



Literature Review on the Welfare Implications of
Laying Hen Housing
(January 26, 2012)

THE ISSUE

Laying hen housing systems must provide feed, water, light, air quality, space and sanitation that promote good health and welfare for the hens. Housing systems should provide for expression of important natural behaviors, protect the hens from disease, injury and predation, and promote food safety. Cages for laying hens were developed in the United States during the 1920s and 30s to reduce disease, (e.g., coccidiosis and roundworms) and injuries due to pecking. In addition, the conventional cage simplified husbandry by increasing efficiency and required less real estate. In the late 1980s and 1990s, as international regulations began to restrict the use of conventional cages, greater use was made of free-range systems. However ongoing problems with disease and pecking in large flocks led to the development of an array of intermediate enriched cage, aviary and barn systems that aim to balance environmental enrichment with environmental containment and disease control. Currently, multiple housing methods and husbandry systems are in commercial use in the United States and around the world. Each system has advantages and disadvantages that vary depending on local conditions and management. Not all installations will exhibit all of the traits described as typical in the summaries below, especially as all housing types are undergoing active development and refinement.

CONVENTIONAL CAGE

Definition: A wire enclosure housing 3 to 6 birds and having a sloped floor. In commercial production however, birds are commonly housed at the density of 7 to 8 birds per cage.

Advantages:

Reduced exposure to environmental and social hazards: Cages reduce the negative consequences of contact with manure, including infestation with roundworms and coccidia.¹ Cages also provide protection from predators and other wildlife.

Reduced proliferation of injurious pecking and subsequent mortalities: If hens begin to cause serious pecking injury² then the small social group size in each cage limits the proliferation of pecking and subsequent mortalities that may be associated with it.

Monitoring: Conventional caging improves the opportunity to monitor individual birds' health and well-being.

Biosecurity: Hens housed in cage housing systems are at a lower risk of infectious disease than hens housed in litter-based systems irregardless of outdoor access.³

Air Quality: Conventional caging does not incorporate the use of litter. Litter-based systems have been shown to have increased levels of ammonia, dust, and bacteria.⁴

Disadvantages:

Restriction of natural behaviors: Hens in cages are less able to perform behaviors such as dust bathing,⁵ walking⁶ and foraging.⁵ Spatial restriction has also been shown to decrease the hen's performance of

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comfort behaviors (e.g., wing flapping, stretching, body shakes, tail wagging).⁶ Nesting and roosting are not options in the conventional caging systems.

Variable risk—Cage-related injury: Hens may become trapped between wires, or experience foot damage secondary to overgrown claws. However improved cage designs⁷ and the use of abrasive strips⁸ largely eliminate these occurrences.

Variable risk—Feather pecking: Injurious feather pecking does occur in cages, often necessitating beak trimming. Providing devices such as plastic objects in a conventional cage,^{9,10} or balls in the feeder^{11,12} has produced equivocal results; however, string tassels^{13,14,15,16} may have some potential to attract pecking and reduce associated injuries. Selection methods in which the genetic effect of an animal on the survival of its group members is taken into account (group selection) have been shown to be effective in reducing mortality due to feather pecking and cannibalism in laying hens.¹⁷

Summary: Cages can provide a highly controllable environment that protects hens from a range of health and injury problems; however, they afford limited space and behavioral enrichments (e.g., opportunities for perching and dust bathing) and many natural behaviors cannot be performed in conventionally-sized and equipped cages. Cages tend to have an economic advantage. Egg production,^{2,18,19} quality^{2,20,21} and efficiency²² are often greatest in cage systems.

ENRICHED/FURNISHED HOUSING

Definition: Housing that provides additional features often including perches, a nest box/area, litter or scratch area and more space per hen.²³ Size and construction vary, including colony housing for up to 60^{8,19,24} birds.

Advantages:

Effective environmental features provide specific benefits. Most enriched housing would include the following:

Perches: Hens are motivated to perch, especially to roost at night.^{25,26} Perches improve bone strength,^{27,28} as well as foot² and claw condition.² However, perch use can lead to proliferative hyperkeratosis.²⁹

Nest box/area: When a nest box is available most eggs are laid in it.^{2,30} Hens will make an effort to gain access to nest boxes^{31,32} even when they have no prior experience with using one.^{33,34} If eggs are laid in the nest, the number of damaged eggs is similar between enriched and standard cages.³⁵

Litter: Early access to litter may reduce later incidence of feather pecking³⁶ and may improve adult feather condition.^{2,37} Most hens will use a dust bath if it is available, for either bathing or foraging.^{27,31} Consumption of litter was not observed to effect egg production.³⁸

Increased behavioral opportunities: Additional space allows birds more freedom of movement³⁹ and therefore behaviors such as stretching, wing flapping, and walking are more unrestricted and varied.

Health: Dietary health can be better controlled in hens housed in confined environments, allowing for a more balanced intake of nutrients needed for body maintenance and egg production.⁴⁰ However, access to non-nutritive substances such as dust bathing material or litter can lead to imbalanced nutrient intake.⁴⁰ Additionally, bone mineral density is increased for hens in enriched housing compared with hens housed in conventional cages.⁴¹ Mortality is numerically lower in enriched colony housing when compared to conventional cages, barn/aviary, and free-range housing.⁴²

Disadvantages:

Variable risk—Feature malfunction: Each of the additional features in an enriched colony has the potential to malfunction causing injury, harboring disease vectors or parasites or provoking aggression. For example, poorly designed perches can cause increased levels of keel deformation² and or bumblefoot.⁴³

