



Emerging Diseases in Cage-Free Production



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PROS & CONS OF CAGE-FREE HOUSING SYSTEMS



- More room to exhibit “natural behaviors”
 - Perching
 - Short flights
 - Dust bathing
 - Wing flapping
 - Locomotion
 - Grooming



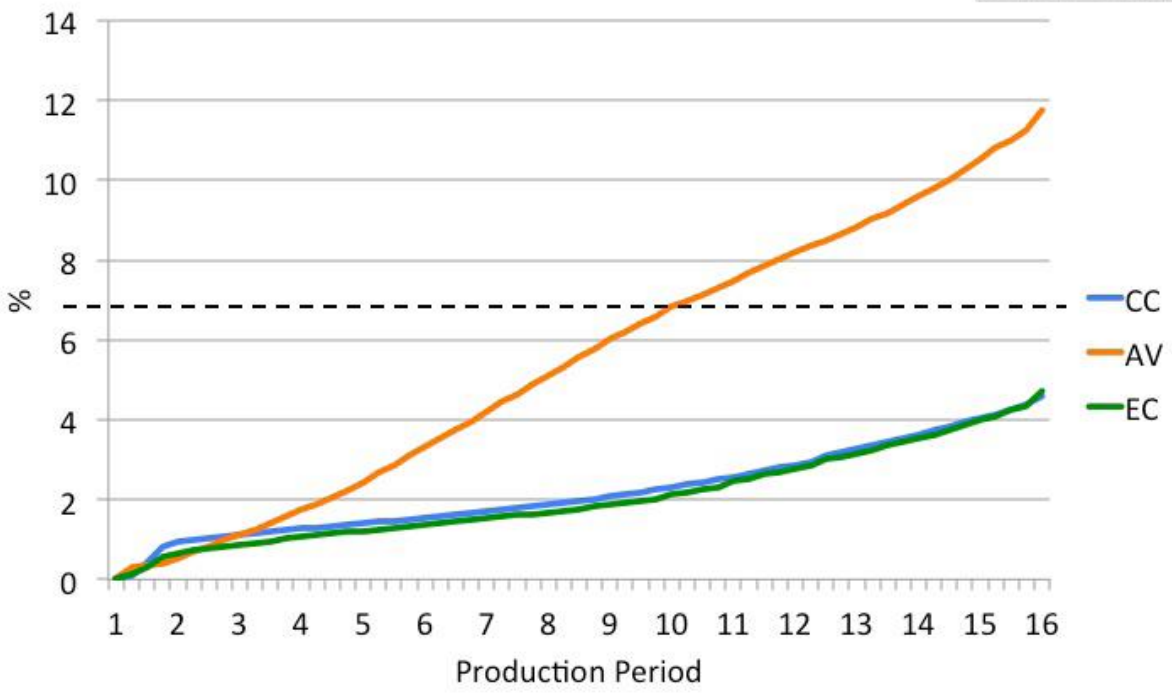
Cons of Cage-Free Housing

- Risks with a more open environment
- Management issues (e.g. floor/system eggs, litter management, difficult to C&D)
- Increased morbidity & mortality from both disease and behavioral issues
- Food safety issues
- Environmental working conditions for employees

Conventional Cage (CC) vs. Enriched Cage (EC) vs. Aviary (AV): Cumulative Mortality (%)

Coalition for Sustainable Egg Supply (CSES)

