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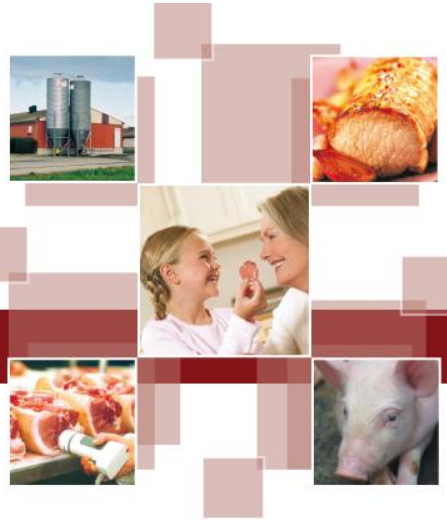
Anticiper | Fédérer et accompagner



Investigation of reproduction troubles in sows and gilts.

How can we use hormonal profiles and echography to improve farm results ?

Sylviane BOULOT
IFIP, France
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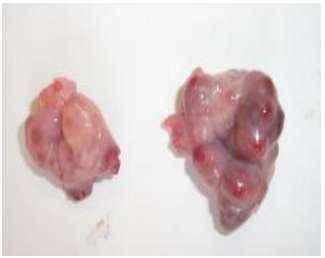
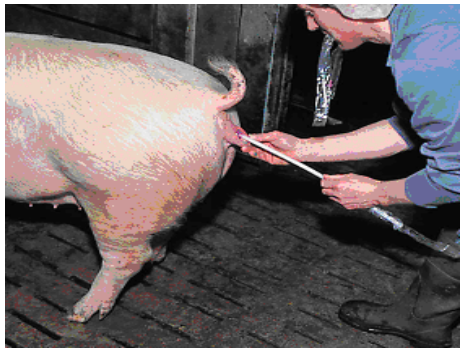
2011 Training Symposium, Italian Swine Practitionneers Association, 3rd March, Mantova

Methods to investigate reproduction troubles

- Farm visit : talks, visual inspection of animals and equipments
- Detailed analysis of reproduction data
- Clinical exams, Serologies
- Reprod. tracts at slaughter-house
- Urinary Test strips…..





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Echography ? Hormonal profiles ?

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Applications of Ultrasonography

Various research applications

In Farms : limited number of applications

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At Farm Level : more portability

Agroscan (ECM)

Tringa
(Esaote- Pie Médical)

Falco Vet
(Esaote- Pie Médical)

Sonofarm
(Draminsky)

Etc …..

In the Lab : More options

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Other portable machines

Virtual Scan (ECM)

Exago(ECM)

EASISCAN (BCF)

VSCAN (GE)

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Back to real life…

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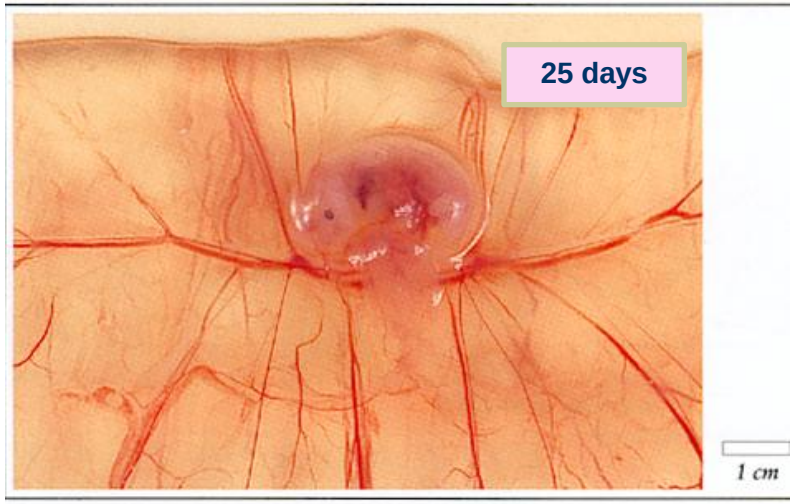
Basic Pregnancy diagnosis

- **Since the 1980s….**
- **Now > 80 % farms in France**
  - Farmers or specialized operators (data banks)
  - Sectorial probes 3,5 – 5 MHz
  - Exams at G28-G35



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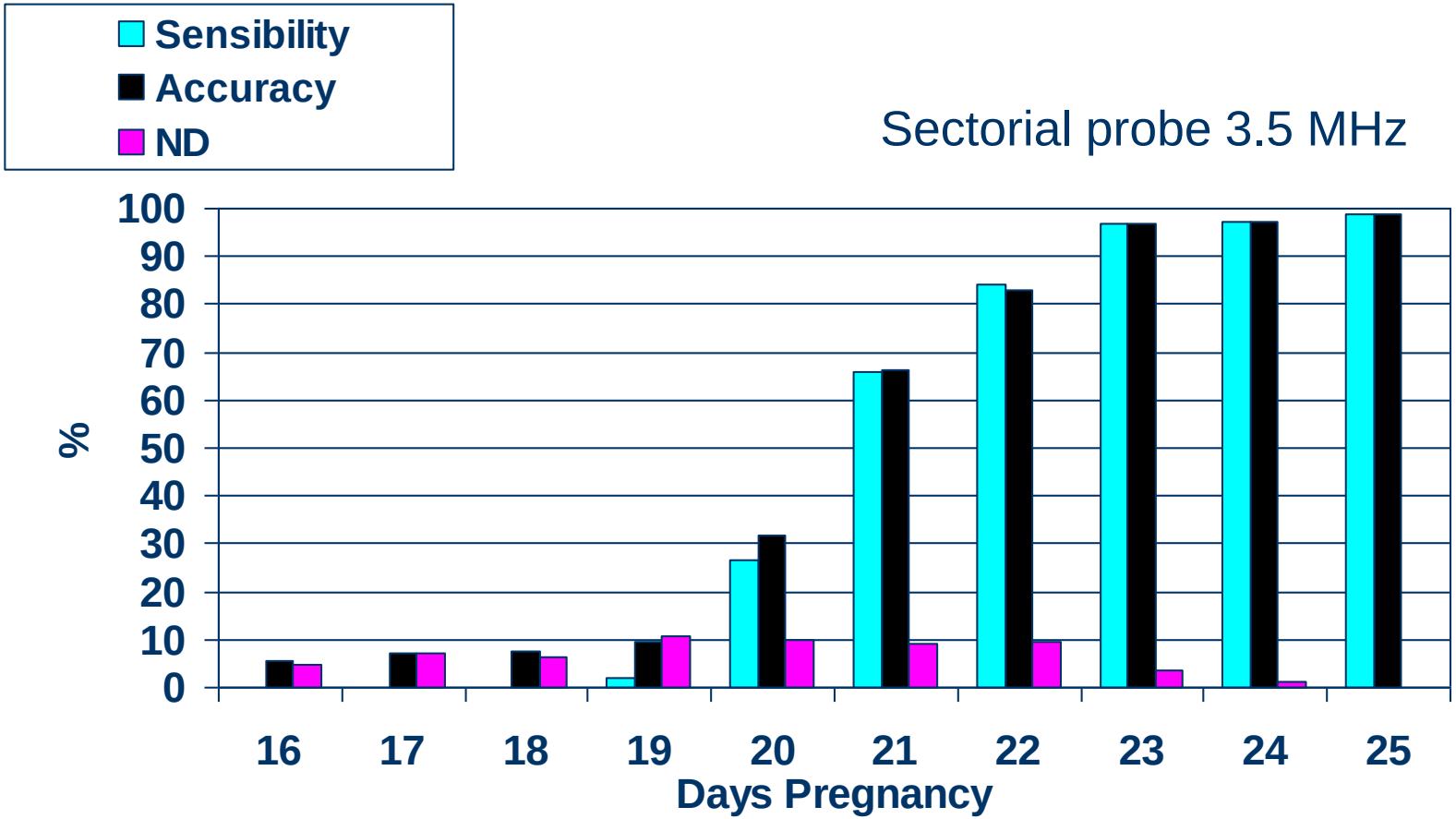
Can we check earlier now ?



Maes et al, 2006

Non determined = 10 % at G21

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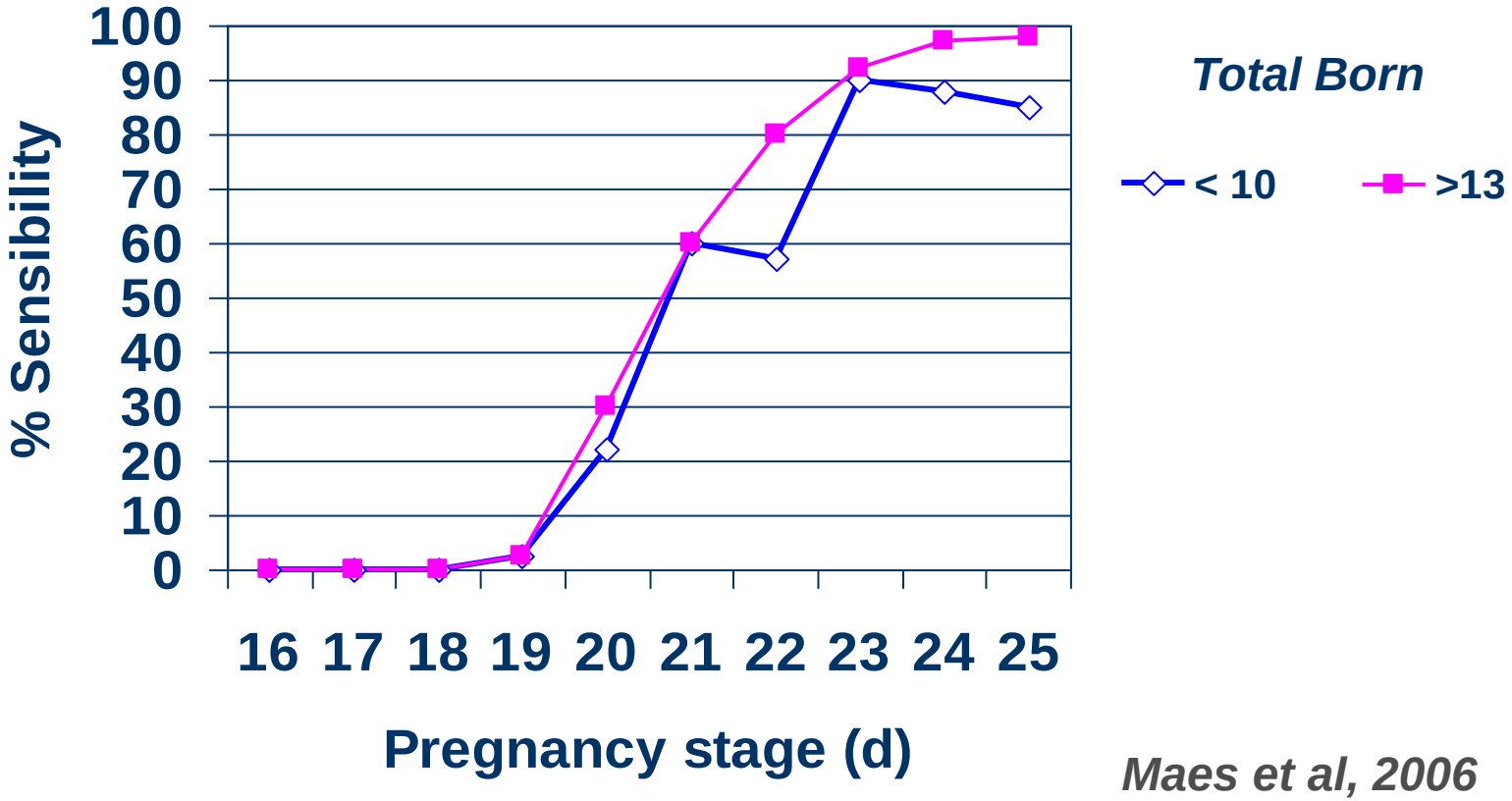
Accuracy and litter size



Maes et al, 2006

Small litters = more risks of mistakes

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Need for 2 nd later pregnancy check ?

- Pseudo-pregancy = Not-In-Pig » sows at farrowing…
  - Were checked pregnant at 24-28 days
  - Never returned
  - Never seen aborted
  - Never farrowed !

