Manure management and state of innovations in the Netherlands

Oscar Schoumans (Wageningen University & Research, Alterra)

New approaches for nutrient recovery from manure and wastewater.
DPP-Forum, 11 November 2016, Berlin

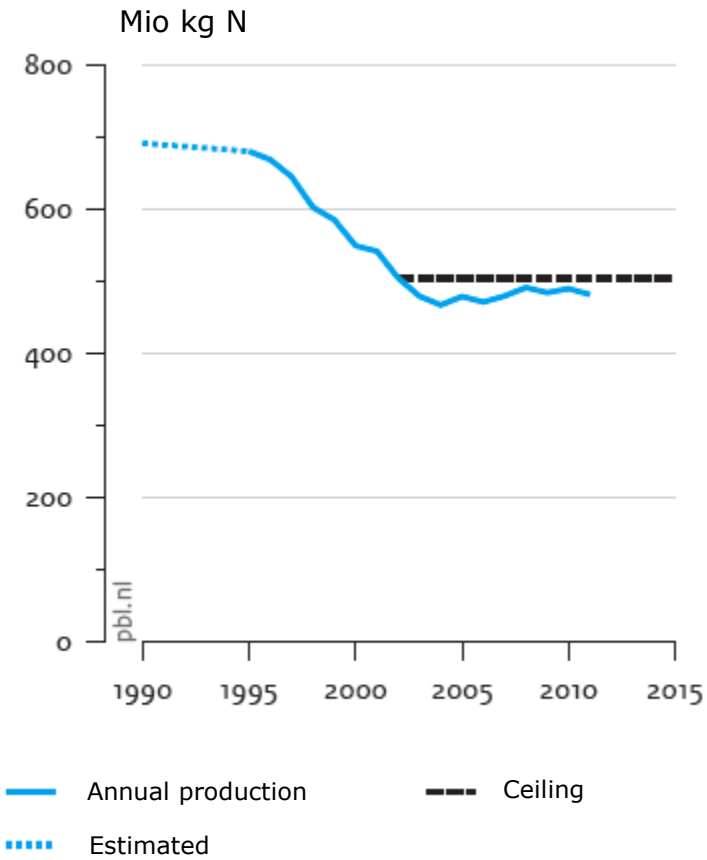
WAGENINGEN
UNIVERSITY & RESEARCH

Outline

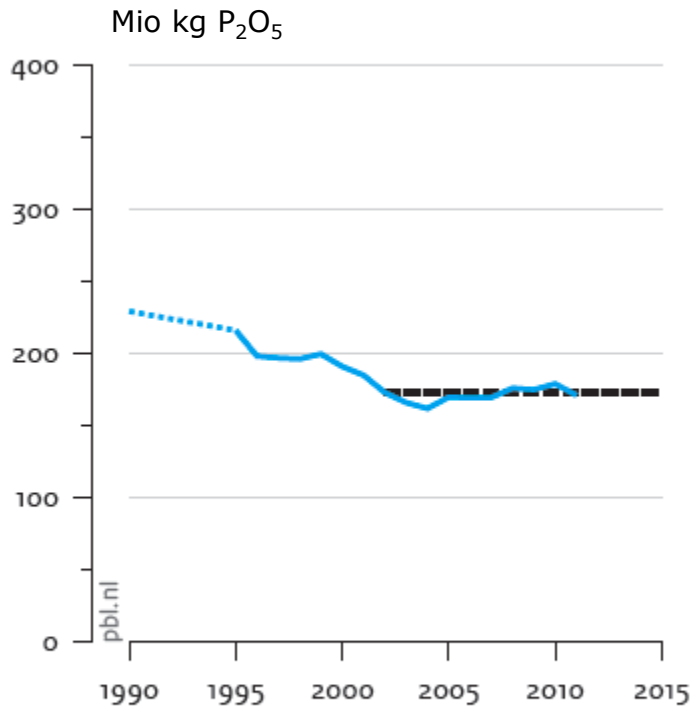
- Manure surplus and legislation (NL)
- State of the art Dutch manure processing
- New developments (nutrient recovery)
- Conclusions

Mineral production husbandry (NL)

