ATTRA Sustainable Agriculture
A program of the National Center for Appropriate Technology • 1-800-346-9140 • www.attra.ncat.org

Poultry House Management for Alternative Production

Anne Fanatico, NCAT
Agriculture Specialist
Published 2007
Updated Oct. 2018
by Kevin Ellis, NCAT
Agriculture Specialist

IP308

Although access to the outdoors is an important feature of many alternative or free-range production systems, the indoor environment and management are also crucial. Poultry need access to an appropriate indoor environment for good production and welfare. Ideally, poultry should be able to choose their preferred environment, whether inside or outside. Attention to ventilation, temperature, lighting, and litter conditions is necessary. Additional good management practices include rodent control with a minimum of toxic materials. Alternative poultry production is often on a small scale with portable houses. In order to obtain organic certification, special practices may be needed compared to conventional poultry production. Alternative poultry production is a way to boost farm income and add fertility or diversity to a farm while providing specialty poultry products to consumers.


Alternative poultry production usually includes access to pasture or the outdoors. Photo: NCAT"

Contents

Introduction

Alternative poultry production is an important part of sustainable agriculture, protecting the environment while addressing consumer concerns. As an alternative to conventional poultry housing, alternative systems are often pasture-based or cage-free. Some may feature large, fixed houses with yards. Others may use small, portable houses regularly moved to fresh pasture. Some may consist of small shelters surrounded by moveable fencing. Alternative poultry production is often small-scale, integrated onto a diversified farm, and certified organic. Although free range is a main feature, environmental conditions inside the house are also important for good welfare—particularly ventilation, temperature, lighting, and litter.

A lot of information is available on environmental control in conventional poultry production. This publication, however, focuses on alternative production, for which information is less available. Nonetheless, some practices apply to both alternative and conventional production.

This publication provides how-to information about environment and management in alternative poultry production and highlights the practices of innovative producers. Many of the practices described here can be employed in organic production. For more information on

 

The indoor area is just as important as the outdoor area in free-range poultry production. Photo: NCAT

certified organic regulations and practices, see ATTRA's *Organic Poultry Production.* For information on other production topics, such as breeds, feed, and health, refer to other resources, including the ATTRA publications listed at www.attra.ncat.org/attra-pub/poultry. For information on providing outdoor access and managing the outdoor area, see ATTRA's *Alternative Poultry Production Systems and Outdoor Access.*

Related ATTRA Publications
www.attra.ncat.org

Poultry: Equipment for Alternative Production

Range Poultry Housing

Alternative Poultry Production Systems and Outdoor Access

Arsenic in Poultry Litter: Organic Regulations

Environment

Poultry housing should be weatherproof to provide protection from the elements (cold, rain, wind, and hot sun) and provide warmth, especially during brooding. Housing should also provide good ventilation, as well as protection from predators. Many innovative housing designs are used in alternative poultry production, including fixed houses with permanent foundations, mobile houses, and simple shelters.

Birds and equipment should be inspected at least twice per day to monitor health and identify any problems. Caretakers should be trained in bird management and welfare. They should treat the birds calmly with no rough handling. Although birds usually have outdoor access, additional enrichments can be used in houses to improve welfare of birds, and these include roosts, straw bales, and scratch grains.

For information on small-scale housing design, materials, and construction plans, see ATTRA's *Range Poultry Housing.* For information on waterers, feeders, fencing, roosts, and nestboxes, see ATTRA's *Poultry: Equipment for Alternative Production.* The conventional poultry industry has extensive information on large-scale housing, environmental control, and equipment that can be used for large-scale free-range or cage-free production. See *Commercial Chicken Production Manual* (Bell and Weaver, 2002) or Extension materials. Detailed information on ventilation, lighting, and other types of environmental control are available on the University of Georgia's Poultry House Environmental Control Website at www.poultryventilation.com.

Power

Although small, portable houses may or may not use power, reliable power is important in large houses to power equipment such as ventilation systems, fans, lights, heat, and motors for automated feeding systems. Diesel generators can be used for power in a poultry house if electricity isn't available, and they are also useful for backup power in case of an electrical outage.

Temperature

The body temperature of an adult chicken is 105°F to 107°F (40.6°C to 41.7°C). The thermoneutral zone, which allows chickens to maintain their body temperature, is 65°F to 75°F (18°C to 24°C). If the temperature is above this zone, heat must be lost in some way. Chickens have no sweat glands. Because eating increases body temperature, chickens reduce their feed intake during hot weather, and therefore gains will be less. Chickens begin panting at 85°F (29.4°C) to help dissipate heat, and drink more to avoid dehydration. A combination of high temperature and high humidity is a problem because panting does not cool them under these conditions (Bell and Weaver, 2002). In the United States, heat is usually more of a problem than cold. Fast-growing broilers are particularly susceptible to heat stress due to their high level of production. Producers should provide abundant cool drinking water in close proximity to the birds, both inside and outside the housing.

