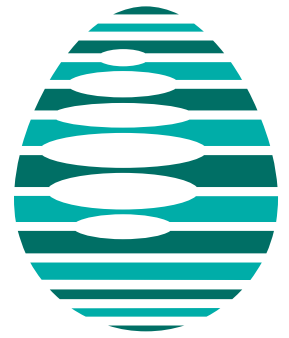


Breeder Management Manual



Hubbard

YOUR CHOICE, OUR COMMITMENT

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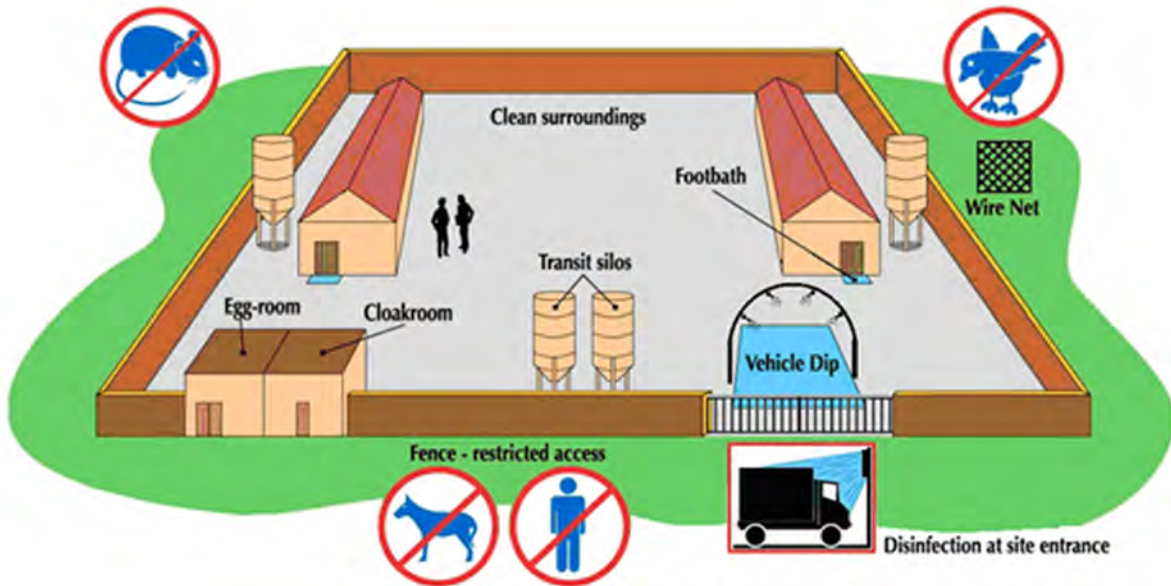
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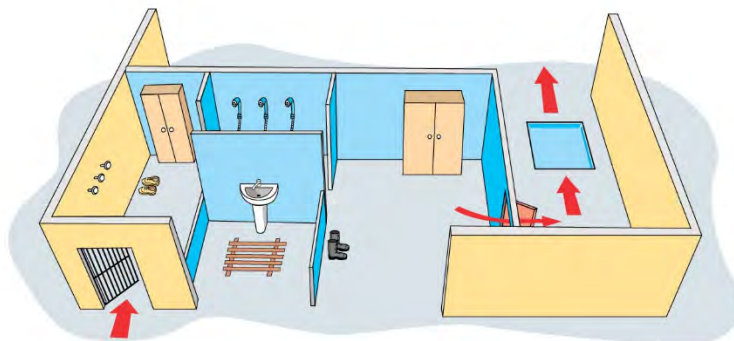
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1. GENERAL FARM RULES

- The golden rule of breeder management is to have one age and one breed per site, so as to follow the "all-in, all-out" principle.
- The choice of the site for the farm, as well as the layout of the houses must aim at keeping them free from any source of contamination. Protection is reinforced by hygiene controls.



- A changing room should be made available at the entrance of the site. It must be used by everybody entering the farm (a shower and a change of clothes).



- When the old flock is removed and before the arrival of the new flock, all houses and equipment must be thoroughly cleaned and disinfected according to strict procedures and protocols. This should be followed by a resting period of at least 10 days.

2. CLEANING AND DISINFECTION OF POULTRY HOUSES

Between each flock, cleaning and disinfection of the houses, their annexes, surroundings and access ways are both essential to ensure the good sanitary conditions required for the incoming flock to improve its profitability.

2.1. INSECT CONTROL

The first application of an organophosphorus-type insecticide is made immediately after the old breeders have been removed, when the house is still warm. The insecticide is sprayed over the pits, the litter and the lower part of the walls up to 1 metre high. Leave the insecticide to work for 24 hours.

2.2. OPERATIONS PRIOR TO CLEANING

Water tank, pipes and nipples:

- empty the complete water system onto the litter

- carefully clean the complete water system with an alkaline detergent. Follow this by descaling with an acid solution, and leave to soak for about 6 hours
- double rinse with clean water.

All the equipment (nests, feeders, drinkers, etc.) is removed and stored on a concrete area.

The entire ventilation system (air inlets and outlets, fans, heating and ventilation ducts if they are present) and individual radiant or pancake type brooders are brushed and vacuum cleaned.

Litter is removed.

2.3. WASHING

When washing, one should ensure that the dirty water is directed towards a pit or drain and does not run outside to the house surroundings or access ways.

House

Soak and scour the remaining organic matter.

Apply a bactericidal and fat removing detergent using an appliance capable of dealing with foam products.

Some hours after soaking, wash with a high pressure washer (> 50 kg/cm²) or with hot water, in the following order:

- internal roof surface, from the top down
- walls, from the top down
- finally, the pits and the concrete floor.

2.4. EQUIPMENT

Nests, drinkers, and feeding equipment:

- soak and scour the organic matter
- apply a bactericidal and fat removing detergent using an appliance of dealing with foam products
- thoroughly wash and then rinse. Prior to the final rinsing, dip the removable parts of the nests (perches and nest box bottoms) for 24 hours in a disinfectant solution
- dry on a concrete area (different to that used for washing).

2.5. PLACING THE EQUIPMENT BACK INTO THE HOUSE

The vehicles that may be used for this operation must have been carefully washed and disinfected by spray.

2.6. DISINFECTION

WATER PIPES

Prepare a highly concentrated chlorine solution (200 ppm) in the water tank.

Open the tank to fill the pipes with this solution and leave for 24 hours. Afterwards, drain the water circuit. Do not forget to seal the water tank to protect it from dust.

HOUSE

House and equipment disinfection is achieved using a homologous bactericidal, virucidal and fungicidal disinfectant, applied with a sprayer or a foam-producing machine.

The list of homologous disinfectants may vary from one country to another. We recommend that you consult the local Health Authorities.

SILOS

Scrape, brush, wash and then after drying, fumigate using fungicidal candles.

HEATING AND VENTILATION DUCTS (IF THEY ARE PRESENT)

Disinfect using fungicidal, virucidal and bactericidal candles.

HOUSE SURROUNDINGS AND ACCESS WAYS

Spread a disinfecting product, such as:

- caustic soda : 50 to 100 kg (110 to 220 lb) for 1000 m²
- or quicklime : 400 kg (880 lb) for 1000 m²

2.7. SANITARY PRECAUTIONS

Place clean boots and overalls in the changing room. Replenish footbaths with disinfectant.

2.8. RODENT CONTROL

Rodents may be vectors of numerous bacterial diseases, salmonellosis for example. Control is often based on the use of toxic baits, which generally contain anticoagulants. These are left in places frequented by the rodents. This gives variable results. We advise using a specialised rodent control service.

2.9. CONTROLS TO DETERMINE DISINFECTION EFFICIENCY

VISUAL EXAMINATION

Check for dirt stains in the house and on the equipment.

BACTERIOLOGICAL ANALYSIS

Contact plates or swabs are applied to equipment and to different places in the house. These are then quickly forwarded to a bacteriology laboratory.

2.10. RESTING PERIOD

This starts only when all the above operations have been achieved and lasts for at least 10 days, in order for the house to dry properly.

2.11. BEFORE THE ARRIVAL OF THE NEW FLOCK

3 days before the new flock arrives, a residual insecticide is sprayed on all surfaces.

Fresh litter is placed (never use mouldy material) and its surface sprayed with a larvicidal insecticide.

Equipment is prepared in the brooding area.

24 hours before the new flock arrives, final disinfection, by thermonebulisation, is made. Ventilate well.

