



INTERNATIONAL

*The key to your profit!*



# Layer nutrition in a nutshell

# What are the targets of a layer

1. Produce one egg
2. Produce size with the resources she has

# Layers don't lay number of eggs

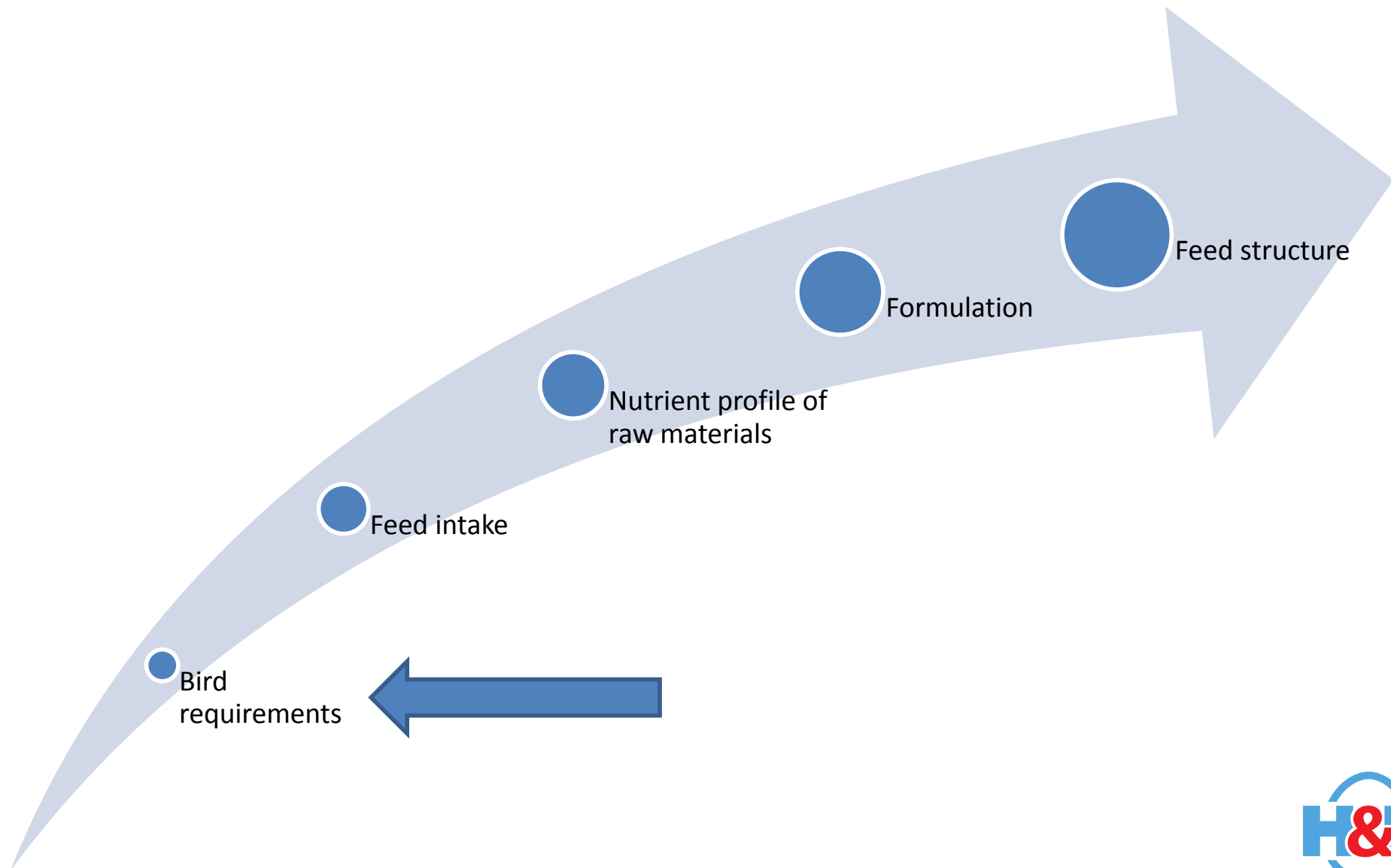
$\text{Kg eggs} = \text{Number of eggs} \times \text{Egg size}$

- Lighting program
- Nutrition

# Behaviour of the birds

- The broiler is a 'hungry' bird
- Hen eats as she needs and what she produces

# 5 steps in feeding



# Bird requirements

- Energy
- Amino acids
  
- Ca / P and Vit D balance
- Vitamins
- Trace minerals

# Where energy is coming?

| Nutrient              | Energy              |
|-----------------------|---------------------|
| Starch and sugars     | $\pm 4$ kcal / gram |
| Amino acids (protein) | $\pm 4$ kcal / gram |
| Fat                   | $\pm 9$ kcal / gram |

# Where is the energy in the raw materials

|                | Energy kcal/kg | Starch | Sugars | Protein | Fat   |
|----------------|----------------|--------|--------|---------|-------|
| Corn           | 3300           | 62%    | 1.7%   | 7.9%    | 3.5%  |
| Wheat          | 3150           | 60.4%  | 1.5%   | 11.2%   | 1.4%  |
| MBM            | 2650           | 0%     | 0%     | 52.3%   | 14.1% |
| Fish meal      | 3410           | 0%     | 0%     | 70%     | 9.5%  |
| Soya meal 47%  | 2360           | 0.5%   | 7%     | 49%     | 1.9%  |
| Rape seed meal | 2030           | 0%     | 7%     | 31.2%   | 7.3%  |
| Palm oil       | 8150           | 0%     | 0%     | 0%      | 99%   |
| Soya oil       | 9000           | 0%     | 0%     | 0%      | 99%   |



# How to calculate energy

- Animal research
  - INRA, NRC, FEDNA...
  - Additive suppliers
- Formula
  - $ME = 3.98 \times \text{gr starch} + 3.10 \times \text{gr sugar} + 3.7 \times \text{gr CP} + 8.19 \times \text{gr fat}$

# Energy methods

| By the book | ME Value | % in diet | Energy contribution | Total (kcal/kg) |
|-------------|----------|-----------|---------------------|-----------------|
| Corn        | 3300     | 55        | 1815                | 2287            |
| Soya        | 2360     | 20        | 472                 |                 |

6.4% more

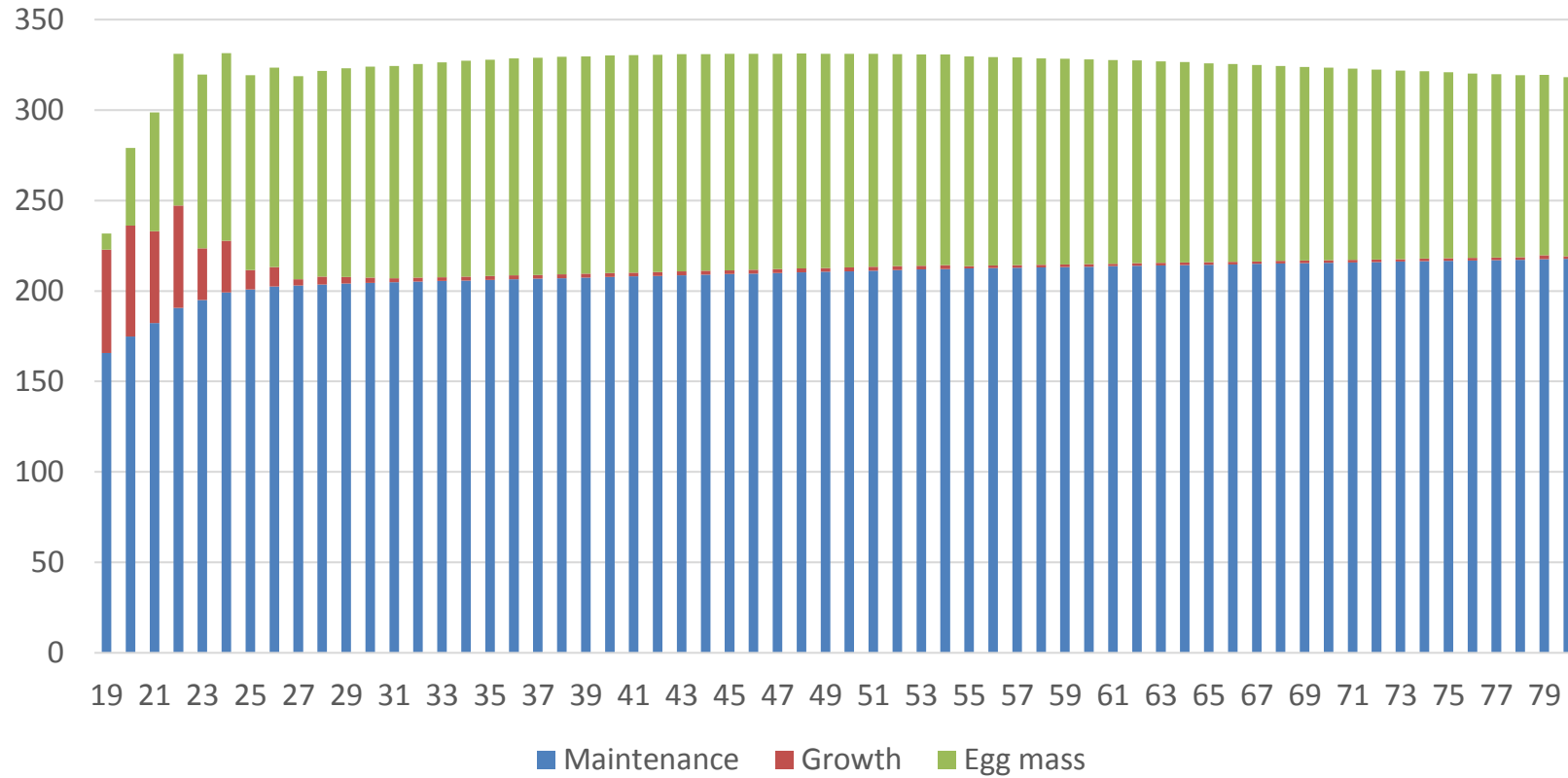
| By the formula | ME Value | % in diet | Energy contribution | Total (kcal/kg) |
|----------------|----------|-----------|---------------------|-----------------|
| Corn           | 3104     | 55        | 1707                | 2149            |
| Soya           | 2210     | 20        | 442                 |                 |

