Breeder Management Guide

breeder

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INTRODUCTION

The Cobb commitment to genetic improvement of our family of products continues to increase the performance potential in all areas of broiler and broiler breeder production. However, to attain both genetic potential and consistent flock production, it is important that the flock manager has a good management program in place. The success of the Cobb broiler breeder worldwide has provided considerable experience of the breed in a wide range of situations, such as hot and cold climates, controlled environment and open housing. This Breeder Management Guide is designed to assist you in building your management program.

Management must not only meet the basic needs of the stock but must also be finely tuned to benefit fully from the breed's potential. Some of the guidelines may need to be adapted locally according to your own experience, and our technical teams will assist with this.

The Cobb Breeder Management guide highlights critical factors that are most likely to influence flock performance and is part of our technical information service, which includes the Cobb Hatchery and Broiler Management Guides, Technical Bulletins and a full range of performance charts. Our recommendations are based on current scientific knowledge and practical experience around the world. You should be aware of local legislation, which may influence the management practice that you choose to adopt.

This Cobb Breeder Management Guide is intended as a reference and supplement to your own flock management skills so that you can apply your knowledge and judgement to obtain consistently good results with the Cobb family of products.

Revised 2008

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1. CHICK MANAGEMENT

1.1 PREPARING FOR CHICK ARRIVAL

The key to successful rearing lies in an effective management program starting well before the chicks arrive on site.

- When importing day-old poultry breeding stock from another country it is advised that you have trained personnel, who know the local customs regulations and necessary documentation procedures required, to ensure clearance from customs as quickly as possible.
- Chick transportation from the airport must be in clean, sanitized, properly ventilated, temperature controlled vehicles. Every effort must be made to coordinate transportation schedules so that upon arrival, day old chicks are cleared through customs and transported to the farm and placed into the houses as soon as possible.
- Brood chicks on a single age farm. Ensure brooding farms are well isolated from older birds. Brood chicks on an all-in, all-out program with a good house security program. The stockman should work only on the brooding farm.
- The rearing facilities must be clean and pathogen free before the chicks arrive. Detailed cleaning and hygiene procedures are described later in this guide. Remember that site biosecurity must be maintained at all times and that biosecurity regulations apply 365 days of the year, including periods when the farm is empty.
- Parent farms must be secure. Vehicles entering the farm should first carry out approved cleaning procedures. Only authorized visitors and personnel should enter the premises and they should be required to follow the correct biosecurity procedures, including showering and wearing the protective clothing provided. The poultry house doors should be kept closed when not in use.

1.2 PLANNING FOR CHICK PLACEMENT

Stocking density should take into consideration environmental or local climatic conditions. Remember that males will be significantly heavier than the females and should be given extra floor space to help ensure they achieve target body weight.

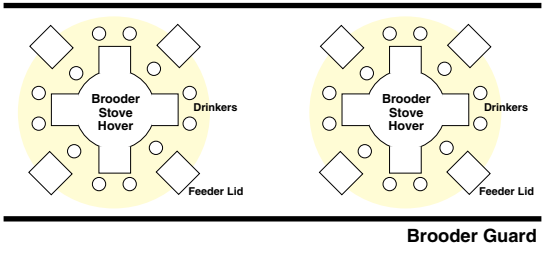
	Floor Space Recommendations	
	sq. ft/bird	birds/sq. meter
FEMALES		
Rearing		
brooding area (First 5 days)	0.36	30.00
open sided rearing	1.75	6.00
dark out rearing	1.50	7.00
Production		
floor-open sided	2.75	3.85
floor-tunneled	2.25	4.70
slatted	2.00	5.25
MALES		
Rearing		
brooding area (First 5 days)	0.36	30.00
open sided rearing	3.00	3.50
dark out rearing	2.75	3.85

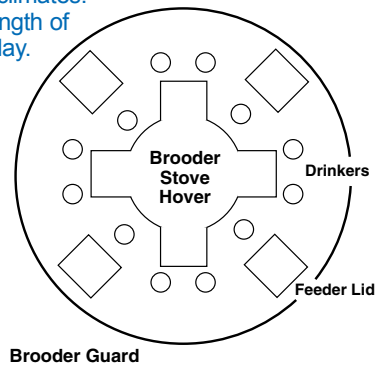
Males should be grown separately to at least 6 weeks of age, but complete separation of rearing the males from the females is recommended to 20-21 weeks of age for best results.

- Flock size may vary for each placement. Before laying out a site for a placement of day-old chicks, confirm chick numbers with the supplier.
- Cover the whole floor with litter to prevent heat loss. Level shavings by raking and compressing firmly. Uneven litter creates uneven floor temperatures, causing groups of chicks to huddle in pockets or under equipment. This could restrict access to feed and water at this critical time of development.
- Ventilate the house to ensure all waste gases from disinfection and heating are removed before the chicks arrive. Formaldehyde gas can create immediate uniformity problems and inhibit early growth rate.
- Start pre-heating the buildings 24 to 48 hours before the chicks arrive depending on climatic conditions. This will ensure the floor is warm and the air temperature is correct when the chicks are placed. Make regular checks to ensure that all brooders are working correctly.
- Ensure that minimum ventilation rates are applied from the day before the chicks arrive. Never sacrifice fresh air quality for heat.
- Provide 2 supplementary drinkers for every 100 chicks and position them near the feed.
- Feeding equipment should not be placed directly under or too close to the brooders and feed should be distributed just prior to the chicks' arrival.
- Provide one feeder tray for every 75 chicks at day old. Ensure that supplementary feed remains fresh. Do not allow chicks to consume stale feed.
- Brooder surround guards (preferably wire mesh) should be no more than 46 cm (18 in) high. The maximum stocking density for chicks in a surrounded brooding area should be 30 chicks/m^2 (0.36 ft^2/bird).
- Where possible construct pens so that chicks from supply flocks of the same age can be reared together. This will improve subsequent flock uniformity.
- Provide attraction lighting so that the chicks remain close to heat source. Provide an intensity of 20-60 lux (2-6 ft candles) the first week to help chicks find feed and water more easily.

Guards

Provide 14 to 18 inch (36-46 cm) brooder guards. One inch (2.5 cm) wire mesh guards are preferred in summer or in warm climates. Guards may be placed around each stove or run the length of your house. Remove the brooder guards after the 7th day.





1.3 LIGHTING

Lighting should be continuous for the first 48 hours following chick placement. The light intensity should be a minimum of 20 lux (2.0 ft candles) to ensure that the chicks find feed and water.

All parent rearing houses should be light proof. For details of the lighting program refer to Section 4. Lighting Program Management.

1.4 BEAK CONDITIONING

Beak conditioning is not usually necessary for parents kept in fully controlled lighting. Beak conditioning may be necessary to control aggressive pecking in open sided houses or situations in which light intensity cannot be controlled. Under these conditions, beak conditioning offers a net welfare benefit.

Females

Check the females' beaks closely at 18 weeks of age to be sure that they have not grown out to the extent that they may cause injury to their flock mates. Birds with overgrown beaks, spoon beaks, parrot beaks or other beak deformities that may prevent them from eating or drinking properly should be reconditioned.

Males

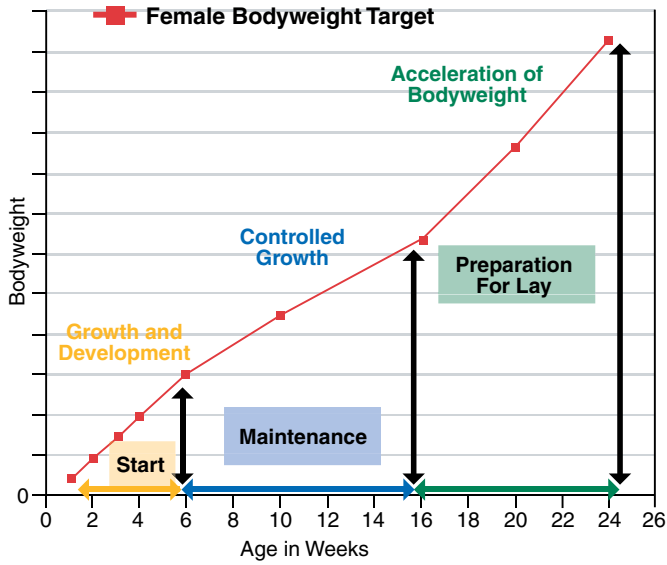
It is essential that male beak conditioning be carried out with precision to maintain uniformity and maximize fertility.

Remove only the keratinized tip of the beak.

Check the male's beaks closely at 18 weeks of age and recondition the birds that show beak overgrowth or any beak deformity.

Beak conditioning males also reduces the risk of damage to the females during mating in the hen house and helps the male mate more effectively.

2. GROWTH PHASES



It is very important to understand the body weight curve in the rearing period and basically it can be divided into 3 phases. The first one is from 0-6 weeks in which part of frame size and uniformity are determined for most of the flock's life. The second phase is from 6 to 16 weeks of age during which the birds should be maintained under a carefully controlled feeding program designed to prevent them from becoming overweight. The third phase is after 16 weeks when the flock needs to accelerate growth rate to prepare for sexual development and achieve proper uniformity, independent of body weight status at that age.

2.1 START OR BROODING PHASE (1-14 DAYS)

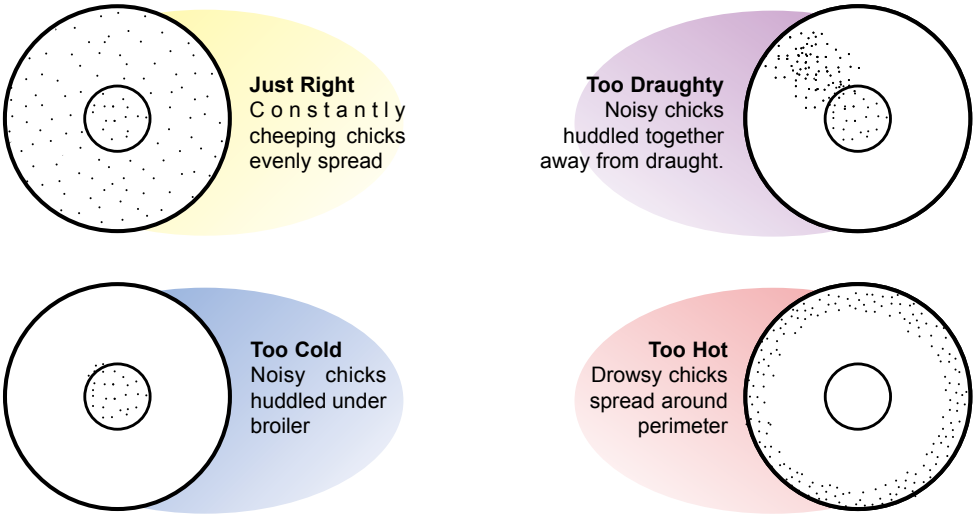
The first 14 days are one of the most important times of a bird's life. Remember the four basics: Feed, Water, Temperature and Air Quality. The importance of the brooding period cannot be over emphasized. The first 14 days of a chick's life sets the precedent for good performance. Efforts spent at the start of the brooding phase will be rewarded in the final performance of the flock.

- Fresh feed and water should be made available to chicks on arrival in the rearing house.
- Brooders and heaters should be checked regularly to ensure that they are working correctly.
- Supplemental drinkers are recommended from day old to 7 days of age. Use mini drinkers or chick founts, not open trays. This will help to avoid problems with foot infections. Do not place drinkers directly under brooders.
- All chick boxes should be placed in the house with the appropriate number of boxes aligned with each brooder prior to releasing chicks. Strive for even chick distribution throughout the brood area. Do not stack full boxes inside the house or place full boxes inside the brooding area.

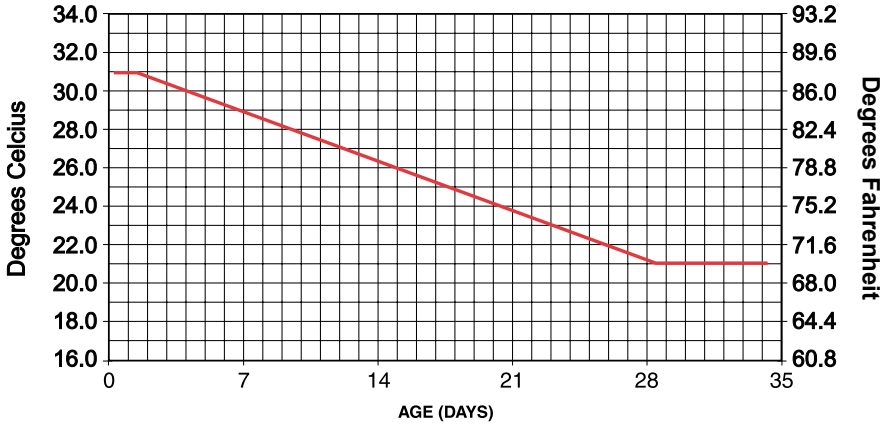
- Seven day weights are an excellent overall indicator of how successful brooding management has been. The effects of early stress may not be seen until much later and may negatively affect the subsequent reproductive performance of the flock. The main reason for insufficient early weight gain is low feed consumption. Presentation of food in the form of a good quality, small crumble is necessary to get the proper feed intake in the first week. Insufficient feed amount and/or feeder space will affect feed intake, weights and bird uniformity. It is also important to mention that early protein intake will especially affect four-week weights, flock uniformity, and ultimately egg production.
- Check chicks two hours after placement. Ensure they are comfortable with the temperature.
- Crop assessment is a useful tool to judge how effectively chicks have found feed and water. Randomly select 100 chicks and gently palpate the crop 6 to 8 hours following placement. (or the next morning if the delivery is later in the day). The crop should be soft and pliable. If the crop is hard, this is an indication the chicks have not found adequate amounts of water. If the crops are swollen and distended with water, the chicks have not found enough feed. A minimum of 95% of the birds' crops should be full and pliable upon examination.

