



JTI – Swedish Institute of Agricultural
and Environmental Engineering



Manure production and handling techniques on large-scale farms in the Baltic Sea Region

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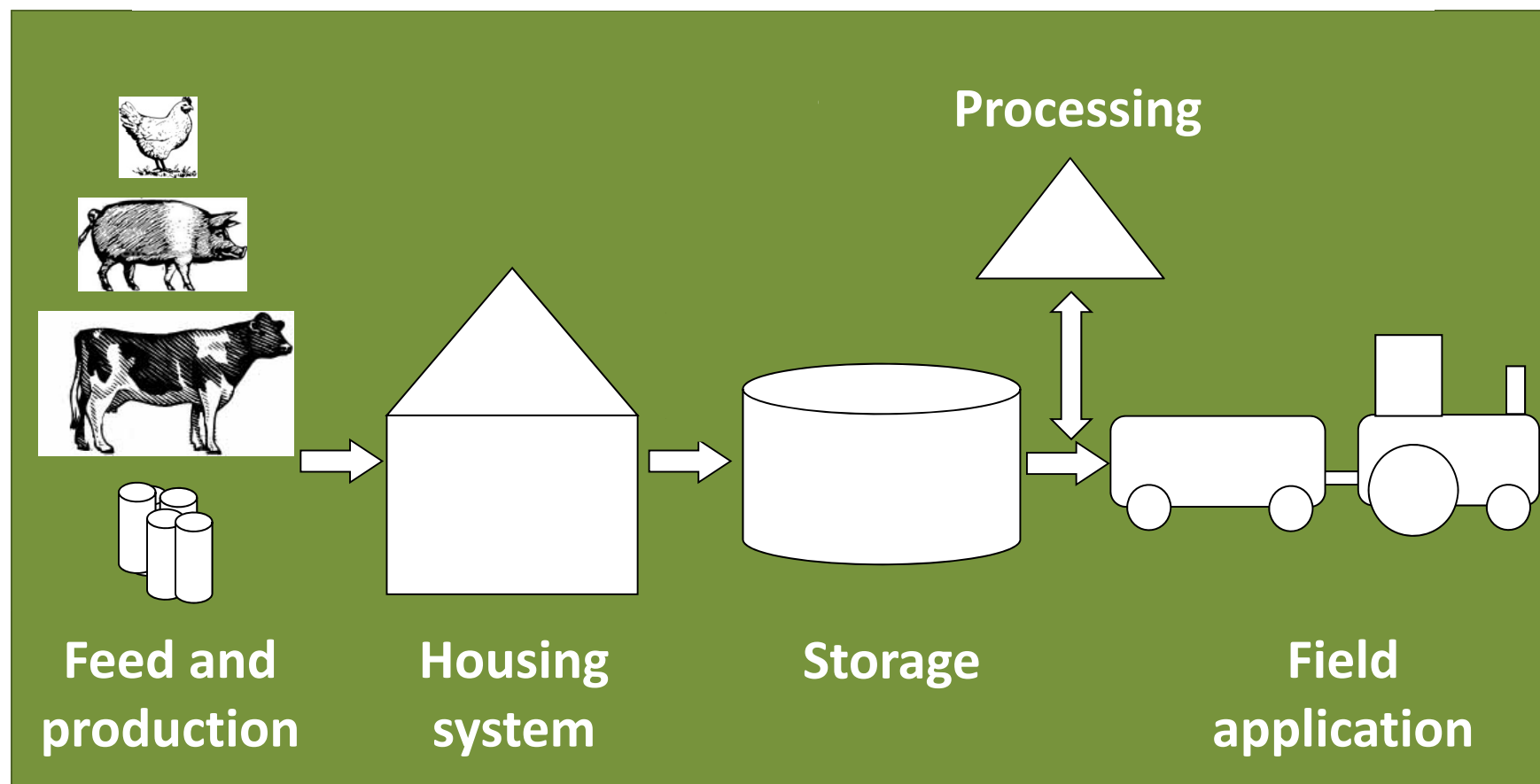
GABBS, 2013

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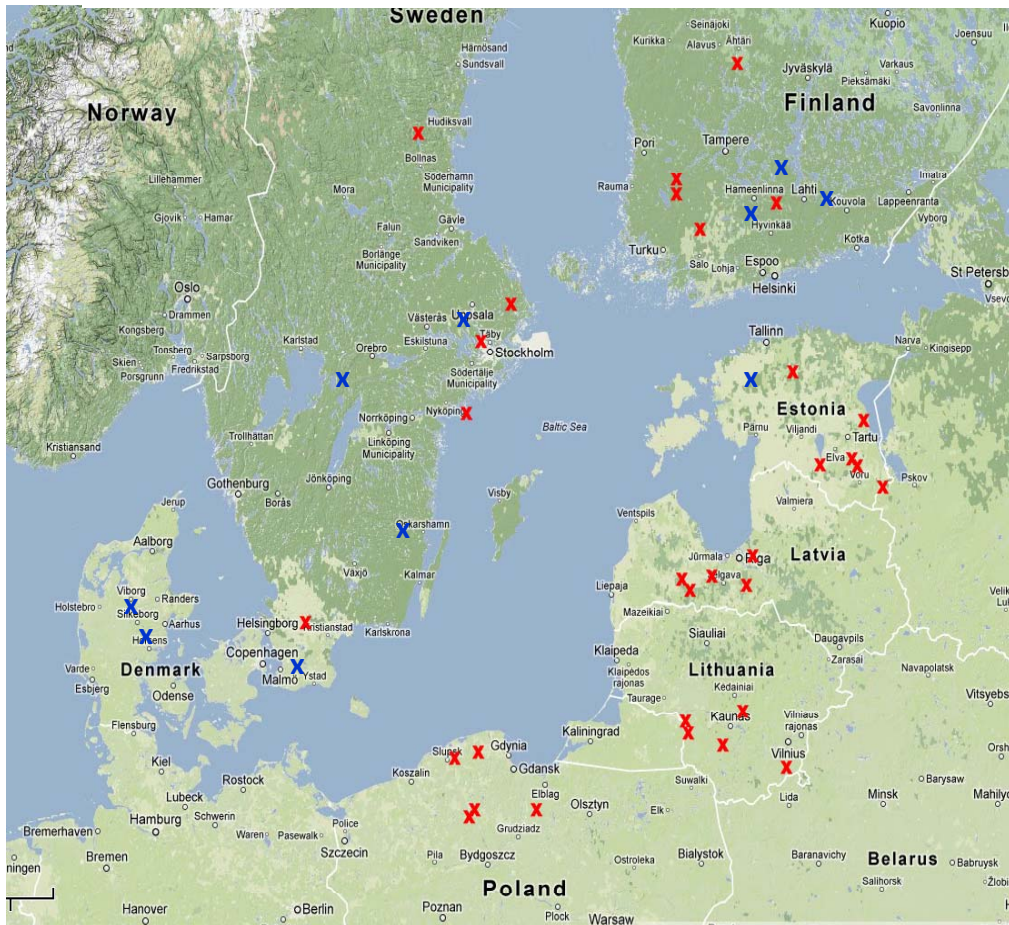
- **Manure handling** - techniques used on case-study farms in BSR
- **Manure processing** - examples of farm implemented technology
- **Management** impacts on manure quality
- **Conclusions & recommendations**



