COBB GERMANY

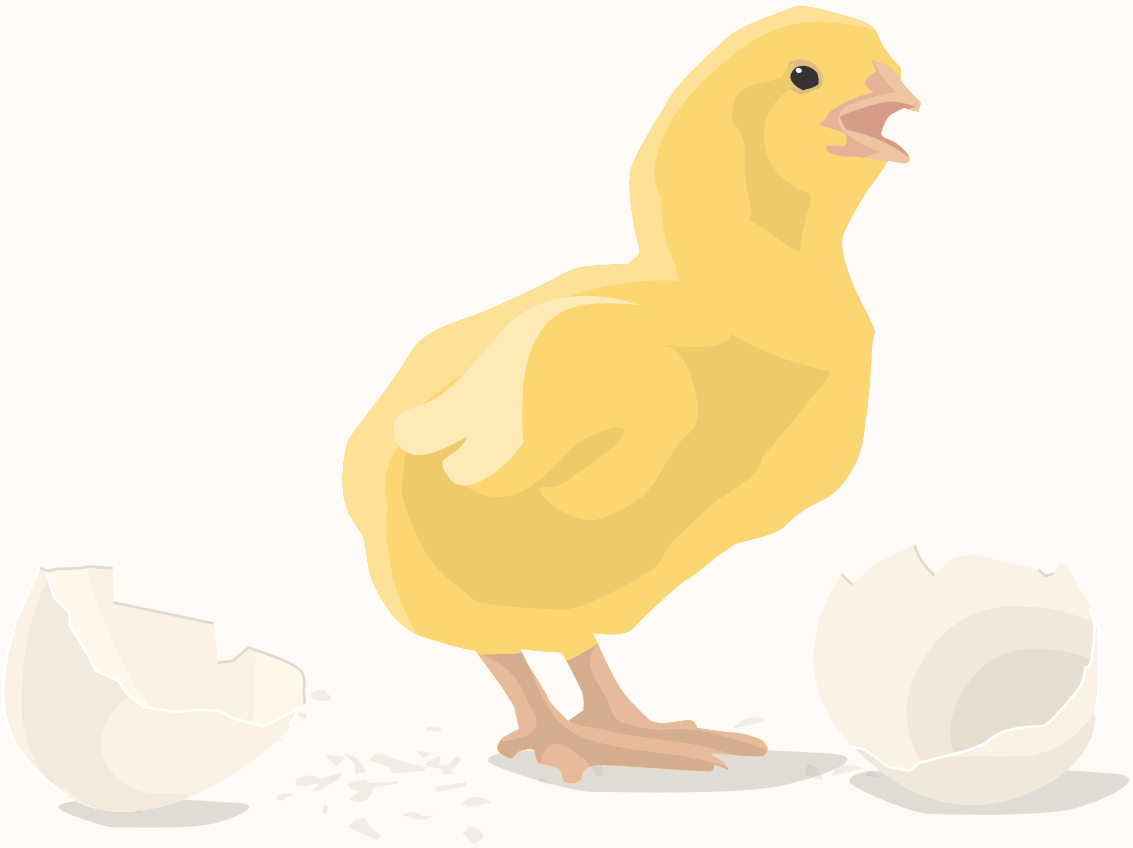
Breeder Booklet

Quick Reference Guide

Breeder Booklet

This Cobb Germany Breeder booklet is intended as a quick reference guide, covering the most important management aspects to achieve the maximum performance of your Cobb 500 breeder flocks in Cobb Germany's market area.

For a wider scope with more detailed information, please refer to the world-wide applicable Cobb–Vantress Cobb Breeder Management Guide as well as Cobb Hatchery and Cobb Broiler Management Guide, Cobb Germany Broiler booklet, Cobb Vaccination Guide, Cobb and Cobb Germany Supplements and a full range of performance charts. To optimise your results and the economic performance do not hesitate to ask your local Cobb technical representative.

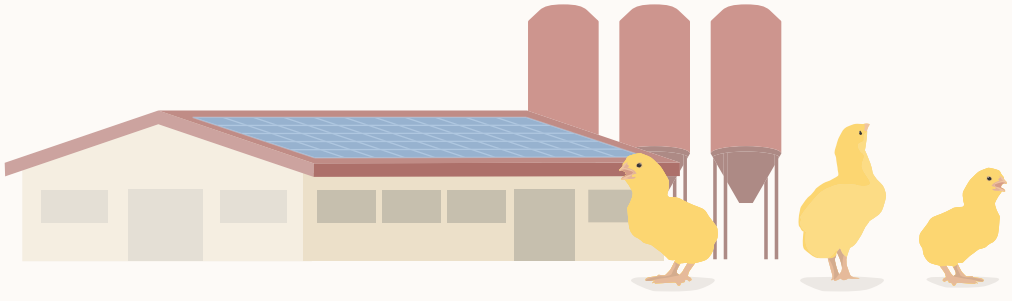


Housing requirements for Cobb 500 breeders

Rearing

Floor space	
Females	7 to 10 birds per m^2
Males	3 - 4 birds per m^2
Training slats recommended	

Feeding space females	
Chain feeder	15 cm per bird
Pan feeder (diameter 30 cm)	12 birds per pan
Spin feeder	maximum 1200 birds per spin feeder



Feeding space males	
Chain feeder	18 cm per bird
Pan feeder (diameter 30 cm)	10 birds per pan
Spin feeder	maximum 1000 birds per spin feeder

Drinkers	
Birds per nipple	8 to 10
Birds per bell drinker	80
Forced Air Heaters	capacity min. 0.075 kW/m^3 of house volume
Feed distribution time	less than 3 minutes
Light intensity	dimmable 2 lux – 40 lux (Minimum of 40 lux is required for placement of day old chicks)
Light temperature	3000 – 3500 K

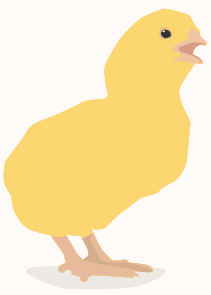
Production

Floor space	
Environmentally controlled housing	6 – 7 females per m^2 + males

Feeding space - Chain feeder	
Females	15 cm per bird
Males	18 cm per bird

Feeding space - Pan feeder	(diameter 30 cm)
Females	12 birds per pan
Males	10 birds per pan

Drinkers	
Birds per nipple	8 to 10
Birds per bell drinker	70
Feed distribution time	less than 3 minutes
Light intensity	dimmable 5 lux, minimum 60 - 70 lux
Light temperature	2500 – 3000 K



Recommended progressive feeder space for Cobb 500 females in rearing

Age in weeks	Chain feeder	Round Pan 30 cm diameter	Oval Pan
	cm/bird	birds/pen	birds/pen
0 to 4	5	20 to 25	23 to 25
5 to 8	9	16 to 18	18 to 20
9 to 12	13	14 to 16	16 to 18
13 to 21	15	10 to 12	13 to 14

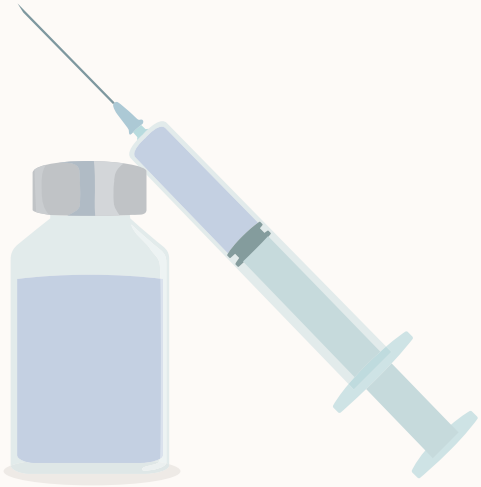
Recommended progressive feeder space for Cobb 500 males in rearing

Age in weeks	Chain feeder	Round Pan 30 cm diameter	Oval Pan
	cm/bird	birds/pen	birds/pen
0 to 4	6	20 to 23	23 to 25
5 to 8	10	14 to 16	16 to 18
9 to 12	14	12 to 14	14 to 16
13 to 21	18	8 to 10	10 to 12

Recommended minimum feeder space for Cobb 500 males and females in production

Sex	Chain feeder or trough feeder for males cm/bird	Round Pan 30 cm diameter birds/pen	Oval Pan birds/pen
Females	15	10 to 12	13 to 14
Males	18 to 20	8 to 10	10 to 12

Disease prevention



In order to obtain maximum performance from the Cobb 500 breeders, it is essential to avoid diseases. Most diseases are the result of a combination of management factors and infectious agents like bacteria, viruses or parasites. Disease prevention is based upon providing the birds with good overall immunity with good management, specific immunity by vaccination and a limited exposure to infections.

