The Nutrition and Feeding of Pullets

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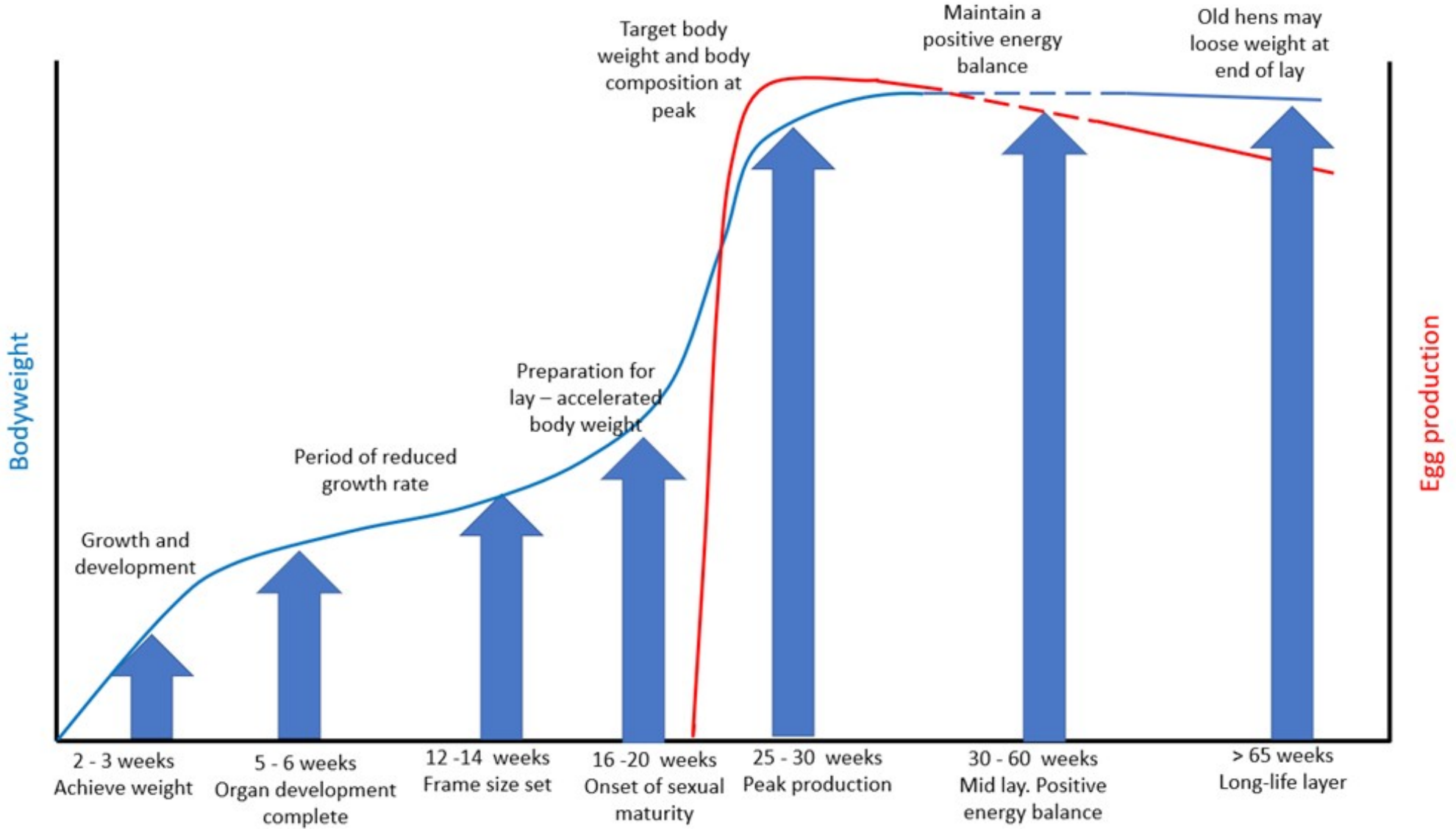
Introduction

- Number of changing factors to consider when feeding layers
  - Poultry genotypes continue to evolve.
  - Hens are being kept for longer.
  - Consumer pressure – alternative housing.
  - The economic landscape is prone to ups and downs.
  - We now appreciate that sustainability is crucial.
- What has not changed – we must make a profit.

Layer life cycle – a continuum.



Phases and Goals

Nutritional Goals

- Organ development by 5 to 6 weeks.
- Frame size by 12 to 14 weeks.
- Correct weigh for age at point of lay:
  - Aim for 10% more in hot climates.
  - Acceptable uniformity.

Nutritional Goals

- Correct body composition at point of lay:
  - Enough but not excessive.
  - Well developed organs.
  - Positive energy balance (fat).
- Frame too small – too much fat – prolapse.
- Well developed appetite.
- Good plumage.

Nutritional Goals

- Pre-peak:
  - Requirements for egg, growth, maintenance.
  - Feed intake – may be constrained.
- Post-peak:
  - Hens in steady state. Must be in positive energy balance.
- Late lay:
  - Egg quality and egg number a challenge.
  - Not a lot of data.