Manure handling chain



Plus farm examples of manure processing



5 farms per country

2 dairy

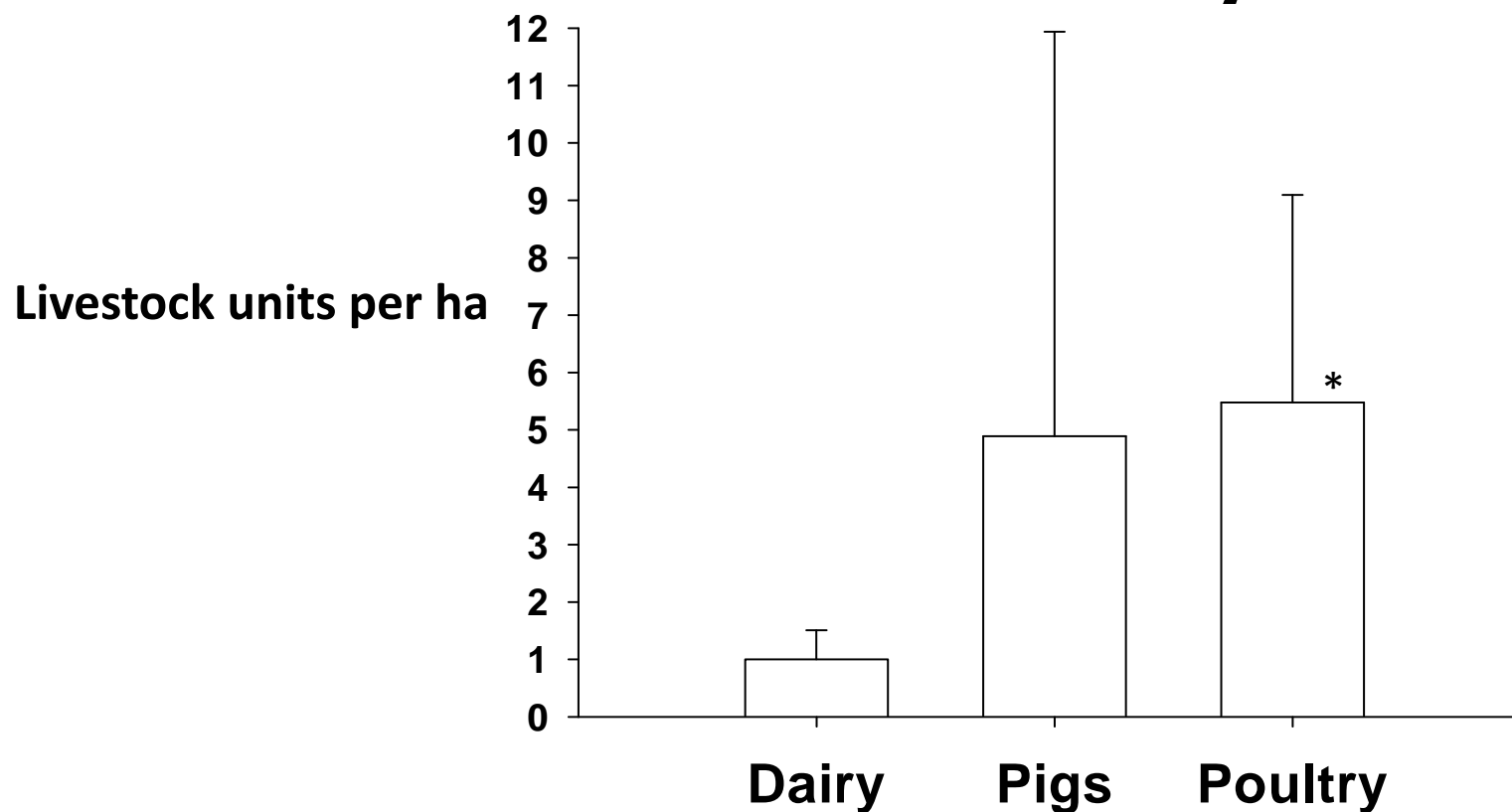
2 pig

1 poultry

X 6 countries

10 extra farms

Livestock density



Dairy n=13, pigs n=12, poultry n=4. Error bars = 1 SD.

*2 poultry farms do not have land for spreading manure so livestock density could not be calculated

Manure handling systems

	Total LU	Solid manure (%)	Slurry (%)
Dairy*	6 736	37.6 60	62.4 40
Pigs	66 169	0.2 80	99.8 20
Poultry	36 769	86.7 100	13.3 0

* Total herd including heifers and calves

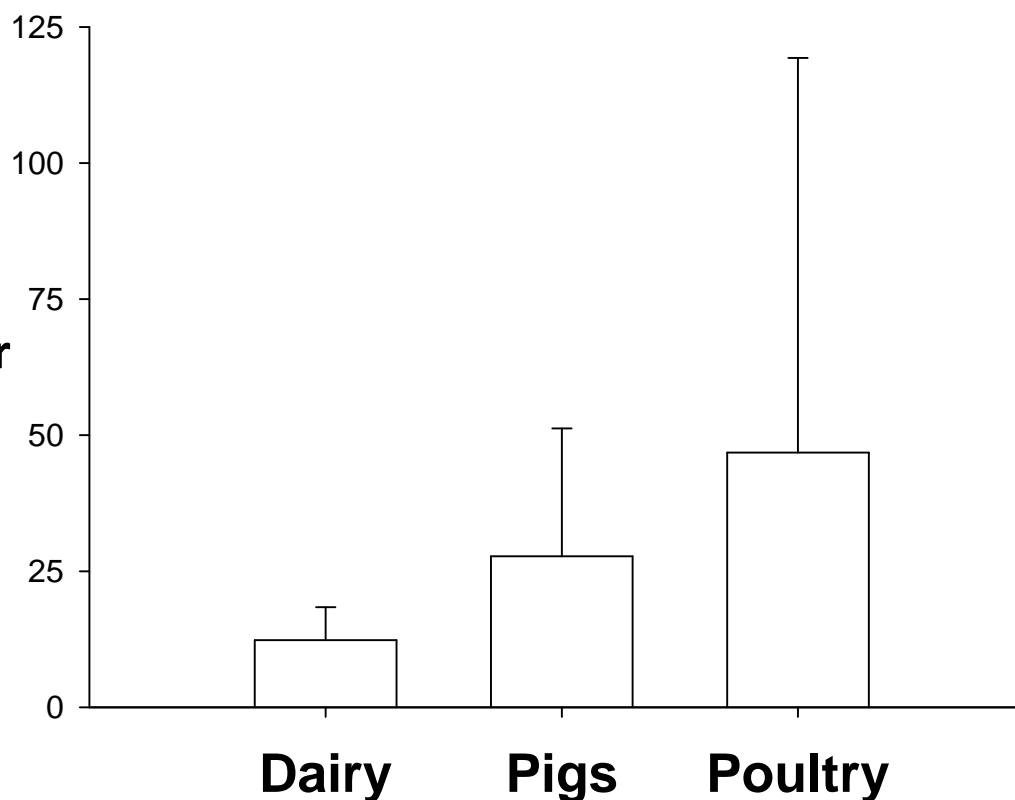
% of total manure amounts in
EE, FI, LT, LV, PL, SE
from Sari Luostarinen (ed.)2013

Mucking out frequency

Livestock type	Daily	1-2 times a week	Every 2-3 weeks	Once per batch
Dairy	11	5	0	0
Pigs	10	1	2	0
Poultry	0	3	0	3
Total	21	9	2	3

Manure production (ex-storage)