Nitrogen

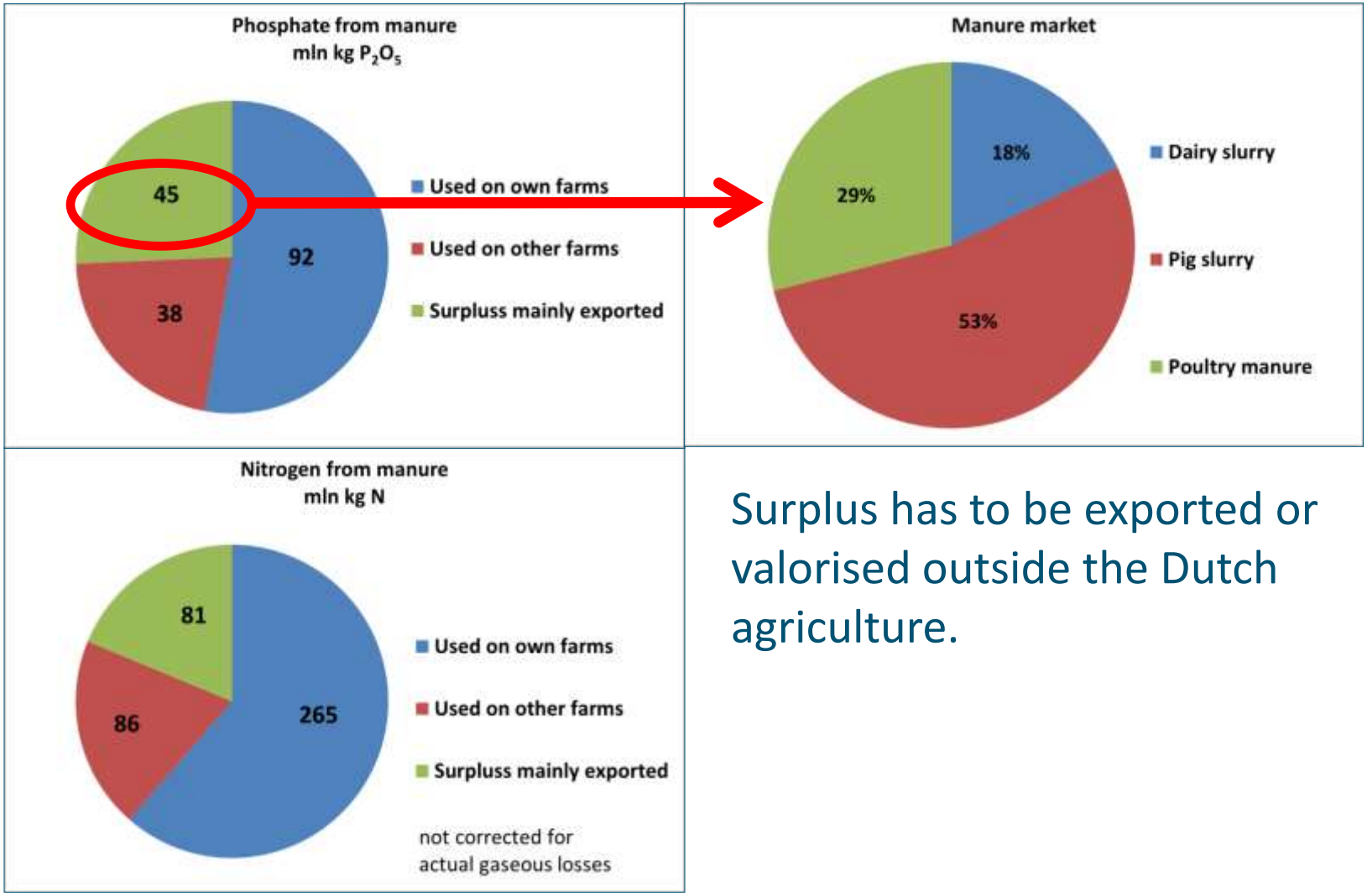


Phosphorus



Source: CBS statline

Manure utilisation and market (NL)



Surplus has to be exported or valorised outside the Dutch agriculture.