3. WATER

3.1. QUALITY

As yet, there are no drinking water standards for farm animals. However, some chemical and biological standards do exist that allow an estimation of water quality. Amongst these, **the level of organic matter, ammonia, nitrates and nitrites, as well as the presence of bacteria** (total and heat tolerant coliforms, faecal streptococci and sulphur-reducing clostridia), **which indicate faecal contamination, represent the main indicators for determining the quality of drinking water. In all situations, water should be free from salmonellae and pathogenic organisms.** The following table shows some microbiological and chemical standards:

Below we show the maximum levels of some chemical substances, which can lead to physiological disorders and reduction in performance. These same elements are also susceptible at high levels of damaging the water pipelines.

- chlorides (Cl) 500 ppm
- sulphates (SO₄) 1100 ppm
- iron (Fe) 500 ppm
- magnesium (Mg) 200 ppm
- arsenic (As) 0.01 ppm
- nitrites (NO₂) 5 ppm
- nitrates (NO₃) 50 ppm
- sodium (Na) 500 ppm
- potassium (K) 500 ppm

	Units	Drinkable water
Total flora	number/ml	10 to 100
Salmonella	number/ml	0
E. coli	number/ml	0
Hardness		15 to 30°
Organic matter	mg/l	1
Nitrates	mg/l	0 to 15
Ammonia	mg/l	0
Turbidity		5 U
Iron	mg/l	0.3
Manganese	mg/l	0.1
Copper	mg/l	1
Zinc	mg/l	5
Calcium	mg/l	75
Magnesium	mg/l	50
Sulphates	mg/l	200
Chlorides	mg/l	200
pH		7 to 7.5

In regions where the water is very salty, it could be worth reducing the level of salt in the feed, but at the same time ensuring that there will be no deficiency.

In regions where water is very hard, the use of softeners or ion exchangers can lead to a significant increase in the level of sodium. This sodium excess can be responsible for watery droppings, reduced eggshell quality, and even some production problems.

For the chicken the ideal pH lies between 6 and 7. A pH that is too acid can cause corrosion to the water pipes. A pH above 7 favours the growth of bacteria. Organic acids can be used to lower the pH (vinegar, for example).

3.2. MONITORING WATER QUALITY

The drinking water should be analysed on a regular basis, for both bacteria and chemical levels, using a competent laboratory. The value of any analysis depends on when, where (where the water enters the house and at the end of the drinker line) and how the sample has been taken. To eliminate chance of a false reading, it is best to sterilise the point that the water sample is taken from (from the tap for example) with heat from a lighter or blowtorch, and let about 10 litres of water flow, before taking the sample. It is important to realise that the sodium thiosulphate, contained in the flasks supplied by the laboratories carrying out bacteriological tests on water, only neutralises chlorine or bleach. It has no action on quaternary ammonium compounds. The result of the analysis only reflects the water quality at the moment of taking the sample. There is no guarantee of this result remaining the same. Thus, water should be analysed on a periodic basis; a minimum of twice yearly for water taken from wells (at the end of the summer and again at the end of winter); once yearly when using town mains supply.

3.3. CLEANING THE PIPE SYSTEM DURING THE SANITARY BREAK

The mineral and organic deposits that accumulate during the life of a flock in the water pipelines offer favourable conditions for bacterial growth, which in turn reduces the chlorine activity. It is therefore essential to decontaminate the pipelines, as soon as the flock has departed. The best solution is to use a succession of alkaline and acid products. Systematically, a

bacteriological test on water taken from the end of the circuit should be made before the new flock arrives to determine the effectiveness of the cleaning process.

3.4. TREATMENT OF THE DRINKING WATER

Chlorination is still the best and most economic method of treating drinking water. The chlorine can be administered using a dosing pump. A contact time of 15 to 30 minutes between the water and the chlorine is required for proper disinfection. It is essential to monitor the level of residual active chlorine at the end of the pipe system once weekly. Only the test measuring the reaction to D.P.D (Diethyl Phenylene Diamine) allows us to do this. The colorimetric test using orthotoluidine does in fact measure chlorine in all its forms (active and inactive).

The residual level of active chlorine at the end of the system should be 0.3-0.4 mg/litre (0.3-0.4 ppm). Chlorine becomes dissociated in water into hypochlorous acid and hypochlorite ions. The respective level of these two forms of chlorine depends on the pH. Hypochlorous acid is 120 times more active than the hypochlorite ion. It is best if the pH of the treated water remains below 7, so that chlorine disinfection can be effective.

4. HEALTH PROGRAMME

It is impossible to devise a health programme to adequately suit all geographic areas. For this reason, it is strongly recommended that a **local specialist be consulted to help** produce a prevention programme adapted to that region.

This guide limits its comments to the description of some rules for the use of vaccines and other treatments. To be successful, respecting these rules is as important as choosing the right products.

- Staff should be properly trained to carry out veterinary operations. It is useful to create a Standard Operating Procedure Manual that describes in full detail the way to perform each vaccination or treatment.
- All the necessary equipment (sprayers, syringes, etc.) must be correctly maintained, and checked before each use.
- Each operation should be planned and supervised by a technically competent person.
- Vaccines and treatments should be stored in appropriate conditions, in suitable quantities considering the requirements and supply time.
- Report carefully in the flock records the details of all operations: date, time, vaccine batch number, route, etc.
- Finally, it is useful to have the help of a laboratory in order to anticipate health problems ahead of time and to assess the efficiency of the operations:
 - control of disinfection, water and feed quality
 - serological monitoring
 - post mortem examination, routine parasite checks.

5. FEMALE GROWING PERIOD

5.1. TARGETS AT 20 WEEKS

- Uniform bodyweight: Uniformity +/- 10% = 80%; C.V. = 8.
- Uniform sexual maturity (comb, wattles).

The success of a flock depends mostly on uniformity. Therefore, everything must be done to obtain a uniform flock with adequate bodyweight and conformation at the start of lay.

5.2. REARING HOUSES

It is highly recommended to use dark houses with controlled environment, since they allow for better control of sexual maturity.

See product Management Guidelines for Floor space and equipment standards from 0 to 20 weeks

Note: the “spin feeder” system, which distributes pelleted feed on the floor using a spinning disc, has been used in several countries for many years, especially if daily feeding is practiced. Spin feeders are only suitable for rearing since during production the males and females must be fed separately. Good quality, hard pellets, usually based on wheat, are a requirement where spin feeders are used. Soft pellets will break during distribution and the fine particles will be lost in the litter.

The advantages of the spin feeder system include:

- Very flexible feed allocation so every pen can be fed the appropriate amount
- fast feed distribution, over a wider surface

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- increased time for feed consumption
- lower feeding equipment cost
- no obstacle on floor, easier bird circulation and rearing surface organization (pens)
- bird density per m² may be increased (up to + 20%)
- easy cleaning at the end of the rearing flock and reduced turnaround time

IMPORTANT POINTS

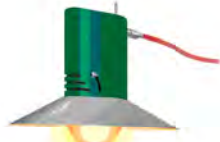
Pre-heat the whole house 30-40 hours prior to the arrival of the chicks.

Never overheat the chicks. When using radiant type heaters allow the chicks a choice within a certain temperature range: the spread should be about 8-10°C (46-50°F). Place the brooders high enough above the litter, at least 1.5m (5 ft), at an angle, to allow for uniform distribution of the chicks over the living area.

The use of whole house heating does not allow for a large enough temperature range. It is therefore necessary to respect the suggested temperatures.

Ventilate correctly right from the chick's arrival (ventilation needs during the brooding period = 1 m³ per kg liveweight per hour). Unless there are cold air drafts in the house, use wire net fence instead of cardboard.

In the case where brooding takes place in one part of the house, do not exceed a density of 25 chicks per available m² (0.43 ft²/bird). It is better to allow the chicks to spread quickly over the whole house, by 7 days at latest.



