

PARENTS STOCK

Pocket Guide

2019

Production

20 Weeks to Depletion



ROSS

An Aviagen Brand

The Pocket Guide

This Pocket Guide was produced to compliment the Ross® Parent Stock Management Handbook. It should be used for quick and practical reference.

This Pocket Guide is not intended to provide definitive information on every aspect of stock management, but draws attention to important features which, if overlooked, may depress flock performance.

Performance

This Pocket Guide summarizes best practice management for parent stock that receive first light stimulation after 21 weeks (147 days) of age and achieve 5% production at 25 weeks of age. However, poultry production is a global activity and across the world, differing management strategies may need to be adapted for local conditions.

The information within this Pocket Guide cannot wholly protect against performance variations which may occur for a wide variety of reasons. The management techniques covered are considered to be the most appropriate to achieve good performance, consistent with maintaining the health and welfare of the bird.

For further information on the management of Ross parent stock, please contact your local Ross representative or visit the website at www.aviagen.com.

www.aviagen.com

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Key Management Timetable

Age (days)	Action
140	<p>Calculate and record the uniformity (CV%) and evaluate the sexual maturity of the flock to determine the lighting program.</p> <p>If a flock has a CV of less than or equal to 10%, follow the normal recommended lighting program.</p> <p>If the flock is uneven (CV greater than 10%), light stimulation should be delayed by 7-14 days (1-2 weeks).</p>
147-161	<p>First light increase given (not before 147 days/21 weeks of age).</p> <p>Monitor and record body weight weekly.</p>
147-168	<p>Mating-up: the exact time will depend on the relative maturity of both males and females.</p> <p>Immature males should never be mated with mature females. If males are more mature than females, they should be introduced gradually.</p> <p>Monitor and record body weight weekly.</p>
168-175	<p>Introduce the breeder feed from 5% hen-day production at the latest.</p>
161-196	<p>From first egg, increase feed amounts according to the rate of daily egg production, daily egg weight and body weight.</p> <p>Monitor and record body weight weekly.</p>

continued...

Age (days)	Action
210- depletion	Manage males by observing bird condition. Remove non-working males to maintain appropriate mating ratios. Monitor and record body weight.
245- depletion	Female post-peak feed reduction should be started approximately 35 days (5 weeks) after peak production is achieved, which is generally at 252 days (36 weeks) of age. Feed intake should be reviewed weekly and any reductions in feed should be based on feed clean-up time, egg production, daily egg weight, egg mass and body weight.

BIRD HANDLING

It is important that all birds are handled in a calm and correct way at all times. All people handling birds should be experienced and appropriately trained so that they can handle the birds with the care that is appropriate for the purpose, age and sex of the bird.

Stockmanship

Stockmanship is a continuous process that uses all of the stockman's senses to monitor the flock.

Hearing

Listen to the birds' vocalization, breathing and respiratory sounds. Listen to the mechanical sounds of fan bearings and feed augers.

Sight

Observe behaviors such as bird distribution in the house and number of birds feeding, drinking, preening, mating and using nest boxes. Observe the environment such as dust in the air and litter quality. Observe bird health and demeanor such as posture, alertness, eyes and gait.

Smell

Keep notice of smells in the environment such as ammonia levels. Is the air stale or stuffy?

Taste

Water and feed quality.



Feel

Handle the birds to assess crop fill and check the birds' general condition (breast conformation, vent and feather condition). Take notice of air movement across your skin. Is there a draft? What does the temperature of the house feel like?

These observations will help build a picture for each individual flock/house. **Remember, no two flocks or houses are the same!**

- Compare this 'stock sense' information with actual farm records - are the birds on target?
- Investigate any irregularities and develop an action plan to address any issues.

The Relationship Between Stockmanship and Bird Welfare

Stock sense, combined with the stockman's knowledge, experience and skills in husbandry will produce a rounded technician who will also have personal qualities such as patience, dedication and empathy when working with the birds. The implementation of the **Three Essentials of Stockmanship** will not only bring the birds as close as possible to the ideal state of **The Five Freedoms of Animal Welfare**, it will ensure efficiency and profitability.

The Three Essentials of Stockmanship include:

- Knowledge of animal husbandry.
- Skills in animal husbandry.
- Personal qualities.

The Five Freedoms of Animal Welfare include:

- Freedom from hunger and thirst.
- Freedom from discomfort.
- Freedom from pain, injury and disease.
- Freedom to express normal behavior.
- Freedom from fear and distress.

(Source: Farm Animal Welfare Committee (FAWC) defined as the 'ideal state to strive for').

Section 1

Management into Lay (20 Weeks to Peak Production)

Objectives

To minimize variation in the onset of sexual maturity of the flock and to prepare the flock for the physiological demands of reproduction.

To bring the female into lay by stimulating and supporting egg production using feed and light. To promote and support female reproductive performance throughout the laying cycle.

Pages	Contents
9	From 140 Days (20 weeks) to Peak Production
14	Separate-sex Feeding Equipment
15	Assessment of Bird Condition
19	Lighting
20	Management of Females Post Light Stimulation until 5% Production
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25	Management of Males Post Light Stimulation until Peak Egg Production

From 140 Days (20 Weeks to Light Stimulation)

Management Considerations

Recommended stocking densities from 20 weeks of age.

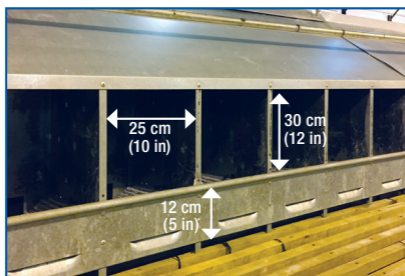
	Stocking Density Birds/m ² (ft ² /bird)
	20 weeks to depletion
Male	3.5-5.5 (2.0-3.1)
Female	

Recommended feeder and drinker space from 20 weeks of age.

