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Aviagen® Turkeys

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MANAGEMENT GUIDELINES FOR COMMERCIAL 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 improvement 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:
Freedom to express normal behaviour	Affinity and empathy with animals
Freedom from fear and distress	Dedication and patience

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

- 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 different species farms and, preferably, not even between poultry farms.
- No-one should enter the farm if they have influenza, diarrhoea or 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.

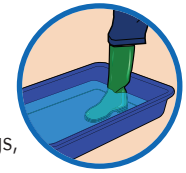
- Anyone entering the facility must adhere to all biosecurity procedures and sign the visitors' book or register, indicating the date, place of last livestock contact and contact details. This is to allow traceability of movements in the event of a disease outbreak.
- Connecting corridors between buildings 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.

- Anyone entering the farm must wear farm-dedicated clothing, footwear and wash their hands.
- If a shower is provided, enter the shower room and shower, paying special attention to washing hair, hands and fingernails.
- 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.

Figure 1. Feed bins

Birds, rodents, insects and mammals

- Ensure all poultry houses are wild bird-proof.
- Pest-proof buildings as much as possible.
- Put out rodenticides and insecticides and check them regularly in accordance with local legislation.

- Do not allow pets or other animals to enter the farm perimeter.
- Do not allow the accumulation of materials, waste and redundant equipment in and around the farm.
- Maintain a "vegetation-free" zone at least 1m around all houses, and control all grass and weed growth.
- Avoid and immediately clean up any feed spills.
- Avoid and repair leaking plumbing or other sources of standing water.
- 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.

Figure 2. Rat bait box

CLEANING AND DISINFECTION

An essential element to keeping the farm free of disease is the 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 long enough to allow for thorough cleaning and disinfection.
- 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.
- 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, after every flock.

Figure 3. 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, hoppers, fans and drinker lines.
  - Flush water lines and drinkers with fresh, chlorinated water after line disinfecting (see Water, page 30).
- Secondary disinfecting:
  - To enhance disinfection, fumigation can be useful after the equipment has been put in place.
- 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 bio-security 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.*
- Fumigate 2–3 days before placement.
- Hygiene testing is useful in monitoring the effectiveness of cleaning and disinfecting.

Figure 4. Thermal fogger (Courtesy of Agrex Limited)

PREVENTIVE HEALTH CARE

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

- Growth rate.
- Feed conversion efficiency.
- Condemnations.
- Liveability.
- Processing traits.

The flock must start with healthy, good-quality day-old poults. The poults should be sourced from breeder flocks with a known good health status.

On-farm disease control programmes involve:

- Disease prevention, including biosecurity and vaccination programmes.
- Early detection of ill health by monitoring health status and production parameters.
- Timely treatment of identified disease conditions.

Biosecurity and vaccination are both essential to successful health management. Biosecurity is used to prevent the introduction of disease. Vaccination programmes are used to address endemic disease. A poultry veterinarian familiar with local challenges and licensed products should be consulted for an appropriate vaccination programme.

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:

- Birds dead on arrival (D.O.A.).
- Weekly weights.
- Daily and weekly mortality.
- Daily water consumption.
- Daily feed consumption.
- Weekly average body weight (daily or weekly).
- Processing condemnations.

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.

GROWING SYSTEMS

Basically there are two systems for growing turkeys:

- **All-in, all-out system.** Birds are grown on the same farm or house for their entire life. The space available to them is gradually adjusted depending on the age of the birds and the level of management.

	HEAVY BREEDS (poults/m²)	MEDIUM BREEDS (poults/m²)
Males only	3.2 – 3.3	3.6 – 4
Females only	5.8 – 6.2	6.2 – 7
As hatched (50% of each sex)	4.3 – 4.5	4.9 – 5.5

Table 2. Suggested day-old stocking density

However, these numbers have to be adapted depending on the quality of the farm and the level of management, local legislation and customer requirements. Stocking density should be calculated on floor space available for the birds, excluding space taken up by equipment.

- **Brood and move system.** Birds are reared on a brooding farm or house normally until 4–6 weeks of age. Birds which are moved at around 6 weeks of age should not be stocked at more than 8–10 birds/m² maximum. Birds are then transferred to finishing houses for the remainder of the cycle. Finishing houses may be located on the same farm or, preferably, on a separate finishing farm.

