



Smart Poultry Nutrition

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Poultry Innovation Showcase Webinar

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POULTRY INNOVATION PARTNERSHIP

visionary

change

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opportunity

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How Are Things in Your World?



Light Management is Complex, and it Matters!

- ▶ Broiler breeders on the verge of being underfed will not undergo pubertal development

GnIH



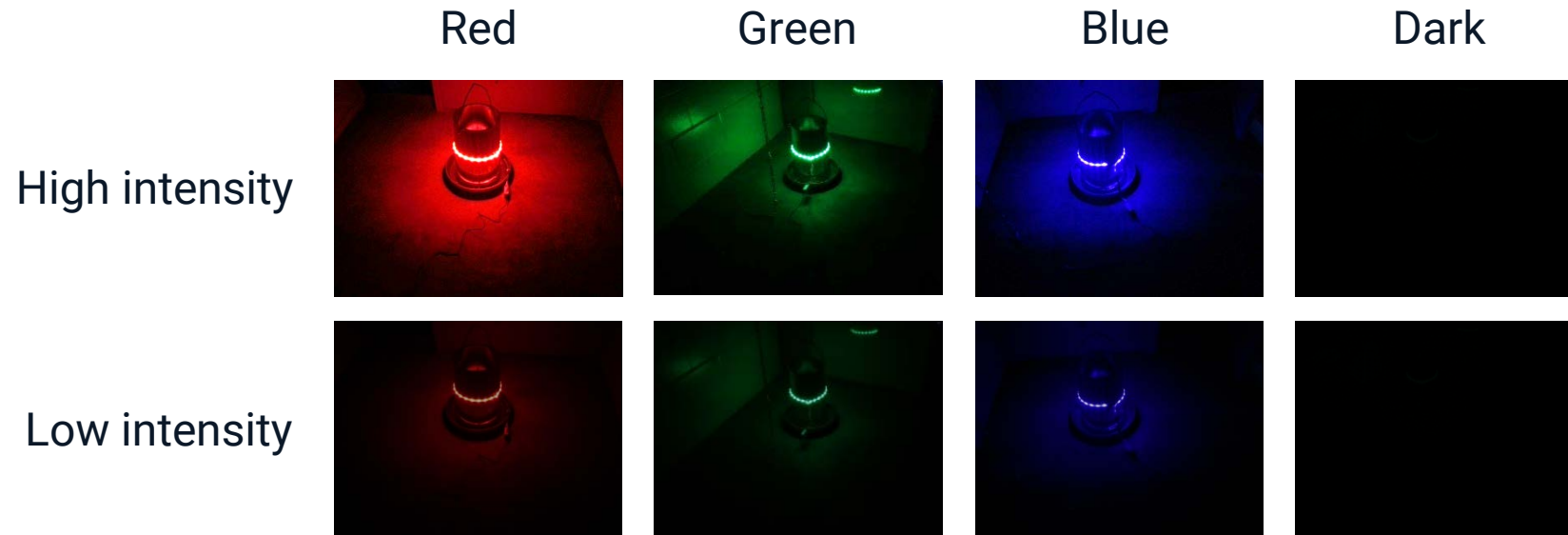
GnRH

Feed (esp. during puberty)
Body composition

Suboptimal management can be like
applying the brakes on your car

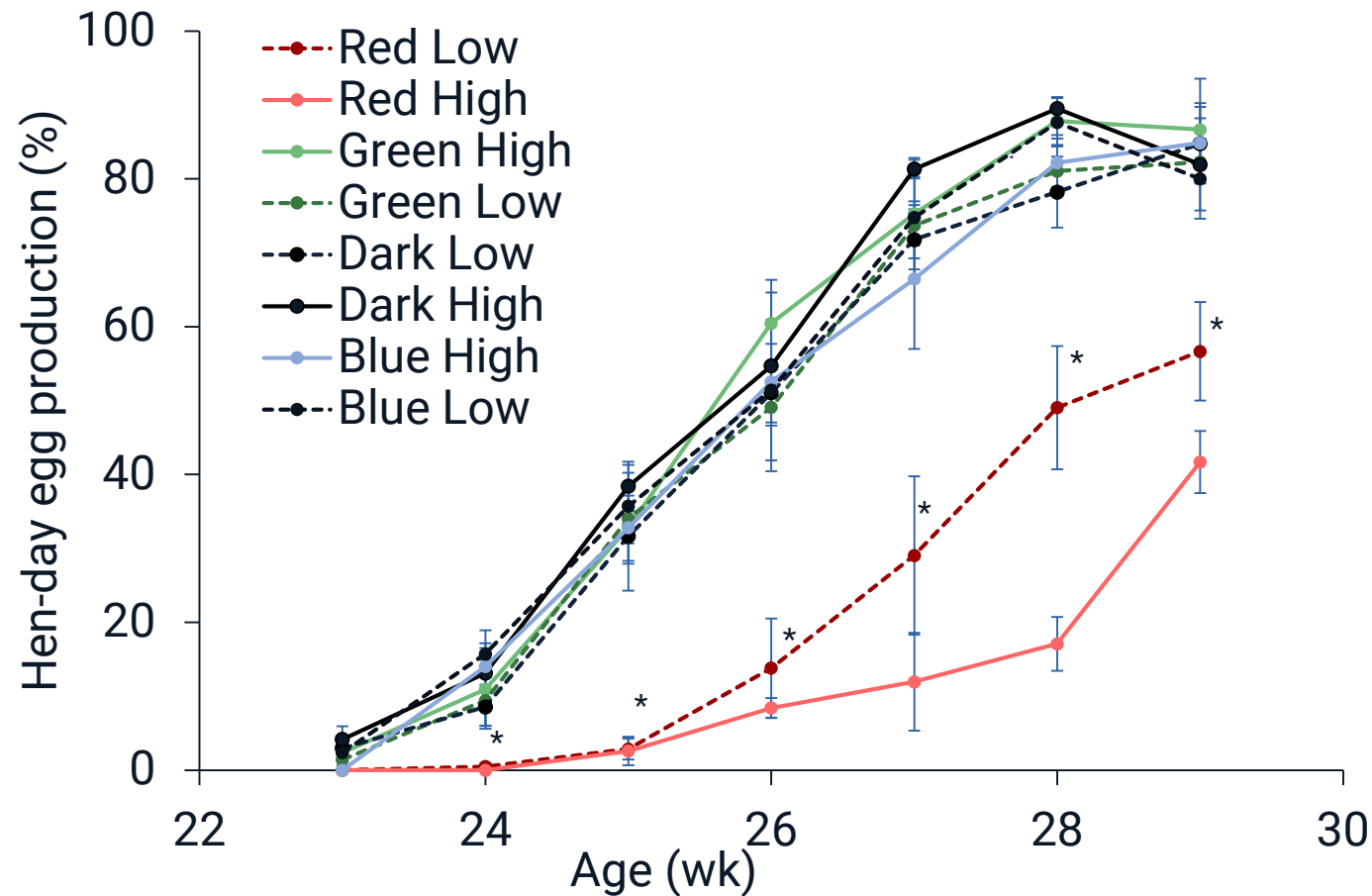
Some Lighting Insights

Night-time supplemental lighting



Adriana Rodriguez
MSc student - Dr. Gregoy Bédécarrats
University of Guelph

Night-time Supplemental Lighting



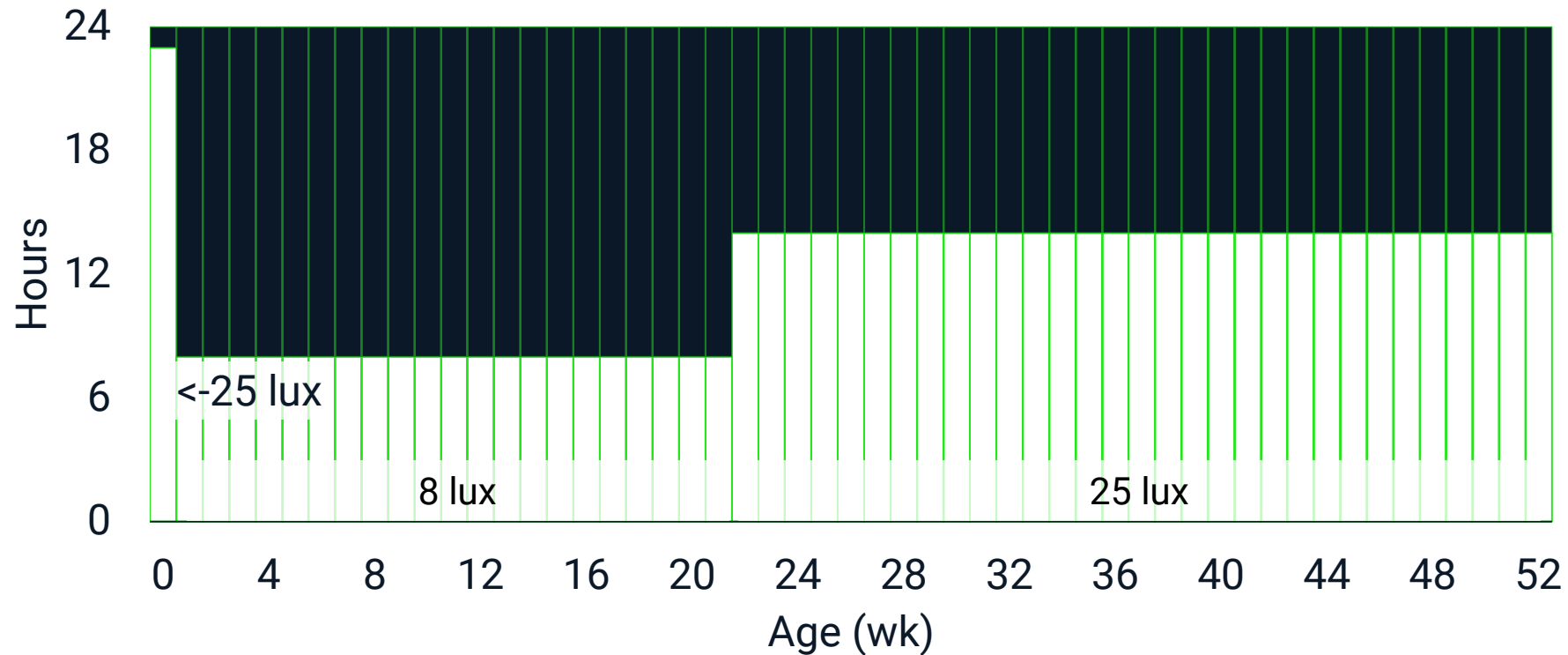
- ▶ Supplemental red light (24 h/day exposure) delayed onset of lay in a dose-dependent manner
- ▶ “Photorefractory”

