Coalition for a Sustainable Egg Supply

Richard Blatchford
University of California, Davis
Growing public interest in food production

Concern about hen welfare, focusing on conventional cages
Overview

• Egg industry in the U.S. and internationally in transition
• Knowledge base for transition?
  – 2008 American Egg Board study identified many knowledge gaps
Lack of North American studies evaluating alternative hen housing systems

Lack of commercial-scale research

Lack of holistic research
Members

- American Humane
- AVMA
- Bob Evans Farms
- British Columbia Egg Marketing Board
- Burnbrae Farms
- Cargill
- Cracker Barrel Old Country Store
- Daybreak Foods
- Egg Farmers of Canada
- Egg Farmers of Ontario
- Flowers Foods, Inc.
- Forsman Farms
- Fremont Farms of Iowa
- General Mills

- Herbruck Poultry Ranch
- Iowa State University
- McDonald’s
- Michael Foods
- Midwest Poultry Services
- Ohio Egg Marketing Program
- Poultry Science Association
- Purdue University
- Sparboe Foods
- Sysco Corporation
- Tyson Foods
- United Egg Producers
- University of Guelph
CSES Research Overview

- **Three types of hen housing systems evaluated**
  - Conventional cage system
  - Enriched colony system
  - Cage-free aviary

- **Across five sustainability factors:**
  - Environmental Impact
  - Food Safety
  - Worker Safety
  - Animal Health and Well-Being
  - Food Affordability

- **On a commercial farm in the upper Midwest**
  - Conventional cage system already on farm; other two houses built for project
  - But all managed as commercial operation

- **Over two full flock cycles**
Conventional Housing (CC)
Enriched Colony Housing (EC)

Perch

Nest box

Scratch area
Aviary Housing (AV)
# Hen & Housing Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Conventional Cage</th>
<th>Cage-free Aviary</th>
<th>Enriched Colony</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hen genetics</td>
<td>Lohmann White</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pullet rearing</td>
<td>Conventional cage</td>
<td>Cage-free aviary</td>
<td>Conventional cage</td>
</tr>
<tr>
<td>Hen population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(19 weeks – Flock 1)</td>
<td>193,424</td>
<td>49,842</td>
<td>46,795</td>
</tr>
<tr>
<td>Hen population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(19 weeks – Flock 2)</td>
<td>198,816</td>
<td>49,677</td>
<td>46,729</td>
</tr>
<tr>
<td>Hens per housing unit</td>
<td>6</td>
<td>852/1,704</td>
<td>60</td>
</tr>
<tr>
<td>Space per bird, cm²</td>
<td>516 (80)</td>
<td>1,171/1,166 (144)</td>
<td>754 (116)</td>
</tr>
<tr>
<td>(in²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrichment options</td>
<td>N/A</td>
<td>Perch, nest area, litter access</td>
<td>Perch, nest area, scratch pad</td>
</tr>
</tbody>
</table>
### Management Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Conventional Cage</th>
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</thead>
<tbody>
<tr>
<td>Photoperiod</td>
<td></td>
<td>16L:8D</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td>Commercial diets formulated to maximize production efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeding schedule</td>
<td>2x/d</td>
<td>5x/d</td>
<td>2x/d includes scratch auger</td>
</tr>
<tr>
<td>Ventilation type</td>
<td>Tunnel</td>
<td>Cross</td>
<td>Cross</td>
</tr>
<tr>
<td>Manure handling</td>
<td>Belt</td>
<td>Belt/Litter</td>
<td>Belt</td>
</tr>
<tr>
<td>Manure removal</td>
<td>3 to 4 days</td>
<td>3 to 4 days/ end of lay</td>
<td>3 to 4 days</td>
</tr>
<tr>
<td>Supplemental heat</td>
<td>-</td>
<td>3 heaters</td>
<td>-</td>
</tr>
</tbody>
</table>
Animal Health and Well-Being

Michigan State – Mick Fulton, Darrin Karcher, Mike Orth, Janice Siegford, Janice Swanson
UC Davis – Joy Mench, Cassandra Tucker
Objectives

• Hen health
  – Physical condition of hens in flock
  – Causes of mortality and health findings in hens that died

• Behavior
  – Resource use (e.g. perches, nests, scratch pad, litter) in Enriched Colony and Aviary

• Bone strength (leg and wing)
  – Osteoporosis and exercise effects on bone strength

• Stress physiology
Hen Health
## Total Accumulated Mortality*

### Flock 1

<table>
<thead>
<tr>
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<th>Conventional</th>
<th>Aviary</th>
<th>Enriched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of birds</td>
<td>9369</td>
<td>5852</td>
<td>2439</td>
</tr>
<tr>
<td>Mortality</td>
<td>4.7%</td>
<td>11.5%</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

### Flock 2

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Aviary</th>
<th>Enriched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of birds</td>
<td>9140</td>
<td>5858</td>
<td>2216</td>
</tr>
<tr>
<td>Mortality</td>
<td>4.2%</td>
<td>11.5%</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

Number of necropsies: CC = 797; AV = 1176; EC = 538
Mortality Causes - % of mortalities
(Flocks 1 & 2 combined)
**Skeletal Structure Issues**  
*(not a cause of mortality)*