- Ensure a good general resistance of the birds by providing them with a good start, a good quality, easy digestible feed with the right level of nutrients, clean and fresh water, a good litter quality and an optimum climate and ventilation. Avoid stress in the flock as much as possible as it will suppress the immune system of the birds.

- Supply a vaccination program that is suited for the actual conditions in the area where the birds are placed. This means that a standard vaccination program cannot be given but should be made by an experienced poultry veterinarian who is familiar with the local challenges.

- Ensure that the correct vaccination procedures are followed. Monitoring antibodies is a good way to check the effectiveness of a vaccination program.

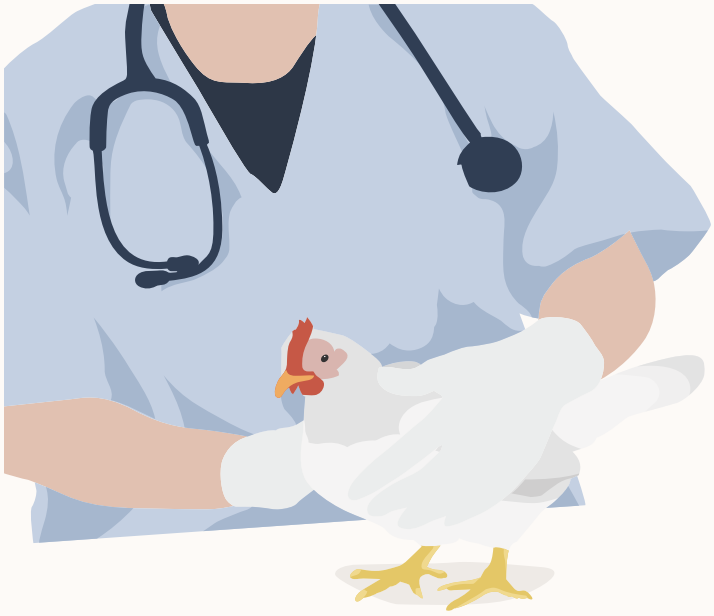
- Apply a single age, all in - all out principle at farm level to avoid contact between young and older birds. This will prevent the spread of diseases from older birds to younger chickens.

- To minimize the exposure to pathogens, contact of the birds with other poultry, slaughterhouses, and poultry waste should be avoided. Also contact via personnel, materials and feed with broilers within the same company should be avoided.

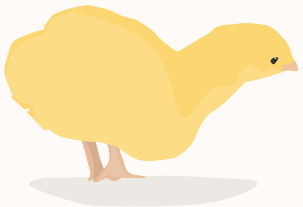
- Access for people, equipment and other materials should be limited as much as possible. Make sure that the farm is properly fenced. On entering the site, showering and the changing of clothes and footwear are recommended. Equipment should be cleaned and disinfected before entering a farm.

- Make sure wild birds cannot enter the houses and apply a sufficient rodent control program.

- Thorough cleaning and disinfection of farm and equipment in every cycle is necessary to reduce the spread of infections between flocks. Good cleaning procedures are the basis for adequate disinfection. After cleaning and disinfection, it is advisable to control the effectiveness of the procedures by applying a microbiological check.



Before your chicks arrive



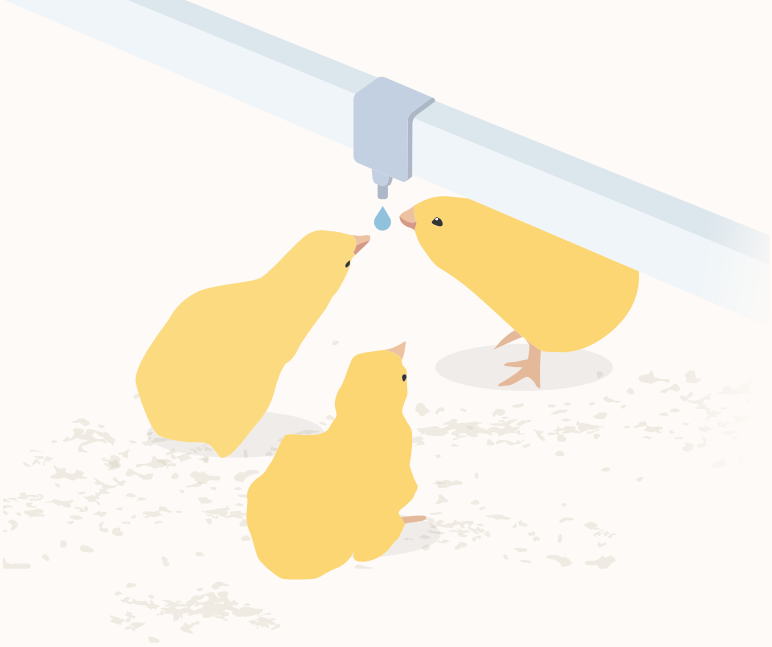
- Spread evenly clean good quality litter. Level litter by raking and compressing firmly. Uneven litter creates uneven floor temperatures, causing groups of chicks to huddle in pockets or under equipment. Uneven litter can also result in unintended restricted access to feed and water at this critical time of development.

- Preheat the house 2 – 3 days prior to chick arrival. Concrete temperature (below the litter) should be 28 to 30°C. At placement, litter temperatures should be 30 to 32°C. The chicks are highly dependent upon the stockperson to provide the correct litter and floor temperature. Chicks do not have the ability to regulate body temperature for the first 5 days and thermoregulation is not fully developed until 14 days of age. If the litter and air temperatures are too low, internal body temperature will decrease, leading to decreased activity, reduced feed and water intake, stunted growth, susceptibility to diseases, and loss of flock uniformity. Check the body temperature of the chicks regularly in the first days. Optimum is 40oC. Body temperatures below 39.5oC make the birds huddle and sit, temperatures above 41oC leads to panting and dehydration.

- Ideal relative humidity is between 30 to 50 %. Do not try to increase relative humidity by spraying water or using fogging lines. Chick dehydration is not caused by low humidity but rather by too high body temperature. If chicks start panting because of overheating, they can lose 5 to 10 g in weight during the first 24 hours and then dehydration occurs.

- Ensure sufficient and uniform lighting. Light intensity should be a minimum of 40 lux below the lamp and measured at chick height to enhance chick activity and encourage good early feed and water intake. Concentrating light around the nipple line will attract the chicks and improve early water and feed intake.

- Cover at least 50% of the placement area with paper and put the recommended amount of feed per bird on it. Do not use ad libitum feeding but give the required feed on a daily base. The paper used must be durable and resistant to puncture and make a noise when birds are walking on it and feeding, so that other chicks are attracted to this area.



