Breeder Nutrition

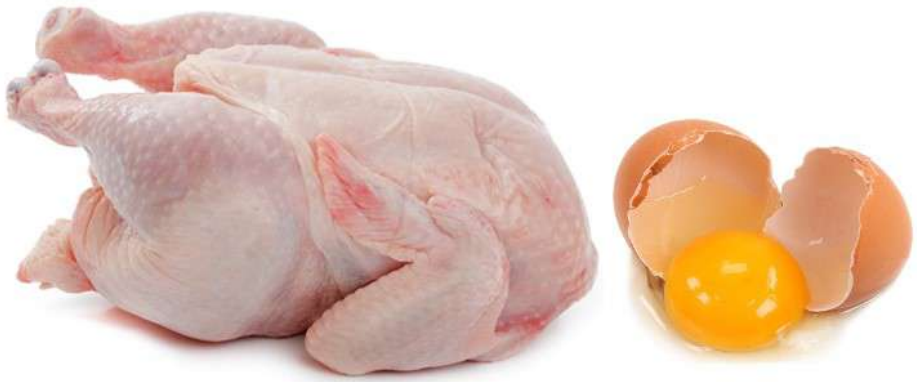
Lely Delima S, drh, M. Si

What is Nutrition ?

Nutrition is the science that deals with the utilization of food/feed and the processes which transform food/feed into body tissues and energy.

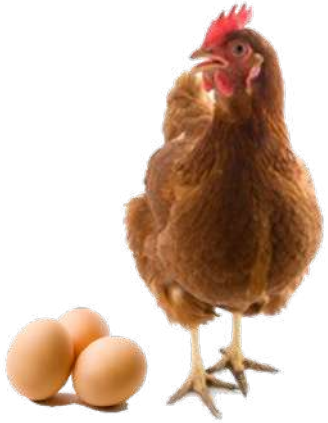
Why is Nutrition is Important ?

Animals need to obtain and utilize feed stuffs to maintain and convert into products such as milk, meat, eggs and work.

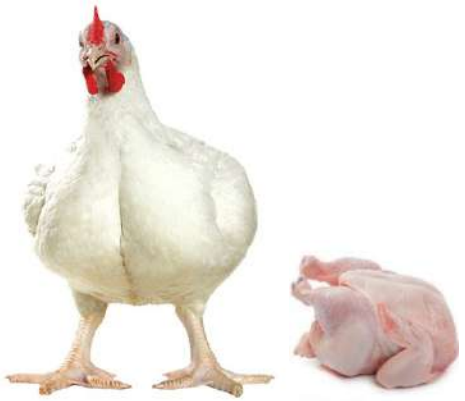


Jadilah generasi yang cerdas dengan makan ayam dan telur.
Yuuukk makan Ayam dan Telur !

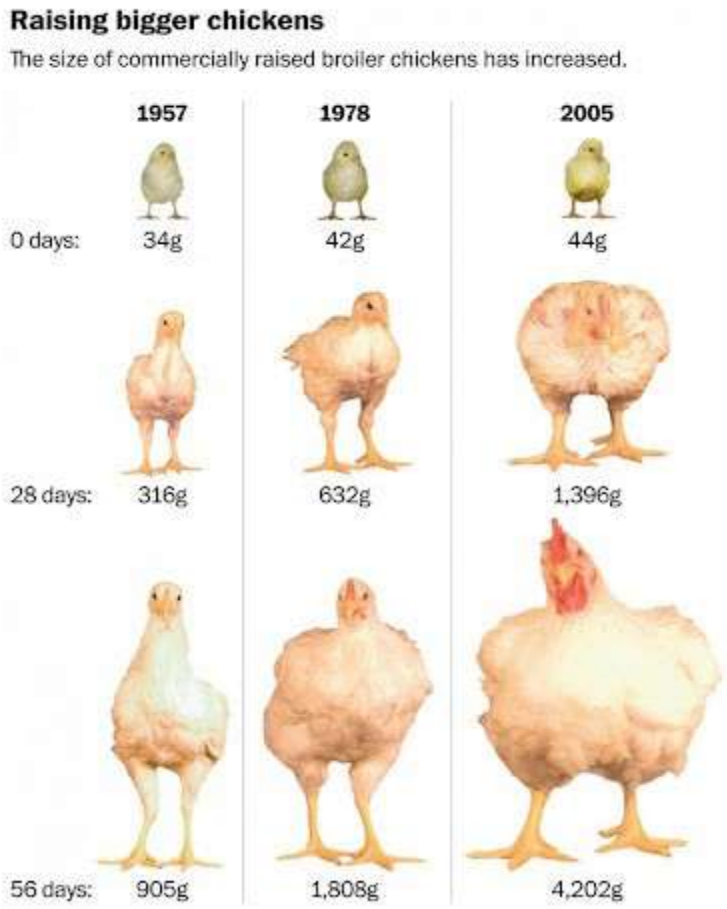
Parent Stock Brown Layer



Parent Stock Broiler

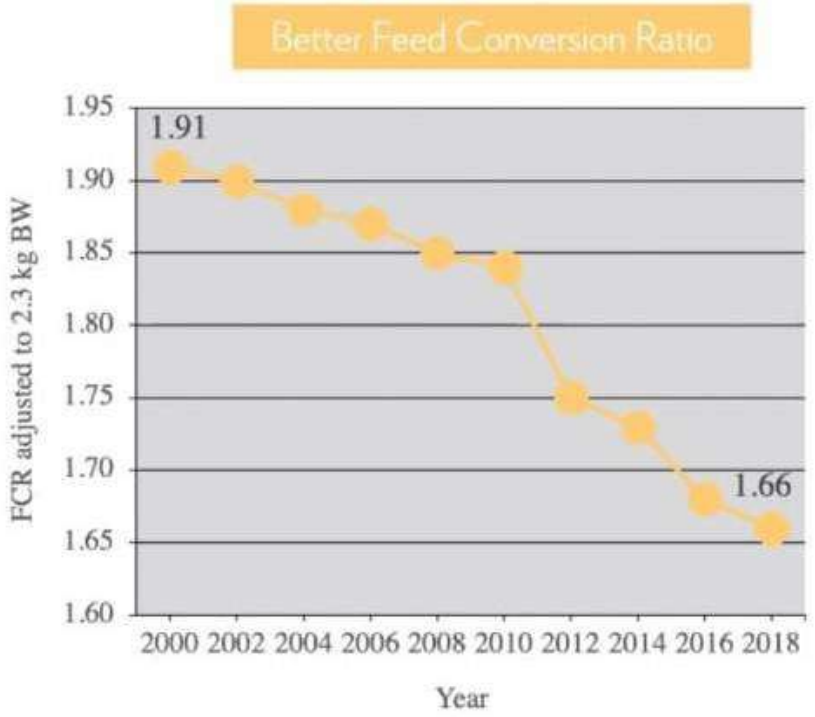


Broiler Modern



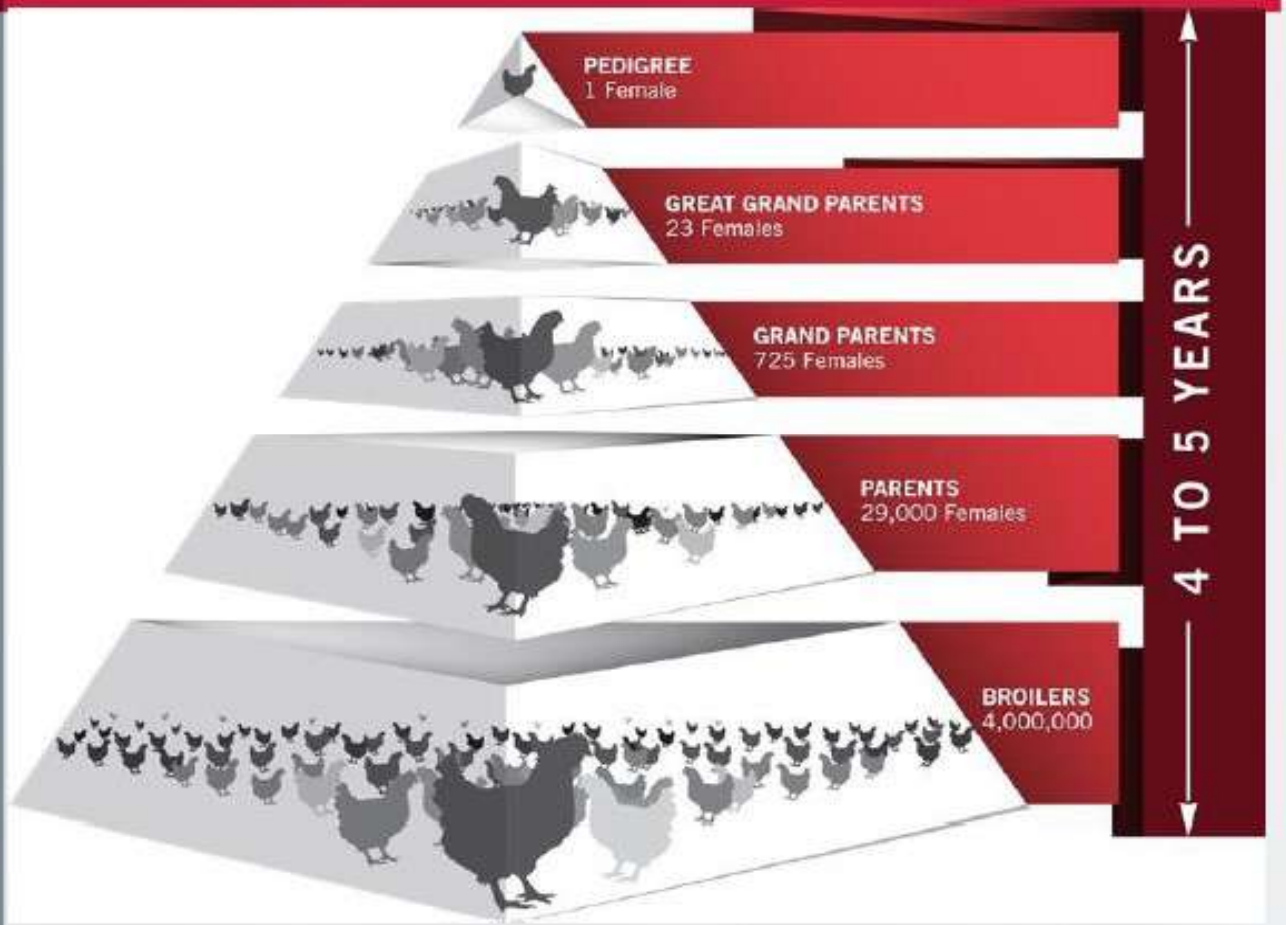
Zuidhof et al., 2014

Significantly improvement of broiler genetic over the year



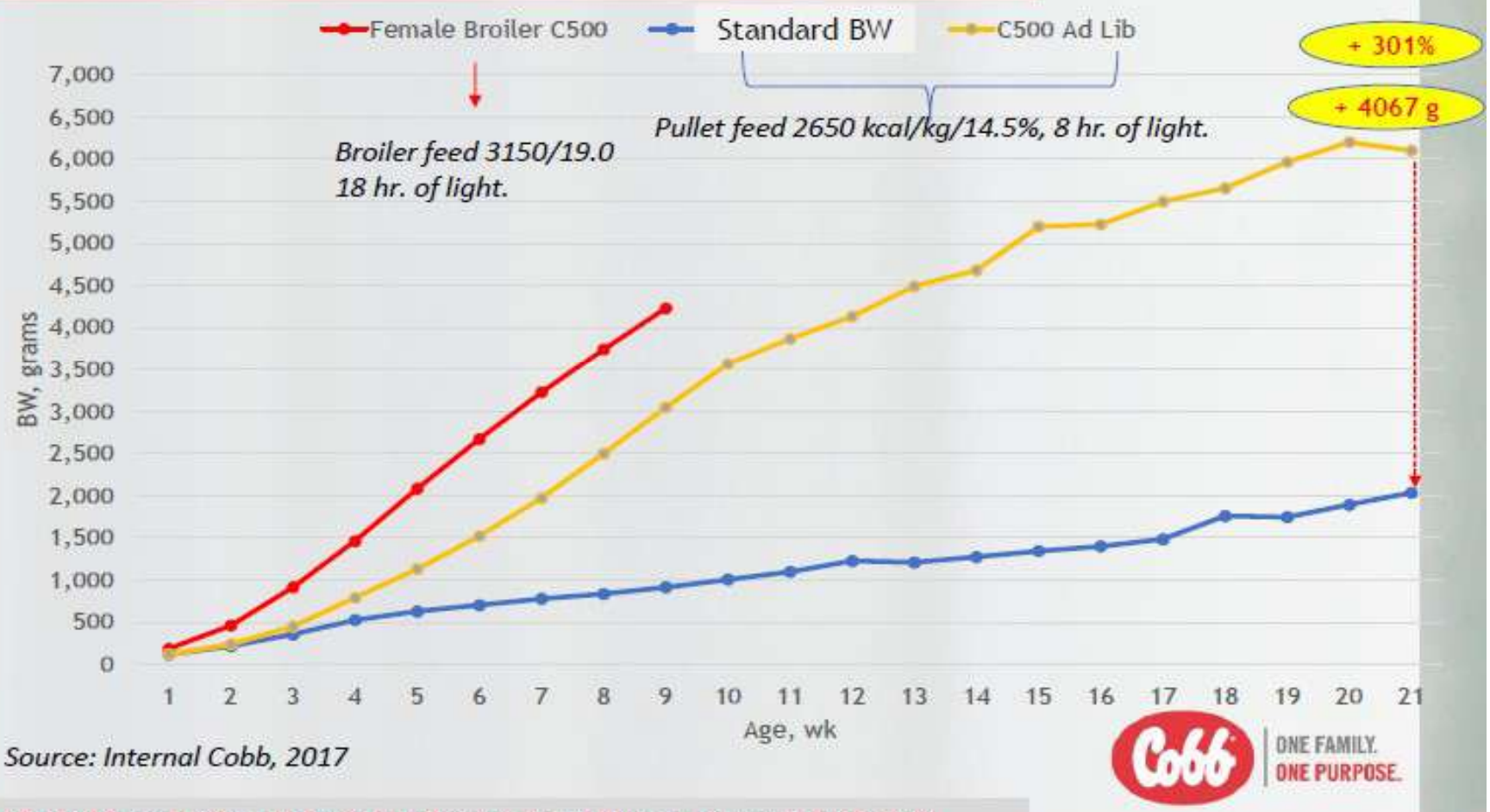
Cerrate and Corzo, 2019

Production Pyramid



Cobb ONE FAMILY. ONE PURPOSE.

Potential growth of a broiler breeder



Source: Internal Cobb, 2017

ONE FAMILY.
ONE PURPOSE.

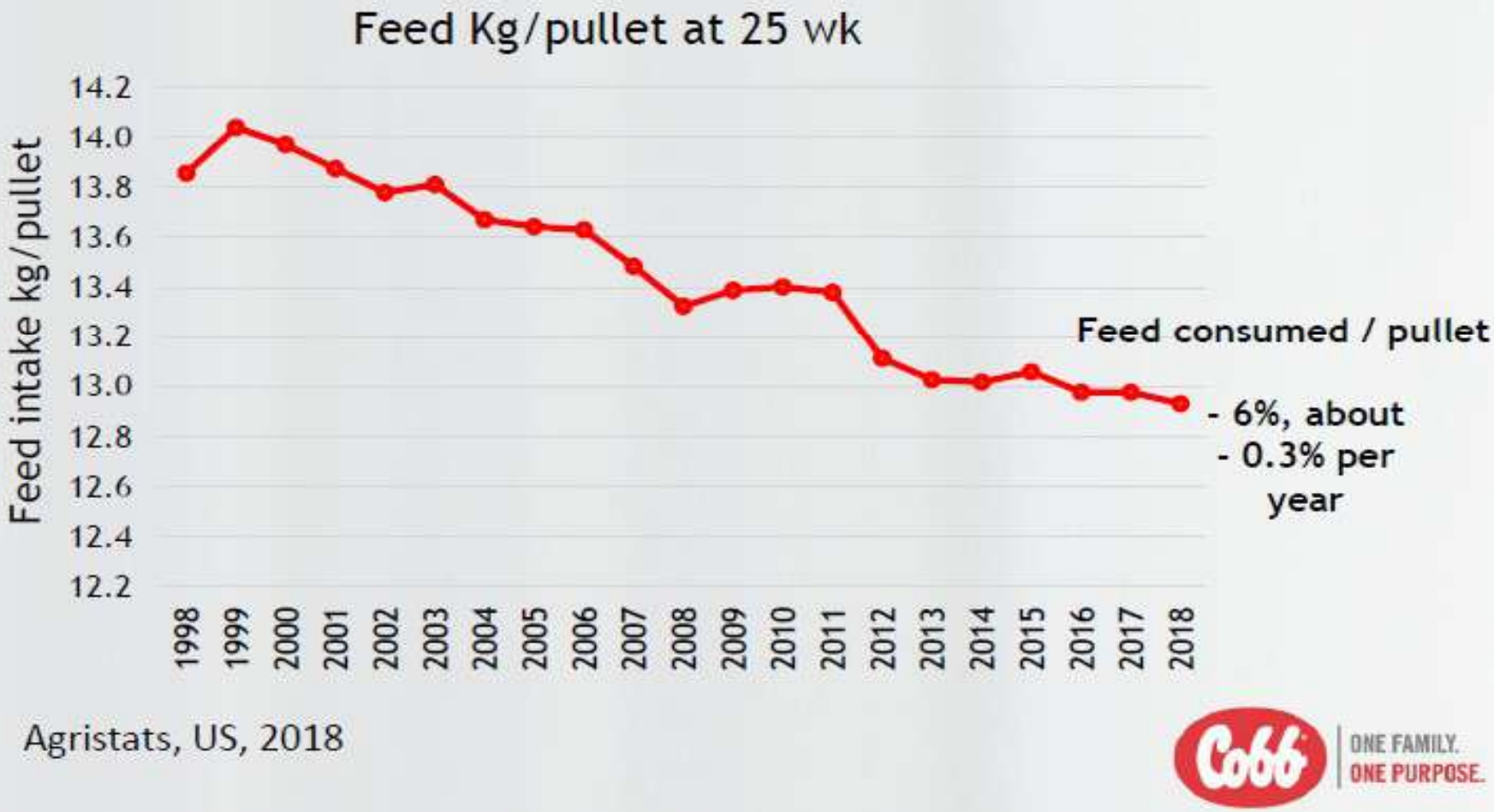
* Adapted from the female broiler performance nutrition supplement, Cobb 2015

Genetic Potential vs. Breeders Weight 28d

Weight (28 days)	Broilers (Females)	Breeders	(%) Restriction
1998	790	430	46%
2018	1554	540	65%

Calculations: Cobb-Vantress, Inc.: Breeder Management Guide 1988-2018

Parent Stock
Cobb*500*™ (Feed Consumed 1998 - 2018)



Feeding The Breeder Takes a Team Effort

- Farm Manager
- Veterinarian
- Nutritionist
- Formulation
- Feedmill

Quotes from Nutritionists

Management & Nutrition of the broiler breeder is the most complex piece of poultry production (Kleyn, 2013)

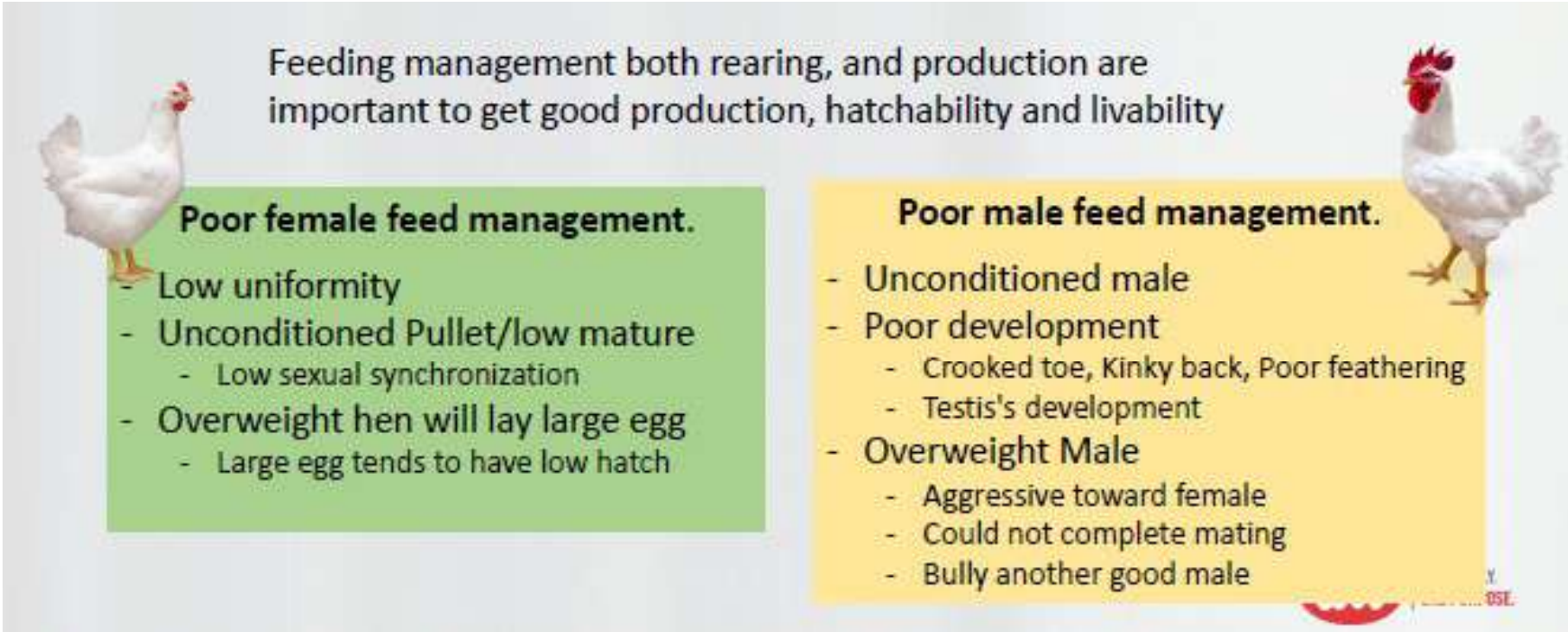
Nutrition should not be the reason why performance is not achieved (Caldas, 2019)

Cobb ONE FAMILY. ONE PURPOSE.

