HIPRA

Monitoring colostrum uptake MDA Transfer Test

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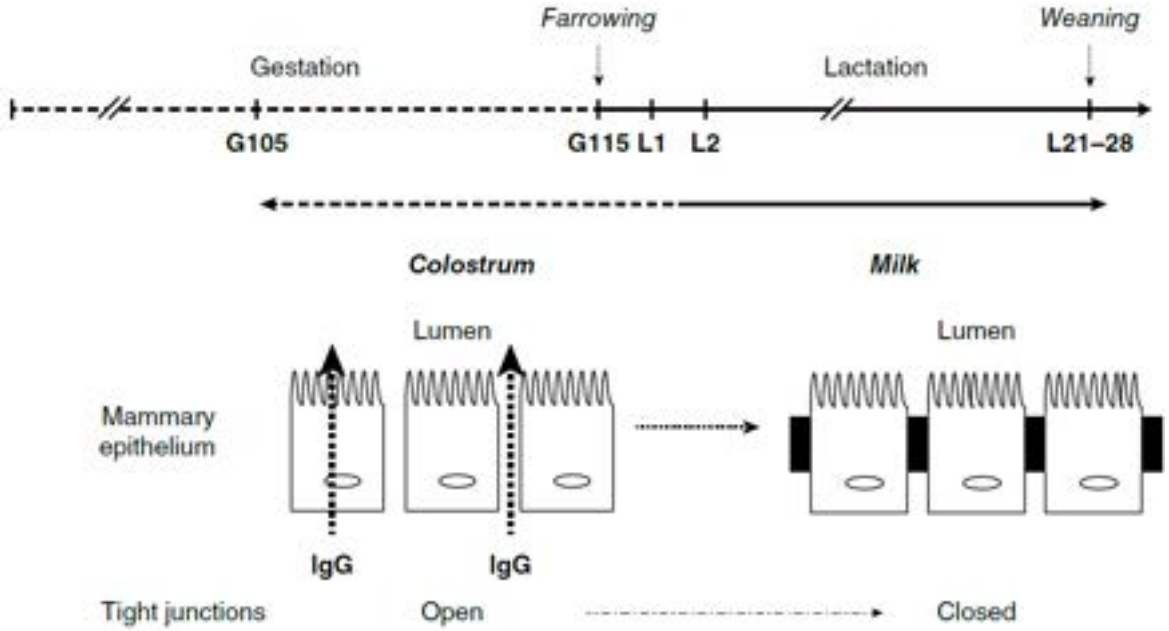
The importance of colostrum

3 main functions

- Source of energy and nutrients
- Source of both Passive and Celular immunity
- Growth factors that estimulate intestinal closure and maturation

Colostrum production and absorption



Source of energy and immune protection

	Colostrum			Transient milk		Mature milk	
Time *postpartum*	Early 0 h	mid 12 h	late 24 h	36 h	72 h	17 day	s.e.m.
Chemical composition (g/100 g)[1]							
Fat	5.1^{c}	5.3^{c}	6.9^{bc}	9.1^{a}	9.8^{a}	8.2^{b}	0.5
Protein	17.7^{a}	12.2^{b}	8.6^{c}	7.3^{cd}	6.1^{d}	4.7^{e}	0.5
Lactose	3.5^{d}	4.0^{c}	4.4^{bc}	4.6^{b}	4.8^{ab}	5.1^{a}	0.1
Dry matter	27.3^{a}	22.4^{b}	20.6^{b}	21.4^{b}	21.2^{b}	18.9^{c}	0.6
Energy (kJ/100 g)[2]	260^{d}	276^{d}	346^{c}	435^{ab}	468^{a}	409^{b}	21

	Early colostrum	Mature milk
IgG (total) (mg/ml)	61.8	1.6
IgA (mg/ml)	11.3	4.1
IgM (mg/ml)	3.8	1.5

Source: Adapted from Theil et al. (2014a)

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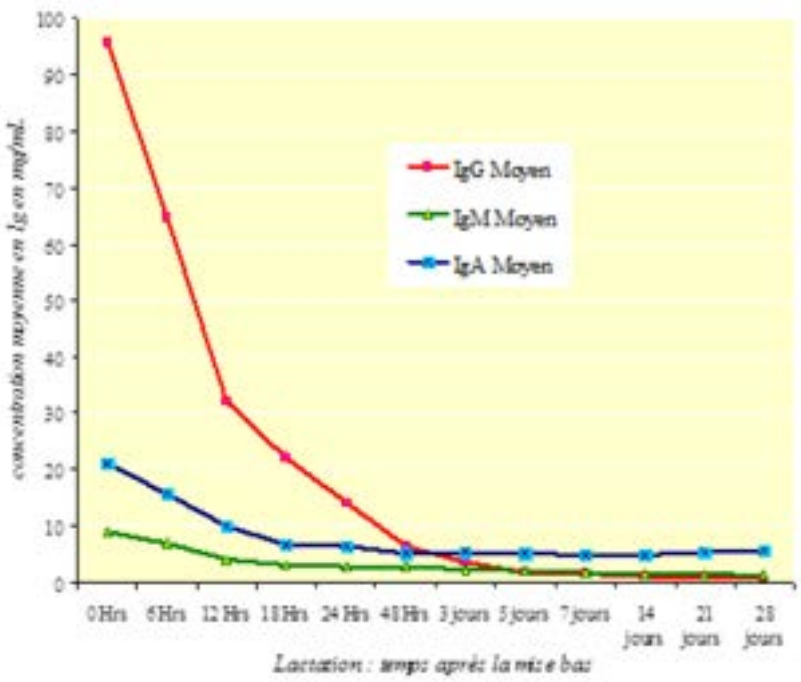
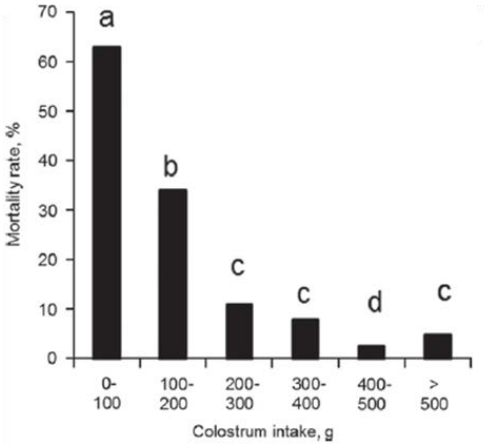
Colostrum production and absorption



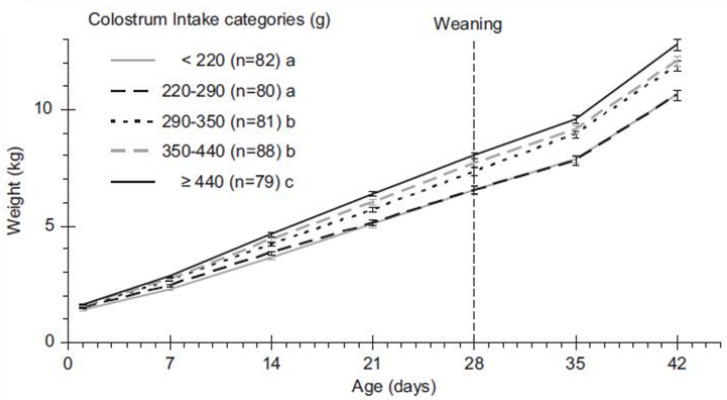
Influence of colostrum intake during the first 24h

Mortality rate until weaning



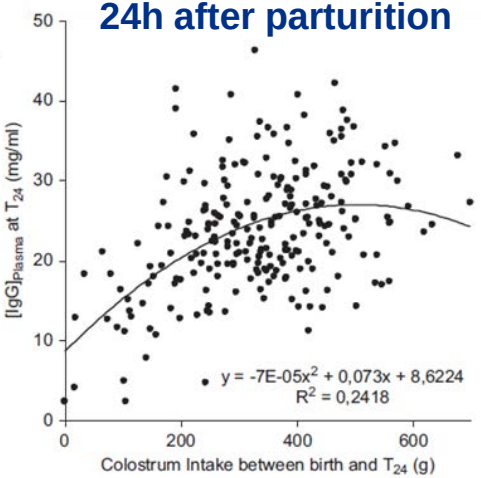
Mortality rate was as low as **7.1%** when piglets ingested **>200 g** and **increased** to **43.4%** when intake was **<200 g**

Piglet growth from 1 to 42 days of age



Colostrum intake has **long-term effects** on piglets' growth from 3 weeks of age **until after weaning**

Plasma [IgG] of piglets 24h after parturition



Plasma **[IgG] reaches** a **plateau** when colostrum intake increases **beyond 200-250 g**

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¿How much colostrum (Kg) can a sow produces?

Mean: 2,5 – 3,5 kg

1,1 kg to 4,7 kg (Foisnet *et al*., 2010)

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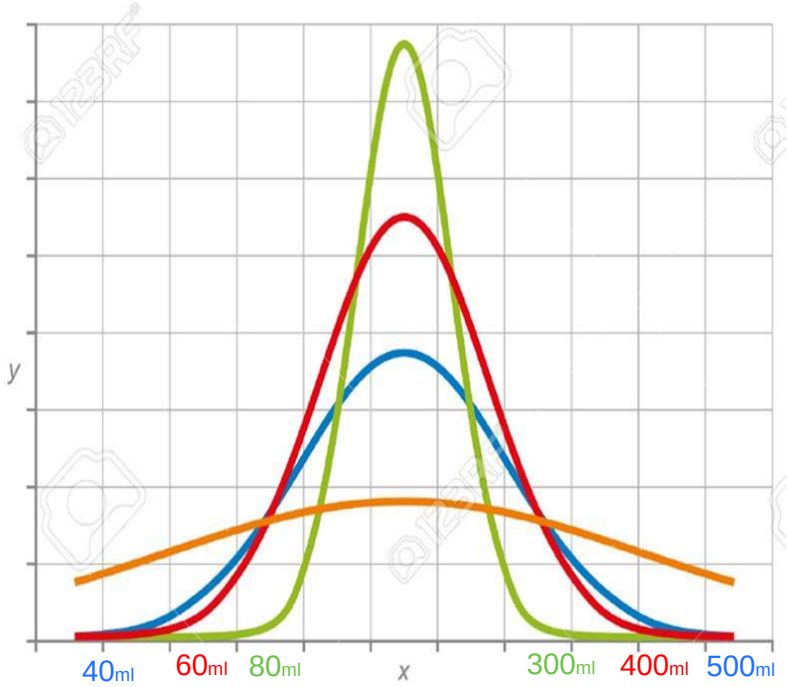
- **Recommended intake** is **200-250 g/piglet**
- **Hiperprolificity:** Difficult to reach the recommended quantity in all the piglets

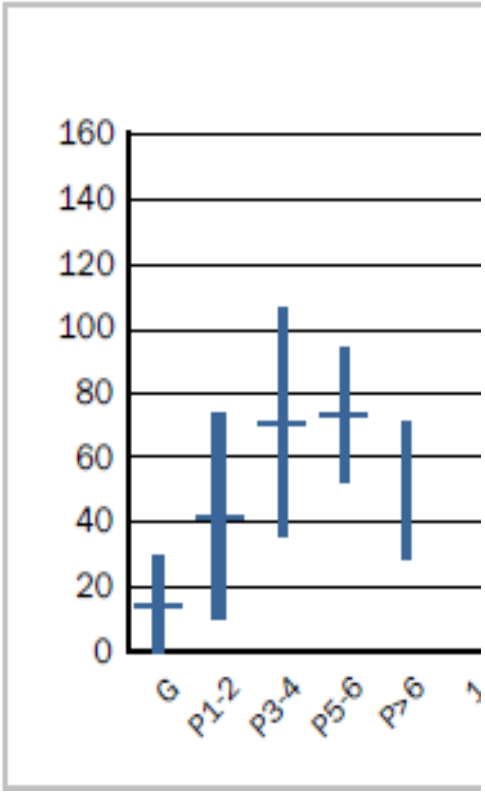
Piglet subpopulations will always exist

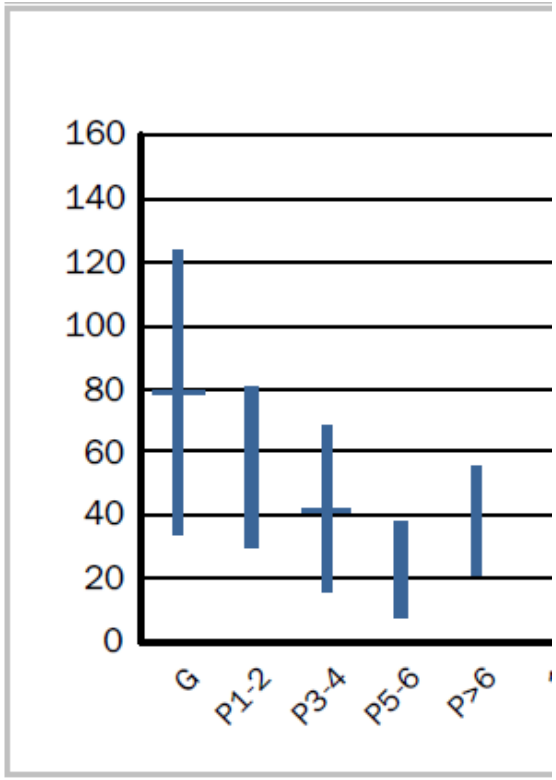


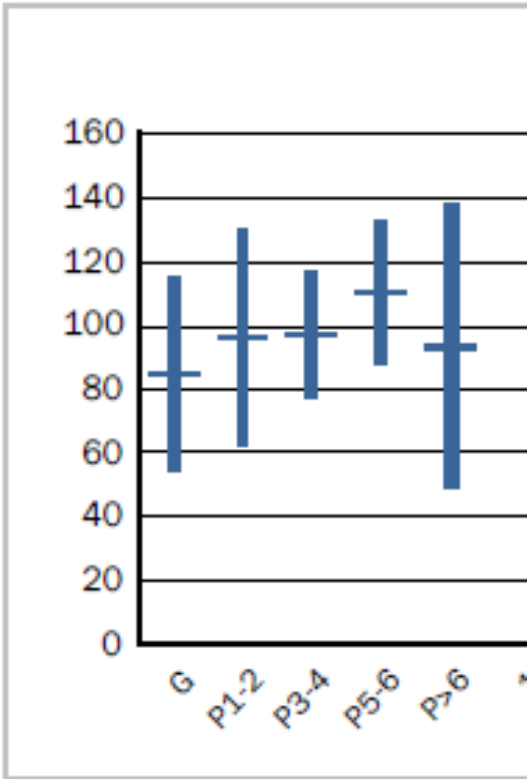
What generates colostrum subpopulations ?

