25 Years

LALLEMAND

LALLEMAND ANIMAL NUTRITION

EUROPEAN PIG PRODUCERS

Speaker: DAVID SAORNIL

Thursday 3rd-4th june 2015

25 Years

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EUROPEAN PIG PRODUCERS

OXIDATIVE STRESS IN SWINE

Thursday 4th june 2015

Table of content

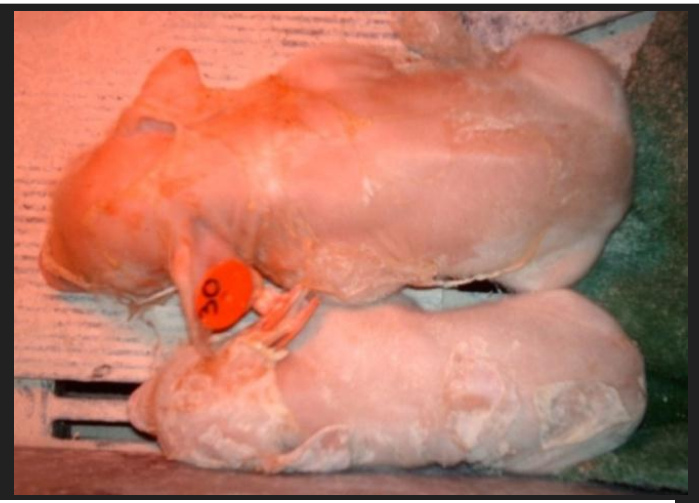
Major changes 10y.

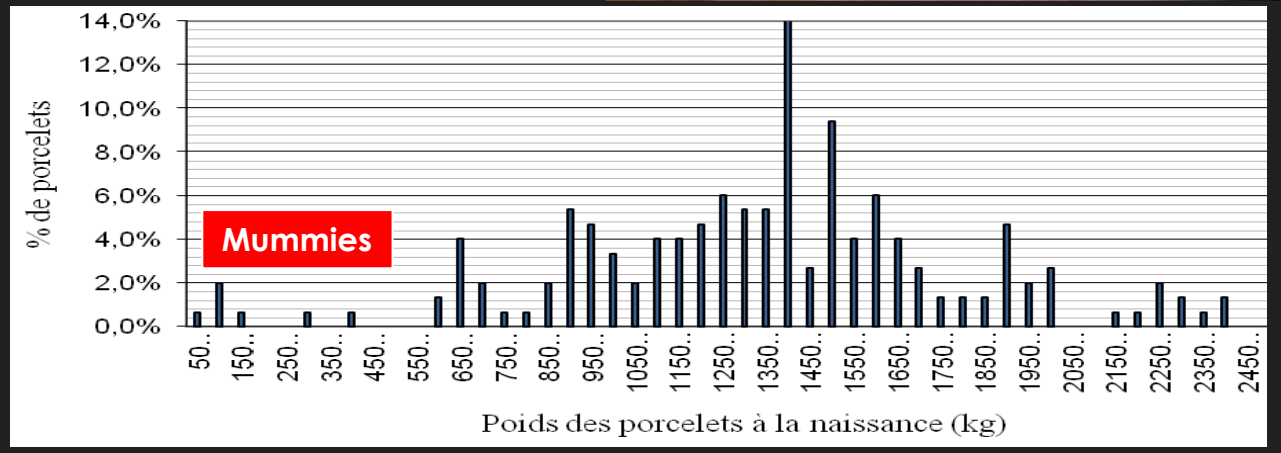
- **Hyperprolific sows**: ⬆ **litter size**
  - Piglet birth weight **heterogeneity**
  - **Immaturity**/**Vitality**: New concepts
- **New emergent viral disease**: **PRRS, PMWS, PED…**
- **Nutrition**:
  - **Immune response** / AA metabolism and requirements
  - **Micro-elements** & Macro-nutrition
  - **Microflora** & Nutrition

Increased Litter Size.