Breeder Nutrition

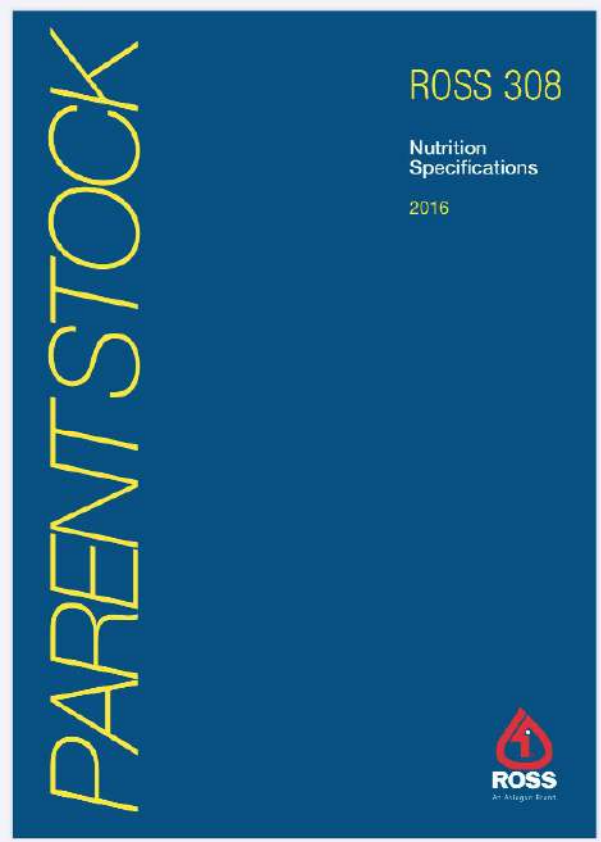
- Both Male and Female Nutrition is Important in Producing a High Number of Quality Chicks
- Vegetarian ⟶ Salmonella Free
- Nutrition – function of feed specification and Allocation – hands of farm manager.
- “Improvements in breeder nutrition will come about through improved feed management rather than improved specs”.
- Feed Restriction – leads to welfare issues.

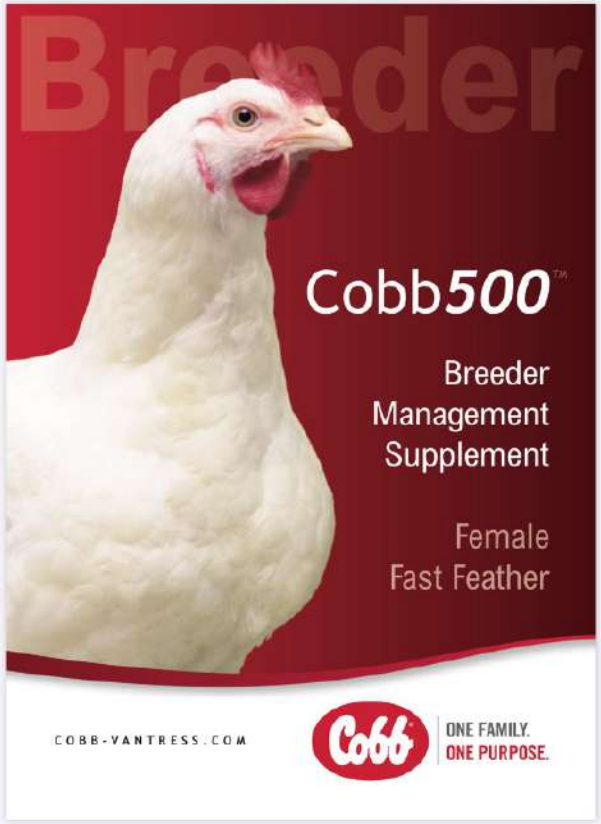
Impact of Poor Feeding Management to Hatchability

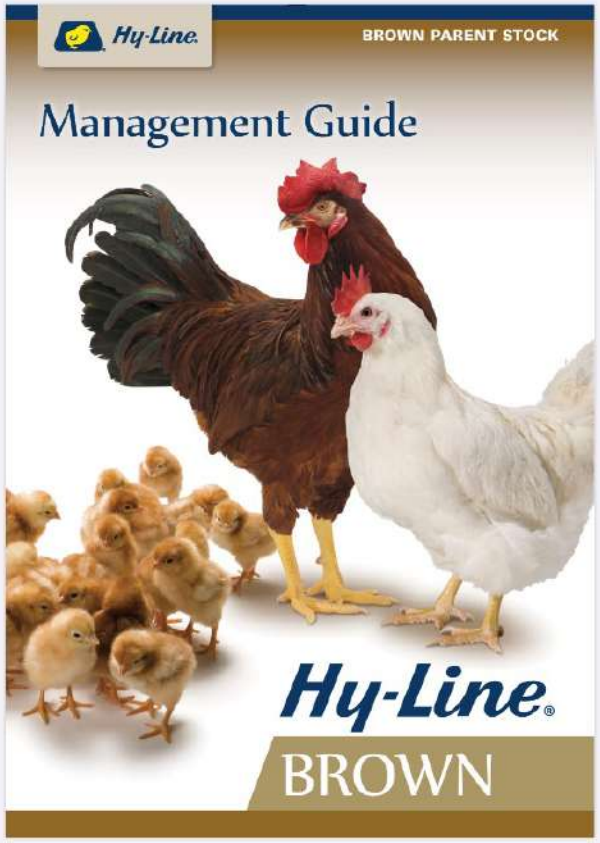


Cobb, 2021

Breeder Nutrition Recommendation







SNI Pakan Broiler Breeder

Kode	No SNI	Jenis Pakan	Penggunaan	Proximate Analysis (%)				
				M (max)	CP (min)	Fat (min)	Fiber (max)	Ash (max)
PSBR1	7652.1: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Pedaging (Starter 1)	umur 1 - 21 hari	13.00	19.00	3.00	5.00	8.00
PSBR2	7652.2: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Pedaging (Starter 2)	umur 22 - 42 hari	13.00	17.00	3.00	5.00	8.00
PSBR3	7652.3: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Pedaging (Grower)	umur 43 - 125 hari	13.00	15.00	3.00	6.00	8.00
PSBR4	7652.4: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Pedaging (Pre Layer)	umur 126 - 154 hari	13.00	16.00	3.00	6.00	12.00
PSBR5	7652.5: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Pedaging (Layer)	> umur 154 hari	13.00	16.00	3.00	6.00	14.00
PSBR6	7652.6: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Pedaging – Jantan	> umur 154 hari	13.00	14.00	3.00	7.00	8.00

Kode	Ca	P total (%)		Asam Amino (%, min)					ME	Aflatoxin
	(%)	total	available	Lysine	Methionine	Meth + Cyst	Trypthophan	Threonine	(min, Kcal/kg)	(ppb, max)
PSBR1	0.90 - 1.20	0.60 - 0.80	0.45	1.05	0.45	0.77	0.20	-	2850	40
PSBR2	0.90 - 1.20	0.60 - 0.80	0.40	0.86	0.36	0.69	0.14	-	2800	40
PSBR3	0.90 - 1.20	0.60 - 0.80	0.40	0.64	0.27	0.52	0.11	-	2700	40
PSBR4	1.50 - 2.50	0.60 - 0.80	0.40	0.67	0.34	0.61	0.16	-	2700	40
PSBR5	3.00 - 4.00	0.60 - 0.80	0.40	0.75	0.4	0.69	0.17	-	2700	40
PSBR6	0.90 - 1.20	0.60 - 0.80	0.40	0.65	0.30	0.50	0.15	-	2700	40

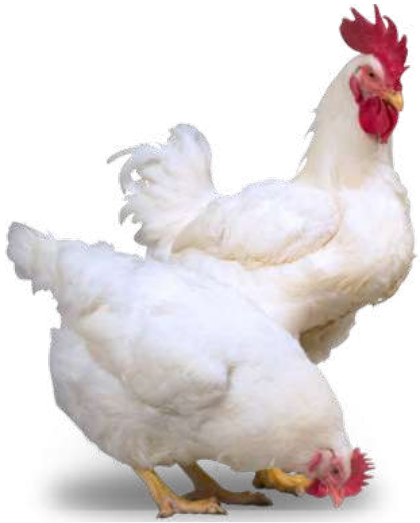
SNI Pakan Layer Breeder

Kode	No SNI	Jenis Pakan	Penggunaan	Proximate Analysis (%)				
				M (max)	CP (min)	Fat (min)	Fiber (max)	Ash (max)
PSP1	7700.1: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Petelur (Starter)	umur 1 - 28 hari	13.00	19.00	3.00	6.00	8.00
PSP2	7700.2: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Petelur (Grower)	umur 29 - 84 hari	13.00	17.00	3.00	6.00	8.00
PSP3	7700.3: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Petelur (Pullet)	umur 85 - 126 hari	13.00	15.00	3.00	6.00	8.00
PSP4	7700.4: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Petelur (Pre Layer)	umur 127 - 154 hari	13.00	16.00	3.00	6.50	12.00
PSP5	7700.5: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Petelur (Layer)	> umur 154 hari	13.00	16.00	3.00	6.50	14.00
PSP6	7700.6: 2011	Pakan Bibit Induk (PS) Ayam Ras Tipe Petelur – Jantan	> umur 154 hari	13.00	12.50	3.00	7.00	8.00

Kode	Ca	P total (%)		Asam Amino (%, min)					ME	Aflatoxin
	(%)	total	available	Lysine	Methionine	Meth + Cyst	Trypthophan	Threonine	(min, Kcal/kg)	(ppb, max)
PSP1	0.90 - 1.20	0.60 - 0.90	0.45	1.10	0.48	0.75	0.20	-	2900	40
PSP2	0.90 - 1.20	0.60 - 0.90	0.40	0.95	0.41	0.70	0.18	-	2700	40
PSP3	0.80 - 1.20	0.60 - 0.90	0.35	0.75	0.35	0.50	0.16	-	2700	40
PSP4	1.50 - 2.50	0.60 - 0.90	0.40	0.80	0.41	0.62	0.18	-	2700	40
PSP5	2.70 - 4.00	0.60 - 0.90	0.35	0.80	0.41	0.62	0.18	-	2700	40
PSP6	0.80 - 1.20	0.60 - 0.90	0.35	0.65	0.30	0.50	0.16	-	2700	40

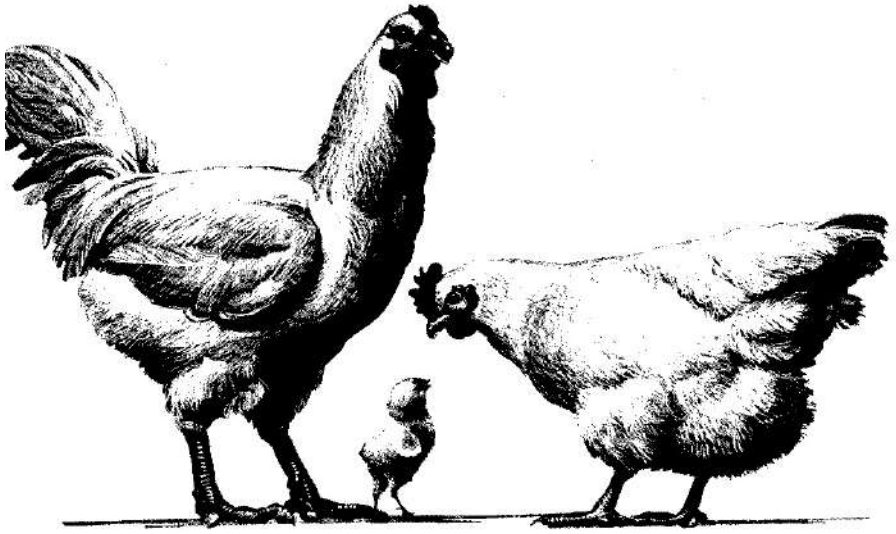
Breeder Nutrition

- Breeder nutrition has three phases
  - The rearing phase
  - The pre-peak laying period
  - The post peak laying period
- Must be seen as a continuum



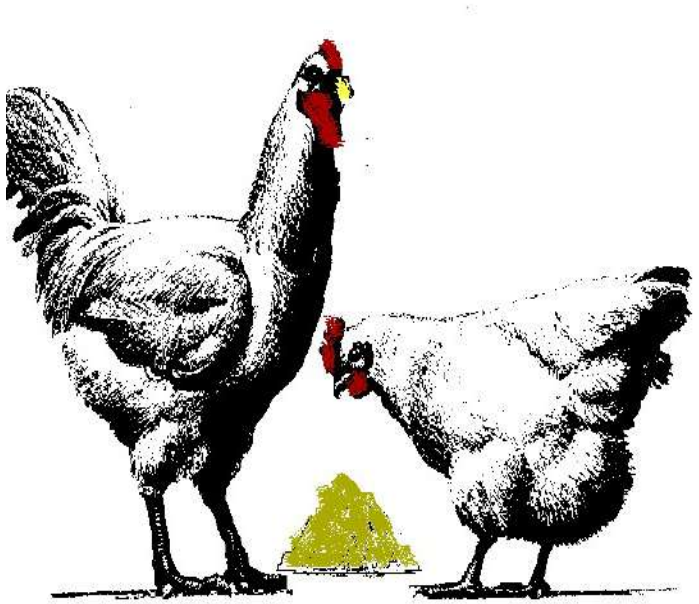
Breeder Nutrition

- Critical Nutritient
  - Energy
  - Amino Acids
  - Phosphorus
  - Calcium
  - Protein



Energy is the Most Critical Factor in Feeding Broiler Breeders

- Energy of Formula Specification
- Energy of Ingredients in Formula
- Energy Requirements of the Breeder



Protein and Amino Acids

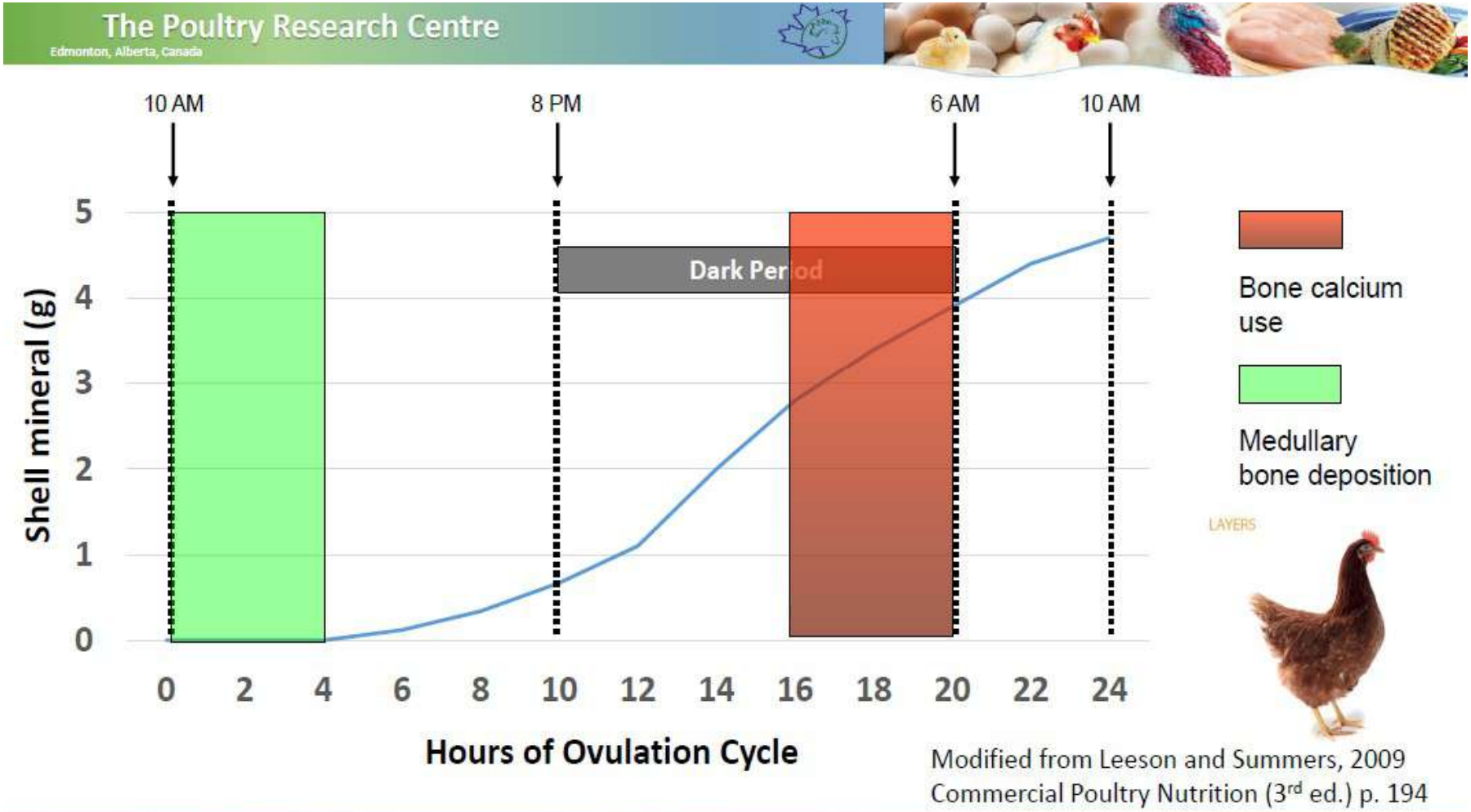
- In reality are only concerned with amino acids and not Crude Protein.
- Lysine will be used to indicate amino acid content of the diet.
- Two sets of recommendations exist
  - Breeding companies
  - Scientific literature
- When in doubt – apply the breeder manual
- Consider the SNI as government regulation

Breeder Company vs SNI

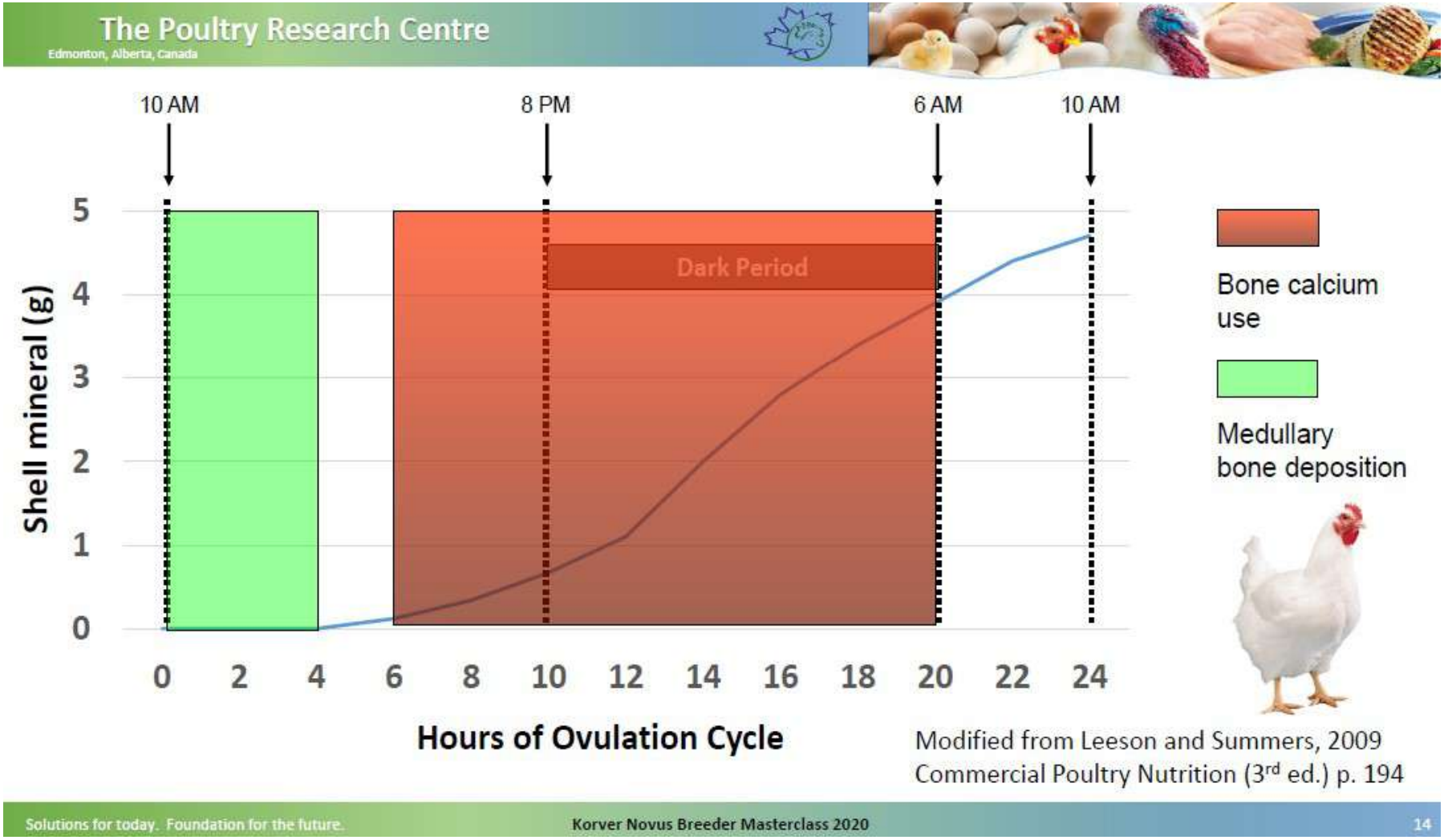
Phase	Age (day)	Energy (Kcal/kg)			Crude Protein (%)		
		Cobb500	Ross308	SNI	Cobb500	Ross308	SNI
Starter 1	0 - 21	2850	2800	**2850**	19	19	**19**
Starter 2	22 - 35		2800	**2800**		17	**17**
Grower		2700	2800	**2700**	14.5	13 - 14	**15**
Pre Breeder	106 - 5% prod	2800	2800	**2700**	15	14	**16**
Breeder 1	5% prod - 245	2800	2800	**2700**	15	15	**16**
Breeder 2	246 - 350	2800	2800	**2700**	14.5	14	**16**
Breeder 3	> 351		2800	**2700**		13	**16**
Male	> 168	2700	2700	**2700**	13	11.5	**14**

