

Revision of the Simplified Balance Method to Evaluate Phosphorus Excretion by pullets and laying hens



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Laetitia Cloutier

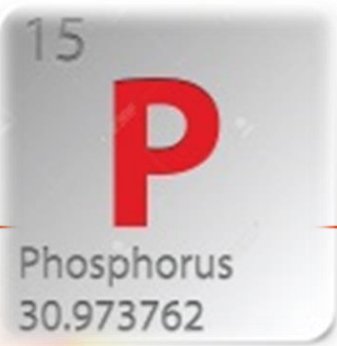
Rachel Chiasson

**Marie-Pierre
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Montminy**



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San Antonio Marriott Rivercenter





Introduction

- Plays vital roles such as energy metabolism and bone structure
- Found into bone, soft tissue and eggs
- High in vegetable feedstuffs of poultry diet but in the form of phytate which is **not available without an enzyme hydrolysis**

Introduction

- The use of a mineral source of P is still necessary to meet the needs of animals (DCP, MCP, ...)



- In Canada and USA , meat and bone meal is also used as a source of available P



Introduction

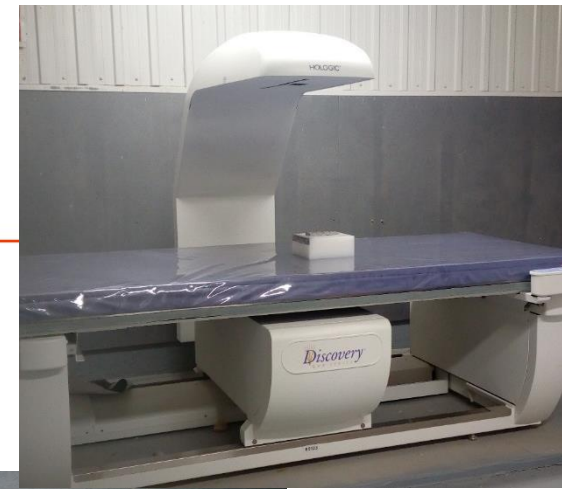
- Since 2010, guidelines have been developed in Quebec to minimize the risks associated with the application of livestock manure to agricultural soils.
- Each farm should assess P content of manure and adjusted manure application to crop needs.
- To simplify farmers work, that actually analyzed manure P chemically, the simplified balance method has been proposed.
 - **$P \text{ excretion} = P \text{ inputs} - P \text{ outputs}$.**

Objectives

The objectives of this work are to

1. Estimate the amount of P retained by **pullets, laying hens and egg** which has never been assessed in modern layers
2. Make a sensitivity analysis to highlight the factors of variation.

Methodology



Methodology

11 pullets and **13 laying hens** farms gave:

1. Feed and water samples
2. Birds and eggs to estimate P retention
3. Data to perform P balance (e.g. feed intake, body weight, eggs production and their classification)

