Cage-Free Research Update

Hongwei Xin

hxin2@utk.edu; hxin@iastate.edu

A Presentation at the 2019 EIC Annual Forum

April 16-17, 2019, Kansas City, MO

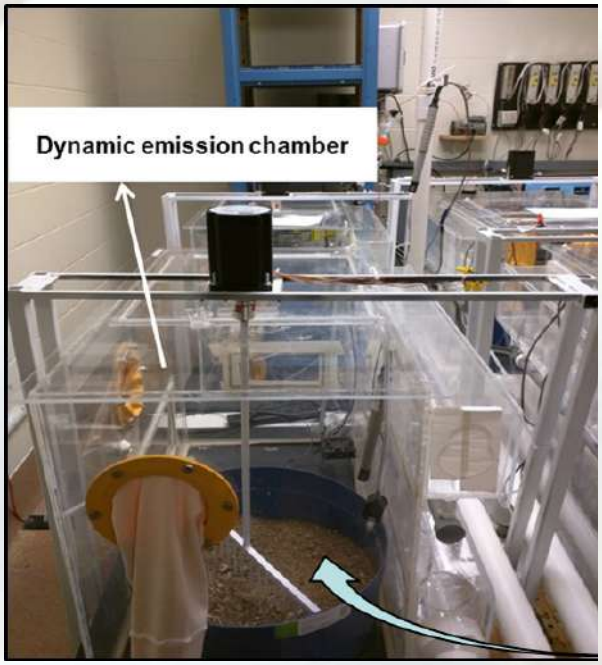
Our Team

- Dr. Lilong Chai, ISU/UGA
- Jofran Oliveira, ISU
- Dr. Brett Ramirez, ISU
- Kailao Wang, ISU/ZU
- Yu Wang, ISU/CAU
- Dr. Hongwei Xin, ISU/UT

Studies Covered

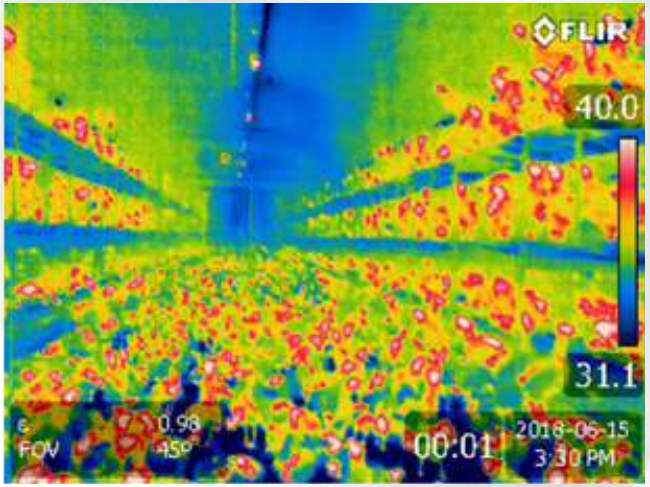
1. PM Mitigation & Heat Relief in Cage-Free House by Water Spray
2. Managing Practices in Cage-Free Housing to Reduce Floor Eggs
3. Production Performance of a Large Fully Open Cage-Free House – A Case Study

1. PM Mitigation & Heat Relief in CF House by Water Spray



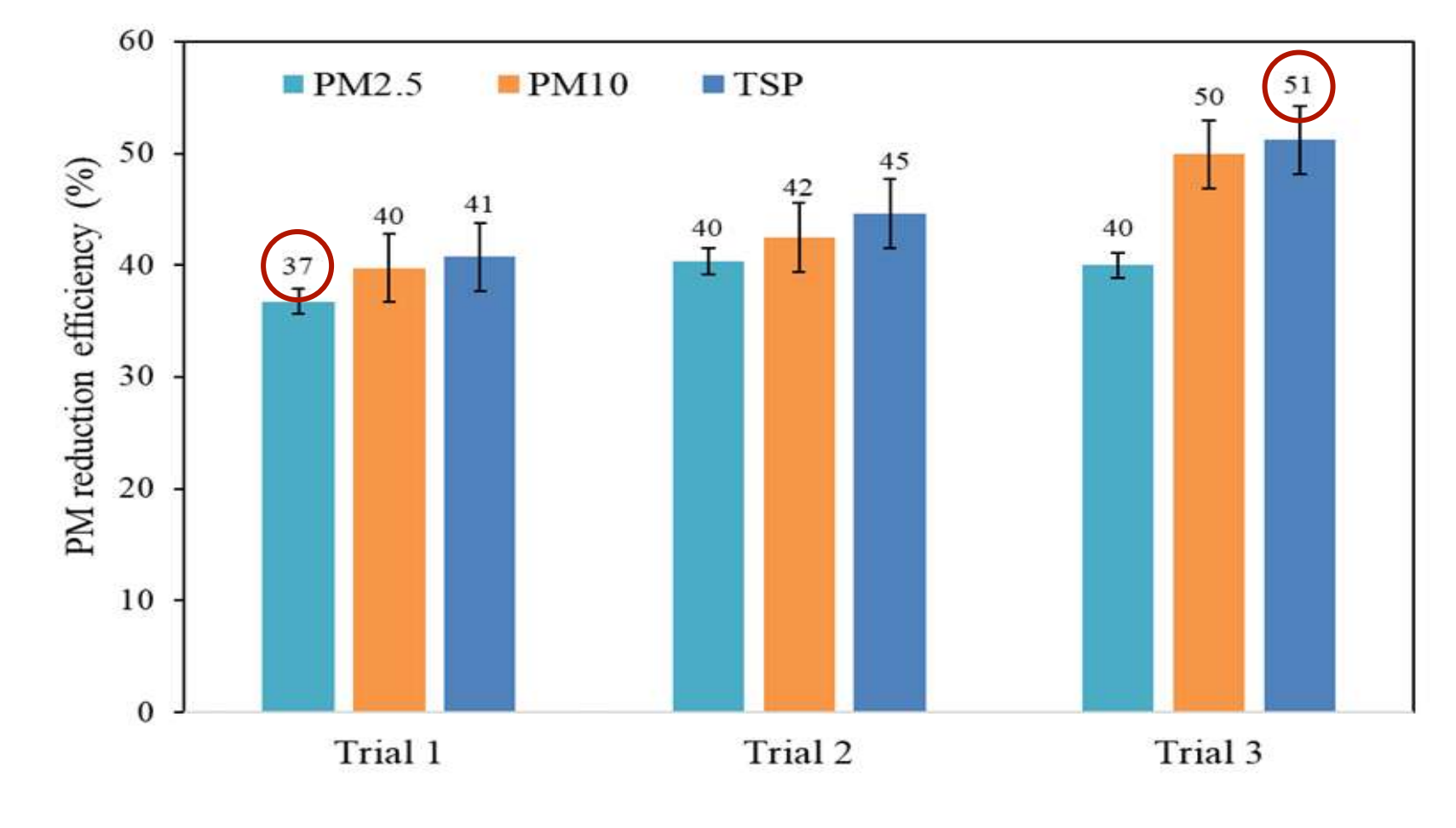
Lab-scale study on spray dosage and efficacy

Field verification test (50,000 DeKalb hens)



