



The Modern Hen

A Look at Cage-free Housing Solutions
& Practices for a Changing Market

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Executive Summary

Egg farmers started bringing chickens indoors in the 1940s and 1950s in order to keep them safe from diseases and predators. Today, the egg industry is facing pressure from animal welfare groups, consumers, and food chains vowing to use only cage-free eggs. The lack of unified guidelines and industry conflict on what “cage-free” really looks like have left farmers in a grey area, unclear about how to switch to cage-free housing, what housing system to switch to, and how to most effectively manage a cage-free facility to maintain optimal production.

There are three primary organizations that offer cage-free labeling certifications: United Egg Producers, Humane Farm Animal Care, and American Humane Association. Each organization has strict rules that must be adhered to in order to be certified under their label. These rules range from how much space each bird should have to move around and perform natural activities such as perching and dust bathing to regulations on air quality and light intensity throughout the day.

When choosing to go cage-free, farmers have several housing options – aviary systems, enriched or convertible systems, and floor housing. Each has its own set of advantages and drawbacks; aviary systems allow greater stocking densities and the greatest freedom of movement, but can result in higher incidences of hen aggression and floor eggs; enriched allow for better feed control and bird health, but with less room to move; floor systems have low stocking density for the foot print, but birds have the greatest amount of space to move.

Using certifier regulations as a guideline, we’ve outlined a series of best practices and considerations to create a successful, productive, cage-free layer barn. Diet, breed choice, and attentive personnel all play a vital role in creating an optimal facility, and when blended with the right system, the right practices can lead to a productive farm with many happy, healthy, hens.



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A Brief History

Egg farms in the 1920s only housed 400-500 hens, at most¹. More commonly, eggs were a byproduct of general farming, and flocks were normally about 100-300 large. Their diets consisted primarily of waste grain, seeds, and bugs. There were no enclosures, which left the hens exposed to the elements, predators, and disease, resulting in a high mortality rate.

By the 1940s the birds were brought indoors, protecting them from predators and the elements, effectively reducing the incidence of disease and lowering bird mortality. New medicines were developed to control diseases and lighting was adjusted to maximize egg production from the hens. Continuing to increase efficiency, farmers started housing birds in cubbies made of chicken wire in the 1950s because they could accommodate 1/3-2/3 more hens.

The modern cage system had eliminated most disease by the 1940s, providing hens with protection from the weather with environmentally controlled housing, and improving food safety by keeping the birds away from their feces². As a result of caging, flock nutrition could be managed, waste contact eliminated, and eggs kept cleaner for the consumer.

Industry Shift Back out of Cages

The shift back to cage-free eggs began following a shift in consumer demand and pressure from animal welfare advocacy groups. Many companies, including McDonalds, Burger King, Taco Bell, and Target have pledged to source 100% of their eggs from cage-free facilities in the next five to ten years. McDonalds alone buys two billion eggs per year for their US restaurants. Wal-Mart is the most recent retailer to join the cage-free movement, committing to a 2025 deadline for the transition. As the industry's largest grocer, this may mean that the premium for cage-free eggs will drop as cage-free becomes the industry standard³.

The cage-free egg market has not yet expanded enough to meet the retailer commitments for cage-free eggs. As with any niche market, there is a large amount of volatility and the market itself can quickly become imbalanced. The U.S. Department of Agriculture's Agriculture Analytics Division estimates that the nation's cage-free flock will need to expand to 139.5 million laying hens – a 900 percent increase – to fulfil the needs of the restaurant and food service

¹ (The Insanely Complicated Logistics of Cage-free Eggs for All)

² *American Egg Farming*. United Egg Producers.

http://www.unitedegg.org/information/pdf/American_Egg_Farming.pdf

³ Malcolm, Hadley. "Wal-Mart's Cage-free Egg Vow Could Cut Prices, aid Hens" *USA Today* 7 April 2016



companies pledging to go cage-free by 2030⁴. This expansion would require a retreat in the caged layer flock, otherwise, there will be a significant egg price adjustment. The table egg flock size was 288 million layers as of January 2016, meaning almost 50 percent of the current layers would have to be housed cage-free to meet the 2030 demand. In September of 2015, the US cage-free flock totaled 8.6% or 23.6 million hens. Of that 23.6 million, 11.4 million birds were USDA certified organic, and another 12.2 million birds were considered “other cage-free”.⁵

