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**Aviagen**<sup>®</sup>  
Turkeys

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Driving innovation, research and performance

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**BREEDER**  
**BREEDER**



*Nicholas*

# MANAGEMENT GUIDELINES FOR BREEDING TURKEYS

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# INTRODUCTION

Aviagen® Turkeys is a primary breeding company developing pedigree lines of birds for the global turkey industry. Through the application of the latest selection technologies in the pedigree breeding programme, Aviagen Turkeys is able to deliver simultaneous improvements in commercial, breeder and welfare-related traits.

Achieving the genetic potential of Aviagen Turkeys breeds depends on an appropriate environment, good feed and water quality, as well as an effective biosecurity and disease control programme. All of these are interdependent. If any of these elements are sub-optimal, bird performance will be compromised.

The aim of this booklet is to assist turkey producers achieve optimum performance from their birds. It draws attention to essential management issues which, if overlooked, may reduce flock performance. These management techniques will help maintain bird health and welfare, allowing your turkeys to perform well.

The environment in which turkeys are grown must take into account their needs and protect them from physical and thermal discomfort, fear and distress. Ongoing education of personnel in contact with turkeys is important to ensure proper stock management and promote good animal welfare practices.

Good practices that prevent disease and promote good health and production, as presented in this manual, will support good animal welfare.

At its basis are the 'Five Freedoms' of animal welfare and the 'Three Essentials' of stockmanship:

5 FREEDOMS	3 ESSENTIALS
Freedom from thirst and hunger	Knowledge of animal husbandry
Freedom from discomfort	Skills in animal husbandry
Freedom from pain, injury and disease	Personal qualities: Affinity and empathy with animals Dedication and patience
Freedom to express normal behaviour	
Freedom from fear and distress	

Table 1. Animal welfare

Information presented in this booklet combines the collective data derived from internal research trials, published scientific knowledge and the expertise, practical skills and experience of the Aviagen Turkeys' Customer Support Team.

For further information on raising turkeys, contact your local Management Specialist or Aviagen Turkeys directly.

Whilst every attempt has been made to ensure the accuracy of the information presented, Aviagen Turkeys accepts no liability for the consequences of using these management guidelines.

## BIOSECURITY

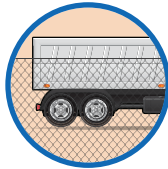
To safeguard the health of the turkeys and consumers, producers must have a strict biosecurity programme designed to prevent poultry from being exposed to infectious diseases. If a pathogen is present on a site, then good biosecurity should prevent its spread to other parts of the system. An effective programme requires the identification of the most likely sources of disease and the establishment of practices designed to prevent the introduction and the spread of these pathogens into and between flocks. It is important to educate employees regarding biosecurity procedures and disease risks.

### Employees and visitors

- Essential visitors only.
- Anyone who will be entering the facility should avoid contact with other poultry, companion birds or other relevant livestock where there may be a potential risk to the health of the birds. They should not visit live bird markets, livestock laboratories, processing plants, or similar facilities.
- Do not share staff between any kind of different farms.
- No-one should enter the farm if they have influenza, diarrhoea or are otherwise feeling unwell.

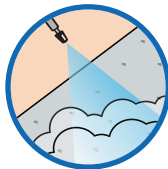
## Maintaining a secure facility

- Secure farm with a perimeter fence.
- Keep gates and buildings locked at all times.
- Post signs to prevent entry by unauthorised visitors.
- Do not allow visitors inside the secured area without approval from the farm manager or company.
- Anyone entering the facility must adhere to all biosecurity procedures and sign the visitors' book or register, indicating the date, place of last livestock contact and contact details. This is to allow traceability of movements in the event of a disease outbreak.
- Connecting corridors between buildings can improve biosecurity.

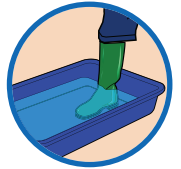


## Hygiene procedures

- The area prior to starting the on-farm hygiene procedures is considered dirty. The area after completing the hygiene procedures is considered clean.
- There should be a clear distinction between the dirty and clean areas when entering the farm, so personnel can easily identify this threshold.
- Disinfect all items before entering the farm.
- A shower should be provided. Enter the shower room and shower, paying special attention to washing hair, hands and fingernails.
- Anyone entering the farm must wear farm-dedicated clothing, footwear and wash their hands.
- Enter the clean area and put on clothing provided by the farm.



- After entering the farm, there must not be any contact with the dirty area once in the clean area.
- Before entering and leaving farm buildings, wash and disinfect boots and hands.
- Wash hands before and after breaks and meals.



## Vehicles, equipment and facilities

- Locate feed bins, gas tanks, generators and relevant equipment, so they can be serviced from outside the perimeter fence.
- Permit only essential vehicles to enter the farm and ensure they are clean.
- All delivery vehicles and service personnel, irrespective of whether they enter the facility or not, must adhere to the relevant biosecurity procedures and sign the visitor register.
- Source biosecure feed, bedding material and other supplies.
- Provide a vehicle disinfection area at the gate entering the facility. Thoroughly disinfect all equipment and tools entering the farm.
- Avoid using any equipment that has been used on other farms to prevent cross-contamination.
- Use biosecure facilities for storage and disposal of mortalities, e.g. freezer or incinerator.

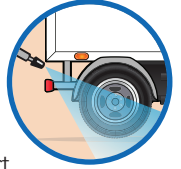
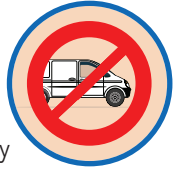
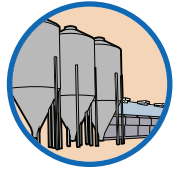


Figure 1. Feed bins

# CLEANING AND DISINFECTION

An essential element to keeping your farm free of disease is proper cleaning and disinfection between flocks. Diseases and pathogens can be introduced in numerous ways. Taking the time to clean and properly disinfect can help to reduce health risks and break disease cycles.

- Downtime between flocks should be as long as possible.
- Cleaning:
  - Empty feed pans, hoppers and feed bins - and flush water lines.
  - Remove litter, dust and debris from house.
  - Use a blower for dust removal, paying special attention to electronic equipment, fan housing, inlets and outlets.
  - Brush the floor.
  - Extra care should be taken when cleaning nest boxes.
  - Wet the house, then spray detergent foam/gel and leave to soak as required, before washing with warm water using a pressure washer.
  - Wash feed bins inside and out.
  - Dismantle all possible equipment such as drinkers, feeders, panels and clean.
  - Clean waterlines, and any supplemental drinkers, thoroughly after every flock.

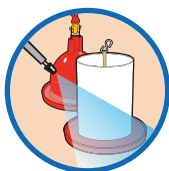


Figure 2. Cleaned shed

- Disinfecting:
  - After the house is dry, disinfect using an approved disinfectant at the manufacturers recommended concentration. Spray to the point of run-off.
  - The choice of disinfectants may be influenced by the disease/ biosecurity status on the farm.
  - Disinfect all equipment, including feed bins, feed pans, feed hoppers, fans and drinker lines.
  - Flush water lines and drinkers with fresh, chlorinated water after line disinfecting (see Water, page 72).
- Secondary disinfecting:
  - To enhance disinfection, fumigation can be useful after the equipment has been put in place. This should be done 2-3 days before placement.
  - Treat appropriately for insects, e.g. flies, darkling beetles. Rotate insecticide products to avoid build-up of resistance.
  - Do not enter a clean building without following proper biosecurity procedures. Keep doors closed and locked to keep unauthorised visitors and animals from entering the house.
  - Bring shavings into the house after it is thoroughly dry. *Applying shavings to a wet floor can promote the growth of mould.*
  - Hygiene testing is useful in monitoring the effectiveness of cleaning and disinfecting.



Figure 3. Thermal fogger (Courtesy of Agrex Limited)

## PREVENTIVE HEALTHCARE

Poor bird health will have a negative impact on animal welfare and bird productivity, including:

- Bird weight.
- Liveability.
- Fertility.
- Hatchability.
- Poult quality.

### **On-farm disease control programmes involve:**

- Disease prevention, including biosecurity and vaccination programmes.
- Monitoring of flock health through routine testing for infectious agents such as *Mycoplasma*, *Salmonella* etc.
- Early detection of ill health by monitoring flock performance.
- Timely treatment of identified disease conditions.
- Hygiene testing.
- Feed sanitation, e.g. using heat treated feed.

Daily monitoring of feed and water consumption is vital for early disease detection and targeted intervention. It is important that early identification and action in one flock will help prevent disease in surrounding and successive flocks.

### **Record production information such as:**

- Water consumption.
- Feed consumption.
- Mortality.
- Egg production.
- Bird weight.

These should be reviewed closely and compared with company targets. When monitored production fails to meet the established targets, a detailed investigation should be conducted by trained personnel.

## VACCINATION

Biosecurity and vaccination are both essential to successful health management. Biosecurity is used to prevent the introduction and spread of disease. Vaccination programmes are used to address endemic diseases.

Vaccination exposes the birds to a form of the infectious organism (antigen) trying to achieve a good immunological response. The aim of vaccination is that it will actively protect the birds from subsequent field challenge and/or provide passive protection (via maternally derived antibody) to the progeny.

Diseases, like Newcastle Disease (ND), Turkey Rhinotracheitis (TRT), and Fowl Cholera (caused by *Pasteurella multocida*) should be routinely considered when a vaccination programme is prepared. However, vaccination requirements will vary depending on local challenges, vaccine availability and local regulations. A poultry veterinarian familiar with local challenges and licensed products should be consulted for an appropriate vaccination programme.

Protection against each individual disease should be assessed when devising a suitable control strategy. Vaccines should be limited to those which are absolutely necessary to maximise vaccine response, reduce bird stress and reduce cost.

Obtain vaccines from reputable manufacturers and follow the recommendations. Correct storage, handling, preparation and application are vital for a successful vaccination and can often be a factor in why vaccines do not work. Some vaccines are very sensitive to disinfectants, so ensure no residues are present in the equipment used to administer the vaccine, e.g. drinker lines.

Vaccine administration should be carried out by experienced and appropriately trained personnel. It is important that all birds are handled in a calm and correct way at all times. In hot weather, vaccinations should be performed in the cooler parts of the day. Flocks which are unwell at the time of a planned vaccination should not be vaccinated. Records, including vaccine batch number should be kept for future reference.

Dyes, antibody titres, and the elimination of clinical signs of disease, can be used to assess the effectiveness of vaccines and vaccine delivery. Antibody titres are not always correlated with protection but are still useful for evaluating the vaccination programme.

Excessive vaccination may lead to poor antibody titres and/or coefficient of variation (CVs) of titres. Overly aggressive vaccination programmes can also be stressful for growing poults, so minimise stressful events, such as bird handling, around the time of vaccination. The field situation should also be considered in evaluating the effectiveness of a vaccination programme.

Strict hygiene and maintenance of vaccination equipment is crucial. It is important to follow vaccine manufacturers' instructions on methods of administration to get optimum results.

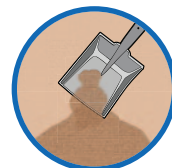
## PEST MANAGEMENT

The aim of pest management is to prevent transmission of diseases from other animals. Pests affecting poultry production may be classed as ectoparasites (e.g. mites and lice) or premises pests e.g. darkling beetles, various flies and rodents (mice and rats). Populations of these pests are largely determined by housing, waste, and flock management practices.

An integrated pest management (IPM) approach, tailored to the production system, is required for satisfactory control. Rodent control is an important part of an IPM. In order to realise an IPM, it is necessary to examine the biology and control strategies for these pests in relation to the types of poultry management and housing.

### Basic principles:

- Whenever possible, place the farm on an 'all in/all out' placement cycle. Multiple age turkeys on the same site provide a reservoir for disease organisms.
- An area of concrete or gravel extending to a width of 1-3m free of vegetation around the house will discourage entry of rodents. Control all grass and weed growth.
- Cut back all vegetation within 15m of the buildings to discourage rodents and wild animals.
- Ensure all poultry houses are wild bird-proof.
- Eliminate holes, cracks and other openings where rodents or birds might enter houses.
- Eliminate nesting areas and remove any nests found, in accordance with local legislation.
- Pest-proof buildings as much as possible.
- Put out rodenticides and insecticides and check them regularly in accordance with local legislation. Maintain an effective control programme.



- Store litter material in bags, preferably inside a fully closed storage building.
- Do not allow accumulation of materials, waste and redundant equipment in and around the farm. This will reduce the cover for rodents and wild animals.