Methodology

Pullet farms gave 5 birds 3 times during the cycle

Week 1



Week 10



Week 19

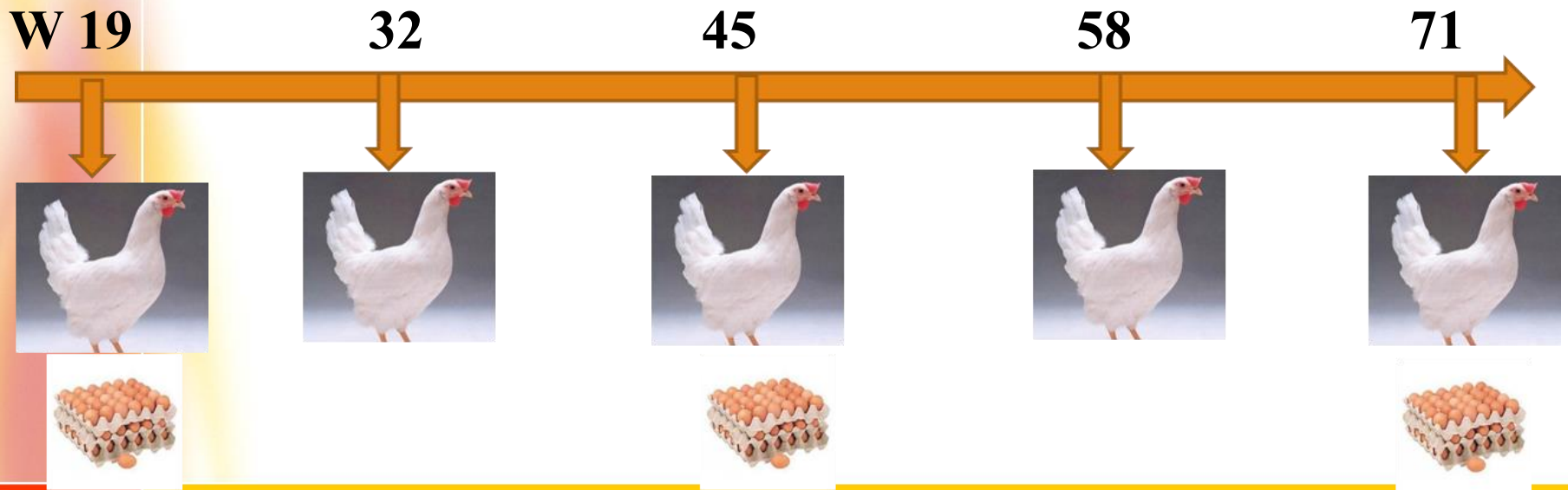


5 chicks per breeding X 11 producers X 3 deliveries

Methodology

Laying hens farms

- 5 deliveries of laying hens
- 3 deliveries of eggs (3 dozen eggs of different size)



Methodology



**Slaughtered, Scan
with Dual X-Ray
(DXA)**



**Grounded until
a homogeneous
sample is
obtained**



N, P, and Ca

**Body
retention**

Methodology



Scan with Dual X-Ray (DXA)



Eggs weight, strength, and Thickness



N, P, and Ca

Egg retention



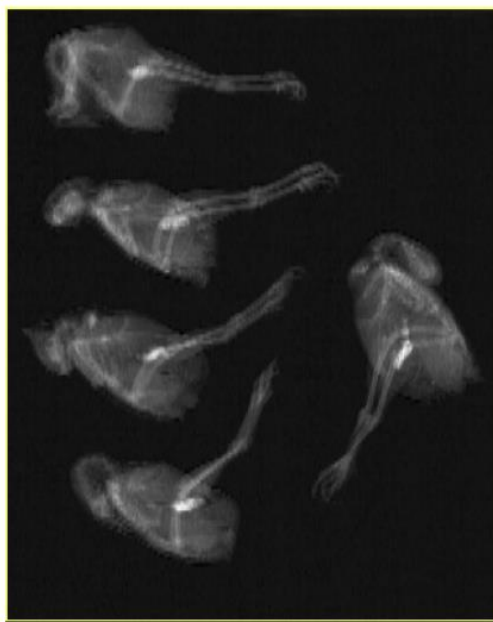
Results

Results

Pullets

$$-0.152 + 0.00664 * BW(g)$$

$$R^2 = 98\%$$



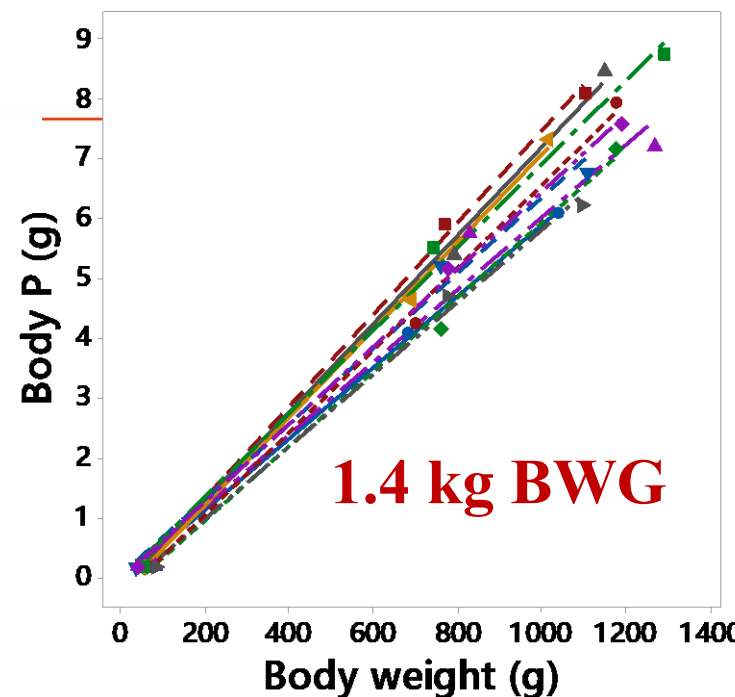
Scan Information:

Scan Date: 11 April 2017 ID: A04111706
 Scan Type: a Infant WB
 Analysis: 11 April 2017 08:50 Version 13.6.0.2:7
 InfantWB
 Operator:
 Model: Discovery W (S/N 85123)
 Comment:

DXA Results Summary:

Region	Area (cm ²)	BMC (g)	BMD (g/cm ²)	
GLOBAL	872.23	170.51	0.195	
Region	Fat Mass (g)	Lean + BMC (g)	Total Mass (g)	% Fat
GLOBAL	2015.5	6123.1	8138.6	24.8

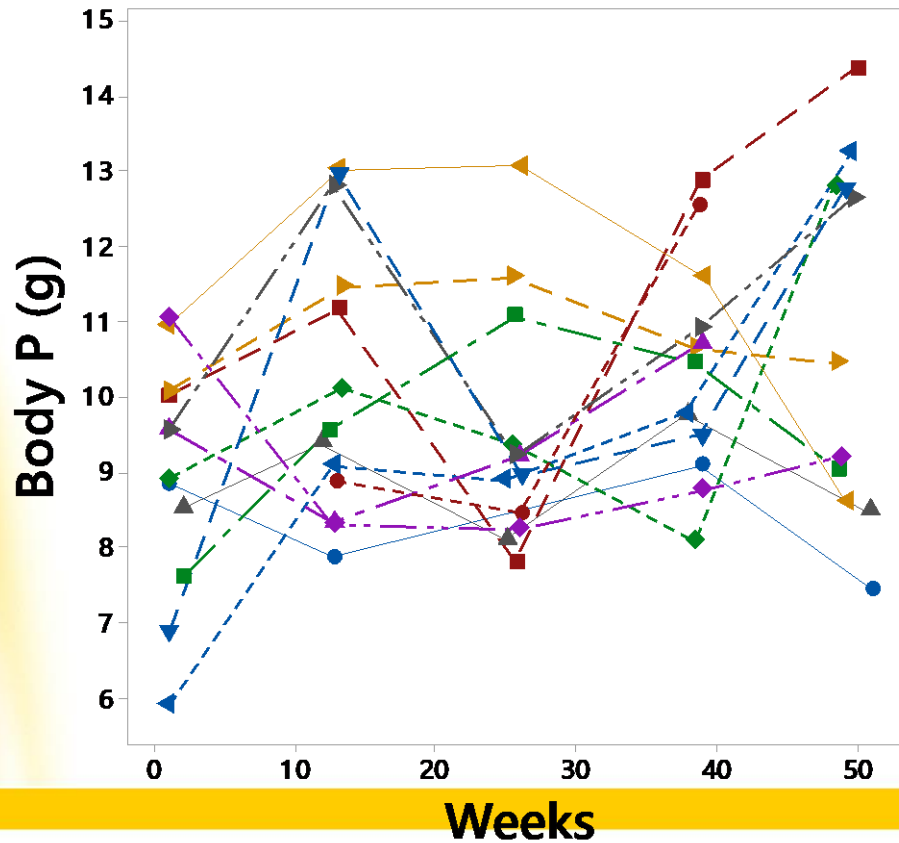
TBAR303



P retention pullets :
6.6 g/kg BWG

Laying hens

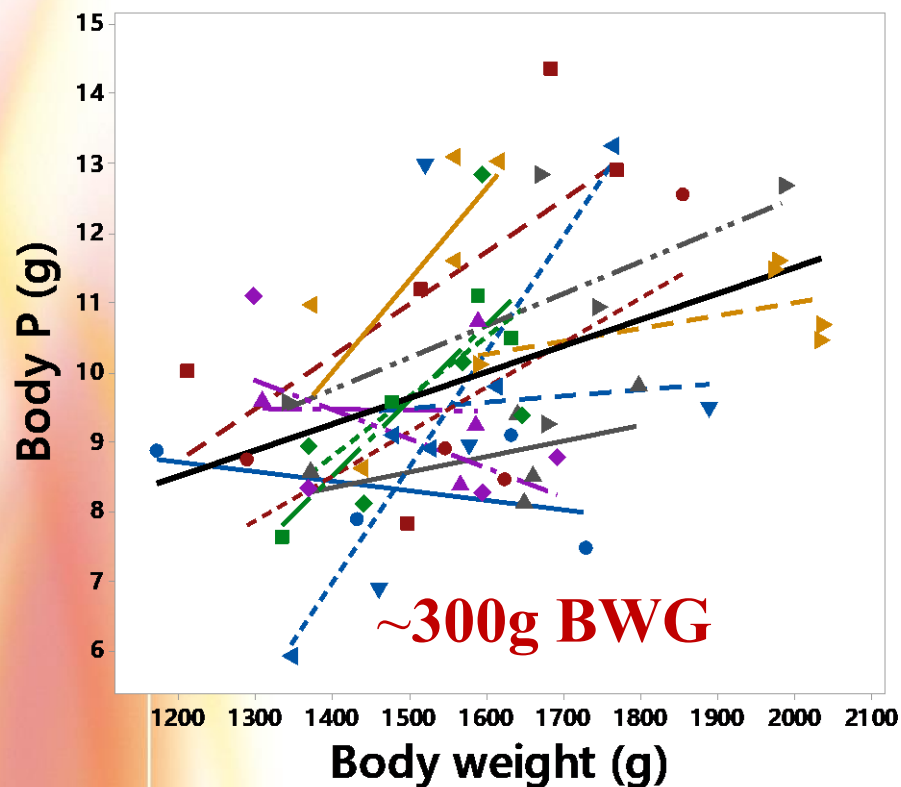
Results



Body P retention
variable and low

Results

Laying hens

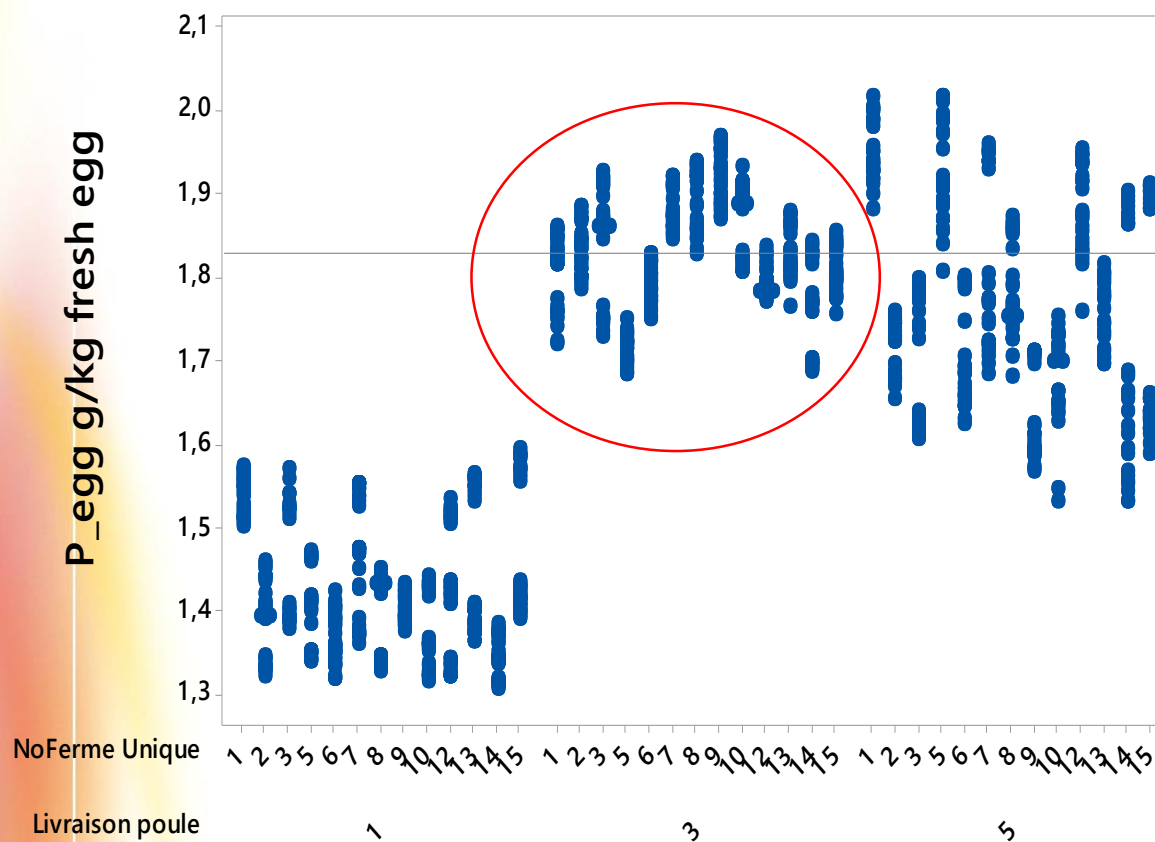


$$3.97 + 0.00376 * BW(g)$$
$$R^2 = 17\%$$

- A low correlation
between the body P and