WAGENINGEN
UNIVERSITY & RESEARCH

Mandatory Manure Processing

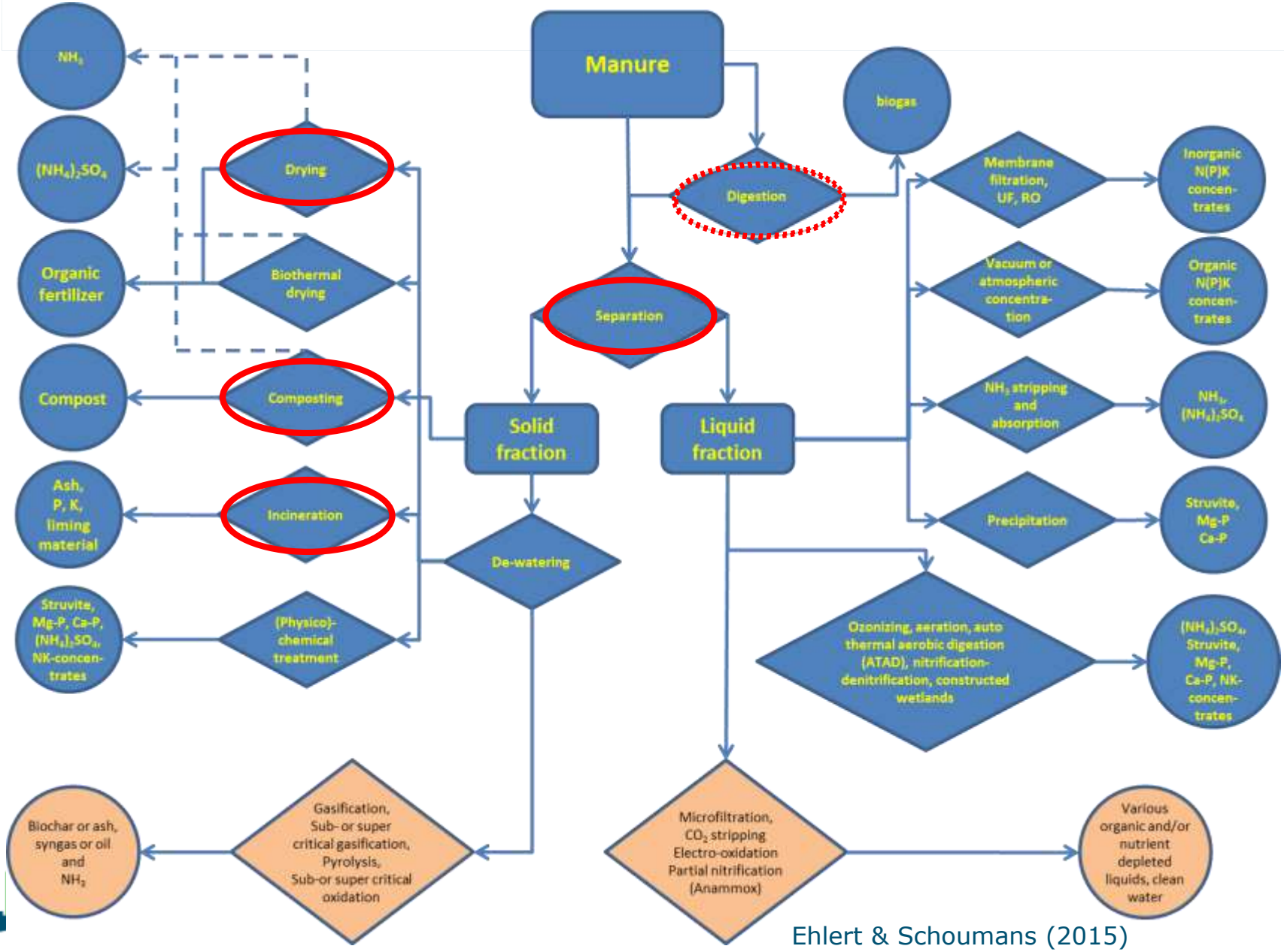
Region	2014	2015	2016	2017*
Other	5%	10%	10%	*10%*
East	15%	30%	35%	*50%*
South	30%	50%	55%	*60%*

* tentative

- Not only P export, but also export of valuable organic matter and nitrogen!
- High costs (export, additional N fertilizer)

WAGENINGEN UNIVERSITY & RESEARCH

Manure valorisation techniques, overview



Ehlert & Schoumans (2015)

State of the art: Manure separation
Composition thin and thick fractions, kg/ton

Animal	Fraction	Dry matter	Organic matter	N	P_2O_5	K_2O
Cow	Liquid	66	50	3.7 (2.5)	1.2 (1)	5.9 (4.9)
	Solid	250	188	7.8 (0.5)	4.4 (1)	4.8 (1.1)
Pig	Liquid	73	34	6.7 (1.5)	3.6 (1)	5.9 (1.6)
	Solid	250	116	10.5 (0.5)	12.4 (1)	4.8 (0.4)
www.bemestingsadvies.nl						