Manure,
1000 t per farm and yr



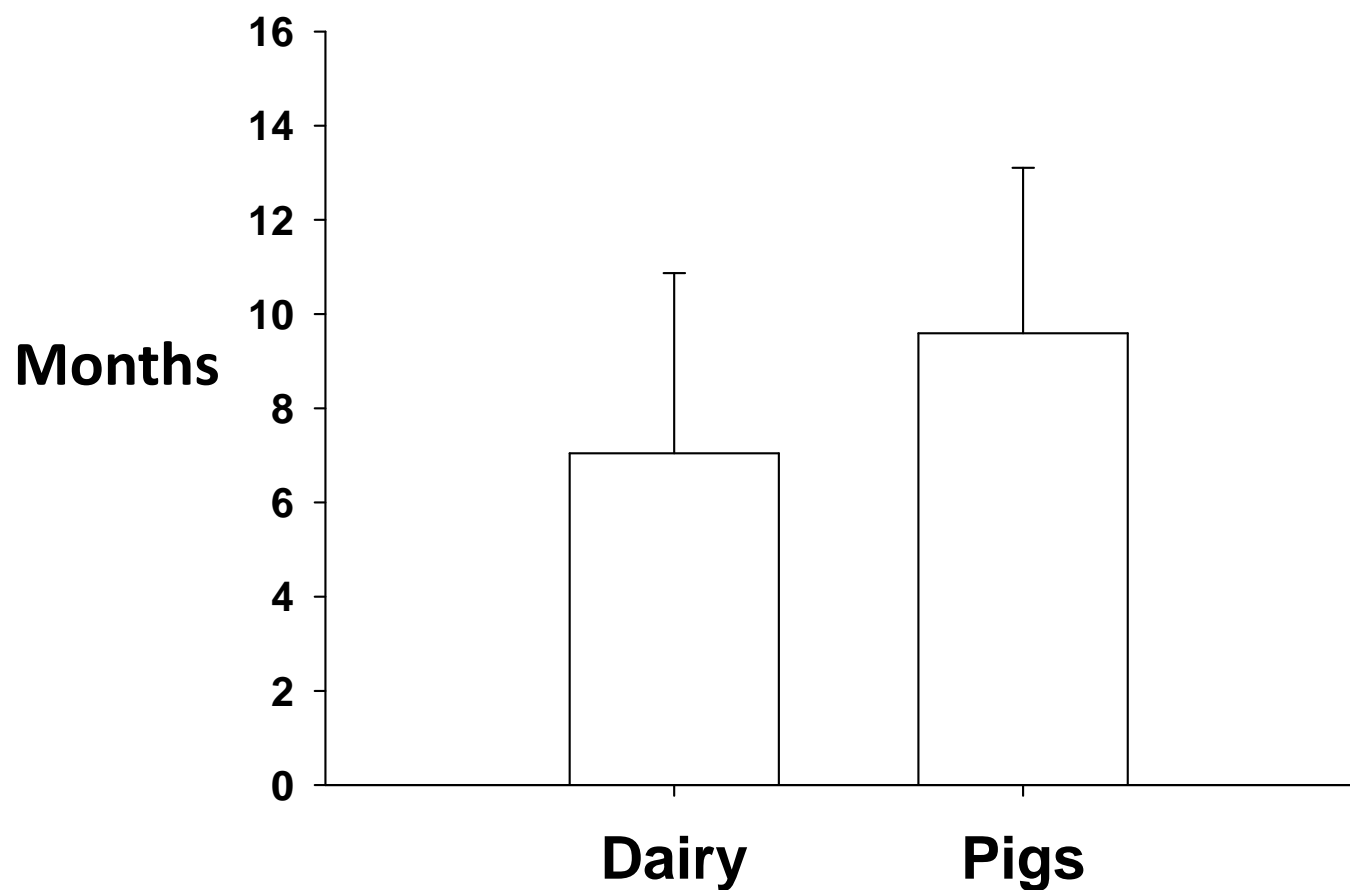
Dairy n=13, pigs n=12, poultry n=6 . Error bars = 1 SD.

Manure processing on 29% of farms

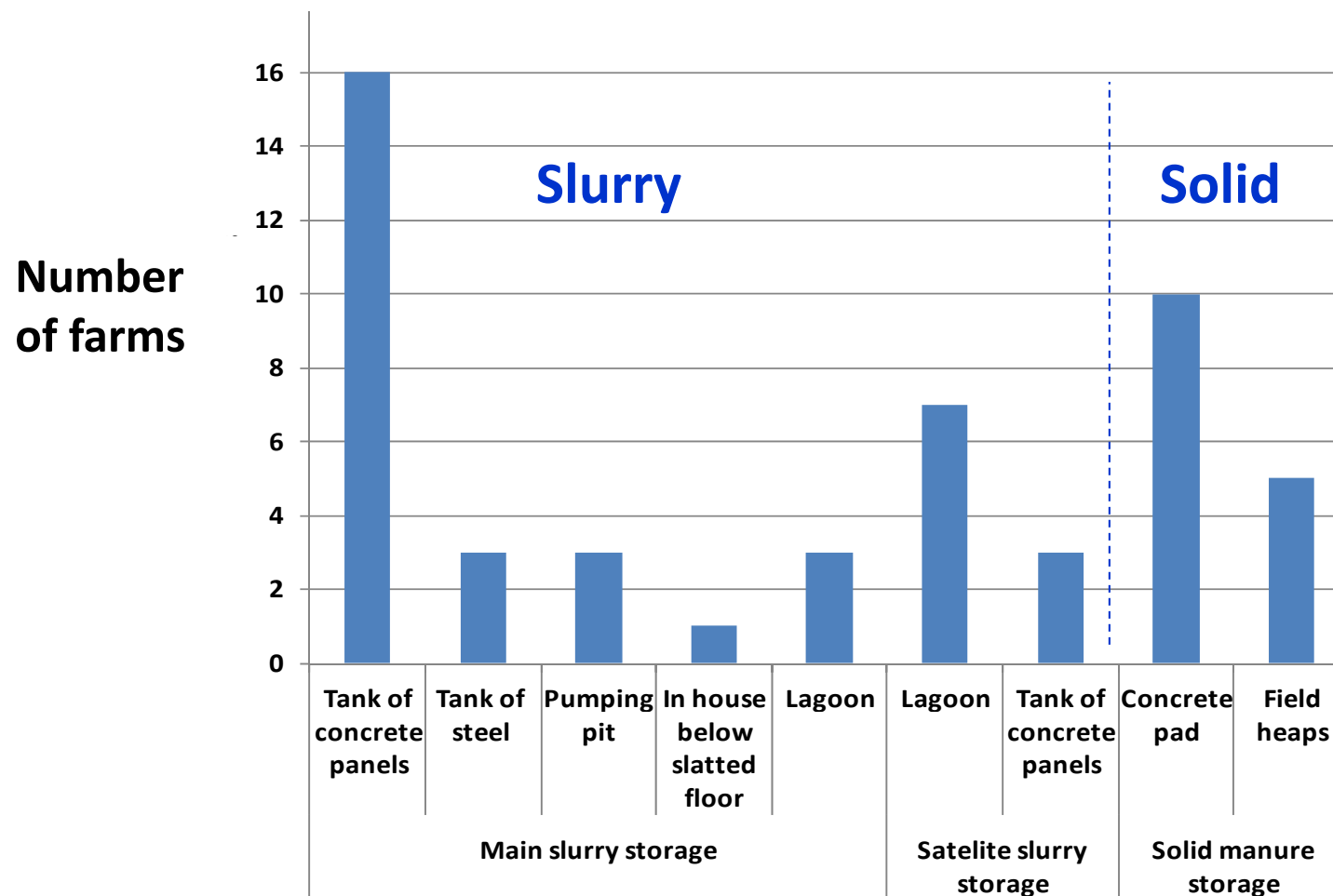
Technology	Number of farms	Livestock type	Countries
Anaerobic digestion	5 + 2*	Dairy, pig (dairy, poultry)	Sweden, Finland, Latvia, Poland
Mechanical separation	2	Dairy, pig	Lithuania, Poland

*(exported manure to biogas plant)

