept in buildings with natural daylight

When designing the lighting program for housing, it should be taken into consideration about whether hens have access to winter gardens or an outdoor enclosure, or if windows, ventilation shafts and other openings cannot be blacked out sufficiently to protect the birds completely from the effects of natural daylight.
Advice on how to create lighting programs for facilities which are influenced by natural daylight (the seasonal swing of the length of day) can be found on page 16.

It makes a difference whether the housed pullets come from a windowless growing facility or if they were reared in a building whose windows were blacked-out in synchronicity with the lighting program or whether they were fully exposed to natural daylight during the growing period.

In the case of hens which did not realise the natural change of the lighting day during rearing (windowless housing or windows with blackout facility), it is important to avoid excessive stimulation when transferring the same to open laying houses. This will result in stress due to the abrupt lengthening of the day (in spring and summer). An increase in the day length by not more than 2 – 3 hours is desirable.

In open housing, the lighting program in the spring and summer months are determined by the length of the natural day which reaches a maximum of about 17 hours daylight*. When the natural day length begins to decrease from July onwards, the 17-hour day length should be constantly maintained until the end of the laying period.
* Central Europe

This is easily achieved by using an automatic time clock and dimmer switch:

- 04.00* hours: light on – dimmer switch off at > 50 – 60 Lux
- Dimmer switch on at ≤ 50 – 60 Lux – 21.00* hours light off

** CE summer time*

The artificial light should preferably not be switched on before 04.00 hours (CE summer time).

Table 16: Lighting Program for white and brown hens in closed houses

Age (Weeks)	Product			
	LSL-CLASSIC, LSL-LITE		LB-CLASSIC, LB-LITE, LB-EXTRA, LB-PLUS, Lohmann Tradition	
	Light (hours)	Light intensity (Lux)	Light (hours)	Light intensity (Lux)
17	8	4 – 6	10	10 – 15
18	8	10 – 15	11	10 – 15
19	9	10 – 15	12	10 – 15
20	10	10 – 15	13	10 – 15
21	11	10 – 15	14	10 – 15
22	12	10 – 15	14	10 – 15
23	13	10 – 15	14	10 – 15
24	14	10 – 15	14	10 – 15
25*	14 – 16	10 – 15	14 – 16	10 – 15

** until end of production*

MANAGEMENT OF LAYING HENS

Crucial points to consider in the management of laying hens, the choice of light sources and the design of lighting programs:

- Artificial light from fluorescent bulbs operating within a frequency range at 50 – 60 Hz is perceived as flickering by hens. Incandescent bulbs or fluorescent tubes operating at high frequencies over 2000 Hz are preferable.
- Artificial filtered light, but also unfiltered light from conventional light sources, restricts the vision of hens by limiting the light spectrum that is visible to them.
- Stimulation of hens in windowless housing follows the simple principle of shortening the light period until the desired stimulation time has been achieved, followed by a lengthening of the light period. A reduction of the day length during the laying period is not allowed.
- If technically possible, open housing for laying hens should also have facilities for blacking out the windows. These could then be opened and shut in synchronicity with the lighting program or remain completely shut until the maximum day length has been reached (in accordance with the lighting program).

The egg producer and the pullet supplier should agree on the following in order to coordinate lighting programs during rearing and the subsequent laying period:

- For pullets which are moved to open housing with windows that do not have a blackout facility, an option would be to design lighting programs which are synchronised with the hatching date of the flock. In order to avoid a "light shock" if re-housing were to take place during a period of very long days, the step-down program during rearing should be modified in such a way that upon transfer to the laying house, the hens are exposed to an increase in day length of not more than two or three hours at the most.
- If technically possible, open housing for laying hens should also have facilities for blacking out the windows. These could then be opened and shut in synchronicity with the lighting program or remain completely shut until the maximum day length has been reached (in accordance with the lighting program).
- Hens reared under artificial light and later moved to housing with natural daylight have to get used to the altered perception of their surroundings.
- Pullets reared in buildings that cannot be darkened are affected by the length of the natural day, especially in the spring and summer months. Early maturing of pullets can only be prevented by adapted lighting programs, but effective stimulation of such hens with lighting programs is only possible to a certain extent.

Flock control

In the first days after housing, the foundations are laid for the behaviour of the flock during the laying period. Paying special attention to detail during the first two weeks after moving the flock to an alternative production system will result in ample dividends later on.
Every morning after the light is switched on, it is necessary to conduct a thorough inspection. This should comprise checks for the proper functioning of:

- Drinkers
- Feeders
- Lighting installations and
- Laying nests

The climate of the house should be checked and the condition of the flock and the hen's behaviour assessed.

Floor eggs

Immediately after the start of lay, multiple inspections are recommended to collect floor eggs, if any. This helps the hens to get used to the attendants while at the same time, rapidly reducing the quantity of floor eggs.

The occurrence of floor eggs can be reduced by incorporating the following experiences in the design of the laying house and the management of young flocks:

- Laying nests should be readily accessible to the hens and positioned in a central location in the barn
- The entire building should be well-lit, dark corners and excessively littered scratching areas should be avoided
- Draughty nests disturb the hens during lay and should therefore be avoided
- The entrance to the nest must be clearly visible to the hens.

- Additional lighting of the interior of the nest can improve nest acceptance at the onset of lay.
- Litter depth should not exceed 2 cm at the onset of the laying period. Light-coloured litter material is preferable to dark material.
- Feeders and drinkers should not be more than 2 to 3 meters away from the nest area.
- The provision of drinking water in the vicinity of the nest entices the hens to this area.
- Feeders and drinkers should be positioned in such a way that they do not create attractive areas for egg laying.
- If nest boxes are mounted on the dropping pits, the perforated floors should have a gradient of about 7° towards the nest. This increases the motivation of the hens to deposit eggs in the nest.
- If walkable surfaces are installed in front of the nests, these should incorporate barriers every two meters to stop the hens from parading in front of the nests and blocking the access.
- Pullets should not be moved to the production facility before 17 – 18 weeks of age.
- The laying nests should be opened 10 to 14 days before the onset of lay.
- Hens should not be disturbed while laying eggs. Avoid feeding at this time, if possible.
- Do not carry out flock inspections during the main laying period in the morning.
- Floor eggs should be collected quickly and if necessary, several times a day.
- If floor eggs still occur, increasing the day length by adding an extra hour of light at the start of the day is often an effective solution.

ANIMAL HEALTH

Vaccinations

Pullets destined for deep litter, aviary systems and free range are vaccinated in the rearing period against viral (Marek's Disease, IB, ND, Gumboro, ILT), bacterial (Salmonella) and parasitic diseases (Coccidiosis) (see "Vaccination" in chapter "rearing pullets").
In alternative layer housing systems, the infection pressure from Fowlpox and EDS is so high that the birds should also be vaccinated against these diseases, if there are any risks of infection.
Combined vaccinations against IB, ND, EDS and sometimes also against ART are widely applied. Booster vaccinations against IB are advisable at 6 – 8-week intervals.
In addition to the vaccinations given during rearing, an additional booster vaccination is required for the high infection pressure of Salmonella.
Bacterial infections such as E. coli, Erysipelas and Pasteurella Multocida are common in alternative production systems. Outbreaks depend on the type of infectious agent, the infection pressure and the condition of the flock.
Immune protection can also be achieved by combined vaccinations. Effective treatment of bacterial infections in laying hens is hardly possible.
As there are currently no medications available for Coccidia, Pasteurella, Erysipelas etc., preventive vaccination with autogenous vaccines is therefore advisable. This initial outlay can help prevent high losses and a premature end to production. The bacteria causing Erysipelas and Pasteurella infections are usually found in rodent pests in the vicinity of affected hens. Effective control of mice and rats is an important tool for prevention.

A local veterinarian should be consulted when setting-up a vaccination schedule as he would be aware of the disease situation in the region.

Parasites

Roundworms and threadworms occur in hens and are transmitted via the droppings. If worm infestation is suspected, a swab of faecal sample should be taken and sent to a veterinary laboratory for analysis. If necessary, the flock may have to be de-wormed.

Red poultry mites are a major problem in alternative production systems. They damage health and affect the productivity of flocks. Heavy infestation can also cause high mortalities (by transmitting diseases). Infestation causes distress in the flock (feather pecking, cannibalism, depressed production). Continuous monitoring of the flock is therefore advisable.

Common hiding places of mites are:
- In corners of nest boxes
- Under next box covers
- At the foot of feeding chains, trough connectors
- On crossbars of perches
- On dropping pit trays
- In the corners of walls and
- Inside the perches (hollow tubes).

Mites should be combated with the application of acaricides or other suitable chemicals. These should be applied in the evening as mites are active during the night. It is important that the treatment reaches all hiding places of the mites.
The amount of chemicals applied isn't as substantial as compared to how it's thoroughly and uniformly distributed. The mite and beetle treatment should begin as soon as the flock has been depopulated, i.e. while the laying house is still warm.

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Otherwise, these pests will crawl away and hide in inaccessible areas of the laying house.

In the last years, the extraction of liquid silicate dust (96 % amorphous diatomite) has been proven to be successful. This is a bio-physical treatment and doesn't have any latency time. Additionally, mites are not able to build up resistance to such a treatment. The effectiveness is very high, i.e. if the extraction is done properly.

Rodent pests

Housing for laying hens should be free of rats and mice. They carry disease and are often the cause of bacterial infections in the flock. Rats and mice are often carriers of Salmonella as well. A severe rodent infestation should be eradicated immediately and effectively by a professional pest controller.

The use of suitable building materials, good structural maintenance and the closing of all openings in the walls of the building (ventilation grids) are ways of keeping rodent numbers down. Shingles and pebbledash (1 – 2 m applied to exterior walls) are avoided by rats and can reduce their numbers in the vicinity of poultry buildings.

Behavioural disorders

Watch closely for any signs of abnormal behaviour such as feather pecking or cannibalism. If feather pecking or cannibalism suddenly occurs, the same parameters as mentioned in the rearing chapter (see page 19) should be looked at.

The following measures can be taken when behavioural disorder occurs:

- Reduce light intensity
- Enrich the environment: supply grain into the litter, place soft rocks or bales of alfalfa in the barn to motivate the hens to occupy themselves
- Make sure that hens empty the trough once a day to avoid selective eating
- If applicable, reduce stocking density or form small groups

FEEDING

The nutrient requirement of a laying hen is divided into the requirement for maintenance, for growth and for egg production. This way, recommended nutrient allowances can be formulated irrespective of the production system. This enables allowances to be accurately matched to alternative management systems.
The maintenance requirement of a laying hen is approximately 60 – 65 % of the total energy requirement. Compared with laying hens kept in cages or in small groups under optimal management conditions, the maintenance requirement in alternative systems is higher due to the increased activity of the hens. It has been calculated at +10 % for floor hens and +15 % for free range hens.

The daily nutrient intake of laying hens can be calculated using the following formula:

Nutrient content in the diet
x
feed intake /hen/ day
=
nutrient intake /hen / day

Example:
11,4 MJ/kg x 115 g / hen / day
=
1.31 MJ / hen / day

The necessary prerequisites for a good and sufficiently high nutrient intake of hens are:

- a diet with a sufficiently high energy content / nutrient density
- and an adequate feed intake

Raising the nutrient density / nutrient content of layer diets is not always economically viable. As such, an adequate feed intake per hen and day is an important prerequisite for the hen's normal genetic production potential.

The feed intake capacity of the laying hen is determined by many factors and can also be altered by genetic measures. It is mainly dependent on:

- The hen's body weight
- Laying performance
- Ambient temperature
- Condition of the hen's plumage
- Energy content of the ration
- Genetics
- Health status

In alternative systems, pullets are sometimes moved to the laying house as early as 16 – 18 weeks old. At that age, however, the birds are not fully developed yet and should therefore not be fed with a layer diet.
The high calcium content of a layer diet would prematurely stimulate the hens to lay eggs. Layer diets with more than 3 % calcium should therefore not be introduced too early. At 16 – 18 or 17 – 19 weeks of age the hens in the laying house are still fed a pre-lay diet for another two weeks. The change to a high-density layer starter should not be made until about 5 % daily production is reached. The time for feeding a pre-layer diet and the best time for switching should be coordinated with the pullet supplier. Precise information concerning the correct use of the pre-layer

diet can be found in the chapter rearing on page 26.

The changes occurring during the transition phase from pullet to laying hen often lead to a reduced feed intake, which may, in some cases, drop to well below 100 g per hen and day. This rate of consumption does not, however, meet the hen's nutrient requirement at that age and based on the standard energy levels of commercial layer rations, must definitely be considered too low. A suboptimal nutrient supply at the onset of lay places a strain on the birds' metabolism as endogenous energy reserves have to be mobilized and it can potentially contribute to the development of fatty liver syndrome.
During this phase, every effort must be made to increase the feed intake as quickly as possible to at least 120 g per bird and day.

Measures how to increase the feed intake in this critical phase:
- Frequently operate the feeders
- Wet the feed slightly
- Feed on an empty feeder
- Use only feed of excellent structure.

Phase feeding

The basis for any feeding program in alternative production systems must be the hens nutrient requirement. This changes continuously as the birds get older. This is why different types and formulation of feed should be utilised:

- **Layer starter (phase 1)** with high nutrient density for a safe start to the laying period. This feed has been designed to meet the demand for a maximum egg mass production of the different breeds.
- Balanced **phase 2 diets** ensure good laying persistency with a slightly reduced protein and amino acid content and a reduced linoleic acid content as well.
- **Phase 3 diets** are designed for optimal shell quality and corresponding egg weights.

The recommended nutrient demands shown in the tables 9 – 11 (phase 1 – 3) assume a dietary energy concentration of 11.4 MJ/kg (2725 kcal) metabolisable energy, a house temperature of 20 °C and good plumage.

The time for switching diets is determined more by the level of production and the need for calcium rather than by age.

Major changes in the raw material composition of the various phase diets or marked changes in feed consistency should be avoided.

In order to guarantee an optimal start of production with feed intake of around 90 – 100 g/day, it is recommendable to use a phase 1 feed with 11.6 ME MJ (2770 Kcal) for a period of 5 – 6 weeks. At around 26 weeks, a normal phase feeding program with 11.4 ME MJ (2725 Kcal)/kg should be introduced. The basis for the feed formulation in terms of nutrient and mineral content in each phase is the daily nutrient requirement and actual feed consumption.

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Table 17: Recommended Nutrient Level for different LOHMANN Layers
Phase 1 per kg of feed for different Daily Feed Consumption
Approx. week 19 – 45*

Nutrient (%)	Daily Feed Consumption									
	Requirement g / Hen / Day		105 g		110 g		115 g		120 g	
	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE
Protein	18.70	18.50	17.81	17.62	17.00	16.82	16.26	16.09	15.58	15.42
Calcium***	4.10	4.10	3.90	3.90	3.73	3.73	3.57	3.57	3.42	3.42
Phosphorus****	0.60	0.60	0.57	0.57	0.55	0.55	0.52	0.52	0.50	0.50
Av. Phosphorus	0.42	0.42	0.40	0.40	0.38	0.38	0.37	0.37	0.35	0.35
Sodium	0.18	0.18	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15
Chlorine	0.18	0.18	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15
Lysine	0.88	0.87	0.84	0.82	0.80	0.79	0.76	0.75	0.73	0.72
Dig. Lysine	0.72	0.71	0.69	0.68	0.65	0.65	0.63	0.62	0.60	0.59
Methionine	0.44	0.44	0.42	0.42	0.40	0.40	0.38	0.38	0.37	0.37
Dig. Methionine	0.36	0.36	0.34	0.34	0.33	0.33	0.31	0.31	0.30	0.30
Meth. / Cyst.	0.80	0.80	0.76	0.76	0.73	0.73	0.69	0.69	0.67	0.67
Dig. M / C	0.66	0.66	0.62	0.62	0.60	0.60	0.57	0.57	0.55	0.55
Arginine	0.91	0.91	0.87	0.87	0.83	0.83	0.80	0.80	0.76	0.76
Dig. Arginine	0.75	0.75	0.71	0.71	0.68	0.68	0.65	0.65	0.63	0.63
Valine	0.74	0.74	0.71	0.71	0.67	0.67	0.64	0.64	0.62	0.62
Dig. Valine	0.63	0.63	0.60	0.60	0.57	0.57	0.55	0.55	0.53	0.53
Tryptophan	0.18	0.18	0.17	0.17	0.17	0.17	0.16	0.16	0.15	0.15
Dig. Tryptophan	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13
Threonine	0.61	0.61	0.58	0.58	0.55	0.55	0.53	0.53	0.51	0.51
Dig. Threonine	0.50	0.50	0.48	0.48	0.45	0.45	0.43	0.43	0.42	0.42
Isoleucine	0.70	0.70	0.66	0.66	0.63	0.63	0.60	0.60	0.58	0.58
Dig. Isoleucine	0.57	0.57	0.54	0.54	0.52	0.52	0.50	0.50	0.48	0.48
Linoleic Acid	2.00	2.20	1.90	2.10	1.82	2.00	1.74	1.91	1.67	1.83

* *Until the maximum daily egg mass is reached, please refer to tables 28–34.*
** *LT = Lohmann Tradition*
*** *Please refer to table 21 about relation of fine and coarse limestone.*
**** *without phytase*

Table 18: Recommended Nutrient Level for different LOHMANN Layers
Phase 2 per kg of feed of different daily feed consumption
Approx. Week 46 – 65*

