PSA Emerging Issues Symposium: Social Sustainability of Egg Production

1022 The egg industry—Market context and sustainability issues. J. A. Mench*, D. A. Sumner, and J. T. Rosen-Molina, *University of California*, *Davis*.

The egg industry is being pressured from many directions to change its production practices, particularly to address concerns about hen welfare in conventional cage systems. Responding to similar pressures, in 1999 the European Union banned conventional laying cages starting in 2012. This now impending European ban has led to the development of several alternative housing systems. These include non-cage systems like aviaries, and modified (enriched or furnished) cages that include perches, areas in which the hens can forage and dust bathe, and nests. Understanding the European experience is valuable as the United States considers alternatives. In the United States the proportion of eggs produced in alternative systems is small (less than 5 percent of output) but growing, at least in part due to market and political incentives for systems that provide hens with more behavioral freedom than conventional cages. Animal welfare, however, is only one element of a sustainable production system. Other elements include those related to public values, the environment, economics, worker health, and food safety and quality. Eggs are a primary source of animal protein globally, and the United States is the third largest producer of eggs in the world, behind China and the European Union. The national table egg flock comprises about 280 million hens housed in all regions, but with approximately 60% of eggs produced in the 10 leading states. Adopting new housing systems will have substantial effects on costs and other aspects of egg production on both a regional and national scale, with potential negative impacts that need to be carefully considered. This paper discusses the US egg industry in the context of legislation and standards related to hen housing systems. It also addresses initiatives by retailers, non-governmental organizations, and private certification organizations to shape production practices in the egg industry, and how those initiatives might affect various aspects of the sustainability of egg production.

Key Words: sustainability, egg production, housing systems

1023 Economic and market issues on the sustainability of egg production in the united states: analysis of alternative production systems. D. A. Sumner*[1], H. R. Gow[2], D. R. Hayes[3], W. A. Matthews[1], F. B. Norwood[4], J. T. Rosen-Molina[1], and W. N. Thurman[5], [1]*University of California*, *Davis,* [2]*Michigan State University*, *East Lansing,* [3]*Iowa State University*, *Ames,* [4]*Oklahoma State University*, *Stillwater,* [5]*North Carolina State University*, *Raleigh*.

Conventional cage housing evolved as a cost-effective egg production system. Imposing housing alternatives raises marginal production costs and requires sizable capital investment. Farm-level cost increases of about 40% per dozen for shifts from conventional cages to relatively low-cost barn housing are consistent with California data. Data on costs per dozen associated with such alternatives as furnished cages are not readily available for the United States and European data are difficult to extrapolate to the US industry structure. Even if mandated by government or major buyers, a shift to alternative housing systems would likely occur with lead-times of at least 5 years (consistent with the recent California schedule) and therefore egg producers and input suppliers would have considerable time to build new facilities and plan new systems. A small share of US consumers now pay high retail premiums for eggs from hens housed in alternative systems. Data from consumer experiments indicate that some consumers who do not now buy specialty eggs would be willing to pay significant premiums. However, current data does not allow easy extrapolation to understand the willingness to pay for such eggs by the vast majority of conventional egg consumers. US egg consumption tends to be relatively unresponsive to price changes, with farm level price increases of 40% likely to reduce consumption by less than 10%. This combination of parameters suggest that, unless low-cost imports grew rapidly, imposed changes to higher-cost hen housing systems would raise US egg prices considerably, while reducing egg consumption only marginally. Eggs are a low-cost source of animal protein and low-income consumers would be hardest hit. But, since egg expenditures are a very small share of the consumer budget, the real-income loss per consumer would be small in percentage terms. Finally, the high egg prices implied by alternative hen housing systems raise complex issues about linking policy costs to policy beneficiaries.

Key Words: egg economics, layer housing costs, economics of animal welfare

1024 The impact of different housing systems on egg safety and quality. P. S. Holt*[1], R. H. Davies[2], J. Dewulf[3], R. K. Gast[1], J. K. Huwe[4], D. R. Jones[1], D. Waltman[5], and K. R. Willian[6], [1]*USDA/ARS Egg Safety and Quality Research Unit*, *Athens, GA,* [2]*Veterinary Laboratory Agencies*, *Weybridge, United Kingdom*, [3]*Veterinary Epidemiology, Ghent University*, *Ghent, Belgium*, [4]*USDA/ARS Animal Metabolism Research Unit*, *Fargo, ND,* [5]*Georgia Poultry Laboratory*, *Oakwood,* [6]*Chemistry Department, Tuskegee University*, *Tuskegee, AL*.