Brooders

Place no more than 30 chick/m^2 (.36ft^2/bird). Brooders should be operating for 24-48 hours before chicks arrive, maintaining a temperature of 85-90°F (29-32°C) 5 cm (2 in) from the litter at the brooder edge. Observe chicks and adjust for their comfort, but be careful not to over heat. The diagrams below illustrate how to observe chicks and correct for the brooding temperature.



Brooding temperature profile for parent breeders



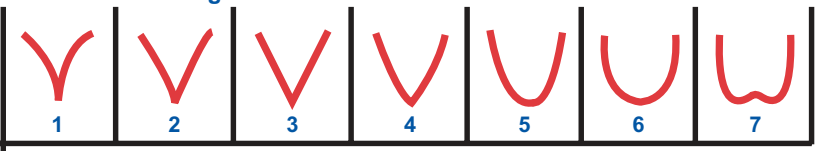
2.2 MAINTENANCE PHASE

The main objective in the maintenance phase of the bird's life is weight and fleshing control. It is important that the birds be handed as often as possible and their fleshing scored throughout this phase. The more birds handled at different ages, the better the condition of the birds will be understood. Bird condition at lighting is critical, and the only way to achieve the desired results (at least 85% of the birds in the proper breast shape for a particular age - chart on page 7) is with proper weight control throughout the maintenance phase.

Fleshing Scores

1. Substantially under the desired level of fleshing
2. Ideal breast shape at age of least fleshing (12 to 15 weeks).
3. Breast fleshing shape during preparation for lay - early weeks.
4. Breast fleshing shape during preparation for lay - later weeks.
5. Ideal breast shape for 4 weeks of age and again at light stimulation.
6. Desired level of fleshing during production.
7. Subatantially over the desired level of fleshing.

Fleshing Conformation for Cobb Females



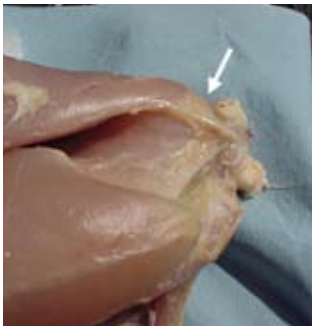
AGE	1	2	3	4	5	6	7
4 Weeks				X X X	X X X X X X	X X	
12 Weeks	X	X X X X X X X	X X X				
16 Weeks		X X X	X X X X X X X	X			
18 Weeks			X X	X X X X X X	X		
Light Stimulation				X X	X X X X X	X X	

2.3 PREPARATION FOR LAY PHASE

This is the phase in the bird's life when consistent weight gains are needed. The objective is to provide enough fleshing and fat reserves to carry the bird throughout the rest of its life. It is very important to understand the following:

- Placing correct emphasis on regular feed increases
- Ensuring correct age and condition at light stimulation
- Maintaining consistent frame size
- Building adequate fleshing and fat reserve
- Preventing stalls or drops in weight gain

Remember it is better to delay light stimulation if you feel the birds are not in the correct condition. The best way to achieve good breeder flock egg production is to develop feed and weight programs that prepare the pullets for a uniform response to light stimulation. The response of the hens to light stimulation is based on the condition and body weight of the bird. It is important not to stimulate the flock if it still contains underweight birds. To determine the average body weight at which to begin light stimulation, refer to the relevant breeder management supplement. Flock uniformity should be a minimum of 70% and the birds should achieve the appropriate breed specific average body weight to ensure the proper response to initial light stimulation. If either the average body weight or uniformity are below the breed specific recommendations, consider a delay in initial light stimulation.



Adequate fat covering on pelvic bones prior to move

No fat reserve on the outer tips of the pelvic bones prior to light stimulation

2.4 FEMALE BODY WEIGHT GAIN FROM 16-20 WEEKS

It is essential that the female parent achieves sufficient body weight gain between 16 and 20 weeks of age to maximize peak egg production and maintain post peak persistency.

The female's body composition at lighting is as important as the bird's body weight. This means that the hen must have adequate fat reserve and fleshing at this point. Birds normally lay down fleshing quite easily between 16 and 20 weeks of age, however this is not the case with building fat reserve.

In order to build an adequate amount of fat deposition the female must have sufficient weight gains in this critical 16 to 20 week period. A good management tool is to have a 33 to 35 percent increase in female bodyweight during the period from 16 weeks (112 days) of age to 20 weeks (140 days). It is also possible to calculate as a guide the BW increase from 16 weeks to first light stimulation, if the flock is light stimulated later than 140 days. This increase should be between 45%-50%.

As a general conclusion it is evident in the Cobb product lines that first light stimulation is not age but body weight dependent. Uniformity of body weight determines in large part the sexual uniformity of the flock and hence the peak production performance and its persistency over 80% and 70% production.

3. FEED MANAGEMENT

3.1 REARING PERIOD

Females are fed ad libitum for the first 2 weeks and then their intake controlled to ensure they do not exceed the target weight at 4 weeks of age. Parent males need to achieve the body weight standard each week for the first 4 weeks to obtain uniformity of the flock and have proper frame development. Feed is presented ad libitum for the first week and then is controlled so the males do not exceed the target at 4 weeks of age. If the males do not achieve target body weight during the first 4 weeks a longer ad libitum feed time is recommended. Males should be grown separately to at least 6 weeks of age, but complete separation of rearing the males from the females is recommended to 20-21 weeks of age for best results.

- Provide one feeder tray per 75 chicks at day old. Ensure that supplementary feed remains fresh. Do not allow the birds to consume stale feed.
- For males, during the ad libitum feeding period allow 4.0 cm (1.5 in) of trough space or 45 birds per pan. During the rearing period while on controlled feeding, a minimum trough space of 15.0 cm (6 in) per bird must be provided for both males and females. If pans are used allow for 11.5 cm (4.5 in) per bird.
- Feed should be distributed to all birds throughout the house in less than 3 minutes. Inexpensive methods of improving feed delivery should be considered. For example, slave hoppers could be added to the system to increase points of feed distribution. Or, additional lines of feeders (chain loops or another line of pans), will add more space so all of the birds can eat at the same time. Other methods of feeding could also be considered; either feeding the first feed in the dark, or using “signal light” feeding. Either of these methods will keep the flock calmer, resulting in less piling and better flock uniformity.
- Weekly feed increases should be based on body weight targets.

3.2 ALTERNATIVE FEEDING METHODS

Birds should be fed every day. However, there may be situations in which it is better to adopt an alternative feeding program.

Skip-A-Day Feeding

This program uses the same weekly feed amounts as the daily recommendations. However, from 21 or 28 days until the birds are 140 days of age, feed the equivalent of 2 days feed on a single day, providing only a scratch feed the next day. Skip-a-day feeding may be advantageous when feeding space is limited, since it provides feed over a longer period of time and allows timid birds at the lower end of the peck order to feed properly.

Example: week 8 - 9 (female line programs)

Female daily feed allowance = 53 g/bird/day

Sunday	106 g/bird
Monday	No feed/Scratch feed
Tuesday	106 g/bird
Wednesday	No feed/Scratch feed
Thursday	106 g/bird
Friday	No feed/Scratch feed
Saturday	106 g/bird
Sunday	No feed/Scratch feed

Female daily feed allowance = 11.68 lbs/100/birds

Sunday	23.36 lbs/100 bird
Monday	No feed/Scratch feed
Tuesday	23.36 lbs/100 bird
Wednesday	No feed/Scratch feed
Thursday	23.36 lbs/100 bird
Friday	No feed/Scratch feed
Saturday	23.36 lbs/100 bird
Sunday	No feed/Scratch feed

A good rule of thumb when using a skip-a-day feed program is to never exceed the anticipated "peak feed amount" at any time. For example, if the skip-a-day amount approaches 34 lbs/100 = 154 g/bird (17 lbs/100 = 77 g/bird) the flock should be carefully monitored for signs of "feed impaction" and a switch to a 4-3 or 5-2 feed program considered.

Five Days / Week Feeding (5-2 Feeding)

This program is a compromise between everyday and skip-a-day programs so that birds are fed on the same days each week throughout the rearing period. This program significantly reduces the maximum feed amounts presented to the birds on a single day compared to skip-a-day. Typically this program is used during the later part of the growing period, particularly if "feed impaction" has become a problem on feed days.

Example: week 8 - 9

Female daily feed allowance = 53 g
Female weekly feed allowance = 53 g x 7 = 371 g ÷ 5 feeds = 74 g / bird.

Sunday	74 g/bird
Monday	74 g/bird
Tuesday	74 g/bird
Wednesday	No feed/Scratch feed
Thursday	74 g/bird
Friday	74 g/bird
Saturday	No feed/Scratch feed
Sunday	74 g/bird

Female daily feed allowance = 11.68 lbs/100 birds
Female weekly feed allowance = 11.68 lbs x 7 = 81.76 lbs ÷ 5 feeds = 16.35 lbs/100 birds.

Sunday	16.35 lbs/100 birds
Monday	16.35 lbs/100 birds
Tuesday	16.35 lbs/100 birds
Wednesday	No feed/Scratch feed
Thursday	16.35 lbs/100 birds
Friday	16.35 lbs/100 birds
Saturday	No feed/Scratch feed
Sunday	16.35 lbs/100 birds

4. LIGHTING PROGRAM MANAGEMENT

The response of chickens to light is a complex subject. The following paragraphs provide basic advice on lighting programs that are proven for Cobb product lines. Local conditions and housing types may necessitate the use of modified lighting programs, which should be discussed with your Cobb Technical Service representative.

Broiler breeder hens come into lay in response to increases in the day length when made at the appropriate time. The response of the hens to light stimulation is based on their condition, body weight and age. In light controlled housing, delay light stimulation if the flock still contains significant numbers of underweight birds. Depending on which body weight curve is used, this age at first light stimulation could be 20 or 21 weeks of age. When transferring birds from dark-out rearing to open sided laying houses, the weight and body condition must be correct at time of transfer.

The following recommendations for lighting programs are given for 3 situations:

- Dark-out rearing to dark-out production.
- Dark-out rearing to natural daylight production.
- Natural daylight rearing to natural daylight production.

4.1 DARK-OUT REARING HOUSES

Parents should be reared in lightproof housing. The light intensity in such houses must be less than 0.5 lux when the lights are switched off.

Open houses can be converted to dark out rearing by eliminating all areas that allow light leakage using effective blackout curtains. Provision must then be made for sufficient fan capacity to allow correct ventilation. Fans and air inlets must also be covered with adequate light traps.

4.2 DARK-OUT REARING TO DARK-OUT PRODUCTION

Dark-out houses should provide total light control.

- Start chicks on 24 hours of light reducing to eight hours by two to three weeks of age. The age at which 8 hours day length is reached will depend on feed consumption time. Generally, the 8 hour daylength can be started when the birds consume their every-day restricted amount of feed in 5 hours or less.
- The day length remains at 8 hours to 20 weeks (140 days) of age when the step-up programs should be followed.

Modifications can be discussed with your Cobb technical services representative. It is important not to stimulate the flock if it still contains significant numbers of underweight birds.

Recommended lighting program in dark-out production housing for flocks reared in dark-out housing

Age (weeks)	Age (days)	Light (hours)	Light intensity (lux)	Light intensity (foot candles)
1 to 3	Day-old to 21	Decreasing from 24 hours at day 1 to 8 hours by 14-21 days	Days 0-2 maximum light (>20 lux) reducing to 20 lux by day 7	Days 0-2 maximum light (>2 fc) reducing to 2.0 fc by day 7
3 - 20	21 -140	8	5 - 10	0.5-1.0
20 - 21	140 - 147	11	40 - 60	4.0-6.0
21 - 22	147 - 154	13	40 - 60	4.0-6.0
22 - 23	154 - 161	14	40 - 60	4.0-6.0
23 - 60	161 - 420	15	40 - 60	4.0-6.0

4.3 DARK-OUT REARING TO NATURAL DAYLIGHT PRODUCTION

Start chicks on 24 hours of light reducing to eight hours by two to three weeks of age. The age at which 8 hours day length is reached will depend on feed consumption time. Generally, the 8 hour daylength can be started when the birds consume their every-day restricted amount of feed in 5 hours or less.

The day length remains at 8 hours to 20 weeks (140 days) of age when the step-up programs should be followed.

Light intensity during the production period must be 80-100 lux (8-10 ft candles). This includes additional artificial light.

Light should be uniform throughout house

Recommended lighting program in open-sided production housing for flocks reared in dark-out housing

Age (days)	Light (hours)	Light intensity (lux)	Light intensity (foot candles)
Day-old to 21wks. with wet body weight of 2420g	Decreasing from 24 hours at day 1 to 8 hours by 14-21 days	Days 0-2 maximum light (>20 lux) reducing to 20 lux by day 7	Days 0-2 maximum light (>2 fc) reducing to 2.0 fc by day 7
21-Transfer	8	5-10	0.5-1.0
Transfer	13	Natural (min. 80 - 100 lux)	Natural (min. 8.0-10.0 fc)
Transfer + 7	14	Natural (min. 80 - 100 lux)	Natural (min. 8.0-10.0 fc)
5% production hen day	15	Natural (min. 80 - 100 lux)	Natural (min. 8.0-10.0 fc)
50% production hen day	16	Natural (min. 80 - 100 lux)	Natural (min. 8.0-10.0 fc)

4.4 NATURAL DAYLIGHT REARING TO NATURAL DAYLIGHT PRODUCTION

It is recommended that parents not be reared in natural daylight houses. However, it is recognized that this production system is used in certain parts of the world and works well if the variation in natural day length is small.