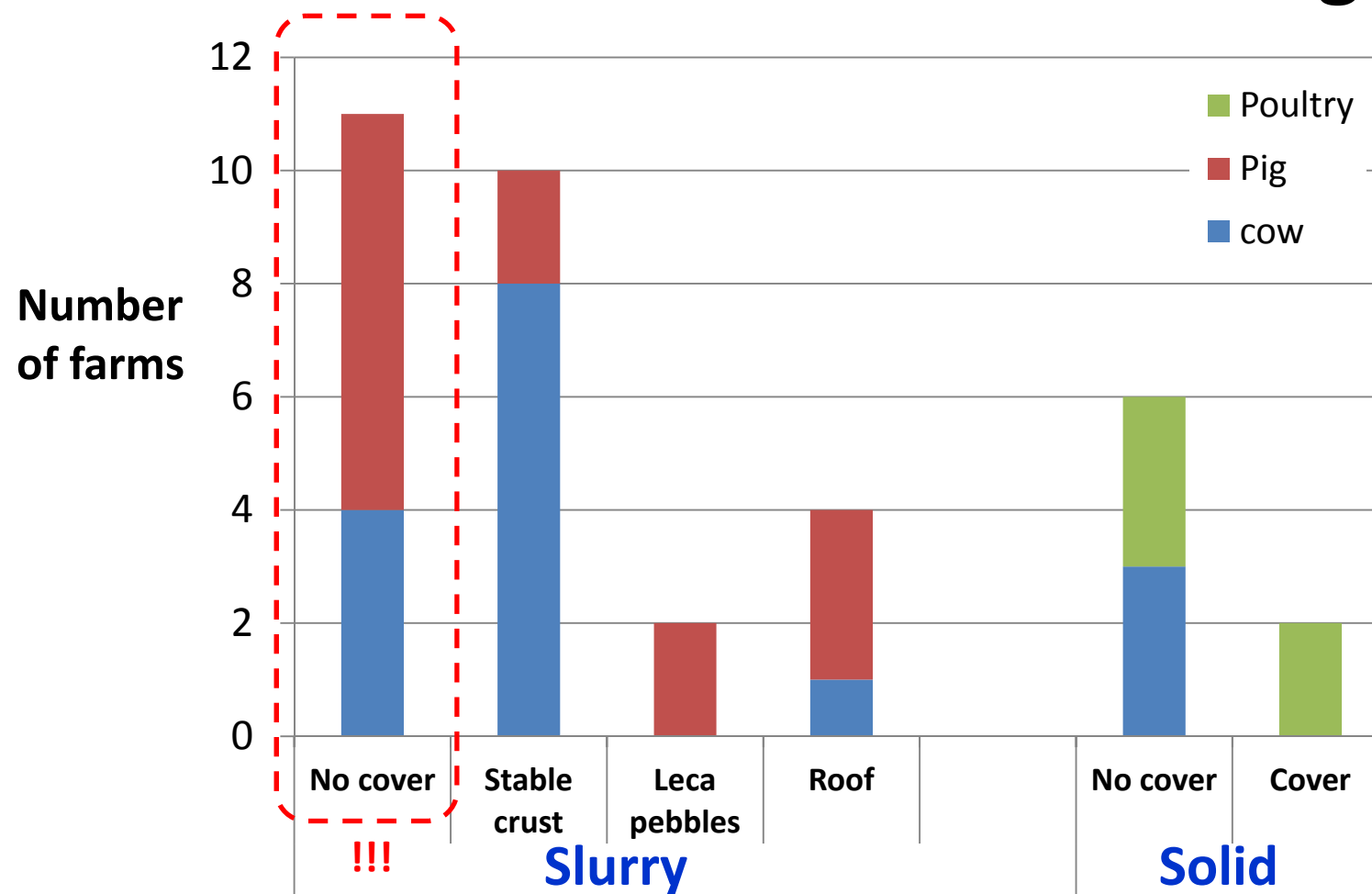
Slurry storage capacity



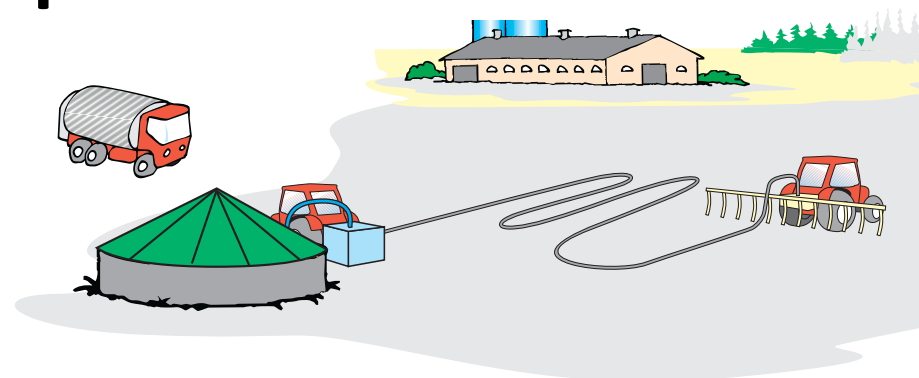
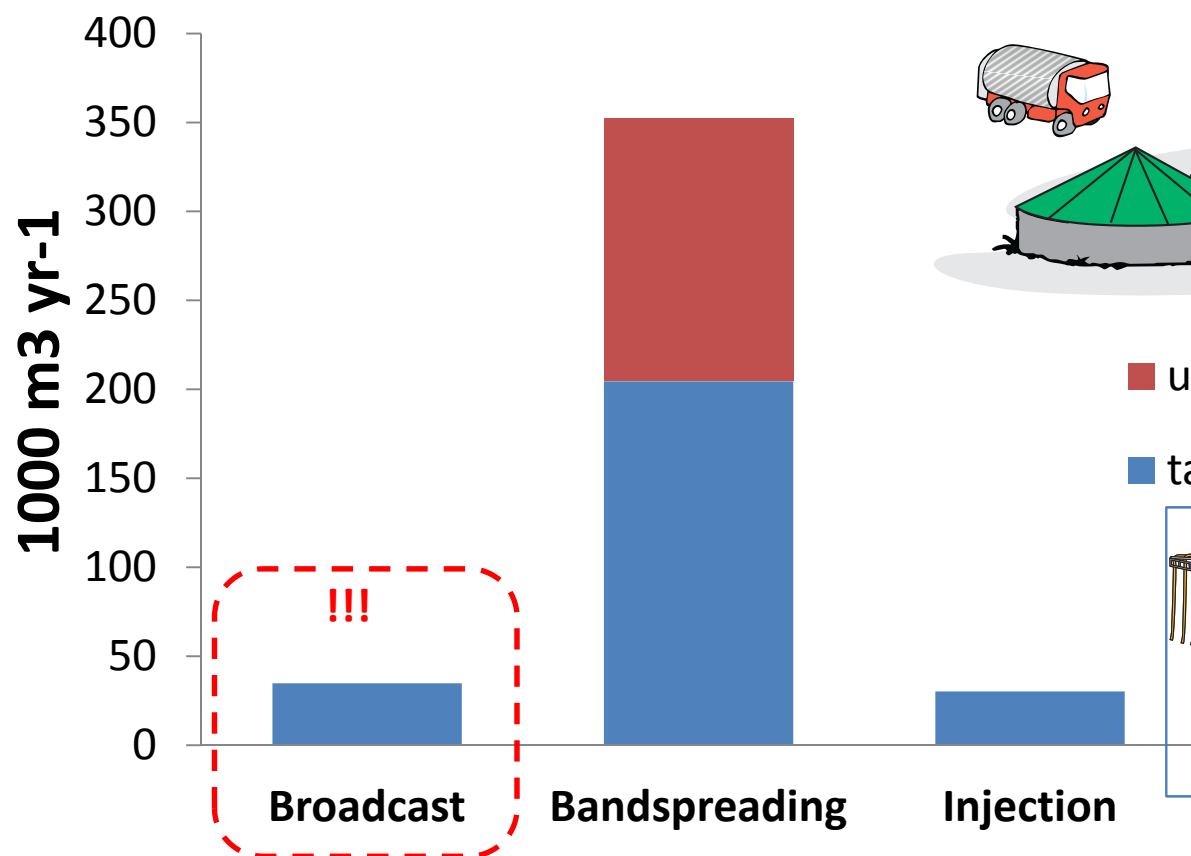
Types of storage for slurry and solid manure