The Problems

Cage-free Guidelines

There is no single set of guidelines that define what “cage-free” is, and each verification agency or certifier has their own practices in place to ensure that farmers are meeting their standards. So, farmers who want to switch to cage-free are met with profound complications. For example, California passed Proposition 2 in January 2015 – a ballot measure that intended to end the use of cages in layer houses. The requirements of Prop 2 state that “every bird should have room to lie down, turn in a circle, and fully extend their wings.”⁶ However, the use of cages is not explicitly banned by the California Department of Agricultural Regulations; cages can still be used as long as each bird has 116 square inches of space to move around. Comparatively, McDonalds’ cage-free requirement involves the use of an aviary system – a “cage” that cannot be closed, allows more room per bird, and the ability to travel vertically through the house on a series of ramps and platforms⁷.

Cage-free Certifiers

Three independent organizations offer auditing and certification of animal livestock operations: United Egg Producers, Humane Farm Animal Care, and American Humane Association. The United Egg Producers guidelines are included in their Animal Husbandry for Laying Hens guidelines. Humane Farm Animal Care guidelines are close to the guidelines established by the Royal Society for Prevention of Cruelty to Animals. Animal Humane Association standards were adopted from the Council Directive 1999/74/EC – the European Union law that mandated the

⁴ Alonzo, Austin. “Retailer’s Cage-free Pledges Demand Millions of Layers” *WATT Publishing*. 15 April 2016

⁵ United Egg Producers. www.uep.com

⁶ Kesmodel, David. “Flap Over Eggs: Whether to go Cage-free.” *Wall Street Journal*, 16 March 2016.

⁷ *The Insanely Complicated Logistics of Cage-free Eggs for All*. 16 March 2016.



welfare standards for laying hens⁸. Each offers a certification label, UEP Certified, Certified Humane, and American Humane Certified, respectively. These organizations all agree on some aspects of animal husbandry, although there are some significant differences (see Table 1 below for a detailed outline of each organization's requirements). The Humane Farm Animal Care standards do not permit any battery cages, enriched cages, or aviary systems that are designed to confine birds in any way. In other words, housing systems cannot have doors. The American Humane Association has stated that more research must be done to say what effects temporarily locking birds in the system may have, and therefore allows convertible or aviary systems with doors. All audits are conducted by independent, third-party auditors that are not employed by the organizations offering certification.

Table 1:	<i>American Humane Certified</i> ⁹	<i>Humane Animal Care Standards</i> ¹⁰	<i>United Egg Producers</i> ¹¹
Feed	A wholesome and sufficient diet to maintain good health and nutrition. <ul style="list-style-type: none"> • Minimum of 1.5 linear inches if double-sided troughs are used, or • 3.0 linear inches if single-sided troughs are used, or • 1.5 perimeter inches of circular feeder if pans are used. 	Must receive wholesome, nutritious feed appropriate to the age, production stage, and breed. <ul style="list-style-type: none"> • 2.0 inches of double-sided linear trough, or • 4.0 inches of single-sided linear trough, or • 1.5 perimeter inches if using pan feeders. Withdrawal of feed to induce molting is not permitted. May not contain animal by product, growth-promoters, or antibiotics/coccidiostats (except for therapeutic reasons).	Must have access to fresh feed at all times. <ul style="list-style-type: none"> • 1.5 linear inches when using double-sided trough, or • 3.0 linear inches when using single-sided trough, or • 1.5 perimeter inches when using pan feeders.
Water	Must have continuous access to an adequate	Must have continuous access to an adequate	Clean, fresh water must be accessible at all times, in a quantity sufficient to

⁸ Alonzo, Austin. "A Closer Look at the Standards of Cage-free Certifiers." 14 April 2016. Watt Ag Net. Online. 25 April 2016.