A move from conventional cages to either an enriched cage or a noncage system may affect the safety and/or quality of the eggs laid by hens raised in this new environment. The safety of the eggs may be altered either microbiologically through contamination of internal contents with *Salmonella enterica* serovar Enteritidis (*S. enteritidis*) and/or other pathogens, or chemically due to contamination of internal contents with dioxins, pesticides, or heavy metals. Quality may be affected through changes in the integrity of the shell, yolk, or albumen along with changes in function, composition or nutrition. Season, hen breed, flock age, and flock disease/vaccination status also interact to affect egg safety and quality and must be taken into account. An understanding of these different effects is prudent before any large scale move to an alternative housing system is undertaken.

Key Words: egg safety, egg quality, alternative housing

1025 Environmental impacts and sustainability of egg production systems. H. Xin*[1], R. S. Gates[2], A. R. Green[2], F. M. Mitloehner[3], P. A. Moore Jr.[4], and C. M. Wathes[5], [1]*Iowa State University*, *Ames*, [2]*University of Illinois*, *Urbana-Champaign*, [3]*University of California*, *Davis*, [4]*USDA-ARS*, *Fayetteville, AR*, [5]*University of London*, *United Kingdom*.

As an integral part of a systemic assessment toward "*Social Sustainability of Egg Production*," we reviewed the current state of knowledge about environmental impacts of different egg production systems, and identified knowledge gaps requiring further research. Highlights of the current knowledge include: 1) High-rise (HR) cage houses generally have lower air quality and emit more ammonia than manure-belt (MB) cage houses; 2) Manure removal frequency in MB houses greatly impacts ammonia emissions; 3) Emissions from manure storage are largely affected by storage conditions including ventilation rate, manure

moisture content, air temperature, and stacking profile; 4) More baseline data on air emissions from (6) HR and (2) MB houses are being collected in US; 5) Non-cage (NC) houses generally have reduced air quality (ammonia and dust levels) than cage houses; 6) NC houses tend to be colder during cold weather due to lower stocking density than caged houses; 7) NC houses are more energy intensive in winter; 8) Hens in NC houses are less efficient in resource (feed, energy and land) utilization, leading to greater carbon footprint; 9) Excessive application of hen manure to cropland can lead to nutrient runoff to water bodies; 10) Hen manure on open range may be subject to runoff during rainfall, although quantitative data are lacking; 11) Mitigation technologies exist to reduce generation and emission of noxious gases and dust, however work is needed to evaluate their economic feasibility and optimize design; and 12) Dietary modification shows promise for emissions mitigation. The identified knowledge gaps and research needs include: 1) Indoor air quality, barn emissions, thermal conditions and energy use for alternative hen housing systems (1-story floor, aviary, and enriched cage systems) along with conventional housing systems under US production conditions; 2) Environmental footprint for different egg production systems in US through life cycle assessment; 3) Process-based models for predicting air emissions and their fate; and 4) Further exploration of practical means to mitigate air emissions from different production systems.

Key Words: hen-housing system, environmental footprint, emissions mitigation

1026 Values and public acceptability dimensions of sustainable egg production. P. B. Thompson*[1], M. Appleby[5], L. Busch[1,2], L. Kalof[1], M. Miele[3], B. Norwood[6], and E. Pajor[4], [1]*Michigan State University*, *East Lansing,* [2]*Lancaster University*, *Lancaster, UK*, [3]*Cardiff University*, *Cardiff, Wales, UK*, [4]*Calgary University*, *Calgary, AL, Canada*, [5]*World Society for the Protection of Animals*, *London, UK*, [6]*Oklahoma State University*, *Stillwater*.