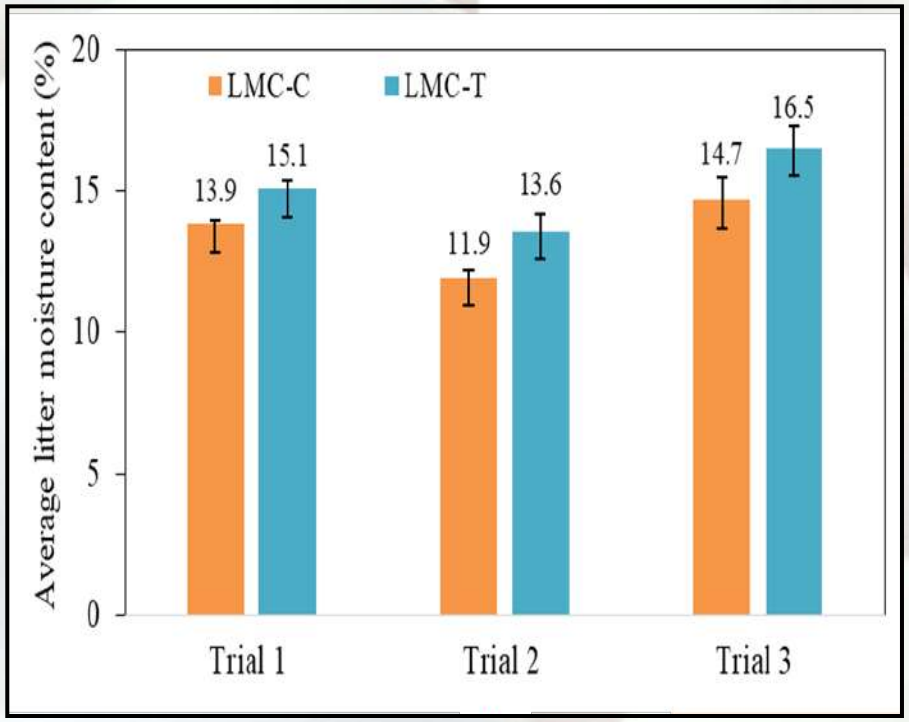
Thermograph of water spray cooling

Efficacy of PM Mitigation in CF House by Water Spray

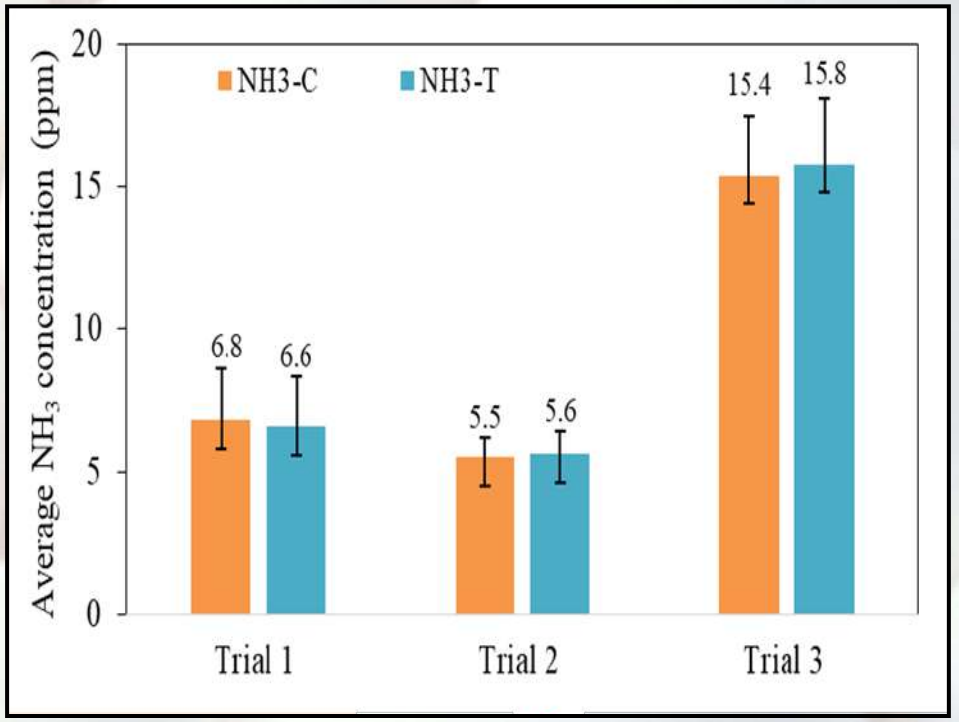


Field Test period: Late Fall to Winter (Oct – Jan)