⁹ American Humane Certified™ Animal Welfare Standards for Laying Hens – Cage-free. March 2016

¹⁰ Humane Farm Animal Care Standards – 2014 Standards. 18 August 2014

¹¹ United Egg Producers Animal Husbandry Guidelines for U.S. Egg Laying Flocks – 2016 Edition.



	<p>supply of clean, fresh drinking water at all times.</p> <ul style="list-style-type: none"> • 1 nipple per 10 hens, or • .4 inches when using round drinkers, or • .5 inch of double-sided trough space, or • 1 inch of single-sided trough space. • Per manufacturer's instructions if using bell drinkers. 	<p>supply of clean, fresh drinking water.</p> <ul style="list-style-type: none"> • 1 bell drinker per 100 hens, or • 1 nipple per 12 hens. 	<p>promote normal hydration, health, and productivity.</p> <ul style="list-style-type: none"> • 1 bell drinker per 100 hens, or • 1 nipple or cup per 10 hens, or • .5 inch of double-sided trough space, or • 1 inch of single-trough space. <p>Hens must not have to travel more than 26 feet to access water.</p>
Air Quality	<p>Ammonia levels may not exceed 25 parts per million (ppm).</p>	<p>Ammonia concentration cannot exceed 10 ppm at bird height, or 25 ppm total.</p> <ul style="list-style-type: none"> • Hydrogen sulfide should be less than .5 ppm but cannot exceed 2.5 ppm. • Carbon dioxide should be less than 3000 ppm but cannot exceed 5000 ppm. • Carbon monoxide should be less than 10 ppm but cannot exceed 50 ppm/. 	<p>There must be a continuous flow of fresh air provided for every bird.</p> <p>Ammonia should ideally be less than 10 ppm but may not exceed 25 ppm.</p>
Floor/Litter	<p>Hens must have access at all times to well-maintained litter or scratch areas.</p> <ul style="list-style-type: none"> • 15% of the total usable house must be suitable litter and substrate to allow for dust bathing. 	<p>Must have daily access to litter in an area large enough to allow for dust bathing and foraging freely.</p> <ul style="list-style-type: none"> • 15% of available floor space must be suitable substrate. 	<p>Must have continual access to a scratch area covered with litter.</p> <p>Scratch areas should cover 15% of usable floor space.</p>
Nests	<p>Nests must be enclosed or provide curtains or dividers so hens desiring privacy can have it.</p>	<p>Nests must contain substrate that encourages nesting.</p>	<p>A minimum of 9 square feet per 100 hens is required for nesting.</p>

	<p>Nests must have artificial nest padding OR substrate (2"-4" deep) that encourages nesting.</p> <ul style="list-style-type: none"> Individual nest boxes: 1 nest box per 5-7 hens Colony nests: 9.0 square feet per 100 hens. 	<ul style="list-style-type: none"> Individual nest boxes: 1 per 5 hens. Community nests: minimum of 9 square feet per 100 hens. 	<p>Nests should contain suitable floor substrate that encourages nesting.</p>
Perching	<p>A minimum of 6 linear inches per hen is required. Alighting rail in front of nest boxes is included.</p> <ul style="list-style-type: none"> 1-1^{3/4} diameter to be grasped effectively. <p>Minimum of 20% of perches should be raised for hens to avoid aggression.</p> <ul style="list-style-type: none"> 16-39.4 inches above adjacent floor. At least 1 foot from wall or other perches. 9.5 inches of head room over perches. 	<p>Perches must be accessible at all times.</p> <ul style="list-style-type: none"> A minimum of 6 inches of perch per hen – can include alighting rail. Minimum of 1 inch wide or 1 inch in diameter and not more than 3 inches. .5 inches of room on any side of the perch to grip without trapping claws. <p>20% of linear perch must be elevated.</p> <ul style="list-style-type: none"> 16 inches to 3.3 feet from ground. 8 inches from wall or ceiling. 	<p>A minimum of 6 linear inches per hen is required.</p> <p>A minimum of 20% of perch space must be elevated at least 16 inches above adjacent flooring, and at least one horizontal foot from adjacent perches or walls.</p>
Light	<p>A minimum of 10 lux (or 1 foot-candle) should be maintained throughout the house.</p>	<p>Must be bright enough that birds can see, and that they can be inspected without difficulty.</p> <p>In a 24 hour period, hens must have:</p> <ul style="list-style-type: none"> 8 hours of continuous light, 6 hours of continuous dark 	<p>Light intensity should be a minimum of .5 foot-candle at feeders and drinkers during the daytime.</p> <p>Sufficient lighting must be provided to allow for effective inspection of all birds at least one time per day.</p>
Space/ Bird Density	<p>Usable floor area includes main floor and litter area, plus any elevated floor areas with at least 17.7</p>	<p>Floor space does not include nests or nest boxes or elevated perches. Non-elevated</p>	<p>Usable floor space consists of combined litter and drop through areas including elevated</p>