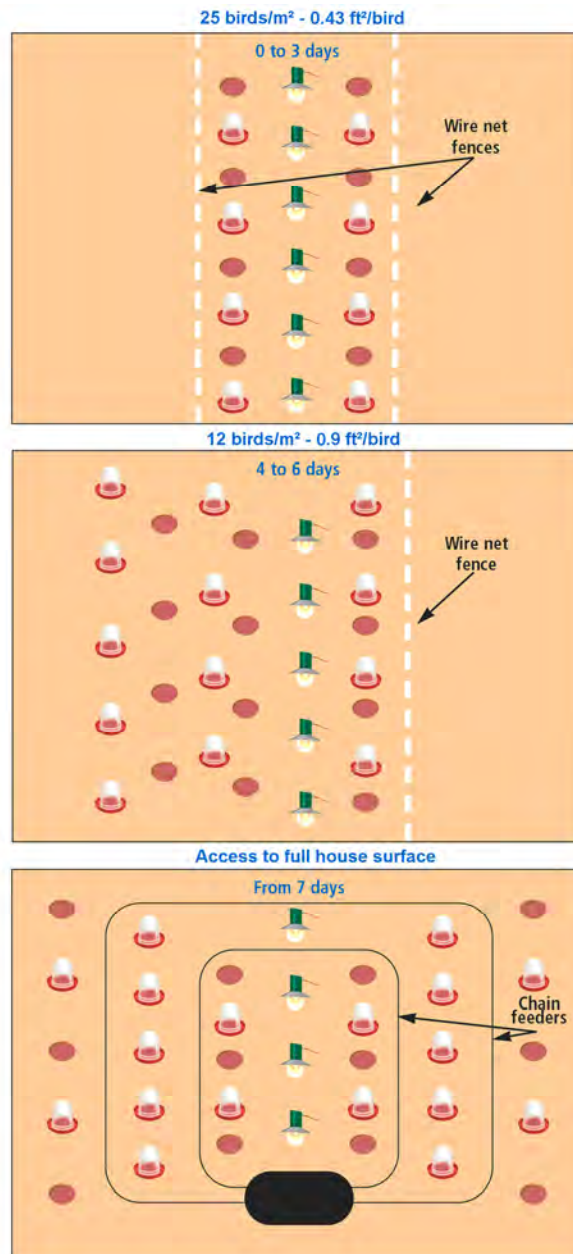
Brooder



Drinker



Feed tray



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Note: supplementary feeding and drinking equipment should be removed gradually after 4-5 days of age when it is clear that the birds are feeding and drinking normally. Reduce the number of drinkers and feeder trays over a period of 3-4 days, taking care that the chicks have good access to the main feeding and drinking systems.

When using vaccines against coccidiosis, it may be of use to take some litter from the brooding area and to uniformly spread it on the new litter, as the brooding area is expanded. This operation allows for better recycling of oocysts and for a uniform immune response.

5.3. BEAK TRIMMING

Beak trimming is usually not necessary. However, in cases where a high risk of pecking is anticipated, it may be done at around 7 days of age.



5.4. MONITORING BODYWEIGHT AND UNIFORMITY DURING REARING

The main purpose of the rearing period is to achieve the bodyweight and uniformity target at 20 weeks following a smooth and regular growth curve. It is most important to obtain a regular weekly weight gain, as well as achieving the weekly target weights in the first few weeks to help develop a flock, which is uniform in skeletal size. This must be achieved before 10 weeks, as after this it is too late.

BODYWEIGHT CONTROL

The birds must be weighed weekly from the first week. During the first 2 weeks, collective weights can be taken in batches of 5 or 10 birds using a bucket. Subsequently, the birds are weighed individually.

Weigh a sufficient number of birds (around 100) cornered using lightweight screens in 2 or 3 places in the house. For an accurate interpretation of the result, it is important to weigh all the birds caught in the screens. Weights can be recorded on a weighing sheet, which is available from our technicians.

Weighing should always be carried out on the same day of the week, at the same time, on non-fed birds. For a daily fed flock do this in the morning just after the light is switched on, before they eat. For a flock on the no-feed day type feed programmes, weigh them on a no-feed day.

Bodyweight control is easier when automatic systems are in use. To ensure it remains reliable, this type of weigh scale should be recalibrated every 2 weeks by weighing 100 birds manually and then resetting the scale.

After weighing, average weight and uniformity are calculated and immediately graphed on the growing curve. The analysis of the growing curve helps to accurately adjust the feed allowance and, if need be, to take the appropriate steps to correct the uniformity.

UNIFORMITY CONTROL

A uniform flock at the end of rearing will contain birds of a very similar bodyweight and sexual maturity that will respond to stimulation in uniform manner, producing a predictable peak and high egg output.

The target for flock uniformity at 20 weeks of age is 80% or above, which is difficult to achieve without grading. Grading is carried out to separate large, fast eating and small, slow eating birds from the average population. The ideal time for grading is at 28 days, once feed control has started and allowing sufficient time for the birds' skeleton to develop to its potential at 10 weeks of age.

However, what is essential is prevention. The following factors play an important role in achieving and maintaining good uniformity:

- health status of the flock
- access to feed and water (see equipment standards)
- water restriction should not be too severe. Crops should be checked before water withdrawal to ensure sufficient water consumption
- feed distribution time, should be quick and as close as possible **to 4 minutes**. When too slow, corrections must be made:
 - adding extra hoppers in the middle of the feeding circuit
 - in the longer term, replacement of the equipment by a faster system.

Approximative correspondance CV / Uniformity	
CV (%)	Uniformity (%)
5	97
6	92
7	87
8	80
9	75
10	70
11	65
12	60
13	55
14	47
15	40

- feed consumption time. The target is to have the flock finish its feed in 40-60 minutes. A shorter or longer consumption time is detrimental to uniformity.

If the eating time becomes too short, try to increase it by not feeding on certain days in the week and then dividing the same weekly feed quantity over the remaining days.

The feed quantity distributed is then higher, which increases the consumption time.

Therefore, from the 3rd or 4th week, it is advised to switch to 5/7 feed (2 non-consecutive days without feed: Monday and Friday for example). The 4/7 feed (3 non-consecutive days without feed: Monday, Wednesday and Friday for example) can be used if necessary.

It is generally not necessary to use programmes different to the ones described above to achieve the feed consumption time target. From the practical point of view, when the 1/2 (skip-a-day) system is used, this would suggest that the feeding equipment is not suitable.

Maintain the "no-feed day" system if possible up to when the first eggs are laid.

5.5. GRIT AND GRAIN

To maintain an active feeding behaviour, help the development of the digestive tract and encourage the birds to scratch the litter, we advise giving the birds grit and grain from 4 to 5 weeks of age:

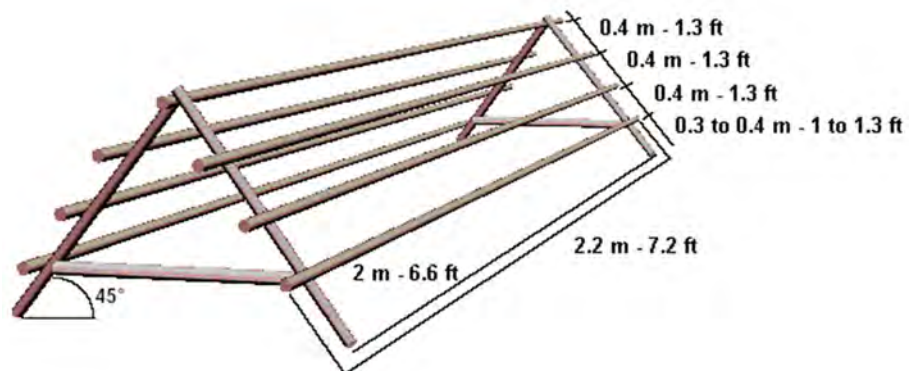
- grit (insoluble stone particles of 2 to 4 mm): 3 to 5 g per week per bird, distributed over 2 or 3 days
- grain (broken maize, or whole wheat): 3 g per bird every day, or every other day. This is thrown on the litter, a few hours before the dark period.

5.6. PERCHES

To develop the sense of balance, to learn to both jump and perch, which lowers the chance of floor laying during production, we recommend the use of perches.

They can be used from the 4th week onwards until the completion of the rearing period.

Their use can be continued in the production period if space permits. Calculate 3 cm of perch space per pullet.



5.7. WATER

CLEANING THE DRINKERS

The water in drinkers often becomes soiled by feed residues and sometimes also by infection. To prevent the development of germs, drinkers should be cleaned at least once daily during the first two weeks and once weekly thereafter. In hot climates clean the drinkers daily. The water height should be 15 mm.

CONTROLLING WATER

Controlling the water allowance during rearing is often necessary to avoid over-consumption and litter deterioration. Practically, water is given about ½ hour before feed is distributed, and must remain available 1 to 2 hours after the feed has been finished. It is also advisable to give water 30-45 minutes before the dark period. When using feed programmes where the flock only eats on certain days in the week, the same water schedule can be kept on the days without feed.