Effects of Water Spray on Litter Moisture & Indoor Ammonia Levels

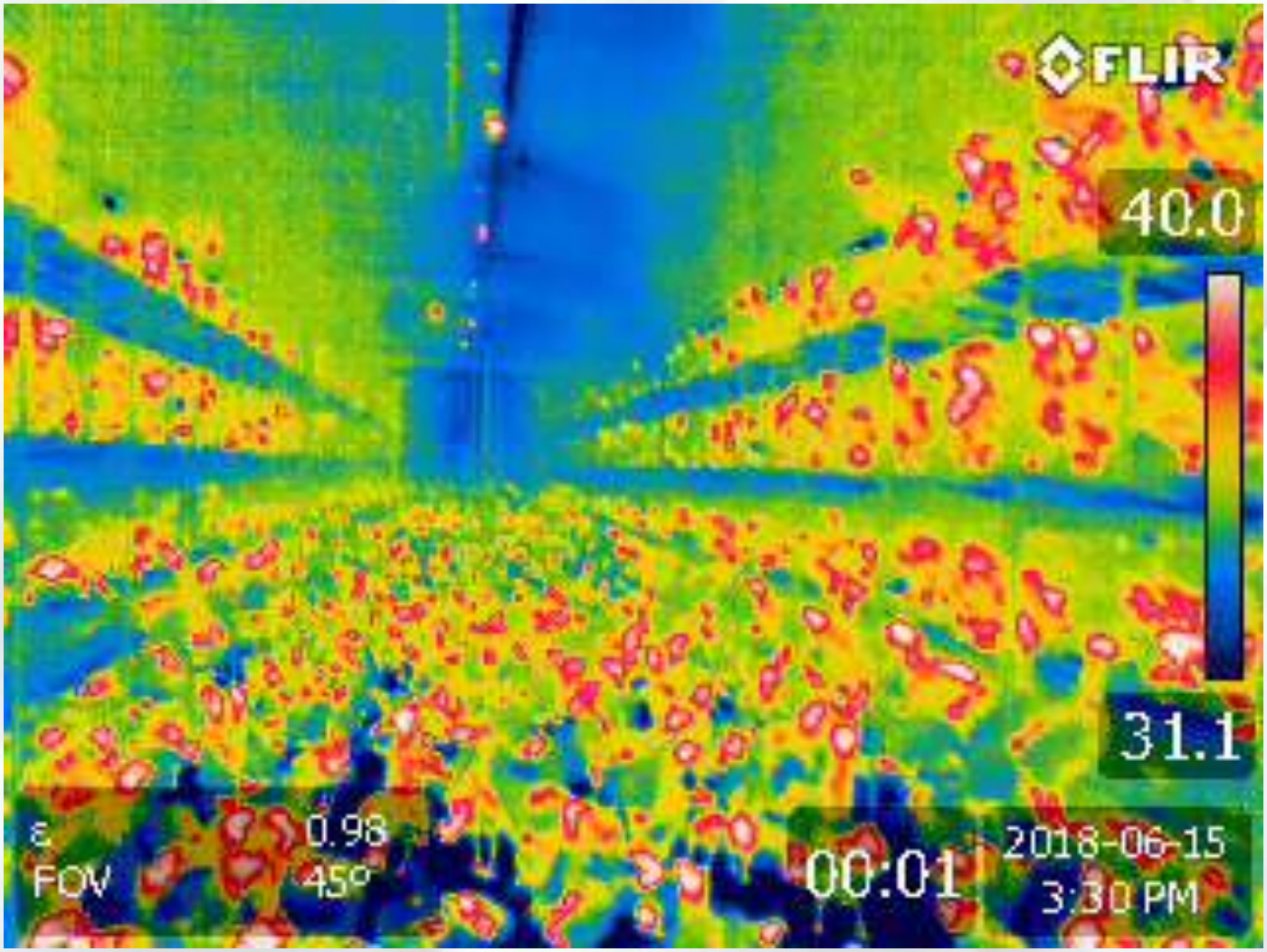


Litter Moisture Content



Ammonia Level

Heat Relief in CF House by Water Spray



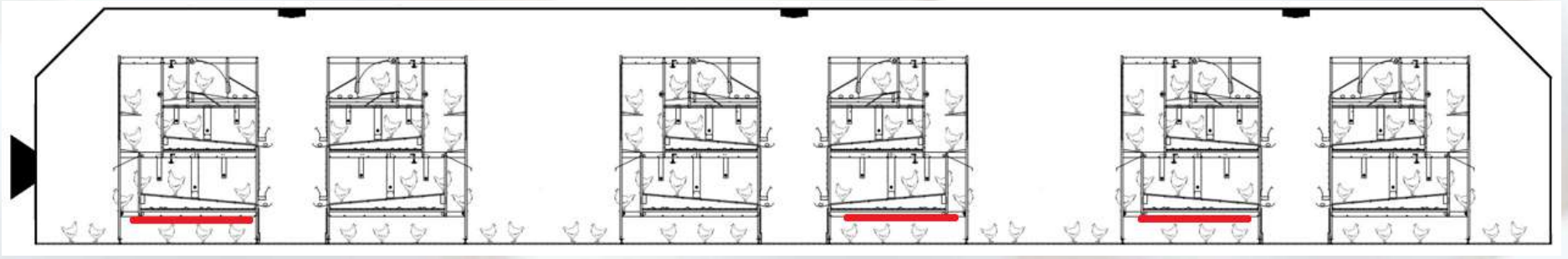
Indoor:

T = 95°F,

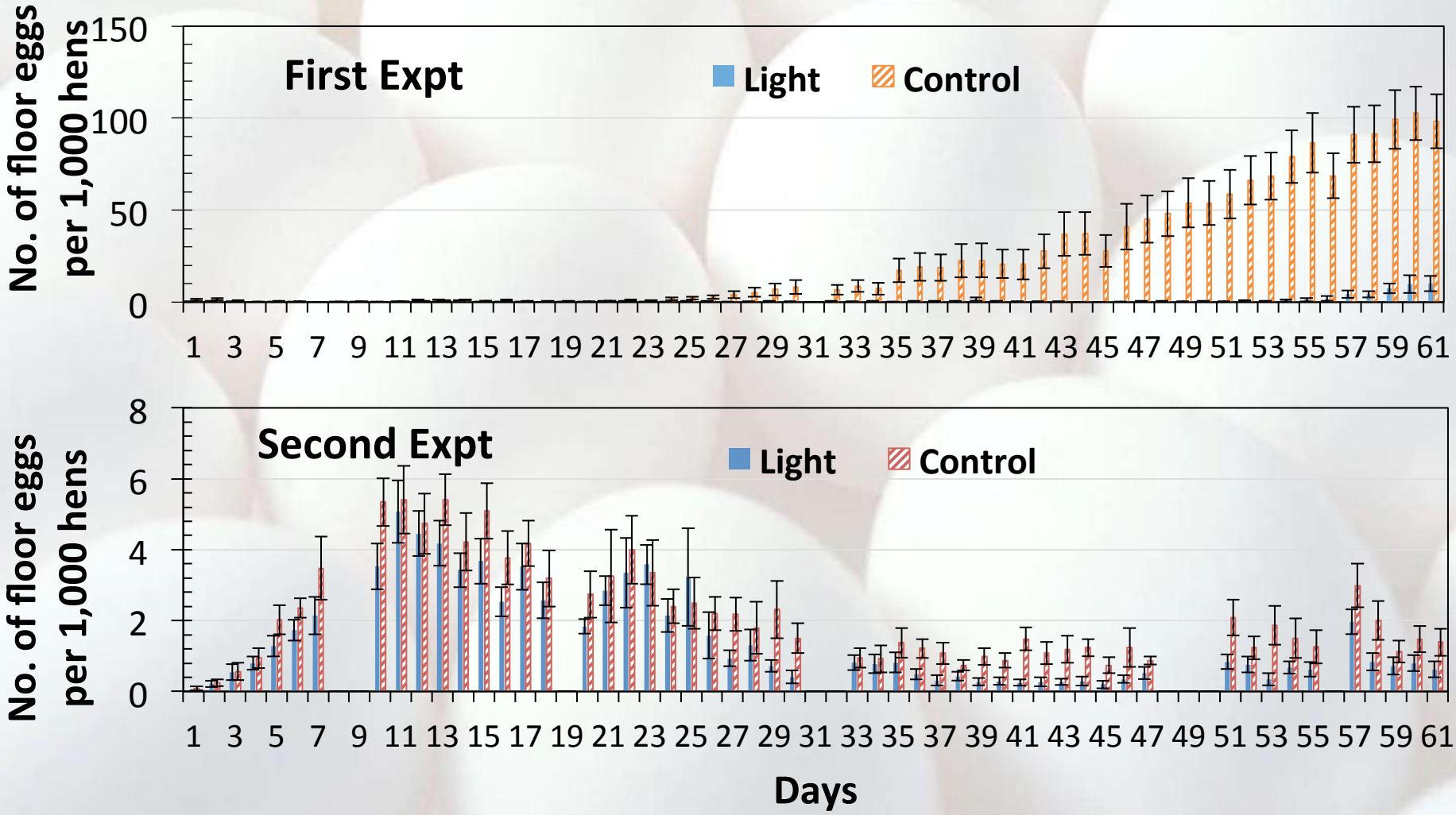
RH = 32%

Hen surface temp reduced by 12 °F right after spray

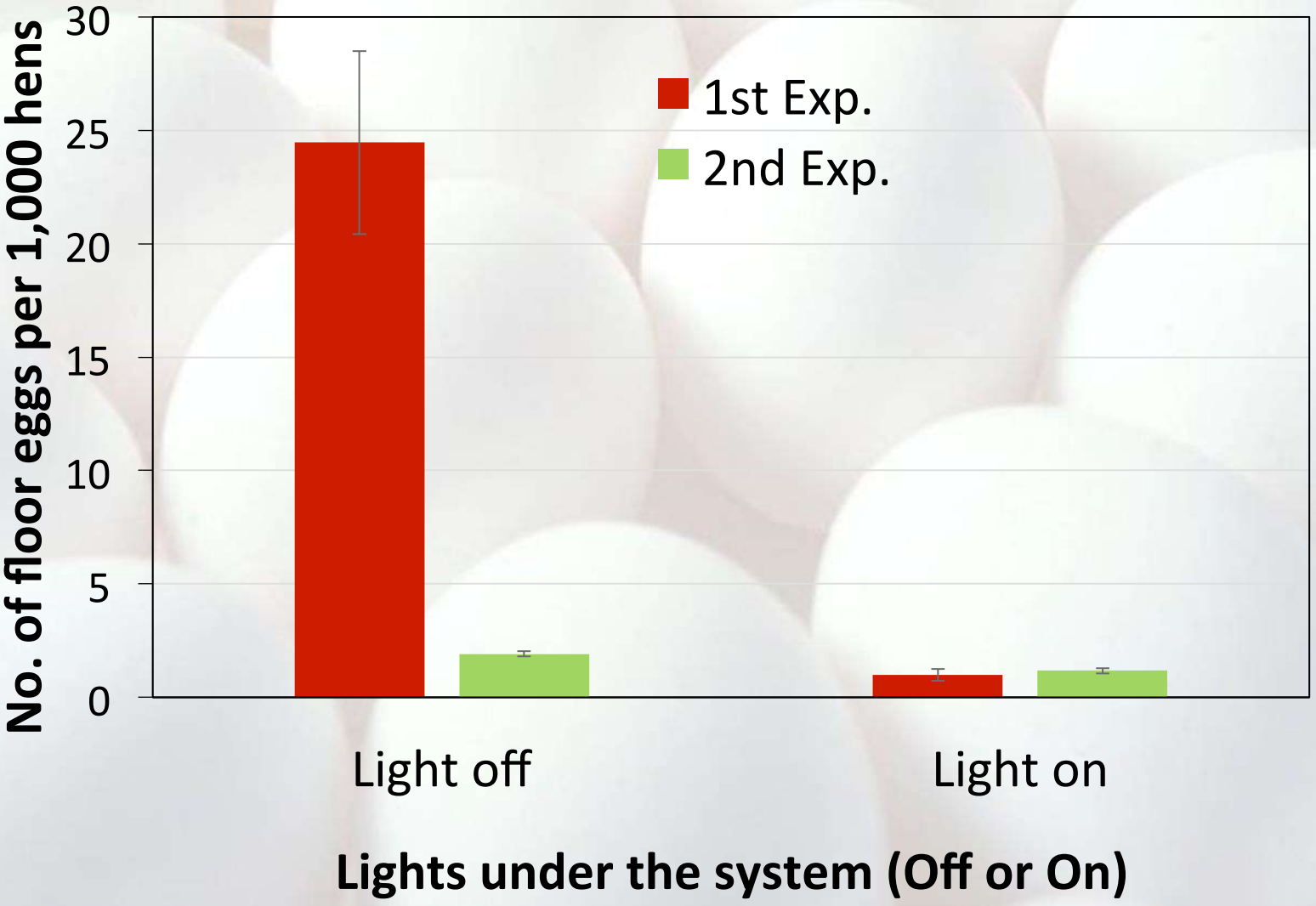
2. Impact of Managing Hens to Reduce Floor Eggs – *Light vs. No light under the system*