- **Last 7 years:**
  - 30% ⬆ litters +15 piglets total born/litter
  - Denmark: 90% +16 piglets

- **Consequencies at birth**
  - ⬇ average birth weight
  - ⬆ weight heterogeneity





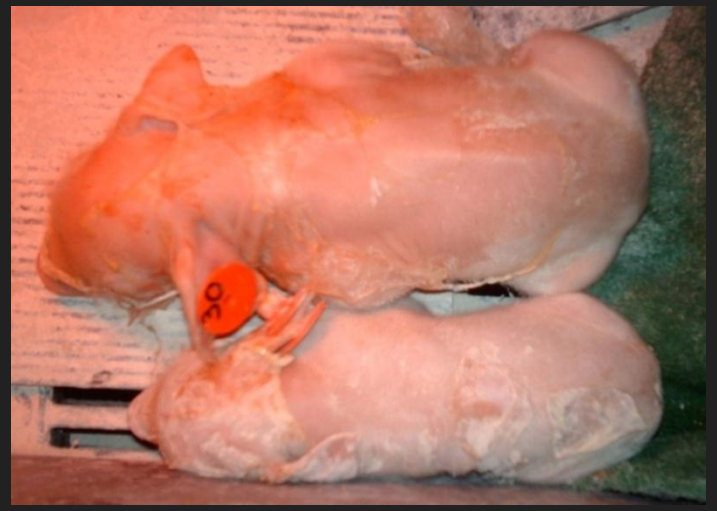
Piglet live weight at birth in grams. (Lallemand 2008)

Heterogeneity at birth.

- Usually described as **piglet birthweight range**.
  Forgetting:
  - **Vitality**
  - **Morphology**
  - **Maturity**

Piglet immaturity.

- Well known in human medicine (Premature babies)
- Suggested by Foxcroft (62 piglets!)
- Confirmed by **Sacy** (**Lallemand** 2008: 924 piglets)



Assumption: Some piglets suffering from **foetal growth retardation (IUGR)** and are really not mature.

Piglet immaturity.

- **Very light** but also **immature**
  - Big oval shapped head (dolphin head), ⬇vitality.
  - ⬆**Brain/Liver ratio**

Brain/liver ratio	Mean	SD	N
Immatures	1.68[a]	0.68	147
Matures	1.01[b]	0.43	282
Total	1.24	0.61	429

- ⬇metabolism and performance, ⬆mortality (**IUGR**)

Other consequencies.

- **Longer farrowing durations**
  - ⬆ Oxytocin injections
  - ⬆ sleevings
- ⬆ **Stillborn piglets** = 0.86 x Total born – 5
  - Last 3rd of parturition = 71% (Sacy 2008, Canario 2007)
  - Most of them asphyxiated
- ⬇ **piglet vitality at birth**
  - ⬇ colostrum intake
  - ⬆ mortality within the first 2 days

What is piglet vitality?

- **Born dead piglets** easy to describe: Born/alive
- **Vitality:** More difficult.
- **Vitality score** published by **Lallemand** (Sacy 2008, Le Treut: IPVS 2010)

Vitality	Observations
0	Piglet not moving nor breathing during first 15" of life.
1	Piglet still not moving after 15", but starts breathing or try to start breathing
2	Piglet breathes and starts really moving in the first 15" of life.
3	Piglet moves actively, breathes well and tries to get up during the first 15" of life.

Piglet vitality at birth

- Based on the description and scoring of the piglet behavior during the first 15” of life.