- Adjust water pressure at placement so that chicks can see a drop of water on the nipple pins. Nipples should be with 3600side action. Chicks need to be able to push easily towards the nipple pins to activate them. Ensure that nipple drinkers are at the chicks' eye level at reception. Adjust drinking lines after 24 hours so the chicks' necks are slightly stretched to drink.

- It's important to get chicks drinking quickly and evenly, especially if chicks arrive after a long journey. Often underestimated is noise. Baby chicks are attracted to sounds (like in nature – the broody, mother hen). After placing chicks do not disturb them, keep quiet and allow the chicks to attract other chicks to the feeding area or water area in an otherwise quiet poultry house. Use self-activating cups which make a sound when chicks peck them or 2 supplementary drinkers per 100 chicks placed. Chicks will find the water faster and drink more easily than only from nipples.

- Ventilate sufficiently from day one onwards, especially when using forced air heaters. Provide minimum ventilation using very slow air speeds over birds. A cycle timer can help to get enough air speed through the inlets for an even air distribution in the house. Check carbon dioxide level before placing chicks. CO2 levels should be less than 3000 ppm.

- 12 hours prior to chick placement check the floor temperature.

- Ensure the number of personnel required are present and waiting when the truck arrives so that chicks can be placed as quickly as possible. Prevent overheating the chicks by unloading boxes as soon as possible. Do not leave the full trolleys waiting in the rearing house.

- Never start with vaccine preparation or spraying Coccidiosis vaccine on the feed before you see the truck at the gate. A delay of arrival can always happen.

From the first day until grading at 3 – 4 weeks

During the first month of growth the chick experiences rapid development of support organs that lay the groundwork for the healthy maturation of the breeders.

Controlled feeding is necessary to prevent birds from exceeding the body weight standard.
Avoid overweight in the first 4 weeks. Ad libitum feeding is not necessary at the beginning anymore. Instead, use specific amounts of feed with small incremental changes each day during the first week.

By feeding a designated amount of feed each day, the body weight of the females and males should be on target by 4 weeks of age, meaning between 98 % and 102 % of target.

A strong and supporting skeleton is the basis for a stable, healthy growing and production period. One dose of vitamin D3 at 1,250 I.U. / bird per day administrated in the drinking water on day 4 and 5 is therefore advisable. Requirement of both vitamin D3 and vitamin A is higher than the level in feed allowed by legislation in many countries.

For the dark-out program to be effective, light intensity must be less than 0.5 lux during the dark period. This should be checked with full ventilation, to avoid false light entering from outside during warm summer days.

Start with a day length of 20 hours and reduce slowly to 8 hours by 14 days of age. A period of darkness during the first days helps birds to relax. During the first two weeks a higher light intensity is given to enable the birds to easily find feed and water. After two weeks of age a maximum light intensity of 5 lux is recommended.

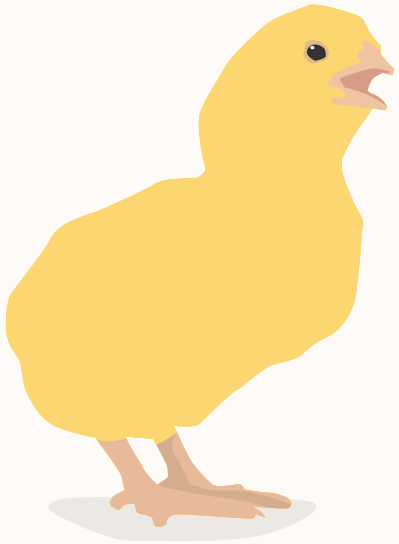
Example of light program for first 14 days:

Age (days)	Placement	4	6	8	10	12	14
Hours of light	20	20	17	13	11	9	8
Light intensity (lux)	Minimum 40	20	20	10	10	10	5

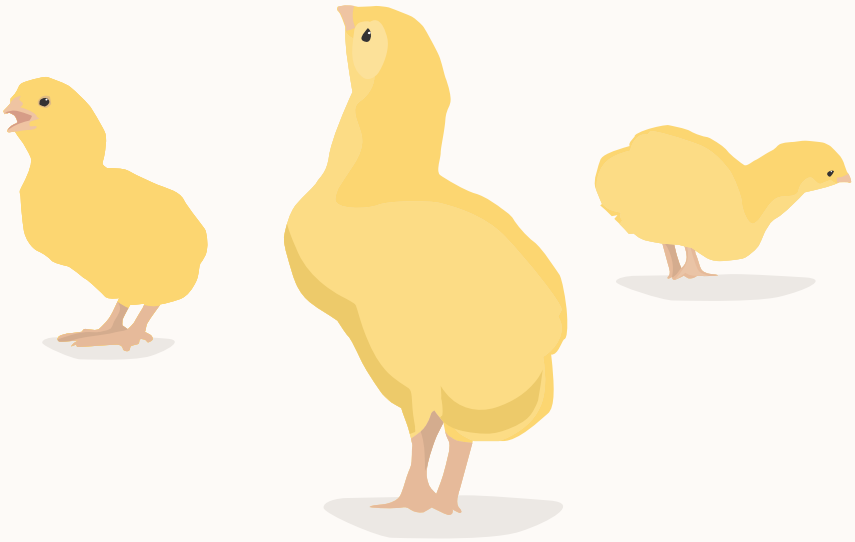
After that, the day length is set at 8 hours until 147 days of age.

Example of ambient temperature guideline in °C at relative humidity of 50 %

Age (days)	Placement
0	33 – 34
1 to 3	32
4 to 7	30
8 to 15	29
16 to 18	28
19 to 21	26
22 to 24	24
25 to 27	22



Grading and sorting process



Most of the flocks will require at least one grading in order to achieve a good uniformity. A uniform breeder flock will be easier to manage and will produce more chicks per hen housed than an uneven flock.

The best age for grading is between 21 and 28 days of age. Performing a grading at this age will provide more time to correct any uniformity issues. As the differences in weight are relatively small, all birds must be weighed. When the graded birds are placed in a new house or on new litter, care should be taken that the multiplication and spreading of vaccine coccidia is not interrupted.

Prior to grading, a sample of the flock (roughly 3 %) should be weighed to determine the grading weight limits.

Increasing the feed amounts after grading is normally not needed. By separating the small birds, the competition for feed will be reduced and they will automatically get more feed. Ensure to have the small birds close to standard body weight by 8 weeks of age.

From grading until 16 weeks

In this period, the primary objective is a regular feed increase of minimum 3 gram per week. This should result in a correct body weight and bird development. If feed quality or bird condition differs from standard an adaption of the feed increases might be needed, but aim should be a minimum increase of 3 gram of feed per week. Correct weights and high uniformity at 4 weeks of age will prevent the need for severe feed restrictions or increasing feed amounts in this period.

It is highly recommended to feed birds daily. Using an alternative system of feeding with 1 or 2 non-feed days during the week is not recommended as it introduces too much stress for the birds. If due to the limited feeding space non-feed days must be introduced, try to limit the non-feed days as much as possible. When feeder space is only a bit limited, it is better to accept the limited feeder space than to change to non-feed days, but preferably increase the feeder space. Do not introduce non-feed days because of the need of a weighing day. Weigh the birds before feeding. Your local technical representative can assist in developing a feed program.

This period has the lowest weekly feed increases of the rearing period. An increase of minimum of 3 g per week for females and 3 g per week for males is essential to avoid nervousness, feather pecking and cannibalism and to let the birds develop into sexual maturity.