  In the "brood and move" system, the stocking density of the birds will depend on the level of management, housing, litter and ventilation, as well as the age of the birds at transfer. Care should be taken to avoid transferring the birds at the same time as other stressors, such as vaccination or feed changes. Changes to feeders, drinkers, litter type and stocking density should be introduced gradually. Delays (even 1–2 days) in planned transfer to the finishing houses, and resulting increase in stocking density, can cause flock unevenness and lack of growth.

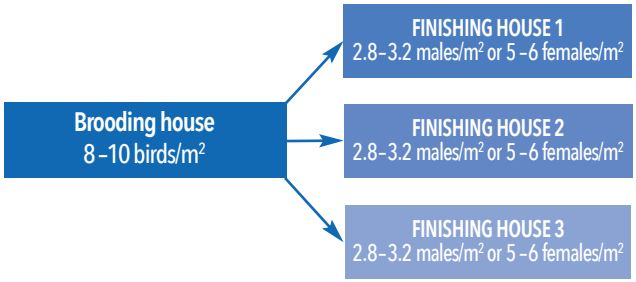


Figure 5. Example of a brood and move system

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 poults 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 6. Example of supplementary drinking equipment

- Water lines should be cleaned prior to placement.
- Provide 2 drinking points per 100 birds, 50% of which are supplementary equipment.
- 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 a bucket and discarded outside of the brooding room.
- No vitamins or antibiotics should be added at placement, unless for a specific known problem – as prescribed by a veterinarian.

Feed

- Ensure 2 feeding points per 100 birds, 50% of which are supplementary equipment to equal 2.5cm of feeding space per poult; provide a combination of feeders and cardboard egg trays (see Figure 7).
- Position feeders at least 30cm from the edge of the 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 an optimal size, consistent and with minimal fine particles <1mm (see Feed section, page 35).
- 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.

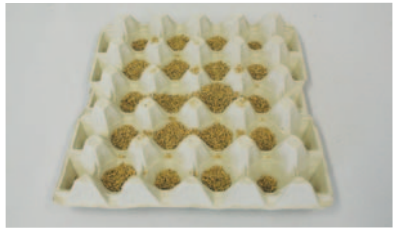


Figure 7. Examples of supplementary feeding equipment

Crop fill assessment

Assessment of crop fill at key times after placement is a useful means of determining appetite development and checking that all poults 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 poults have found feed and water (see Table 3). During our studies, carrying out a crop fill analysis between 5–8 hours gives the strongest representation of how the poults have started and the early development of the poults. A minimum of 100 poults 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 3. Target crop fill assessment guidelines

Scan the QR Code for the full procedure to check your day-old placements of poults 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 1m 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 temperature 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.

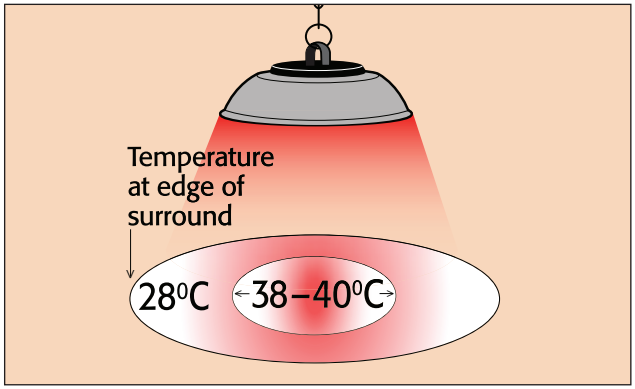


Figure 8. Brooder temperature

Lighting

- Provide a minimum of 80 lux of light in the house.
- For the first 24 hours, birds 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 8 hours of continuous darkness per night. (see page 24).

Brooding in surrounds

- Brooder surrounds should be 3–5m in diameter depending on brooder power (see Table 4).