No breath

No move

No move

Starts breathing

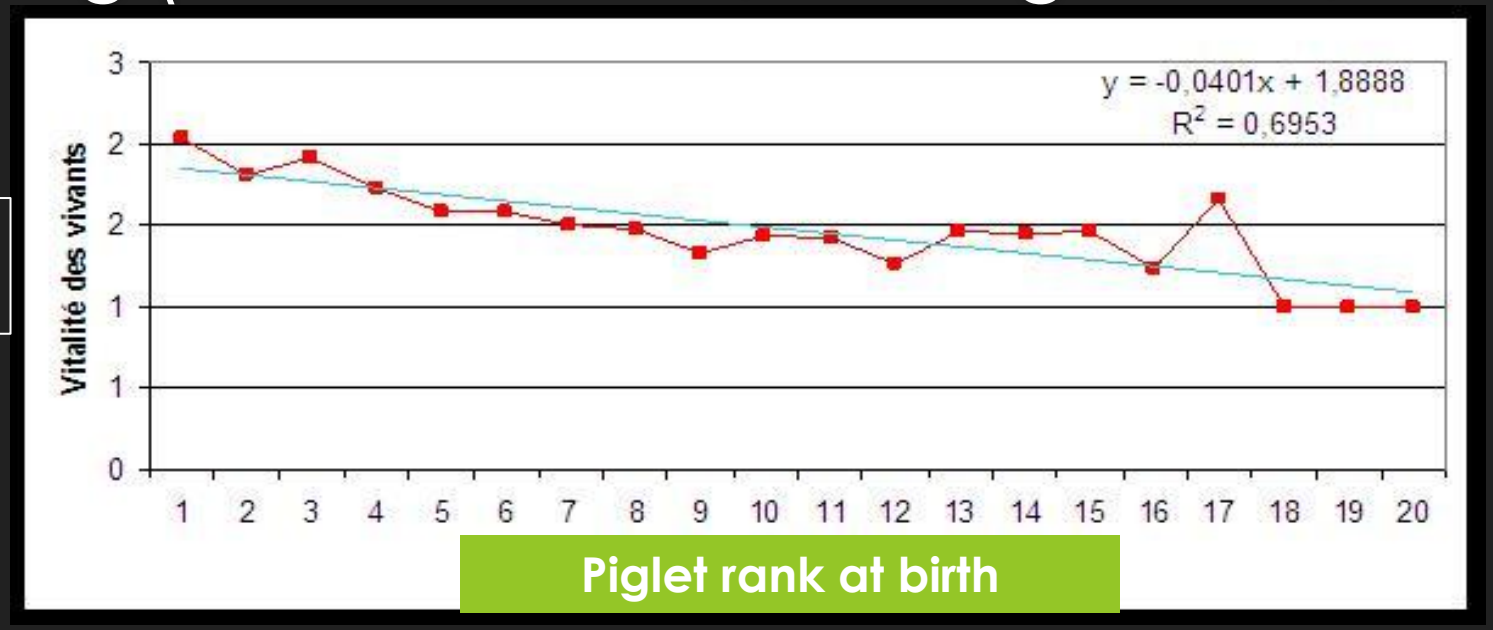
Piglet breaths

Starts moving

Piglet tries to get up!

Effect of rank at birth

- **Lallemand vitality score:** useful to screen options at farrowing (feed additives, management, etc...) (Sacy 2008)



- Importance of rank at birth: Even **worse for the last ones!**

Ox. Stress & Reproduc.

- Pere (Inra): Lost between ovulation and born alive piglets.

	Sow 1	Sow 2	Sow 3
Lutea corps/ovary	4.8	8.3	16.9
Foetus/horn at day 35	3	6.6	10.8
Piglets number/horn at day 112	3	4.8	4.9

- Litter size: Challenge of early gestation
- The idea of oxidative stress emerged:
  - Very fast cell multiplication
  - Nidation: Local inflammatory responses / embryo rejection

Embryo Micronutrition.

- Very specific: Tryptophan, Glycine and Folic acid.
- The role of Vitamin B9 in reproduction described in the early 80's: MATTE (PhD thesis 1987). Effect of early B9 supplementation on litter size: 10.5 ⟶ 12.0 piglets.