# What the birds need



# Energy needs

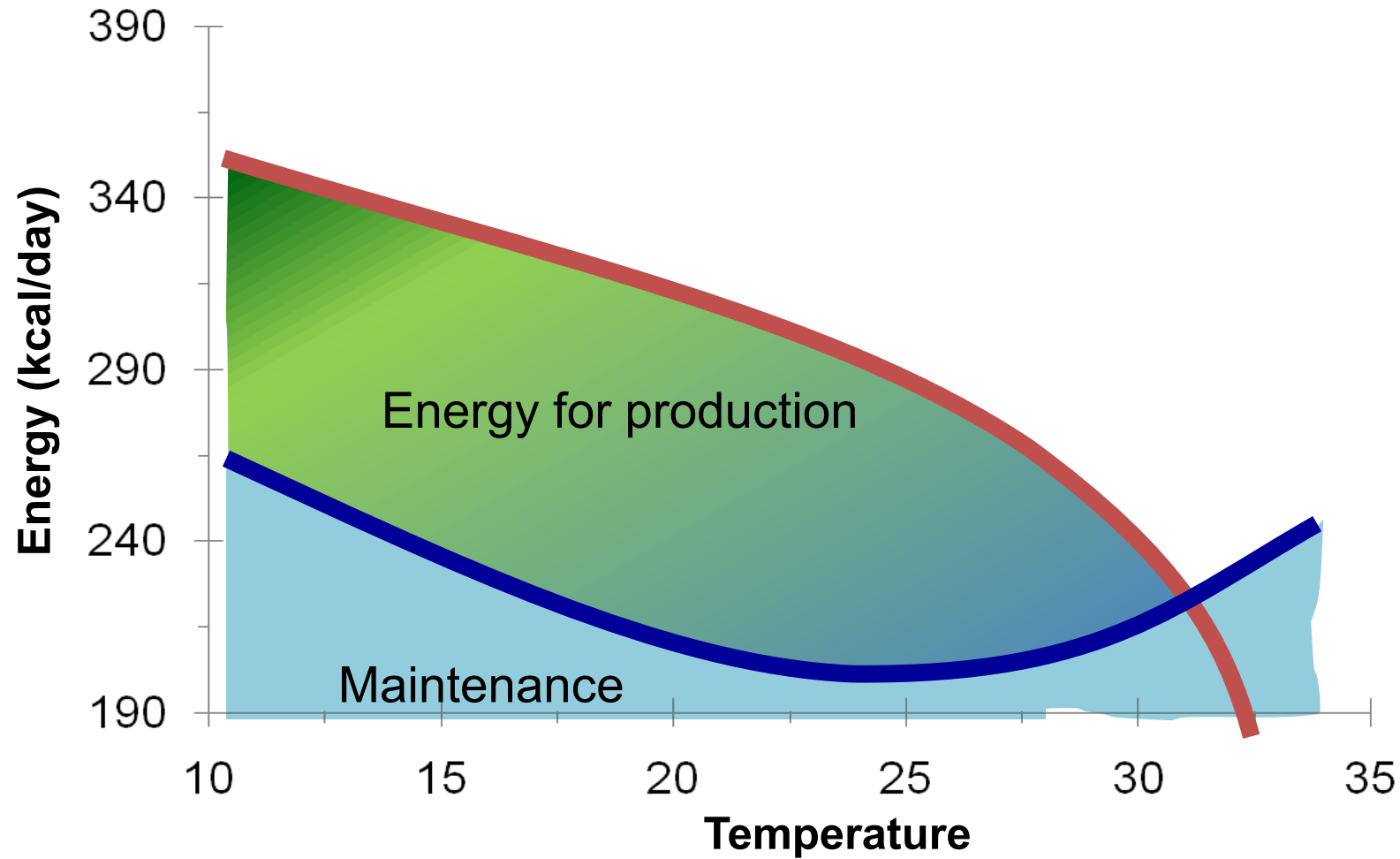
Energy Brown Nick



**Maintenance 64%** Growth 2% Egg mass 34%



# Effect of the temperature



Adapted from Leeson (2012)



# Amino acids

- They will be limiting the production
  - Egg production and size
  - Growth
  - Feathering
- Key AA:
  - 1st Methionine; 2nd Lys; 3rd M+C
  - Keep a balance



# AA profile

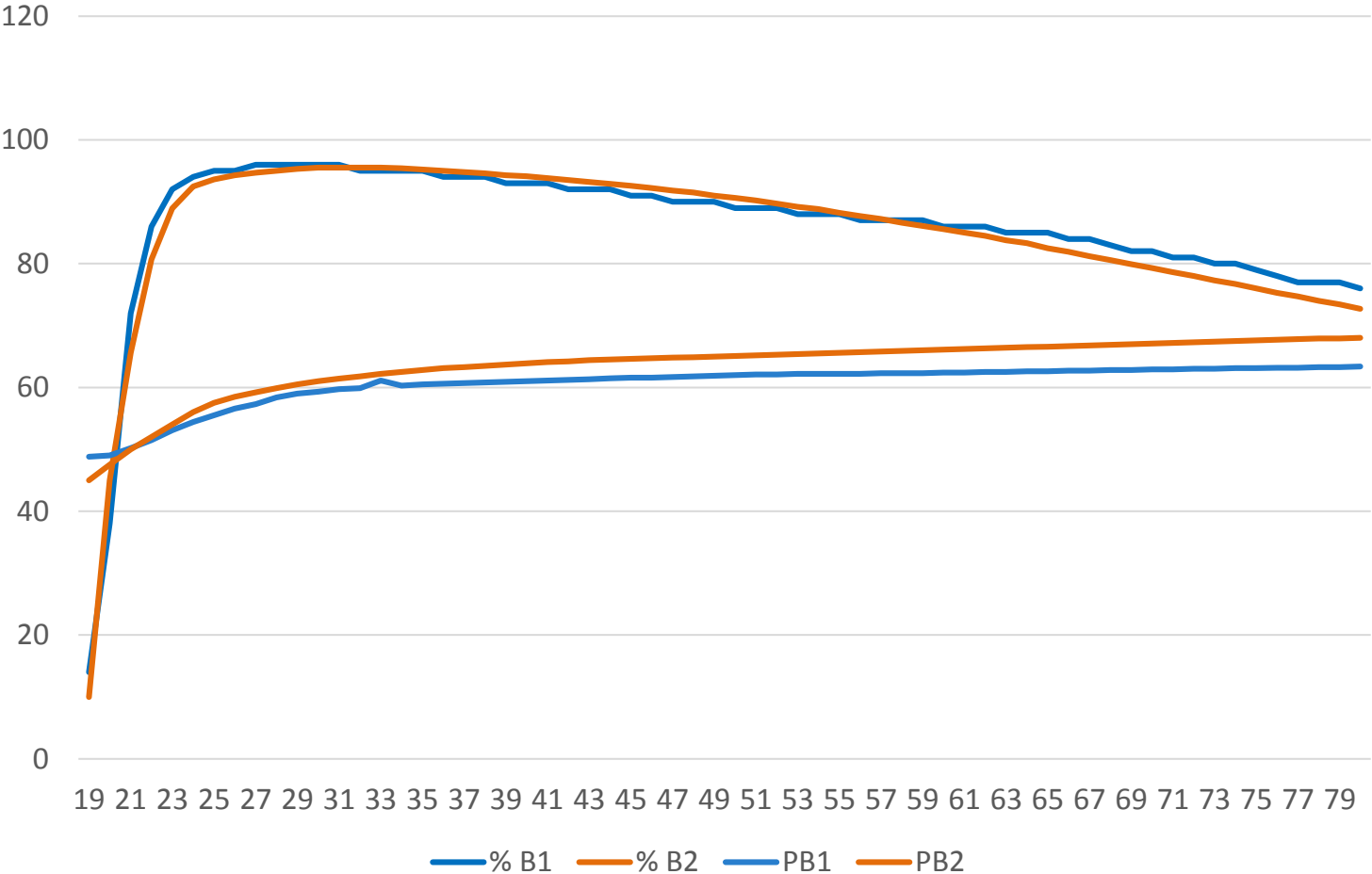
|            | 0-5 | 6-10 | 11-17 | Layer |
|------------|-----|------|-------|-------|
| Lysine     | 100 | 100  | 100   | 100   |
| Methionine | 44  | 45   | 47    | 50    |
| M+C        | 75  | 80   | 85    | 92    |
| Threonine  | 66  | 70   | 70    | 69    |
| Tryptophan | 19  | 21   | 24    | 21    |
| Arginine   | 105 | 106  | 106   | 104   |
| Valine     | 78  | 78   | 87    | 88    |
| Isoleucine | 69  | 76   | 76    | 79    |