Surround diameter (m)	Brooder Power (kW)	Suggested poult number
3.0–3.5	2.6/3.8	200–220
3.5–4.0	3.8/4.7	270–290
GENERALLY LESS BIRDS = LESS COMPETITION		

Table 4. Suggested brooding requirements

- Surrounds should be at least 60cm away from the outside wall of the house.
- Make surrounds with cardboard or wire mesh 30–45cm high. When the house temperature is expected to drop below 21°C or the house is draughty, use 45cm 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 brooder ring.

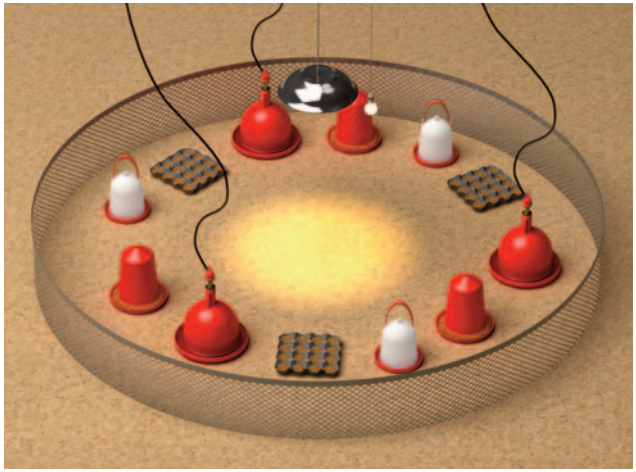


Figure 9. Brooding set-up

Place poults 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 poults' behaviour and house conditions every 2 hours will determine which adjustments should be made (see Figure 10). Excessive noise from the poults may indicate the wrong temperature or lack of water or feed. Avoid exposure of the poults to sudden temperature or environmental changes. Let the poults 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 poults.
- After 5–7 days of age, poults can be released from surrounds.

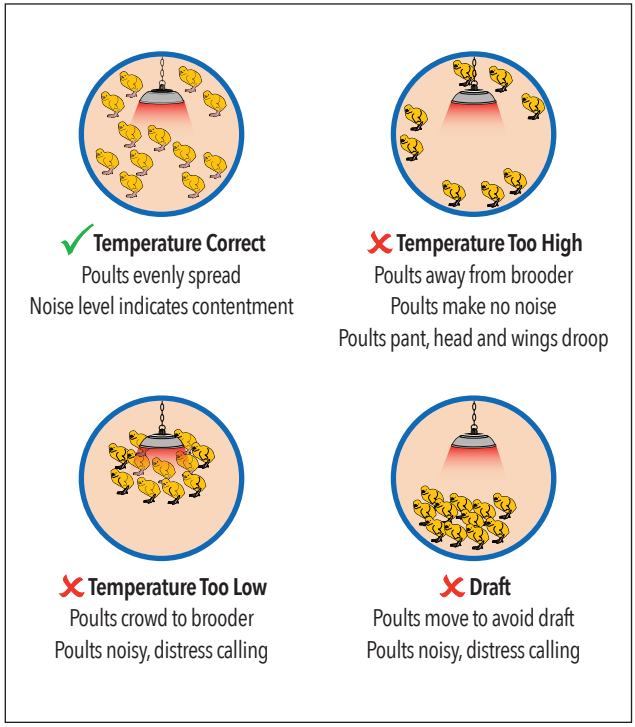


Figure 10. Poult distribution in brooder surrounds

Whole house brooding

- Whole house brooding involves warming the entire shed to the required brooding temperature. No surrounds or very large surrounds are used.
- Whole house brooding is sometimes used to simplify brooding management and reduce heating costs **however it requires more careful management compared to brooding in a ring and may not be suitable for poults which have had a long transfer from the hatchery.**
- The most important aspect is to produce an environment without temperature fluctuations and draughts within the house, to keep poults from piling or grouping and to keep them evenly spread and active.
- Houses should be pre-warmed for a minimum of 48 hours prior to poult placement, and 72 hours ahead during cold months of the year.
- Ambient temperature should be at least 36–37°C on the first day and the floor temperature at least 30°C.
- For a weekly target temperature profile see Table 5 on page 21.
- It is also important to evenly distribute the water and feeder supply over the entire usable area. The layout of the brooding house should be similar to that employed in surrounds, to ensure that poults should be able to find water and feed within 1.5m.
- At placement, ensure immediate fresh water availability at room temperature.