- Sow **age & adaptation protocol for gilts**
- **Body weight** at birth
- **Problems** (with the sow / with the piglet)
- **Mis-management** (split suckling / feeding)

The importance of the sow age







Measuring colostrum intake

Piglet's suckling ability

Sow's colostrum yield

Measuring colostrum intake

Qualitative methods

Quantitative methods

Type	Methodology	Bibliography
Qualitative	**Termography**	https://www.nationalhogfarmer.com/animal-health/measuring-post-natal-changes-piglet-body-temperature
	Body weight	**Devillers et al., 2004**. Estimation of colostrum intake in the neonatal pig
		Devillers et al., 2011. Influence of colostrum intake in piglet survival and immunity

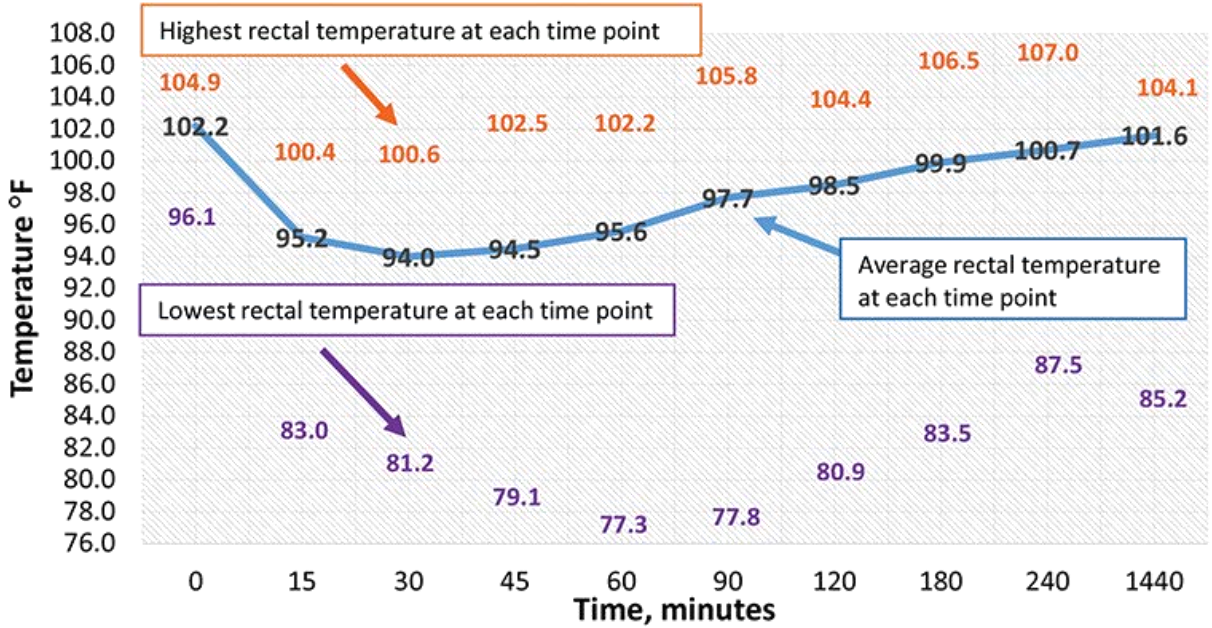
Measuring colostrum intake

Thermography

Sow body temperature
38.3 – 38.9°C

Piglet body temperature
0h - 39°C
45 min - 34,7°C
24h – 38,6°C

Figure 1: Change in rectal temperature over 24 hours after birth

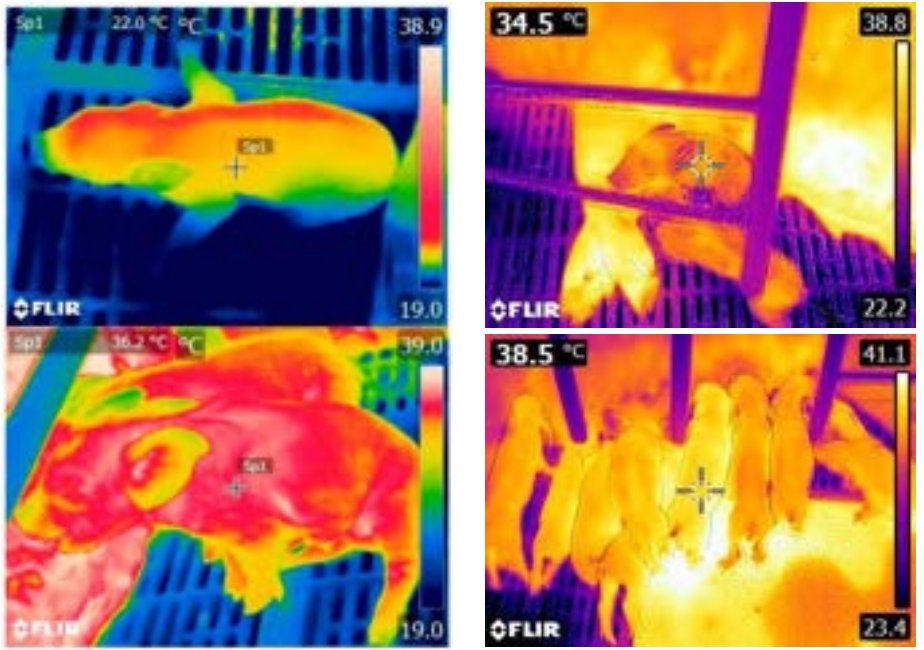


Source: National Hog Farmer

Measuring colostrum intake

Thermography

If the piglet does not take enough colostrum, there is a decrease in body temperature between 2.5°C - 4°C.



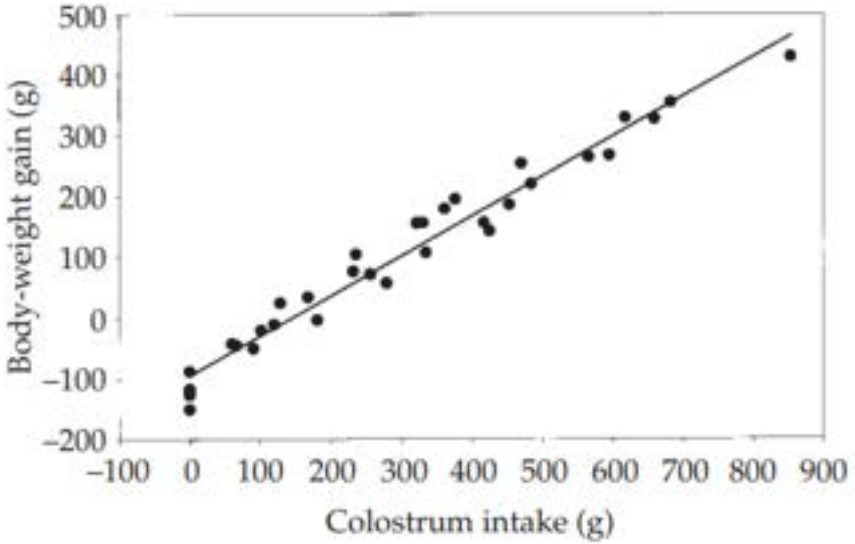
Measuring colostrum intake

Body weight

80% of the colostrum is taken within the first 8h of life

Colostrum intake = BW^{24h} – BW farrowing

It does not take into consideration the evaporative lose of water.



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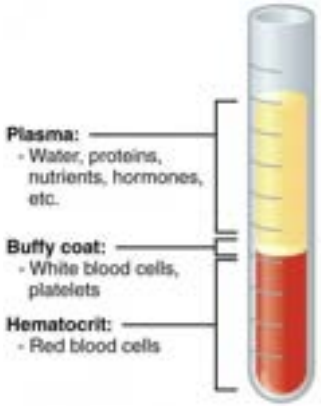
Quantitative	Inmunocrit	**Peters B. M., 2015.** Reference values for immunocrit ratios to assess maternal antibody uptake in 1-day-old piglets
		Vallet J. L., 2015. Relationships between day one piglet serum immunoglobulin immunocrit and subsequent growth, puberty attainment, litter size, and lactation performance
		Sánchez-Matamoros A. et al., 2019. Immunocrit assay is a tool to evaluate the management of maternally derived immunity in sow farms
		Benneman P. E.., 2021. Performance of piglets according to colostrum intake and serum immunoglobulin concentration determined by the immunocrit method

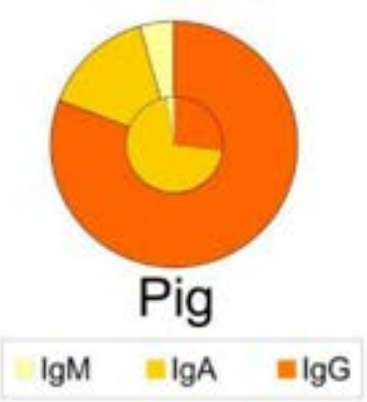
Measuring colostrum intake

Inmunocrit

Method that allows to quantify the amount of protein in serum by means of its precipitation.

Colostrum is composed by 17% of protein, basically immunoglobulins like IgA and IgG.

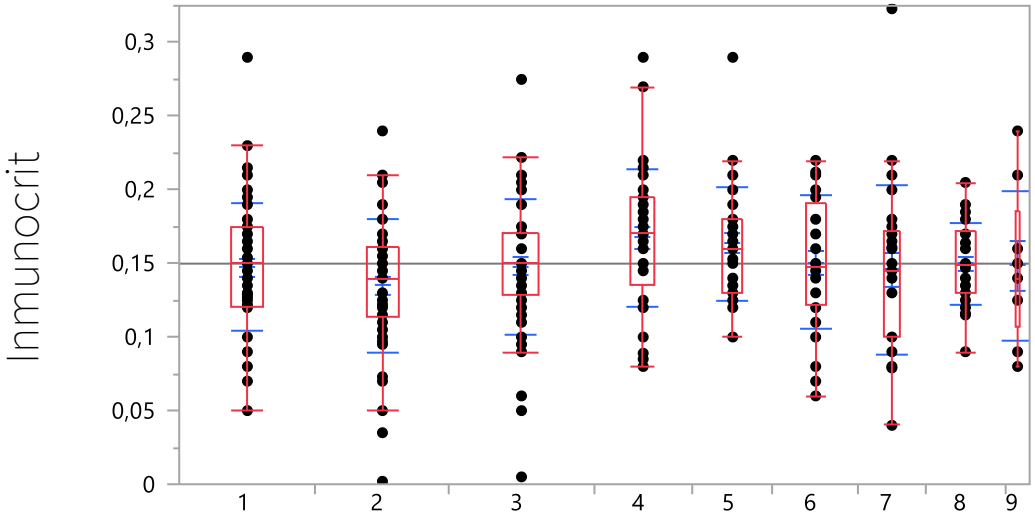




Source: Hurley et al. 2011

Measuring colostrum intake

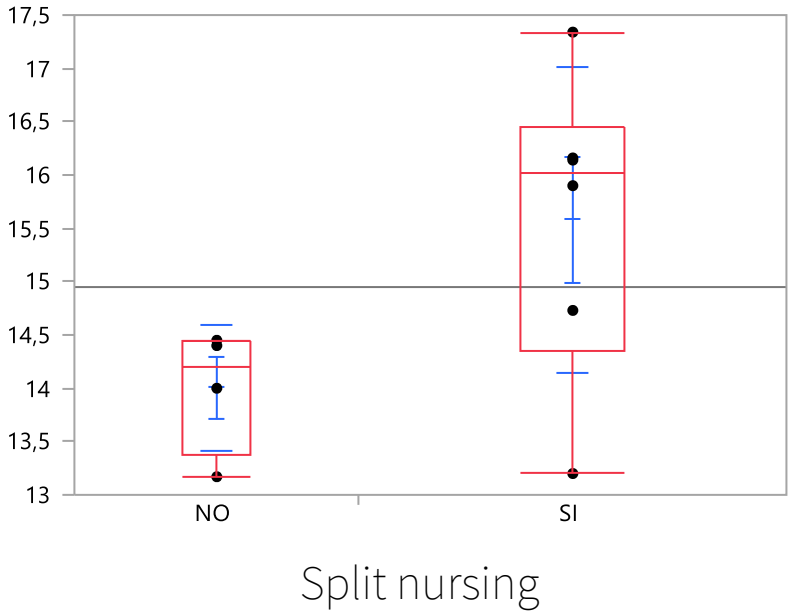
Inmunocrit at individual piglet level



Source: Maternally derived immunity in pigs. Exploring its management through the immunocrit assay. Sánchez-Matamoros et al 2018