- Mechanism :
  - Embryos died before ossification (35-40 d) but after maternal recognition of pregnancy (10-18 d)
  - Ovaries maintained normal progesterone and false pregnancy
  - (P4 test is of no use !)

- Possible Causes :
  - Social stress, High temperatures, Poor hygiene, Pathogens, Endometritis Cysts, Zeralenone…

- Target = < 1% sows
- If risk factors : 2nd US Test at 50-60 days is recommended

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The « come-back » of NIP sows…

	Group	Stalls	Stat
Number of Farms	513	513	-
Number of Cycles at culling	5,3	5,4	P<0.05
Culling rate at Cycle 1 %	9,4%	8,6%	P<0.05
% Farms with « open sows at farrowing » >6% total cullings	7,3 %	2,7 %	P<0.10

Boulot et al 2011

- Group housing pregnant sows =risks social stress ?
- Abortions and returns are more difficult to see !

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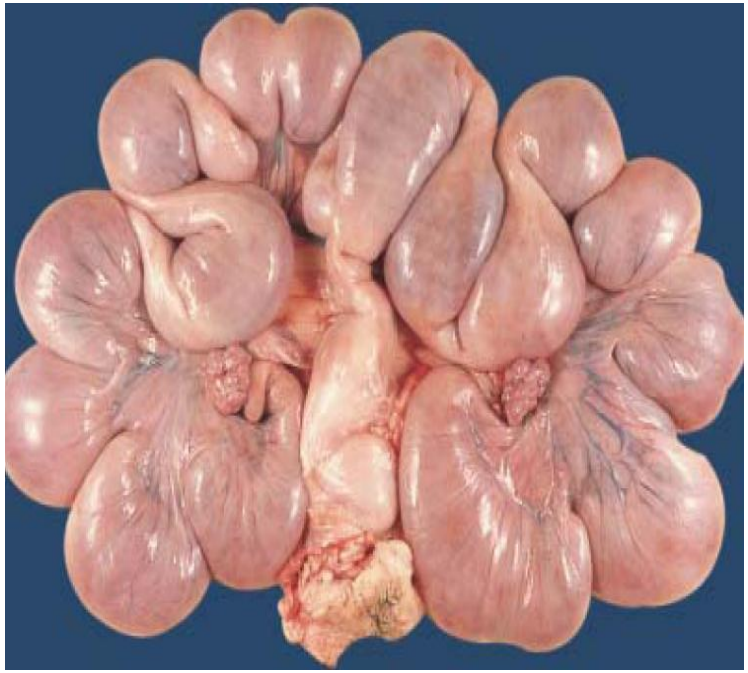
Evaluation of embryo and litter size?

- **Benefits ?**
  - Selective culling of extra- pregnant sows
  - Feeding according to embryo numbers
  - Plannification of farrowing supervision

- **Methodological problems :**
  - Large litters :
    - Crowding (hidden piglets)



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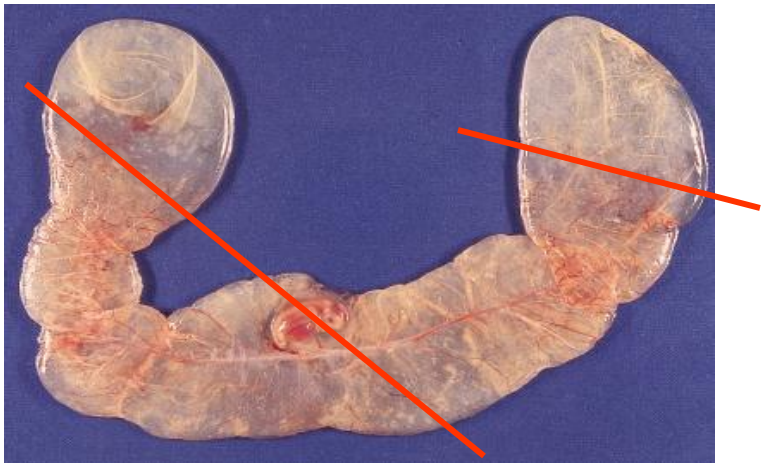
Evaluation of embryo and litter size?

- **Methodological problems :**
  - Uterine circonvolutions :
  - Uterine folds, multiple counts
  - Over-estimation ?
- **Count embryos not embryonic vesicles !**
  - **1 or 3 embryos ?**



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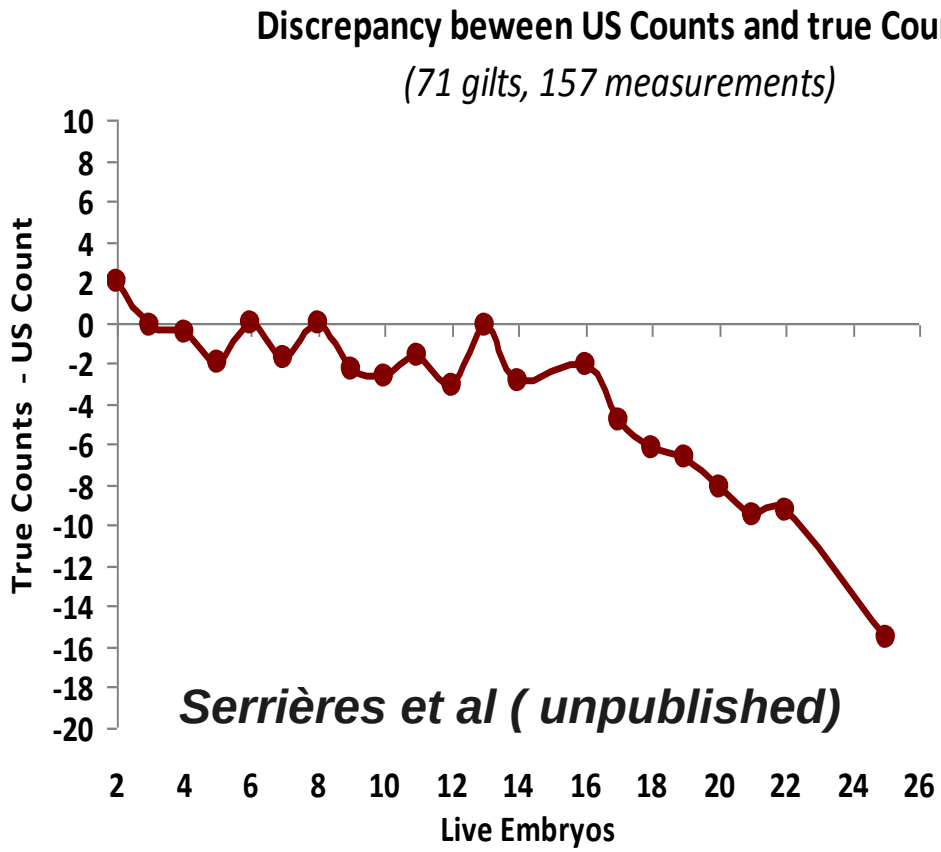
Accuracy of US embryo counts



In large litters 20-30% under-estimation

- **Small litters (<10) may be identified.**
- **Error ± 2 piglets**
- **Standard machines ?**

Empiric « index » low embryo density is frequent !

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Echography and retained piglets

- Retained piglets = 6% of sows *(Christensen et al, 1995, Johnson 2003)*
  - ↗ Sow mortality an morbidity
  - ↘ Weaned litter size, Sow longevity
- US detection (3.5 sector brobe) = 98% global accuracy (*298 sows, Johnson 2003)*
- ☹ Sensitivity = 74% (False -)
  - Single side exam
  - Piglet in birth canal
- ☹ Cost - Duration of exams (up to 15 mn !)

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No application !

Puberty evaluation

☹ 10 % of gilts culled before first farrowing

Reproduction problems : silent heat, infertility…

Inseminated at first oestrus :➘ litter size, fertility

Ultrasonographic diagnosis of puberty is possible in the farms With standard equipment

Martinat-Botté et al. 2003
Kauffold et al. 2004
Boulot et al 2006

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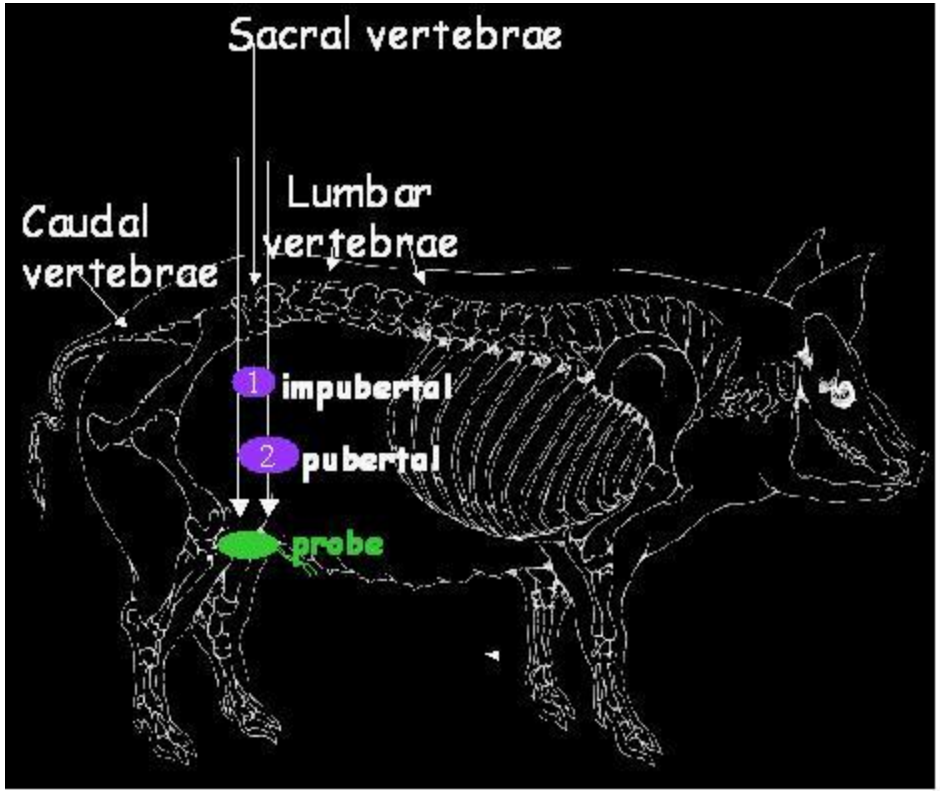
Puberty diagnosis : the method