In cold months, while the conventional industry usually uses propane heaters for heating, many alternative poultry producers do not heat houses, relying only on the body warmth of the birds for heat. It may be more cost-effective to heat the house instead of paying for more feed. Heaters, such as gas brooders or heaters, can even be provided in small portable houses, with a gas tank mounted on a trailer to be moved along with the house.

To modulate temperatures, insulation under the roof is important in any climate; insulation in the walls is also helpful. During hot weather, insulation keeps heat from entering the building, and during cold weather, it keeps heat from leaving. The greater the difference between the inside temperature and the outside temperature, the greater the need for insulation. Proper ventilation will also help regulate house temperature. Each house should have a thermometer to display the current temperature as well as the high and low temperatures in a daily period, and producers should pay attention to weather forecasts.

Curtains can be lowered to provide natural ventilation. Photo: NCAT

Ventilation

Ventilation brings fresh air into a poultry house and removes heat, moisture, and gases (Bell and Weaver, 2002). Ventilation designs may be natural or mechanical. Most houses in alternative poultry production depend on natural ventilation, because doorways are usually open to provide outdoor access. There may also be additional air inlets, side curtains, or large windows that can be opened to allow more ventilation in hot weather. Ridge vents in the roof —"whirly bird" vents— allow hot air to escape. Natural ventilation makes use of the movement of air (warm air rises and cold air falls) and wind currents. A roof at least six feet tall will allow sufficient height differential for cool air to enter through low air inlets and warm air to escape through high vents. There is less control in natural ventilation than mechanical.

The reasons for ventilating during winter and summer are different. During warm months, the purpose is to remove heat and control the temperature in the house, and therefore large amounts of air are moved. During cold months, the ventilation system must remove moisture and gases, especially ammonia, while conserving heat. This is tricky because producers tend to want to keep houses closed up tight to conserve heat. Adequate ventilation is accomplished by controlling air inlets and is possible because warm air holds more moisture than cold air does. Therefore, during

Open windows help increase natural ventilation. Photo: NCAT

Fans can help exhaust air and moisture out of a house. Photo: NCAT cold weather, producers can bring small amounts of air into a house with high moisture in the air, allow the fresh air to heat to room temperature and, when this air leaves, it takes moisture out of the house (Bell and Weaver, 2002).

Mechanical ventilation systems use fans to direct air into the house (positive pressure) or exhaust air from the house (negative pressure). The negative-pressure system is most common and controls the air inlet to help mix the incoming fresh air with the air in the house (Bell and Weaver, 2002). Mechanical ventilation is less appropriate for free-range houses because it requires the doorways to be closed to maintain "static pressure." For more information see Appendix 1: Mechanical Ventilation.

Lighting

Birds need a dark period for good health. They only produce melatonin—a hormone important in immune function—during dark periods.

Poultry are very sensitive to light. Light not only allows them to be active and find their food, but it also stimulates their brains for seasonal reproduction. Light is perceived through the eyes but can also be received by other receptors in the brain, after penetrating the feathers, skin, and skull. Even blind birds respond to light. In the spectrum of visible light, blue light has relatively short wavelengths, while red light has long (see Figure 1). Because red wavelengths are longer, they are more able to penetrate to the brain to stimulate activity and reproduction and even aggression. If the light intensity is low, then the wavelength is important. However, if light intensity is high, then wavelength is not as important (Bell and Weaver, 2002).

Birds need a dark period for good health. They only produce melatonin—a hormone important in immune function—during dark periods. Welfare programs usually require at least four to six hours of dark daily, with some programs requiring eight hours of darkness (Animal Welfare Approved, 2017). Many alternative poultry producers use only natural light and therefore have a long dark period. Dark periods can be especially helpful for fast-growing broilers in the first weeks of life to slow growth, build frame, and reduce leg disorders. Baby chicks, however, need 24 hours of light the first three days to ensure that they learn to find food and water. In contrast, the conventional poultry industry uses long light periods to encourage feed consumption and weight gain by fast-growing broilers, because birds do not eat in the dark. When birds have a dark period, they are more active during the light period than birds that have continuous light.

In the United States, light intensity is measured in foot-candles (fc): the amount of light emitted by a standard candle at one foot away; lux is a metric measurement. Alternative poultry production tends to use a higher light intensity than conventional. Most welfare programs require at least 1 fc light intensity; above 1 fc leads to increased activity, which can reduce leg problems but results in decreased weight gains (Bell and Weaver, 2002). A curtain-sided house may have a light intensity of 200 fc or more when the sun is overhead, but this depends on cloud cover (Bell and Weaver, 2002). The conventional industry typically keeps light intensity low in poultry houses to reduce activity and help birds gain weight more efficiently. The conventional industry uses about 0.5 fc or less, similar to a moonlit night, for broilers and layers.