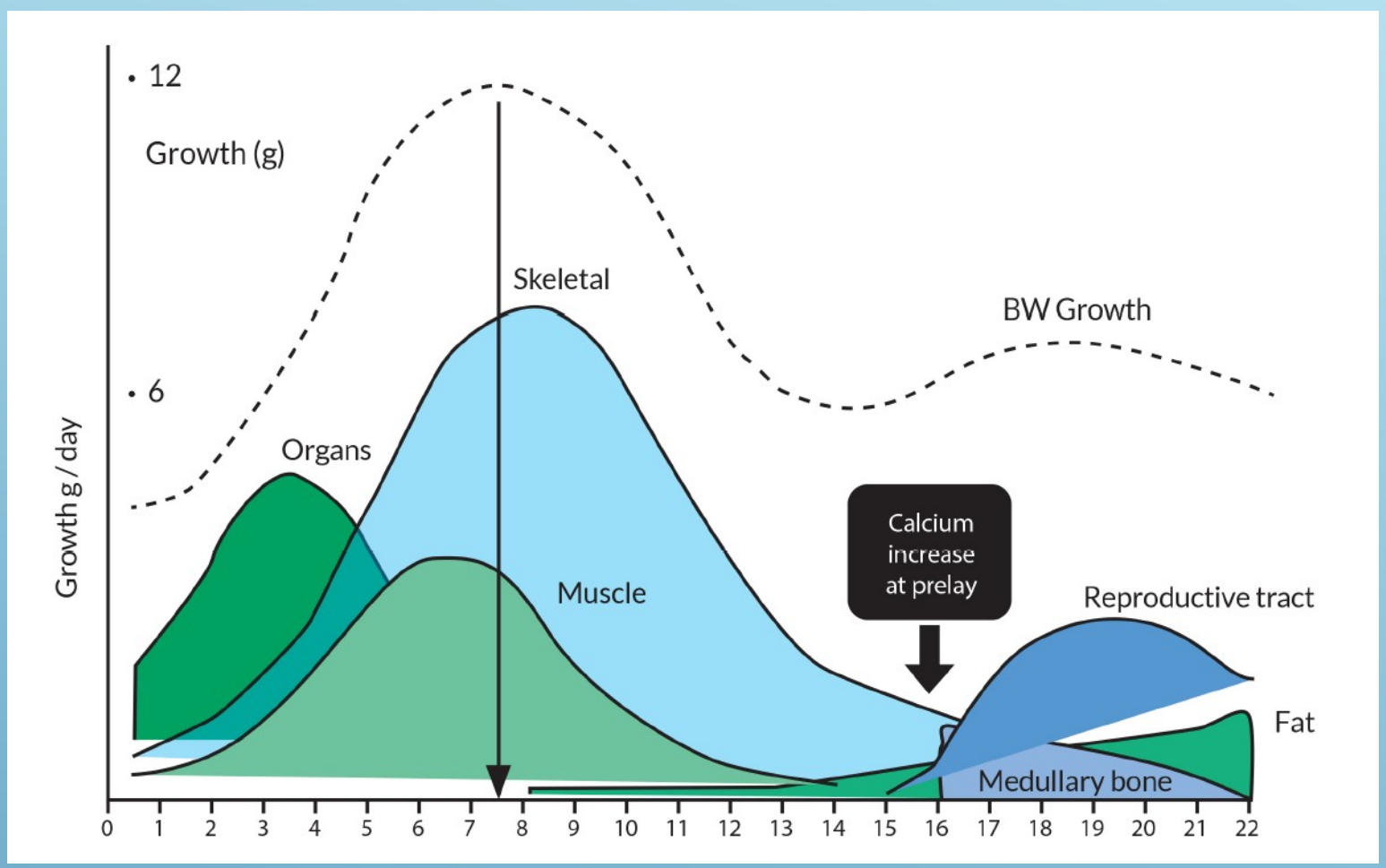
The Future – “Long Life” Layers

- Will need to focus on:
  - Egg quality – both internal and external.
  - Liver and gut health.
  - Viability of the oviduct.
  - Skeletal integrity (Ca metabolism).
  - Plumage.

Rearing

Nutrition of Pullets

- Age at maturity has decreased.
- Attainment of weight for age - difficult.
  - Younger at point of lay – trend has stopped.
  - Modern birds are smaller & shy eaters.
- Slightly heavy birds lay best.
- Uniformity is important.
- Some “ideal” body composition is important.


12
Growth (g)
6
Growth g / day
Skeletal
BW Growth
Organs
Muscle
Calcium increase at prelay
Reproductive tract
Fat
Medullary bone
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Energy

- Energy intake is the limiting factor.
- Anything that impacts on feed intake will play a role.
- Stimulate feed intake in young bird:
  - Plenty feed on paper.
  - Use crumbles for 3 weeks .
  - Use and alternating lighting program

Energy During Rear

(Saldana *et al.*, 2015)

		VLE	LE	ME	HE	VHE	Lys/ME
Starter	kcal/Kg	2850	2900	2950	3000	3050	
(0-5 weeks)	MJ/kg	11.9	12.1	12.3	12.6	12.8	0.81
Grower	kcal/Kg	2700	2750	2800	2850	2900	
(5-10 weeks)	MJ/kg	11.3	11.5	11.7	11.9	12.1	0.74
Finisher	kcal/Kg	2600	2650	2700	2750	2800	
(10 - 17 weeks	MJ/kg	10.9	11.1	11.3	11.5	11.7	0.56

Lohmann Brown

Energy effect to 5 weeks

(Saldana *et al.*, 2015)

Energy		Daily FI	ADG	CV	Gizzard (at 5 weeks)	
kcal/Kg	MJ/kg	(g)	g	%	Relative %	pH
VLE	11.9	21.2[a]	9.4	8.65	4.55	3.19
LE	12.1	21[ab]	9.4	8.02	4.58	3.05
ME	12.3	21[ab]	9.4	8.44	4.32	2.95
HE	12.6	20.8[ab]	9.5	7.71	4.38	3.09
VHE	12.8	20.6[b]	9.5	8.58	4.35	3.07
Mash		21.1[a]	9.1[a]	8.57	5.08[a]	2.97[b]
Crumbles		20.7[b]	9.7[b]	7.98	3.79[b]	3.17[a]

