Faculty of Agricultural and Nutritional Science

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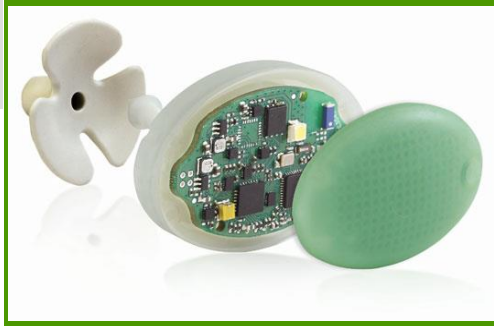
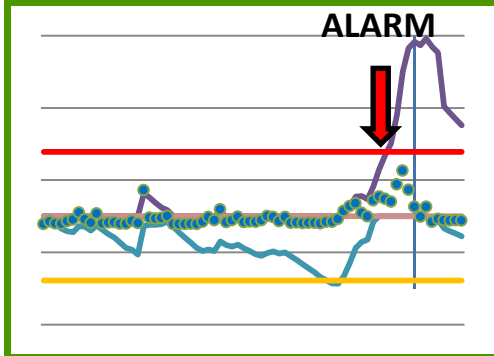
Institute of Animal Breeding and Husbandry

Using acceleration data to detect automatically the beginning of farrowing in sows





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Introduction

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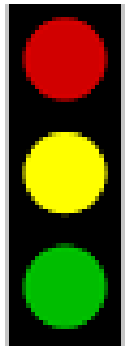
- Increasing herd sizes require management tools to support farmers and stockpersons
- Early warning system allow targeted animal observation and control
- Development of acceleration sensors to monitor the activity of sows
- Increasing activity of sows before farrowing, e.g. nest building behaviour



Prediction of the beginning of farrowing using acceleration measurements

Material and Methods

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Data

- 30 sows in 3 batches
- 12/2013 – 03/2014

- Sows equipped with an ear tag to measure acceleration (1Hz)

- Video recordings as reference to determine beginning of farrowing (Birth of the first piglet)

Material and Methods

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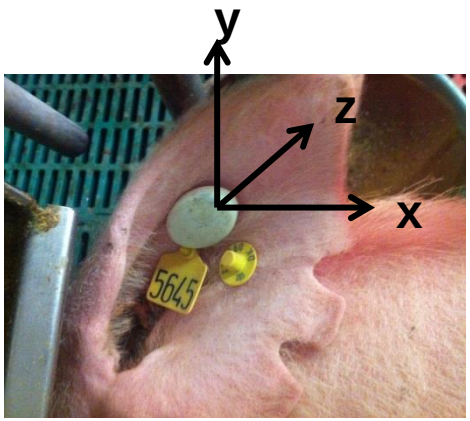
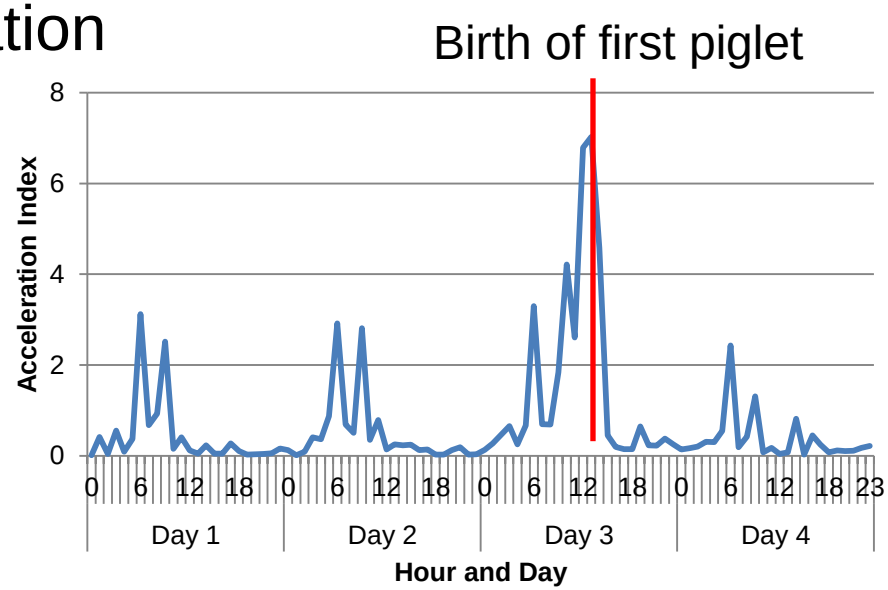
Trait