Water control must be relaxed whenever the temperature increase or the behaviour of the flock demonstrates excessive thirst. Each poultry house should be equipped with a reliable water meter to monitor consumption. In temperate conditions, it is about 1.6 times that of feed. However, the reasons for variations are such that only observation of the birds can lead to proper adjustment (particular attention should be paid to the crop, which must remain soft once the birds have eaten).

6. PRODUCTION PERIOD

6.1. MAIN TARGET

- Onset of production: 10% production (weekly average) at 25 weeks

6.2. PRODUCTION HOUSE

As for rearing, dark houses with a controlled environment are the easiest to manage. Open-sided houses remain a very acceptable solution for the production period, provided that some extra precautions are taken:

- good insulation of the roof
- heating system for the coldest periods
- powered ventilation, or even a cooling system for the hottest periods.

See Product Management Guidelines for Equipment standards in production

6.3. MANAGEMENT DURING PRODUCTION

BODYWEIGHT AND UNIFORMITY

Control methods are the same as those described in the rearing period. Weigh as follows:

- every week until 32 weeks (twice a week during onset of production)
- then at least every 3 or 4 weeks. The ideal is to continue weighing every week until the end of production.

FROM TRANSFER TO PEAK

Until the first eggs, the feed amount* is **strictly adapted to the bodyweight target**, in order to avoid fattening that would be detrimental to production later on.

A quick increase in feed is advised **when the flock reaches 10% daily production**, in order to allow for a good increase in both production and egg size. This method of management allows the flock to achieve peak production with a reasonable bodyweight (from 20 weeks of age till peak of lay – around 29-30 weeks, ensure female growth speed is in line with product recommendations).

AFTER PEAK

Good management of bodyweight from peak until the end of production is essential to obtain satisfactory persistency in production and hatch. Try to reach the final bodyweight following an **even** growth curve (+10 g per week from 32 weeks until the end of production).

The information gathered during the period up to peak production helps to determine the rate at which feed* should be reduced following peak production. Feed must be reduced **starting the week after the peak**, depending on the following factors:

- % production
- egg weight
- bodyweight
- house temperature
- time for feed consumption.

* More information on feeding during production can be found in the chapter “Feeding after 20 weeks”.

GRIT AND GRAIN

- Grain: 3 to 5 g per bird every day.
- Grit: 3 g per bird, once or twice a week.

This is thrown on the litter in the middle of the afternoon to stimulate mating and scratching activity.

Grit and grain must be subjected to the same biosecurity procedure as the rest of the diet

7. MALE MANAGEMENT

7.1. TARGETS

- Males with good sexual development at transfer.
- Maturity in equilibrium with the females.
- Sufficient number to allow for further culling and remain with 9 to 10 good males (M77) or 8 good males (M99) for every 100 females at 24 weeks.

7.2. THE ESSENTIAL POINTS FOR MANAGING MALES

The general technical recommendations are the same as for the females.

See Product Management Guidelines for Equipment standards

It is better to rear the males in a different house separate from the females. Then it is possible to adjust the lighting programme of one sex without affecting the other. Feed control starts from the first day. The brooding period is the same as for the females. Thereafter, the feed amount is adapted according to the weekly bodyweight. It is carried out according to the same principles as for the females. Water restriction will also follow the same principles.

AROUND 4 WEEKS

First, make a detailed evaluation of the state of the flock. Cull the weak birds. If the flock is not uniform enough, it may be useful to isolate those less developed birds in a separate pen. They should then be able to go back with the rest of the flock after 1 to 3 weeks. This simple step is usually sufficient. If the work is done soon enough, there is no need to calculate different feed amounts for the birds in this pen and the rest of the flock.

AFTER 15 WEEKS

From this age onwards, it is better to have a higher weekly weight gain (+125-150 g/week – 0.28-0.33 lb/week), in order to ensure proper testicle development.

AROUND 17 WEEKS

Make a second detailed evaluation of the flock, assessing carefully the sexual development of the males: **comb, wattles, behaviour**, and the quality of beak tipping.

If need be, separate those birds with insufficient development into a special pen and readjust the lighting programme.

This preparation is essential for a successful transfer. It ensures that both males and females have a similar level of sexual maturity and avoids having poorly developed males at mixing time.

TRANSFER MIXING WITH THE FEMALES

Transfer is usually made between 20 and 22 weeks of age. It is during the days following transfer that a good part of the relationship between males and females is established.

This period is of the **UTMOST IMPORTANCE** to future production.

Never transfer shy, sexually underdeveloped males.

Observe carefully the male/female interaction during the first few days.

If the males are too aggressive, remove some of them. Place them in a separate pen and reintroduce them progressively, as the hens become more mature and ready to accept them. An alternative is to mix the males in 2 or 3 successive phases, by first placing not more than 6% of the more mature males at the time of mixing and mix the rest later when the first eggs are laid. This latter method means that a place must be found to store the spare males, either at the rearing farm or in the production house following the same conditions for density and equipment as at the rearing farm.

Aim to have around 9 to 10% good males (M77) or 8% good males (M99) at 24 weeks, after selecting out the poor quality males.

DURING PRODUCTION

The males must grow **slowly and evenly** (+20-25 grams – +0.044-0.055 lb weekly).

To avoid problems of behaviour and distribution, males should be fed in the morning just at the moment when **the last of the female feed is being distributed**.

The height of the male feeder should be high enough to stop the females from eating with the males.

Male feeding can be automated. However, it is better that the males are fed when the house attendant arrives, so that he/she can make sure that every bird has normal access to the feeders and that the consumption time remains within an acceptable range of 30 minutes.

Good litter is especially important to prevent leg problems, which for males, quickly affects mating activity.

In many cases spiking takes place at 40 weeks of age. Those males in bad condition are eliminated and replaced by younger mature males aged about 25 weeks.

To prevent from risk of contamination, this practice involves strict sanitary control of the males to be spiked. Concerning persistency of fertility, it is however, a practice that gives better results than spiking males of the same age as the breeder flock.

8. FEED FEEDING PROGRAMME / FORMULATION

Refer to Product Management Guidelines for specific recommendations.

PRE-STARTER AND/OR STARTER FEED: 0-5 WEEKS

Higher early crude protein & amino-acids intake increases lean tissue accretion, skeletal mass and flock uniformity.

When it may be difficult to achieve the targeted bodyweight to four weeks of age for all birds (chicks from young breeders, long chicks transportation,...etc.), it is advisable to use a high amino-acids pre-starter for the first 10 days of age before moving to the more conventional starter diet.

Pre-starter and/or Starter feed should be best provided as a sieved crumble.

GROWER RATION: 6-19/23 WEEKS

During this period when feed allowance is at its most restricted, extending the eating time will give a better opportunity for all the birds to feed.

A low energy grower feed (< 2650 Kcal) presented in the form of a regular mash is the best compromise. It is important for the grit to be uniform, with low levels of small and large particles.

An acceptable eating time of 40-60 minutes is achievable using a '4 or 5 feed days in 7 days' feeding program, providing this is permitted by local regulations.

In some management systems, such as floor feeding (spin feeding), a high quality durable grower pellet is essential.

TRANSITION TO BREEDER DIET

The use of a pre-lay feed is optional and the grower diet may be fed until point of lay, especially for hens that are heavier than the breed target. Feeding too much protein before egg production may increase the risk of over fleshing in modern breeds.

However, from 20 to 24 weeks, a higher energy "pre-lay" or "transition" diet may be needed for flocks with insufficient weekly weight gains, if fleshing is very poor or when the difference between grower and breeder ME level is more than 100 Kcal/kg.

The calcium level (1.4%) is slightly higher compared to the grower feed, to obtain a better mineral balance that helps to avoid kidney damage and litter deterioration.

BREEDER DIETS

The flock must be fed a breeder diet when egg production starts and at the latest by 5% daily egg production.

The simplest feeding program during the laying period employs only one feed formulation. The lower daily requirement for amino acid intake after peak production is normally compensated by the withdrawal of feed and therefore the levels of amino acids can be maintained. Calcium requirements will increase for older birds, but this can be satisfied by feeding additional calcium grit in the chicken house.

Such a single diet has to be designed to meet the peak nutritional requirements of the hens at all times under all conditions (level of production, season, etc). The feed has a high nutrient density to meet the maximum energy and amino-acids requirements needed at peak of lay. This may result in an over-fortified and overpriced feed during the remaining period of the laying cycle.