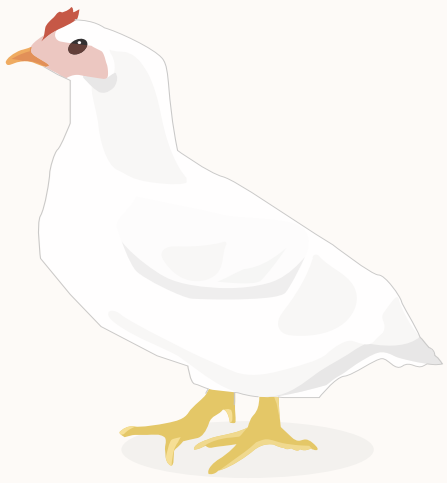
A well-chosen feeding profile is even more important than the weight of the birds. Follow the recommendations for the feed amounts. Very slight deviations of the weekly increase of feed amounts can be applied if the weight deviates from the recommended curve, however, never remain on the same feed amount for more than one week.

Larger feed increases when birds are 13 - 14 weeks old may be required to prepare females with proper body conformation for the production period.

Accelerated growth from 16 to 20 weeks

In this phase, consistent weight gains are needed. This weight gain will allow the females to develop the desired condition and sexual uniformity to maximize peak egg production and maintain post peak persistency. A consistent weight gain is important during this phase, as well as pullet condition expressed by fleshing. The objective of the accelerated growth phase is to provide enough fleshing (a "U" shape of the breast by palpating) to last the hen through peak production.

A minimum increase of female body weight of 36 – 40 % is needed from 16 weeks (112 days) to 20 weeks (140 days) when using the Cobb recommended feed specifications. To achieve this gain of 36 – 40 % in body weight, the feed must be increased a minimum of 42 - 48 % under normal conditions. Do not feed in this period based on body weight but on a fixed feeding profile because the body weight response is delayed by 2 to 3 weeks, which means that one needs to feed ahead of the body weight profile. The largest feed increases should begin at 16 weeks otherwise proper conditioning will not be achieved before the light stimulation.



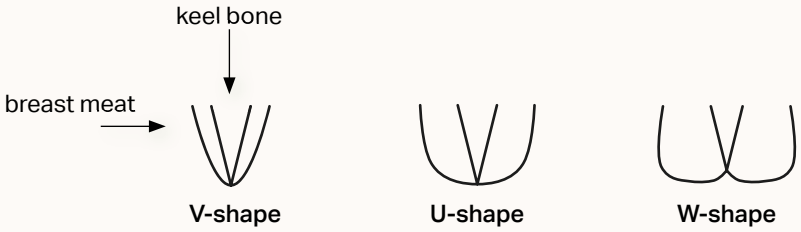
Fleshing

The condition of both males and females is reflected not only by their body weight, appearance and colouring, but also by the condition of the breast meat, the so-called “fleshing”. At various moments in rearing and production the fleshing of males and females can be determined, to get an impression of their development.
In general we consider three major categories of fleshing condition, represented by three different letters, “V”, “U” and “W”.

- If the fleshing represents the **letter V**, it means there is only a very limited amount of breast meat present on the bird, and the sharp shape of the keel bone can be felt easily.

- If the fleshing represents the **letter U**, the keel bone can still be felt and is still the deepest point in the rounded breast.

- If the fleshing represents the **letter W**, the keel bone can hardly be felt and is bedded in the breast meat.



Depending on the age of the flock, the gender and the condition, the shape of the breast will vary. For females in production, we usually consider the V-shape to be a sign of under-developed birds, the U-shape as the condition that we are looking for, and the W-shape as a sign of over-developed birds. Males in production preferably have a more V-shape type of breast.

Transfer from rearing to production

The transfer from the rearing to the production farm is a stressful event for the birds. Because of the transfer stress, growth can be slightly reduced. A small increase in feed amount for a limited time of two or three days will help to compensate any reduction of growth. The amount of extra feed and the time when it is given will depend on the season and the distance travelled. On the day of moving, withdraw the feed in time before transfer to limit mortality and dirty crates.
Don't carry birds by one leg. Handle the birds carefully, do not overfill crates.

Birds should not lose weight, condition, or uniformity because of the transfer. When taking birds out of the crates or coops place them directly on the slats.

Birds should find water quickly when they reach the production house. Birds with dirty beaks are an indication that they did not find water but get water from the manure under the slats. These birds need to be supported to find water from the drinking system.

Preparing for the start of production 20 to 24 weeks

The development from 20 weeks until the start of production should be gradual. This period usually requires feed increases between 3 to 5 g/bird/week. Increasing the feed amounts in 2 steps such as every 4 days with 2 g increments will help to keep the flock calm with the correct body weight increase.

The light stimulation program should start at 147 days. The first extension of the light length should be made by 3 or 4 hours to achieve a light day length of 11 or 12 hours.

Example of the lighting program

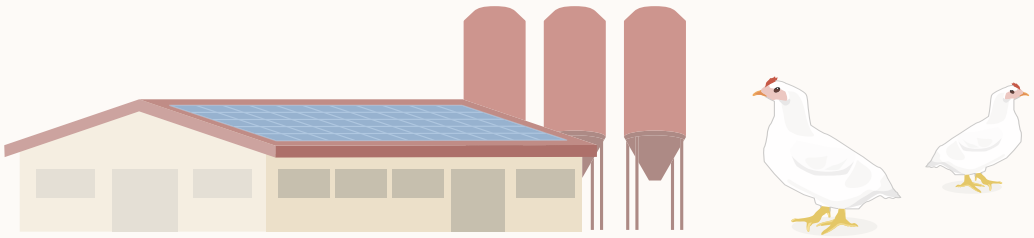
Age Weeks	Age days	Light hours	Light intensity lux
2-21	up to 146	8	maximum 5
21	147	11	minimum 20
22	154	12	minimum 40
23	161	13	minimum 60 - 70
27	189	14	minimum 60 - 70
optional			

The flock is prepared for light stimulation when the average female body weights is 2450 to 2600 g and a sufficient fleshing (a "U" shape of the breast) in 95 % of the hens.
If the flock has very poor uniformity with many underweight birds, light stimulation at 154 days may be considered but preferably we want to avoid any delay.

It typically takes 14 to 16 days from the light stimulation until the first egg is laid and another 7 days to reach 1 to 2 % daily egg production. Once photo stimulation occurs, birds should never be exposed to a decrease in day length or light intensity through the production cycle. Females should receive a maximum of 13 to 14 hours of light in dark out production houses.

Light intensity should be a minimum of 60-70 lux for good sexual stimulation of the males and for reducing floor eggs.

At photo stimulation, the timing of hours of light increase is more important than the increase of light intensity. Light intensity in production is normally maintained to encourage bird activity and for caretakers to perform their routine house inspections and management of birds and litter. However, if nervousness, feather picking or cannibalistic behaviour occurs after transfer to the production house, light intensity can be reduced.



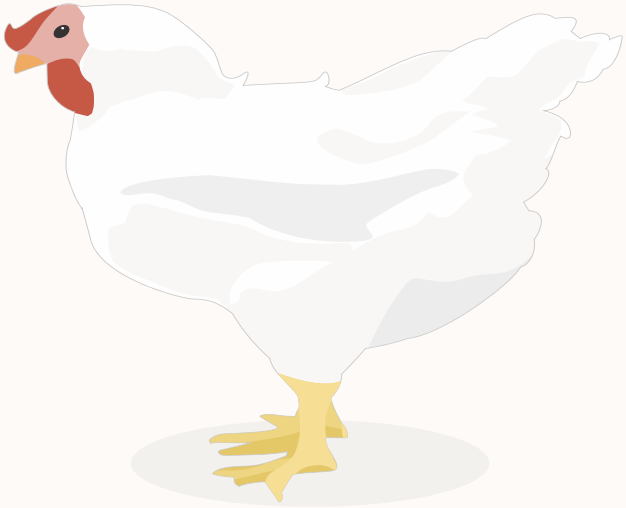
Production 24 to 30 weeks (peak production)

For optimum egg production over the hen´s life, it is important not to let the hen become overweight.