	Nulliparous		Multiparous	
Folic acid	-	+	-	+
Born alive	9.1	9.3	11.5	13.5
Embryonic mortality (%)	14.4	12.8	39.2	32.6

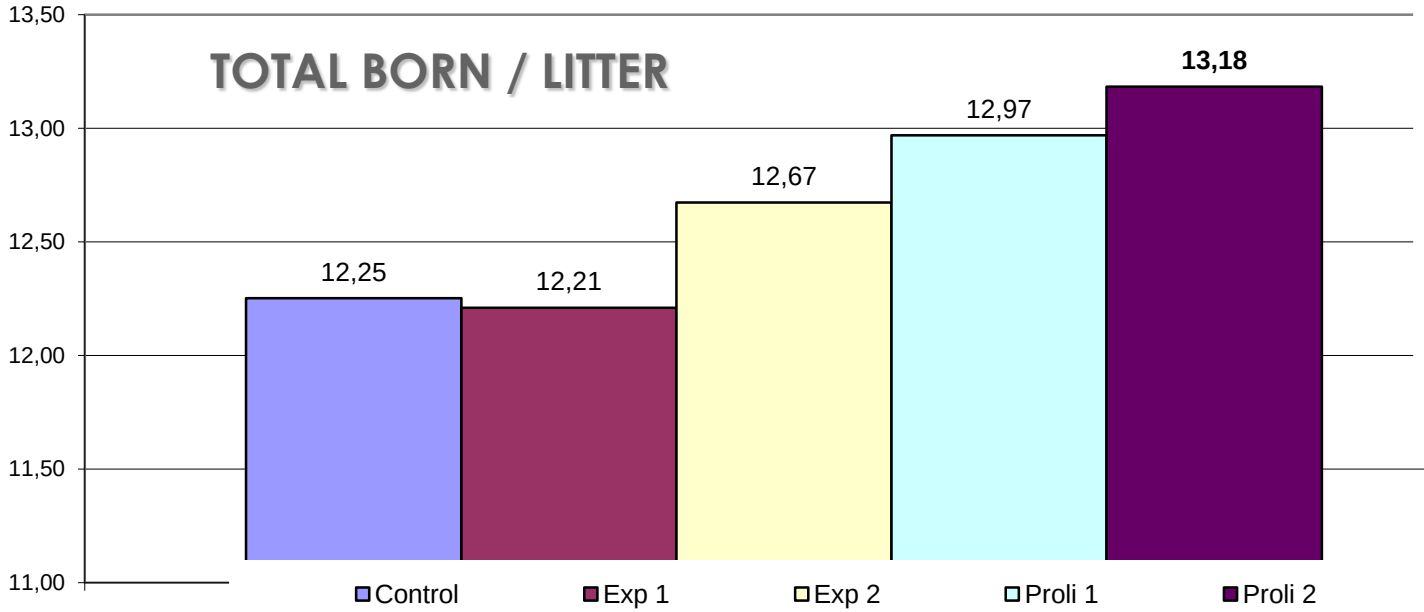
Adapted from Lindeman et Kornegay 1989, Giguere 2000, Guay 2004)

Antioxidants.

- Gestation: Phase of a high intense oxidative stress. Very high mithocondrial activity.
  - Implantation process failure.
  - Intra-uterine growth delay,

Commercial farm trial

- 450 Topigs sows (farrow to finish, France)
- 4 different blends top dressed after weaning



