

MANAGEMENT GUIDELINES

Turkey Breeders



 **Aviagen**[™]
Turkeys

Aviagen Turkeys is the premier supplier of turkey breeding stock worldwide, supporting the world-class brands of B.U.T. and Nicholas. We provide our customers with choice, presenting an extensive product portfolio. Unique among turkey primary breeders, Aviagen Turkeys is a truly global supplier, with pedigree breeding programs in the USA (Aviagen Turkeys, Inc.) and Europe (Aviagen Turkeys, Ltd.).

Multiple breeding programs and production centers provide a more secure, global supply source and the opportunity to maximize product improvement and new product development. Aviagen Turkeys utilizes innovative technologies and maintains diverse genetic lines to enable selection of turkeys that give the best performance in a wide range of environments. Investment and innovation are key to product development, producing the turkeys of the future.



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Management Guidelines - Turkey Breeders

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Introduction and Animal Welfare

Aviagen Turkeys is a primary breeding company developing pedigree lines of birds for the global turkey industry. Through the application of advanced technologies and unique systems in the breeding program, Aviagen is able to utilize a balanced approach to genetic progress.

This allows for continuous improvement in both commercial traits such as live weight, feed efficiency and meat yield, as well as welfare traits such as robustness, cardiovascular fitness and leg strength. Achieving this genetic potential depends on:

- An appropriate environment, including temperature and air quality, which meets the birds' requirements.
- A dietary regime that provides nutrients, in both feed and water.
- An effective biosecurity and disease control program.

All of these are interdependent. If any of these elements are sub-optimal, performance will suffer.

The aim of this booklet is to assist producers of Nicholas turkeys to achieve optimum performance from their birds. It draws attention to essential management issues, which if overlooked may depress flock performance.

These management techniques will help maintain bird health and welfare, allowing your turkeys to perform well in both live and processing characteristics.

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' technical service team.

While every attempt has been made to ensure the accuracy of the information presented, Aviagen Turkeys accepts no liability for the consequences of using this turkey management information.

For further information on raising Nicholas turkeys, contact your local technical service representative or an Aviagen Turkeys sales office.

Animal Welfare

Aviagen Turkeys is committed to the proper care of our animals. We developed this Best Management Practices guide to encourage and assist the industry as they develop their own management programs. Responsible management and good stockmanship are essential to good animal welfare practices.

The environment in which turkeys are grown must take into account their needs and protect them from physical and thermal discomfort, fear and distress. Continuing education of personnel who have daily contact with turkeys is one of the most important ways to ensure proper behaviors that support and promote good animal welfare practices.

Good management practices that avoid destructive behavior, prevent disease, and promote good health and production as set forth in this manual, are consistent with the generally accepted practices of animal welfare. At its basis are the five freedoms of animal welfare:

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

Biosecurity

Breeder facilities must have a strict set of rules designed to prevent poultry from being exposed to infectious diseases to safeguard the health of the turkeys. Biosecurity is an ongoing program that must be followed at all times. Carry out each step judiciously to effectively reduce disease contamination.

Routinely train all employees in biosecurity procedures. Always use disinfectants, rodenticides, insecticides, etc., in a safe manner and according to manufacturers' recommendations and regional regulations.

To develop a biosecurity program, it is necessary to first recognize the sources of disease and then take appropriate measures to reduce and, if possible, eliminate their contact with the turkey. Following are several potential disease sources and measures that can be taken to reduce the risk of infection.

Employees & Visitors

Maintain a Secure Facility

- Secure farm with a fence
- Keep gates and buildings locked
- Post signs to prevent unauthorized entry
- Do not share staff between different species farms and preferably not even between poultry farms.
- Do not allow any visitors inside the secured area without approval from the farm owner or company. Persons coming from known high risk disease areas should not be allowed to enter the farm.
- Anyone who will be entering the facility should avoid contact with chickens, waterfowl, quail, wild turkeys, pheasants, companion birds, fighting cockerels, etc. He / she should not visit live bird markets, pet stores, zoos, livestock labs, processing plants, etc. or those people in contact with them.



- Anyone entering the facility must adhere to all sanitation procedures.
- All visitors must sign visitor log indicating date and place of last livestock contact.

Sanitation Procedures

- Employees or growers must wear poultry house designated clean clothing and footwear.
- Visitors must wear clean coveralls, boots and hairnets.
- If a shower is provided, enter the shower room and shower (pay special attention to washing hair, hands and finger nails). Then enter clean room and put on farm clothing and re-wash hands.
- After entering the farm, at no time should the person return to the dirty room nor should any items such as towels, clothing or personal effects be transferred between the dirty and clean areas.
- Before entering and exiting turkey buildings, wash and disinfect boots and hands.
- Sanitize all items before entering the farms.
- Wash hands after breaks and lunch.



Additional Items

- Educate employees regarding sanitation procedures and disease risks.
- Do not allow raw eggs or raw meat on facilities.
- Remove food from lunch bag and transfer into clean bag supplied by farm.
- Sanitize all items before bringing onto the farms.
- Wash hands after breaks, lunch and using the restroom.
- Anyone with flu-like symptoms or an elevated temperature should not come in contact with turkeys. Recommend that all employees take an annual flu shot.

Vehicles & Equipment

- Limit traffic onto facilities as much as possible.
- Avoid using any equipment that has been used on other farms to prevent cross-contamination.
- Locate feed bins, gas tanks, propane tanks, generators, etc., such that they can be serviced from outside the farm.
- Provide a vehicle disinfection area at the gate entering the facility.
- Thoroughly disinfect all vehicles, equipment and tools entering the farm and before use including the exterior, under carriage, wheel wells, tires, interior, floor, doors, seat, steering wheel, etc.
- Once the vehicle is disinfected, the driver should not re-enter the vehicle until he/she has taken a shower.
- Provide a vehicle disinfection area at the gate entering the facility. Scrub brushes and towels should also be available to perform an adequate job of sanitation.



Birds, Rodents, Insects, Mammals

- Do not allow the accumulation of materials, trash or other debris in and around the farm.
- Maintain a “vegetation-free” zone at least 36 inches (1 meter) around all barns 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 destroy any nests that are found.
- Pest proof buildings as much as possible.
- Put out rodenticides and insecticides.
- Continually be on the alert for pests and eliminate them when seen.
- Do not allow pets or other animals to enter the barns.

Feed, Water and Litter

- Use feed ingredients free of contaminants.
- Keep feed delivery trucks, mill area and equipment clean and sanitized.
- Chlorinate water (2-3 ppm of free chlorine at last drinker).
- Clean up water spills and fix leaks immediately.
- Clean and disinfect drinkers daily.
- Clean and disinfect water lines between flocks.
- Use clean litter from credible sources.
- Regularly check litter for contamination.

Egg Sanitation

- Maintain a strict sanitation and monitoring program.
- Keep nest litter clean and replenish regularly.
- Collect eggs every 45-60 minutes.
- Do not send cold floor eggs or dirty eggs to the hatchery.
- Prior to egg sanitation, protect the eggs from rapid cooling or sweating.
- Avoid the use of steel wool, sand paper and sponges to clean eggs.
- Clean and monitor the egg sanitizing equipment on a daily basis. Use proper operating temperatures and disinfectant levels.
- Keep poult and egg trucks clean.



Cleaning and Disinfection

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

- Bait for rats and mice. Rotate types of baits used quarterly.
- Empty feed pans, hoppers, and feed bins.
- Remove litter, dust and debris from barn.
- Scrape and sweep floor down to bare floor.
- Dry clean house using backpack blower or broom paying special attention to screens, fan housings, vents, and louvers.
- Wash house down with water, preferably hot, and a detergent product using a pressure washer.
- After barn is dry, disinfect using an approved



disinfectant. Spray to the point of run-off. *Remember, cleaning, washing and disinfection are three separate steps.*

- Wash and disinfect all equipment before bringing it back into the barn.
- Treat for insects, e.g. flies, darkling beetles, etc., as required. Rotate insecticide products to avoid building resistance.
- Clean and disinfect waterlines and any supplemental drinkers after every flock. Flush lines and drinkers (dump 2 – 3 times) with fresh, chlorinated water after line cleaning. *See Water Line Cleaning, page 49*
- Do not enter clean building without following proper biosecurity procedures. Keep doors closed and locked to keep unauthorized visitors and animals from entering barn.
- Bring shavings into the barn after it is thoroughly dry. *Applying shavings to a wet floor can promote the growth of mold.*



Brooding

After hatch a poult has basic needs that must be satisfied if it is to survive and become a quality breeder. These basic needs are fresh air, clean water, quality feed, good litter and heat. To improve their chances of survival, the poult should be confined to an area where feed, water and heat are readily available.



This can be done by using a variety of brooder set-ups. The actual brooder ring setup will vary depending on house, stove type, brooding equipment, past experience, company preference and the time of year.

Shavings

Use a clean, dry mixture of coarse and fine softwood shavings. Avoid hardwoods and wet sawdust.

- New shavings are recommended for every flock.
- Spread evenly at 3 to 4 inches (75 to 100mm) depth.
- Smooth to level within rings prior to setting up equipment.

Water

- Water lines should be cleaned prior to placement. See Water Line Cleaning, page 49
- No vitamins or antibiotic should be added at placement (unless for a specific known problem as prescribed by a veterinarian). Always use clean sanitized water.
- Provide one bell-type drinker per 100 poult.
- If using nipple drinkers follow the manufacturer recommendations.



- Level drinkers to avoid floods while making sure poult have good access to drinkers.
- Adjust automatic depth to $\frac{3}{4}$ inch (20mm); hand fill to lip prior to placement.
- If using nipple drinkers, double rings are recommended.

Feed

- Pre-starter crumble should be good and consistent in size with minimal fines.
- Provide one 48 inch (1.2m) trough-type feeder per 100 poult to equal 1 linear inch (25mm) per poult; or provide a combination of 18 inch (0.5m) red feeders and bucket type - 100 poult per one bucket and one 18inch (0.5m) red feeder.
- If using brooder rings, position feeders at least 12 inches (300mm) from edge of stove and brooder guard.
- Fill feeders with fresh feed immediately prior to placement.
- Consider supplementing 48 inch (1.2m) trough-type feeders with 18 inch (0.5m) red feeders while poult are in rings for optimum feed consumption. Meat trays or egg flats may also be used.
- Keep feed clean and free from shavings, debris and manure.



Conventional Jet Brooder Stoves

- Confirm that each stove is operating properly.
- Check propane level in tank.
- Stoves should be lit 24 hours prior to poult arrival to warm room and shavings. A minimum of 12 hours prior to poult arrival, set stoves to reach starting target temperature.

- Target a 3 – 4 foot (1.0-1.3m) “hot spot” of 100–105° F (38-40° C) in the center of the ring.
- Adjust all stoves to 24 inches (0.6m) above the litter.
- Confirm that the cycling of each stove provides a hot spot of no less than 100° F (38° C) and no more than 115° F (46° C) at any time.
- Set zone controlled systems so that the majority of stoves are within target range. Stoves that are hotter or cooler than target should be physically raised or lowered to achieve the desired temperatures.
- Use one 75-100 watt incandescent brooder light per stove to prevent shadows and draw poults to heat source. Use only while poults are in rings.

Ventilation and Temperature Control

- Confirm that stoves are properly set and that all ventilation equipment is operational.
- Calibrate all thermostats to ensure accurate settings.
- Set fan thermostats according to target temperature.
- Adjust ventilation to provide the minimum CFM’s required according to the lowest anticipated outside temperatures.
- Adjust all vents to the same opening. For wintertime ventilation a portion of vents may need to be closed off completely.
- Test vent operation to ensure all vents are opening and closing correctly.
- Use mixing fans to reduce temperature stratification and improve heating efficiency. Small 18-24 inch / 45-60cm fans are recommended hanging close to ceiling at approximately 50-60 feet (15-18m) apart.
- Seal cracks and any areas where air can leak in causing drafts and heat loss. Pay close attention to end doors and curtains.

Lighting

- Provide a minimum of 8 footcandles (80 lux) of light in house.
- Provide poults with full light for the first one to three days. Afterwards, poults should have 10-14 hours of continuous light per day.

Single Brooder Rings

- Brooder rings should be 12-15 feet in diameter
- Rings should be at least two feet away from the wall.
- Make rings with cardboard brooder guard 12-18 inches high. When the barn temperature is expected to drop below 70°F (21°C) or the barn is drafty, use 18 inch brooder guard.
- Place a maximum of 300 tom poults or 350 hen poults per stove.
- Feeders – For every 100 poults use one 48 inch feeder, or one bucket feeder, or two 24 inch plastic feeders.
- Drinkers – For every 100 one bell or mini drinker. Follow manufacturer’s recommendation when using nipple drinkers.
- After three days combine rings to include up to four stoves.
- After five to seven days poults can be released from rings.



Brooding

Multi-Stove Brooder Rings

- Brooder rings should include no more than four brooder stoves.
- Rings should be at least two feet away from the wall.
- Make rings with cardboard brooder guard 12-18 inches high. When the barn temperature is expected to drop below 70°F (21°C) or the barn is drafty, use 18 inch brooder guard.
- Place a maximum of 300 tom poults or 350 hen poults per stove.



- Feeders - For every 100 poult use one 48 inch (1.4 m) feeder, or one bucket feeder, or two 24 inch (.7 m) plastic feeders.
- Drinkers - For every 100 one bell or mini drinker. Follow manufacturer's recommendation when using nipple drinkers.
- After five to seven days poult can be released from rings.

Large Ring or Whole House Brooding

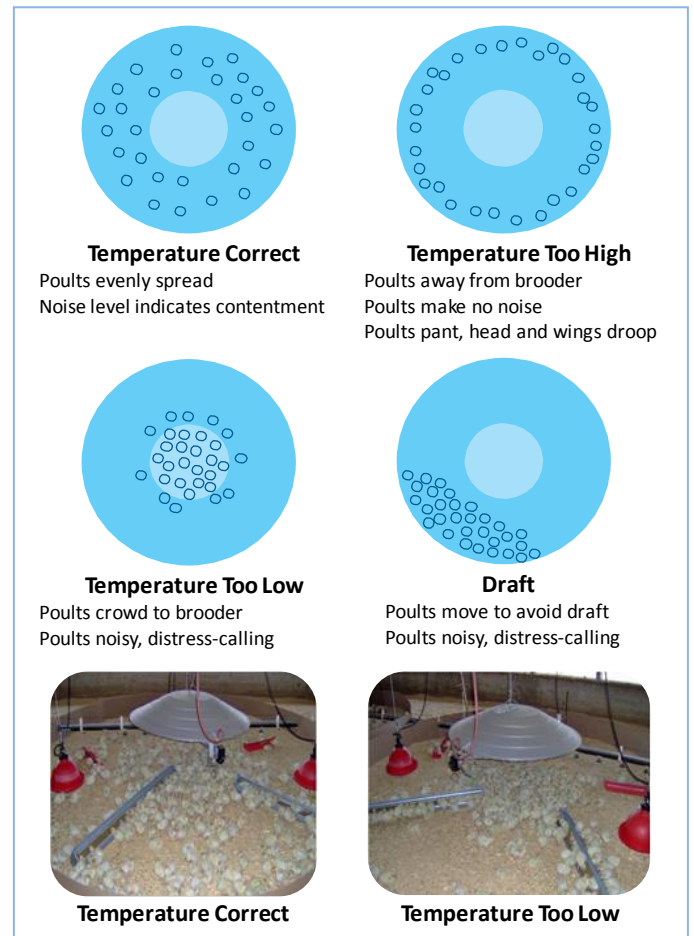
- One 80,000 BTU stove per 1,500 sq. ft.
- Two stoves are recommended per ring, with both stoves not being on the same circuit. It works best to have all even stoves on one circuit and all odd stoves on another circuit.
- Stoves work best 40 ft apart to prevent cold spots.
- Houses should be pre-warmed a minimum of 24 hours prior to poult placement and 48 hours ahead during cold months of the year.
- Stoves should ideally be located 7-8 feet off of the shavings, with floor temp under the heater at 110-115° F for day of placement; floor temperature near side walls on inside edge of cardboard should be 90 degrees.
- If piling becomes an issue, it is possible that more heat may be required. Let the flock dictate where the proper starting temperature needs to be.
- Rings should be at least two feet away from the wall.
- Make rings with cardboard brooder guard 12-18 inches high. If the house is drafty, use 18 inch brooder guard.
- All feeders and drinkers should be down and accessible to the poults.
- Utilize supplemental feeders and drinkers as necessary.