Energy effect for Rearing Period

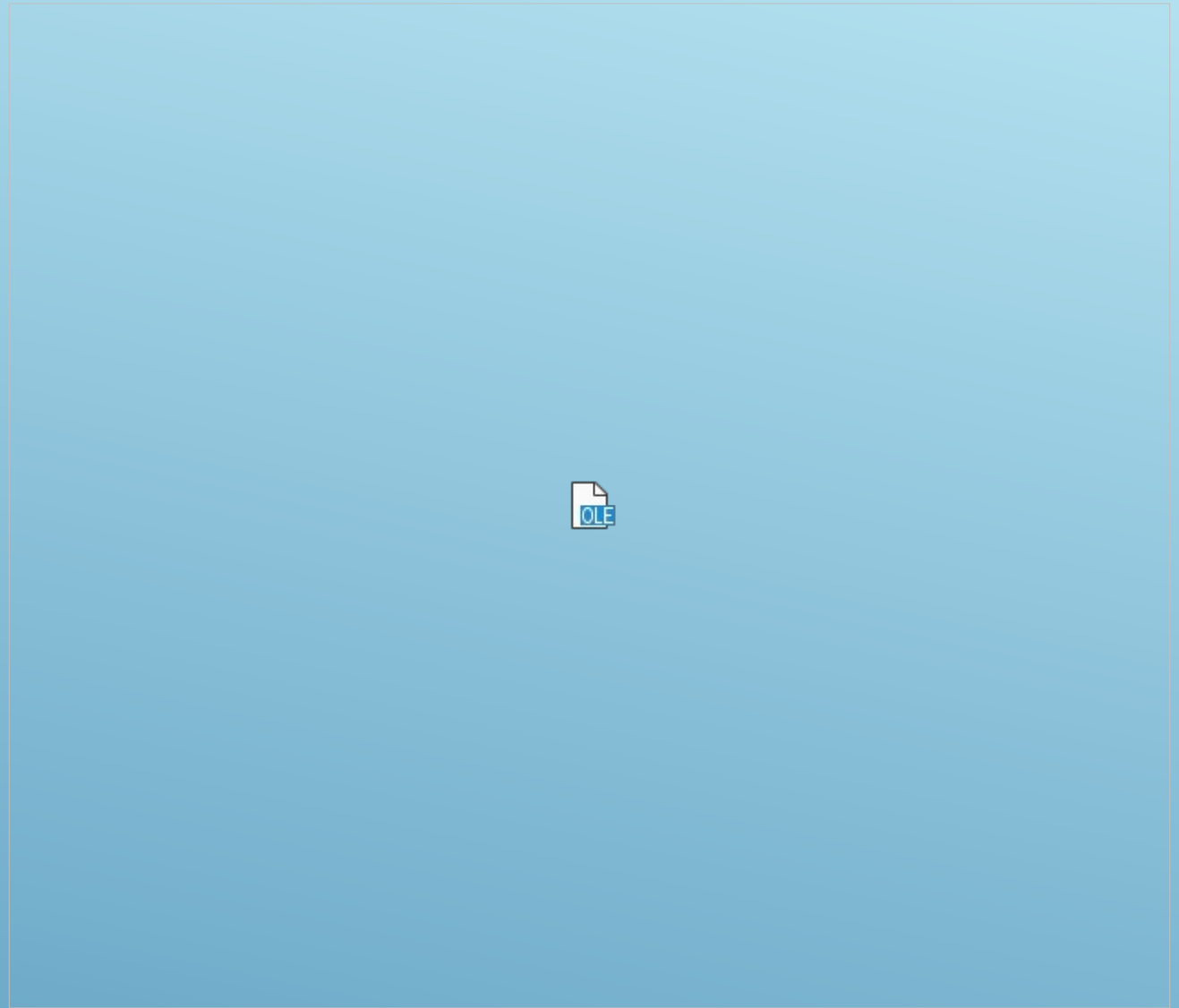
(Saldana *et al.*, 2015)

Energy	Daily FI	ADG	CV	Gizzard (at 17 weeks)	
kcal/Kg	(g)	g	%	Relative %	pH
VLE	53.3[a]	12.0	9.00	3.14	3.57
LE	52.1[ab]	12.1	8.12	2.91	3.75
ME	50.8[bc]	12.1	8.57	3.05	3.61
HE	50.6[c]	12.2	7.43	3.03	3.67
VHE	49.8[c]	12.2	8.95	2.95	3.63
Mash	49.7[a]	11.6[a]	9.25a	3.65[a]	3.26[b]
Crumbles	52.9.7[b]	12.7[b]	7.97b	2.38[b]	4.03[a]

Protein

- If adequate protein intake is achieved, additional protein in the diet does little to stimulate intake.
- It is possible to reduce protein as birds get older.

Protein Gain vs. protein intake male broilers (o-o) and male layers (×-×).



Protein and Pullets

Diet protein (%)	Body weight 20 weeks (g)	Energy intake 0–20 weeks (MJ)	Protein intake 0– 20 weeks (kg)
15	1445	101.67	1.28 [d]
16	1459	95.81	1.28 [d]
17	1423	95.81	1.37 [cd]
18	1427	92.00	1.39 [c]
19	1444	95.81	1.53 [b]
20	1480	96.23	1.62 [a]

Comparison

- Broiler 7 days:

  weights 185 g, gains 30g, eats 30 g.

  Consume 16.55 mg/lys /g of gain.

- H&N Pullet 7 days:

  weighs 70 g, gains 8 g and 15 g.

  Consume 31.42 mg/lys g

Calcium and Phosphorus

- Little research exists for Ca and P during rear.
- Level suggested by primary breeders – high.
- Especially when we add phytase.
- Purdam (2013) - bone mineral density increased and keel bone deformites reduced by almost half when “grit” as opposed to powder is fed.

Phosphorus during rear.