Cumulative Mortality Flock 2



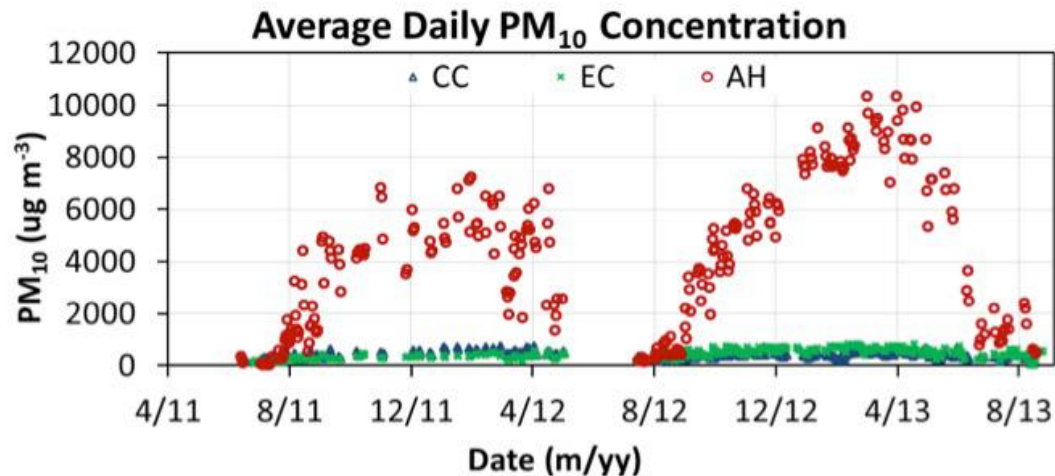


Increased Disease Risks

- More contact with manure => Increased bacterial and parasitic diseases
- Reduced air quality => Increased ammonia and dust (particulate matter)
- Pathogen buildup – minimal C&D between flocks
- Higher risk for exposure to bacterial and parasitic pathogens (e.g. *E. coli*, *Salmonella* species)
- Coccidiosis tops the list of parasitic diseases
- Intestinal damage => Poor nutrient absorption, increased mortality, decreased production, poor shell quality, etc.

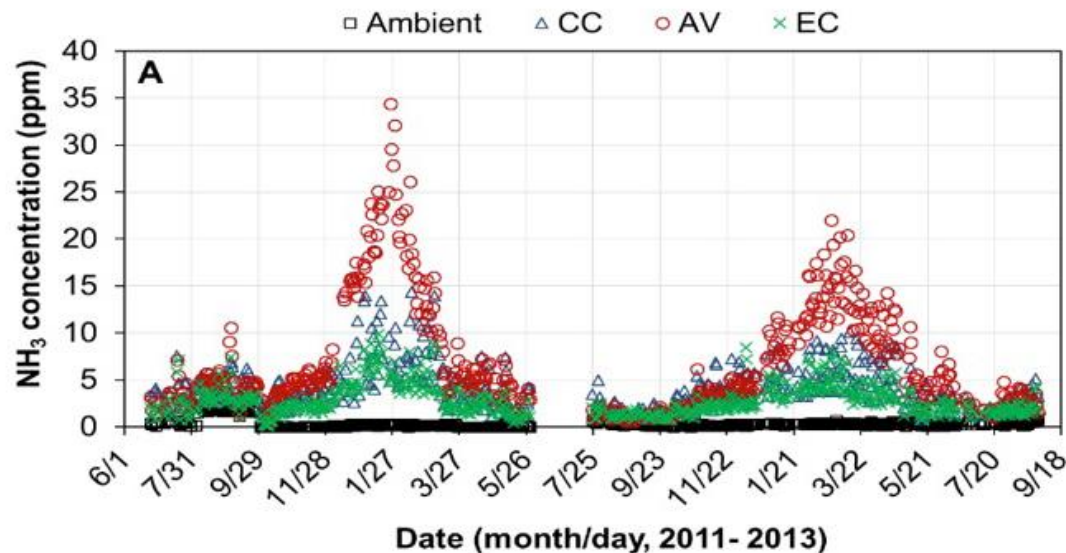
Conventional Cage (CC) vs. Enriched Cage (EC) vs. Aviary (AH):
Average daily particulate matter (dust) concentration
Coalition for Sustainable Egg Supply (CSES)

PM₁₀ Concentrations – Flocks 1 and 2



Conventional Cage (CC) vs. Enriched Cage (EC) vs. Aviary (AH):
Average Daily Ammonia Concentration
Coalition for Sustainable Egg Supply (CSES)

Ammonia Concentrations – Flocks 1 and 2





(....or “Re-emerging diseases”???)

- Bacterial diseases
 - E. coli
 - Necrotic Enteritis
 - Focal duodenal necrosis (FDN)
 - Infectious Coryza
- Parasitic diseases
 - Coccidiosis
 - Mites
 - Worms
- Fungal disease
 - Aspergillosis
- Behavioral issues
 - Cannibalism, vent picking



BACTERIAL DISEASES



E. coli Infection

- A.K.A. *E. coli* peritonitis, colibacillosis
- *E. coli* = gram-negative, rod-shaped bacteria
- Usually a secondary (opportunistic) bacterial infection
- Pathogenic strains cause clinical disease & death
- In the GIT and shed in feces – continuous exposure
- Occurs in all ages
- Respiratory, oral, ascending infection (from reproductive tract), & navel infection