Lighting

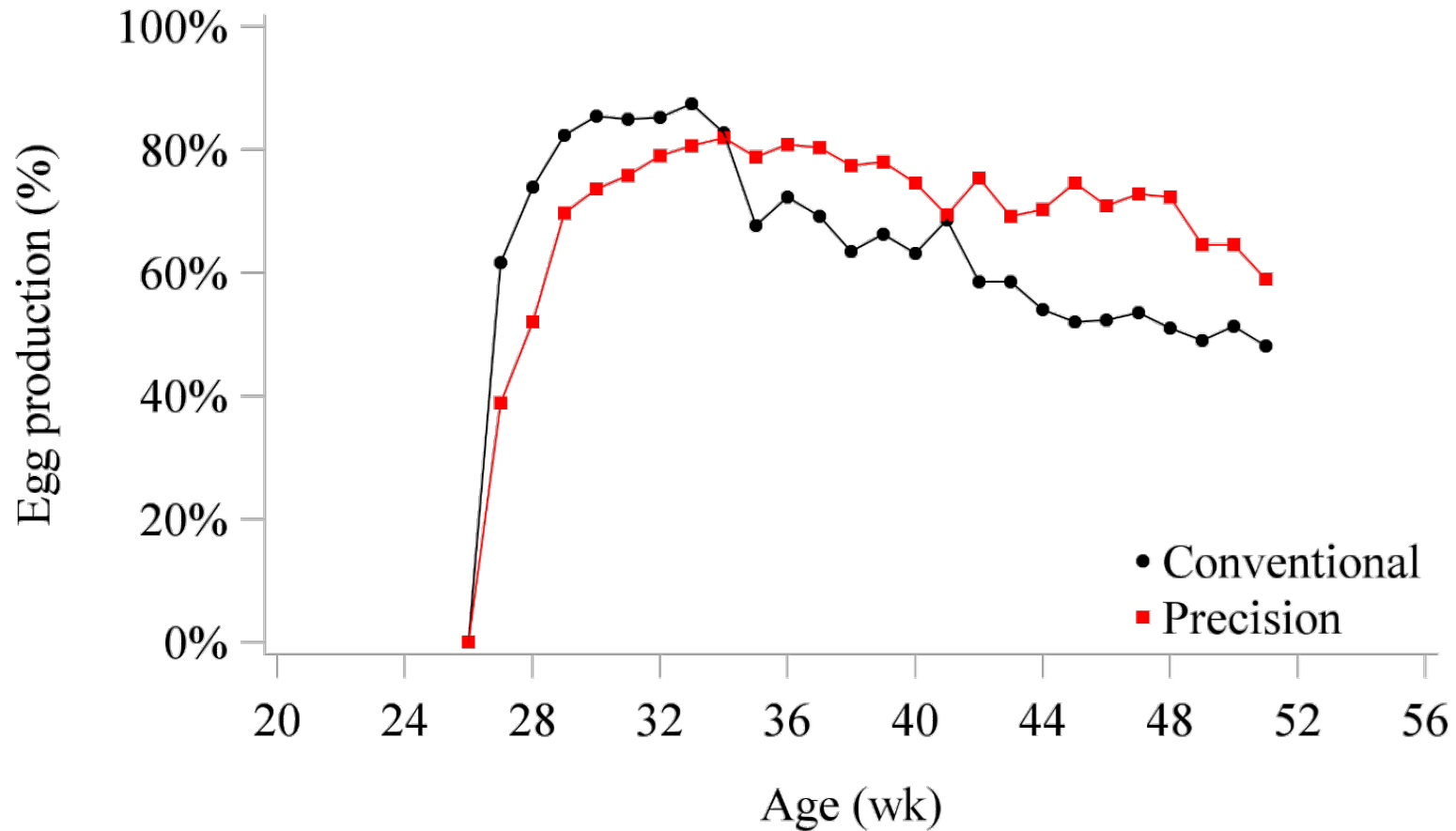
Main house lighting:
Supplemental lighting:

Fluorescent (dawn / dusk)
Green monochromatic LED ($\lambda=480$ nm) @ 2-10 lux
inside precision feeding station only

□ Light ■ Dark

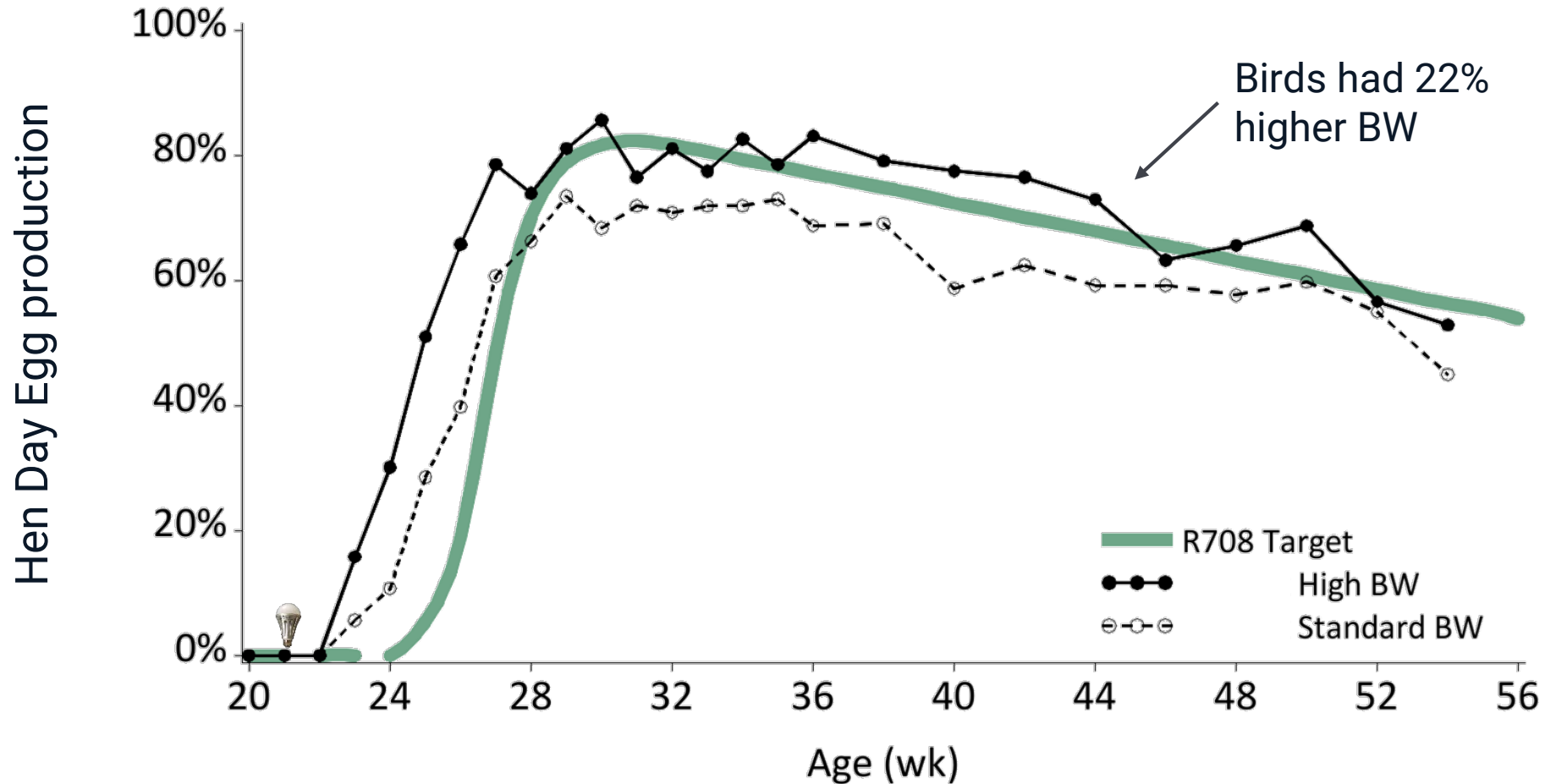


Egg Production Conventional vs. Precision Feeding

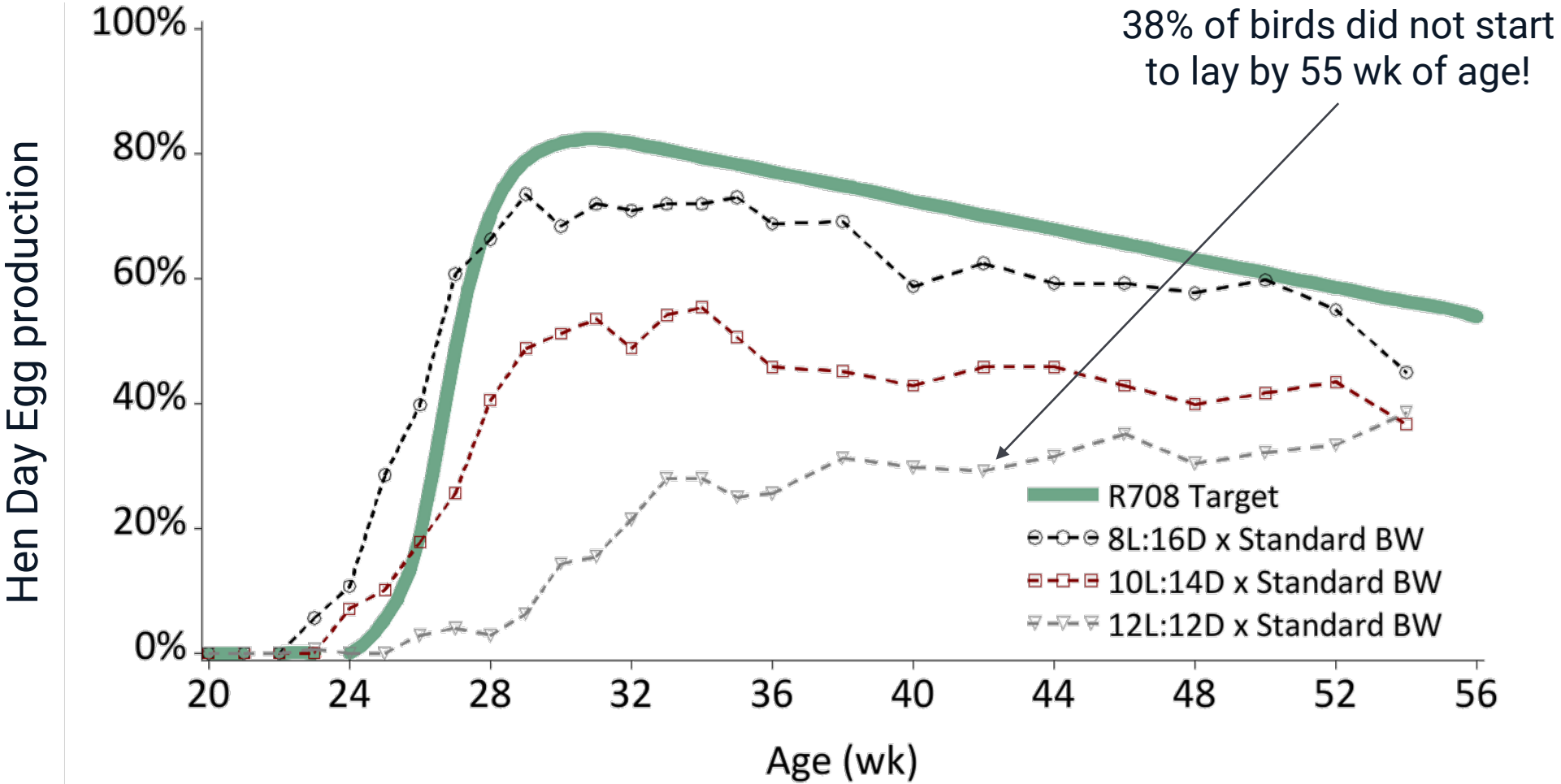


Hadinia (2015)