Once the poults are placed in the barn, they should be allowed a minimum of one hour to acclimate themselves to their new environment. After this time, further adjustment of the ventilation, stove height, stove temperature, drinkers or feeders may be necessary. Careful observation of the poults behavior and barn conditions will determine what adjustments should be made. *See Figure 1*

In addition to visual examination, it is very important to listen to the poults. Excessive noise may indicate wrong temperature or lack of water or feed. Avoid exposure of the poults to sudden temperature or environmental changes.

Figure 1. Poult Distribution Under Brooders



Target Room Temperature

Table 1. Target Environmental Temperatures

Age	Sex	Conventional Brooding		Large Ring / Whole House Brooding	
		°F	°C	°F	°C
Day 1	M+F	86	30	94	34
Week 1	M+F	83	28	88	31
Week 2	M+F	80	27	84	29
Week 3	M+F	77	25	82	28
Week 4	M+F	74	23	76	24
Week 5	M+F	72	22	72	22
Week 6	M+F	70	21	70	21
Week 7	M+F	68	20	68	20
Week 8	M+F	66	19	66	19
Week 9	M+F	64	18	64	18
Week 10	M+F	62	17	62	17
Week 11	M+F	60	16	60	16
Week 12	M+F	58	14	58	14
Week 13+	Females	58	14	58	14
Week 13	Males	56	13	56	13
Week 14+	Males	55	13	55	13

Daily Care

Turkeys should be checked regularly. If the weather changes or the flock is experiencing a problem more frequent checks may be required. Perform the following duties during each flock visit.

Check the drinkers. Drinkers should be cleaned and sanitized at least once a day. After three weeks of age, adjust the drinkers keeping the lip of the drinker even with or slightly above the level of the bird's back. The

level of water in the drinker should be high enough that a bird can easily drink without spilling water.

Check the feeders. Remove any litter, manure, mold, or caked feed. Adjust the feeders keeping the lip of the feeder even with the bird's breast. The level of feed in the feeder should be high enough that a bird can easily eat without spilling feed.

Remove any mortality. This will reduce the spread of disease. Periodically, a postmortem should be performed and the mortality should be examined for any signs of disease. See the Appendix for additional information on postmortem. Maintain a record of mortality. As a general rule, any time the mortality is higher than 0.25% a day, it may be an indication of possible problems.

Check for sick or injured birds. Euthanize and record any birds which are unthrifty daily.

Carefully monitor the ventilation. Adjust the fans or curtains to maintain good air quality keeping dust and ammonia to a minimum.

Manage the litter. Stir caked litter with a pitch fork or rototiller. Any wet litter should be removed and replaced. Poor litter management will lead to burned footpads and may contribute to leg problems later in life.



Change Equipment. Between five and seven weeks of age, change to adult type equipment. It is best to make this change gradually over a period of three days, replacing 1/3 of the equipment each day. Follow the manufacturer's recommendations regarding the number of birds per adult feeder and drinker.

As the turkeys grow, allow them sufficient space as suggested in *Table 2 on page 11*.

Growing

Growing turkeys should be checked regularly. If the weather changes or the flock is experiencing a problem more visits may be required.

Litter

- Ensure a minimum litter depth of 4-5 inches / 10-13cm.
- Tilling weekly or as needed will optimize foot pad and leg integrity.
- Consider using a litter amendment for ammonia control in extremely cold weather conditions.
- Do NOT compromise litter conditions for fuel savings.

Water

- Provide a bell type drinker per 100 - 150 birds.
- For bell type drinkers maintain depth at $\frac{1}{2}$ to $\frac{3}{4}$ inch (12-20mm), depending on drinker style, drinking activity, ambient temperature and litter conditions.
- For bell type drinkers maintain lip of drinker even with or slightly above the height of the average birds' backs.
- Continue to chlorinate to target 3 – 5 PPM free chlorine in the drinker furthest from the source.
- Clean drinkers daily.
- During hot weather, flush overhead lines to provide fresh, cool water.



Feed

- Ensure quality feed is available when the birds are delivered.
- When birds arrive have cones adjusted to flood feeder.
- Provide a minimum of one (1) automatic type feed pan per 50 toms and 60 hens.

- Maintain lip of feed pan even with the height of the average birds' backs.
- Check bins, augers, hoppers, etc. regularly for moldy feed.

Ventilation

- Confirm that all ventilation equipment is operational.
- Calibrate all thermostats to enable accurate settings.
- If power ventilating, adjust fan thermostats according to target temperature. Thermostat fans should begin to come on 2°F (1°C) above target temperature.
- Utilize heat as needed to reduce litter moisture (with increased ventilation).
- Do NOT compromise air quality for fuel savings.

Temperature

Follow the temperature guidelines in Table 1 on page 9.

Daily Care

Turkeys should be checked regularly. If the weather changes or the flock is experiencing a problem more frequent checks may be required. Perform the following duties during each flock visit.

Check the drinkers. Drinkers should be cleaned and sanitized at least once a day. After three weeks of age, adjust the drinkers keeping the lip of the drinker even with or slightly above the level of the bird's back. The level of water in the drinker should be high enough that a bird can easily drink without spilling water.

Check the feeders. Remove any litter, manure, mold, or caked feed. Adjust the feeders keeping the lip of the feeder even with the bird's breast. The level of feed in the feeder should be high enough that a bird can easily eat without spilling feed.

Remove any mortality. This will reduce the spread of disease. Periodically, a postmortem should be performed and the mortality be examined for any signs of disease. *See Postmortem Examination, page 52.* Maintain a record of mortality. As a general rule, any time the mortality is higher than 0.25% a day, it may be an indication of possible problems.

Check for sick or injured birds. Euthanize and record any birds which are unthrifty daily.

Carefully monitor the ventilation. Adjust the fans or curtains to maintain good air quality keeping dust and ammonia to a minimum.

Manage the litter. Stir caked litter with a pitch fork or rototiller. Any wet litter should be removed and replaced with dry litter. Poor litter management will lead to burned footpads and may contribute to leg problems later in life.

Change Equipment. Between five and seven weeks of age, change to adult type equipment. It is best to make this change gradually over a period of three days, replacing 1/3 of the equipment each day. Follow the manufacturer's recommendations regarding the number of birds per adult feeder and drinker.

Manage floor space. As the turkeys grow, allow them sufficient space. Following are the suggested floor space recommendations for Nicholas breeder turkeys. Consideration must be given to litter type and time of year.

Table 2. Breeder Floor Space

Age (weeks)	Square Feet / Bird		Birds / Square Meter	
	Hens	Toms	Hens	Toms
0-8	1.5	2.0	7.0	5.5
9-selection	2.5	6.0	4.5	2.0
selection-29	4.0	10.0	3.0	1.0
29 to end	7.0	10.0	1.5	1.0

These recommendations should be considered as general guidelines. Following these recommendations will not guarantee success. However, if used in conjunction with a sound management, nutritional, and health program, they will form the basis for achieving good performance.

Look for possible problems. Higher than expected mortality, flock unevenness, lack of activity, excessive noise, abrupt changes in water and feed consumption, poor feathering, respiratory problems and mobility problems may all be signs of poor management, poor feed quality and/or disease. The occurrence of any of these signs should be taken seriously. Find the cause and correct it immediately.

Weigh birds regularly. Properly conditioning breeders for reproduction requires weight control. Beginning at six weeks of age, breeder flocks should be weighed on a weekly basis to ensure the flock weights are close to our projected weight curve. If the flock is below the suggested weight, it should be left on the higher protein feeds until it catches up to the weight curve. If the flock is above the weight curve, it may be advisable to switch to the next diet in the feed schedule. Avoid drastic drops in protein on birds under 14 weeks of age.

Check for parasites. The flock should be routinely checked for worms, mites and other parasites. If any parasites are found, the flock should be treated immediately. Dusty conditions and/or ammonia should be avoided by using good litter management and ventilation. Dust and repeated exposure to ammonia can compromise the respiratory system of the bird and reduce performance.

By anticipating possible problems and making the proper adjustments, complications can be avoided, enabling the flock to reach the breeder barn in prime condition.

Selection

The primary goal of selection is to select breeder candidates that are strong, fit, healthy and will be able to stand up to the rigors of breeding. If the flock has been well managed up to this point, the majority of the flock will fall into this category.

Hens

Selection in hens usually involves walking through the flock and culling out any hens with obvious defects - severe respiratory problems, drop crops, bad legs, severely swollen feet, etc. - anything which will affect their ability to go to the nest and lay eggs.

Toms

Because one tom will be mated to several hens, the tom has a much greater influence on the progeny of the flock. For this reason, the toms should be carefully selected. We suggest using the following procedures for selecting breeder toms.

Walking the Birds. The purpose of this step is to remove any unfit birds. First, push the birds to one end of the house and set up the panels as shown in Figure 2. As the birds walk past the exit, remove any birds that walk poorly, have bad posture, respiratory problems, breast blisters, drop crops, crooked toes or any other defect and place them in the cull pen. Count the birds culled and the birds kept as they are walked. This information will be used to verify the number of birds available for weight selection.

Weight Selection. To select the toms by weight, push the birds to one end

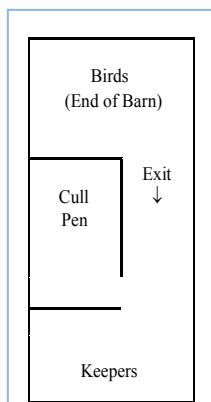


Figure 2

of the barn and set up the panels as shown in Figure 3. To determine the number of birds to select, add 6% to the number of breeder toms needed. Weigh a 100 bird sample of the remaining potential breeders. Put the weights on a weight sheet (*see the weight sheet on the following page*).

The next step is to determine the percent of keepers needed and the cut-off weight. The percent of keepers needed is the number of birds to select divided by the number of potential breeders left after the walking multiplied by 100.

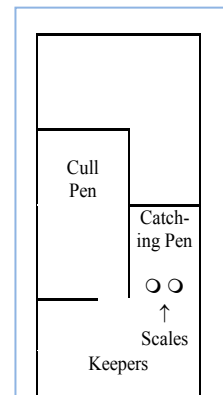


Figure 3

Selection Calculation

Starting at the bottom of the weight sheet, count up

$$\frac{\text{Number of birds to select}}{\text{Number of breeders left after walking}} \times 100 = \% \text{ keepers needed}$$

until the number of birds counted is equal to the percent of keepers needed. The weight on the left side of the page will be the cut-off weight. Birds that are this weight and heavier and exhibit no defects will be the final keepers.

During the weighing process, count both keepers and culls. Check the number and percentage of keepers while selecting to insure a sufficient number of birds are kept. It may be necessary to adjust the cut off weight.

Selection is a very important time in a breeder candidate's life. The information gathered on flock weight and condition will be vital in determining what management strategy is best for the condition and production phases of the breeder's life.

Weight Sheet

Flock #	_____	Strain	_____	Selection Date	_____
# Placed	_____	Location	_____	Ave. Weight	_____
# Needed	_____	% Mort.	_____	Cut-Off Weight	_____
# Walkouts	_____	# Selected	_____	# Alive At Sel.	_____
Comments	_____				

lbs.	Kgs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
18	8.0																				
19	8.5																				
20	9.0																				
21	9.5																				
22	10.0																				
23	10.5																				
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48	23.0																				
49	23.5																				
50	24.0																				

Selection

Lighting - Hens

Lighting is a major factor influencing the performance of the breeder candidate. A good lighting program may be the difference between profit or loss.

What works with one type of barn, may not work with another type and what works at one latitude, may not necessarily work at another latitude. In addition, one must consider age and reproductive maturity of the bird when implementing a lighting program. Illustrated below is a hen lighting program.

It is impossible to recommend a lighting program that will work for all flocks in all geographical locations, with different types of housing, climatic conditions and management systems. Instead, we offer the following general guidelines which we have found useful in developing lighting programs.

1. It takes a hen's reproductive system 14 to 19 days to develop, provided sufficient light and weight are attained. Hens are capable of responding to light

when the last juvenile molt is completed between 17 and 20 weeks. However, hens lit prior to 28 weeks of age may tend to lay more cull eggs, have lower hatchability and poorer poult quality. It is recommended to keep the hens in the dark house until lighting at 29-30 weeks.

2. It is recommended to use six hours of light in the dark house for a minimum of ten weeks.
3. **Never decrease light** once the stimulatory phase prior to the onset of egg production has been initiated. During the fall and winter when the natural day is shortening, additional care must be taken to assure the hens are not exposed to shortening day length.
4. Lights should be placed to uniformly spread light and to reduce shadows.
5. The time from when the lights come on until nests are opened should not exceed 4-5 hours.

Table 3. Suggested Light Schedule for Breeder Hens

Period	Open Housing and Light Controlled Housing	Minimum Intensity
Hatch to 17 weeks	Provide hens with 10 – 14 hours of continuous light. If the natural day length is less than 10 hours, add artificial light.	8-10 foot candle 80 – 100 lux
16-18 weeks to Lighting (29 or 30 weeks)	Reduce the hours of light the hens receive to a maximum of 6 hours a day. The purpose of the darkening period is to control or synchronize sexual development of the hen. During this stage, the hens should be in a lightproof barn so that when the lights are out, the barn is <u>totally</u> dark.	2 – 10 foot candle 20 - 100 lux
Lighting to market	Provide hens with 14 hours of continuous light. If the hens are exposed to natural daylight and the day length is less than 14 hours, add artificial light. If the hens are laying in a solid sidewall barn, give 14 hours of artificial light. The day length should never be decreased during the laying period.	12 foot candle 120 lux

Lighting

Lighting Programs - Toms

Lighting is a major factor influencing the performance of the breeder tom. A good lighting program may be the difference between profit or loss. What works with one type of barn, may not work with another type and what works at one latitude, may not necessarily work at another latitude.

In addition, one must consider age and reproductive maturity of the bird when implementing a lighting program. Illustrated below is a tom lighting program.

It is impossible to recommend a lighting program that will work for all flocks in all geographic locations under all types of housing, climatic conditions and management systems. Instead, we offer the following general guidelines which we have found useful in developing lighting programs.