WAGENINGEN UNIVERSITY & RESEARCH

Option to increase nutrient efficiency of manure and to minimize mineral fertilizer use

State of the art: Incineration (poultry litter)

Biomassa Centrale (BMC) Moerdijk

State of the art: P-ash: Composition & effectivity

Composition

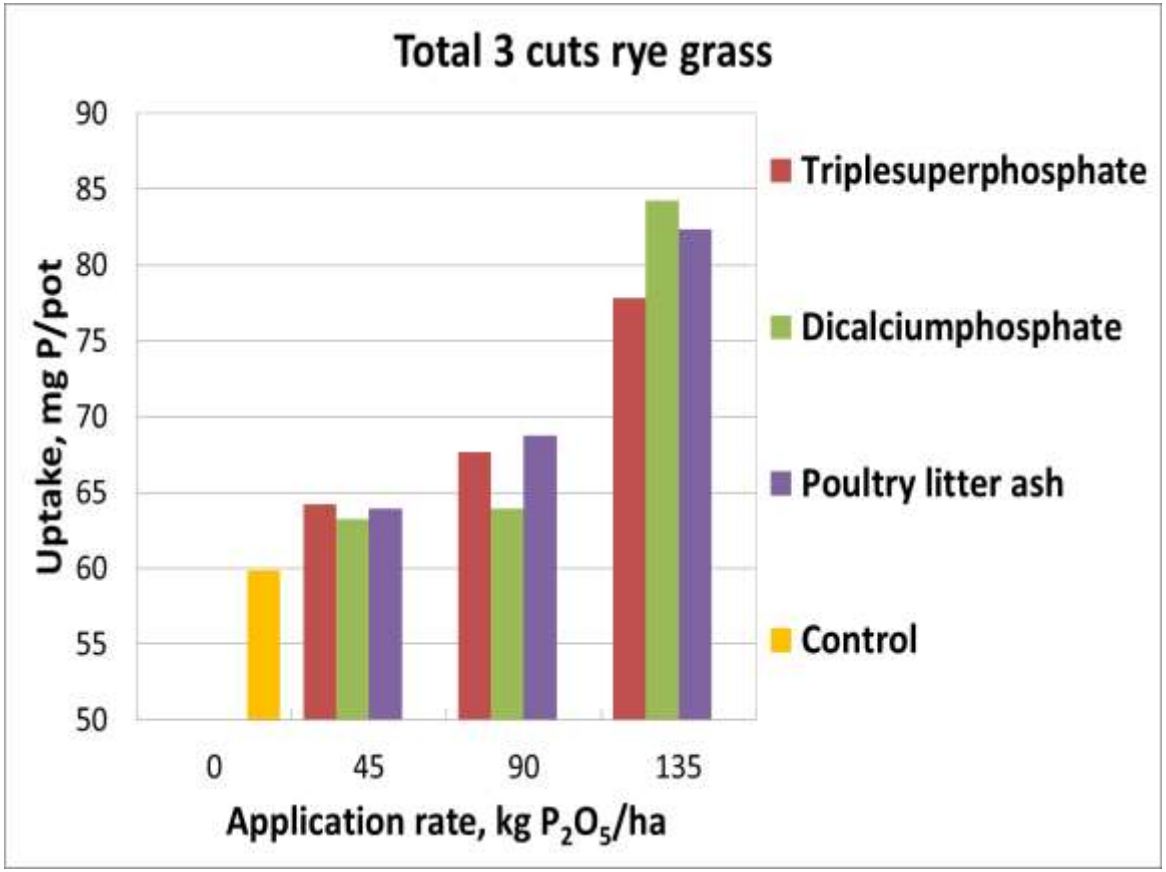
Dry matter 90%

P_2O_5 9.6%

K_2O 9.4%

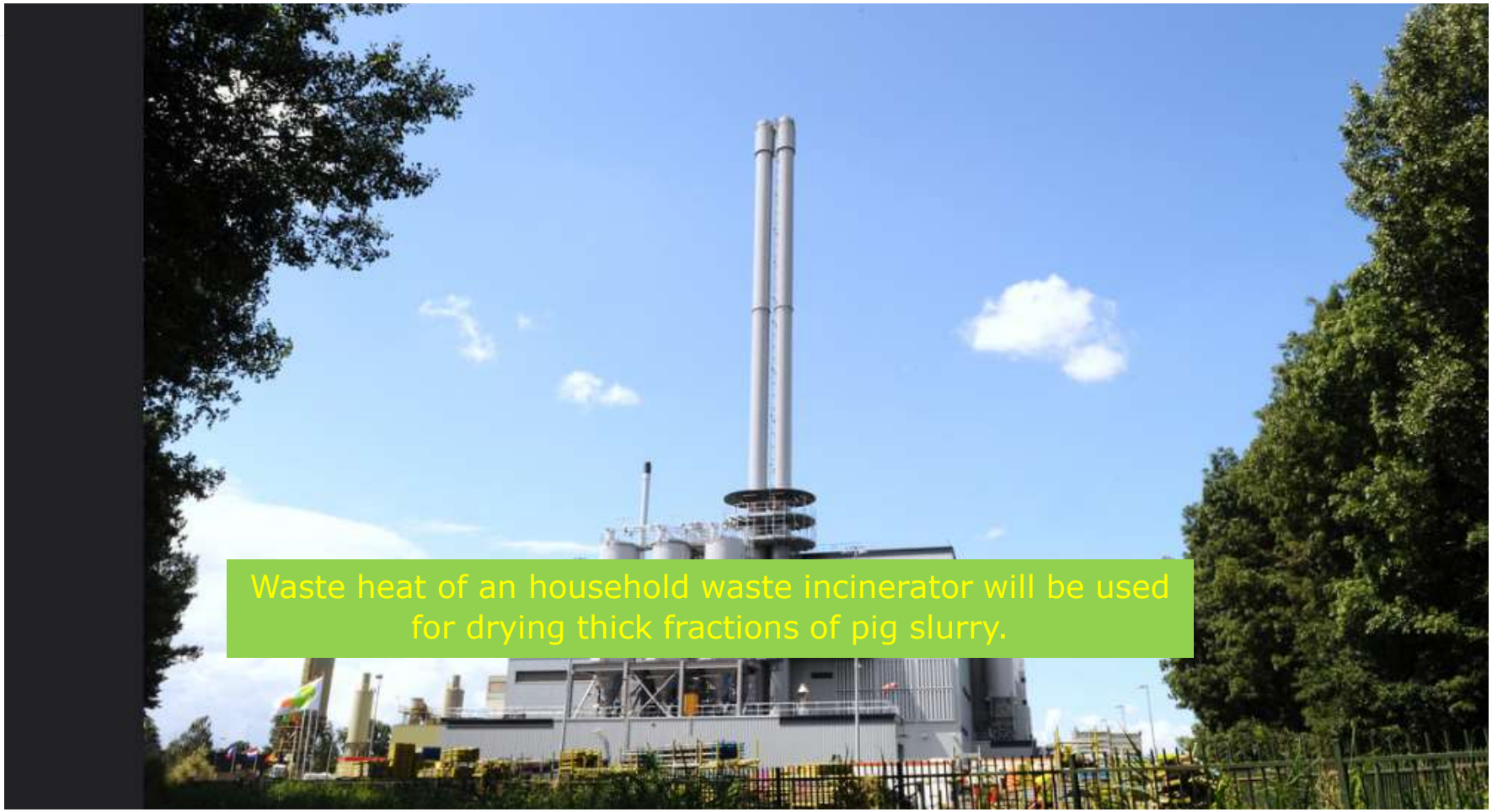
Neutralising value 33.9%

Ehlert & Nelemans, 2014



WAGENINGEN UNIVERSITY & RESEARCH

State of the art
New initiative: EoW heat Sita Roosendaal



State of the art
Dried pelletised thick fraction pig slurry (Biominerals)

Information
Peter Brouwers
LTO

WAGENINGEN
UNIVERSITY & RESEARCH

Manure processing: 2015 and planned

- In 2015: Total volume 20.3 mln kg P_2O_5
- Planned capacity 11.2 mln kg P_2O_5

Product	Mln kg P_2O_5
Ash	9.24
Compost[1]	3.09
Manure pellets[1]	2.57
Solid fraction digestate	2.47
Dried digestate	1.30
Slurry[1]	0.83
Solid fraction manure	0.75