E. coli Infection

Clinical Signs

- Elevated mortality
- Lethargic, depressed
- +/- Respiratory signs

Post-mortem Lesions

- Omphalitis/yolk sac infection
- Peritonitis
- Airsacculitis
- Pericarditis
- Salpingitis (oviduct infection)
- Enteritis
- Septicemia



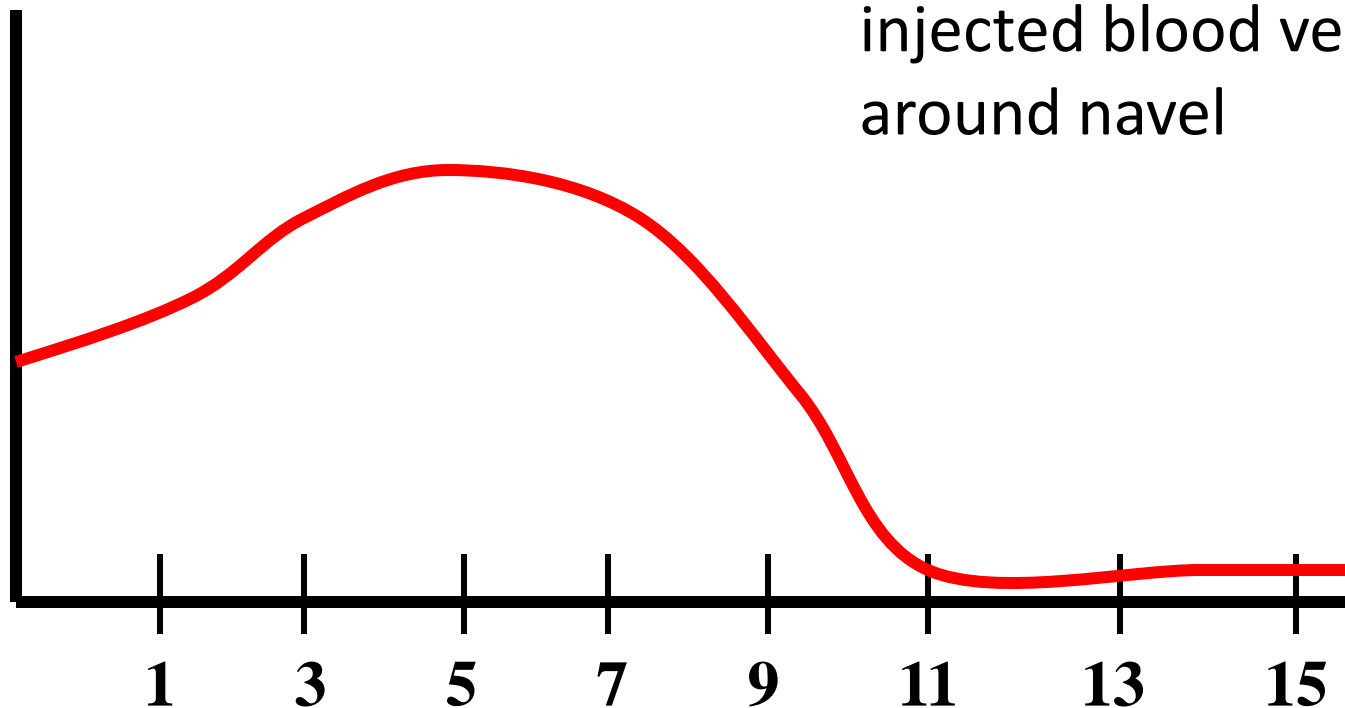
Omphalitis

- Major cause of increased first-week chick mortality
- Various bacteria may be involved (*E. coli*, *Enterococcus*, etc.)
- Can originate from bacterial contamination in hatchery or grow house
- No treatment at this age



Omphalitis

Mortality



- Clinical signs/lesions: elevated mortality (~3-7 days), open navels, malodorous yolk sac, injected blood vessels around navel