Impact of Light *vs.* No Light under the System on Floor Eggs

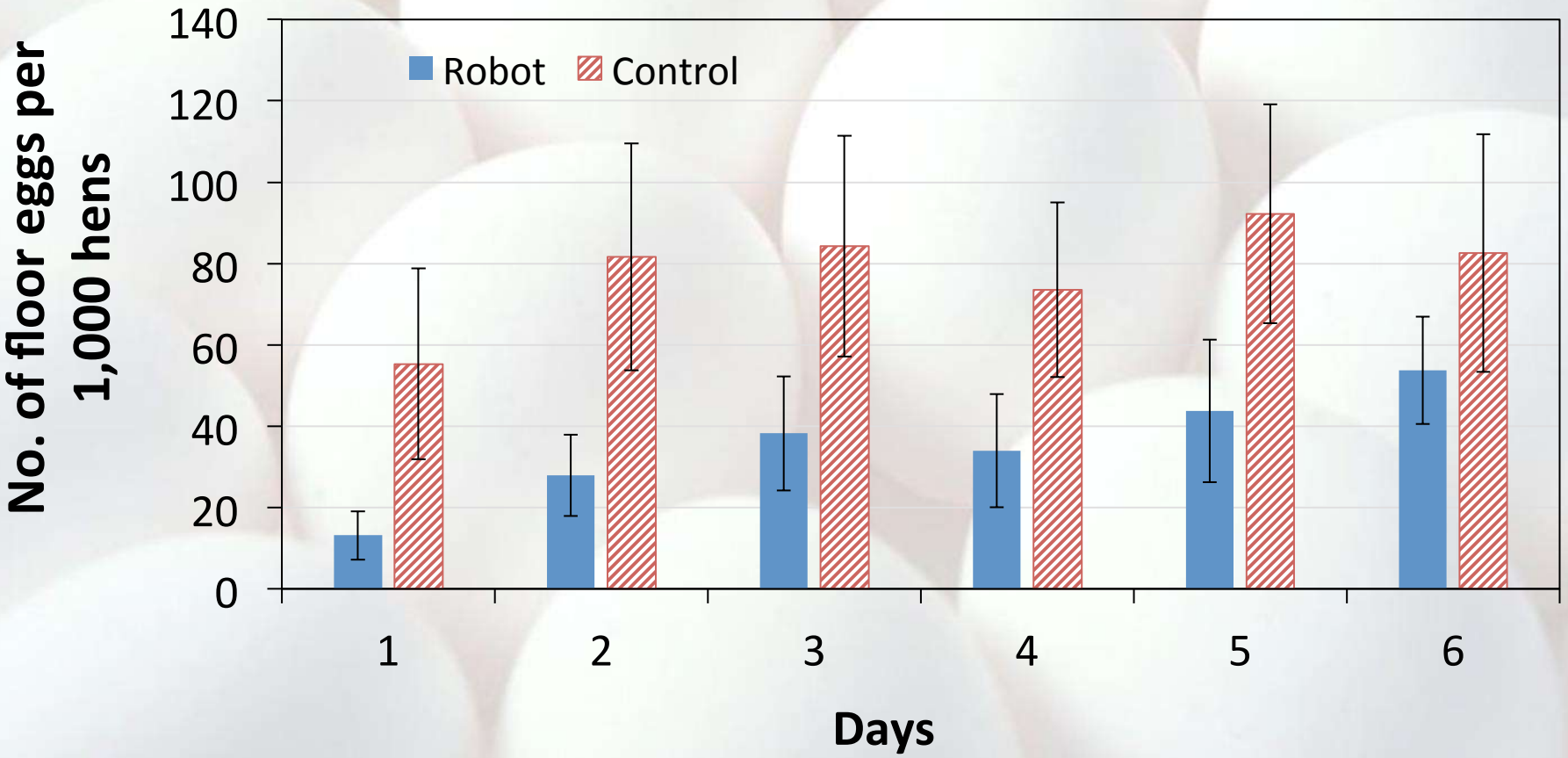


Impact of Light *vs.* No Light under the System on Floor Eggs

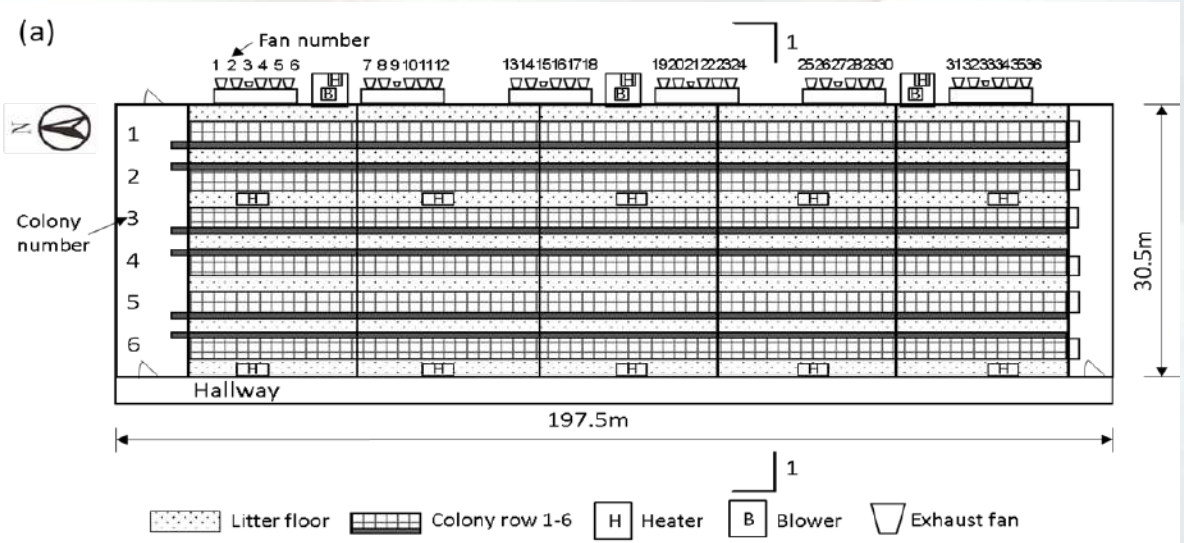


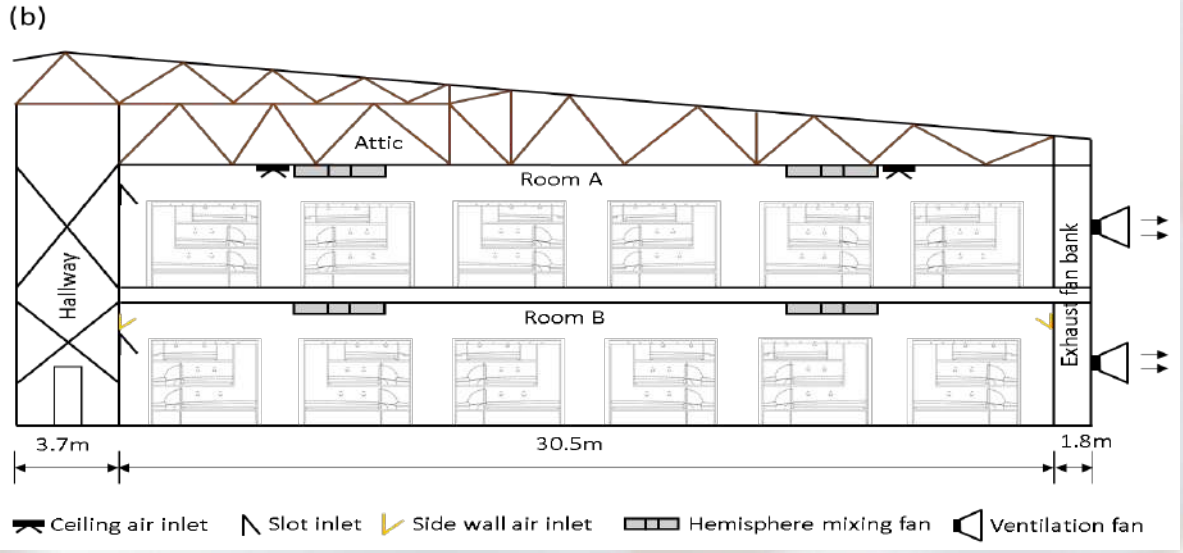
Impact of Managing CF Hens – *Operating Robots on Floor Eggs*