Relationship between size of uterus and physiological status



Transcutaneous exploration
Inguinal fold

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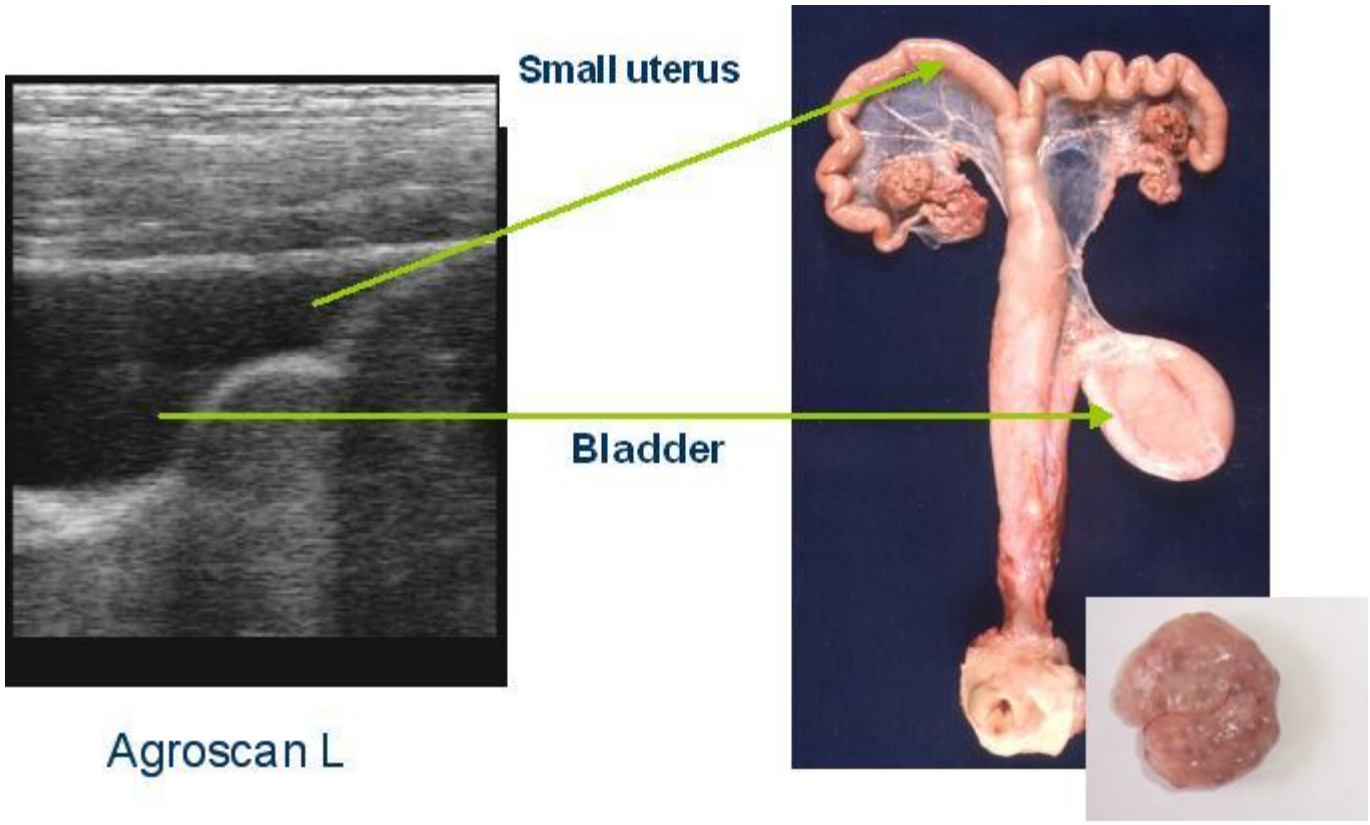
Non pubertal gilt

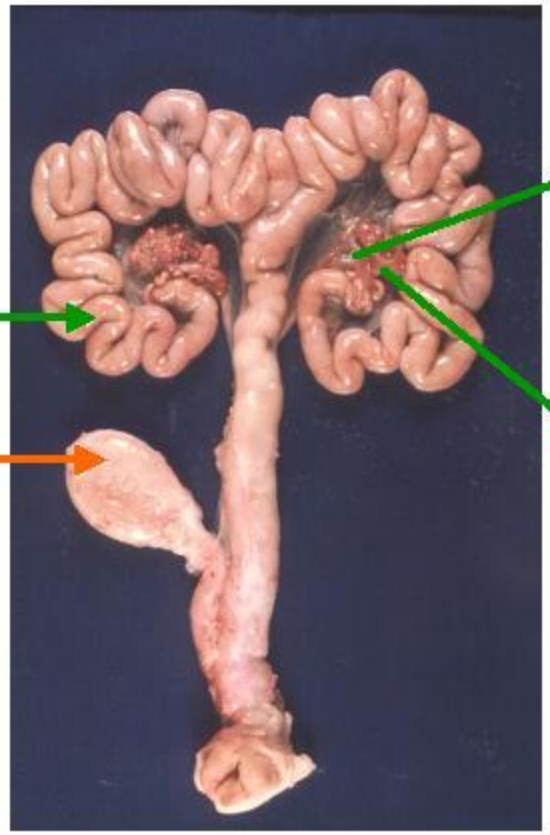


Pubertal gilt

Agroscan L

Large uterus

Bladder



Pre-pubertal gilt
Large follicules, No CL

Cyclic gilt
Corpus Luteum

Puberty diagnosis : accuracy

	Agroscan L (linear)	Agroscan A16 (sector)
N (6 months)	63	90
% Pubertal gilts	67 %	38 %
Sensibility %	97,6	86.1
Specificity %	95,2	98.1
Accuracy %	96,8 %	93.3 %

Sector probe + young gilts = More false negatives ….

Confirm before culling !

Boulot et al 2006

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Case study : Herds with gilt problems

- *4 herds*
- *gilt reproduction troubles : low fertility, poor estrus signs, late puberty*
- *Estrus synchronisation (progestagen)*

	E1	E2	E3	E4
Herd size	210	390	560	260
Self production of gilts	Yes	Yes	No	No
Early estrus detection	No	Yes	No	No

Between 6 months and 1st AI : 232 explorations

- *quarantine (arrival, departure)*
- *Insemination unit (before and after progestagen)*

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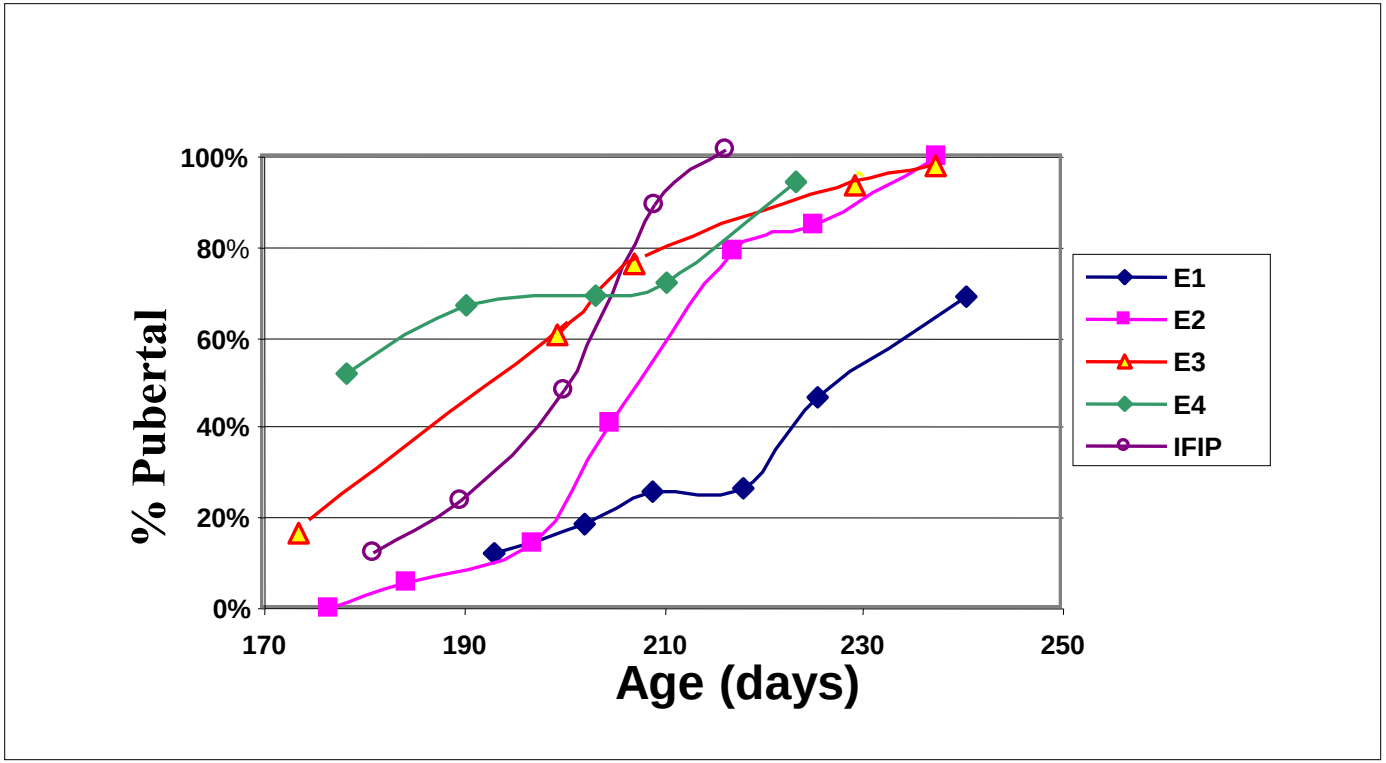
Variability of puberty



Late gilts : E1 - E2

Early gilts : E3, E4, IFIP

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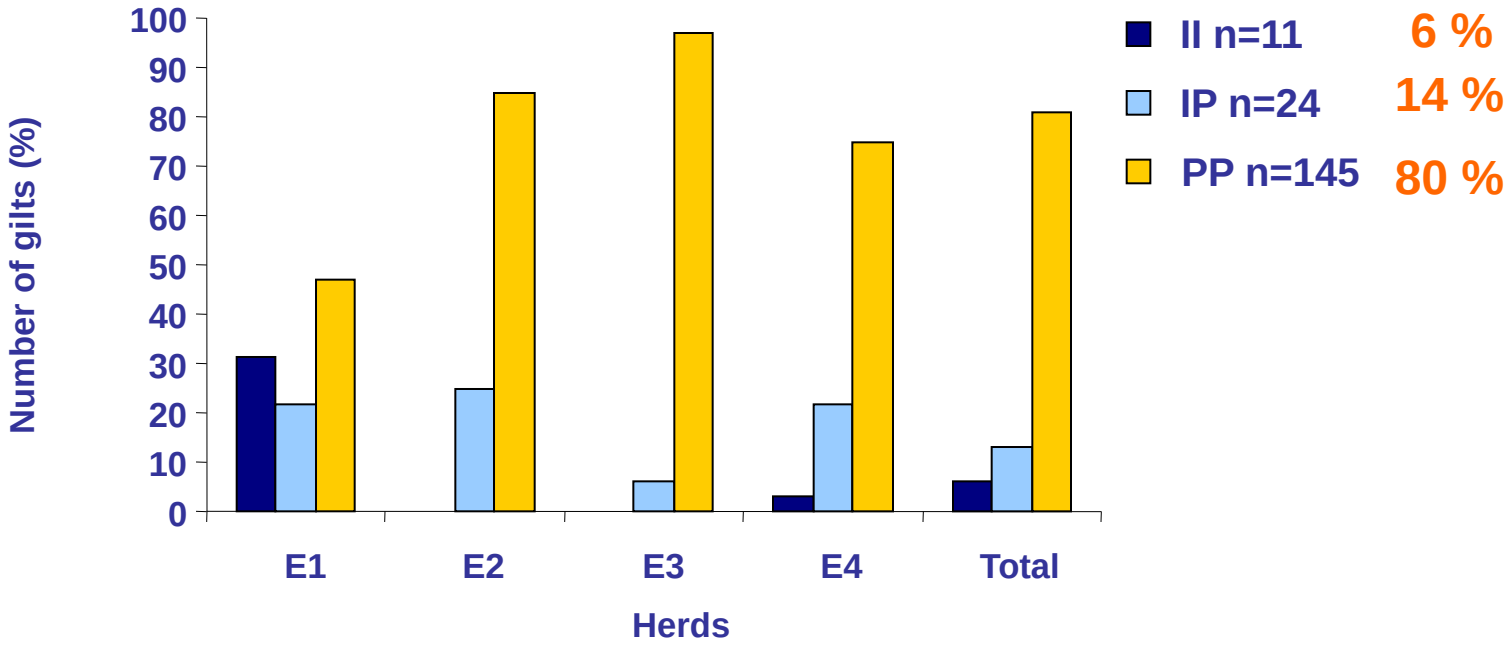
Puberty and Altrenogest treatment

Non pubertal gilts

Before treatment : 20%
End of treatment : 6 %



Risk : AI at 1st estrus ?