	Age	Feeder		Drinker		
		Track cm (in)	Pan cm (in)	Bell cm (in)	Nipple	Cups
Male	20 weeks to depletion	20 (8)	13 (5)	2.5 (1.0)	6-10 birds per nipple	15-20 birds per cup
Female	20 weeks to depletion	15 (6)	10 (4)			

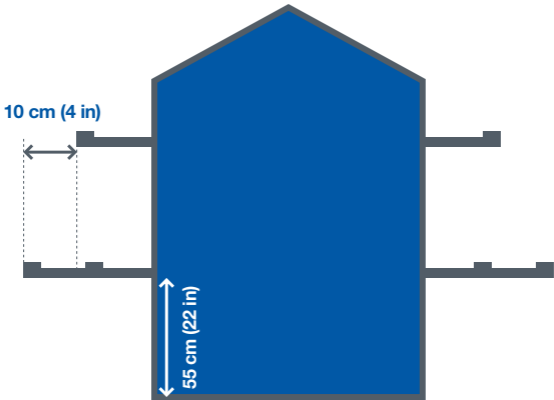
Nest Box Set-up

- Nest boxes must be set up prior to the onset of lay.
- The entrance to the nest must be large enough for the hen to enter, turn around and exit comfortably.
- Nests must have a firm entrance and a solid base and be securely fixed in place.



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(20 Weeks to Peak Production)

- For manual nest boxes, the lower alighting rail should be no more than 55 cm (22 in) from the floor and it should extend to a minimum of 10 cm (4 in) beyond the rail of the second tier.



Rear and Move Facilities

- Transfer should never be completed before 126 days/18 weeks of age or after 161 days/23 weeks of age.
- For light proof laying facilities transfer should not occur later than 147 days/21 weeks of age.
- For open-sided laying facilities transfer may need to be later than 21 weeks depending on the season.
- Transfer males at least 24 hours before the females to allow them to find feeders and drinkers.
- Increase feed allocation by approximately 50% on the day before and the day of transfer to help compensate for any moving challenges.
- Do not feed birds on the morning they are due to be moved, but ensure feeders are fully charged so that birds have immediate access to feed upon arrival.
- Return feed levels to normal on the first or possibly the second day after transfer.

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- Assess crop fill after transfer to ensure all birds have found feed and water. Check 50 males and 50 females 30 minutes and 24 hours after their first feed.
- Minimize environmental and equipment differences between rear and lay facilities.

Day-old to Depletion Facilities

- If the feeding system is changed between rear and lay, new feeders must be introduced so that birds are able to access them and find feed easily.
- Check crop fill to determine that all birds have found the new feeders and are managing to access feed.

Mating-up

- Mating-up should start from 147 days/21 weeks of age.
- Ensure both males and females are sexually mature at mating-up.
- A mature male/female will have a well-developed comb and wattles that are red in color.
- Where variation exists in sexual maturity within the male population and some males are visibly immature, the more mature males should be mixed with the females first.
 - As an example, mix half of the total number of required males (those that are most mature) at 21 weeks, mix a further quarter (again the most mature males) a week later, and then finally mix the remaining males the following week.
- Mating-up should be postponed by 7-14 days if sexual maturity is delayed, or when moving from dark-out rear to open-sided lay facilities.

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(20 Weeks to Peak Production)

Example of a sexually mature male (on the left) and an immature male (on the right).



Example of a sexually mature female (on the left) and an immature female (on the right).



Sexing Errors

It is good practice to remove sexing errors whenever they are identified during the life of the flock. Ideally, all sexing errors should be removed before mating-up.

Criteria for identifying males and females for the resolution of sexing errors.

Male



Comb and Wattles
105 days (15 weeks)
More developed and redder in males.



Hock Joints
140 days (20 weeks)
Thicker and broader in males. Narrower and smoother in females.

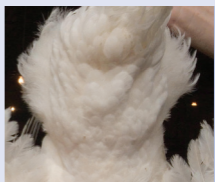


Feathering Around the Neck
140 days (20 weeks)
Long-fringed, spear-shaped feathers in males. Denser, paddle-shaped feathers in females.



Body Shape
140 days (20 weeks)
Males longer and narrower. Females more compact and broader around pelvis.

Female

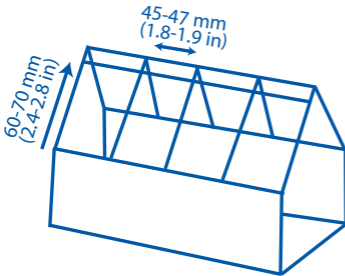


Separate-sex Feeding Equipment

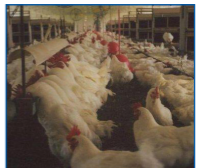
After mating-up, feed males and females from separate feeding systems.

- Female feeding systems should have grills fitted to prevent male access.

Female feeder with male excluder grill.



- Male feeders must be raised to a height that will allow only males to access them.



- Observe feeding behavior daily to ensure both sexes are feeding separately, male feeders are at the correct height, and feeding space and feed distribution are adequate.
- Make daily checks for damage, displacement or irregularity of gaps in the female feeder system.

PROCEDURE

Individual Weighing from 20 Weeks

1. Suspend the scales in a secure place in the weighing pen, and ensure that they are set to “zero” with a shackle for holding birds firmly attached.
2. Using a catching pen, sample at least 2%, or 50 birds per population, whichever is greater. Male sample size should be increased to 10% after mating-up.
3. Birds should be sampled from at least 3 points within the house, away from doors and walls.
4. Calmly and correctly handle each bird, place it on the shackles, wait until it is still, and record the weight from the scale.
5. Release the bird back into the main pen population and repeat the process until **all birds caught** have been weighed.

Assessment of Bird Condition

- Handle a representative sample of both males and females weekly during weighing from 20 weeks to determine overall flock condition.
- It is also good practice to catch and physically assess individual birds while doing a house ‘walk-through’ (20-30 females and 15 males should be selected at random).
- Be aware of the degree of fleshing, general health, alertness, and activity.

MANAGEMENT FUNDAMENTAL

Regular assessments of male and female physical condition (fleshing) should be made throughout the life of the flock.