- Activity Index (Acc) based on acceleration measurement in x, y and z dimension

$$Acc = \sqrt{x^2 + y^2 + z^2}$$

- Standardization of Acceleration index with sow individual average



Material and Methods

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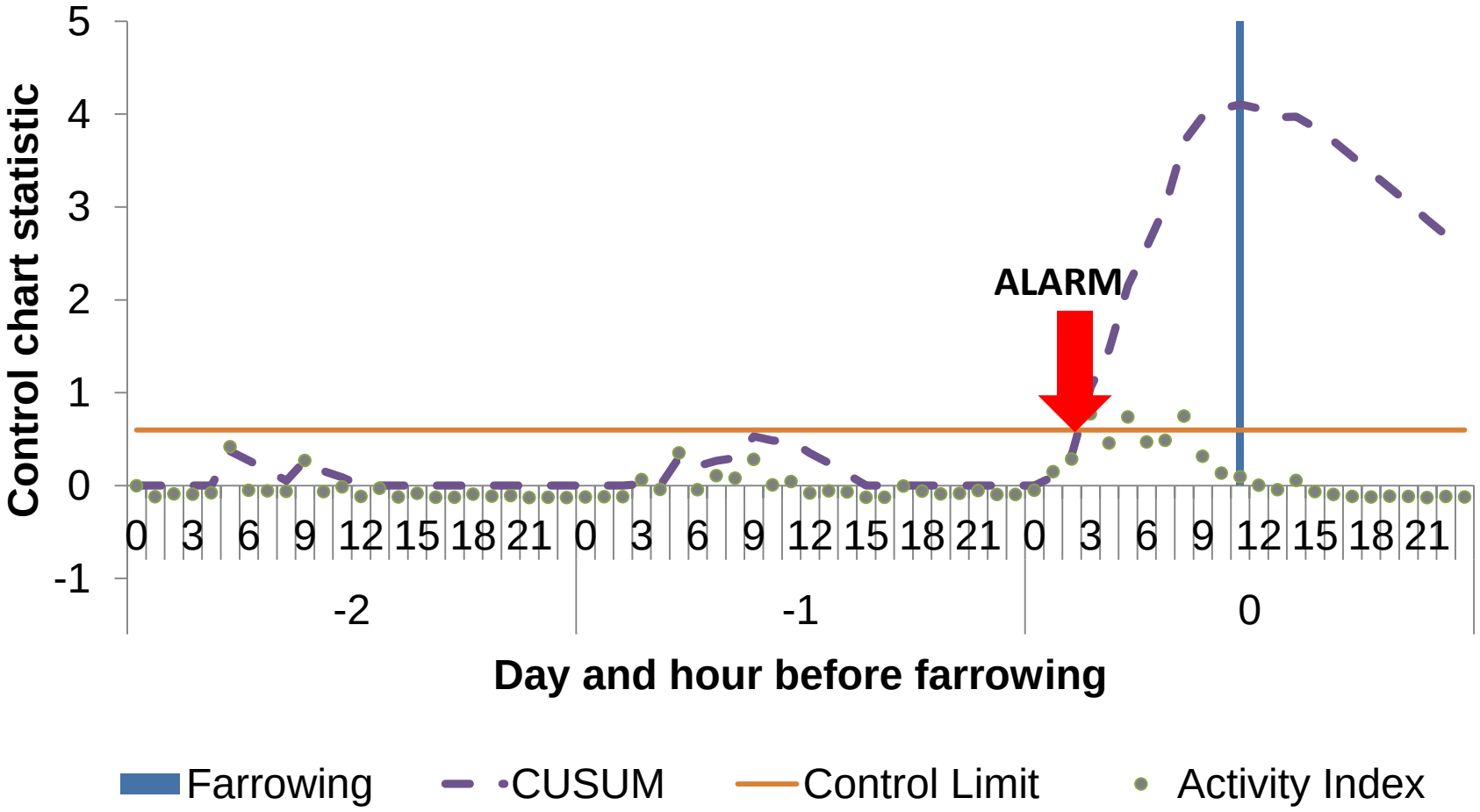
Method