Nutrient (%)	Daily Feed Consumption									
	Requirement g / Hen / Day		105 g		110 g		115 g		120 g	
	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT**	LSL-CLASSIC LSL-LITE
Protein	17.95	17.76	17.10	16.91	16.32	16.15	15.61	15.44	14.96	14.80
Calcium***	4.40	4.40	4.19	4.19	4.00	4.00	3.83	3.83	3.67	3.67
Phosphorus****	0.58	0.58	0.55	0.55	0.52	0.52	0.50	0.50	0.48	0.48
Av. Phosphorus	0.40	0.40	0.38	0.38	0.37	0.37	0.35	0.35	0.34	0.34
Sodium	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14
Chlorine	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14
Lysine	0.84	0.83	0.80	0.79	0.77	0.76	0.73	0.72	0.70	0.69
Dig. Lysine	0.69	0.68	0.66	0.65	0.63	0.62	0.60	0.59	0.58	0.57
Methionine	0.42	0.42	0.40	0.40	0.38	0.38	0.37	0.37	0.35	0.35
Dig. Methionine	0.35	0.35	0.33	0.33	0.31	0.31	0.30	0.30	0.29	0.29
Meth. / Cyst.	0.77	0.77	0.73	0.73	0.70	0.70	0.67	0.67	0.64	0.64
Dig. M / C	0.63	0.63	0.60	0.60	0.57	0.57	0.55	0.55	0.52	0.52
Arginine	0.88	0.88	0.84	0.84	0.80	0.80	0.76	0.76	0.73	0.73
Dig. Arginine	0.72	0.72	0.69	0.69	0.65	0.65	0.63	0.63	0.60	0.60
Valine	0.71	0.71	0.68	0.68	0.65	0.65	0.62	0.62	0.59	0.59
Dig. Valine	0.60	0.60	0.58	0.58	0.55	0.55	0.53	0.53	0.50	0.50
Tryptophan	0.18	0.18	0.17	0.17	0.16	0.16	0.15	0.15	0.15	0.15
Dig. Tryptophan	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.12
Threonine	0.59	0.59	0.56	0.56	0.53	0.53	0.51	0.51	0.49	0.49
Dig. Threonine	0.48	0.48	0.46	0.46	0.44	0.44	0.42	0.42	0.40	0.40
Isoleucine	0.67	0.67	0.64	0.64	0.61	0.61	0.58	0.58	0.56	0.56
Dig. Isoleucine	0.55	0.55	0.52	0.52	0.50	0.50	0.48	0.48	0.46	0.46
Linoleic Acid	1.60	1.60	1.52	1.52	1.45	1.45	1.39	1.39	1.33	1.33

** After the maximum daily egg mass is reached, please refer to tables 28–34.*
*** LT = Lohmann Tradition*
**** Please refer to table 21 about relation of fine and coarse limestone.*
***** without phytase*

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Table 19: Recommended Nutrient Level for different LOHMANN Layers
Phase 3 per kg of feed of different Daily Feed Consumption
After Week 65

Nutrient (%)	Daily Feed Consumption									
	Requirement g / Hen / Day		105 g		110 g		115 g		120 g	
	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT*	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT*	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT*	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT*	LSL-CLASSIC LSL-LITE	LB-CLASSIC LB-LITE LB-EXTRA LB-PLUS LT*	LSL-CLASSIC LSL-LITE
Protein	17.02	16.84	16.21	16.03	15.47	15.30	14.80	14.64	14.18	14.03
Calcium**	4.50	4.50	4.29	4.29	4.09	4.09	3.91	3.91	3.75	3.75
Phosphorus***	0.55	0.55	0.52	0.52	0.50	0.50	0.47	0.47	0.46	0.46
Av. Phosphorus	0.38	0.38	0.36	0.36	0.35	0.35	0.33	0.33	0.32	0.32
Sodium	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.14	0.14
Chlorine	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.14	0.14
Lysine	0.80	0.79	0.76	0.75	0.73	0.72	0.69	0.69	0.67	0.66
Dig. Lysine	0.66	0.65	0.62	0.62	0.60	0.59	0.57	0.56	0.55	0.54
Methionine	0.40	0.40	0.38	0.38	0.36	0.36	0.35	0.35	0.33	0.33
Dig. Methionine	0.33	0.33	0.31	0.31	0.30	0.30	0.28	0.28	0.27	0.27
Meth. / Cyst.	0.73	0.73	0.69	0.69	0.66	0.66	0.63	0.63	0.61	0.61
Dig. M / C	0.60	0.60	0.57	0.57	0.54	0.54	0.52	0.52	0.50	0.50
Arginine	0.83	0.83	0.79	0.79	0.76	0.76	0.72	0.72	0.69	0.69
Dig. Arginine	0.68	0.68	0.65	0.65	0.62	0.62	0.59	0.59	0.57	0.57
Valine	0.67	0.67	0.64	0.64	0.61	0.61	0.59	0.59	0.56	0.56
Dig. Valine	0.57	0.57	0.55	0.55	0.52	0.52	0.50	0.50	0.48	0.48
Tryptophan	0.17	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.14	0.14
Dig. Tryptophan	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11
Threonine	0.55	0.55	0.53	0.53	0.50	0.50	0.48	0.48	0.46	0.46
Dig. Threonine	0.46	0.46	0.43	0.43	0.41	0.41	0.40	0.40	0.38	0.38
Isoleucine	0.63	0.63	0.60	0.60	0.58	0.58	0.55	0.55	0.53	0.53
Dig. Isoleucine	0.52	0.52	0.49	0.49	0.47	0.47	0.45	0.45	0.43	0.43
Linoleic Acid	1.30	1.30	1.24	1.24	1.18	1.18	1.13	1.13	1.08	1.08

** LT = Lohmann Tradition*
*** Please refer to table 21 about relation of fine and coarse limestone.*
***** without phytase*

The basic principles of phase feeding can also be implemented in laying hen operations with several age groups and only one feed silo. Even here, the hens changing nutrient requirements can be met by selecting appropriate feed types, although expert advice should be sought from a poultry nutritionist. The best way of ensuring an optimal feed and nutrient supply is to have a separate feed silo for each age group. This variant is also preferable from an economic perspective. In larger laying hen facilities with several housing units, it is recommended to supply each housing unit by aid of two silos. This facilitates cleaning of the silos and allows a quick change of diet if necessary. The alternate filling of two separate feed silos makes it easy to check the feed consumption of each flock and to determine the feed intake per hen. Modern, computer-controlled systems should, however, be available in large operations to facilitate accurate measurement of feed consumption.

Feeding and egg weight

Egg weight can be manipulated to some extent by adjusting nutrition to fit farm-specific requirements. The hens diet can be adjusted to achieve different objectives:

- During rearing, hens are fed for a high/lower body weight/frame size at onset of lay, aiming at a high/medium egg weight throughout the laying period.
- By increasing dietary crude protein, methionine and linoleic acid concentrations while maintaining a balanced energy supply, egg weight development is influenced positively or, alternatively, restricted by reducing the above components.
- Egg weight can be increased by stimulating feed intake with structured feed, selecting the optimal feeding time and adjusting the number of daily feedings.
- Egg weight development can be kept under control by controlled feeding and if necessary, with a restriction on feed intake.

The production of eggs with the correct weight for the market is of prime importance in alternative housing systems. Egg weight and shell quality are negatively correlated. Large eggs at the end of lay often have a poorer shell quality. Measures to control egg weight should therefore begin during the pullet rearing phase and be implemented in the early stages. A noticeable reduction in egg weight is very difficult to achieve in high production flocks during the laying period. It is therefore advisable to talk to the pullet producer and feed supplier as early as possible regarding the diet formulations to be used.

Supplements

Supplements ensure the necessary supply of essential vitamins, trace elements and substances such as anti-oxidants or carotinoids.

Suitable supplements can compensate for the varying contents of raw materials and safeguard the supply of all necessary nutrients.

Table 20: Recommended Micro-Nutrient Specification for LOHMANN Layers

Supplements per kg feed		Pre-layer / Layer diet
Vitamin A	I.U.	10000
Vitamin D_3	I.U.	2500
Vitamin E	mg	15 – 30**
Vitamin K_3	mg	3***
Vitamin B_1	mg	1
Vitamin B_2	mg	4
Vitamin B_6	mg	3
Vitamin B_{12}	mcg	25
Pantothenic Acid	mg	10
Nicotinic Acid	mg	30
Folic Acid	mg	0.5
Biotin	mcg	50
Cholin	mg	400
Antioxydan	mg	100 – 150**
Manganese*	mg	100
Zinc*	mg	60
Iron	mg	25
Copper*	mg	5
Iodine	mg	0.5
Selenium*	mg	0.2

** so called "organic sources" has a better biological availability*
*** according to fat additives*
**** double in cases of heat treated feed*

Vitamin C is normally synthesized by poultry. This vitamin is not considered as essential, but in certain circumstances such as heat stress or hot climate, it may be beneficial to add 100 – 200 mg/kg complete feed during the production period.

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Table 21: Continuous Supply of Fine and Coarse Limestone (Recommended Relation in Feed)

Feed type	Fine Limestone 0 – 0.5 mm	Coarse Limestone* 1.5 – 3.5 mm
Layer Phase 1	30 %	70 %
Layer Phase 2	25 %	75 %
Layer Phase 3	15 %	85 %

** can be partly replaced by oyster shells*

Table 22: Condition of plumage and daily energy maintenance requirement (at 18–22 °C house temperature)

	Plumage (%)					
	100	90	80	70	60	50
Additional maintenance requirements (kcal)	0	7.5	14.4	21.6	28.8	36
Additional feed requirement (g / day) *	0	2.6	5.2	7.8	10.4	13

** Feed with 2770 kcal, or 11.6 MJ /kg*

Source: Peguri et al., 1993

Condition of plumage and feed intake

Maintaining the hens plumage in good condition throughout the production period should be a major concern of every farmer. In doing so, he fulfils his legal obligations under animal welfare laws, but well-maintained plumage is also essential for keeping the hens in good health. It protects against heat loss, thus restricting feed consumption. The increased feed and nutrient requirement of hens with damaged plumage is explained by the maintenance requirement, which accounts for 60 – 65 % of the total nutrient requirement and in this case, is needed to maintain the birds body temperature. A daily feed consumption of 130 g / hen / day (or more) is therefore not unusual in special situations.

Grit

Insoluble grit or fine gravel should be provided for free access feeding, also for fully grown laying hens. Due to the specialised digestive system of birds, this can stimulate digestion and improve nutrient intake capacity.

The following are reference values for granulation and amount of grit to be supplied:

Once a month 3 g / hen (4 – 6 mm granulation)

WATER

Drinking water should be of acceptable quality even for laying hens. Only sufficient water quality ensures sufficient water and feed intake. Precise details concerning water quality can be found in the chapter "water" on page 27. All details provided are also valid for adult laying hens (see table 14).

CLEANING AND DISINFECTION

As soon as the hens have been moved out, it is advisable to treat walls and ceilings with insecticides whilst the building is still warm. All portable equipment (drinkers, feeders) should be taken outside. Litter and droppings must be disposed of. All litter must be removed and brought as far away from the building as possible (> 1 km). Stabilising materials such as wood chips or similar should be removed from the outdoor area adjacent to the laying house and replaced at the same time as the litter. Prior to the cleaning operation (24 h), the entire interior of the building, including walls, ceilings and the remaining furniture, should be soaked. Fat and protein-dissolving substances should be used for this purpose. The room should then be cleaned with pressure washers, starting with the ceiling and working down towards the floor. Special attention should be paid to ventilation elements, pipework, edges and the tops of beams. The room should be well lit during the cleaning operation so that dirt deposits are clearly visible. After washing, all surfaces and equipment should be rinsed with clean water.

The furniture that was taken outside and the external carcass of the building including any concrete surfaces should be washed down. Dirty drinkers are potential hazard sources and must therefore

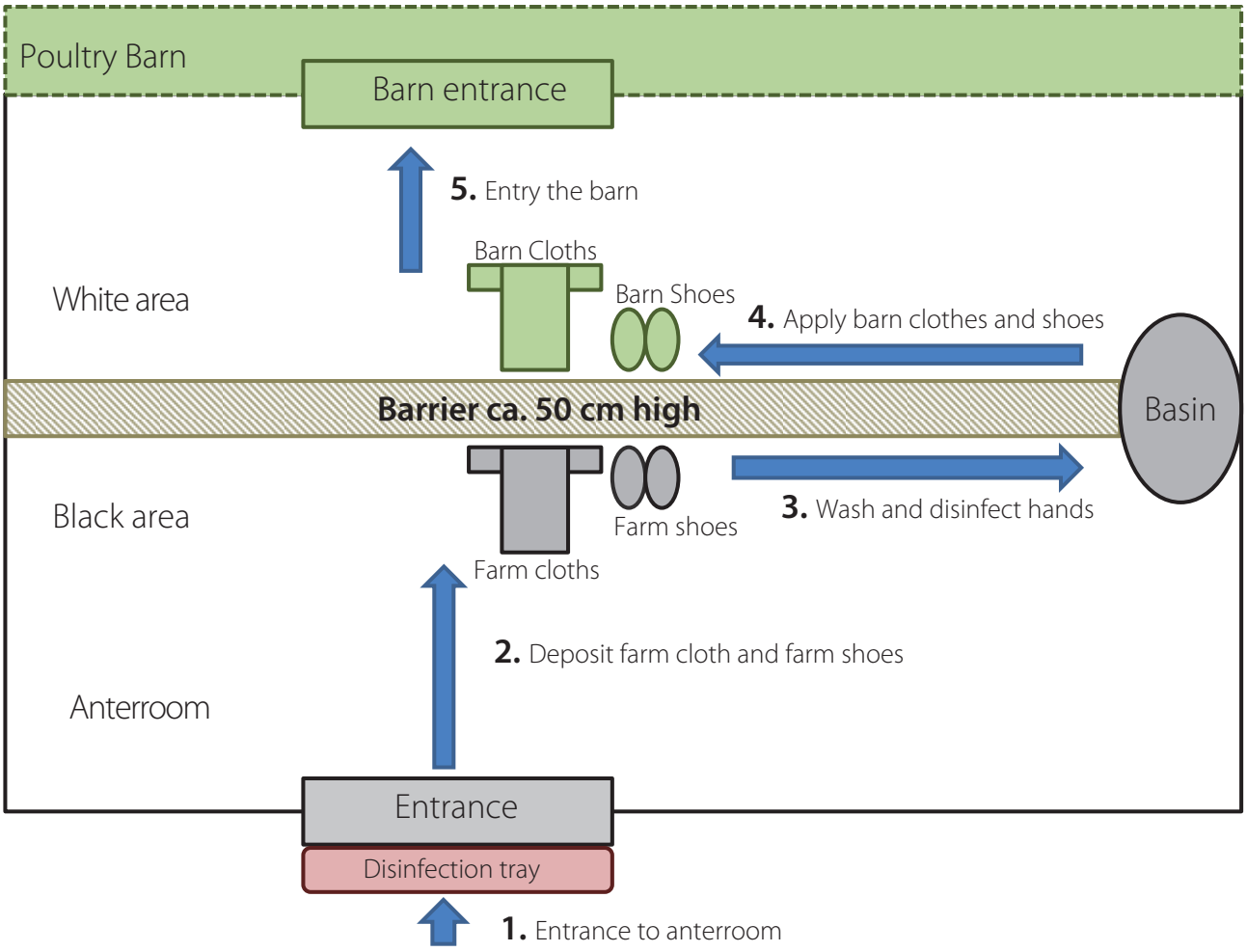
be cleaned and disinfected. Drinker lines should be thoroughly flushed out after disinfection. Disinfectant residues in drinkers should be avoided. Any traces of leftover feed should be removed from the farm. All parts of the feeding installation and the feed silo should be thoroughly cleaned, washed and disinfected.

Consult the manufacturer when choosing or combining disinfectants. Pathogenic agents can build up resistances. Therefore, a regular switch of active components is advisable.

Before entering a barn, clothes and shoes have to be changed. For this purpose, a simple personnel lock should be installed, which can be handled easily but not avoided (see figure 3 as example of a hygiene lock).

A possibility to wash and disinfect the hands should be installed at all barn entrances.