Figure 11. Whole house brooding

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 poult level. Target environmental temperatures for commercial stock are detailed in Table 5.

Age	Sex	Under the Brooder °C	Ambient Temperature °C	Whole House Brooding °C
Day 1	M+F	40		36–37
Day 2	M+F	40		35–36
Day 3	M+F	39–40		34–35
Day 4 to 7	M+F	38–40		Decrease 1°C per day
Week 2	M+F		27–28	27–28
Week 3	M+F		25–26	25–26
Week 4	M+F		23–24	23–24
Week 5	M+F		21–22	21–22
Week 6	M+F		20–21	20–21
Week 7	M+F		19–20	19–20
Week 8	M+F		18–19	18–19
Week 9	M+F		17–18	17–18
Week 10 until depletion	M+F		16–17	16–17

Table 5. Target environmental temperatures

GROWING MANAGEMENT

Drinkers

- Provide one bell-type drinker per 80–100 birds (see Figure 12).
- 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 drinker height so that the drinker lip is at the average bird back height.
- Drinkers should be cleaned daily.
- During hot weather, flush drinker lines to provide fresh, cool water.

Nipple drinkers are being used more commonly in commercial turkey production.

- These have the advantage by maintaining higher water hygiene levels and lower labour inputs.
- Follow manufacturer's instructions for birds per nipple and management techniques.

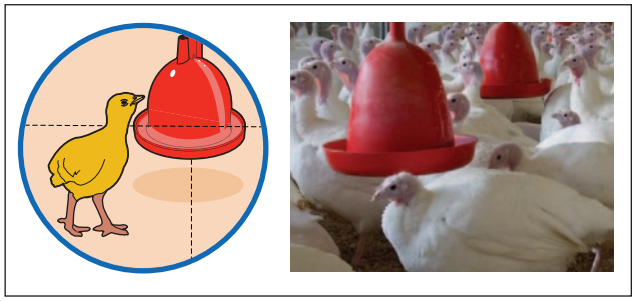


Figure 12. Example of drinker height

Feeders

- Ensure good-quality feed is available when the birds are delivered.
- Before the birds arrive, adjust the feed level so the feeders are full.
- 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 height so that the feeder lip is at the average bird back height.
- Check feed 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, respiratory disease and carcass downgrades.

Good litter materials should be dry, absorbent and friable, provide insulation and be free from contaminants. Wood shavings (recommended) and chopped straw are commonly used litter materials for turkeys. 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 6. Litter quality *1 = low to 5 = high*

Fresh litter should be used for each crop, 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 level within the brooding surrounds.

It is important to avoid 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 feeders and drinkers to the correct height as the turkeys grow.
5. Good ventilation management.

Light

Due to the variety of housing systems, it is difficult to provide a generic lighting programme. However, the key principles which should be followed are:

- Always check local regulations and codes of practice concerning minimum and maximum periods of light for turkeys.
- Light levels should be uniform across the entire house.
- During the first few days of life, the lighting programme must be adapted to bird activity and behaviour.
- Measure light intensity at bird height.
- Use of dimmable lamps is recommended to allow adjustment of light intensity, according to bird behaviour.
- Light intensity and day length will influence activity, feed consumption, and pecking; adjust as needed.
- Use the correct light from the colour spectrum for growing commercial turkeys which should be >4000 kelvin.
- A minimum of 8 hours of darkness is recommended for good bone development and optimum performance (see Table 7).
- Transition between light and dark at the start or end of the day should be gradual.
- Always replace faulty bulbs/tubes immediately.

Lighting Program	
Day 1	23 hours of light (80 – 100 lux)
Days 2 – 5	Increase the dark period gradually
Day 5 until depletion	At least 8 hours of darkness to promote good bone development

Table 7. Lighting program

VENTILATION

Ventilation management is a key aspect of successful turkey production. Too little ventilation results in ammonia and wet litter, whilst too much ventilation results in draughty conditions, increased dust particles from feed, feathers and 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 8.