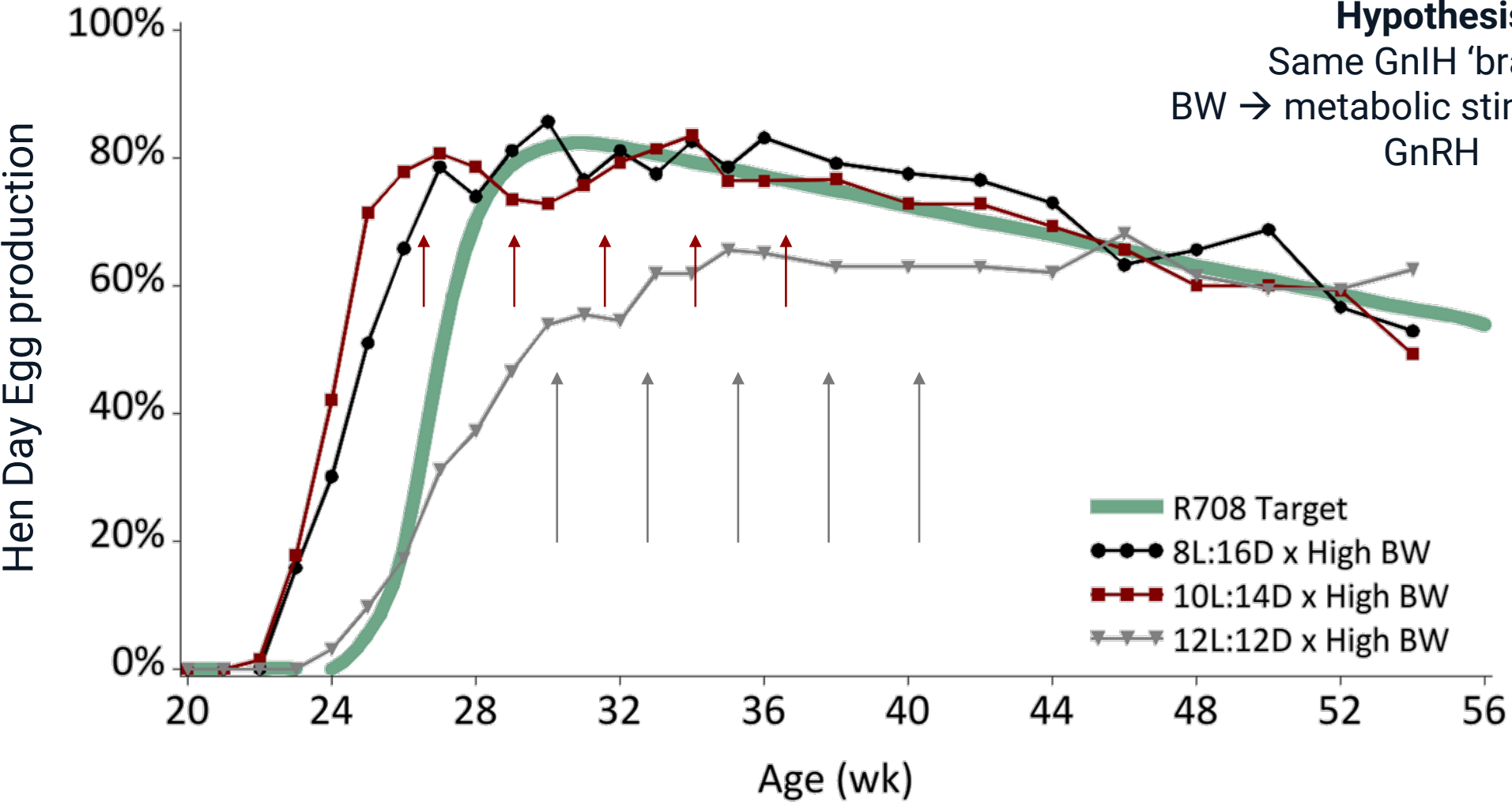
(Precision Fed) Hens on a Higher Target BW Laid Better...



Egg Production on Standard Target BW



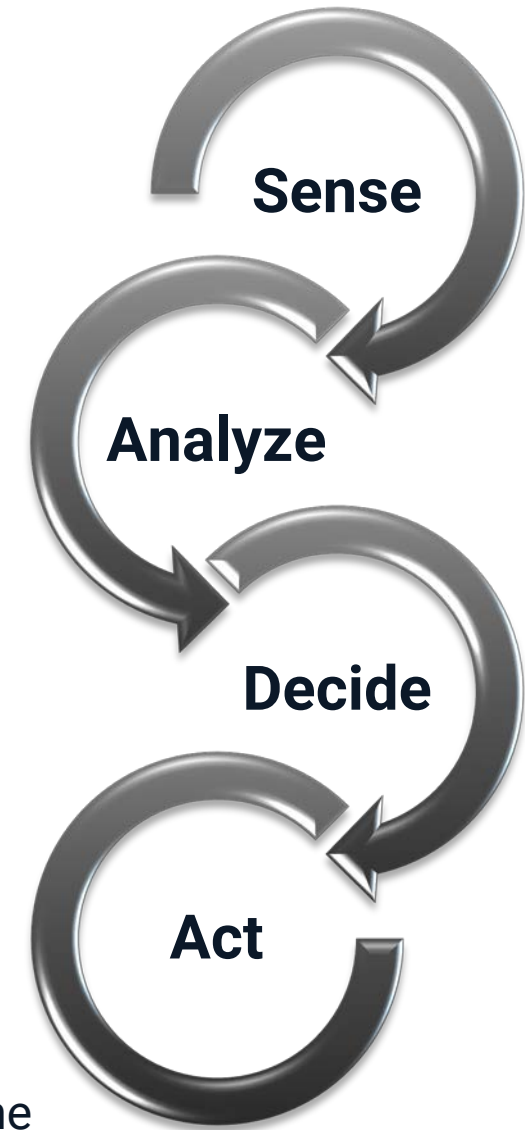
Egg Production on High Target BW



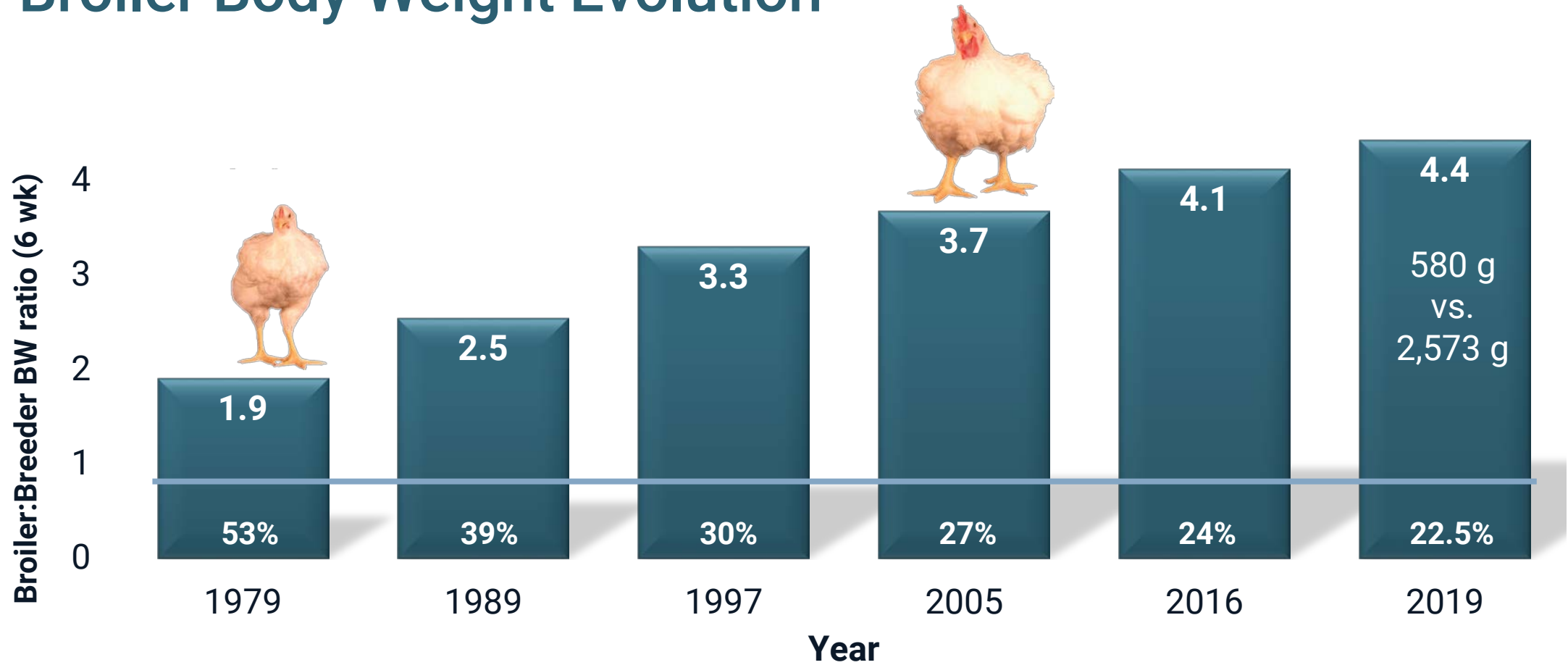
Smart Agriculture

- ▶ What is Precision Farming?
 - ▶ Using sensor data to implement optimal decisions in real-time
- ▶ Precision Feeding (PF) is an example of precision farming
- ▶ Smart Nutrition uses big data to optimize feeding decisions in real-time

In the poultry industry, can the benefits of PF outweigh the costs?

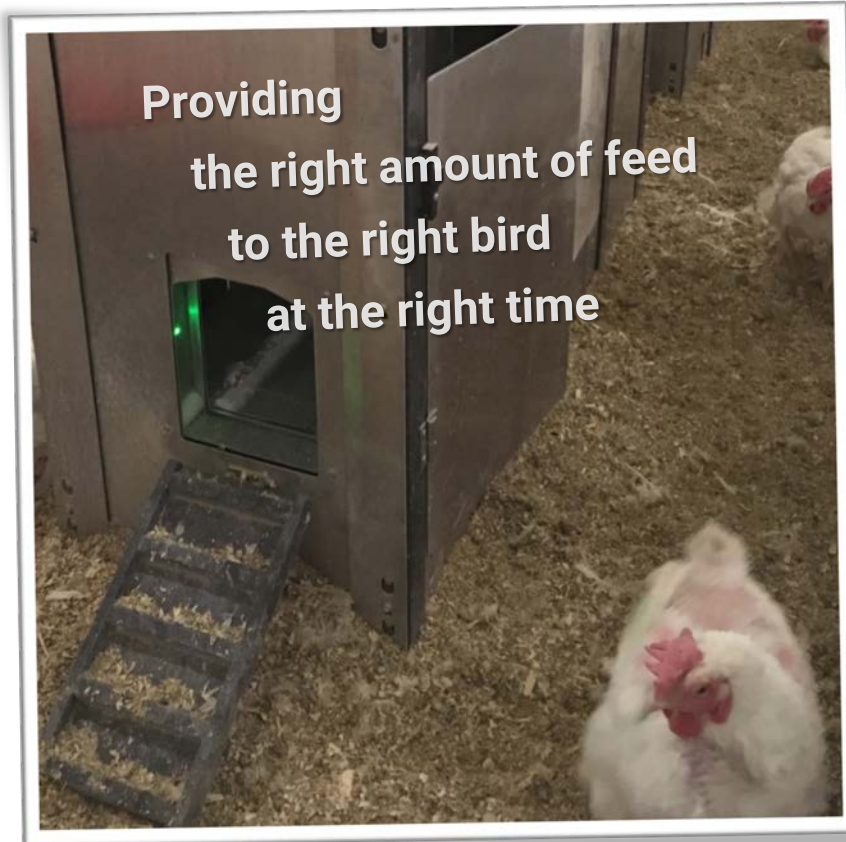


Driving Motivation for PF: Uniformity as it Relates to Broiler Body Weight Evolution