In open-sided and windowed houses, local day length conditions require that a specific program be adopted for each flock as agreed with the technical services representative. The following guidelines apply to all such programs.

During the rearing period birds can remain on natural light in all seasons until an artificial light stimulus is given. The program to be applied is determined by the natural day length at 140 days. When extending the day length, provide extra light at both the beginning and end of the natural day light period to be certain that the intended day length is achieved.

Additional light during this period must be 80 – 100 lux (8-10 ft candles) to ensure that the birds are stimulated.

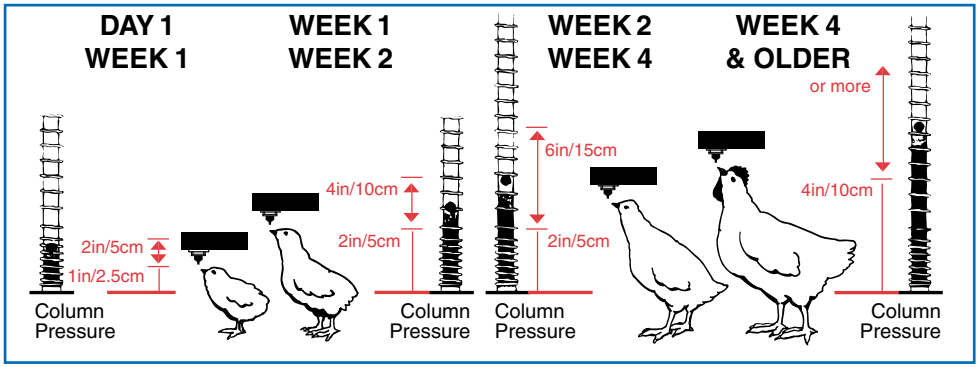
Recommended program for open-sided housing according to natural day length at 20 weeks (140 days)

Natural day length hours at 133 days	Lighting program				
	133 days	140 days	147 days	154 days	161 days
15	Natural	17	17	17	17
14	Natural	16	17	17	17
13	Natural	15	16	17	17
12	Natural	14	15	16	17
11	Natural	14	15	16	17
10	Natural	13	14	15	16
9	Natural	12	13	14	15

5. WATER MANAGEMENT

It is essential to provide easy access to fresh, clean water so that feed intake and growth are maintained.

- The main drinking system may be bell drinkers or nipple drinkers. Bell drinkers should be installed at the rate of one per 80 birds. Nipple drinkers should be installed at the rate of 8-10 birds per nipple. Birds should not have to travel more than 3 m (10 ft) to access water.
- Supplementary drinkers should be provided at the rate of 2 per 100 chicks from day old to 7 days. Ensure that the birds have access to the main drinking system from day-old.
- Nipple drinkers are a more hygienic water delivery system. Nipple drinkers should be adjusted as per manufacturer's recommendations.



- Bell drinkers must be thoroughly washed at least every other day. Buckets and brushes used for cleaning should be disinfected with chlorine or quaternary ammonium sanitizer.
- Header tanks must have lids to avoid contamination from airborne bacteria etc.
- From 4 weeks onwards, the bell drinker height should be adjusted to bird back height Adjustments should be made frequently to prevent spillage and spoiling of litter.

Daily water consumption (taken from meter readings before feeding - the only precise time to record) can give early warning of nutritional, disease or house temperature problems in time to take corrective action. Chickens normally drink between 1.6 – 2.0 times their feed intake on a daily basis at 21°C (70°F). This applies to both ad libitum and control fed flocks. Water consumption of more than 2.0 times the feed can occur in excessively high temperatures (above 30°C (86°F)). High consumption may also indicate errors in the feed formulation or leaking drinker systems.

Example Water Consumption Calculation At 60 g of feed a day per bird, water consumption is approximately 1.8 x 60 = 108 g. As 1 kg water = 1 liter, this is 0.108 liters per bird.

Example Water Consumption Calculation At 13.2 lbs feed/100 birds per day, water consumption is approximately 1.8 x 13.2 lb/100 = 23.8 lbs of water per 100 birds. As 1 gallon of water = 8.33 pounds, this is 2.86 gallons of water per 100 birds.

6. BIRD WEIGHING AND BODY WEIGHT CONTROL

The objective of body weight control is to rear all of the birds to the target weight for age with good uniformity. Body weight targets are achieved by controlling feed allowances. Feed amounts during rearing are based on body weight and maintenance, whereas in lay they are based on these two factors plus egg production and egg weight.

Feed amounts can only be determined if the body weight is measured accurately every week.

To measure body weight, weigh between 60 - 100 birds per pen each week or 1%-2% of the population. At 7 and 14 days weigh a bulk sample of birds or 10 birds weighed together in a bucket. Thereafter, weigh birds individually at the same time on the same day of every week. Be sure the bird weights are taken on an “off day” or before feeding if everyday feeding is used.

Follow these simple procedures to ensure accuracy:

1. The scales used to measure body weight must have a capacity of 5 kg (11.02 lbs.) and be accurate to +/- 20 g (.04 lbs.). Check regularly that the scales are properly calibrated. It is an advantage to have electronic balances with a printout facility.
2. Gather approximately 100 birds in a catching pen.
3. Weigh **every** bird in the catching pen, including small birds (cull sexing errors during this operation.)
4. Record body weight using the following chart.
5. Calculate the average weight of all birds weighed.
6. Plot the average body weight on the appropriate chart.
7. Decide on the feed amount for the following days.
8. During rearing, feed amounts should be maintained or increased. Never decrease the feed amount.
9. After peak egg production feed amounts are normally reduced to control mature body weight and ensure persistency of egg production and fertility. The precise method of feed reduction could vary from flock to flock, and should be discussed with your Cobb Technical Service representative.

6.1 ANALYSIS OF BIRD WEIGHTS

The following is an example of a completed body weight recording chart.

Example Body Weight Recording Chart

	g	lb																						No. of Birds
	460	1.01																						
	480	1.06																						
	500	1.10	x																					1
	520	1.15	x	x	x																			3
-10%->	540	1.19	x	x	x	x	x																	5
	560	1.23	x	x	x	x	x	x	x	x	x	x	x	x	x	x								15
Av.->	580	1.28	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			20
Target➡	600	1.32	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	23
	620	1.37	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						17
+10%->	640	1.41	x	x	x	x	x	x	x	x	x	x												10
	660	1.46	x	x	x	x																		4
	680	1.50	x	x																				2
	700	1.54																						
	720	1.59																						

Date	__/__/__
Age	35 days
House / Pen reference	-
Number of birds / Pen	-
Number sampled	100
Target weight (g) (lbs)	(600) (1.32)
Average weight (g) (lbs)	(595) (1.31)
Coefficient of variation (CV)	6.0
Percentage within +/- 10% of average weight	90%

Body weight should be analyzed in the following way

Average Weight of Birds Sampled

Using the chart above:

Total weight of 100 birds = 59,500 g or 131 lbs.

Average weight per bird = 595 g or 1.31 lbs.

Uniformity

Mark the chart at body weights of 10% either side of the average body weight. Count the number of birds that fall into this band. Calculate the percentage of the sample that this number represents.

Coefficient of Variation (CV)

Variation can be expressed in terms of the average bird weight, the standard deviation of body weight and the coefficient of variation in body weight. In a normal flock approximately 95% of the individual birds will fall in a band +/- two standard deviations either side of the average body weight. The coefficient of variation is a comparative measure of variation that allows the change in variation during the growth of the flock to be monitored. The coefficient of variation is the standard deviation expressed as a percentage of the mean.

The standard deviation is a measure of how widely values are dispersed around the average value (the mean).

(Standard deviation (g)/average body weight (g))*100 = CV (%)

The following table gives an approximation of flock uniformity (%within +/- 10%) into CV (%).

% Uniformity	CV (%)
95.4	5
90.4	6
84.7	7
78.8	8
73.3	9
68.3	10
63.7	11
58.2	12
55.8	13
52.0	14
49.5	15
46.8	16

7. MAINTAINING GOOD UNIFORMITY

A uniform Parent breeder flock will be easier to manage and will produce more chicks per hen housed than an uneven flock. Good uniformity results from careful attention to detail.

7.1 COMMON FACTORS LEADING TO BODY WEIGHT UNIFORMITY PROBLEMS

- Presence of formaldehyde gas at chick placement
- Mixing of parent age sources at day old
- Beak conditioning, if not carried out to a high standard
- Extreme temperatures
- Poor feed distribution
- Incorrect feed amounts
- Incorrectly ground feed or variable pellet size
- Over stocking
- Insufficient water supply
- Too high or too low energy feeds
- Insufficient light at feeding time
- Incorrect feeder height
- Irregular feeding times
- Incorrect bird numbers or pen drift
- Disease or parasitic infection

7.2 GRADING

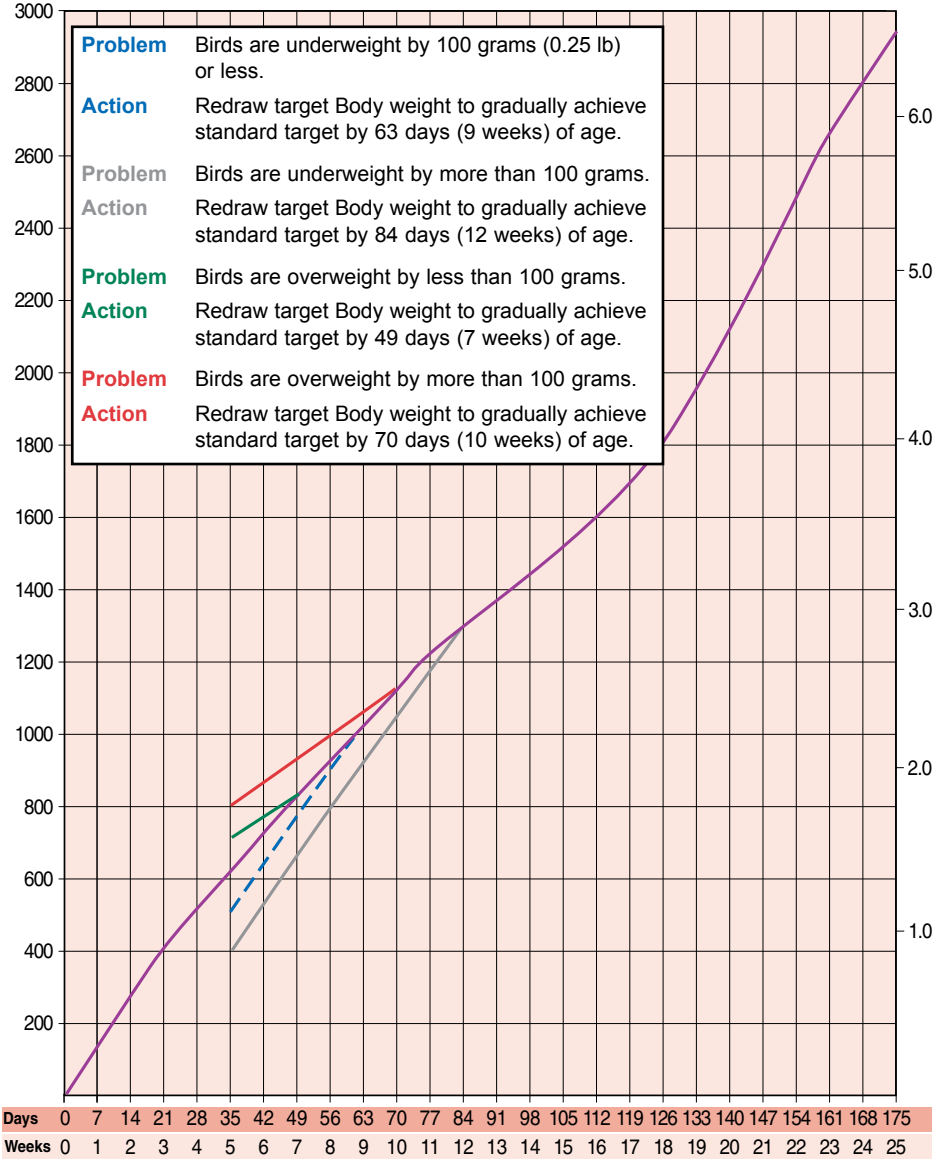
Bodyweight grading helps to maintain flock uniformity if it is done correctly. Females should be graded between 23 and 28 days. Remove 20 - 25% of the lightest birds and place them in a separate pen, where they can be fed according to their needs. Males should be graded after 35 days of age. An additional grading done at the end of the maintenance phase may be needed. This grading may best be done by grading for fleshing and body conformation rather than bodyweight alone.