Air Quality Guidelines	
Oxygen%	>19.6%
Carbon Dioxide (CO_2)	<2500 ppm
Carbon Monoxide	<10 ppm
Ammonia	<20 ppm
Relative Humidity	50–70%
Inspirable Dust	<5 mg/m^3

Table 8. 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 space 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 environmentally controlled, 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 13). 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.

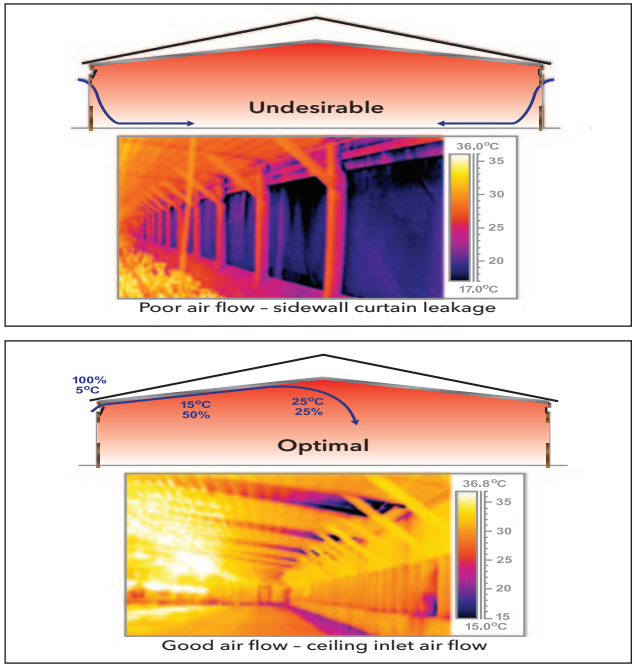


Figure 13. Air flow

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.

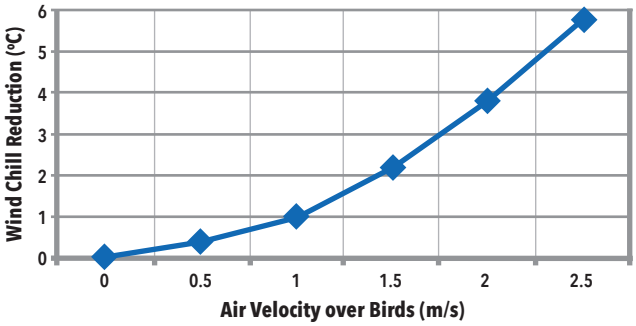
Transitional ventilation works in the same way as minimum ventilation, but a larger fan capacity gives a larger volume of air exchange. Successful transitional ventilation requires vents linked to a static pressure controller so heat can be removed without switching to tunnel ventilation.

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 14). 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.



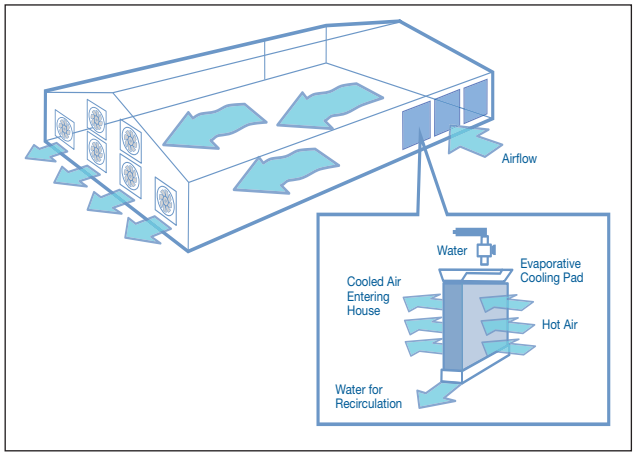


Figure 14: Pad cooling with tunnel ventilation

As a general rule, ventilate a turkey house by providing a constant minimum ratio of 1 m^3 of air /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 CO_2 level (<2500 ppm), moisture, ammonia and dust. This ratio can be adjusted by monitoring bird behaviour, internal house temperature and humidity.

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, 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 program 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 15: 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 9. Acceptable concentrations of minerals and organic matter in water supply

The established guidelines for microbial and mineral water quality for turkeys are outlined in Table 9. 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 the 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 10).