Measuring colostrum intake

Inmunocrit at litter level



Source: Internal data (HIPRA)

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	Brix grades	**Schoos A. et al., 2021.** Evaluation of the agreement between Brix refractometry and serum immunoglobulin concentration in neonatal piglets

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Measuring colostrum intake

Refractometry

Evaluation of the agreement between Brix refractometry and serum immunoglobulin concentration in neonatal piglets

A. Schoos [a,*], W. De Spiegelaere [b], A. Cools [d], B. Pardon [c], E. Van Audenhove [a], E. Bernaerdt [a], G.P.J. Janssens [d], D. Maes [a]

[a] Department of Reproduction, Obstetrics and Herd Health, Unit of Porcine Health Management, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium
[b] Department of Morphology, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium
[c] Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium
[d] Department of Nutrition, Genetics and Ethology, Faculty of Veterinary Medicine, Ghent University, Heidestraat 19, 9820 Merelbeke, Belgium

- Measures total solid percentage in a solution (Ig represent >50% of total protein in neonatal piglet serum)
- Suggested Brix cut-off values can help to evaluate if there is a lack of antibodies in piglets during a herd visit
- Commonly used in calves and foals

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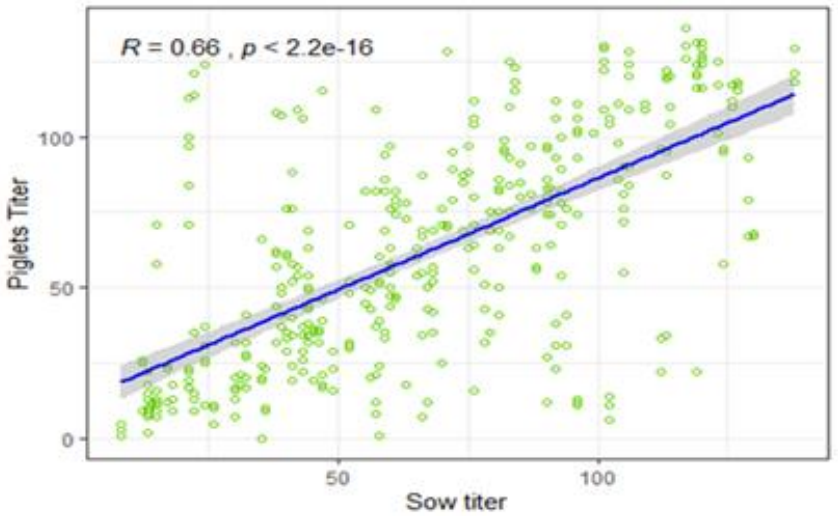
	ELISA	**Devillers et al., 2011.** Influence of colostrum intake in piglet survival and immunity
		Molitor T. W. et al., 2014. Colostral antibody-mediated and cell-mediated immunity contributes to innate and antigen-specific immunity in piglets

Measuring colostrum intake

ELISA Test

Take blood samples from the sow and the piglet after inducing a immune response against a specific disease.



Strengths and weaknesses

	CUALITATIVE		QUANTITATIVE		
	Termography	Body Weight	Immunocrite	Brix	ELISA
Especificity	Low	Low	Medium	Medium	High
Cost	Medium	Low	Low	Low	Medium
Labour	Low	High	Medium	Medium	Medium

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ELISA Swine Erysipelas

- 100% sows get vaccinated against Swine Erysipelas

- Swine Erysipelas vaccination induce an antibody response which is mesurable by ELISA .
- CIVTEST Suis SE/MR
  - Is robust: consistent results when repeating the test
  - Allows to quantify the amount of antibodies

- There is a **direct corelation** between antibody level of the sow and the ones transfered to their offspring via colostrum

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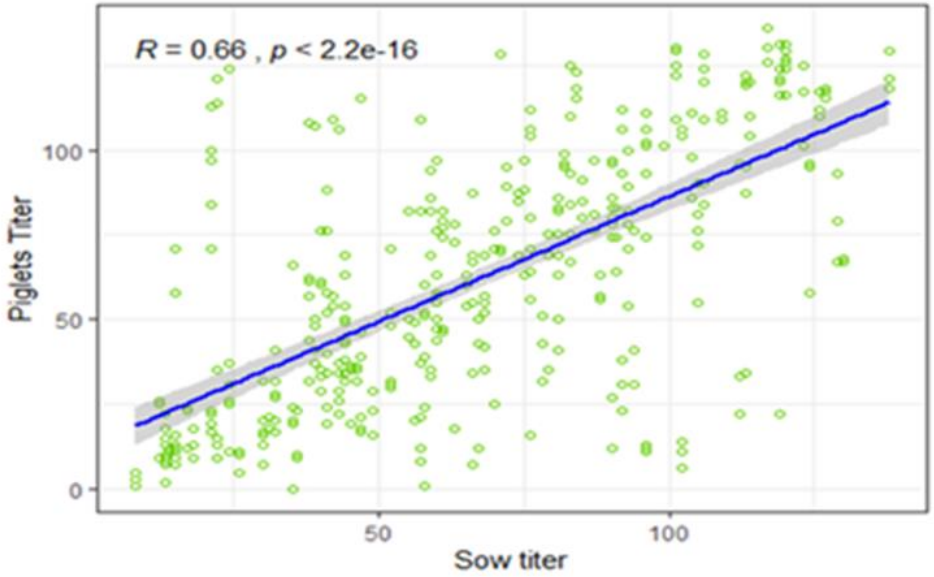
To assess the correct transfer of immunity from mother to piglet



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Sow - piglet antibody titer corelation

Sow titre	Piglet titre
100	≈ 90 - 110
65	≈ 55 - 75
40	≈ 30 - 50
25	≈ 20 - 30

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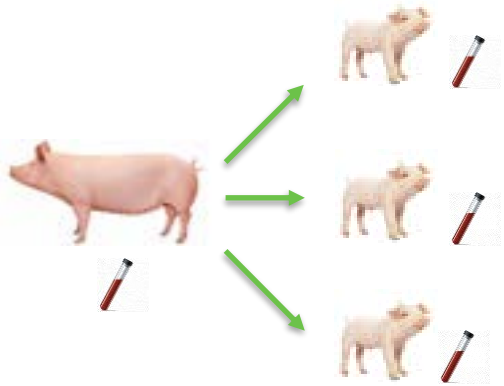
How to do it?

Step 1: select and mark 4 midle size piglets/sows at the date of farrowing

Farm size (sows)	Sampling (sows)
< 500	10
500 - 800	15
800 – 1,000	20
1,000 – 2,000	25

Step 2: collect blood samples from each sow and its piglets (n=3) at day 7 after farrowing



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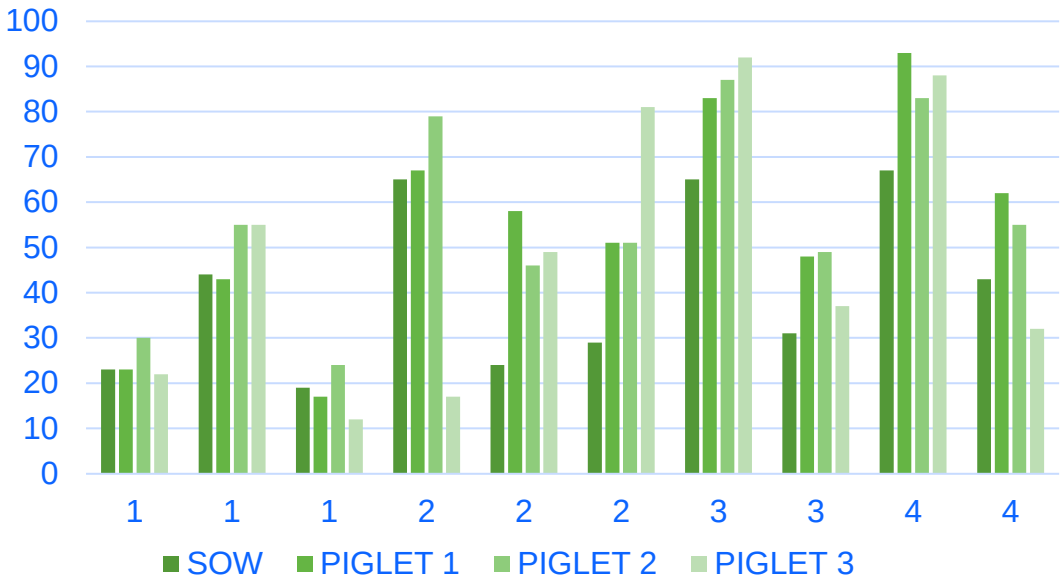
What do we expect in case of good colostrum intake?

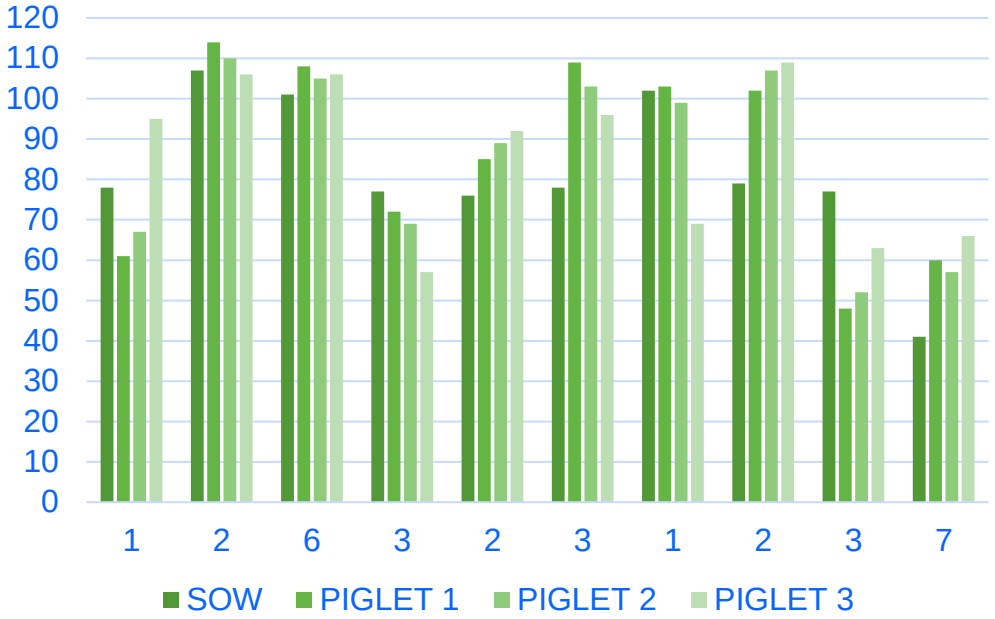
Sow Nº - Parity	Sow titre	Piglet 1	Piglet 2	Piglet 3
1890 - 1º	59	71	56	56
611 - 3º	41	59	59	50
643 - 3º	30	46	71	46
130 - 4º	52	73	69	75
9391 - 5º	51	38	30	35
9388 - 5º	36	52	1	46
9360 - 5º	72	91	115	78
8949 - 6º	56	48	68	72



France: 250 sow farm Farrow to Finish; Weaning at 21 days;

Vaccination : ALUMINIUM HYDROXIDE vaccine at 15 **after farrowing**;