- Insects must be destroyed before they migrate into woodwork or other materials. As soon as the flock has been removed from the house and while still warm, the litter, equipment, and all the surfaces should be sprayed with a locally permitted insecticide. A second treatment should be completed before fumigation.



- Avoid (or repair) leaking plumbing or other sources of standing water. Leaking water systems result in wet litter, which fosters fly development.
- Keep feeding systems in good repair. Poorly adjusted feeding systems result in feed spillage, which provides additional nutrients and fosters fly and beetle populations. Clean up feed spills as soon as they occur.
- Do not allow pets or other animals to enter the farm perimeter.
- Any systems put in place (or products used) must conform to local laws and regulations.



Figure 4. Rat bait box

## BROODING MANAGEMENT

A poult has basic needs in order to grow properly. These basic needs are fresh air, clean water, high-quality feed, good litter and heat.

The actual brooder surround set-up will vary depending on house, brooder type, brooding equipment, past experience, company preference and the time of year. It is essential that the set-up of the house is finished adequately in advance of the poult arriving on the farm.

### Litter

- Use clean, dry, white and dust-free softwood shavings. Avoid hardwood shavings and wet sawdust.
- Litter should be spread to provide a smooth, even surface (min. 7cm ☀ Spring/Summer - 10cm ❄ Autumn/Winter).

### Water

- Various drinker types are available but designs which provide open and readily available water are preferable. Drinker set-up and management should follow the manufacturer recommendations.



Figure 5. Example of supplementary drinking equipment



- Water lines should be cleaned prior to placement.
- Provide 2 drinking points per 100 birds, 50% of which is supplementary equipment (see Figure 5).
- Position drinkers at least 30cm from the edge of the brooder and brooder surround. Adjust water depth to 2cm.
- Always use clean water.
- Clean and refill drinkers at least 3 times per day and minimise spillage. The dirty water should be emptied into the drainage system.
- No vitamins or antibiotics should be added at placement, unless for a specific known problem - and as prescribed by a veterinarian.

## Feed

- Ensure 2 feeding points per 100 birds, 50% of which is supplementary equipment to equal 2.5cm of feeding space per poult; or provide a combination of feeders and paper egg trays (see Figure 6).
- Position feeders at least 30cm from edge of brooder and brooder surround.
- Fill feeders with fresh feed immediately prior to placement and refresh at least every 2 days.
- Pre-starter crumb should be of optimal size and consistent with minimal fines (see Feeding and Nutrition section, page 62).
- Keep feed clean and free from shavings, debris and droppings.
- Feed trays should gradually be moved towards the main feeders after 24 hours and then removed and disposed of between 2- 4 days.

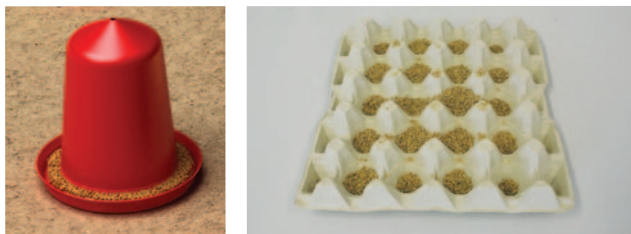


Figure 6. Examples of supplementary feeding equipment

## Crop fill assessment

Assessment of crop fill at key times after placement is a useful means of determining appetite development and checking that all poult have found feed and water. If adequate crop fill is achieved, appetite development will be boosted, early growth rate will be enhanced, ensuring welfare and liveability of the birds is at a good level and skeletal and intestinal gut development will be at desired levels, so affecting flock uniformity and production potential. Optimising early development also supports development of the immune system which can have lasting effects on the bird's health.

### The procedure for assessing crop fill

Crop fill should be monitored between the first 5 and 8 hours after placement and will indicate if the poult have found feed and water (see Table 2). During our studies, carrying out a crop fill analysis between 5-8 hours gives the strongest representation of how the poult have started and the early development of the poult. A minimum of 100 poult should be assessed in multiple locations to give accurate results.

### Equipment required

- 1 A catching frame.
- 2 A pen or pencil.
- 3 Paper to record crop fill.



Time of Crop Fill Check After Placement	Target Crop Fill (% of Poults with category 2 & 3 crops)
5 Hours	>50%
6 Hours	>60%
7 Hours	>70%
8 Hours	>80%

Table 2. Target crop fill assessment guidelines

Scan the QR Code for the full procedure to check your day-old placements of poult to see if they are consuming enough feed on the first day of placement.



## Brooders

- Check gas level in the storage tank before placement.
- Check that each brooder is operating properly.
- Use appropriate pre-heating, depending on season (48–72 hours before the poults arrive).
- A target spot temperature of 40°C under the brooder should be achieved with brooders hung at 1 m above the litter. A check of the litter surface temperature directly under the brooder using a laser thermometer can be used to check the spot temperatures and adjustments made to the brooder height if required.
- Set zone-controlled systems so that the majority of brooders are within target range. Brooders that are hotter or cooler than target should be physically raised or lowered to achieve the desired temperatures.

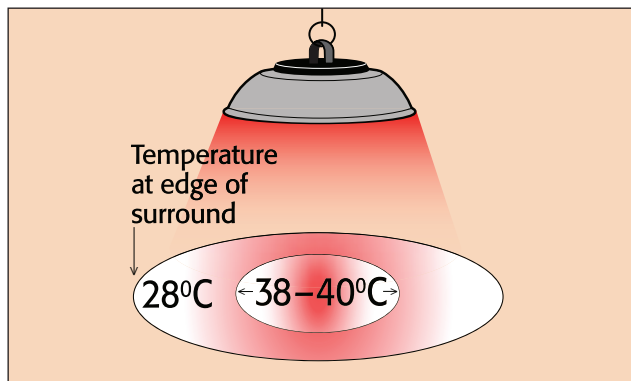


Figure 7. Brooder temperature

## Lighting

- Provide a minimum of 80 Lux of light in the house.
- For the first 24 hours, poults should receive 1 hour minimum of darkness. Increase period of darkness each day until birds receive 8 hours of continuous darkness by 5 days of age.
- After 5 days, poults should have 10 hours of continuous darkness per night (see Female and Male Lighting section, page 27).

## Brooding in surrounds

- Brooder surrounds should be 3–5 m in diameter depending on brooder power (see Table 3).

Surround Diameter (m)	Brooder Power (kW)	Suggested Poults Number
3.0–3.5	2.6/3.8	200–220
3.5–4.0	3.8/4.7	270–290
<b>GENERALLY LESS BIRDS = LESS COMPETITION</b>		

Table 3. Suggested brooding requirements

- Surrounds should be at least 60 cm away from the outside wall of the house.
- Make surrounds with cardboard or wire mesh 30–45 cm high. When the house temperature is expected to drop below 21°C or the house is draughty, use 45 cm cardboard. If the house temperatures are continually over 30°C, use wire mesh.
- At placement, ensure immediate fresh water availability at room temperature.
- Place a maximum of 270 male poults or 290 female poults per brooders ring.

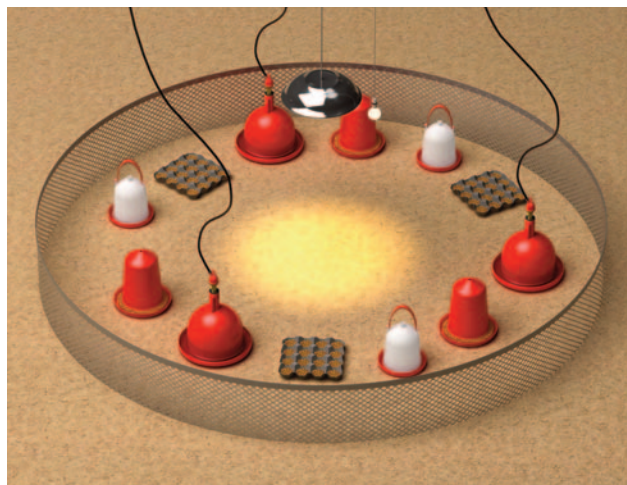


Figure 8. Brooding set-up

Place poultts quickly and quietly in the house, then leave them for a minimum of one hour to acclimatise to their new environment. After this time, further adjustment of the ventilation, brooder height, brooder temperature, drinkers or feeders may be necessary. Careful observation of the poultts' behaviour and house conditions every 2 hours will determine which adjustments should be made (see Figure 9). Excessive noise from the poultts may indicate the wrong temperature or lack of water or feed. Avoid exposure of the poultts to sudden temperature or environmental changes. Let the flock dictate their preferred starting temperature.

- After 3-4 days of age, combine two surrounds together to form one surround, to give extra space to the poultts.
- After 5-7 days of age, poultts can be released from surrounds.

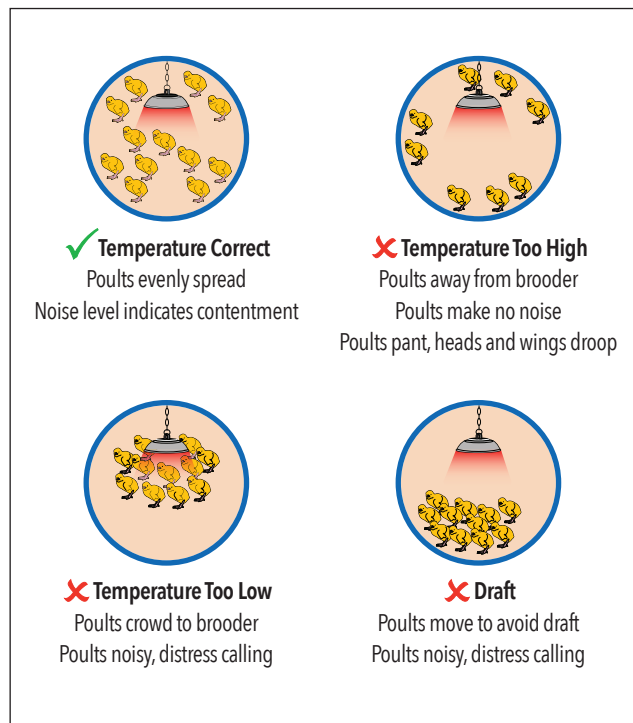


Figure 9. Poult distribution in brooder surrounds

## Temperature

Appropriate pre-heating of the house prior to poult arrival depends on the season. In cold climates, pre-heating by as much as 48-72 hours may be required. Litter temperature is a good indicator of adequate pre-heating. After delivery, poult behaviour is a key indicator whether the environment inside the ring or the house is correct. Temperature should be measured at bird level. Target environmental temperatures for breeding stock are detailed in Table 4.

Age	Sex	Under the Brooder °C	Ambient Temperature °C
Day 1	M+F	36-40	
Day 2	M+F	36-40	
Day 3	M+F	35-36	
Day 4 to 7	M+F	34-35	
Week 2	M+F		27-28
Week 3	M+F		25-26
Week 4	M+F		23-24
Week 5	M+F		21-22
Week 6	M+F		20-21
Week 7	M+F		19-20
Week 8	M+F		18-19
Week 9	M+F		17-18
Week 10 until depletion	M+F		16-17

Table 4. Target environmental temperatures

# REARING MANAGEMENT

## Drinkers

- Provide one bell-type drinker per 80-100 birds (see Figure 10).
- For other types of drinkers, follow the manufacturer's recommendations.
- For bell-type drinkers, maintain a minimum water depth of 2-2.5cm, depending on drinker style, drinking activity, ambient temperature and litter conditions.
- Manage the drinkers so that the drinker lip is at the average bird back height.
- Drinkers should be cleaned daily.
- During hot weather, flush overhead lines to provide fresh, cool water.

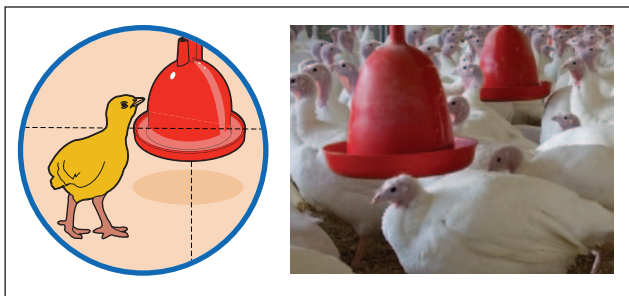


Figure 10. Example of drinker height

## Feeders

- Ensure good-quality feed is available when the birds are delivered.
- Provide a minimum of one feed pan per 40-60 males or 60-80 females which allows at least 2cm of feeding space per female or 3cm of feeding space per male.
- Maintain the feed pan so that the feeder lip is at the average bird back height.