7.3 TROUBLESHOOTING BODY WEIGHT CONTROL

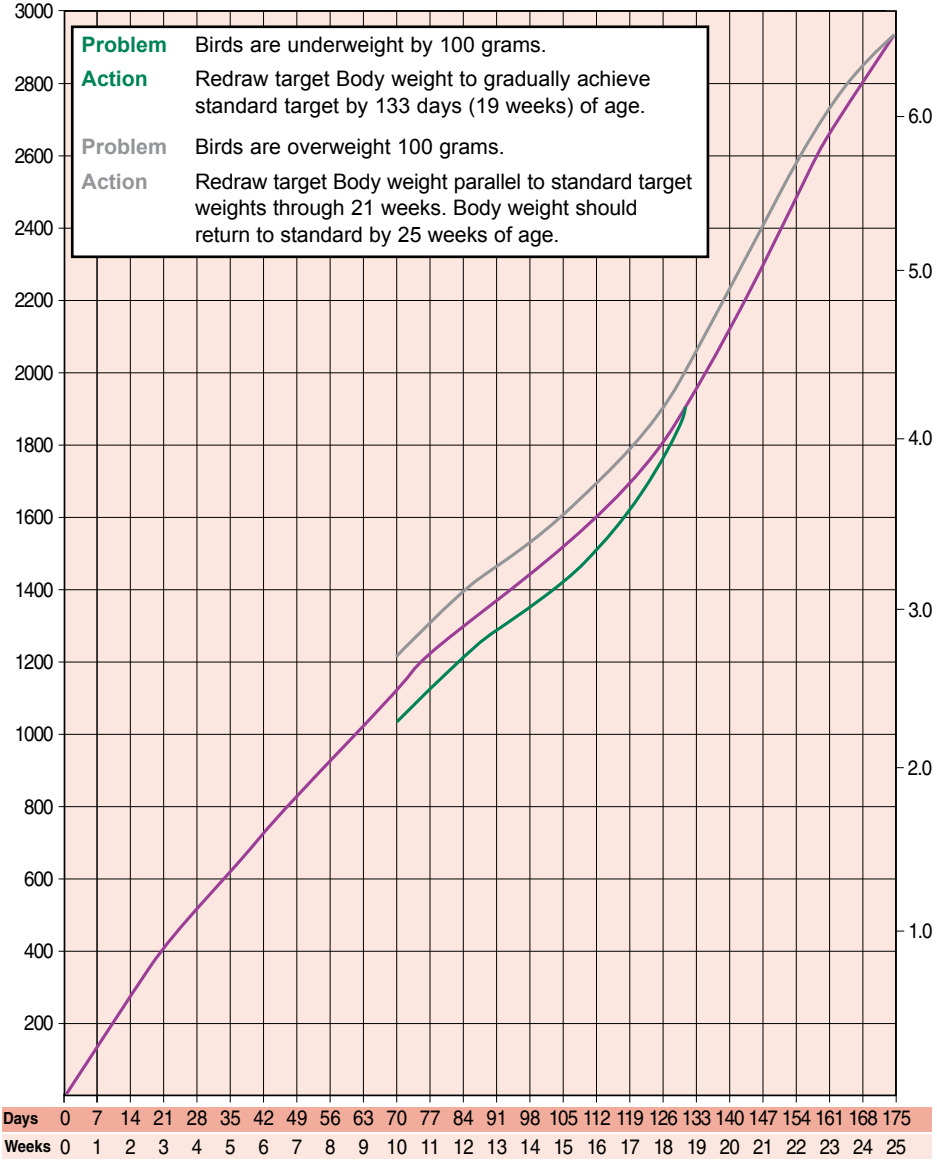
There will be occasions when flocks are not on the body weight target. Any corrective action taken on these flocks should be carried out with long term rather than short-term goals. Adjustments to the growth rate of the flock must ensure that the females will still achieve the necessary body condition and weight gains to allow them to reach sexual maturity.

The following examples illustrate the way in which corrective action should be taken in four different situations:

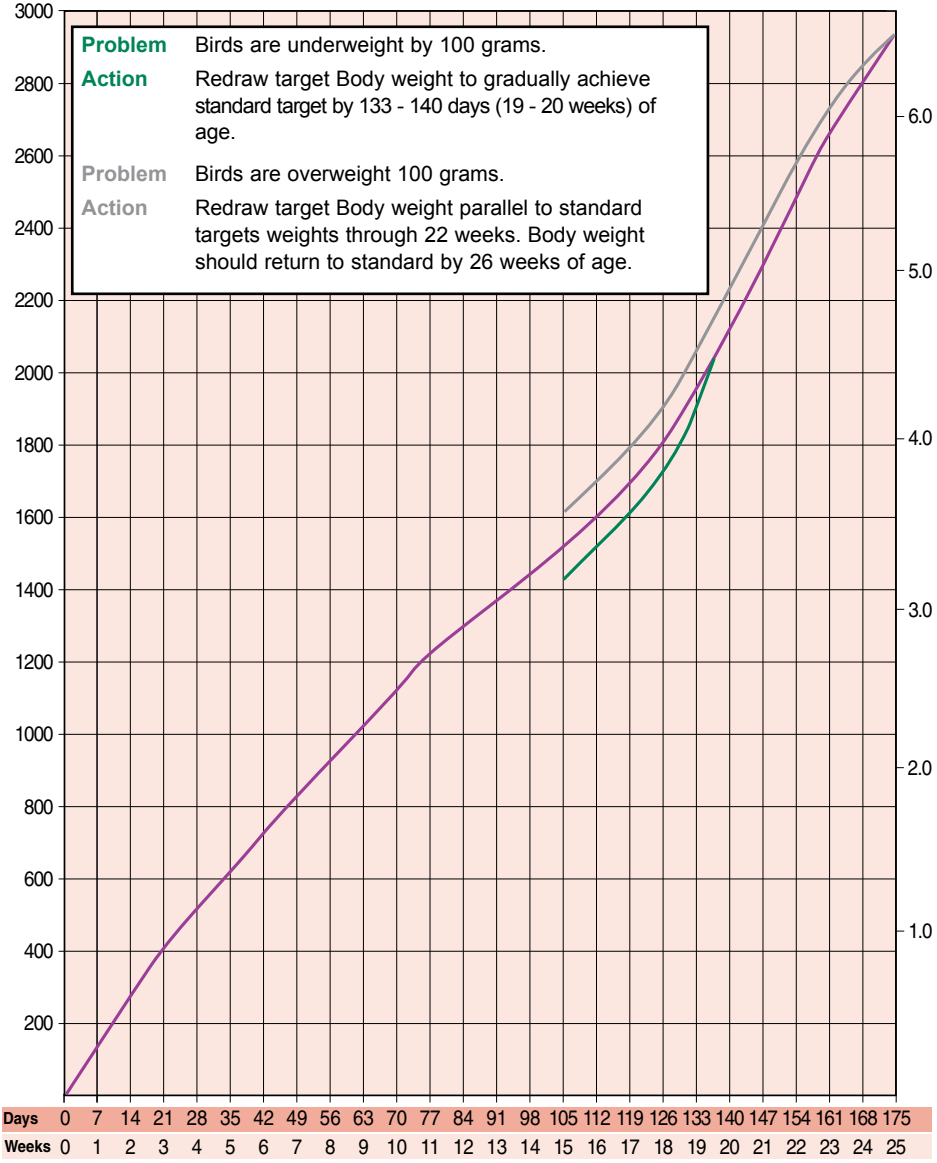
Flock weight off target at 5 weeks



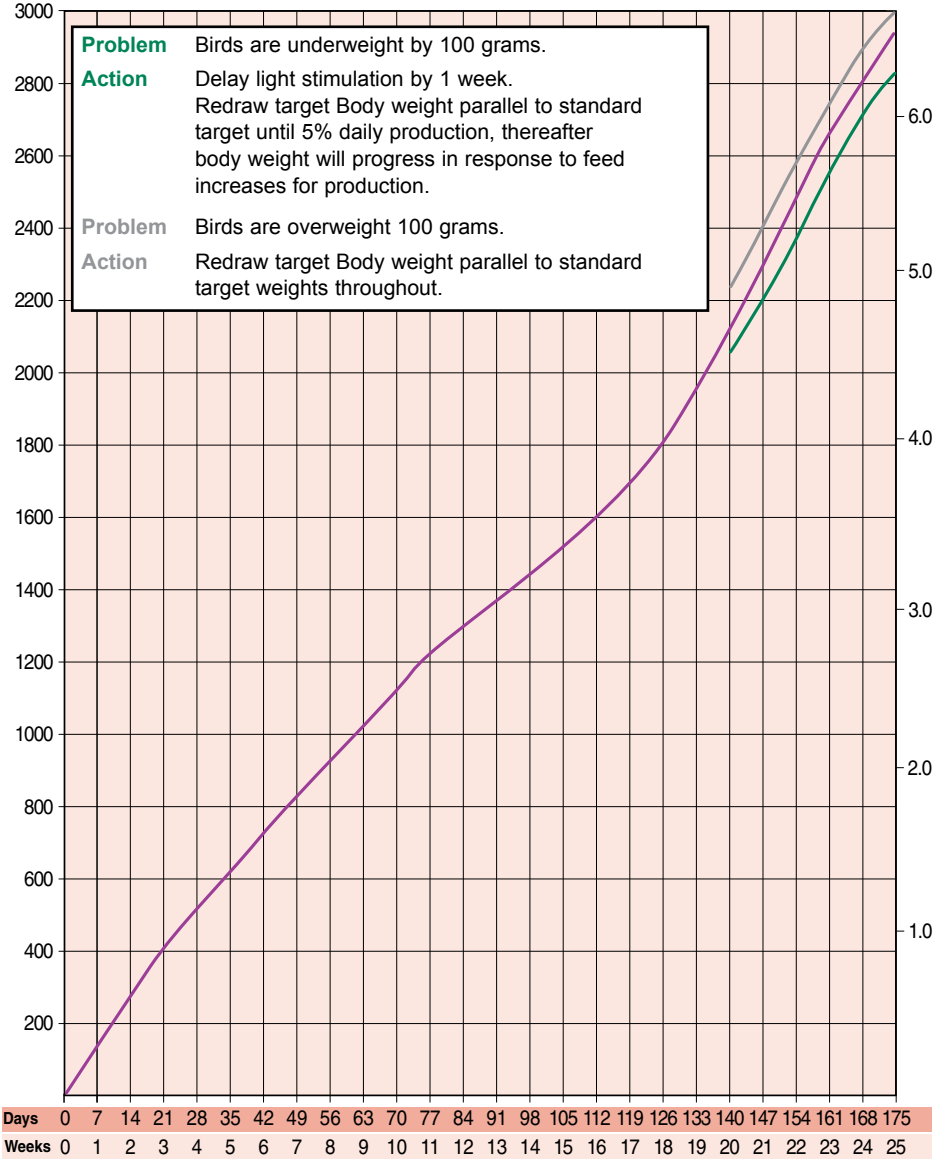
Flock weight off target at 10 weeks



Flock weight off target at 15 weeks



Flock weight off target at 20 weeks



8. TRANSFERRING STOCK FROM REARING TO PRODUCTION FARMS

Age for transferring stock to the production farms is determined mainly by the facilities available, body weight and the lighting program. The transfer can be a very stressful time for the birds and every effort should be taken to ensure that it is carried out smoothly. Plan the work in detail and handle the birds carefully.

Prior to transfer, the rearing and laying managers should meet to discuss the flock. A copy of the rearing records should be transferred with the flock to the laying farm. These should include details of disease challenges, body weights, lighting program, intensity of light, feed amounts, time of feeding, medication, vaccination program, transfer bird numbers, water consumption and any other relevant information to assist the production farm manager during the settling in period.

Sometimes it may be necessary to give additional feed before and after the birds have been moved. The amount of extra feed and the time when it is given will depend on the season and the distance travelled. It is important to ensure that the birds do not lose weight, condition or uniformity as a result of transfer. They must find feed and water quickly when they reach the laying house.

The following points must be considered when planning the transfer procedure:

- The laying house must be ready to receive the flock, with the feeders, drinkers, and nest boxes fully operational, one week before the planned transfer date.
- Ensure that there are enough clean crates to move the whole flock at the start of each day.
- The final selection and transfer of the males should be carried out 2 to 3 days before the transfer of the females.
- The females should be carefully observed and obvious defects removed before moving to laying house.
- Move the birds at night or in the early morning.
- After transfer observe the birds closely, handling their crops, to make sure that they are all able to find feed and water.

Walk through the house frequently to encourage birds to use slatted area. The recommended slat height is 45 cm (approximately 18 inches).

9. PRODUCTION PERIOD

9.1 HOUSING AND EQUIPMENT REQUIREMENTS

- The ventilation system must be capable of achieving desired temperatures in a wide variety of climatic conditions. In cooler climates, there should be a minimum ventilation fan volume of at least one air exchange every 8 minutes, and the exhaust fans should run 1 minute out of every 5 minutes, or 2 minutes out of every 10 minutes. If the temperature in the house exceeds the temperature set point, then the maximum ventilation system should provide fan volume equal to one air exchange every 5 minutes until the temperature falls below the set point.
- Provide a minimum of 15 cm (6 in) of feeding space per female for chain feeders and 12 females per pan to ensure that feed can be distributed in less than 3 minutes.
- Nipple drinkers are preferred for parents and should be installed at the rate of 6 to 8 birds/nipple. Bell drinkers should be installed at the rate of 60 to 70 birds per drinker. Drinker lines should be positioned approximately 1 m (3 ft) in front of the nesting system to encourage use of the nests.
- Manual nesting systems should provide for 4 birds per nest. Communal mechanical nests should provide for 50 birds/m^2 of nest floor area. Allow 6 birds per nest hole in single bird rollaway nests.

House set up with the mechanical community nest:

World wide there is a tendency to mechanize egg gathering. The egg collection in the house can be automated with individual or community nests. The individual mechanical nest system is more common with the U.S. house setup of 2/3 slats with 1/3 scratch area in the center of the house. In this setup there is 1 line of mechanical nests on each of the slats, giving a total of 2 lines of nests per house.

The community nest system is another option for mechanical collection of eggs. In this design, there is only 1 line of automatic nests placed in the central part of the house with slats extending out from either side of the nests. There are, however, very important issues in the house setup that need to be addressed to avoid problems with floor eggs.