Both conventional and alternative egg producers use artificial lighting to stimulate production during days of declining natural light, resulting in a more constant supply of eggs. Small-scale producers often use 14 hours of light for layers. Generally, the light period should not be longer than the longest day of the year. Day length should not be increased for young growing pullets or they will begin producing eggs too soon; likewise, day length should not be decreased for layers and breeders in production or they will stop producing eggs.

Sunlight is a broad-spectrum white light and contains all the wavelengths of visible light. Common types of artificial light are incandescent and fluorescent. Incandescent lights are a broad-spectrum light with a predominance of long (red) wavelengths. Fluorescent lights are a variable light spectrum, depending on their manufacture. Two types commonly used in poultry houses are "warm white" and "cool white." Warm white has a predominance of long yellow wavelengths, and cool white has a predominance of shorter blue-to-green wavelengths. Fluorescent lights come in tube and compact forms. The 2700K compact is similar to the "warm white" and the 2700K is similar to the "cool white." Incandescent lights are easier and less expensive to purchase and install, but fluorescent bulbs are more energy-efficient, have a longer

Table 1. The spectrum of visible light

425	475	525	575	625	675
Violet	Blue	Green	Yellow	Orange	Red

life, and can be dimmed with special equipment. However, as the lamp ages, fluorescent lights lose lumen output. The life expectancy of incandescent bulbs is usually 1,000 hours; fluorescent can last 20,000 hours (Bell and Weaver, 2002).

For growers using incandescent lighting, small-flock producer Robert Plamondon in Oregon has the following recommendations (Plamondon, 2003):

- Use a 60-watt incandescent bulb for every 200 square feet of henhouse.
- Use flat reflectors to maximize light.
- Clean/dust bulbs regularly.
- Position light fixtures so people or birds don't run into them. Use a guard over the light to prevent breakage or simply suspend a bare bulb that will swing if hit.
- Put a dab of petroleum jelly on the threads of the bulb to keep the contacts from corroding and to keep mites and other tiny bugs out of the light sockets.
- If you use fluorescent, use the kind with sealed ballasts because the vents in vented ballasts let in moisture and dust. Sealed ballasts are available from farm-supply businesses.
- Use a timer to control the light period because if you forget to turn the lights on, it can cause hens to stop laying.
- Use a wired-in electromechanical timer (rather than plug-in type), and check it regularly, resetting it after any power outage.
- Use permanent wiring when possible (fixed houses).
- Use waterproof sockets: porcelain or plastic (not brass shell).
- Use heavy-duty extension cords for portable houses and cover connections to protect them from the weather.

Providing additional light in the morning instead of the evening will allow a natural dusk for the birds and allow them to choose their roosts for the night. However, a dimmer can be used to create dusk conditions. On a timer, it is necessary to make adjustments (usually weekly) to keep the day length at a certain length. Instead of regularly adjusting timers, Plamondon uses a dusk-to-dawn light-sensing switch that will turn the light off during the day (no waste of electricity) and turn it on at night. He turns lights off in the spring.

Wood shavings are typically used as bedding in poultry houses. Photo: NCAT

In a house without electricity, batteries (such as a 12-volt) can be used to power lighting. An inverter can be used if there is a need to switch from DC to AC voltage. Companies in the U.K. offer 12-volt lighting systems specifically for mobile poultry housing (see www.roosterbooster.co.uk).

A solar panel can recharge batteries. Henlight is an LED lighting unit powered by a solar panel, meant to be installed in mobile laying-hen coops. The LED light provides the correct wavelength needed to stimulate egg production, while staying cool and posing no health risk to the flock. LED lighting is relatively new. Although expensive, LED lights are more durable and last longer than other lighting sources and are a viable option for farmers.

In the absence of electricity, poultry houses may be lit by other means. For example, large Amish poultry houses without electricity are sometimes lighted with Coleman lanterns, which burn naptha gas, and kerosene lamps.

Litter

Litter management is very important in most poultry production systems. Floors in poultry houses are usually concrete, wood, or earthen, with some kind of litter used to cover the floor. Litter dilutes manure and absorbs moisture, provides cushioning and insulation for the birds, and captures nutrients for spreading outside where desired. Litter is also a medium for birds to scratch and is important for welfare. Litter should not

High moisture in litter is very problematic, resulting in "cake," or a nonabsorbent crust. Caking occurs especially under waterers or in other high-impact areas.

only be absorbent, but also allow birds to have traction while moving, in order to avoid leg injuries or deformities. Litter materials should also be comfortable for birds to both walk and sit on.

Alternatively, birds can be raised on slat flooring through which the droppings fall into a pit below for later removal. Keeping droppings dry will reduce odors and flies.

Common litter materials include soft wood shavings or rice hulls. Other materials that may be suitable include sand, dried wood fiber, peanut hulls, and chopped pine straw. Small-scale poultry producers have tried various materials and have identified some problems: hay and straw become slimy, chicks eat sawdust, wood chips are costly, and hardwood shavings can splinter and cause skin punctures. When applying fresh wood chips, producers should remove any large, sharp pieces to reduce the chances of injury to birds. Litter material should be high in carbon to prevent loss of nitrogen, and it should compost well.