Use of covers on manure storages

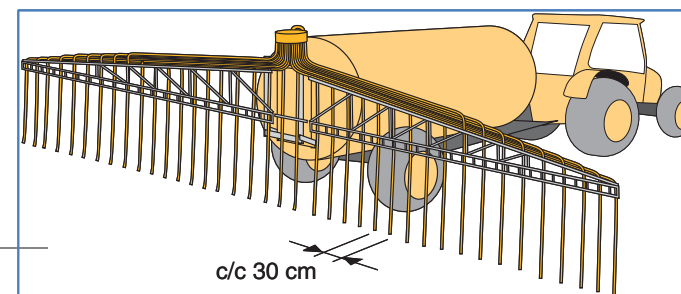


Volume of slurry spread with various techniques



■ umbilical

■ tanker



Application rates on different crops

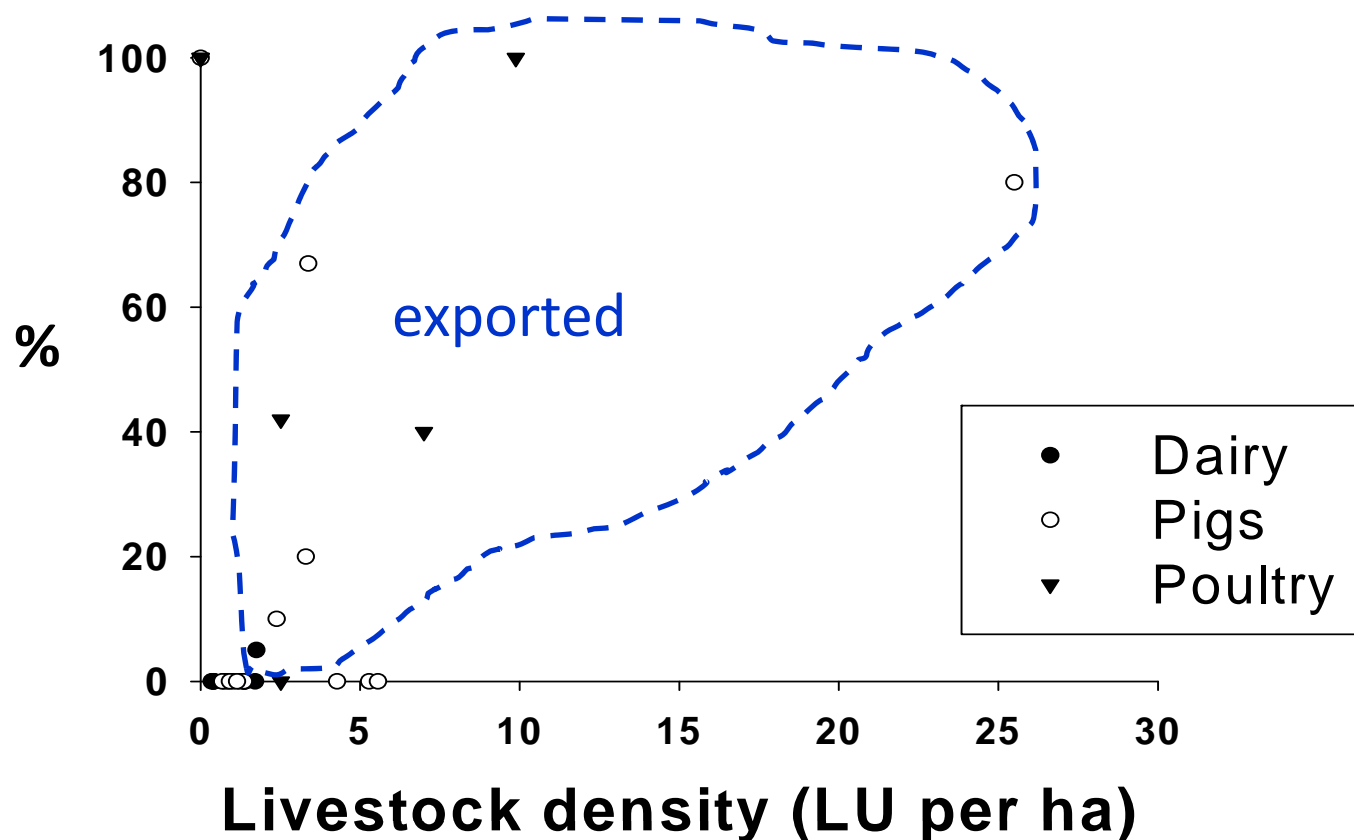
Crop	tonnes/ha													
	2.5*	5*	10*	15	20	25	30	40	50	60	70	80	90	NI
Grassland					XX	XXXX	XXXX	XXX	X			X		XX
Spring cereal	x	x	XX	x	XX	XXXX	XXX	x				XX		XX
Winter cereal	x	x	XX		X		X		XXX			X		
Rapeseed	x				XXX	X						X		
Maize			X		X	X		X	XXX		!!!			
Sugar beet						XX								
Green manure					X									
Peas	x		X											
Crop unknown			X				XXX	XX						
Total	4	2	7	1	11	12	11	7	7			5		4

*poultry manure

Application time

Crop	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Grassland	xxxx	x	xxxx	x	x	xxxxxx			xx
Spring cereal	xxxxxxxx	xxxxxxxx							
Winter cereal	xxxx				xxxx	xxxxxx			
Rapeseed	xxx	x			x	x			
Maize	x	xxx							
Sugar beet		x							
Green manure		x							
Before ploughing							x		
Peas	x	x							
Crops unknown		xxxx	x	x	x	x	xxxx		
Total	21	20	5	2	7	14	5		2

Percentage manure exported off-farm



Bottlenecks for utilizing manure

4 types of barriers

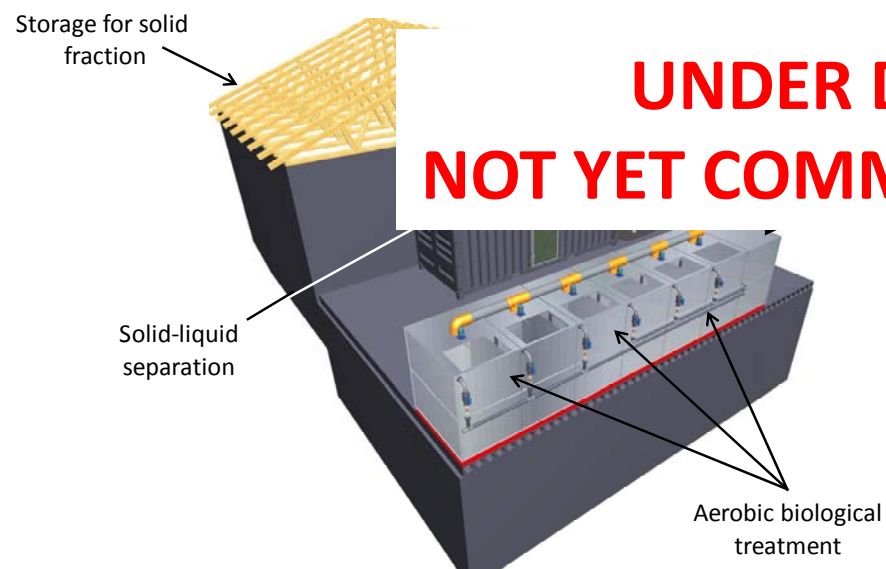
1. Cost / economic factors
2. Technological limitations
3. Lack of knowledge
4. Regulations or lack of support mechanisms for adopting BAT