Adapted from Renema et al., 2007
Photo (adapted): Zuidhof et al., 2014

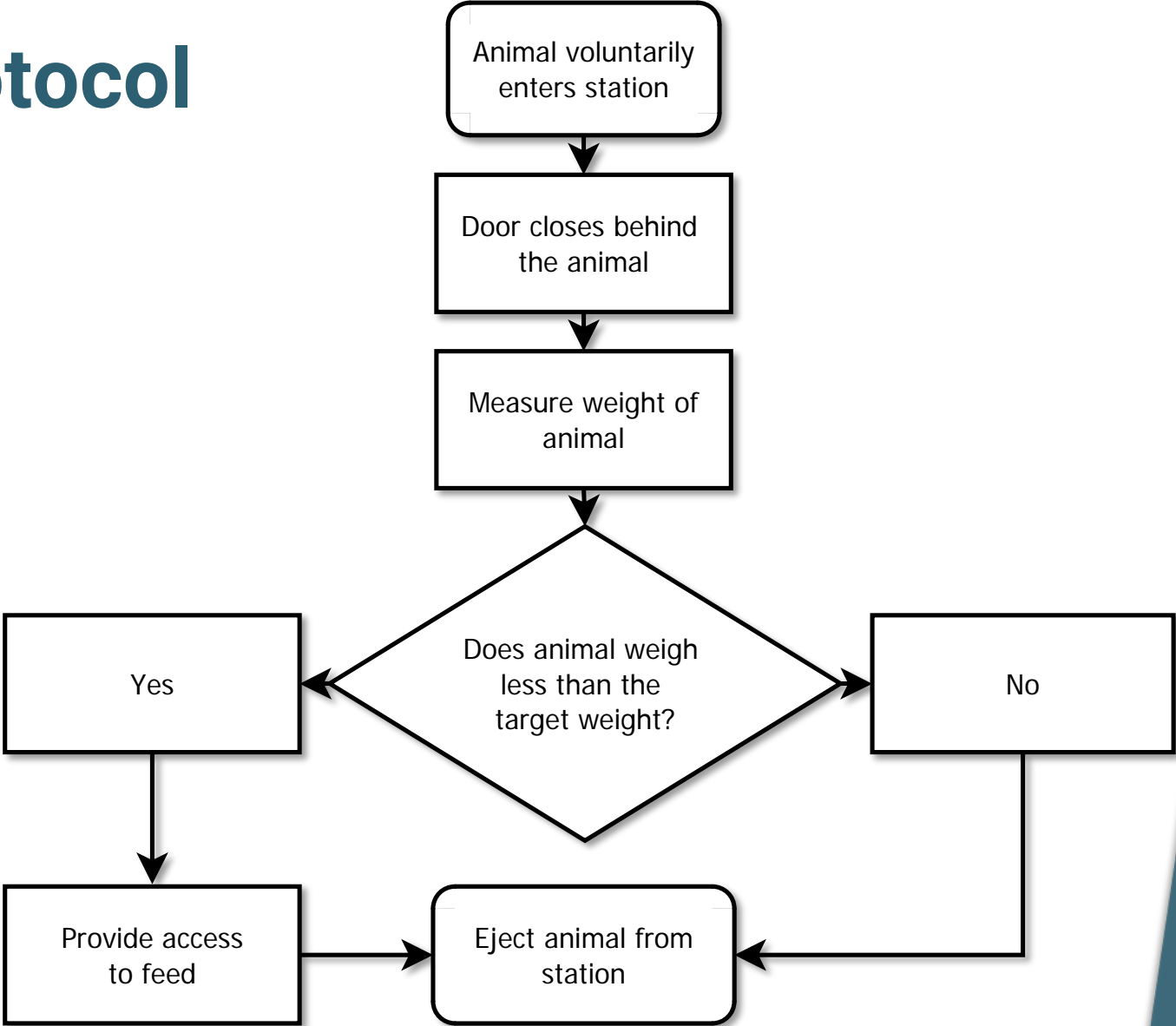
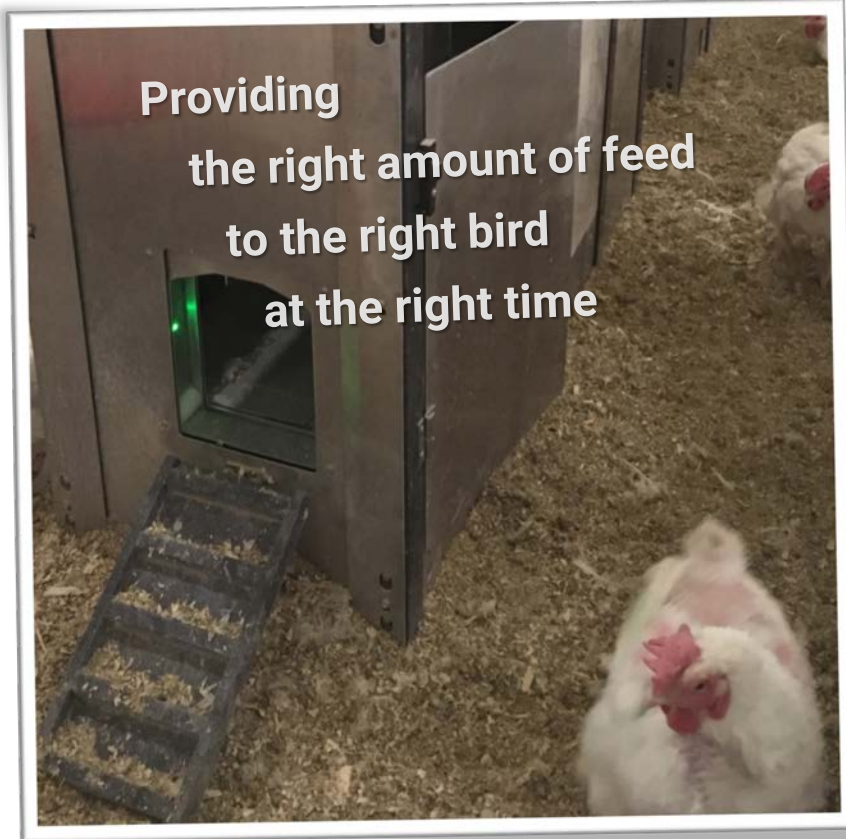
Precision Feeding Protocols



- ▶ Feed to any criteria
 - ▶ Target BW (breeders)
 - ▶ Ad libitum
 - ▶ Specific diets
 - ▶ Feed restriction
 - ▶ Specific days
 - ▶ Specific times of day
 - ▶ Proportion of target
 - ▶ BW
 - ▶ Feed curve
 - ▶ Paired bird(s)
- ▶ Future: model-based match of feed to meet real-time requirements



Breeder Feeding Protocol





Training Phase

- 10 to 14 day acclimation period
- Provide ad libitum access to feed
- Progression of feeding station modes
 - Training (with supplemental feed)
 - Movement training
 - Transition
 - Individual
- Remedial training



Body Weight (0 to 52 wk)