- Check bins, augers, hoppers, etc. regularly for mouldy feed.
- In extreme hot weather conditions, consider withdrawing feed during the hottest part of the day to lower metabolic temperature and allow birds to handle hot weather conditions.

## Litter

Turkeys spend their life in close contact with litter material. The aim is to establish and maintain good, dry litter conditions and an environment free from dust to reduce footpad dermatitis and respiratory disease.

Good litter materials should be dry, absorbent and friable, provide insulation and be free from contaminants. Wood shavings and chopped straw are recommended for turkey breeders. The characteristics of some common litter materials are shown below.

	Cost	Insulating Capacity	Dustiness	Workability	Absorbent Capacity
Dust-free shaving	4	5	2	4	4
Straw	1	4	1	1	1
De-fibred and chopped straw	3	5	3	3	2
Coconut shells	5	3	5	4	5
Rice hulls	2	2	2	5	1

Table 5. Litter quality

1 = low to 5 = high

Fresh litter should be used for each flock, after cleaning and disinfection to prevent re-infection by pathogens. Litter should be stored in a facility protected from the weather and secure from access by vermin and birds or other animals.

Litter depth should be at least 7cm for summer placements and 10cm for winter placements. Where underfloor heating is being used, litter depth can be reduced. Litter should be spread evenly throughout the house and smoothed to level within the brooding surrounds.

It is important to avoid the litter becoming wet and caked, especially in the first week of life. The objective is to maintain clean and dry feet by adopting the following measures:

- 1 Regularly move feeding and drinker equipment.
- 2 Till the litter regularly and add fresh litter as required, especially around drinker and feeder lines.
- 3 Remove wet or caked litter.
- 4 Raise the lines of feeders and drinkers to the correct height as the turkeys grow.
- 5 Good ventilation management.

## Weighing

Birds should be weighed weekly to ensure growth and variability are meeting target specification. Weighing should be performed frequently to identify any problems early and to allow prompt remedial action to be taken. This knowledge, and safe subsequent actions, can only be achieved if the measurement of the growth is accurate.

Weighing birds the week before each feed change allows the possibility of adapting the feeding programme in accordance to the growth curve. Comparing flocks with an established benchmark is also an essential tool to evaluate management, health and nutrition programmes.

Flock Uniformity CV% <sup>1</sup>	Homogeneity <sup>2</sup>	Number of Birds to Weigh <sup>3</sup>
8	79	64
10	68	100
12	52	144

**Table 6.** Number of birds required to estimate flock weight

$$^1CV\% = (\text{Standard deviation} / \text{average live weight}) \times 100$$

<sup>2</sup>Percentage of birds within +/- 10% of average weight

<sup>3</sup>This will give an estimated live weight within +/-2% of the actual flock weight 95% of the time.

Weighing devices must be periodically calibrated, as appropriate for the size of the bird. If used, platform scales must allow birds easy access on and off the platform.

Weighing of birds can be done manually where birds are penned and weighed by farm personnel. Automatic weighing systems provide a lower labour-intensive solution; however they do require appropriate set-up and maintenance to ensure accurate estimation of flock weights.

## Manual weighing

Care must be taken when catching and weighing birds.

When weighing birds manually, equal-sized samples of birds should be taken from at least 3 locations in each house or pen, avoiding sampling near to doors and walls.

Before 6 weeks of age, birds usually have to be weighed collectively in a crate that holds 10-20 birds. After 6 weeks, the recommended method for sample weighing is to drive groups of birds into a sample pen and to weigh every individual bird in the pen. The weighing locations should be separated as much as possible to avoid any birds being re-weighed.



**Figure 11.** Manual weighing

To determine flock uniformity, individual birds should be weighed (see Figure 11). Birds should be caught using a catching frame or pen. Scales should be fitted with a shackle for holding the birds firmly during the weighing process. Calmly and correctly, pick up each bird, and place it on the shackles, wait until it is still and record the weight from the scale. Release the bird back into the main house area. All birds in the catching pen must be weighed to eliminate selective bias. Once all sample birds have been weighed in the house, calculate average live weight and flock uniformity (CV%) for each house.

Should the average weights for each group sampled in a house differ by more than 5%, then another group should be weighed from a different area in the centre of the house in order to improve the accuracy of the average of all birds weighed.

A policy of increasing the frequency of sample weighing, but reducing the number of birds weighed, is not recommended, as this will lead to comparison of sample weights with greater margins of error. This could make it difficult to interpret the results and could delay the time taken to respond to a management problem.

### Automatic weighing

Automatic weighing systems should be located where large numbers of birds congregate and where individual birds will remain long enough for weights to be recorded (see Figure 12). Inaccurate live weight estimation will result from small sample sizes or weights taken from birds which are not representative of the flock as a whole. For example, older and heavier males tend to use auto-weighers less frequently, which biases the flock mean downwards.

Readings from any auto-weigher should be regularly checked for usage rate (number of completed weights per day). The mean live weights achieved should be cross-checked by routine manual weighing.



Figure 12. Automatic weighing (Courtesy of Lansu Kalkkuna)

## FEMALE AND MALE LIGHTING

Lighting is a major factor influencing hormonal cycle, sexual maturity, eggs and spermatozoa production. A good lighting programme is a combination of three different parameters which control the shed environment: light spectrum, intensity, and duration of light/dark period.

To ensure the birds' reproductive development is normal, synchronised within the flock and timed to coincide with transfer to the laying farm, a number of key points must be followed.

- Use of a dimmable lighting system which is checked periodically with a light meter.
- Light should be evenly distributed in the shed.
- Clean lightbulbs or tubes regularly to remove the dust that accumulates and reduces their effectiveness.
- Always replace burnt out or damaged bulbs/tubes immediately.
- During dark periods, ensure no light enters the house. There must be no light leakage from doors, fans and air inlets or other openings.

**Warning:** Always check local regulations and codes of practice concerning the minimum and maximum periods of continuous illumination for poultry.

### Light source and light spectrum

Poultry have 4 types of receptor: violet, blue, green and red (humans have only 3); they are also sensitive to ultraviolet light.

In order to cover the light requirement of turkeys, the light source should have a proportion of blue and green light for growth and uniformity. Laying females should also have a sufficient red for stimulating sexual maturity and egg production.

When rearing and laying Breeder flocks use lighting with the warm white light measured at 2700–3000 Kelvin.

## Light intensity and duration for females

The guide below is typically for females reared in controlled environment housing, as used by many producers. Advice for other housing systems can be obtained from Aviagen Turkeys' Management Specialists.

- Use high light intensity (80-100 Lux) in the first 2 days.
- From 5 days of age until the end of 11 weeks of age, the light intensity should be kept constant at around 50-60 Lux, with a day length of 14 hours (to promote good bone development).
- From 12-18 weeks of age, reduce the light duration to 6-7 hours to promote juvenile moult.
- Fans and air inlets often allow additional light to enter the house and should be adequately light-proofed. Failure to do so can cause early egg production and poor future performance.
- The introduction of a shorter day length (6-7 hours) from 18-29 weeks of age ensures stimulation of egg production when females are transferred to laying houses with longer day length (see Table 7).

Age	Day Length (L = Light/D = Dark)	Level Intensity (Lux)
Day 1	23L1D	80-100 Lux
Days 2-5	Gradually increase dark period to achieve 16L8D by day 5	Gradually reduce light intensity to achieve 50-60 Lux by day 5
Days 5-7	14L10D	50-60 Lux
Weeks 2-11	14L10D	50-60 Lux
Week 12	13L11D	50-60 Lux
Week 13	12L12D	50-60 Lux
Week 14	11L13D	50-60 Lux
Week 15	10L14D	50-60 Lux
Week 16	9L15D	50-60 Lux
Week 17	8L16D	50-60 Lux
Weeks 18-29	6-7L17-18D	50-60 Lux

Table 7. Light intensity and duration for females

**Warning:** If a light intensity of less than 50 Lux is used during the conditioning phase, then it is possible that the females will come into lay slowly and not achieve a good peak egg production. For surveillance we recommend to install a light outside the house to indicate when the female lights are on.

## Light intensity and duration for males

Two male lighting programmes are described below (see Table 8). Advice on the most appropriate programme for each situation can be obtained from Aviagen Turkeys Management Specialists.

Use a light intensity of 80-100 Lux in the first 2 days. For the first 24 hours, birds should receive a minimum of 1 hour darkness. Increase the period of darkness each day until the birds receive 10 hours of continuous darkness by 4-7 days.

Age (weeks)	Programme 1		Programme 2	
	Day Length (hours)	Lux	Day Length (hours)	Lux
1-2	14	50	14	50
15	14	50	10	50
17	14	50	8	15-20
18	14	50	7	15-20
22	14	50	14*	25-30
29	Transfer		Transfer	

\* this should be achieved by gradually increasing the number of hours of light during week 22.

Table 8. Light programme for males

- A minimum Light intensity of 50 Lux is required when using quantitative feed management.
- Light intensity should be adjusted depending on male behaviour and maturity.

Males can also follow the same lighting programme as females until 22 weeks of age. In this situation, **from 23-29 weeks of age, males must be stimulated with a long day length (14 hours of light) at an intensity of 50 Lux** in order to achieve complete maturation of the testis and sufficient sperm production for the 1st insemination.

**Warning:** If any lighting issues occur please contact an Aviagen Turkeys Management Specialist for advice.

## LIGHTING IN PRODUCTION

Breeder females are normally photo-stimulated (increasing of daylight) at 29–30 weeks of age. This normally happens when they are transferred from the rearing to the laying house.

Females must always move to a higher light intensity from that used during rearing and in this respect, a light intensity of 100 Lux or more during lay is recommended.

Natural daylight, or an artificial warm source to mimic daylight, provides the best light intensity and quality, since it has broad spectrum of wavelengths. The red part of the spectrum of long wavelength (600–700 nm) has been shown to be most important for the photo-stimulation of egg production.

### Production in controlled environment housing

In order to mimic the seasonal effect of light increase, the light duration should be increased every 4 weeks to help the sexual hormone cycle and minimise broodiness (see Table 9).

Age (weeks)	Laying (weeks)	Duration of Light	Lux Level Intensity	
			Female	Male
29/30		14L/10D	100–140 Lux	50 Lux
31–33	0–2	14L/10D	100–140 Lux	50 Lux
34–35	3–4	14L/10D	100–140 Lux	50 Lux
36–37	5–6	14½L/9½D	100–140 Lux	50 Lux
38–39	7–8	14½L/9½D	100–140 Lux	50 Lux
40–41	9–10	15L/9D	100–140 Lux	50 Lux
42–43	11–12	15L/9D	100–140 Lux	50 Lux
44–45	13–14	15½L/8½D	100–140 Lux	50 Lux
46–47	15–16	15½L/8½D	100–140 Lux	50 Lux
48 to the end	17 to end	16L/8D	100–140 Lux	50 Lux

Table 9. Example of light production in a closed house

### Production in open housing

When females are brought into production in naturally ventilated (open or curtain sided) housing during periods of long natural day length, then this day length MUST be maintained throughout the laying period. Supplement with artificial light if required.

When the days are short (not more than 14 hours of light, e.g. in winter) then follow the same lighting programme as detailed above for females in controlled environment houses.

Flocks which come into production before the longest day will always be on a naturally increasing light programme, having increments of approximately ½ hour per week up to a maximum of 17 hours day length.

Use a lighting program starting at 06.00 hours until 20.00 hours in the Winter and 05.00 to 21.00 hours in the peak of the Summer.

On dull days when there is little or no sunlight, the natural daylight must be supplemented by using artificial lighting. It is also recommended to install a photoelectric cell which is calibrated to switch on the lights when the natural light intensity falls below 100 Lux.

Care must be taken with reducing natural day length. Supplement with artificial light if required.

**Warning:** Day length or light intensity during lay must NEVER be allowed to decrease. Reducing the day length can induce the females into a premature moult (feather loss) and egg production can drop.



## FEMALE WEIGHT CONDITIONING

- Adequate control of the body-weight development of females can be achieved through qualitative feed management, as long as the process is established at an early stage and a pattern of weighing and adjustment of the feed programme started within the first few weeks (see Feeding Females, page 63).
- **Warning:** Quantitative feed management of females is not recommended.
- Achieving the target weight at the end of the rearing period is important for successful egg production.