Sanitizer	Common Forms	Target Residual	Comments
Chlorine	Gas-(Cl_2) Sodium hypochlorite NaOCl Calcium hypochlorite $Ca(OCl)_2$	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.
Chlorine Dioxide	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.
Hydrogen Peroxide	H_2O_2	25 – 50 ppm	Not as effective in oxidising iron and manganese. Stabilised products provide residual longer than non-stabilised forms. Expensive.
Ozone	O_3		Unstable so must be generated at point of use. No residual activity. Very effective germicide and virucide. Must filter water post-ozonation. Expensive.

Table 10. Commonly used water disinfectants

FEEDING AND NUTRITION

Aviagen Turkeys provides nutritional specifications in order to achieve performance objectives. Turkeys need to be able to consume the required amount of feed efficiently on a regular basis to achieve these objectives. Any factors that delay or discourage birds from eating will result in slower development. The physical form of the feed can be as important as the nutrient content.

Coccidiostats must only be used according to local regulations. 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 at older ages. There are numerous reports of poisoning cases caused by coccidiostats in turkeys.

Feed form

A good poult start ensures the best performance from the flock. During the first 4 weeks of a bird's life the fundamental development of the skeleton, immune system and cardiovascular system takes place. Exposure to stress during this period compromises the development of these vital systems. Good health status, feed quality and feed intake allows birds to establish the foundation required to carry them through the finishing stage.

In the first 24–72 hours of life it is very important that poults consume as much food as possible. The starter feed should be presented as a sieved crumb, manufactured from durable pellets with a maximum diameter of 3.5mm. If a crumbed product is not available, then a coarse mash can be fed; however, the levels of fines (particles <1 mm) must be minimised. Small-diameter pellets 1.5–2.0mm can be used, though pellet length should not be longer than the diameter. Both crumbs and pellets should not contain more than 10% fines. Table 11 should be used as a guide for the optimal crumble particle size to be presented to the poults.

Particle Size	<1mm	1 to 2mm	2 to 3mm	>3mm
Starter 1	0 – 10%	45 – 55%	30 – 40%	0%
Starter 2	0 – 10%	25 – 30%	35 – 45%	10 – 15%

Table 11. Crumb particle size profile

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. Therefore mix the two feeds when possible. A reduction in feed intake for 12–24 hours can result in a day's lost growth and increase susceptibility to enteric challenges. A change in feed from crumb to pellets at the same time as the move to the finisher house can stress birds and reduce consumption. Therefore, it is best to wait for a few days after moving birds before introducing a new feed form.

The grower and finisher diet must be in the form of a consistent durable pellet in order to optimise feed intake, fine particles (<1mm) must be kept to a minimum, lower than 10%.

Figure 16. Example of a starter feed crumble

An excellent quality (sieved crumble with less than 10% of fine particles) ensures optimal feed and nutrient intake.

As the poults get older, crumble size can be coarser. Generally the use of a good quality mini-pellet provides a superior feed form if crumble quality is poor with too many fine particles.

Figure 17. Coarser crumb

The first pellet introduced after a crumble or a mini-pellet should be short-cut (4–5mm length) and not too hard. The durability should be 88–92% (Holmen, 30 seconds).

Figure 18. Short pellet

The pellet durability of a finisher diet should be between 90–95% (Holmen, 30 seconds) and the level of fine particles minimized (<10%).

Figure 19. Finishing diet

Turkeys are very sensitive to variation in feed physical quality; Feed intake is optimized when pellet quality is consistent from one delivery to the next.

Physical quality of feed is practically assessed by the size of the feed particles actually presented to the birds. It is often difficult to assess this on the farm, where subjective opinions can lead to a poor description of feed texture. A portable shaker sieve can be used by feed specialists to quantify particle size (see Figure 20) distribution on the farm.

Figure 20. Feed sieve

Addition of whole grain

Whole grain can be applied in two ways; either incorporated into the pelleted feed at the mill, or added as a separate ingredient post-pelleting – either at the mill or on the farm. Addition of whole grain dilutes the nutrient concentration of diets and can negatively affect performance. It is highly recommended that diet density is always adjusted to take into account any diluting effect of whole wheat.