	<p>inches of clear headroom, but excludes nest areas.</p> <ul style="list-style-type: none"> • Houses with all-litter floors must have 1.5 square feet per hen. • Multi-tier systems housing medium weight birds must have 1.2 square feet per hen. • Multi-tier systems housing lightweight birds must have 1.0 square feet per hen. 	<p>perches are included in floor space.</p> <ul style="list-style-type: none"> • 1.5 square feet per hen in single-level, all-litter houses. • 1.2 square feet per hen in enriched systems. • 1 square foot per hen in aviary systems. • 1 square foot in pasture-raised systems. <p>Birds must have sufficient freedom of movement to stand normally, turn around, and stretch their wings, as well as perch or sit quietly without disturbance.</p>	<p>tiers and covers over belts, but excludes nest space.</p> <ul style="list-style-type: none"> • 1 square foot per bird in aviary systems. • 1.5 square feet in single-level systems.
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Housing Systems

Every housing solution has its advantages and drawbacks varying from stocking densities, to mortality rates, to disease control and the number of floor eggs. Aviary systems enable higher barn stocking densities and ensure that birds will never be penned up. They encourage nesting, perching, and the use of floor litter, as well as movement, exercise, and flight – which can improve hen health and alleviate most animal welfare concerns. Enriched or convertible cages afford birds more movement and amenities (perches, scratch pad, and nesting areas), while still allowing for greater feed and health care control. Floor housing systems allow the birds to roam in the litter; perches and colony nests are provided for comfort.

Aviary and floor housing allow birds to come into contact with their feces so it's important to keep litter dry in an effort to reduce transmission of disease. Traditional cages and enriched convertible cages keep birds away from their excreta, lowering risk for disease and other health issues, as well as lowering the risk of salmonella contamination that can affect both the birds and the consumer. Salmonella can infect the ovaries of the hen, causing infected birds to lay



eggs that contain Salmonella¹²; it is imperative to maintain strict biosecurity measures. In any system, dedicated management is essential for successful production in loose housing systems.

Pullet Housing

Raising pullets in a system that resembles the intended future layer housing will ease the transition from pullet barns to production housing. Pullets raised in conventional cages will be the least expensive to purchase but will never adjust to the vertical facilities of an aviary system. Floor raised pullets, while mid-range in price, understand horizontal movements, but may take some time to learn to move upwards if placed in an aviary convertible system. Aviary pullets, though most expensive, will have already become accustomed to being able to move both vertically and horizontally, and will be most productive as layers in an aviary system¹³. Pushing the birds into the system at night between the ages of four and eight weeks will get them accustomed to moving into the aviary for the night, as well as get them accustomed to being around nest boxes. Research has found that when birds are in the system in the morning, they are less likely to lay floor eggs¹⁴.

Transfer birds to production units no later than 17 weeks, or about one to two weeks prior to the onset of lay – this gives them enough time to acclimate to their surroundings and become familiar with the nest boxes before starting to lay¹⁵. Light intensity levels should match that of the rearing house. Feeders and drinkers should be in the same location for rearing and production units¹⁶. Drinkers should be available close to, but not in reach of, the nest boxes, as hens like to drink before and after laying their eggs.