Control

-**Exp 1**: fœtus nutrients

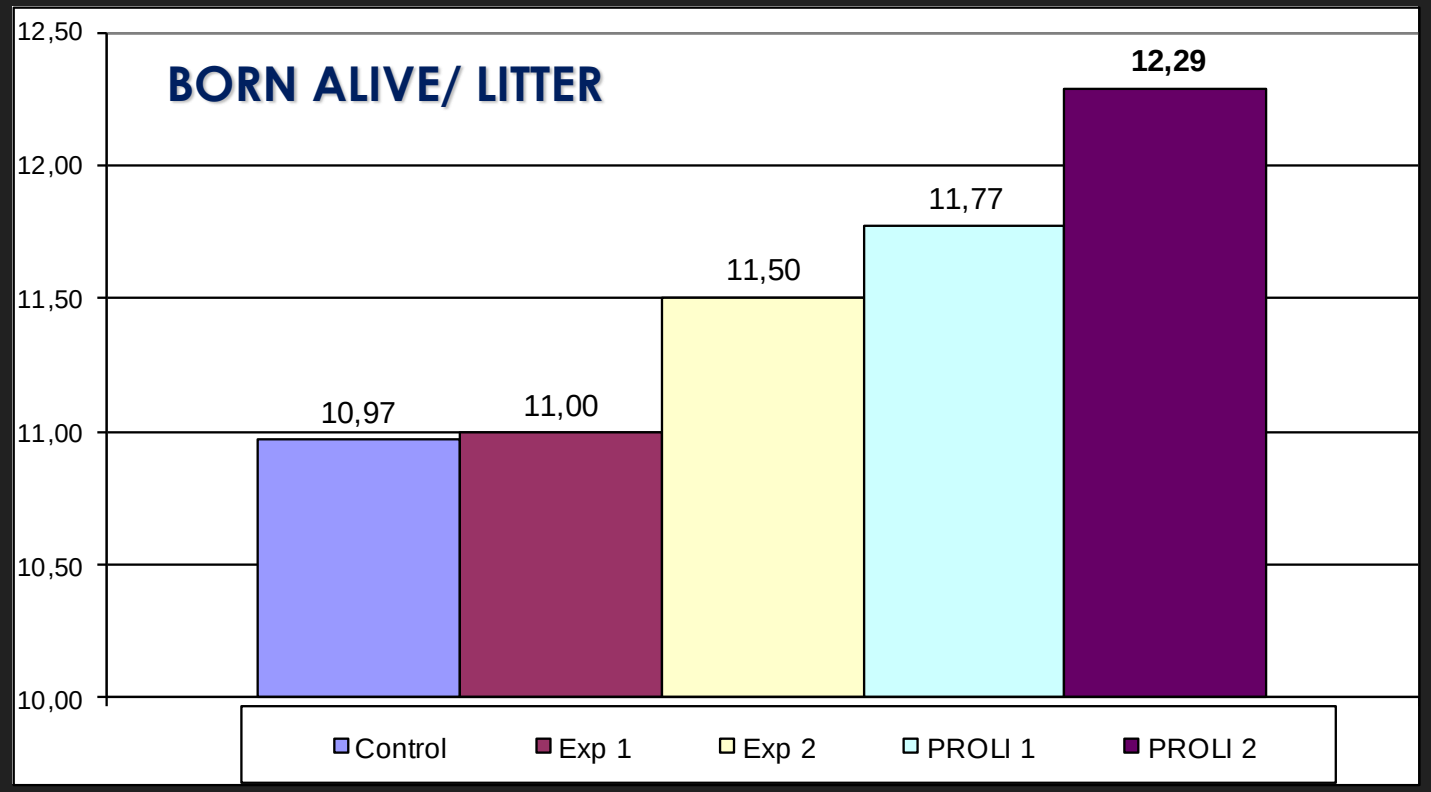
-**Exp 2:** fœtus nutrients (higher levels)

-**Proli 1:** SOD + Alkosel

-**Proli 2:** SOD + Alkosel at higher doses
+ fœtus nutrients at high doses too!

+ 0.93 Total Born

Antiox. Blend & live born



+1.32 live born piglet/litter

Immaturity & Vitality

Antiox. blend		Foetal Growth Retardation (% of piglets in a litter)
No		21.1[a]
Yes		8.8[b]
No	P1	26.7*
	P2-5	11.0
	P>5	25.6*
Yes	P1	6.3*
	P2-5	7.4
	P>5	12.7*