1. Toms are capable of responding to very low light intensities. In addition, there is evidence they can respond to somewhat shorter day lengths than hens. Thus, they can readily respond to morning and evening twilight as well as any light leaking into the barns. It is advisable to eliminate all light leaks.
2. In a healthy, fit tom, it takes approximately six to eight weeks for the testis to develop from a non-stimulated state to its full, active state. For this reason,

the tom lighting program should start at least 8-10 weeks before semen is needed. Toms should be in semen production a minimum of two weeks prior to the first insemination to allow sufficient time for two pre-milkings.

3. Once toms have completed their last juvenile molt, gonadal development will occur any time they are exposed to 12 or more hours of light.
4. When implementing a lighting program, the current daylength the toms are exposed to should be considered. For example, if the toms are on more than 12 hours of light and have completed their last juvenile molt prior to commencement of the lighting program, they may already have initiated gonadal development. If the lighting program has fewer hours of light than what the toms are currently on, some toms will respond to the decreased light negatively (i.e., the onset of semen production in these toms will be delayed). Wattle and caruncular development, increased strutting, aggressiveness and gobbling are early signs that toms are responding to light.
5. Once light stimulation has been initiated, **do not decrease the light or intensity**. This will have a negative effect on sexual development and delay the onset of semen production.

Table 4. Suggested Light Schedule for Control Fed Breeder Toms

Period	Open Housing*	Light Controlled Housing	Minimum Intensity
Hatch to Selection (16-19 weeks)	Ambient Light	10L:14D	8-10 foot candles 80-100 lux
Selection to the end of Production	Ambient + artificial light to maintain at least a 14L:10D daylength or longest natural daylength between selection and the end of production. <u>Lights should not be decreased at any time in daylength or intensity.</u>	A constant 14L:10D** or a gradual increase to a maximum daylength of 16L:8D by the end of production. If the toms appear to be behind in development, lights can be increased by one hour.	10 foot candles 100 lux
** When moving toms from open housing to light controlled housing, the artificial daylength must be equal to or longer than the ambient daylength.			

6. Lighting patterns in the tom barn should be uniform. The lights should be placed so shadows in the pens are minimized.

7. Control fed toms do better on higher light intensities - 10 foot candles or more. Full fed toms do well on lower light intensities - 2-3 foot candles.

8. Weekly weighing and evaluation of strutting, gobbling and phallus development is an integral part of breeder tom management. If the toms are behind schedule in sexual development, it may be advisable to

give them more light and/or feed. Sexual maturity is influenced by both light and body weight. If the toms are full fed and below the target body weight, it will be necessary to keep them on a higher nutrient diet until they catch up to the target weight, then lower the protein level. If the toms are control fed and below the target body weight, the daily feed allotment should be increased.

These recommendations assume the turkeys are fit, of good health and relatively close to our suggested weight curve.

Hen Management - Conditioning

For any hen to produce quality eggs at or close to her genetic potential, she must be:

- Physiologically primed for egg production.
- In good health.
- Physically fit.



Using a dark house to expose the hen to short day lengths is the preferred method of priming the hen for egg production. The hen is capable of responding to light when she has completed her last juvenile

molt, usually between 17 and 20 weeks of age. It is advisable to have the hens in the dark house as soon after selection as possible. In addition, the hen needs a minimum of ten weeks of short day lengths to perform optimally.

The best results are achieved with six hours of light during the darkening period. In addition, when the lights are off, there should be no light leaking into the barn. Putting the hens in the dark house late or excessive light leakage when the lights are off could cause non-uniform commencement of egg production and low peak production.

To ensure the hen arrives at lighting time physically fit and in good health, a weight control program is necessary. A dynamic system of monitoring and reacting to body weight is crucial to achieve the best results.

Provide Appropriate Diets from Day One. During the first 6 weeks the fundamental development of the skeletal, immune system and cardiovascular system takes place. It is important to get the hens off to a good start by following the weight profile and by providing diets that have the correct balance of nutrients at the right time.

Start a weekly weighing program when the birds are 3 weeks of age. It is important to monitor the weekly weights against the target to ensure the birds are on track to hit the 6 week weight. By the time the birds leave the brooder house birds should be close to standard weight. Contact your Aviagen Turkeys technical representative for current weight curve.

Key Weights are at 6, 16 and 22 Weeks. From 6 to 22 weeks of age the birds continue to develop their skeletal structure as well as feather coverage and musculature. Achieving the target weights at 6, 16 and 22 weeks of age are paramount to maintaining the hen on target. Research has shown that if these three points are achieved in a smooth, relatively unbroken line the hen will be set to come in on target and with the proper body composition.



Do not allow birds to get over weight when moved from the brooder house. Consider adjusting the feeding program if the hens are more than 10% away from the target weight.

If birds are off the weight target prior to 16 weeks, use diets and patience to bring the birds back to the correct line. Move heavy flocks onto the next ration sooner. Avoid placing hens on hold diet prior to 14 weeks. Hold light flocks on the higher protein diets longer. If weight gain stalls due to high ambient temperatures, move birds back to a higher protein diet to maintain desired growth. Rapid weight adjustments should not be attempted, whether the birds are over or under weight.

At 16 weeks if the birds are heavier than the target draw a new target that runs parallel to the original line, see Figure 5. If the hen is in a positive growth status at lighting, even if the flock is slightly overweight, the

response of the bird to the light stimulus allows good production. Flocks *must not* be forced back to the target line by more severe nutritional controls.

Twenty two weeks to lighting is a key period in the development of the hen. The objective is to keep the bird growing at a steady rate so when the light stimulus is given at 29/30 weeks the metabolism of the bird is able to respond immediately and meet the rapid changes in the reproductive system.

From lighting to first egg flocks should increase in weight by 2-3 lbs (0.8-1.2kg). Flocks that plateau in weight prior to light stimulation do not respond as positively. When weight gain is insufficient, peak egg production is lower and spread over a longer period.

Flock Uniformity

Uniformity should continuously improve over the life of the flock. If the flock is becoming less uniform, factors such as bird health, feed access, feed quality and water availability should be checked. At point of lay, flock uniformity should be greater than 90% or have a CV of less than 10%.

Additional Considerations:

- 1) It may not be necessary or advisable to put the hens on a pre-breeder feed if they are close to the projected weight curve. Breeder feed may be given at lighting or a few days after lighting.

- 2) Attention should be given to the prevention of any enteric problems (e.g., worms) which may affect the hens ability to absorb nutrients from the feed.
- 3) The health of the hen is paramount to successful egg production. Litter and ventilation conditions will have a large impact on bird health. Caked litter, wet litter, dust and ammonia are known to have a detrimental effect on the hen's health and must be managed constantly to produce healthy hens.

Figure 4. Target Hen Weight Curve

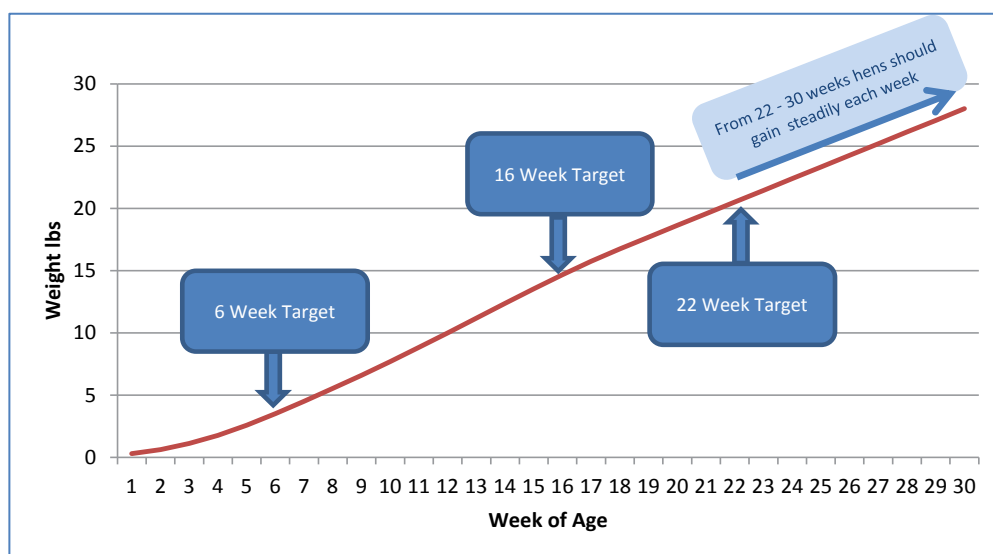
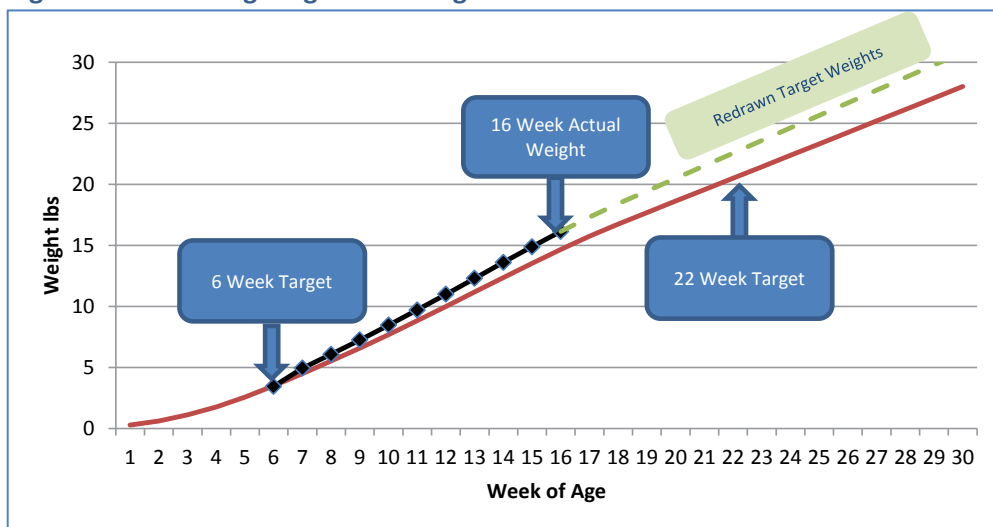


Figure 5. Redrawing Target Hen Weights



Hen Management - Production

Attaining high egg production is the goal of every turkey breeder. Disease, nutrition, climate and management can have a great influence on egg production. Following are some of the management factors that can affect egg production.

Peak Egg Production

Peak egg production is highly influenced by conditioning during the growing and darkening stages. Our recommendations for these areas are discussed in the sections on brooding, growing, conditioning and lighting of hens.

It is recommended that hens be moved and lit in the lay barn to allow them ample time to familiarize themselves with their new surroundings. The barn should be completely ready with all nest boxes and nest litter in place, all panels and gates set up, with drinkers and feeders operating properly.



Floor layers can have a significant economic impact on breeder flock performance. Therefore, it is critical to encourage hens to go to the nests at the onset of the lay.

When starting a flock using automatic nests, the nests should be bedded down with 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. During the next several days, nothing should be done which might discourage the birds from going to the nests. At the onset of production, the eggs should be gathered by hand. When production reaches approximately 25%, automatic gathering should be gradually introduced. Around the tenth day of production, traps should be shut down gradually, a few

traps a day, so that by the fourteenth day, all traps will be in operation.

It is generally easier to get hens to go to conventional nests than automatic nests. As with

automatic nests, prior to the birds arrival at the laying farm, conventional nests should be bedded down with either clean straw or wood shavings. Traps should be tied in the open position when birds arrive at the lay farm. During the next several 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 shut down each day until all traps are down.

Nest space can affect peak egg production. The preferred hen to nest ratio is five hens to one nest. A higher number of hens per nest could result in crowding of the nests during peak lay. Less dominant hens would be kept away from the nest by their dominant pen mates. More eggs may be laid on the floor, and the duration of peak lay during the day may be extended.

Using a nest litter different from the floor litter and making access to the nest as easy for the hen as possible, all aid in attracting the hen to the nest.

In addition, with certain flocks, it is necessary to physically put hens that appear to be looking for a nest in corners or along the walls of the barn on the nests. It may also be necessary to place panels in the corners or place additional lights in dark areas to discourage hens from laying in these areas. Walking the pen at regular intervals, breaking up any hens which appear to be congregating in certain areas has also proven to be an effective method of improving egg production.



Easy and plentiful access to water and feed as well as sufficient floor space (see Table 2. Breeder Floor Space, page 11) are also important in achieving high egg production.

Persistency of Production

Factors which affect peak production also affect the persistency of production. In addition, persistency of production is highly influenced by broody control (see section titled *Broody Control*), the presence of floor eggs, the frequency of egg collection and the timing of nest opening and closing.

The presence of floor eggs can be minimized by making access to the nests as easy as possible, training the hens to the nest, having sufficient nest space, picking up floor eggs after each gathering and breaking up any hens congregating or exhibiting nesting behavior in the main pen area.



The frequency of collection should be at least every 45 to 60 minutes. During the day when the hens are peaking in production, it may be necessary to collect the eggs every 30 to 45 minutes to prevent crowding of the nests. When egg production is slower, every 45 to 60 minutes may suffice.

Suggestions regarding the timing of nest opening and closing:

- ◆ Nests should be opened within four hours after the lights are turned on.
- ◆ Nests can be closed up to two hours prior to lights off.

Obviously, if a high percentage of night eggs are being laid or the hens are still laying heavily at closing, the timing of nest opening and closing may need to be modified.

Accurate, up-to-date records (which include types of cull eggs), close observation of flock behavior and prompt corrective action when problems begin to appear will improve flock performance.

Hen Management - Broody Control

Nature has provided the turkey with a way to generate offspring by laying a clutch of 10-15 eggs and then ceasing production. The hen will then want to sit on the eggs until they hatch. Relatively speaking, turkeys have been domesticated for a short period of time, so the natural urge for the hen to want to “go broody” or to sit on the eggs is still there.

The desire of the hen to incubate her eggs, also known as the “onset of broodiness”, is caused by the increased production of the hormone called prolactin. This hormone develops gradually over a period of four to five days right before the end of a clutch of eggs. The broody hen represents a loss of income. Broodiness must be kept at the lowest level possible if the breeder flock is to produce a profit.

Therefore, it is critical to recognize the symptoms of broodiness. Hens which are starting to “go broody” show the following symptoms:

- Become harder to move off the nest.
- Lay pattern shifts toward the end of the day.
- Number of hens on the nest at the end of the day increases.
- Oviduct becomes smaller and paler at insemination.
- Production starts to decline.
- Feed consumption starts to decline and the flock becomes less active.
- A tendon forms between the pubic bones pulling the bones closer together.

If any of these symptoms are present, it is critical to identify these hens for broody treatment.

In warmer climates, start looking for potential broody hens no later than 10 days after the onset of production. In the winter months when the climate is milder, broodiness may not come on quite as fast, but still start looking for potential broody hens no later than 14 days after the onset of production. Please be aware that hens squatting in the dark house may start

production earlier and may need to be identified and put through broody treatment sooner.

An important aspect of broody control is the identification and elimination of factors which encourage broodiness. Table 5 on page 22 details factors which encourage broodiness and gives some possible ways to reduce their effect and increase egg production.