Assessing Body Condition (breast shape or fleshing)

PROCEDURE

Assessing Body Condition (fleshing)

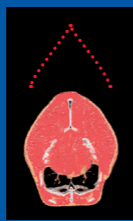

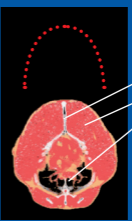
1. While holding the bird by both legs, run hand over the keel bone.
2. Assess the prominence of the keel bone, and the amount, shape, and firmness of the breast bone, on either side of the keel bone.
3. The breast should be firm and rounded to the touch.



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- Record condition scores and calculate the flock average. Monitor the trend over time.
- Determine appropriate management and feeding strategies using body condition in conjunction with body weight and uniformity.
- Ideally, the same person should score the birds each week.

Assessing Bird Condition (breast scoring)

	Score 1	Score 2	Score 3	
				<ul style="list-style-type: none"> ○ Keel Bone ○ Breast Muscle ○ Abdominal Cavity <ul style="list-style-type: none"> ■ Muscle ■ Fat ■ Bone
Breast Shape	V Shape	Narrow U Shape	Wide U Shape	
Keel Bone	Prominent and easily felt.	Less prominent and smooth to touch.	Not obvious and often indented (dimple can be seen) at extreme.	
Breast Muscle	Little breast muscle (volume and depth), will feel concave (rather than convex) in shape. Poor muscle tone.	Good breast muscle covering that will feel convex or rounded in shape. Firm muscle tone.	Excessive breast muscle covering with high volume and depth. Firm muscle tone.	

Pin Bone Spacing

PROCEDURE

Monitoring Pin Bone Spacing

1. Monitor pin bone spacing regularly from 105-112 days/15-16 weeks of age up to point of lay.
2. Monitor every time the house is 'walked' but as a minimum, once per week during weighing.
3. Ideally, the same person should measure pin bone spacing from week to week to ensure accurate and consistent measurement and allow for differences in hand size.
4. Select females randomly during the monitoring process and handle with care.
5. Hold the female in one hand and measure spacing by placing your fingers between the pin (pelvic) bones, measuring the distance between them (*see picture to the right*).
6. As a general rule, birds are at the point of lay when the distance between the pin bones is about 3 fingers (approximately 5-6 cm or 2-2.5 in).



Expected changes in pin bone spacing with age.

Age	Pin Bone Spacing
84-91 days	Closed
119 days	1 finger
21 days before first egg	1½ fingers
10 days before first egg	2-2½ fingers
Point of lay	3 fingers

If pin bone spacing does not develop as expected, i.e., is below 1.5 fingers at first light stimulation, or if there is a big variation in pin bone spacing between individuals, then delay light stimulation by approximately 1 week.

Lighting

Daylength increases from rearing to laying.

Age		Daylength (hours) for flocks with different CV% at 140 days/20 weeks		Lighting Intensity
Days	Weeks	Laying Daylengths (hours)		
		CV 10% or less	CV 10% or greater	
140-146		8	8	10-20 lux (1-2 fc)
147	21	11	8	30-60 lux (3-6 fc)
154	22	12	12	
161	23	13	13	
168	24	13	13	
175-depletion	25-depletion	13	13	

- The maximum response to the pre-lay increase in daylength is only obtained by achieving the correct body-weight profile during rear, good flock uniformity and the appropriate nutritional input.
- During lay, there is no advantage in exceeding 13 to 14 hours of light per day at any stage (where light proofing is good, there is no need to go beyond 13 hours).
- Where birds are kept in open-sided housing during lay, and the longest natural daylength exceeds 14 hours, the combined artificial and natural lighting should be extended beyond 14 hours to equal the longest natural daylength.

Management of Females Post Light Stimulation until 5% Production

Management Considerations

- Achieve target body weight by concentrating on correct weekly incremental feed increases and resultant bird gains.
- Follow the recommended lighting program.
- Monitor flock uniformity, body weight, and feed clean-up time, and respond quickly to any issues.
- Measure pin bone spacing.
- Provide ad libitum access to clean, good quality water.
- Change from grower to breeder layer feed at 5% production at the latest.
- Open nest boxes just before anticipated arrival of first egg.
- Where automatic nest systems are used, run the egg gathering belt several times each day before the start of lay so that birds become accustomed to the sound and vibration.

Lay

During lay, the main drivers for decisions on feeding management for females are body weight, egg production, and egg weight. Regular monitoring of pin bone spacing, fleshing, and fat-pad development can provide useful supportive management information.

Management of Females from 5% Hen-day Production until Peak Egg Production

Management Considerations

The table below shows the frequency of observation of important production parameters used to determine whether or not feed allocation is correct.

Parameter	Frequency
Egg production	Daily
Increase in egg production	Daily
Egg weight	Daily
Body weight	Weekly (manual) / Daily (automatic)
Body-weight gain	Weekly (manual) / Daily (automatic)
Feed clean-up time	Daily
House temperature (min. and max.)	Daily
Body condition and fleshing	Weekly (and on walk-through)

- Monitoring body weight, egg weight and egg production is key.
- Monitor and record both absolute and trend data.

Feed Increases from 5% Production to Peak

- Define program of feed increases based on feed amount prior to production, dietary energy level, ambient temperature, and expected flock productivity.
- Feed increases given should be proportional to actual rates of production.
- To prevent excessive weight gain, small but frequent increases should be used.
- The first feed increase should be given at 5% production if flock CV is less than 10%.

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- If flock CV is greater than 10%, the first feed increase should be delayed until 10% production is reached.
- In high-producing flocks, feed increases beyond recommendations may be required.
- If egg weights and/or body weights are judged to be markedly below expected targets, feed increases should be advanced.

Feed Clean-up Trends

A guide to feed clean-up times is given in the table below.

Feed Clean-up Time at Peak Production (hours)	Feed Texture
3-4	Coarse Mash
2-3	Crumble
1-2	Pellet

- Monitor feed clean-up times and trends in feed clean-up times.
- Respond to any changes in feed clean-up trends.