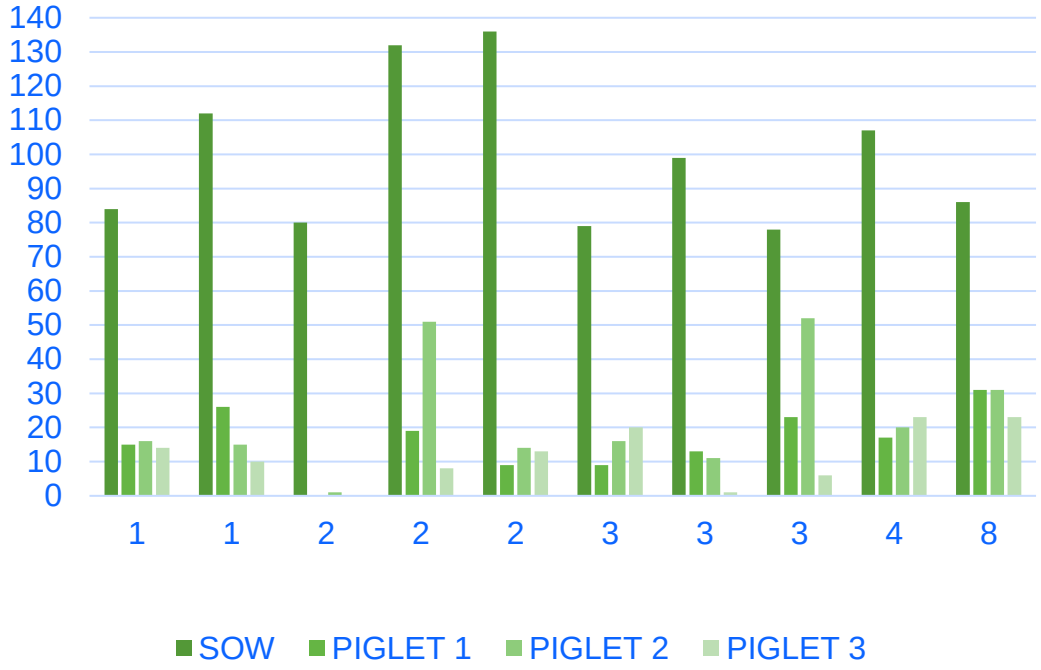
Sampling: **7 days** of age



France: 250 sows / weaning at 21 days

Vaccination : Special adjuvant (vaccine 1) at 2 weeks **before farrowing**

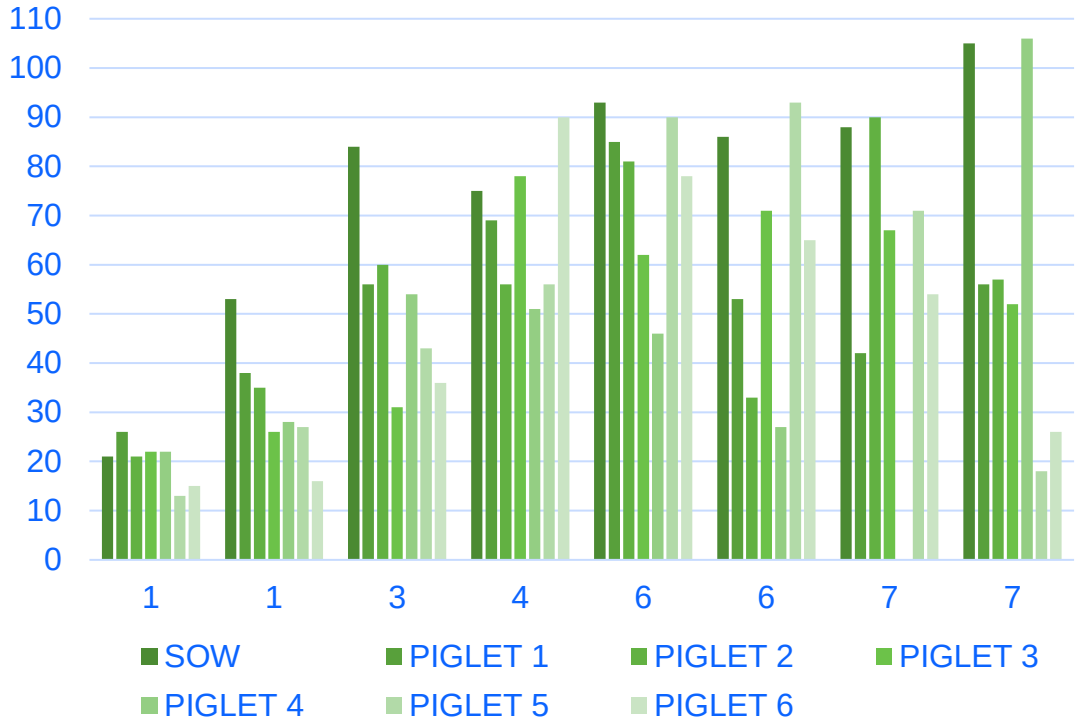
Sampling: **8 days** of age



Spain: 2500 sows, weaning at 24 days

Vaccination: Special adjuvant (vaccine 1) at 21 days **after farrowing**

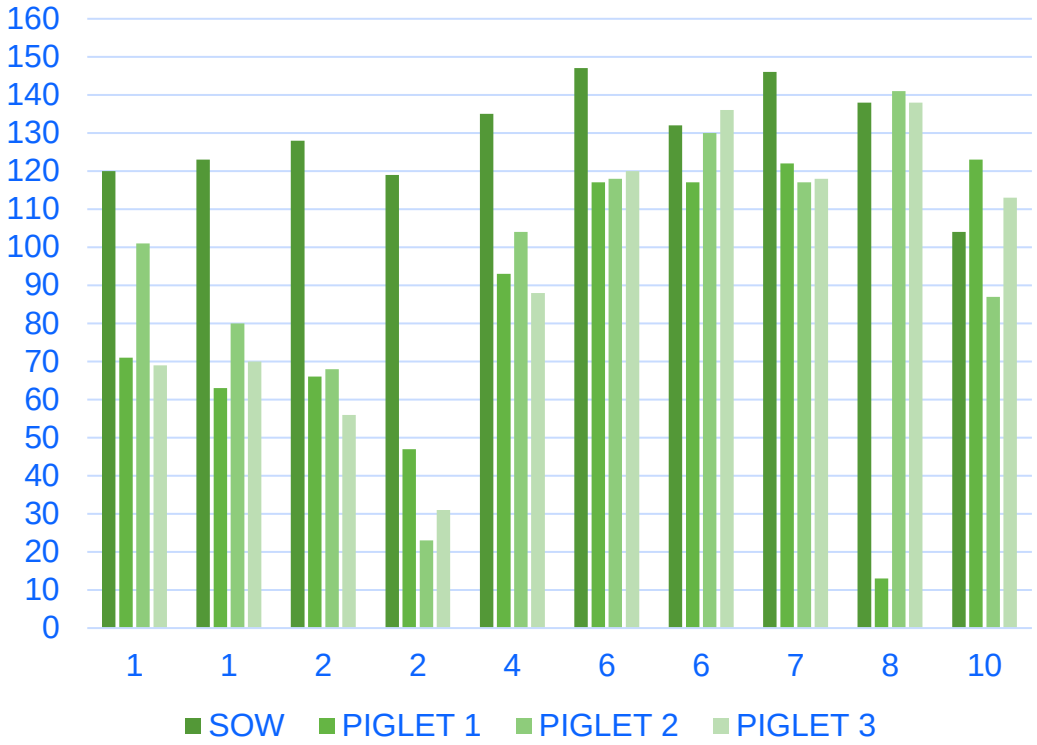
Sampling: **7 days** of age



Belgium: Farm 440 sows, weaning at 24 days

Vaccination: Special adjuvant (vaccine 2) at 10 days **after farrowing**

Sampling: **7 days** of age



France: FF 140 sows, weaning at 21 days

Vaccination: Special adjuvant (vaccine 1) at 15 days **after farrowing**

Sampling: at **7 days** of age

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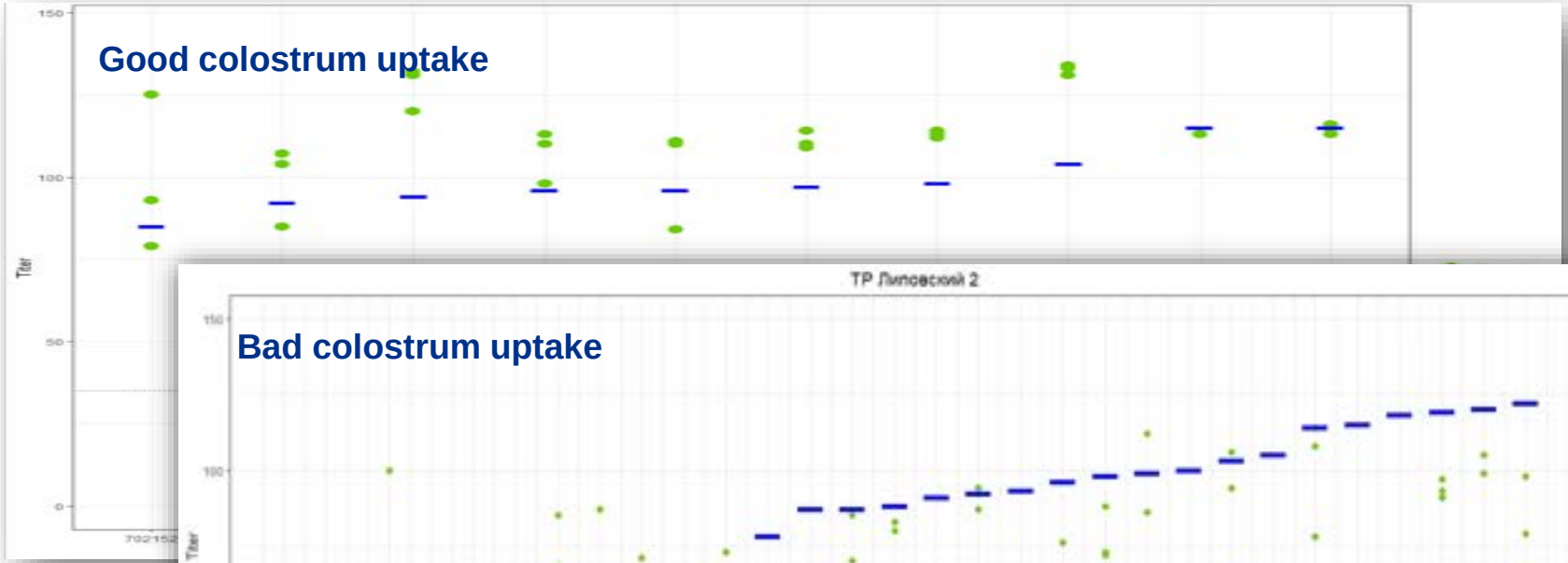
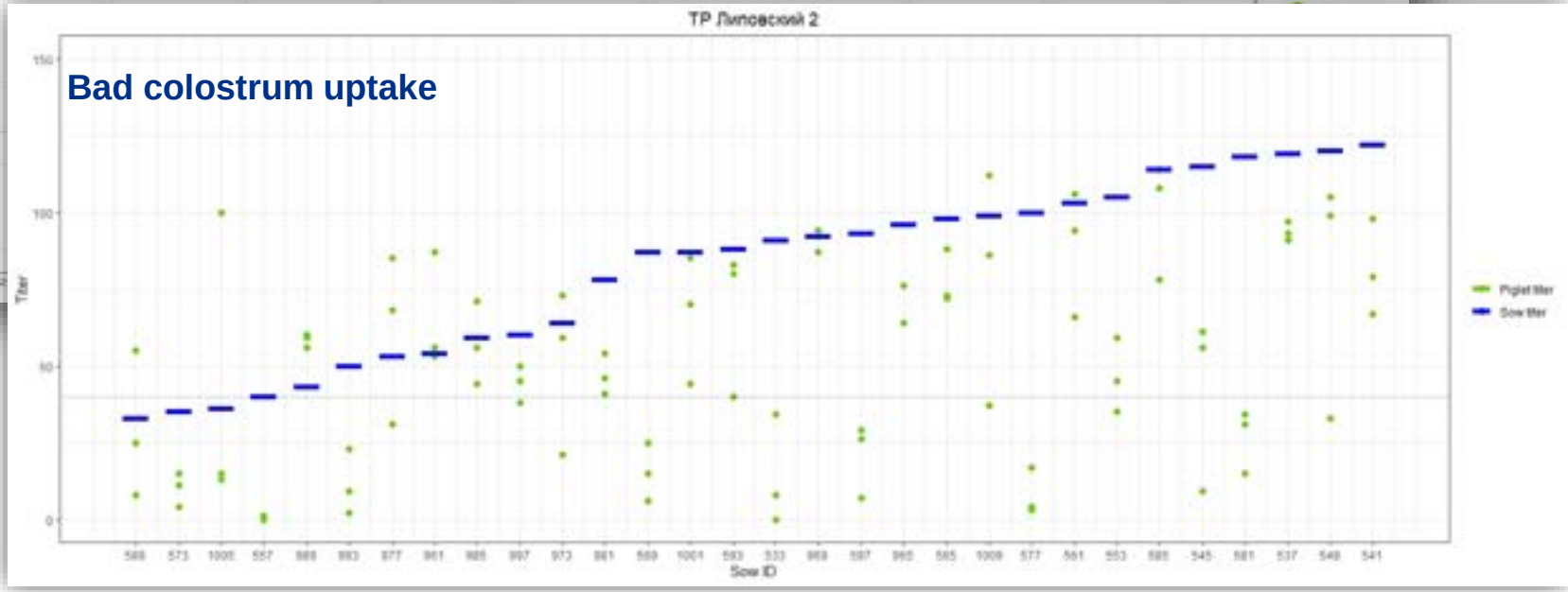
Good colostrum uptake



Bad colostrum uptake



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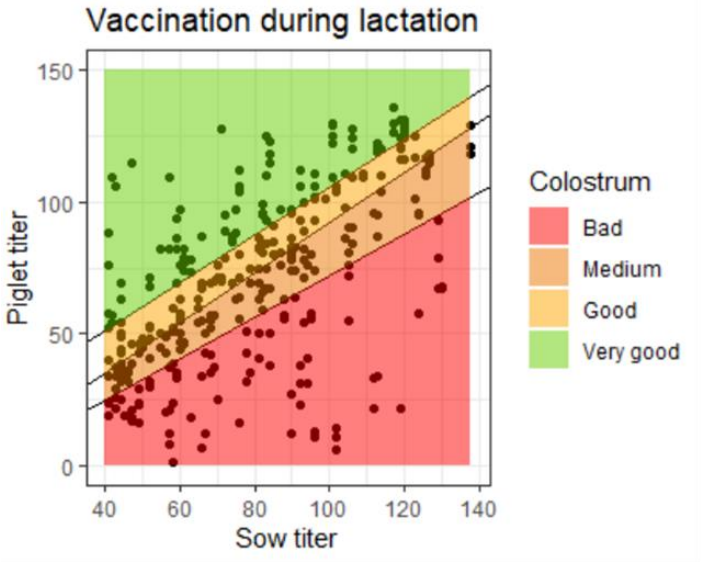
Creating a farm scoring



$$Farm\ Scoring(\%) = \frac{\sum Points\ 30\ piglets}{120}\ x\ 100$$

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Creating a farm scoring

MDA TRANSFERTEST

Gestation vaccination
Gestation vaccination
Gestation vaccination
Gestation vaccination
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Gestation vaccination
Lactation vaccination
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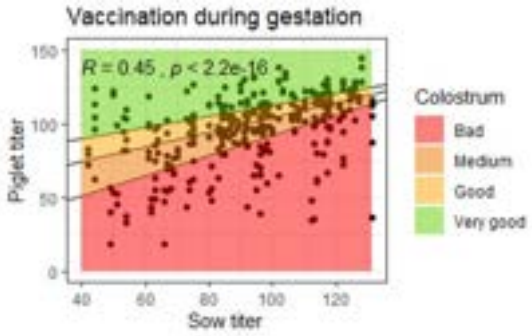
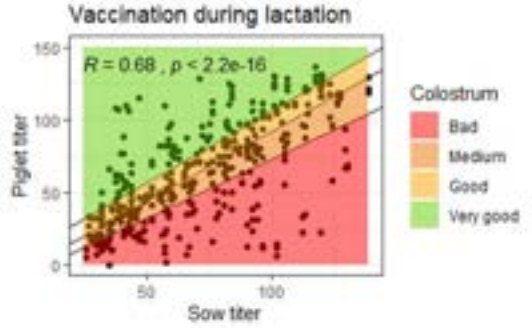
Algorithms Gestation