Impact of Using Robots or Not on Floor Eggs

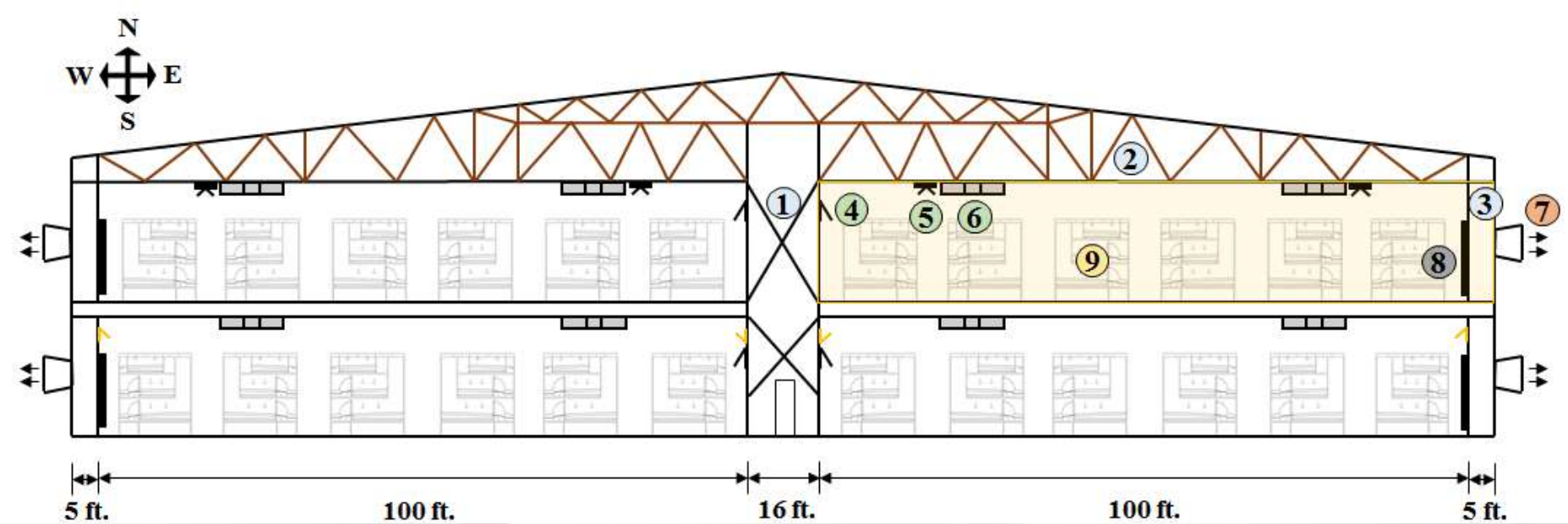


3. Production Performance of a Large, Fully Open CF House

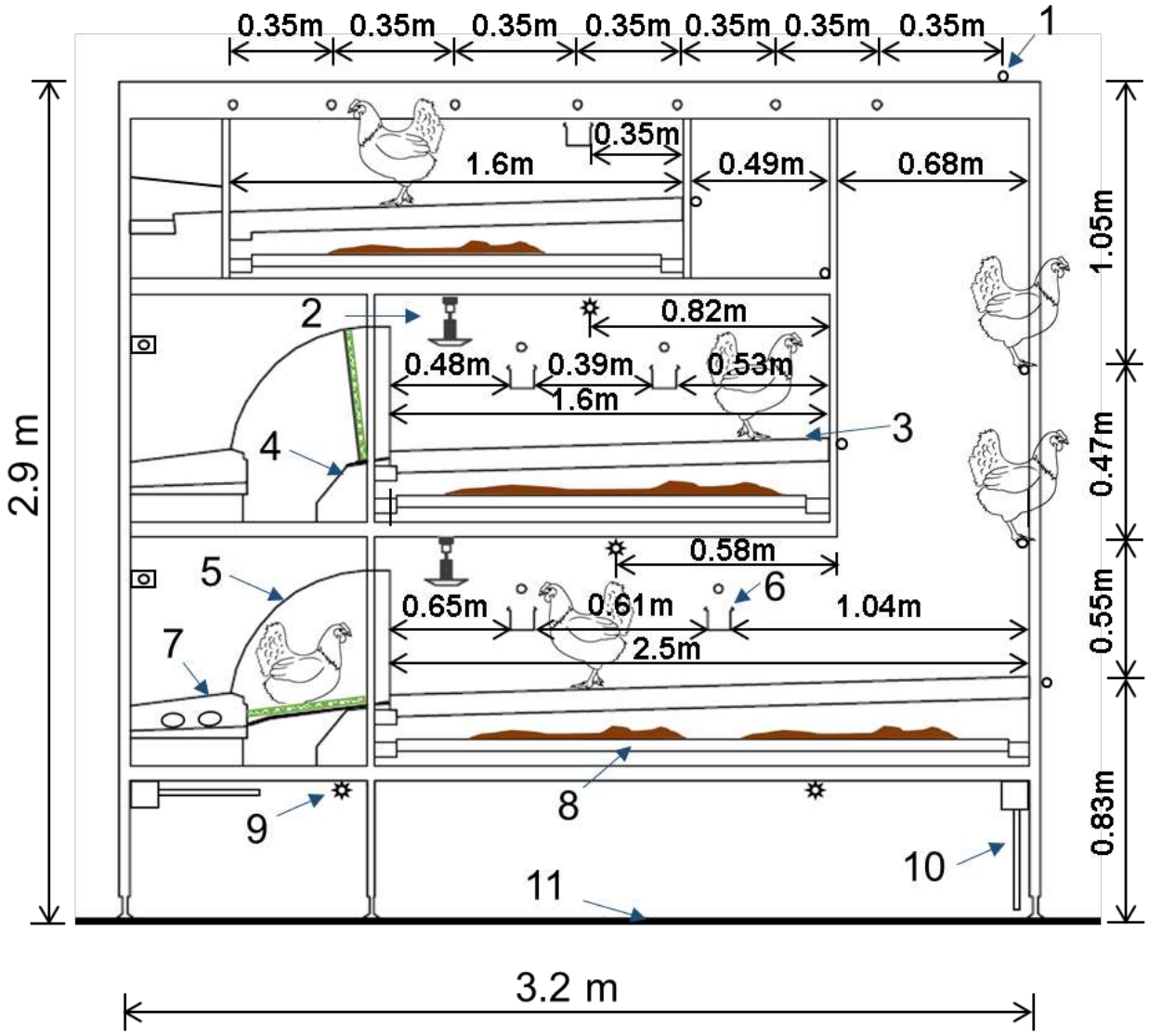




Cross-sectional View of the Large, Fully Open CF House



A Close-Up View of the System



1 Perch
2 Nipple drinker
3 Slat floor
4 Air duct
5 Nest box
6 Feed trough
7 Egg belt
8 Manure belt
9 LED lighting
10 Wire-mesh separation
11 Litter floor

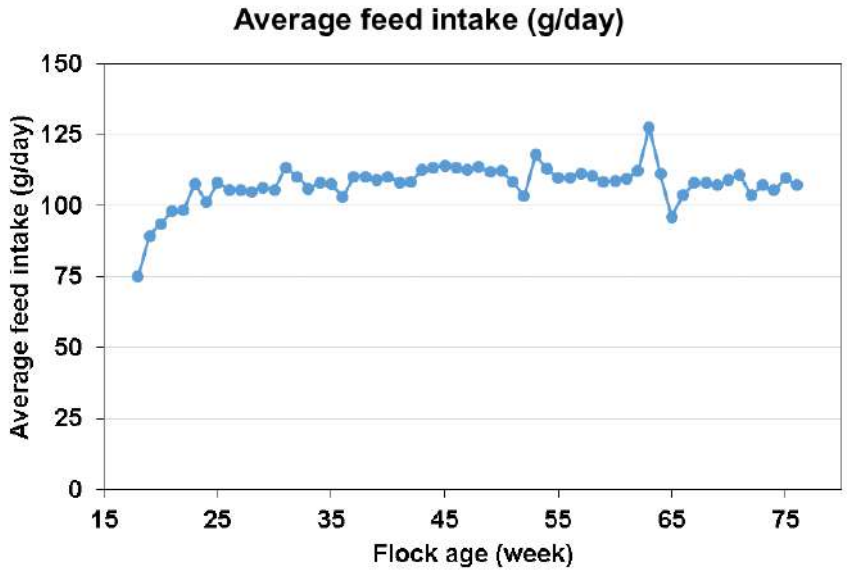
Resource Allowance of the Large, Fully Open CF House