### Consequences of being overweight at transfer

- Poor activity of females during the late rearing period prior to moving to the laying farm.
- Handling overweight females on the laying farm for insemination is more physically demanding.
- Risk of feed intake reduction during photo-stimulation, which increases the risk of broodiness.
- High feed cost per egg.

### Consequences of being underweight at transfer

- Insufficient body reserves during early egg production when feed intake and body weight are declining, especially in hot climates.
- Increase in the risk of poor flock uniformity, which may lead to a variable onset of egg production, making management of early inseminations and broody control harder to coordinate.

Coefficient of Variation (CV%)	Uniformity (% +/- 10% of average of flock)
5	95.4
6	90.5
7	84.7
8	78.9
9	73.3
10	68.3
11	63.7
12	59.3

*Table 10. Uniformity equivalent*

### Target

- Flock variation should be between 5-7% coefficient of variation (CV%) at 29 weeks. If greater than 8% CV%, then management conditions during the rearing of the flock should be examined closely to assess risks to subsequent flocks.
- Uniformity measurements are sometimes used (see Table 10).

## FEMALE PRODUCTION

Maximising settable egg production is the goal of every turkey breeder farmer. Disease, nutrition, climate and management can have a great influence on peak and persistency of egg production.

It is recommended that females are photo-stimulated at 29 weeks when they are transferred to the laying shed. The shed should be ready, with all nest boxes and nest litter in place, all panels and gates set up, with drinkers and feeders checked and operating properly.

Birds laying floor eggs have a significant economic impact on breeder flock performance; therefore, it is critical to encourage females to go to the nests (manual or automatic) at the onset of the lay.

The nests should contain either clean straw or wood shavings. The nests should be opened and the traps tied in the open position when birds arrive at the lay farm.

Do not replenish floor litter until after peak production, to discourage eggs being laid on the floor.

During the next few days, nothing should be done which might discourage the birds from going to the nests. Five to seven days after the onset of production, 25% of the traps should be placed in the working position each day until all traps are working. If automatic nests are used, it is vital that nest management is carried out for any adjustments (see Automatic Nests section, page 45).

Nest space can affect peak egg production and the typical female-to-nest ratio is five females to one nest. High numbers of females per nest could result in crowding of the nests during peak lay and cause a delay in peak of egg production. Less dominant females would be kept away from the nest by their dominant pen mates and it is possible that eggs may be laid on the floor.

- Persistency of production is influenced by uniformity, the correct conditioning of the females in rearing, and broody management (see Broody Control section, page 37). The presence of floor eggs, the frequency of egg collection and the timing of nest opening and closing can influence production pattern during the day.
- The presence of floor eggs can be minimised by making access to the nests as easy as possible, training the females to go to the nest, having sufficient nest space, picking up floor eggs after each collection and disturbing any females congregating or exhibiting nesting behaviour in the main pen area.
- The frequency of egg collections should be at least every 60 minutes. During the day when the females are peaking in production, it may be necessary to collect the eggs every 45 minutes to prevent crowding of the nests.
- Accurate, up-to-date records (which include types of reject eggs), close observation of flock behaviour and prompt corrective action when problems begin to appear will improve flock performance.

## FEMALE BROODY MANAGEMENT

A wild female turkey begins to lay eggs in the spring, stimulated by the increase in day length. When a female has laid her first clutch of eggs (10-15) she ceases egg production and begins to prepare to incubate her eggs (broody behaviour).

In commercial production, broody behaviour is not desirable because we need the female to continue producing eggs. Generations of selection have reduced the tendency of modern turkey breeds to become broody. Management to prevent broodiness ('broody control') is still very important to prevent a reduction in egg production of a flock.

### Factors that promote broodiness:

- Hot weather.
- Poor uniformity of the flock.
- Allowing females to sit on the eggs too long through insufficient frequency of egg collections in the nest or on the floor.
- Allowing females to sit on nests overnight.
- Starting broody control too late.
- Poor functioning and maintenance of the nests.
- Floor layers, which are encouraged by:
  - Dark corners in the pen (uneven lighting).
  - Inadequate training to use nest boxes.
  - Not moving females that are sitting and crowding in the corners or on nest ramps.
  - The wrong ratio of birds per nest.

**Early identification of those females going broody is essential if they are to be treated successfully and egg numbers are to be maintained.**

### The important signs of broodiness are:

- Lay pattern moves toward the end of the day.
- Number of females on the nest at the end of the day increases.
- Production starts to decline.
- Feed consumption starts to decline and the flock becomes less active.
- Many birds nesting on the floor.
- Aggressive behaviour when disturbed (e.g. pecking, hissing or raising the feathers).
- Birds move slower when disturbed.
- An early sign of broodiness:
  - Production of distinctive-smelling faeces when the female is picked up and the oviduct everted.
- As she becomes more broody:
  - The oviduct becomes drier and harder to evert.
  - The pelvic bones move closer together and the skin between the pelvic bones becomes taut.
- If it is not possible to place three fingers between the pelvic bones (known as palpation).



Figure 13. Palpation of pelvic bones



Figure 14. Oviduct eversion of normal (left) and broody (right) females.

Figure 14 shows a normal and broody female when the oviduct is everted. A broody female will be harder and drier to evert.

### Broody control techniques

There are two typical systems that can be used to help manage females which are broody.

- There are advantages and disadvantages to both techniques (see Table 11).
- The control can be carried out at first egg collection, or 20 minutes after the last egg collection at night.

### Important points for both breeding techniques:

- Start broody management in the second week of lay:
  - Starting too early can affect the achievement of a good peak.
  - Starting too late will result in some birds already having gone broody.
  - It is important not to over-stress the birds trying too hard to manage broodiness, since this risks disturbing good layers.
- For best results Broody Control should be practised every day until 6 weeks of production have taken place.
- Nests should be closed at night to prevent hens accessing the nests.

## Technique 1 - Inspection method

- Requires a nest box that allows removal or inspection of the bird from the nest.
- All females found on the nest 20 minutes after egg collection must be inspected manually by palpation or oviduct eversion for broodiness.
- Do NOT allow a potentially broody female to escape the nest before it is inspected.

## Technique 2 - Spray method

- All females found on the nest are sprayed with a colour marker.
  - Use a different colour each day (see Figure 15).
  - Can be carried out at first egg collection, or 20 minutes after the last egg collection at night.
- Any bird on the nest with the same colour at the next check should be assumed to be broody.
- All marked females should be removed from the nest.



Figure 15. The spray method

Technique	Advantages	Disadvantages
Inspection Method	With trained personnel it is very accurate. (Does not remove too many non-broody females from the laying pen).	It does not provide early identification of 'non-physical' broody signs. May not work as well as other systems in hot weather.
Spray Method	This method is based on nesting behaviour, therefore it gives an early indication of broodiness.	The females can become multi-coloured, making correct identification of the colour for that day difficult.

Table 11. Advantages and disadvantages of broody control techniques

## Broody pen treatment

Having identified broody females using either one of the methods described, the broody females must be moved to a separate broody pen.

- The broody pen usually consists of a series of pens situated in the coolest part of the laying house.
- 5-10% of space for broody pens, to be modified depending on local experience and need.
- Each pen will ideally have a different floor or floor covering.
- Each pen must be equipped with adequate feeding and drinking space, since deprivation of either will permanently stop broody females from laying.
- Ensure air movement in the broody area.
- Maintain a light intensity greater than the main pen.



*Figure 16. Broody pens with higher light intensity*

- During egg collection, walk through the broody pens, moving the females.
- Use oviduct eversion to check if the birds are still broody. Any birds found squatting or no longer broody should be returned to the main pen.
- Every day, move the remaining females to the next pen.
- In the final pen, check the remaining birds for the effectiveness of the broody treatment. Evert them and check the oviduct, which should be wet and enlarged. Measure the distance between the pelvic bones; this should be at least three fingers. If so, the bird is ready to return to the main pen.
- If any female is difficult to open or too tight, put her through the broody cycle again or remove her from the flock.

Generally, broody pen treatment lasts three to four days; then females start laying again, provided they were identified early enough.

## FEMALE EGG HANDLING AND STORAGE

The main objectives of an egg-handling system are:

- Reduce or eliminate harmful organisms that may be on the egg-shell surface.
- Prevent the eggs coming into contact with microbial contaminants.
- Provide the proper humidity and temperature control for maintaining hatchability.

Before eggs arrive in the hatchery, they can come into contact with many sources of contamination, such as human interaction, faecal material, floor litter and airborne dust. When the eggs cool down, organisms are absorbed through the egg-shell pores. This is the reason it is so important to clean and sanitise the egg-shell surface before it cools down.

The eggs should be transferred to the egg grading room as soon as possible. Floor eggs should be collected and handled separately from nest eggs to prevent possible cross contamination.

### Egg cleaning and sanitation

When eggs are collected, any light residue of straw, shavings or litter that remains on the shell surface should be gently removed. Heavily soiled eggs and floor eggs should be discarded.

At this point, eggs should be sanitised with an egg-sanitising machine or with fumigation.

### Egg storage

After cleaning and sanitation, eggs are moved to the egg storage room. The main purpose is to keep the eggs in the optimum environment to stop the embryonic development and to minimise hatch loss. To achieve this, the egg storage room should be fully environmentally controlled.

For egg storage conditions, refer to Figure 17.

Relative humidity and temperature should be checked in the egg holding room with an accurate thermometer and hygrometer. Make sure that humidification equipment does not wet the eggs. Cool eggs to storage temperature as quickly as possible after collection and sanitation, and allow air to circulate around the eggs while they are cooling in order to stabilise the embryonic stage evenly in all of the eggs.

Ensure all eggs are correctly identified with the date of production, so that the oldest eggs are set before the youngest eggs.

- Do not store eggs directly in front of heaters, coolers or humidifiers.

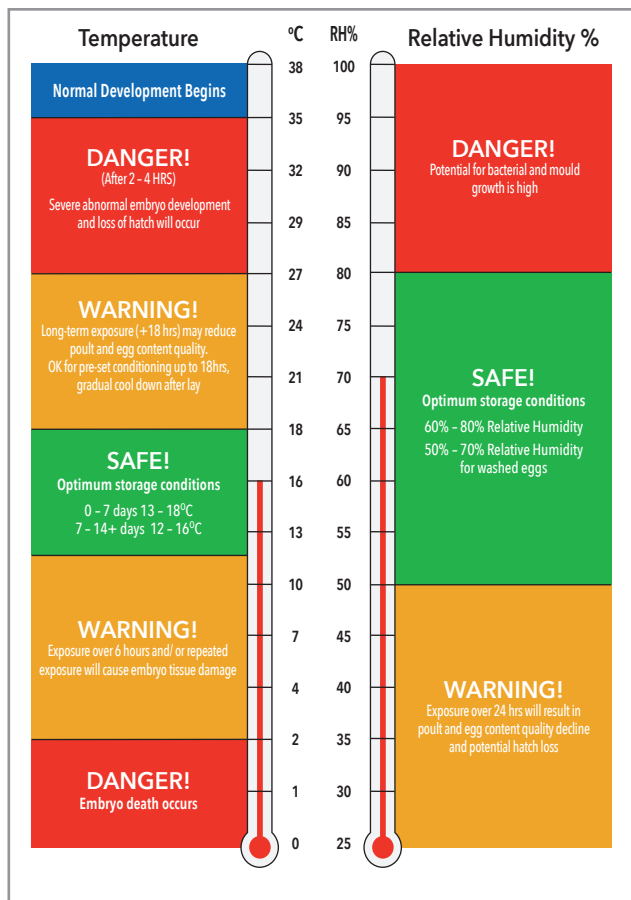


Figure 17. Storage conditions

- Separate the egg trays and do not put eggs in boxes before they reach the storage temperature.
- The use of a small circulation fan can improve the uniformity of the temperature and humidity in the store. Similarly, keep doors closed and minimise the amount of air moving in and out of the room.
- It is good practice to record store temperature and humidity (min/max) daily.

The egg storage room should have a dispatch door to the outside so that the driver collecting the eggs does not need to enter the room.

## MANUAL AND AUTOMATIC NESTS

### Definition

Nest boxes provide a safe, quiet and darkened place where females will instinctively go to lay their eggs. There are manual and automatic nest systems available.

#### Aviagen Turkeys recommends:

- 4.5 - 5 females per nest box for Heavy strain females
- 5 - 5.5 females per nest box for Heavy-medium strain females



Caution - high nest box ratios can reduce the number of settable eggs by increasing bird broodiness, floor/dirty eggs and the number of reject eggs.