Layer Housing

Aviary Systems

A true aviary system is defined as a series of multi-tiered platforms and perches inside a barn with a cement or litter floor¹⁷. Each tier allows for different activities – nesting, perching, and feeding can all be found on various levels. These platforms allow for vertical movement throughout the house and allow for greater bird stocking densities. Because these systems

¹² Aquije, Sonia. "From Food Safety to Animal Welfare: The Cage-free Movement" *Food Quality and Safety*. 31 March 2016

¹³ Ament, Derrick. *Product Manager, Environmental Controls* Ericka Mongeau. 25 April 2016. In person.

¹⁴ Dr. John Church, Michelle Jendral. "Alternative Layer Hen Housing Systems in Europe." Alberta Egg Producers (2005). Online.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ AVMA, op cit.



allow for more bird movement, hens often have improved bone strength¹⁸. Birds housed in an aviary system enjoy the ability to forage, dust bathe, and perch at will. However, these birds have greater exposure to their feces in the litter, and it is more difficult to control ammonia and dust levels¹⁹.



Research has reported that feather pecking is greatest amongst hens kept in aviary systems²⁰ (as compared to enriched or conventional cages). Encouraging bird distribution helps reduce aggression, therefore, areas should be designated for specific activities such as nesting, feeding, and movement, bathing or scratching and resting²¹.

¹⁸ Ibid.

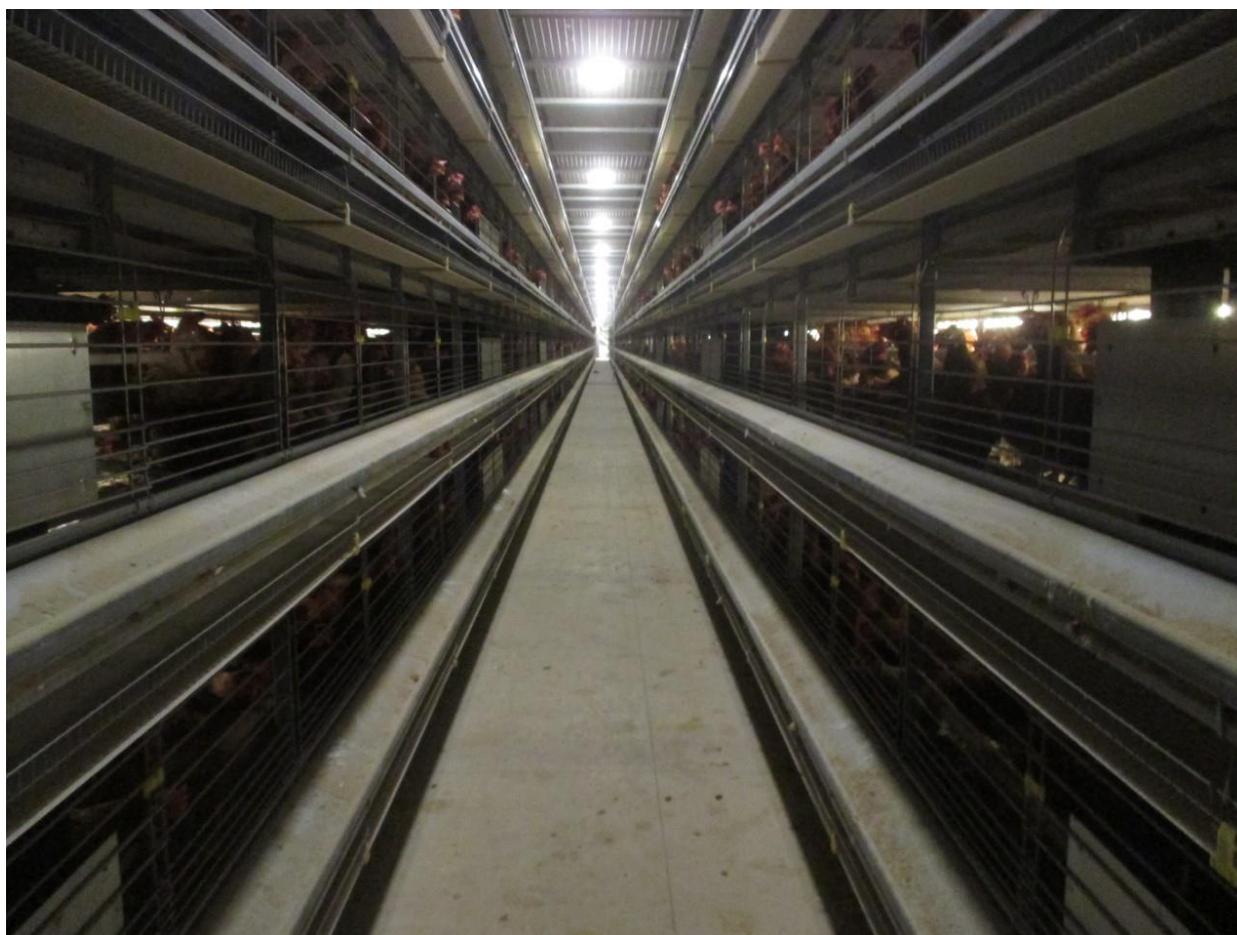
¹⁹ Church, op cit.