Litter is normally spread two to four inches deep and maintained at 20% to 30% moisture. Birds have a concentrated form of waste called uric acid, which makes it possible to keep a lot of birds on litter, but moisture can build up. If litter feels damp to the back of the hand, it is probably at least 30% moisture. The house should be ventilated well to remove moisture in the air, and water leaks or sources of moisture such as condensation from uninsulated metal roofs or leaking waterers should be repaired. Litter moisture can be evaluated quickly. When a handful of litter is squeezed, the ball should begin to break up when released. When the litter is too wet, it remains balled up. When litter is too dry, it will not ball up.

High moisture in litter is very problematic, resulting in "cake," or a nonabsorbent crust. Caking occurs especially under waterers or in other high-impact areas. Wet litter causes breast blisters and sores on the birds' foot pads and hocks, and pathogens and parasites such as coccidia proliferate. In wet litter, uric acid is converted by bacteria to ammonia. Ammonia is a toxic gas that can damage the respiratory system of the birds and make them more susceptible to infections. Ammonia levels should not exceed 25 parts per million (ppm) in the house. Levels can be measured with an ammonia meter, but these are expensive. Inexpensive methods are ammonia strips, or dräger tubes (see the Further Resources section). Ammonia measurements should be taken at bird level on a regular basis and particularly at finishing. Fly larvae also grow in wet litter and can be a nuisance.

Conditions should be maintained to prevent cake, but if it develops, some producers rototill their litter during production, while the birds are present, to loosen the cake. After loosening, cake should be removed. Tilling the litter may cause a spike in ammonia that should be dissipated as quickly as possible through open windows or with fans. According to Virginia producer Joel Salatin, at a low stocking density the bedding is tilled and aerated as fast as the birds manure, so it does not cake (1996). Tossing in whole grains may encourage birds to scratch and till. Heavy broilers are not as active at tilling litter as layers.

Litter is removed after the flock is finished, and the house is cleaned. In meat-bird production, the litter is often kept in place and reused for several flocks. If it is to be re-used, cake needs to be removed with a pitchfork or decaking equipment. Used litter should be top-dressed with fresh litter. Waiting two to three weeks between flocks can reduce the chance or likelihood of disease problems for the new flock. The litter should not be reused if disease occurred in the flock.

Litter treatments are added to re-used litter in the conventional poultry industry to reduce the formation of ammonia from nitrogen by lowering the pH. Typical poultry litter has a pH between 9 and 10 (Blake and Hess, 2001). Ammonia release is low when the environment is acidic (pH is less than 7). Low pH will also inhibit microorganisms, including pathogenic bacteria like salmonella. Poultry Litter Treatment (PLT), or sodium bisulfite, is the most common litter treatment. Aluminum sulfate is also used to reduce ammonia release, but these materials are not permitted in organic production. Soft rock phosphate can be used as a litter amendment to control odor and to reduce flies. Note that hydrated lime is not permitted in organic production to deodorize animal wastes.

Used litter is removed from large houses with machinery. In small houses, litter is removed by hand, which is very labor-intensive. After removal from the house, manure and litter are usually spread on pasture and other agricultural land. In many areas, poultry manure and litter are a great benefit and add valuable nutrients such as nitrogen (N), phosphorus (P), and potassium (K) to the soil. Poultry manure has 3.84% nitrogen, 2.01% phosphorus, and 1.42% potassium on a dry basis (Bell and Weaver, 2002). On a fresh basis, there is more moisture in the manure, which dilutes the amounts of nutrients. As a rule of thumb, the amount of manure is equal to the amount of feed provided (Bell and Weaver, 2002).

Composting the litter adds further value to the manure because compost is an excellent soil amendment. Usually, more carbon material needs to be added to increase the carbon:nitrogen ratio. During composting, ammonia is released to the atmosphere, which lowers the nitrogen in the final product. Organic standards for compost require that starting carbon:nitrogen ratios be between 25:1 and 40:1. See Appendix 2 for information on composting poultry litter. Litter can also be composted in the poultry house after the birds have been removed. To do this, windrows are made in the house and the litter is re-spread after composting. The building must be ventilated so that gases can escape.

The manure/litter from poultry houses has a natural tie to organic crop production. Synthetic fertilizers are not allowed in organic crop production; poultry litter has the advantage of being a natural fertilizer (as long as synthetic materials are not added to it).

Unfortunately, in high poultry-producing areas, manure/litter has become a liability because there is so much of it. Phosphorus is a nutrient pollutant because it may end up in runoff water, allowing algae to grow and contributing to water-quality problems. Litter/manure cannot be dumped on land without consideration of crop/forage needs. Nutrient application from animal waste is becoming more regulated in the United States, and nutrient inventories are kept on the farm. Regulations vary by state and are phosphorus-based or nitrogen-based. Best management practices are important in applying animal waste to land, such as incorporating litter instead of surface application, vegetative buffer strips to capture runoff nutrients prior to reaching waterways, and other practices. In some parts of the country, litter should not be spread during the winter because the ground is frozen, or crops may only be fertilized in spring and summer, so proper storage is required for litter.