Weigh the flock weekly, even after the rearing. It will provide you with a better overview of the body weight developments towards peak and after. In the period from 24 weeks to peak production it can be considered to even weigh twice per week, to have a continuous control on the development of the birds.

The feed amount at 5% daily production depends on the energy level in the feed but should not exceed 120-125 grams. When the flock reaches 5% daily egg production, a feeding program should be based more on development of the daily egg production than on development of the body weight. In the first part of the production increase (from 5% to 40-45% production) the feed increase per unit of production increase should be lower than in the period from 40-45% to peak production, to avoid over stimulation of the birds that are not ready for production yet. In the period from 5% to 40-45% production approximately 40% of the total feed increase should be given, in the period from 40-45% to peak the remaining 60% of the total feed increase should be given. Feed increases should be done every two or three days, depending on the production development of the last days. Daily increases are not recommended to prevent over feeding.

The recommended feed amounts for peak production are based on an estimated production peak of 85% and body weight according to the standard. For each 2% production above 85%, add 1 g of feed to help sustain the high production performance. For each 100 g of extra body weight over the standard add approximately 2 g of feed. Flocks peaking over 86% production are recommended to remain on peak feed for an extra one or two weeks. These flocks do not tend to become overweight because the females are converting feed into high egg mass output. Feed amounts should be corrected for the actual energy levels in the feed.



There are two options for feeding broiler breeders in the production. Each has its advantages and disadvantages. Consult your Cobb Germany representative to discuss what option is best for your flock.

The most popular option is initiating feed distribution in the dark a few minutes before the lights come on in the morning, or up to maximum one hour after the lights turn on.

If the birds are being fed after the lights come on, switch off the lights when feed distribution starts to keep the birds calm and to get the best feed and bird distribution over the whole length of the house. The chain feeding systems should make one complete round before lights are turned on. The feed should be distributed in less than 3 minutes.

Another option is feeding 7 to 8 hours after the lights turn on. Also, with this feeding schedule switch off the lights during feed distribution. The lights are switched on when the first loop of the feeders has been completed. Good environmental control is very important to prevent any heat stress – do not use this option without good tunnel ventilation and evaporative cooling systems.

Check regularly if all the birds go to the feeders when the feeding starts. When birds remain on the slats for drinking, the water restriction might be too severe. Water to feed ratio in production should be minimum 1.8: 1, depending on the climate in the house and the drinking system. Regularly check some hours after feeding if the crops are soft, indicating that the birds had enough water.

Production 30 to 65 weeks (depletion)

The females can easily become overweight causing problems with persistency of lay and fertility in the later stages of their life. The biggest risk of having females too heavy is after peak production if the feed level is too high and not reduced on time. However, the average body weight of the flock should always increase a little. If there is no weight gain, some individual birds will gain weight and some birds will lose weight which will result in reduced performance of such females.

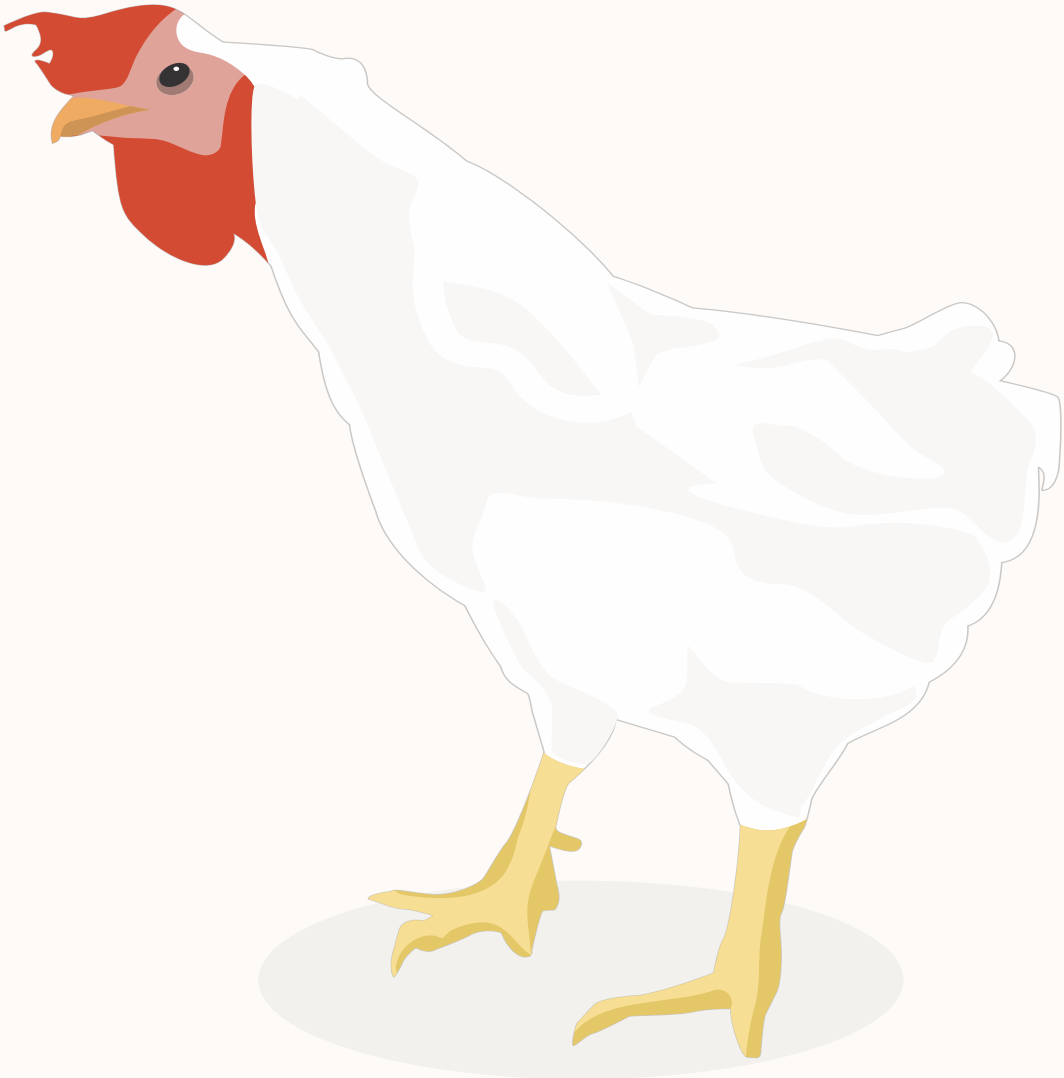
Decrease feed by 1-2 g approximately two weeks post peak production. Peak production is generally the point that the average percentage of production for the past 7 – 10 days is not increasing anymore. Then, decrease 1 g per 2-3 weeks until the cumulative drop in feed is 3-4%.

Periodic handling of the hens, along with weighing, is necessary to determine the correct feed withdrawal. The flock may require no feed reduction after 40 weeks of age. If the birds are overweight, they need roughly 2 g extra feed for every 100 g over the target.

Do not drop feed if production starts dropping faster than it should, especially when the body weight is not gaining. Decide quickly because delayed reaction will be less effective. One needs to prevent the drop in production by feeding enough, to maintain controlled but steady body weight gain from 35 to 55 weeks of age.

Egg weight and body weight are interrelated. A higher body weight of the hens will normally result in a higher egg weight. Introducing Breeder-2 feed when egg weight is at 60 g can be an efficient way to control body weight and egg weight, but the change in feed formulation should not be too big to prevent a drop in production and loss of condition.

