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Assessing the drinking behaviour of individual pigs using RFID registrations

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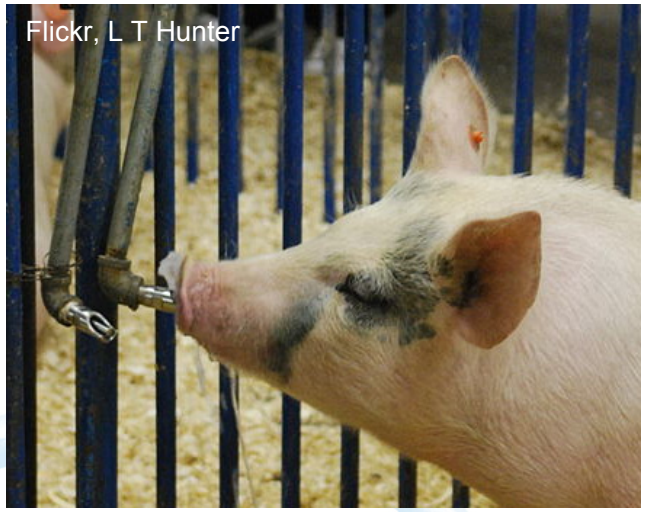
Why measure drinking behaviour?

Automatically monitor drinking behaviour



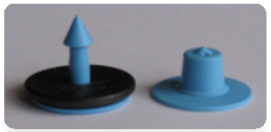
Reveal health, welfare, productivity problems
e.g. diarrhea (Madsen & Kristensen, 2005)

→ fast farmer intervention
→ ↘ economic losses
→ ↘ antibiotics use
→ happier, healthier pigs
→ sustainable agriculture

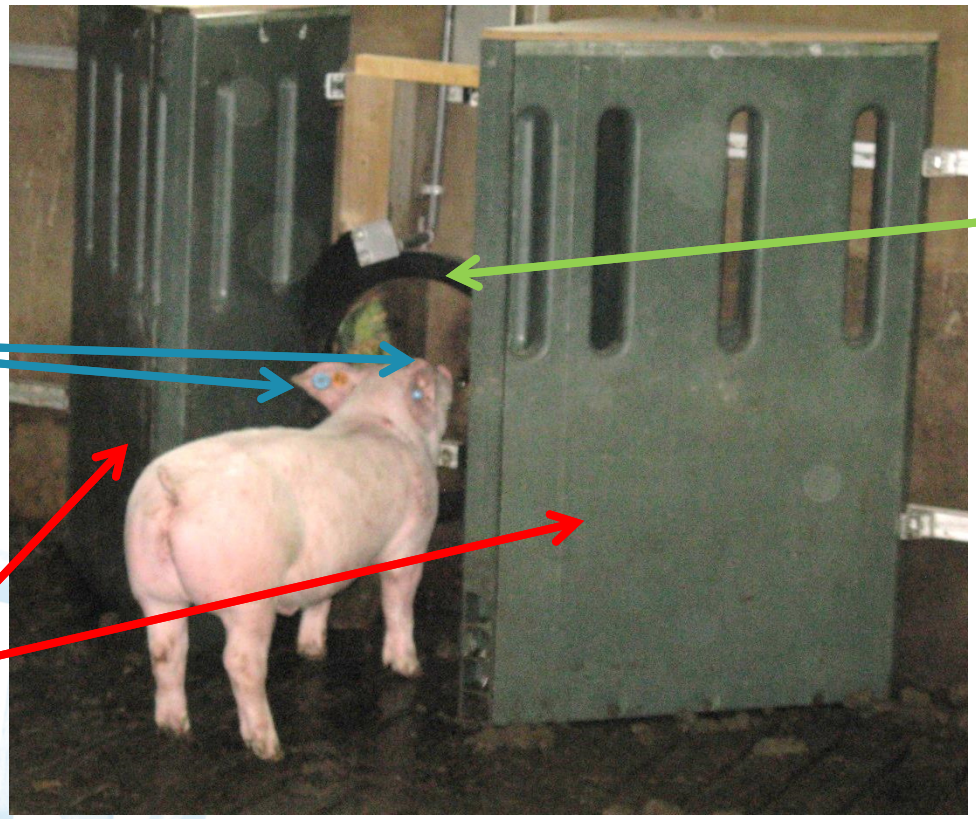
➡ Precision Livestock Farming on individual level!