Identifying Broody Hens

There are many ways to identify broody hens. The “paint and pull” method is a successful method that is simple to implement in most breeder programs and reduces the chances of missing hens because of inexperienced labor.

To use the “paint and pull” method, mix food coloring into a garden sprayer or a plastic spray bottle. Be sure not to dilute the solution too much because it has to stay on the bird throughout the day.

After the first collection, allow the hens 20 minutes to return to the nests. Then begin spraying the hens. We recommend that a different food coloring be used each day. A color chart should be set up so everyone on the farm knows what color is being used for that day. The next day switch to another color. After the last collection of the day, wait 20 minutes for the hens to get back on the nest. Any hen with the color of that day must be pulled off the nests for broody treatment.

There are many broody programs in the turkey industry. When implementing a broody program, it is crucial that the program is one the farm personnel will carry out on a daily basis. One option is to use a three-day or three-pen broody program. Be sure to provide enough floor space in each broody pen so overcrowding does not occur.

Table 5. Methods to Encourage Egg Production

Factor Encouraging Broodiness	Methods to Encourage Egg Production
1. Presence of eggs in the nest over a period of time.	1A) Collect eggs frequently - at least every 45-60 minutes.
2. Hens laying or nesting on floor.	2A) Begin training hens to the nest when they are placed in the lay barn. Pick up any hens nesting on the floor and place them in the nests.
	2B) The hens may be having difficulties entering the nest or there may not be enough nest space. Improve nest access and increase nest space (five hens per nest is recommended).
	2C) Round out corners and add more light, especially in the dark areas.
	2D) Walk the floor frequently to move the hens, and pick up any floor eggs.
	2E) Switch sides on potential floor broodies or run them through the broody program.
3. High percentage of eggs laid on the floor at night.	3A) Items 1A, 2A and 2B above. Open nests earlier or close nests later.
	3B) Light entering main pen from the broody pens or other source.
4. High number of hens in nests at end of the day	4A) Side switch late layers.

The Three-Day Broody Program

The First Day:

Once the hens are pulled off the nest, place them in the first pen. This pen should be made environmentally different by using a litter different from the main pen, for example, sand, dirt or gravel. Make sure the hens have plenty of feed, water and ventilation. Never deprive hens of these necessities because it may cause them to go completely out of production.

Leave the hens in this pen for a full 24 hours before moving them to the second pen. Walk the broody pens during every collection to keep the birds moving. Any hens which squat should be returned to the main pen.

The Second Day:

Move the hens from the first pen to the second pen after last collection of the day and before pulling hens from the nests. The litter in this pen needs to be different from day one pen. This can be achieved by using sawdust or sand on the floor.

Make sure the hens have plenty of feed, water and ventilation. Leave the hens in this pen for a full 24 hours before moving them to the third pen. Walk the broody pens during every collection to keep the birds moving. Any hens which squat should be returned to the main pen.

The Third Day:

Move the hens from the second pen to the third pen after last collection of the day. The environment needs to be different from the second pen, for example shavings can be used as litter. Make sure the hens have plenty of feed, water and ventilation. Walk the broody pens during every collection to keep the birds moving. Any hens which squat can be returned to the main pen.

After the hens have been in this pen for 24 hours and after removing all the squatters, it may be useful to check the remaining birds for the effectiveness of the broody treatment. One way to do this is to evert the hen and observe the oviduct, which should be moist

and enlarged. Another way is to measure the distance between the pubic bones. If you can place three fingers between the bones, the bird is ready to return to the main pen. If the hen does not break, she can be put through the broody cycle again or removed from flock.

Broody Control Options

1. PEN SWITCH. If nests are placed down the center of the building, pen switching, whereby the whole mass of birds is switched from one side to the other may be used. This has been very effective in the past, and it is still an effective tool to use when the masses get to a point that they are **sticking** on the nest and egg production is declining.

2. PHASE LIGHTING. Another option, called phase lighting, involves increasing the photo period by four hours for one night. The best use of phase lighting is as a supplement to the regular broody control program and can be used on an insemination day.

For example, if you inseminate on Monday morning and if the lights normally come on at 4:00 a.m., set the time clock so that the lights come on at midnight. This is four hours of increased light. Phase lighting tends to do two things: 1) It helps keep production at a high point, and 2) It tends to shift the birds from laying later in the afternoon to earlier in the morning.

Phase lighting can be used in conjunction with any other broody control program that you are presently using. (Do not forget to return the time clocks to their regular time the next day after the phase lighting).

3. 24 HOURS OF LIGHT IN THE BROODY PEN. In this option the broody hens are kept in the broody pen for only 24 hours during which time they are exposed to 24 hours of light. (Do not expose the hens to 24 hours of light for more than one day. Long term exposure to constant light can cause serious production problems.)

Broody hens can be found not only in the nest but also in the main pen. Because these hens make their nests on the floor, they are called floor broodies. The best

cure for floor broodies is prevention. When the hens are moved to the lay barn, begin training them to the nests. Often, using a nest litter different from the floor litter and tying the nest gates open will aid in enticing the hens to the nest.



In addition, walk the floor area, and if any hens appear to be nesting on the floor, move them around or put them in the nests. Once egg production begins, walk the floor removing floor eggs and moving the hens at each

egg gathering. Brightening up the floor area, removing dark areas and rounding out corners or blocking corners will also help in reducing floor broodies.

Occasionally floor broodies will occur in large numbers. In this situation they should be identified by spraying them with food coloring. When the hens are inseminated, they can be pulled out and pen switched or put into the broody program.

Frequent collection of the eggs will also reduce broodiness. The eggs should be collected every 45-60 minutes to prevent the hen from sitting on the nest for

long periods. When collecting eggs, all the hens should be pushed away from the nest. This will deter the potential broody hen from returning quickly to the nest and give another hen the opportunity to enter the nest and lay her egg.

The egg gatherer can have a large impact on broody control. It is up to the egg gatherer to identify potential broodies as well as factors that may encourage broodiness and take corrective action before a problem occurs.

Broody problems tend to be more severe in warmer climates. Thus, the broody program that works best in one area might not be the best in another area. Anticipation and proper preparation will most certainly provide improved results. No one system seems to universally work for everyone. "Trial and success" seem to be the only way for each farm or company to determine which program or system works for it.

All flocks are different and all production systems vary. It is up to local management to determine what broody program works best for their situation. At Aviagen Turkeys, we are dedicated to working with our customers to design a broody control program that works best for them and allows them to produce the least cost egg.

Hen Management - Egg Handling

The main objectives of a good egg handling system are to reduce or eliminate harmful organisms that may be on the eggshell surface, prevent the egg from becoming contaminated through handling and provide the proper humidity and temperature control for maintaining hatchability.

The egg comes in contact with many sources of possible contamination before it gets to the hatchery. Organisms such as salmonellas, coliforms, pseudomonas, etc., may be found in the environment. When an egg comes in contact with fecal material, floor litter, and airborne dust, the eggshell surface may be instantly contaminated.

Organisms get inside the egg by being drawn through thousands of tiny pores in the shell as a result of the pressure differential that occurs when the temperature of the interior of the egg cools down. This is why it is so important to sanitize the egg shell surface **before it cools down**. Obviously nest sanitation is of the utmost importance.

Maintaining Hatching Egg Quality

When an egg is laid, embryonic development has begun. Therefore, it is important to avoid sudden temperature and humidity changes. A gradual decrease in temperature is preferred. For this reason the eggs should be taken from the lay barn to the egg house and processed as soon as possible.

EGG SANITATION

An egg sanitizing machine is used for sanitizing eggs. An air intake should be provided for the machine from a clean air source outside of the sanitizing room in order



to prevent contamination of the cleaned eggs. An air exhaust system should be provided to remove humidity and fumes from the egg sanitizer and from the sanitizing room. The air flow goes from the clean room and out the sanitizing room.

The egg sanitizing machine should be constantly monitored for correct water temperature (110°F-130°F / 43°C-54°C) and disinfectant levels (follow manufacturer's recommendations). It should be sprayed out after every gathering and should be taken apart and thoroughly cleaned at the end of each day. Eggs with fecal material or other contaminants on the shell should not be run through the machine and must be discarded. The room and floor should be kept clean at all times and sanitized daily.

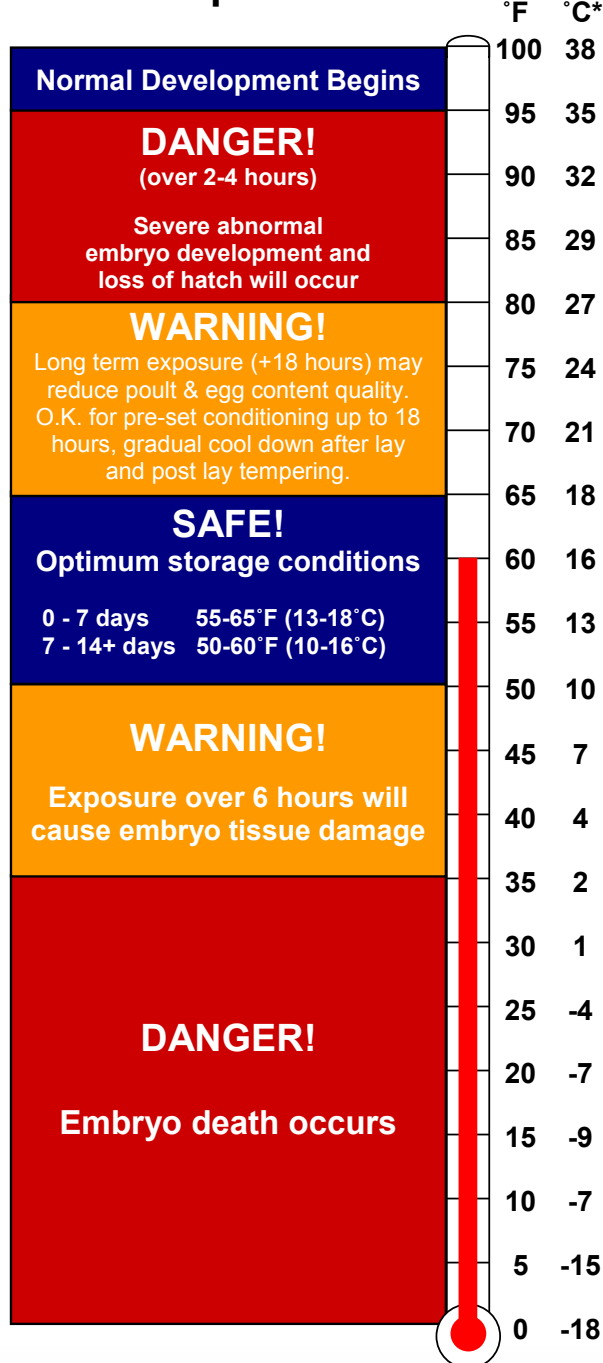
EGG HOLDING

This room should be fully insulated with a cooler capable of maintaining a temperature of 58°F (14°C) and a humidifier / dehumidifier capable of maintaining 60-80% relative humidity with accurate thermometer and humidity indicators.

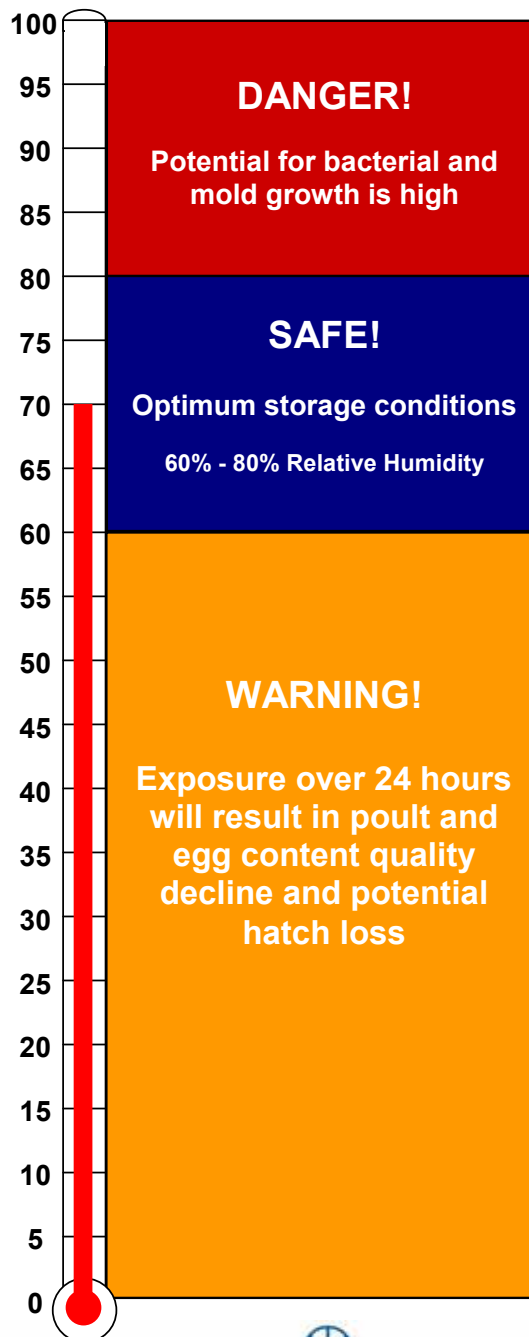


There should be a connecting door between the egg sanitizing room and the egg holding room. At the entrance to the egg holding room there should be a sink for washing hands and a foot dip pan. The egg holding room should have an access door to the outside, with a foot dip pan for egg pick up. The truck driver picking up eggs does not enter this room. **ONLY** cased eggs, or racked eggs, and a three day supply of cases and flats are stored in this room, so they can absorb moisture. The floor in this room should be mopped daily with a disinfectant solution.

Temperature



% Relative Humidity



*C is rounded to the nearest degree.



Tom Management - Semen Production

The Nicholas male line tom is an efficient, fast growing bird capable of attaining weights of more than 50 lbs. by the time it is 20 weeks of age. This type of growth is very desirable in the commercial progeny but must be controlled to maximize the reproductive efficiency of the breeder tom.

The suggested weight curve for the Nicholas Male Line Tom, has been developed over a period of several years. It is based from our experiences as well as those of our customers. Check with your Aviagen Turkeys technical representative for current weight curve.

Hatch Through Selection

Raising toms for semen production begins at day one. It is important to get the birds off to a good start. Further information on brooding tom poults can be found in the *Brooding* section. From 5 to 16-18 weeks, the objective is to allow the tom to develop his bone structure and musculature such that he is “fit and ready” to begin sexual maturity.

Light toms may be stunted and slow to mature. Heavy toms may have posture and mobility problems which will shorten their usefulness as a breeder. Heavy toms may also be close to their maximum body weight, reducing the potential for continued weight gain later in life.

Prior to selection there is very little development of the reproductive organs. Weight control during this period is achieved by weighing a sample of 25 toms and either reducing or increasing the amount of protein a tom gets by switching feeds according to the flock’s weight.

For example, if the toms are underweight, they should remain at their present protein level until they catch up to the growth curve even if the feed schedule indicates changing the feed sooner. If the toms are overweight they should be changed to the next protein level even if the feed schedule indicates it is not time to change. Avoid changing to holding diets prior to 14 weeks.