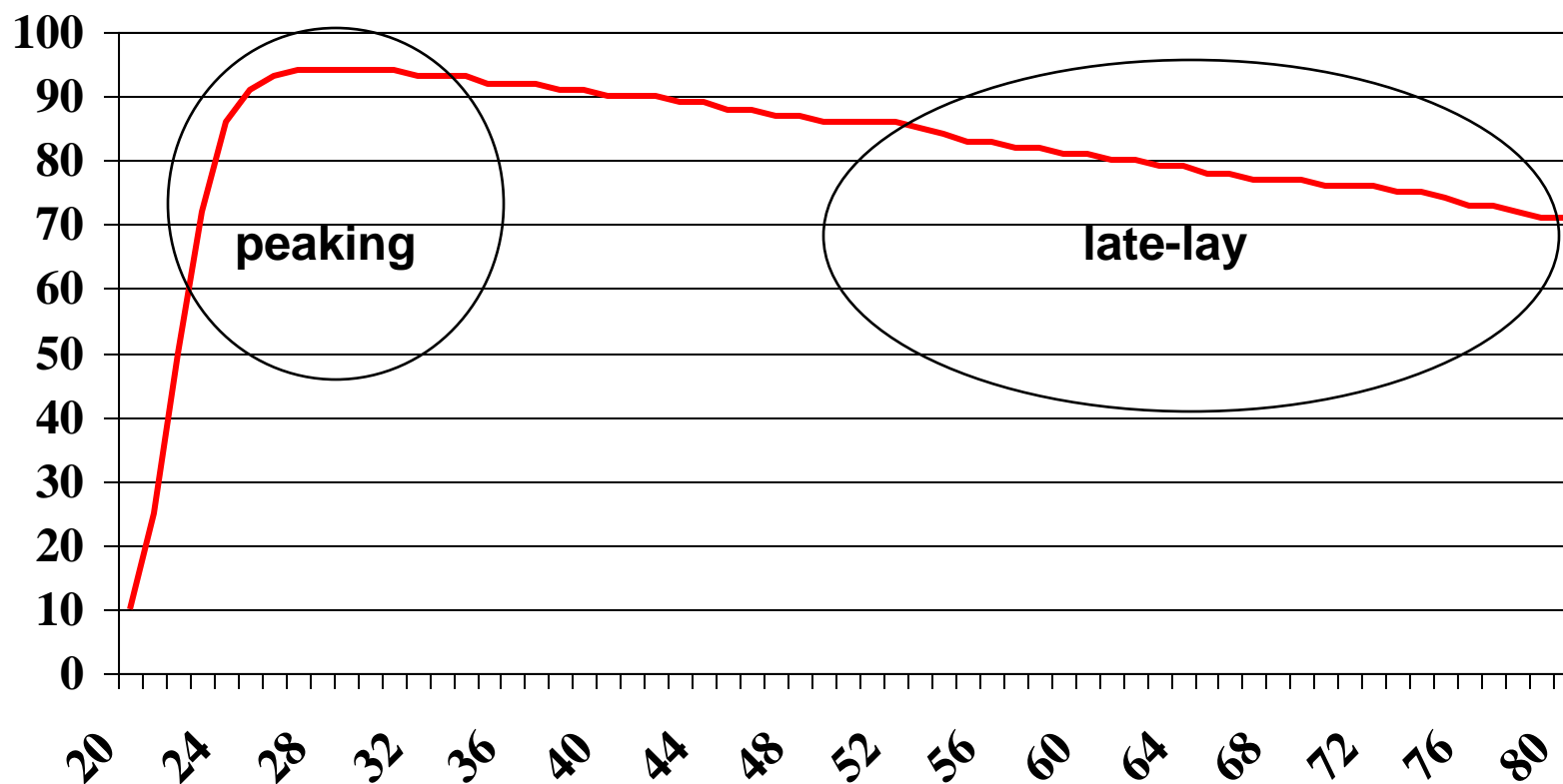


E. coli Peritonitis

- Postmortem lesions:
 - Peritonitis
 - Airsacculitis
 - Pericarditis
 - Salpingitis
 - Etc.

E. coli Peritonitis

*Usually two predominant ages affected





Predisposing Factors

- Peaking period – respiratory origin
- Generally occurs in multi-age complexes
- Post-housing exposure to mycoplasma (MG or MS)
- Post-housing exposure to “endemic” bronchitis
- Poor air conditions – elevated dust and ammonia levels
- Sometimes none – just a very virulent *E. coli*???