A scratch feed may be beneficial to maintain fertility. It should be fed late in the afternoon at the rate of 0.5 kg per 100 birds.



Male Management

The key to obtaining good hatchability from today's broiler breeders is to develop feeding and management programs that allow a correct development of the male's reproductive system while controlling their growth potential and capacity to deposit breast muscle. The Cobb male is known for its huge growth potential. The male growth profile is the single most important factor that correlates with flock fertility. Another factor is the foot pad quality which can be influenced by too high body weight and poor litter quality.

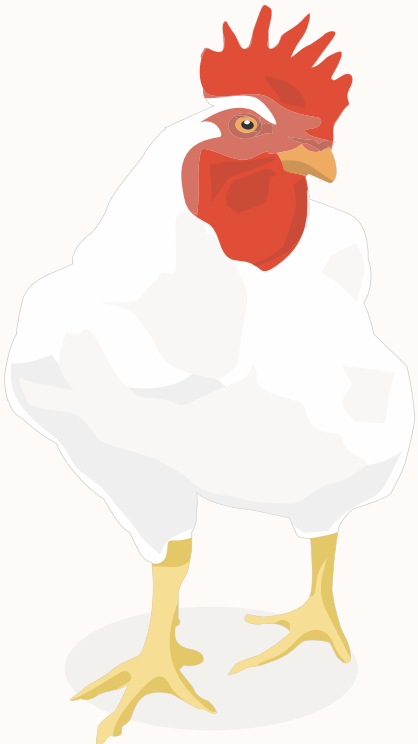
Male Rearing

Males should be reared separated from females until they get moved to the production farm. The stocking density should not exceed 3 to 4 males/m2 in the rearing farm. Males need more space to become dominant and develop their territorial behaviour before the production period. Additional to floor space, enough feeding space is essential to allow all males to eat at the same time. Quick and even feed distribution is very important to keep a good uniformity. The foot pad and leg quality of males in production are highly influenced by the quality of the litter in production but especially in rearing. Good litter quality in rearing is essential for females but especially for males.

The body weight development in the first 8 weeks will determine the frame size later in life. Males with big frame and long shanks have a better mobility and are more able to complete mating in production. Furthermore, they can carry more weight in the production period and will have less leg problems. Males should be weighed once a week from 1 to 30 weeks.

Monitor weights and uniformity weekly and adjust the feed amounts giving not less than 3g and not more than 4g weekly increases to keep the body weight close to target. It is recommendable to grade all males at 3 to 4 weeks of age to separate the heavy males from the rest. Avoid overweight birds especially in the first 4 weeks. Very heavy males at transfer will react stronger to light stimulation and stress the females during production.

When slats are used in the production farm, males need to learn to jump so they will not have problems finding water on the slats. Place training slats under all drinking lines in the rearing farm at 4 weeks of age so all males learn and will be forced to jump.

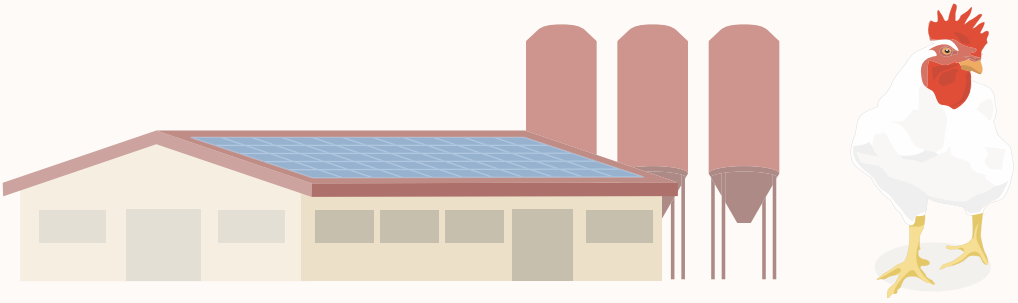


Transferring Males from Rearing to Production Houses

Consider transferring the males a few days earlier than females so they can get used to the production farm equipment and will find feed and water before the females arrive. Handle males by both legs and do not overfill transfer crates with too many males. Maintain the same conditions from the rearing farm in the production houses in terms of temperature, feeding time and light program (length and intensity). The fewer the changes, the better for the birds.

After transfer, males may steal feed from female lines. It is important to determine the percentage of males that are eating from the female line to reallocate some male feed to the female feed track. It may be necessary to start with just 30% of male feed in the male feeders. The rest goes into female feeder. Allow the males to have access to their feeders at the same time or up to a minute earlier before females are fed, to avoid as much as possible that they start to look for feed in the female feeders. Be consistent in the routine of timing and set up of the feeding procedures to avoid stress. Determine the amount of males that are stealing by observing males during feeding and adjust the ratio of male feed going into the female feeder accordingly. Gradually put more feed into the male feeder and less into the female ones. Usually, the males are not able to eat from the female feeder at about 25-26 weeks, which is when they should get the full male feed amount in male feeders. If the male feed amount is not well controlled, they can develop much faster than females. Especially if the males were further in their development already in rearing, this could lead to poor sexual synchronization and male aggressiveness. Mating avoidance and poor fertility can easily be the result of it. In such situations, even transferring males after females could be considered.

Mate the heavier males with heavier females, and light males with light females. This mating scheme will ensure proper sexual synchronization between males and females and a proper body weight differential. This greatly enhances hen receptivity and mating efficiency.



The target male ratio is between 8 – 10% and should be based on the sexual synchronization. Especially if male maturation is ahead of the female, consider placing males gradually in the production houses. Begin by mixing at a lower male ratio. Mix 8 to 8.5 % males until peak production. Increase the male ratio to 9.5 to 10 % at 30 to 31 weeks or at first spike. The male ratio should not go under 6.5 %.

After transfer keep grower feed for males until 140 days and then change to male feed (do not give the pre-breeder feed to males). Pre-breeder feed has often higher levels of energy and protein to prepare females for the egg production. However, pre-breeder feed for males can accelerate their development, causing issues with overweight and aggressiveness during the production.

Males in Production

It is essential to use separate sex feeding in the production farm. This will prevent the males from eating from the female feeder lines. The female feeder should include an exclusion system like grill, roller bar or wooden board to avoid males' access to female feed. The exclusion grill should create both a vertical 60 mm and horizontal 45 mm restriction. In systems with a wooden board or roller bar restriction, the vertical restriction should be 50 mm. The vertical restriction should be adjustable. There are usually three different height settings: 42 mm, 46 mm and 50 mm. Begin at 20 weeks with 42 mm, then increase to 46 mm roughly in peak production and finally to 50 mm at about 40 - 50 weeks of age. Once some females are looking for a place with bigger space, increase the height of the board or bar.

The males can usually steal feed from females in the period from transfer up to 25-26 weeks because of their small comb. When females arrive, observe closely males and females at feeding time and establish how many males are eating from female feeders. Over feeding in the period after transfer may result in over-fleshed males requiring additional feed for maintenance. If necessary, reduce male feed by 10% in the period from transfer to 23 weeks. Place male feeders on the outside wall of the house and not between female feeder lines or close to the slats. This allows females to move freely to the nest and will help to reduce floor eggs.

In addition to weight control, conduct routine fleshing scores of males to avoid them losing condition or becoming over-fleshed. Breast fleshing should be frequently palpated by hand with the objective of maintaining a V-shape for as long as possible. During sexual maturation and start of production the breast muscle of

the males will develop and turn from a V-shape slowly into a U-shape. Over-fleshing into a W-shape should be avoided. Towards the end of the production some males will move slowly into a W-shape, but this percentage should be as low as possible, without the males losing weight or condition at any age. Reduction of the fleshing (from a W -shape back to a U -shape) should therefore be avoided.