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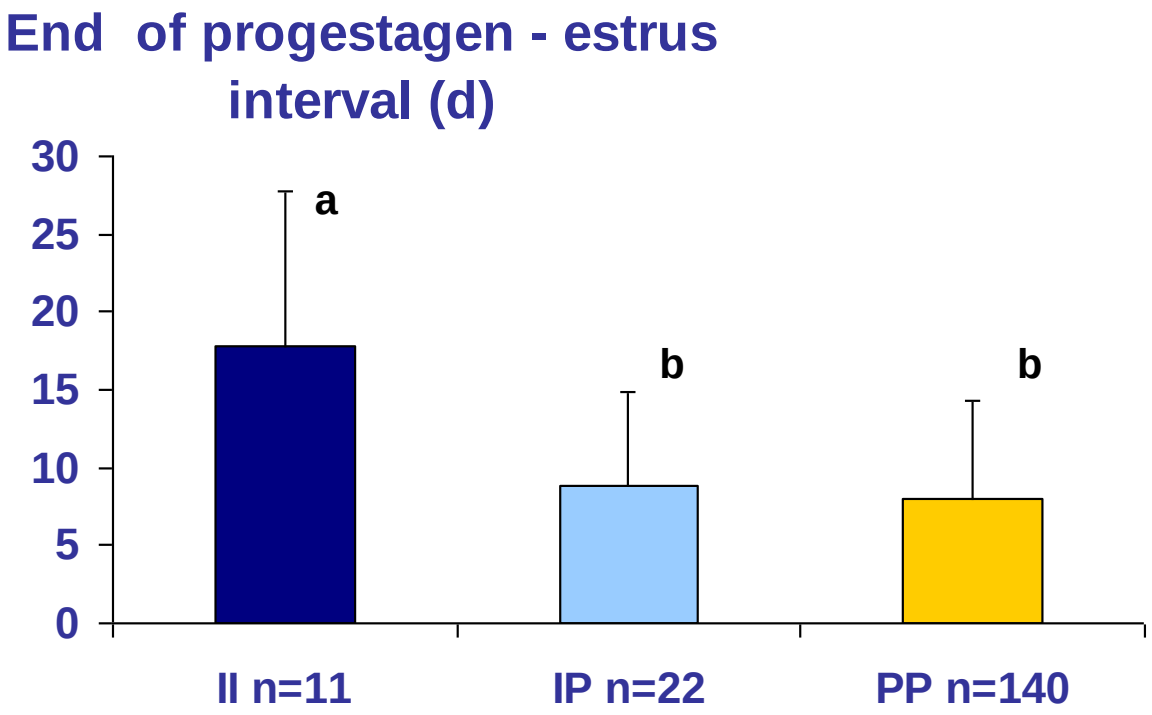
Estrus after Altrenogest treatment



Estrus is delaid among non pubertal gilts

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Benefits of puberty contrôle ?

- **Investigating gilt problems**
  - True puberty problem ?
  - Poor estrus detection technique ?
  - Abnormalities ?
- **Routine technique**
  - Choice of true mature gilts
  - Early culling (abnormalities, immatures > 240 d)
  - More efficient hormonal treatment

➡ ***Not to early***

Before progestagene

On arrival in AI unit

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Prediction of ovulation

- **US of ovaries = gold standard**
  - Ovulation time
  - Ovarian Status of infertile sows

- **Applications**
  - **R &D**
    - Fragile semen (Frozen, Sexed…)
    - New Hormonal treatments
    - Optimization of AI Protocol
  - **Fertility AUDIT or trials in farms :** *Kauffold et al 2005-2007, Alvarenga et al 2006, Szcebiot et al 2008, Bohma et Bilkei, 2008, Boulot unpublished….*

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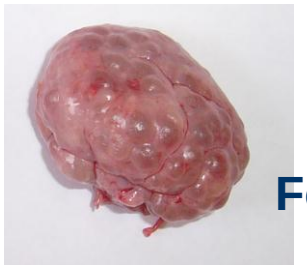
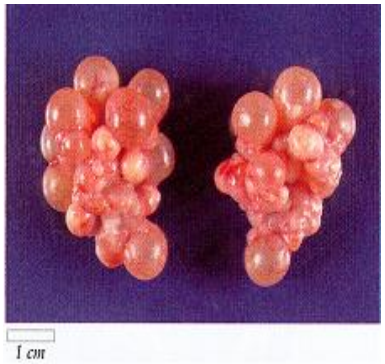
Sow ovaries and ovulation



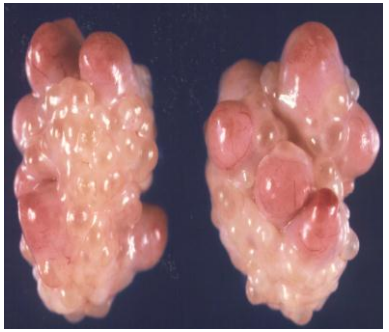
Follicules 3 mm

Follicules 5 mm



Follicules 7-9 mm

Ovulation

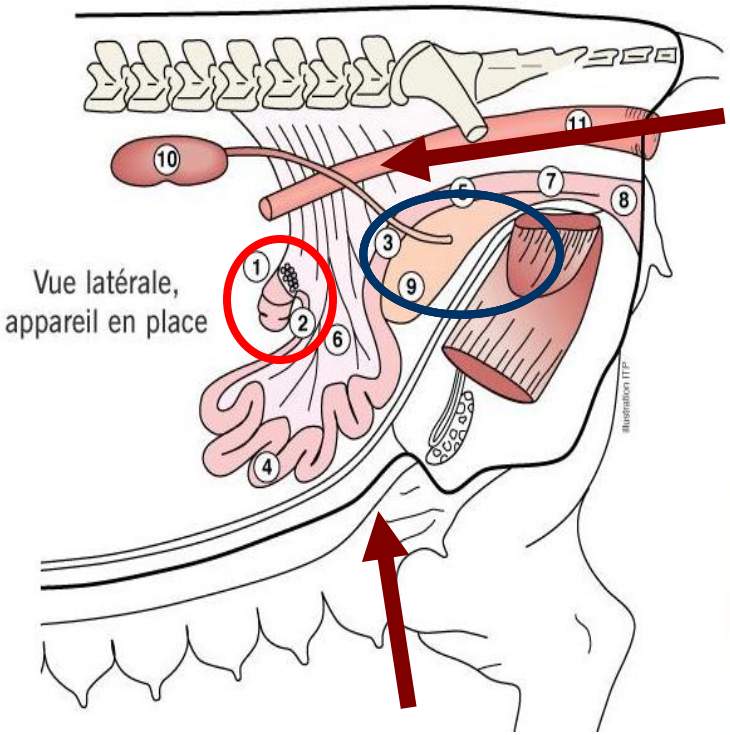


Corpus Luteum

(clichés F. Martinat-Botté, INRA)

Localisation of ovaries

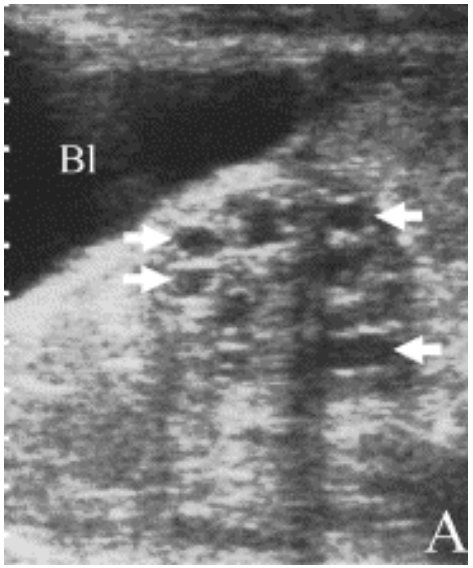
Deep, close to the bladder, 7th lomb.

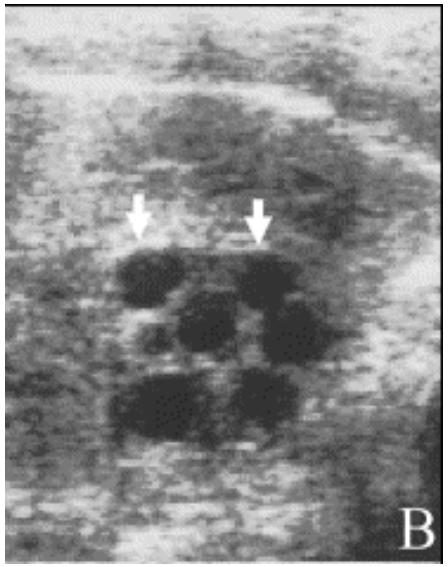


Trans-rectal : (5 - 7.5 Mhz)

Trans-abdominal : (5 Mhz)

Prediction of ovulation





Early follicular phase

Before ovulation

After ovulation

Ovulation = 2 exams/day

Kauffold et al 2004

5 MHz, linear probe, abdominal

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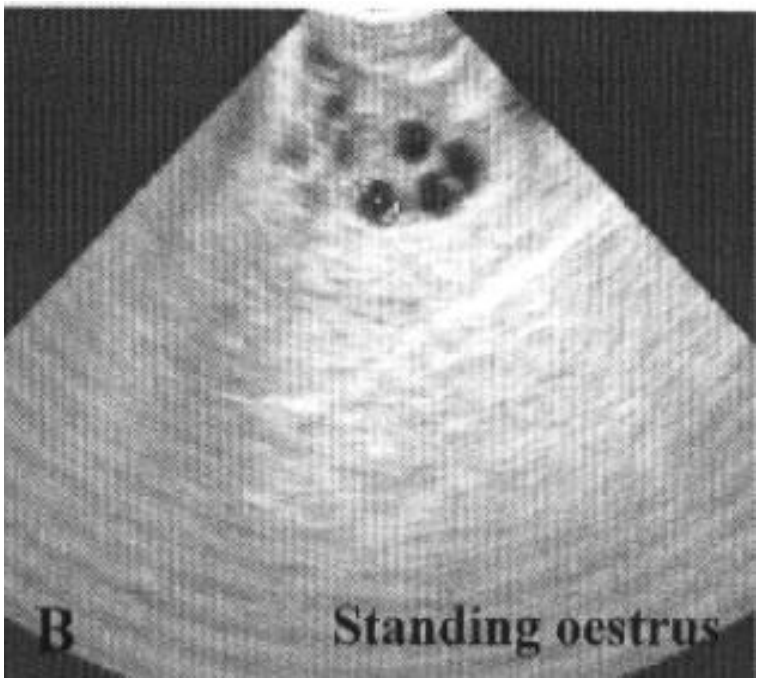
Accuracy of Ovarian Scans

- Experience of the operator (artefacts ….)
- Quality of probe and machine
- Frequency of measurements



Pre-ovulatory Ovaries (Trans-cutaneous US) : Kaeoket 2003 (left), Boulot (right)

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Simple On-Farm Ovarian evaluation

- **Ovarian status** ***(Kauffold et al 2007)*** **:**
  - Foll 2-6 (pre-ovulatory)
  - Foll 7-9 (peri-ovulatory)
  - No more Foll (post-ovulatory ?)
  - POD (cysts)

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Simple On-Farm Ovarian evaluation

- **At 1st AI**
- **After the last AI**
- **Anestrus sows**
- **Estimations ?**
  - % sows ovulating < 1st AI : AI to late
  - % sows ovulating > last AI : more AI ?
  - % quiet ovaries
  - % silent heat ?

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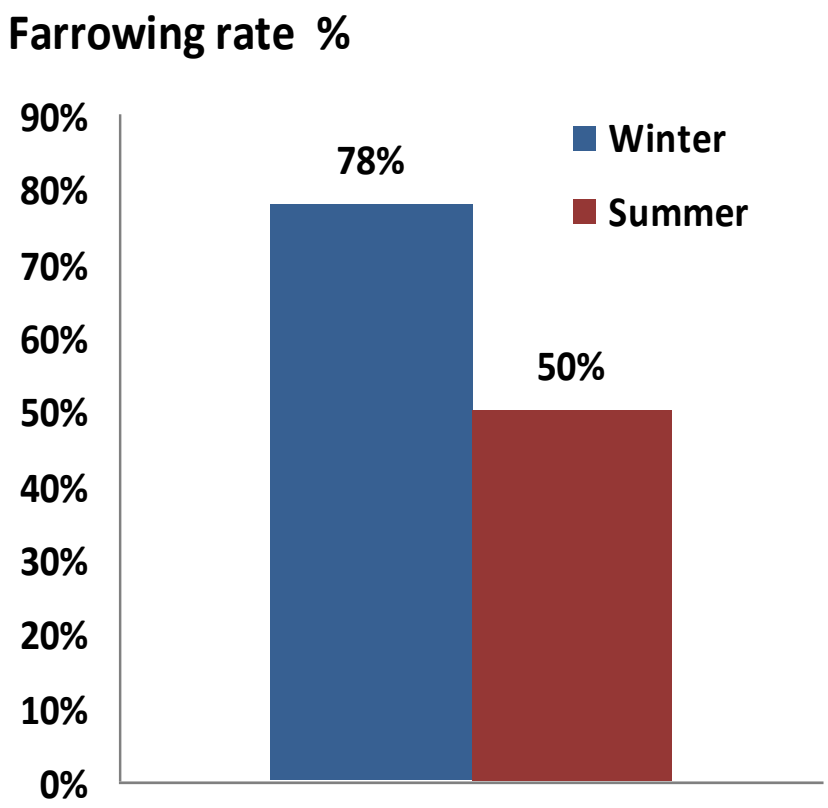
Case study : AI Protocol for frozen semen



- In vivo life-span of frozen semen is short
- Best if AI 8-12 h before ovulation
- Poor results with frozen semen in summer .