### Manual nests

In addition to the bird's needs, it is also important to consider the ergonomics of egg collection and the welfare of the egg collector when designing a nest box system. Good design will not only aid collection efficiency but also help to ensure that all females are pushed off the nests, therefore making it easier to control broodiness.

Nest boxes can be constructed from wood, plastic or metal. However, plastic or metal boxes are easier to clean.

## Nest box design

- The nest box should be large enough to allow sufficient space for the female to turn around and stand easily.
- Typical dimensions are 45–60cm wide x 60cm deep x 60cm high. The minimum front opening height should be 35cm and should not be decreased by the nest trap (see Figure 18).
- It is essential that the trap mechanism does not cause damage to the female on entering or exiting the nest.

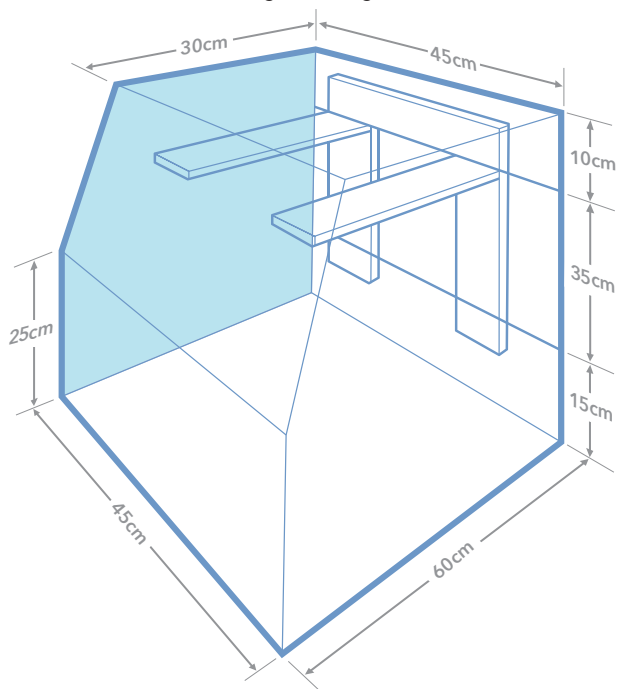


Figure 18. Example of a typical manual nest design with a trap

- Steps up to the nest are usually between 12–18cm high, depending on the strain. Heavier birds generally prefer lower steps.
- The nest box entrance is fitted with a trap (see Figure 18). This is a moveable barrier, which allows the female easy access in and out of the nest box but prevents more than one female entering the nest at a time.

- Building nest boxes together in units (blocks of 4, 5 or 6 boxes) makes it easier to remove them from the house for cleaning at the end of lay.
- Bottomless nest boxes are easier to clean and disinfect.
- Lowering the house passageway between the nest boxes, or putting in place an access ramp or a concrete platform can assist egg collection and broody control (see Figure 19).

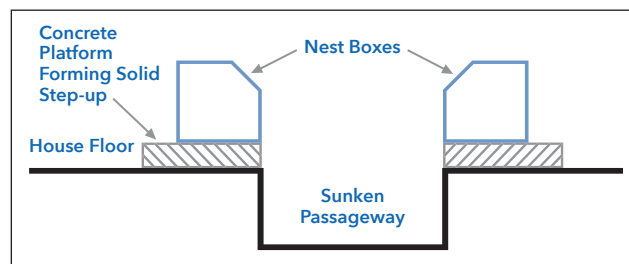


Figure 19. Example of a nest box system with a sunken passageway

## Manual nest box management

- Make nests available 24 hours per day, beginning no later than 7 days post-lighting.
- Tie open nest traps from the time nests are opened until egg production reaches 25%–35%.
- Thereafter, untie them gradually over 3–4 days.
- Collect eggs and push out females at least 8 times per day from 2–2.5 hours after lights-on.

## Automatic nests

Automatic nest box systems provide boxes for females to lay their eggs. They incorporate a mechanical system for pushing birds off the nests ('push-off') and collect eggs automatically.

### Advantages

- Saves on labour-intensive manual egg collection.
- Allows for many collections per day.
- Prevents soiling of eggs in the nest.

Automatic nest boxes represent a large capital investment, so it is important to ensure the highest standard of management practices to obtain the best return on investment. For closed environment sheds, it is preferable to have the nest boxes sited along walls of the shed to prevent floor eggs.

The time between photo stimulation and peak production is the most important period for both familiarisation of the females with their new environment and for training them to use the nests so as to reduce the number of females laying eggs on the floor.

### Automatic nest box management

- 1 The nests have to be maintained regularly during and between flocks.
- 2 The nests, but not the pen area, need to be darkened at the start of production. This can be achieved by lowering the light intensity above the nests. At peak of production, the light intensity above the nests should be the same as the rest of the house.
- 3 The nest-box opening and closing mechanism should be run twice per day. As soon as the females are in the laying house, the nest should be opened 30 minutes after lights on and closed 30 minutes before the lights switch OFF. This practice will help familiarise the birds with the operation of the nest mechanism, avoiding any stress associated with its activation. This will also avoid the birds sleeping in the nest at night and will prevent the mats getting dirty.
- 4 Visit the laying house four or five times per day to familiarise the birds to the activity of the farm workers. Do NOT walk through the passageways, as this will disturb the birds whilst they are learning to use the nests.

- 5 The nest control unit can be set to both Manual or Automatic 'push-off' and collection. Gradually increase the number of push-offs from the nests as the egg production increases (see Table 12).

Egg Production %	Number of "push-offs" per day
10	2
20	4
30	6
50	8
70	10
80+	12+

**Table 12. Egg production**

- 6 Manual push-aways from the ramps are required to allow other turkeys to enter the nest. The frequency of ramp push-aways (6-8 times per day) depends on requirements and should be focused on the time of peak of lay during the day, around 4-11 hours after the Lights ON. One final ramp push-away should be performed 30 minutes before Lights OFF to avoid females sleeping in front of the nest (see Table 13).
- 7 It is important to collect floor eggs at least every time a ramp push-away is conducted.



Time	Action Required
4	Lights ON
4:30	Open nests
5:30	Push-off
6:30	Push-off
7:30	Push-off + Ramp Push-Away
8:30	Push-off + Ramp Push-Away
9:15	Push-off + Ramp Push-Away
10:00	Push-off + Ramp Push-Away
11:00	Push-off + Ramp Push-Away
12:00	Push-off + Ramp Push-Away
13:00	Push-off + Ramp Push-Away
14:00	Push-off
15:00	Push-off
16:00	Push-off
17:00	Push-off
18:00	Push-off + Ramp Push-Away, close nests
18:30	Lights OFF

*Table 13. Example of an automatic nest management programme in enclosed environments*



*Figure 20. Example of an automatic nest box system (Courtesy of Vencomatic)*



*Figure 21. Example of an automatic nest box system showing ramps and "push-off" mechanisms (Courtesy of MGH)*

# MALE CONDITIONING

For rearing males, refer to the Rearing Management section (see page 22).

To achieve optimal reproductive performance, it is necessary to manage the male feeding regime from around 15 weeks of age, after selection has been made for the strong, healthy males for the reproductive period.

## Male selection

- Before selection, males should be grown to achieve the target body-weight profile.
- Selections should take place between 14 and 18 weeks of age.
- Walk the birds to identify (and remove) those that show any abnormality (walk poorly, poor posture, respiratory problems, breast blisters, drop crops, crooked toes, small birds or any other defects).
- To determine the numbers of birds to select, add 10% to the number of breeder males needed as a contingency for any losses after selection.

## Male weight management benefits:

- Management of male weight improves fitness and liveability.
- Males are lighter and easier to handle during vaccination and semen collection.
- Semen production is both better and longer, which helps to maintain late fertility.
- Reduces the risk of males going into a moult after 40 weeks of age.
- The feed cost per semen dose produced is reduced.

## Techniques for managing breeder male weights

Two techniques can be applied: Qualitative feed management and Quantitative feed management.

**Qualitative feed management** is when the feeding programme is adjusted, based on the actual growth trend.

- Male flocks heavier than target should move on to the next ration sooner.
- Male flocks lighter than target should be held on the higher protein ration for longer.
- In periods of high ambient temperature, if weight gain stalls, the males must be changed back to higher protein rations to maintain the desired growth.

Qualitative feed management is only used during the rearing phase of the bird's life, not in production.

**Quantitative feed management** uses the allocation of a defined feed quantity to manage bird growth rate. Adjustments are made to the feed quantity to ensure the birds achieve the target weight profile. This is the preferred method of managing male breeder weights.

- Quantitative feed management can be applied when the birds reach 20kg and are at least 20 weeks old.
- Provide the right feeder space for each male. There must be 22–25cm of feeder space per bird with round feeders or 30cm per bird with linear-type feeders (see Figure 22). For example, 1 round feeder pan of 50cm diameter would supply feeding space for 6–7 birds.
- Only one meal per day – all the birds have to eat at the same time.
- At the start of quantitative feed management, supply 450–500g of feed per bird per day (depending if it is winter or summer). Feed allocations are then increased or decreased by increments of 5%, depending on their weight relative to the target.

- Water should always be available.
- The average weight of the flock must increase every week by 500-600g per male.

**Warning:** Males should NEVER lose weight (follow the qualitative or quantitative body-weight profile).



Figure 22. Correct feeder space

Some producers use a combination of these two approaches in rearing, with a qualitative approach being used initially, followed by quantitative feed management.

Any concerns about male development should be discussed with Aviagen Turkeys Management Specialists at an early stage to ensure corrective action can be taken if necessary. The quality of the males is of equal importance to the females and care must be taken to ensure this part of the breeder package performs properly.

## MALE MANAGEMENT IN PRODUCTION

Quantitative feed management should be continued into production. The ideal situation is to place males in small pens, with 12-24 birds in each pen. The stocking density should be a maximum of 1 male per m<sup>2</sup>.

### Pen design in production

- Pen shape, and its position inside the house, should be designed to ensure correct distribution of the feed and water.
- Linear trough feeders (minimum of 35cm per male) placed along the corridors are more suitable than suspended round feeder pans.
- Designing the pens so that the longest side of the box is on the corridor will increase the available feeding space and allow the operator to fill the feeders from the outside, saving time and decreasing the risk of birds fighting.

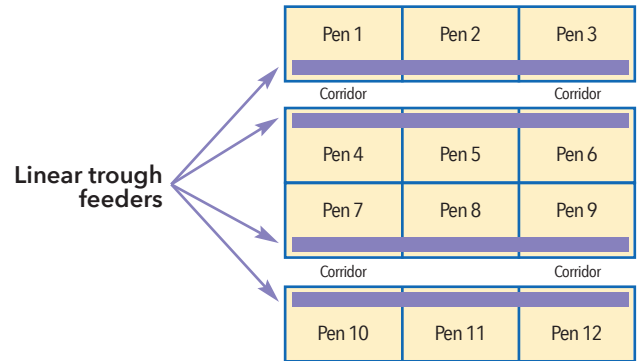


Figure 23. Example arrangement of 4 rows of pens using just two corridors: note that pens have the longest side along the corridor.

## Feed management in production

- To determine if it is necessary to feed males with more or less food, a sample of birds from each pen have to be weighed every week. The sample birds should be identified with a stock marker on their backs. The same marked birds should be weighed weekly from each pen.
- It is important to weigh birds each time at the same period of the day. The males should never lose body weight, and should increase in weight every week (around 200–250 gram weekly): if they do not increase or they lose weight, then supply them with more food.
- Males should be fed after milking because this helps to collect cleaner semen for insemination.
- Feeding should be at the same time every day.
- Good pellet quality is an important factor as dusty feed will increase competition for feed, increase water intake and may increase the risk of respiratory problems.
- Do not move birds from one pen to another as this can cause aggression as the group needs to re-establish social hierarchies.
- Always count males present in each pen before the distribution of the meal and adjust feed quantities accordingly.
- If some males show weakness or loss of condition, they should be moved to a recovery pen where they should be fed “*ad libitum*” and have time to recover.

## ARTIFICIAL INSEMINATION

Artificial Insemination (AI) is the process by which semen from males is collected and then introduced to females for the purpose of fertilising eggs. The objective is then to place the required dose of semen into the oviduct of the female so that it is deposited near the sperm storage glands.

### Semen collection

- To prevent contamination, operators must always wash their hands at the start and end of semen collection, and should not change jobs during a session. It should be remembered that some diseases are spread venereally e.g. Mycoplasma.
- To accustom males to handling, and to check on semen quality, they should be pre-milked at least two or three times before the first insemination.
- Ensure that a bright light source is available to illuminate the area over the milking position.
- The birds should be handled firmly but gently at all times.
- The process of milking males generally requires two operators, one to catch and milk the male and the other to hold the male and collect the semen. However, one man with a milking bench is an acceptable alternative, provided the operator is trained in the proper use of the equipment.