Mainly, the birds need to become comfortable on the slats, so they spend enough time there to become familiar with the nest system. This is achieved by using:

- A ratio of 50-60% floor area to 40-50% slat area.
  - With a 12 meter (40 ft) wide house, slats need to extend approximately 2 meters (6.5 ft) from the front of the nest on each side.
  - With a 13 or 14 m. (44-46 ft) wide house, slats need to extend approximately 2.5 meters (8.1 ft) from the from of the nest on each side.
- Reduce the slat slope with the wider slats or make it almost flat.
- Most of the female feeder lines need to be on the slats.
  - When you have slats extending 2 meters, place the waterline in front of the nest and then install 1 female feeding line further out on the slats.
  - When using 2.5 meter or more extended slats, it is possible to have two female feeding lines on the slats (complete loop).
  - With very high female bird densities, also keep one female feeding line in the scratch area.

- Never put waterlines in the scratch area. Recommended distances from the nest are: nest to water line, 60-70 cm; water line to feeder line, 60-70 cm.
- Lights should be placed just outside the slat area (above the scratch area) so that they do not give a shadow of the slats in the scratch area.
    - The scratch area should have enough light intensity (80-100 lux), with uniform light distribution.
    - The lights should be located to allow 2-4 lux to reach the back of the nest.
    - No extra lights inside or directly above the nest are needed.
- Ventilation: No air should go through the nest and cause draft (important when using cross ventilation).

When using the mechanical community nest, the following guidelines are recommended:
There are 2 nest types in general use; 40-41 cm deep or 45-46 cm deep by 240 cm long. Each nest unit has 4 entrance holes, 2 on each side.

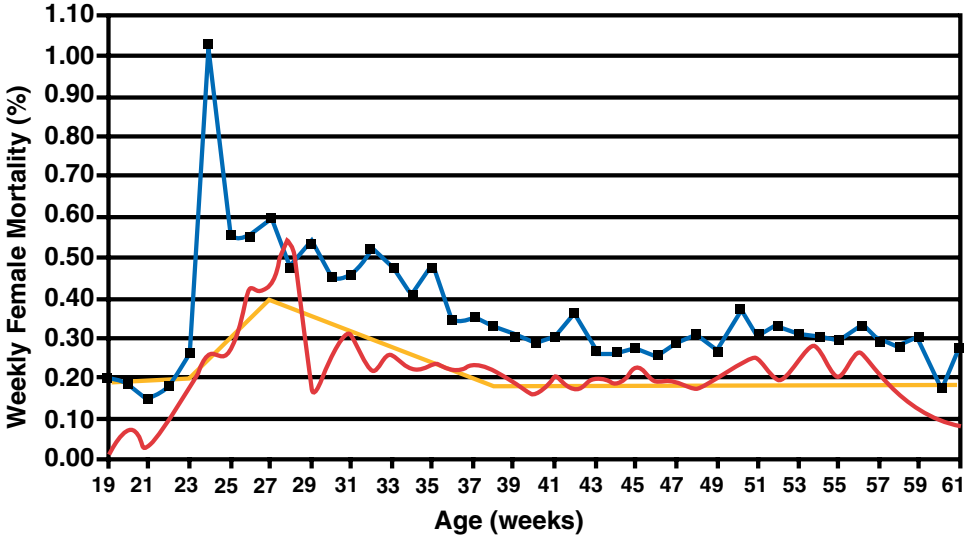
- With the 40-41 cm deep nest, calculate ±230 females per nest unit (4 holes) or 58 females per hole or 96 females per meter house length (48 females on each side of the nest per 1 m house length).
- With the 45-46 cm deep nest calculate ±265 females per nest unit (4 holes) or 66 females per hole or 110 females per meter house length (55 females on each side of the nest per 1 m house length). This deeper nest system can be used with wider houses.

9.2 FEMALE FEED MANAGEMENT FROM LIGHT STIMULATION TO PEAK PRODUCTION

- From the point of light stimulation to peak production is one of the most critical periods in the life of a breeder flock in terms of nutrition. After light stimulation the female will partition the available nutrients between maintenance, growth and the development of the reproductive system. A well designed management program can influence how this partitioning takes place.
- From light stimulation to onset of production feed according to body weight. When the birds are light stimulated with the right body condition, this period usually requires small feed increases (4-6 g/bird/day or 0.9-1.3 lbs/100 bird/day).
- Conservative feeding programs from light stimulation to onset of production will also help with:
    - Female body weight control. This is especially true with under conditioned birds as they will probably not respond to light stimulation and partition most of their feed to increases for body weight and less for the development of their reproductive system.
    - Egg weight control.
    - The reduction of onset of production mortality (prolapses, SDS, heart attacks, fatty liver, etc.) See Weekly Mortality Trends on the following page.

Weekly Mortality Trends

Weekly mortality trends of two groups of 12 flocks from a company with different feeding programs after light stimulation. The aggressive feeding program created extra mortality coming into production and apparently some lingering effects for the rest of the flock's life.



Feed in g/b/d (lb/100/d)	Conservative	Aggressive
Light Stimulation	102 (22.4)	104 (22.9)
5%	128 (28.2)	141 (31.1)
Peak	162 (35.7)	170 (37.4)

- Observe and handle the birds, checking their crops to ensure that they are eating and drinking. Check their fleshing to monitor their condition. Weigh the females every week, taking a sample of between 60 and 100 birds per house or 1% to 2% of the population. Calculate the mean body weight and flock uniformity.
- Continue feeding for body weight until 5% production, thereafter, feed increases should be according to hen day egg production. When the flock reaches 5% daily production, a program to lead production with feed should be developed. The program can be built by deducting actual feed at 5% from peak feed. Calculate an amount to increase for each 10% increase in egg production.
- Peak feed intake should be reached by 60-70% hen day egg production. This maximum figure will depend on the energy value and form of the feed, but for all practical purposes will be around 168 g/bird/day (37 lb/100 birds/day) using mash feed or 162 g/bird/day (35.7 lb/100 birds/day) using a crumb or pellet to provide 465 kcal /bird/day (1.95 MJ/kg).

The birds should be capable of sustaining peak production on 25 g of protein per day. Variation in house temperature has an effect on the amount of feed that the birds require. House temperatures should ideally be held between 15°C (59°F), and 25°C (77°F). Feed allowances may need to be adjusted to suit temperatures outside this range.

Calculating Production Feeding		
	Grams per Bird	Pounds per 100
Feed at % Daily Production:	130	28.6
Peak Food Amount:	166	36.6
Amount to Increase:	36	8.0
Number of Increases:	6	6
Amount of Feed to Increase per 10%	6	1.3

	Standard		Alternative*	
Egg Prod. HD	Grams per Bird	Pounds per 100	Grams per Bird	Pounds per 100
5%	130	28.6	130	28.6
15%	136	30.0	133	29.3
25%	142	31.3	136	30.0
35%	148	32.6	142	31.3
45%	154	33.9	150	33.0
55%	160	35.2	160	35.2
65%	166	36.6	166	36.6

- Please consult your technical services representative for more information on peak feeding, feed reduction and related issues.
- To ensure consistent performance, avoid changes in feed formulation. Check the quality of each feed delivery and report any problems immediately. Samples of feed (1 - 2 kg), as fed should be retained on the farm to allow testing in the event of production problems. Samples must be stored in a cool, dark place.
- An accurate method of weighing feed is essential. Weighing systems must be checked weekly.
- Calculate the feed amounts based on the actual number of birds, not the number of birds housed.
- The time taken by the flock to consume the whole feed allowance should normally be 2.5 to 3 hours in peak production. If the time taken to eat the feed changes suddenly this may be an indication of a problem requiring immediate investigation.
- Second stage breeder feed containing lower essential fatty acids and higher calcium levels may be beneficial at around 40 weeks.
- A scratch feed may be beneficial to maintain fertility. It should be fed late in the afternoon at the maximum rate of 0.5 kg per 100 birds.

- Prevent feed wastage. Check for worn feeder troughs and spillage at the return to the feeder bins. The feed level in the trough should be set to one-third depth. Check slide gates daily for correct height.
- Feed only when staff are present and in one continuous period. Do not split feed other than scratch feed. Continue to run the feeding system until the whole of the day's feed allowance has been distributed.
- Bulk bins should be emptied between feed types and at least once a month during production to maintain good feed quality.

9.3 REQUIRED BODY WEIGHT INCREASE FROM START TO PEAK PRODUCTION

The body weight of the females gives a clear idea what is happening within the flock. It is the most important parameter to know if enough feed has been obtained to achieve maximum peak production with enough fat reserves.

The peak production is determined by the uniformity, the body weight and the feeding program in the rearing period. A good benchmark is to measure the weight gain of females from the onset of lay to the age at peak egg production. Onset of lay can be defined as the weekly weight taken between 0.5% and 3.0% production. There should be an 18 to 20 percent increase in female bodyweight from this weighing to the flock weight at peak. Less than 18 percent weight gain may necessitate leaving peak feed amounts on the flock a bit longer. Weight gains of over 20 percent indicates that the hens are getting more nutrients than they need to sustain production, and feed reduction can begin."

This rule of 18-20% body weight increase is used when the body weight of the females is between 2800 and 3100 grams with a 0.5% to 3% average weekly production. If the production in the first week surpasses 3% an average body weight can be calculated with the week before. If the flock starts production with a body weight lower than 2800 grams, the birds need more than 20% body weight increase to peak in order to have enough fat reserves to maintain production persistency. If the flock begins production with a body weight higher than 3100 grams then the flock can perform well with a body weight increase lower than 18% simply because the females have already accumulated an adequate amount of fat reserves.

Analysis of 3 flock situations:

	Flock 1			Flock 2	Flock 3
Age	Body weight increase of 18-20%	Feed in g	Prod. %	Body weight increase is not enough	Body weight increase is too much
24	2900	125	2	2900	2900
25	3000 (+100)	135	17	2950 (+50)	3100 (+200)
26	3100 (+100)	150	38	3010 (+60)	3300 (+200)
27	3200 (+100)	165	55	*Feed must be increased faster to get more fat reserves or it will result in lower peak production.*	*Excess feed given. Adjust feed in younger flocks. Can start reducing feed when body weight obtains 20% increase.*
28	3300 (+100)	165	70		
29	3380	165	79		
30	3440 (18%)	165	82		
31	3480 (20%)	164	84		
	Normal behavior of PS flock				

As can be seen from the table the most important data needed to follow flock performance is age, body weight, feed amount and % production in combination with the timing of the first light increase. The standards published are only a guide. A poultry technician can calculate from the start of production what the body weight should be at peak production and then add another 200 to 400 grams to get the target final body weight of the females at 65 weeks of age. In this case the poultry technician could make the standard body weight for each flock for the production period.

9.4 POST PEAK FEEDING/FEED REDUCTION

- The hen carries some of the genes for excellent broiler performance that are seen in her progeny. The female can easily become overweight, causing problems with persistency of lay and fertility in the later stages of her life. Therefore, one must be careful in feeding the flock after peak production has been reached. Generally, peak production is defined as the point that the average production percent of the 5 most recent hen-days begins to decrease. At this time, reduction of the daily amount fed is important in order to keep the hens performing adequately.
- The first reduction is normally 2 - 2.5 grams per bird (0.5 lbs/100 birds) for the first week. This can be followed one week later with another reduction of the same amount. Subsequent reductions are normally one gram per bird (.22 lbs/100) each week until a cumulative reduction of around 14% from the peak amount has been attained.

CAUTION!
Several items should be considered when determining the schedule for feed withdrawal:

- **Level of peak production.** When a flock peaks well, withdrawing feed too soon could seriously damage the rate of lay, as the birds will need the nutrients to maintain egg production. Conversely, if a flock peaks poorly, feed withdrawal should be more rapid, as the birds do not need the higher level of feed, and will only convert it into unwanted weight gain.
- **Amount of Peak Feed.** When a flock has been fed 470-480 Kcals/hen/day (1.966-2.008 MJ/hen/day), then it will be easier (and more desirable) to reduce feed levels sooner and at a more rapid rate than a flock that was fed only 440-450 Kcals/hen/day (1.841-1.883 MJ/hen/day) at peak.
- **Weight of Hens.** Accurate weight monitoring is critical during this time. A flock that is gaining weight excessively will become overweight quickly if feed is not reduced. A flock that is not gaining or even losing weight during and after peak probably needs added feed in order to maintain egg production.

Periodic handling of the hens, along with weighing, is necessary to determine subtle changes in body composition, condition and body reserves of the hens.

- **Egg Mass.** Egg mass is determined by multiplying the daily production times the average weight of the eggs. (See Section 12, Egg Weighing). Even though the flock may be past peak production, the egg size may be increasing, and the hens will require the proper nutrients to sustain production.
- **Cleanup time.** A feed cleanup time from 1.5 (crumble) to 3 hours (mash) is considered ideal. A flock that consumes the daily ration in less than that time is not receiving the nutrients needed, and is hungry. Feed withdrawal could adversely affect production in such a flock. On the other hand, if the birds are receiving too much feed then the feed consumption time could go past 3.5 to 4.0 hours. The birds could become overweight and uneven. More rapid withdrawal would be needed in this case.

NOTE: Many things can affect feed cleanup time, including:

1. Feed physical form (pellets/crumble/mash)
2. Feed raw materials
3. Hot/Cold temperatures
4. Watering system (nipples or open trough),
5. Feeding system and speed of feed delivery
6. Possible disease considerations.

10. 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 male growth profile is the single most important factor that correlates with flock fertility. Males should be weighed at least weekly from one to 30 weeks of age and at least every other week thereafter.