Egg Weight

PROCEDURE

Weighing Eggs

1. Record daily egg weight from 10% hen-day production onwards.
2. Bulk weigh a sample of 120-150 eggs daily.
3. Collect the eggs directly from the second nest collection.
4. Remove any double-yolked, small and abnormal eggs (e.g., soft shelled).
5. Calculate average daily egg weight by dividing the bulk egg weight (weight of eggs minus weight of tray or trays) by the number of eggs weighed.
6. Plot the daily weight against the target.
7. If the flock is being underfed, egg size will not increase over a 3-4 day period and egg weight will deviate from the target.
 - ➡ If peak feed amount has not been reached then the next planned feed increase should be brought forward.
 - ➡ If peak feed has been reached then an additional increase in peak feed amount will be required (3 to 5 g [0.1 to 0.2 oz]).

Floor Eggs

To help manage and reduce floor egg levels, the following management points may be used:

- Incorporate a suitable alighting/perching rail in nest box design.
- Have uniform distribution of light greater than 30-60 lux (3-6 foot candles); avoiding the presence of dark and shaded areas next to walls, corners, and in the areas next to steps and slat fronts.
- Run egg gathering belts several times each day from transfer where automated systems are used.
- Walk around the house as frequently as possible (at least 6 and up to 12 times per day) picking up any floor eggs.
- Set feeder and drinker heights appropriately so that they are not obstacles to nest access.
- When using manual nests place 20% on floor level to start. Thereafter, gradually raise them (over a period of 3-4 weeks) to the normal height.
- Allow 3.5-4 hens per nest hole for manual nests.
- Allow 40 hens per linear meter (12 birds per linear foot) for mechanical (communal type) nests.
- Set feeding times to avoid the peak of egg laying activity. Feeding time should be either within 30 minutes of "lights on", or 5-6 hours after "lights on" to prevent birds from feeding when the most eggs are likely to be laid.
- Provide correct feeder space for females.
- Follow the recommended lighting program and ensure that light stimulation is synchronized with body weight.

MANAGEMENT FUNDAMENTAL

Attention to detail avoids floor eggs.

Management of Males Post Light Stimulation until Peak Egg Production

To maintain fertility throughout lay, substandard and nonworking males can be progressively removed from the flock as it ages.

A guide to typical mating ratios as a flock ages.

Age		Number of Good Quality Males Per 100 Females
Days	Weeks	
154 - 168	22 - 24	9.50 - 10.00
168 - 210	24 - 30	9.00 - 10.00
210 - 245	30 - 35	8.50 - 9.75
245 - 280	35 - 40	8.00 - 9.50
280 - 350	40 - 50	7.50 - 9.25
350 to depletion	50 to depletion	7.00 - 9.00

Males retained for mating should have the following characteristics:

- Uniform in body weight.
- Free from physical abnormalities (alert and active).
- Strong, straight legs and toes.
- Well feathered.
- Good upright stance.
- Good muscle tone and body condition (fleshing).
- Comb and wattles should be red in color.
- Vent should be moist and show signs of mating activity.

Review mating ratios weekly. Whenever over-mating occurs, surplus males must be removed as quickly as possible.

Section 2

Management into Lay (Peak to Depletion)

Objective

To maximize the number of fertile hatching eggs produced per female, by ensuring persistency of egg production post peak.

Pages	Contents
26	Management of Males after Peak Production Through to Depletion
29	Management of Females after Peak Production Through to Depletion

Management of Males after Peak Production Through to Depletion

Body Condition

- Body condition should be scored at least weekly from peak to depletion.
- The target fleshing score should be a 2, although this may vary between individual flocks around a 2 score.

MANAGEMENT FUNDAMENTAL

Regular assessments of male physical condition (fleshing) should be made throughout the life of the flock.

Assessment of Male Condition for Mating Ratios

Physical assessment of male condition must be comprehensive and include:

- Alertness and activity.



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- Body condition (fleshing) - shape and softness or hardness of breast muscle tone.
- Legs and feet - the legs should be straight with no bent toes, and the footpads should be free from abrasions.



- Head - males should have a uniform, intense red color around the comb, wattle and eye area. Beaks should be uniform in shape.

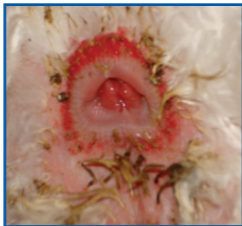


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- Feathering - a good quality male will exhibit some partial feather loss, especially around the shoulders and thighs.



- Vent - should show some feather wear, be large and moist, with good (red) coloration.



- Body weight - according to target.

Management of Males after Peak

- Ensure sufficient sample of males are weighed (10% in lay).
- Never decrease male feed allocation.
- Feed increases should account for body weight, fleshing, and physical condition, to maintain growth and persistency of fertility.
- Maintain litter quality to promote good footpad health.
- Follow a planned male reduction program.

Management of Females after Peak Production Through to Depletion

General Guidelines for Post-peak Feed Reduction

- Follow a feed reduction program that allows the birds to gain weight at a rate of 15 to 20 grams per week (0.5 to 0.7 oz).
- Failure to control body weight from peak production will reduce production persistency and effect egg size.
- Make weekly feed adjustments based on trends in egg weight and body weight.
- Flocks producing at levels above production targets may require more feed. Feed reductions should be of smaller amounts and more gradual.
- If a flock peaks poorly, the feed withdrawal should be more rapid to avoid birds becoming fat.
- As temperature changes, review and adjust feed levels to ensure correct energy requirements are achieved.
- Poorly feathered hens will have a higher energy need to ensure drops in production do not occur.

The following characteristics should be measured, recorded, and graphed onto a chart:

- Daily (or weekly) body weight and body-weight change relative to target.
- Daily egg weight and egg-weight change relative to target.
- Daily changes in feed clean-up time.

Monitoring Body Condition in Females

In general, a uniform flock of females achieving the target body-weight profile in lay should also achieve an acceptable body condition.

- Handle females frequently (at least weekly) to assess body condition/fleshing.
- Use the same scoring system for females as males.
- Average flock score in lay should be maintained between 2 and 2.5.
- In lay, the occurrence of Score 1 females (under-fleshed) must be minimized.

Abdominal Fat Pad

- Assess fat pad routinely (at least weekly) from the start of lay.
- As a guide, maximum fat pad volume should be no more than the size of an average person's cupped hand or a large egg (roughly 8-10 cm [3-4 in]).

Assessing abdominal fat pad in a female broiler breeder.