# Crude protein

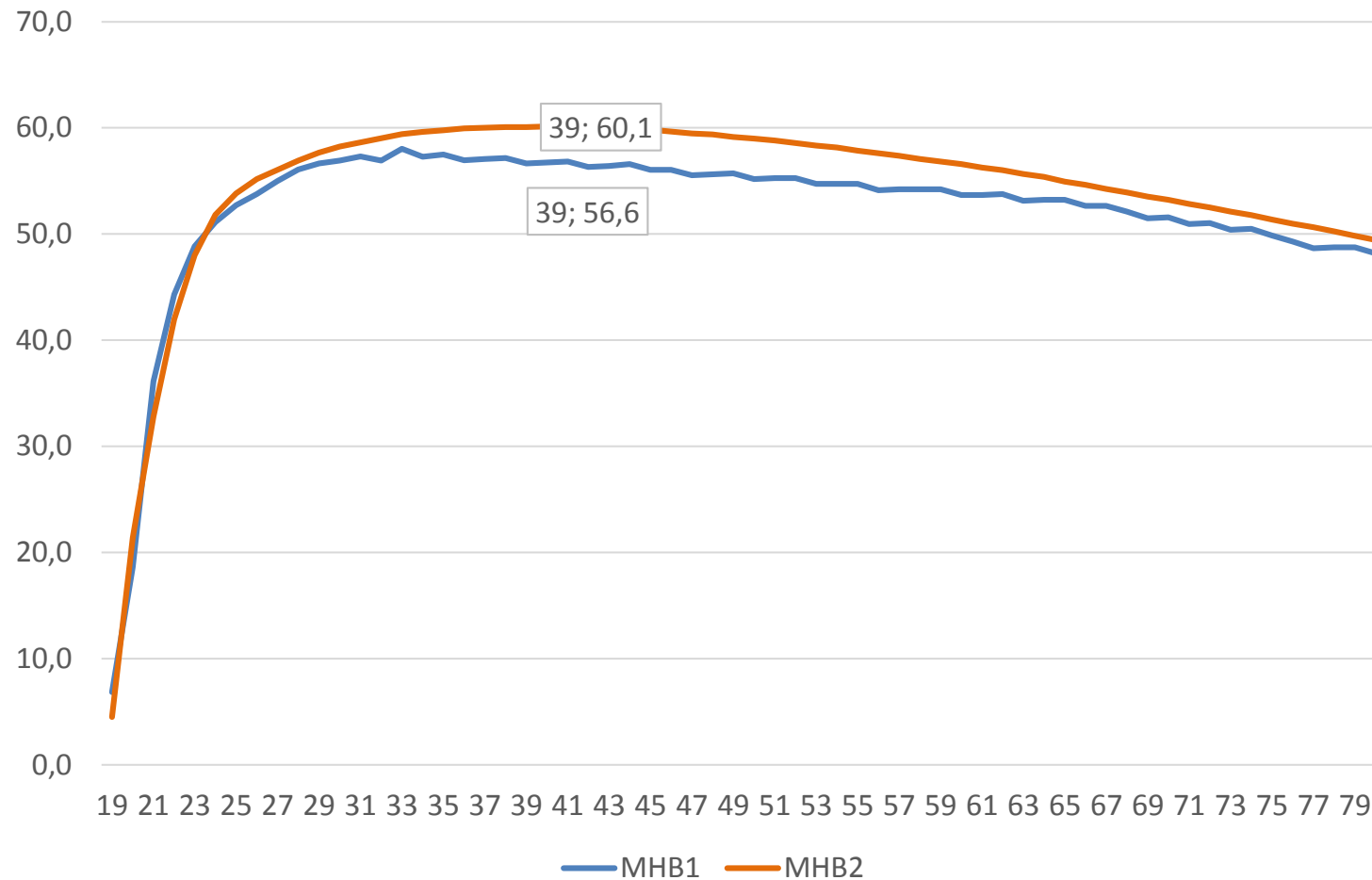
- The crude protein (CP) content is calculated from the nitrogen content of the feed or raw materials
- It is assumed that the nitrogen is derived from protein containing 16 per cent nitrogen, and by multiplying the nitrogen figure by 6.25 (i.e.  $100/16$ ) an approximate protein value is obtained
- This is not 'true protein' since the method determines nitrogen from sources other than protein, such as free amino acids, amines and nucleic acids



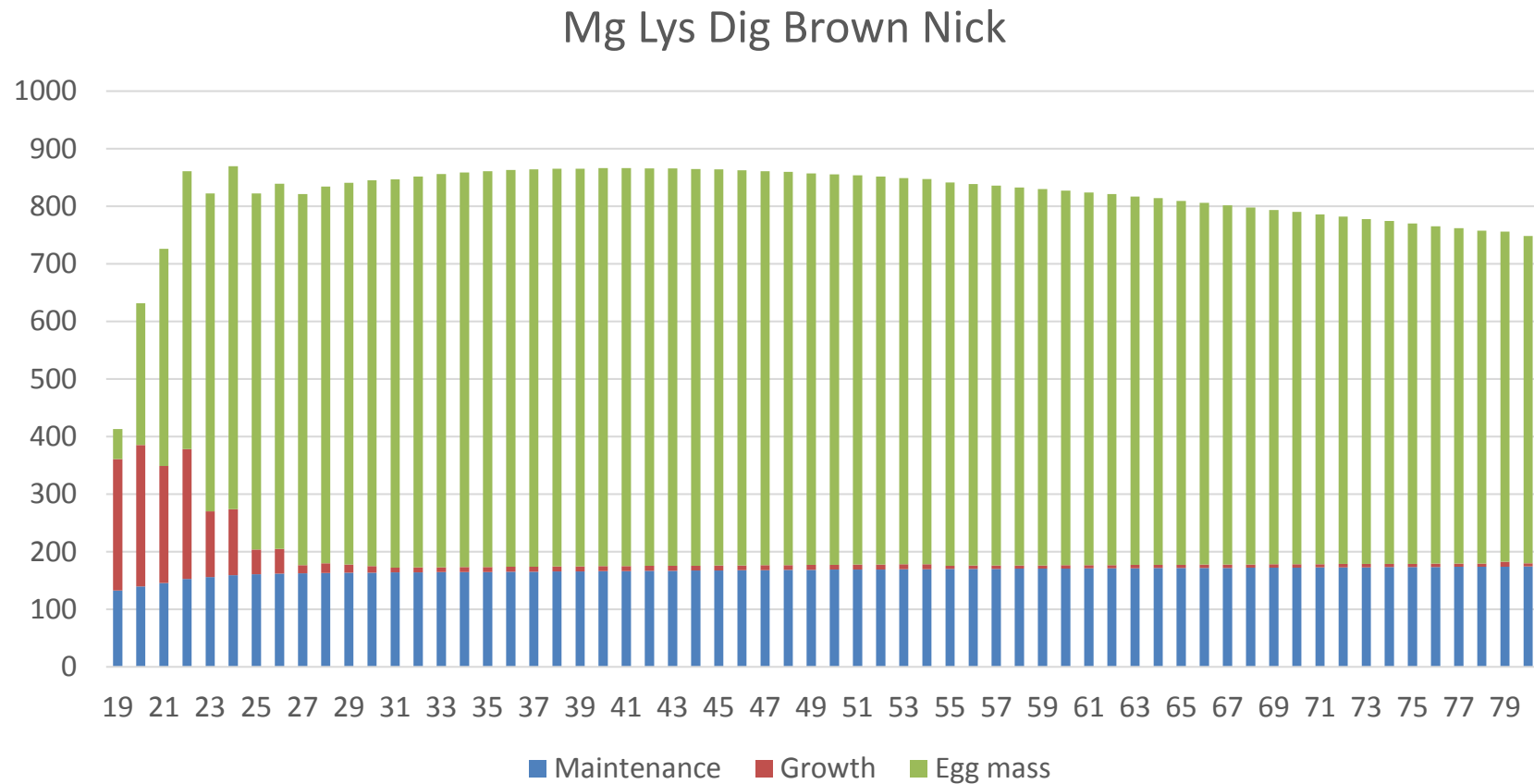
# Once upon a time...



# The egg mass...



# Amino acid needs



Maintenance 20% Growth 1% **Egg mass 79%**



# Make formulation based on egg mass

Egg mass 60-58

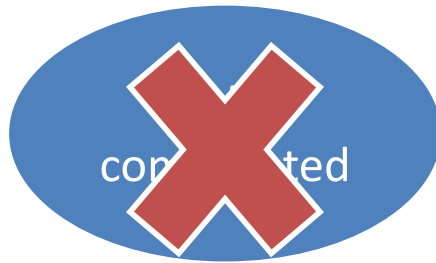
|                 | 301 kcal / hen / day |       |       |       |
|-----------------|----------------------|-------|-------|-------|
|                 | 17.5 gr / hen / day  |       |       |       |
|                 | mg / hen / day       | 100   | 105   | 110   |
| Dig Lysine      | 810                  | 0.810 | 0.771 | 0.736 |
| Dig Methionine  | 405                  | 0.405 | 0.386 | 0.368 |
| Dig Met + Cys   | 729                  | 0.729 | 0.694 | 0.663 |
| Dig Threonine   | 567                  | 0.567 | 0.540 | 0.515 |
| Dig Tryptophane | 178                  | 0.178 | 0.170 | 0.162 |
| Dig Isoleucine  | 648                  | 0.648 | 0.617 | 0.589 |
| Dig Valine      | 709                  | 0.709 | 0.675 | 0.644 |
| Dig Argenine    | 844                  | 0.844 | 0.804 | 0.767 |