²⁰ Muirhead, Sarah. "Study Compares Laying Hen Housing Systems" *Feestuffs Foodlink*. 20 March 2015

²¹ Ibid.

Enriched Convertible Systems

The convertible cage system has all the features of an enriched or furnished cage, with external perches so that birds can move between cage sections when the doors are opened. Enriched convertible cages provide additional features that allow for natural behaviors such as perching, litter and nest box use, and more space to move about²². There is more room for natural behaviors such as stretching, wing flapping and walking. Perches can improve bone strength and foot condition; litter use – either in the cage or on the floor – will decrease levels of aggression towards other birds. Dietary health can still be closely monitored and controlled as birds are still contained to smaller groups, which normally results in better feed conversion than that seen in aviary or floor systems.



The biggest risk with using either an enriched system or aviary system is that of housing system equipment malfunction²³. One study found that an aviary system resulted in the highest number of deaths caused by birds getting caught in the system. It also reported that birds in enriched

²² Ament, op cit.

²³ AVMA, op cit.

cages showed patterns of feather loss due to abrasion against the cages²⁴. It is imperative that cages are checked regularly for broken equipment and sharp edges that can injure or kill the birds.

Floor Systems

Floor systems are located inside of large barns where hens can roam on the floor with access to litter and nest boxes or colony nest facilities. The floor system allows for greater movement horizontally, but there is less vertical movement around the house²⁵. Perches are provided throughout the house at a height of 12"-16", and often are located along water lines, feed lines, or along the tops of the community nests. Feeders and water lines are commonly found on slats above the floor that keep the majority of the feces away from the birds.

Floor housing can result in higher mortality rates with greater incidences of feather pecking and cannibalism. In groups, hens develop a pecking order. When housed in cages, the group is limited to a few birds and not subject to change; therefore, once a hierarchy is established, aggression among the hens decreases. In a floor system, where birds are constantly moving around and creating new social interactions, there is never an established pecking order causing hens to constantly establish and re-establish themselves. It may help to section the barn into smaller areas, but adequate perching opportunities should also be provided so that hens can escape aggression. Intensive stockperson maintenance is required to ensure bird health is maintained.

Best Practices

This list of best practices and other considerations hereafter are designed to follow the regulations set forth by the various cage-free certification labels. They can be applied to any of the three housing systems discussed previously.

Feed and water

In cages, feed is wasted when birds overeat from boredom. In cage-free systems birds have enough room to move about and keep themselves entertained, so feed is wasted primarily by insufficient feeder design²⁶. Be sure you are using a high quality feeder that features a feed

²⁴ Muirhead, op cit.

²⁵ AVMA, op cit.

²⁶ Mavromichalis, Ioannis. "8 Tips for Feeding Cage-free Layers." 21 March 2016. WattAgNet. 30 March 2016. <www.wattagnet.com>



saving lip and anti-rake fins to reduce billing. Competition for food increases when birds are taken out of their cages. In order to counteract this, be sure there are an adequate number of feeders available so that lower ranking birds have ample opportunity to feed.