MANAGEMENT FUNDAMENTAL

Using a combination of physical assessments (body weight, fleshing, fat pad, and pin bone spacing) provides a reliable indication of overall female condition.

Section 3

Care of Hatching Eggs on Farm

Objective

To keep the embryo and egg contents in the best possible condition for good hatchability and chick quality.

Pages	Contents
31	Egg Quality
31	Best Practice for Care of Hatching Eggs
33	Dew Point or Condensation

Egg Quality

Examples of good quality hatching eggs.



Good quality nest eggs

Examples of eggs with an increased risk of contamination or lower hatchability.



Slight soiling

Clean floor egg

Pale shell

Examples of eggs that should be rejected.



Fecal soiling

Yolk on shell

Blood on shell

Best Practice for Care of Hatching Eggs

Egg Collection

- Keep the insides of the nests and any collection belts free of litter and droppings.
- Collect eggs a minimum of 4 times per day.
- Collect floor eggs separately and as often as possible, and keep them separate from nest eggs.

Egg Packing and Selection

PROCEDURE

Egg Packing and Selection

1. Select and pack eggs immediately after each collection.
2. Reject eggs that are cracked or damaged, misshapen eggs, double-yolk eggs, soft shelled eggs, and any eggs that are more than 25% covered with dirt or droppings.
3. Record numbers rejected in each category and monitor them.
4. Place packed trays in egg store immediately. Pack trolleys from bottom up.
5. Do not remove trolleys from the egg store when loading eggs.
6. If boxing, eggs should be cooled to egg store temperature first.
7. Do not wrap eggs or trolleys in plastic until they have cooled to egg store temperature.

Egg Storage

Relationship between length of egg storage and temperature of egg store.

Storage Period (days)	Temperature of Storage* °C (°F)
1-3	20 (68)
1-7	15 (59)
> 7	15 (59)

Humidity

- Ideally, egg store humidity should be held between 70 and 80% RH.
- Do not move cold eggs into a warm humid atmosphere to prevent condensation forming.
- Ensure the water in the humidifier is clean and that spray nozzles are maintained properly so that they produce a fine mist of water and not large droplets.

Dew Point or Condensation

When eggs are moved from a cold environment to warmer, more humid conditions, they may sweat. The following table gives the shell temperature that will result in condensation when moving eggs into a wide variety of temperatures and humidities. To avoid condensation, the egg shell temperature needs to be higher than that given in the table below. If eggs are sweating, they should not be fumigated or put into a cold egg store until they are dry.

Egg Store Temperature °C (°F)	Relative Humidity (%RH) of Room Eggs Moved Into				
	40	50	60	70	80
12 (54)	27 (81)	23 (73)	20 (68)	18 (64)	15 (59)
13 (55)	28 (82)	24 (75)	21 (70)	19 (66)	16 (61)
14 (57)	29 (84)	25 (77)	22 (72)	20 (68)	17 (63)
15 (59)	30 (86)	26 (79)	23 (73)	21 (70)	18 (64)
16 (61)	31 (88)	27 (81)	24 (75)	22 (72)	19 (66)
17 (63)	32 (90)	28 (82)	25 (77)	23 (73)	20 (68)
18 (64)	33 (91)	29 (84)	26 (79)	24 (75)	21 (70)

Condensation on the surface of the egg.



Section 4

Ventilation

Objective

To ensure that good welfare and reproductive performance is achieved by maintaining birds under appropriate, and where possible, optimal environmental conditions.

Pages	Contents
35	Ventilation

Ventilation

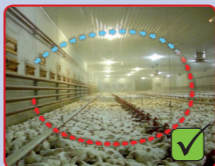
Open-sided / Natural Ventilation

Natural ventilation requires continuous 24 hour management if the house environment is to be satisfactorily controlled.

- Vary curtain height to achieve optimum airflow.
- Curtains should be fastened to the sidewalls at the bottom and be opened from the top down to minimize drafts and wind flowing directly onto birds.
- Open curtains on both sides of the house to provide cross-ventilation.
- In light wind or wind that changes direction frequently curtains on each side should be opened the same amount.
- If the wind is coming consistently from one side of the building, the curtain on the prevailing side should be opened less than the downwind side to minimize drafts.
- Recirculation fans should be used to supplement and enhance temperature control within the house.
- In hot weather conditions, several steps can be taken to minimize the impact of high temperatures:
 - ➔ Reduce stocking densities.
 - ➔ Ensure adequate roof insulation is in place; spraying water on the roof will help keep it cool (use with caution as this may raise RH levels).
 - ➔ Use circulation fans.

Negative Pressure Ventilation Systems (Controlled Environment Housing)

Achieve Good Airflow and Volume

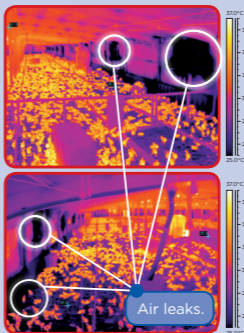


If incoming airflow speed and volume is too low:

- Cold air will drop directly on to the birds/litter.
- Litter will become wet and birds may get chilled.

Ensure House is Tightly Sealed

- Ventilation only works effectively if the house is adequately sealed and there are no air leaks.
- This ensures that airflow speed and volume entering the house are controlled and correct.



Uniform Air Inlet Openings

- Open air inlets must be evenly distributed through the house and be opened equally.
- This will create uniform:
 - ➔ volume of airflow
 - ➔ speed of airflow
 - ➔ direction of airflow
 - ➔ distribution of airflow
- At lower ventilation rates close some inlets to force the same volume of air through fewer inlets.