An alternative type of litter management is composting litter while the birds are in the house in order to reduce the volume of litter and create a healthy environment. This process has received little scientific attention since the 1950s. It usually starts with at least six inches of litter. The poultry till and aerate the litter, or the litter may be tilled with machinery. Thin layers of fresh litter are added with new flocks or if the litter becomes wet. Small flock producer Robert Plamondon uses this technique and removes only half the litter at a time, when the accumulation becomes too much for the house. Although composting litter is a form of composting or decomposition, it is not as efficient as the composting process described in Appendix 2. The amount of decomposition that occurs depends on the number of birds in relation to amount of litter and temperature. The carbon:nitrogen ratio is not likely to be ideal unless a lot of extra litter is added. Producer Joel Salatin adds enough litter to keep the carbon:nitrogen ratio at 30:1, but doing so is expensive (1996). There may be some heat from decomposition, and ammonia gas is produced, so the house should be well ventilated. Salatin says the bedding pack must be at least 12 inches deep to work (1996). Composting litter is rich in Vitamin B12, most likely due to the presence of microbes.

Air Quality

A poultry house of any size can have poor air quality if ammonia and dust levels are high. In large houses, air emissions to the outside are an issue for environmental air quality. Tree shelter belts have been used around houses as a way to capture emissions. Again, keeping litter dry helps reduce ammonia. In addition to ammonia and dust levels, it is also important to monitor hydrogen sulfide, carbon dioxide, and carbon monoxide levels, especially in large houses. Pasture-based or free-range systems have the advantage of fresh air.

Poultry flocks start their development in the brooder where they are kept warm and given unrestricted access to food and clean water. Photo: NCAT

Brooding Environment and Management

Brooding is a critical period for poultry. New chicks can't maintain their own temperatures, so they are usually brooded until they are fully feathered. In natural brooding, the mother hen provides heat, but in artificial brooding, heat is provided by an external heater. A brooder should provide a warm, dry, and secure environment to encourage good health and proper development.

Large-scale broiler producers usually brood in the same building where the birds will be kept to market age, which is "one-stage production." Layers and turkeys usually use a "two-stage" system in which a different growing facility is used after brooding. Small producers often use two-stage production; they brood in a central building and then move the birds out to small portable houses on pasture after brooding. The brooding building may be located close to home so the producer can keep a close eye on the young chicks. However, moving birds to a new facility after brooding is labor-intensive and a source of stress for the chicks. Brooding in the field in small portable houses reduces the need for moving chicks and allows early access to range, but field brooding requires an insulated house, small brooders, propane tanks, and battery-run lights in each house.

Brooding can be "spot-brooding" vs. "whole-house" brooding. Spot-brooding heats a localized area, while whole-house brooding heats an entire room. This is also called "cool-room" vs. "warm-room" brooding, respectively. In the past, very cold-room brooding was practiced in drafty barns or other outbuildings. The brooder was surrounded with curtains or insulation to prevent heat from being lost to the room. This method fell out of practice as brooding and poultry production moved to large poultry houses, and brooders of this type are no longer available.

Heat lamps can be used as a source of warmth for chicks in the brooder. Photo: NCAT

A brooding house must have good ventilation while preventing drafts. Although some small producers use a dedicated, purpose-built structure or building, many improvise with an outbuilding. Brooder guards (usually cardboard) stop floor drafts.

Types of Brooders

Heat Lamps

Many small producers of poultry use spot brooding in a variety of setups with an electrical heat lamp. Heat lamps are generally used above a box that keeps the chicks close to the heat source and reduces drafts. This set-up is usually placed in a residence or an outbuilding. According to producer Robert Plamondon, a 250-watt heat lamp suspended 18 to 24 inches over the brooding area, completely surrounded by a draft guard 18 to 24 inches high, will brood 75 chicks at 50° F minimum room temperature. This method is dependent on the presence of an effective draft guard. Heat lamps should be fastened securely so that they do not drop into the brooder and become a fire hazard. Many hardware stores carry heat lamps.

Hovers

Hovers are brooders with a canopy to keep warm air close to the ground to warm chicks. Hovers are usually suspended from the ceiling. In large-scale production, hover brooders often have an umbrella or pancake shape and are fueled by propane or natural gas. Again, cardboard brooder guards provide protection from floor drafts.