Algorithms Lactation



Classification models



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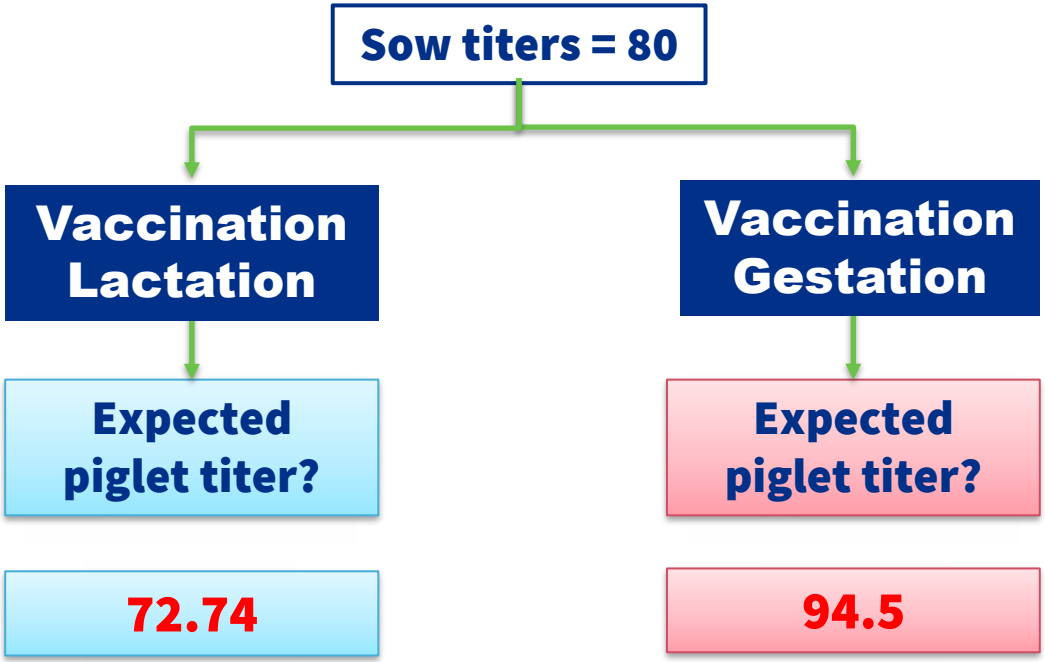
MDA TRANSFERTEST

Creating a farm scoring



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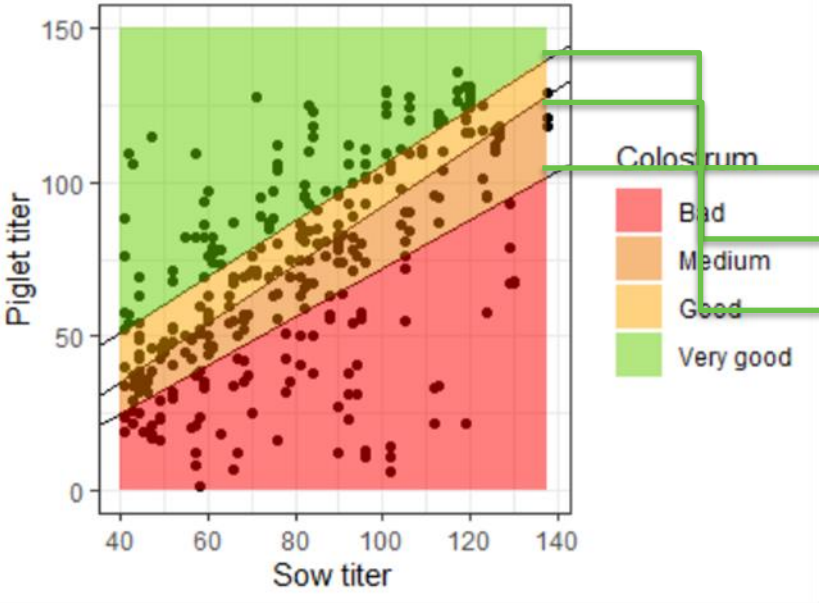
Creating a farm scoring

Vaccination Lactation



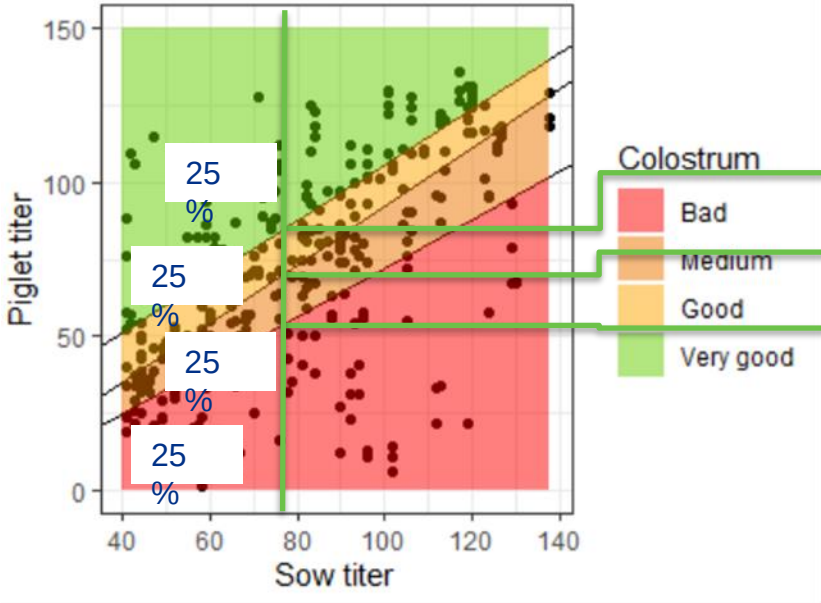
Higher model: 80 = 87

Medium model: 80 = 72.74

Lower model: 80 = 45.35

Creating a farm scoring

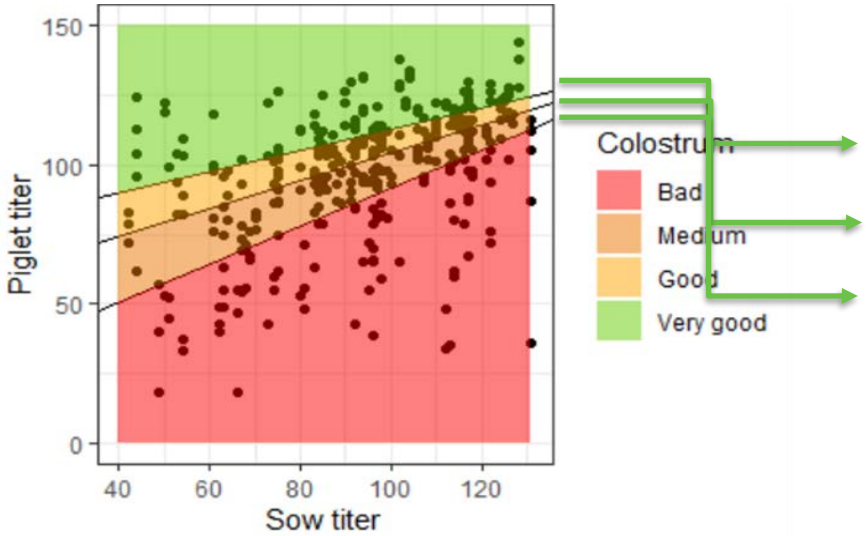
Vaccination Lactation



- > 87
- >72.74
- > 45.35

Creating a farm scoring

Vaccination Gestation



- Higher model: 80 = 110
- Medium model: 80 = 94.5
- Lower model: 80 = 78.19

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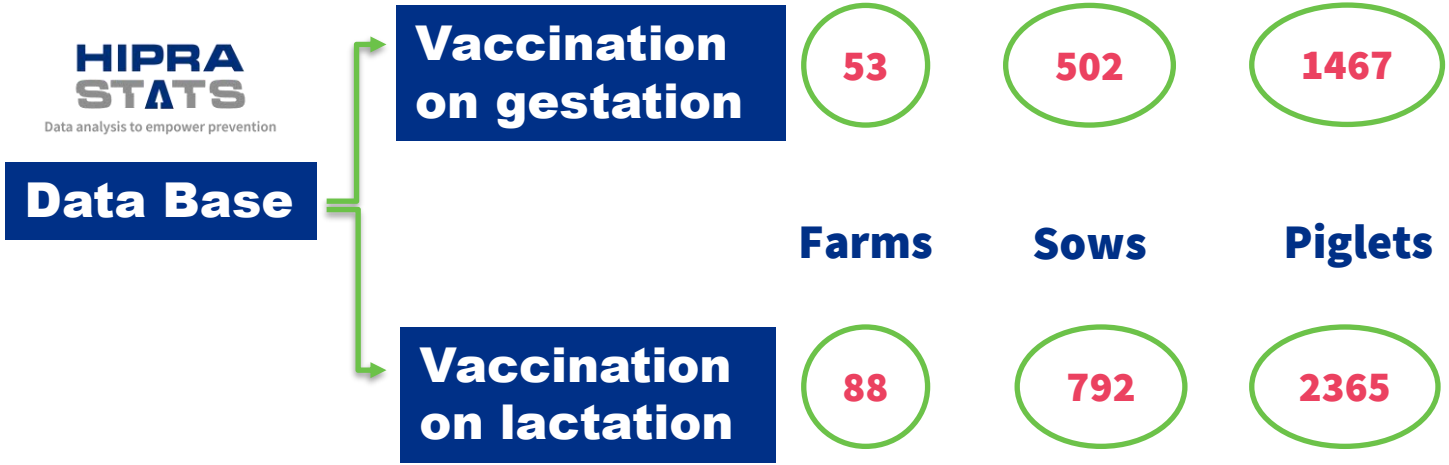
2022 Updated DataBase



Robust and reliable algorithms

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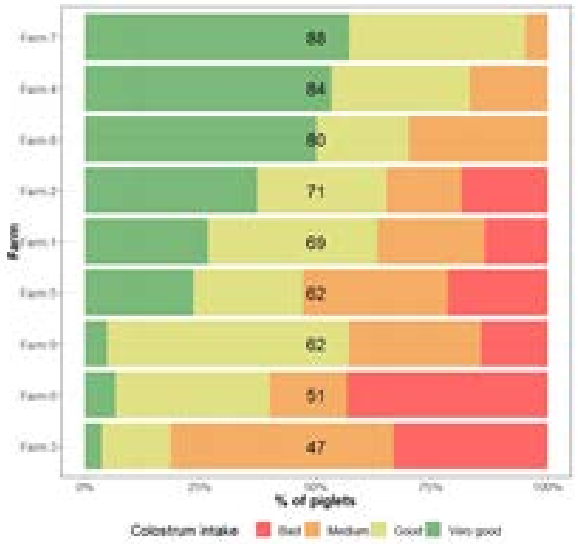
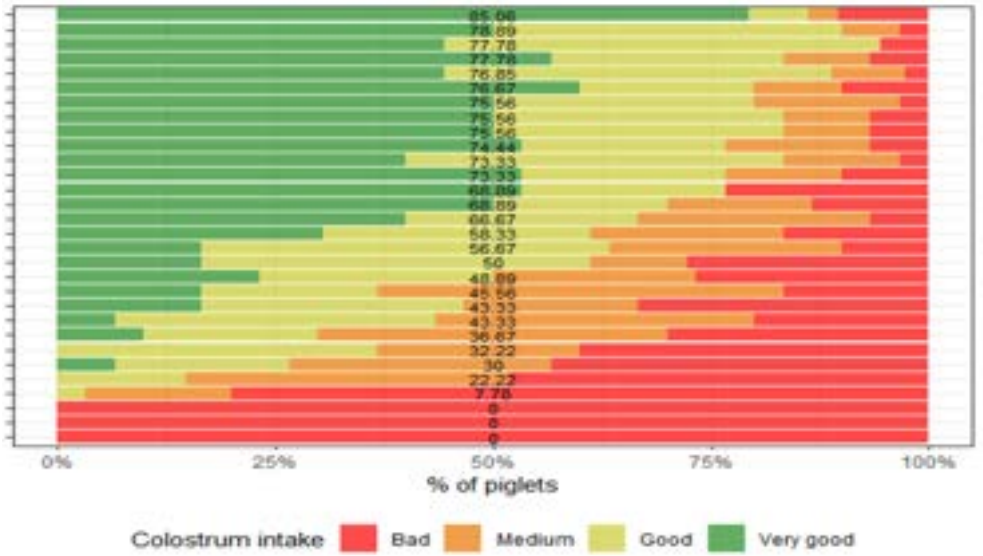
MDA TRANSFERTEST