Monitor and Evaluate Regularly

- Monitor house pressure & air speed:
 - ➔ For every increase in negative pressure of 3-4 Pa (0.012-0.016 inches of water column) air will travel ~ 1 m (3.3 ft) into the house.
 - ➔ Incoming air should be thrown into the center of the house.
- Use smoke tests or cassette tape to confirm if airflow direction and inlet settings are correct.
- **Monitor bird behavior.**
- Complete regular evaluation of:
 - ➔ air quality
 - ➔ relative humidity
 - ➔ signs of condensation
 - ➔ dust levels
 - ➔ litter quality



PROCEDURE

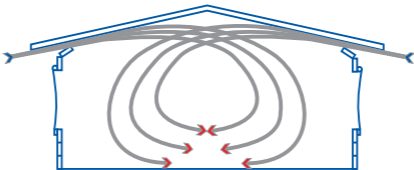
Evaluating Negative Pressure of Controlled Environment Housing

1. Close all doors and inlets in the house.
2. Switch on one 122 cm/127 cm (48 in/50 in) fan, or two 91 cm (35 in) fans.
3. The pressure in the house should not measure less than 37.5 Pa (0.15 inches of water column).

Minimum Ventilation

- It is essential to provide some ventilation to the house regardless of the outside conditions.
- Minimum ventilation is used for nighttime, or winter ventilation.
- Extraction fans (usually 91 cm [36 in] in size) operating on a cycle timer (on/off) draw air into the house through sidewall or ceiling air inlets.
- It is recommended that a 5 minute cycle timer is used.
- Air inlets should be opened at least 5 cm (2 in) for the airflow into the house to be effective.
- Accurate ventilation settings for the house can be determined by carrying out smoke tests. Alternatively, strips of cassette tape can be hung from the ceiling every 1-1.5 m (3-5 ft) in front of an air inlet up to the apex of the house.

Correct airflow during minimum ventilation.



MANAGEMENT FUNDAMENTAL

Monitor airflow, bird distribution and bird behavior to determine if settings are correct.

Minimum Ventilation Rates

Minimum ventilation requirements are shown below.

- Prior to 7 days, the actual air speed at floor level should be no more than 0.15 m/sec (30 ft/min).
- Maximum levels of RH, carbon monoxide, carbon dioxide, and ammonia should never be exceeded.
- Approximate minimum ventilation rates (per bird) for temperatures between -1 and 16°C (30 and 61°F).

Average Weight kg (lb)	Ventilation Rate m ³ /hr (ft ³ /hr)
2.20 (4.85)	1.56 (0.92)
2.40 (5.29)	1.67 (0.98)
2.60 (5.73)	1.77 (1.04)
2.80 (6.17)	1.87 (1.10)
3.00 (6.62)	1.97 (1.16)
3.20 (7.06)	2.07 (1.22)
3.40 (7.50)	2.16 (1.27)
3.60 (7.94)	2.26 (1.33)
3.80 (8.38)	2.35 (1.39)
4.00 (8.82)	2.44 (1.44)
4.20 (9.26)	2.53 (1.49)
4.40 (9.70)	2.62 (1.55)
4.60 (10.14)	2.71 (1.60)
4.80 (10.58)	2.80 (1.65)
5.00 (11.03)	2.89 (1.70)

NOTE: This table should only be used as a guideline as actual rates may need to be adjusted to environmental conditions, bird behavior and bird biomass (total bird weight in the house).

PROCEDURE

Calculating Minimum Ventilation Requirement

1. Determine the average body weight of birds in the house.
2. Select the appropriate ventilation rate for average body weight in the house.
3. Calculate the minimum ventilation requirement.

$$\text{Minimum ventilation requirement (m}^3\text{/hr or ft}^3\text{/min)} = \text{Number of birds in the house} \times \text{Appropriate minimum ventilation requirement}$$

PROCEDURE

Calculating Cycle Timer Settings

1. Calculate the minimum ventilation requirement (m³/hr or ft³/min).
2. Calculate the percentage time the fans need to be running.

$$\text{Percentage of time} = \frac{\text{Minimum ventilation requirement}}{\text{Total capacity of fans being used}}$$

Air

Effects of common parent stock house air contaminants.

Ammonia	<p>Ideal level <10 ppm. Can be detected by smell at 20 ppm or above. >10 ppm will damage lung surface. >20 ppm will increase susceptibility to respiratory diseases. >25 ppm may reduce growth rate depending upon temperature and age.</p>
Carbon Dioxide	<p>Ideal level <3,000 ppm. >3,500 ppm causes ascites. Carbon dioxide is fatal at high levels.</p>
Carbon Monoxide	<p>Ideal level <10 ppm. >50 ppm affects bird health. Carbon monoxide is fatal at high levels.</p>
Dust	<p>Damage to respiratory tract lining and increased susceptibility to disease. Dust levels within the house should be kept to a minimum.</p>
Humidity	<p>Ideal level 50-60% after brooding. Effects vary with temperature. At >29°C (84.2°F) and >70% relative humidity, growth will be affected. Relative humidity <50% particularly during brooding will affect growth.</p>

Transitional Ventilation

- Transitional ventilation is used when the house temperature is above the desired (or set point) temperature, but it is not yet warm enough, or the birds are still not old enough, to use tunnel ventilation.
- A general guideline for transitional ventilation is to open enough air inlets so that approximately 40-50% of the tunnel fan capacity is being used.

Tunnel Ventilation

- Keeps the birds feeling cool.
- Switch from transitional ventilation to tunnel ventilation when birds need the cooling effect of wind chill.
- Younger birds that are not fully feathered will feel a greater wind chill than older birds and so are more prone to chilling.

PROCEDURE

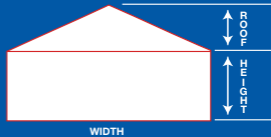
Tunnel Ventilation Calculations

1. Determine the fan capacity required for a given air speed.

Required fan capacity = (design air speed) x (cross section area)

Where:

- Design air speed (min).
 - 2.03 m/sec or 400 ft/min for rearing.
 - 2.54 m/sec or 500 ft/min for production.
- Cross section area = $(0.5 \times \text{Width} \times \text{Roof}) + (\text{Width} \times \text{Height})$.
 - Cross section area is the effective area through which the air flows down the length of the house. If there are other major obstructions such as nests in the house, then the area of these obstructions can be subtracted from the total cross section area.



2. Determine the number of fans required:

Number of fans = $\frac{(\text{Required fan capacity})}{(\text{Fan operating capacity})}$

Where:

- Fan operating capacity is the capacity at the assumed operating pressure.
- As a guideline for tunnel ventilation with cooling pads, use the fan capacity at an operating pressure of 37.5 Pa (0.15 inches water column).