Although theoretically individual males do not have to gain weight to stay in good condition, if the average growth of the males is zero, some individual males will increase weight and some males will lose weight. Consequently, these males will lose condition and fertility will be reduced. Increase gradually male feed levels in accordance with male fleshing scoring to satisfy their maintenance and mating activity. Do not keep the same feed amount on males for longer than three weeks. Normally feed amounts are not decreased in males. However, if after 30 weeks, the male body weight increases too fast, reduce the feed by 5 g/male and monitor for three weeks until weight gains level off. This is one of the most important periods to adjust feed downwards in males, but only as an emergency procedure.

Identify the inactive males and remove them from the flock as soon as possible. This enhances the activity of other males. Be aware that males must always have warm feet. The presence of cold feet with dry litter is an indicator that males are starting to lose condition and feed amounts need to be adjusted. Another indicator is the loss of red colour in the face and the posture of the males (not upright anymore). Give a feed increase of at least 3 g per male as soon as you recognize some of these conditions.

It is advisable to use a separate feed for males which is lower in protein and energy than the feed for females. This allows to feed more and helps to maintain bird condition and uniformity. However, make sure that especially the protein requirement in the male feed is respected. If it is not possible to make male feed with protein levels according to the Cobb specifications, it is advisable to use female feed for males and reduce the feed amounts with approximately 3 to 5%.

Spiking Males During Production

If required, spiking can be considered. The most important is to maintain the good condition of the original males, however, spiking can help achieve even better fertility. Spiking is the addition of young males into an older flock to compensate for the decline in fertility that usually occurs after 45 weeks of age. This happens because of testicle regression and reduction of sperm quality but especially because of lack of

mating activity after 50 weeks of age. The spiking procedure should be planned well ahead before the drop in fertility happens. Only spiking males with a known health status should be transferred. Bringing new birds to the farm always represents a biosecurity risk for the flock.

Spiking males should be around 4 kg body weight, so that the body weight of young and old males is similar. Usually spiking males are kept for a longer period in the rearing house or in a separate male house to make them ready for spiking. If the males for spiking can be separated at 10-12 weeks of age, an increased feed profile can be used to let them achieve the required body weight at an earlier age. In this way it is possible to use males for spiking at a younger age and move them together with the other birds.

When males are not enough developed, they will not become dominant enough to mate females and will be unable to change the current hierarchy in the flock. Add at least 20 % new males in every house between 35 and 40 weeks of age. Adequate number of new males will break more easily the existing hierarchy in the flock. Poor quality older males should be selected 1 - 2 weeks before new males arrive. This avoids the selection of too many males in one day.

Be sure that spiking males can find water after their arrival. Do not use any water restriction the first 2 to 3 days after transfer. Spiking males should be trained to jump in the rearing farm so they will not have problems finding water in the production. A few days without water can cause serious physiological damage. It can be necessary to bring some males to the drinking nipples. Feed males immediately after transfer. The week after transfer give all males a 5g feed increase as the mating activity will increase considerably.

Intra-spiking

Intra-spiking involves the exchange of 35 to 40 % of primary males between houses on the same farm, without importing any new young males, to stimulate mating. As with spiking, intra-spiking has better results when carried out in the early production period (<45 weeks). Intra-spiking between 40 and 48 weeks always produces the best results. Mating activity should increase very significantly after intra-spiking and lasts between 6 and 8 weeks.

Egg collection

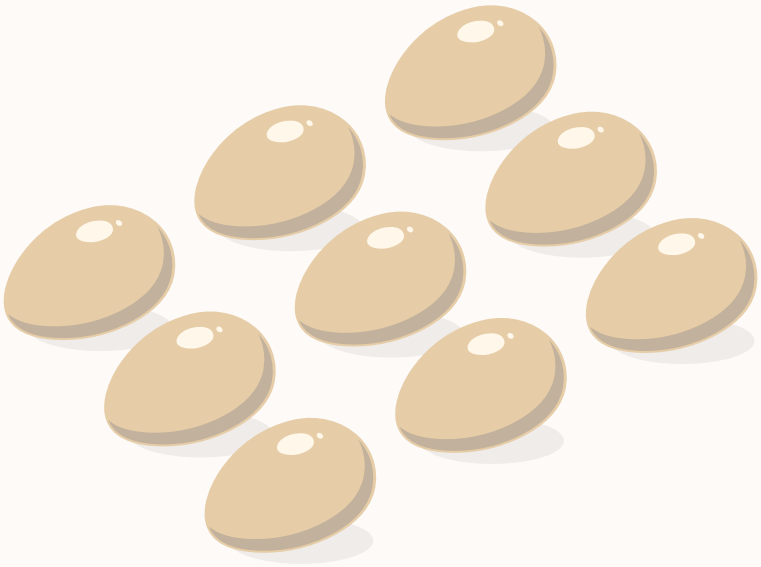
Good egg quality starts in the laying nests. Contamination is one of the biggest risks for the embryo and for chick quality and happens directly after the egg is produced, due to eggs cooling down and pulling in air through the pores. This makes the quality of the nests crucial for egg and chick quality. The number of floor eggs, the shell hygiene and shell integrity but also the temperature of the eggs are influenced by the nests.

- Although nowadays mostly community roll-away nests are used, litter nests are still existing in some markets. At the onset of production, open litter nest several weeks before the eggs are expected, but open roll-away nests preferably as shortly as possible before finding the first eggs, or even at finding the first egg. When the eggs start being produced, inspect the nests regarding hygiene, and make sure the nests are functioning correctly and open as expected.

- If litter nests are used, the nests must be cleaned frequently, broken eggs and droppings must be removed and clean litter must be added. Eggs should be collected at least four times a day, more frequently in cold but especially in hot conditions, to prevent pre-incubation of the eggs.

- Also, in roll away nests the temperature can become too high for the eggs. If the temperature in the nests rises above 25-27oC, pre-incubation can occur which will lead to increased early embryonic mortality. If the temperature in the house cannot be controlled adequately, egg collection must be done more frequently.

- In the case of roll-away nests, nest pads must be checked and cleaned regularly, to avoid contamination. Ideally, nests should have a closing and expel system, to avoid contamination of the nests during the night.



- Egg belts should be wide enough to avoid egg breakage and hair cracks, especially at peak production. Preferably, no eggs should be in the nests overnight. A regular check at the end of the day to determine the number of remaining eggs in the nests is advisable.

- When nests, mats and belts are getting older, often the eggs do not roll smoothly to the belt anymore, which increases the risk of losing egg quality. Nest maintenance should be carried out during every service period.

- When roll away nests are used, it is necessary to use slats in front of the nests, preferably made from plastic or wood. Slats will keep the nests cleaner and also invite the birds to go to the nest more easily.

- Floor eggs have an increased risk of contamination and should always be considered dirty and of lower quality, even if they appear to be clean. They also have an increased risk of exploding during incubation, which will negatively influence other eggs and chicks and increase first week mortality and leg issues. For this reason, they should be kept separated from nest eggs and set in a separate machine, to avoid contamination of other eggs.

Egg washing and disinfection

Dirty eggs are a risk for chick quality and hatchability. Options for increasing the quality once the eggs are contaminated are very limited. Consider dirty eggs as non-hatching eggs and preferably do not set them. Although washing will make dirty eggs visually clean, contamination will still be in the pores. Hatch results and chick quality will be significantly reduced. If dirty eggs must be used, washing can be used to remove the dirt on the shell as much as possible and lower the bacterial pressure during hatching. However, washed eggs should still be treated as risk eggs and should be set separately.

- Washing procedures must be based on clean water, adequate temperature control of the water and the use of a proper detergent. For each batch of eggs fresh water should be used, to avoid cross contamination. Allow the eggs to dry after washing before packing them.