Figure 3: Example of a simple hygienic sluice

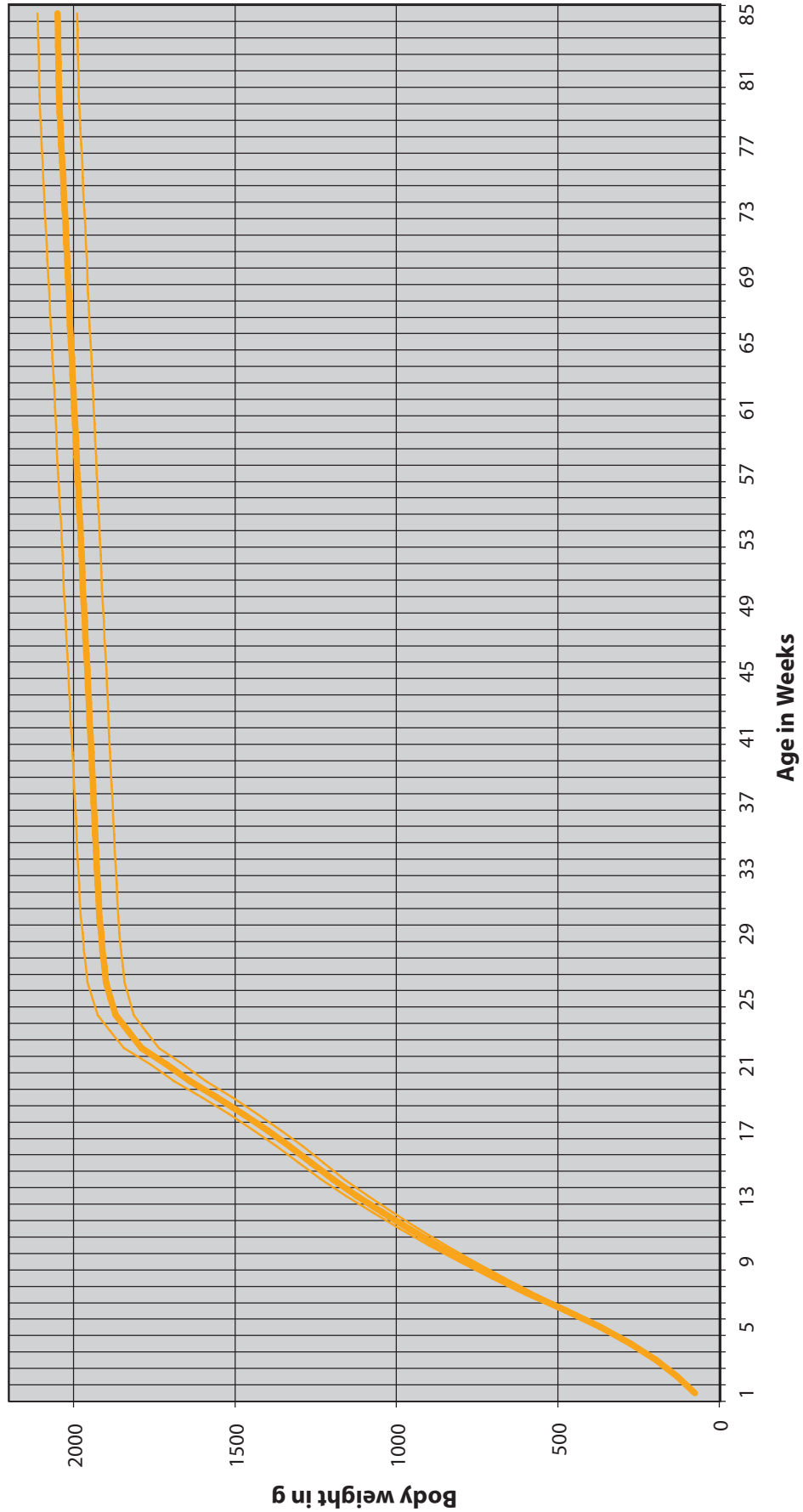


GENERAL INFORMATION

Table 23: Body Weight Development of LOHMANN BROWN-CLASSIC

Age	Min.	Max.	Standard
1	73	77	75
2	126	134	130
3	189	201	195
4	267	283	275
5	356	378	367
6	461	489	475
7	566	600	583
8	664	706	685
9	759	805	782
10	848	900	874
11	932	990	961
12	1012	1074	1043
13	1089	1157	1123
14	1161	1233	1197
15	1226	1302	1264
16	1290	1370	1330
17	1358	1442	1400
18	1431	1519	1475
19	1508	1602	1555
20	1591	1689	1640
21	1660	1762	1711
22	1736	1844	1790
23	1775	1885	1830
24	1814	1926	1870
25	1828	1942	1885
26	1843	1957	1900
27	1848	1962	1905
28	1854	1968	1911
29	1858	1972	1915
30	1862	1978	1920
31	1865	1981	1923
32	1867	1983	1925
33	1870	1986	1928
34	1873	1989	1931
35	1875	1991	1933
36	1877	1993	1935
37	1880	1996	1938
38	1882	1998	1940
39	1885	2001	1943
40	1887	2003	1945
41	1890	2006	1948
42	1892	2010	1951
43	1894	2012	1953
44	1896	2014	1955
45	1899	2017	1958
46	1901	2019	1960
47	1904	2022	1963
48	1906	2024	1965
49	1909	2027	1968
50	1912	2030	1971
51	1914	2032	1973
52	1916	2034	1975
53	1919	2037	1978
54	1921	2039	1980
55	1924	2044	1984
56	1925	2045	1985
57	1929	2049	1989
58	1931	2051	1991
59	1933	2053	1993
60	1935	2055	1995
61	1938	2058	1998
62	1940	2060	2000
63	1943	2063	2003
64	1945	2065	2005
65	1948	2068	2008
66	1951	2071	2011
67	1953	2073	2013
68	1955	2075	2015
69	1957	2079	2018
70	1959	2081	2020
71	1962	2084	2023
72	1964	2086	2025
73	1967	2089	2028
74	1970	2092	2031
75	1972	2094	2033
76	1974	2096	2035
77	1977	2099	2038
78	1979	2101	2040
79	1982	2104	2043
80	1984	2106	2045
81	1985	2107	2046
82	1986	2108	2047
83	1987	2109	2048
84	1988	2110	2049
85	1989	2112	2050

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN BROWN-CLASSIC

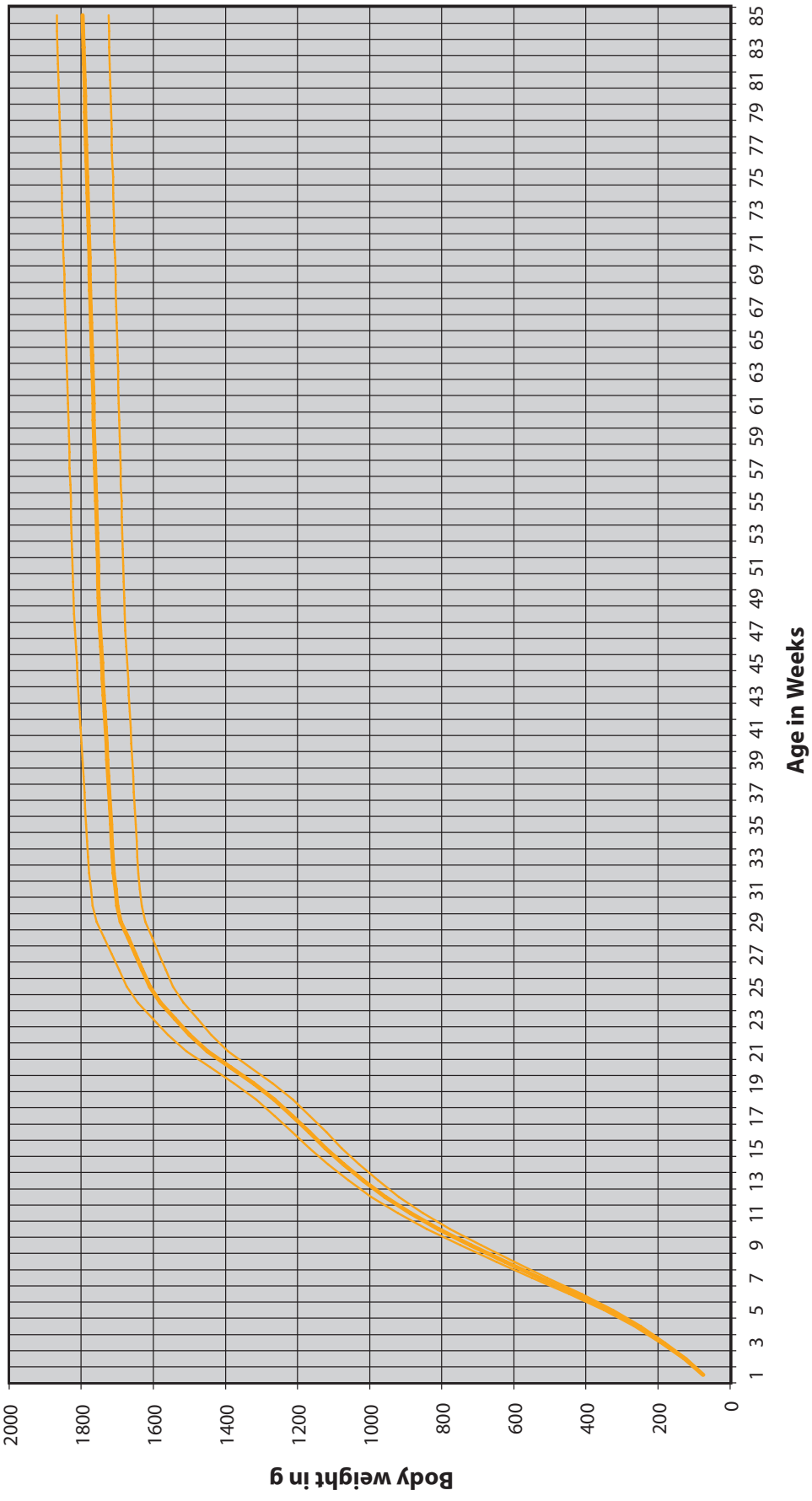


GENERAL INFORMATION

Table 24: Body Weight Development of LOHMANN LSL-CLASSIC

Age	Min.	Max.	Standard
1	72	78	75
2	120	130	125
3	180	194	187
4	247	267	257
5	324	350	337
6	412	446	429
7	508	550	529
8	599	649	624
9	690	748	719
10	777	841	809
11	852	922	887
12	919	995	957
13	976	1058	1017
14	1029	1115	1072
15	1077	1167	1122
16	1120	1214	1167
17	1165	1263	1214
18	1213	1315	1264
19	1269	1375	1322
20	1331	1441	1386
21	1392	1508	1450
22	1440	1560	1500
23	1478	1602	1540
24	1517	1643	1580
25	1546	1674	1610
26	1565	1695	1630
27	1584	1716	1650
28	1603	1737	1670
29	1622	1758	1690
30	1632	1768	1700
31	1637	1773	1705
32	1642	1778	1710
33	1644	1781	1713
34	1646	1784	1715
35	1649	1786	1718
36	1651	1789	1720
37	1654	1791	1723
38	1656	1794	1725
39	1658	1797	1728
40	1661	1799	1730
41	1663	1802	1733
42	1666	1804	1735
43	1668	1807	1738
44	1670	1810	1740
45	1673	1812	1743
46	1675	1815	1745
47	1678	1817	1748
48	1680	1820	1750
49	1681	1821	1751
50	1682	1823	1753
51	1684	1824	1754
52	1685	1825	1755
53	1686	1827	1756
54	1687	1828	1758
55	1688	1829	1759
56	1690	1830	1760
57	1691	1832	1761
58	1692	1833	1763
59	1693	1834	1764
60	1694	1836	1765
61	1696	1837	1766
62	1697	1838	1768
63	1698	1840	1769
64	1699	1841	1770
65	1700	1842	1771
66	1702	1843	1773
67	1703	1845	1774
68	1704	1846	1775
69	1705	1847	1776
70	1706	1849	1778
71	1708	1850	1779
72	1709	1851	1780
73	1710	1853	1781
74	1711	1854	1783
75	1712	1855	1784
76	1714	1856	1785
77	1715	1858	1786
78	1716	1859	1788
79	1717	1860	1789
80	1718	1862	1790
81	1720	1863	1791
82	1721	1864	1793
83	1722	1866	1794
84	1723	1867	1795
85	1724	1868	1796

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN LSL-CLASSIC

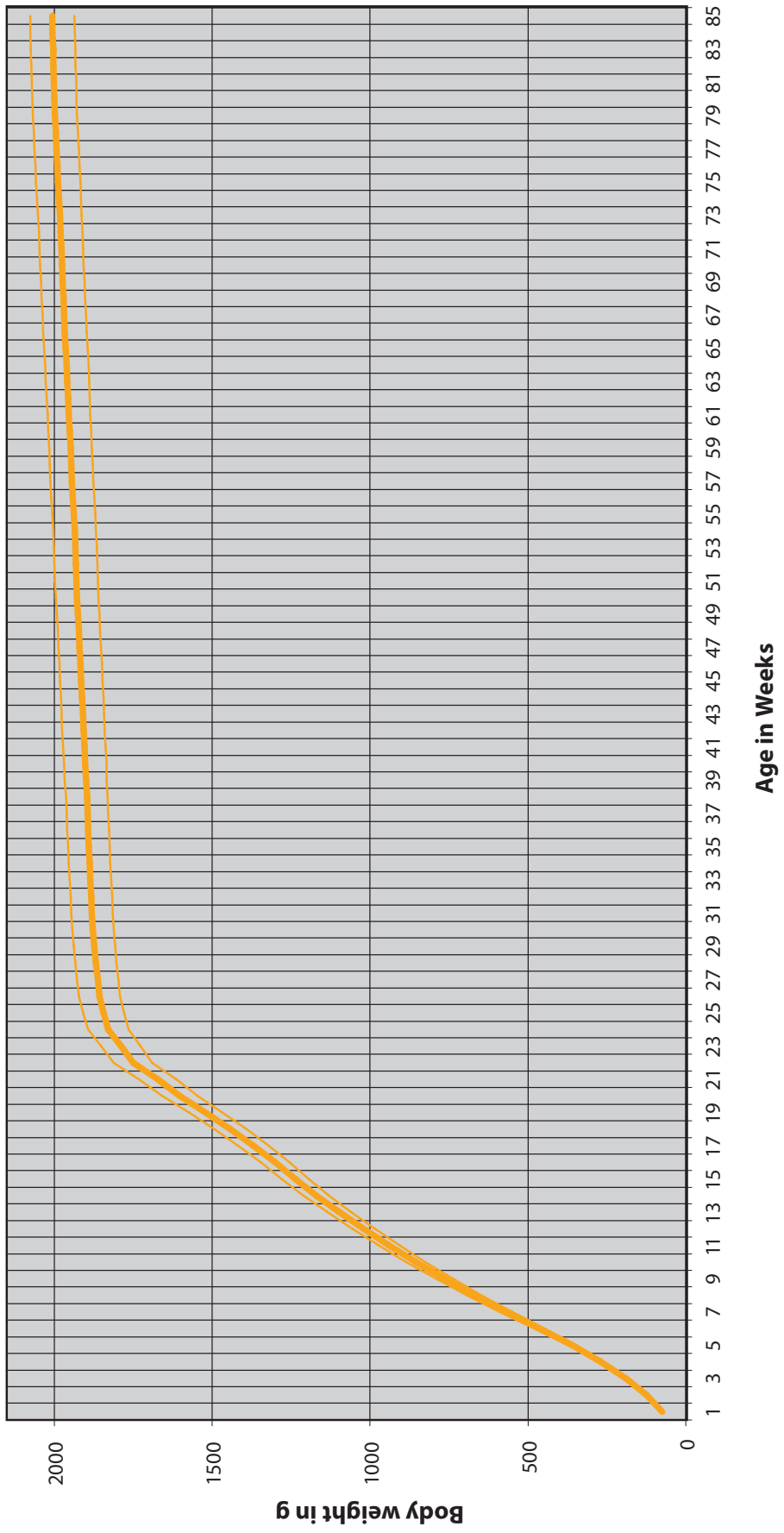


GENERAL INFORMATION

Table 25: Body Weight Development of LOHMANN BROWN-LITE

Age	Min.	Max.	Standard
1	72	78	75
2	121	129	125
3	183	197	190
4	261	279	270
5	347	373	360
6	449	481	465
7	550	590	570
8	647	693	670
9	738	792	765
10	825	885	855
11	907	973	940
12	984	1056	1020
13	1060	1136	1098
14	1130	1212	1171
15	1193	1279	1236
16	1255	1347	1301
17	1321	1417	1369
18	1392	1494	1443
19	1468	1574	1521
20	1548	1660	1604
21	1614	1732	1673
22	1690	1812	1751
23	1727	1853	1790
24	1765	1893	1829
25	1779	1909	1844
26	1793	1923	1858
27	1798	1928	1863
28	1804	1934	1869
29	1807	1939	1873
30	1812	1944	1878
31	1815	1947	1881
32	1817	1949	1883
33	1820	1952	1886
34	1823	1955	1889
35	1825	1957	1891
36	1827	1959	1893
37	1829	1961	1895
38	1831	1963	1897
39	1834	1967	1900
40	1835	1969	1902
41	1838	1972	1905
42	1841	1975	1908
43	1843	1977	1910
44	1845	1979	1912
45	1848	1982	1915
46	1850	1984	1917
47	1853	1987	1920
48	1855	1989	1922
49	1858	1992	1925
50	1861	1995	1928
51	1862	1998	1930
52	1864	2000	1932
53	1866	2002	1934
54	1868	2004	1936
55	1871	2007	1939
56	1874	2010	1942
57	1877	2013	1945
58	1879	2015	1947
59	1881	2017	1949
60	1883	2019	1951
61	1886	2022	1954
62	1888	2024	1956
63	1890	2028	1959
64	1892	2030	1961
65	1895	2033	1964
66	1898	2036	1967
67	1900	2038	1969
68	1902	2040	1971
69	1905	2043	1974
70	1907	2045	1976
71	1909	2047	1978
72	1911	2049	1980
73	1914	2052	1983
74	1916	2056	1986
75	1918	2058	1988
76	1920	2060	1990
77	1923	2063	1993
78	1925	2065	1995
79	1928	2068	1998
80	1930	2070	2000
81	1931	2071	2001
82	1933	2073	2003
83	1934	2074	2004
84	1936	2076	2006
85	1937	2077	2007