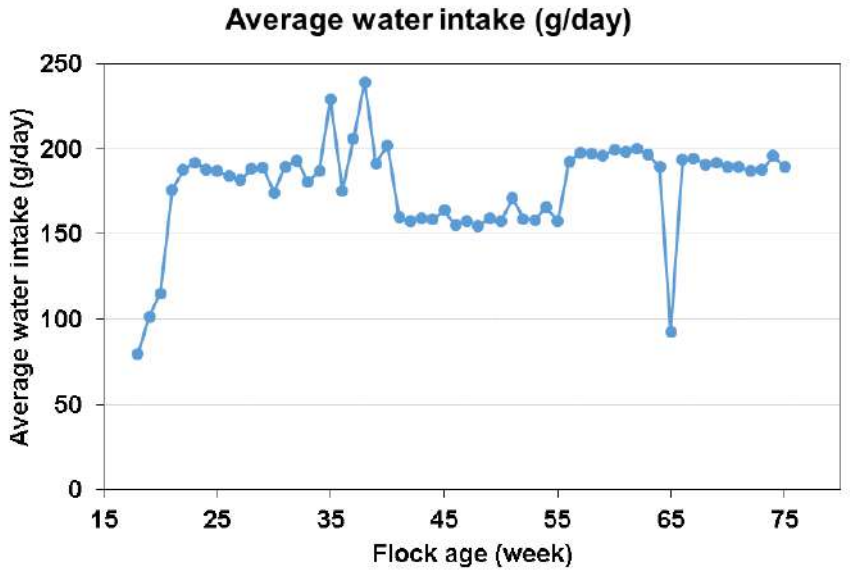
Parameter	Unit	
Hens per colony unit*		299
Total available space*	in^2/hen	129
Slatted floor area	in^2/hen	68
Littered floor area	in^2/hen	61
Feeder space	in/hen	1.82
Drinker space	hens per drinker	9.8
Nest space	in^2/hen	13.2
Perch space	in/hen	4.93

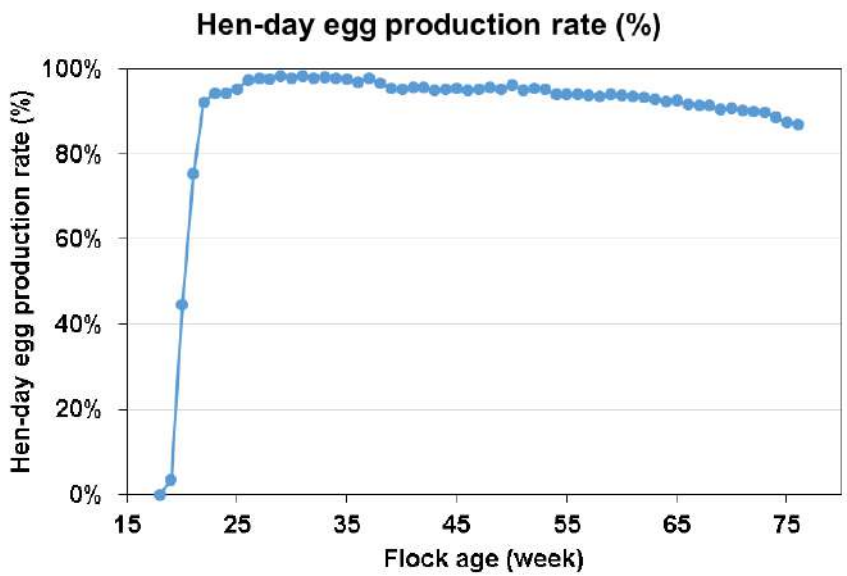
*Each colony unit measures 2.3 m (7.5ft) in length. The house had 6 colony rows and each row had 78 colony units (CU's). The house was partitioned into 5 pens along the length of the house with wire mesh, and each pen had 15–16 CU's per row.

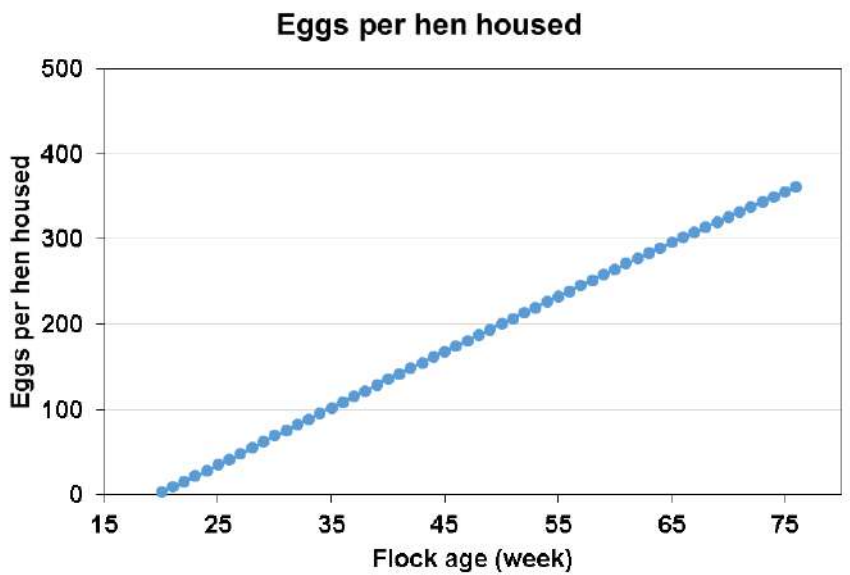
*Total available space: slatted floor area + littered floor area