➡ Aim to more accurate, early detection of problems

How to measure drinking behaviour?



HF RFID ear tags



HF RFID antenna around the nipple

Block other pigs from being in range of the antenna

→ Identification of ear tag of pig when close to the antenna & nipple
(Maselyne et al, 2014)

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Validation of new sensor system

Validate RFID system using live observations:

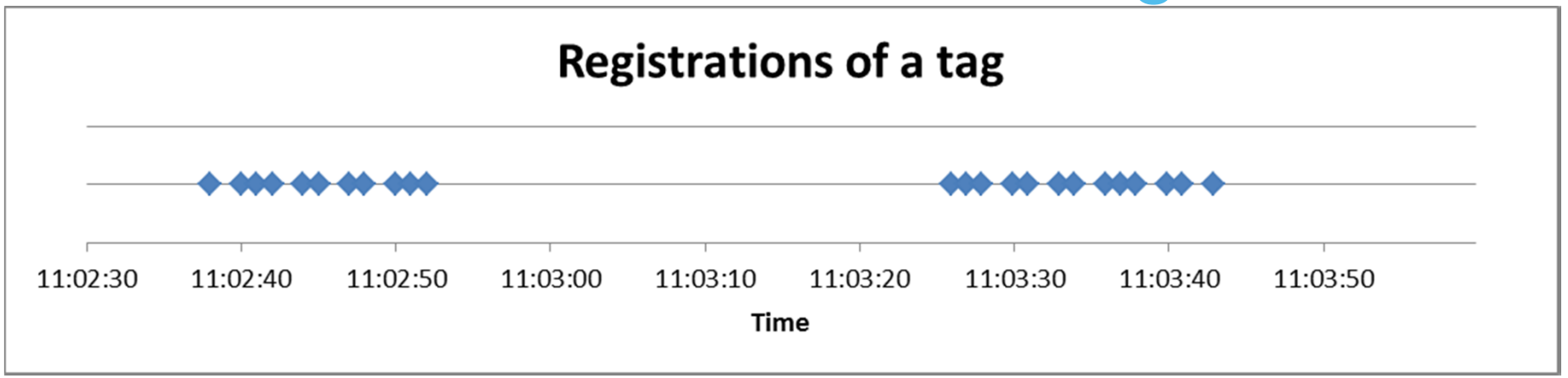
- 55 focal pigs, age 20-21 weeks
- 4 nipples, 6 hours observed
- 1st & 3rd of October 2013
- nipple 1&2 in the morning, nipple 3&4 in the afternoon

+

Validate RFID system using flow meters per nipple

- 1st of October 2013

Construct RFID based drinking bouts



Registrations need to be clustered

- Bout criterion: max gap between registrations to be part of the same drinking bout → 11s
- Minimum duration of a drinking bout → 2s
- Maximum duration of a drinking bout → 180s

Results bout criteria

These criteria gave minimal difference between number and duration of observed and RFID based bouts (from the criteria tested):

	Observed	RFID based	Deviation
Number of bouts	401	443	+10%
Total duration of drinking	177.6 min	211.7 min	+19%

Overlap comparison

Number of drinking bouts per observation time					
Comparison	# overlap	# obs surplus	# RFID surplus	# flow surplus	% overlap
Obs – RFID	390	11	65	X	97.3%
Obs – flow	188	13	X	23	93.5%
RFID – flow	307	X	40	4	98.7%

Duration (min) of drinking bouts per observation time					
Comparison	Duration overlap	Duration obs surplus	Duration RFID surplus	Duration flow surplus	% overlap
Obs – RFID	174.1	3.5	21.1	X	98.0%
Obs – flow	89.8	1.9	X	2.5	97.9%
RFID – flow	71.7	X	14.1	0.7	99.1%

Overlap comparison

Number of drinking bouts per observation time					
Comparison	# overlap	# obs surplus	# RFID surplus	# flow surplus	% overlap
Obs – RFID	390	11	65	X	97.3%
Obs – flow	188	13	X	23	93.5%
RFID – flow	307	X	40	4	98.7%

Surplus RFID based bouts: due to pigs lying, sitting or standing near the nipples without drinking.