(Jing et al., 2017)

	Starter	Grower	Developer
Age (w)	**0-4**	**4-8**	**8-16**
Ca	11	10	9.5
Low	2	1.75	1.5
Low/Medium	3	2.75	2.5
Medium/High	4	3.75	3.5
High	5	4.75	4.5

Note high Ca levels

Growth Performance

(Jing et al., 2017)

	Starter	Grower	Developer	Tibia Ash (%)
Age (w)	**0-4**	**4-8**	**8-16**	**16**
Low (g)	215^{b}	394^{b}	585^{a}	54.3
Low/Medium (g)	236^{a}	417^{a}	574^{ab}	55.5
Medium/High (g)	242^{a}	410^{a}	554^{b}	55.0
High (g)	250^{a}	409^{a}	554^{b}	56.1

Changing P levels had no impact on any bone parameter measured.
Phytase was not used in experimental diets.

Dietary Ca and P during rear

(Dijkslag et al. 2021)

	High Ca & P		Low Ca & P	
	Ca (g/kg)	Dig P (g/kg)	Ca (g/kg)	Dig P (g/kg)
0-5 weeks	7.5	3.6	5.8	3.2
6-10 weeks	6.7	3.2	4.7	2.6
11-16 weeks	7.3	3.0	5.0	2.4
ADG (g)	13.6		13.5	
Keel bone (relative %)	0.3		0.3	
Tibia ash (% of DM)	33.0[a]		32.3[b]	
Bone breaking strength (kg)	23.4		22.1	

*All diets contained phytase

Dietary Ca and P during rear

(Dijkslag et al. 2021)

	High Ca & P		Low Ca & P	
	Ca (g/kg)	Dig P (g/kg)	Ca (g/kg)	Dig P (g/kg)
	38.8	3.3	37.0	3.1
Hen day production (%)	94.2		94.0	
Egg weight (g)	56.0		56.1	
Feed intake (g/d)	113.2		114.0	
Body weight (kg)	1.899		1.895	
Bone breaking strength (kg)	25.05		22.54	
Shell thickness (mm)	0.391		0.402	
Breaking strength (g)	5940		6240	
Dirties and crack (%)	4.45		4.5	

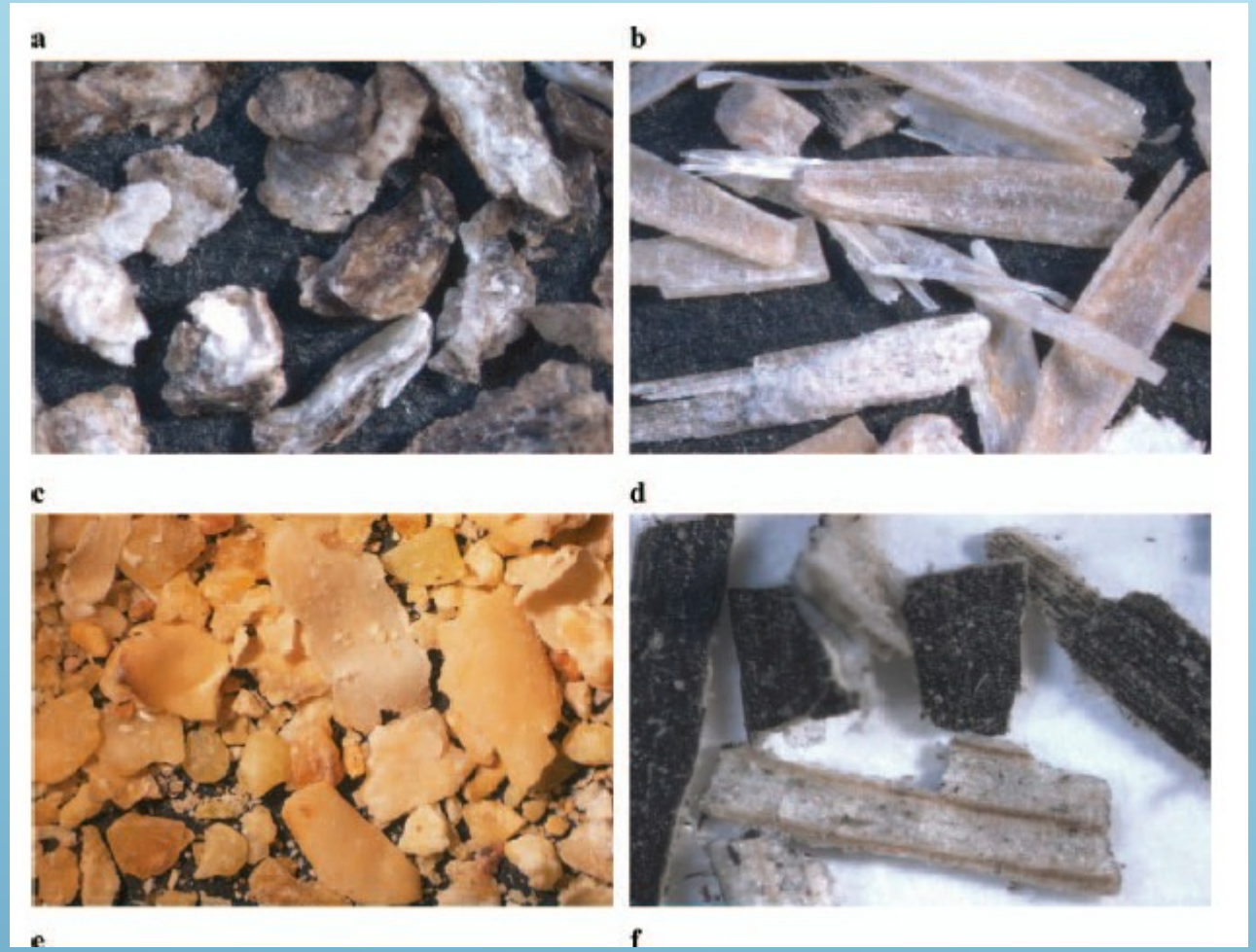
*All diets contained phytase

Fibre in the diet

Guzmán et al., (2015)