Cobb500, 2018
Ross308, 2019
SNI Pakan Broiler Breeder, 2011

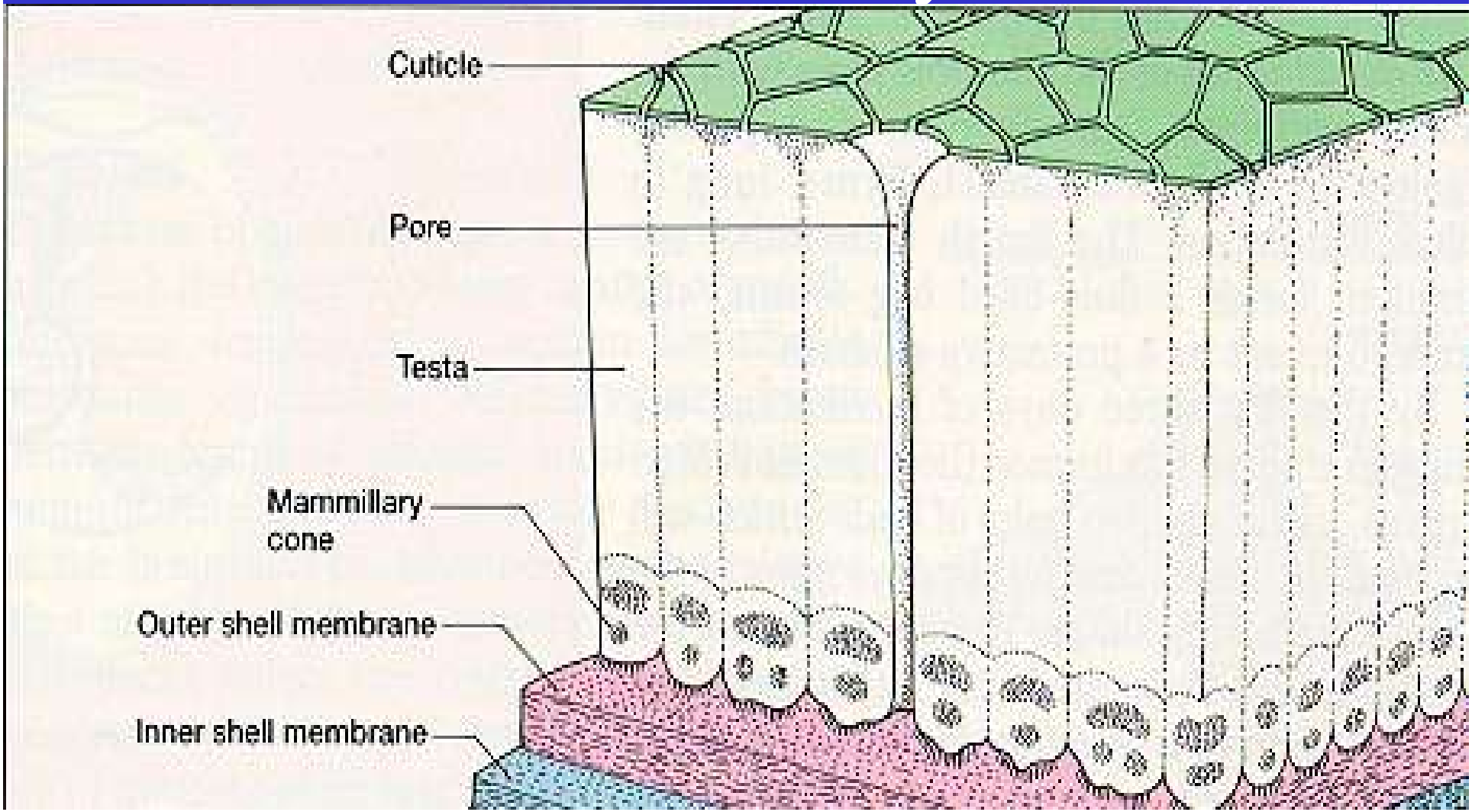
Layer Ovulation Cycle



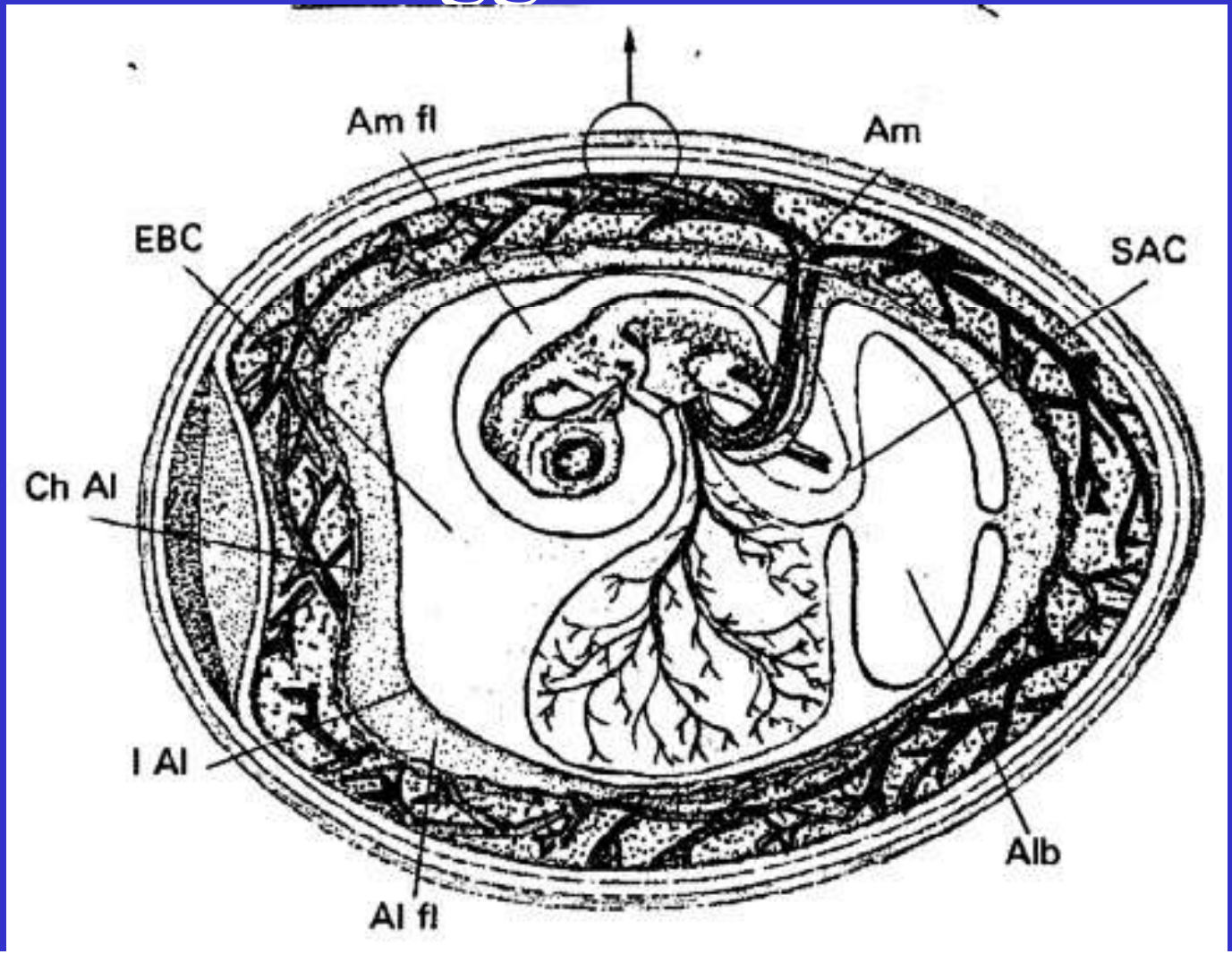
Breeder Ovulation Cycle



Shell Quality Important to Hatchability



Exchange of Gases Across the Egg Shell



Calcium and Phosphorus for Breeder

Calcium:

- **Bone Structure**
- 99% of body calcium
- Muscle contraction
- Blood clotting
- Enzyme function
- Second messenger
- Response to hormones
- **Eggshell formation**

Phosphorus

- **Bone Structure**
- 80 – 85% of body phosphorus
- Phospholipids
- DNA and RNA
- Enzyme and coenzyme system
- Metabolic Regulation
- Energy Metabolism (ATP, NADP, etc)
- Blood Buffering (pH control)
- Control of biological functions of proteins

Calcium for Breeder

The Poultry Research Centre
Edmonton, Alberta, Canada

Breeder dietary calcium

Table 4.5 Effect of calcium level and age on bone mechanical properties of broiler breeder hens during lay

	Treatment	Age (weeks) 35	60	Means	Treatment	Age	Interaction	CV
Right tibia								
Bone strength (N)	1.5% Ca	235.00 ± 68.74	252.00 ± 93.43	242.20 ±15.56^{a}	0.0001	0.9809	0.7308	23.3
	2.5% Ca	320.42 ± 56.18	315.00 ± 58.54	317.71 ± 14.44^{b}				
	3.5% Ca	350.00 ± 54.10	340.00 ± 105.45	343.50 ± 14.79^{b}				
	Means	300.93 ± 12.00^{a}	301.34 ± 12.38^{a}					
Bone stress (N/mm^2)	1.5% Ca	27.90 ± 5.47	19.33 ± 6.86	23.61 ± 4.39^{a}	0.5893	0.0081	0.7790	68.5
	2.5% Ca	32.63 ± 5.47	16.50 ± 6.42	24.57 ± 4.22^{a}				
	3.5% Ca	37.39 ± 6.05	21.38 ± 5.74	29.38 ± 4.17^{a}				
	Means	32.33 ± 3.27^{a}	19.07 ± 3.67^{b}					
Right humerus								
Bone strength (N)	1.5% Ca	235.00 ± 22.38	252.00 ± 23.47	243.50 ± 16.22^{b}	0.0001	0.9768	0.8149	24.4
	2.5% Ca	320.42 ± 21.43	315.00 ± 21.43	317.71 ± 15.15^{a}				
	3.5% Ca	350.00 ± 21.43	340.00 ± 22.38	345.00 ± 15.49^{a}				
	Means	301.81 ± 12.56^{a}	302.33 ± 1.96^{a}					

Moreki, 2005

Calcium for Breeder

The Poultry Research Centre
Edmonton, Alberta, Canada

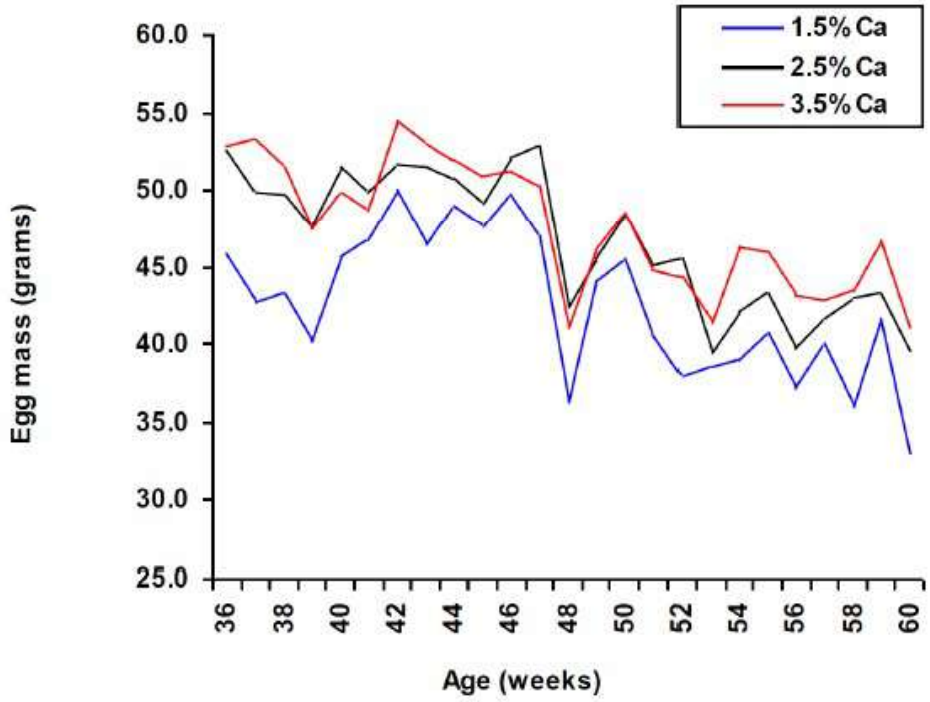
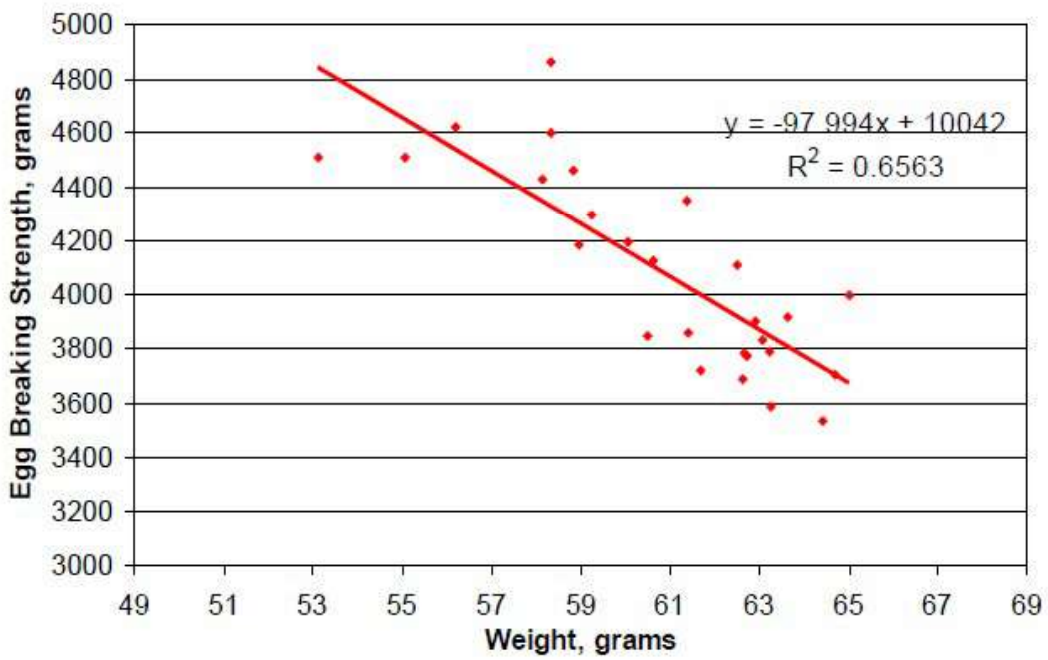


Fig. 1- Effect of dietary Ca levels and age on egg mass

Moreki et al., 2011

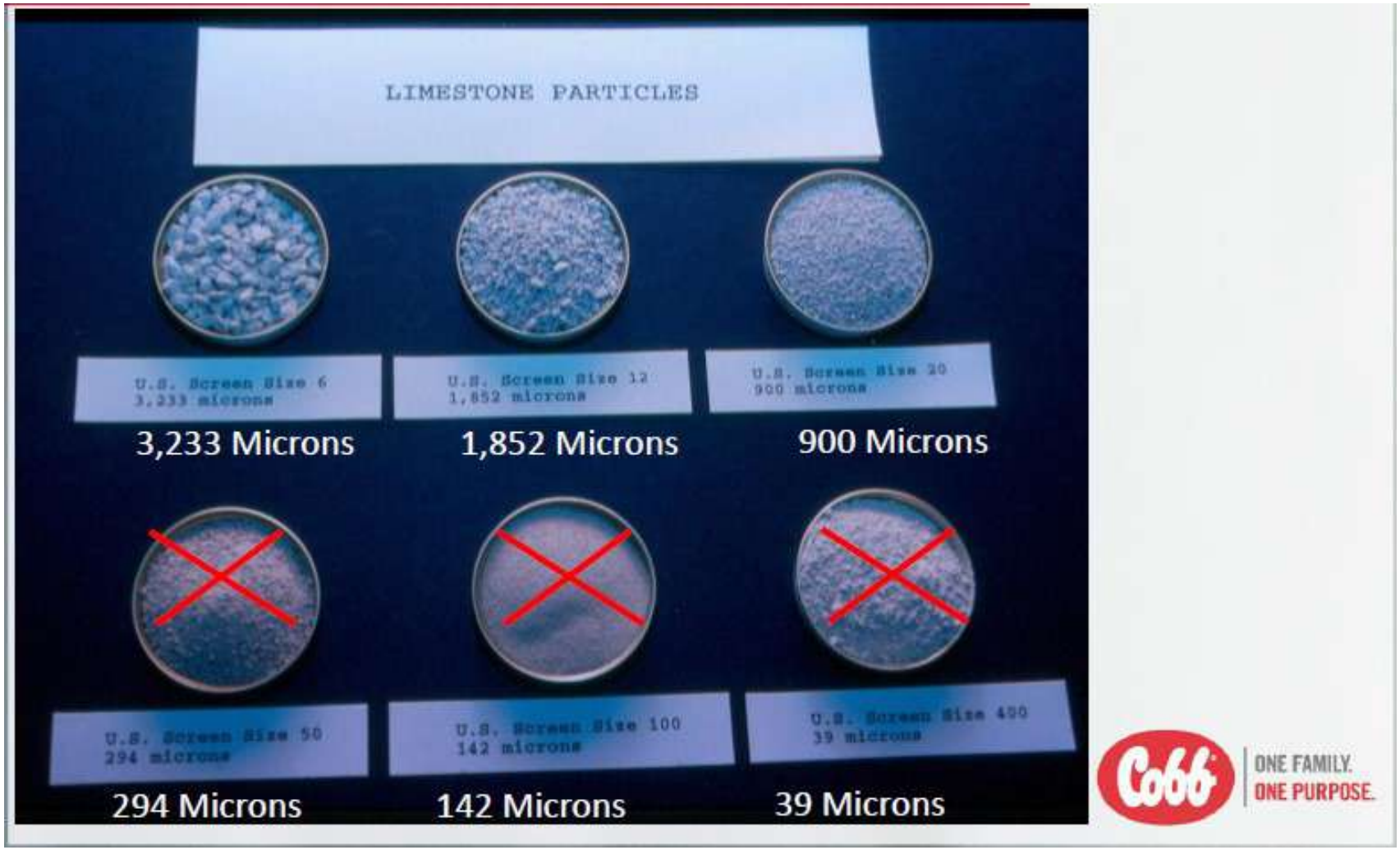
Calcium for Breeder

Effect of egg weight on shell breaking strength



Slide courtesy Marcus Kenny, Hy-Line International

Limestone for Pullet and Breeder



Maternal Nutrition

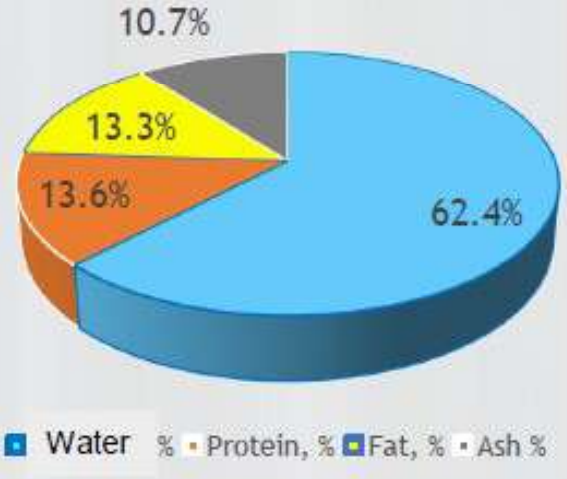
- Nutrient supply to embryo
- Maternal feed interventions are shown to influence progeny in:
  - Transfer of antibodies
  - Embryo livability
  - Embryo skeletal development
  - Immunocompetence
  - Broiler live production performance (livability, FCR)
  - Carcass meat yield and meat quality

Maternal Nutrition

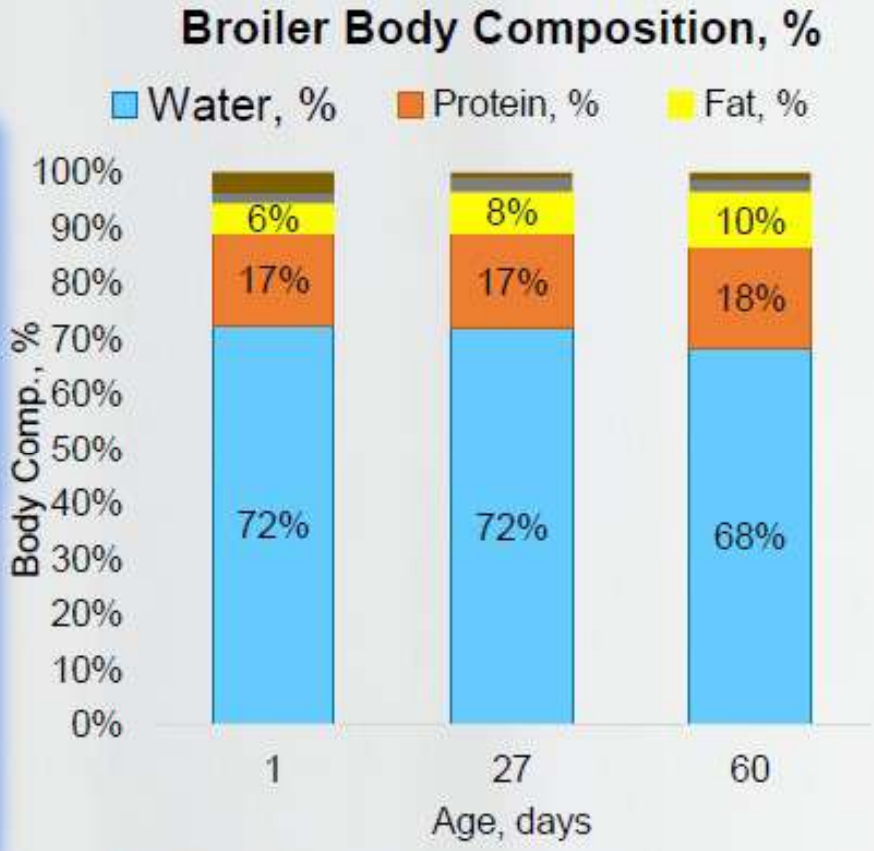
- Feed formulation point of view:
  - Protein (Ideal Amino Acid Ratio), energy, energy to protein ratio (in pullets & hens).
  - Fatty Acid nutrition
  - Antioxidants (synthetic & natural – vit E & Se)
  - Vit D3 and 25-OH-D3 (HyD, Bio-D)
  - Zn, Mn, Cu