Benchmarking between farms of the same company





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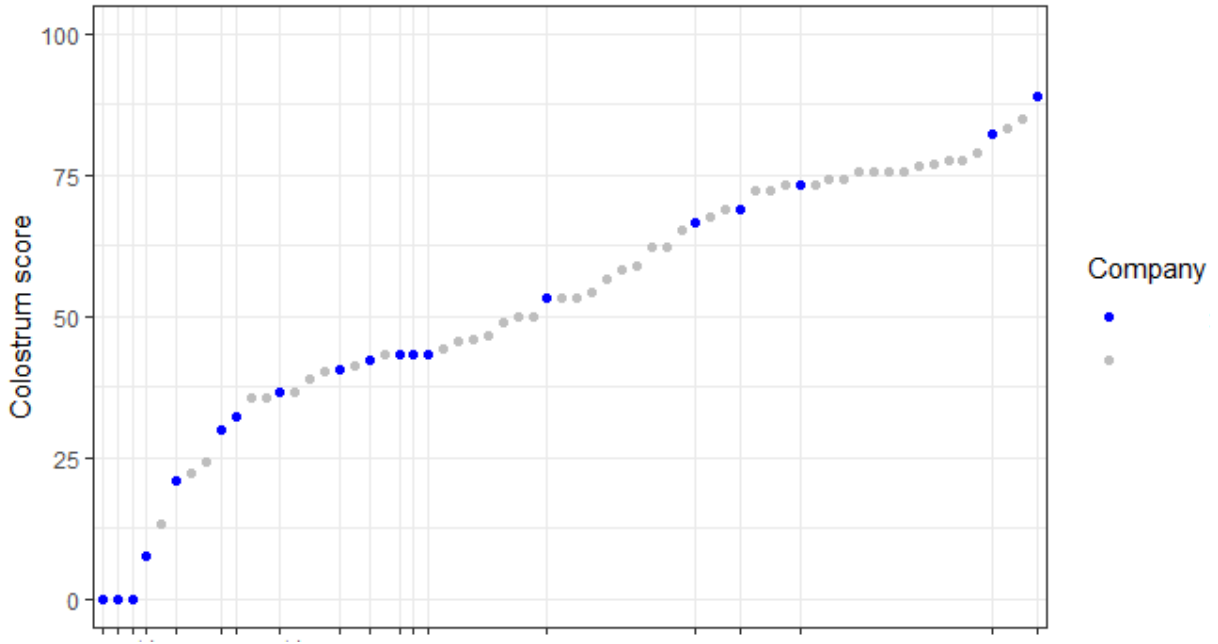
MDA TRANSFERTEST

Benchmarking between farms of different companies



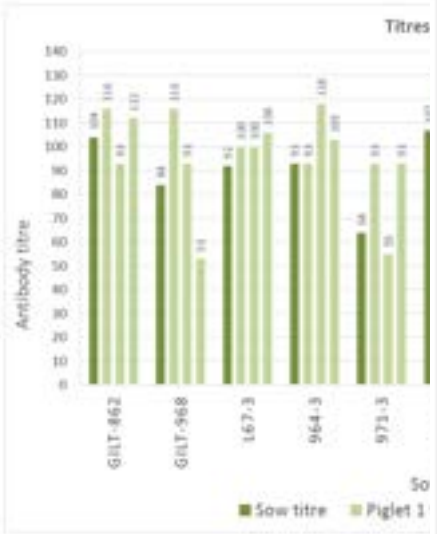
Company

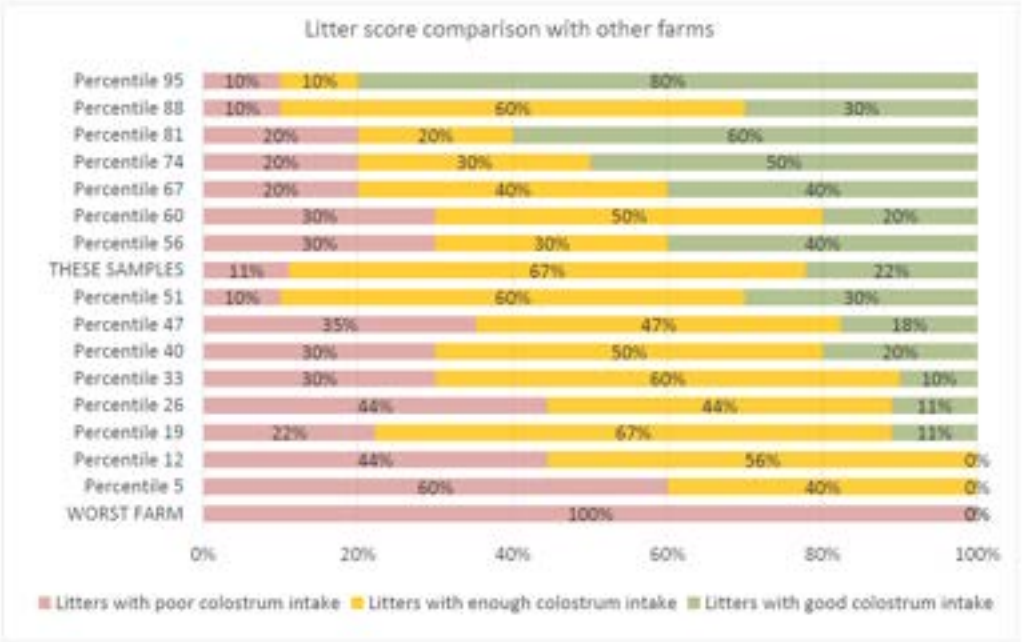
Report Output

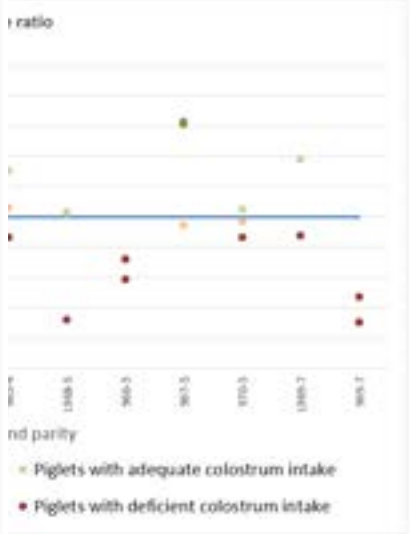
- **Correlation between sow and piglet titres**
- **Benchmarking graph based on MDA score**
- **Benchmarking graph based on Litter score**

	Litter score cut-off set up	
	min	max
Litters with **poor** colostrum intake	1	2
Litters with **enough** colostrum intake	2.1	3
Litters with **good** colostrum intake	3.1	4

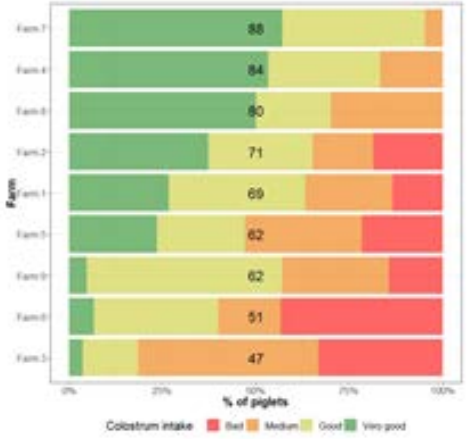
- **Titres sow-litter**
- **Piglet/Sow titre ratio**

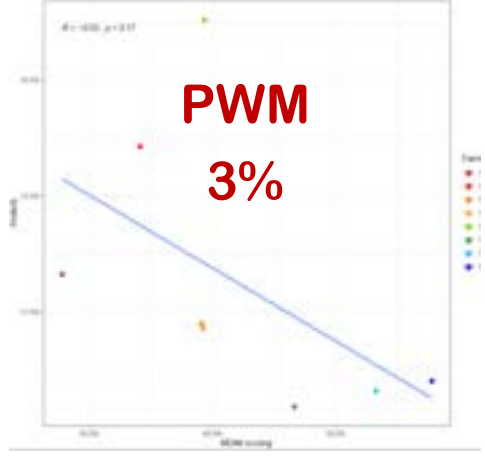


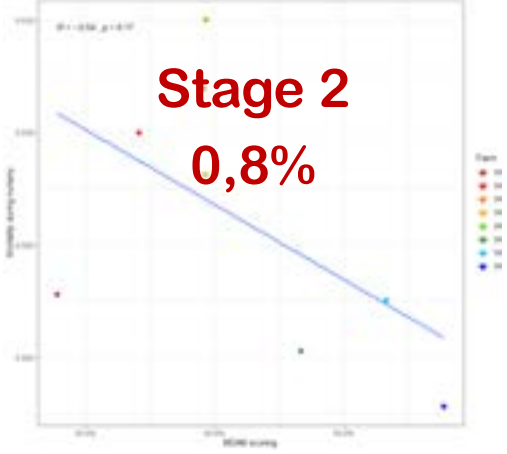


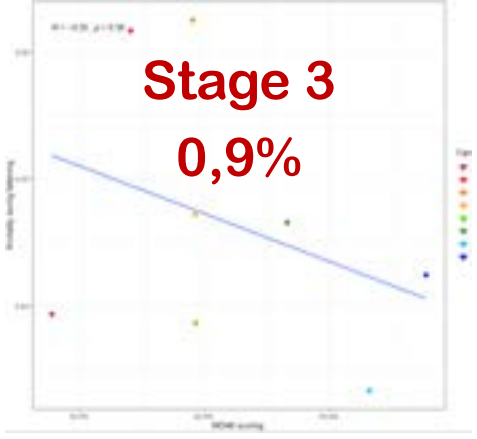


Farm scoring corelates with mortality









Case 1: Germany

Correlation between MDA TT and different techniques to measure colostrom intake

P. Könighoff[1], H.J. Sake[1], J. Miguel[2], D. Llopart[2], D. Angelats[2], C. Meistermann[3], M. Ganter[4], H. Schuberth[5], K. Heenemann[7], I.Hennig-Pauka[6]

[1]HIPRA Deutschland; [2]HIPRA HQ; [3]Tierarztpraxis am Brettberg GbR; [4]Clinic for Swine, University of Veterinary Hannover; [5]Institute of Immunology, University of Veterinary Hannover; [6]Field Station for Epidemiology, University of Hannover; [7]Center for Infectious Diseases, Institute of Virology, Faculty of Veterinary Medicine Leipzig

Objective

- MDA TT correlation with:
  - Inmunoglobulin IgG ELISA
  - Immunocrit

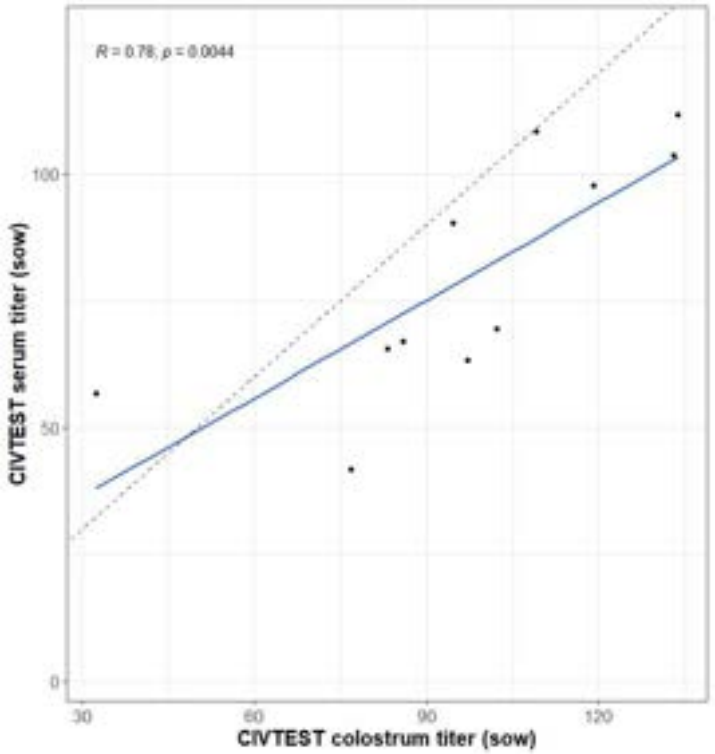
Material & Methods

- 11 sows & 33 piglets
- Colostrum at d0: SE titers & IgG
- Blood at d7: SE titers, IgG & Immunocrit