Conventional GP females

~50% uniformity* at 22 wk
14% CV

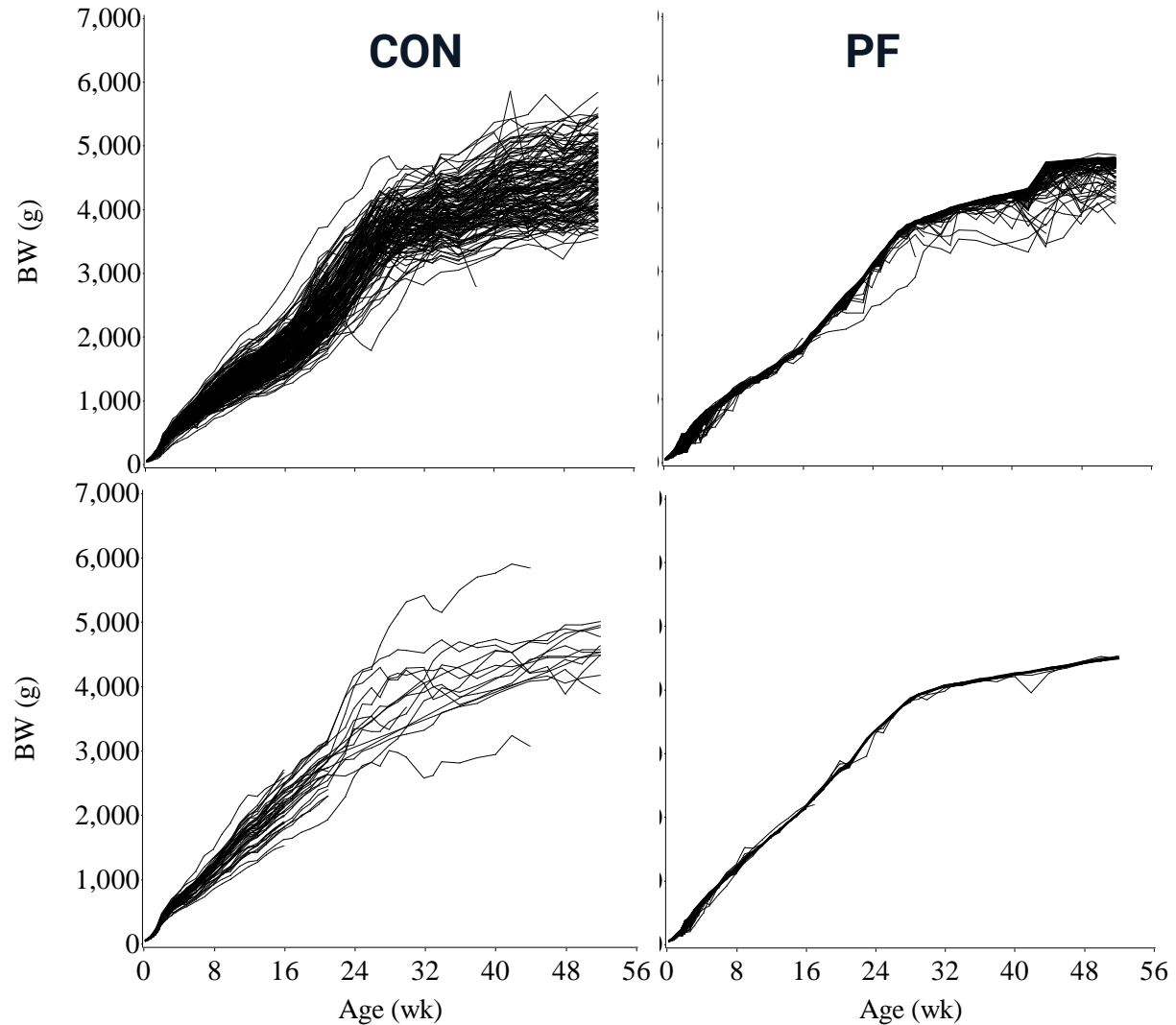
Precision fed GP females

100% uniformity* at 22 wk
2% CV

*Uniformity: % of birds within $\pm 10\%$ of the mean

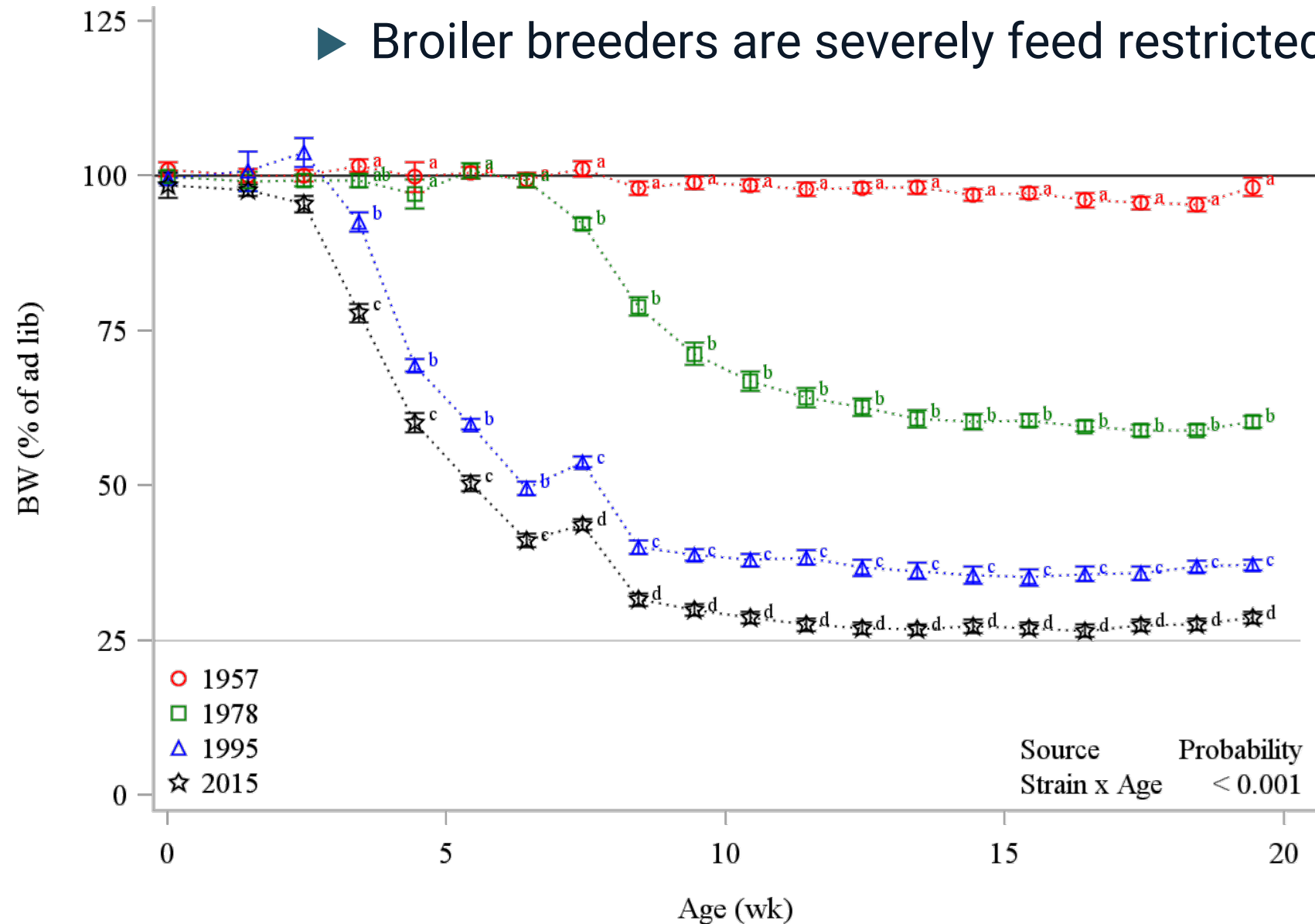
♀

♂



Feeding Frequency Matters!

► Broiler breeders are severely feed restricted



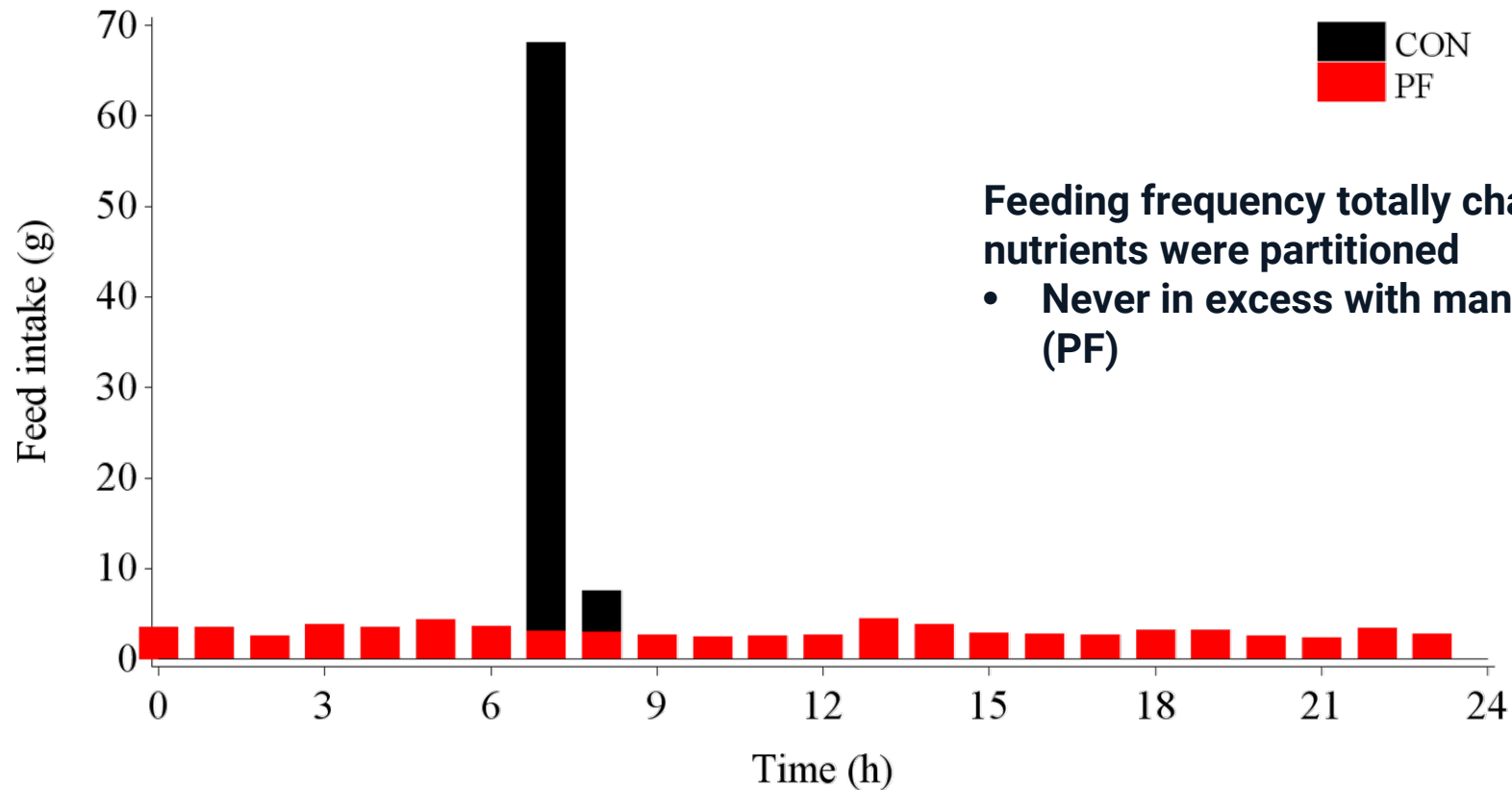
Feeding Frequency Matters!

- ▶ Broiler breeders are severely feed restricted
- ▶ Conventional Feeding
 - ▶ 1 meal per 24 or 48 hours
 - ▶ Overwhelm the system periodically with nutrients
 - ▶ Some fat is stored
- ▶ Precision Feeding
 - ▶ 10 meals per day
 - ▶ Growing tissues lap up nutrients in real-time
 - ▶ Very little fat is stored

Diurnal Feed Intake Pattern

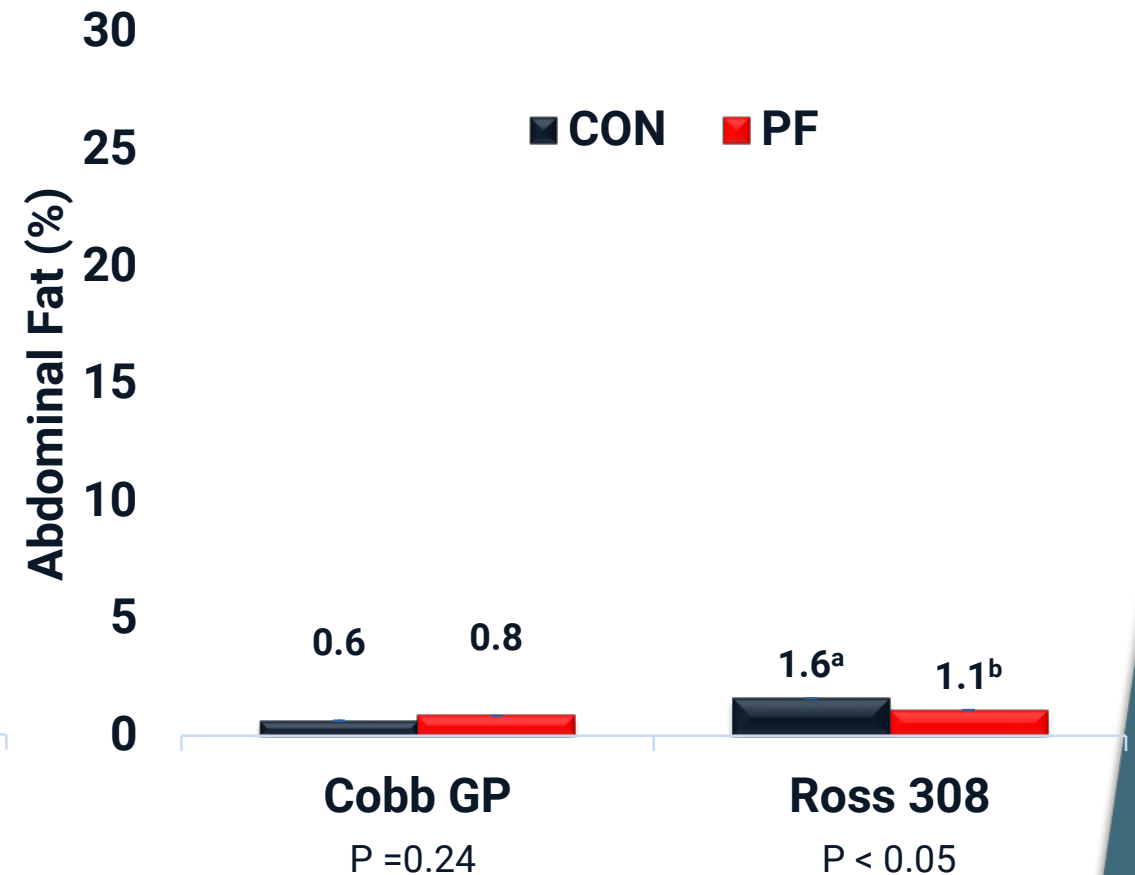
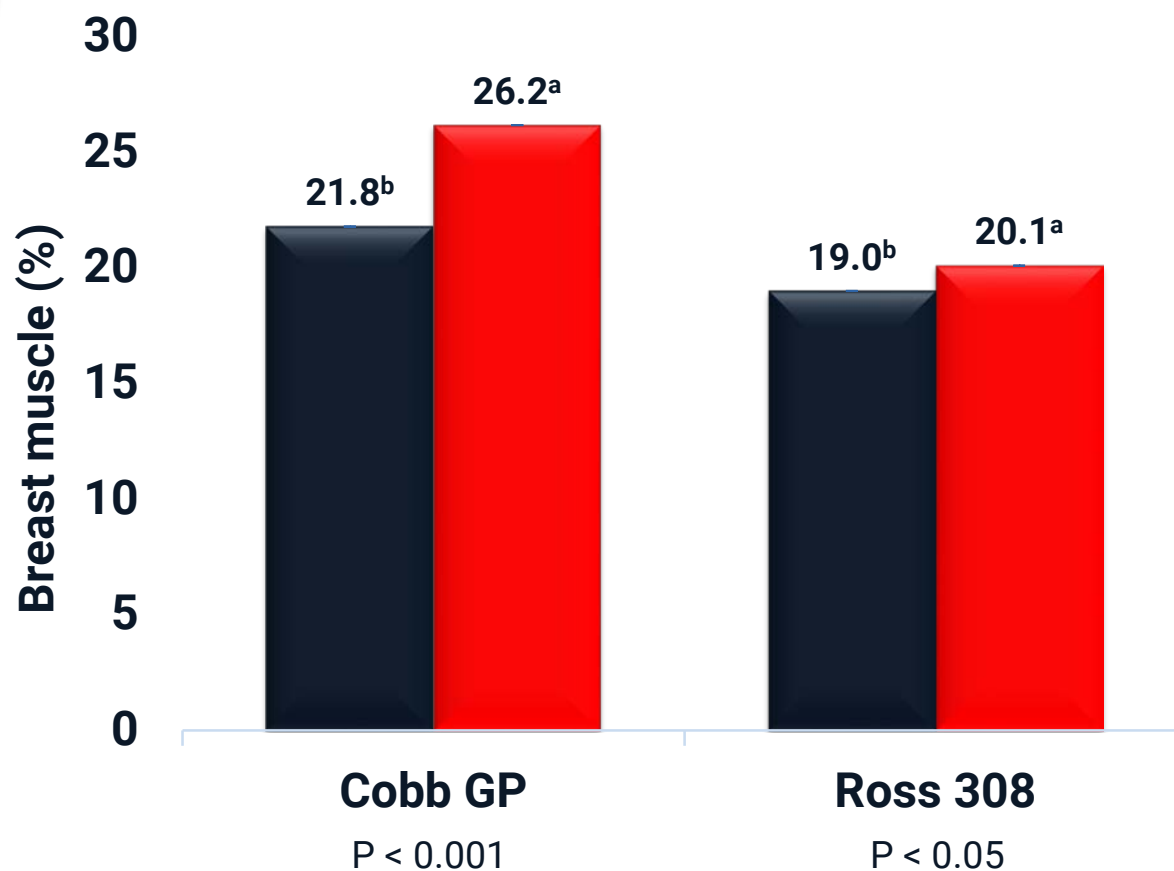
Example: 1 day during rearing (70 d of age)