	Daily Feed Intake (g)	Daily Gain (g)	FCR	Ene*
Fibre Inclusion				
Control	19.2[b]	8.11[b]	2.37	7.03[a]
Fibre Inclusion	19.9[a]	8.44[a]	2.36	6.81[b]
Source				
Straw	19.9	8.42	2.36	6.78
Sunflower Hull	20	8.56	2.34	6.73
Sugar Beet Pulp	19.9	8.32	2.39	6.91
Inclusion Level				
2(%)	19.8	8.49	2.34[b]	6.80
4(%)	20	8.35	2.39[a]	6.82

A) sugar beet B) oats C) soya D sunflower



Added Fibre

(Guzmán *et al.*, 2015).

- FI by 4.6%
- ADG improved by 4.1%.
- Sunflower gave best results
- 6 to 7% Sunflower cake is equivalent of 2% added husk.

Pullet Feeding Regimes

Anderson and Jenkins (2010)

	Starter	Grower I	Grower II
SDP			
Protein (%)	20	18	16
Feed (weeks)	0-6	7-16	17-18
ME (MJ/kg)	12.4	12.4	12.4
SUP_9			
Protein (%)	12	16	18
Feed (weeks)	0-9	10-16	17-18
ME (MJ/kg)	11.5	12.4	12.4
SUP_{12}			
Protein (%)	12	16	18
Feed (weeks)	0-12	13-16	17-18
ME (MJ/kg)	11.5	12.4	12.4

Pullet Feeding Regimes

Anderson and Jenkins (2010)

Rearing Regime	Weight (kg)	Feed Cons (kg)	Energy Cons (kJ)	Ster - num (mm)	Head and Neck (%)
SDP	1.618^{a}	7.278	902.2	112^{ab}	8.2^{b}
SUP_{9}	1.555^{b}	7.323	901.0	113^{a}	8.1^{b}
SUP_{12}	1.510^{b}	7.160	893.5	110^{b}	8.5^{a}

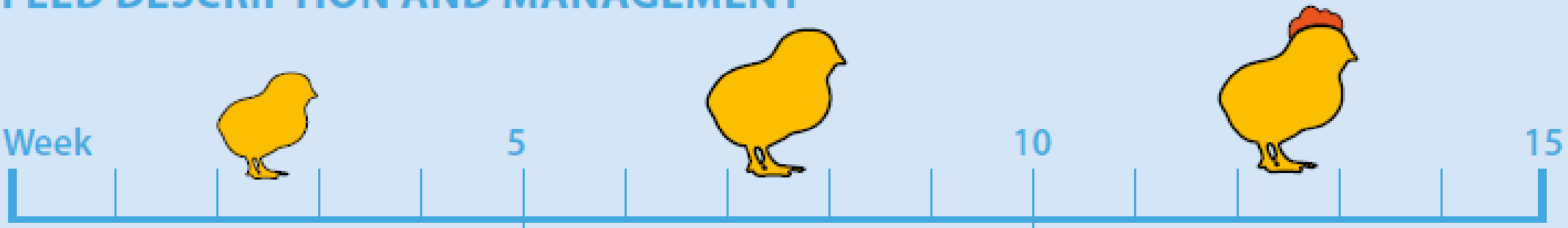
Pullet Feeding Regimes

Anderson and Jenkins (2010)

	Prod (%)	Eggs HH	Egg Weight (g)	FCR	Mortality (%)
Rearing					
SDP	78.2	276	64.7	2.47^{a}	17.2^{b}
SUP_9	78.1	284	64.3	2.49^{a}	12.9^{ab}
SUP_{12}	77.8	286	64.4	2.55^{b}	10.7^{a}
Feeder Space					
10.2 cm	79.9	300	64.3	2.33^{p}	10.6
13.6 cm	79.0	297	64.5	2.43^{q}	11.8
Density					
361 cm^2	76.8^{x}	263^{x}	64.2	2.51	17.6^{x}
482 cm^2	79.3^{y}	300^{y}	64.5	2.50	9.5^{y}

Suggested Program

FEED DESCRIPTION AND MANAGEMENT



Starter feed

- High density diet with highly digestible raw materials.
- Investment that sets up the basis of skeletal and muscular growth of the pullet.
- Feed should always be available.