Flock Production Performance

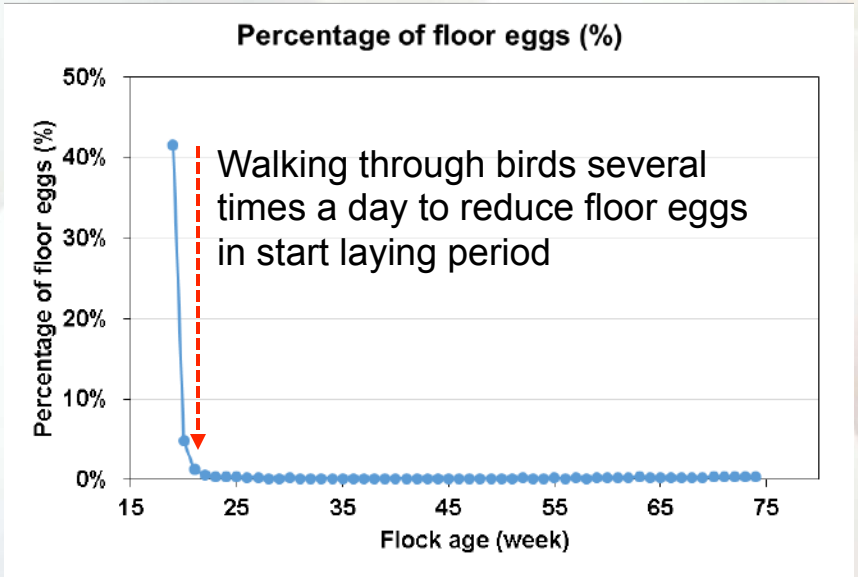


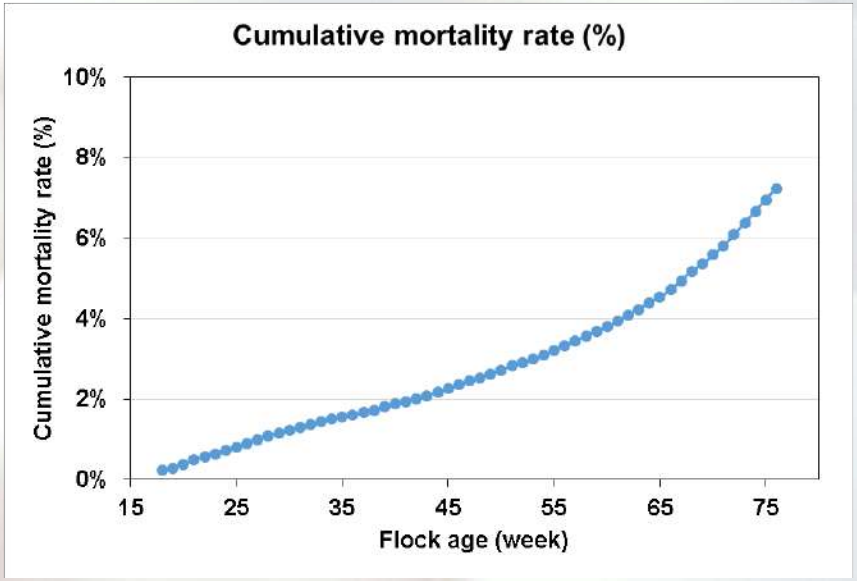


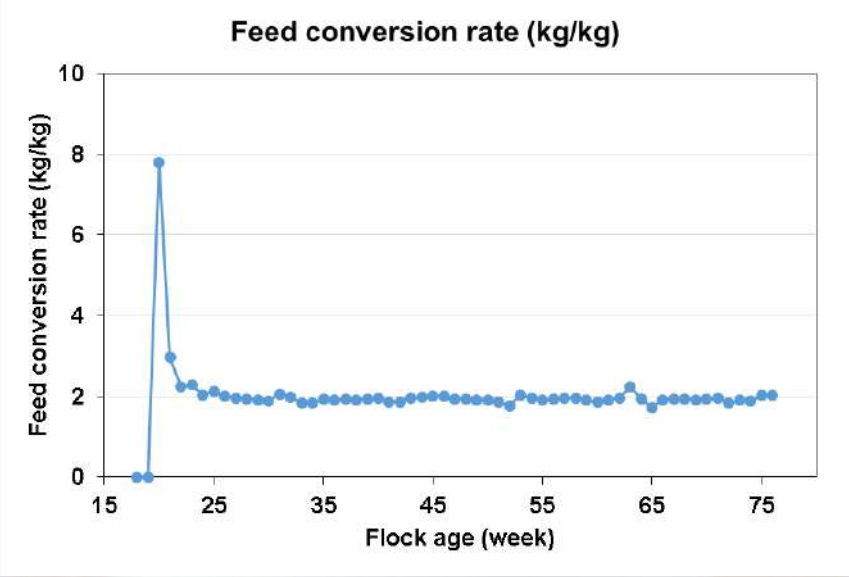




Flock Production Performance







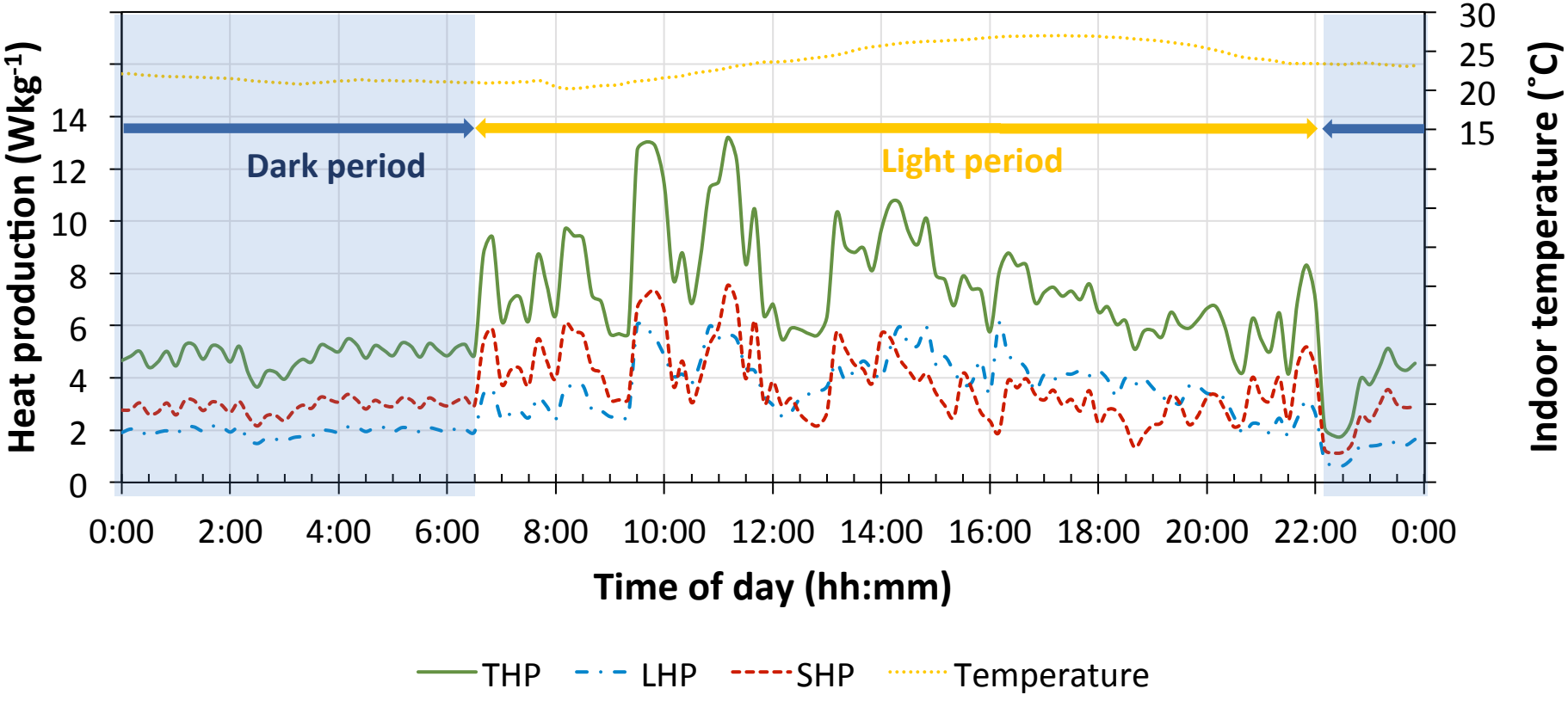
Summary of Production Performance of the CF Flock

Date: 1/27/2018 ~ 3/9/2019

Laying period (18-76 Weeks)	This Flock	Production Guide*
Average daily feed intake, g/day	108	118
Average daily water intake, g/ day	179	—
Cumulative mortality, %	7.22	4.73
Hen-day egg production rate, %	89.98	85.32
Eggs per hen housed	361	344
Overall feed conversion ratio	2.04	2.21
Daily percentage of floor eggs	0.28% (20-74 Weeks)	—

*Dekalb white production guide for aviary barn system: dekalb-poultry.com

Heat and Moisture Generation by Hens in the CF House



THP = 7.7 ± 0.2 W kg^{-1} (11.9 BTU/hr-lb)

SHP = 5.0 ± 0.3 W kg^{-1} (7.8 BTU/hr-lb, 65% THP)

LHP = 2.7 ± 0.2 W kg^{-1} (4.2 BTU/hr-lb, 35% THP)

Acknowledgements

United States Department of Agriculture
National Institute of Food and Agriculture

Iowa Cage-free