- Does ovulation change in summer ?
- Change the AI protocol ?

Bolarin et al 2009

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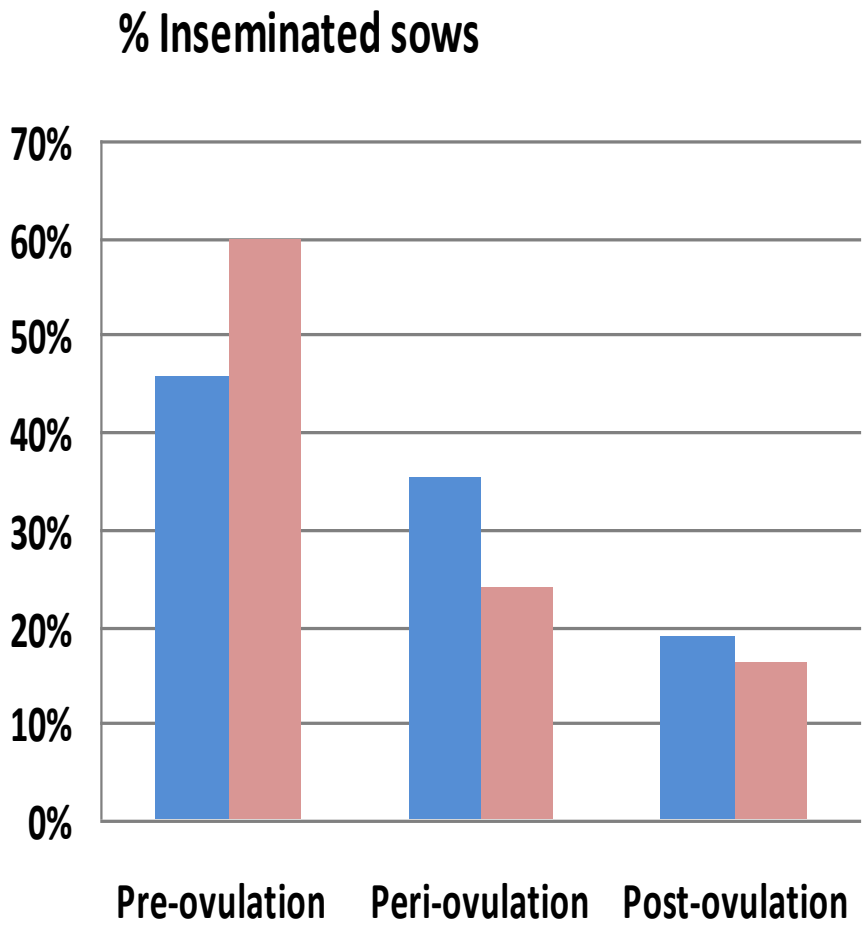
Ovarian status at insemination



216 sows
2 AI at 33 and 39h post estrus
Frozen semen
US ovarian scans at AI

Less ovulations between 2 IA in summer.
Later ovulation in summer ?
AI to far from ovulation !

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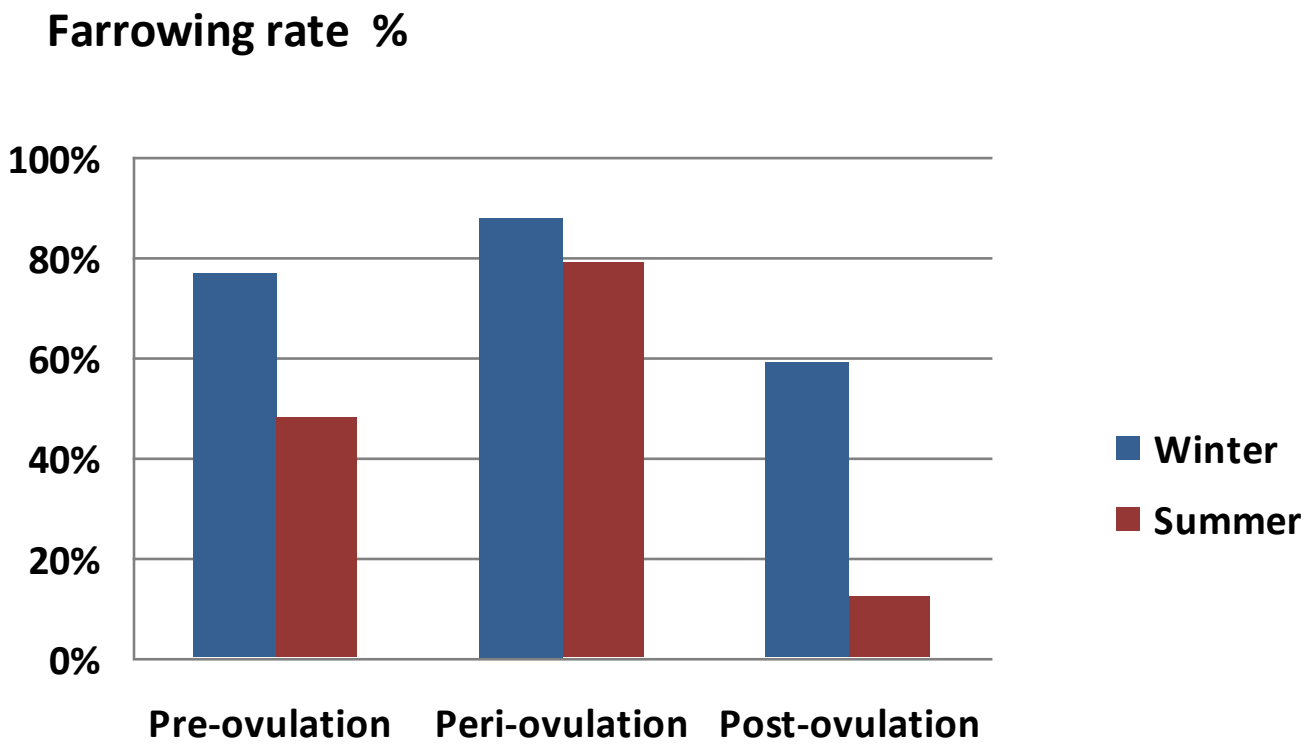
Ovarian status at insemination



Inseminate later in summer ?
Other factors may still decrease fertility …

Anestrus and Non Pregnant sows

- Will they return ?
- When ?
- Wait, Treat or Cull ?

- Not easy answer …
- Check for POD or uro-genital pbme (cull)
- Inactive ovaries : several scans required (P4 test ?)
- Check for body condition, lameness
- Treat for timely integration in batches ? (Kauffold et al 2007)

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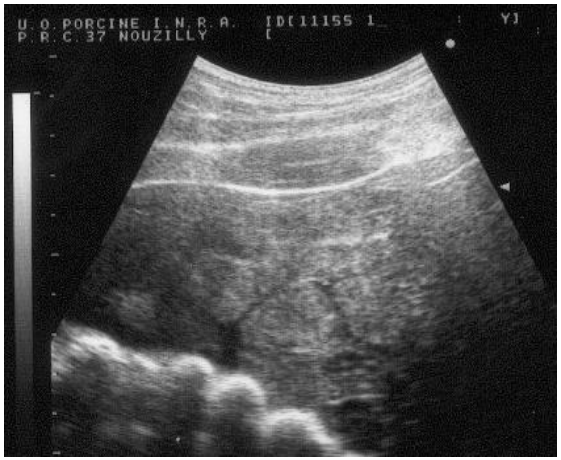
Oestrus prediction

- Echo-texture varies during the cycle

Day of weaning (D0)



Next day (D1)

Day before oestrus (D4)

- Prediction of sows with delaid oestrus ?

(Martinat-Botté et al 2008)

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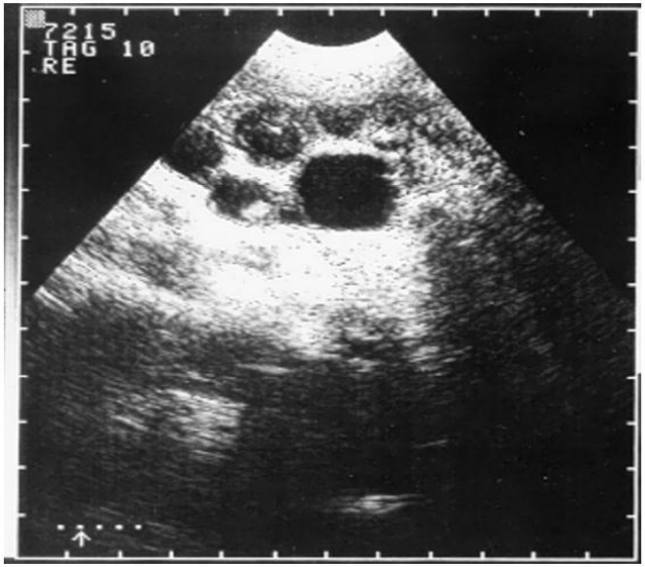
Ovarian Cysts

- Diameter >10 mm
- Anechogenic
- ± Luteinised wall :
  - Cystic Follicules
  - Cystic CL
- Single or Polycystic (POD)

(F Martinat-Botté)



(Waberski et al 1999)

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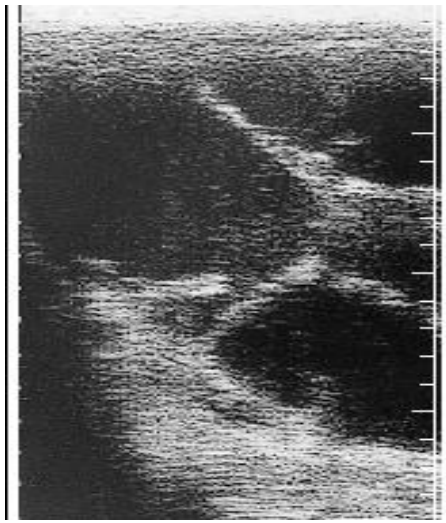
Ovarian Cysts

- **May spontaneously regress (single)**
- **Possible confusions :**
  - Embryonic vesicles
  - Liquid vesicles on uterine walls



(F Martinat-Botté)

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Ovarian Cysts

- **2.5 to 40% non pregnant or culled sows**
- **Only POD impact fertility**
- **Main Causes**
  - Non accurate Hormonal treatments
  - Stress ….
- **Poor response to treatments (POD) :** ***Cech and Dolezel 2007***

	% AI	% Pregnant
Contrôle (29)	17 %	7 %
GnRH 200µg (25)	84 %	44 %
hCG 3000 IU (21)	38 %	24 %
PGF2 250µg (27)	38 %	12 %