A two phase feeding program is used by most companies. Typically, the levels of other nutrients, along with protein and amino acids, are lowered in the breeder II diet. The calcium percentage is increased due to skeletal calcium depletion and poor calcium absorption especially after 45 or 50 weeks of age.

In hot conditions or when flocks start early in lay (which proper management should strive to prevent), a specific diet for the onset of lay period may be recommended. In such specific onset of lay diet, increasing vitamin and mineral premix by 10 to 20%, increasing synthetic amino-acids and linoleic acid are additional precautions.

It is better if feed is consumed quickly (3-4 hours) to help the hens to organise their eating, laying and mating activities throughout the day. It is undesirable if eating time is too long (eggs laid on the floor, risk of having males eating with the females and less mating activity in the afternoon). In this case, it is important to feed a palatable mash, made of coarse particles.

MALE FEED

Excessive intake of protein and calcium by males may have consequences for the fertility of hatching eggs. A specific male feed with a high level of insoluble fibre, lower protein and calcium content will help male behaviour towards females, favours uniformity, male health and activity.

As poly-unsaturated oil and anti-oxidants such as vitamin E and selenium have several biological functions impacting the reproductive systems and sperm quality, supplementary levels are beneficial and not too expensive when used in male feed only.

A separate male feed is recommended for the production period, but good results can be achieved by controlling the feed allowance and by following strictly the male bodyweight standard.

9. FEEDING AFTER 20 WEEKS

9.1. FROM 20 WEEKS TO THE FIRST EGGS

Hens are frequently transferred from the rearing farm to the production house at about 20 weeks of age.

As noted in the general feeding recommendations, **the physiological needs of the pullets do not change significantly before the first eggs appear**. It is therefore better not to give Breeder N° 1 feed too far ahead of the onset of production.

When a “no-feed day” system has been used until the end of rearing, it is better to maintain this same system until the first eggs. Use of the 4/7 feeding system is, however, not recommended, as it tends to delay the onset of production. If this programme has been used during the rearing period, it is preferable to switch at transfer to a 5/7 or even 6/7 feeding system. The same feed distribution programme should be used for the males, to avoid any additional stress.

Until the first eggs, feed allowance is **strictly based on female bodyweight targets**, and it is adjusted according to the actual bodyweight, the weekly weight gain and to the muscular development of the breast (fleshing).

Feed distribution should take place in the morning, when the house attendant arrives, so he/she can observe the bird's behaviour, verify that the feeding system is in good order and observe the eating time.

Pre-lay feed may be given until as late as 20-30% daily production, if the risk of sudden death syndrome (SDS) exists during the onset of lay.

9.2. FROM THE FIRST EGGS TO PEAK

At the first eggs Breeder N° 1 is given and the switch to daily feeding is made. At this stage, the female feeding time is advanced and the first feed distribution takes place about **30-60 minutes after the lights are switched on**.

As production increases and the daily feed allowance has become high enough, it is possible to keep one part of the feed for an end of the afternoon meal, 3 hours or so before the night period. If so, it is important to make sure that this feed quantity is sufficient to allow for uniform distribution in the feed circuit when this last meal is given.

This technique is useful when aiming to reduce excessive consumption time by splitting the allocated feed or when trying to improve afternoon activity of the flock to improve mating behaviour. This may be noted during periods of hot weather, for instance.

When the flock reaches 5 to 10% daily production, **a rapid increase in feed** is desired to allow for a sustainable increase in egg size. The estimated maximum feed allowance is given at 50 to 60% daily production.

Since there is no universal feeding programme, the above example must be adapted to the actual flock performance. In this respect, it is strongly advised to use the Average egg weight evolution at the onset of production table, which is designed to quickly illustrate whether the bird's requirements are properly covered, so as to allow for reaction before production is affected.

9.3. FROM PEAK TO THE END OF PRODUCTION

The bodyweight targets shown between transfer and the first eggs, and the feeding techniques described from transfer to peak of production, allow under normal conditions, to obtain peak production with a reasonable female bodyweight.

Achieving a **reasonable bodyweight at peak** is an important factor for the remainder of the production period. It avoids excessive fattening which can disrupt hen behaviour and productivity. It also allows for a more relaxed control of the bodyweight increases until the end of production.

The maximum daily feed allowance is maintained until peak production. Afterwards, feed quantity is progressively decreased until the end of production. The first decrease takes place the week following peak production (-2 or -3 g/female ; minus 0.44 lb or 0.66 lb/100 females). Afterwards, decrease feed according to the production rate, egg weight, and bodyweight (generally -0.5 to -1 g /female/week ; minus 0.11 lb to 0.22 lb/100 females/week). Sometimes stronger reductions are required in the order of -2 g/female/week (minus 0.44 lb/100 females/week) for the 3-4 weeks following peak to control the risk of fattening. Adding extra feed (challenge feeding) to flocks with a poor peak production (less than 80%) induces fattening and affects persistency of lay, without significantly improving production.

Continue to monitor bodyweight weekly until the end of the flock. The bodyweight at the end of production should be obtained following **as even a growth curve as possible (+10 g - +0.022 lb/week from the 32nd week until the end of production)**. Any sudden bodyweight increase is likely to result in unnecessary fattening. Any prolonged stalling of bodyweight is likely to affect production.

In our feeding programme, we do not recommend using systematically a Breeder N° 2 feed, since switching to a different feed is often likely to create problems. It is better to maintain the same formula and monitor the flock's feed intake.

Under certain conditions (for example, too high a protein level and very large egg size), one can use a Breeder N° 2 feed from 32 weeks and/or 60 g egg weight (25.4 oz/dozen). See the Feed formulation tables in the Nutrition guide.

10. LIGHTING PROGRAMMES

The use of a lighting programme during rearing and production allows for a better control of age at sexual maturity in both males and females. This control is necessary to obtain the optimum number of fertile hatching eggs, of the correct size. The consequences of too early an onset of production are often more detrimental than a slight delay.

Note: see Product Management Guidelines for the specific lighting programme during the first 2 weeks of life

10.1. TARGET: 10% PRODUCTION (WEEK AVERAGE) AT 25 WEEKS

Many factors influence sexual maturity: type of house, region, latitude, season, flock bodyweight and uniformity.

The experience acquired in one given farm is very useful. Knowing the result of lighting programmes applied to previous flocks allows for more precise adjustments to achieve the target.

SOME GENERAL PRINCIPLES SHOULD BE REMEMBER

- During rearing, particularly after 10 weeks of age, increasing daylength and light intensity tends to advance sexual maturity. Conversely, decreasing daylength and light intensity tends to delay sexual maturity.
- Bodyweight is an essential factor in sexual maturity: too high, it will tend to advance it; too low it will tend to delay it. Control of flock growth is critical to the age at the first eggs.
- During the production period, daylength and light intensity should never decrease.

The sexual development of the flock can be assessed by checking the opening of the pelvic bones. Beginning at 20 weeks of age check the pelvic opening each week, at the same time observing the development of other secondary sexual characteristics such as the colour and size of the comb and wattles, the pre-nuptial moult, the fleshing and uniformity of bodyweight. These observations can be made when the flock is weighed and should be recorded. Monitoring sexual development in this way allows the point of stimulation to be adjusted to suit the individual flock. **If there is any doubt that a significant number of the birds are ready then stimulation should be delayed.**

The male lighting programme is often the same as that of the females. However, this can be adjusted according to the level of sexual maturity observed in both sexes towards the end of the rearing period (comb, wattles, the amount of redness around eyes, and pelvic aperture). This is a useful step that allows for a similar level of sexual maturity between the two sexes at the time of mixing.

Under standard conditions, around 3 weeks elapse between the start of light stimulation and the first eggs for mini breeders. It is always advisable to study the local schedules for sunrise and sunset. This allows for an artificial light programme that will better cover the actual natural day.

LIGHT INTENSITY

In open-sided houses, light intensity increases when the latitude decreases. If the latitude is more than 40°, the minimum artificial light intensity should be 40 lux. When latitude is less than 40°, the minimum artificial light intensity should be 60 lux with a light spectrum in the yellow, orange and red band range.