After Selection

Sexual Development usually occurs sometime between 16 weeks and 32 weeks depending on the lighting schedule and weight gain. This period is characterized by rapid development of the reproductive organs and the initiation of semen production. It is important that the toms gain well during this phase. A gain of 1 lb. or more per week should provide the tom with sufficient energy for testicular development. Weight control during this period can be achieved either by full feeding or control feeding. No matter which method is used, it is advisable to identify several toms in the flock and weigh them on a weekly basis. The same toms should be weighed every week.

When full feeding, weight control is achieved by feeding the toms a low protein feed (10% protein) if they are on or over the weight curve and a higher protein feed (12% protein) if they are under the weight curve.

On the other hand, control feeding utilizes a 14% protein diet. If the toms are underweight, they can be full fed. In general, most flocks will require a daily feed allotment of 1.0 to 1.5 lbs. of feed during the sexual development phase of the growth curve. It is very important that the toms receive all the vitamins, minerals and essential nutrients they require in their daily feed allotment. *See Control Feeding on page 30.*

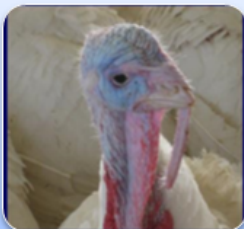


After 33 weeks, most tom flocks have sexually matured. The toms only need to gain enough weight to maintain the testis in a reproductive state. During this period the tom's weekly rate of gain can be gradually reduced to a minimum of 0.2 lbs. per week.

Following are some general tips for optimizing the reproductive performance of the Nicholas tom:

- During the Sexual Development phase from 16 to 32 weeks, the behavior and development of the additional sex characteristics should be monitored. See Figure 6. These toms may be in semen production soon.
- Nicholas toms need to weigh at least 50 lbs. when semen is needed. Below 48 lbs. the toms may not produce the best volume of semen. Above 55 lbs., they may become "heavy" later in production affecting the ability of the manager to maintain weight gain during the breeding season.
- The toms should continue to gain weight during production. A loss of weight may slow down the maturation of the toms during sexual maturity or may cause a molt in toms which are in semen production.
- If the flock is overweight and has already begun to mature or is in semen production, do not attempt to reduce their weight. Instead parallel the projected weight curve allowing the flock to gain at the same rate suggested by the weight curve.
- During the period from 38 to 48 weeks some flocks may go through a rolling molt. The regrowth of new feathers requires a lot of energy and protein. If the rate of gain is not sufficient, or slows down too much during this period, the toms may not have enough energy and protein available to maintain their reproductive system. If a larger percentage of the flock is molting it may be advisable to increase the protein or feed allotment OR increase the hours of light.
- If the birds are not gaining as expected, possible causes can range from enteric disorders to improper lighting. See Table 6 on Page 29 for more information.

Figure 6. Signs of Sexual Development



20 Weeks

Several toms should be showing caruncle and wattle development. Many of the toms should be strutting. Several should be gobbling or attempting to gobble. A few toms may protrude a small phallus when stimulated.



24 Weeks

A majority of the toms should be strutting and gobbling. Their caruncles and wattles should be well developed. Several toms should protrude their phallus and a few may appear to have small amounts of semen. The phallus should be pink to dark pink in color.



28 Weeks

A majority of the toms should be in semen production. A few may show only a protruded phallus when stimulated, but the phallus should be large and pink to red in appearance. These toms may be in semen production soon.

- Prior to each weighing, the scale should be checked with a test weight to assure the scales are operating properly. It is best to use a test weight which is in the same weight range as the toms being weighed.

Uniformity

In addition to the weight and the weight gain, flock uniformity is also important. Flocks with better weight uniformity come into production in a more even manner and produce better quality semen. Uniformity is measured using the Coefficient of Variation or CV. The CV is the Standard Deviation of the flock divided by the average weight of the flock multiplied by 100. A CV or Coefficient of Variation of 6.5 to 7.5 is considered ideal. A CV above 9 may indicate a potential problem. Table 7 below details some areas to review if the flock has a high CV.

Table 7. Areas to Review for Potential Uniformity Problems

Ventilation:	Dusty conditions may compromise the respiratory system of the turkey and affect future performance. Make sure the fans and louvers are clean and operating properly and the intakes adjusted correctly. It may be necessary to add moisture to the barn to reduce dust.
Litter:	Wet, damp litter can cause swollen feet and affect the tom’s ability to walk especially as his weight increases. If the litter is wet, it may be necessary to adjust the ventilation, to remove the moisture in the barn or to top dress the litter.
Equipment:	Equipment problems such as the wrong type of equipment, improperly adjusted equipment or broken equipment can affect the ability of the birds to eat and drink as they grow.
Changes:	Changes in feed and water quality can affect flock uniformity. Make sure drinkers are working correctly and are adjusted to the right height.
Temperature:	Hot or cold temperatures can affect the flock’s ability to gain weight and increase the variation in the flock. It is extremely important to maintain a uniform temperature throughout the barn.
Vaccination:	A poorly executed vaccination can influence the feed consumption of the tom and increase the variation in the flock.
Beak trim:	Toms with short beaks, uneven beaks or other problems will have difficulty eating.

Table 6. Possible Causes for Lack of Weight Gain

Enteric Disorders:	Worms, diarrhea and enteric problems can affect weight gain.
Feed Quality:	Feed must contain all the nutrients the tom needs to maintain weight gain.
Water Access:	Toms which have limited access to water will not eat properly.
Drafts:	If the toms are in a draft or chilled, their ability to gain may be reduced.
Lights:	Occasionally a reduction in weight gain is related to a malfunction in the lighting.

Tom Management - Control Feeding

Control feeding the turkey breeder tom from selection through the breeding cycle may reduce feed costs and will also improve reproductive performance which allows better use of superior toms. The following procedures and requirements, if met, should produce excellent results.

- 1) Select breeder toms according to Aviagen Turkeys selection procedures. Identify the selected toms by marking them with food coloring or with large colored wing tags.
- 2) As soon after selection as possible, move the toms to the conditioning barns. Place no more than 25 toms per pen with at least ten square feet per tom.
- 3) Using tags, identify at least 25 toms (one or two at random from each pen) to be used for sample weighing. Individually weigh toms at weekly intervals. These toms will serve as a monitor and allow adjustments in the feeding schedule to accomplish the target weights recommended.
- 4) After the toms have been moved into the conditioning barns, they should be full fed for a few days to allow them to adjust to their new surroundings. Once this is accomplished, begin control feeding by adjusting the feed allotment to bring the weight and weight gain in line with the male line tom breeder weight curve. The actual caloric content of the diet is not critical, but the daily allotment must be adjusted to ensure the toms are gaining according to the weight curve. In addition, the



daily allotment must contain sufficient nutrients to satisfy the toms' daily requirements.

- 5) If there is a large spread in body weight, it would be advisable to divide the flock into two or three weight groups and feed each group accordingly so that the weight of each group is similar to the weight suggested in the male line tom breeder weight curve.
- 6) Feed trough design is an important aspect of a controlled feeding program. It is recommended that only long, deep, "V" troughs be used so the feed depth in the trough will be sufficient for beak trimmed birds to feed easily. An absolute minimum of 12 linear inches of feeder space must be provided for each tom. Fourteen linear inches of feeder space is considered optimum.
- 8) Tips for best performance include:
 - A) Troughs for control fed toms must be positioned considerably lower than normal. This will prevent toms from scooping out feed and also prevent toms from bruising their necks during vigorous feeding.
 - B) Feed the toms their entire allotment once daily, usually in the early morning or after semen collection.
 - C) Be careful to calculate the correct feed allotment for each pen based on the actual number of toms per pen and be sure that feed is not spilled as it is distributed in the troughs.
 - D) If the average barn temperature changes more than 10°F (5.5°C), it may be necessary to change the feed allotment accordingly to maintain the desired weight gains. As a general rule, increase the feed

allotment 10% for each 10°F (5.5°C) decrease in average barn temperature.

- 9) The most critical aspect of control feeding toms is to ensure the target weight is reached when semen is needed. Weekly sample weights taken are very important to ensure the control fed toms are on schedule. Remember, sexual maturity is influenced by both body weight and lighting.

- 10) This controlled feeding program has been designed to slow the rate of sexual maturity in breeder toms and assumes that the corresponding hens will be lit for production at 29-30 weeks of age. To ensure that the toms are producing adequate semen at 32-33 weeks of age, use the lighting program suggested in the section titled *Lighting Toms*. If semen is needed at an earlier age, adjustments will need to be made in both the tom lighting and feeding programs.

Artificial Insemination

The following recommendations regarding insemination are made with the assumption that both the hen and tom are healthy, well conditioned, fit and ready for insemination.

Milking the Tom:

The first semen produced by a tom most likely has been in the toms' reproductive system for some time. In addition, at the initiation of semen production, an immature developing testis may not produce the highest quality semen. Experience has shown it generally takes two pre-milkings to bring toms into good quality semen production.

When milking the tom, it is important to hold him securely and comfortably. Massage the tom on the abdomen with one hand and the back in front of the tail with the other hand to stimulate the tom. As the tom responds, push the tail up over the back and bring the thumb and forefinger of the hand that was massaging the tail into position to squeeze inward at the base of the erect phallus. With the index finger of the other hand, squeeze inward and up to expel the semen from the bulbous ductus. Using an aspirator, collect the semen from the tip of the phallus.

Collect only thick, white semen. Semen that is yellow, thin or contaminated with blood, urates, feces, dirt, etc., should be avoided as it tends to be of lower quality and can adversely affect fertility.

Insemination of the Hen:

Insemination is best achieved by everting the hen and gently probing into the vagina with an A.I. tube along the horizontal axis until a very slight resistance is felt due to a flexure in the vagina. The A.I. tube should then be given a slight circular movement at which time it will generally enter further. The A.I. tube must follow in and the semen be expelled simultaneously with the oviduct being allowed to revert to its normal position by releasing pressure on the abdomen of the hen.

At no time should force be applied to the A.I. tube. Applying force may cause penetration of the oviduct and result in lower fertility, reduced egg production and possibly the death of the hen.



Figure 7. As the male responds, push the tail up over the back.



Figure 8. Squeeze inward and toward the phallus to expel the semen.



Figure 9. Using an aspirator, collect the semen.

There are three checks that an inseminator should make during each and every insemination:

CHECK 1:	Before inserting the A.I. tube, make sure the opening to the oviduct is clearly visible, the A.I. tube is correctly filled and the semen is of good quality.
CHECK 2:	Make sure the tube is properly inserted and the semen is expelled.
CHECK 3:	After the tube has been removed, make sure the oviduct has returned to its normal position, the semen did not come back out of the oviduct and there is no semen splashed onto the vent area or the A.I. tube.

Additional Considerations:

The following considerations may improve the A.I. process and, thus, improve fertility:

- 1) Handle the birds gently and securely. Design the tom pens, milking benches, insemination pits or chutes, holding pens, insemination chairs, etc., to reduce stress on the birds and crew. Train the crew to handle the birds as gently as possible. Proper handling will increase semen yield, improve fertility and make the job easier.

Table 8. Number of Sperm Cells Required

Week of Production	Minimum Sperm Cells Required (millions)
0 - 2	360
3 - 10	320
11 - 16	345
17 - 22	370
23 - 28	395

- 2) Inseminate sufficient spermatozoa to attain maximum fertility. Shown in the table below are our recommended minimum sperm cell requirements. We recommend that all hens in the flock receive at least the minimum number of sperm cells. Depending on semen quality and

insemination technique, it may be necessary to inseminate higher sperm numbers to maximize fertilities. Several methods have been developed to estimate the number of spermatozoa being inseminated into the hen. Contact your Aviagen Turkeys technical representative for more information.

- 3) It is believed the presence of sperm cells in the sperm storage glands causes a stimulatory response on the functioning of the gland itself. Thus, it is important to promptly fill the storage sites and maintain them full by using a regular insemination schedule. The first insemination should be when 95% or more of the hens “break.” This usually occurs 14 to 17 days after the lights have been turned on. If fewer than 95% of the hens actually “break” at the first artificial insemination, this insemination should be disregarded, and the next insemination should be considered the first. The first three inseminations should be done in the first week followed by weekly inseminations.
- 4) Allow the toms to rest two full days between milkings. Toms that have been stressed due to management or health will require a longer rest period before they will again be ready for milking.
- 5) Fertilizing capacity of the semen will be improved by reducing the stress the semen is exposed to. Avoid rough handling of the semen and exposure to extreme temperatures.
- 6) Survival of the semen outside the tom is limited. With on farm toms, the ideal time limit from when the first tom is milked to when the last hen from each vial is inseminated should not exceed 30 minutes. However, in stud farm situations the ideal time from when the first tom is milked to when the last hen from each vial is inseminated should not exceed two hours. If semen is held for more than 30 minutes long term storage techniques as described below should be used.

Long Term Semen Storage:



From a fertility standpoint, the sooner the semen is used, the better. However, if it is necessary to hold the semen for more than 30 minutes, certain semen storage

techniques should be considered. The following method is adequate for holding semen for as long as 6 hours however semen quality will decline after 2 hours. Thus it is recommended semen be used within 2 hours.

- 1) Prior to collecting the semen, wet the collection vial with one to two cc of extender. Milk the semen into the extender and mix after each collection. The collection vial and extender should be at room temperature (68°F-70°F / 20°C-21°C). Exposure of the semen to sudden hot or cold temperature extremes is not recommended.
- 2) Collect only clean, white, thick semen. Poor quality semen (yellow, gray and thin) and/or contaminated semen (semen containing feces, urine, urates, blood, etc.) will not store well. *See Figure 10.*
- 3) Within 20 minutes of collection take the semen to a clean, dust free area to add additional extender. The extender to be added should be close to the temperature of the semen. Add the semen extender 0.5 cc at a time mixing the sample between each addition. This will allow the semen time to adjust to the extender.
- 4) The semen should be diluted 50% (one part semen:one part extender). The extender has many qualities beneficial for semen storage. Using less

the reduction in the benefits gained from the extender. **CAUTION: Use only proven extenders intended for turkey semen storage. Not all extenders are suitable for holding semen for extended periods.**

- 5) As a general rule, stored semen should not be held for longer than six hours from first tom to last hen. New techniques for holding semen are evolving, but our recommendation at this time is to use semen as soon as possible after milking.
- 6) Temperature is very important. Once the extender is added to the semen, it should be placed in a water bath at 41°F (5°C). The semen should remain at this temperature until it is ready for use. The suggested cooling rate is 1.8°F per minute (1°C per minute). Do not allow the semen to freeze. Frozen semen is dead semen. Storage temperatures above 50°F (10°C) result in a more rapid decline in semen quality. Although a refrigerated water bath is preferred for semen cooling, simply placing the flask of semen in crushed ice and water will also work.
- 7) Since oxygen is very important for sperm cell survival, 50cc Erlenmeyer flasks are recommended for storing semen. The flask should have at least 10cc of semen to prevent drying out of the semen and not more than 25cc to maximize exposure of the semen to air. It is recommended that the surface diameter, the distance across the top of the semen, be three times the depth of the semen. The flask should be capped with a two-hole rubber stopper or an aluminum foil cover with some small holes in it to allow an exchange of air but prevent spillage.