Egg mass 57-55

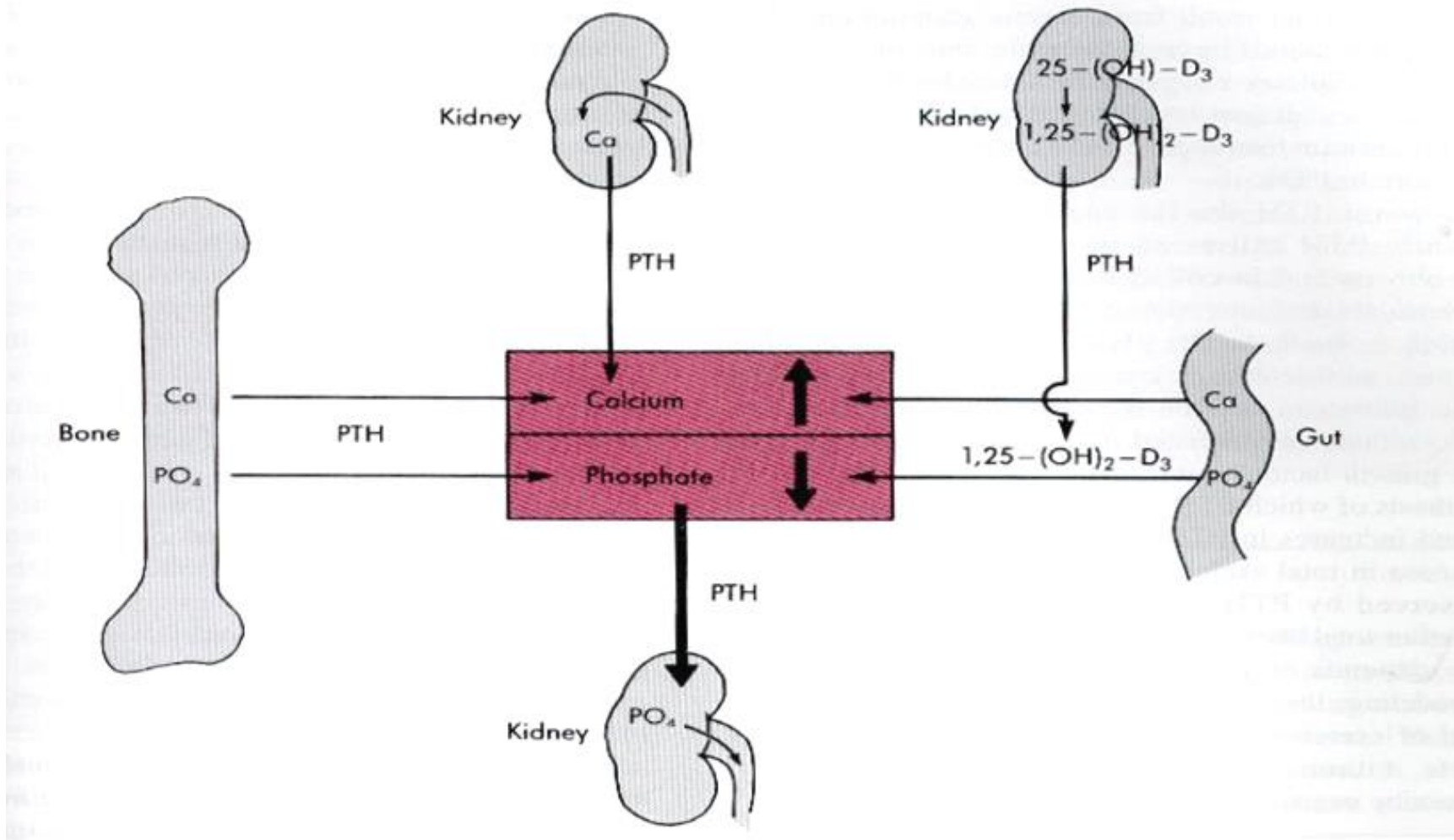
|                 | 295 kcal / hen / day |       |       |       |
|-----------------|----------------------|-------|-------|-------|
|                 | 17.2 gr / hen / day  |       |       |       |
|                 | mg / hen / day       | 100   | 105   | 110   |
| Dig Lysine      | 780                  | 0.780 | 0.743 | 0.709 |
| Dig Methionine  | 390                  | 0.390 | 0.371 | 0.355 |
| Dig Met + Cys   | 702                  | 0.702 | 0.669 | 0.638 |
| Dig Threonine   | 546                  | 0.546 | 0.520 | 0.496 |
| Dig Tryptophane | 172                  | 0.172 | 0.163 | 0.156 |
| Dig Isoleucine  | 624                  | 0.624 | 0.594 | 0.567 |
| Dig Valine      | 683                  | 0.683 | 0.650 | 0.620 |
| Dig Argenine    | 813                  | 0.813 | 0.774 | 0.739 |