Manure processing technology – examples used on farms

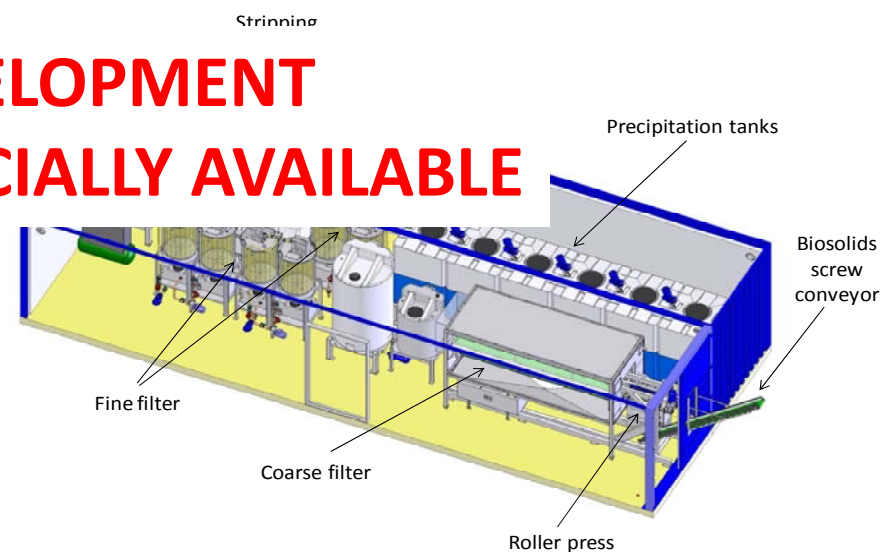
Concentration technologies

Pellon

Biotain



**UNDER DEVELOPMENT
NOT YET COMMERCIALY AVAILABLE**



Manure processing technology – examples used on farms

Mechanical separation



Manure processing technology – examples used on farms

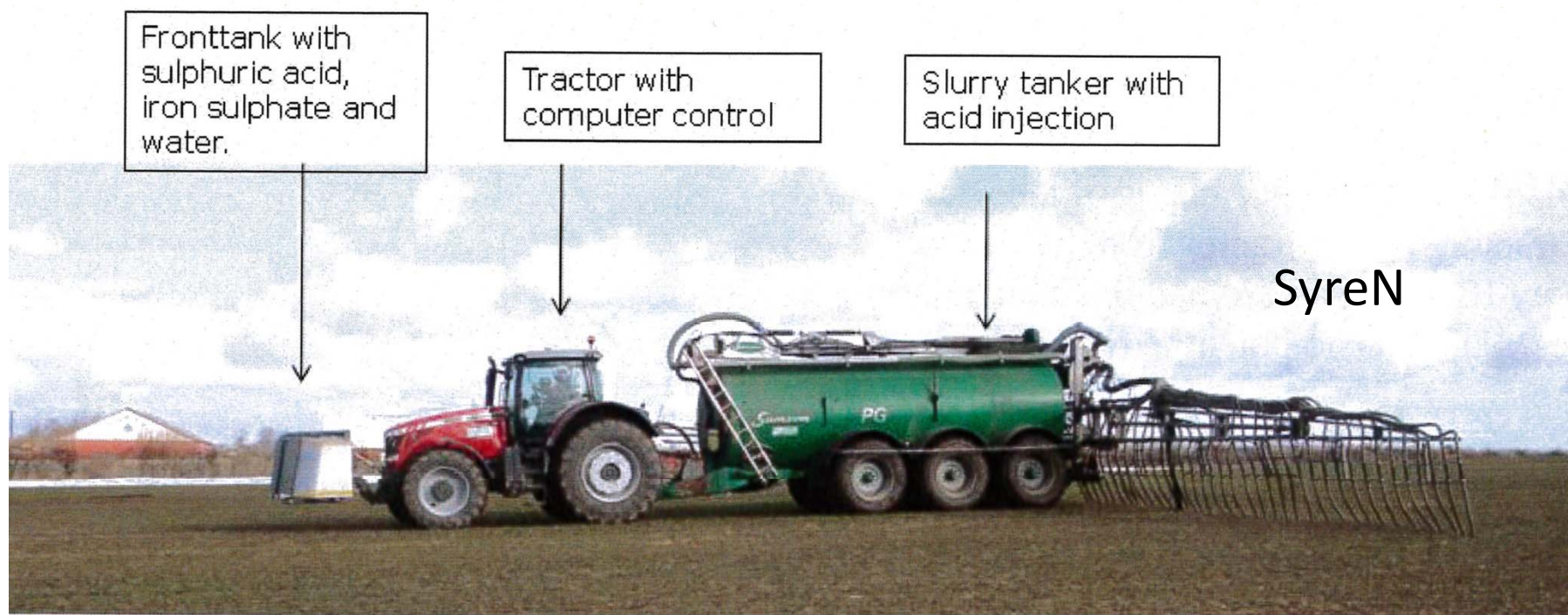
Drum composting



ESCAB

Manure processing technology – examples used on farms

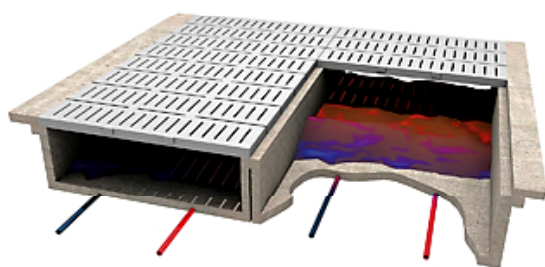
Acidification



Manure processing technology – examples used on farms

Slurry cooling

Pellon

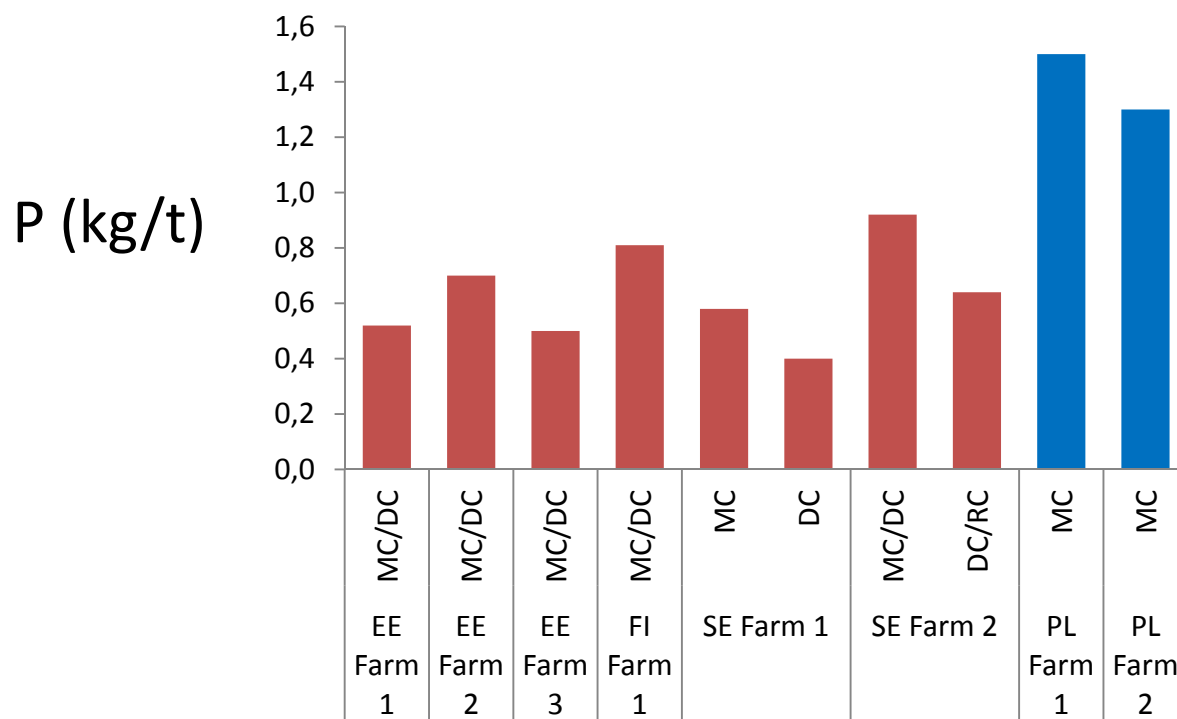


Manure processing technology – examples used on farms

Anaerobic digestion

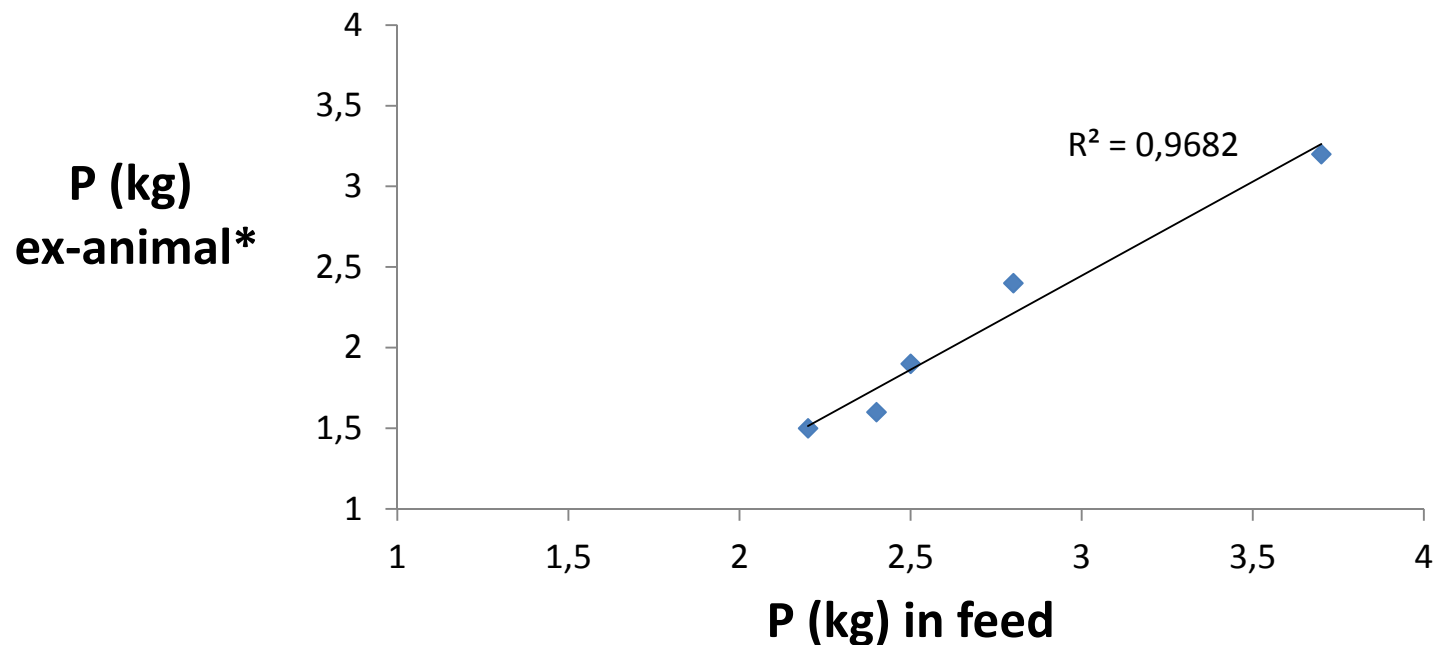


Management factors that impact manure



Management factors that impact manure

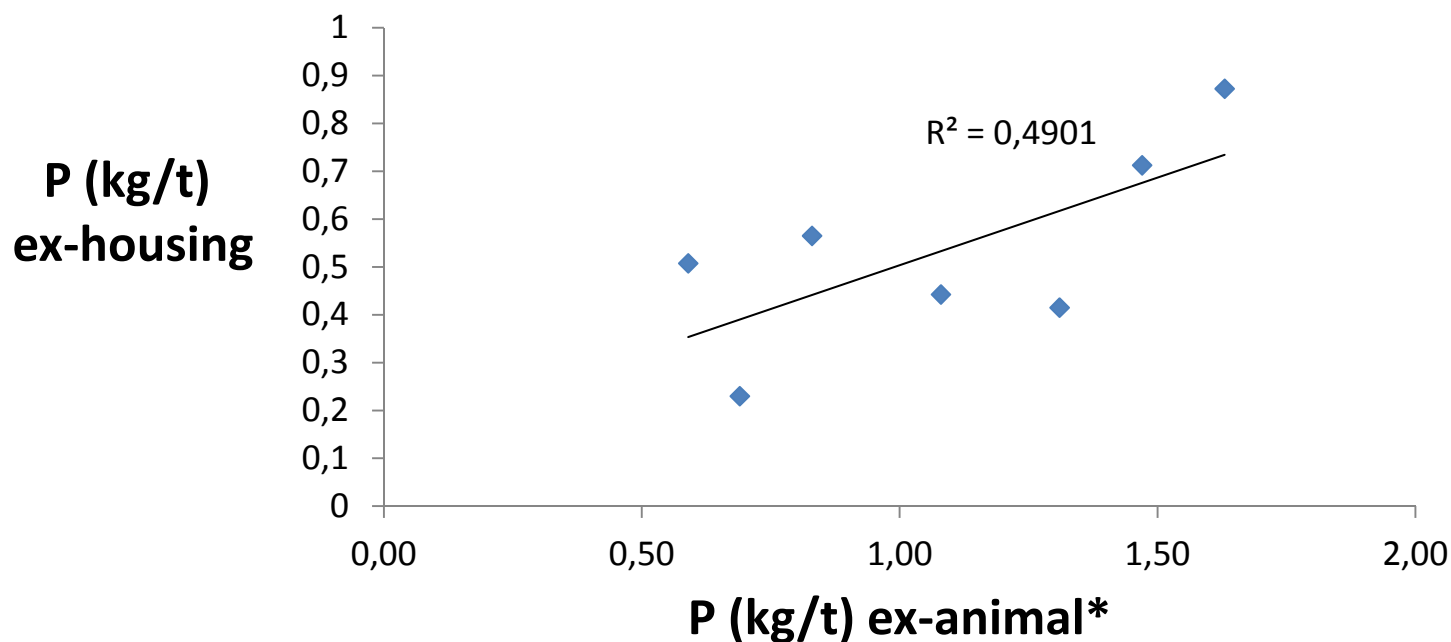