Standing hovers are placed on the floor above the birds. On his website (plamondon.com), Plamondon describes a box-shaped, standing

Suspended propane hover for use in the brooder. Photo: NCAT

Brooder boxes can be placed in the brooder to allow chicks to walk underneath for warmth. Photo: NCAT

hover that is insulated and heated by electric lamps. It was developed in the 1940s by the Ohio Experiment Station and was popular for small flocks. It was designed for brooding under farm conditions—in drafty barns and in portable houses on range. It can be insulated by adding litter on top or by adding aluminized bubble wrap inside.

Brooder boxes are a type of very small hover. These are individual boxes that contain their own electrical heating element, feeder, and waterer and are placed on the floor on litter.

Space Heaters

Space heaters heat an entire area; they are not placed directly above the birds as hovers are.

Propane heaters can be suspended from the ceiling of a poultry house. Photo: NCAT

Battery Brooders

Battery brooders are a unit of brooder boxes stacked on top of each other, separated by wire floors. It may be possible to find older, used battery brooders from commercial operations. When using a battery brooder, the room should be kept above 60° F and ventilated well (Plamondon, 2003). Paper or plastic liners on the manure trays make removing manure easier.

Using the Brooder

Propane usually keeps litter drier than electric heat lamps. It is easier to keep a stable temperature during brooding with propane heat and the addition of thermostats. Backup heat is needed for electrical set-ups because electrical outages are always a concern.

The brooding area should be prepared with fresh litter and heated before the chicks arrive, so that the litter is warm. The temperature at the start of brooding is 90 to 95°F and is reduced by 5°F every week until it reaches the ambient temperature, or for two to four weeks. The chicks should be able to move away from the heat when they desire. The chicks are well distributed when the temperature is right for them. If it is cold, they will huddle. If it is too hot, they will spread away from the heat source.

Chick-size waterers and feeders are used during brooding, because chicks can fall into waterers and get chilled. Feed should be provided on the floor in a shallow pan, so the chicks can easily find it. Feed should be replaced frequently to remove manure that may build up. Dipping the beaks of a few of the chicks in water and feed will help them learn quickly to eat and drink, and the other chicks will imitate them. When placing the chicks in the brooder, provide round-the-clock light to help chicks find food. Dark periods can be added after a few days. "Starve-outs" are chicks that don't learn to drink and eat. Turkey poults, in particular, are susceptible to this, as well as to stress and chilling. Electrolyte supplements can be added to water if chicks have been stressed during shipping. Adding one tablespoon of sugar per gallon of water is also useful to provide energy for the first days the flock will be in the brooder. Other producers have used one tablespoon apple cider vinegar and one teaspoon blackstrap molasses to a gallon of water. Supplements in the water are only useful the first day because the chicks find the feed after that. Supplements need to be organic if the flock is certified organic.

During the brooding period, a chick's legs can be susceptible to deformities such as splayed legs, which can be permanent. This is often due to a slick walking surface in the brooder. To lower the risk for leg problems, a layer of burlap or paper towels can be laid on top of the bedding material for the first one to two weeks of brooding. This will allow the chicks to get traction as they move around the brooder and will allow their legs to develop in a healthy manner.

Some producers provide outdoor access or harvested forage during brooding. Finely chopped grass or pieces of turf may help chicks become accustomed to digesting forage and the microbes they encounter outside; small grit should be provided to help their gizzards grind fibrous feed. Three-week-old chicks are still at risk from cold temperature when placed on pasture. They should have access to a warm place or a heat source. The traditional time to move birds out to pasture is when they are well feathered. Fast-growing broilers usually leave the brooder at three to four weeks. Layer chicks are slower-growing and may need heat until four to five weeks, depending on weather.

Rodent control is a very important management practice in poultry production: rats kill chicks, eat feed, and spread disease.

Rodent Control

Rodent control is a very important management practice in poultry production: rats kill chicks, eat feed, and spread disease. Problem rodents for U.S. poultry production include the Norway rat *(Rattus norvegicus),* the roof rat *(Rattus rattus),* and the house mouse *(Mus musculus)* (Scanes et al., 2003). Rodent control is a systems-based approach of prevention and exclusion including the following:

Habitat reduction. Vegetation should be kept short around houses, spilled feed cleaned up, and hide-outs dismantled, including scrap piles. Rodents should be exposed so they are vulnerable to predation.

Exclusion. Concrete or gravel floors help keep rodents from tunneling into a house. In a small portable house with a raised floor, the space between the ground and the floor provides attractive, darkened nesting sites, unless the floor is high enough above the ground that rodents do not feel protected. Poultry feed should be stored in rodent-proof containers.

Traps. Traps include snap traps, sticky traps, or mechanical "tin cat" traps.

Predators. Cats and dogs can help control rodents; rat terriers are especially helpful. Barn owls eat rodents but also eat chicks unless the chicks are in predator-proof houses at night. Birds of prey will also attack fully grown poultry when they are out on pasture.

Bait. Rodenticides are chemicals that kill rodents and are incorporated into attractive food or baits. Most rodenticides are not permitted in organic programs. The only approved synthetic rodenticide materials for use in organic production are sulfur dioxide and Vitamin D3. If either is used, it must be included in the Organic System Plan.