Figure 10. Poor Quality Semen



than 50% extender is not recommended because of

- 8) During A.I., the flask should be gently swirled using an agitator. The swirling should not be rough enough to cause damage to the sperm cells.
- 9) Once the semen is removed from the cooler, it should be used right away.
- 10) Stored semen is more highly diluted. Thus, it is necessary to inseminate a proportionately larger dose to ensure sufficient sperm cells are

inseminated into the hen to achieve good fertility. The packed cell volume evaluation of semen concentration is an excellent method of monitoring the number of sperm cells inseminated. In addition, because the semen is highly diluted, it will be more apt to run out of the tube. Caution must be practiced in order to inseminate the complete dose into each hen.

Ventilation



Ventilation control is the principle means of controlling bird environment. It is essential to deliver a constant and uniform supply of good quality

air at bird level. Fresh air is required at all stages of growth to allow the bird to remain in good health and achieve full potential.

Ventilation helps to maintain in-house temperatures within the birds' comfort zone. During the early part of the production period keeping birds warm is the primary concern, but as they grow keeping them cool becomes the main objective.

The housing and ventilation systems used will depend upon climate, but in all cases effective ventilation should remove excess heat and moisture and improve air quality by removing harmful gases and dust. Sensors that monitor ammonia, carbon dioxide, relative humidity and temperature are available commercially and can be used to monitor the ventilation system.

As turkeys grow they consume oxygen and produce carbon dioxide and water vapor. Combustion by stoves contributes additional harmful gases in the turkey house. The ventilation system must remove these harmful gases from the house and deliver good quality air.

Air Quality

The main contaminants of air within the house environment are dust, ammonia, carbon dioxide, carbon monoxide and excess water vapor. These contaminants can damage the respiratory tract, decreasing the efficiency of respiration and reducing bird performance.

Continued exposure to contaminated and moist air may trigger respiratory disease, reduce performance, affect temperature regulation and contribute to poor litter quality.

Target levels to maximize bird performance:

Carbon dioxide concentrations	below 3,500 ppm
Carbon monoxide concentrations	below 35 ppm
Relative humidity	50% - 70%
Ammonia concentrations	below 25 ppm

Housing and Ventilation Systems

There are two basic types of ventilation system: natural and power.

Natural (Open-sided Housing), which can be:

- Non-mechanically assisted
- Mechanically assisted

Power (Controlled Environment Housing), which can be:

- Minimum
- Transitional & Tunnel
- Evaporative Pad
- Fogging/Misting

Natural Ventilation: Open-Sided Housing

Natural ventilation refers to an open-sided house with curtains. Natural ventilation involves opening and closing the curtains to control the air flow and environment inside the house.



Curtain ventilation requires diligent management if house environment is to be satisfactorily controlled. The monitoring of conditions and adjustment of curtains is required to compensate for changes in temperature, humidity, wind velocity and wind direction.

The air exchange rate depends on outside winds, and fan assistance improves the efficacy of air circulation. On warm to hot days with little wind, fans provide a wind chill cooling effect. Foggers, misters or sprinklers should be used with circulation fans to add a second level of cooling.

In cold weather, when curtain openings are small, heavy outside air enters at low speed and drops immediately to the floor which can chill the birds and create wet litter. At the same time, warmer air escapes from the house which can result in large temperature swings. This can be reduced by using circulation fans help to mix incoming cold air with warm in-house air.

Power Ventilation Systems: Controlled Environment Housing

Power or negative pressure ventilation systems are becoming more popular for controlling house environment. Better control over air exchange rates and airflow patterns provide more uniform conditions throughout the house.

Power ventilated systems use exhaust fans to draw air out of the house and create a lower pressure within the house. This creates a partial vacuum (negative or static pressure) inside the house so that outside air can pass in through controlled vent openings. The speed at which air enters the house is determined by fan capacity and vent area.

Matching the vent openings to the number of exhaust fans in operation is the key to achieving correct negative (static) pressure. Mechanical controls will automatically adjust vent openings to the number of fans running. The amount of negative pressure generated can be monitored by a static pressure gauge.

Negative pressure ventilation can be operated in three different modes according to the ventilation needs of the birds:

- Minimum ventilation
- Transitional ventilation
- Tunnel ventilation

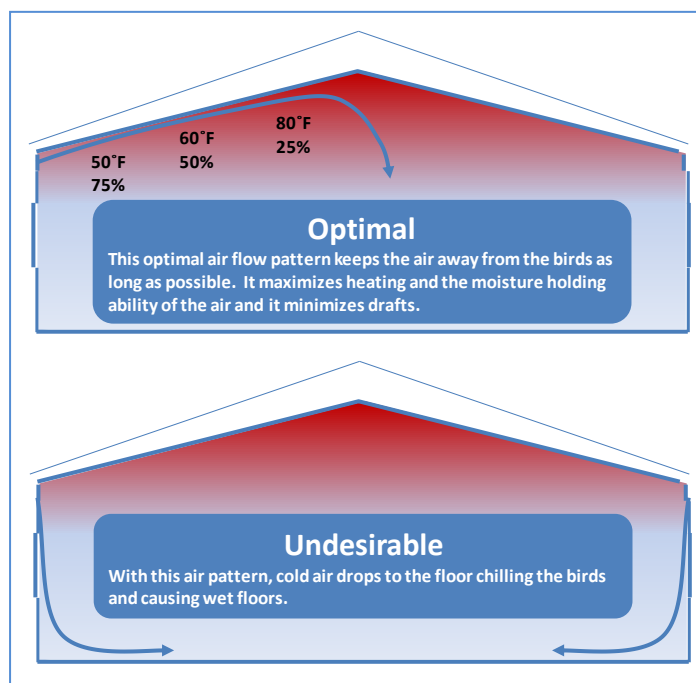
With any powered system, a standby emergency generator is required.

Minimum Ventilation Systems

Minimum ventilation is used for cooler weather and for young birds. The aim of minimum ventilation is to maintain required air temperature, bring in fresh air and remove excess moisture and harmful gases.

The key to successful minimum ventilation is creating a partial vacuum (negative pressure) so air comes through all 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 11*. This type of ventilation is preferably timer-driven.

Figure 11. Optimal Air Flow Pattern



Transitional Ventilation Systems

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 Systems

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.

Evaporative Cooling Systems

Tunnel ventilation is well-suited to the addition of an evaporative cooling system. Evaporative cooling is used to improve environmental conditions in hot weather

and enhances the efficiency of tunnel ventilation.

Evaporative cooling systems use the principle of water evaporation to reduce the temperature in the house.



Evaporative cooling is best implemented to maintain a required temperature in the house, rather than to reduce temperatures that have already become stressfully high.

The three factors which directly affect evaporative cooling are:

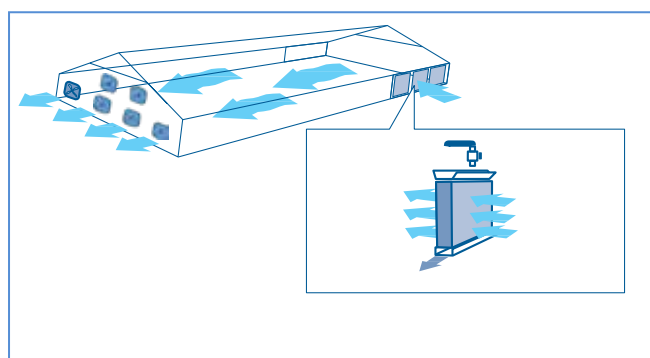
- Outside air temperature
- Relative humidity (RH) of outside air
- Evaporation efficiency

There are two primary types of evaporative cooling systems; pad cooling with tunnel ventilation and foggers, misters and sprinklers.

Pad Cooling with Tunnel Ventilation

Pad cooling systems cool air by drawing it through wetted cellulose pads, see *Figure 12*. The dual effect of pad cooling and air speed allows control of the environment when house temperatures are above 85°F (30°C). Excessively high house humidity can be minimized by making sure that evaporative cooling pads/fogging systems do not operate at temperatures below 80°F (27°C) in areas where the ambient humidity is high (greater than 80%).

Figure 12: Pad Cooling with Tunnel Ventilation



Fogging/Misting

Fogging systems cool incoming air by evaporation of water created by pumping water through fogger nozzles.

There are three types of fogging systems:

- Low pressure, 100–200 psi; droplet size up to 30 microns.
- High pressure, 400–600 psi; droplet size 10–15 microns.
- Ultra high pressure, 700–1,000 psi; droplet size 5 microns.

Pressure	PSI	Droplet Size
Low Pressure	100 - 200	Up to 30 Microns
High Pressure	400 - 600	10 – 15 Microns
Ultra High Pressure	700 - 1000	5 Microns

With low pressure systems, larger particle sizes can cause wet litter if house humidity is high. High pressure systems minimize residual moisture giving an extended humidity range. Fine droplet size will help avoid wet litter.

Cold Weather

During cold weather primary consideration should be given to the control of ammonia and humidity. Ventilating too little can lead to poor air and litter quality, resulting in bird health and performance issues. Ventilating too much can lead to drafty conditions and high heating costs.

Following are some tips to ensure proper ventilation during cold weather.

- Maintain ammonia level below 25 ppm. If ammonia levels become too high, increase minimum ventilation level. At times it may become necessary to add heat depending on age of flock and outside temperature. The amount of ammonia produced is a function of factors such as age of litter, litter moisture, amount of caked litter and length of downtime between flocks.
- Maintain relative humidity between 50% and 70%. If the barn becomes dusty add moisture. When humidity reaches 60% begin to increase minimum ventilation rates. At times it may become necessary to add heat depending on age of flock, outside temperature and humidity.
- Ensure house tightness, there should be no air leaks. The best way to evaluate house tightness is with a static pressure test, *see Figure 13*. Seal all cracks with caulk or foam insulation as needed. A smoke emitter will be useful to identify leaks.
- Maintain minimum ventilation rate regardless of the inside or outside conditions. Without at least the minimum ventilation rate the inside air quality will deteriorate and litter moisture and ammonia problems will occur. If wet litter or ammonia becomes a problem, increase the minimum ventilation rate.
- Ensure that incoming air is mixed with warm in-house air above the birds rather than dropping directly onto the birds and chilling them. This requires matching the number of vents and fans to maintain static pressure.

Figure 13. Procedures for Static Pressure Test

Static Pressure Test

1. Close all vents, doors, curtains, etc.
2. Turn on enough fans to equal 1 CFM per square foot (1.7 cubic meters per hour per 0.093 square meters)
3. Static pressure should be 0.2 or better.
4. If the number is lower than 0.2, too much air is coming in through leaks and cracks. The higher the number, the better the tightness.

- Use stir fans to reduce temperature stratification. Do not direct airflow onto the birds.
- Make sure fans are well maintained and working properly. Fan belts should be tight and louvers should be clean and free of dust. Replace belts annually.
- If the house gets too warm, check the thermostat setting not the fan timer setting.
- Maintain cables to ensure proper opening and closing of vents.
- Maintain heaters to ensure efficient operation and to reduce carbon monoxide.
- Check plumbing fixtures for leaks.
- Upgrade insulation if needed. Heavy condensation can indicate areas of poor insulation.
- During down time, empty water lines to avoid freezing and breakage.

Hot Weather Ventilation



When turkeys are exposed to excessive heat they begin to suffer from heat stress. Some signs of heat stress are decreased feed consumption, increased water consumption, gasping, open mouth panting, wing spreading, stupor, slowness and lethargy. The longer the

flock is exposed to high temperatures, the greater the stress and its effects.

Following are some ventilation techniques to help control house temperature during hot weather.

- Ensure all fans are in working order, belts are tightened and fan housings are kept free of dust. Clean louvers and vent openings frequently as any dust accumulation will reduce air flow.
- Set and activate alarms. This is especially critical for barns using tunnel and static pressure ventilation.
- Temperature targets will vary with flock age.
- Test alarms weekly.
- Properly set thermostats on both fans and curtain machines according to flock age and outside temperature considerations.
- Direct hanging fans so air flows across the birds and not up to the ceiling.
- In open sided housing sidewall screens and end door screens should be kept clean at all times to maximum air flow.
- For static pressure barns, remember the goal is to pull enough static pressure to eliminate dead air spots in the center of the barn while still increasing air volume. *Not all barns are the same width and will have different requirements. Check with your service technician on recommendations for your barn.*
- Set up tunnel ventilated barns in stages based on outside temperatures and bird requirements.
- For curtain sided barns, keep screens clean of dust and feathers. Keep perimeter of building clear of tall grass, equipment and any other air flow obstructions.
- Test any foggers, misters or sprinklers prior to use each summer. Nozzles can become clogged; hoses and pipes can become cracked. Dripping nozzles will reduce mist onto birds and create wet spots. Watch for drips and repair as needed.
- Do not run foggers, misters or sprinklers without also using fans.

Generators, Alarms and Curtain Drops

Generators should be tested weekly, serviced and maintained as per manufacturer's recommendations. Both a service log and test log should be kept on site with equipment.

Additionally, alarms and curtain drops are to be tested weekly with logs kept.



Vaccination

Vaccination is a complement to a good biosecurity program. The design of a vaccination program that provides good immunity in turkeys at the least cost is highly dependent on the disease incidence and prevalence in the region where the turkeys are raised. A serology program for assessing challenges would help determine which diseases are important in a given area.

Some considerations are:

- 1) What diseases in your area are of concern?
- 2) What is the incidence and prevalence of each disease?
- 3) At what age do the diseases generally occur in flocks in your area?
- 4) What other types of birds, livestock and wildlife are present in your area? Could any of these species serve as a reservoir for any of the diseases?
- 5) How good are the on-farm biosecurity measures? Do you have a shower-in/shower-out system?
- 6) Are rodents, insects or other pests a problem on your farms?
- 7) What other stresses are occurring that may affect vaccination? Timing of vaccination needs to be such that the stresses on the flock are minimal.
- 8) When will the flock be selected? When will the select outs be marketed? Is there sufficient withdrawal time for the vaccine applied to your flock?

Once a vaccination program has been designed and implemented, it should be periodically monitored and evaluated by using the available test system in your area.

Even the best vaccination programs can fail. Possible causes of failure are:

- 1) Immunosuppression- Stressed or sick flocks may not respond to vaccination as expected.
- 2) Incorrect mixing and dosage of vaccine.
- 3) Application errors- When water vaccinated ensure all chemical water treatment has been cleared from lines prior to administering vaccines. When injecting vaccines make sure each bird is correctly vaccinated.
- 4) Loss of vaccine potency- Check expiration dates on vaccine before administering to flock. Vaccine also needs to have been properly stored per manufacturers recommendations.
- 5) Scheduling errors- Timing of vaccination is critical to keep flocks healthy and avoiding interruptions in egg production.
- 6) Serotype variants- Vaccines are most effective when serotype matches the disease challenge in your area.

When using vaccines, it is imperative to read the label and follow the manufacturer's recommendations. Always seek the advice of a qualified veterinarian and always use clean, sterile equipment.

As indicated, design your vaccination programs based on incidence and prevalence of disease in your area.

Water Vaccination

Prior to Vaccinating

- Remove chlorine, antibiotics, disinfectants and other additives from the water. Presence of these materials will interfere with the vaccine.
 - Two days prior to scheduled vaccination, turn off chlorine.
 - If water is chlorinated from the supply source use a charcoal filter to remove

chlorine or let water stand in holding tank for two days.