Evaporative Cooling Systems

- Effectiveness of evaporative cooling systems depends on the RH levels.
- Evaporative cooling adds moisture to the air and increases RH. It is important to operate the system based on RH, as well as dry bulb temperature, to ensure bird welfare.

MANAGEMENT FUNDAMENTAL

If in-house relative humidity levels reach more than 70-80%, turn off the evaporative cooling system.

Spray Cooling (fogger)

- High pressure (water) spray systems should operate at 400-600 psi (28-41 bar), and produce a very fine mist with a droplet size of 10-15 microns.
- Low pressure fogging systems operate at 100-200 psi (7-14 bar), and produce a droplet size greater than 30 microns.
- Fogging lines must be placed near air inlets in order to maximize the speed of evaporation, and additional lines should be placed throughout the house.

Pad Cooling

- In pad cooling systems, cool air is drawn through a water soaked filter (cooling pad) by the tunnel ventilation fans.

$$\text{Required cooling pad area} = \frac{\text{(Tunnel fan capacity)}}{\text{(Pad air speed)}}$$

- Cooling pad area is the total area required. Half of this area is usually installed on each outside wall of the inlet end of the house.
- Tunnel fan capacity is the actual total operating capacity.
- Expected pad air speeds:
 - ➔ For 100 mm (4 in) thick pad, use 1.27 m/s (250 fpm).
 - ➔ For 150 mm (6 in) thick pad, use 1.91 m/s (375 fpm).

Evaluating Ventilation

Spread/distribution of the birds:

- Are they well spread?
- Are there specific areas of the house that are being avoided?

Bird activity:

- Look along the feeder and drinker lines – is there bird activity at them?
- Birds should be feeding, drinking, and resting. During lay, there should be mating activity and birds using nest boxes.

Section 5

Nutrition

Objective

To maximize welfare, reproductive potential (of both males and females), and chick quality by supplying a range of balanced diets that meet the requirements of broiler parent stock at all stages of their development and production.

Pages	Contents
45	Nutrition

Nutrition

- Birds respond to daily intakes of nutrients, therefore feeding programs (and feed levels) must relate to dietary nutrient content; especially energy and the nutritional requirements of the bird at a given age.
- Diets need to be regularly sampled and the samples analyzed to ensure that the diet is as it should be.

Feeding Programs

The Laying Stage

During this stage, a breeder feed should be fed from 5% production through to depletion.

Laying hens require 4-5 g (14-18 oz Ca per 100 birds) of calcium per hen per day to maintain calcium balance. In practice, this is achieved by feeding the recommended breeder ration calcium levels no later than 5% egg production. To maintain optimal shell quality, consider supplementing 1.0 g (0.03 oz Ca per bird per day) of calcium in the form of a large particle-sized limestone (diameter 3.2 mm [1/8 in]) or oyster shell.

Consequences for the laying flock of not meeting the nutrient specifications.

	Effect of Undersupply	Effect of Oversupply
Crude protein	Depends on amino acid levels, but generally decreased egg size and number. Poor chick quality from young flocks.	Increased egg size and lower hatchability. Increased metabolic stress during hot weather conditions.
Energy	Body weight, egg size and egg number will decrease unless feed quantity is adjusted.	Excess leads to increased double yolks, oversized eggs and obesity. Late fertility/hatchability suffers.
Lysine, methionine & cystine	Decrease egg size and number.	
Linoleic acid	Decreased egg size.	
Calcium	Poor shell quality.	Reduced availability of nutrients.
Available phosphorous	May impair egg production and hatchability. Reduced bone ash in chicks.	Poor shell quality.

If a separate male diet is used, it should be introduced when birds are moved to the laying house or at light stimulation.

Energy

Recommended feeding levels in the **Ross Parent Stock Performance Objectives** assume a given dietary energy level per kg for starter, grower and laying flocks. Because birds respond to nutrient intake (not nutrient concentration), if diets have feed nutrient levels different from those assumed, then proportional changes in feed allowances must be made. An example of the calculation is given below:

METRIC

$$\begin{aligned} \text{Energy intake} &= 166 \text{ g/bird/day} \times (2,800 \text{ kcal/kg} \div 1000) \\ &= 464.8 \text{ kcal/bird/day} \end{aligned}$$

$$\begin{aligned} \text{Adjusted feed intake} &= 464.8 \text{ kcal/bird/day} \div (2,700 \text{ kcal/kg} \div 1000) \\ &= 172 \text{ g/bird/day} \end{aligned}$$

IMPERIAL

$$\begin{aligned} \text{Energy intake} &= 36.6 \text{ lb/100 birds} \times 1,269 \text{ kcal/lb} \\ &= 46,445.4 \text{ kcal/100 birds} \end{aligned}$$

$$\begin{aligned} \text{Adjusted feed intake} &= 46,445.4 \text{ kcal/100 birds} \div 1,224 \text{ kcal/lb} \\ &= 37.9 \text{ lb/100 birds} \end{aligned}$$

Adjustment of energy (feed) intake must be based largely on observation of the birds' responses in body weight, body condition, feed clean-up time, and egg mass.

Energy contents of successive feeds should not vary widely. Feed changes should be gradual and carefully controlled, especially when changing diets (e.g., transition from Grower to Breeder rations).

Temperature Effect on Energy Requirements

As operating temperature differs from 20°C (68°F), energy intakes should be adjusted pro rata as follows:

- Increased by 0.126 MJ (30 kcal) per bird per day if temperature is decreased by 5°C from 20° to 15°C (68° to 59°F).
- Reduced by 0.105 MJ (25 kcal) per bird per day if temperature is increased by 5°C from 20° to 25°C (68° to 77°F).

When temperatures are above 25°C (77°F) the relationship is not as straight forward. Feed composition, feed amount, and environmental management should be controlled to reduce heat stress.