Anticoagulants. Because these rodenticides prevent blood clotting, the rodent dies through internal bleeding. The well-known Warfarin© was the first type developed. Multiple-dose anticoagulants are the safest type to use because a rodent has to nibble the bait several times to be affected. Single-dose anticoagulatants are more lethal and work faster but are less safe around children and pets.

- Vitamin D metabolites, such as cholecalciferol, are single-dose, slow-acting poisons that are relatively safe because an animal has to eat a large amount. Vitamin D3 is a synthetic material that is allowed in organic production.
- There are also single-dose toxins, but these can be dangerous to use because a small amount is toxic to most animals. These include natural poisons such as strychnine or synthetic ones such as bromethalin, and are usually used only during clean-out, when birds are not present. These are not allowed in organic production.

Baits come in several forms: blocks, bulk pellets, and pellet place packs. Norway rats live underground in burrows, where bulk pellets can be placed. Roof rats and mice can be controlled with blocks (Bruesch, 2005) that are nailed or tied down to prevent them from being dragged away to store. Putting bait in a bait station will keep random animals from eating the bait. Baits are usually rotated to prevent rodents from becoming accustomed to them. Sulfur dioxide smoke bombs are permitted in organic production as an underground rodent control.

For more information on rodents and their control, see Mississippi State University's *Controlling Rodents on the Poultry Farm.*

Deterrents. There are many types of deterrents, such as sound or light. For example, owl predator lights will startle owls that are preying on birds at night. Some producers hang CDs or pie tins to reflect light and throw off an owl's sense of sight. Some producers use blinking holiday lights or "predator eyes" to imitate the look of a larger, unknown predator.

In addition to controlling rodents, producers should also control wild birds, because they can introduce disease. Screening openings will prevent wild birds from entering the house; their nests should be removed from the house.

Conclusion

In addition to outdoor access, an appropriate indoor environment is important for birds in alternative poultry production. Attention to good ventilation, proper lighting, litter management, and air quality will help maintain performance while providing good welfare.

References

Animal Welfare Approved. 2017. Laying Hen Standards. https://agreenerworld.org/certifications/animal-welfare-approved/standards/#8-housing-and-shelter

Bell, Donald D., and William D. Weaver. 2002. Commercial Chicken Production Manual, 5th Ed. Kluwer Academic Publishers, Norwell, MA.

Blake, John and Joseph Hess. 2001. Litter treatments for poultry. ANR-1199. Alabama Cooperative Extension Service. Auburn, AL

Bruesch, Ted. 2005. Develop plan to eliminate rodents in poultry houses. Feedstuffs. November 7. p. 15.

Cooperband, L. 2002. The Art and Science of Composting: A Resource for Farmers and Compost Producers. Center for Integrated Agricultural Systems. University of Wisconsin, Madison, WI. www.cias.wisc.edu/wp-content/uploads/2008/07/artofcompost.pdf

Plamondon, Robert. 2003. Success with Baby Chicks. Norton Creek Farm Press, Blodget, OR.

Salatin, Joel. 1996. Pastured Poultry Profit$. Polyface, Swoope, VA.

Scanes, Colin G., George Brant, and M. E. Ensminger. 2003. Poultry Science. 4th Edition. Prentice Hall, Upper Saddle River, NJ.

Further Resources

Publications and Online Resources

Auburn University
National Poultry Technology Center
Poultry Ventilation and Housing
www.aces.edu/poultryventilation

Auburn University offers a website devoted to innovations directly relating to the management of poultry houses.

Controlling Rodents on the Poultry Farm. 2017. By Tom Tabler, Morgan Farnell, Jessica Wells, Haitham Yakout, and Yi Liang. Mississippi State University, Starkville, MS. http://extension.msstate.edu/publications/publications/controlling-rodents-the-poultry-farm

Mississippi State University
Poultry Science Department
46 Old Bully
Mississippi State, MS 39762
662-325-3416
www.poultry.msstate.edu

Mississippi State University has a publication that covers rodent control in poultry houses.

Litter Treatments for Poultry. 2001. By John Blake and Joseph Hess. ANR-1199. Alabama Cooperative Extension Service. Auburn, AL. www.aces.edu/pubs/docs/A/ANR-1199/ANR-1199.pdf

UGA Poultry House Environmental Management and Energy Conservation
University of Georgia Department of Poultry Science
Poultry Science Building
Athens, GA 30602-2772
Fax: 706-542-1827
poultry@uga.edu
www.poultryventilation.com

The University of Georgia offers a website devoted to innovations directly relating to the management of poultry houses.