Water: One of the most important nutrient

Egg composition, %

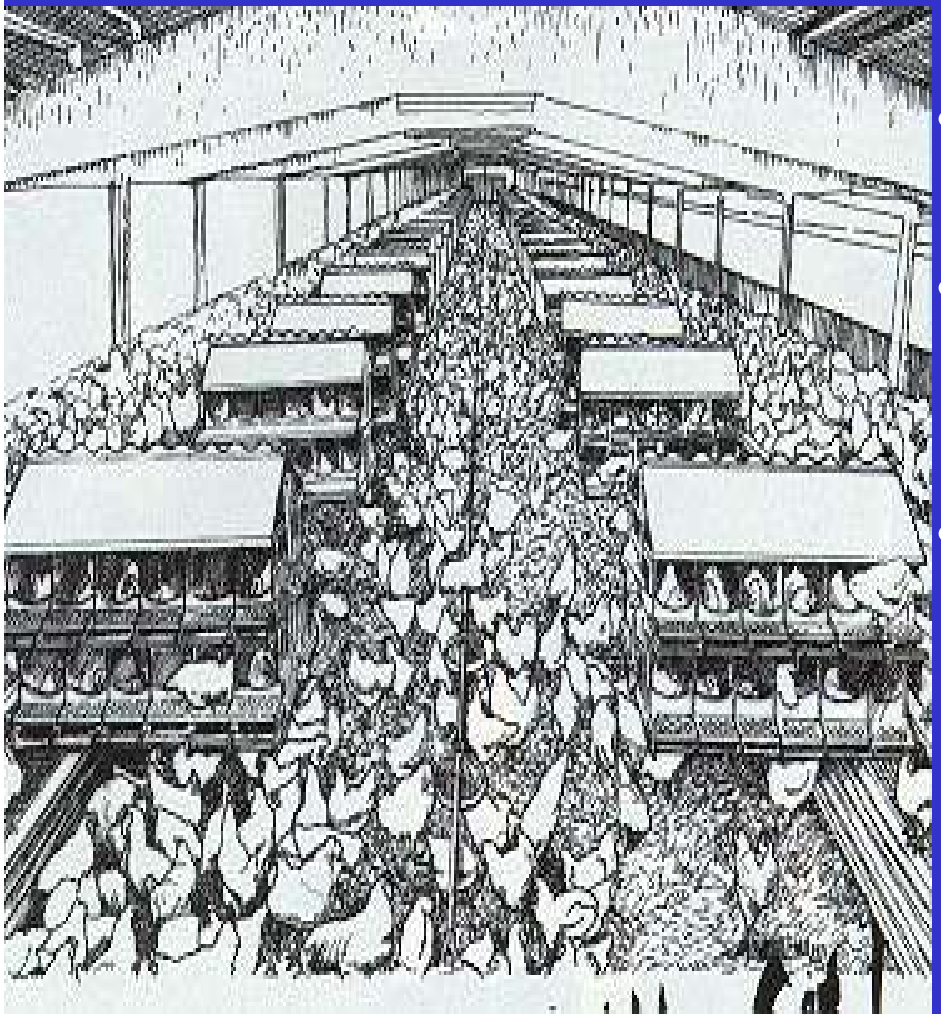


Source: Cobb-Vantress, 2017



Source: Caldas J., 2015

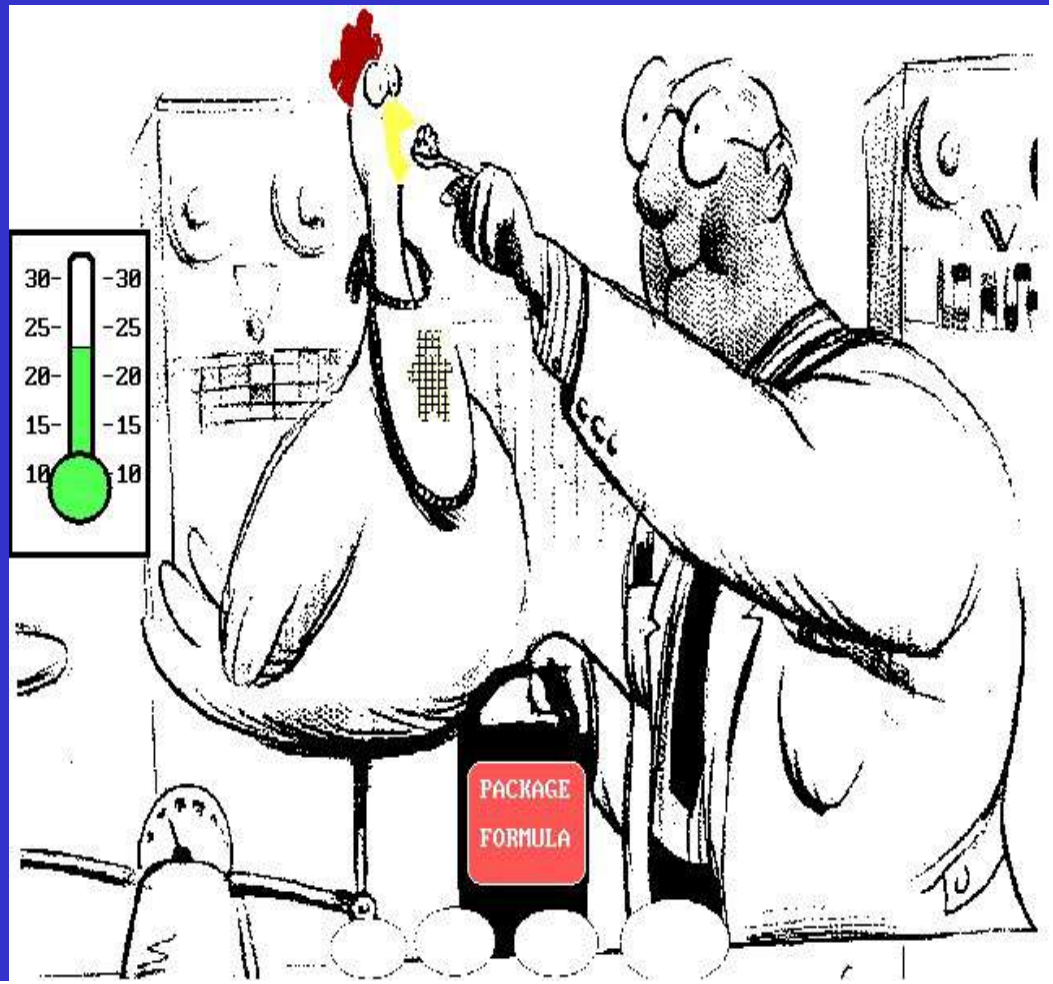
It is Important to Know How the Birds are Managed To Set Proper Feeding Program



- Environment is important for well being and energy needs
- Feed systems and water systems must be adequate and working properly
- Establish lighting programs for type of house and location and body weight of bird. North East is closed Housing, lighting program less of a problem

A Modeling Approach to Know The Requirements So Less Problem of Over or Under Feeding

- Body Weight
- Body Weight Gain
- Egg Production
- Egg Size
- Temperature
- Ventilation Rates
- Feathering
- Activity



Practical Feeding of Breeders

- Perform over a wide range of specification
- Specification x Feed allocation
- If it is working – change carefully
- All changes – slow and small

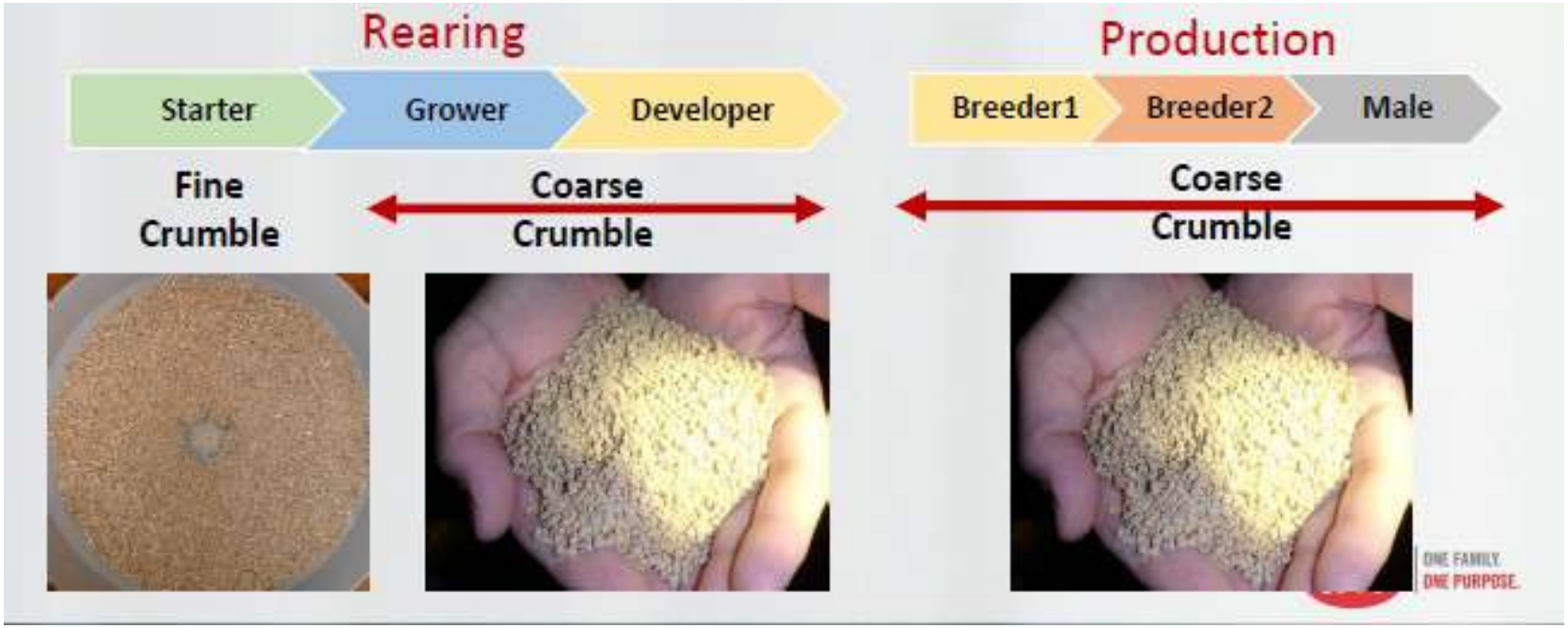
Feed Intake Time

- Feed intake time, or feed cleanup time, is a key consideration in both the rearing and production periods.
- Cleanup times will vary over the rearing period and depend on several important factors such as:
  - feed amounts
  - genetic line
  - the type of feeding program
  - the feed form presented
  - light intensity being used in the house.

Factors Effecting Feed Cleanup Time

- Feeding program used in rearing
- Physical form (pellets/crumble/mash)
- Raw materials
- Climate and daily temperature fluctuations
- Drinking system (shortage of water)
- Feeding system and speed of feed delivery
- Flock health (sick birds will eat less or not at all)

The Feed Form for Broiler Breeder



Cobb, 2021

Pelleted feed diperbolehkan untuk diberikan saat fase produksi, akan tetapi perlu diperhatikan jumlah feed intake dan kecepatan penambahan BW.

Feeding Programs

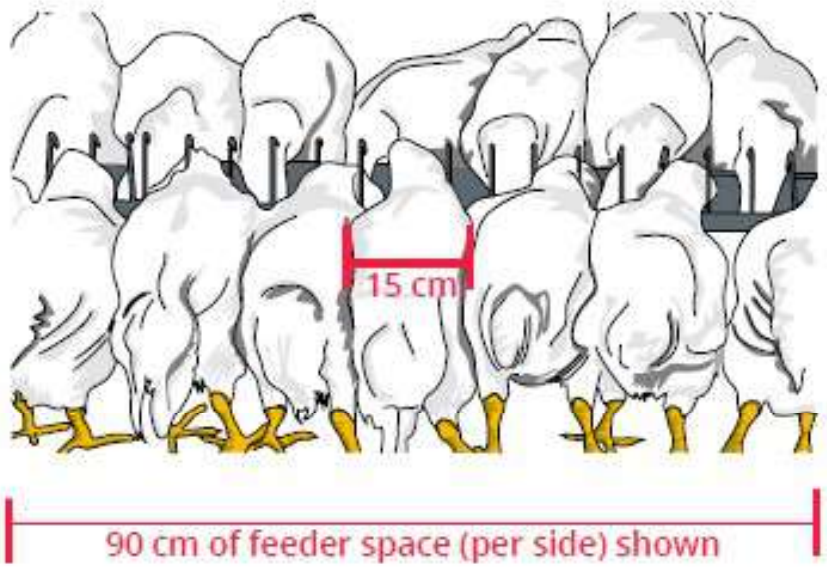
❖Simple

- Starter 0 – 4 wk
- Grower 4 – 20 wk
- Breeder 20 – 64 wk

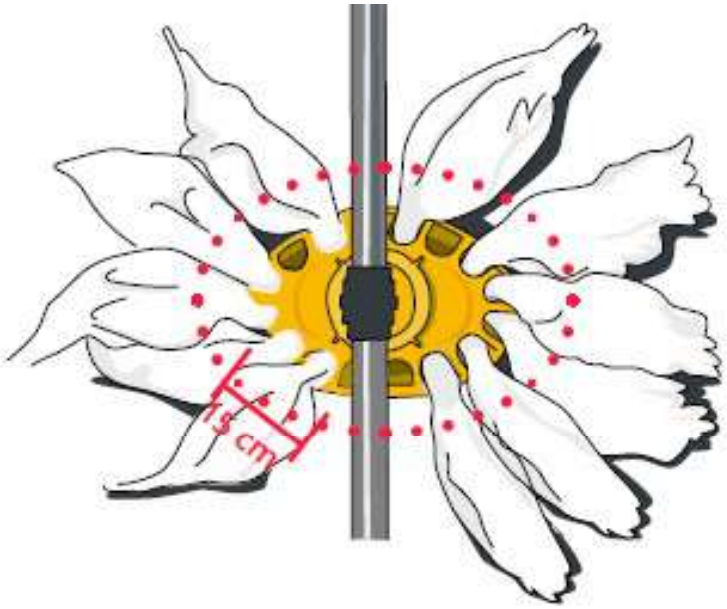
❖Complex

- Pre-starter 0 – 1wk
- Starter 1 – 4 wk
- Grower I 4 – 8 wk
- Grower II 8 – 12 wk
- Developer 12 – 19 wk
- Prebreeder 19 – 22 wk
- Breeder I 22 – 44 wk
- Breeder II 44 – 64 wk

Feeder Space



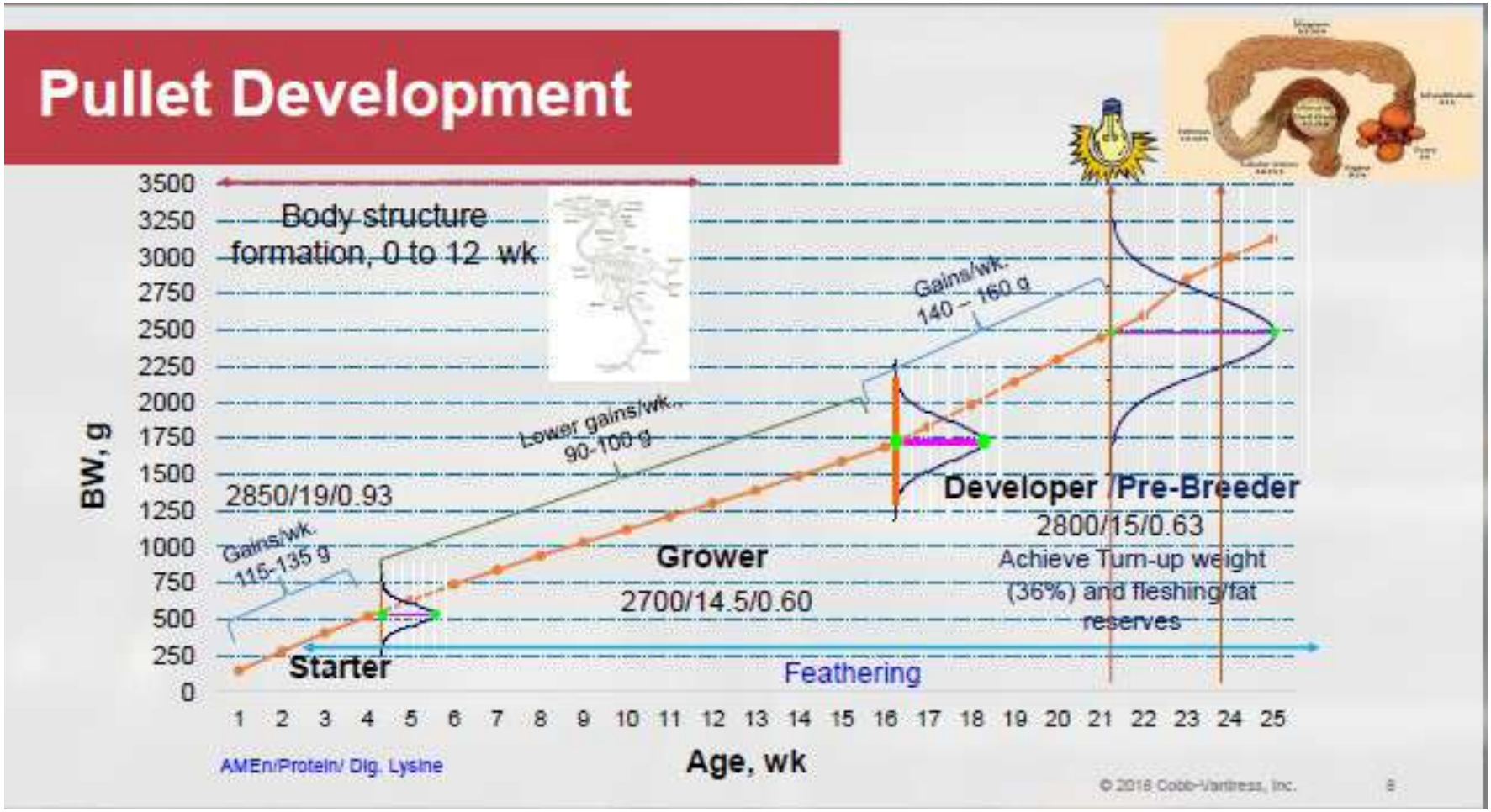
Chain feeder space is calculated based on the widest part of the full grown hen (15 cm). Divide the linear length of the chain feeder in cm by 15 to determine the number of birds each side of the chain feeder can accommodate.



Oval and pan feeder space is calculated based on the widest part of the full grown hen (15 cm). Use the actual feeding circle (red dotted line) to calculate the linear space available for the birds.