- Cumulative sum (CUSUM) Control Chart



Material and Methods

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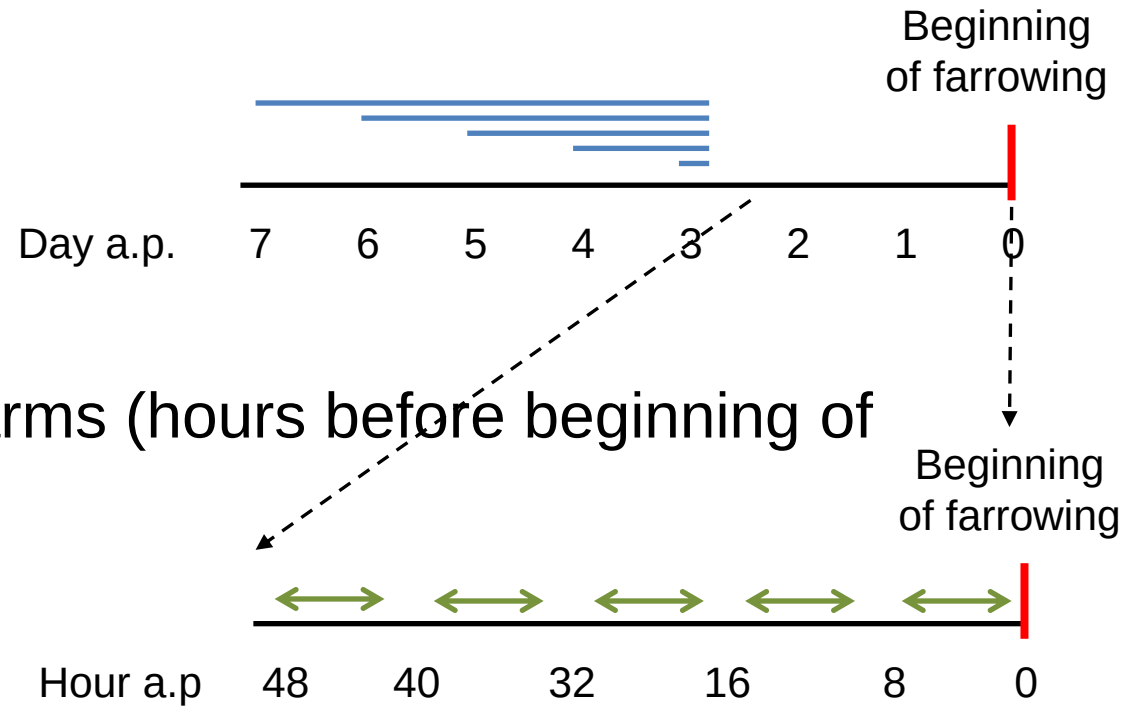
Method

- Cumulative sum (CUSUM) Control Chart

- Sow individual initialization parameters based on average of day(s) ante partum (a.p.)
  - Day 3 a.p.
  - Days 3-4 a.p.
  - Days 3-5 a.p.
  - Days 3-6 a.p.
  - Days 3-7 a.p.

- Time windows of alarms (hours before beginning of farrowing)
  - 1-8
  - 9-16
  - … 41-48



Results

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Number of alarms per time window depending on initialization period

Time window (hours before beginning of farrowing)	**Time period before farrowing used to initiate CUSUM Chart**				
	Day 3	**Days 3-4**	**Days 3-5**	**Days 3-6**	**Days 3-7**
1-8	8	9	8	8	8
9-16	10	11	11	10	10
16-24	2	3	3	3	3
25-32	-	1	2	2	2
33-40	1	1	1	1	1
41-48	2	1	3	3	3

Results

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Number of alarms per time window depending on initialization period and CUSUM calibration parameter

Time window (hours before beginning of farrowing)	**Time period before farrowing used to initiate CUSUM Chart**			
	Day 3	**Days 3-7**	**Day 3**	**Days 3-7**
	Average limits (H=10)		**Stricter limits (H=13)**	
1-8	8	8	9	9
9-16	10	10	10	11
16-24	2	3	4	4
25-32	-	2	-	-
33-40	1	1	-	-
41-48	2	3	1	1