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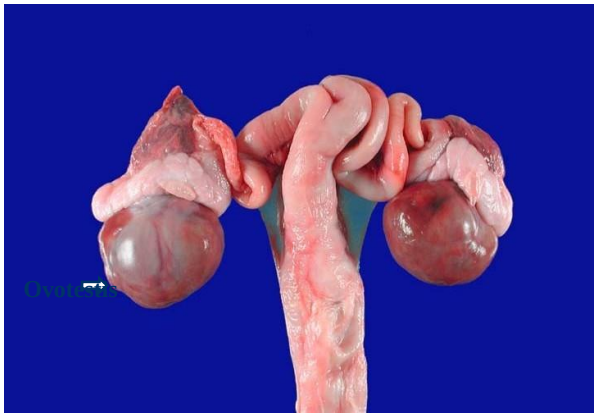
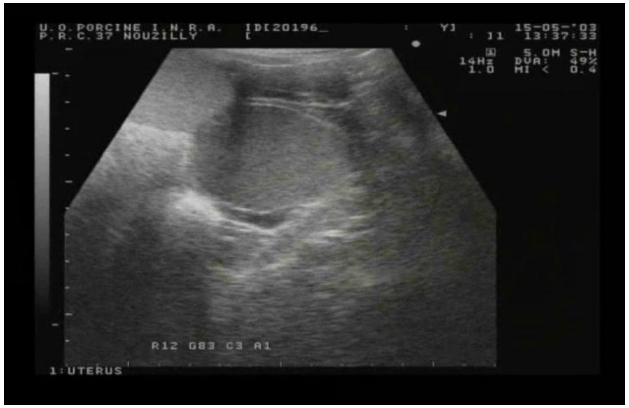
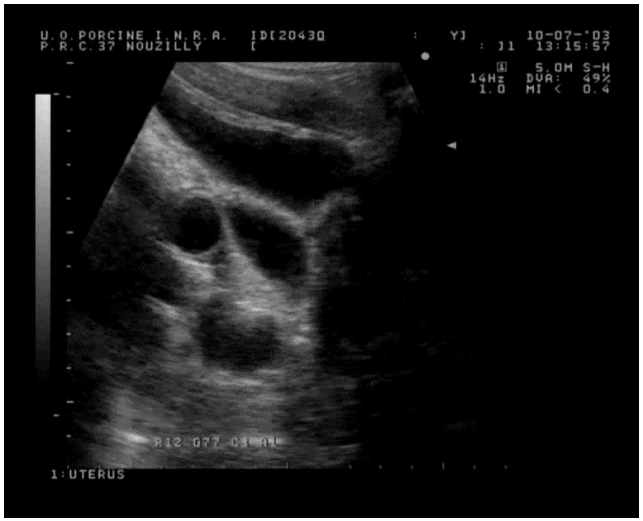
Genital abnormalities

- **Ovotestis**





- **Hypertrophy of ureters**



(clichés F. Martinat-Botté, INRA)

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Uterine disorders

- **Uterine disorders (metritis, endometritis, poor uterine involution …) :**
  - Fluid filled uterus (T*hilmant 2010)*
  - ↗ Echotexture *(Kauffold et al 2005) :*

Failed sows (4 min/sow, Transcutaneous US, culling)

45/47 sows with endometritis

Echo-texture Grade - Oedema Grade : r=0.57 p< 0.001

- **Requires validation and training !**
- **Still Check vulvar Discharge visually !**

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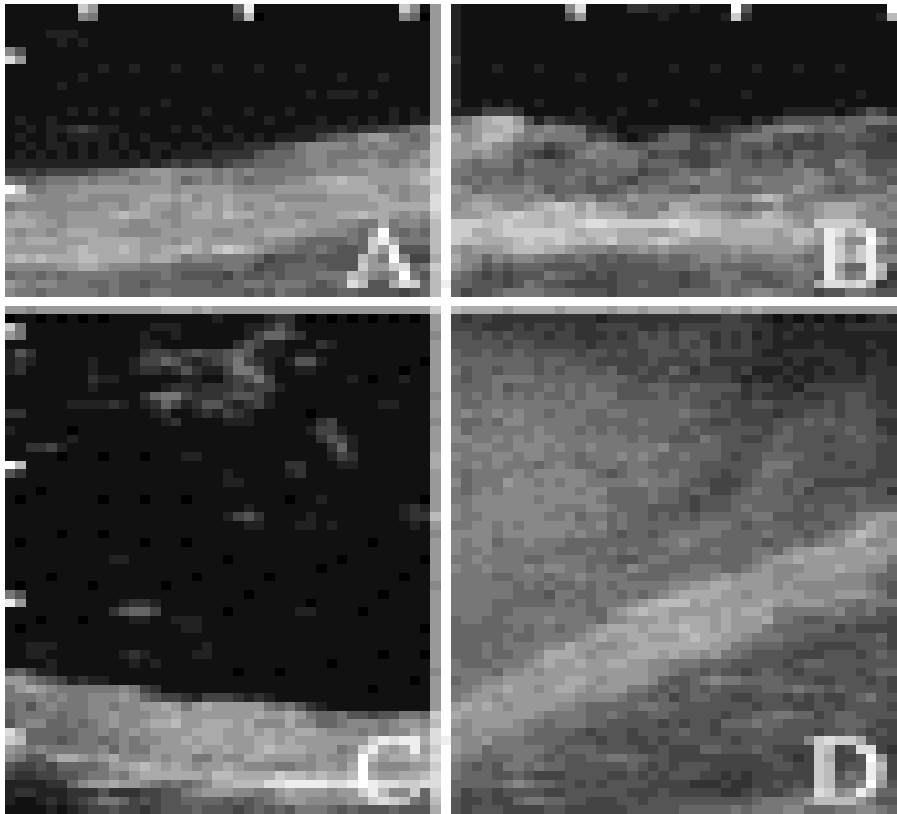
Urinary tract infections

Kauffold et al 2010 : 46 sows – Rectal US

- **Bladder measurements = no link with UTI**
- **Moderate/high amounts of sediment = predictive UTI**
- **Uro-lithiasis or bacterial infection ?**

A) Slightly irregular wall
B) Moderately irregular wall
C) Low amounts of sediment.
D) High amounts of sediment.



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Urinary tract infections

- US inspection of the bladder could support early culling decision/treatment for sows diagnosed open
- Accuracy to be confirmed …
- For routine herd evaluation : test-strips !

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Pathologies of mammary glands

- Sows with history of MMA can be US checked for pathologic changes of the mammary gland = *Hyper-echogenic (*Baer et Bilkei, 2005)

	MMA	Contrôle
N	663	1 125
Hyper-Echo (Abdom Glds)	87.4 %	15.5 %

- ☺ Selective earlier culling (most are infectious)
- ☺ 4 min/exam
- ☹ Specific 8.5 MHz Linear probe

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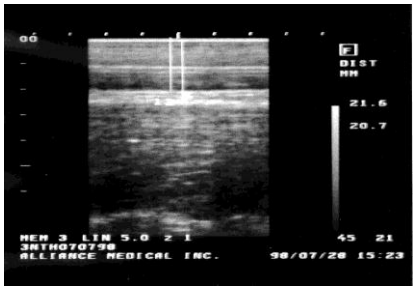
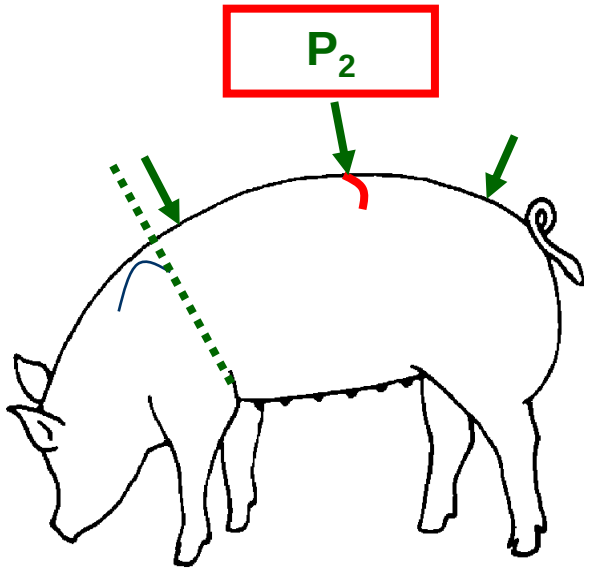
Body Fat monitoring

- **Body reserve impacts on fertility, farrowing and piglet viability**

US + Linear probe = more accuracy



Renco® : also suitable



- **Routine Diagnostic tool**
- **Target values to be adapted to genotypes**

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Muscle depth and reproduction ?

- For selection *(Maignel et al 2009)*
- Hyper « muscled-sow » syndrome ?

  (Martineau et al 2010)
- Target values and link with reproduction troubles ?

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Case Study : « Abortions and thin sows »

- N.W. France : 750 sows, wean 21 d, 14.3 T Born
- AI in stalls, Pregnant sows in groups of 6-8 after 28d (4 meals/d, collective thoughs)
- 💣↗ Abortion rate ↗ Small litters

	2008	2009	2010
Annual abortion rate %	1,6	2,8	4,7 *
Distribution of abortions %			
July to October	94	60	nd
Other months	6	40	nd

* 4 months in 2010

- Veterinary investigations : Ok
- Management ? Food competition ?

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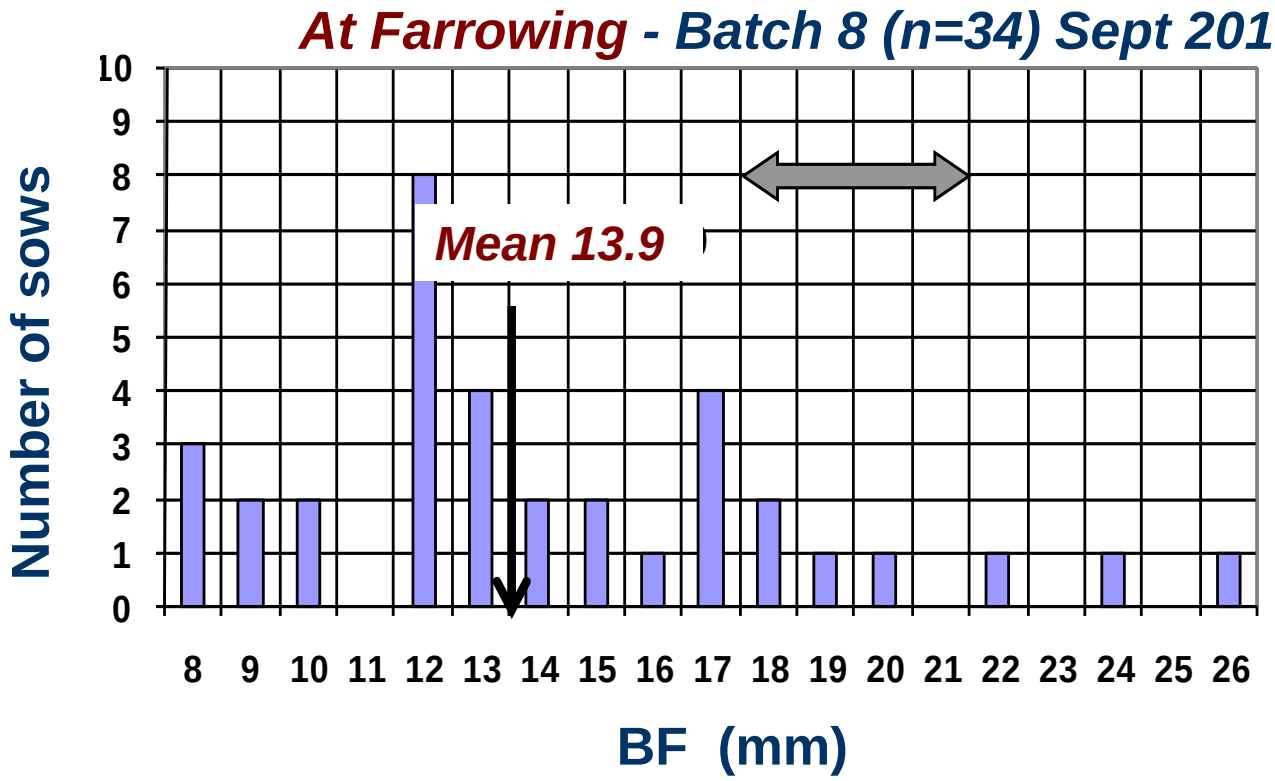
Case Study : « abortions and thin sows »



- 40% sows < 12.5 mm at farrowing
- Heterogeneous groups
- Competition during meals