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN BROWN-LITE

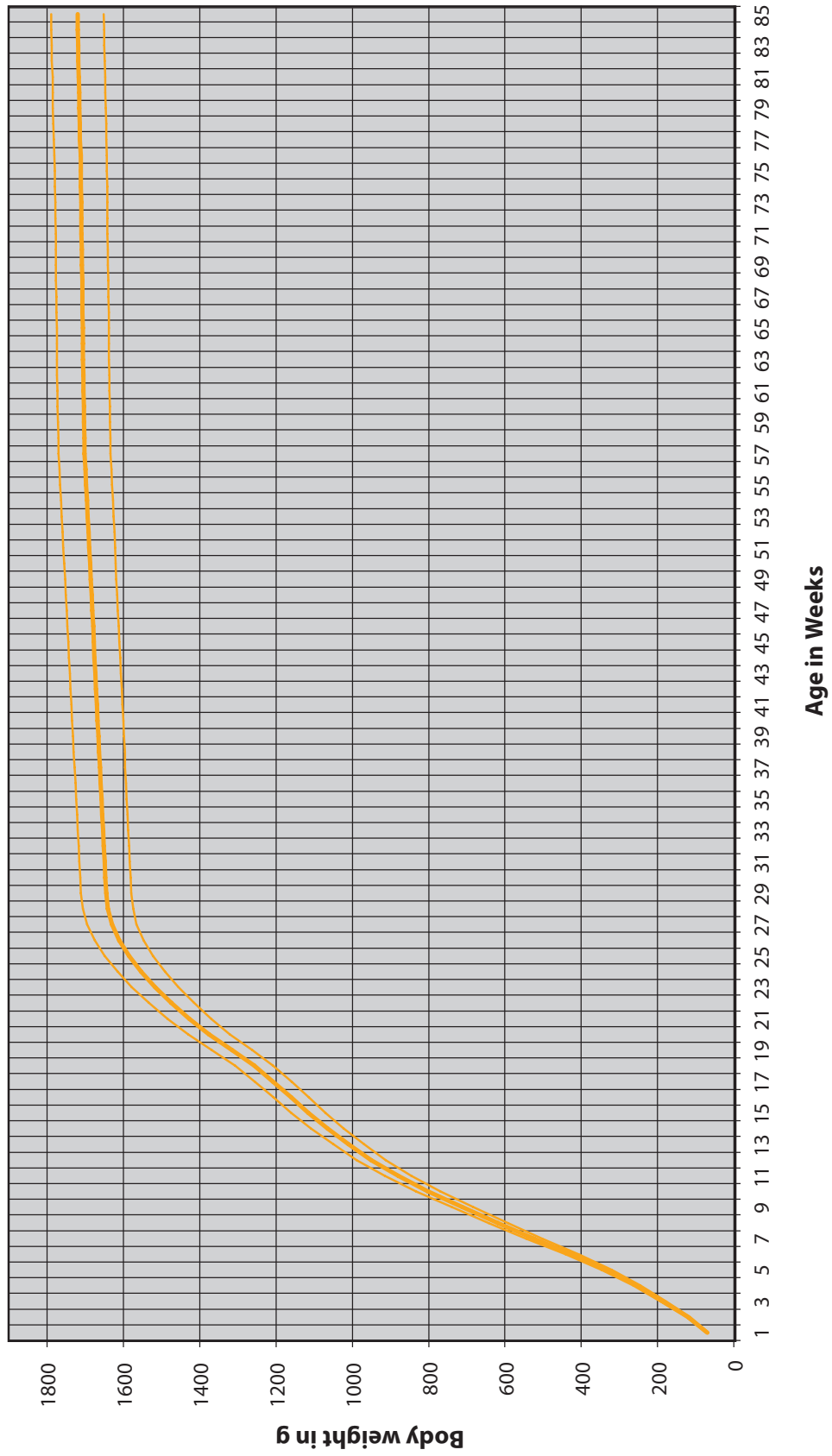


GENERAL INFORMATION

Table 26: Body Weight Development of LOHMANN LSL-LITE

Age	Min.	Max.	Standard
1	67	73	70
2	115	125	120
3	178	192	185
4	245	265	255
5	321	347	334
6	408	442	425
7	503	545	524
8	593	643	618
9	684	740	712
10	770	834	802
11	845	915	880
12	912	988	950
13	970	1050	1010
14	1022	1108	1065
15	1070	1160	1115
16	1114	1206	1160
17	1159	1255	1207
18	1207	1307	1257
19	1262	1368	1315
20	1320	1430	1375
21	1370	1484	1427
22	1415	1533	1474
23	1455	1577	1516
24	1491	1615	1553
25	1522	1648	1585
26	1546	1674	1610
27	1565	1695	1630
28	1574	1706	1640
29	1579	1711	1645
30	1581	1713	1647
31	1583	1715	1649
32	1585	1717	1651
33	1587	1719	1653
34	1589	1721	1655
35	1591	1723	1657
36	1593	1725	1659
37	1595	1727	1661
38	1596	1730	1663
39	1598	1732	1665
40	1600	1734	1667
41	1602	1736	1669
42	1604	1738	1671
43	1606	1740	1673
44	1608	1742	1675
45	1610	1744	1677
46	1612	1746	1679
47	1614	1748	1681
48	1616	1750	1683
49	1618	1752	1685
50	1620	1754	1687
51	1621	1757	1689
52	1623	1759	1691
53	1625	1761	1693
54	1627	1763	1695
55	1629	1765	1697
56	1631	1767	1699
57	1633	1769	1701
58	1634	1770	1702
59	1635	1771	1703
60	1635	1772	1704
61	1636	1772	1704
62	1636	1773	1705
63	1637	1773	1705
64	1637	1774	1706
65	1638	1774	1706
66	1638	1775	1707
67	1639	1775	1707
68	1639	1776	1708
69	1640	1776	1708
70	1640	1777	1709
71	1641	1777	1709
72	1641	1778	1710
73	1642	1778	1710
74	1642	1779	1711
75	1643	1779	1711
76	1643	1780	1712
77	1645	1782	1714
78	1645	1783	1714
79	1646	1784	1715
80	1647	1784	1716
81	1647	1785	1716
82	1649	1787	1718
83	1650	1787	1719
84	1650	1788	1719
85	1651	1788	1720

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN LSL-LITE

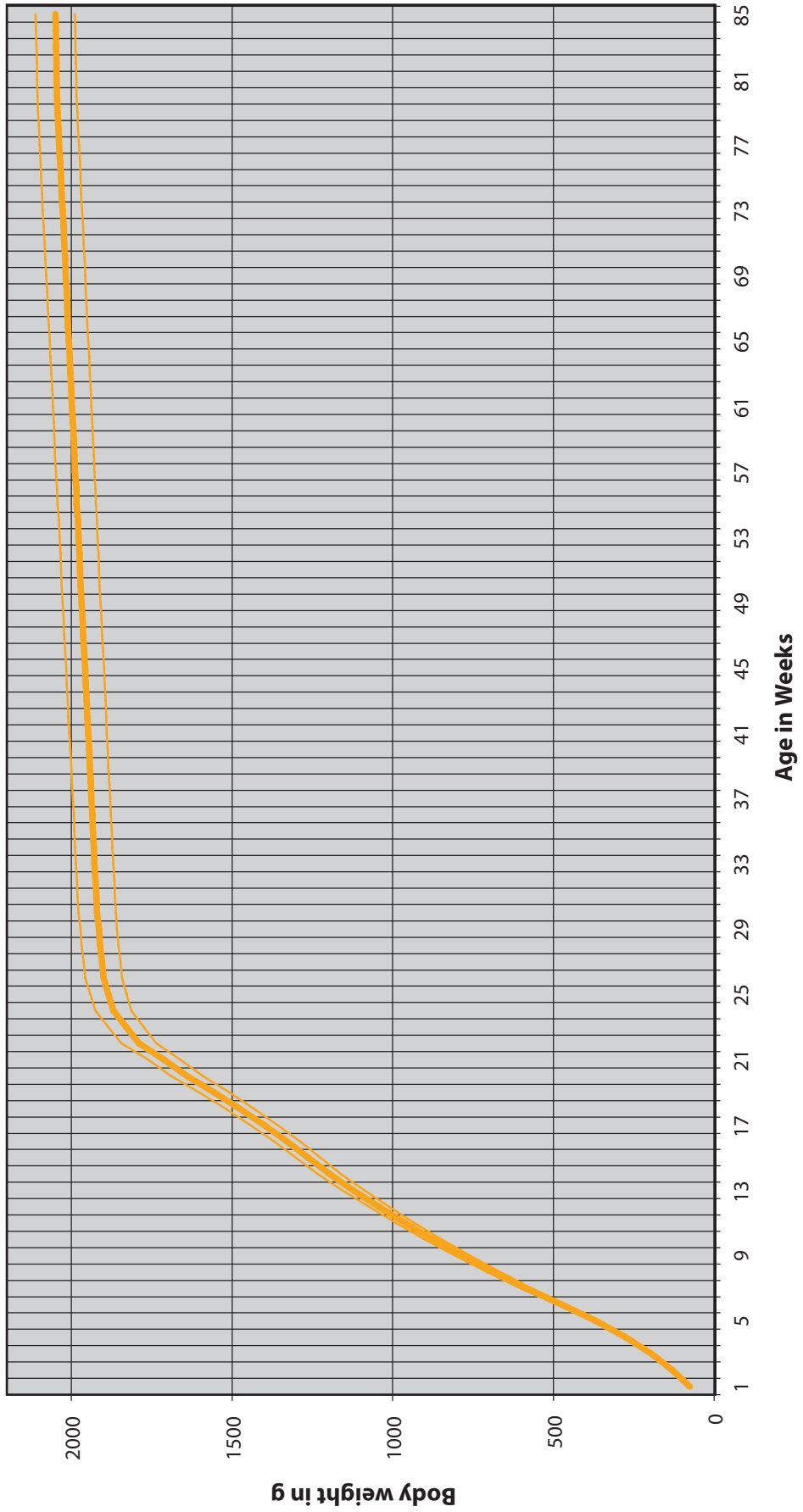


GENERAL INFORMATION

Table 27: Body Weight Development of LOHMANN BROWN-EXTRA

Age	Min.	Max.	Standard
1	73	77	75
2	126	134	130
3	189	201	195
4	267	283	275
5	356	378	367
6	461	489	475
7	566	600	583
8	664	706	685
9	759	805	782
10	848	900	874
11	932	990	961
12	1012	1074	1043
13	1089	1157	1123
14	1161	1233	1197
15	1226	1302	1264
16	1290	1370	1330
17	1358	1442	1400
18	1431	1519	1475
19	1508	1602	1555
20	1591	1689	1640
21	1660	1762	1711
22	1736	1844	1790
23	1775	1885	1830
24	1814	1926	1870
25	1828	1942	1885
26	1843	1957	1900
27	1848	1962	1905
28	1854	1968	1911
29	1858	1972	1915
30	1862	1978	1920
31	1865	1981	1923
32	1867	1983	1925
33	1870	1986	1928
34	1873	1989	1931
35	1875	1991	1933
36	1877	1993	1935
37	1880	1996	1938
38	1882	1998	1940
39	1885	2001	1943
40	1887	2003	1945
41	1890	2006	1948
42	1892	2010	1951
43	1894	2012	1953
44	1896	2014	1955
45	1899	2017	1958
46	1901	2019	1960
47	1904	2022	1963
48	1906	2024	1965
49	1909	2027	1968
50	1912	2030	1971
51	1914	2032	1973
52	1916	2034	1975
53	1919	2037	1978
54	1921	2039	1980
55	1924	2044	1984
56	1925	2045	1985
57	1929	2049	1989
58	1931	2051	1991
59	1933	2053	1993
60	1935	2055	1995
61	1938	2058	1998
62	1940	2060	2000
63	1943	2063	2003
64	1945	2065	2005
65	1948	2068	2008
66	1951	2071	2011
67	1953	2073	2013
68	1955	2075	2015
69	1957	2079	2018
70	1959	2081	2020
71	1962	2084	2023
72	1964	2086	2025
73	1967	2089	2028
74	1970	2092	2031
75	1972	2094	2033
76	1974	2096	2035
77	1977	2099	2038
78	1979	2101	2040
79	1982	2104	2043
80	1984	2106	2045
81	1985	2107	2046
82	1986	2108	2047
83	1987	2109	2048
84	1988	2110	2049
85	1989	2112	2050

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN BROWN-EXTRA

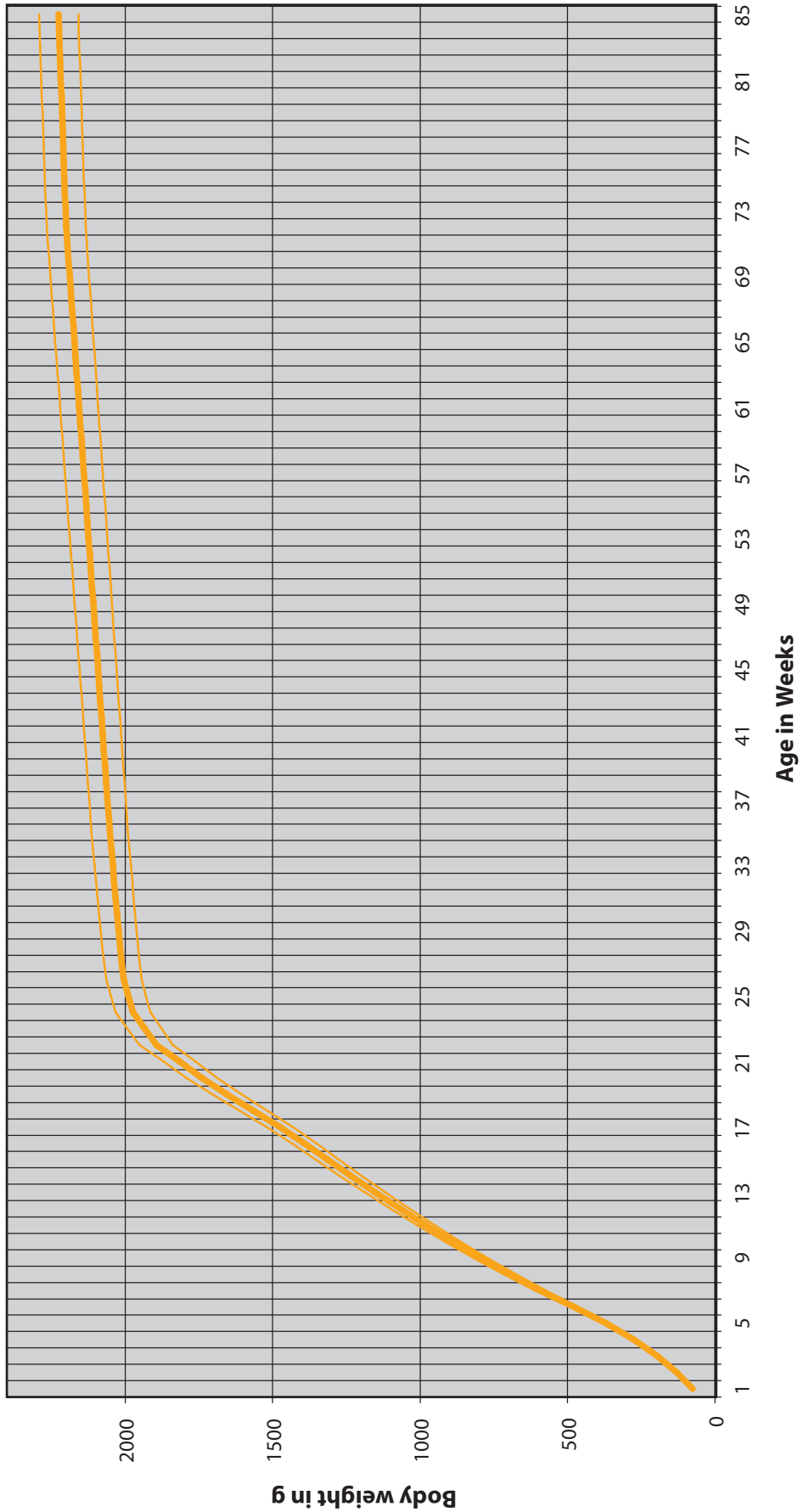


GENERAL INFORMATION

Table 28: Body Weight Development of LOHMANN BROWN-PLUS

Age	Min.	Max.	Standard
1	73	77	75
2	126	134	130
3	189	201	195
4	267	283	275
5	359	381	370
6	466	494	480
7	572	608	590
8	674	716	695
9	771	819	795
10	863	917	890
11	951	1009	980
12	1036	1100	1068
13	1118	1188	1153
14	1198	1272	1235
15	1276	1354	1315
16	1353	1437	1395
17	1431	1519	1475
18	1518	1612	1565
19	1605	1705	1655
20	1688	1792	1740
21	1761	1869	1815
22	1837	1951	1894
23	1876	1992	1934
24	1915	2033	1974
25	1929	2049	1989
26	1944	2064	2004
27	1951	2071	2011
28	1956	2078	2017
29	1961	2083	2022
30	1966	2088	2027
31	1971	2093	2032
32	1976	2098	2037
33	1981	2103	2042
34	1986	2108	2047
35	1990	2114	2052
36	1994	2118	2056
37	1998	2122	2060
38	2002	2126	2064
39	2006	2130	2068
40	2010	2134	2072
41	2014	2138	2076
42	2018	2142	2080
43	2021	2147	2084
44	2025	2151	2088
45	2029	2155	2092
46	2033	2159	2096
47	2037	2163	2100
48	2041	2167	2104
49	2045	2171	2108
50	2049	2175	2112
51	2053	2179	2116
52	2056	2184	2120
53	2060	2188	2124
54	2064	2192	2128
55	2068	2196	2132
56	2072	2200	2136
57	2076	2204	2140
58	2080	2208	2144
59	2084	2212	2148
60	2087	2217	2152
61	2091	2221	2156
62	2095	2225	2160
63	2099	2229	2164
64	2103	2233	2168
65	2107	2237	2172
66	2111	2241	2176
67	2115	2245	2180
68	2118	2250	2184
69	2122	2254	2188
70	2126	2258	2192
71	2130	2262	2196
72	2134	2266	2200
73	2136	2268	2202
74	2138	2270	2204
75	2140	2272	2206
76	2142	2274	2208
77	2144	2276	2210
78	2146	2278	2212
79	2148	2280	2214
80	2150	2282	2216
81	2151	2285	2218
82	2153	2287	2220
83	2155	2289	2222
84	2157	2291	2224
85	2158	2292	2225