Predisposing Factors

- Late lay period – vent origin
- Generally associated with vent trauma
- Sub-lethal vent cannibalism
- Sub-lethal partial prolapse
- Excessively large egg size
- Excessive vent fat pad
- Small framed birds
- Excessive light intensity



E. coli Infection

Treatment/Control

- Antibiotic in feed or water (e.g. Aureomycin)
- *E. coli* spray vaccination
- Autogenous vaccine

Prevention

- Vaccinate during grow
- Water sanitation – prevent bacterial growth in drinking water
- Temperature & dust control (good air quality)
- C&D houses between flocks



Necrotic Enteritis

- Acute bacterial infection usually with intestinal mucosal damage (e.g. coccidiosis)
- Overgrowth of *Clostridium perfringens* and its toxins in the GIT



Necrotic Enteritis

Clinical Signs

- Rapid elevated mortality
- Depressed, ruffled feathers

Post-mortem Lesions

- Distended and friable intestines
- Mucosa covered in brownish diphtheritic membrane with foul-smelling intestinal contents



Necrotic Enteritis

Treatment/Control

- Coccidiosis treatment in the water or feed (e.g. Amprol, Coban)
- Bacitracin), an antibiotic, in the feed or water to treat bacterial infection

Prevention

- Coccidiosis spray vaccination at hatchery



Focal Duodenal Necrosis (FDN)

- Intestinal disease syndrome
- Bacterial cause: *Clostridium perfringens*
- Found in all strains of layers – brown & white
- >14 weeks of age
- Clinical Signs:
 - Drop in production (up to 10%)
 - Drop in egg size
 - +/- pale combs



- Necropsy freshly euthanized birds or intestinal lesions almost disappear
- Lesions:
 - Grey ulcerative areas in the duodenal loop



- Responds to antibiotic treatment :
 - Bacitracin (BMD)
- Treat only when found or can use preventative medication
- Routine monitoring:
 - 5-10 birds euthanized & necropsied



- Acute respiratory disease
- Clinical Signs:
 - Nasal discharge, sneezing, swollen sinuses
 - +/- reduced feed/water consumption
- Bacterial disease:
 - *Avibacterium paragallinarum*
- All ages susceptible
- Horizontal transmission



- Good biosecurity
- “All-in/all-out” management can help eradicate from a commercial farm
- Antibiotic treatment
 - E.g. Erythromycin
- Vaccination program:
 - Bacterin vaccine – using serovars present in target flock
 - Vaccinate 4 weeks before infection occurs



PARASITIC DISEASES



- Northern Fowl Mite (NFM)
- Clinical Signs:
 - Presence of dark red-black mites (usually around vent area)
 - Restless/agitated
 - Reduced feed intake
 - Loss of body weight
 - Anemia (pale combs)
 - Drop in egg production
 - Spots on eggs

Treatment/Control/Prevention

- Addition of feed-grade sulfur
- Dust boxes using sulfur dust (e.g. Yellow Jacket)
- Spraying both birds (focusing on vent areas) and nests with insecticide **every 5 days** (e.g. Ravap)
- Monitor mortality and live birds – repeat spray as necessary
- C&D houses between flocks
- Good biosecurity



Coccidiosis

- Protozoal disease
- 9 species of *Eimeria*:
 - *E. acervulina*
 - *E. necatrix*
 - *E. maxima*
 - *E. brunetti*
 - *E. tenella*
 - *E. mivati*
 - *E. mitis*
 - *E. praecox*
 - *E. hagani*
- Clinical disease dependent on *Eimeria* species
- Very pathogenic to no lesions



Coccidiosis

Clinical Signs

- Mucoïd-bloody diarrhea
- Dehydration
- Lethargic, depressed, weak
- Ruffled feathers
- Anemia
- Elevated morbidity/mortality
- Poor growth/weight gain
- Uniformity issues
- In lay flocks, drop in egg production

Post-mortem Lesions

- Enteritis +/- blood in small intestines and ceca
- Distended GIT
- Necrotic enteritis (bacterial)



Treatment/Control/Prevention

- Treatment via water/feed (e.g. Amprol, Coban)
- Coccidiosis spray vaccination at hatchery
- Management of coccidiosis vaccine in grow house to ensure *immunization*

- Most important factors to achieve long-term immunity against coccidiosis are:
 - Proper, uniform vaccination at hatchery
 - Feed, water, temperature & litter moisture
 - Continuous water/feed supply to stimulate cycling in GIT
 - Adequate temperature/humidity levels to stimulate oocyst sporulation (Goal of 50-60% relative humidity)
 - Use of paper during brooding