Surplus RFID compared to observed and to flowmeter are mostly the same bouts → flowmeter-data can improve RFID based bouts.

Overlap comparison

Number of drinking bouts per observation time					
Comparison	# overlap	# obs surplus	# RFID surplus	# flow surplus	% overlap
Obs – RFID	390	11	65	X	97.3%
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RFID – flow	307	X	40	4	98.7%

Bouts missed by the RFID system: due to transponders orientation not favorable for detection during that visit.
(Maselyne et al, 2013b)

Overlap comparison

Number of drinking bouts per observation time					
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Obs – RFID	390	11	65	X	97.3%
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RFID – flow	307	X	40	4	98.7%

Overlap between observation and flowmeter is not 100%: due to lack of synchronization, observation errors and suckling instead of drinking

Regressions

Estimate water volume consumed (proven indicator for problem detection)?

Variables tested for linear regression with volume of water consumed	R^2
Total duration of RFID based bouts	0.87
Number of RFID based bouts	0.49
Mean duration of RFID based bouts	0.29
Total duration of flow based bouts	0.98

- Total duration of RFID bouts could be good indicator.
- Using also flow meters water volume can be measured directly.

Discussion & conclusion

- Overlap between RFID based drinking bouts & observed was high, but overestimation of number & duration

→ proposed RFID system could be sufficient

→ total duration of RFID bouts could be useful variable

- Adding flowmeter data could improve the system

→ increases complexity & cost

→ water-volume consumed is known

➢ Both RFID system alone & two-sensor system will be investigated further

Discussion & conclusion

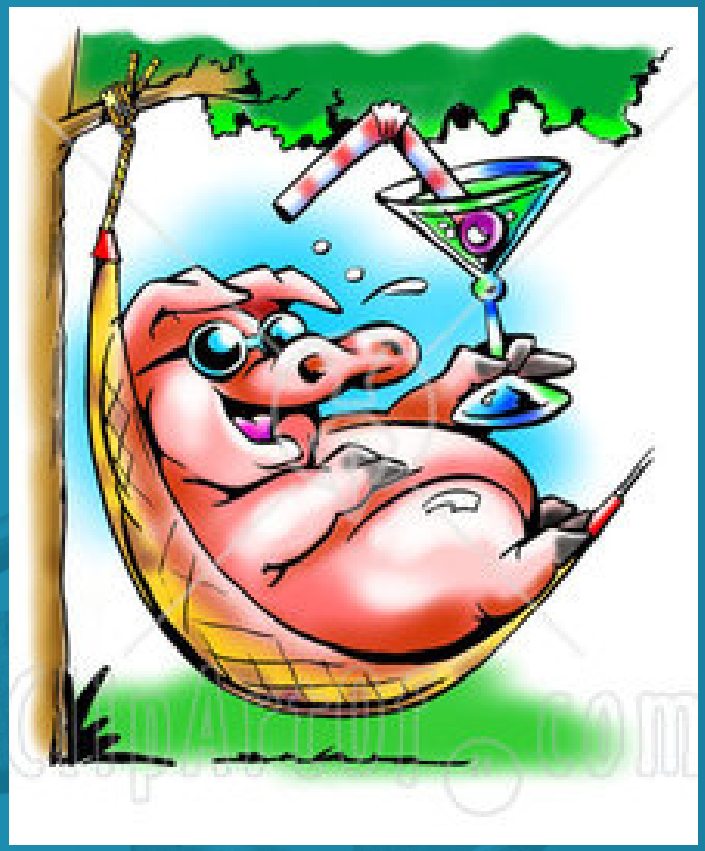
- Criteria were necessary to turn registrations into bouts

→ max duration criterion was important for reduction of non-drinking RFID registrations

→ effect of age, production system, group size on optimal criteria is not known

- For health monitoring: construction of time series of individual pigs drinking behaviour becomes possible

→ changes in this behaviour can indicate problems



Thank you for your attention!

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