<table>
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<th>Conventional</th>
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<th>Enriched</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flock 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keel fracture, recent</td>
<td>18 (4.2%)</td>
<td>17 (2.7%)</td>
<td>14 (4.9%)</td>
</tr>
<tr>
<td>Keel fracture, old</td>
<td>11 (2.6%)</td>
<td>75 (12.1%)</td>
<td>9 (3.1%)</td>
</tr>
<tr>
<td>Keel, S-shaped</td>
<td>27 (6.3%)</td>
<td>72 (11.6%)</td>
<td>24 (8.4%)</td>
</tr>
<tr>
<td>Keel, Folded</td>
<td>8 (1.9%)</td>
<td>4 (0.6%)</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td><strong>Flock 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keel fracture, recent</td>
<td>10 (2.8%)</td>
<td>13 (2.3%)</td>
<td>3 (1.2%)</td>
</tr>
<tr>
<td>Keel fracture, old</td>
<td>27 (7.3%)</td>
<td>183 (33.0%)</td>
<td>43 (17.1%)</td>
</tr>
<tr>
<td>Keel, S-shaped</td>
<td>54 (14.6%)</td>
<td>120 (21.7%)</td>
<td>43 (17.1%)</td>
</tr>
<tr>
<td>Keel, Folded</td>
<td>14 (3.8%)</td>
<td>23 (4.2%)</td>
<td>4 (1.6%)</td>
</tr>
</tbody>
</table>
Physical Condition
Methods: Welfare Assessment

• Evaluate the physical condition of hens in all three housing systems using the Welfare Quality® protocol for poultry
  – 100 hens/system
  – 3 times during flock cycle
Physical Condition

- Pullets were in overall good physical condition, although AV-reared pullets already had keel bone deviations
- In general, physical condition of all hens was good
  - No or low incidence of most issues, including comb abnormalities & wounds, beak abnormalities, eye problems, respiratory problems, ectoparasites, skin lesions, toe damage
## WQ: Conclusions

<table>
<thead>
<tr>
<th>Measure</th>
<th>Conventional</th>
<th>Enriched</th>
<th>Aviary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claw length</td>
<td>3.0 – 3.4 cm</td>
<td>2.8 – 3.2 cm</td>
<td>3.1 – 3.5 cm</td>
</tr>
<tr>
<td>Foot Lesion Incidence</td>
<td>60-95% of hens</td>
<td>14-72% of hens</td>
<td>21-84% of hens</td>
</tr>
<tr>
<td>Foot Lesion Severity</td>
<td>0% of hens</td>
<td>0% of hens</td>
<td>2-7% of hens</td>
</tr>
<tr>
<td>Keel abnormalities</td>
<td>3-22% of hens</td>
<td>8-41% of hens</td>
<td>18-49% of hens</td>
</tr>
<tr>
<td>Feather cleanliness</td>
<td>1-33% hens dirty</td>
<td>0-20% hens dirty</td>
<td>15-60% hens dirty</td>
</tr>
<tr>
<td>Feather loss pattern</td>
<td>Throat &amp; belly</td>
<td>Throat, belly &amp; head</td>
<td>Head</td>
</tr>
</tbody>
</table>
Skeletal Measures
Skeletal Methods

• Bone density & size
• Bone breaking strength
• Bone stiffness
• Bone mineral content
• Biochemical markers of bone formation & resorption
Bones

• AV-reared pullets had better load-bearing capacity and were stiffer than CC-reared
• This better bone quality was maintained in AV hens to 72 weeks of age
• Bone quality increased in EC, but was not as good as AV at 72 weeks of age
• Bone quality worst in CC
  – Exercise
Resource Use
Aviary

Views of litter

Focal sections

Tiered cages

Single row

Double row
Enriched Colony

Camera Views

Focal sections (cages from 3 tiers in each)
Cleanliness Scoring
## Resource Use: Summary

<table>
<thead>
<tr>
<th>Measure</th>
<th>Enriched</th>
<th>Aviary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nest Use</td>
<td>97%</td>
<td>97%*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.3% system, 0.7% floor)</td>
</tr>
<tr>
<td>Nest Cleanliness</td>
<td>Very Clean</td>
<td>Very Clean</td>
</tr>
<tr>
<td>Daytime Perch Use</td>
<td>8-13%</td>
<td>18-46%</td>
</tr>
<tr>
<td>Nighttime Perch Use</td>
<td>44-80%</td>
<td>34-60%</td>
</tr>
<tr>
<td>Dust Bathing in Afternoon</td>
<td>17% in entire cage</td>
<td>22% in open litter</td>
</tr>
<tr>
<td>Scratch Pad Cleanliness &amp; Use</td>
<td>Gets somewhat dirty. Little dust-bathing (~6%) or foraging (≤2%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Open Area Litter Use</td>
<td>N/A</td>
<td>15-35%</td>
</tr>
</tbody>
</table>

*Only data from 8/25/12-11/3/12 = aviary opening at peak lay to mid-lay.
Stress Physiology
Stress Physiology: Conclusions

• Heterophil to lymphocyte ratios were within normal ranges for hens in all systems

• Total white blood cell counts were high for hens in all systems

• No difference in adrenal weights of hens across systems during lay (small sample size?)
Conclusions

- Resources in EC and AV generally well used; best use in AV
- Higher mortality in AV
- Better bone strength in AV
- EC hens generally intermediate in terms of physical condition issues
- No evidence of acute or chronic stress in any system
SNAPSHOT IN TIME

Photograph Mo Scarpelli
Why Important?

• True multi-stakeholder process via formation of the Coalition
• Holistic approach – integration of information
Why Important?

• Identify trade-offs, not “best” or “worst” system
• Inform stakeholder decisions going forward
• Identify areas for mitigation/improvement in all systems
Goals

IDENTIFY TRADEOFFS

http://www2.sustainableeggcoalition.org/