	Whole wheat incorporated into pelleted feed	Added whole wheat post pelleting
Crumble 0 – 2 weeks	0 – 3%	0%
Pellets 2 – 6 weeks	3 – 5%	0 – 3%
Pellets 7 – 12 weeks	10 – 15%	5 – 10%
Pellets 13+ weeks	15 – 25%	15 – 25%

Table 12. Wheat recommendations

Figure 21. Whole wheat/pellet

Addition of insoluble grit

Grit can be added on top of feed in the early stages and is best given 3 days per week up to 8 weeks of age. After 8 weeks, grit can be given either on top of the feed in the feeders or in specific grit hoppers, allowing the turkeys free access.

Some processors have problems with grit damaging the gizzard-stripping equipment in their factories, so typically grit should not be fed for 3 weeks prior to slaughter.

	Size of Grit (mm)	Quantity per turkey per week (grams)
0 – 2 weeks	1.5 – 2.5	5
2 – 4 weeks	2.5 – 5.0	10
4 – 8 weeks	5.0 – 8.0	30
9 – 14 weeks	8.0 – 11.0	40 or ad-lib
14 + weeks*	11.0 – 15.0	50 or ad-lib

Table 13. Grit recommendations **stop feeding 3 weeks prior to processing*

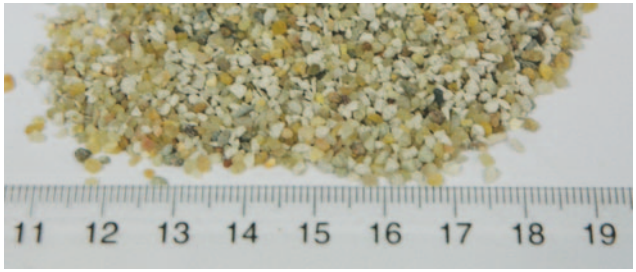


Figure 22. Small, fine grit

Figure 23. Large grit

Feed composition

The ingredients that are used in the diets should be of good quality and highly digestible. Attention should be paid to the quality of high-protein materials. The inclusion of fishmeal in diets for young turkeys, where permitted, contributes essential amino acids to the diet and reduces over-reliance on soya meal as the principal protein source. The use of ingredients with protein of low digestibility should be restricted, especially for early-stage diets. Undigested protein can accumulate in the caecae of the turkey and stimulate proteolytic bacterial development, resulting in digestive upsets and wet droppings, which can lead to wet litter and increased condemnations.

Fats are an important energy source in turkey diets; however young turkeys have a limited capacity to digest some fats. In general, the use of vegetable oils like soya bean or sunflower oil is recommended for starter diets.

Consistent use of ingredients in the feeding programme is important to ensure the transition from one diet to the next does not initiate enteric issues. The degree of change in use of ingredients from one diet to the next should be moderated to minimise shifts in the gut microflora. This can best be achieved by limiting the change in inclusion of ingredients to a maximum of 25% from one diet to the next. All such changes should be minimised and introduced on a gradual basis.

Feed intake can be affected by changes in colour and overall appearance of the pellets. High levels of sunflower or rapeseed can result in black particles from the seed coat being visible in the pellets. This has been shown to lead to feed rejection, even at low inclusion levels of these materials.

Feed management

The feeders should be kept clean and free from contamination and the level of fines should not be allowed to build up. 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 out 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 change 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 24. Bad example of feed (Dust)

Figure 25. Good example of feed

WEIGHING

Birds should be weighed 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 to adapt 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 programs.

Prediction of flock live weight at depletion requires large numbers of birds to be repeatedly sampled close to processing age. The number of birds to sample weigh can be predicted from statistical theory (see Table 14).

Flock Uniformity CV%[1]	Homogeneity[2]	Number of birds to weigh[3]
8	79	64
10	68	100
12	52	144

Table 14: Number of birds required to estimate flock weight

[1]CV% = (Standard deviation / average liveweight) x 100

[2]Percentage of birds within +/- 10% of average weight

[3]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 bird and 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 26. Manual weighing

To determine flock uniformity, individual birds should be weighed (see Figure 26). 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 27). 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 27. Automatic weighing

APPENDIX

Page 30 – 34 *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.

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