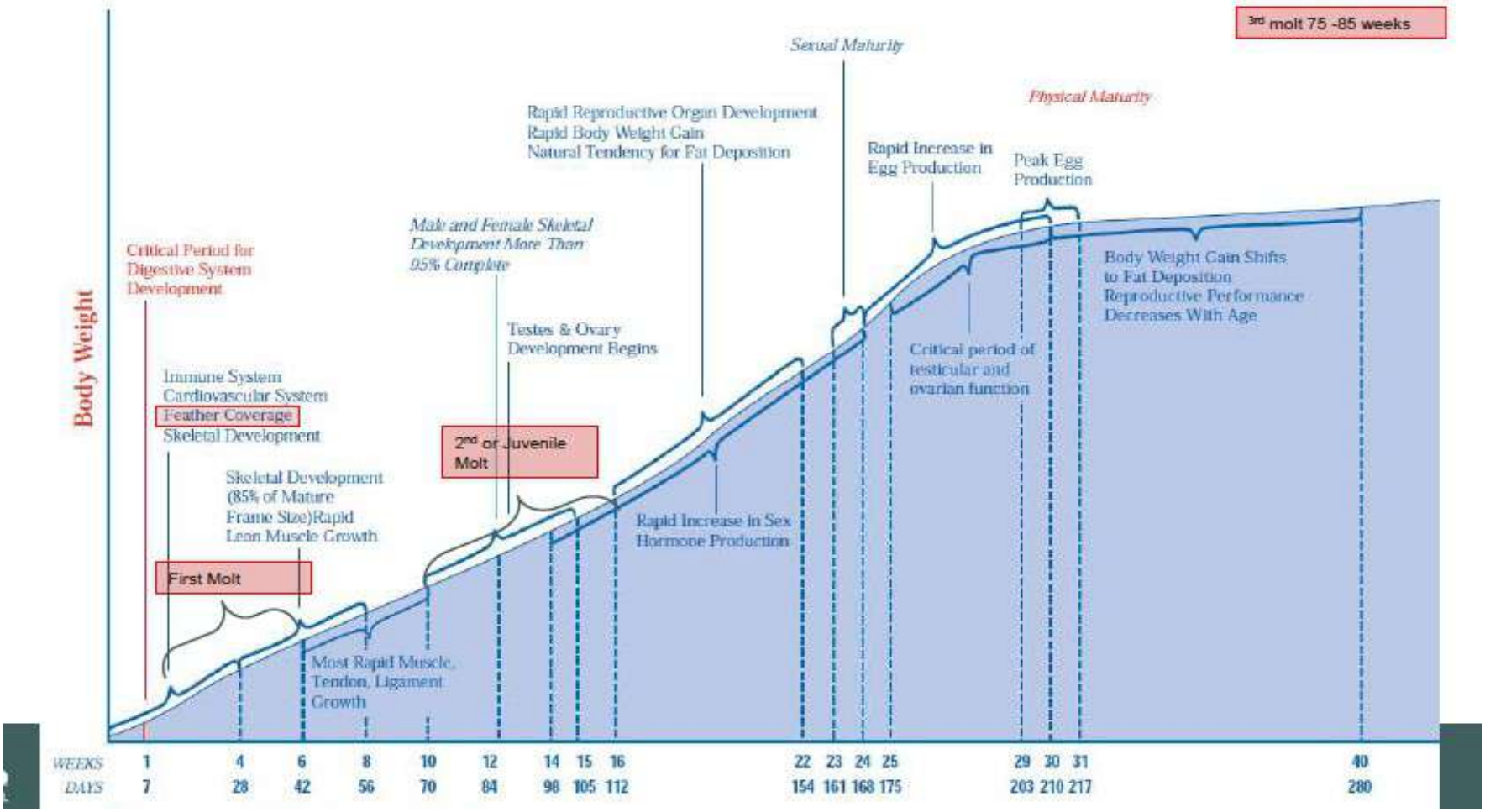
Cobb, 2018

Pullet Breeder



Cobb, 2018

Physiological Development



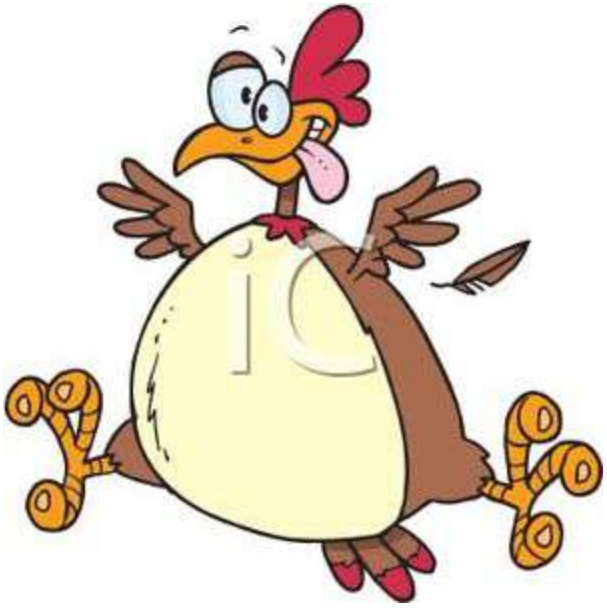
Corzo, 2020

Practical Feeding of Breeders

- Too much protein:
  - high lean growth (low fertility)
  - larger egg size
- Almost impossible to feed too little CP
- Too much energy
  - high fat growth – associated problems
- Too little energy:
  - loose body weight – then production & fertility

Feed Changes

- Stress when:
  - change nutrient
  - change ingredients
  - change texture
  - feed outages



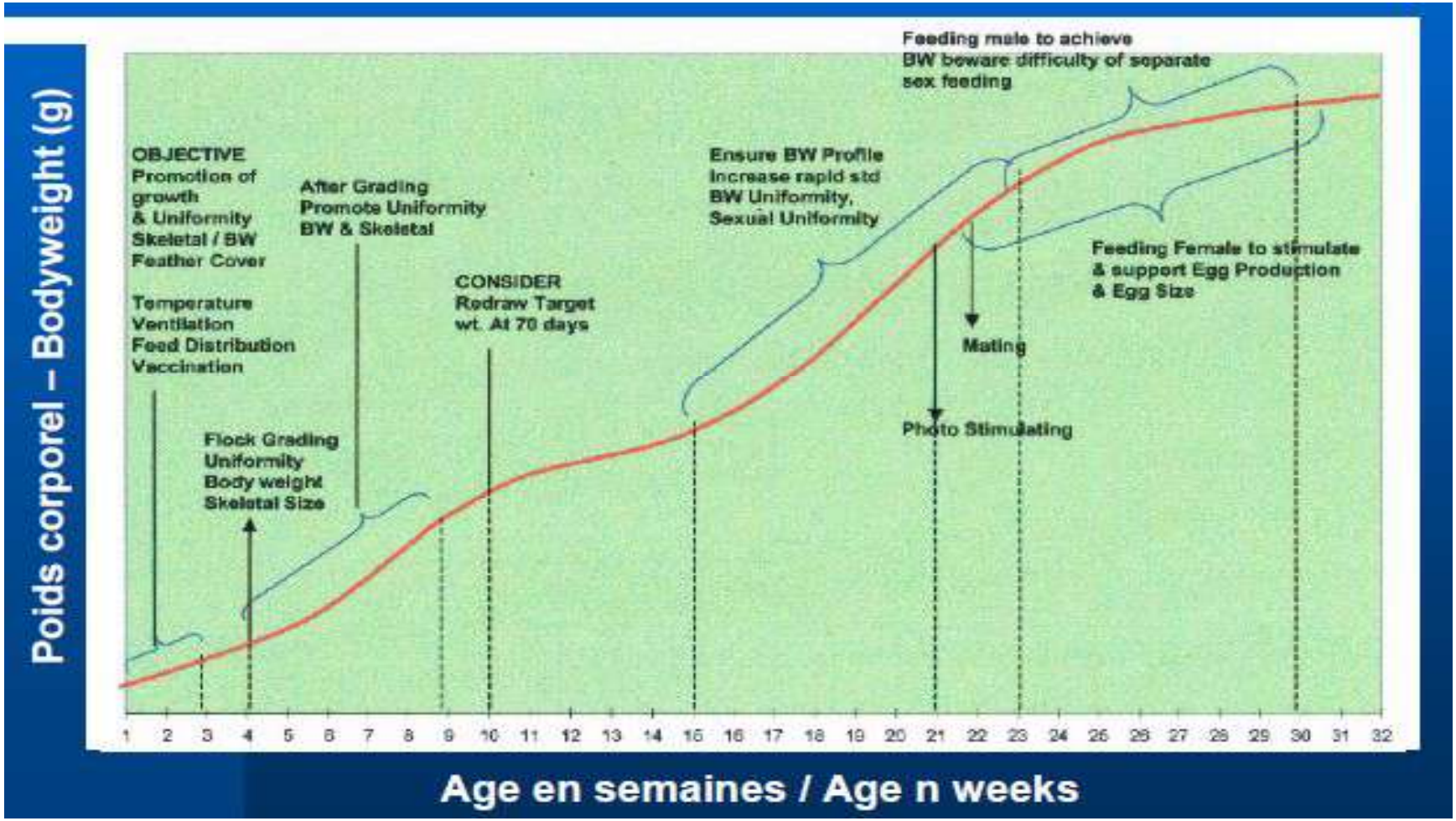
Rearing Phase

- Poor rearing – financial implication
- Correct weight for age & uniformity
- Correct body composition
- Too heavy rather than too light
- Uniformity – synchronized sexual maturity
- Promote future performance

Nutritional Goals

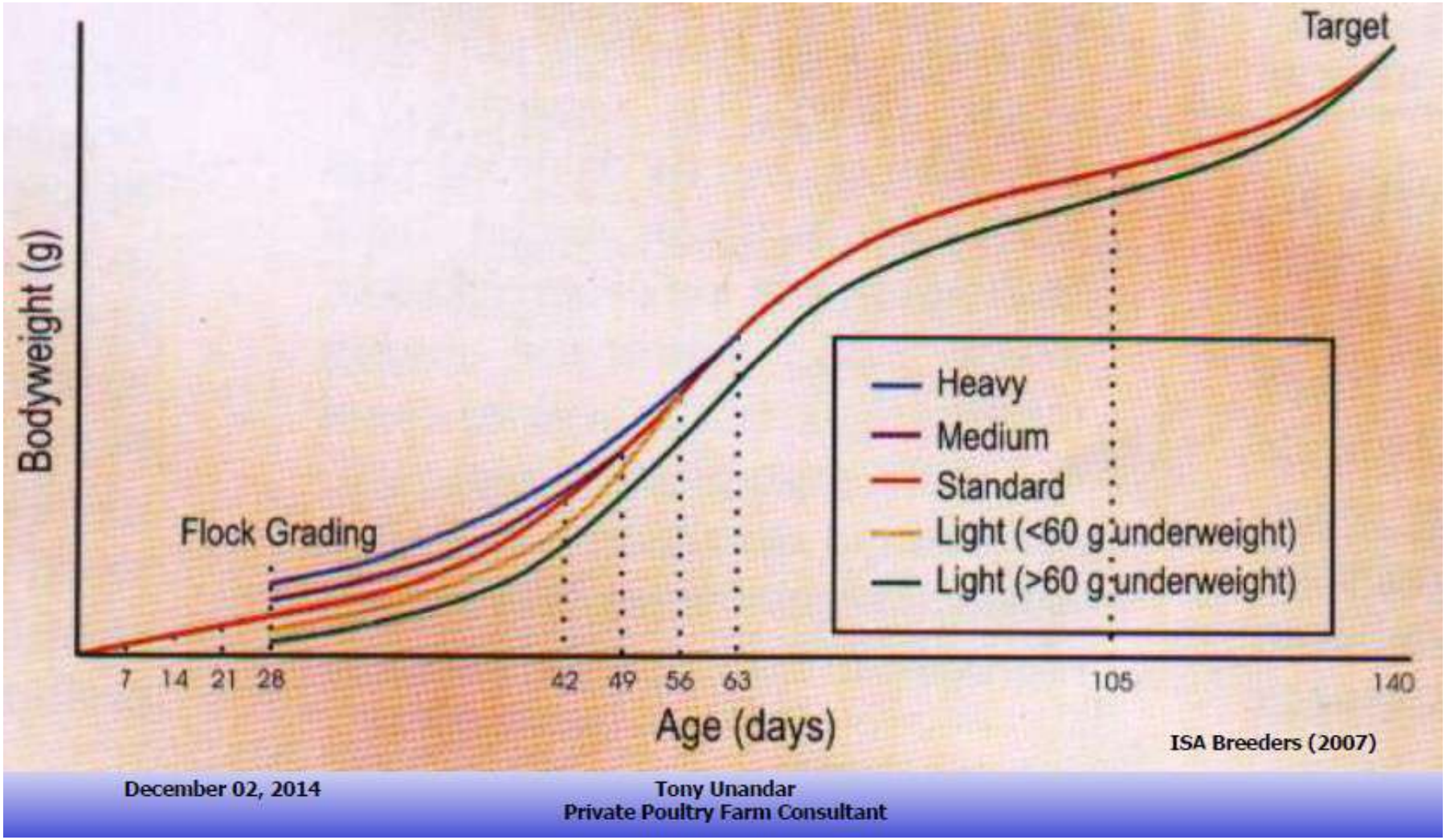
- Organ development – 5 to 6 weeks
- Frame size – 12 to 14 weeks
- Correct weight for age throughout rear
- Ensure adequate uniformity
- Positive energy balance at peak
- Control weight and feed intake during lay

Physiological Development



Hubbard, 2003

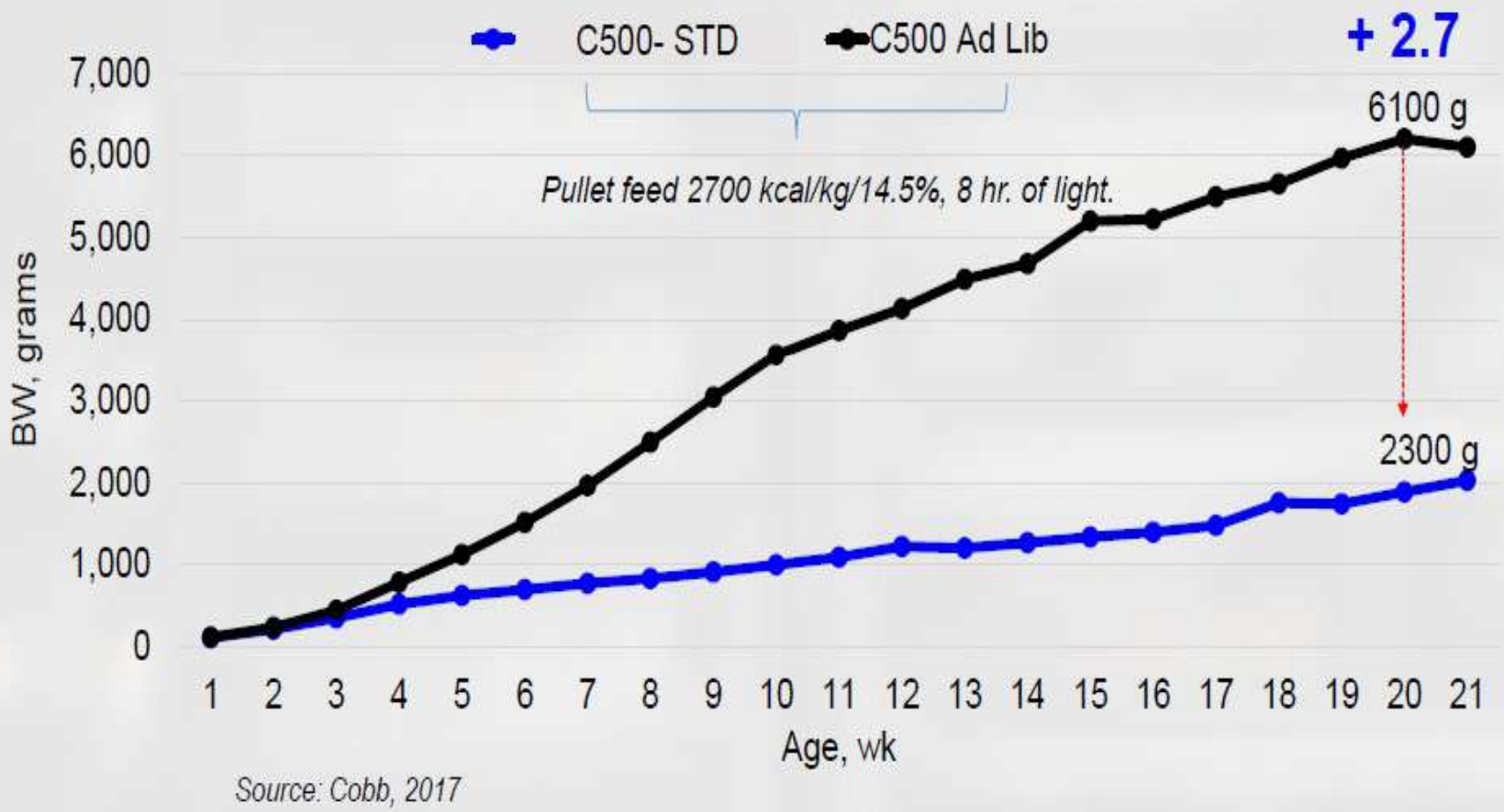
Grading


Target
Bodyweight (g)
Flock Grading
Heavy
Medium
Standard
Light (<60 g underweight)
Light (>60 g underweight)
7
14
21
28
42
49
56
63
105
140
Age (days)
ISA Breeders (2007)
December 02, 2014
Tony Unandar
Private Poultry Farm Consultant

Broiler Breeders - Rearing

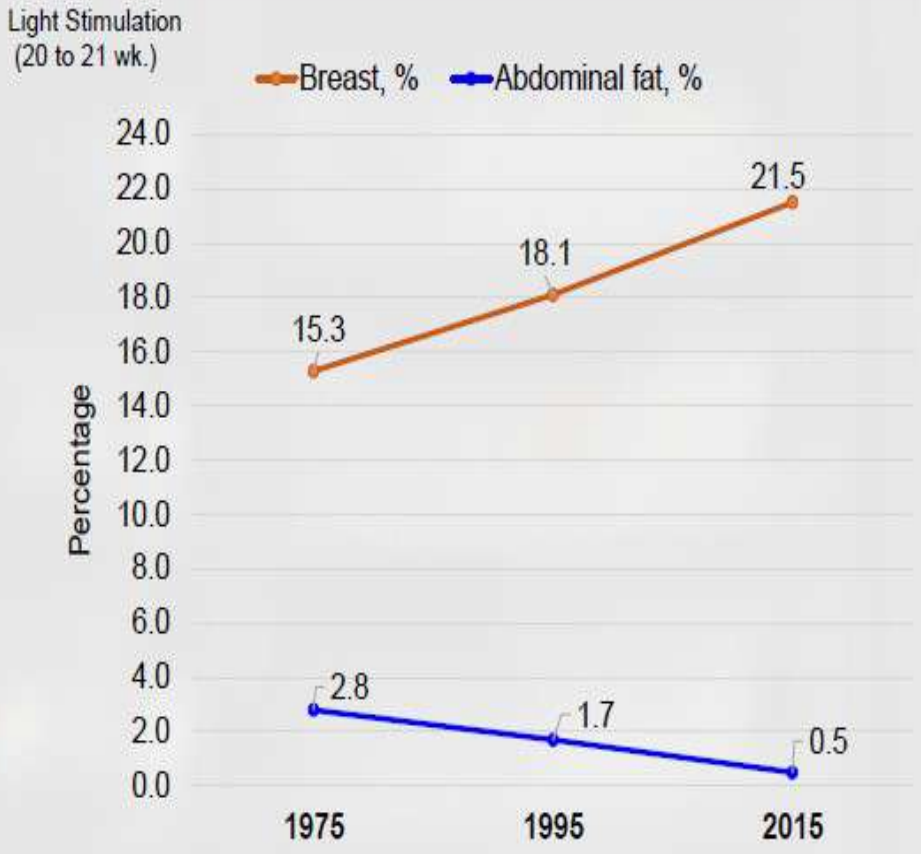
- Attainment of weight for age – difficult
  - larger mature weights
  - modern genotypes are very lean
- Growth slow – protein requirement low

Potential Growth of a Broiler Breeder



Source: Cobb, 2017

Change in Percentage Breast and Abdominal Fat in Breeders: 1975 to 2015



Source: University Alberta, Canada, PSA 2016

Source: Bowmake and Gous, 1989; Fattri et al , 1993, Renema et al, 2001a, Sun et al., 2006, Robinson et al., 2007, Mba et al 2010. From Van Emous 2018; Caldas 2019

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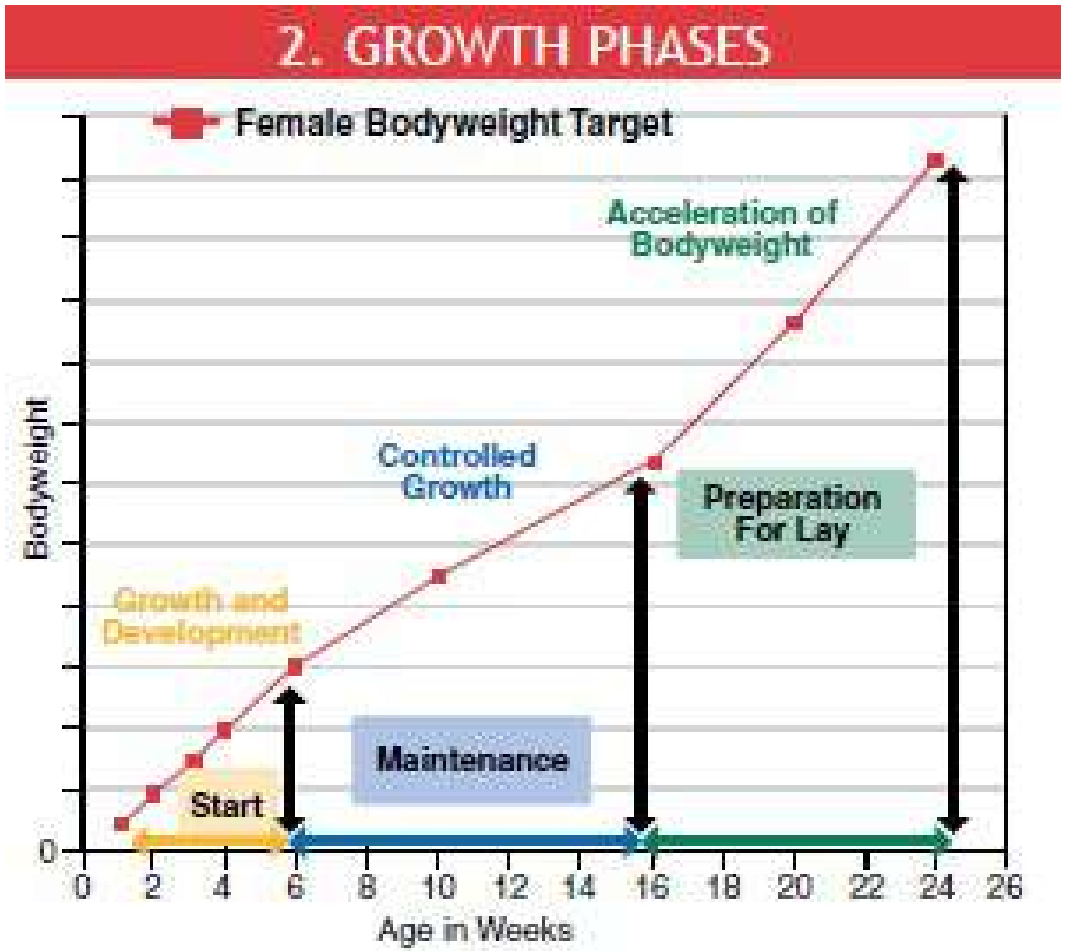
Feed Restriction

- Qualitative
  - low protein and/or energy – lead to variable flocks
  - severe cases – canibalism and feather peacking
- Quantitative
  - set amount each day
  - skip-a-day feeding
  - 5 days a week feeding
- Getting restriction correct – difficult
- Severe restriction of feed intake/growth
- Modern strain – require more restriction

Feed Restriction



Source: Cobb, 2008

Quantitative Feed Restriction

Q

What is the concept of skip feeding in rearing ?

Concept : To improve uniformity by even distribution and improving feed clean up time while maintain same feed gram/bird/week.

Resulting in uniform maturity, better production and livability.