the weight of the hen

P retention laying hens :
3.8 g/kg BWG

Results



P retention egg:
1.8 g/kg egg

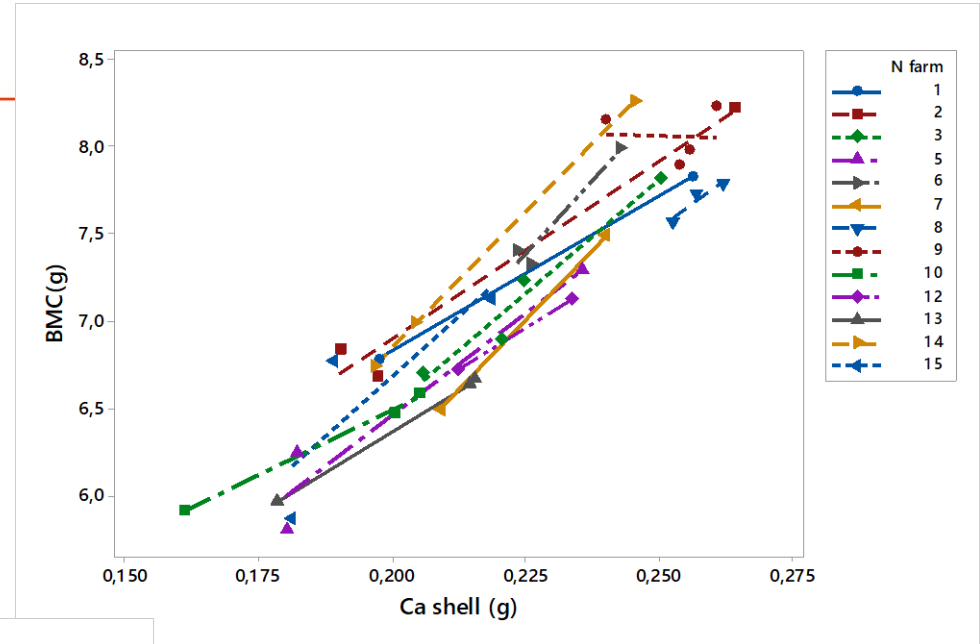
Results

Using P retention coefficients obtained and farms data:

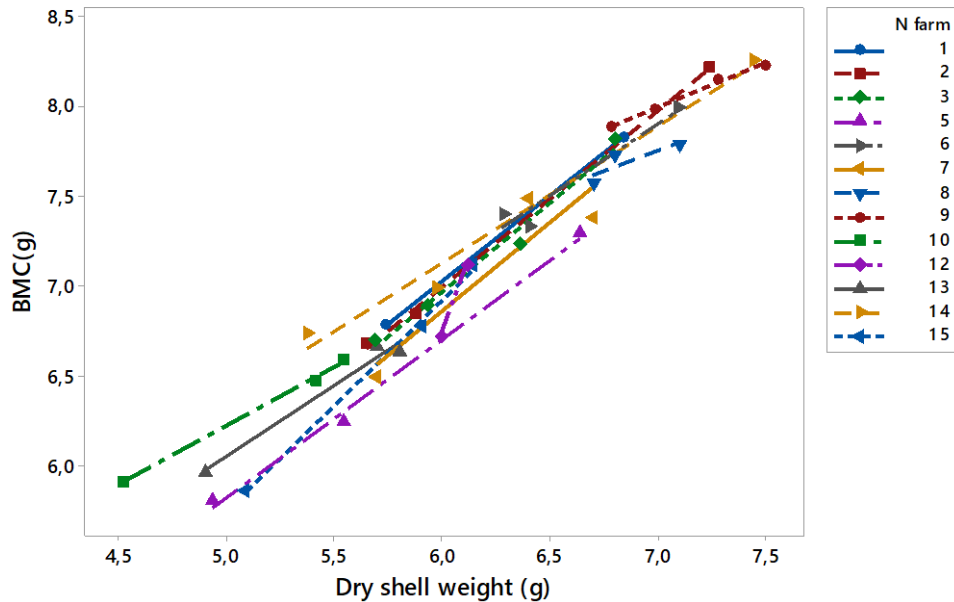
- Pullet retained only 25% of dietary P
- Laying hens retained 17% of dietary P in eggs and 2% in body