- Contrôle of Feeding Equipment : Technical Pbme
- Gestating sows under-fed

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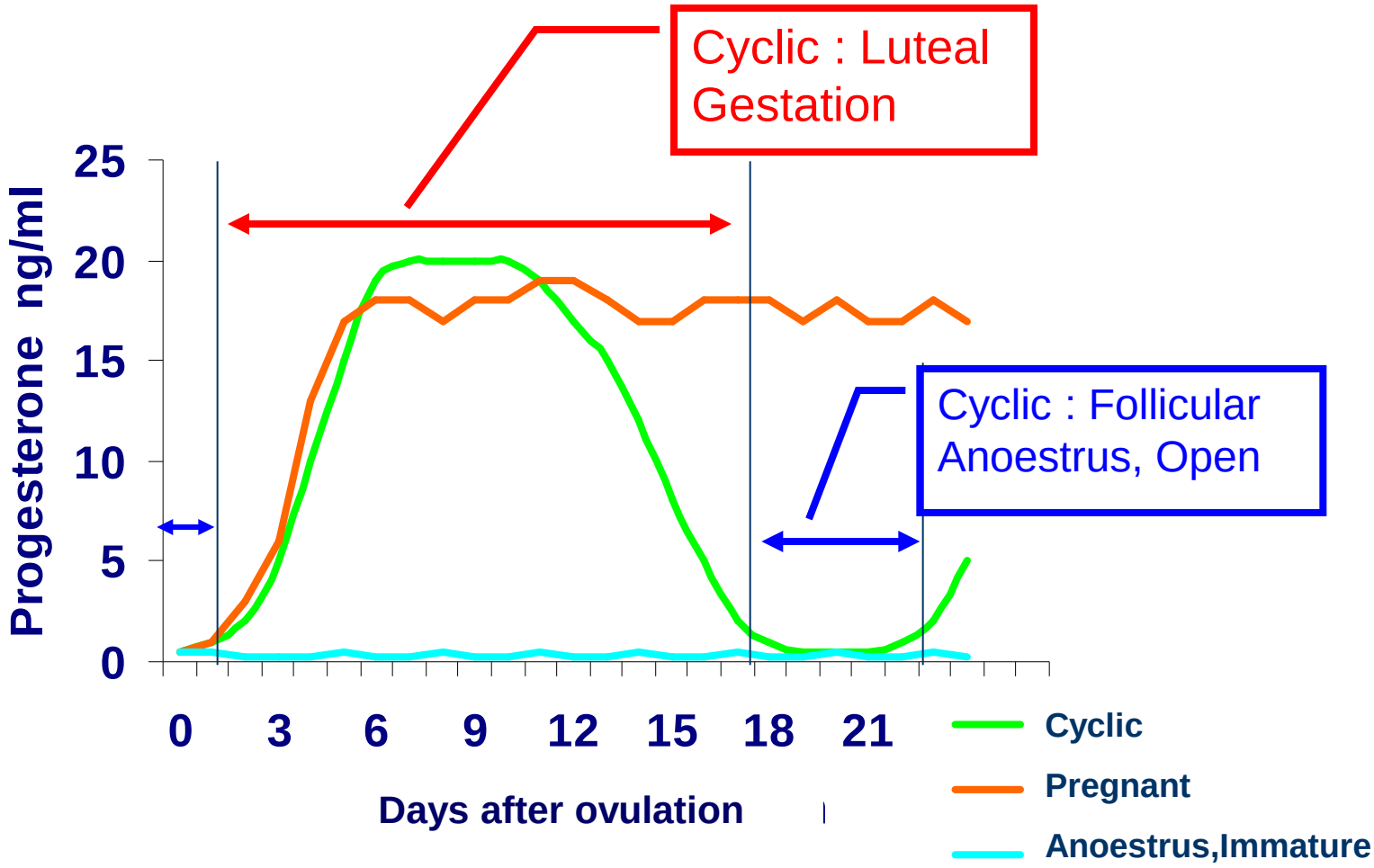
Hormonal investigations

Progesterone in the sow



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Why progesterone ?

- **Blood progesterone (P4) = Standard criteria to explore reproduction in many species (dog, mare, cow…)**
- **Origin = Ovarian CL + Surrenals**
- **Blood (plasma, serum), Saliva, Feces, (Urine)**
- **Some bias :**
  - Stress↗ P4
  - High P4 associated to Cysts : not always (Chung et al 2002). **Use Echography in combination** !

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Progesterone determination

- **Quantitative RIA or ELISA :**
  - Accuracy, detection level
  - Delays, sample management , costs

- **Semi-quantitative ELISA:**
  - **PigReprokit® , Ovulation Test®, Target ®, Ovucheck Premate® ….**
  - **Variables threshold : 1 2 2.5 5 ng/ml**
    - Rapid (On farm)
    - Low cost
    - Less precise…

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Accuracy of an ELISA Kit for pigs

Threshold 2,5 ng		RIA		
		Négatives	Positives	
PigReproKit	Negatives	27	0	27
	Positives	5	28	33
	Total	32	28	60

Sensitivity : 100%

Specificity : 84%

Global accuracy : 92%

(Boulot and Sallé, IVPS 2008)

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Sow Progesterone studies ….

- **AFMVP, France :**
  - 1988 : Pregnancy tests : Progesterone Kit vs Echography (F. Martinat-Botté)
  - 2005 : Diagnosis of lactational oestrus (*J. Avon et al.*)
  - 2006 : Progesterone in herds with reproduction trouble (*G. Scimia, B. Delahaye*)

- **AI programs, Ovulation :**
  - Specific AI program for Basque breed (*Labroue et al 2000*)
  - Estimate Ovulation time (*Terqui et al 2000*, *Martinat-Botté et al 2010)*

- **Reproduction troubles :**
  - Anœstrus, open failed sows (*Chung et al 2002, Bohma et Bilkei, 2008*)
  - Immature females, silent oestrus (*Le Neveu et Sallé 2008, ISPAIA seminar*)
  - Early disruption of pregnancy

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Test of cyclicity or puberty

- 2 Blood samples 8 – 10 days appart
- Positive Threshold = 2 ng
- Cyclic and pubertal animals : at least one positive value
- Correct interpretation requires :
  - Position of samplig according to weaning, estrus detection or AI
  - Informations on previous history (returns, duration of estrus …)

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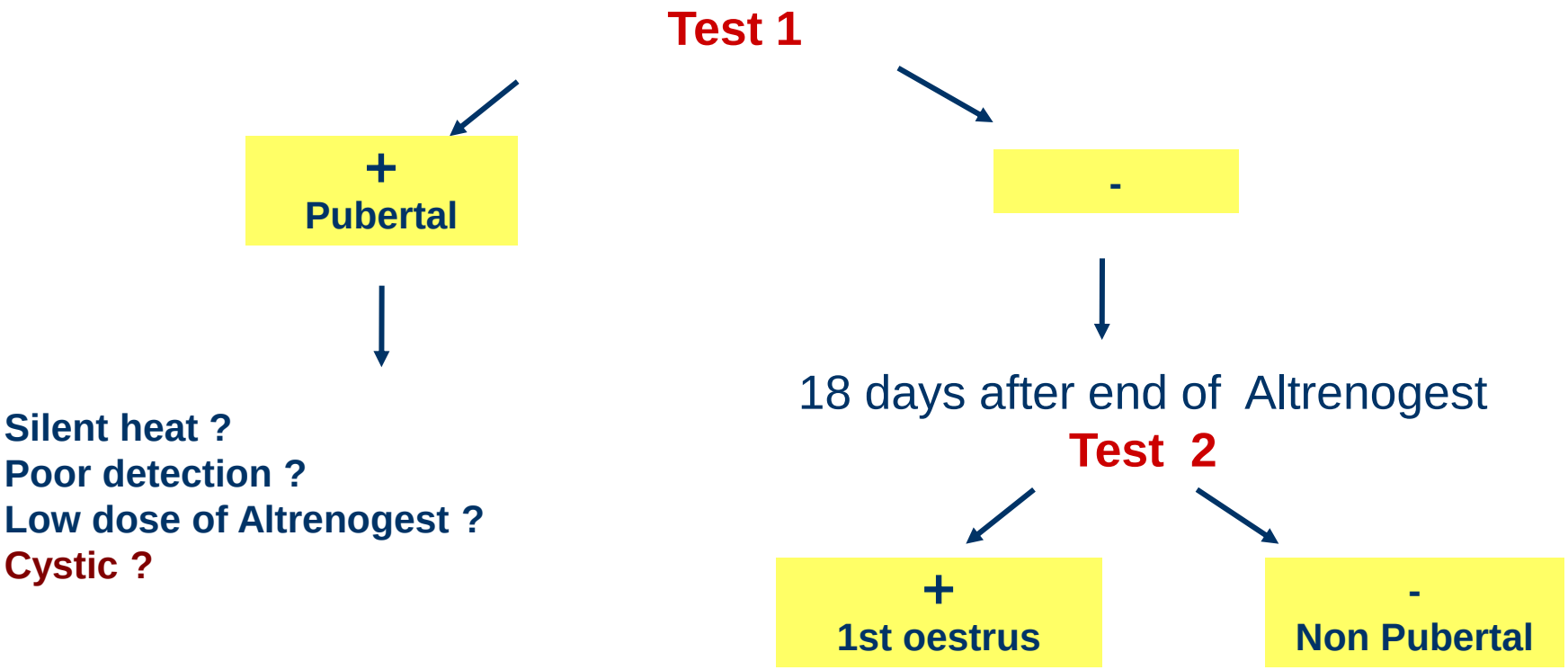
Anestrus Gilts 8 days after the end of Altrenogest



Non pubertal at Altrenogest
Check puberty before Altrenogest
Stimulate puberty(cf management, health….)

Check puberty early
Cull if old
Induce Puberty ?
See Management/Health

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Progesterone and estimation of ovulation time

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Progesterone and estimation of ovulation time

- **Modelisation of P4 cinetics during oestrus**
- **Retrospective détermination**
- **Strong Correlation with Echography**

  Terqui et al 2002, Martinat-Botté et al 2010

☹ ***High costs…***

- **2 samples /day for up to 6 days (estrus)**
- **Quantitative determination**

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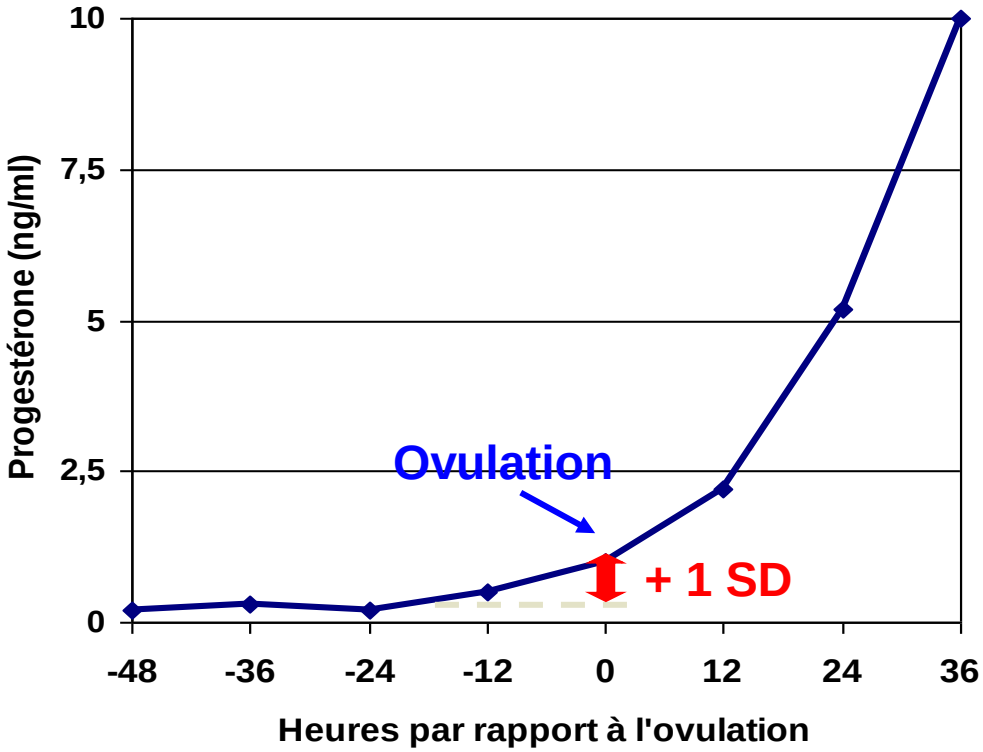
Modelisation of ovulation time



Ovulation :

1 st High point
Or
+ 1 SD / basal

(Terqui et al. 2000)