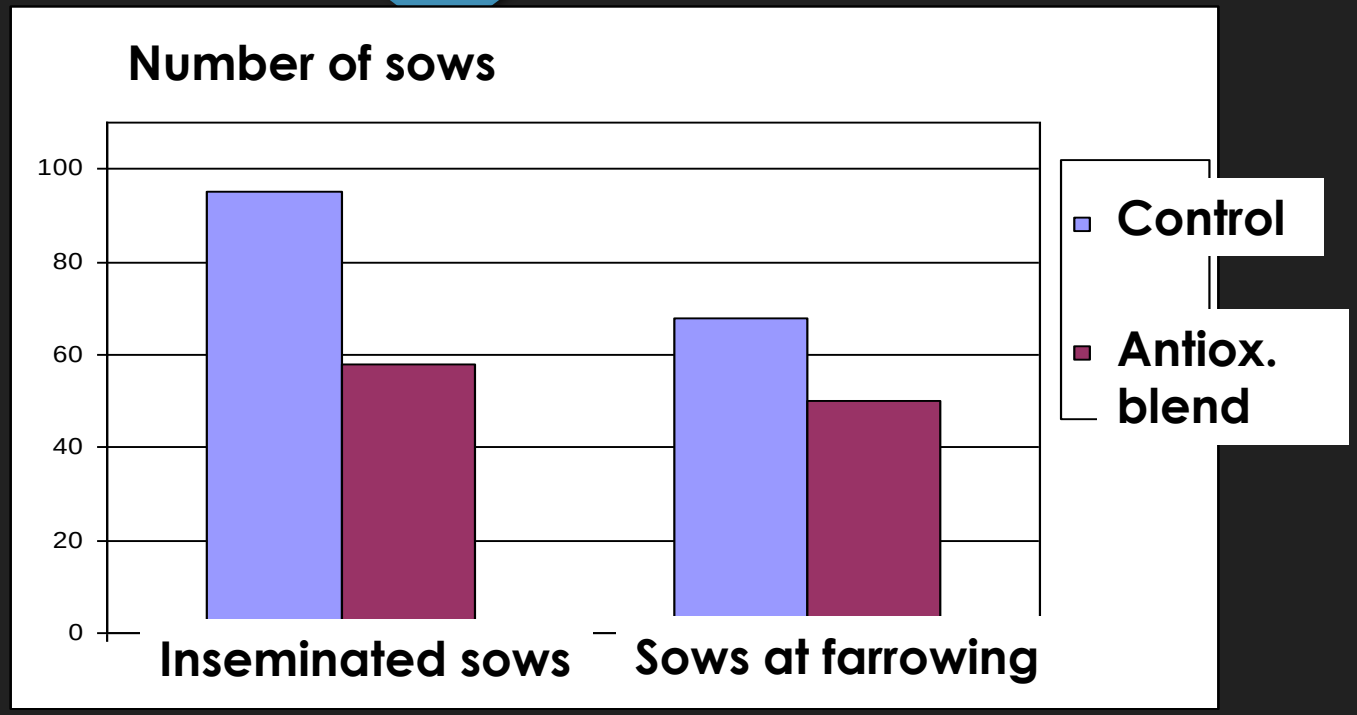
*: P<0.05 Sacy 2008

-Reduction of the % of **immature piglets** in a litter.

-Major effect on piglets from P1 and old multiparous sows.

-Same effect on **vitality**: 1.63 vs 1.16 (P<0.05)

Fertility



- 600 sow farm. France
- Fertility:
  - Summer infertility
  - Heat stress prevention
  - Better "heat" behaviour

Control	Antiox blend	Farm average (1 year without antiox blend)
73.1%	87.7%	76.2%

Weaning.

- **Intense Oxidative stress.**
  - 6 days after weaning (plasma, healthy piglets)