- Test water to ensure chlorine is removed. It may take longer than two days.
- Rinse and flush water tank or ensure you have a clean medication bucket for proportioner.
- Wash drinkers the day before vaccination.
- One day prior to scheduled vaccination, run vaccine stabilizer.

Day of Vaccination

- Only vaccinate healthy birds.
- Restrict water intake to ensure birds are thirsty for the vaccine water.
- Two hours prior to lights coming on (or prior to normal chore activities):
 - Flush water lines with clean water
 - Raise the drinkers
 - Turn off the water
- Mix correct number of vaccine doses into enough water to last 3-4 hours.
- Add vaccine stabilizer (with blue dye).
- Flush the water lines, ensuring that all the drinkers in the house have water with blue dye. Drinkers must be emptied to get vaccine water started.
- Lower the drinkers.
- Walk through the barn every 20-30 minutes.
- Resume chlorination 4 – 6 hours after all the vaccine is consumed.

Vaccination by injection

The following are some guidelines to consider when administering vaccine by injection:

- Vaccination site can vary depending on type of vaccine, company preference, condition of flock, and age of flock.
- Chutes, catch pens and equipment used needs to set up in such a way to avoid rough handling and piling.
- Check vaccine equipment for proper calibration and dosage before starting.
- Avoid vaccinating on extremely hot days.
- Take into consideration moving schedule, lighting schedule, to minimize stress on flock.
- Last vaccination should be completed 3 weeks before lighting flock.
- Avoid vaccinating during “broody peaks.”
- Change needles after every bottle of vaccine.
- Thoroughly clean equipment after vaccination is completed.

Vaccination alone cannot protect flocks against overwhelming disease challenges and poor management practices. Develop programs for birds in consultation with a trained poultry veterinarian. Vaccination is more effective when disease challenges are minimized; good management and biosecurity will help reduce these challenges. Base your vaccination programs on local disease challenges and remember every bird must receive the intended dose of vaccine.

Pest Management

Controlling pests requires an Integrated Pest Management (IPM) system and utilizes multiple tools to manage pests. It includes planning and implementing proper sanitation practices, mechanical devices, pest behavior and pesticides to provide a foundation to prevent pest outbreaks and predict when and what types of treatment are most economically beneficial.

The primary pests that impact poultry production are darkling beetles, rodents, flies, wild birds and worms. Controlling weeds is a key part of a pest management program due to the impact on pest behavior.

Darkling Beetles



Darkling beetles are best controlled with insecticide.

- Apply the label recommended amount of each insecticide. **Using**

less than the recommended amount will lead to increased resistance to the insecticide.

- If large populations of beetles are present, apply insecticide before placement of each flock to keep the beetle populations under control.
- If using an Organophosphate or Pyrethroid, add 1 packet of Citric Acid or another acidifier to each insecticide tank mix before applying the material. These insecticides kill more beetles when they have an acid added to the tank mix.
- If using a Spinosad, add 1-2 ounces of clear household ammonia per gallon of tank mix.
- If using a neo-nicotinoid class of insecticide, such as Imidacloprid no tank additives are necessary.
- Rotate products utilizing a minimum of four different classes of insecticide per year.

- Apply the insecticide using as little water as possible, as recommended by the manufacturer.
- Change nozzle tips to a flat fan, 04-08 nozzle tip, to get a fine mist instead of a coarse spray application.
- Do not apply insecticide to the entire house.
- Focus the insecticide applications to the areas where the beetles are living when the birds are in the house for much better control:
 - 3 foot wide band under the feed lines
 - 3 foot wide band along the walls, including the footing
 - 2 feet up onto the wood above the footing
- Apply the insecticide on top of fresh shavings after clean out or on top of the litter after caking out. The beetles crawl on top of the litter as they are making their way to the feed line areas after bird placement. Results are not as good if insecticide is applied on the bare floor.
- Prior to clean out apply a wall treatment such as Permethrin 10% to prevent beetles from retreating to the walls during clean out.
- After clean out or caking out, apply the insecticide currently used in rotational program to any litter stored in the litter shed. This will prevent the beetles from migrating back into the houses.
- The number of beetles killed in the first 24 hours is not the best indication of the insecticide's efficiency. Some insecticides may not work as quickly but have more consistent results.
- You have good control if there are only a few beetles and larvae present under the feed pans when the birds are 4 weeks old and near the end of the flock.

Rodents

Control Procedures at Cleanout

- Immediately after depopulating the houses:
 - Use a “quick kill” product such as zinc phosphate.
 - Place shallow trays (egg flats work well) 40 feet apart along the walls.
 - Place one tray at each end door.
 - Put bait in each tray as recommended by the manufacturer.
- Check and replenish the bait in the trays every day for at least 5 days.
- At any time during cleanout place bait in the attic space of the house.
- Liquid bait can be used if no water is present in the house during down time.
- Just prior to bird placement, pressure wash all bait stations, allow them to dry and replenish with fresh bait. This should be done on every flock.

Rodent Prevention

- Do not allow the accumulation of materials, trash or other debris in and around the farm.
- 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 might enter houses.
- Maintain a “vegetation-free” zone at least 36 inches around all barns and control all grass and weed growth.
- Rotate bait using different active ingredients at least three times per year to keep rodents from becoming “bait shy”.

Rodent Bait Station Placement

- Place bait stations along the perimeter fence every 60 to 100 feet.



- For all turkey houses, place outside bait stations one every 40 feet and two on each end.
- If cool cells are being used, place 2 stations in each access area.
- Attach outside stations in an upright position to the footings or walls, ¾ inch above the ground using contractors adhesive. This keeps the stations in the most advantageous spots and allows them to be cleaned with a portable power washer.
- Place inside stations one for every 20 feet of exposed wall.
- Place stations in each building / room where rodents could enter, e.g. equipment room, storage shed, entry building, break room, egg house, etc.

Rodent Bait Station Maintenance

- Treat bait stations as if they are harboring disease – they should only be handled at the end of the day and when wearing gloves.
- Keep bait stations clean and free of insects and excessive dirt.
- Keep bait fresh and dry.
- Check stations at least monthly and keep a record of rodent activity and bait consumption.
- Monthly cleaning – caution should be used during cleaning, as rodents can carry salmonella and other diseases. Contents should never be emptied where it can come in contact with birds.
 - Open all bait stations and remove the bait.
 - Clean the inside of the bait stations using a dry rag or a stiff bristled paintbrush.
 - Contain and carefully dispose of removed contents to avoid spreading disease.
 - Replenish with fresh bait as necessary to maintain manufacturer’s recommended supply.
- All bait stations should be thoroughly cleaned or pressure washed at least once per year.

Fly Control

Management Techniques

- Clean up feed and water spills.
- Properly store feed.
- Dispose of dead birds promptly.
- Keep outside clear of any manure.
- Maintain a “vegetation-free” zone at least 36 inches around all barns and control all grass and weed growth.
- Keep perimeter vegetation short and tidy.
- Manage drinkers to minimize wet cake underneath drinkers and nipple lines.
- Maintain dry litter conditions.

Chemical Measures

- Apply an approved residual fly spray around perimeter and in the houses according to manufacturer’s recommendations.

- Use bait stations or traps in areas of heavy infestation, such as corners and around doors. Ensure they are out of birds’ reach.
- Apply larvacides directly to manure according to manufacturer’s recommendation to control fly larva.

Worms

Worms can have a significant detrimental effect on performance, including poor weight gain, increased feed conversion and increased mortality. Therefore worming should be done on a routine basis using a veterinary approved turkey worming program. The life cycle of a worm is 28 days, so worming should be done a minimum of every four weeks.

Water



Water is an essential ingredient for life. Water supplied to turkeys should not contain excessive amounts of minerals and should not be contaminated with bacteria. Test the water supply to check the level of calcium salts (water hardness), salinity and nitrates. After the house has been cleaned and before the birds have arrived, sample water for bacterial contamination at the source, at the storage tanks and at the last drinker, *see Table 9*.

Table 9. Acceptable Concentrations of Minerals and Organic Matter in Water Supply

Contaminant, Mineral or Ion	Levels Considered Average	Maximum Acceptable Level	Comments
Bacteria			
Total Bacteria (TPC) CFU/ml	0 CFU/ml	1000 CFU/ml	<p>Total Bacteria is used as an indicator of system cleanliness, high numbers do not necessarily mean the bacteria present is harmful but it does mean that the system is capable of harboring pathogenic organisms. High bacteria levels can impact taste of water resulting in reduced consumption.</p> <p>Treatment-Shock well, then implement sanitation program such as chlorine, hydrogen peroxide or other sanitizers. Maintain a residual level of sanitizer.</p> <p>Presence of any fecal coliform means water is unfit for consumption.</p>
Total Coliforms	0 CFU/ml	50 CFU/ml	
Fecal Coliforms	0 CFU/ml	0 CFU/ml	
pH	6.5-7.8	5-8	<p>pH below 5 can be harmful to drinker equipment-causing corrosion to metal components with long term exposure.</p> <p>Treatment-If pH is lower than 5 use soda ash or caustic soda injection to raise pH.</p> <p>pH above 8- impacts effectiveness of most water sanitizers. High pH associated with high alkalinity, may result in reduced water consumption due to “bitter” taste.</p> <p>Treatment- If pH is high acid injection will be required.</p>
Total Hardness	60-180 mg/l	110 mg/l	<p>Total Hardness (Calcium plus Magnesium) causes scale which reduces pipe volume and causes drinkers to be hard to trigger or leak.</p> <p>Treatment- Softeners can reduce hardness up to a practical limit of 1 gpg or 17 ppm/mg/l. If the hardness is above 3 gpg or the sodium to hardness ratio is greater than 33% then the sodium level will be high after softening and reverse osmosis may be required.</p>
Natural Elements			
Calcium (Ca)	60 mg/l		<p>Birds are very tolerant of calcium but values above 110 mg/l may require water softener, polyphosphates or acidifier to prevent scaling. In areas of high calcium care must be taken to ensure proper calcium/phosphorus ratios for egg production.</p> <p>Higher levels of magnesium may cause flushing due to laxative effect particularly if high sulfate is present.</p>
Magnesium (Mg)	14 mg/l	125 mg/l	

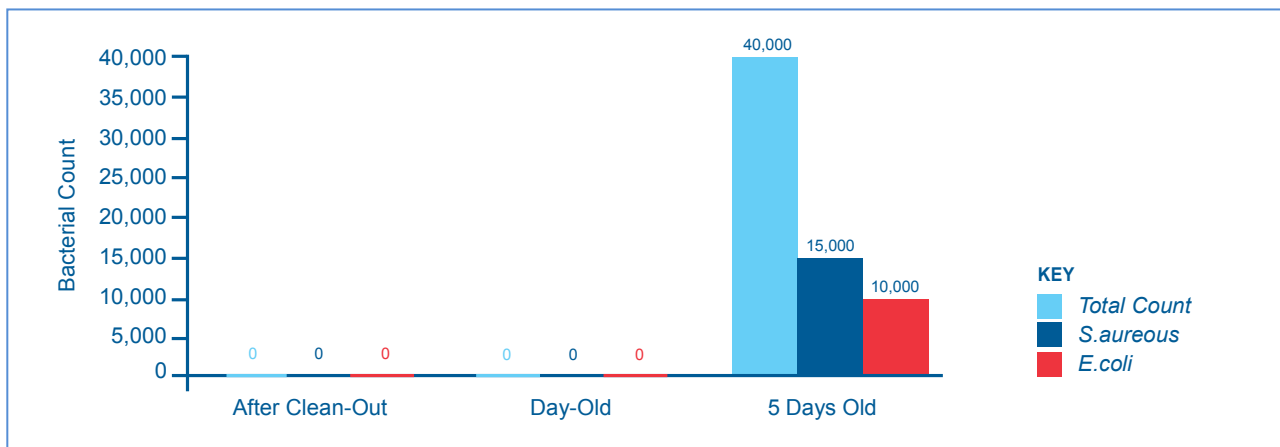
Contaminant, Mineral or Ion	Levels Considered Average	Maximum Acceptable Level	Comments
Iron (Fe)	0.2 mg/l	0.3 mg/l	Birds are tolerant of the metallic taste of iron . Iron can cause leaking drinkers and promote the growth of E coli and pseudomonas. Iron is linked to thick slime producing bacteria such as crenofoms. Treatment- Includes oxidation with chlorine, chlorine dioxide or ozone followed by filtration.
Manganese (Mn)	0.01 mg/l	0.05 mg/l	Manganese can result in black grainy residue on filters and in drinkers. Treatment- Includes oxidation with chlorine, chlorine dioxide or ozone then filtration. Green sand filtration and softeners will remove manganese. Pay close attention to pH when deciding what method to use. Farms with manganese in the water have been problematic.
Chloride (Cl)	50 mg/l	150 mg/l	Chloride , when combined with high sodium levels, creates salty water that can act as a laxative causing flushing. Salty water can promote the growth of <i>Enterococci</i> organisms that can lead to enteric issues. Treatment- Reverse Osmosis, anion exchange resin, lower dietary salt levels, blend source with non-saline water. Keep water clean and use daily sanitizers such as hydrogen peroxide or iodine to prevent microbial growth.
Sodium (Na)	50 mg/l	150 mg/l	Sodium , when combined with high chloride levels, creates salty water that can act as a laxative causing flushing. Salty water can promote the growth of <i>Enterococci</i> organisms that can lead to enteric issues or possibly kinky back. Treatment- Reverse Osmosis; lower dietary salt level; blend source with non-saline water; Keep water clean and use daily sanitizers such as hydrogen peroxide or iodine to prevent microbial growth.
Sulfates (SO₄)	15-40 mg/l	200 mg/l	Sulfates can cause flushing in birds. If rotten egg odor is present, then bacteria producing hydrogen sulfide (H ₂ S) are present. Treatment- System will require shock chlorination plus establishment of good daily water sanitation program, sulfates can be removed by reverse osmosis or anion resin. If H ₂ S is present (the rotten egg smell) then aerate water into a holding tank, treat with sanitizers then filtration.
Nitrates	1-5 mg/l	25 mg/l	High nitrate levels can result in poor growth and feed conversion. Presence of nitrates may also indicate fecal contamination therefore testing for bacteria is recommended. Treatment- Reverse Osmosis or anion exchange resin.
Lead	0 mg/l	0.014 mg/l	Long term exposure to lead can cause weak bones and fertility problems. Treatment- Reverse osmosis, softener or activated carbon will greatly reduce lead.
Copper	0.002 mg/l	0.6 mg/l	
Zinc		1.5 mg/l	

Water may have excessive nitrate levels and high bacterial counts. Where bacterial counts are high, determine the cause and correct the problem. Bacterial contamination can often reduce performance.

Water that is clean at the point of entry to the house can become contaminated by exposure to bacteria

within the house environment particularly with open drinker systems, *see Figure 14*. To maintain clean water, clean and sanitize drinkers daily and keep free chlorine levels between 3-5ppm at last drinker. The chart below demonstrates the importance of keeping the water system clean through frequent drinker cleaning and water sanitation.

Figure 14: Increase in Bacterial Count in Open Drinkers



Water Line Cleaning

Successful water sanitation begins with a thorough water line cleaning program. The variability and dynamics of water systems can create cleaning challenges, but these can be overcome with proper water analysis, a little effort and the right tools.