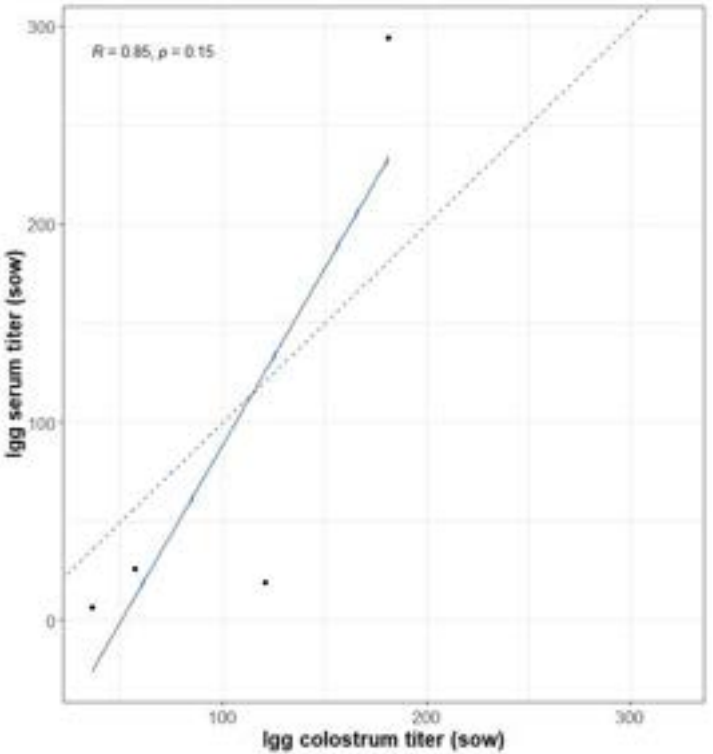
Case 1: Germany

Results

SE serum & colostrum titers



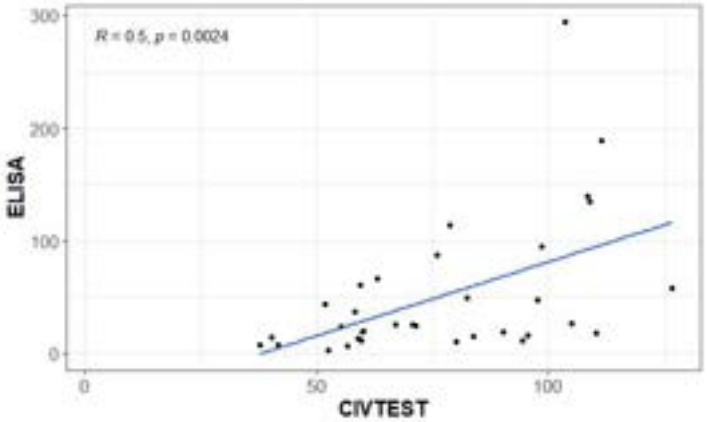
IgG serum & colostrum titers



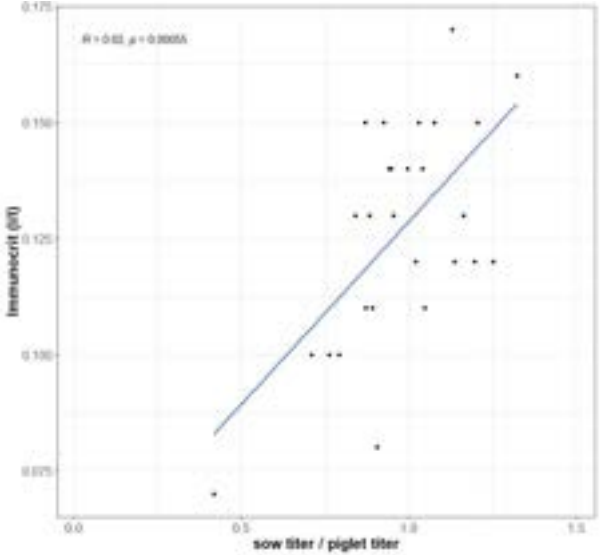
Case 1: Germany

Results

Correlation IgG and CIVTEST



Immunocrit & sow/piglet titre ratio



Conclusion

- **Correlation MDA TT** and the **other techniques**
- **Correlation SE titers** in **colostrum** at **d0** and **serum** from **sows** and **piglets** at **d7**

Case 2: Netherlands

Litter size is a well-manageable (risk) factor for colostrum intake on Dutch sow farms

J. Beek[1], J. Miguel[2], C.Jurjens[3], M. Solé[2], D. Llopart[2], M. Wilhelm[1]
[1]HIPRA Benelux, [2]HIPRA HQ, [3]The Oosthof

Objective

- Evaluate MDA score and its relation with litter size and fostering (yes/no, within or after 24h)

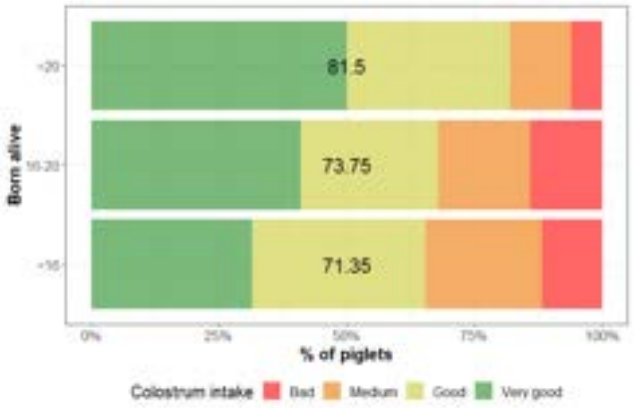
Material & Methods

- 8 farms, 10-20 sows/farm, 3-6 piglets/sow
- Sampling at d7
- Parameters recorded: PBA, date and time of fostering

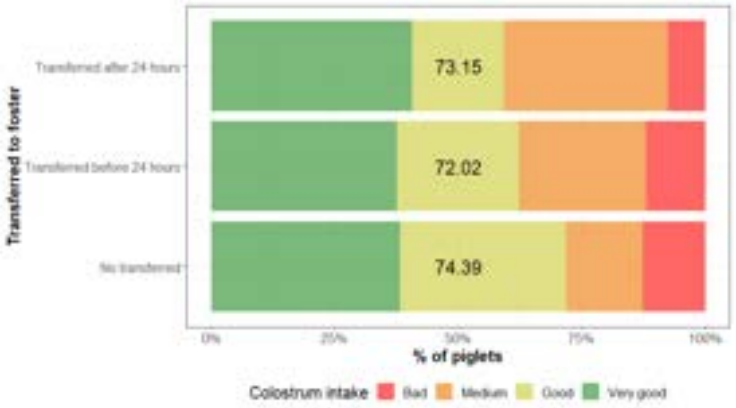
Case 2: Netherlands

Results

MDA TT score based on BA piglets



MDA TT score based on fostering

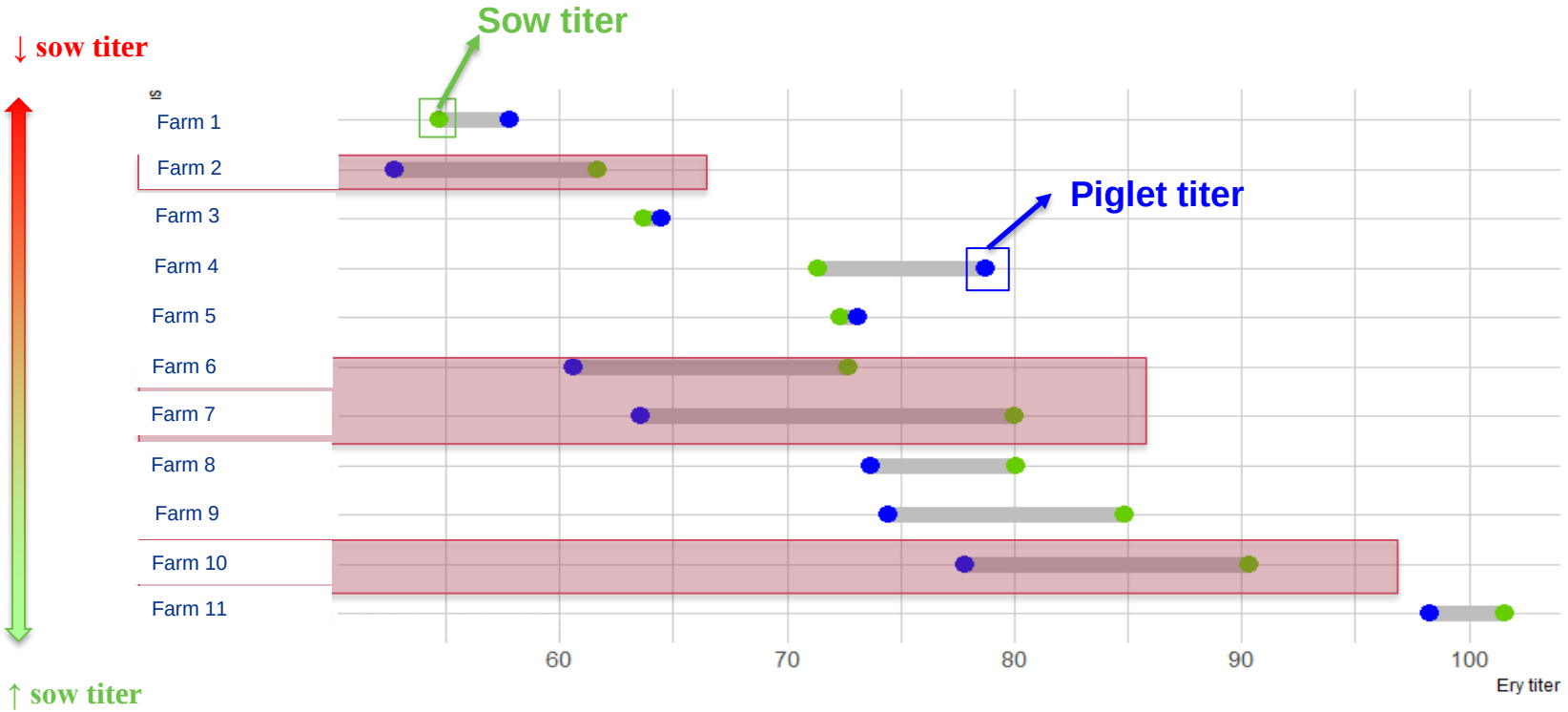


Conclusion

- **Litter size** as **risk factor** can be **overcome** with **management**
- Start **fostering** piglets **after 24** hours