Results

The results obtained by the scan showed that the BMC is well correlated with the weight of the dry shell and Ca content



$$\text{Ca shell(g)} = -0.0405 + 0.0367 * \text{BMC(g)}$$
$$R^2 = 85\%$$



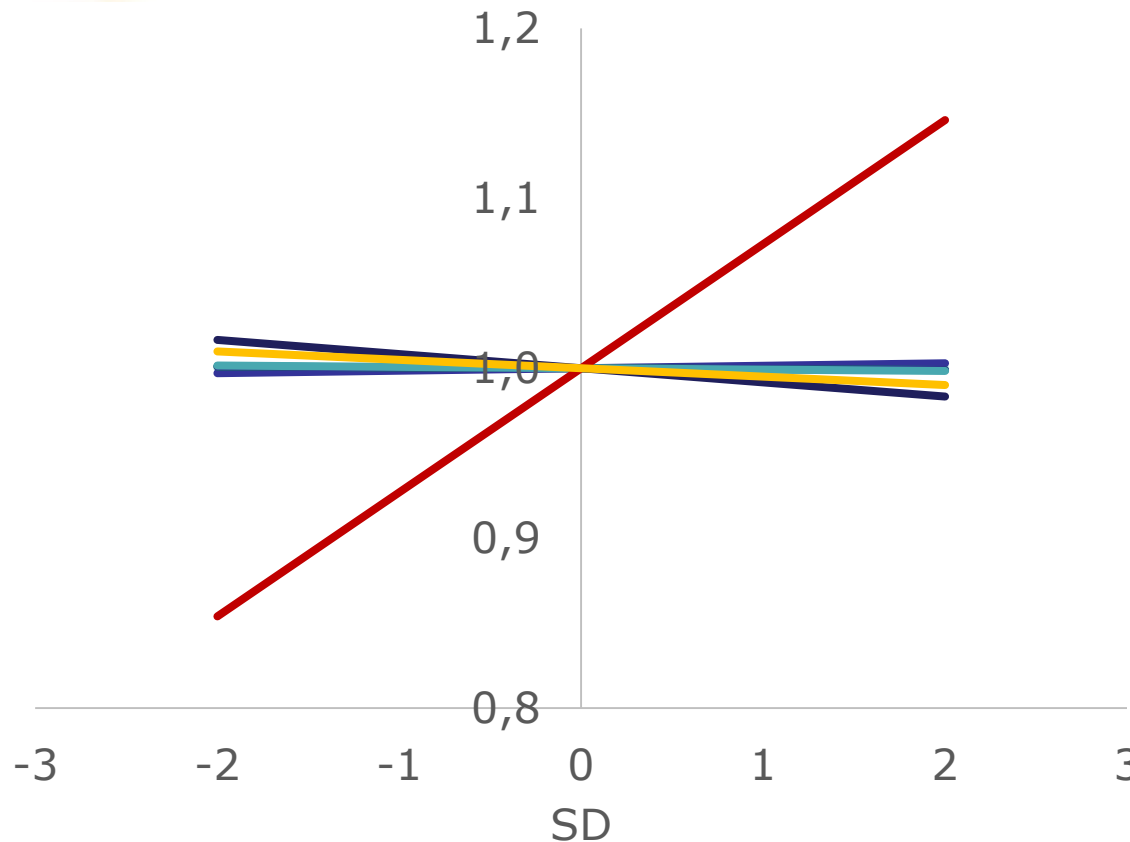
$$\text{Dry shell weight (g)} = -1.201 + 1.0366 * \text{BMC(g)}$$
$$R^2 = 95\%$$

Sensitivity analysis

Allows to study the impact of the variability of the input factors of the model on the output variable