Week=10 Day=70

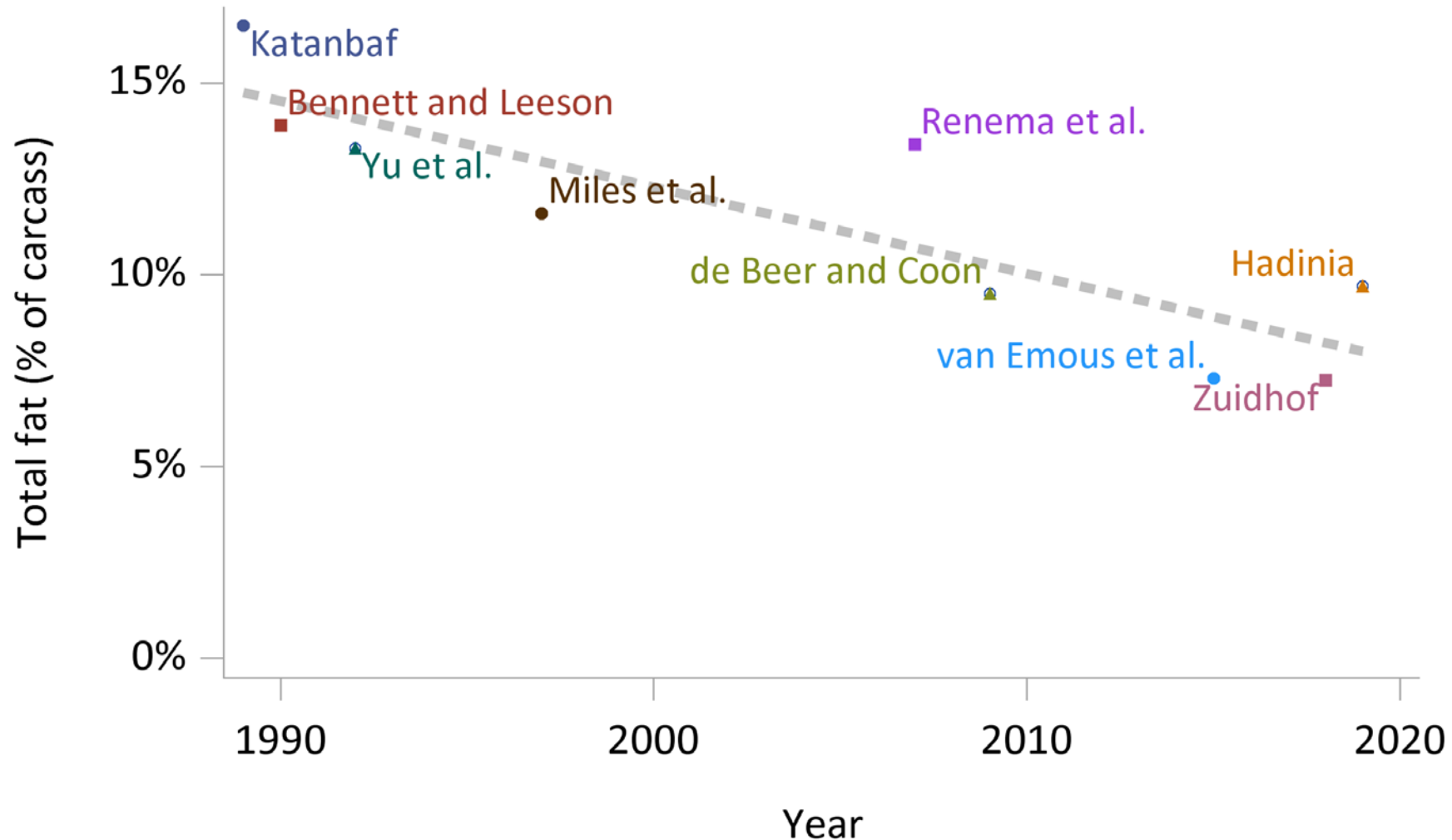


Body Composition at Photostimulation

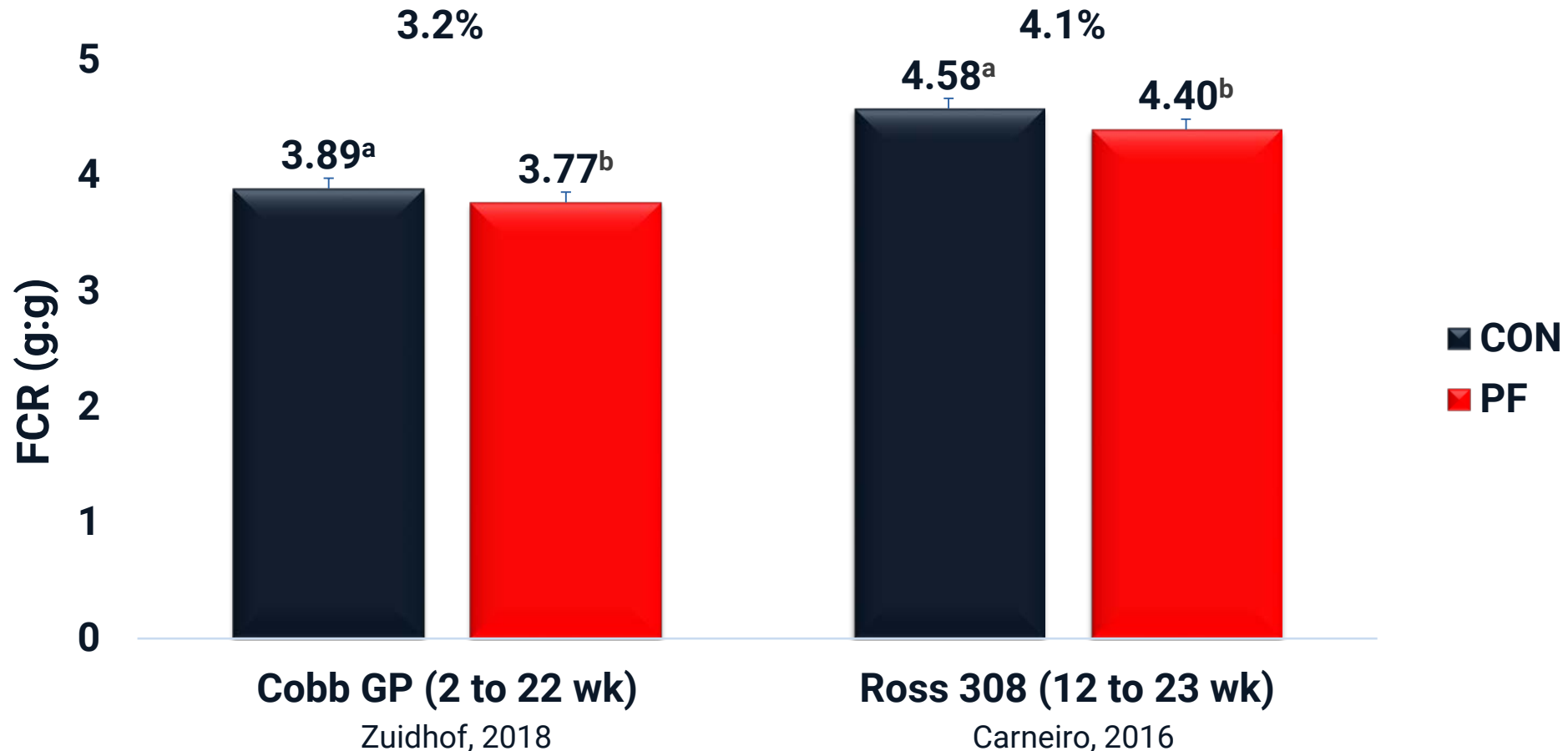
At 22 wk, PF birds had more breast muscle... ... and similar (or less) abdominal fat



Increasing Feed Restriction Intensity has Reduced Broiler Breeder Fat (at Photostimulation)