Flock uniformity can be enhanced by distributing feed at multiple locations and providing enough feed that both top and bottom hens can eat their fill. This will help prevent flocking, overcrowding, and aggression at the feeders. Running the feed belt eight or more times will reduce crowding at the feeders and encourage subordinate birds to feed²⁷. Providing less feed more often also reduces feed wastage and maximizes feed intake.

Air quality

It's important to keep the litter dry in order to maintain low ammonia and dust levels. In an aviary system, bird movement in higher tiers helps reduce manure accumulation in the litter since it is deposited on manure belts. This keeps the litter drier and improves air quality. Floors can be dried by using an appropriate ventilation system adopted from the broiler industry, but also by

²⁷ Church, op cit.

encouraging hens to scratch and dust bathe²⁸, as these activities rotate the litter. Increasing the attractiveness of the litter often directs pecking behavior at the ground, thus averting pecking behavior directed at other birds, minimizing aggressive behavior and injuries and maintaining plumage.

Limiting the amount of litter to a level that enables hens to scratch at the concrete will satisfy the hen requirement for foraging and bathing, minimize ammonia and dust levels, and prevent hens from laying eggs on the floor. The ideal depth for litter is one inch – deep enough to dust bathe, shallow enough to dry quickly, and not deep enough for the hens to scratch it into a nest. Litter should be renewed at least once during the production cycle²⁹ but should also be removed and replaced when the litter becomes too wet or dirty. Litter should not excrete any liquid when a handful is squeezed.^{30,31,32}

Nests

In order to reduce floor eggs, hens should be accustomed to the nest box before lay commences. Frequent collection of floor eggs will discourage other birds from laying in the same location, and prevent the birds from eating cracked eggs. Adequate lighting to minimize shadows on the floor and scratch area will help prevent floor laying.

All certifiers for cage-free laying hens agree that birds should have access to either individual nest boxes (1 per 5 hens) or a colony nesting systems that allows a minimum of 9 square feet per 100 birds. Hens more readily use nest facilities along the length of the barn when dividers are present³³ and encouraging this distribution will reduce floor laying and improve egg quality. Nest boxes should be available at least two hours before barn lights are turned on and should be closed at least one hour before lights out for the night³⁴ to discourage floor laying and brooding.

Perches

Perching is a high priority for hens; subordinate hens use them as a means to escape aggressors, but it also helps to keep the hens from resting in the litter where they would be

²⁸ Ibid.

²⁹ Ibid.

³⁰ American Humane Certified™ Animal Welfare Standards for Laying Hens – Cage-free. March 2016

³¹ Humane Farm Animal Care Standards – 2014 Standards. 18 August 2014

³² United Egg Producers Animal Husbandry Guidelines for U.S. Egg Laying Flocks – 2016 Edition.

³³ Ibid.

³⁴ Ibid.



more susceptible to litter-borne bacteria or parasites. In an aviary system, perches are best situated at the top, as it encourages bird movement upwards³⁵. As birds rest on the perches, manure will fall to the manure belts below, instead of in the litter, which helps maintain air quality.



All cage-free certification programs require at least six inches of linear perch space per bird in all housing systems. Twenty percent of the total perch space must be raised a minimum of 16 inches above the adjacent floor height in all cage-free layer housing systems.

Lighting

The standard duration of light needed per day to reach maximum production is 16 hours. Light intensity is required to be a minimum of 10 Lux throughout the house, but optimal lighting of 30 Lux – or three foot-candles³⁶ – at the feed troughs leads to more efficient production. Research has shown that sufficient lighting in the red spectrum – at around 2700-3000K – can lead to

³⁵ Ibid.