Choose a Cleaner

Have water analyzed for scale-causing minerals: calcium, magnesium and manganese. If the water contains more than 90 ppm combined calcium and magnesium or 0.05 ppm manganese, you will need to include a “descaler” or an acid in your cleaning program. These products will dissolve the mineral deposits in water lines and fittings.

Choose a cleaner that can effectively dissolve any bio-film or slime in the system. Some of the best products for this job are concentrated hydrogen peroxides.

Prior to using any strong cleaners, make sure standpipes are working properly so air pressure buildup in the lines will be released. Consult equipment suppliers before using products to prevent unnecessary damage and always follow manufacturer’s recommendation.

Prepare the Cleaning Solution

For best results, use cleaning products at the strongest concentration recommended on the label. Most proportioners will only allow concentrations between 0.8 and 1.6% of the original material.

If you need to use higher concentrations it is better to mix the stock solution in a large tank and then distribute without use of a proportioner. For example, if a 3% solution is required, mix three volumes of the cleaner with 97 volumes of water for the final solution.

An excellent cleaning solution can be made up by using 35% hydrogen peroxide solution. Mix this as described for a 3% solution.

Clean the Lines

It takes 8-10 gallons (30 – 37 liters) of water to fill and clean 100 feet (30 meters) of ¾ inch (20 mm) water line. If your building is 500 feet (150 meters) long and has two water lines you should make up a minimum of 100 gallons (370 liters) of cleaning solution.

Water lines should be designed so that they can be opened to drain completely when the cleaning is complete.

Follow these steps to clean the water lines:

- 1) Open water lines and drain completely.
- 2) Begin pumping the cleaner through the water lines.
- 3) Watch the water as it leaves the drain line for signs of the product such as foaming or suds.
- 4) Once water lines are filled with the cleaner, close the tap and leave product in the lines for as long as the manufacturer recommends (over 24 hours if possible).
- 5) Additionally, it is recommended that all regulators be taken apart and cleaned at this point.
- 6) Flush cleaner from the water lines after the holding period. Water used to flush the lines should contain the level of sanitizer normally used in the drinking water.

In the absence of a standard water sanitation program add 4 ounces of 5% bleach per gallon (32 ml / liter) of stock solution and proportion at a rate of 1 ounce per gallon of water (0.8% or 1:128). This will provide approximately 3–5 ppm of free chlorine in the final rinse water.

- 7) Water lines from the source to the turkey barns should also be cleaned and sanitized between flocks. Do not flush the outside water lines through the water lines inside the buildings. Connect a water hose to the medicator faucet to drain the outside lines

Remove Mineral Build-up

After lines are cleaned, use a descaler or acid product to remove the mineral build-up. Use product according to the manufacturer's recommendation. Citric acid is one option:

- 1) Make a stock solution by mixing 4 – 6 packs of citric acid in one gallon of water. Proportion at one ounce per gallon (0.8% or 1:128). Fill water lines and let stand for 24 hours. It is critical that the water pH is below 5 for optimum scale removal.
- 2) Empty the water lines. Then refill the lines with clean water containing 8-12 ounces of 5% bleach per gallon (64-95 ml / liter) of stock solution proportioned at one ounce per gallon (0.8% or 1:128). Leave in the water lines for four hours. This concentration of chlorine will kill any residual bacteria, and further remove bio-film residue.
- 3) Perform a final flush of the water lines using water with a normal drinking water level of sanitizer (4 to 6 ounces of 5% bleach per gallon (32 – 48 ml / liter) of stock solution proportioned at one ounce per gallon). Continue flushing until chlorine smell is gone. Test the water in the lines to make sure it contains no more than 5 ppm of free chlorine.

Keep the System Clean

Once the system has been cleaned, it is important to keep it sanitized. Develop a good daily water sanitation program for your birds. The ideal water line sanitation program should include optimizing sanitizer residual which requires injecting an acid if chlorine is used. It is important to note that the procedure requires two injectors since acids and bleach should **never** be mixed in the same stock solution.

If only one proportioner or injector is available, then inject bleach (concentration of 5%) at a rate of 4 to 6 ounces per gallon (32 – 48 ml / liter) stock solution; proportion at 1 ounce of stock solution per gallon of drinking water.

The objective is to provide a clean source of drinking water with a continuous level of sanitizer (3-5 ppm of free chlorine) at the last drinker without over sanitizing the drinkers at the front of the barn.

Water Sanitation

Utilization of sanitizers approved for use in the drinking water of food animals provides protection from pathogens that may be naturally occurring in water sources or which get seeded into water systems by sick birds and other vectors. By maintaining residual levels appropriate for the different types of sanitizers commonly used, many operations can effectively limit disease challenges.

Chlorine is the most popular sanitizer because it is inexpensive to use and widely available. The three most commonly used forms are gas chlorine, sodium hypochlorite (liquid bleach) and calcium hypochlorite (dry or tablet form). Chlorine is most effective in the hypochlorous form which is the most prevalent when the pH is between 4 and 7. Therefore, optimal sanitation with chlorine typically requires additional injection with an acid.

Other commonly used water sanitizers are chlorine dioxide, iodine and hydrogen peroxide (*See Table 10, page 51*).



Table 10. Commonly Used Water Sanitizers

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 oxidizing manganese, iron and sulfur. 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 oxidizing iron and manganese. Expensive
Iodine	Sodium Iodate-NaIO ₃	1-2 ppm	Not as effective as chlorine as a virucide. More effective at pH neutral to slightly basic. Expensive
Hydrogen Peroxide	H ₂ O ₂	25-50 ppm	Not as effective in oxidizing iron and manganese. Stabilized products provide residual longer than non-stabilized forms. Expensive
Ozone	O ₃		Unstable so must be generated at point of use. No residual. Very effective germicide and virucide. Must filter water post-ozonation. Expensive

Additional Considerations:

Drinker valves and pipes may become blocked if the water is hard and contains high levels of calcium salts or iron. If sediment blocks the pipes, filter the supply with a mesh of 40–50 microns.

Do not use acid as the sole method of water treatment since acids alone can cause bacterial or fungal growth in water systems.

When administering other products to your birds it is a good idea to stop the inclusion of chlorine (and other sanitizers) in the drinking water. Chlorine will inactivate vaccines, and reduce the effectiveness of some medications. Resume use of chlorine and/or other sanitizers after treatment is finished.



Aviagen Turkeys thanks 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 programs.

Post Mortem Examination

The objective of post mortem examination in the field (field necropsy) is to provide information that can be combined with flock history and field observations to help to determine the causes of performance problems, clinical signs and mortality.

Field necropsy should be backed up with laboratory diagnostic investigations on tissue samples, serology and live/dead mortality specimens, especially if the field problem persists. The technique of turkey necropsy in the field can vary, but the following can serve as a general guideline.

Case History of the Flock

A key to identifying health problems is understanding the flock history. Accurate records are important and should include the following information:

- Age
- Flock size
- Morbidity (sick birds and mortality numbers)
- Principal clinical signs noted and duration of clinical signs
- Previous flock/farm history
- Last handling of birds
- Management factors:
 - Feeding & water systems
 - Housing
 - Ventilation
 - Litter conditions
 - Vaccination/medication program
- Unusual management changes
- Performance records (egg production and weight gains)

- Breeder flock source
- Feeding regime

Observe Clinical Signs of Disease

Monitor the flock and note any abnormal behavior such as:

Respiratory: Gasping, nasal discharge, snicking, swollen sinuses, mouth breathing, coughing, blood in mouth

Digestive signs: Diarrhea, soiled vent, excessive chirping

Nervous signs: Head and neck held in an abnormal manner, tremors, spasms, paralysis, circling motion

Locomotive signs: Unable to stand or walk, limping, poor gait, inability to use one or both legs, lying on side, swollen foot pads and swollen joints

Observe the Bird in Question

Examine the exterior surface of the bird and note the following:

General condition: Thin, good flesh, trauma, dehydrated

Examine the head: Eyes, sinus, eye lids, oral cavity

Examine the legs, hocks and note mobility: Palpate legs, joints and feet

Examine the skin for external parasites, particularly beneath the vent: Lice and mites

Necropsy Equipment to Have on Hand

- Sharp knife
- Scissors (blunt point)
- Bone shears
- Forceps
- Disposable or rubber gloves
- Vacutainers or plastic tubes for blood collection
- Whirl packs for tissue samples
- 10% buffered formalin solution in a wide-mouth plastic container
- Sterile swabs for bacterial culture
- Disinfectant to clean and disinfect equipment



Post Mortem Examination

There are a number of procedures used. What is important is to make sure that one proceeds with the necropsy in an orderly fashion. This will reduce the chance of overlooking something.

1. Euthanize the bird according to your company's approved welfare standards.
2. Place bird on its back. Incise the loose skin on the inside of each thigh. Grab the leg in one hand and holding the body with the other hand, pull the leg down and outward from the body until the hip joint is disarticulated.



3. Cut the skin across the lower abdomen. Pull the skin over the breast, sternum and crop. Examine the breast muscle and subcutaneous tissue for any abnormal appearances such as blisters, hemorrhage, dehydration (darkening of the muscle), etc.



4. For fresh dead, break down the adhesions between the heart and breast bone prior to lifting up on the keel bone.
5. Using bone shears, cut through the ribs and under the clavicle and coracoid bones (on older birds, two cuts can be made above the shoulder area down through the breast muscle to the shoulder joint). This will assist you when reflecting the keel.



6. Pull the keel forward to allow access to the internal organs. Examine liver, heart, gizzard, intestines and air sacs without touching them.



7. Take bacterial cultures (liver, pericardial sac) or tissue samples and the whole bird for virus isolation and additional investigations.



8. Hold the gizzard and pull, along with the intestines, to the bird's right side.
9. Examine the spleen and air sacs. Take bacterial cultures from spleen and/or air sacs, if necessary.
10. Remove the lungs and examine. Note the consistency and color. Make several transecting cuts over the lung and examine lung tissue.



11. Hold proventriculus, cut esophagus near proventriculus junction and then pull out the entire digestive system including liver, spleen and small intestines and lay small intestines out.

12. Examine liver, kidneys, pancreas, surface of the intestines and gonads.
13. Examine the stifle, hock joints and tendons.
14. Examine leg bones (tibiotarsus) for rigidity by bending and breaking the bone to check for nutritional deficiencies such as rickets in young birds (1-6 weeks). A healthy bone should make a snap when it breaks.
15. Examine the tibia in growing birds by cutting longitudinally on the medial inside surface through the epiphysis (growth plate) to examine for abnormalities such as TD and osteomyelitis.



16. Examine costochondral junctions (ribs) for enlargements (beading).
17. Cut through the left side of the mouth using heavy scissors and continue the incision through the skin and esophagus to the thoracic inlet and pull the skin laterally.



18. Examine oral cavity and organs of the neck region (thymus, thyroids and parathyroids).
19. Make a longitudinal cut through the larynx and trachea. Examine for blood, congestion, etc.
20. Examine esophagus and crop. Note any abnormalities in esophagus and crop such as crop mycosis (candidiasis), trichomoniasis or capillaria worms.
21. Make a lateral incision through the wall of the infraorbital sinus and examine for exudates, etc.
22. To examine the brain remove the skin on the skull. Then remove the skull bone by cutting the bone all the way around the periphery of the cranial cavity with heavy scissors or heavy bone shears. Lift the loosened portion of the bony skull with forceps or scissors.
23. Examine the digestive system by making a longitudinal cut through the proventriculus, gizzards, small intestines, cecum, colon and rectum.
24. Examine the intestines by making a longitudinal cut through the wall of the intestines continuing to cut in order to inspect the bird for worms.



In order to make the best use of information derived from field post mortem examinations, field supervisors/ managers should routinely post the flock mortality to gain experience in detecting the normal from abnormal tissue/ organ conditions.

Poults, 1-7 Days of Age:

1. Fold both wings over the breast muscle and hold both with one hand. With the other hand, hold the neck and work the thumb down between the crop and breast muscle to the thoracic inlet.
2. Pull the wings and breast muscle back towards the tail with one hand while the other hand holds the neck with the thumb pushing down against the thoracic inlet and cervical vertebrae, separating the breast muscle and wings away from the back bone.
3. Poults can also be opened by cutting the clavicular and coracoid bones (the thoracic inlet, wish bone area) and then through the rib cage and abdominal wall.

Water Consumption Table

Estimated Water Consumption Per 1000 Birds / Day

Water Consumption

Weeks of Age	Gallons 50-70f	Gallons 70-80f	Gallons 80-95f	Gallons +95f
1	10	10	10	10
2	25	30	30	30
3	35	40	45	50
4	50	60	65	70
5	60	70	90	110
6	80	95	115	145
7	100	115	135	150
8	120	145	150	185
9	150	175	195	220
10	165	190	225	275
11	180	220	250	300
12	210	240	285	320
13	220	280	305	340
14	230	290	325	375
15	230	290	325	375
16	235	295	330	380

Weeks of Age	Liters 10-20c	Liters 20-25c	Liters 25-35c	Liters +35c
1	38	38	38	38
2	95	114	114	114
3	132	151	170	189
4	189	227	246	265
5	227	265	341	416
6	303	360	435	549
7	379	435	511	568
8	454	549	568	700
9	568	662	738	833
10	625	719	852	1041
11	681	833	946	1136
12	795	908	1079	1211
13	833	1060	1154	1287
14	871	1098	1230	1419
15	871	1098	1230	1419
16	889	1117	1249	1438

Water consumption will vary with sex of birds, age, temperature, diet, type of equipment, flock health and a number of other factors.

Conversion Data

WEIGHT

1 ounce	=	28.35 grams
1 pound	=	16 ounces
1 pound	=	453.6 grams
1 pound	=	7,000 grains
1 ton (USA)	=	2,000 pounds
1 metric ton	=	2,204.62 pounds
1 long ton	=	2,240 pounds
1 kilogram	=	2.2046 pounds
1 gram	=	1,000 milligrams
1 milligram	=	1,000 micrograms
1 microgram/gram	=	1 part per million
1 bushel of wheat	=	61 pounds / 0.0272 metric tons
1 bushel of corn	=	56 pounds / 0.0254 metric tons
1 bushel of soybeans	=	60 pounds / 0.0272 metric tons

AREA

1 square foot	=	0.093 square meters
1 square meter	=	10.764 square feet
1 acre	=	43,560 square feet = 0.405 hectare
1 hectare	=	10,000 square meters = 2.471 acres
1 square mile	=	2.6 square kilometers

LENGTH

1 centimeter	=	0.3937 inches
1 meter	=	3.2808 feet
1 foot	=	0.3048 meters
1 kilometer	=	0.6214 mile
1 mile	=	5,280 feet
1 mile	=	1.609 kilometers

TEMPERATURE

°Fahrenheit	=	(°Celsius X 9/5) + 32
°Celsius	=	(°Fahrenheit - 32) X 5/9

FLUID MEASURE

1 fluid ounce	=	30 ml
1 pint (U.S.)	=	473 ml
1 quart (U.S.)	=	946 ml
1 liter	=	1,000 ml
1 liter	=	1.057 quarts (U.S.)
1 gallon (U.S.)	=	3.785 liters
1 part per million	=	0.0001%

VOLUME

1 ml	=	0.061 cubic inches
1 cubic meter	=	35.3145 cubic feet



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