- It is advisable to disinfect hatching eggs as quickly as possible after collection. Although several methods are available, formaldehyde fumigation remains the preferred method as it can penetrate the pores of the eggshell.

- Eggs placed on cardboard trays are less effectively disinfected than on incubator trays, due to limited air flow.

- Do not fumigate eggs two times within 24 hours, and do not fumigate for longer than 20 minutes. Do not bring eggs in contact with formaldehyde during the first 12 to 96 hours of incubation. Use 3 to 7 g of active formaldehyde per m3 of disinfection room. Fumigate at 25-27oC and 50-60% relative humidity. Ensure sufficient air circulation during disinfection.

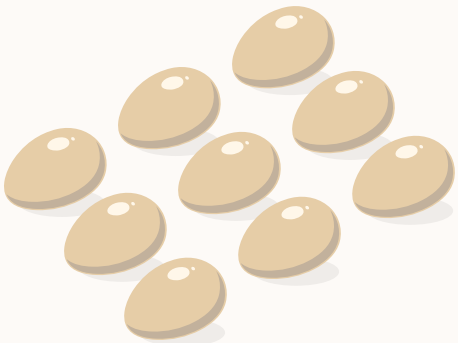
- An alternative method for formaldehyde fumigation is disinfection with hydrogen peroxide, although as a liquid the penetration into the pores of the eggshell is limited. Hydrogen peroxide needs to be stabilized, which often is done with an acid like peracetic acid or organic acids. Stabilizing with products like silver nitrate or glycerol is also possible.

- Other alternatives used are quaternary ammonium, ozone, chlorine, UV-light.

Egg storage

Hatchability and chick quality go down after 5 to 7 days of egg storage, especially on very young and older flocks. This effect starts from the moment the egg is produced. Therefore, the time on the farm should also be considered as storage period. Negative effects can be minimised by proper storage conditions, but not completely avoided.

- Allow eggs to cool down for 1 or 2 hours before stacking them and placing them in the storage room.
- Eggs collected on paper trays require much longer time to cool down than eggs on incubator trays. Do not pack the eggs in transport boxes before they have reached the correct temperature.
- The storage room should be held at 18-20°C when stored for less than 5 days. Optimum temperature for storage periods of 5-7 days is 17-18oC. For periods over a week, temperature should be lowered to 15oC.
- An air-conditioned storage room is necessary if outside temperatures occasionally exceed 22oC.
- When moving cold eggs to a warm environment, there is a risk of condensation (sweating) on the eggs. This sweating must be absolutely avoided. Make sure that the next step in the logistic chain (egg storage – truck – hatchery) is equal or lower in temperature, to avoid exceeding the dewpoint of the eggs.
- Relative humidity (R.H.) is not as crucial as the temperature but aim for 50-75%. At higher R.H. levels, the risk of condensation increases. Do not increase RH by spraying water but by limiting the ventilation in the egg storage room.



Reduction of hatchability after egg storage
Baseline 90 % hatch* at 2-5 days of storage

Although there will be variation, some general guidelines can be used as an indicator for the level of reduction in hatchability that can be expected. In the following table an indication for the reduction of the hatchability for several breeder ages is given.

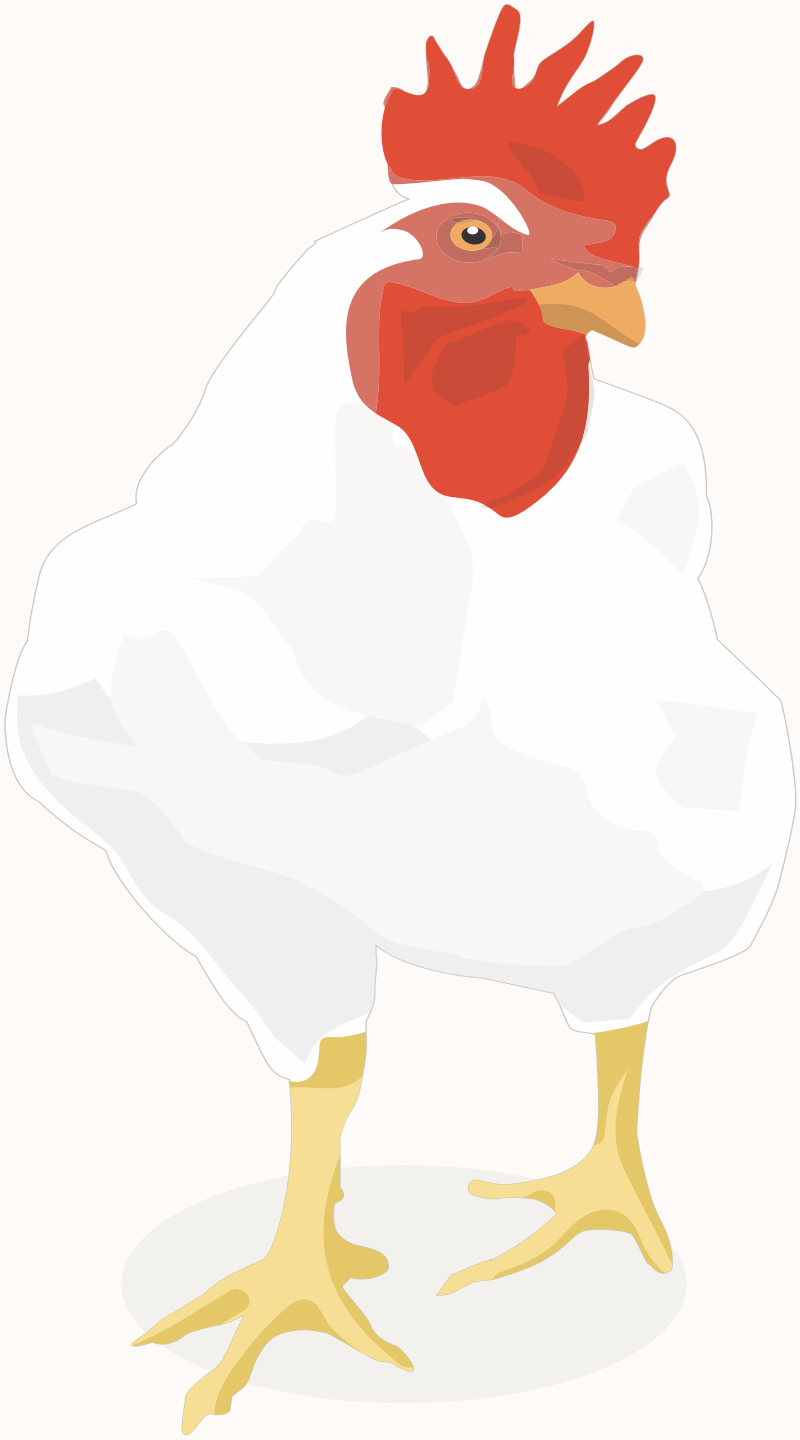
Reduction in hatchability (%) after egg storage

storage (days)	Average	27-32 weeks	32-50 weeks	50+ weeks
0-1	-2	-2	-2	-1
2-5	0	0	0	0
7	-1	-1	0	-2
10	-3	-4	-2	-4
15	-7	-10	-5	-8
20	-14	-20	-8	-17

Reduction of hatch of fertile after egg storage
Baseline 90 % hatch* at 2-5 days storage

Hatch of Fertile %

Egg age (days)	25 weeks	35 weeks	45 weeks	55 weeks	65 weeks
0-1	83	91	90	87	85
2-5	**85**	**93**	**92**	**89**	**87**
7	84	93	91	86	83
10	86	91	89	83	79
15	80	88	86	80	74
20	67	85	83	75	68



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