Results

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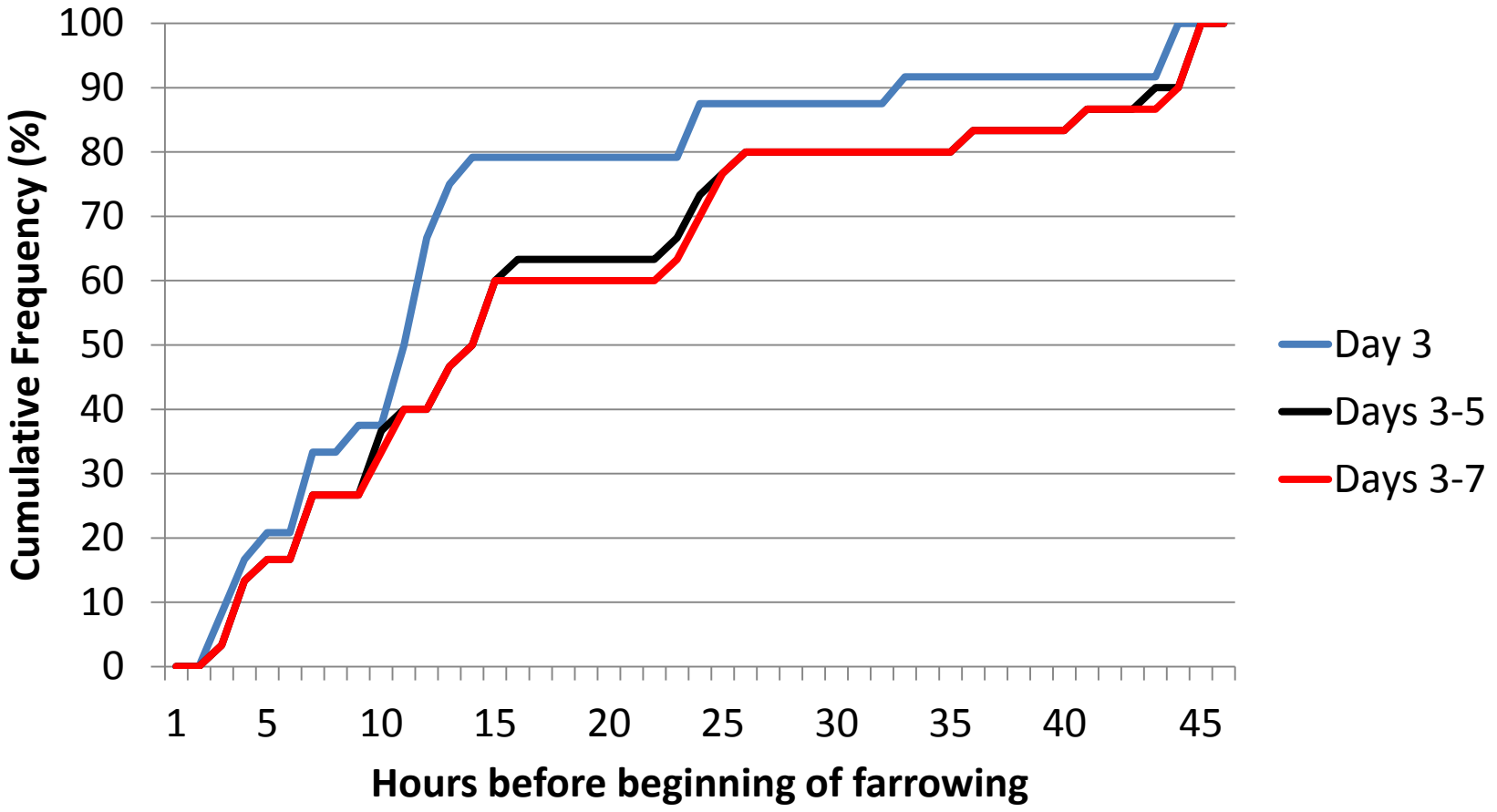
Cumulative Frequency of alarms depending on hour before beginning of farrowing and initialization period