Figure 24. Milking the males



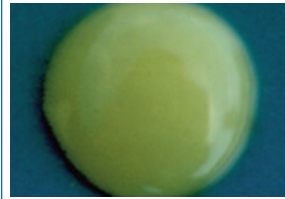
**Figure 25. Collecting the semen**

- The pen should be divided to separate males that have been milked from males that have not been milked.
- Stimulate the male gently by massaging him on the abdomen with one hand and place the other hand in front of the tail to expose the vent.
- As the male responds, push the tail up over the back and bring the other hand to the base of the erected phallus.
- Using the thumb and forefinger, squeeze inward and toward the phallus to expel the semen (Burrows & Quinn, 1937).
- The semen should be collected using a suction tube or syringe.
- Never squeeze the male more than 2 times, to avoid risk of injury. The technique is wrong if any bleeding occurs.
- Milking the males twice a week will help to maintain semen quality during the production period and produce more semen.
- All males should be milked at least once per week even if the semen is not required that week. This ensures that the males are ready to produce good-quality semen if and when required.

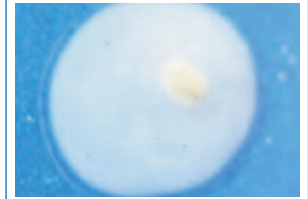
## Semen quality evaluation and conservation

- First inspect the cloaca (vent) for dirt or faeces. To prevent contamination of the semen and only when necessary, gently remove any dirt and faeces.
- Semen should be pearly white and free from urates, faeces or blood (see Figure 26).
- **DO NOT COLLECT**

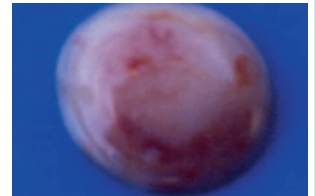
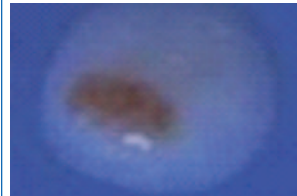
**Yellow semen** – may reduce the fertilizing capacity of the entire sample.



**Thin semen** – a low sperm count can result in reduced duration of fertility and lower overall fertility.



**Contaminated semen** – dirt, urates, faeces and blood can damage spermatozoa and reduce fertility.



**Figure 26. Semen quality**

- Semen from several males is usually pooled.
- The diluent should be warmed before use (e.g. in pocket or hand). Dispense 1ml of diluent in the semen tube before semen collection. Add the semen directly to the diluent as it is collected to prevent clumping and to aid mixing.
- The semen and diluent should be mixed gently but thoroughly, by inverting (ensure there is sufficient space in the collecting tube/syringe to enable proper mixing).

- It is recommended to use no more than a 50–50% dilution rate of semen to diluent because adding more than 50% diluent will cause the semen to run out of the insemination tube.

**Warning:** Once the pooled semen has been collected and diluted, it should be used within 30 minutes and should NOT be allowed to become chilled.

## INSEMINATION OF FEMALES

Different techniques and equipment are used but the basic procedures are common to all approaches. At all times, attention must be paid to the welfare of the bird, the safety of the operator, and high standards of hygiene.

### Insemination

The bird-handler presents the female with everted oviduct towards the inseminator (see Figure 27).



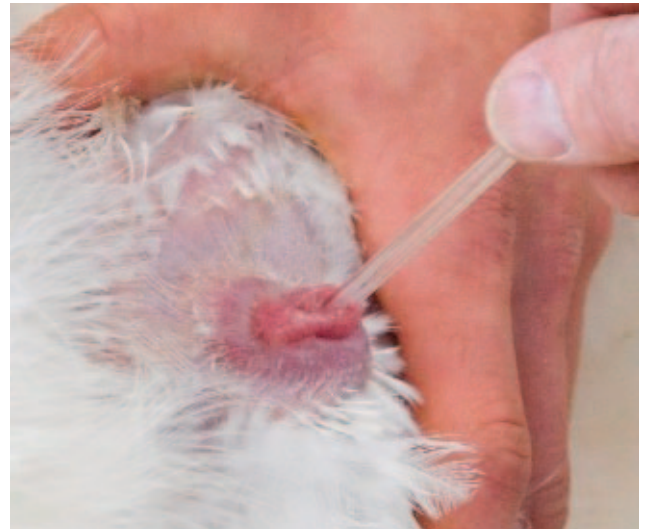
**Figure 27.** Presenting the female with an everted oviduct

During insemination, the handler holds the bird upside-down with both legs in the right hand and the breast between the knees and the inside of the legs. The left hand everts the oviduct around the vent area and squeeze gently with the knees to present the open oviduct towards the inseminator. The inseminator gently inserts the AI tube into the oviduct along the horizontal axis until a very slight resistance is felt due to a flexure in the vagina (see Figure 28).



**Figure 28.** Inserting the AI tube into the oviduct

The AI tube should then be given a slight, gentle circular movement, at which time it will generally enter further. Once the AI tube is inserted into the oviduct, the handler must release the pressure and the oviduct must be allowed to revert to its normal position (see Figure 29). At the same time, the inseminator must expel the semen out (do not use too much force when expelling the semen out) and withdraw the AI tube.



**Figure 29.** Oviduct reverts to normal position

When the AI tube is removed, the female should be gently lowered, holding the tail and releasing the legs to allow the bird to recover her normal posture. If the female is released without care, the semen will be expelled out of the oviduct, which can reduce fertility levels.

If the female fails to retain the semen when the AI tube is removed, then the female should be re-inseminated.

To prevent contamination, it is very important that the inseminator or handler never touches the oviduct of the bird with their fingers. Use cotton wool to remove faeces or other dirty matter if required.

If 'tight' females are encountered when everting the oviduct, this may indicate that the female is not ready for insemination, or that it is going broody, in either case do not force the insemination as this may lead to damage of the oviduct.

## First insemination

Females reach sexual maturity at around 29 weeks of age at point of lay (POL).

The timing of the first insemination is important in helping ensure a high initial fertility and long persistency. The first AI takes place 14-16 days after lighting for medium heavy lines and 18-19 days, or even more for heavy lines.

It is important to identify when the females are ready for first insemination. First insemination is after the first few eggs are laid. If insemination is carried out before this time, there is an increased risk of damage to the oviduct, which could result in infection, egg peritonitis and loss of both production and fertility.

### Key indicators of readiness for 1st insemination:

- 1 Almost all the females show squatting behaviour. Squatting is a manifestation of sexual maturity, particularly when approached (see Figure 30).



Figure 30. Squatting behaviour

- 2 More than 95% of the females can have their oviduct everted. If this is not possible (hymen is present), it is advised to stop the operation and wait another day or two before recommencing.

## Insemination frequency

The first inseminations must be carried out with great care and attention and should avoid unnecessary stress on the females. One insemination will provide enough spermatozoa to fertilise the eggs for many weeks. However, for maximum fertility, 3 inseminations should be planned in the first 7-8 days.

Subsequent inseminations should be made every 7 days throughout the production period. With this insemination frequency, an unsuccessful insemination on one attempt will not affect the fertility of the female before the next insemination. Females should not be inseminated at the peak time of daily egg production (between 10am and 2pm), as this can reduce egg production and fertility.

## Organisation of the insemination process

Different systems are employed for inseminating females. These include standing methods, automatic AI chairs, ramps, and pit systems. Each insemination system must have its own operating protocol, taking into consideration bird welfare, operator safety, and hygiene. The following information outlines the main considerations and basic procedures common to all systems but may require some adjustment, depending on the system employed.

The pen should be organised for insemination using frames to keep birds that have been inseminated separated from the remaining flock. Avoid stressing the females and do not put too many birds in the catching pens (if used). At the same time, avoid any situation where birds may crowd when driven towards the insemination site.

## Semen dosage

A minimum of 0.025ml of semen is required to be inseminated per female to ensure target fertility levels. 1ml of neat semen will be enough to inseminate 40 females. 2ml of semen and diluent can be mixed at 50-50% to reduce the amount of semen residue in the insemination tube.

For the first inseminations, the ratio of semen to diluent is 50:50. This should be increased to 60:40 around the middle of production period. The higher semen ratio is required as the semen storage ability of females reduces with age.

## FEEDING AND NUTRITION

The main objective of feeding the turkey breeder is to produce as many viable poults as possible. To achieve optimum breeder performance, both males and females must achieve adequate physiological development and achieve the breed body-weight standards through rear and lay. This is particularly important in rear as it is well established that growth during the rearing period affects peak production and later persistency.

Adequate management of female body-weight development can be achieved through qualitative feed management, as long as the process is established at an early stage of rear. Quantitative feed management of females is not recommended.

Males need to be fed and reared separately from females, as their protein needs are greater. Therefore, it is critical they receive the correct inputs to achieve full productive capacity. Quantitative feed management of males has considerable benefits in terms of health and livability.

If coccidiostats are being used, they must be checked for their safe use in turkeys. Coccidiostats have a narrow safety margin and can only be used for the correct target species. Chicken feed can contain coccidiostats which turkeys are very sensitive to, particularly after several weeks of age. There are numerous reports of intoxication cases caused by these medications in turkeys. They must as well only be used according to local regulations.

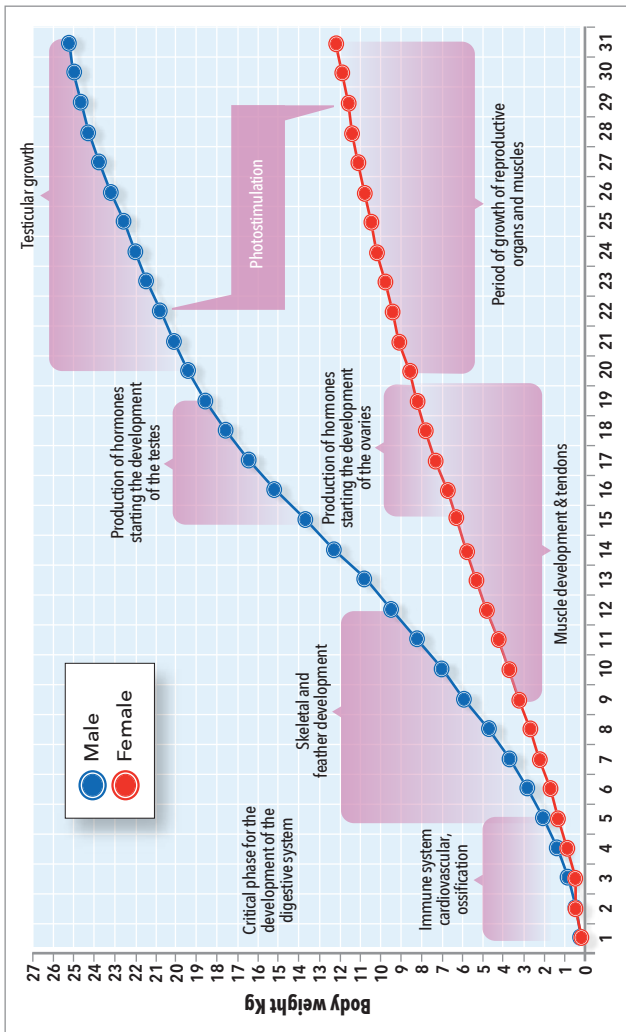
## Feeding females

Achieving development in early rear (5-10 weeks) is critical in achieving the best level of egg production. Females must be in a positive physiological state when day length increases so they can respond to the light stimulus and increase their body weight as the reproductive tract expands. During the early laying period, female feed consumption decreases and consequently body weight tends to decrease. The female must be assisted in this period, as there needs to be sufficient body reserves to support full egg production. This can be achieved by ensuring there is sufficient increase in body weight following light stimulation.

Crucial to a good rear is a dynamic system of monitoring, as well as a reaction to body weight development by adjustment of the feeding programme.

Figure 31 shows the phases of development of major organs and tissues as the bird develops. Breeder nutrition is aimed at satisfying the needs of the bird through these phases.





**Figure 31. Physiological development of breeding stock**

Birds must be able to consume the required amount of feed efficiently on a regular basis to achieve these objectives. Diets must be nutritionally optimal and presented in a form that encourages the birds to develop their appetites.