³⁶ Belabbio, Juliet. "The Science of Poultry Lighting" *Once Innovations, Inc.* Accessed: 16 May 2016

higher egg production³⁷. Manipulating light intensity over the course of the day may increase nest box use. Bright lighting in the morning will increase bird activity and encourage entry into the nest box³⁸. Light intensity should be reduced after midday. Simulating dawn and dusk lighting encourages birds to calmly settle. If using an aviary system, dimming lights from the floor upwards will encourage vertical movement in the house as the birds move to higher resting areas³⁹, which will help keep the floor cleaner and have the hens in the system closer to the nesting area so that eggs are laid in the nests.

Other Considerations

Cage-free Diet

Feeding cage-free layers is tremendously different than feeding caged ones. The extra freedom to move means there is more energy being spent and higher competition for food. Because the birds are using more energy to move around, they need to consume more energy, possibly 5-15% more⁴⁰. There are two options to increase energy intake:

1. Increase the daily allowance of feed based on previous records. It's recommended to start at about 10% increase, and adjust according to bird weights.
2. Keep feed levels the same but add a lipid source. This avoids overspending on expensive additives but protein concentration might need a slight increase to allow for somewhat heavier musculature⁴¹.

Lipids (fats) are concentrated sources of energy⁴². They will increase energy intake without the expense of additives, but might require a protein increase to support the heavier musculature⁴³.

Egg production requires a large amount of calcium from the bird, and because the birds will be moving about more, their bones will require more calcium to stay strong. Limestone, oyster shells, and other marine shells are valuable sources of calcium⁴⁴; feeding dietary calcium in large particle size (limestone: 2-5mm, oyster shell: 2-8mm) ensures that there is enough

³⁷ "Understanding Poultry Lighting: A Guide to LED Bulbs and Other Sources of Light for Egg Producers" Accessed: 16 May 2016

³⁸ UEP Husbandry Guidelines, op cit.

³⁹ Ibid.

⁴⁰ Mavromichalis, op cit.

⁴¹ Mavromichalis, op cit.

⁴² "Alternative Systems Management Guide" *Hy-Line North America Edition*. Accessed 16 May 2016

⁴³ Mavromichalis, op cit.

⁴⁴ Hy-Line, op cit.



calcium to be absorbed and used during peak egg formation⁴⁵. It is also imperative that caretakers design a feed plan that aids calcium absorption – adding organic acids and an adequate amount of vitamin D can help achieve this⁴⁶.

Breed of Choice

Selecting the right breed for the right housing system is fundamental to successful production. Some breeds are more aggressive than others, and some breeds are prone to exploring their surroundings. Breeds vary in feed conversion rates, egg production rates, egg shell strength, color, and size, as well as temperament, and adaptability. For optimal production, farmers should consider their housing facility and caretaker handling capacities, and select the breed that is the best fit.

Stockperson Handling

The well-being of a flock is fundamentally dependent on the care that is provided by the farmers and personnel. Stockpersons should be alert and aware at all times and regularly examine and document the condition of both the equipment and the flock. Managers and caretakers should know and understand the guidelines under which the farm is operating, implement suitable training programs for new caretakers⁴⁷, and demonstrate responsible animal husbandry. Caretakers should know the normal behavior of laying hens⁴⁸ and be able to recognize illness and other problems at their earliest signs, so they may be resolved in a swift and humane manner.

Conclusion

With all of the turbulence currently affecting the egg industry it's hard to say what the best cage-free system will be. While aviary systems afford hens a greater amount of space to walk about, flap their wings, and lay their eggs, it may prove to be too consuming of worker resources to be efficient or too harsh on delicate bird immune systems. Floor systems face similar challenges, with a lower bird density reducing bird heat in the winter. Enriched convertible cages can afford the birds all the comfort of an aviary system when operated as cage-free, while still keeping the

⁴⁵ Mavromichallis, op cit.

⁴⁶ Ibid.

⁴⁷ Humane Farm Animal Care Standards – 2014 Standards. 18 August 2014

⁴⁸ Ibid.



birds in small enough groups that they do not become too aggressive and their health remains easily maintained.

It is ultimately up to the farmer to decide what system will work best for his farm. Cage-free birds come with a new set of needs that farmers must learn to properly care for and this will become easier with time as the industry, hen breeds, and information evolve to paint a more complete picture of what it really means to be cage-free.



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