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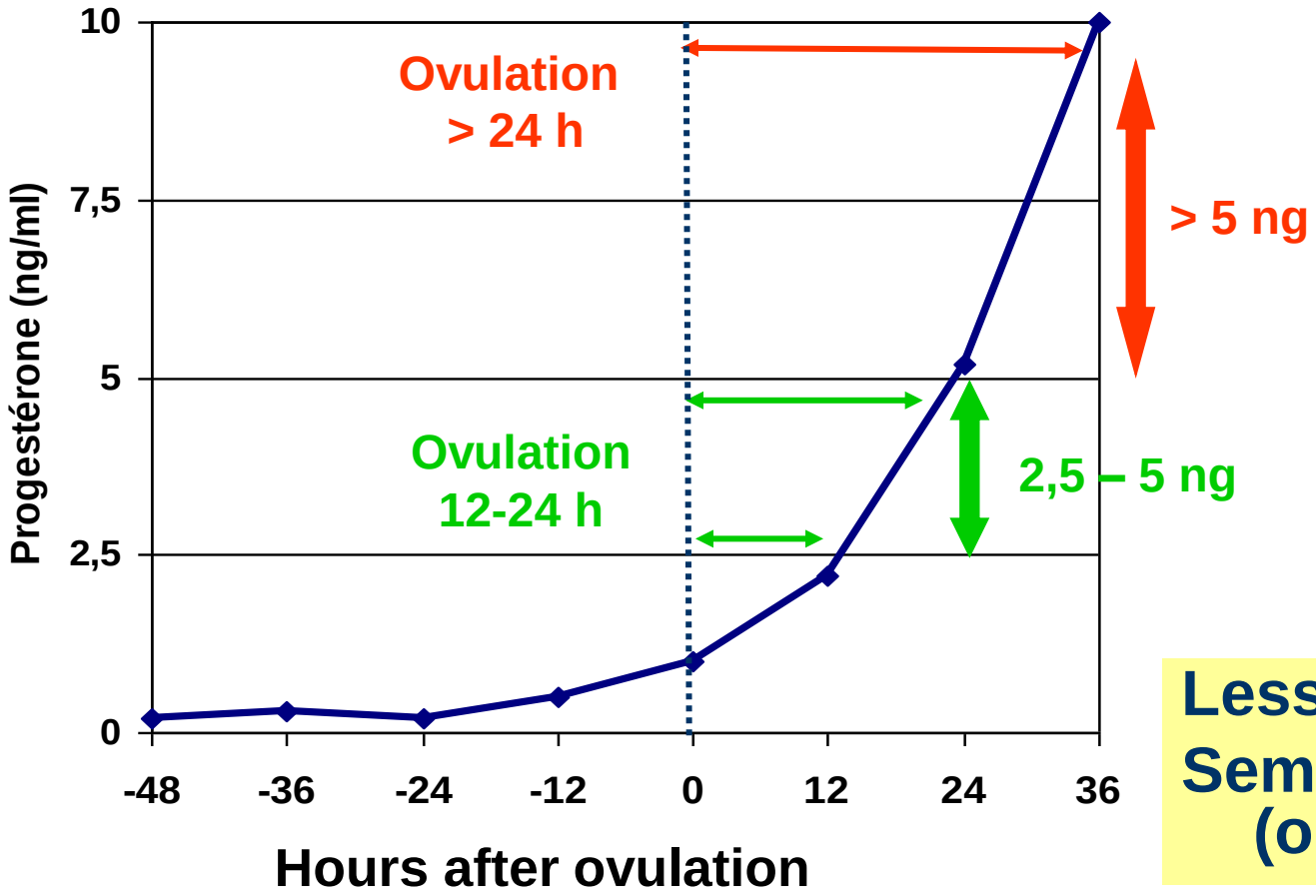
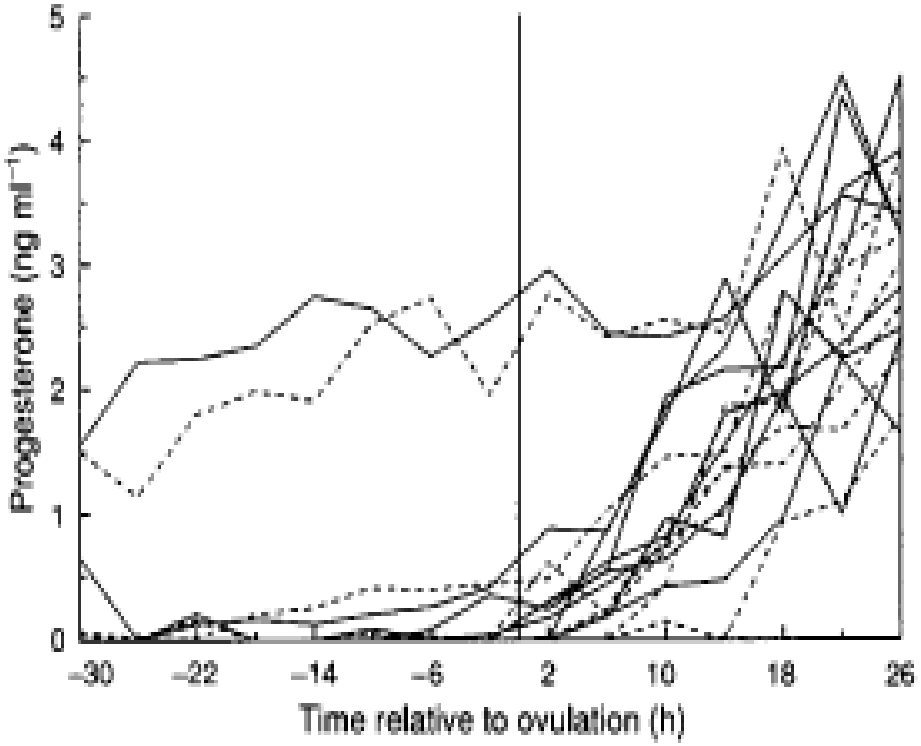
Range of probable Ovulation ?

Threshold method less precise : field use.
Based on theoretical average post-ovulatory P4 curve



Less samples
Semi-quantitative
(on Farm ?)

Limits of the « Threshold method »



- **Risks of errors :**
  - High basal P4 (rare)
  - Slow P4 rise

- **Basal values should be taken into account** *(Soede et al 1994)*

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Field use of «Threshold » method

- *Le Neveu et Sallé, 2008 (ISPAIA seminar)*
- **Critical analysis of AI schedule : 2 samples**
  - 12 - 24h > 1st AI : ovulation before 1st AI ?
  - 24-36 h > last AI : ovulation > last IA ?
- **Quality of estrus detection, silent heat :**
  - Sample negative sows up to 7 days post weaning
- **Empty sows, anestrus sows and gilts : 2 samples**
- **Benefits for farm advise ?**

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Some Farm examples

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Case : Gilt problems (Dr Delaunay)

(from Le Neveu et Sallé, 2008)

	23 01	24 01	25 01	26 01	27 01	28 01	29 01	30 01	31 01	01 02	02 02	03 02	04 02	05 02	06 02	07 02	08 02	09 02	10 02	11 02
1040	H							+	Altrenogest											
1094	-							-					-							+
1043	-							-					-							-

- True immaturity in quarantine was confirmed
- Quarantine management was revised

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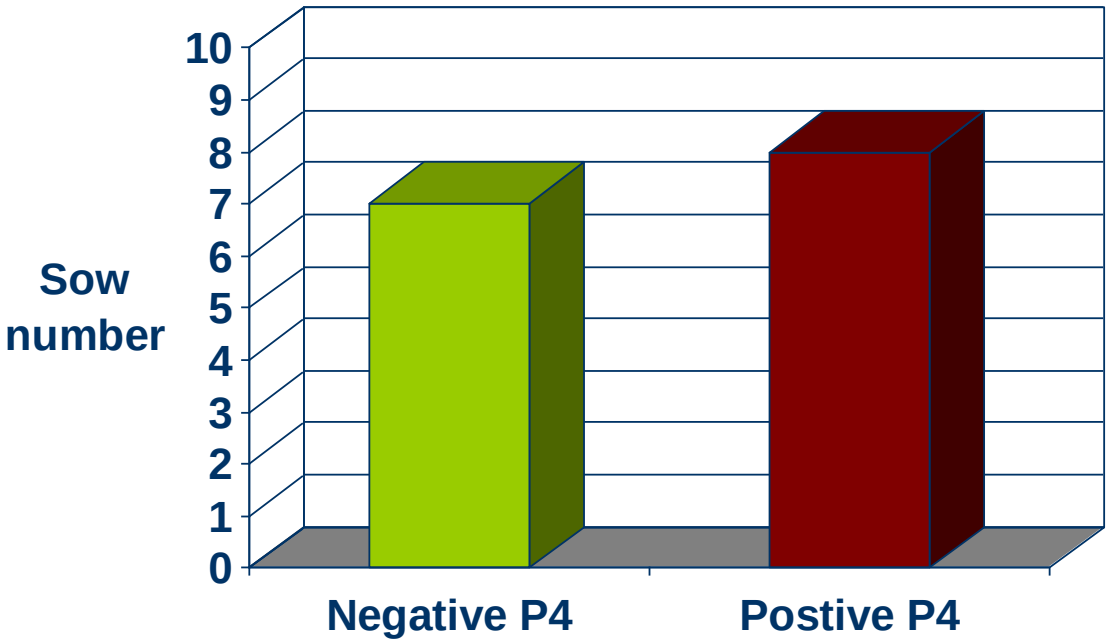
Case : Lactational oestrus (Dr Morin)

(from Le Neveu et Sallé, 2008)



- Delaid post-weaning oestrus = lactational oestrus ?
- The day of weaning P4 is positive > 50% sows

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Case : Poor fertility, vaginal discharge

Dr Scimia Boulot 2009

jour	*jour*			*Lundi*						*Mardi*						*Mercredi*						*Jeudi*						*Vendredi*						*Samedi*					
date	*date*			*23-févr*						*24-févr*						*25-févr*						*26-févr*						*27-févr*						*28-févr*					
n° truie		**rang**	**sevrage**	**0**	**4**	**8**	**12**	**16**	**20**	**0**	**4**	**8**	**12**	**16**	**20**	**0**	**4**	**8**	**12**	**16**	**20**	**0**	**4**	**8**	**12**	**16**	**20**	**0**	**4**	**8**	**12**	**16**	**20**	**0**	**4**	**8**	**12**	**16**	**20**
158	chaleurs + IA	0				IA						IA						IA						IA						IA									
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2188	chaleurs + IA	2										IA						IA						IA															
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	PSg					-														-											+								
	interprétation																																						
	couverture IA																																						
35	chaleurs + IA	4										IA						IA						IA															
	PSg					-												-													++								
	interprétation																																						
	couverture IA																																						

- **Poor oestrus detection confirmed**
- **AI on anestrus sows = Risk of VDS !**

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Case : Specific « Basque » AI protocole
(Labroue et al 2000)

- **70 % Fertility, <40% with frozen semen !**
- **Ovulation : P4 modeling during oestrus (10-12points)**

12 sows	Mean	Min-Max
Oestrus duration	64 h	48-94
Oestrus to ovulation	53 h	39-63

84 % Oestrus

- **AI at 12-24-36 h non suitable to late ovulation.**
- **New protocole : AI at 32-48h or 24-48h**

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Case : Treatments of anestrus
(Chung et al 2002)

- **Three P4 determinations (0-7-14 d) : treatment according to status (empty sows)**

Progesterone	Status	n	Treat.	Estrus	% FR
In estrus during sampling		15	None	100 %	80 %
Fluctuate < 2.5	Cyclic	10	PG600 hCG	80 %	62 %
Low <2.5	Immature	7	PG600	71 %	80 %
High > 5	CL	6	PGF2	67 %	75 %
Others	Cysts ?	0	Culling		

Echography or progesterone ?

Problem	Echography	Progesterone
Pregnancy check	++	+-
Cysts and abnormalities	++	--
Puberty	++	++
Silent heat	--	++
Poor estrus detection Lactational oestrus	--	++
Optimization of AI protocole	+-	++
Post-weaning anestrus	-+	++

They are complementary ….

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Other practical points

Echography vs Blood sampling

- ☺ Less invasive than blood sampling
- 😐 High cost of high quality machines
- 😐 Training
- 😐 Biosecurity ?
- 😐 Animal restraint ?

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Thank you for your attention.

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