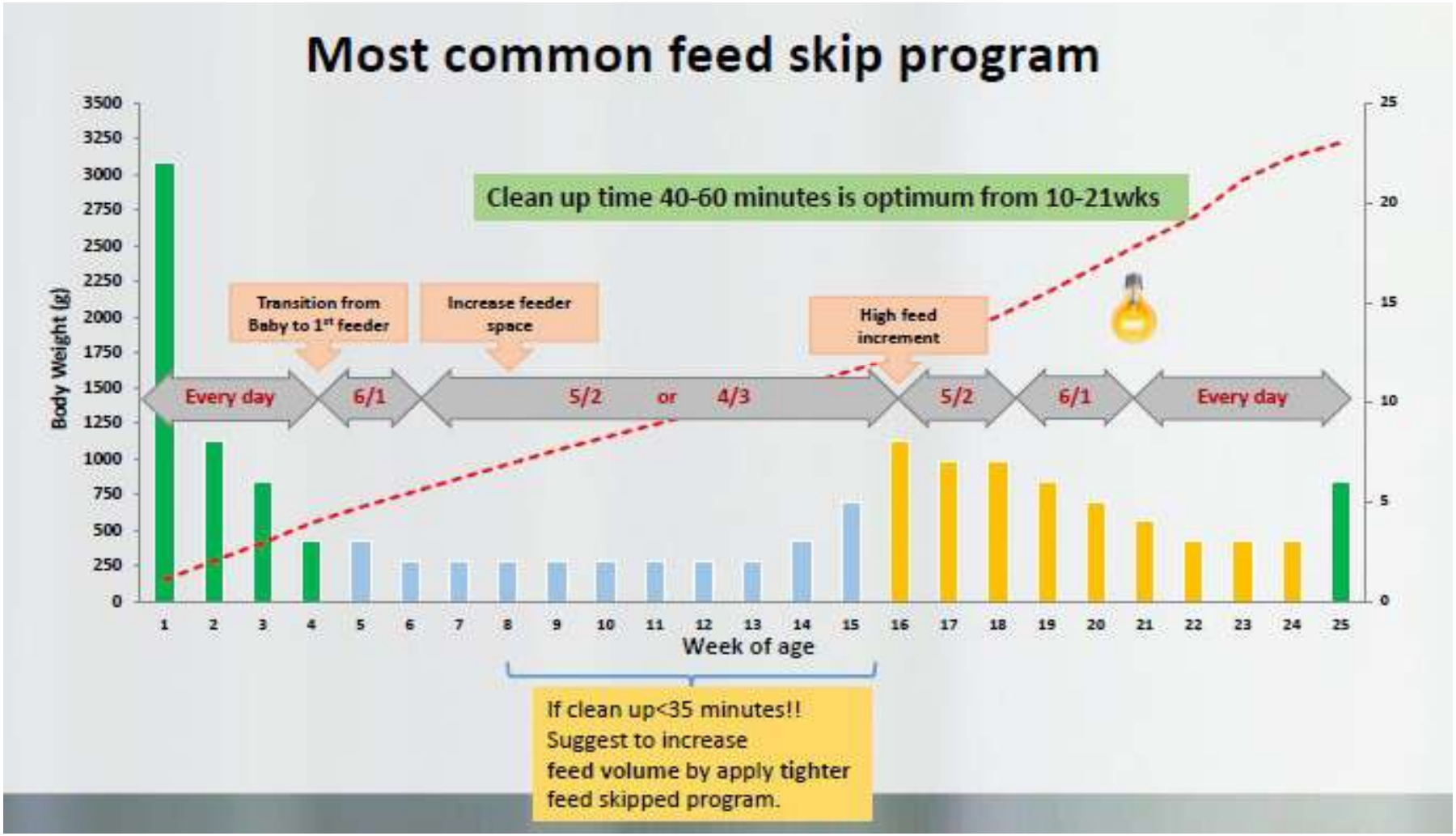
Every Day - Every day feeding
5/2 : $7days\ of\ feed \div 5$ Birds are fed 5 days & off 2 days
4/3- $7days\ of\ feed \div 4$ Birds are fed 4 days & off 3 days
Skip-a-day - Birds are fed every other day
6/1 - $7days\ of\ feed \div 6$ Birds are fed 6 days & off 1 days

Remark:
- Be aware of any national/local legislation.
- Never do 2 consecutive off days.
- Off feed day can set on the same placement day to complete week and able to weight bird without feed (dry weight)

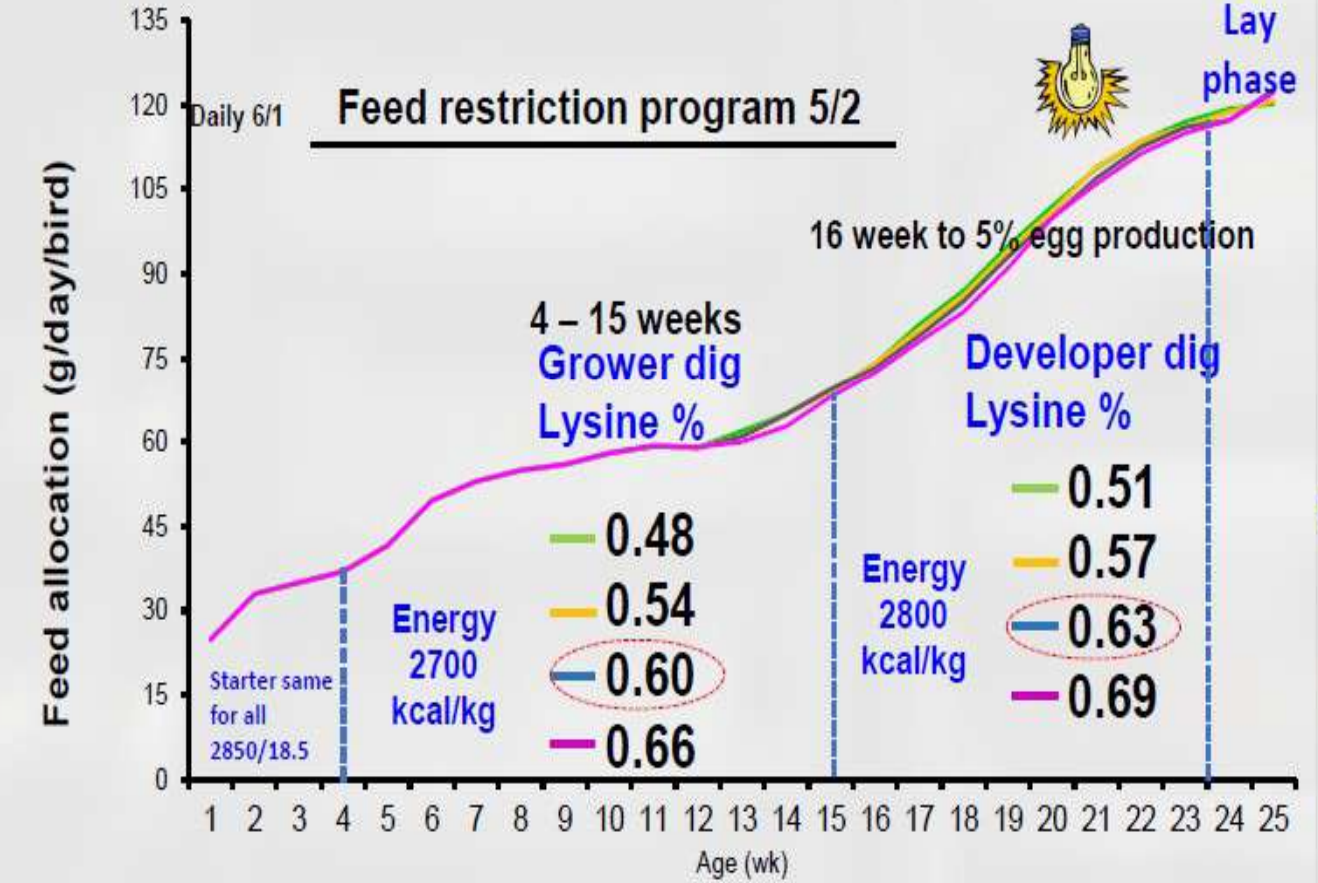
Week	Feed Day	Every Day	6/1	5/2	4/3	Skip-a-day
6	Sunday	on	on	on	on	on
	Monday	on	on	on	off	off
	Tuesday	on	off	off	on	on
	Wednesday	on	on	on	off	off
	Thursday	on	on	on	on	on
	Friday	on	on	on	off	off
	Saturday	on	on	off	on	on
7	Sunday	on	on	on	on	off
	Monday	on	on	on	off	on
	Tuesday	on	off	off	on	off
	Wednesday	on	on	on	off	on
	Thursday	on	on	on	on	off
	Friday	on	on	on	off	on
	Saturday	on	on	off	on	off

Cobb ONE FAMILY. ONE PURPOSE.

Common Feed Skip Program



Study 1: Amino Acid Nutrition in Rearing Affect Egg Production



Other amino acids were increased in the same ratio to Lysine

Source: NCSU, Oviedo 2018-2019

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Body Weight, CV, Feed and Digestible Lysine Intake at 10 wk

ONE FAMILY. ONE PURPOSE.

Std BW=1150

Target range: 98 to 102%

Dietary treatments	BW	CV	Weight/ STD WT	Cum Feed Intake	Cum Dig. Lys intake
	---(g)---	---(%)---	---(%)---	---(g)---	---(g)---
A = Dig. Lys 0.48%	1127[b]	11.2	98%	3101	19.2
B = Dig. Lys 0.54%	1139[b]	10.1	99%	3101	20.3
C = Dig. Lys 0.60%	1173[a]	9.8	102%	3101	21.6
D = Dig. Lys 0.66%	1194[a]	9.5	104%	3101	22.9

Cobb Rec.

Conclusion: The higher the dig. Lysine levels, the better the BW CV and the better the condition of the flock

Source: NCSU, Oviedo 2018-2019

Body Weight, Feed Intake and Organ Development at 20 wk

Dietary treatments	BW (97-101%)	Cum Feed Intake	Cum Dig. Lys intake	Relative to BW		
				Breast	Abd. fat	Liver
	---(g)---	---(g)---	---(g)---	----------(%)----------		
A = Dig. Lys 0.49/0.51	2267	8372	46	22.3 ^{b}	1.31	1.39 ^{b}
B = Dig. Lys 0.54/0.57	2313	8337	49	22.8 ^{ab}	1.01	1.75 ^{a}
C = Dig. Lys 0.60/0.63	2338	8302	53	23.6 ^{ab}	0.86	1.73 ^{a}
D = Dig. Lys 0.66/0.69	2351	7812	55	24.3 ^{a}	0.74	1.64 ^{ab}

Source: NCSU, Oviedo 2018-2019

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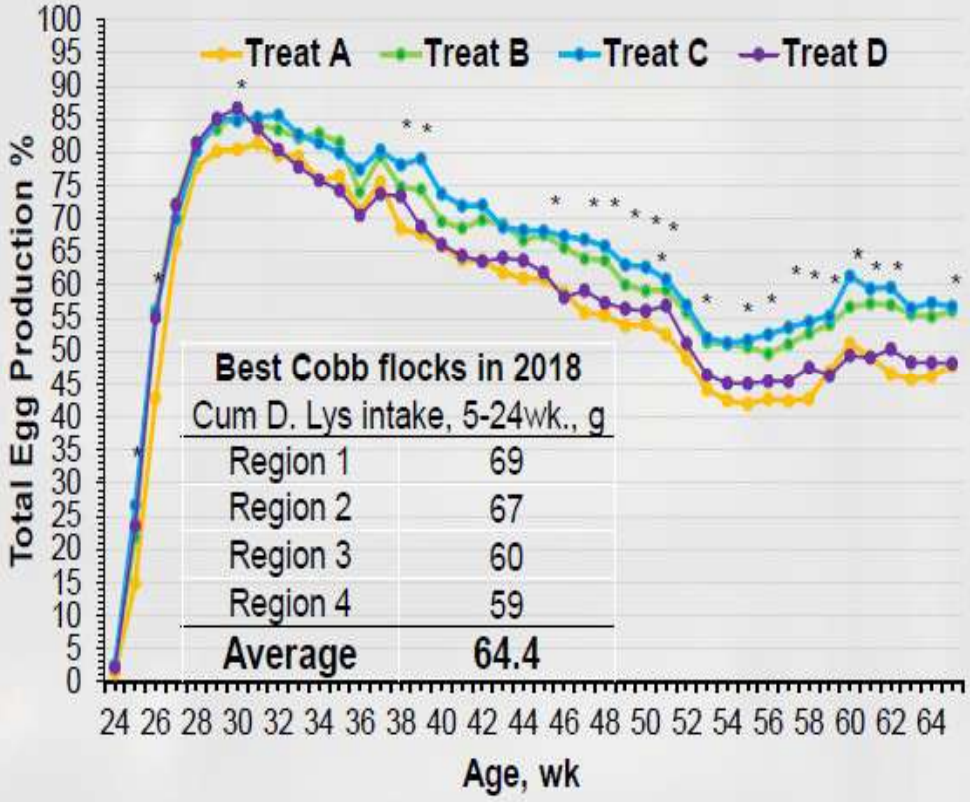
Amino Acid Intake During Rearing and its Effect in Production at 65 wk



Best Cobb flocks in 2018

Cum D. Lys intake, 5-24wk., g	
Region 1	69
Region 2	67
Region 3	60
Region 4	59
Average	**64.4**

Same feed amount and nutrients 2800/15/0.66 in breeder 1, and 2800/14.5/0.63 in breeder 2

Source: NCSU, Oviedo 2018-2019

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Cobb recommendations

	WK.	A	B	C	D
Grow 1, D. Lys, %		0.48	0.54	0.60	0.67
Develop, D. Lys, %		0.51	0.57	0.63	0.70
Cum Dig. Lysine intake, g (5-24 wk.)		53	59	**65**	68
Px, %	30	81 b	86 a	86 a	87 a
	40	66	69	**74**	66
TE/HH	40	72 b	78 ab	**79** a	75 b
	65	152 c	173 ab	**175** a	162 b

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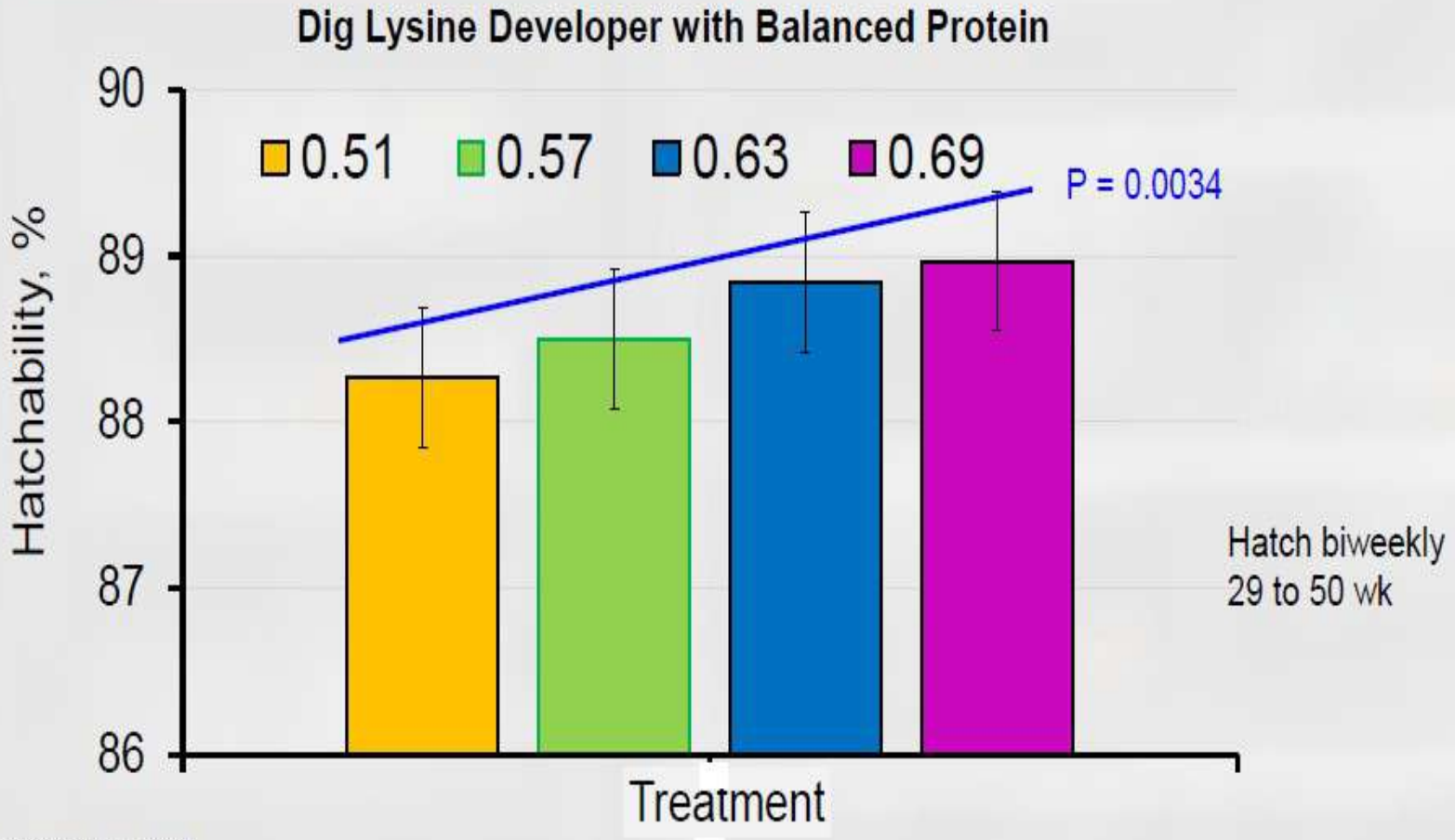
Effects of Dietary Amino Acid Level Fed During the Rearing Phase on Percentage Hatchability

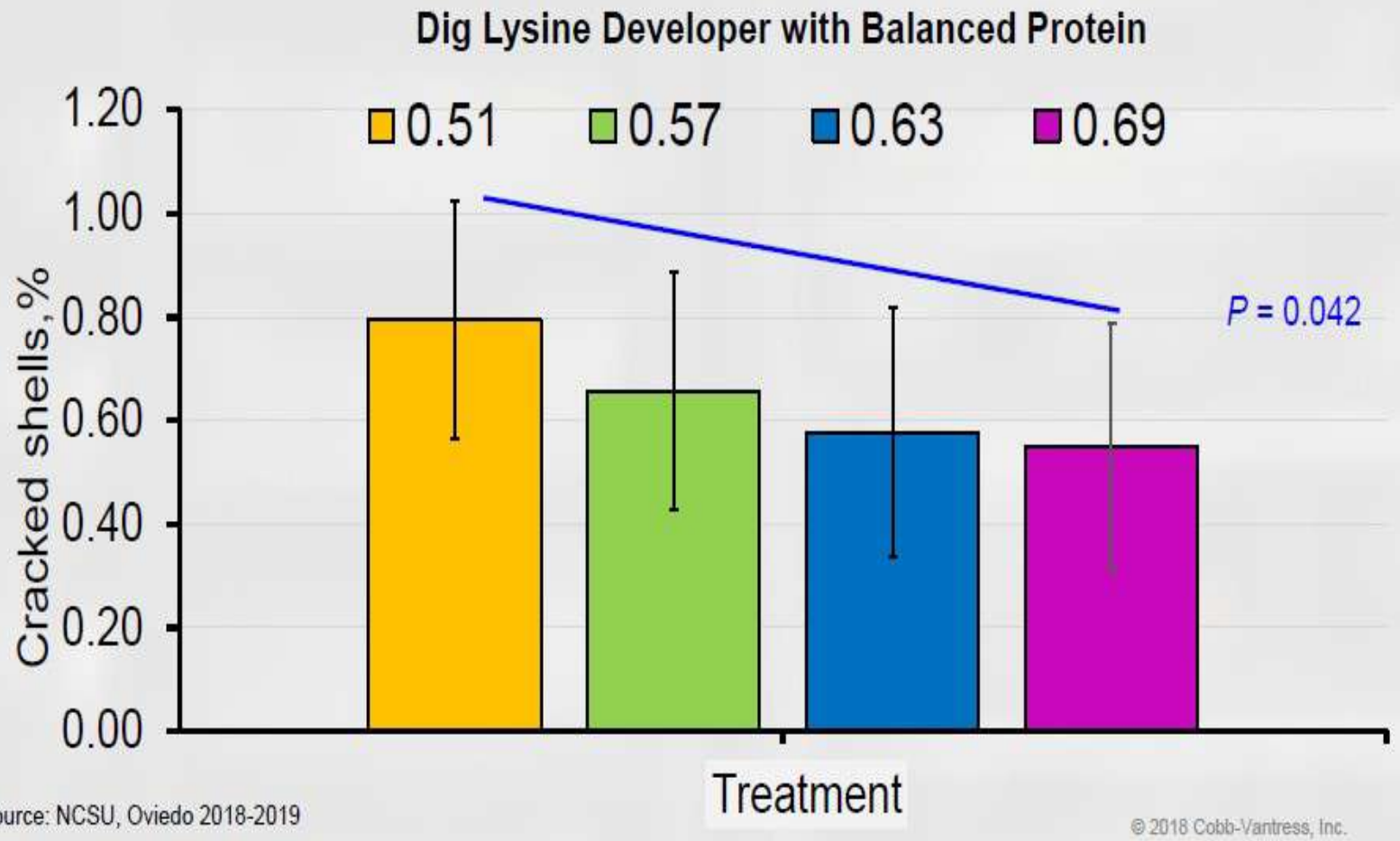
ONE FAMILY. ONE PURPOSE.



Source: NCSU, Oviedo 2018-2019

Effect of Dietary Amino Acid Level Fed During the Rearing Phase on Percentage Cracked Shells

ONE FAMILY. ONE PURPOSE.



Source: NCSU, Oviedo 2018-2019

Protein Intake from 1 to 20 wk

ONE FAMILY. ONE PURPOSE.