Results

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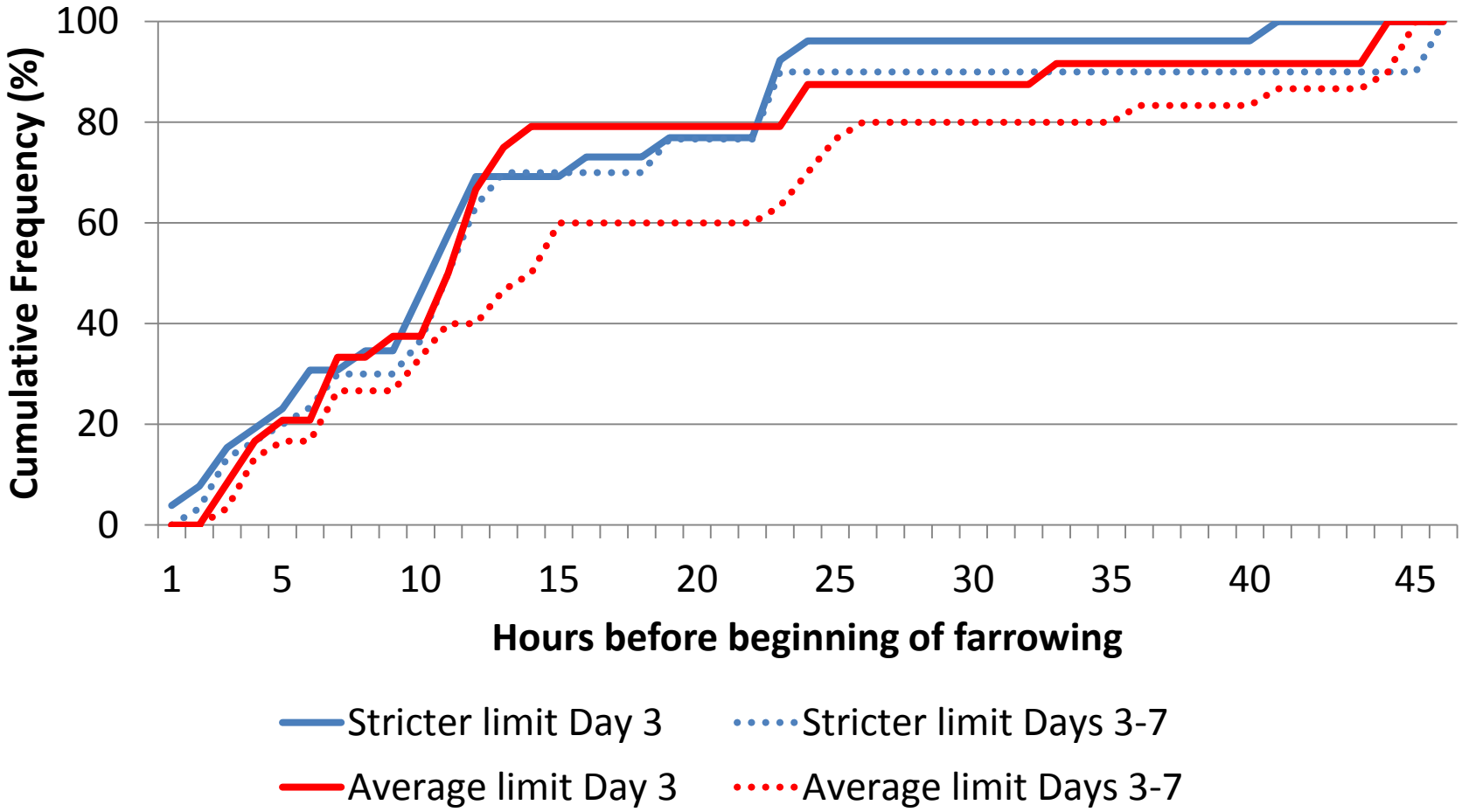
Cumulative Frequency of alarms depending on hour before beginning of farrowing and initialization period



Conclusion

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- Higher activity of sows before beginning of farrowing can be monitored using acceleration sensors as ear tags
- Some sows show no higher activity (4 of 27) before farrowing → not detectable
- Good results in early detection of the beginning of farrowing (about 75 % within 16 hours before beginning of farrowing)
  - Consider sow individual activity level
  - Initialization period of day 3 before farrowing is sufficient
  - Strict control limits should be preferred

Thank you for your attention!