10.1 REARING

- A good start in rearing males is crucial for weight uniformity as well as good organ and skeletal development, which are correlated with future male fertility. It is important that the males achieve body weight targets according to the standard. For best results, the males should be reared separately from the females until housing at around 20 weeks of age. In brown out or dark out houses, enough light intensity (minimum of 20 lux) and duration must be available to ensure that the proper amount of feed is consumed during the first 4-week period.
- The body weight development in the first 16 weeks determines most of the frame size later in life. The heavier males will develop the largest frame size, so the male weights need to be kept very close to the standard body weight from 4 thru 16 weeks of age. One way to do this is to separate the heaviest males at 3 to 4 weeks of age, by visual grading, and then controlling the male body weight in the growing period.
- 8 week Standards Test – Handle all males and remove obvious males with visual (phenotypic) faults; i.e., crooked and bent toes, spinal abnormalities, eye and beak abnormalities.

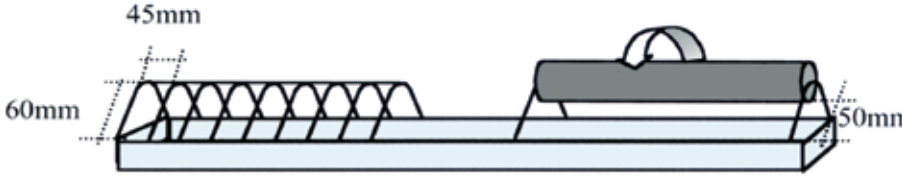
Situations in the Field that give positive results		
Compact male with strict body weight control	Larger male with good control of body weight in production	Larger male and no good control of body weight in production
Grill size 45-46 mm wide x 60 mm in height	Grill size 45-46 mm wide x 60 mm in height	Use male feed with 12-13% protein to have "V" shaped breast muscle
Result: Good high persistent fertility	Result: Good high persistent fertility	Result: Acceptable fertility with persistency

- Uniformity is more and more important with the conformation of males today, not only to have a uniform distribution of the female numbers per male in production, but also to control the size of the male. With slats in production, a compact male, close to the Cobb standard weight, will produce fewer leg problems and result in good overall fertility. With floor operations a larger male can be used as long as the breast muscle is not oversized which can create stability and fertility problems.
- After 16 weeks of age stimulate the males constantly with feed to maintain body weight and testes development. Any severe stress or drop in body weight or even stagnation of growth from 18 to 27 weeks of age will result in smaller and less uniform testes in the males and lower initial hatches and can result in a low fertility throughout the production period.
- When transferring from rearing to production houses consider the following:
  - It is best to transfer males to the production house 3 to 5 days earlier than the females. This will help train the males to their feeder system, resulting in less feed stealing and better body weight control.
  - Select your males to leave a male/female ratio of 7 – 11% at transfer.
  - Select only healthy males with no obvious skeletal defects.
  - Aim to keep the middleweight population by culling out underweight males but also extremely heavy ones. (The heavy ones would be ideal for spiking).
  - The recommendation is to have a mating ratio of 9% (with slatted houses, where males tend to be more territorial and can express some aggressiveness) to 11% (in floor operations) by 23 weeks. Culling of poorly conditioned, extremely big or males with skeletal or leg problems should be practiced regularly. The feed allocation of males in poor condition will be eaten by other males that will, in turn, get overweight.
  - Aim to match heavier groups of males with heavier females and light males with light females. It is important to ensure a proper synchronization between male and female sexual maturity and a proper body weight differential. This helps with hen receptivity and mating efficiency. The body weight differential goal from 20 to 40 weeks should be closer to 500-600 g and past 40 weeks between 800-900 (+23-25%). It is however possible to have a lower body weight in males in the production period and many flocks perform well with a 20% body weight difference from the females body weight.

10.2 MALE FEEDING AND WEIGHT TRENDS DURING PRODUCTION

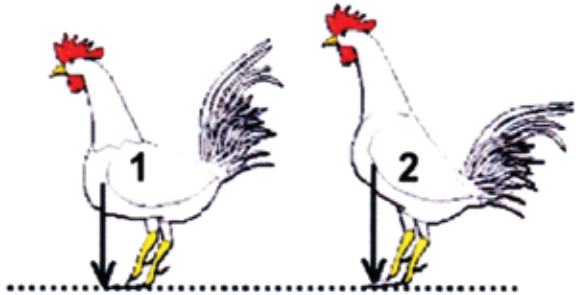
- One challenge for the farm manager and the feeding system selected is to distribute a small amount of feed per male as uniformly as possible and keep all males with a uniform growth and activity level.
- It is highly recommended to use Separate Sex Feeding (SSF) in production. True SSF implies that males should not have access to the female feed and vice versa. A normal set up would include a male exclusion system placed on the female feeder (grill, roller bar, plank…) and a line of pans, trough or tube feeders for the males. The exclusion grill should create both a vertical (60 mm) and horizontal (45 mm) restriction (See Female Track Feeder on the following page). In systems with a plank or roller bar restriction the vertical restriction should be 50-55 mm.

**Different exclusion methods on a female track feeder.
A grill on the left and a roller bar on the right.**



- It is equally important to keep the female from eating from the male feeder. Keep the male feeder at a height that makes the males stretch slightly to eat and prevents the females from reaching. A male feeder should always be stable and not be allowed to swing. The height needs to be frequently adjusted by observing feeding behavior at least once a week up to 30 weeks of age.
- It is highly recommended not to dub males. A complete comb, or one partially dubbed helps restrict the males earlier in production. However, full exclusion does not start until the combs are completely developed (26-27 weeks of age). It is very important to take this into account.
- Training is key to the success of Sex Separate Feeding. The males need to quickly identify and use their specific feeders. The best option is to have the same type of male feeder in rearing and production. Other options include:
  - Use decoy feeders in the rearing house. For example, if the males are fed on a chain and they will be faced with pans in production, place a few pans in the rearing house and manually add some feed. The males will then learn to identify the pans as feeders.
  - Transfer the males a few days earlier (2-3 days) so they are specifically trained to eat from their feeders before the females arrive to the production house.
  - Start the male feeders first.
- For the male, it is best to give small feed increases (3-5 g/week or 0.66-1.1 lb/100/week) from transfer to adult weight (30 weeks). The key is to monitor weights weekly and adjust feed accordingly. It is possible that feed has to remain constant for some weeks while stealing from the female feeder takes place. If the male is fed too much after transfer, the result will be continued male skeletal growth producing larger males that will need more energy to maintain body weight. The male will show a delayed sexual maturity that can negatively affect fertility throughout the production period.
- The adult male can be kept very active and in good condition with 370-380 Kcal/male day (1.548-1.590 MJ/male/day) and 20-21 g crude protein/male/day (With crumbled feed calculate about 5 g less feed than with mash). Males that are active sexually will not easily become overweight.

- After 30 weeks feed allocations should be modified according to weight trends. Ideally small amounts of feed should be given by 28-30 weeks to allow slight feed increases throughout the production period to maintain the proper weight gains and keep the males stimulated and active (1-2g/week or 0.22-0.44lb/100/week every 3-4 weeks). This feed increase is particularly important in slat operations, especially after 40 weeks of age.
- If the male body weights increase too rapidly at 28-29 weeks, an alternative is to reduce feed amounts (5 to 10 grams but no more than 5g at a time) to get closer to the actual needs of the male. Act immediately so males do not increase body weight too fast.
- Ensure that good positive growth takes place during the first 4 weeks after light stimulation, when testis development takes place.
- The Cobb standard for male weights is designed to keep the male light early in production (not more than 4 kg (8.8 lb) at 30 weeks) and have a consistent positive growth of about 25 g (0.06 lb) per week from 30 weeks to depletion (approx. 4.9 kg at 64 weeks). Field data shows that the worst hatching flocks are those with males that grow too much to 30 weeks (4500-4600 g) and not enough afterwards. In many of these flocks there are males losing body condition.
- Males should never loose weight in production. A SLIGHT LOSS IN BODY WEIGHT WILL RESULT IN AN IMMEDIATE REDUCTION IN SPERM QUALITY.
- Males should not weigh more than 5.5 kg (12.1 lbs) or mating efficiency starts to go down, as they are not able to complete their matings. As males get too heavy they become more flat in shape and unbalanced (male number 1 on the figure below) and more inefficient mating is the result.
- Evaluating male breast shape by hand is a good way of estimating body condition. Aim to keep a V-shaped breast for as long as possible. The breast muscle should be tight in consistency.
- Separate sex feeding (SSF) allows the use of special male rations. Male diets are not widely used in the industry yet but research and field results suggest they improved fertility, especially by lowering protein levels down to 11-13%. This helps control body weight and breast muscle growth. With specific male rations it is even more important that the SSF system excludes completely the females from the male feeder.



10.3 SPIKING

Spiking is the addition of young broiler breeder males into an older flock to compensate for the decline in fertility that usually occurs after 45 weeks of age. As far as the male is concerned this can be due to a decline in mating interest (natural post 35-40 weeks of age), a reduction in sperm quality (natural post 55 weeks), lower mating efficiency (poor management leading to males in poor physical condition such as weight or leg and feet disorders, etc.), and excess male mortality resulting in a reduced male to female ratio.

- Extra males are moved to a separate house/farm at transfer and held until moved to a number of older flocks. Alternatively, the males are moved to another flock and held in a pen until used to spike that flock.
- Spike a minimum of 20% additional males to an existing flock.
- Spiked males should be of good quality and free of physical defects. Males must be at least 25 weeks of age with a minimum weight of 3.8-4.0 kg and sexually mature.
- Constantly cull poor males and reduce sex ratio. Spiking males are then added to increase the ratio to the original levels without need for massive culling.
- When an early spiking is assured there is the opportunity to start with less males (7-8% at 21-22 weeks of age) and to add extra males as needed over time, to increase the numbers to 9-10%. This will improve female receptivity and mixing.
- A slight feed increase just after spiking (2-3g/bird/day) could be beneficial since spiking significantly increases male's mating activity (for at least 4 weeks the old males will be mating like a 30-week old male).
- Better results are obtained if spiking is done prior to 40 weeks. Have a program in place. Do not wait for fertility to decline.
- Often good results are seen with spiking just after peak production when females are very receptive.
- Once in the life of the flock is normally enough. Flocks spiked twice on a 8 to 10 week interval also show good results.
- Spiking is usually not economical beyond 55 weeks of age.

Expected Results

- Peak fertility response is reached approximately 2-3 weeks post-spiking. Generally, spiking results in a 2-3% increase in overall hatchability.
- Spiking stimulates mating activity significantly in the original (old) males. This stimulation lasts about 6 to 8 weeks.
- Male aggression and mating interference usually increase for 2 weeks after introducing young males. Male mortality can increase slightly but not dramatically if the males were ready to compete when added.

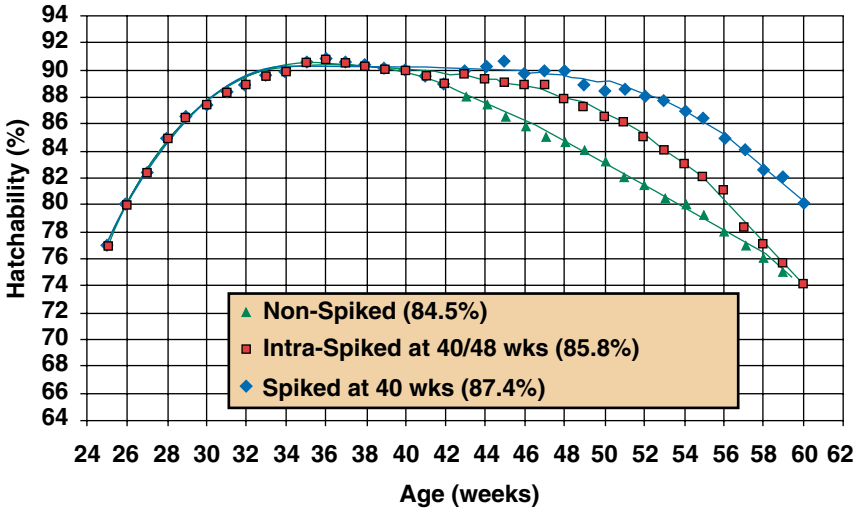
- Spiking does not solve pre-existing problems (overweight males, poor mixing, etc.)
- There is the danger of not taking proper care of original males, which are the most important.
- To keep males in reserve in good condition is difficult. The longer they are without females post 23 weeks, the worse their condition normally is. Make sure that the male pen is stocked lightly (3 males/m^2), and has plenty of drinkers, feeders and hiding places.
- Keeping the full compliment of started males with the young hen flock until spiking can create severe female receptivity problems, as the flock will have too many males just when the mating activity is highest.
- Biosecurity risk is the main reason some choose not to spike.

Spiking the Biosecure Way

- Males should come from a single source flock.
- The source flock should be serologically tested, 5 to 7 days before moving.
- Test for Mycoplasma and other diseases as appropriate: AI, TRT and environmental Salmonella. Also check for external parasites (worms, mites…) and any overt signs of disease (fowl cholera).
- Any positive or suspect results should put the move on hold.
- Plan the time and pathway of the move to minimize contact with other poultry. Use an enclosed vehicle when possible.

10.4 INTRA-SPIKING

- Intra-spiking simply means exchanging 25-30% of original males between houses from the same farm, without importing any young males, to create a similar stimulus to mating activity as the one created by spiking.
- Like spiking, intra-spiking gives better results when done earlier in life (<45 weeks). Intra-spikings at 40 and 48 weeks of age can produce even better results.
- Mating activity increases very significantly after intra-spiking. The effects may last between 6 and 8 weeks. One advantage is that with intra-spiking the males exchanged are already trained in mating and usually have similar weight and maturity as the original males, improving their chances to compete successfully.
- Intra-spiking increases male aggression for two weeks after mixing. There are usually no problems with male or female mortality.
- Hatchability does not go up dramatically after intra-spiking. However, the persistency of hatchability is improved and with a double intra-spiking procedure one can expect an increase between 1 and 1.5% in the overall hatchability of the flock.
- Intra-spiking is inexpensive, easy-to-practice and, most importantly, rarely presents a biosecurity risk.