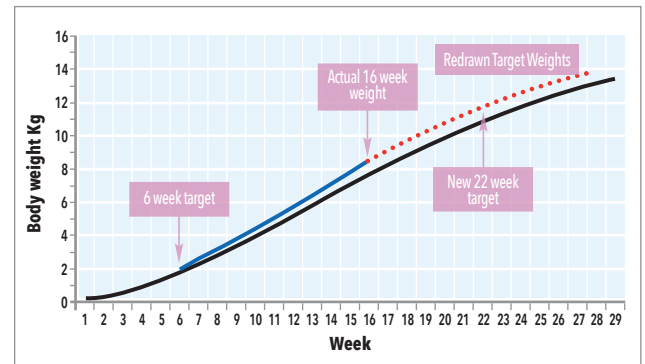
During the first 6 weeks of life, the fundamental development of the digestive, skeletal, immune and cardiovascular system takes place. In the first 24–72 hours, it is important that poults consume as much feed as possible, to get off to a good start and to reach target body weights.

Feed a good quality pre-starter diet that provides the correct balance of nutrients. This should be presented as a sieved crumb or mini-pellet, which encourages the bird’s appetite (see Feed Presentation section, page 66).

From 6 weeks of age through to 22 weeks of age, the birds continue to develop their skeletal structure, as well as feather coverage and musculature. The growth profile of the bird needs to be monitored closely, ensuring body-weight targets are achieved at key critical ages; 6, 16 and 22 weeks of age. Research has shown that if these three points are achieved in a smooth, relatively unbroken line, the female will be set to come in on target and with the proper body composition. Adjustment of the feeding programme may be necessary, based on the growth trend in each period; heavy flocks should move to the next stage diet sooner, while lighter flocks should be held on the higher protein diet longer until body weight objectives are achieved.

Events which place increased demands such as high temperatures, may result in reduced feed intakes and body weights. Females should be changed back to higher-density diets during this period.

From 20 weeks of age, females must be in a positive growth trajectory. Any flock which is heavier than target should not be forced back to the target line by more severe nutritional management. Instead, a new target line should be re-drawn that runs parallel to the original line.



**Figure 32. Female body-weight growth**

The key is that the female is in a positive growth status at lighting in order to respond to the light stimulus. This applies even if the flock is slightly overweight.

From 22 weeks of age to lighting is a key period of development for the females. The key objective is to keep the bird growing at a steady rate through this period, so when light stimulus is given at 29/30 weeks of age, the metabolism of the bird is able to respond immediately and meet the rapid changes in the reproductive system.

From light stimulation to first egg, birds must continue to maintain a positive growth trajectory. Flocks that plateau in weight prior to light stimulation do not respond as positively, if weight gain is insufficient, peak egg production is likely to be lower and spread over a longer period.

## Feeding males

Males must follow a feeding schedule that nutritionally matches their needs and must not be compromised by following the female regime. The protein requirement for males is much higher than females during the earlier stages of growth. Males should be fed the starter diet for at least the first 4 weeks of life.

Male weight should be managed in the same way as for females, through regular monitoring of body-weight development (against target and adjustment of the feeding schedule) when the birds begin to move away from the breed target.

Following final selection, males should be fed diets which enable them to make positive weight-gains week-on-week without becoming overly conditioned, whether they are fed ad-lib or adapted amounts. Avoid excessive drops in dietary protein (digestible amino acid) density in any feeds given to birds less than 14 weeks of age.

During the productive period, males should receive the same vitamin and trace mineral supplementation as the laying female.

## Feed presentation

Feed presentation on the farm needs to be suitable to encourage efficient feed intake by the turkeys. The feed should meet the standards shown in Table 14, to ensure the crumble or pellets actually arriving at the feeder are suitable for the turkeys to readily consume.

### Crumble Profile - in front of the poults

Particle Size (mm)	<1	1-2	2-3	>3
Proportion (%)	<10	40-50	30-40	5-10

### Pellet Size

Age (weeks)	0-2	2-4	4-8	8-12	12+
Diameter in mm	Crumble made from 3mm pellet	2-3mm	3-3.5mm	3-3.5mm	3-4.5mm

**Table 14.** Guideline specifications for crumbles and pellets

During the starter period, it is essential to feed a good-quality diet presented as a sieved crumb, which encourages the birds appetite. Crumb must be provided in an even form and particle size profile ranging from 1-3mm (see Figure 33), with minimal levels of fines (<10% particles less than 1 mm).



**Figure 33.** Example of a starter feed crumble

The diet needs to have enough structure to enable the young birds to pick up particles. Too fine or dusty a feed will result in the birds being unable to pick up particles. Too large a particle and the birds will not be able to swallow the particles.

As the poults get older, the feed particle size can be increased (see Figure 34) and small-diameter pellets can be introduced after 21 days. Males should be fed the starter diet for a minimum of 4 weeks.



**Figure 34. Coarser crumb**

Generally, the use of a good-quality mini-pellet (up to 2mm in diameter) provides a superior feed form if crumble quality is poor. However, pellet length should not be any longer than the diameter.

The transition from crumbled to pelleted feed should be gradual, to ensure that the benefits from the early growth period are maintained. Birds may reject feed if pellets are too large or too long, as they may not be ready for the larger size, and it is recommended that the two feeds are mixed for a period to allow for adaptation. The first pellets introduced after the crumbled or mini-pellet diet should be short-cut, 4-5mm in length (see Figure 35), and not too hard. Durability should be 88%-92% (Holmen, 30 seconds).



**Figure 35. Short cut pellets**

Birds are very sensitive to variation in feed physical quality, feed intake will be consistent when pellet quality is consistent from one delivery to the next. Pelleted diets must be a consistent durable pellet (90%-95% Holmen, 30 seconds) in order to provide for efficient feed consumption. Fine particles (<1mm) must be kept to a minimum, lower than 10% (see Figure 36).



**Figure 36. Pelletised diet**

Physical quality of feed is practically assessed by the size of the feed particles actually presented to the birds in the feeding system. Assessment of feed physical quality is often difficult on the farm and subjective opinions can lead to a poor description of feed texture. A portable shaker sieve can be used on the farm to quantify particle size profile of feed (see Figure 37). Samples must be made of the feed from the feed pan, as presented to the bird. Further guidelines on the use of the hand sieve can be found on the Aviagen Turkeys website.



**Figure 37. Feed sieve**

## Feed management

Feeders should be kept clean and free from contamination, and the level of fines should not be allowed to build up (see Figure 38 and 39). As a management tool, it can be useful to switch off the feeder line for a short period twice a week to encourage the turkeys to clean down the pans and to stimulate appetite. The turkeys should never be left without any feed available for longer than 1 hour.

To reduce nutritional change for the bird due to any alterations in the feed (raw material use or presentation), a gradual transition between two sequential diets can be achieved by mixing the two rations together for 1–2 days, if the farm has the suitable equipment.



*Figure 38. Bad example of feed (Dust)*



*Figure 39. Good example of feed*

## Feed composition

The ingredients used in turkey diets need to be highly digestible and of the best available quality, as young birds in particular are very responsive to digestible protein intake. Use of excessive levels of soya should be avoided and use of consistent higher protein density sources are preferable. Use of alternative protein sources can help to reduce over-reliance on soya protein ingredients; this can be particularly beneficial in early stage diets. Excessive levels of indigestible protein can have a negative effect on performance and health; undigested protein can accumulate in the caeca of the turkey, resulting in digestive upsets and wet droppings. This can lead to increased condemnations and also have negative impacts on welfare.

## Feed quality and processing

In order to maintain a zero Salmonella status in a breeder flock, it is important to source feed from a feed company that is capable of ensuring the microbiological status of the feed matches the requirements of the customer. The feed company should have procedures in place to monitor ingredients on a regular basis and to both kill Salmonella during processing and prevent recontamination afterwards. A control system based on HACCP principles should be in place with outcomes in line with the biosecurity requirements of the flock.

Mycotoxins are secondary metabolites produced by fungi, which can be toxic to humans and animals. Poultry are highly susceptible to T-2 type toxins and moderately sensitive to aflatoxins; however turkeys, especially younger birds, are most sensitive to these toxins in general.

Several mycotoxin binders and deactivators are available. To gain the most cost effective response, it is necessary to understand the challenge to the feedstuff by analysing the mycotoxins present. The correct mycotoxin binder or deactivator should be selected, based on the appropriateness of its activity.

## WATER

Providing a clean, healthy and safe water supply is crucial to ensuring flocks perform at their best. Water not only serves as a vital nutrient but it also impacts on virtually every physiological function in the body. Factors which might alter water quality, such as bacterial content, pH, nitrogen levels, hardness, alkalinity or mineral levels, smell and tastes can directly impact water consumption or the bird's ability to utilise consumed water.

### Biological function

- Digestion and absorption, where it supports enzymatic function and nutrient transportation.
- Thermoregulation.
- Passage of food through the gastrointestinal tract.
- Elimination of waste.
- It is also an essential component of blood and body tissues.

### Cleaning water lines between flocks

For effective water hygiene management during the flock life cycle, the water distribution system must be thoroughly cleaned during the clean-out period to remove biofilm, scale and other deposits.

### Water quality management through the life cycle

Daily water line cleaning is required in addition to water line cleaning between flocks. This is because bacteria, fungi or yeasts can quickly re-establish a biofilm in the water system. Some additive products provided via water can also create conditions favourable for the growth of yeasts and moulds if present.

A daily water sanitation programme will therefore benefit the birds and the water system.

To maintain clean water, water lines and drinkers need to be routinely cleaned. Water lines should be flushed and drinkers washed a minimum of three times per week. During the first week of life, cleaning should be done at least once per day.

High-pressure flushing of water lines will create the velocity and turbulence in the pipe to remove biofilm.

Utilisation of disinfectants approved for use in the drinking water of food animals reduces the level of water-borne pathogens. Chlorine is the most popular disinfectant because it is inexpensive and widely available. Turkeys are sensitive to taste and can reduce the water intake as a result.

### Measuring water line sanitation



*Figure 40. Measure of water quality*

ORP (Oxidation-Reduction Potential) is an important measure of water disinfection. ORP refers to the property of disinfectants (such as chlorine) to be a strong oxidiser. A strong oxidiser destroys viruses, bacteria and other organic material, leaving water microbiologically safe.

An ORP value in the range of 650 millivolts or greater indicates good-quality water that can be effectively disinfected by as little as 2-4 ppm free chlorine. A lower ORP value such as 250 millivolts can indicate a heavy organic load that will most likely overwhelm chlorine's ability to properly disinfect the water.

Testing the free chlorine level in the water can be used to identify supplies with inadequate free chlorine and for adjusting this without overusing chlorine.

Water with a heavy organic load would result in a greater percentage of bound chlorine, resulting in a poor sanitation.

The most important points are to utilise information on pH, ORP and chlorine level to determine if the disinfection programme is effective. This information can also be used to prevent equipment damage by the overuse of chemicals.

**Warning:** *Water must be free from disinfectants during the period of administering vaccines or medications!*

**Do not mix several disinfectant products in the same stock solution!**

Regular assessments of water quality are necessary for monitoring microbial load and mineral content. The water supply should be checked for the level of hardness (calcium salts), salinity and nitrates. After cleaning out, and prior to poult delivery, water should be sampled for bacterial contamination at source, from storage tanks and from drinkers. Regular assessments of water quality throughout the production period should also be made.

Contaminant, Mineral or Ion	Acceptable Level
Total Bacteria	<1000 CFU/ml
Total Coliforms	<50 CFU/ml
Fecal Coliforms	0 CFU/ml
pH	5-8
ORP	650-700 millivolts
Total Hardness	<110 mg/l
Mineral Elements	
Calcium	<110 mg/l
Magnesium	<125 mg/l
Iron	<0.3 mg/l
Manganese	<0.05 mg/l
Chloride	<150 mg/l
Sodium	<150 mg/l
Sulphates	<200 mg/l
Nitrates	<25 mg/l
Lead	<0.014 mg/l
Copper	<0.6 mg/l
Zinc	<1.5 mg/l

**Table 15.** *Acceptable concentrations of minerals and organic matter in water supply*

The established guidelines for microbial and mineral water quality for poultry are outlined in Table 15. This table, and the factors outlined below, should be used to develop a daily water line disinfection programme applicable for the local conditions of the farm.

## Water disinfection

Water lines should be designed so that they can be opened to drain completely when the cleaning is complete. Once the system has been cleaned, it is important to keep it clean using a daily water disinfection programme for your birds.