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN BROWN-EXTRA

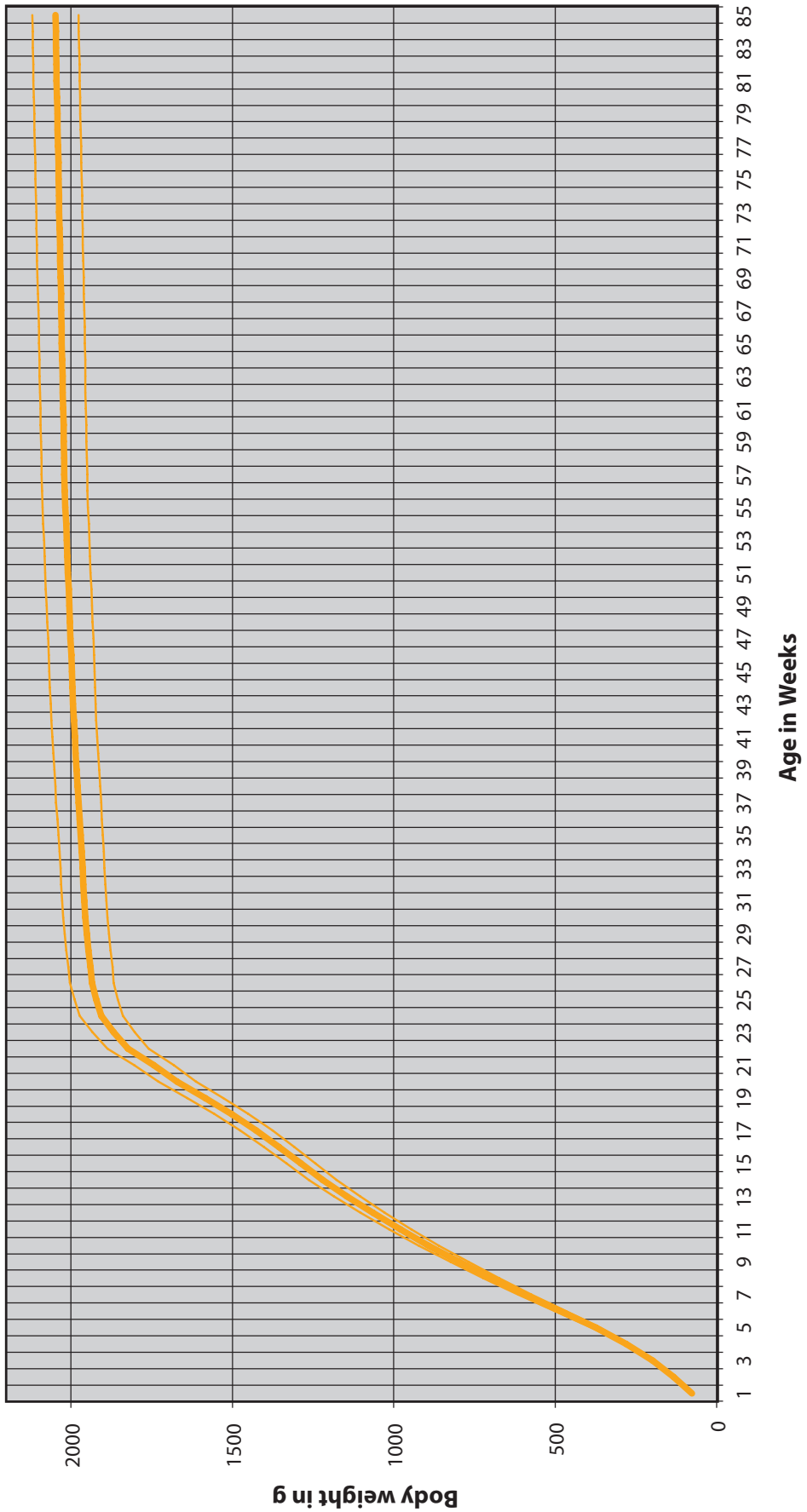


GENERAL INFORMATION

Table 29: Body Weight Development of LOHMANN TRADITION

Age	Min.	Max.	Standard
1	74	79	76
2	128	137	132
3	191	205	198
4	271	290	280
5	361	388	374
6	467	501	484
7	574	615	594
8	674	723	698
9	769	825	797
10	860	923	891
11	946	1015	980
12	1027	1102	1064
13	1105	1185	1145
14	1178	1263	1220
15	1243	1333	1288
16	1308	1403	1355
17	1376	1476	1426
18	1450	1555	1502
19	1529	1640	1584
20	1613	1730	1671
21	1682	1804	1743
22	1760	1887	1823
23	1803	1934	1868
24	1840	1973	1906
25	1855	1990	1922
26	1868	2003	1935
27	1872	2008	1940
28	1878	2015	1946
29	1883	2020	1951
30	1887	2024	1955
31	1890	2027	1958
32	1893	2030	1961
33	1896	2033	1964
34	1899	2036	1967
35	1901	2039	1970
36	1904	2042	1973
37	1907	2046	1976
38	1910	2049	1979
39	1913	2052	1982
40	1916	2055	1985
41	1919	2058	1988
42	1922	2061	1991
43	1924	2063	1993
44	1926	2065	1995
45	1927	2067	1997
46	1929	2069	1999
47	1931	2071	2001
48	1933	2074	2003
49	1935	2076	2005
50	1937	2078	2007
51	1939	2080	2009
52	1941	2082	2011
53	1943	2084	2013
54	1945	2086	2015
55	1947	2088	2017
56	1949	2090	2019
57	1950	2091	2020
58	1951	2092	2021
59	1952	2093	2022
60	1953	2094	2023
61	1954	2095	2024
62	1955	2096	2025
63	1955	2097	2026
64	1956	2098	2027
65	1957	2099	2028
66	1958	2100	2029
67	1959	2101	2030
68	1960	2102	2031
69	1961	2104	2032
70	1962	2105	2033
71	1963	2106	2034
72	1964	2107	2035
73	1965	2108	2036
74	1966	2109	2037
75	1967	2110	2038
76	1968	2111	2039
77	1969	2112	2040
78	1970	2113	2041
79	1971	2114	2042
80	1972	2115	2043
81	1973	2116	2044
82	1974	2117	2045
83	1975	2118	2046
84	1976	2119	2047
85	1977	2120	2048

GROWTH AND BODY WEIGHT DEVELOPMENT OF LOHMANN TRADITION



GENERAL INFORMATION

Table 30: Performance Goals of LOHMANN BROWN-CLASSIC
Week 20 – 52

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
20	0.7	10.0	10.0	44.8	42.9	4.5	0.03
21	3.8	44.8	44.8	47.3	47.4	21.2	0.18
22	8.3	64.7	64.8	49.8	49.4	32.3	0.41
23	13.9	79.7	79.9	52.3	50.4	41.8	0.70
24	20.0	87.7	88.0	54.5	51.5	47.9	1.03
25	26.4	91.2	91.6	56.3	52.7	51.5	1.39
26	32.9	92.2	92.7	57.7	53.5	53.5	1.76
27	39.4	92.8	93.4	58.7	54.3	54.8	2.14
28	45.9	93.1	93.8	59.5	55.1	55.8	2.53
29	52.4	93.3	94.1	60.2	55.7	56.6	2.92
30	58.9	93.5	94.4	60.8	56.4	57.4	3.32
31	65.4	93.6	94.6	61.2	56.9	57.9	3.72
32	71.9	93.5	94.6	61.5	57.3	58.2	4.12
33	78.4	93.3	94.5	61.8	57.7	58.4	4.52
34	84.9	93.1	94.4	62.1	58.0	58.6	4.92
35	91.4	92.9	94.3	62.3	58.3	58.8	5.33
36	97.9	92.7	94.2	62.6	58.6	58.9	5.74
37	104.4	92.4	94.1	62.8	58.9	59.1	6.15
38	110.9	92.2	93.9	63.1	59.2	59.2	6.56
39	117.3	91.9	93.8	63.3	59.4	59.4	6.97
40	123.7	91.7	93.7	63.5	59.7	59.5	7.38
41	130.1	91.4	93.6	63.7	59.9	59.6	7.79
42	136.5	91.1	93.4	63.9	60.1	59.7	8.20
43	142.9	90.8	93.3	64.1	60.3	59.8	8.61
44	149.2	90.5	93.1	64.3	60.5	59.9	9.02
45	155.5	90.2	92.9	64.5	60.6	59.9	9.43
46	161.8	89.8	92.7	64.7	60.8	59.9	9.84
47	168.1	89.5	92.5	64.8	61.0	59.9	10.25
48	174.3	89.1	92.2	65.0	61.2	59.9	10.66
49	180.5	88.8	92.0	65.1	61.3	59.9	11.06
50	186.7	88.4	91.7	65.3	61.4	59.9	11.46
51	192.9	88.0	91.5	65.4	61.5	59.8	11.86
52	199.0	87.6	91.2	65.6	61.6	59.8	12.26

Table 30: Performance Goals of LOHMANN BROWN-CLASSIC
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	205.1	87.2	90.9	65.7	61.7	59.7	12.66
54	211.2	86.7	90.6	65.8	61.8	59.6	13.06
55	217.2	86.3	90.3	65.9	62.0	59.5	13.46
56	223.2	85.8	89.9	66.0	62.1	59.3	13.86
57	229.2	85.4	89.6	66.1	62.2	59.2	14.25
58	235.1	84.9	89.3	66.2	62.3	59.1	14.64
59	241.0	84.5	88.9	66.3	62.4	58.9	15.03
60	246.9	84.0	88.6	66.4	62.5	58.8	15.42
61	252.7	83.5	88.2	66.5	62.6	58.6	15.81
62	258.5	83.0	87.8	66.6	62.7	58.5	16.20
63	264.3	82.5	87.4	66.7	62.8	58.3	16.59
64	270.0	82.0	87.0	66.8	62.9	58.1	16.97
65	275.7	81.4	86.6	66.9	62.9	57.9	17.35
66	281.4	80.9	86.1	67.0	63.0	57.7	17.73
67	287.0	80.3	85.7	67.1	63.1	57.4	18.11
68	292.6	79.8	85.2	67.2	63.2	57.2	18.48
69	298.1	79.2	84.7	67.3	63.2	57.0	18.85
70	303.6	78.6	84.2	67.4	63.3	56.7	19.22
71	309.1	78.0	83.7	67.5	63.4	56.5	19.59
72	314.5	77.4	83.2	67.6	63.5	56.2	19.96
73	319.9	76.8	82.7	67.7	63.5	55.9	20.32
74	325.2	76.1	82.1	67.8	63.6	55.6	20.68
75	330.5	75.4	81.5	67.8	63.7	55.3	21.04
76	335.7	74.7	80.9	67.9	63.7	54.9	21.39
77	340.9	73.9	80.2	67.9	63.8	54.5	21.74
78	346.0	73.0	79.4	68.0	63.8	54.0	22.09
79	351.0	72.1	78.6	68.0	63.9	53.5	22.43
80	356.0	71.2	77.8	68.1	64.0	53.0	22.77
81	360.9	70.3	76.9	68.1	64.0	52.4	23.10
82	365.8	69.3	76.1	68.2	64.1	51.9	23.43
83	370.6	68.4	75.2	68.2	64.1	51.3	23.76
84	375.3	67.4	74.3	68.3	64.2	50.7	24.08
85	379.9	66.4	73.3	68.3	64.2	50.1	24.40