LIGHT INTENSITY VALUES	
Characteristics of incandescent lamps:	
60 watts = 630 lumens	
75 watts = 950 lumens	
100 watts = 1380 lumens	
Characteristics of fluorescent lamps:	
20 watts = 750 lumens	
25 watts = 1130 lumens	
40 watts = 1950 lumens	
Intensity:	
lux = lumen 1 ft candle = 10 lux m ²	

Examples:

For a building of 1000 m² (80 m x 12.5 m) the total power level should be 5000 watts (5 watts/m² or an intensity of 60 lux). For uniform light distribution, 3 rows of 22 bulbs (75 watts) should be used.

For a building of 11,000 ft² (250 ft x 44 ft) the total power level should be 5060 watts (0.46 watts/ft² or an intensity of 60 lux = 6 ft candle). For uniform light distribution, 3 rows of 23 bulbs (75 watts) should be used.

A luxmeter is necessary to know the precise light intensity at bird level. Taking this into account, following are some examples of light programmes under different conditions.

10.2. DARK REARING HOUSE AND DARK PRODUCTION HOUSE

In such buildings, any light leakage should be controlled to less than 0.5 lux. These are the easiest conditions to manage, since the light programme is created without considering natural light.

Age (days)	Intensity (lux)	Duration of light (h)
15 to 153	5	8
154	40 minimum	11
161	40 minimum	11
168	40 minimum	13
175	40 minimum	14
182	40 minimum	15
189	40 minimum	15h30
196-end	40 minimum	16

10.3. DARK REARING HOUSE AND NON-DARK PRODUCTION HOUSE

When rearing in a dark house and transferring to a non-dark (open side) house, it is generally not necessary to stimulate the flock before the transfer. The flock is naturally stimulated at the moment of transfer. For flocks reared during periods of increasing daylength, it is better not to move them before 22 weeks of age (154 days) and to refer to the table below to establish the lighting programme.

If the natural light duration does not exceed 11h at the time of transfer, then transfer may be considered before 154 days. In such a case, a flat light programme corresponding to the natural light duration at transfer will be maintained until 153 days of age. The subsequent light programme can be inspired from the table below for 14h of natural light at 154 days.

➔ BREEDER MANAGEMENT MANUAL

Natural daylength (h) at 154 days		< 11	12	13	14	15
Age (days)	Intensity (lux)	Length of artificial light (h)				
15 to 153	5	8	8	10	11	12
154	50 min.	11	12	13	14	15
161	50 min.	11	12	13	14	15
168	50 min.	13	14	15	16	16
175	50 min.	14	15	15h30	16	16
182	50 min.	15	15h30	16	16	16
189	50 min.	15h30	16	16	16	16
196 - end	50 min.	16	16	16	16	16

10.4. NON-DARK REARING HOUSE AND NON-DARK PRODUCTION HOUSE

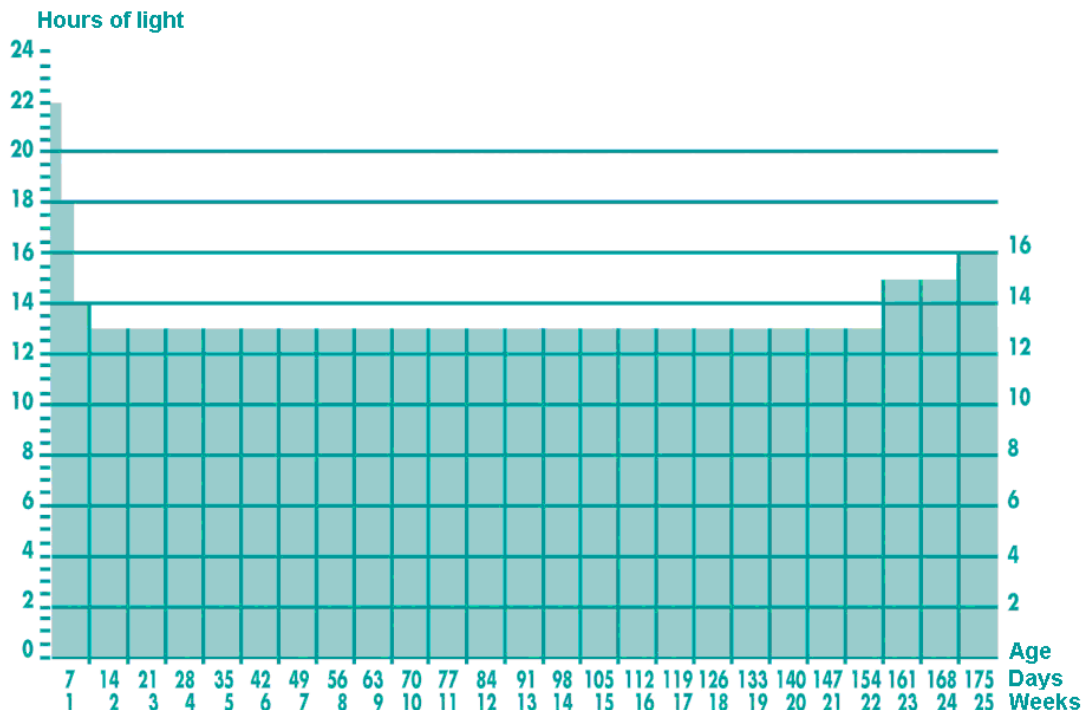
This is the most delicate situation. Each flock must be analysed carefully taking into account previously used light programmes and their results.

NATURALLY INCREASING DAYLENGHT TOWARDS THE END OF THE REARING PERIOD

To suppress the effect of the increasing natural light and to avoid early sexual maturity, birds should be given a constant light programme from 7 days of age. This should be equivalent to the natural daylength when the flock will be 20 weeks. Light intensity in this case should be strong: 40 lux minimum.

Special attention should be paid to monitoring bodyweight, as excess is very likely to advance the onset of production.

Example: rearing on increasing daylight, with 13 hours natural daylength at the age of 20 weeks.



DECREASING DAYLENGHT AT THE END OF THE REARING PERIOD

The challenge of light stimulation must be considered relative to the latitude, where the types of buildings and the outside daytime light intensity are different.

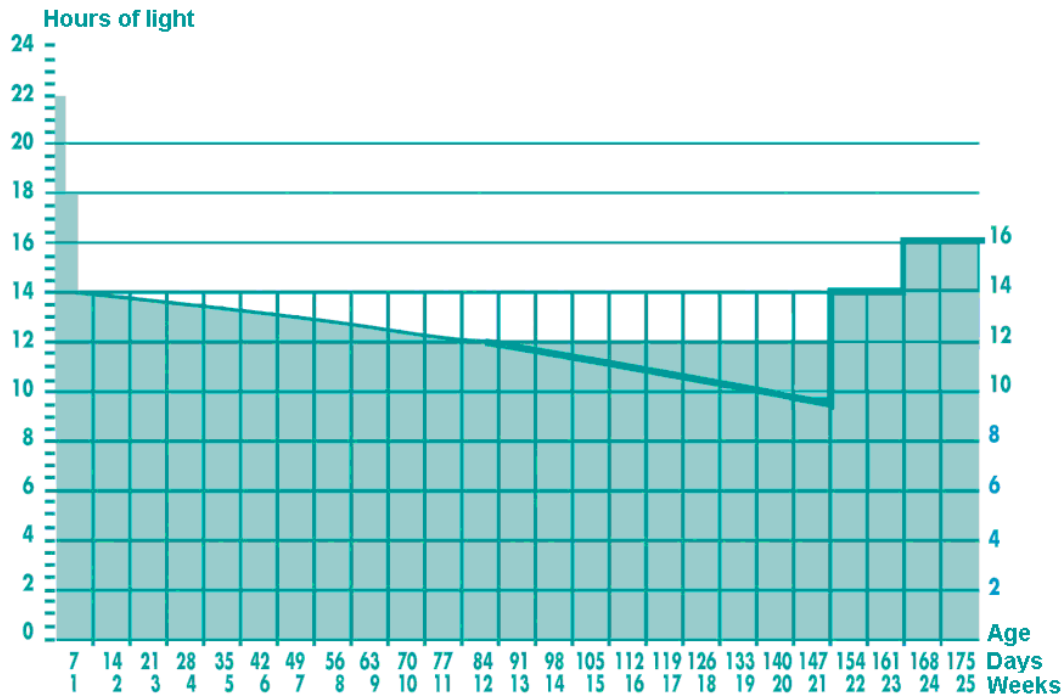
- **LATITUDE ABOVE 40°**

➔ BREEDER MANAGEMENT MANUAL

In these regions, the outside light intensity entering houses that are either open-sided or have windows is often quite low. Light stimulation can be successful using light intensity inside the house in the order of 40 lux.