Use of disinfectants approved for use in the drinking water of food animals provides protection from pathogens. Chlorine is the most popular disinfectant because it is inexpensive to use and widely available (gas chlorine, sodium hypochlorite and calcium hypochlorite). Other commonly used water disinfectants are chlorine dioxide and hydrogen peroxide (see Table 16).

Sanitizer	Common Forms	Target Residual	Comments
<b>Chlorine</b>	Gas-(Cl <sub>2</sub> ) Sodium hypochlorite NaOCl Calcium hypochlorite Ca(OCl) <sub>2</sub>	3 - 5 ppm free chlorine	Chlorine is most effective when water pH is adjusted to 5 - 7. Effective in oxidising manganese, iron and sulphur. Some pathogens are resistant to chlorine. Inexpensive.
<b>Chlorine Dioxide</b>	Generated by reacting liquid sodium chlorite with an acid	0.8 - 2.0 ppm per product recommendations	Effective against chlorine-resistant pathogens and effective over a wide pH range (5 - 9). Also effective in oxidising iron and manganese. Expensive.
<b>Hydrogen Peroxide</b>	H <sub>2</sub> O <sub>2</sub>	25 - 50 ppm	Not as effective in oxidising iron and manganese. Stabilised products provide residual longer than non-stabilised forms. Expensive.
<b>Ozone</b>	O <sub>3</sub>		Unstable, so must be generated at point of use. No residual activity. Very effective germicide and virucide. Must filter water post-ozonation. Expensive.

**Table 16. Commonly used water disinfectants**

## VENTILATION

Ventilation is a key aspect of successful turkey management. Too little ventilation results in ammonia and wet litter, whilst too much ventilation results in draughty conditions, increased dust particles from feed, feathers, dried droppings and high heating costs.

### There are five reasons for ventilating turkey houses:

- 1 To provide oxygen for respiration.
- 2 To remove excess heat.
- 3 To remove excess moisture.
- 4 To minimise airborne dust.
- 5 To minimise build-up of harmful gases such as ammonia, carbon dioxide or carbon monoxide during brooding.

Key air quality guidelines for turkey houses are shown in Table 17.

Air Quality Guidelines	
Oxygen%	>19.6%
Carbon Dioxide (CO <sub>2</sub> )	<2500 ppm
Carbon Monoxide	<10 ppm
Ammonia	<20 ppm
Relative Humidity	50 - 70%
Inspirable Dust	<5 mg/m <sup>3</sup>

**Table 17. Air quality**

Good air quality management requires heating and ventilation systems which provide a balanced environment. The method used to ventilate a house fundamentally depends on the structural design of a turkey house (open or closed housing), the ventilation choice and the local climate. When installing ventilation systems, these should have capacity over-specified by 20% to account for system wear and cleanliness.

## Key points:

- Seal cracks and areas where air can leak in, causing draughts and heat loss. Pay close attention to doors, inlets, outlets or curtains.
- Check correct fan operation between every flock after final disinfection.
- Calibrate all thermostats to enable accurate settings.
- Adjust ventilation to provide the minimum air renewal.
- If power-ventilating, adjust fan thermostats according to target temperature. Thermostat fans should begin to come on 1°C above target temperature.
- Mixing fans can be used to reduce temperature stratification and improve heating efficiency. They should be hung close to the ceiling at approximately every 15-18m.
- Utilise heat as needed to reduce litter moisture, together with increased ventilation.
- Do NOT compromise air quality for energy savings.

## In naturally ventilated housing

- Curtains need to be continually adjusted in response to any changes in the environment, both internal and external.
- When outside conditions are cold, circulation fans can be used to mix the warm air which has risen and has accumulated in the roof of the house.
- In hot weather, circulation fans can also help by creating a cooling effect over the turkeys through air movement. Circulation fans should be hung from the ceiling at 1m of height, with an 80° angle with the floor. The distance from one to the next should be 12m maximum.

## In closed housing

In order to provide the best environment for turkeys throughout the production cycle, a three-stage ventilation programme is recommended:

- Minimum ventilation.
- Transitional ventilation.
- Tunnel ventilation.

## Minimum ventilation

Minimum ventilation rate is the smallest volume of air necessary to ensure that the birds have sufficient oxygen, that pollutants such as dust and ammonia are removed, and that litter quality is maintained through removal of moisture.

The key to successful minimum ventilation is creating a partial vacuum (negative pressure) so air comes through vents and is directed across the ceiling. This will ensure that incoming air is mixed with warm in-house air above the birds, rather than dropping directly onto the birds and chilling them (see Figure 41). This type of ventilation is preferably timer-driven.

A smoke machine or smoke cartridge can be used to indicate air speed and direction. This will help in the management of how many and by how far inlets should be opened.

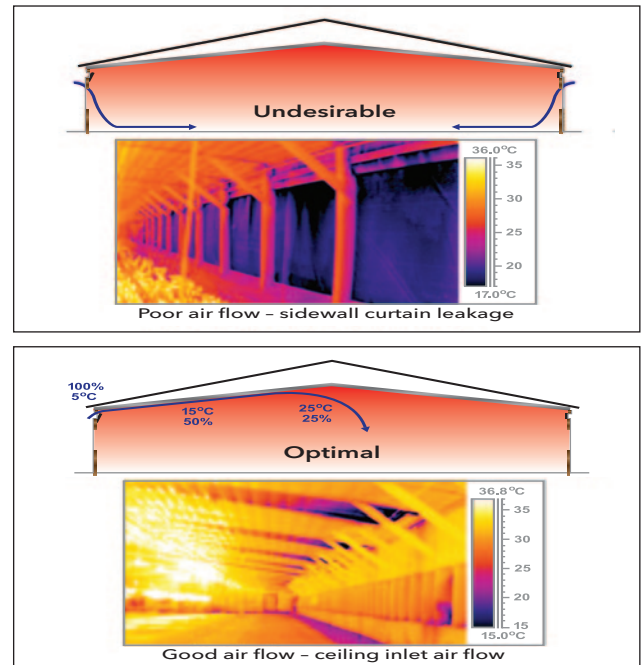


Figure 41. Air flow



## Transitional ventilation

Transitional ventilation operates using two ventilation principles based on the outside temperature and the age of the birds. It is used where both hot and cold periods are experienced. Whereas minimum ventilation is timer-driven, transitional ventilation is temperature-driven. Transitional ventilation begins when a higher than minimum air exchange rate is required. That is, whenever temperature sensors or thermostats override the minimum ventilation timer to keep fans running.

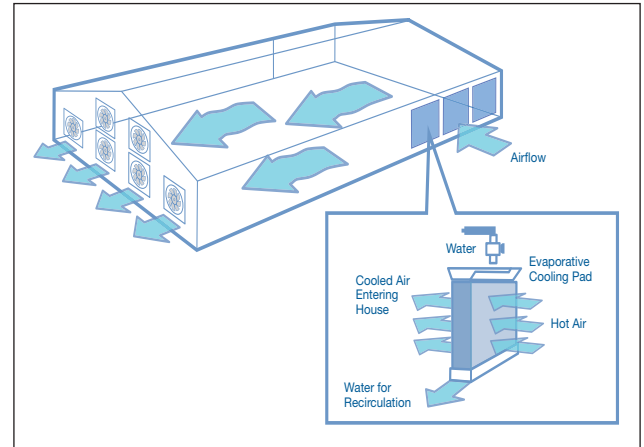
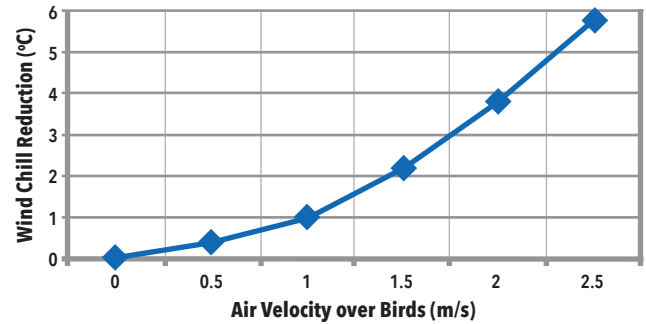
Transitional ventilation works in the same way as minimum ventilation, but a larger fan capacity gives a larger volume of air exchange. Successful transitional ventilation requires vents linked to a static pressure controller so heat can be removed without switching to tunnel ventilation.

## Tunnel ventilation

Tunnel ventilation keeps birds comfortable in warm to hot weather and where large birds are being grown by using the cooling effect of high-velocity airflow. Air movement is one of the most effective methods of cooling birds during hot weather. As air moves over a bird's hot body, heat is removed from the bird, making it feel cooler. The greater the amount of air movement, the greater the cooling effect produced. Birds will feel cooler when exposed to air movement during hot weather, and will continue to eat and grow.

## Cooling systems

The internal house temperature cannot be lower than the external temperature, unless a cooling system is installed, because of heat production from the birds. In summertime it is recommended to use tunnel ventilation in order to obtain an air speed cooling effect and/or the use of pad cooling or a water spray system (see Figure 42). With pad cooling, warm outside air is sucked into the house through moist cellulose pads. The air then takes up humidity and lowers air temperature.



**Figure 42. Pad cooling with tunnel ventilation**

As a general rule, ventilate a turkey house by providing a constant ratio of ventilation of  $1\text{m}^3/\text{kg}$  live weight/hour. This is applicable throughout the production cycle and will allow enough air-flow in the house to enable control of the  $\text{CO}_2$  level ( $<2500$  ppm), moisture, ammonia and dust. This ratio can be adjusted by monitoring bird behaviour, internal house temperature and humidity.

## APPENDIX

### Page 53 - 54 Chapter on 'Male management in production'

*BURROWS, W. H. & QUINN, J. P. (1937). The collection of spermatozoa from the domestic fowl and turkey. Poult. Sci. 16, 19-24.*

### Page 72 - 76 Chapter on 'Water'

*Aviagen Turkeys would like to thank Dr. Susan Watkins from the University of Arkansas for her contribution to this chapter and for her work with the turkey industry on developing water sanitation programmes.*

# POSTER SERIES

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**Aviagen** **How to set up farm biosecurity**

**KEEP A RECORD**

- Physical, digital, paper records

**VEHICLES**

- Wash and disinfect vehicles
- No food
- No pets
- No birds

**SHED TO SHED ACCESS**

- Use footbaths
- Disinfect boots
- No direct access

**LITTER**

- Use clean litter
- Change litter regularly
- Dispose of litter

**WORMS**

- Quarantine new birds
- Avoid shared facilities
- Prevent change of clothes and boots

**PEST CONTROL**

- Regular inspections
- Seal gaps
- Use traps

**ANIMAL CONTROL**

- Secure gates
- No access to farm

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**Aviagen** **Successful turkey poult start**

**Preparation and set up**

- Clean brooder and equipment to standard and disinfect well
- Make sure equipment is working properly (Brooders, Fans, Gasolines, Lights)
- Have sufficient ventilation to maintain good air quality
- Check brooder every 2 hours
- Check brooder every 2 hours
- Check and replace wet litter
- Check and replace wet litter
- Check and replace wet litter
- Check and replace wet litter
- Check and replace wet litter
- Check and replace wet litter

**Constant**

- Good and even lighting
- Check brooder every 2 hours
- Check brooder every 2 hours
- Clean and refill drinkers
- Check and replace wet litter

**Placement**

- Weighing the poults by brooder flock age
- Place poults close to brooder points and brooder points
- Observe and qualify place the poults
- Cover the poults to get used to new environment
- Clean and disinfect

**Key factors to a good start**

- Check brooder every 2 hours
- Availability of brooding points and brooder equipment
- Check and replace wet litter
- Check and replace wet litter
- Check and replace wet litter

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**Aviagen** **What is a good quality hatching egg?**

**Good quality hatching eggs**

- Good
- Good 1
- Good 2

**Eggs with an increased risk of lower hatchability or contamination**

- Blood on shell
- Elongated
- Rough shell
- Slight soiling
- White shell

**Reject eggs like these**

- Cracked
- Misshape
- Hairline crack
- Soft-shell
- Heavily cleaned
- Toe punch
- Large
- Wrinkled shell
- Small
- Soiled
- Skin
- Yolk on shell

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**MANAGING BIRD WELFARE**

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- Functionality
- Maintenance

**LIGHTING**

- Light Quality
- Daily Sleeping Periods

**LITTER**

- Quantity
- Quality
- Management

**MANAGEMENT**

- Training of Staff
- Emergency Plans
- Stockmanship
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- Single Age Farms
- Humane Euthanasia of Sick Birds
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- Air Quality

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## NOTES:

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