GENERAL INFORMATION

EGG PRODUCTION CURVE FOR LOHMANN BROWN-CLASSIC

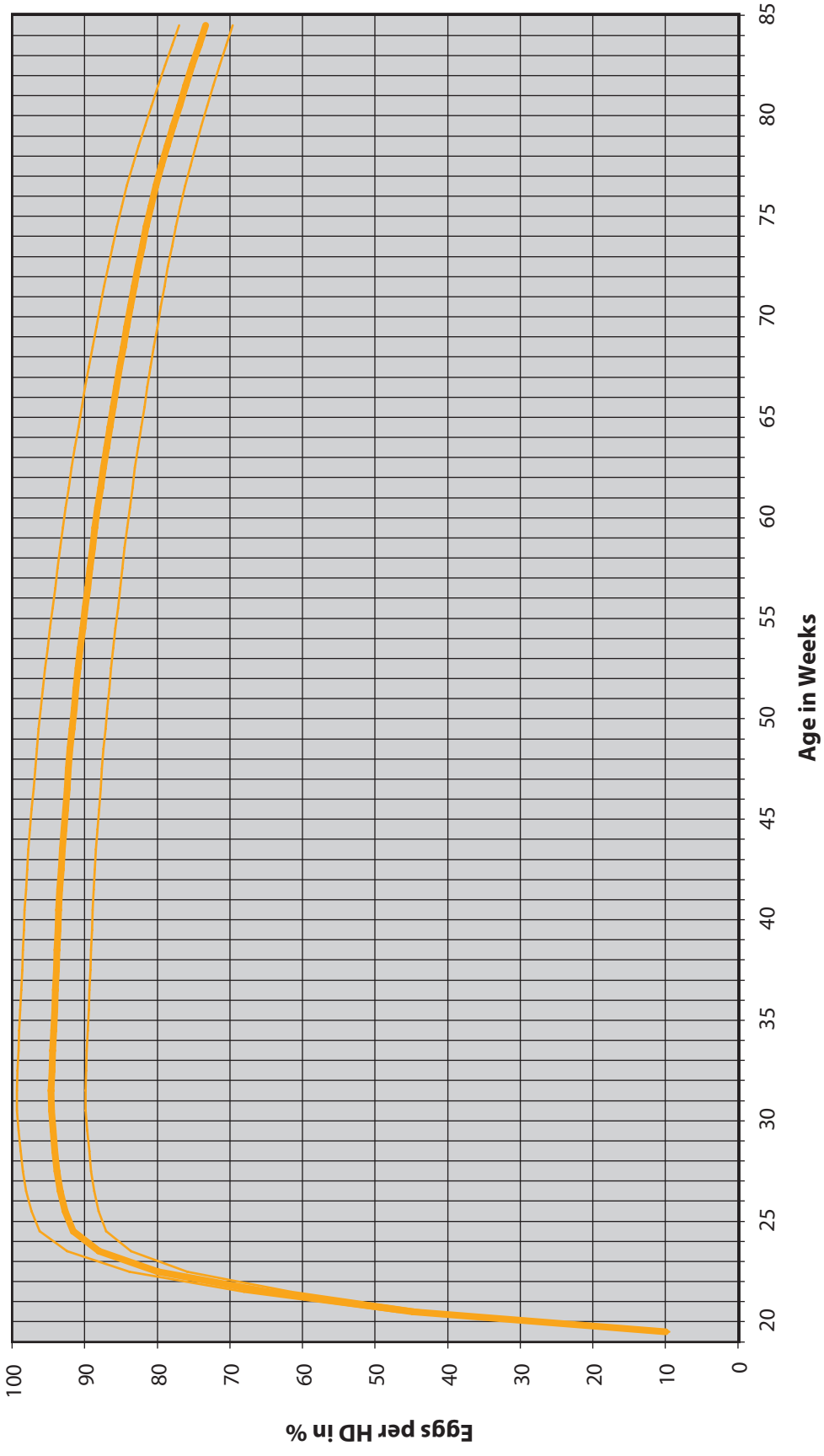


Table 31: Performance Goals of LSL-CLASSIC
Week 20 – 52

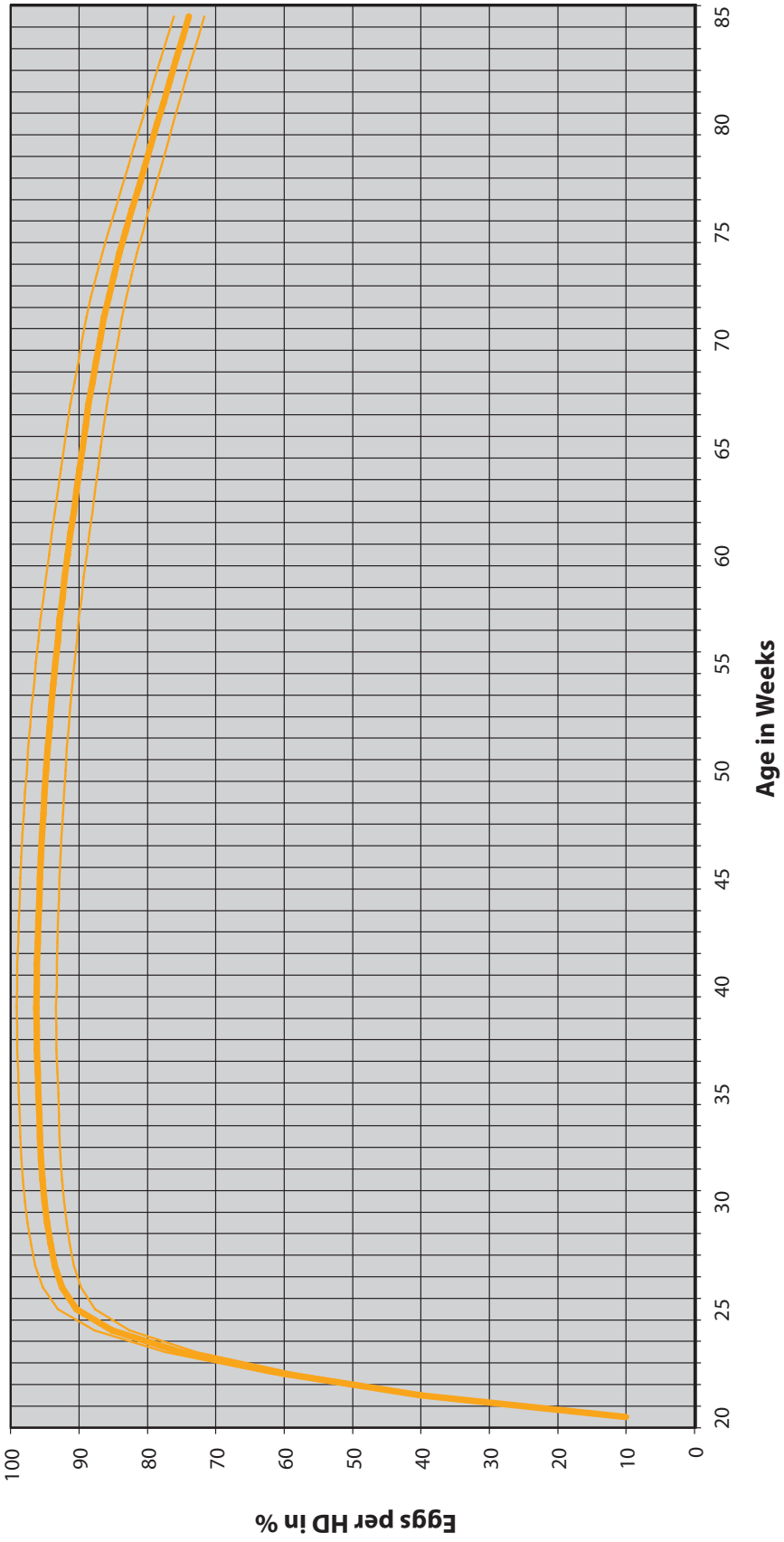
Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
20	0.7	10.0	10.0	43.8	42.9	4.4	0.03
21	3.5	40.0	40.0	47.8	45.7	19.1	0.16
22	7.7	60.0	60.1	50.8	48.1	30.5	0.37
23	13.0	75.0	75.2	52.8	50.0	39.7	0.65
24	19.0	85.0	85.2	54.6	51.1	46.5	0.97
25	25.3	90.0	90.4	56.2	52.2	50.8	1.32
26	31.7	92.0	92.5	57.5	53.3	53.1	1.69
27	38.2	93.0	93.6	58.5	54.2	54.7	2.07
28	44.7	93.5	94.2	59.2	55.0	55.7	2.46
29	51.3	93.9	94.7	59.7	55.6	56.5	2.85
30	57.9	94.2	95.1	60.1	56.1	57.1	3.25
31	64.5	94.4	95.4	60.5	56.6	57.6	3.65
32	71.1	94.5	95.6	60.8	57.0	58.0	4.05
33	77.7	94.6	95.7	61.0	57.3	58.4	4.45
34	84.3	94.6	95.8	61.2	57.7	58.6	4.86
35	90.9	94.6	95.9	61.4	58.0	58.9	5.27
36	97.5	94.6	96.0	61.6	58.3	59.1	5.68
37	104.1	94.5	96.2	61.8	58.5	59.4	6.09
38	110.7	94.4	96.2	62.0	58.7	59.6	6.50
39	117.3	94.3	96.3	62.2	58.9	59.9	6.91
40	123.9	94.1	96.1	62.4	59.1	60.0	7.32
41	130.5	93.9	96.1	62.6	59.2	60.2	7.73
42	137.1	93.7	96.0	62.8	59.4	60.3	8.14
43	143.6	93.5	96.0	62.9	59.5	60.4	8.55
44	150.1	93.2	95.8	63.0	59.7	60.4	8.96
45	156.6	93.0	95.8	63.1	59.8	60.4	9.37
46	163.1	92.7	95.5	63.2	60.0	60.4	9.78
47	169.6	92.4	95.4	63.3	60.1	60.4	10.19
48	176.0	92.1	95.2	63.4	60.2	60.4	10.60
49	182.4	91.7	95.1	63.5	60.4	60.4	11.01
50	188.8	91.4	94.8	63.6	60.5	60.3	11.42
51	195.2	91.0	94.6	63.7	60.6	60.3	11.83
52	201.5	90.6	94.3	63.8	60.7	60.2	12.23

GENERAL INFORMATION

Table 31: Performance Goals of LOHMANN LSL-CLASSIC
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	207.8	90.2	94.1	63.9	60.8	60.1	12.63
54	214.1	89.8	93.8	64.0	60.9	60.0	13.03
55	220.4	89.4	93.5	64.1	60.9	59.9	13.43
56	226.6	88.9	93.1	64.2	61.0	59.8	13.83
57	232.8	88.5	92.8	64.3	61.1	59.7	14.23
58	239.0	88.0	92.4	64.4	61.2	59.5	14.63
59	245.1	87.5	92.1	64.5	61.3	59.4	15.02
60	251.2	87.0	91.7	64.6	61.3	59.2	15.41
61	257.2	86.4	91.3	64.7	61.4	59.0	15.80
62	263.2	85.9	90.8	64.8	61.5	58.8	16.19
63	269.2	85.3	90.4	64.9	61.6	58.7	16.58
64	275.1	84.7	89.9	65.0	61.7	58.5	16.97
65	281.0	84.1	89.5	65.1	61.7	58.3	17.35
66	286.8	83.5	89.1	65.2	61.8	58.1	17.73
67	292.6	82.9	88.6	65.3	61.9	57.9	18.11
68	298.4	82.2	88.0	65.4	62.0	57.6	18.49
69	304.1	81.5	87.5	65.5	62.0	57.3	18.86
70	309.8	80.8	86.9	65.6	62.1	57.0	19.23
71	315.4	80.1	86.3	65.7	62.1	56.7	19.60
72	321.0	79.3	85.7	65.8	62.2	56.4	19.97
73	326.5	78.4	84.9	65.9	62.3	55.9	20.33
74	331.9	77.5	84.1	66.0	62.3	55.5	20.69
75	337.3	76.5	83.2	66.1	62.4	55.0	21.04
76	342.6	75.5	82.3	66.1	62.4	54.4	21.39
77	347.8	74.5	81.4	66.2	62.5	53.9	21.74
78	352.9	73.5	80.4	66.2	62.6	53.3	22.08
79	358.0	72.5	79.5	66.3	62.6	52.7	22.42
80	363.0	71.5	78.6	66.3	62.7	52.2	22.75
81	367.9	70.5	77.7	66.4	62.7	51.6	23.08
82	372.8	69.5	76.7	66.4	62.8	51.0	23.40
83	377.6	68.5	75.8	66.5	62.8	50.4	23.72
84	382.3	67.5	74.9	66.5	62.9	49.8	24.03
85	387.0	66.5	73.9	66.6	62.9	49.2	24.34

EGG PRODUCTION CURVE FOR LOHMANN LSL-CLASSIC



GENERAL INFORMATION

Table 32: Performance Goals of LOHMANN BROWN-LITE
Week 20 – 52

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
20	0.7	10.0	10.0	43.8	42.9	4.4	0.03
21	3.8	44.8	44.8	46.2	47.4	20.7	0.18
22	8.3	64.7	64.8	48.7	48.2	31.6	0.40
23	13.9	79.7	79.9	51.1	49.6	40.8	0.69
24	20.0	87.7	88.0	53.3	51.0	46.9	1.02
25	26.4	91.2	91.6	55.0	51.9	50.4	1.37
26	32.9	92.2	92.7	56.4	52.6	52.3	1.73
27	39.4	92.7	93.3	57.4	53.3	53.5	2.10
28	45.9	93.1	93.8	58.2	54.0	54.6	2.48
29	52.4	93.4	94.2	58.9	54.6	55.5	2.86
30	59.0	93.6	94.6	59.5	55.1	56.2	3.25
31	65.6	93.8	94.8	59.9	55.5	56.8	3.64
32	72.2	93.9	95.0	60.2	56.0	57.2	4.04
33	78.8	93.9	95.1	60.5	56.3	57.5	4.44
34	85.4	93.9	95.2	60.8	56.7	57.9	4.84
35	92.0	93.8	95.2	61.1	57.0	58.1	5.24
36	98.5	93.6	95.1	61.4	57.3	58.3	5.64
37	105.0	93.4	95.0	61.7	57.5	58.6	6.04
38	111.5	93.2	95.0	61.9	57.8	58.7	6.44
39	118.0	93.0	94.9	62.1	58.0	58.9	6.84
40	124.5	92.7	94.8	62.3	58.2	59.0	7.24
41	131.0	92.5	94.7	62.5	58.3	59.1	7.64
42	137.5	92.2	94.6	62.7	58.5	59.3	8.04
43	143.9	92.0	94.5	62.9	58.7	59.4	8.44
44	150.3	91.7	94.3	63.1	58.8	59.5	8.84
45	156.7	91.4	94.1	63.3	59.0	59.6	9.24
46	163.1	91.1	94.0	63.5	59.1	59.6	9.64
47	169.4	90.7	93.8	63.7	59.3	59.7	10.04
48	175.7	90.4	93.5	63.9	59.4	59.7	10.44
49	182.0	90.0	93.3	64.1	59.6	59.8	10.84
50	188.3	89.7	93.1	64.3	59.7	59.8	11.24
51	194.5	89.3	92.8	64.5	59.8	59.8	11.64
52	200.7	88.9	92.6	64.6	60.0	59.8	12.04

Table 32: Performance Goals of LOHMANN BROWN-LITE
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	206.9	88.5	92.3	64.7	60.1	59.7	12.44
54	213.1	88.1	92.0	64.8	60.3	59.6	12.84
55	219.2	87.7	91.7	64.9	60.4	59.5	13.24
56	225.3	87.2	91.4	65.0	60.5	59.4	13.64
57	231.4	86.8	91.1	65.1	60.7	59.3	14.04
58	237.4	86.3	90.8	65.2	60.8	59.1	14.43
59	243.4	85.8	90.4	65.3	60.9	59.0	14.82
60	249.4	85.3	90.0	65.4	61.0	58.8	15.21
61	255.3	84.8	89.6	65.5	61.1	58.7	15.60
62	261.2	84.3	89.2	65.6	61.2	58.5	15.99
63	267.1	83.8	88.8	65.7	61.3	58.3	16.37
64	272.9	83.2	88.3	65.8	61.4	58.1	16.75
65	278.7	82.7	87.9	65.8	61.5	57.9	17.13
66	284.4	82.1	87.5	65.9	61.6	57.7	17.51
67	290.1	81.6	87.1	65.9	61.7	57.4	17.89
68	295.8	81.0	86.7	66.0	61.7	57.2	18.26
69	301.4	80.4	86.2	66.0	61.8	56.9	18.63
70	307.0	79.8	85.8	66.1	61.9	56.7	19.00
71	312.5	79.1	85.2	66.1	62.0	56.4	19.37
72	318.0	78.5	84.7	66.2	62.0	56.1	19.73
73	323.4	77.8	84.2	66.2	62.1	55.8	20.09
74	328.8	77.1	83.6	66.3	62.2	55.4	20.45
75	334.1	76.4	83.0	66.3	62.3	55.1	20.80
76	339.4	75.7	82.5	66.4	62.3	54.7	21.15
77	344.6	75.0	81.8	66.4	62.4	54.3	21.50
78	349.8	74.2	81.2	66.5	62.5	54.0	21.85
79	354.9	73.5	80.5	66.5	62.5	53.6	22.19
80	360.0	72.7	79.8	66.6	62.6	53.1	22.53
81	365.0	71.9	79.1	66.6	62.7	52.7	22.87
82	370.0	71.0	78.4	66.7	62.7	52.2	23.20
83	374.9	70.2	77.6	66.7	62.8	51.8	23.53
84	379.8	69.3	76.8	66.8	62.8	51.3	23.85
85	384.6	68.4	76.0	66.8	62.8	50.8	24.17