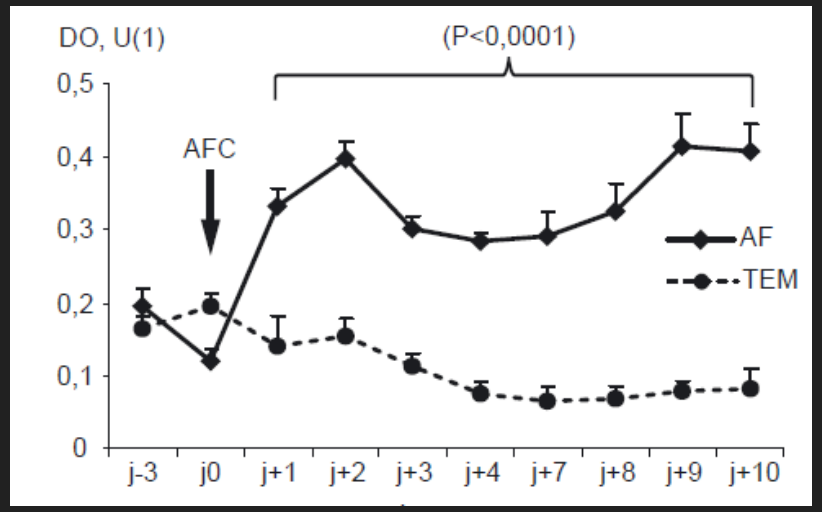
Tocoferols	**-75% to -80%**
Vit. C	**-75% to -80%**
Zinc	**-45% to -50%**
Selenium	**+18%**
Gluthation Peroxidase	**+25% to +30%**
Total Glutathion	**-20%**
Reduced/Oxidized Gluthation	**-45%**

From Robert 2009

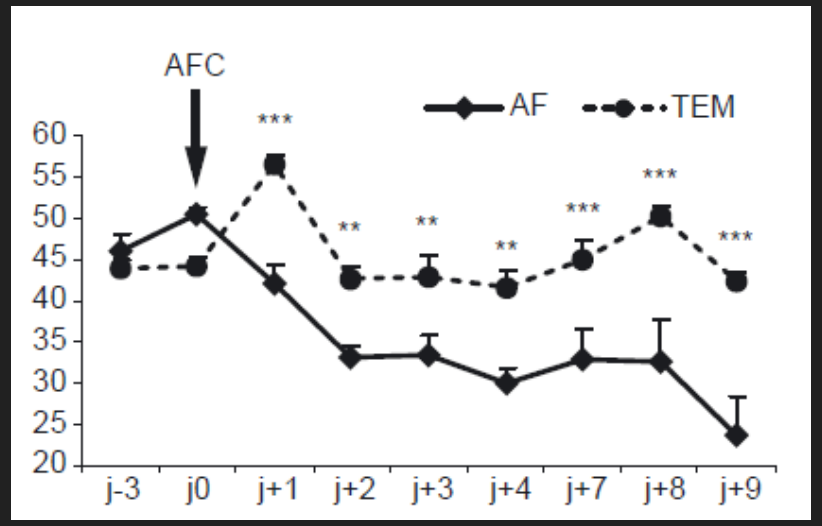
- **Gluthation system activated:** Inflammation, Catabolism

Weaning.