Case 3: Italy

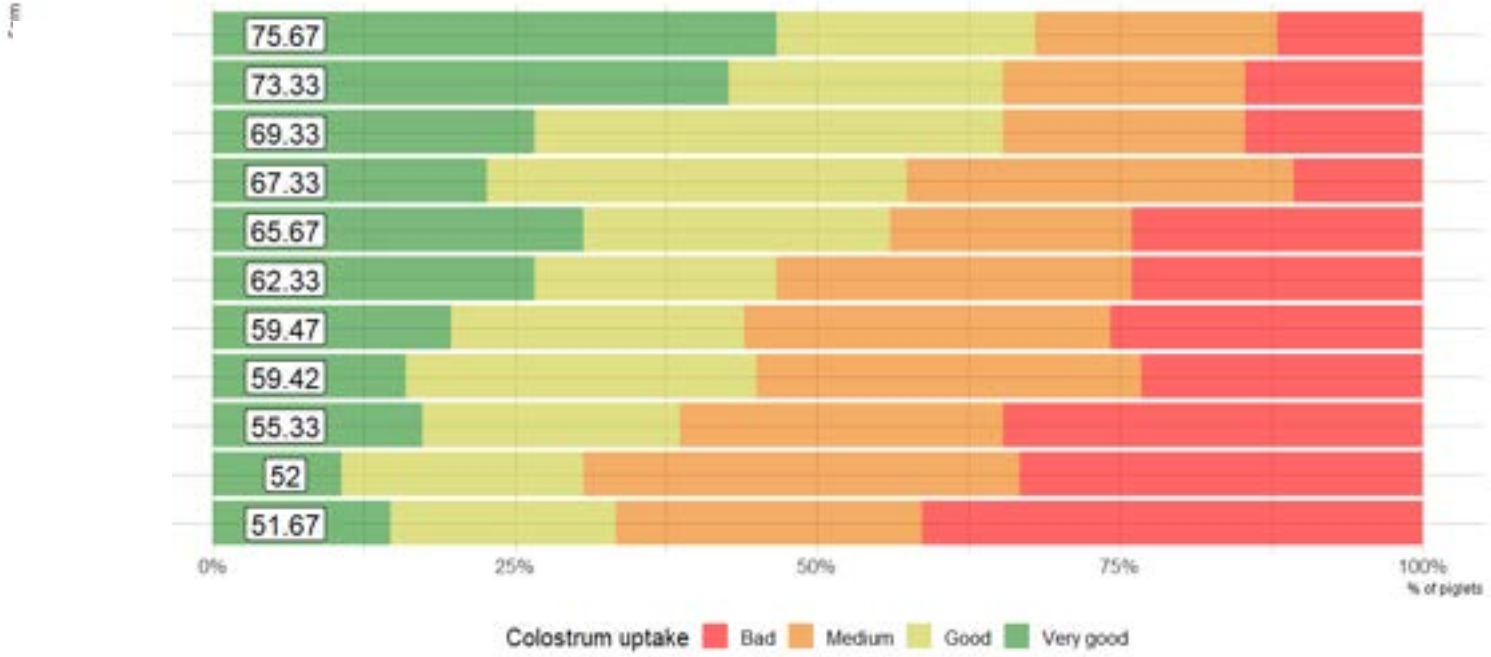
Sow and piglet titer



Case 3: Italy

MDAtt benchmarking

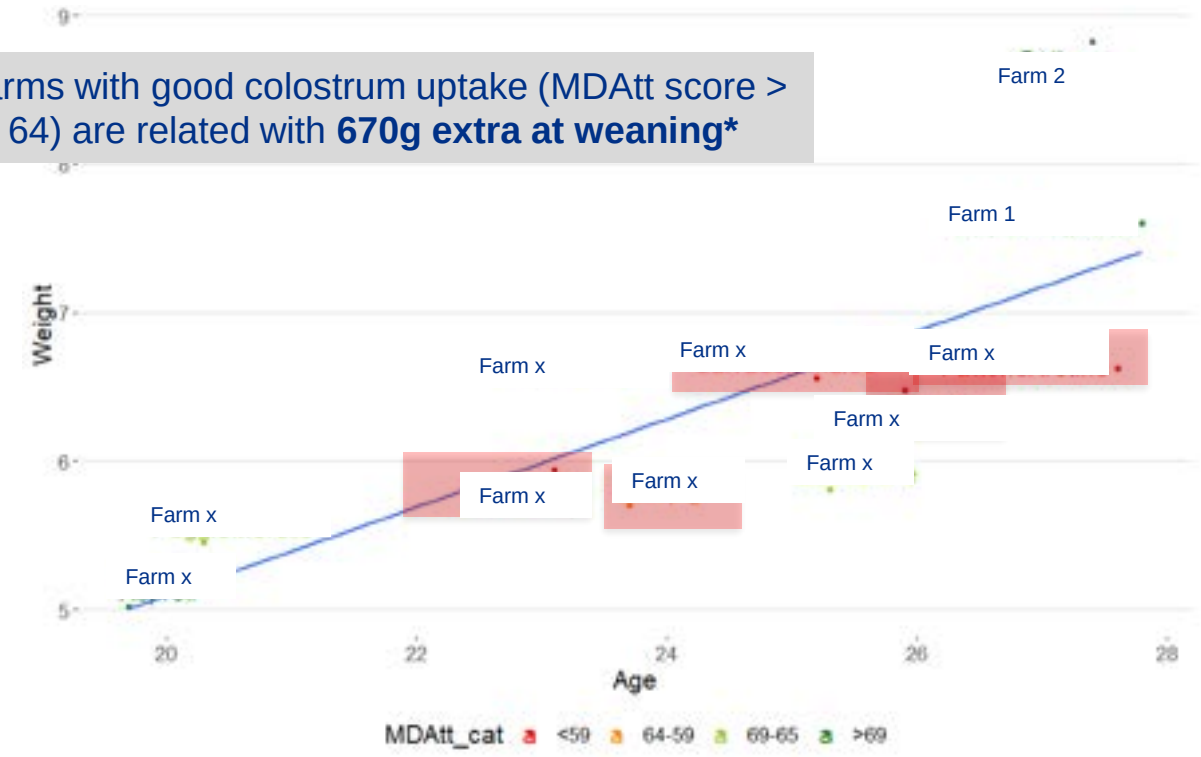
Benchmarking of farms



Case 3: Italy

Weaning weight

Farms with good colostrum uptake (MDAtt score > 64) are related with **670g extra at weaning***



*LRM with Weaning weight as outcome and Weaning age (P-val: 0,002) and MDAtt score (P-val: 0,131) as factors.

Case 4: Netherlands

Lower maternal immunity transfer in primiparous versus multiparous litters can be explained by a combination of sow immunity status and suboptimal colostrum intake

J. Beek[1], J. Miguel[2], C.Jurjens[3], M. Solé[2], D. Llopart[2], M. Wilhelm[1]
[1]HIPRA Benelux, [2]HIPRA HQ, [3]The Oosthof

Objective

- Evaluate MDA score comparing primiparous vs multiparous

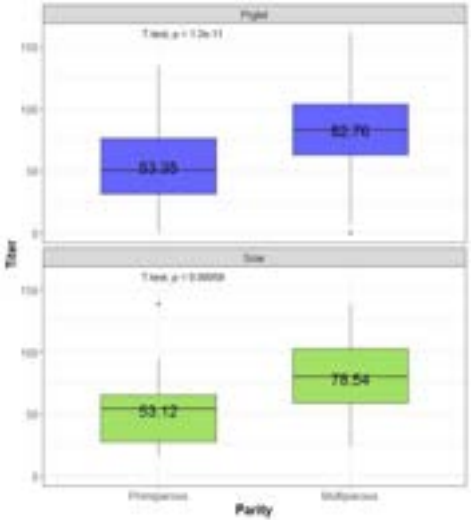
Material & Methods

- 8 farms
- 24 primiparous & 91 multiparous
- 421 piglets
- Sampling date at d7

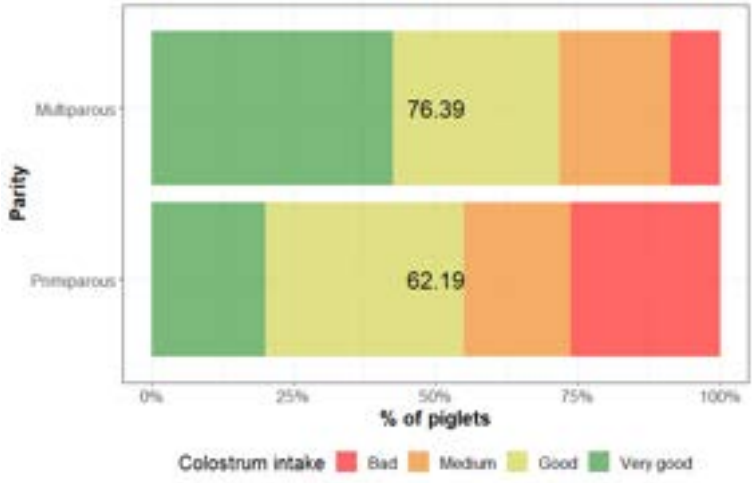
Case 4: Netherlands

Results

Titers based on parity for mothers and its piglets



MDA TT score in primiparous or multiparous piglets



Conclusion

- **Lower titers** and **MDA score** in **primiparous** → **Extrapolated** to other **vaccines?**

Case 5: Brazil

Effect of sow parity order, piglet birth order and weight at birth, on the volume of colostrum intake and the quality of maternal antibody transference

Daniela Bruna [1*]; Tatiana C. G. Dutra[1]; Gabriel Peixoto[1]; Gabriela Ibañez[2]**;** Joaquín Miguel [2]; Lorena Nodar [2]

[1]HIPRA Saúde Animal Brasil, Porto Alegre, RS [2] HIPRA HQ, Amer (Spain)

Objective

- Evaluate the **effect** of sow **parity order**, **piglet birth order** and **weight**, on the **volume** of **colostrum** intake and **quality** of MDA transfer
- **Two methods:**
  - Piglet weight 0-24h and MDA TT

Material & Methods

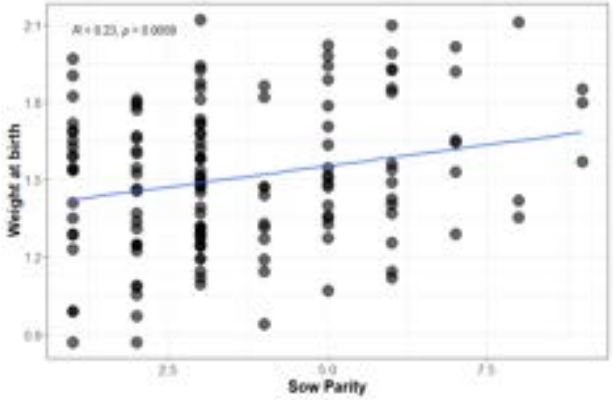
- 49 sows (P1-P8)
- 660 piglets: birth order, weight at 0 and 24h
- Volume of colostrum intake Devillers N *et al.* 2007.
- Birth order: First, middle and last
- Weight: low, medium and high

Case 5: Brazil

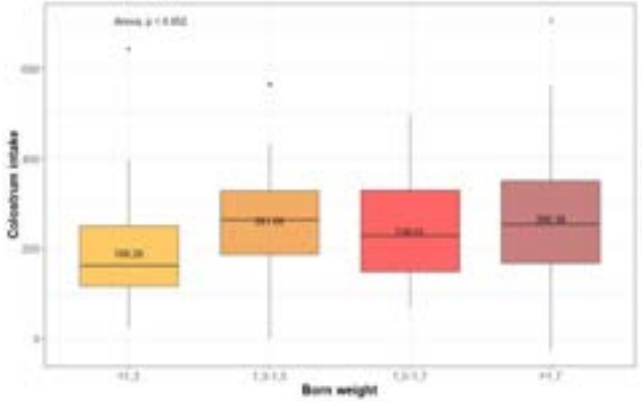
Piglet weight 0-24h & volume

Results

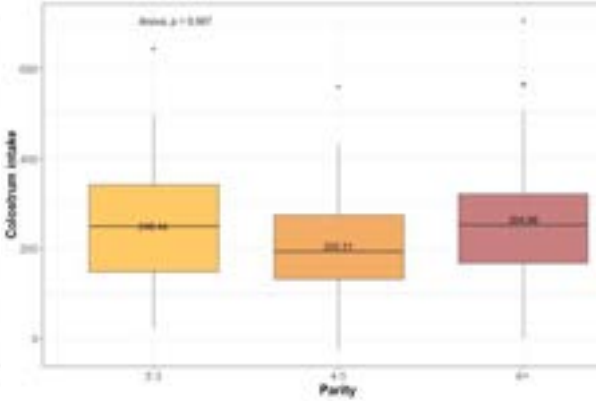
Piglet weight and OP



Colostrum intake and weight at birth



Colostrum intake and OP



Conclusion

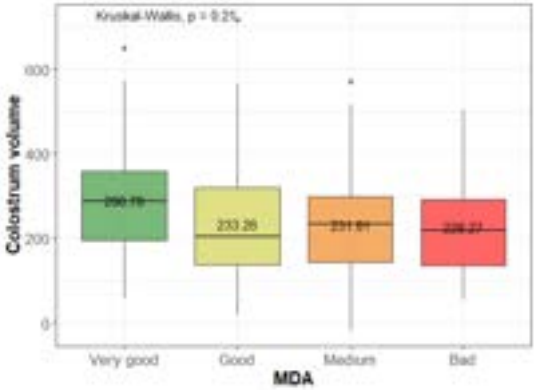
- **Piglet weight** linear **increase** with **sow parity** but not affected by birth order
- Piglets >1.7 kg → **266 g**; Piglets < 1.3 kg → **189 g**
- **Piglets** of **sows OP≥6** had the **highest colostrum** intake

Case 5: Brazil

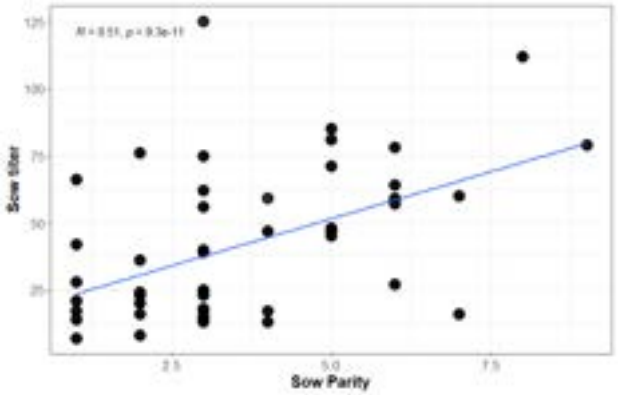
SE titers & MDA TT

Results

Correlation between MDA TT and colostrum volume



Correlation sow titer & parity



Correlation MDA score & parity

Conclusion

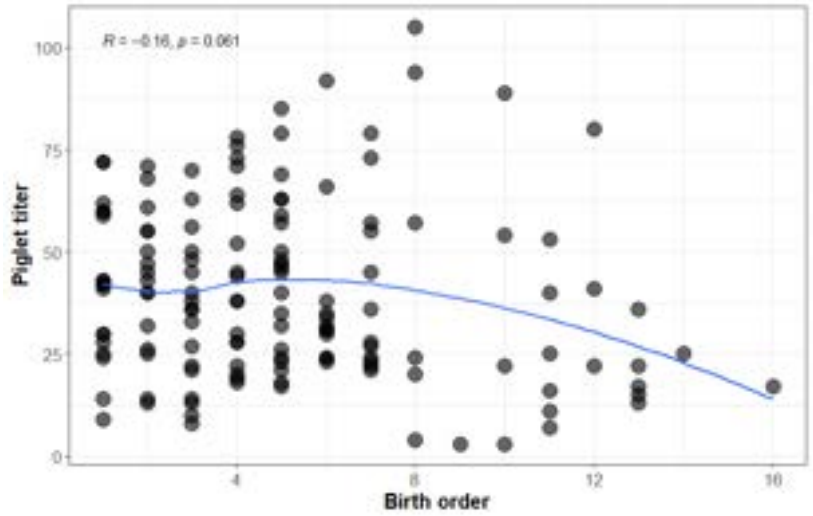
- **Good relation between Colostrum volume and MDA score**
- **Sows OP≥6 had higher titers but the lowest transference**

Case 5: Brazil

SE titers & MDA TT

Results

Piglet titer based on birth order



Conclusion

- **Higher birth order was associated with lower titers**

How to improve the MDA transfer test scoring

Re-check again

The Sow / Farrowing duration

- Farrowing induction
- Nest-Building behaviour
- Farrowing attendance
- Inmune status
- Farm census structure
- Feeding
- Disease

The Piglet

- Split suckling
- Supplementation with colostrum
- Energy supplements
- Disease

The environmental conditions

- Farrowing área

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Once all the previous points have been reviewed and/or implemented, we encourage you to carry out a new MDA TT to see the improvements in the colostrum intake!

MDA TRANSFERTEST

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Building Immunity
for a Healthier World