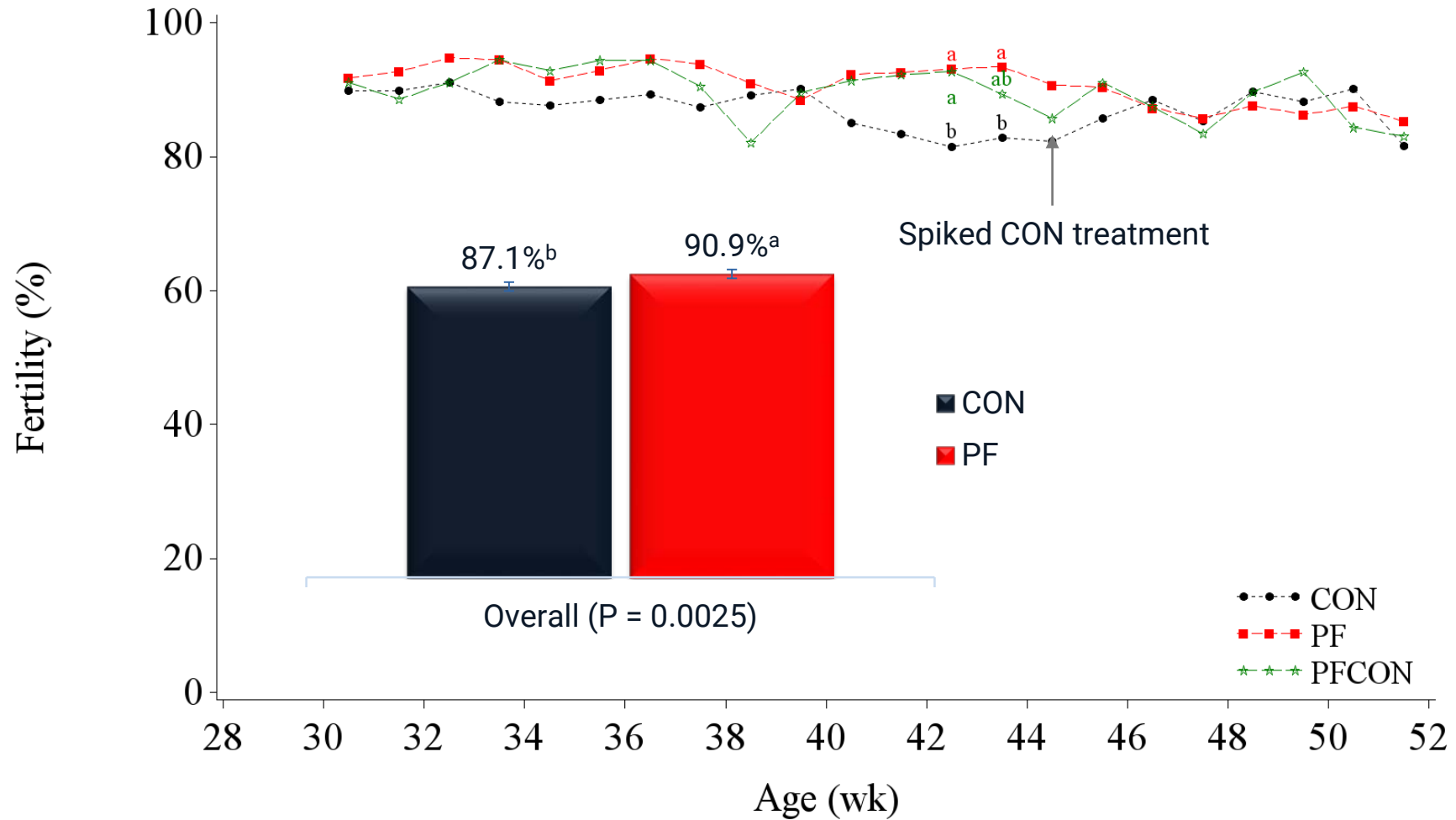


Precision-fed Breeders were 3 to 4% more Efficient



^{a,b}within experiment (line), $P < 0.05$

Fertility was 3.8% Higher with Precision Feeding



Does Precision Feeding Make Economic Sense?

Scenario	Benefits	Net
Females	Chick production Alberta: 145 vs. 115 (>25%) <ul style="list-style-type: none"> 30 extra chicks 	\$19.50/hen

Assuming 50 hens/station, break even cost* per station: \$975

Males	<ul style="list-style-type: none"> 68.4 extra chicks per rooster No replacement males Feed: efficiency & no spiking 	\$42.30/rooster 37.62 2.80 1.88
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Assuming 50 roosters/station, break even cost* per station: \$2,115

*What you could pay for a station and make back your money in one cycle



Offspring Studies

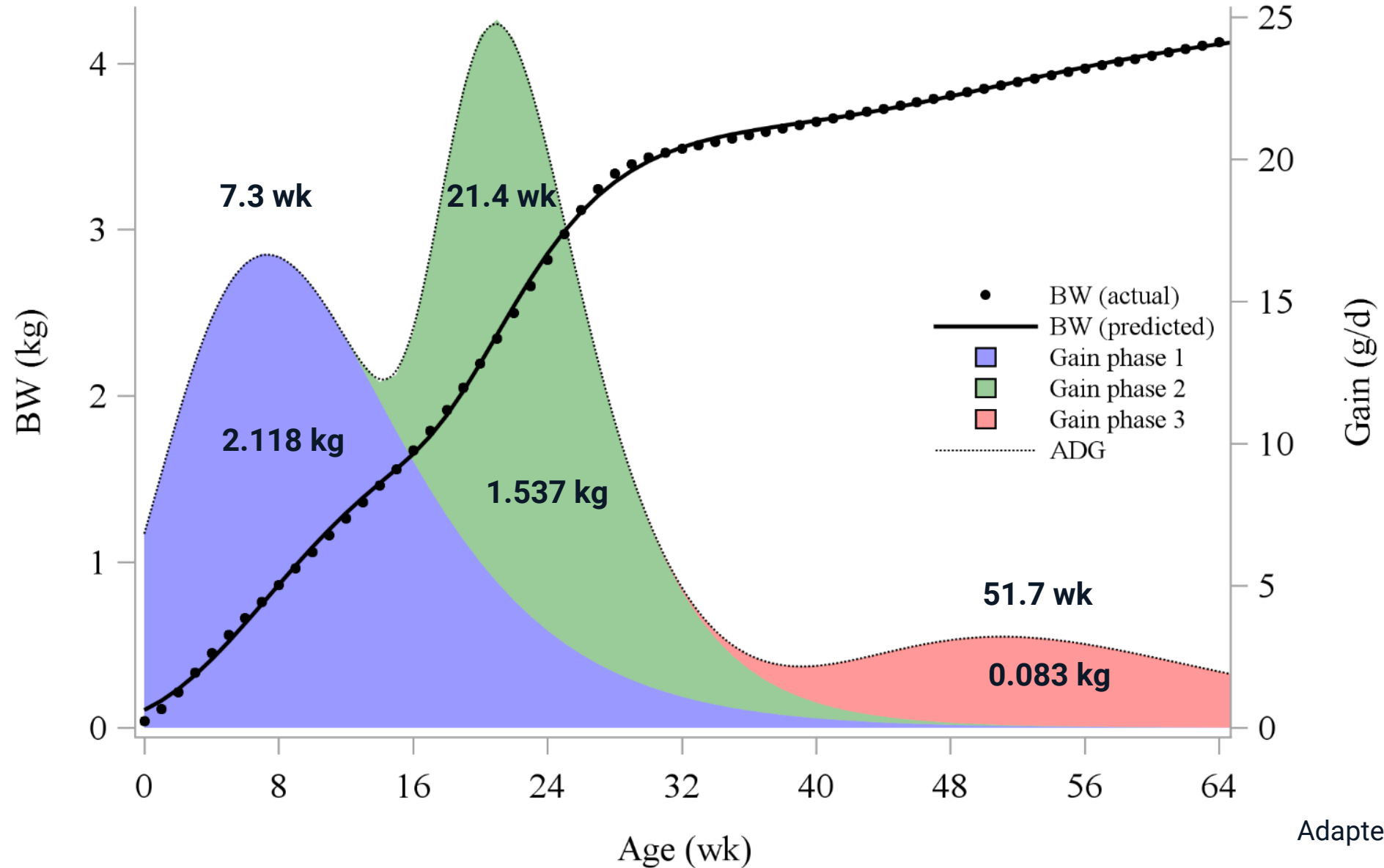
Does precision feeding affect broiler performance?

Does the maternal BW profile affect broiler performance?