A variety of standards regimens have emerged as key arenas where conflicting values and visions for sustainability in egg production are negotiated and action for reform is pursued. These include: Federal regulatory standards for food safety and environmental impact; State, local and Federal standards for air and water quality; Private standards for animal welfare and other variables set by producer groups and retailers. This paper reviews what is known about public attitudes and preferences with respect to standards for egg production and identifies key gaps in knowledge about what the public thinks. What people do as "consumers" (when they spend their money) is not always a good predictor of what they will do as "citizens" (how they will vote, how they will express their views, and what financial or other support they will lend to various forms of social activism). Inconsistent indicators of "what people want," or what they would find acceptable are thus common. Several measures indicate that political support for environmental quality and animal welfare has been growing steadily in the US public, but food safety rates very high as an area of concern in studies that ask respondents to comparatively rank concerns or expectations from the food system. Beyond economic indicators of consumer choice, we have few data that permit judgments about the relative importance or preferred trade-offs that might be made among the various dimensions of sustainable egg production. We have limited ability to forecast scenarios for mobilization of public opinion in support of or in response to specific policy initiatives or patterns of change in production methods. We do not know how subsets of the public would interpret results from scientific studies on environmental, animal welfare, food safety, health or economic dimensions of egg production. We have very limited data on public attitudes to support standards development that would be intended to improve public confidence in the sustainability of egg production.

Key Words: standards, public opinion, politics

1027 Hen welfare in different housing systems. D. C. Lay Jr.*[1], R. M. Fulton[2], P. Y. Hester[3], D. M. Karcher[2], J. B. Kjaer[4], J. A. Mench[5], B. A. Mullens[6], R. C. Newberry[7], C. J. Nicol[8], N. P. O'Sullivan[9], and R. E. Porter[10], [1]*USDA-Agricultural Research Service, Livestock Behavior Research Unit*, *West Lafayette, IN*, [2]*Michigan State University*, *East Lansing*, [3]*Purdue University*, *West Lafayette, IN*, [4]*Fed. Agri. Res. Centre*, *Celle, Germany*, [5]*University of California*, *Davis*, [6]*University of California*, *Riverside*, [7]*Washington State University*, *Pullman*, [8]*University of Bristol*, *United Kingdom*, [9]*Hy-Line International*, *Des Moines, IA*, [10]*University of Minnesota*, *St. Paul*.

Egg production systems have become subject to heightened levels of scrutiny due to animal welfare concerns. Multiple factors such as disease, skeletal and foot health, pest and parasite load, behavior, stress, affective states, nutrition, and genetics influence the level of welfare laying hens experience. Although the need to evaluate the influence these factors is recognized, research into these areas is still in the early stages. We compare conventional cages, furnished cages, non-cage systems, and outdoor systems. Attributes of each system are shown to impact welfare and those systems which have similar attributes are impacted similarly. For instance, environments, such as non-cage and outdoor systems, in which hens are exposed to litter and dirt provide a greater opportunity for disease and parasites. The more complex the environment the more difficult it is to clean, and the larger the group size the more easily disease and parasites are able to spread. Environments, such as conventional cages, which limit movement, can lead to osteoporosis; but environments which have increased complexity, such as non-cage systems, expose hens to an increase incidence of bone fractures. More space allows for hens to perform a greater repertoire of behaviors, although some deleterious behaviors such as cannibalism and crowding, which results in smothering, can occur. Less is understood about the stress which each system imposes on the hen, but it appears that each system has its unique challenges. Selective breeding for desired traits such as improved bone strength and decreased feather pecking and cannibalism may help to improve the welfare of laying hens. It appears that no single housing system is ideal from a hen welfare perspective. Although environmental complexity increases behavioral opportunities, it also introduces difficulties in terms of disease and pest control. In addition, environmental complexity creates opportunities for the hens to express behaviors that are actually detrimental to their welfare. As a result, any attempt to evaluate the sustainability of a switch to an alternative housing system requires careful consideration of the merits and shortcomings of each housing system.

Key Words: poultry, welfare, housing

1028 Valuing stakeholder input in setting research priorities for sustainable egg production. J. C. Swanson*, *Michigan State University*, *East Lansing*.

The importance of stakeholder input in setting future goals for sustainable animal production systems should not be overlooked by the agricultural animal industries. Stakeholders play an integral role in setting the course for an array of factors affecting producers, from influencing consumer preferences to setting public policy. The Social Sustainability of Egg Production Project included a stakeholder workshop to consider and integrate diverse values into the project white papers, which frame the issues and research priorities for the future of sustainable egg produc-

tion. Representatives from the environmental, food safety, food retail, consumer, animal welfare, veterinary, general farm and egg production sectors participated, along with members of the project coordination team, in a 1.5 d workshop to explore and construct a vision for socially sustainable egg production. This presentation will present information about how this vision can be integrated into the science while taking account of the realms of social, political, environment, technology, culture and economics.

Key Words: egg production, sustainable, stakeholder