Summary: There are multiple models of enriched/furnished housing in use and more under development. They provide a wider range of behavioral opportunities, while conserving many of the

advantages of a conventional cage. Egg shell quality³⁵ and shell cleanliness⁴⁴ are similar between conventional cages and enriched colonies with the exception of enriched colonies that are designed with scratch pad areas covered in sand or wood shavings. These designs can lead to dirtier eggs than what is seen in conventional caging.⁴¹ In addition the excretion of Calcium and Phosphorus, two minerals important to shell quality, are reduced in enriched housing situations as compared to conventional cages.⁴⁵

BARN OR AVIARY

Definition (Barn): A shed in which hens are housed on the floor and typically have access to litter and nest boxes.²³

Definition (Aviary): As for 'barn' with the addition of multi-tiered platforms or perches.²³

Advantages:

Health: Barn- and aviary-raised hens may show improvement in bone strength over hens raised in enriched colonies⁴⁶ and lower levels of hyperkeratosis are evident in birds that do not have access to perches.²⁹

Increased activity: Hens kept in barns spend more time walking than those kept in cages.⁵

Increased behavioral opportunities: Increased performance of foraging,⁵ dust bathing⁵ and comfort behaviors^{5,47} and a reduction in stereotypies.⁴⁷

Disadvantages:

Vector exposure: Birds raised on the floor are more likely to encounter disease vectors in feces or dampened litter, potentially leading to reduced health⁴⁸ and conditions such as bumblefoot.¹⁹ This may require handling of the birds to administer treatments or preventatives such as vaccination against coccidiosis.¹

Health: Hens in extensive systems that utilize perches tend to suffer more injuries due to landing failures when jumping from one perch to another. In addition, high usage of perches by hens can lead to keel bone deformation.⁴⁴ Overall performance is more variable, depending on outbreaks of coccidiosis or pecking mortalities.⁴⁹ In some cases, floor housing results in high mortality due to pecking⁵⁰ but some reviews do not support this as a general finding.¹⁹

Variable risk—Increased group size: Extensive housing systems typically house larger flocks with an increased risk of injurious pecking and pecking mortalities.⁵¹

Air Quality: Litter based systems have been shown to have increased levels of ammonia, dust, and bacteria.⁴ Increased ammonia levels can cause keratoconjunctivitis and have deleterious effects on the respiratory tracts of birds.⁴ Dust in housing systems can be biologically active and may have microorganisms attached to the particles.⁴

Summary: More extensive housing allows great freedom of movement, but is often associated with more hazardous conditions such as large social groups and litter which can lead to outbreaks of disease or injurious pecking if not managed carefully.

FREE-RANGE

Definition: The key feature of free-range housing is access to an outdoor area during the day.²³

Advantages: Hens with access to both indoor and outdoor areas have the greatest range of behavioral opportunities. Hens that spend more time outside have better feather condition.⁵²

Disadvantages: Outdoor conditions potentially expose hens to toxins, wild birds and their diseases, predators⁵³ and climatic extremes. Hens are often reluctant to use the range area or venture far from the hen house resulting in wear of the pasture in the area near the house. Farms where the hens make less

use of the pasture have higher incidence of feather pecking.^{54,55} More optimal pasture use can be encouraged by limiting flock size,^{56,57} including cockerels in the flock⁵⁷ and providing cover.^{57,58,59,60}

Summary: When access to the outdoors is provided hens are able to perform the broadest range of naturalistic behaviors, but they may also be exposed to climatic extremes, toxins and disease.

OTHER CONSIDERATIONS

Many hen welfare concerns are not intrinsically linked to housing system type although the system will be one factor that influences the welfare of the birds. Other factors such as genetics, the environment the hen was raised in and quality of human handling⁵⁷ must also be considered because outcomes for the animal generally depend on many overlapping factors. For example, highly productive laying hybrids are susceptible to osteoporosis in all systems.⁶¹ Cage housing is associated with reduced bone strength compared with enriched colony,⁴¹ barn,^{18,62} aviary^{46,63,64}, or free-range⁶² housing and while more extensive housing can lead to increased bone strength there are also increased opportunities for injury.

Feather pecking, peck injury and peck mortality (cannibalism) in poultry occurs at variable rates and may unpredictably become severe and cause high rates of distress, injury and death in a flock. Individual genetic selection may reduce feather-pecking, however, group selection of traits is a more beneficial way to reduce severe pecking while preserving rate of lay and longevity.⁵⁸

CONCLUSIONS

There is considerable domestic and international pressure to eliminate the use of conventional cages. Conventional cages are scheduled to be banned in Europe beginning in 2012. Isolated studies^{65,66} that have looked at people's attitudes toward conventional caging systems have identified concerns associated with the degree of confinement experienced by the birds.⁵⁶ However alternative systems also have considerable liabilities in terms of animal health, biosecurity and economic efficiency. It cannot be assumed that hens in non-cage systems will experience improved welfare. It is also unclear to what extent enriched colonies might be publicly acceptable as a long-term solution.

Some housing decisions depend on weighing welfare versus non-welfare (e.g. economic and public acceptability) factors. For example, as the number of hens kept in a conventional cage is increased, the laying productivity of each hen is reduced.⁶⁷ However, there may be an economic advantage to this practice because of overall increased output from the cage. Hens that produce the most eggs also suffer more from conditions such as osteoporosis.⁶¹

One key decision to be made by producers, consumers and regulators is how to balance the hen's freedom to exercise and perform natural behaviors against exposure to potential hazards such as disease vectors and large social groups. To make this judgment in a transparent manner the advantages, disadvantages and risks associated with each system should be acknowledged. The priorities of all of the stakeholders including regulatory bodies, consumers and producers should also be transparent. As the causes of health conditions like osteoporosis and behaviors such as injurious pecking are better understood the relative advantages and disadvantages of these systems will change and new systems may emerge.

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