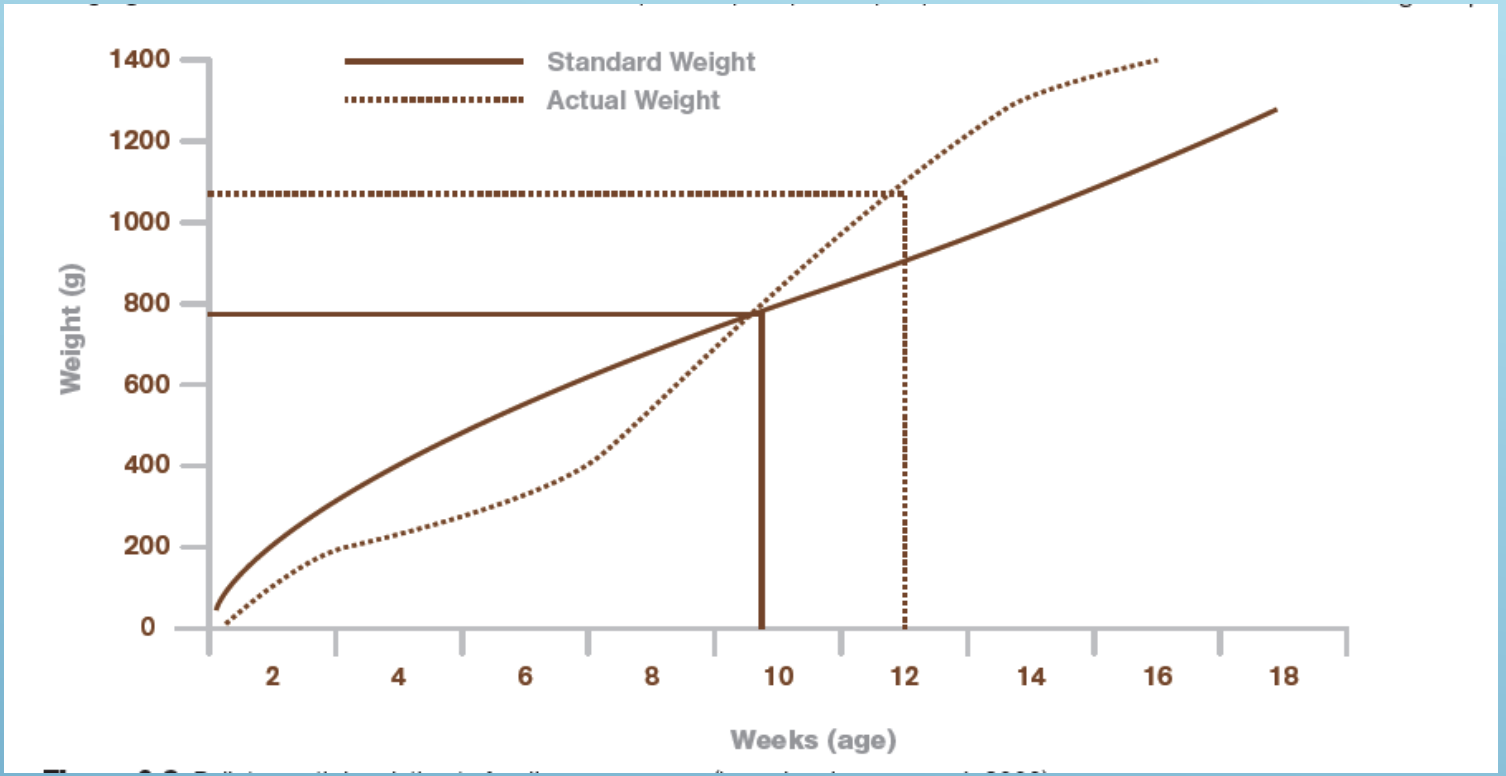
Grower feed

- Medium density diet with more variety of raw materials.
- This supports skeletal and muscular growth.

Developer feed

- Low density diet with raw materials high in fibre.
- Feed with significant levels of fibre or a higher particle size to develop the feed intake for the start of lay.

Pullet growth in relation to feeding program.



The Pre Lay Period

- There are several practices used worldwide.
  1. Do nothing.
  2. Use a high Ca Pre-Lay diet.
  3. Move to Supper Early Lay diet at transfer.
  4. Hybrid feed (link) concept.

Pre Lay Options

		Do - nothing	Pre-Layer	Super Starter	Hybrid
ME	Kcal/kg		2750 - 2800	2750 - 2800	2700
ME	MJ/kg		11.4-11.7	11.4-11.7	11.3
Dig Lys	g/kg		8.4	8.3	8
Dig M+C	g/kg		6.3	7.5	7.2
Dig The	g/kg		4.9	5.8	5.6
Ca	g/kg		20	36	38
Av P	g/kg		4	4.2	4.4
Fibre	g/kg		40	36	40
Sodium	g/kg		1.6	1.8	2.8
Start Feeding		Developer until transfer	15 weeks	Transfer	16 weeks (light stimulation)
End Feeding		Early Lay diet until 50 weeks	18 weeks	Peak	At 70% production

Rationale behind Hybrid Specs

(after Arbe, 2023)

Nutrient		
ME	Kcal / kg	2700
Dig Lys	%	0.8
Dig M+C	%	0.72
Dig Thr	%	0.56
Ca	%	3.8
Av P	%	0.44
CF	%	4
Salt	%	0.28