# Nutrition based on BW and Egg mass

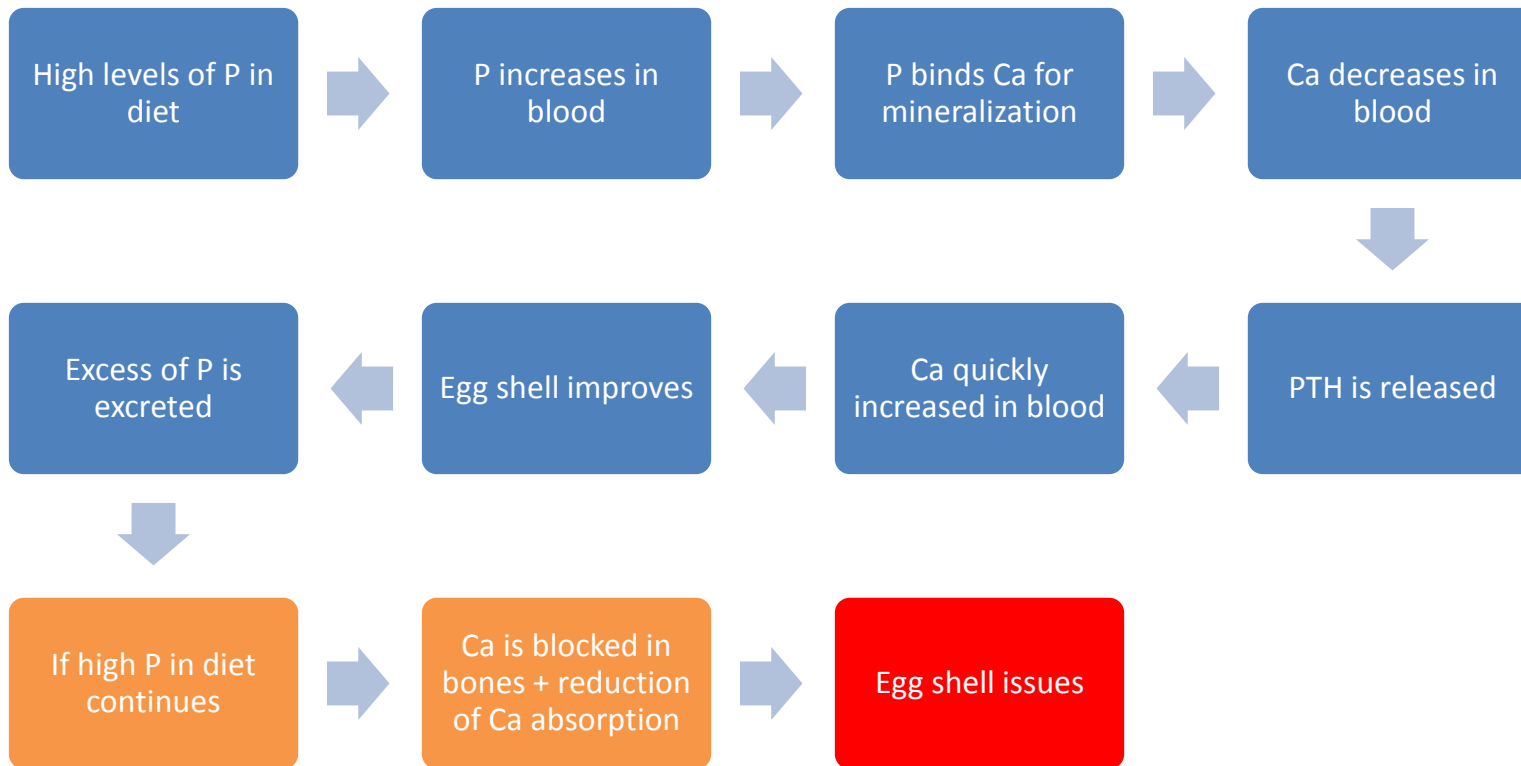


# Ca – P – Vitamin D

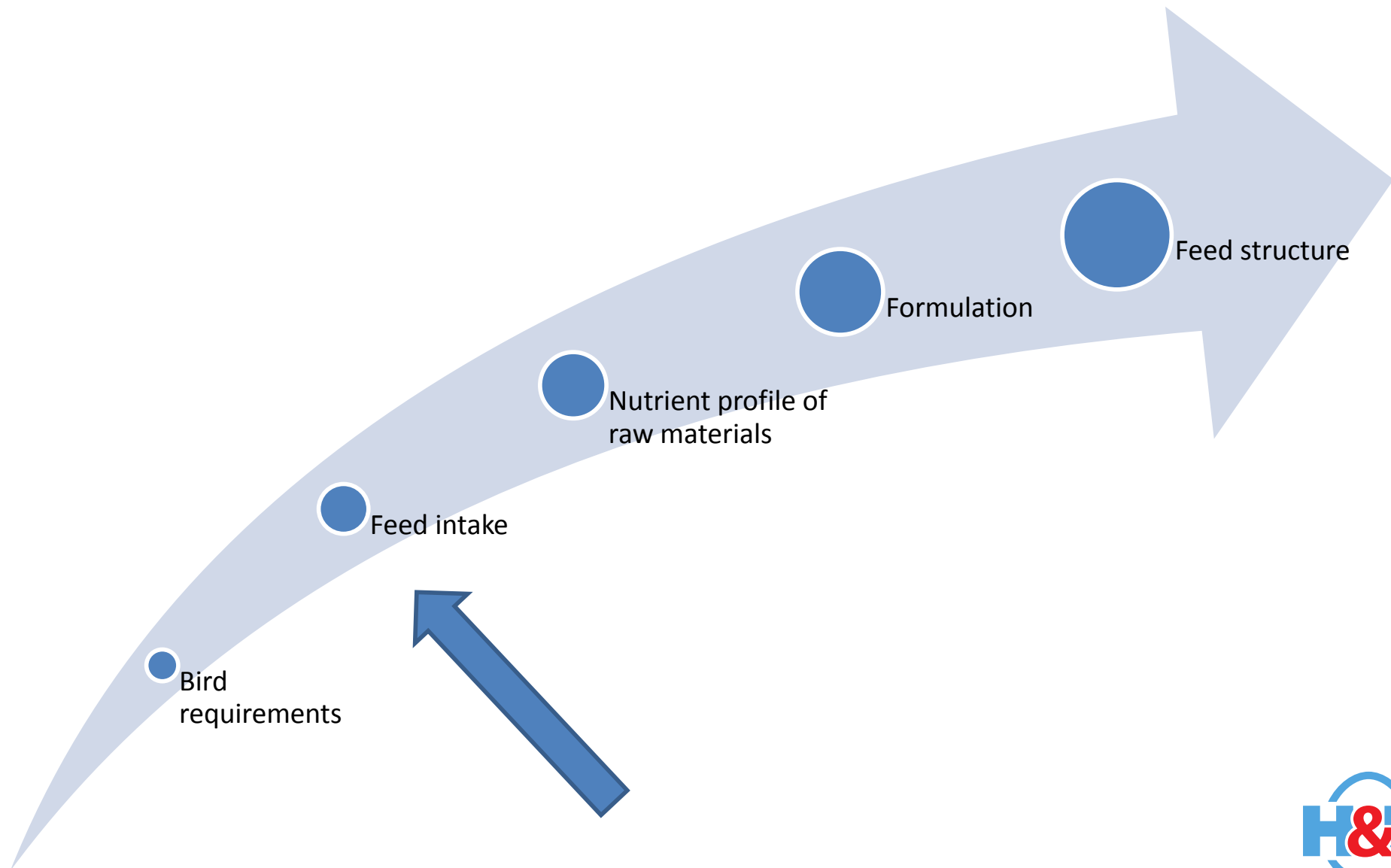


Calcitonine antagonism of the PTH and depends on Ca levels

# Ca – P – Vitamin D balance



# 5 steps in feeding



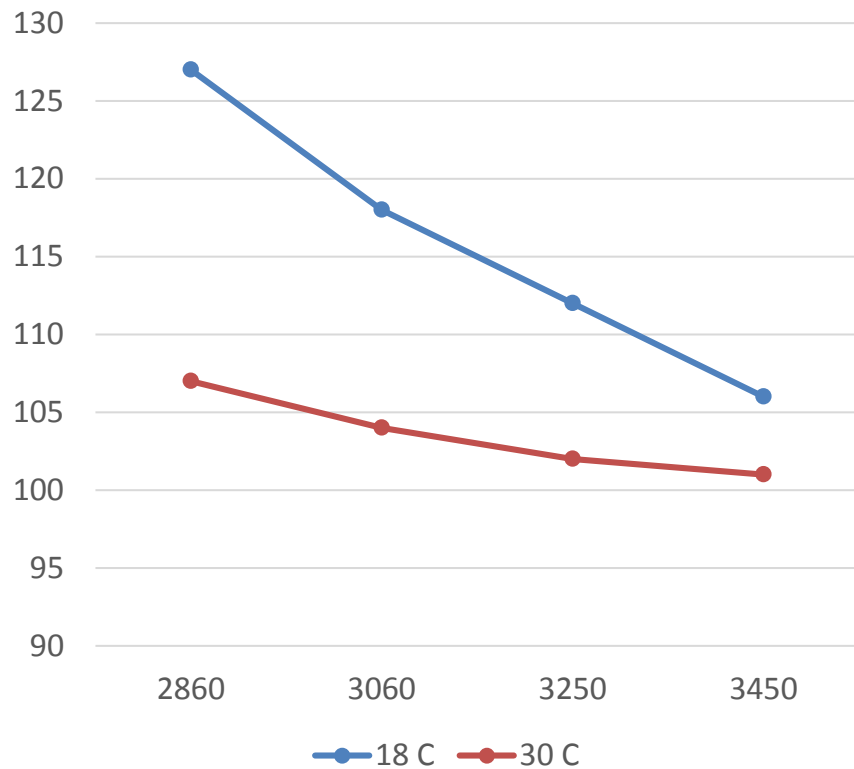


# Feed intake

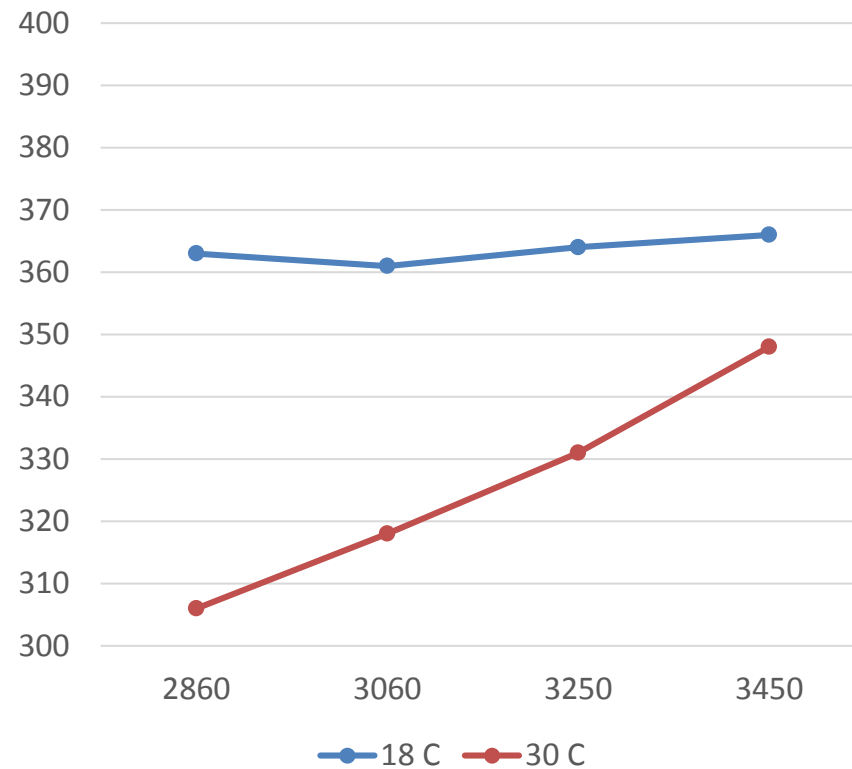
- People dependent:
  - Company-Marketing
  - Farmer targets
- Production dependent:
  - Feed intake capacity
  - Housing:
    - Open vs Close; Winter vs Summer; Cage vs Cage free
  - Health
- Deficiencies in nutrients