GENERAL INFORMATION

EGG PRODUCTION CURVE FOR LOHMANN BROWN-LITE

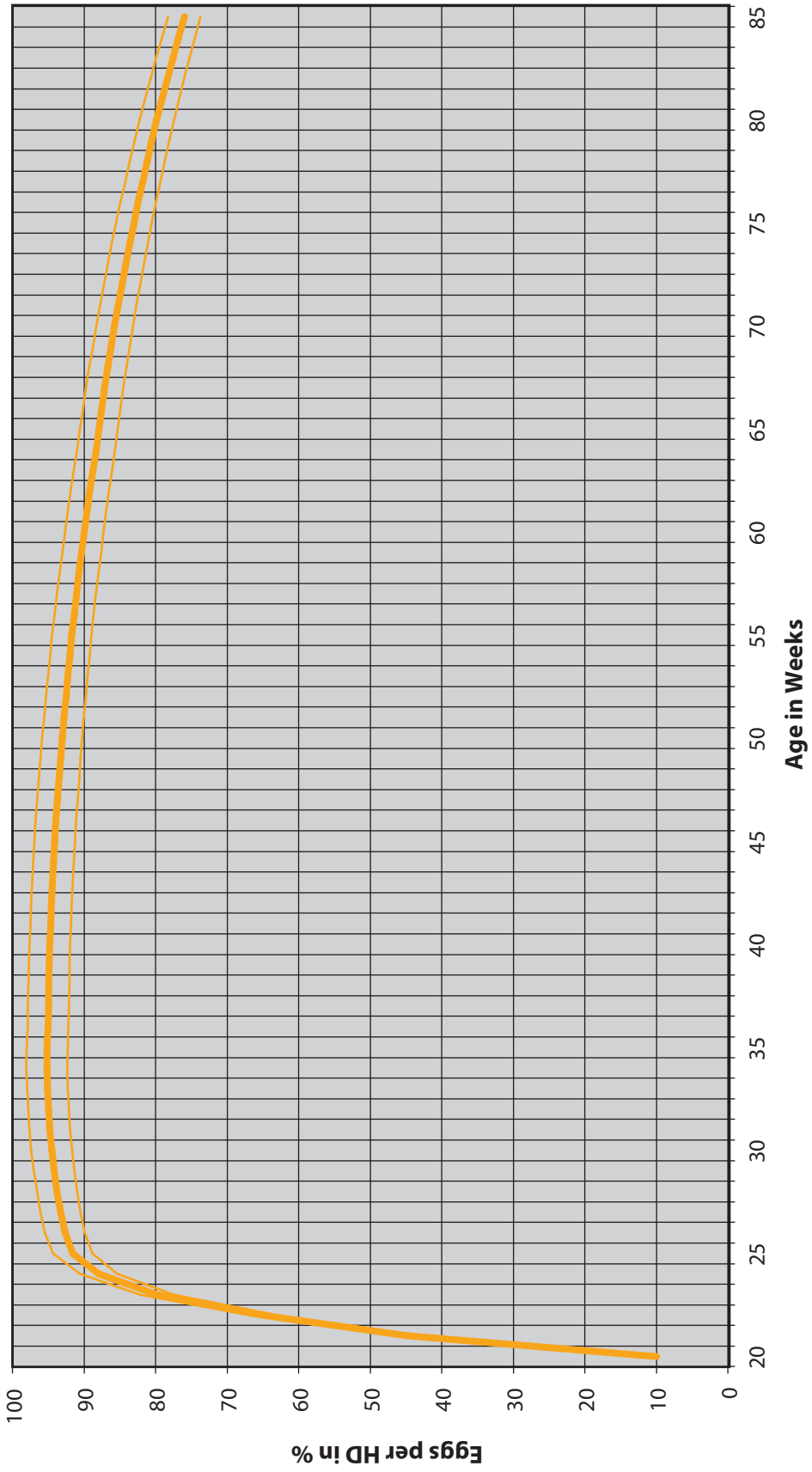


Table 33: Performance Goals of LOHMANN LSL-LITE
Week 20 – 52

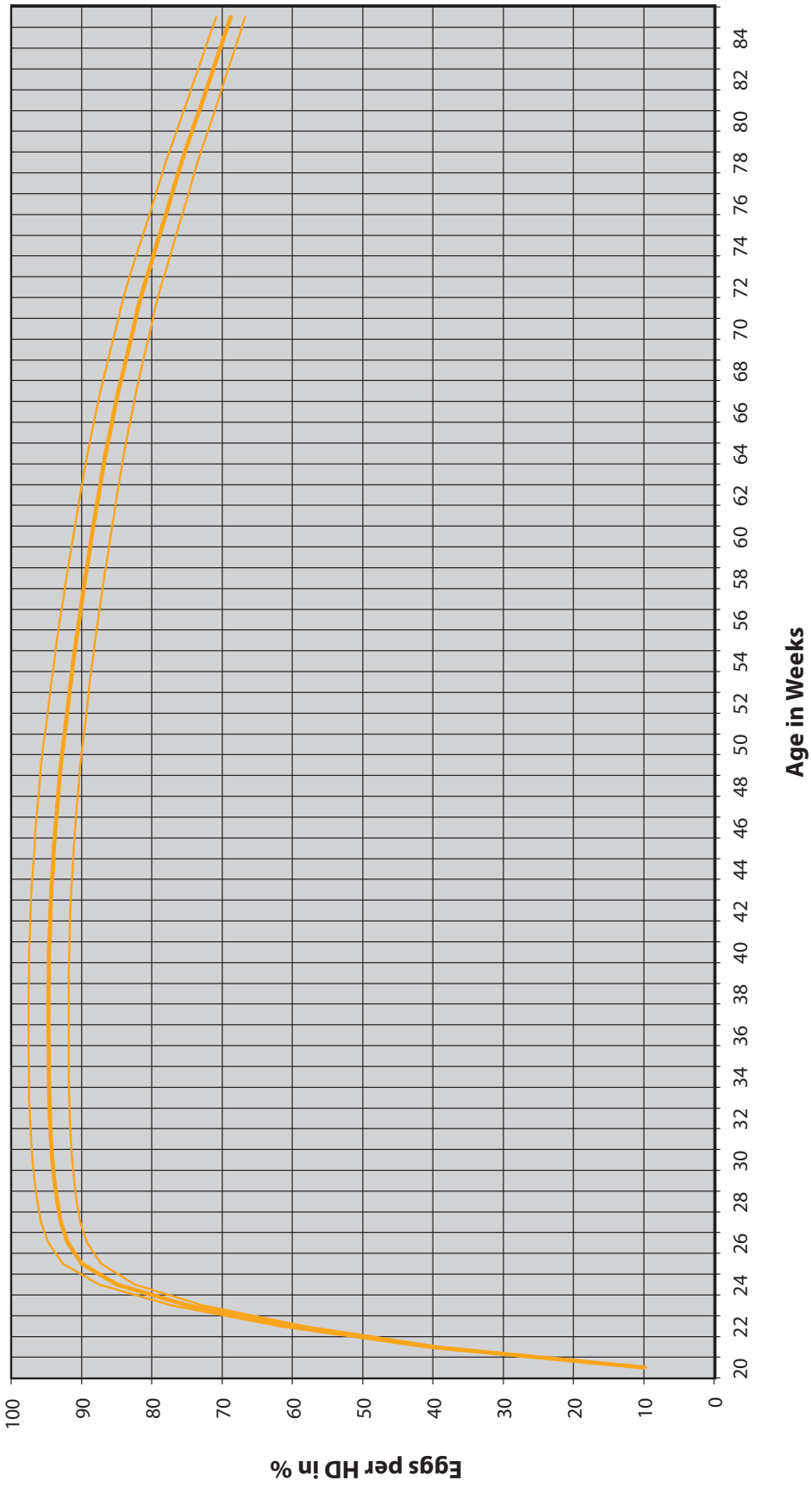
Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
20	0.7	10.0	10.0	40.8	40.8	4.1	0.03
21	3.5	40.0	40.0	43.8	42.9	17.5	0.15
22	7.7	60.0	60.0	46.8	45.5	28.1	0.35
23	12.9	75.0	75.1	49.3	47.3	37.0	0.61
24	18.8	85.0	85.2	51.6	48.9	43.9	0.92
25	25.1	90.0	90.3	53.3	50.2	48.1	1.26
26	31.5	92.0	92.4	54.8	51.1	50.6	1.61
27	38.0	93.0	93.5	56.1	52.1	52.5	1.98
28	44.5	93.5	94.1	57.0	52.8	53.6	2.35
29	51.1	93.9	94.6	57.6	53.4	54.5	2.73
30	57.7	94.2	95.0	58.1	53.9	55.2	3.11
31	64.3	94.4	95.3	58.5	54.4	55.7	3.50
32	70.9	94.5	95.5	58.9	54.9	56.3	3.89
33	77.5	94.6	95.7	59.3	55.2	56.8	4.28
34	84.1	94.7	95.9	59.7	55.6	57.2	4.68
35	90.7	94.7	96.0	60.1	56.0	57.7	5.08
36	97.3	94.7	96.2	60.4	56.3	58.1	5.48
37	103.9	94.7	96.3	60.7	56.6	58.5	5.88
38	110.5	94.7	96.5	61.0	56.8	58.8	6.28
39	117.1	94.7	96.6	61.1	57.0	59.0	6.68
40	123.7	94.6	96.7	61.3	57.3	59.3	7.09
41	130.3	94.5	96.7	61.5	57.6	59.5	7.50
42	136.9	94.4	96.8	61.6	57.8	59.6	7.91
43	143.5	94.3	96.8	61.7	58.0	59.7	8.32
44	150.1	94.1	96.8	61.8	58.2	59.8	8.73
45	156.7	93.9	96.7	61.9	58.3	59.9	9.14
46	163.3	93.7	96.6	62.0	58.5	59.9	9.55
47	169.8	93.5	96.5	62.1	58.7	59.9	9.96
48	176.3	93.2	96.4	62.2	58.8	60.0	10.37
49	182.8	93.0	96.3	62.2	58.9	59.9	10.77
50	189.3	92.6	96.1	62.3	59.0	59.9	11.17
51	195.8	92.3	95.9	62.4	59.1	59.8	11.57
52	202.2	91.9	95.7	62.5	59.2	59.8	11.97

GENERAL INFORMATION

Table 33: Performance Goals of LOHMANN LSL-LITE
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	208.6	91.6	95.5	62.6	59.3	59.8	12.37
54	215.0	91.2	95.2	62.7	59.4	59.7	12.77
55	221.4	90.8	94.9	62.8	59.5	59.6	13.17
56	227.7	90.4	94.7	62.9	59.6	59.5	13.57
57	234.0	89.9	94.3	63.0	59.7	59.4	13.97
58	240.3	89.5	94.0	63.1	59.8	59.3	14.37
59	246.5	89.0	93.7	63.1	59.9	59.1	14.76
60	252.7	88.6	93.4	63.2	60.0	59.0	15.15
61	258.9	88.1	93.0	63.2	60.0	58.8	15.54
62	265.0	87.6	92.6	63.2	60.1	58.5	15.93
63	271.1	87.1	92.2	63.3	60.2	58.4	16.32
64	277.2	86.6	91.9	63.3	60.2	58.2	16.70
65	283.2	86.0	91.4	63.4	60.3	58.0	17.08
66	289.2	85.4	91.0	63.4	60.4	57.7	17.46
67	295.1	84.8	90.5	63.5	60.5	57.5	17.84
68	301.0	84.1	90.0	63.5	60.5	57.1	18.21
69	306.8	83.4	89.4	63.6	60.6	56.9	18.58
70	312.6	82.7	88.9	63.6	60.6	56.5	18.95
71	318.3	82.0	88.3	63.7	60.7	56.2	19.32
72	324.0	81.2	87.6	63.7	60.7	55.8	19.68
73	329.6	80.3	86.9	63.8	60.8	55.4	20.04
74	335.2	79.4	86.1	63.8	60.8	54.9	20.39
75	340.7	78.5	85.3	63.9	60.9	54.5	20.74
76	346.1	77.6	84.5	63.9	60.9	54.0	21.09
77	351.5	76.7	83.7	64.0	61.0	53.6	21.43
78	356.8	75.8	82.9	64.0	61.0	53.0	21.77
79	362.0	74.8	82.0	64.1	61.1	52.5	22.11
80	367.2	73.8	81.0	64.1	61.1	51.9	22.44
81	372.3	72.8	80.1	64.2	61.2	51.4	22.77
82	377.3	71.8	79.2	64.3	61.2	50.9	23.09
83	382.3	70.8	78.3	64.3	61.2	50.3	23.41
84	387.2	69.8	77.3	64.3	61.3	49.7	23.72
85	392.0	68.8	76.4	64.3	61.3	49.1	24.03

EGG PRODUCTION CURVE FOR LOHMANN LSL-LITE



GENERAL INFORMATION

Table 34: Performance Goals of LOHMANN BROWN-EXTRA
Week 20 – 52

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
20	0.7	9.8	9.8	45.0	42.9	4.4	0.03
21	3.8	43.9	43.9	47.6	47.4	20.9	0.18
22	8.2	63.4	63.5	50.1	48.8	31.8	0.40
23	13.7	78.2	78.4	52.6	50.4	41.3	0.69
24	19.7	85.7	86.0	54.9	51.8	47.2	1.02
25	25.9	89.2	89.6	56.7	52.9	50.8	1.37
26	32.2	90.7	91.2	58.1	54.0	53.0	1.74
27	38.6	91.7	92.3	59.3	54.9	54.7	2.12
28	45.1	92.3	93.0	60.1	55.7	55.8	2.51
29	51.6	92.7	93.5	60.8	56.2	56.8	2.90
30	58.1	93.0	93.9	61.4	56.8	57.6	3.30
31	64.6	93.2	94.2	61.8	57.3	58.2	3.70
32	71.1	93.3	94.4	62.1	57.8	58.6	4.11
33	77.6	93.3	94.5	62.4	58.2	59.0	4.52
34	84.1	93.2	94.5	62.7	58.6	59.2	4.93
35	90.6	93.0	94.4	63.0	58.9	59.4	5.34
36	97.1	92.8	94.3	63.2	59.2	59.6	5.75
37	103.6	92.5	94.2	63.5	59.5	59.7	6.16
38	110.1	92.2	94.0	63.7	59.7	59.9	6.57
39	116.5	91.9	93.8	64.0	59.9	60.0	6.98
40	122.9	91.6	93.7	64.2	60.1	60.1	7.39
41	129.3	91.3	93.5	64.4	60.3	60.2	7.80
42	135.7	91.0	93.3	64.6	60.5	60.2	8.21
43	142.0	90.6	93.1	64.8	60.7	60.3	8.62
44	148.3	90.3	92.9	65.0	60.9	60.3	9.03
45	154.6	89.9	92.6	65.2	61.1	60.3	9.44
46	160.9	89.6	92.4	65.3	61.2	60.3	9.85
47	167.1	89.2	92.2	65.5	61.4	60.3	10.26
48	173.3	88.8	91.9	65.6	61.6	60.3	10.67
49	179.5	88.4	91.7	65.8	61.7	60.3	11.08
50	185.7	88.0	91.4	65.9	61.9	60.2	11.49
51	191.8	87.6	91.1	66.1	62.0	60.2	11.90
52	197.9	87.2	90.8	66.2	62.2	60.1	12.30

Table 34: Performance Goals of LOHMANN BROWN-EXTRA
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	204.0	86.7	90.5	66.3	62.3	60.0	12.70
54	210.0	86.2	90.1	66.4	62.4	59.8	13.10
55	216.0	85.7	89.7	66.5	62.5	59.6	13.50
56	222.0	85.2	89.3	66.6	62.6	59.5	13.90
57	227.9	84.7	88.9	66.7	62.7	59.3	14.30
58	233.8	84.2	88.5	66.8	62.8	59.1	14.69
59	239.7	83.6	88.1	66.9	62.9	58.9	15.08
60	245.5	83.1	87.6	67.0	63.0	58.7	15.47
61	251.3	82.5	87.2	67.1	63.1	58.5	15.86
62	257.0	82.0	86.7	67.2	63.2	58.3	16.25
63	262.7	81.4	86.2	67.3	63.3	58.0	16.63
64	268.4	80.8	85.7	67.4	63.4	57.8	17.01
65	274.0	80.2	85.3	67.5	63.5	57.6	17.39
66	279.6	79.6	84.8	67.6	63.6	57.3	17.77
67	285.1	79.0	84.4	67.7	63.6	57.1	18.14
68	290.6	78.3	83.8	67.8	63.7	56.8	18.51
69	296.0	77.6	83.3	67.9	63.8	56.5	18.88
70	301.4	76.9	82.7	68.0	63.9	56.2	19.25
71	306.7	76.2	82.1	68.1	63.9	55.9	19.61
72	312.0	75.4	81.5	68.2	64.0	55.6	19.97
73	317.2	74.6	80.7	68.3	64.1	55.1	20.33
74	322.4	73.7	80.0	68.4	64.1	54.7	20.68
75	327.5	72.9	79.2	68.4	64.2	54.2	21.03
76	332.5	72.0	78.5	68.5	64.3	53.7	21.38
77	337.5	71.1	77.7	68.5	64.4	53.2	21.72
78	342.4	70.2	76.8	68.6	64.4	52.7	22.06
79	347.2	69.3	76.0	68.6	64.5	52.1	22.39
80	352.0	68.3	75.1	68.7	64.5	51.6	22.72
81	356.7	67.4	74.2	68.7	64.6	51.0	23.04
82	361.4	66.4	73.3	68.8	64.6	50.4	23.36
83	366.0	65.5	72.4	68.8	64.7	49.9	23.68
84	370.5	64.5	71.5	68.9	64.8	49.3	23.99
85	375.0	63.6	70.6	68.9	64.8	48.7	24.30