There are 2 possibilities: rear the flock on the natural decreasing daylength throughout the rearing period, or use natural daylength up to 12 weeks and then maintain a constant daylength until light stimulation starts. In both these cases, to reduce the possibility of delayed production, it might be necessary to stimulate earlier, at around 147 days using sufficient light intensity. Light stimulation should be done taking into consideration the total daylength perceived by the birds.

Example:



- **LATITUDE LESS THAN 40°**

In hot climate zones, rearing houses are often open-sided and the outside light intensity entering the house during the daytime is strong. When natural daylength is decreasing, these flocks can be stimulated by:

- Light stimulation at an earlier age: 20 weeks (140 days).
- A light increase of at least 4 hours. Stop at a maximum daylength of 17 hours.
- Using strong light intensity inside the house of at least 60 lux, with the yellow, orange and red light waves as found in the incandescent type light bulbs.

During rearing the light programme should be adapted according to what the natural daylength will be at the time that the flock will be ready for stimulation:

- **INCREASING DAYLENGHT**

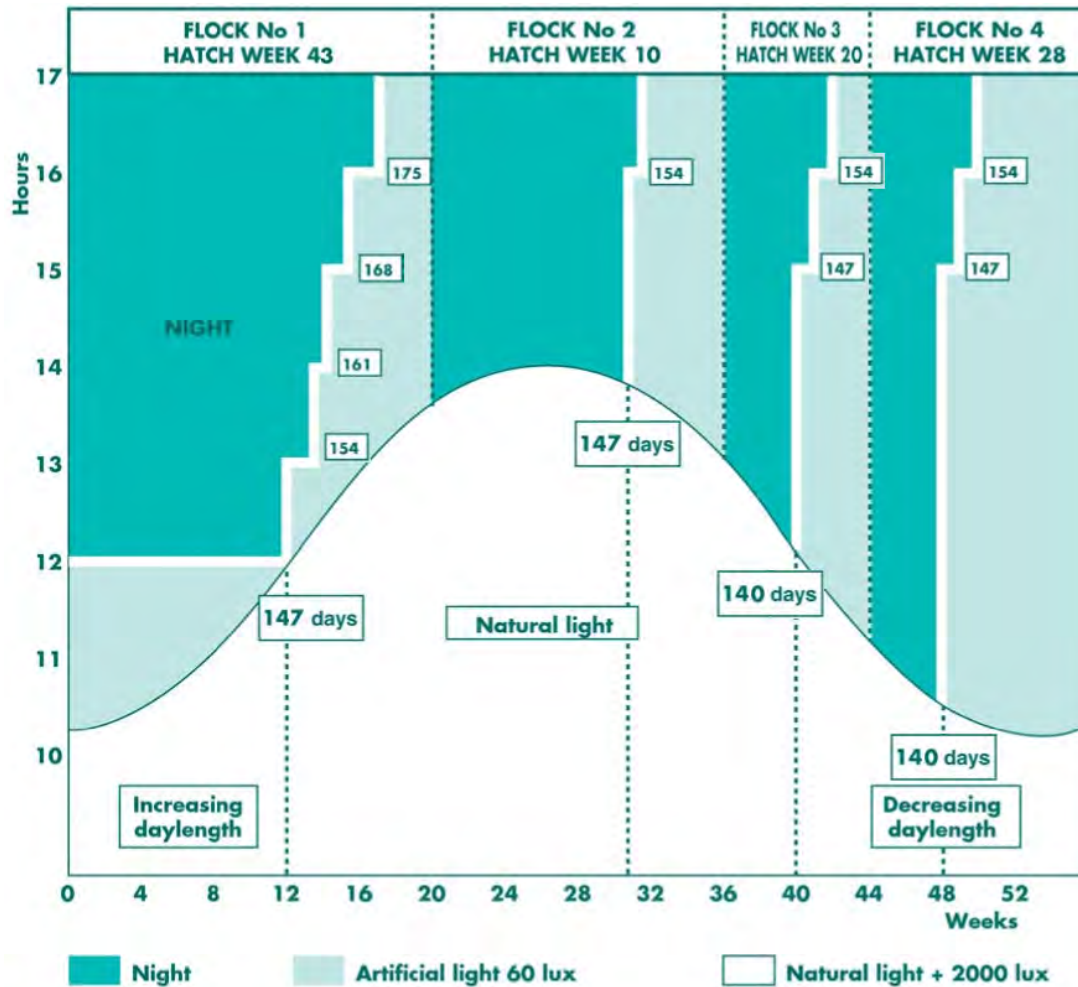
- if the natural daylength will be less than 12 hours at 21 weeks (147 days), rear the flock using a constant daylength of minimum 12 hours (Flock N° 1).
- if the natural daylength will be more than 12 hours at 21 weeks (147 days), rear the flock using natural daylength until the moment of stimulation (Flock N° 2).

- **DECREASING DAYLENGHT:**

- use natural daylength until 20 weeks (140 days) (Flocks N° 3 & 4).

Examples of light stimulation:

Open-sided rearing and production houses, 25-35° latitude North



11. PREVENTING FLOOR EGGS

Eggs laid on the floor are detrimental to the production of the flock because of:

- less useable eggs
- a higher risk of contamination of the hatching eggs
- extra work for the farm staff.

Floor eggs or eggs laid in poorly maintained nests lower chick quality. In the hatchery, exploders generate bacterial contamination. **Floor eggs or dirty eggs should not be incubated.**

If, due to economical constraints, they are set, they must be identified and placed separately in different setters and hatchers or, at least placed at the bottom of the machines, so that fewer eggs are affected by the trickle of liquid bacteria. It is important to understand which factors may increase the incidence of floor eggs, so that the level can be reduced.

11.1. HEN BEHAVIOUR

When laying an egg, oviduct eversion makes the hen particularly vulnerable. She must be able to isolate herself in a place that protects her against the risk of aggression to her or her egg.

On the other hand, it is useful to remember that wild poultry nest on the ground and that hens tend to imitate each other when choosing a place to lay.

If nests are uncomfortable and or are insufficient in number, some hens will choose to lay elsewhere in the house: under the feeding and drinking equipment, along the walls, the slats, etc. Once this habit starts, it is difficult to change it and other hens will imitate it.

Finally, the nest occupation rate is not distributed equally over the day. Most of the eggs are laid during the first 6 to 7 hours of light (see figure 2, page 34).

Therefore, it is essential to provide the hens with sufficient correctly designed and positioned nests.

Males can also influence the female's laying behaviour. At the start of production, males are often aggressive. According to the position of the nest boxes, they can disturb the females trying to reach the nests. It is therefore important that bird behaviour should be carefully observed and the amount of males should be reduced if necessary.

11.2. NUMBER OF NESTS

Nests must be in adequate number considering the number of hens in the house. See Product Management Guidelines for Equipment standards.

11.3. NEST DESIGN

2 nest types are used:

- individual nests with straw, wood shavings or rice hulls and manual egg collection
- collective nests with an automated collection belt.

Both systems give good results when they are designed and managed properly. Nests are either one level, or two levels when bird density is higher.

Access to nests is made easier by the use of wide perches, made of two planks for the lower row and one plank for the upper row. The upper and lower perches must be far enough apart to allow hens to jump from one level to the other.

As explained on page 16, it is better to develop the perching and jumping behaviour during the rearing period by placing the necessary equipment at the rearing farm.

It is advisable to provide manual nests with a closing system and automatic nests with an ejection system to avoid contamination of the nest during the night period.

Hens prefer closed deep nests, protected from drafts except in hot climates, where nests must be well ventilated. We recommend a 12 to 15 cm (4.7 to 5.9 in) depth from the bottom of the nest to the threshold.

The dark shady area under the nests is a common place for floor eggs. To avoid this risk, the bottom of the nest must be high enough above the litter (at least 50 cm – 20 in). Light bulb or tube placement in the house should be designed so as to minimise the shaded areas under the nests.

11.4. NEST POSITION IN THE HOUSE

When choosing the position of the nests, both comfort and security of the female should be considered. Avoid placing nests against cold walls, exposing nests to air movements or intense light and do not obstruct access to the perches.

If communal automatic nests are used, they should be placed on the slats to keep them off the litter area.

When the level of floor eggs is high, some nest boxes can be placed directly onto the litter for a few weeks. Afterwards, they are placed back to their normal height.

At transfer, floor litter quantity should not be too deep (the hens may think that deep floor litter is more attractive), to decrease the risk of floor eggs.