# Feed intake behaviour

### Feed intake



### Energy intake



Courtesy of Steve Leeson



# Business decision

Production

COST

Inventory

Marketing

Gut health

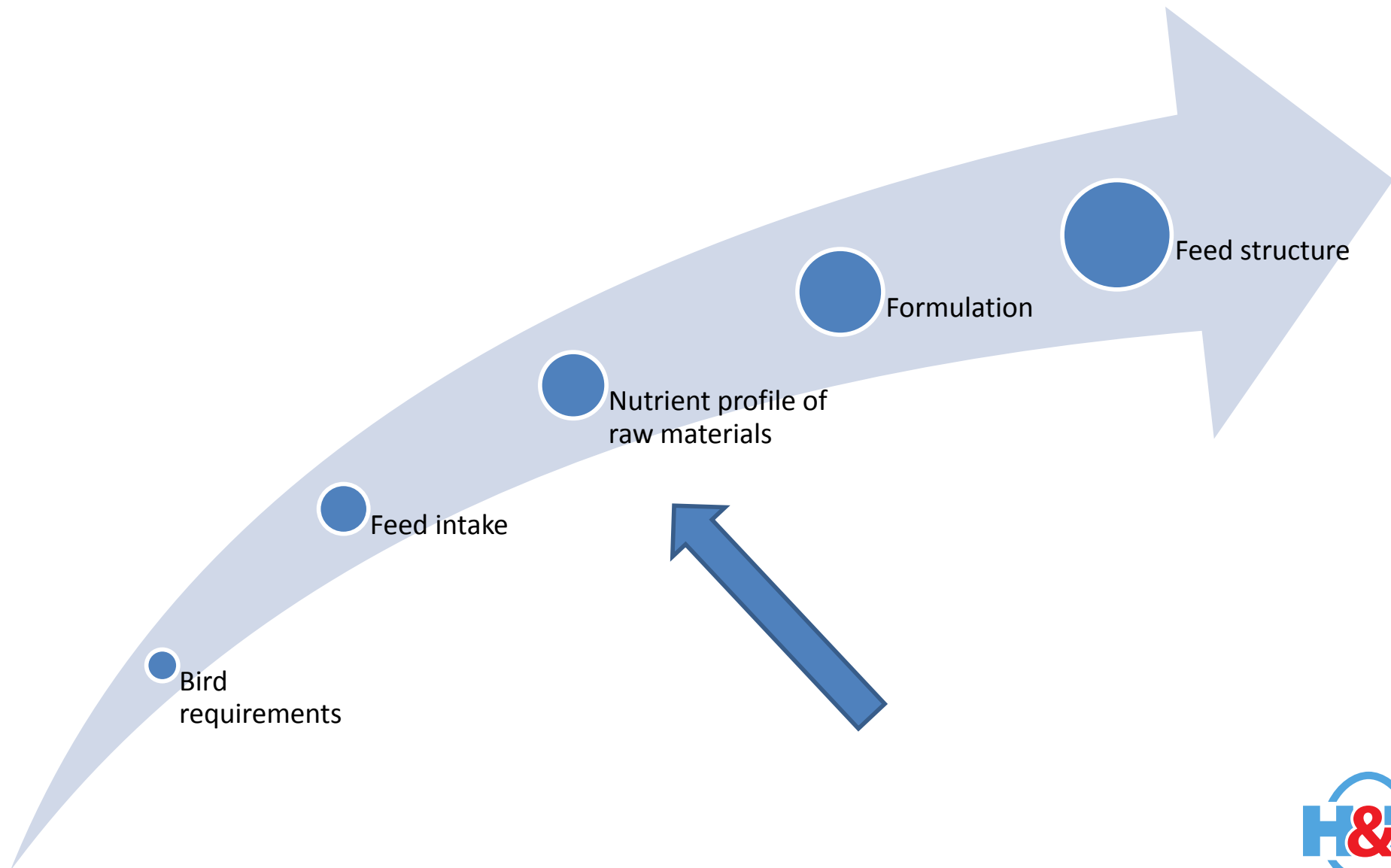
Logistics

# Feed intake and genetics

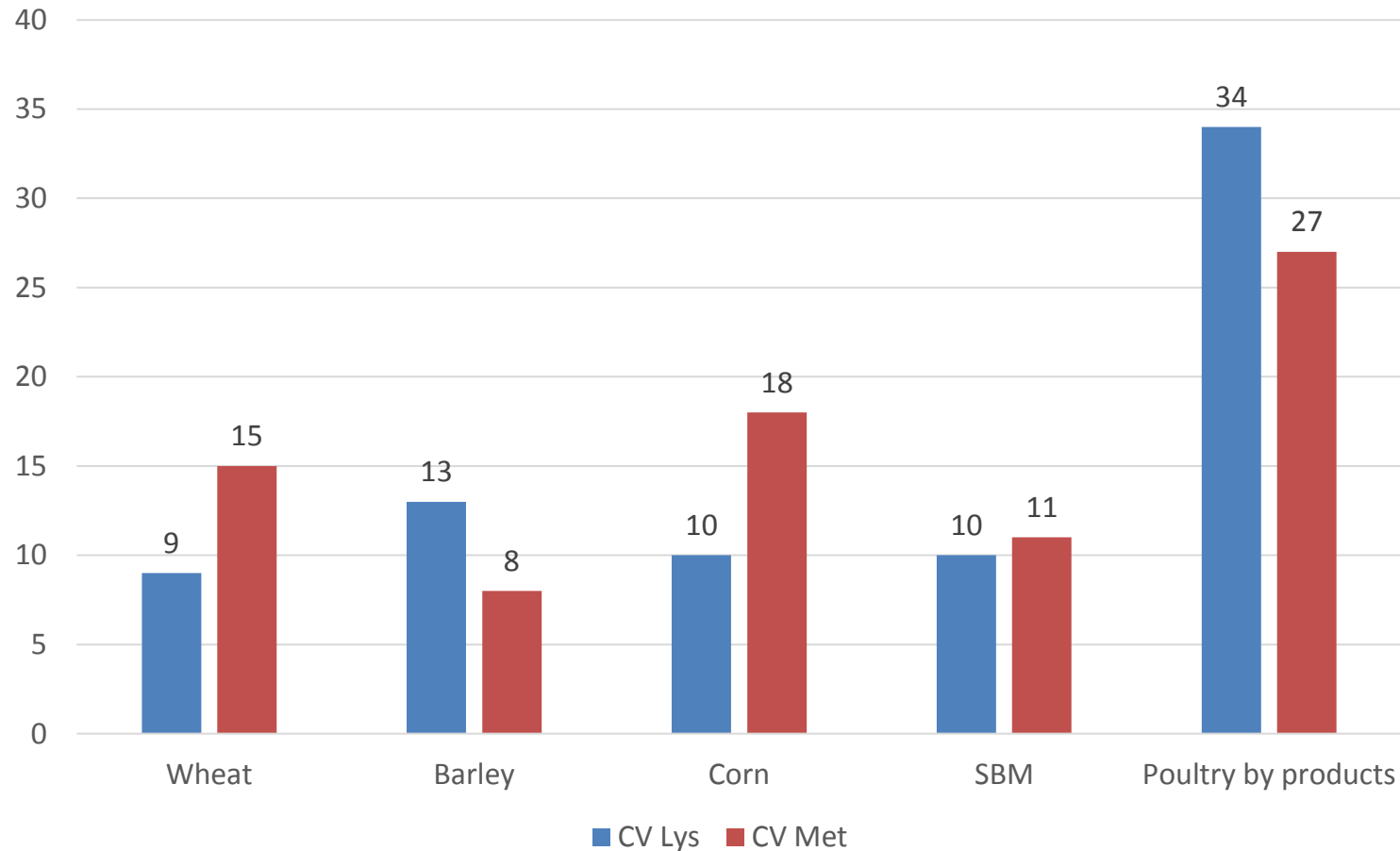
| Age | Feed intake | Feed D Lys | Lys intake (needs) | Maintenance (same BW) | Growth | Egg mass |
|-----|-------------|------------|--------------------|-----------------------|--------|----------|
| 40  | 110         | 0.7        | 770                | 154                   | 8      | 608      |
| 40  | 114         |            | 800                | 154                   | 8      | 638      |

Is it producing same egg mass?

# 5 steps in feeding



# Variability of the raw materials



Simmins PH, van Kempen (1999)



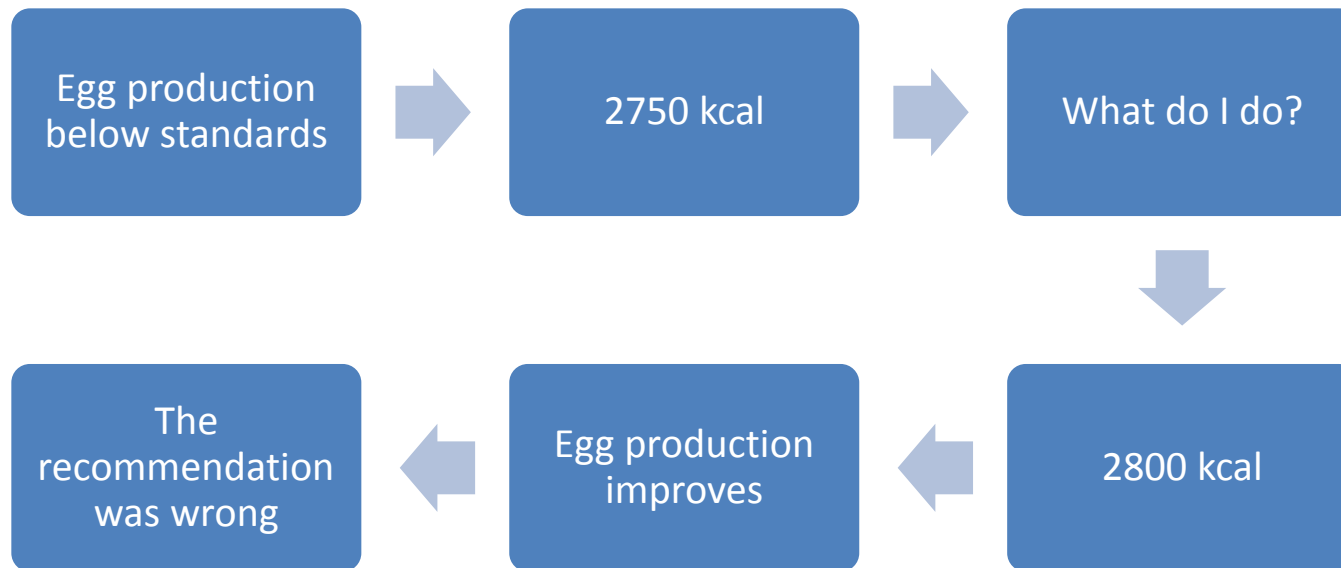
# Same SBM?

|          | n   | Lys               | TSAA              | Thr               | Trp               |
|----------|-----|-------------------|-------------------|-------------------|-------------------|
| ARG      | 141 | 6.10 <sup>b</sup> | 2.87 <sup>a</sup> | 3.93 <sup>a</sup> | 1.37 <sup>a</sup> |
| BRA      | 144 | 6.05 <sup>c</sup> | 2.81 <sup>b</sup> | 3.88 <sup>b</sup> | 1.34 <sup>c</sup> |
| USA      | 170 | 6.16 <sup>a</sup> | 2.87 <sup>a</sup> | 3.91 <sup>a</sup> | 1.36 <sup>b</sup> |
| SEM      |     | 0.005             | 0.005             | 0.002             | 0.001             |
| <i>P</i> |     | ***               | ***               | ***               | ***               |

PSA, 2014



# Formulation – Feed composition



|               | Kcal/kg | In diet | Contribution Kcal/kg |
|---------------|---------|---------|----------------------|
| Corn computer | 3300    | 50%     | 1650                 |
| Corn in feed  | 3200    | 50%     | 1600                 |