Establishment of critical and sensitive parameters

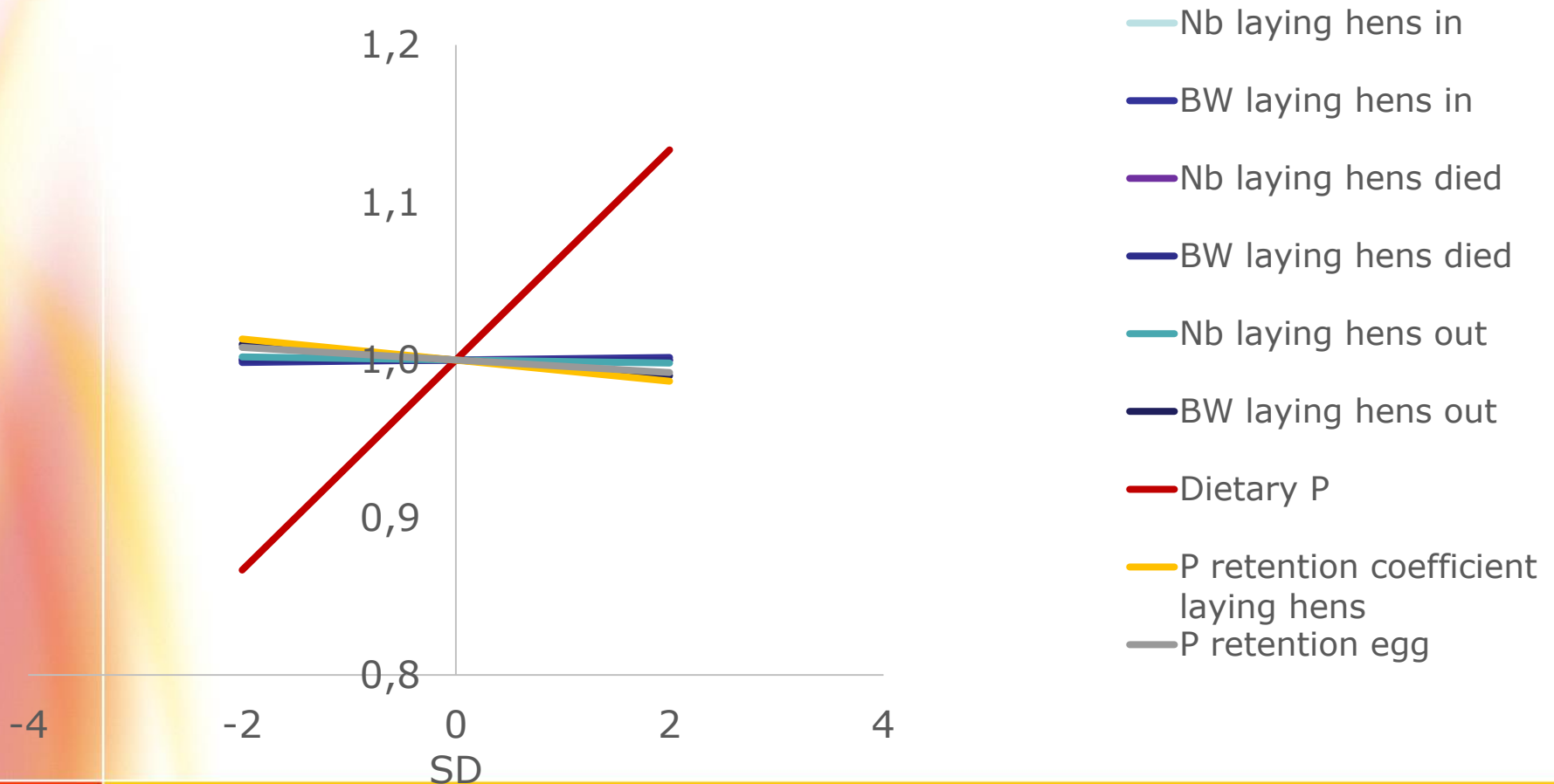
Results



- Nb Pullet in
- BW pullet in
- Nb Pullet died
- BW pullet died
- Nb Pullet out
- BW pullet out

Sensitivity analysis showed that **dietary P** is the only sensitive parameters requiring precise characterization of feedstuffs.

Results



Conclusions

- Low P retention in pullet and laying hens
- For pullets P retention did not vary between farms and was of **6.6 g / kg gain**
- For laying hens, P retention is higher in egg and was of **1.8 g / kg egg** while that of body really variable and low
- Dietary P content is the most sensitive criterion therefore requiring analyzed values



Thank you for your attention

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