GENERAL INFORMATION

EGG PRODUCTION CURVE FOR LOHMANN BROWN-EXTRA

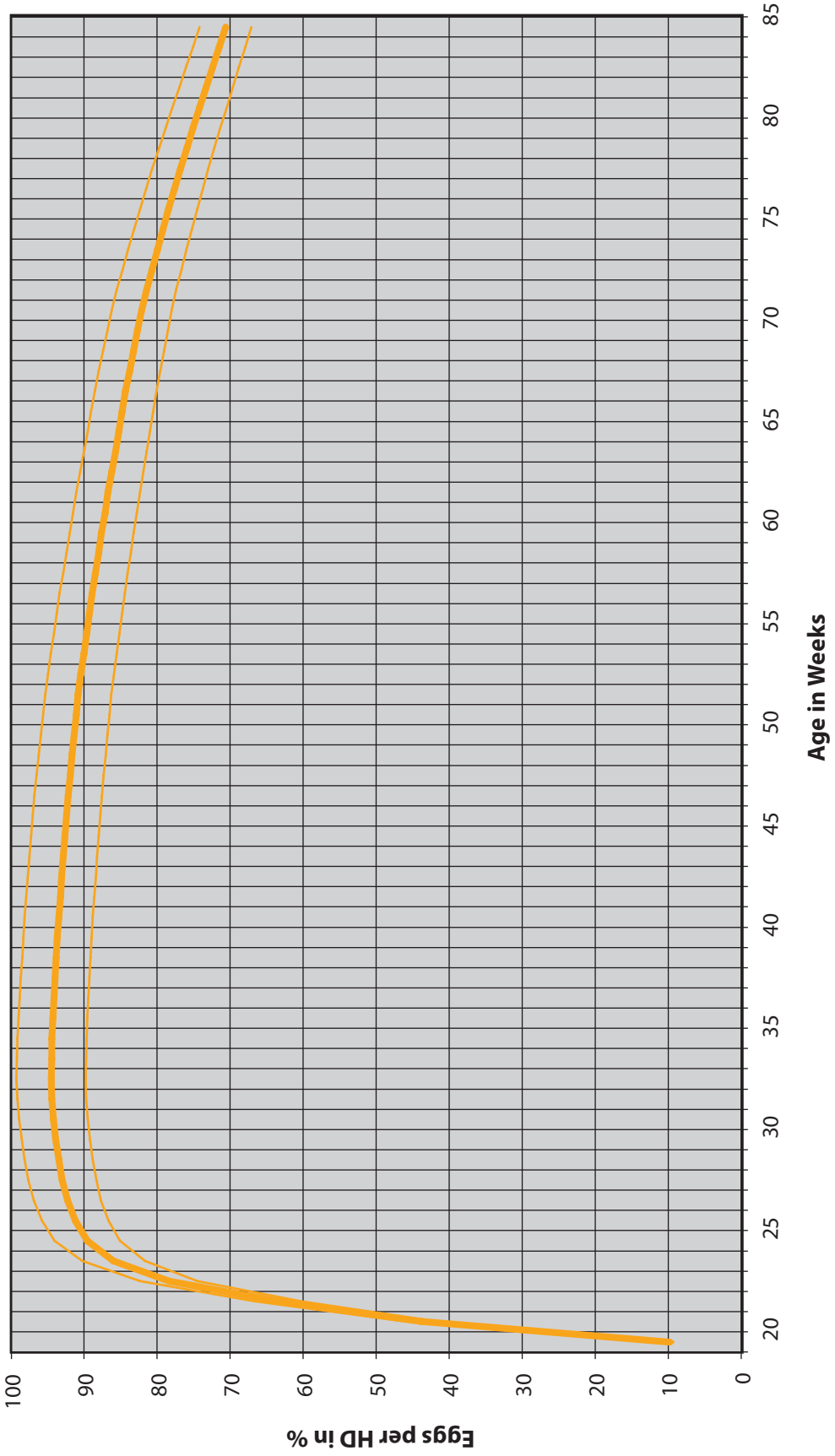


Table 35: Performance Goals of LOHMANN BROWN-PLUS
Week 20 – 52

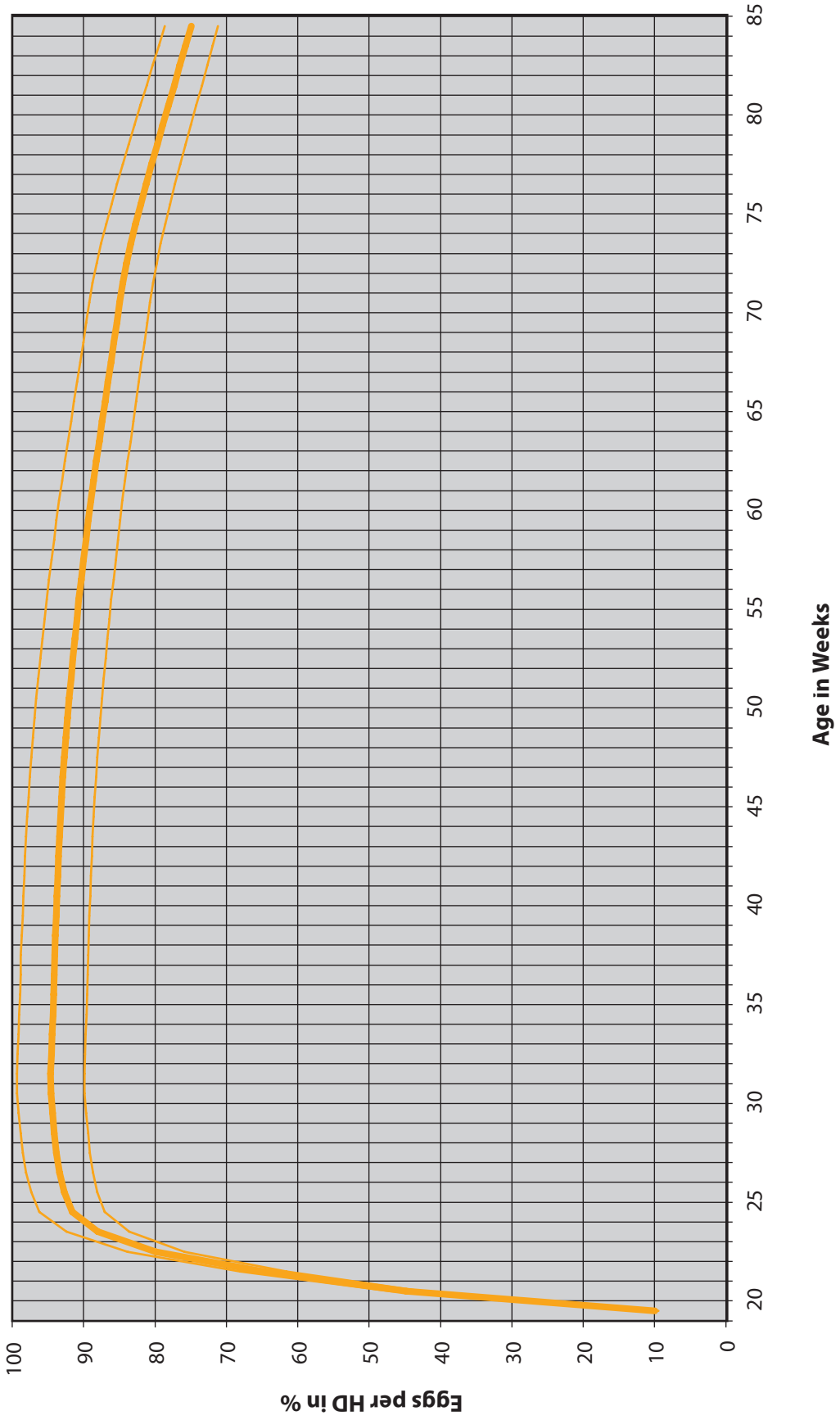
Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
20	0.7	10.0	10.0	44.5	42.9	4.4	0.03
21	3.8	44.8	44.8	47.0	47.4	21.1	0.18
22	8.3	64.7	64.8	49.5	48.2	32.1	0.40
23	13.9	79.7	79.9	52.0	49.6	41.5	0.69
24	20.0	87.7	88.0	54.2	51.0	47.7	1.02
25	26.4	91.2	91.6	56.0	52.3	51.3	1.38
26	32.9	92.2	92.7	57.4	53.2	53.2	1.75
27	39.4	92.8	93.4	58.4	54.1	54.5	2.13
28	45.9	93.1	93.8	59.2	54.9	55.5	2.52
29	52.4	93.3	94.1	59.9	55.5	56.4	2.91
30	58.9	93.5	94.4	60.5	56.2	57.1	3.31
31	65.4	93.6	94.6	60.9	56.7	57.6	3.71
32	71.9	93.5	94.6	61.2	57.2	57.9	4.11
33	78.4	93.3	94.5	61.5	57.5	58.1	4.51
34	84.9	93.1	94.4	61.7	57.8	58.3	4.91
35	91.4	92.9	94.3	62.0	58.1	58.4	5.31
36	97.9	92.7	94.2	62.2	58.3	58.6	5.71
37	104.4	92.5	94.2	62.4	58.5	58.7	6.11
38	110.9	92.3	94.1	62.6	58.7	58.9	6.51
39	117.3	92.1	94.0	62.8	58.9	59.0	6.91
40	123.7	91.8	93.9	63.0	59.1	59.1	7.31
41	130.1	91.6	93.8	63.2	59.3	59.2	7.71
42	136.5	91.3	93.6	63.4	59.4	59.3	8.11
43	142.9	91.1	93.5	63.6	59.6	59.4	8.52
44	149.3	90.8	93.4	63.8	59.8	59.6	8.93
45	155.6	90.5	93.3	64.0	60.0	59.6	9.34
46	161.9	90.2	93.1	64.1	60.2	59.7	9.74
47	168.2	89.9	92.9	64.3	60.3	59.7	10.14
48	174.5	89.6	92.7	64.4	60.4	59.7	10.54
49	180.7	89.2	92.5	64.6	60.5	59.7	10.94
50	186.9	88.9	92.3	64.7	60.7	59.7	11.34
51	193.1	88.5	92.0	64.9	60.8	59.7	11.74
52	199.3	88.1	91.8	65.0	60.9	59.7	12.14

GENERAL INFORMATION

Table 35: Performance Goals of LOHMANN BROWN-PLUS
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	205.4	87.7	91.5	65.1	61.1	59.6	12.54
54	211.5	87.3	91.2	65.2	61.2	59.5	12.94
55	217.6	86.9	91.0	65.3	61.3	59.4	13.34
56	223.7	86.5	90.7	65.4	61.4	59.3	13.74
57	229.7	86.1	90.3	65.5	61.5	59.2	14.13
58	235.7	85.6	90.0	65.6	61.6	59.0	14.52
59	241.7	85.2	89.7	65.7	61.7	58.9	14.91
60	247.6	84.7	89.4	65.8	61.8	58.8	15.30
61	253.5	84.3	89.0	65.9	61.9	58.7	15.69
62	259.4	83.8	88.6	66.0	62.0	58.5	16.08
63	265.2	83.3	88.2	66.1	62.1	58.3	16.47
64	271.0	82.7	87.8	66.2	62.2	58.1	16.85
65	276.8	82.2	87.4	66.3	62.2	57.9	17.23
66	282.5	81.6	87.0	66.4	62.3	57.8	17.61
67	288.2	81.1	86.6	66.5	62.4	57.6	17.99
68	293.8	80.5	86.2	66.6	62.5	57.4	18.37
69	299.4	80.0	85.8	66.7	62.6	57.2	18.74
70	305.0	79.3	85.4	66.8	62.7	57.0	19.11
71	310.5	78.7	85.0	66.9	62.7	56.9	19.48
72	316.0	78.0	84.5	67.0	62.8	56.6	19.85
73	321.4	77.3	84.0	67.1	62.9	56.3	20.21
74	326.8	76.5	83.4	67.2	62.9	56.0	20.57
75	332.1	75.6	82.7	67.2	63.0	55.6	20.93
76	337.3	74.7	82.0	67.3	63.1	55.2	21.28
77	342.5	73.8	81.3	67.3	63.2	54.7	21.63
78	347.6	72.9	80.5	67.4	63.2	54.3	21.97
79	352.6	71.9	79.7	67.4	63.3	53.8	22.31
80	357.6	71.0	78.9	67.5	63.3	53.3	22.65
81	362.5	70.0	78.1	67.5	63.4	52.8	22.98
82	367.3	69.1	77.3	67.6	63.5	52.3	23.31
83	372.1	68.1	76.5	67.6	63.5	51.8	23.63
84	376.8	67.1	75.7	67.7	63.6	51.2	23.95
85	381.4	66.2	74.9	67.7	63.6	50.7	24.26

EGG PRODUCTION CURVE FOR LOHMANN BROWN-PLUS



GENERAL INFORMATION

Table 36: Performance Goals of LOHMANN TRADITION
Week 19 – 52

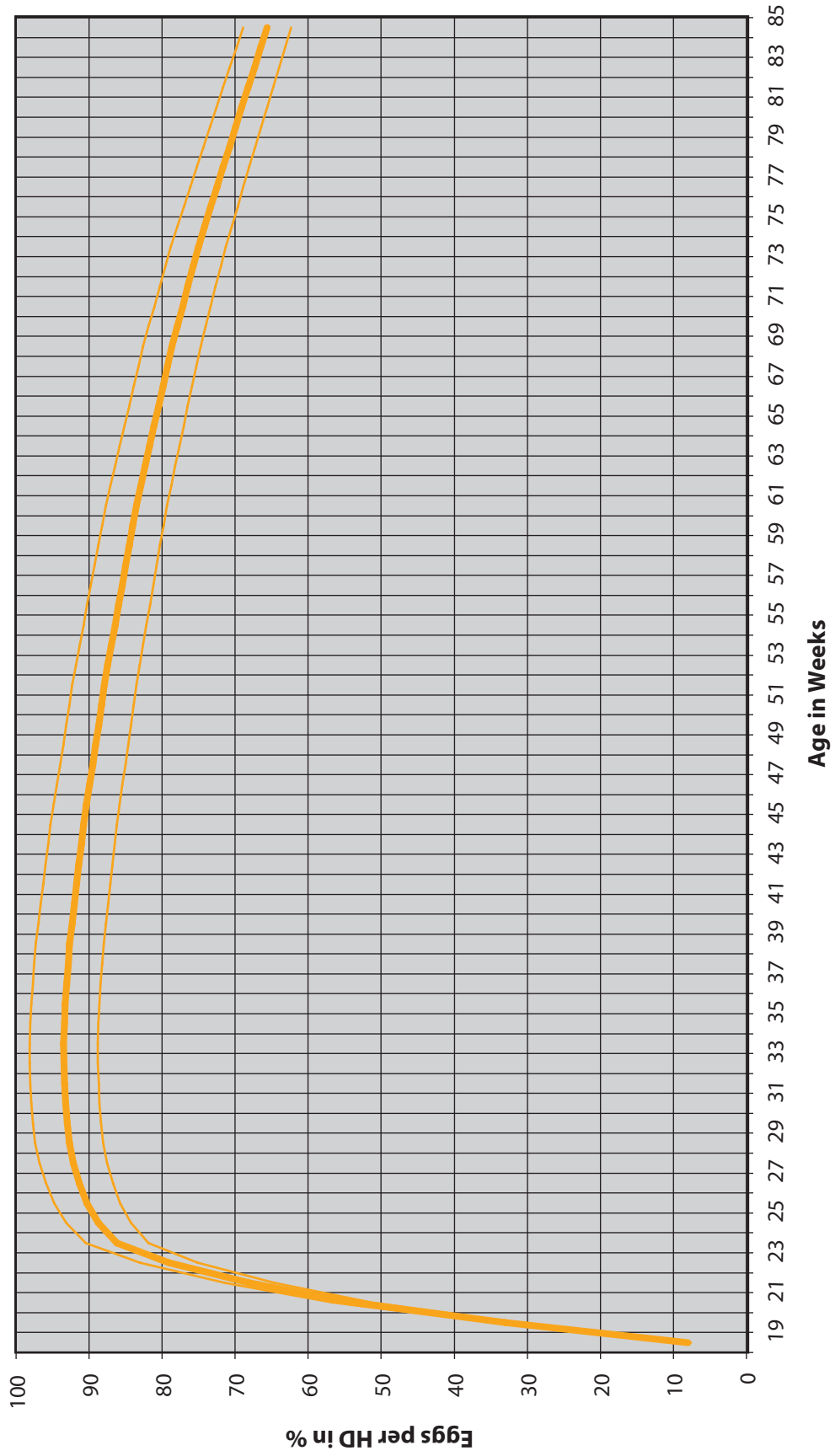
Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
19	0.6	8.0	8.0	45.0	50.0	3.6	0.03
20	2.9	33.0	33.0	47.8	48.3	15.8	0.14
21	6.7	54.0	54.1	50.3	49.3	27.2	0.33
22	11.5	68.0	68.1	52.6	50.4	35.8	0.58
23	17.0	79.0	79.1	54.7	51.8	43.2	0.88
24	23.0	86.0	86.2	56.6	53.0	48.7	1.22
25	29.2	88.5	88.7	58.0	54.1	51.4	1.58
26	35.5	90.0	90.3	59.1	54.9	53.3	1.95
27	41.9	91.0	91.3	60.1	55.6	54.8	2.33
28	48.3	91.8	92.2	61.0	56.3	56.2	2.72
29	54.8	92.3	92.7	61.7	56.9	57.2	3.12
30	61.3	92.6	93.0	62.3	57.4	57.9	3.52
31	67.8	92.7	93.2	62.8	58.0	58.5	3.93
32	74.3	92.7	93.4	63.2	58.4	59.0	4.34
33	80.8	92.7	93.5	63.5	58.8	59.3	4.75
34	87.3	92.7	93.5	63.8	59.1	59.6	5.16
35	93.8	92.5	93.4	64.0	59.4	59.8	5.57
36	100.3	92.3	93.3	64.3	59.6	59.9	5.98
37	106.7	92.0	93.1	64.5	60.0	60.0	6.40
38	113.1	91.7	92.9	64.8	60.3	60.1	6.82
39	119.5	91.4	92.7	65.0	60.6	60.2	7.24
40	125.9	91.0	92.3	65.2	60.8	60.2	7.65
41	132.2	90.6	92.0	65.4	61.0	60.1	8.06
42	138.5	90.2	91.7	65.6	61.2	60.1	8.47
43	144.8	89.8	91.4	65.8	61.3	60.1	8.88
44	151.1	89.4	91.1	66.0	61.5	60.1	9.29
45	157.3	89.0	90.8	66.1	61.7	60.0	9.70
46	163.5	88.5	90.4	66.3	61.8	59.9	10.11
47	169.7	88.0	89.9	66.4	62.0	59.7	10.52
48	175.8	87.5	89.5	66.6	62.2	59.6	10.93
49	181.9	87.0	89.1	66.7	62.3	59.4	11.34
50	188.0	86.5	88.7	66.9	62.4	59.3	11.74
51	194.0	86.0	88.3	67.0	62.6	59.2	12.14
52	200.0	85.5	87.9	67.2	62.7	59.0	12.54

Table 36: Performance Goals of LOHMANN TRADITION
Week 53 – 85

Age in Weeks	Egg No. per H.H.	Rate of Lay %		Egg Weight g		Egg Mass g / H.D.	Egg Mass kg / H.H.
	cumulative	per H.H.	per H.D.	in Week	cumulative	in Week	cumulative
53	205.9	84.9	87.4	67.3	62.8	58.8	12.94
54	211.8	84.3	87.0	67.4	63.0	58.6	13.34
55	217.7	83.7	86.5	67.5	63.1	58.3	13.73
56	223.5	83.1	86.0	67.6	63.2	58.1	14.12
57	229.3	82.5	85.5	67.7	63.3	57.8	14.51
58	235.0	81.9	85.0	67.8	63.4	57.6	14.90
59	240.7	81.3	84.5	67.9	63.5	57.3	15.29
60	246.3	80.7	84.0	68.0	63.6	57.1	15.67
61	251.9	80.1	83.5	68.1	63.7	56.8	16.05
62	257.5	79.4	82.9	68.2	63.8	56.5	16.43
63	263.0	78.7	82.3	68.3	63.9	56.2	16.81
64	268.5	78.0	81.7	68.4	64.0	55.8	17.18
65	273.9	77.3	81.1	68.5	64.1	55.5	17.55
66	279.3	76.6	80.5	68.6	64.2	55.2	17.92
67	284.6	75.9	79.9	68.7	64.2	54.8	18.28
68	289.9	75.2	79.3	68.8	64.3	54.5	18.64
69	295.1	74.5	78.7	68.9	64.4	54.2	19.00
70	300.3	73.7	77.9	69.0	64.5	53.7	19.36
71	305.4	72.9	77.2	69.1	64.5	53.3	19.71
72	310.4	72.1	76.5	69.1	64.6	52.9	20.06
73	315.4	71.3	75.8	69.2	64.7	52.5	20.41
74	320.3	70.5	75.0	69.3	64.8	52.0	20.75
75	325.2	69.6	74.2	69.4	64.9	51.5	21.09
76	330.0	68.7	73.3	69.4	64.9	50.9	21.42
77	334.7	67.8	72.5	69.5	65.0	50.4	21.75
78	339.4	66.9	71.7	69.5	65.1	49.8	22.08
79	344.0	66.0	70.8	69.6	65.1	49.3	22.40
80	348.6	65.1	70.0	69.6	65.2	48.7	22.72
81	353.1	64.2	69.1	69.7	65.2	48.2	23.03
82	357.5	63.3	68.2	69.7	65.3	47.6	23.34
83	361.9	62.4	67.4	69.8	65.3	47.0	23.64
84	366.2	61.5	66.5	69.8	65.4	46.5	23.94
85	370.4	60.6	65.6	69.9	65.4	45.9	24.24

GENERAL INFORMATION

EGG PRODUCTION CURVE FOR LOHMANN TRADITION



INFORMATION

HOW LOHMANN TIERZUCHT IS CALCULATING THE ENERGY CONTENT OF FEED AND RAW MATERIALS (INTERNATIONAL WPSA-FORMULA):

ME MJ/kg = g crude protein x 0.01551
+ g crude fat x 0.03431
+ g starch x 0.01669
+ g sugar x 0.01301 (as saccharose)

ME = metabolizable energy in MJ/kg
1 kcal = 4.187 kJ

CONSULTATION AND DIAGNOSTICS IN ALL QUESTIONS OF POULTRY HEALTH THROUGH:

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04/18

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