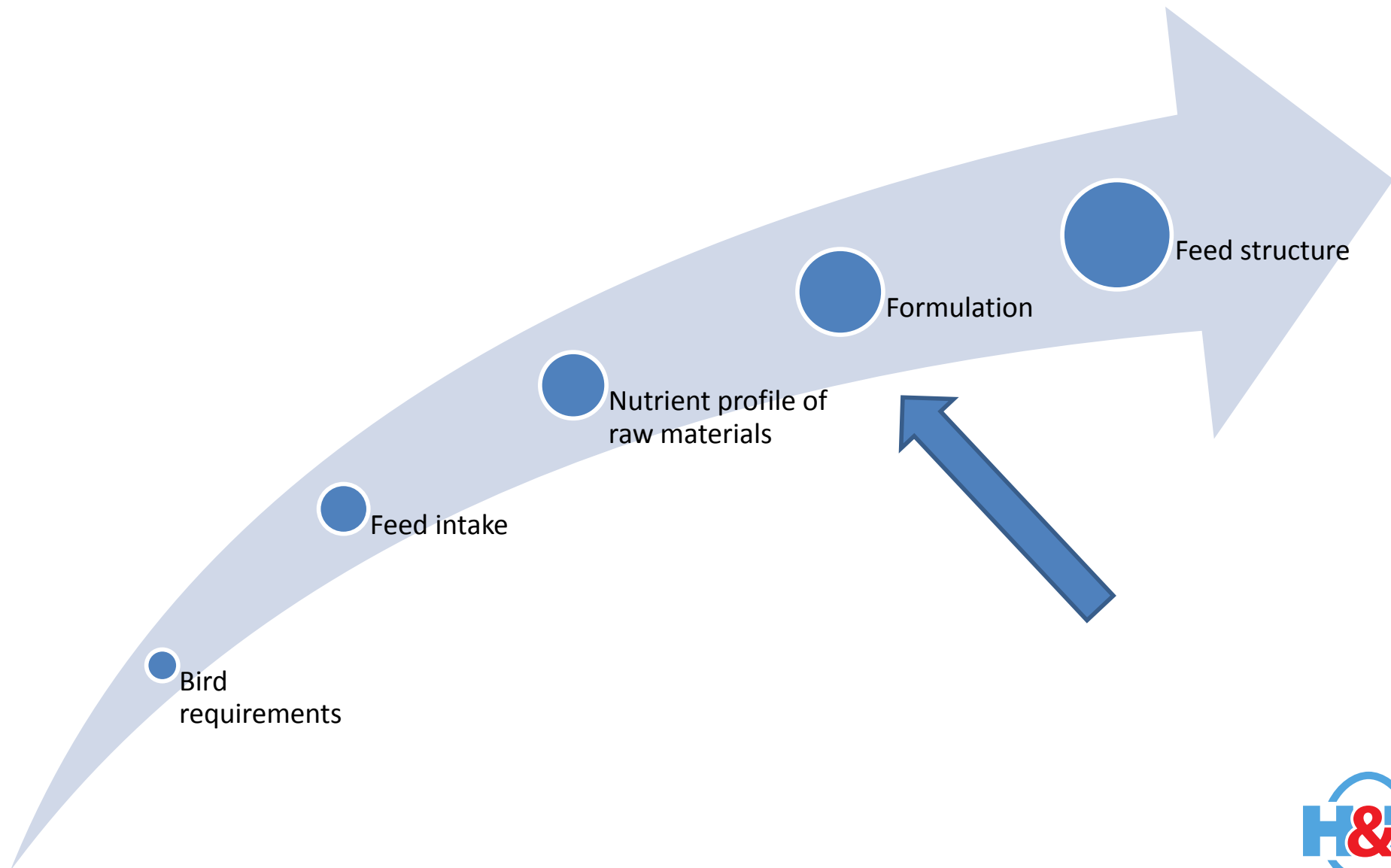




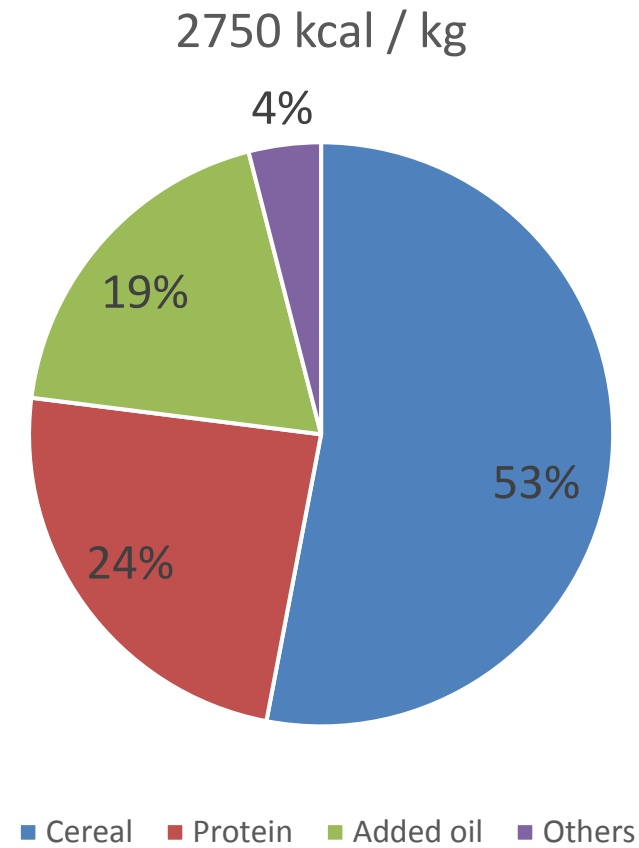
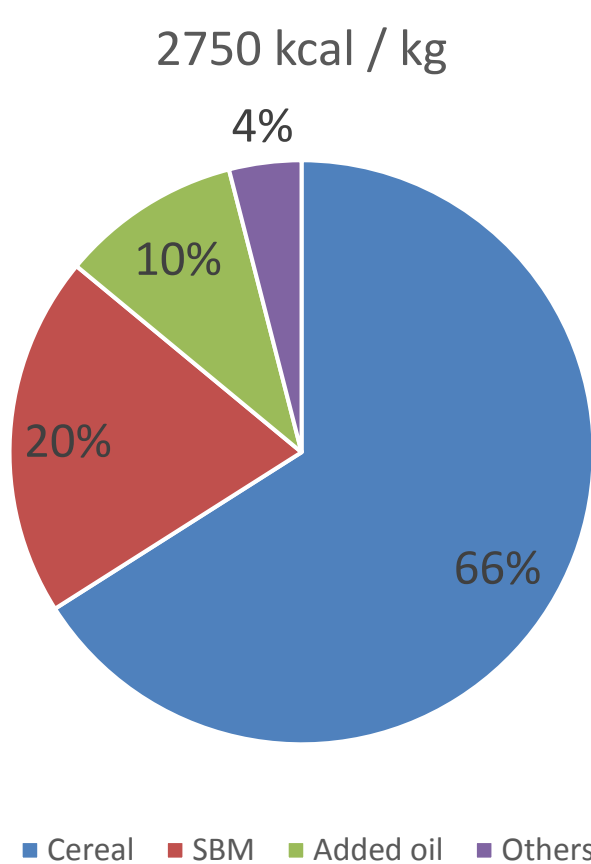
# Need to know what I'm buying

- Moisture
- Protein
- Starch
- Sugar
- Fat
- Crude Fiber
- Ash

# 5 steps in feeding



# Risk management in formulation



# Enzymes need a substrate

| Enzyme            | Substrate           | Where I can find it?    |
|-------------------|---------------------|-------------------------|
| Phytases          | Phytate/Phytic acid | All the vegetables      |
| Xylanase          | Xylans              | Wheat, Barley > Corn    |
| $\beta$ glucanase | $\beta$ glucanase   | Barley > Wheat          |
| Mananase          | Mannans             | SBM, Canola, Copra meal |
| Protease          | Undigested proteain | All raw materials       |

# Effect of phytases

| Diet 1      | %     |
|-------------|-------|
| Corn        | 50.47 |
| Soya        | 34.44 |
| Phytic acid | 0.23  |

| Diet 2      | %     |
|-------------|-------|
| Corn        | 43.31 |
| Soya        | 33.11 |
| Rice bran   | 7     |
| Phytic acid | 0.30  |