Feeding - feed to ex-animal



*calculated

Management factors that impact manure

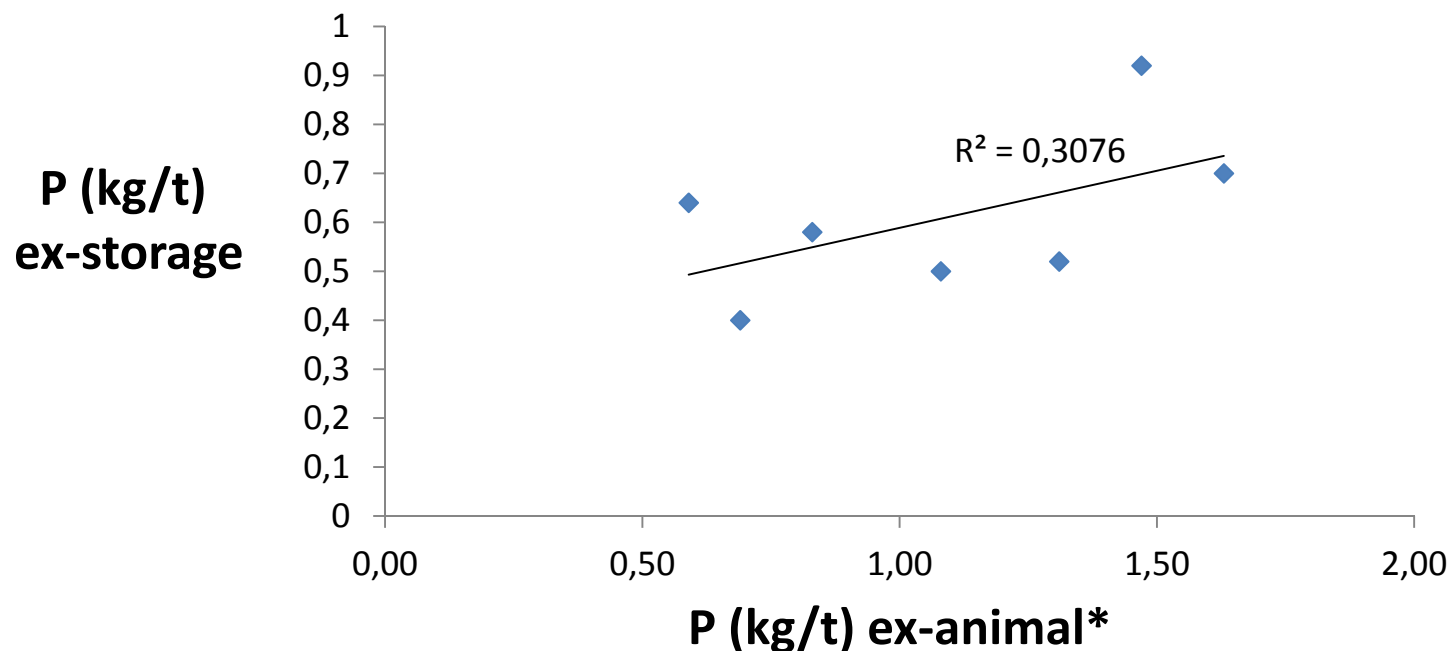
Feeding - ex-animal to ex-housing



*calculated

Management factors that impact manure

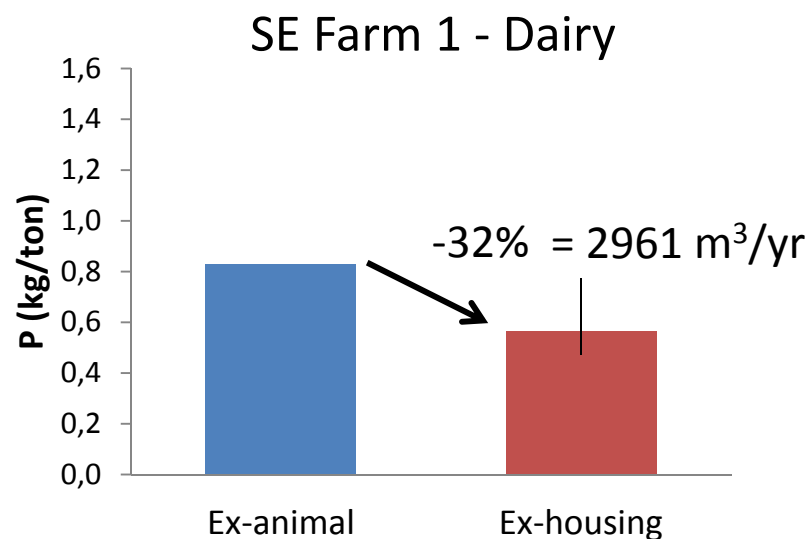
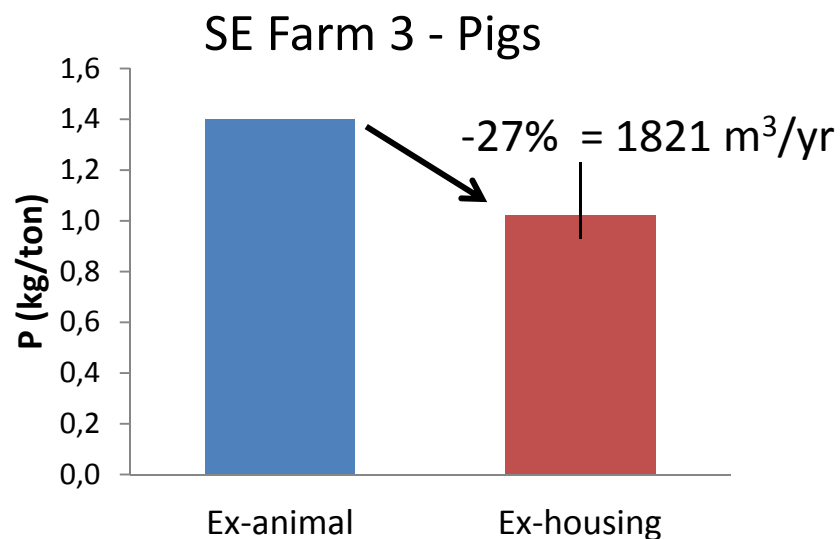
Feeding - ex-animal to ex-storage



*calculated

Management factors that impact manure

Additives – Phosphorus reduction



Management factors that impact manure

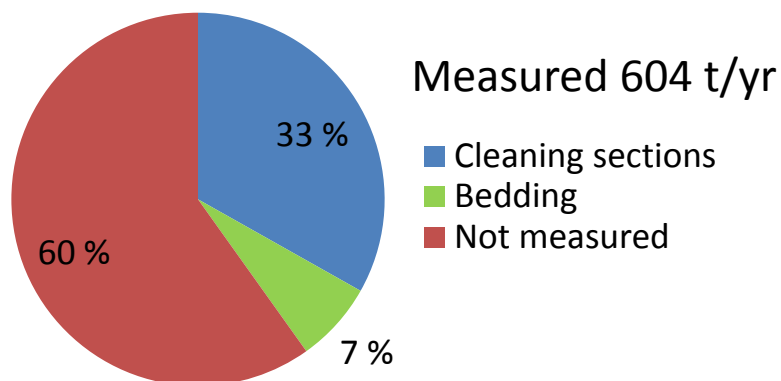
Additives – on dairy farms

	DM			TN			P		
	Ex-animal	Ex-housing	Ex-storage	Ex-animal	Ex-housing	Ex-storage	Ex-animal	Ex-housing	Ex-storage
Average	100	59	60	100	52	59	100	52	61
Max		83	80		75	78		86	108
Min		41	35		24	41		32	40

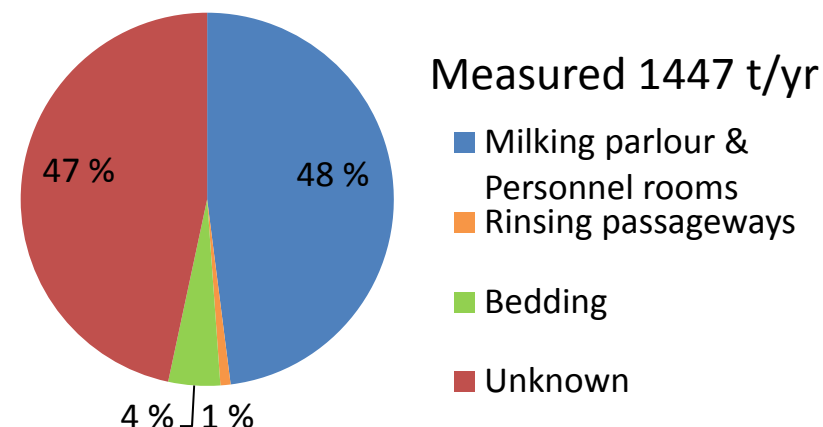
Management factors that impact manure

Measured additions

SE Farm 3 - Pigs
1821 t/yr dilution



SE Farm 1 – Dairy
2961 t/yr dilution



Conclusions

- Most large-scale farms handled manure as slurry
- Large variation in manure produced per LU even for similar livestock types
- Examples of environmentally friendly technology found in all countries
- Manure handling after storage was least well-described part of handling chain
- Cost greatest barrier for implementing innovative handling and processing technology

Recommendations

- Increase storage capacity
- Increase the use of environmentally friendly technology to reduce ammonium emissions from storage and during spreading
- Decrease dilution of slurry as much as possible
- Spreading technology must have high precision
 - Correct dose in the right place at the right time
 - When needed by plants
 - Application rates based on actual nutrient content
 - Site specific conditions
 - Spreading evenness

Seals on Gotska Sandön, August 2013

www.balticmanure.eu