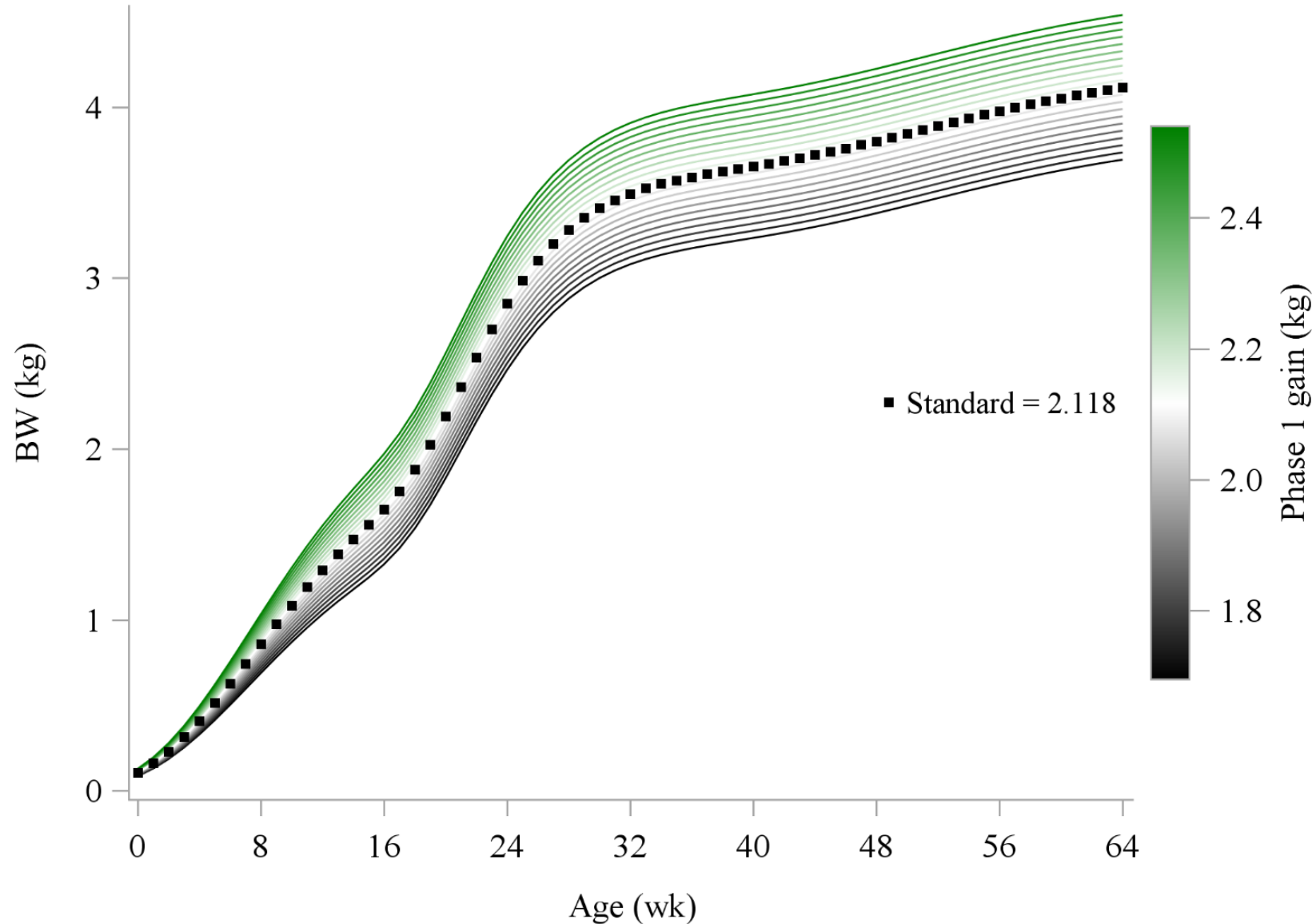
Next Steps

- ▶ Optimizing maternal growth profiles
 - ▶ Multiphasic (3-phase) growth model

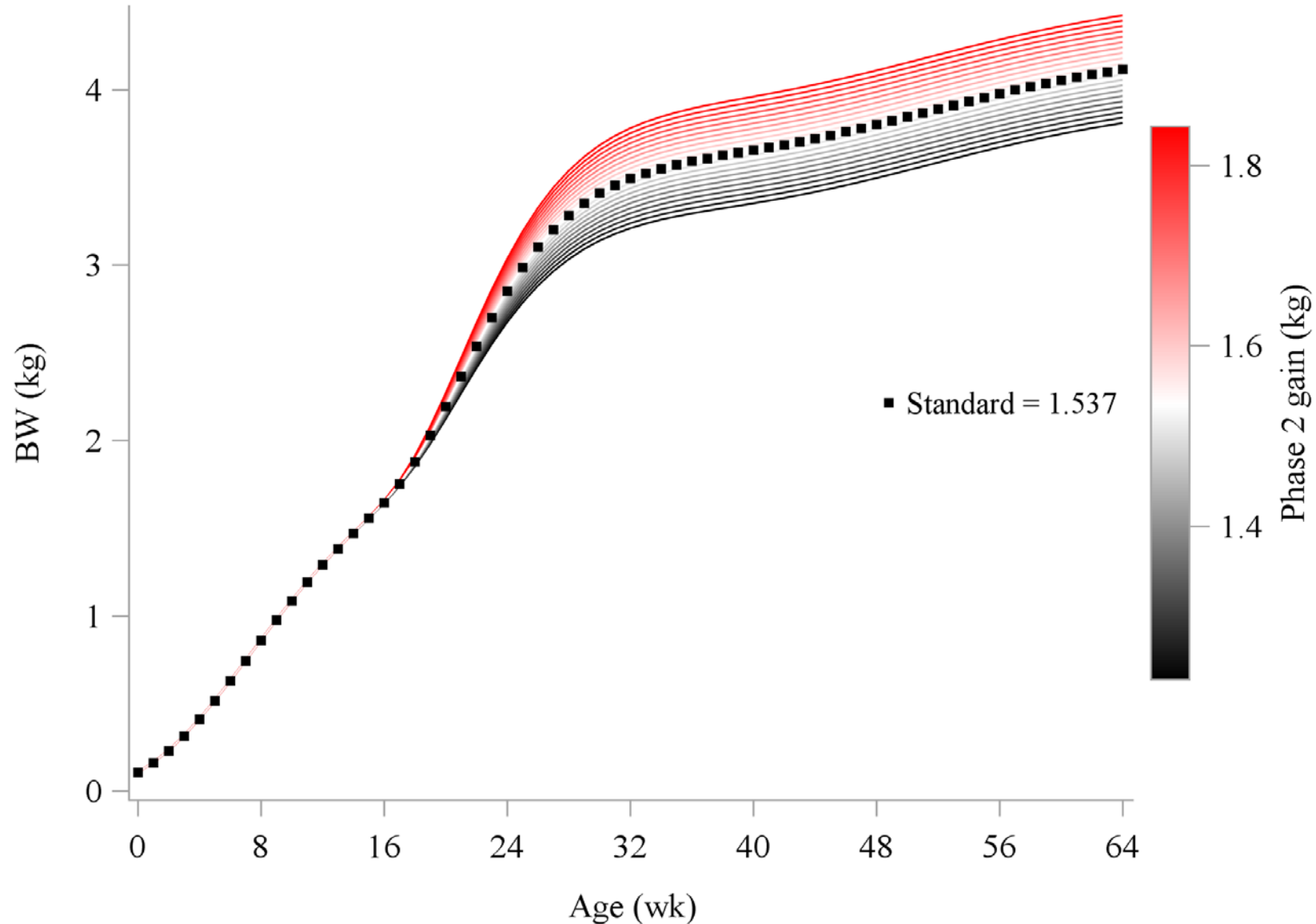
Broiler Breeder 3-Phase Growth



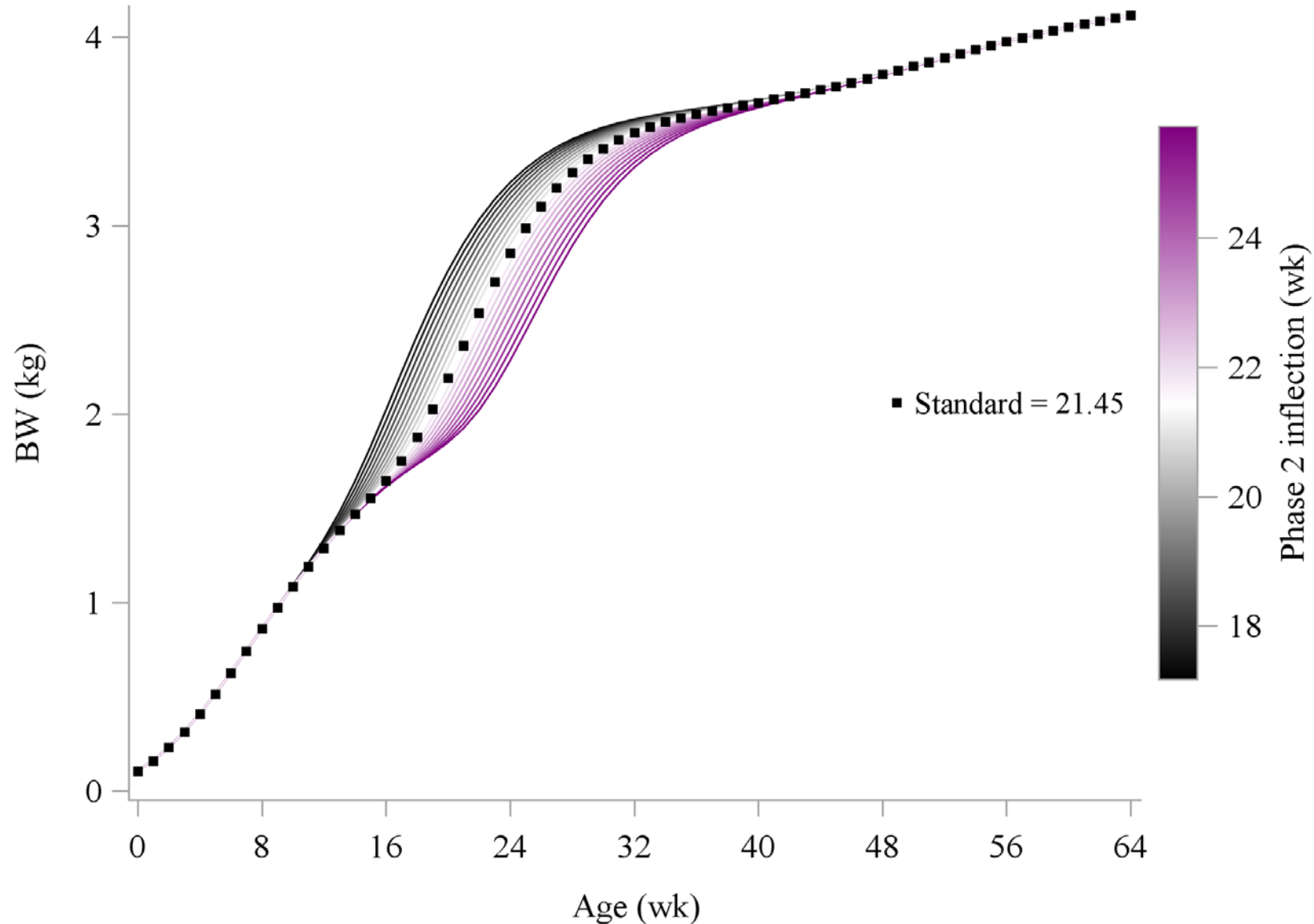
Hypothesis Building: Prepubertal Gain



Hypothesis Building: Pubertal Gain

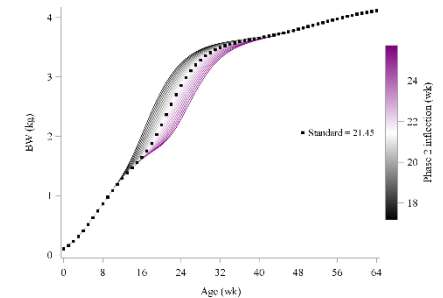
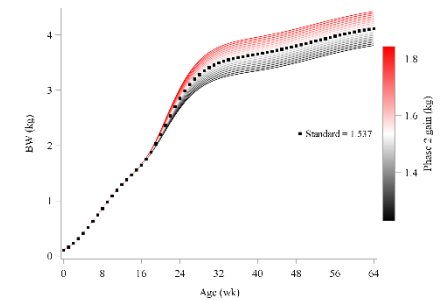
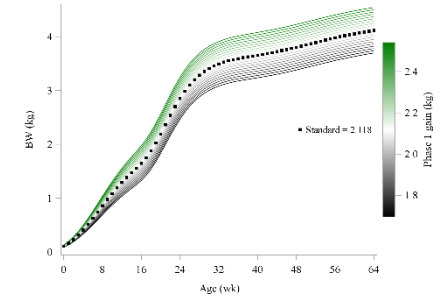


Hypothesis Building: Timing of Pubertal Gain



The Goal of Multiphasic Growth Modeling

- ▶ To find a growing strategy that optimizes body condition to sustain high hen productivity
- ▶ There are an infinite number of potential broiler breeder target BW trajectories
 - ▶ Which is/are optimal?
- ▶ Shift in thinking:
 - FROM comparisons of discrete growth strategies
 - TO response to continuous model parameters (optimization)



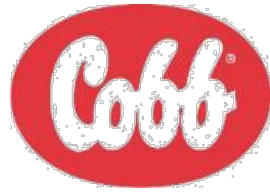
Next Steps

- ▶ Optimizing maternal growth profiles
 - ▶ Multiphasic (3-phase) growth model
- ▶ On-farm precision feeding
 - ▶ Males
 - ▶ Males and females together

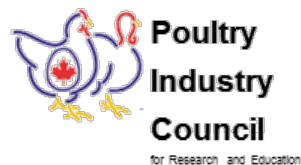
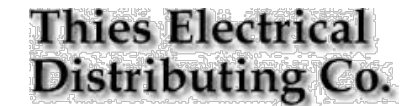
Next Steps

- ▶ Optimizing maternal growth profiles
 - ▶ Multiphasic (3-phase) growth model
- ▶ On-farm precision feeding
 - ▶ Males
 - ▶ Males and females together
- ▶ **Precision formulation / blending**
 - ▶ Quantifying variation in individual nutrient requirements
 - ▶ Model-based determination of nutrient requirements
 - ▶ Precision delivery of the right feed to the right bird at the right time.

Acknowledgement



Ontario Broiler Chicken
Hatching Egg Producers
Association



Precision Feeding – Uses and Expectations

▶ Commercial

- ▶ Grow uniform flocks
- ▶ Increase efficiency
- ▶ Maximize productivity
 - ▶ Eggs, fertility, chicks
- ▶ Reduce excretion (N, P, CO₂, NH₃)
- ▶ Reduce labour, stress



▶ Research

- ▶ Deploy complex experiments with less labour
 - ▶ Body weight control
 - ▶ Feed intake control
 - ▶ Targeted nutrient intake for every bird every time
- ▶ High resolution BW and FI data
 - ▶ Broilers (> 3,000 records per bird in 6 wk)
 - ▶ Breeders (> 20,000 records per bird in 52 wk)
- ▶ Feeding behaviour
- ▶ Every free run bird = experimental unit

▶ Teaching

- ▶ Excellent environment for training HQP
- ▶ Insights from exposure to non-traditional system