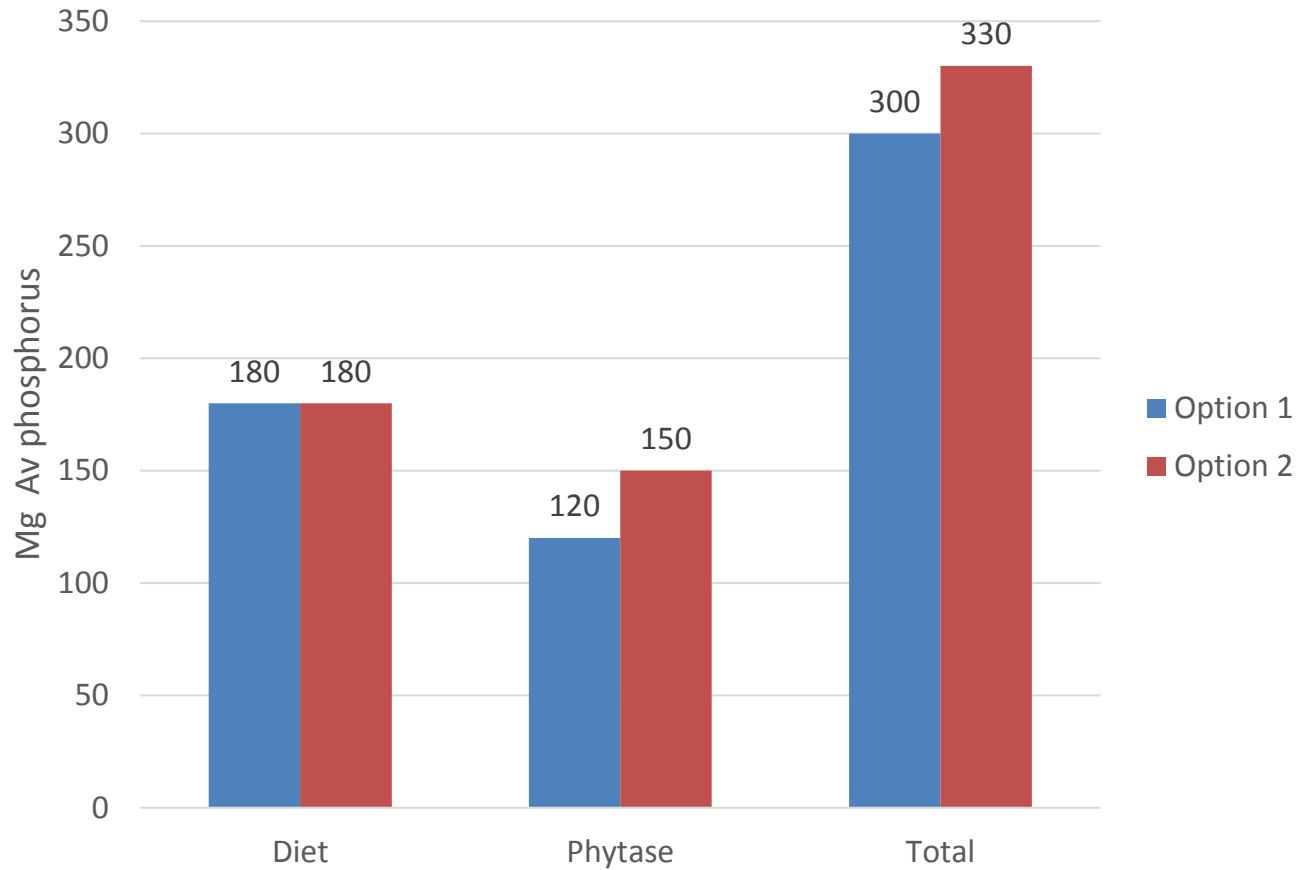
30% more substrate

Same effect of the phytase?

How much more P in the diet?

# Effect of the phytase

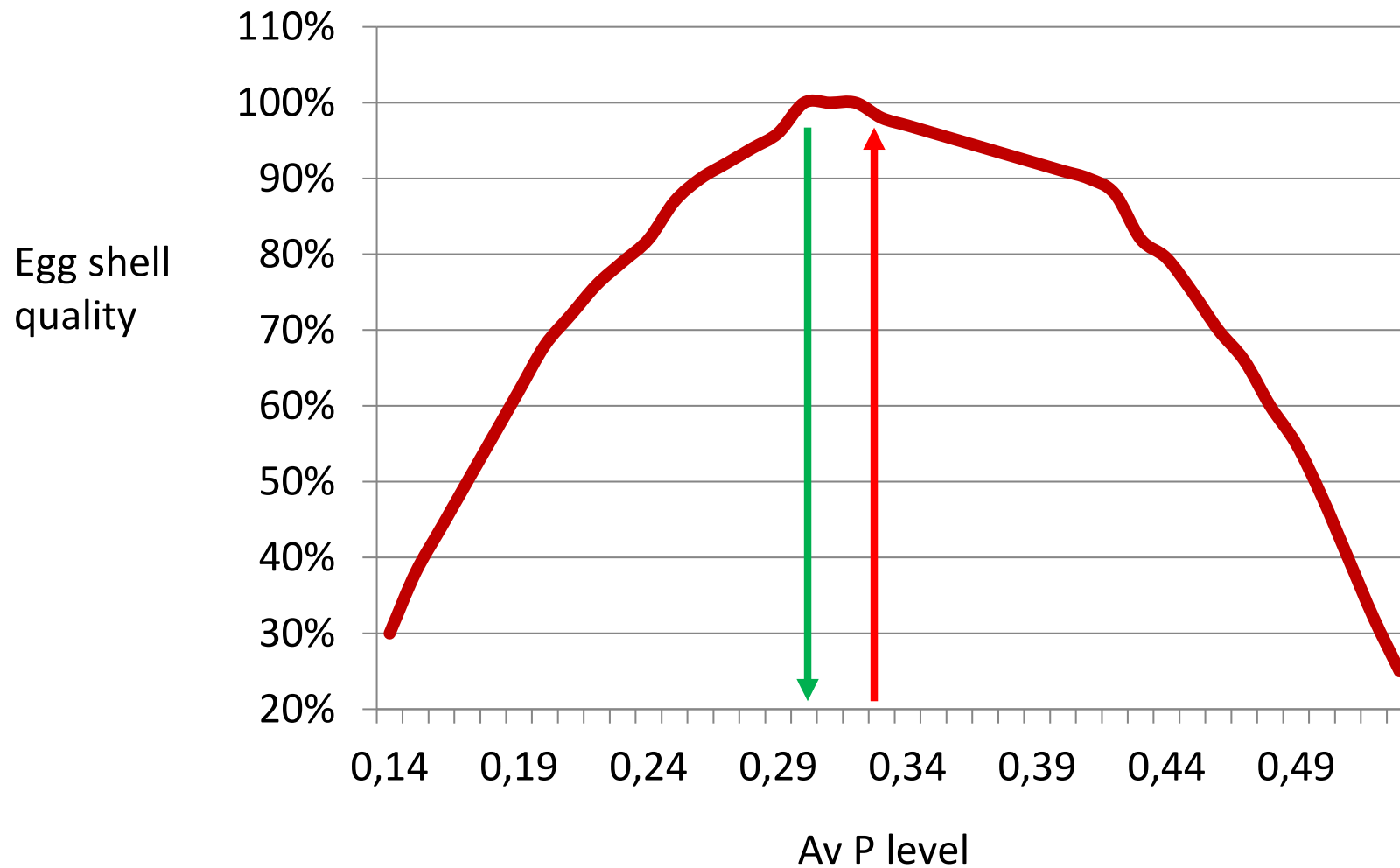
+ 10%



Recommendation after 70 weeks:  
300 mg Av P/ bird / day

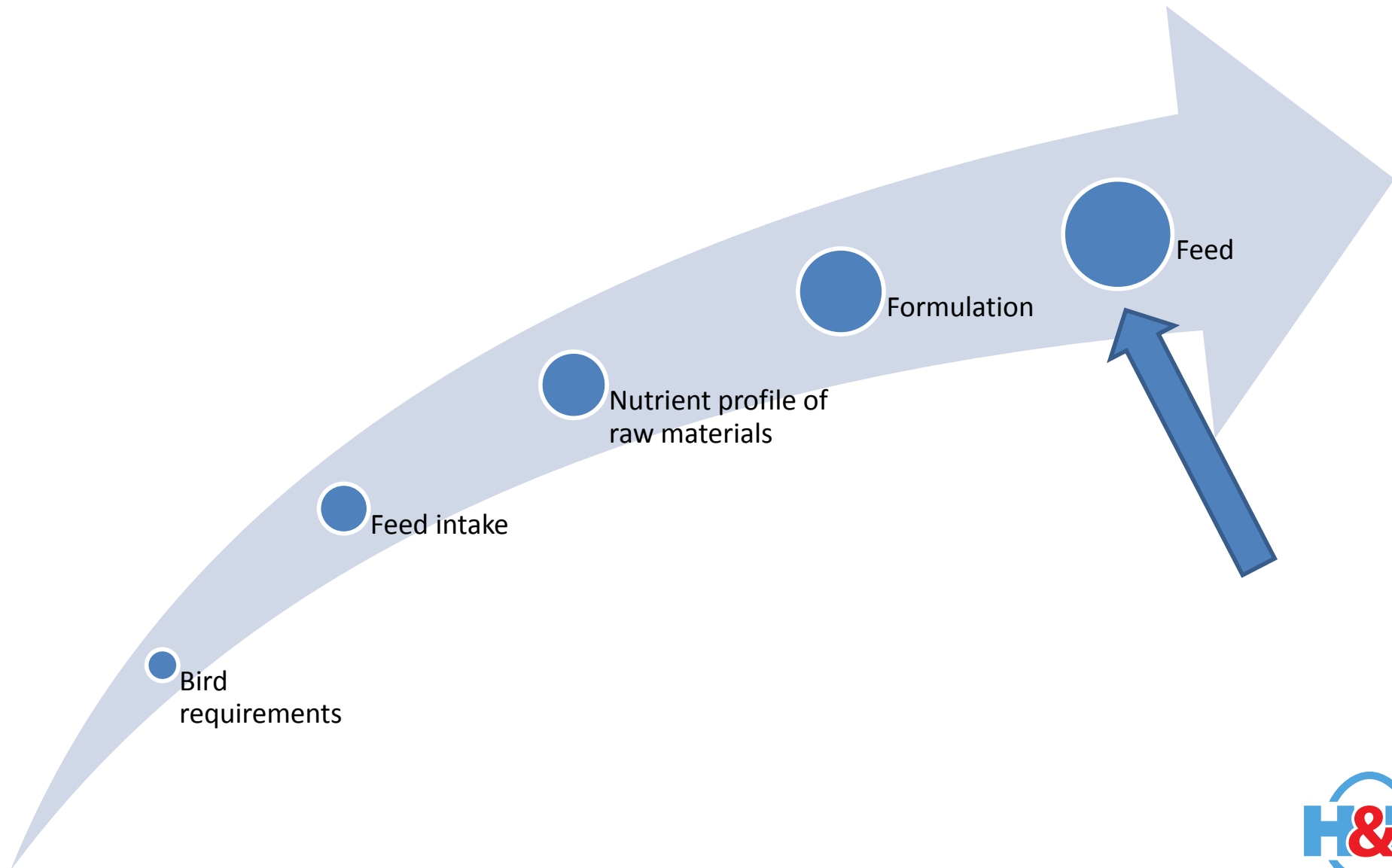


# Performance vs nutrients





# 5 steps in feeding



# Uniformity



# Summary

- We need to understand the needs but also the how we are going to supply those needs
- Birds will tell us how good is the formulation we are doing
- Making the feed is a process, all steps are important