[1] including digestate

Mestverwerkingsloket-BMA, 2015

WAGENINGEN UNIVERSITY & RESEARCH

Replacement of fertilizers by manure fractions

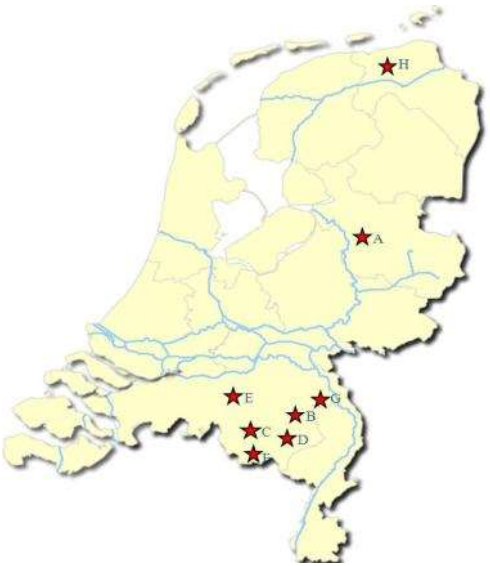
Mineral concentrates

Aim: to produce mineral NK concentrates (substitute for fertilizers) from the liquid fraction of manure

However, the EU-Nitrate Directive states that all products derived from animal manure is animal manure, and has to comply with the manure rules of the Nitrate Directive

Pilot with 10 installations are being tested:

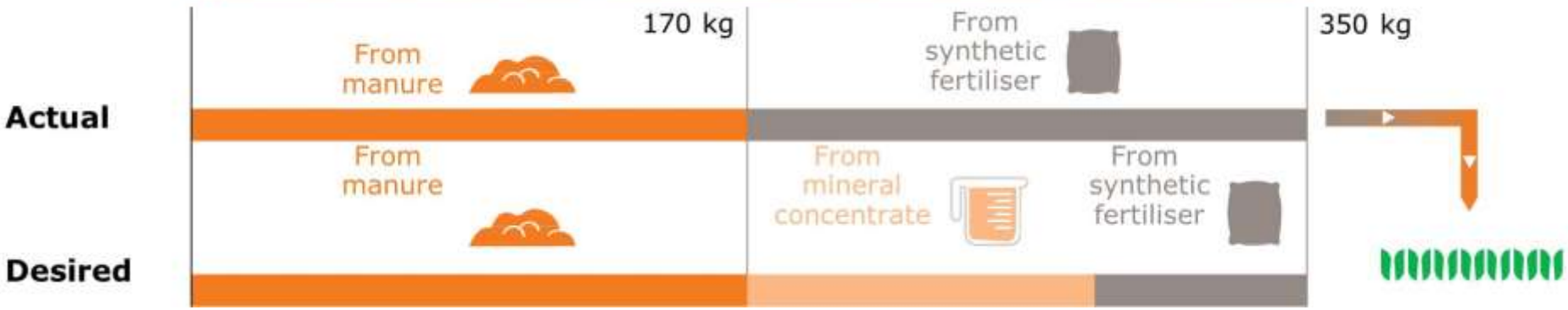
Technique: reversed osmoses (RO)



WAGENINGEN
UNIVERSITY & RESEARCH

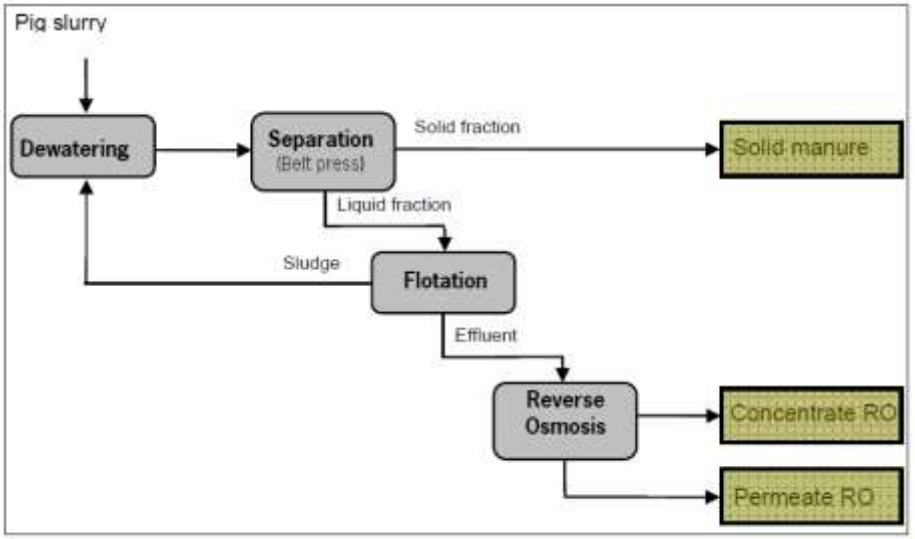
Desired utilisation of Mineral Concentrate