Management of Cocci Vaccine

- Promote proper cycling to achieve at least 3 full “cycles” of different *Eimeria* species in vaccine
 - Day 0 = Controlled dose at hatchery
 - Days 4-7 = 1st cycle
 - Days 14-21 = 2nd cycle
 - Days 28-35 = 3rd cycle



“WORMS”



Large Roundworms

- Ascarids = Large intestinal roundworms
 - *Ascaridia galli*
- Life Cycle
- Transmission via fecal-oral route

Clinical Signs

- Asymptomatic
- Loss of condition/body weight/emaciation (mainly in young birds)
- Impaired feed efficiency & poor growth
- Decreased egg production
- Listlessness/lethargy
- Diarrhea
- Increased mortality by intestinal obstruction

Post-mortem Lesions

- Enteritis
- Worms (up to 12cm in length) in small intestine (duodenum & ileum)



Cecal Worms

- *Heterakis gallinarum*
- Found in the tips of the ceca
- Not considered a major threat – rarely causes clinical signs
- Transmitted via fecal-oral route (+/- earthworm vector)
- Important transport host for *H. meleagridis*



Anthelmintic Treatment

- Treatment:
 - Piperazine
 - Fenbendazole
 - Hygromicin
 - Levamisole
- Roundworm eggs are hardy, many C&D products ineffective
- Biosecurity



FUNGAL DISEASES



Aspergillosis

- Usually affects respiratory system
 - Inhalation of spore-laden dust
- Contaminated litter, feed, and/or hatchery
- Clinical Signs:
 - High mortality in chicks
 - Respiratory signs (difficulty breathing)
 - Reduced feed consumption
 - Emaciation



Aspergillosis

- Post-mortem Lesions:
 - Airsacculitis
 - Lung lesions – white to yellow plaques/nodules
- No treatment
- Improved sanitation:
 - Grow farms (premises & equipment)
 - Hatchery (e.g. hatchers, incubators, etc.)
- Avoid moldy litter



HEN WELFARE RISKS



Hen Welfare Risks

- Feather/vent pecking
- Cannibalism
 - Coalition for Sustainable Egg Supply (CSES):
“Mortality in a cage-free system was double than that of any other housing system, in part due to excessive pecking and cannibalism, despite beak treatment”
- Skeletal injuries
- Genetics – selecting for less aggressive strains



Pecking/Cannibalism

- All birds by nature tend to be aggressive and cannibalistic [to some degree]
- More exaggerated pecking order More outdoor access
- Poorer indoor air quality (↑ ammonia, dust)



Pecking/Cannibalism

- Treatment options for vent picking:
 - Salt deficiency (add salt to diet)
 - Reduce light intensity (dimmable bulbs or remove bulbs)
 - Improve beak trim?



Skeletal Injuries

- Injuries from flying/landing mishaps
 - CSES: “Between 9-21% of flights in an aviary ended in failed landings”
- Broken keel bones, legs, etc.



FOOD SAFETY ISSUES



Food Safety Issues

- Increased risk for bacterial contamination – highest environmental microbial levels in cage-free housing (esp. *Salmonella*)
- USDA research: “Floor eggs have greatest opportunity for exposure to high levels of microorganisms and human pathogens”
- Decrease incidence of floor/system eggs
- Training birds for cage-free systems



Salmonella Vaccination

- Early colonization of the intestine after hatch with live vaccines
 - *Salmonella Typhimurium*
 - Development of local intestinal immunity
- Killed vaccine later in grow (>12 weeks)
 - *Salmonella Enteritidis*
- Vaccination reduces shedding in both the environment and in eggs (vertical transmission)



The challenge in transitioning from cage to cage-free operation is making the switch without compromising flock health, welfare, and production/performance.

IMPACT ON PRODUCERS & ENVIRONMENT



Impact on Producers/Environment

- Increased education – diseases, vaccines, etc.
- Increased disease monitoring – serology, environmental sampling, etc.
- Biosecurity issues (personnel, C&D, etc.)



- Improved hygiene (cleaning/disinfection between flocks)
- Increased biosecurity measures
- Feed treatment (e.g. heat or chemical treatments)
- Vaccination (e.g. *Salmonella*)



Thank you, Questions?