Low energy – stimulate intake

Adequate amino acids

Enough Ca & P for a single egg

Fibre to stimulate gizzard & appetite

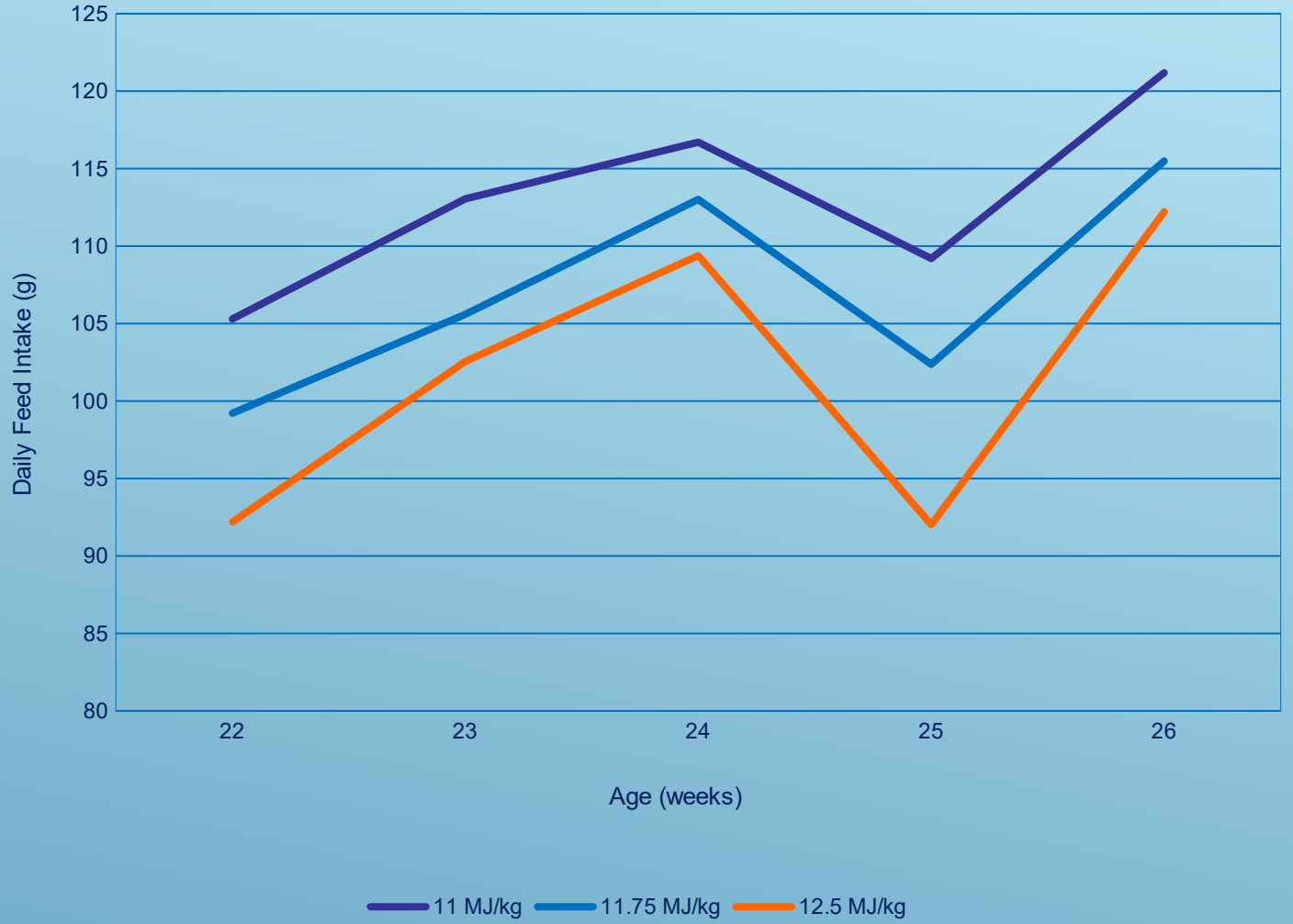
Salt to stimulate water and feed intake

Expected Outcomes

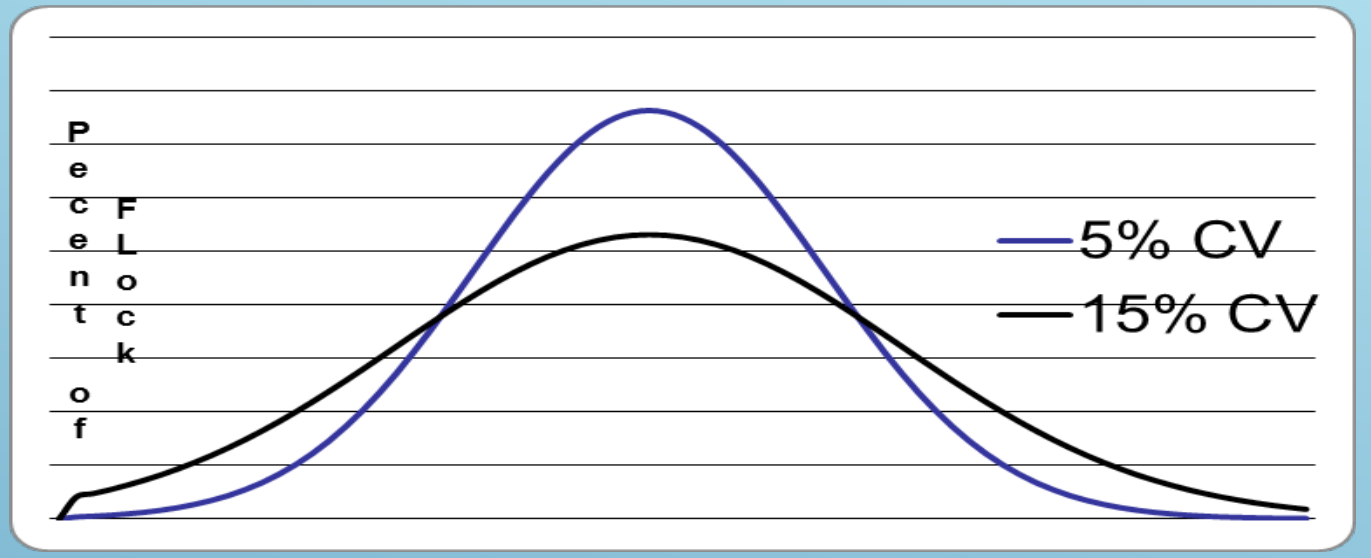
	Do-Nothing	Pre -Lay	Super Starter	Hybrid Feed
Risk	+++	++	+	-
Feed intake development	-	+	-	++
Calcification	-	+	+	+
Egg production	-	-	+	++
Cost of feed	-	+	++	+

192 Individually housed Hy-Line Browns

(Rick, 2019)