Intra-Spiking

Possible hatch trends based on non-spiked flocks, spiked at 40 weeks, or Intra-spiked at 40 & 48 weeks of age. (Shows the cumulative hatchability to 60 weeks of age in each case).

11. RECORDS

Keeping complete and accurate records is an essential part of managing Cobb parent stock. For example, feeding during production is based on the rate-of-lay, egg weight and body weight of the flock. These records must be accurate and up to date in order to make correct management decisions and to achieve good production.

Everyday management decisions are based on the following list of key records.

REARING

Daily

Total mortality
Culls
Feed
Temperature
Water consumption
Feed clean-up time

Weekly

Body weight
Uniformity

PRODUCTION

Daily

Total mortality
Culls
Feed
Temperature
Water consumption
Feed clean-up time
Total egg number
Egg weight
Hatching egg number
Floor eggs
Fertility

Weekly

Body weight
Uniformity

Please contact your Cobb Technical Service Representative for copies of charts to assist in collecting and keeping data.

12. EGG WEIGHING

There are considerable advantages in weighing a sample of eggs each day to establish the trend in egg weight. The analysis of this trend is a useful guide to flock performance and will give an early indication of problems.

The egg weight shown in the table should be expected from normal parent flocks where our recommendations for body weight, feed levels and feed specifications have been followed.

Weigh at least 90 eggs immediately following the mid-morning collection, excluding only double-yolk and cracked eggs. Daily egg weights when plotted on a graph will give an indication of potential problems that should be investigated immediately.

Underweight eggs

- Underfeeding
- Low levels of energy or protein feeds
- Inadequate water supply
- Disease
- Extreme house temperatures
- Underweight birds

Overweight eggs

- Overfeeding
- High levels of energy or protein feeds
- Overweight birds

Egg size is largely determined by the body weight of the female at photostimulation. Delayed lighting will give larger eggs initially and probably throughout the life of the flock.

Please refer to the Breeder Management Supplement for each particular line of Cobb or Cobb/Avian birds for egg weight standards.

13. EGG HANDLING

13.1 EGG COLLECTION

Maximum hatchability and chick quality can only be achieved when the egg is held under optimum conditions between laying and setting in the incubator. Remember that a fertile egg contains many living cells. Once laid, its hatching potential can at best be maintained, not improved. If mishandled, hatching potential will quickly deteriorate.

- Manual nests should be kept well maintained with clean shavings. Any droppings, broken eggs and any soiled material must be removed promptly from the nests and replaced with clean fresh nest material. In the early stages the females will tend to scratch the shavings out, but they will soon lose the habit.
- Frequent walking through the point of lay flock is a good management technique to minimize floor eggs.
- Walking the flock will disturb birds that are looking for nesting sites on the litter or in the corners of the house and encourage them to use the nest boxes.
- Collect eggs at least four times daily and during peak production periods six collections are recommended.
- Egg temperatures within the nest, particularly during hot weather, may be similar to those in an incubator. Therefore eggs must be regularly collected and cooled down to storage temperatures to prevent pre-incubation and embryo development. This will reduce the number of early dead germs and improve hatchability.
- Egg collection from mechanical nests should be timed to avoid the risk of pre incubation.
- Use of floor eggs depresses hatchability and is a hygiene risk. Under no circumstances put floor eggs into the nest boxes. They should be collected and packed separately from nest eggs and clearly identified. If floor eggs are to be incubated, it is recommended that they be set and hatched in separate machines.
- Wash hands before and after each egg collection, and before and after handling floor eggs.
- Prevent hair line cracks by handling eggs carefully at all times. Eggs should be collected in plastic or fiber trays. Egg trays should be stacked and carried 3 tiers high. Do not use baskets or buckets as they result in more eggs becoming cracked and contaminated.
- Eggs collected using mechanical systems must not be allowed to pile up on the collection tables. Operate the system at a speed that allows the egg collectors to work comfortably.

13.2 EGG GRADING

Egg grading should be carried out with care to prevent damage to hatching eggs

Remove and discard eggs unsuitable for hatching. These are:

- Dirty as defined by company policy
- Cracked

- Small - depending on hatchery policy
- Very large or double yolk
- Poor shells
- Grossly misshapen

Rejected eggs should be stored well away from hatching eggs.

It is essential to place hatching eggs carefully into the setter or transport tray with the small (pointed) end facing down.

The egg handling room must be kept clean and tidy.

Maintain good vermin control in the egg store. The egg handling room is the first stage of egg cooling and it is an advantage to keep it cool – cooler than the laying house, but warmer than the egg store.

13.3 EGG HYGIENE

Under certain conditions, it may be beneficial to sanitize hatching eggs. It is recommended that fumigation with formaldehyde be used, but for alternative methods contact your technical service representative.

No procedure will be effective unless the correct chemical concentration, temperature and humidity are maintained. Remember that dirty eggs will reduce the effectiveness of the sanitation more quickly than clean eggs.

13.4 EGG STORAGE

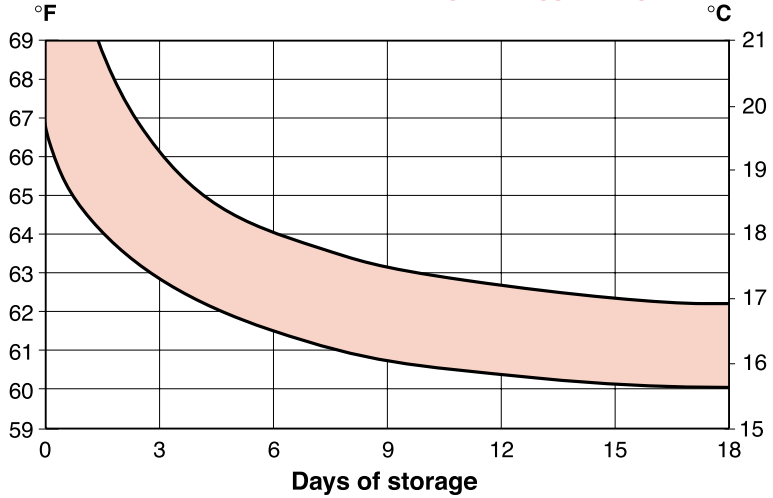
Eggs should be allowed to cool down gradually to the farm egg store temperature (refer to the following Optimum Temperature Range for Egg Storage chart) before putting them into the egg store. Store the eggs in a separate room that can be maintained at all times according to the chart. A Relative Humidity of 75% should be maintained at all times.

For long-term egg storage, refer to Cobb Hatchery Management Guide.

Keep a record of the maximum and minimum temperatures and the relative humidity in the egg store. Read the thermometers three times a day, in the morning, mid-day and in the evening, at the same times every day.

Condensation will form when cold eggs are taken into a warmer environment. This is often overlooked when eggs are being transported from the farm to the hatchery and can be prevented by using temperature controlled egg vehicles to transport eggs from farm to hatchery.

Optimum Temperature Range for Egg Storage



Key Points on Egg Storage

Eggs should be collected from the farms and transported to the hatchery at least twice a week. There are three storage areas: farm egg room, transport, and hatchery egg room. It is important to match the conditions in each of these situations as closely as possible to avoid sharp changes in temperature and humidity, which can lead to condensation (sweating) on eggs, or eggs becoming chilled or over-heated. Recent research shows that the eggs should be gradually cooled from the point of lay to the hatchery egg storage room, which should be the coolest point for the egg. From that point, the eggs should be warmed to incubation temperature by pre warming before setting in the incubator. These temperature changes should happen in a steady pattern down from lay to the coolest point, then in a steady pattern up from the egg storage to the incubator. **Temperature fluctuations during egg storage time will cause a higher early embryonic mortality and poorer quality chicks.**

14. BIOSECURITY ON THE FARM

Good biosecurity must encompass all the operations carried out by a caretaker of breeding stock. Procedures to prevent the introduction and spread of disease or contamination must be put in place for feed production, farm operations, hatchery, general maintenance and personnel. A breakdown in any single area will endanger the whole biosecurity program.

The following paragraphs outline the biosecurity measures that must be implemented at farm level.

- All personnel must understand the importance of following the biosecurity program.
- Choose an isolated site when developing new parent farm facilities.
- Farms should contain flocks of a single age. As a general rule, the distance between flocks of different ages should be no less than 600M (2000 ft). When single age placement is not possible, and caretakers must enter flocks of different ages, always work in the youngest birds first.
- Each farm must have a perimeter fence to prevent unauthorized entry of people, vehicles and animals. Only essential personnel should enter the farm.
- All houses must have concrete floors.
- Feed delivery vehicles should not enter the farm, but should fill feed bins from outside the perimeter fence. Any vehicle that must enter the farm must be washed and disinfected at the gate.
- All farm workers and any other personnel who need to enter the farm must shower and change into a clean uniform. Since shower facilities can be a biosecurity risk, it is important that they are kept clean and disinfected and are designed with a separation between “clean” and “dirty” zones.
- Uniforms and work clothing should be color coded to help control personnel movement within the farm or age groups.
- No other poultry, livestock or domestic pets of any kind should be allowed on parent farms.
- All buildings must be vermin and wild bird proof.
- A vermin control program should be practiced at all times. It is important to maintain a clean, rubbish free environment. Rotate brands of bait regularly to prevent vermin developing resistance. Any spilled feed should be cleaned up immediately. (Please see section 14.8).
- It is recommended that dead birds be disposed of by incinerating the carcasses on farm.
- Keep a record of all visitors.

14.1 BREEDER FARM DISINFECTION SCHEDULE

- All removable equipment and fittings should be taken out of the building and soaked in clean water in a tank or pit. After a thorough soaking they should be cleaned with a pressure washer. Once all dirt has been removed, they should be soaked in a disinfectant solution at the correct dilution as recommended by the manufacturer. Use an officially approved disinfectant.

- After equipment removal, brush or blow off dust.
- Remove the litter from the site in covered transport.
- Pressure wash the surfaces of the house with detergent, paying particular attention to air inlets, fan shafts and concrete floors.
- Use the pressure washer on the outside of the fan shafts and air inlets. It is advisable to wash off the dust that accumulates on the roof and in the gutters.
- At the end of each flock, bag off any surplus feed in the bulk bins and remove from the site. The bins should then be thoroughly cleaned out and fumigated by the most appropriate method, according to the age and design of the bins. Ensure that the feed bins are completely dry before refilling.
- When the interior is clean, add disinfectant to the water and pressure wash the entire house. Again, it is advisable to disinfect the areas of the roof surrounding the fan shafts and the gutters.
- Drain the entire water system of the house and flush pipes out several times to remove any debris that might block valves. Finally, flush the whole system out with a sanitizing solution. Make sure that any trace of disinfectant is removed as it can impair the future use of live vaccines.
- When the floor is dry, spray the floor and the sidewalls with an approved disinfectant. It is advisable to spray an area of 6 m (20 ft) around the house with the disinfectant solution.
- When the house interior is dry, put in the litter and set up the equipment. Then close and warm the house to 21°C (70°F) and fumigate/fog with formaldehyde gas (see details on fumigation shown on pages 48-49). This procedure should be carried out at least 48 hours before restocking.
- After 24 hours, neutralize the gas and then open the house inlets and fully ventilate.
- Include the egg room, feed store and changing room in the cleaning and disinfecting procedures.
- In some cases it may be necessary to treat the house with an insecticide. Follow the manufacturer's instructions and introduce the application into the disinfection schedule as recommended.

Remember:

- Hygiene is your insurance policy.
- No disinfectant is sufficient in itself. All waste matter must be removed before applying the disinfectant.
- It is impossible to sterilize a house but it is possible to reduce the number of pathogens to an insignificant level.
- Maintain a rigorous vermin control policy.
- Keep the doors shut at all times to prevent re-introduction of vermin and other contaminants.

Disinfection: Step by Step

- Empty house of all poultry
- Clean out all organic matter and remove far off site
- Remove all portable equipment for cleaning and disinfecting outside building
- Wash down all the inside surfaces with heavy-duty detergent, under pressure if possible
- Apply disinfectant with guaranteed activity against viruses and bacteria that can infect poultry
- Use an insecticide and rodenticide where these vectors of disease are present
- Fumigate with formaldehyde – active material
- Replace equipment, put down litter and preferably fumigate again before house is re-stocked

14.2 FUMIGATION

Formaldehyde has been used for many years as an effective fumigant. The environment during fumigation is critical to its efficiency, and these are the points to follow:

1. Increase relative humidity to 70-80%.
2. Heat house to 21°C (70°F) as formaldehyde gas has a high temperature coefficient.
3. Wash down all surfaces or place pans of water in the house, so increasing the relative humidity and gaining maximum benefit from both the gaseous actions of formaldehyde and its condensation into a polymerized form.
4. The house should be sealed and left to cool for 24 hours after fumigation, thus promoting uniform condensation.

14.3 FUMIGATION METHODS

Formalin and potassium permanganate

This method produces a violent chemical reaction that generates considerable heat and releases formaldehyde gas. Use 1 liter formalin per 25m^3 (40 fl oz / 1000 ft^3) in the ratio of three parts formalin to two parts of potassium permanganate. Because of the violent chemical reaction, never use more than 1.2 liters (2 pints) of formalin in any one container. The container should have deep sides (at least 3 times the depth of the chemicals, with a diameter equal to the height) to prevent the mixture bubbling over. The formalin must be placed on concrete or metal, and not on shavings or any other inflammable material.