Suppliers

Farmtek
1440 Field of Dreams Way
Dyersville, IA 52040
800-327-6835
Fax: 800-457-8887

Henlight, LLC
Davis, California 95618
530-341-2263
www.henlight.com

Rooster Booster Poultry Lighting
Selmech Supplies LTD
19 Norton Enterprise Park
Churchfields
Salisbury
Wiltshire
01722-413440
www.roosterbooster.co.uk

Appendix 1: Mechanical Ventilation

Components of mechanical ventilation include static pressure and cubic feet per minute (cubic meters per second). Static pressure is the difference between inside and outside atmospheric pressure. It is positive or negative depending on whether fans exhaust air from the building (negative) or blow air into the building (positive) (Bell and Weaver, 2002). The measurement cubic feet per minute (cfm) describes the volume of air entering an air inlet. For a ventilation system that operates under negative pressure year-round, a minimum requirement of 1.5 cfm per pound of bodyweight should be provided for laying hens and 1.25 cfm per pound of bodyweight for broilers to provide oxygen and to remove excess heat, moisture, and gases. If the birds need to be cooled, higher air volume is required. Less ventilation is needed for chicks (0.1 cfm per chick). A 36-inch fan provides about 10,000 cfm. About 15 to 20 square feet of inlet opening is required for each 36-inch exhaust fan (Bell and Weaver, 2002). For cool-weather ventilation, a chicken house that is 40 feet wide should have one 36-inch fan for every 100 feet of house length. Fans can be controlled with thermostats. During cold weather, when ammonia is a problem, thermostats may need to be set in order to remove ammonia more often (Bell and Weaver, 2002).

Air inlets control the volume of air entering the house. Large openings allow air to enter at a slower speed, while small openings allow it to enter at a higher speed. A stream of air (air jet) is used to mix fresh air with moist, ammonia-laden air during cold periods, and to mix fresh air with hot air in warm periods. With no air jet, there is no ability to mix air and the air will just drift toward the fans. Or cold air may fall to floor level, where it chills the birds. Ideally, air jets should be able to reach the center of the house in order to properly mix fresh air with air in the house (Bell and Weaver, 2002). Air inlets are usually located under the eaves along the sidewalls of the house or on the ends of the house. Air inlets should direct air across the ceiling to the center of the house during cold weather, to allow proper mixing of fresh cold air with warm air. If a house has a slightly negative pressure, the air will enter the inlets at 500 to 1,000 feet per minute, which is fast enough to reach the warm air that collects in the ceiling area. In warm weather, air inlets should direct air right above the birds for maximum cooling. It is helpful to have a winch that can open and close inlets (Bell and Weaver, 2002).

Evaporative cooling can cool air in the houses even in humid areas. A system includes evaporative cooling pads and foggers. Tunnel ventilation can be used to remove heat in the summer and increase air speed to cool birds as it passes over them (convective cooling). The fans are located on one side of the house and the air inlets on the other.

Appendix 2: Composting Poultry Litter

Poultry litter is an excellent feedstock for composting. Composting is controlled decomposition, the natural breakdown process of organic materials (Cooperband, 2002). Raw materials are transformed into biologically stable, humic substances that are an organic-matter source with a unique ability to improve the chemical, physical, and biological characteristics of soil. In compost, nutrients are present in the same amounts but in a less-soluble form, and compost has less odor than raw litter. However, some nitrogen (N) escapes during composting, so the phosphorus (P) is more concentrated in compost. Due to the action of microbes, volume of compost is reduced compared to the original litter.

"Water and carbon dioxide lost during composting reduce the litter volume by 25-50 percent and the litter weight by 40-80 percent" (Cooperband, 2002). Composting occurs through the activity of microorganisms naturally found in soils, which colonize the material and start the composting process. During the active phase of composting, the temperatures in the pile get high enough to kill pathogens. The pile should be at least one cubic yard in order to retain heat. During this phase, oxygen must be replenished by aeration or turning of the pile. During the curing phase, temperatures lower, organic materials continue to decompose, and they are converted to biologically stable humic substances. Optimal conditions for rapid composting include a carbon:nitrogen ratio of 25:1 to 35:1, moisture content of 45% to 60%, available oxygen of more than 10%, particle size of less than one inch, bulk density of 1,000 pounds per cubic yard, pH of 6.5 to 8, and temperature of 130°F to 140°F (Cooperband, 2002). If the carbon:nitrogen ratio is less than 20:1, the microbes have surplus nitrogen (N), which can be lost to the atmosphere as ammonia gas. Also the pH should be less than 7.5 to prevent ammonia formation. In order to compost poultry litter, additional shavings or carbon sources may need to be added. If conditions are not optimal, anaerobic decomposition may occur, which produces foul-smelling sulfur and takes longer to compost. Composting bird carcasses (mortalities) is usually done in a bin.

Poultry House Management for Alternative Production
Anne Fanatico, NCAT Agriculture Specialist
© NCAT 2007
Updated Nov. 2018 by Kevin Ellis, NCAT Agriculture Specialist
© NCAT
Tracy Mumma, Editor • Amy Smith, Production
This publication is available on the Web at:
www.attra.ncat.org
IP308
Slot 303
Version 111518