According to Brake, 1997, there is a need of 1180 g cumulative protein from 1-20 wk to have a good fertility.

TRIAL 1, 2018-2019

Dietary treatments	Cum CP Intake	Cum Dig. Lys intake	
	---(g)---	---(g)---	
A = Dig. Lys 0.49/0.51	1,119	46	
B = Dig. Lys 0.54/0.57	1,119	49	
C = Dig. Lys 0.60/0.63	1,184	53	Best Egg Production
D = Dig. Lys 0.66/0.69	1,132	55	

The Effect of Protein Intake During Rearing on Fertility and Hatchability

ONE FAMILY. ONE PURPOSE.

Feed in Rearing	Fertility, %	Hatchability, %
High Protein	94.4	87.1
Medium Protein	93.5	82.3
Low Protein	90.2	83.1
P-value	0.074	0.14

Digestible Lysine intake, g (1 to 20 wk.)

Feed in Rearing	Van Emous, 2015	Cobb, 2019 (NCSU)
High Protein	49.8	49.5 - 53.7
Medium Protein	47.8	
Low Protein	45.6	

Fertility & Hatchability were better when the protein was higher during rearing

Source: Van Emous, 2015

Feed Cost to Produce Broiler Breeder Products (US Dollars)

ONE FAMILY. ONE PURPOSE.

Diet Grower/ Developer	Feed Cost, US$/MT		Feed Cost, US$/bird	
	5-25 wk.	26-65 wk.	1- 25 wk.	1-65 wk.
A = Dig. Lys 0.49/0.51 %	232.1	248	2.87	13.71
B = Dig. Lys 0.54/0.57 %	233.7	248	2.90	13.73
C = Dig. Lys 0.60/0.63 %	237.8	248	2.94	13.73
D = Dig. Lys 0.66/0.69 %	240.5	248	2.87	13.60

Feed Cost to Produce Broiler Breeder Products (US Dollars)

ONE FAMILY. ONE PURPOSE.

Diet Grower/ Developer	Feed cost, U$/MT		Feed cost, U$/bird		Total Feed Cost 1-65 wk. U$/bird	# HE @ 65 wk.	Return invest. U$ cts 30 /HE	Feed Cost, U$ cts/ HE
	5-25 wk.	26-65 wk.	1- 25 wk.	26-65 wk.				
A = Dig. Lys 0.49/0.51	232.1	248	2.87	10.84	13.71	**148**	44.4	9.3
							Source: Asia cost average	Feed is about 30% of the cost of HE
C = Dig. Lys 0.60/0.63	237.8	248	2.94 (+2.4%)	10.79	13.73 (+0.1%)	**171**	51.3 (+15%)	8.0 (-13%)

A more expensive feed in rearing @ 65 wk of +2 U$ cents/ ♀ is payed back in production with more HE (+23) & higher return of +6.9 U$/hen & a 13% lower feed cost/ HE

Study 2: Fat Reserve by Lowering Amino Acids

ONE FAMILY. ONE PURPOSE.

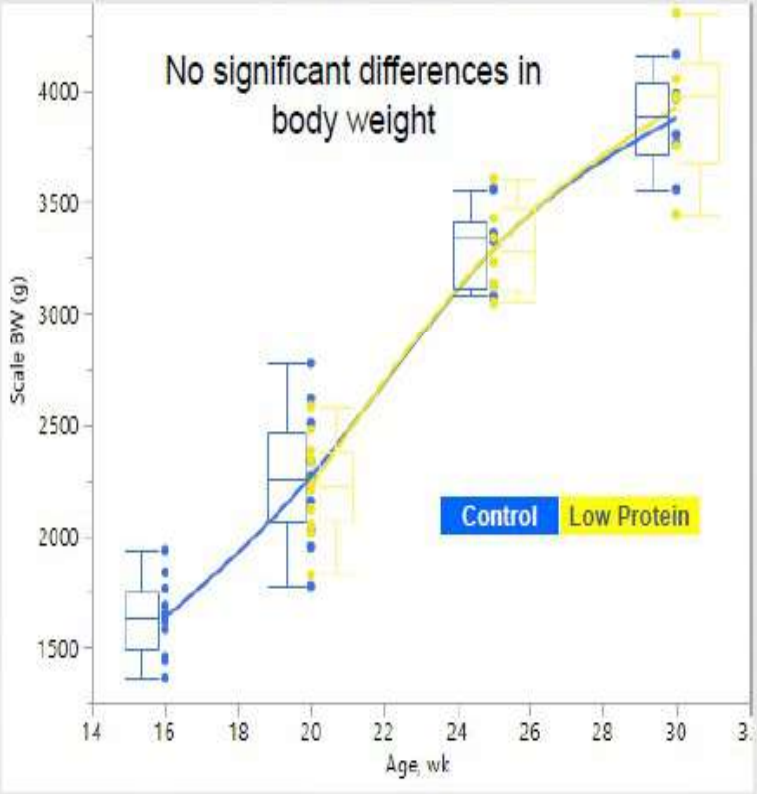
Developer Feed, 16 to 24 wk

	Control	Low Protein	Difference
Energy, kcal/kg	2865	2865	0
Crude Protein, %	15.0	13.5	-1.5
SID Lys, %	0.70	0.60	-0.10
Energy /Protein	191	212	+21
Energy/SID Lys	4093	4775	+682

Source: Dr. Coon's group, University of Arkansas & replicated at Cobb facilities

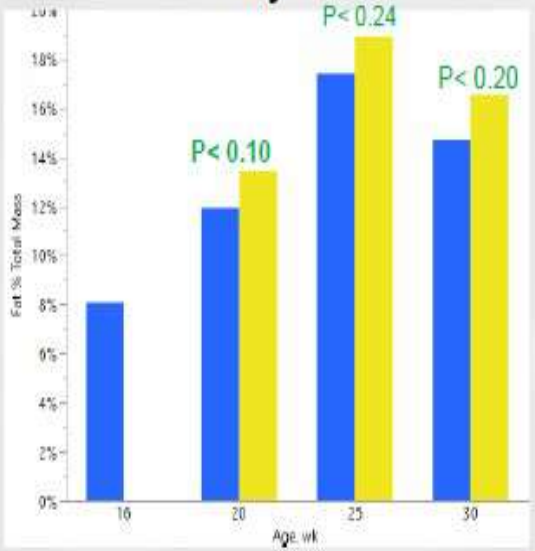
Body Weight, Body Fat and Body Protein of Pullets from 16 to 30 wk

Body Weight, g

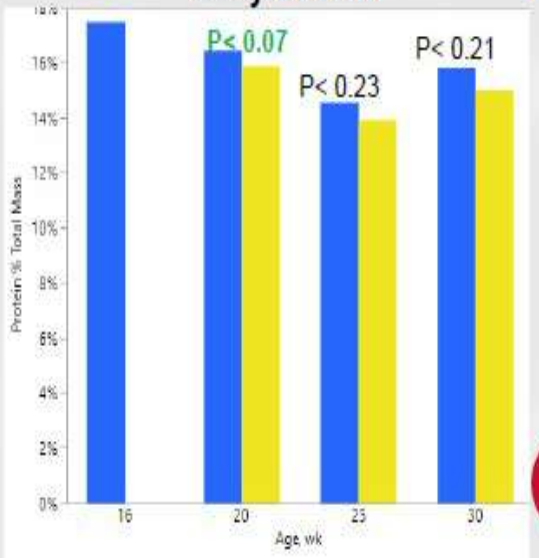


Source: Dr. Coon's group, University of Arkansas

Body Fat



Body Protein



Control Low Protein

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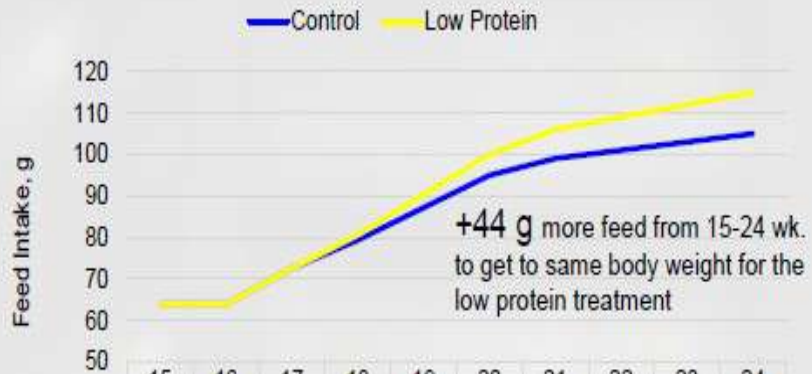
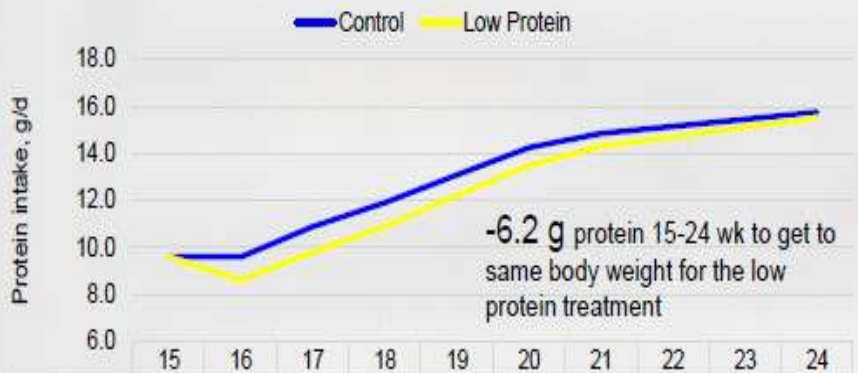
Feed Intake, g/d



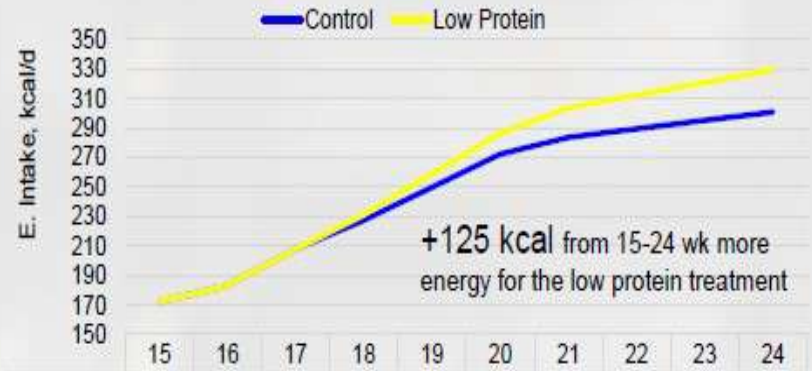
	15	16	17	18	19	20	21	22	23	24
Control	64	64	73	79	87	95	99	101	103	105
Low Protein	64	64	73	81	90	100	106	109	112	115

Protein intake g/d



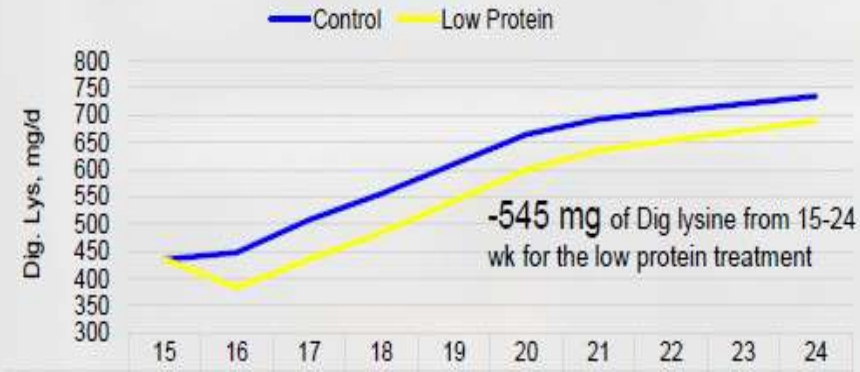
	15	16	17	18	19	20	21	22	23	24
Control	9.6	9.6	10.9	11.9	13.1	14.3	14.9	15.2	15.5	15.8
Low Protein	9.6	8.6	9.8	10.9	12.2	13.5	14.3	14.7	15.1	15.5

Energy intake, kcal/d



	15	16	17	18	19	20	21	22	23	24
Control	172	183	208	227	250	272	284	289	295	301
Low Protein	172	183	208	231	259	287	304	312	321	329

Digestible Lys intake mg/d



	15	16	17	18	19	20	21	22	23	24
Control	435	448	508	556	610	665	693	707	721	735
Low Protein	435	384	435	484	542	600	636	654	672	690

Source: Dr. Coon's group, University of Arkansas

Cobb ONE FAMILY. ONE PURPOSE.

Effect of Control and Low Protein in Total Egg Production

ONE FAMILY. ONE PURPOSE.

STD 500FF 166.2

Treatment	28 wk	32 wk	36 wk	40 wk	44 wk	48 wk	52 wk	56 wk	60 wk
Control (15% CP)	21.4	45.8	67.8	88.3	107.5	107.5	140.5	154.6	167.9
Low Protein (13.5%)	20.2	44.7	66.8	87.7	106.5	105.4	140.0	155.7	169.5
					NS				

Source: Dr. Coon's group, University of Arkansas

Is fat reserve very important to have good performing flocks? **YES, there is a minimum requirement of fat.**

How much fat reserve is really important to start egg production?

We still need to find an objective method to define it since the palpation of pubic bones is subjective and prone to error, we are working on this.

FAT is not the only deciding factor to determine the moment of light stimulation (MOL), but it needs to be in combination with body weight, uniformity, and fleshing condition. MOL needs to happen between 147-154 days of age when BW and fleshing are correct, even when fat is still behind.

Study 3: Impact of Feeding a Low Protein Diet on Feather Development

ONE FAMILY. ONE PURPOSE.

Low Weight (80% STD– Low Protein)

CP intake (1-20 wk.): 944 g

D. Lys intake (1-20 wk.): 40 g

Cobb Recommendations

CP intake (1-20 wk.): 1197 g **+253g**

D. Lys intake (1-20 wk.): 51 g **+11g**

Source: Cobb, 2019-2020

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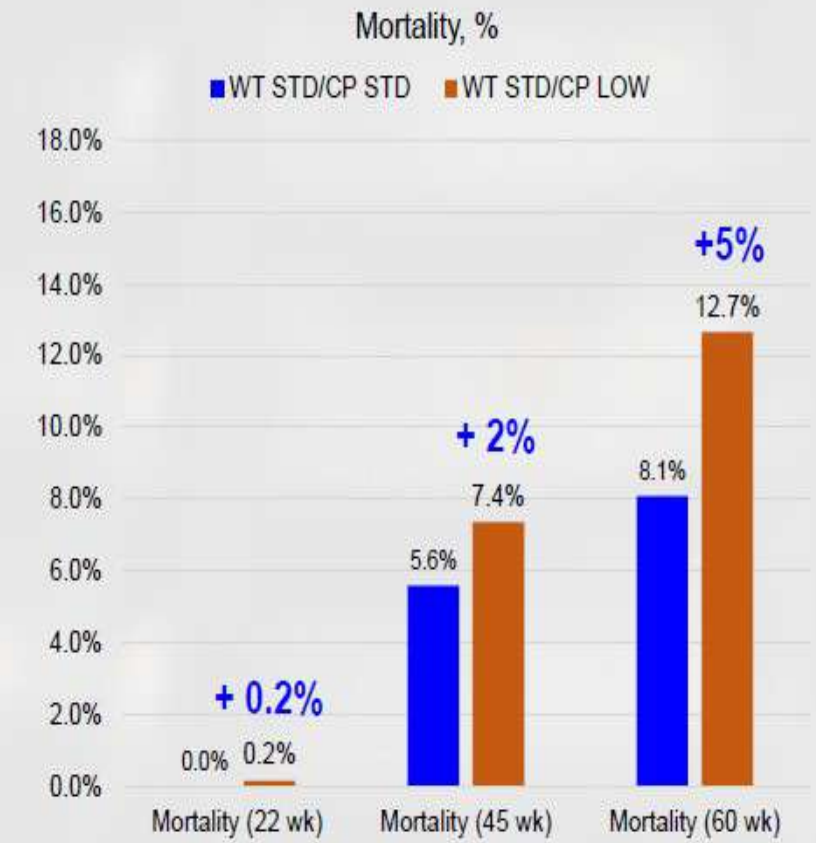
Effects of Protein Intake During Rearing on % Mortality During Production

ONE FAMILY. ONE PURPOSE.

Same body weight, different protein



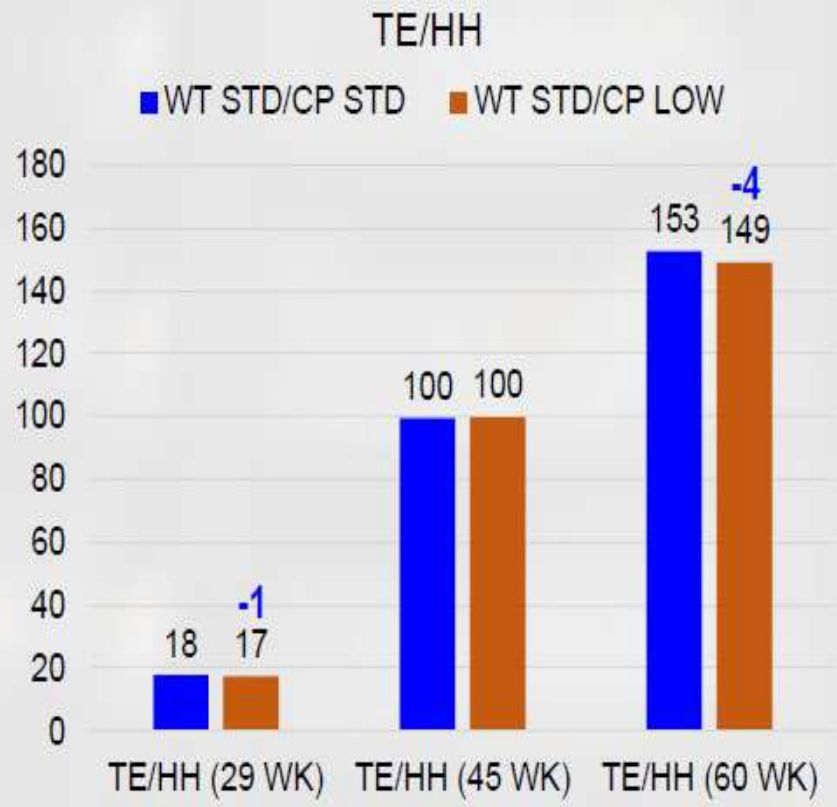
Source: Cobb, 2019-2020

Different body weight, different protein

Effects of Protein Intake During Rearing on Percentage Egg Production

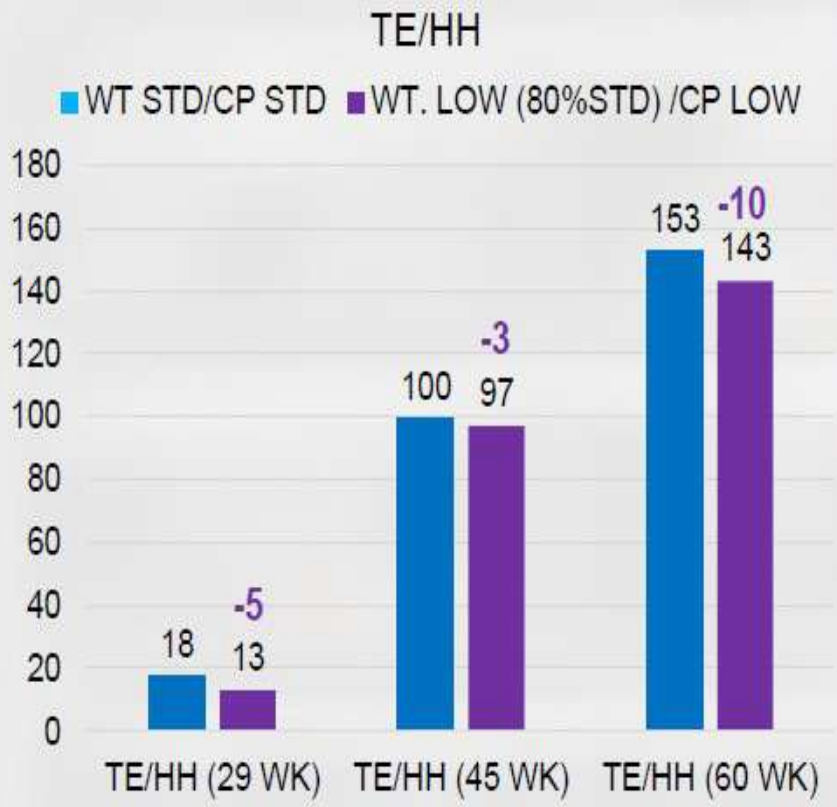
ONE FAMILY. ONE PURPOSE.

Same body weight, different protein



Source: Cobb, 2019-2020

Different body weight, different protein



Protein Intake from 1 to 20 wk

ONE FAMILY. ONE PURPOSE.

TRIAL 1, 2018-2019

Dietary treatments	Cum CP Intake	Cum Dig. Lys intake	
	---(g)---	---(g)---	
A = Dig. Lys 0.49/0.51	1,119	46	
B = Dig. Lys 0.54/0.57	1,119	49	
C = Dig. Lys 0.60/0.63	1,184	53	Best
D = Dig. Lys 0.66/0.69	1,132	55	

NCSU, Oviedo 2018-2019

TRIAL 3, 2018-2019

Dietary treatments	Cum CP Intake	Cum Dig. Lys intake	
	---(g)---	---(g)---	
Low BW (80%STD)/ Low CP	944	40	
Supp. BW/ Low CP	1,125	48	
Supp. BW/ Supp. CP	1,197	51	Best

Cobb USA, Rao-Caldas 2018-2019

- According to Brake, 1997, there is a need of 1180 g cumulative protein from 1-20 wk to have a good fertility.