In practice, first calculate the cubic capacity of the house, e.g. 55 m x 10 m x 3.1 m = 1705 m^3 (60,210 ft^3)

This would require

- 68.2 liters (2400 fl oz or 120 pints) of formalin
- 60 containers
- 45.36 kg (100 lb) of potassium permanganate

Place 760 g (27 oz) of potassium permanganate into each container, preferably with two operators for safety. Start at the far end of the house placing as quickly as possible 1.2 liters (2 pints) of formalin into each container. Operators should wear a respirator throughout the entire procedure.

Heating Solid Paraformaldehyde

This is probably the most convenient method of producing formaldehyde gas. Paraformaldehyde prills are heated to a temperature of 218°C (425°F); generally 1 kg of prills will be sufficient for 300m^3 (1 lb of prills for 5000 ft^3). If the heating device is fitted with a time switch, this system can be fully automatic. Always follow the manufacturer's instructions.

Formalin Vapor

A mixture of equal parts of water and formalin dispersed as an aerosol is a very efficient method. Use 28 ml of formalin per 25m^3 mixed with 28 ml of water, or 5 fl oz of formalin per 1000 ft^3 mixed with 5 fl oz of water. This should be generated as an aerosol using the necessary equipment. In each house it may be necessary to use more than one generator or employ some system of removing the generator and refilling. There are several companies providing such a service to the poultry industry.

PRECAUTIONS – Formalin solution and formaldehyde gas both represent a hazard to human and animal life. Operators must be provided with and wear suitable protective clothing, respirators, eye shields and gloves and should be aware of current legislation affecting these products.

14.4 SALMONELLA AND MYCOPLASMA CONTROLS

All Cobb breeding stock is derived from flocks that have consistently tested negative for M. gallisepticum, M. synoviae, S. gallinarum, S. pullorum, S. enteritidis, S. thyphimurium. To maintain negative status, the following rules are important:

- All houses must have concrete floors to ensure effective cleaning and disinfection.
- Only farm personnel should have regular access to the flocks. Farm personnel should only visit stock for which they are responsible and should not visit any other poultry outside of the farm, including any poultry show, fair or exhibition.
- All personnel should shower and change clothes between visits to different units within a farm. If a flock is found suspect or positive, that flock should be put under strict quarantine, and visited last. A different set of footwear must be worn in each house.
- A complete set of clean protective clothing and boots must be provided for flock supervisors and visitors.
- A wash hand basin, soap or sanitizer with paper towels, and disinfectant foot dip and brush for cleaning footwear must be provided at the entrance to each house.
- Keep all houses locked to prevent unauthorized entry.
- Since it is possible for humans to transmit some species of Salmonella to poultry, any person with an upset stomach should report this immediately to management before starting to work with poultry or poultry feed.

14.5 VACCINATION

The main purpose of a vaccination program is to prevent losses from a specific disease. The usual method is to provide immunity by exposure with a disease agent of less pathogenicity than the field strains of the disease. The scheduling of a vaccination program should be such that it allows any possible reaction to occur at an age in the flock's life that will cause the least economic loss. Vaccination is a necessary stress placed on the birds, therefore pay particular attention to these flocks to help reduce this stress.

It is not practical to recommend a specific vaccination program for poultry in all areas of the world. Consult your local poultry veterinarian for a program that meets the disease challenge and vaccine availability in your geographical area.

- Only vaccinate healthy birds.
- Minimize stress following vaccination by careful flock management.
- Read the label and follow the manufacturers' instructions for vaccine reconstitution, dilution and administration.
- Vaccine refrigerator should be located in clean and secure area.
- Do not use out-dated vaccines.
- Keep vaccines refrigerated at the manufacturers recommended temperature, avoiding heat and exposure to direct sunlight.
- Use the full dosage and do not dilute the vaccines.
- Do not save opened bottles for use at a later date.
- All used and open vaccine containers should be disposed of in a correct manner following each vaccination to prevent accidental spread of the virus.

- Shake the vaccine well prior to administration and regularly during the operation.
- Change needles every 500 doses to ensure that needles are kept sharp.
- One member of the vaccinating team should be responsible for supervising the procedure to check that the vaccine is administered correctly. Any birds that do not receive the full dose should be revaccinated.
- The number of doses administered at the end of the day should be checked against the number of doses taken to the farm.
- One qualified person should be responsible for cleaning and sterilizing the equipment at the end of each day's vaccinating.
- To determine the quality of the vaccine administration, the flock should be monitored post vaccination for neck sores, twisted heads and mortality or leg damage depending on the site of administration.
- Monitor the health and antibody status of the flock on a routine basis.

14.6 MEDICATION

Prevention is by far the most economical and best method of disease control. Prevention is best achieved by the implementation of an effective biosecurity program, including appropriate vaccination. Diseases do, however, overcome these precautions and when they do, it is important to obtain qualified advice as quickly as possible.

Drugs and antibiotics are not only expensive, but they can confuse the characteristics of a disease, preventing the correct diagnosis. The use of the correct medication and the timing of treatment can be crucial in combating a disease problem.

The preferred choice of a drug or antibiotic for some diseases may be harmful if used for the treatment of others. For certain diseases there may not be an effective treatment or it may not be economically feasible to treat. Therefore, always submit 6 to 8 birds showing typical symptoms to a laboratory, so that sensitivity tests can be conducted to identify medication that will be effective against the disease agent involved.

14.7 WATER

Water should be kept clean, cool and free from pathogens. The total dissolved solids in the water should not exceed 3,000 ppm. It is recommended that calcium and magnesium salts (hardness) should be less than 20 ppm and salinity less than 1,000 ppm.

Chlorination may be used to sanitize a water supply. It helps to control bacteria and also helps to prevent slime and algae build-up in water lines. A chlorine level of 3-5 ppm is recommended at the drinker level. Water analysis, at three month intervals, is good practice to determine the need for treatment.

14.8 RODENT CONTROL

Rodents are known to spread diseases to humans and animals. They can be vectors for salmonella, cholera, and numerous other infectious agents. Additionally, they can damage insulation, curtains, hoses, and electrical wire, as well as inflict mortality and injury to poultry. Rodents may come in through almost any opening—holes in walls, openings around pipes, cracks in doors, etc. Mice can squeeze through spaces as small as 20mm (about 3/4") and rats can squeeze through a space as 35mm (about 1 1/2").

An effective rodent control program involves several measures that restrict shelter, food and water. Actions that need to be taken are as follows:

- Minimize hiding places, by removing all the rubbish from around the buildings.
- All vegetation needs to be kept trimmed.
- Make the entrance to the buildings as rodent proof as possible.
- Dispose of dead birds properly and promptly.
- Keep feed spillage to a minimum. Clean up feed spills immediately.
- Keep feed storage areas clean and store feed properly. Keep feed bags on pallets off the floor.
- Maintain permanent bait stations with a fresh supply of rodenticides on a year round basis.
- Rotate the use of different baits on a regular program.
- Use traps where it is practical.

15. GENERAL INFORMATION

1 mm	=	0.0394 in
1 cm	=	10 mm = 0.3937 in
1 m	=	100 cm = 1.0936 yd = 3.2808 ft
1 km	=	1000 m = 0.6215 miles
1 in	=	2.54 cm
1 ft	=	30.48 cm
1 yd	=	0.9144 m
1 mile	=	1.609 km
1 g	=	0.002205 lb = 0.0353 oz
1 kg	=	2.2046 lb
1 ton	=	1000 kg = 0.9842 long tons (British) = 1.1023 short tons (USA)
1 long ton	=	2240 lb = 0.9072 ton = 907.185 kg
1 short ton	=	2000 lb = 1.016 ton = 1016.05 kg
1 oz	=	28.35 g
1 lb	=	0.4536 kg = 453.5924 g
1 cm^2	=	0.155 in^2
1 m^2	=	1.196 yd^2
	=	10.7639 ft^2
1 in^2	=	6.4516 cm^2
1 ft^2	=	0.0929 m^2
1 yd^2	=	0.8363 m^2
1 liter	=	0.22 Imp gal
	=	0.2624 US gal
1 pt (Imp)	=	0.5682 liter
1 pt (USA)	=	0.4732 liter
1 qt (Imp)	=	1.1365 liter
1 qt (USA)	=	0.9463 liter
1 gal (Imp)	=	4.54596 liter
1 gal (USA)	=	3.7853 liter
1 m^3/kg/h	=	16.016 ft^3/lb/h
1 ft^3/lb/h	=	0.0624 m^3/kg/h
1 m^3/h	=	0.5886 cfm
1 m/sec	=	196.85 ft/min
1 kcal	=	3.97 BTU
1000 kcal	=	4.184 MJ
1 kcal/m^3	=	0.1123 BTU/ft^3
1 kcal/kg	=	1.8 BTU/lb
1 ft candle	=	10 lux

3.5 birds/m^2	=	3.08 ft^2/bird
4.0 birds/m^2	=	2.69 ft^2/bird
4.5 birds/m^2	=	2.41 ft^2/bird
5.0 birds/m^2	=	2.15 ft^2/bird
5.5 birds/m^2	=	1.96 ft^2/bird
6.0 birds/m^2	=	1.82 ft^2/bird
6.5 birds/m^2	=	1.67 ft^2/bird
7.0 birds/m^2	=	1.54 ft^2/bird
7.5 birds/m^2	=	1.43 ft^2/bird
8.0 birds/m^2	=	1.35 ft^2/bird
8.5 birds/m^2	=	1.27 ft^2/bird
9.0 birds/m^2	=	1.20 ft^2/bird
9.5 birds/m^2	=	1.13 ft^2/bird
10.0 birds/m^2	=	1.08 ft^2/bird
10.5 birds/m^2	=	1.02 ft^2/bird
11.0 birds/m^2	=	0.98 ft^2/bird
11.5 birds/m^2	=	0.94 ft^2/bird
12.0 birds/m^2	=	0.90 ft^2/bird
12.5 birds/m^2	=	0.86 ft^2/bird
13.0 birds/m^2	=	0.83 ft^2/bird
13.5 birds/m^2	=	0.80 ft^2/bird
14.0 birds/m^2	=	0.77 ft^2/bird
14.5 birds/m^2	=	0.74 ft^2/bird
15.0 birds/m^2	=	0.71 ft^2/bird
15.5 birds/m^2	=	0.69 ft^2/bird
16.0 birds/m^2	=	0.67 ft^2/bird
16.5 birds/m^2	=	0.65 ft^2/bird
17.0 birds/m^2	=	0.63 ft^2/bird
17.5 birds/m^2	=	0.61 ft^2/bird
18.0 birds/m^2	=	0.60 ft^2/bird
18.5 birds/m^2	=	0.58 ft^2/bird
19.0 birds/m^2	=	0.57 ft^2/bird
19.5 birds/m^2	=	0.55 ft^2/bird
20.0 birds/m^2	=	0.54 ft^2/bird
20.5 birds/m^2	=	0.52 ft^2/bird
21.0 birds/m^2	=	0.51 ft^2/bird
21.5 birds/m^2	=	0.50 ft^2/bird
22.0 birds/m^2	=	0.49 ft^2/bird

Temperature	
°C	°F
35	95.00
34	93.20
33	91.40
32	89.60
31	87.80
30	86.00
29	84.20
28	82.40
27	80.60
26	78.80
25	77.00
24	75.20
23	73.40
22	71.60
21	69.80
20	68.00
19	66.20
18	64.40
17	62.60
16	60.80
15	59.00
14	57.20
13	55.40
12	53.60
11	51.80
10	50.00
9	48.20
8	46.40
7	44.60
6	42.80
5	41.00
4	39.20
3	37.40
2	35.60
1	33.80
0	32.00
-1	30.20
-2	28.40
-3	26.60
-4	24.80
-5	23.00

Days / Weeks conversion chart			
Days	Weeks	Days	Weeks
0	0	231	33
7	1	238	34
14	2	245	35
21	3	252	36
28	4	259	37
35	5	266	38
42	6	273	39
49	7	280	40
56	8	287	41
63	9	294	42
70	10	301	43
77	11	308	44
84	12	315	45
91	13	322	46
98	14	329	47
105	15	336	48
112	16	343	49
119	17	350	50
126	18	357	51
133	19	364	52
140	20	371	53
147	21	378	54
154	22	385	55
161	23	392	56
168	24	399	57
175	25	406	58
182	26	413	59
189	27	420	60
196	28	427	61
203	29	434	62
210	30	441	63
217	31	448	64
224	32		

16. BREEDING FARM CONTACTS

	Name	Telephone Number
Breeder flock manager		
Feed mill		
Hatchery manager		
Veterinary service		
Equipment supplier		
Electricity services		
Gas services		
Water services		
Cobb representative		

17. NOTES

NOTES

Cobb-Vantress Inc.
PO Box 1030, Siloam Springs
Arkansas 72761, US
Tel: +1 479 524 3166
Email: info@cobb-vantress.com

Cobb Europe Ltd
Oyster House, Severalls Lane, Colchester
Essex CO4 9PD, UK
Tel: +44 1206 835835
Email: info@cobb-europe.com

Cobb-Vantress Brasil, Ltda.
Rodovia Assis Chateaubriand, Km 10
Cep: 15110-970/Caixa Postal 2
Guapiaçu-SP-Brasil
Tel: +55 (17)3267 9999
Email: cobb.info@cobb-vantress.com.br

Cobb-Vantress Philippines Inc.
5/F 8101 Pearl Plaza, Pearl Drive
Ortigas Center, Pasig City
Philippines
Tel: +63 2 634 3590
Fax: +63 2 634 3598

L-1010-03
December 15, 2008