11.5. NEST MATERIAL

This is an important element in nest attractiveness. Avoid using a material that is less comfortable than the floor litter. Chopped wheat or barley straw is a good solution and it is better than wood shavings. Hay is not recommended.

In automatic nests, plastic carpets are generally used with good results.

Between the end of the plastic carpet and the egg collection belt, there should be sufficient empty space for the manure to dry and fall down.

It is better to wait until the hens are about to lay before filling the nests.

When possible, bird access to the nests is blocked until the first egg. In this case, the upper level is opened first, some days ahead of the lower level.

Opening and filling the nests just before the start of production, allows one to profit from the higher exploration activity that hens show at this stage of their physiology.

Both change and the activity created will arouse their curiosity to the nests at this critical moment.

Some eggs left in the nests at the start of production will also help to make the nests appear more attractive.

It is not good to place a lot of nest material all at once in the nests. Regular filling is preferable.

11.6. FEEDING AND DRINKING

Hens must be able to eat and drink before they lay their eggs. Unsuitable management or insufficient equipment can create competition between these different activities and thus encourages laying on the floor.

When water restriction is too severe, or the water level in the drinkers is too low, birds queue up around the drinking points. This can delay hen movement towards the nests.

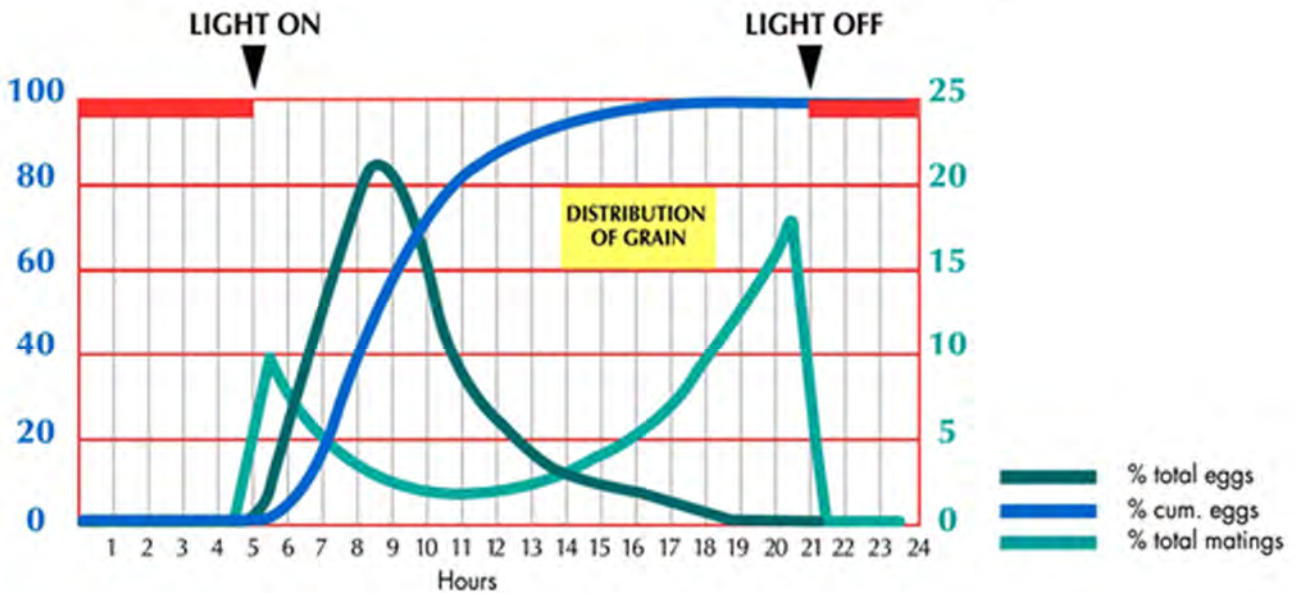
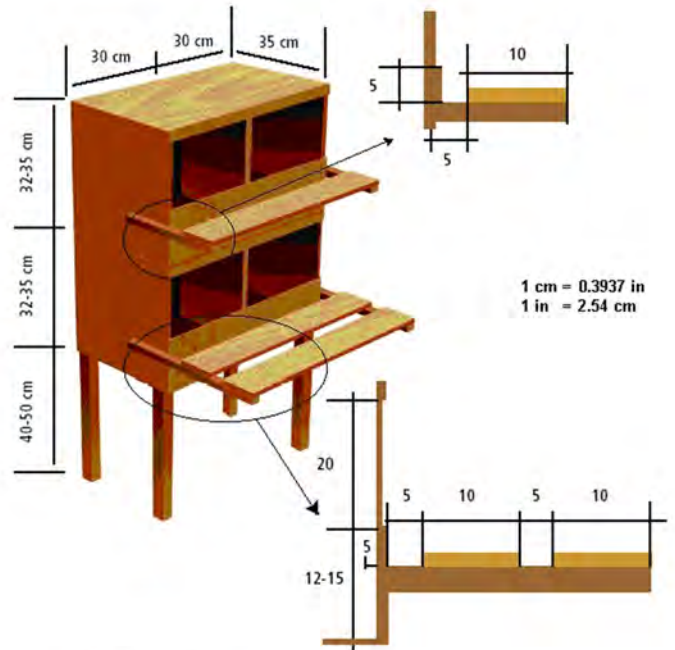
Likewise, the feeding time must allow hens to satisfy their morning appetite before they go to lay. Practically, the first feed distribution is made around 30-60 minutes after the light comes on.

11.7. COLLECTING FLOOR EGGS

At the start of production, it is very important to collect floor laid eggs frequently: every hour until the early afternoon. Otherwise, they become an incentive for other hens to lay in the same place.

During this period, the farm attendant should try to identify those hens laying on the floor and put them into the nests. It is of the utmost importance that these operations be carried out as calmly as possible, in order not to disturb other hens already in the nests. Any undue agitation may increase the incidence of floor eggs.

The amount of floor eggs greatly depends on how quick and observant the farm attendant is and the subsequent action taken.



12. CARE OF HATCHING EGGS

The aim is to protect embryo liveability, which leads to improved hatchability and chick quality.

The eggs must not be incubated before 26 weeks using a minimum egg weight of 51-52 g (21.6-22 oz/dozen).

EGG HANDLING

The main risk for the embryo comes from bacterial contamination immediately after the egg has been laid. As it cools down, the egg content retracts and air comes in. If the environment (litter, nest bottom) is dirty, bacteria will invade the shell and will be difficult to destroy.

Dirty nests and floor eggs are responsible for exploders in setters and for chick contamination by *Pseudomonas* and *Aspergillus*. The nests must be maintained clean. Remove manure and broken eggs frequently and add fresh litter regularly. In automatic nests, plastic bottoms or carpets should be washed frequently.

Nests should be equipped with a closing or ejection system to avoid nest staining at night.

Embryo development is reduced when ambient temperature is below 25°C (77°F) and stops below 21-22°C (70-72°F). The temperature in the nests may reach 30°C (86°F), as both the hens produce heat and litter acts as an insulating material. If eggs are left for too long in these conditions, the embryo starts to develop and becomes more sensitive. This becomes more acute as the flock ages.

Eggs must be collected at least 4 times a day, more often in cold or in hot climates. Collection is made either on new carton trays, or on previously disinfected plastic or setter trays.

FLOOR EGGS

These should be considered as being contaminated even though they look clean. They must be frequently collected and disinfected quickly. If, for economical reasons they must be incubated, they should be set and hatched separately.

EGG WASHING AND DISINFECTION

Dirty eggs should not be incubated. When washed, such eggs look clean but they are actually contaminated.

Washing should be done with clean water at the correct temperature containing an adequate amount of detergent. Water should be changed after each collection to avoid cross contamination.

Specialised equipment must be used, not simply a bucket or a wet cloth. An improper automatic washing process may result in embryo mortality by bacterial putrefaction. Eggs must be dried after washing.

Hatching eggs must be disinfected quickly after collection. Various methods are available, but fumigation with formalin remains the best technique when regulations permit

OTHER HUBBARD TECHNICAL DOCUMENTS

BREEDER PERFORMANCE SUMMARY

BREEDER GUIDE

MALE PERFORMANCE SUMMARY

BROILER PERFORMANCE SUMMARY

INCUBATION GUIDE

NUTRITION GUIDE

BROILER GUIDE

OTHER SPECIFIC TECHNICAL DOCUMENTS NUTRITION GUIDE

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