30

Broiler Breeders - Rearing

- Protein too low – negative impact ovary
- High protein intake
  - large breast muscle
  - low carcass fat
  - excessive follicular development
- Energy intake is the controlling factor

Practical Rearing

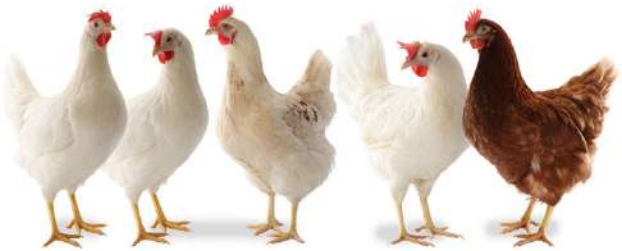
- Can feed pretty much anything
- Provided feed allowance & weight correct
  - feed specification 20%
  - feed allocation 80% (Leeson, 2014)

Practical Rearing

- Determine what is happening on the farm
- Adjust the specs (same profile as broilers)
- Avoid feeding too much protein
- Measure fat content of birds
- Then don’t change anything !!
  - nutrients
  - ingredients
  - texture

Bird Uniformity

- Most important management tool.
- Feed average bird
- Over feed light birds
- Underfeed heavy birds
- More restrictive – worse CV
- Tend to get worse with age



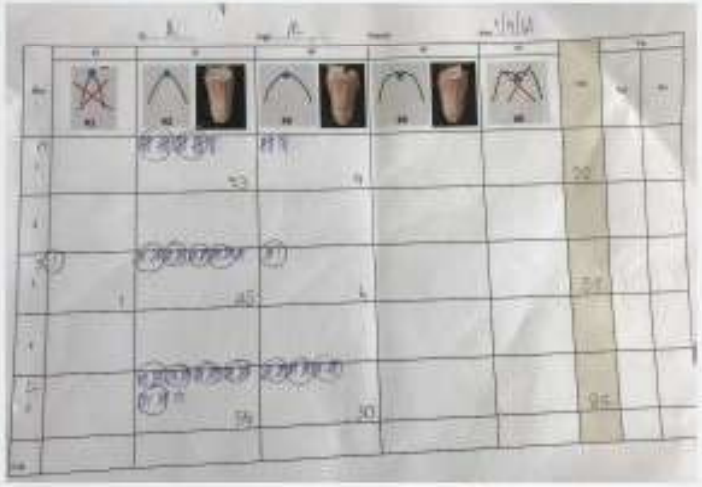
Fleshing and Fat Pat Measurement

Q

How much fat pad in cm is better for optimum?

To decide moment of photo stimulation, we don't measure fat reserve **in quantitative** (cm, gram etc.) but we measure the presence of fat reserve **in qualitative** (yes/no) and calculate % of yes

- If there is **fat,** we consider it as **"yes"** bird
- If there is **no fat,** we consider it as **"no"** bird



Goal: At 147-148 days, flock should have "fat reserve" 90-95% of population

Cobb ONE FAMILY. ONE PURPOSE.

Fleshing Monitoring

Explanation of female fleshing scores

FLESHING 1

Substantially under the desired level of fleshing - very thin birds. Birds with this degree of fleshing need to be evaluated for culling.

FLESHING 2

Ideal breast shape at 12 weeks of age and the lowest fleshing condition over the life of the bird.

FLESHING 3

Breast fleshing shape at 16 to 25 weeks during early preparation for lay

FLESHING 4

Breast fleshing shape at 19 to 25 weeks during preparation for lay.

FLESHING 5

Oversized breast muscle.

Goals for flock percentage (females only) with fleshing score and pelvic fat based on flock age

Age (weeks)	Fleshing Score			Total #3 + #4 (%)	Pelvic fat (%)
	Score 2 (%)	Score 3 (%)	Score 4 (%)		
12	70	30	0	30	0
16	40	60	0	60	0
19	<10	60	30	90	>65
20	<5	60	35	95	>75
21	0	60	40	100	>85
22	0	60	40	100	>90

Cobb, 2018

Fat Pad Measurement

Cobb, 2018

Laying Birds

- Lay – mirror of rearing
- Sexual maturity – new physiological state
- Continuum – can't repair rearing damage
- Breeders
  - strive to achieve mature body weight
  - Huge appetite – large and obese – die
  - must control feed intake

Laying Birds

- Can’t make nutrient shortfall – intake
- Consistency all important
- Feed allocation:
  - Body weight and condition
  - Egg production
  - Feed finishing time

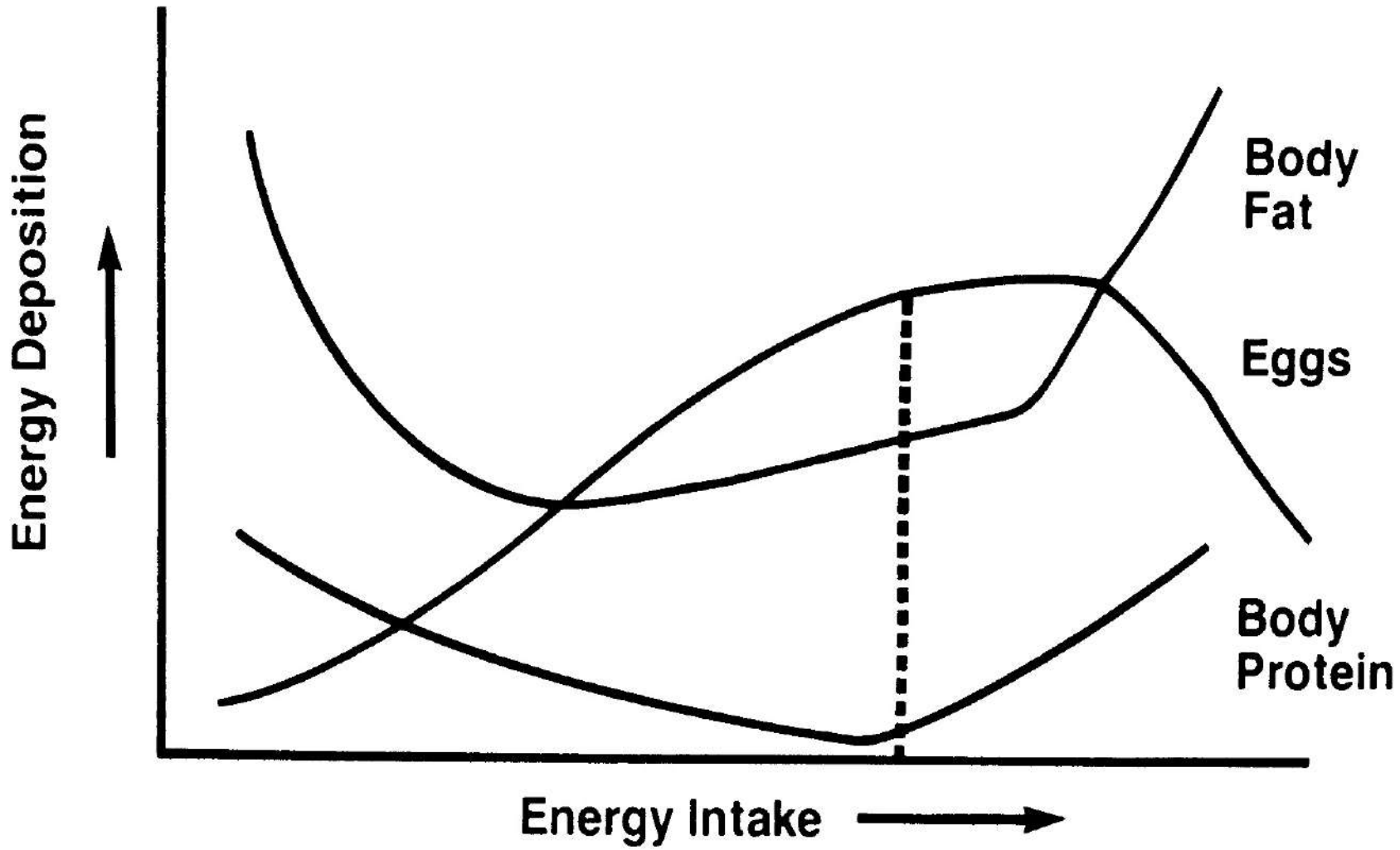
Energy

- Has the largest impact on cost
- Energy most critical component (nutrient) of the diet of the broiler breeder.
  - they have relatively large frame size
  - they have a relatively low egg output
- Practically – feed allocation depends on the energy level in the diet.

Practical Implications

- Energy level – an economic / management decision
- If price or availability of ingredients
- High energy diets – consumed faster
- Uniformity problems can arise
- Birds tend to become overweight
- Prefer lower density diet

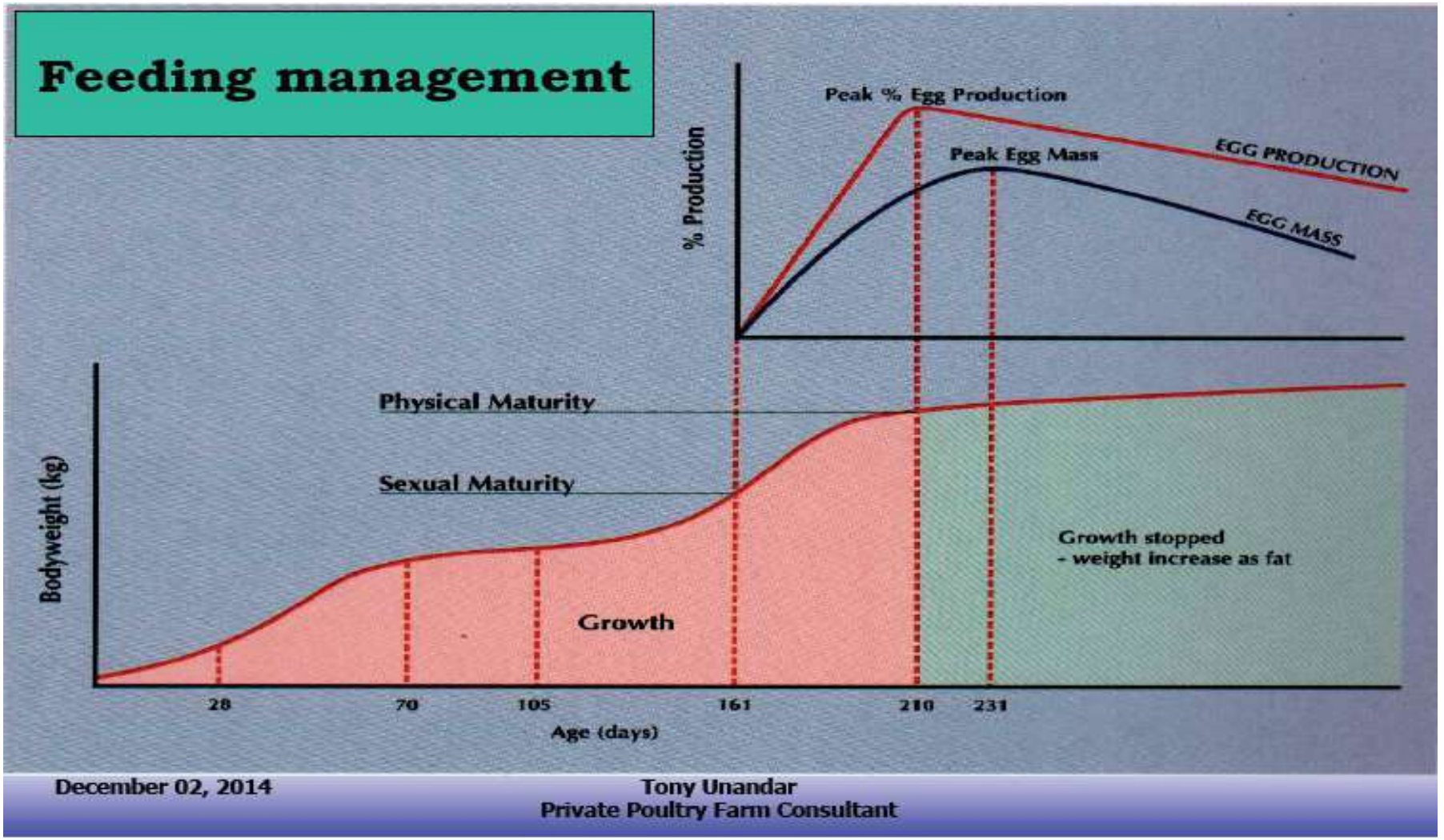
Fig. 6.3 Schematic representation of adult breeders response to diet energy intake.



Laying Birds the Challenge

- Although protein can't be ignored, the driver for feed allocation is energy.
- Challenge – what to do prior to peak
- Body weight increases by 40%
- At 10% production yolk development at 30 – 40%

Laying Phase



Laying Birds

- Peak feed allocation should occur before peak production
- Uniform flock at 35%
- Poor flock at 55 or 60%
- Low energy intake / poor fat reserves to poor and short peak

Peak

- Post peak nutrient requirements change
- Birds require more energy and less protein
- Birds take longer to finish feed
- A bird will not lay more eggs if overfed – rather she will get fat
- Feed withdrawal must begin to prevent birds from getting over weight

Importance of Body Weight

- Overweight – lay erratically, smaller clutches
- Increase in soft – shelled eggs
- Recruitment of excess follicles – double and triple yolk eggs
- Hens to go out of production early
- Reduced fertility and poor mating success
- Embryonic survival may be reduced

Feed Withdrawal

- Loss of weight indicative of too severe
- Remove 3 to 5 g/b/d at any one time
- If sexes are fed together you need 5 – 10% more feed
- Floor feeding requires more feed
- Feed refusal – temperature, feed texture, diarrhoea, fat, salt, mycotoxins

Male Breeder

- In a broiler breeder house, it is the females that are perceived to be of greater value. In reality, although the male population is only 15%, of the breeder house the males and females actually represent equal value.
- The males and females contribute equally, to the production, genetics and cost of the commercial broiler and finally profit.

Male Breeder

- Both the Male and Female can be responsible for contributing to fertility problems.
- The impact of the MALE on flock fertility is approximately 10 x' s greater than the female.
- Continual selection for broiler traits doesn't appear to negatively affect Sperm Quality. However, today's males tend to gain weight more easily, potentially leading to reduced Mating Efficiency & Interest.

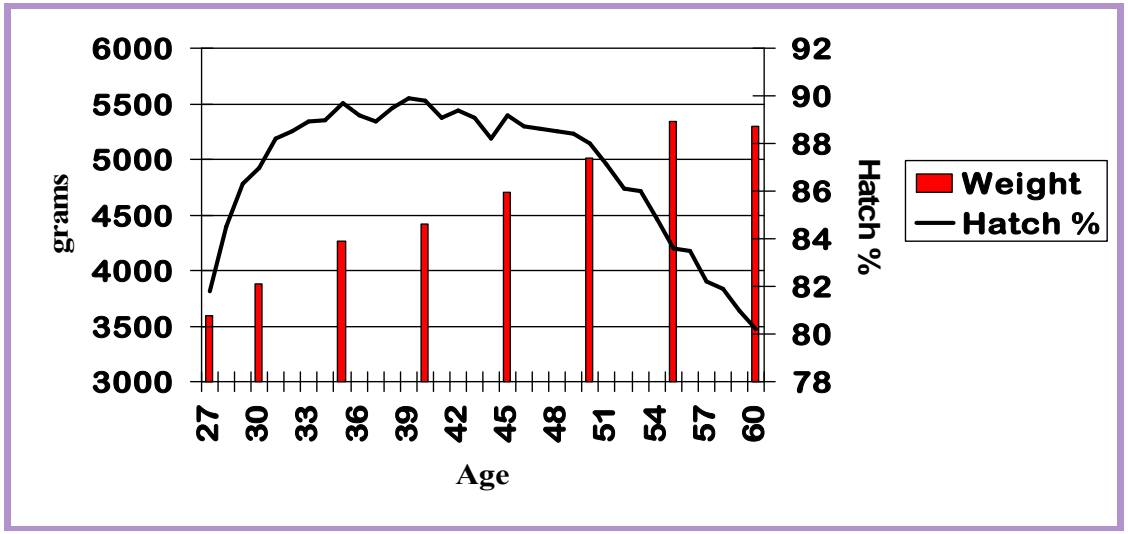
Male Fertility = Sperm Quality + Mating Efficiency

Male Breeder

- Fertility problems can present themselves as poor **Peak Fertility**, **Poor Persistency**, or **both**.
- Poor Peak Fertility can be related to:
  - Sperm quality issues
    - Due to problems created during rearing (poor growth, stress…)
    - Inadequate weight gain post lighting
  - Inadequate male / female interaction:
    - Unreceptive hens
    - Incorrect M / F weight differential
    - Incorrect M / F sexual synchronization
    - Excessive male number

Male Breeder

- Poor Persistency is a more common problem and can be attributed to:
  - Reduced mating efficiency.
  - Reduced interest (libido).
  - Decline in sperm volume/quality



Male Feeding Program

- Basic needs:
  - Growth
  - Maintenance of body function
- Major criteria:
  - Monitoring body weight and body condition
  - Control frame size and uniformity

Male Feeding Program

- Feed restriction has a negative impact on absolute testes weight.
- Male should not be allowed to lose body weight as this has an immediate effect on testes size and fertility.
- At the same time, excessive fleshing reduces mating activity and leads to reduces testes size.

Male Feeding Program

- Rearing period
  - Use female rearing diet
  - Avoid low protein starter diet
- The most critical period is during early maturity.
  - A continued monitoring of bodyweight is essential.
- Separate feeding should begin during the rearing period.

Male Feeding Program

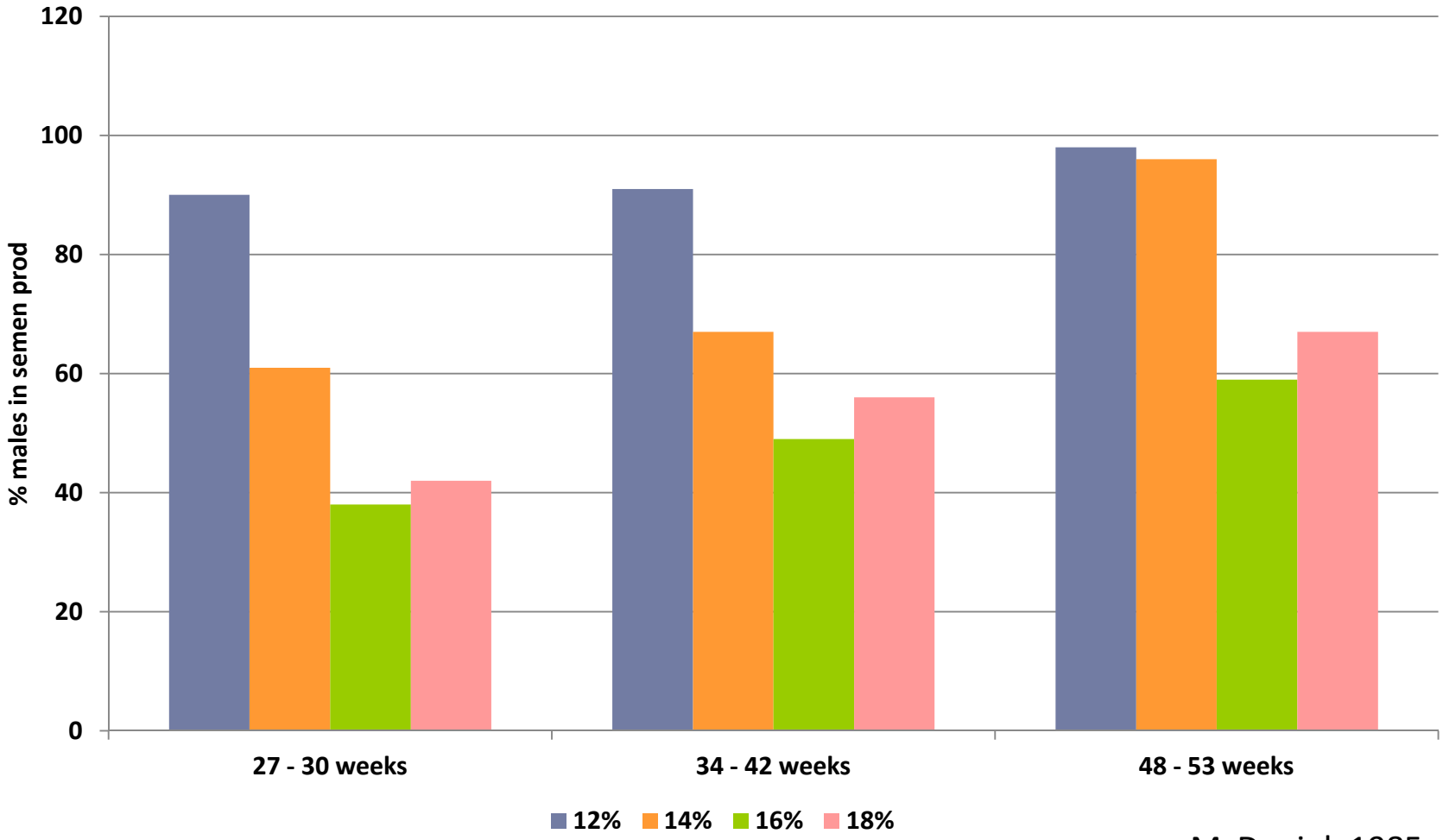
- Separate Feeding:
  - Better uniformity of males and females
  - Improve body weight control of males and females
  - The opportunity to use different feeds for males and females
  - Increase fertility and hatchability
  - Reduce feed consumption

Separate Feeding Technique

- Female only Grill (FOG)
  - Grill horizontal width of 44mm (1-11/16”)
  - Grill vertical height of 60-65 mm (2-9/16”)
- Partial dub or NO dubbing of males
- NOZ-bones
- Prevent females stealing from males.
  - Keep male feeders 45-50 cm (18-20”) high

Separate Feeding Technique

Protein Diet vs Fertility



McDaniel, 1985

Take Home Messages

- Broiler breeders are possibly the most difficult chicken to manage and feed. Not only is growth rate negatively correlated with reproductive performance, but nutrient intake is determined by both the feed specification and the feed allocation on farm.
- Solid team work among breeding team, veterinarian, nutritionist, formulation and feedmill team.
- When in doubt – apply the breeder manual.

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Thank You