Feed Management

- Ideally, feed should not remain on the farm for more than a week.
- Feed bins should always remain covered and be in good condition to prevent water entry. Any feed spills should be cleaned up promptly.
- Use a standard weight to check the accuracy of the feed scales daily before use.
- A visual assessment of every feed delivery should be made. The feed should be assessed on its physical quality, color, appearance, and smell. For mash, check that there is good distribution of raw materials throughout the feed.
- Levels of fines should not exceed 10% for pellets/crumbs or 25% for mash. The level of fines within a feed can be measured using a feed shaker sieve.
- Water is an essential ingredient for life and birds should have unlimited access to clean, fresh water at all times when the birds are active.

Trouble Shooting - Vitamin Deficiency

Possible Cause	Problem							
	Egg Production	Fertility	Hatchability	Resistance to Disease	Feathering	Bone Deformities	Leg Weakness	Thin Shell Eggs
Vitamin A	x		x	x	x		x	
Vitamin D3	x		x			x		x
Vitamin E	x	x	x	x				
Vitamin B12	x		x					
Riboflavin			x	x			x	
Niacin					x	x		
Pantothenic Acid			x	x	x			
Choline	x					x		
Vitamin K								
Folic Acid	x		x		x	x		
Thiamin B1								
Pyridoxine B6	x		x					
Biotin	x	x	x		x	x	x	

Section 6

Health and Biosecurity

Objectives

To achieve hygienic conditions within the poultry house, and to minimize the adverse effects of disease.

To attain optimum performance and bird welfare, and to provide assurance on food safety issues.

Pages	Contents
50	Health and Biosecurity
54	Health Management

Health and Biosecurity

Preventing Diseases Transmitted by Humans

- Minimize the number of visitors and prevent unauthorized access to the farm.
- All people entering the farm should follow a biosecurity procedure. Visit facilities or houses with young birds first before moving to older birds.
- Maintain a record of visitors.
- Workers and visitors should wash and sanitize boots and hands when entering and leaving the poultry house.
- Clean and disinfect tools used in the poultry house.
- It is recommended to only visit one farm per day.

Preventing Diseases Transmitted by Animals

- Place farm on an “all in/all out” placement cycle.
- A minimum downtime of three weeks will reduce contamination on the farm.
- Keep all vegetation cut 15 m (50 ft) away from the buildings to prevent entry of rodents and wild animals.
- Do not leave equipment, building materials or litter lying around.
- Clean up feed spills as soon as they occur.
- Store litter material in bags or inside a storage building or bin.
- Keep wild birds and other wild animals out of all buildings and maintain an effective rodent control program.
- Use an integrated pest management program including mechanical, biological, and chemical controls.
- Keep other farm animals and pets outside the building and the fenced farm area.

Site Cleaning

MANAGEMENT FUNDAMENTAL

Site cleaning must cover both the interior and exterior of the house, all equipment, external house areas, and the feeding and drinking systems.

PROCEDURE

Site Cleaning

1. Plan.
2. Control insects:
 - Once the flock has been removed, while the house is still warm, spray litter, equipment and surfaces with an insecticide.
 - Spraying with an approved insecticide may also be done two weeks before depletion.
 - A second treatment of insecticide should also occur prior to fumigation.
3. Remove dust.
4. Pre-spray with an approved detergent solution throughout the inside of the house.
5. Remove all equipment.
6. Remove and dispose of litter.
7. Wash using a pressure washer with foam detergent, and rinse with hot water.

PROCEDURE

Cleaning Water Systems

1. Drain pipes and header tanks.
2. Flush lines with clean water.
3. Scrub header tanks to remove scale and biofilm deposit and drain to the exterior of the house. If physical cleaning is not possible, cleaning of water lines between flocks may be done using high levels (140 ppm) of chlorine or per-oxygen compounds.
4. Refill the tank with fresh water and add an approved water sanitizer.
5. Run the sanitizer solution through the drinker lines from the header tank, ensuring that there are no air locks.
6. Make up header tank to normal operating level with additional sanitizer and solution at appropriate strength. Replace lid and allow disinfectant to remain for a minimum of 4 hours.
7. Drain and rinse with fresh water.
8. Ensure water lines are flushed completely before birds are allowed to drink.
9. Test water quality routinely for bacterial and mineral contamination and take necessary corrective action based on the test results. Take 58 samples from source, storage tank, and drinker points.

PROCEDURE

Cleaning Feeding Systems

1. Empty, wash, and disinfect all feeding equipment.
2. Empty bulk bins and connecting pipes, and brush out where possible.
3. Clean out and seal all openings.
4. Fumigate wherever possible.

Disinfection

- Disinfection should not take place until the whole building (including the external area) is thoroughly cleaned and all repairs are completed.
- Disinfectants are ineffective in the presence of dirt and organic matter.
- Manufacturers' instructions must be followed at all times.
- Disinfectant should be applied using either a pressure-washer or backpack sprayer.
- Heating houses to high temperatures after sealing can enhance disinfection.
- If using a selective coccidial treatment, this should only be used by suitably trained staff and should be applied to all clean internal surfaces.

Evaluation of Farm Cleaning and Disinfection Efficiency

- Monitor the efficiency and cost of cleaning out and disinfection.
- Complete Salmonella isolations and total viable bacterial counts (TVC).
- Monitoring trends in Salmonella/TVCs will allow continuous improvement in farm hygiene and comparisons to different cleaning and disinfection methods to be made.
- When disinfection has been carried out effectively, the sampling procedure should not isolate any Salmonella species.
- For a detailed description of where to sample, and recommendations of how many samples to take, please consult your Aviagen® veterinarian.

Health Management

- Good management and biosecurity will prevent many poultry diseases.
- Monitor feed and water intake for the first signs of a disease challenge.
- Respond promptly to any signs of a disease challenge by completing post-mortem examinations and contacting an Aviagen veterinarian.
- Vaccination alone cannot prevent flocks from overwhelming disease challenges and poor management.
- Vaccination is most effective when disease challenges are minimized through well designed biosecurity and management programs.
- Base vaccination programs on local disease challenges and availability of vaccine.
- Monitor and control worm burden.
- Salmonella infection via feed is a threat to bird health. Heat treatment and monitoring of raw materials will minimize the risk of contamination.
- Only use antibiotics to treat disease with veterinary supervision.
- Keep records and monitor flock health.



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