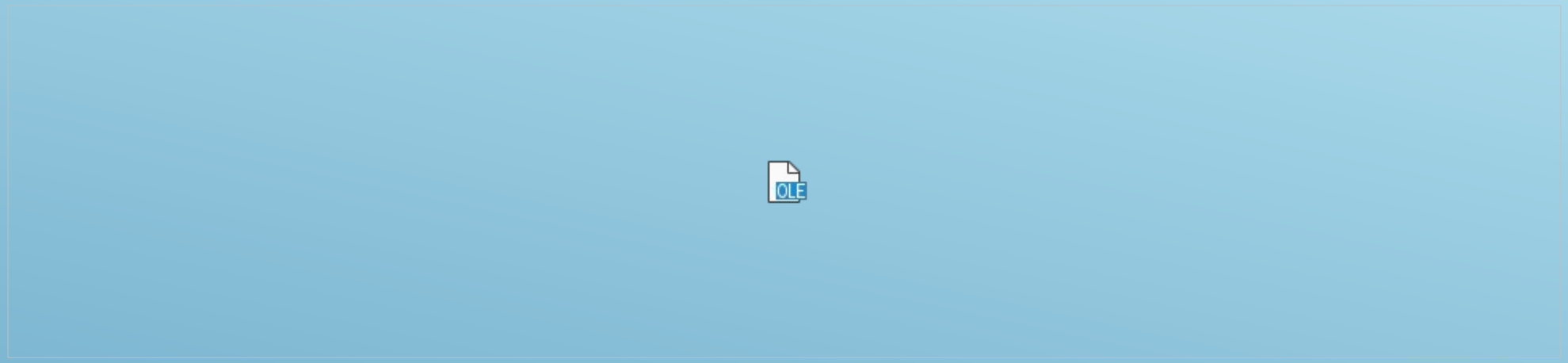
Uniformity



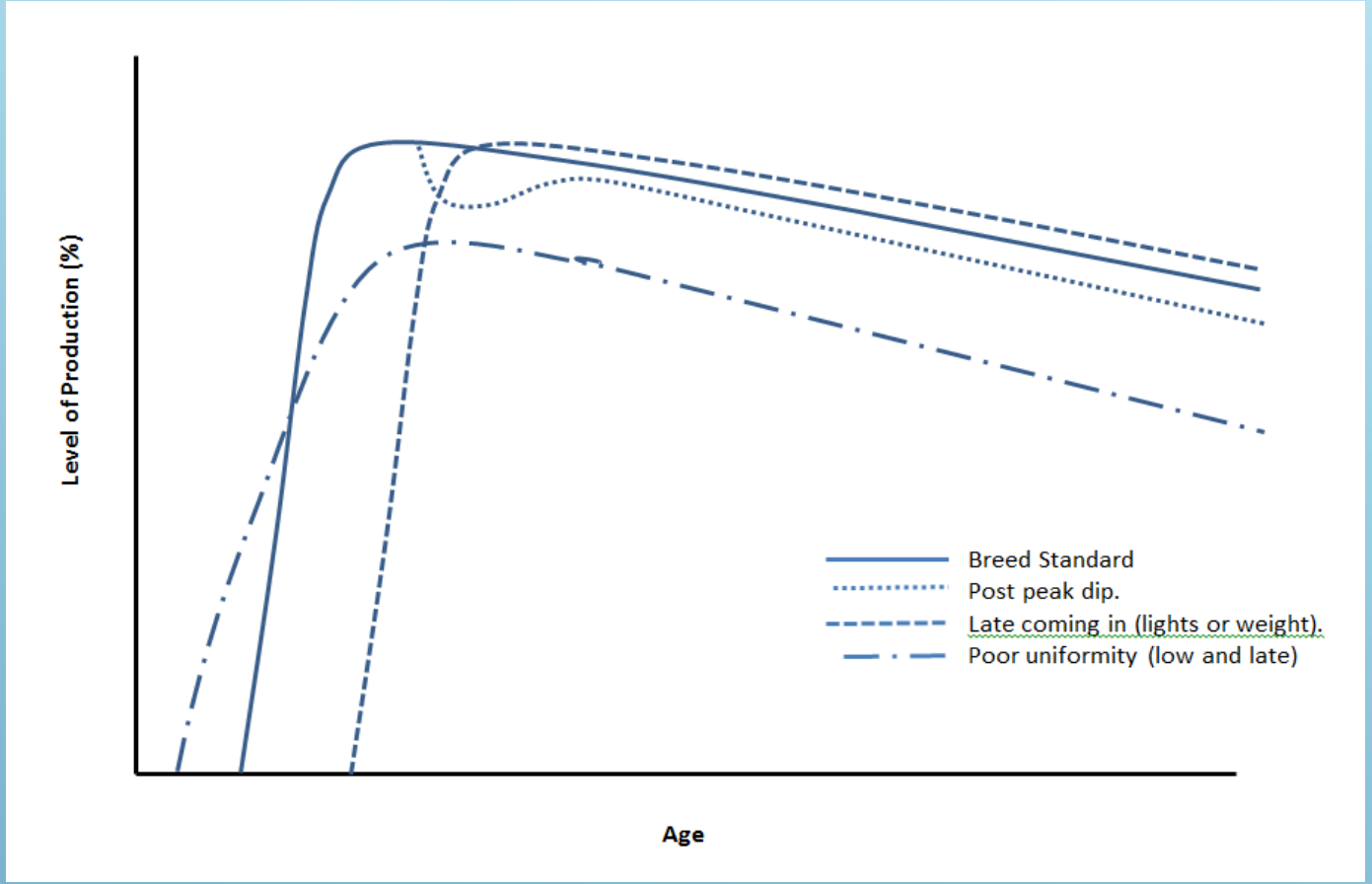
Uniformity

- Abnormal variation is of concern
- Management factors
- Parent flocks
- Feed consistency
- Feeder systems
- Individual bird treatment (vaccination, beak trimming Etc..)
- Measure CV (10%)

Performance of birds of differing body weight at 18 weeks of age (within flocks)



Rearing Problems



Ending Off

- Layer nutrition is a continuum.
- Rearing is where it all begins.
- Skeletal development and feathering – life long impact.
- All the more important fir “long-life”layers.