- Nutrient requirements profile changes with inflammation



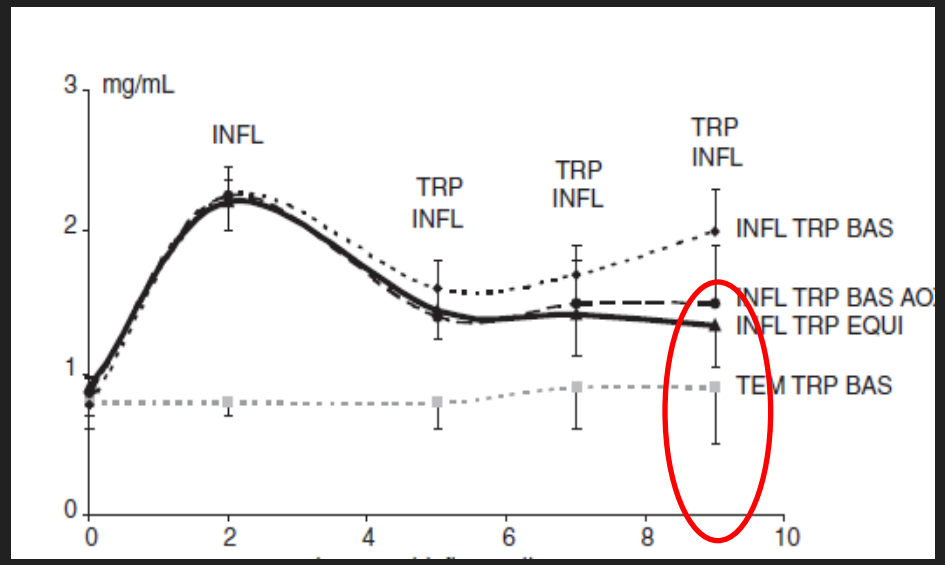
Haptaglobine



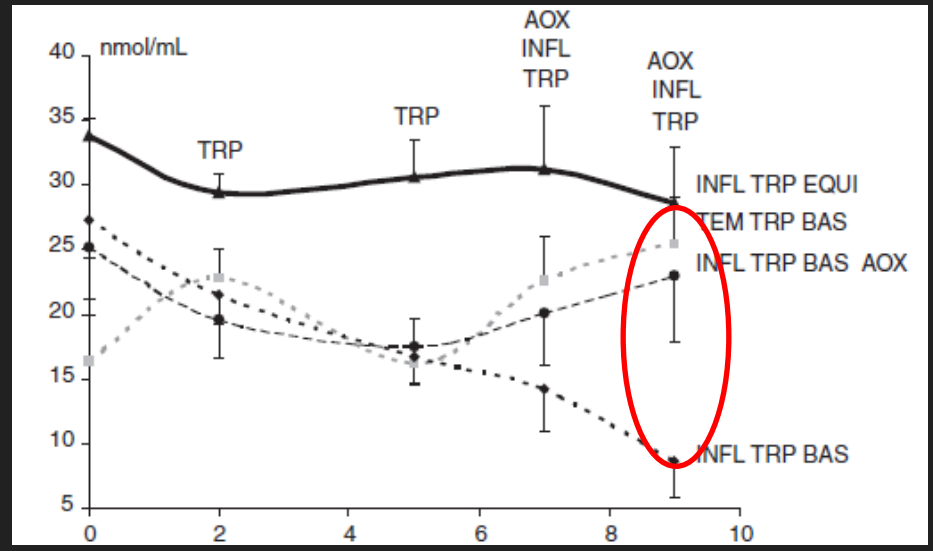
Tryptophan

- <u>Tryptophan reduction:</u> Drop in feed intake
- <u>Haptaglobin increase:</u> Strong inflammation process

Weaning & antioxidants



Haptaglobine conc. after FA challenge



Trp conc. after FA challenge

Le Floch 2004

- **Antioxidant blend** (Vit. E, Vit. C, organic Se, SOD) significantly **reduced Haptaglobine** conc. and **maintained Trp.** conc. in blood.
- Interesting effect on **feed intake** and recovery phase.

Practical benefits

- **Piglets:** ADG + mortality postweaning.
- France, 2002. Effect of an antioxidant blend (Vit. E, organic Se, SOD) in a Circovirus contaminated environment before Circovirus vaccination.

	5 groups before	1° group with	2° group with	3° group with	3 groups with average
Piglets (n)	131	157	130	130	139
starting LW (kg)	8.01	7.58	8.47	7.64	7.87
Finishing LW (kg)	33.06	33.47	38.48	34.83	35.55
DurATION (d)	54.5	51.6	56	53	53.5
ADG (g/d)	460	502	536	513	518
Post-weaningMortality (%)	**9.9**	4.5	3.8	2.3	**3.6**
Fattening Mortality (%)	5 %	<1%	<1%	<1%	< 1%

Take home message.

- **Sows:** Antioxidants efficient improving reproduction and piglet quality. Should be more considered for increased:
  - Fertility
  - Litter size
  - Piglet quality
- **Weaning:** Intense oxidative stress. Even on healthy farms.
  - Antioxidants are really effective for better control weaning stress.
- **Combination** of different but complementary antioxidants: **KEY**
  - **Vit. E, Organic Selenium, SOD.**