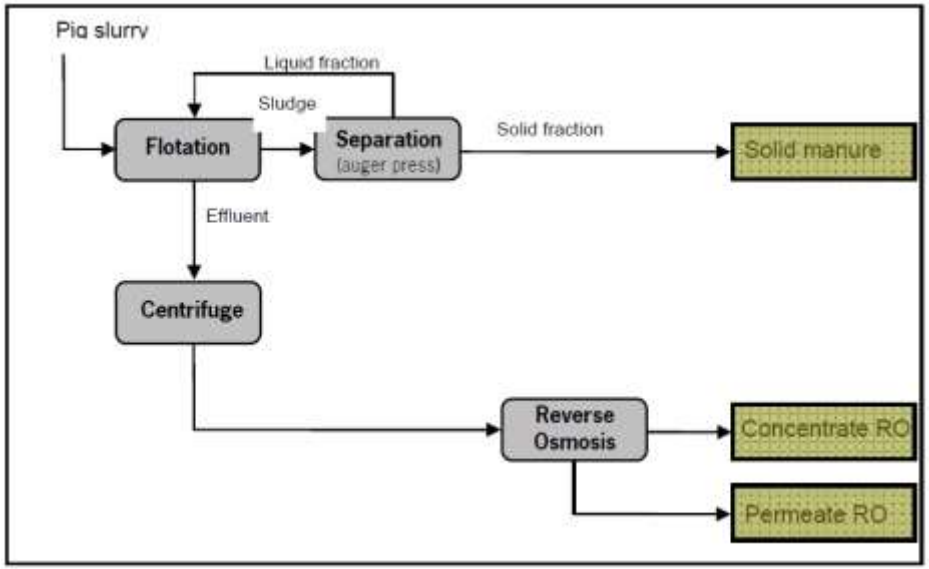
Desired utilisation of nitrogen by source in kg N/ha, per year



WAGENINGEN
UNIVERSITY & RESEARCH

Mineral concentrates: Examples





WAGENINGEN
UNIVERSITY & RESEARCH

Average composition of mineral concentrates

- Increased N and K contents
- Low P content
- NH_4: 86 - 96% of total N
- pH >7.5
- Large differences between treatment plants

Source: Velthof et al. (2012)

Plant	N-total	N-NH_4		P	K
	g/kg	g/kg	% Ntotal	g/kg	g/kg
A	6.4	5.9	92	0.2	7.1
B	7.2	6.9	96	0.01	6.8
C	8.9	7.8	88	0.34	8.4
D	5.3	4.7	89	0.11	6.8
E	4.2	3.6	86	0.08	5.5
F	8.1	7.1	88	0.26	8.1
H	11	10.5	95	0.27	15.7

WAGENINGEN UNIVERSITY & RESEARCH

Products

Mineral concentrate
Liquid N-K solution

Solid fraction
Organic NP manure
Soil conditioner

Permeate
(water)

Pilots: perspectives, but not yet approved by Brussels

WAGENINGEN
UNIVERSITY & RESEARCH

Potential economical value of pig slurry

Potential value of pig slury

	Content[1)] (kg/m^3)	Market price resource[2)] (€/kg)	Value (€/ton)
Nitrogen (N)	0.8 - 6.8	0.167 - 0.389	0.13 - 2.64
Potassium (as K_2O)	2 - 14	0.095 - 0.222	0.19 - 3.10
Phosphate (as P_2O_5)	0.6 - 6.2	0.157 - 0.365	0.09 - 2.26
Organic matter (solid phase)	35 - 45	0.091 - 0.117	3.19 - 5.27
Value of resource (€ / ton)			3.60 - 13.28

[1)] Römkens and Rietra (2008)

[2)] LEI, 2012; resp. **15% - 35% of the fertilizer market price base on** KAS (N), TSP(P_2O_5) and K60 (K_2O) and value of energy production of organic matter (based on 0.07 - 0.09 € per kWh)

Cost of manure processing must be low to make money out of valuable components of manure!!

Source: Schoumans et al. (2010)

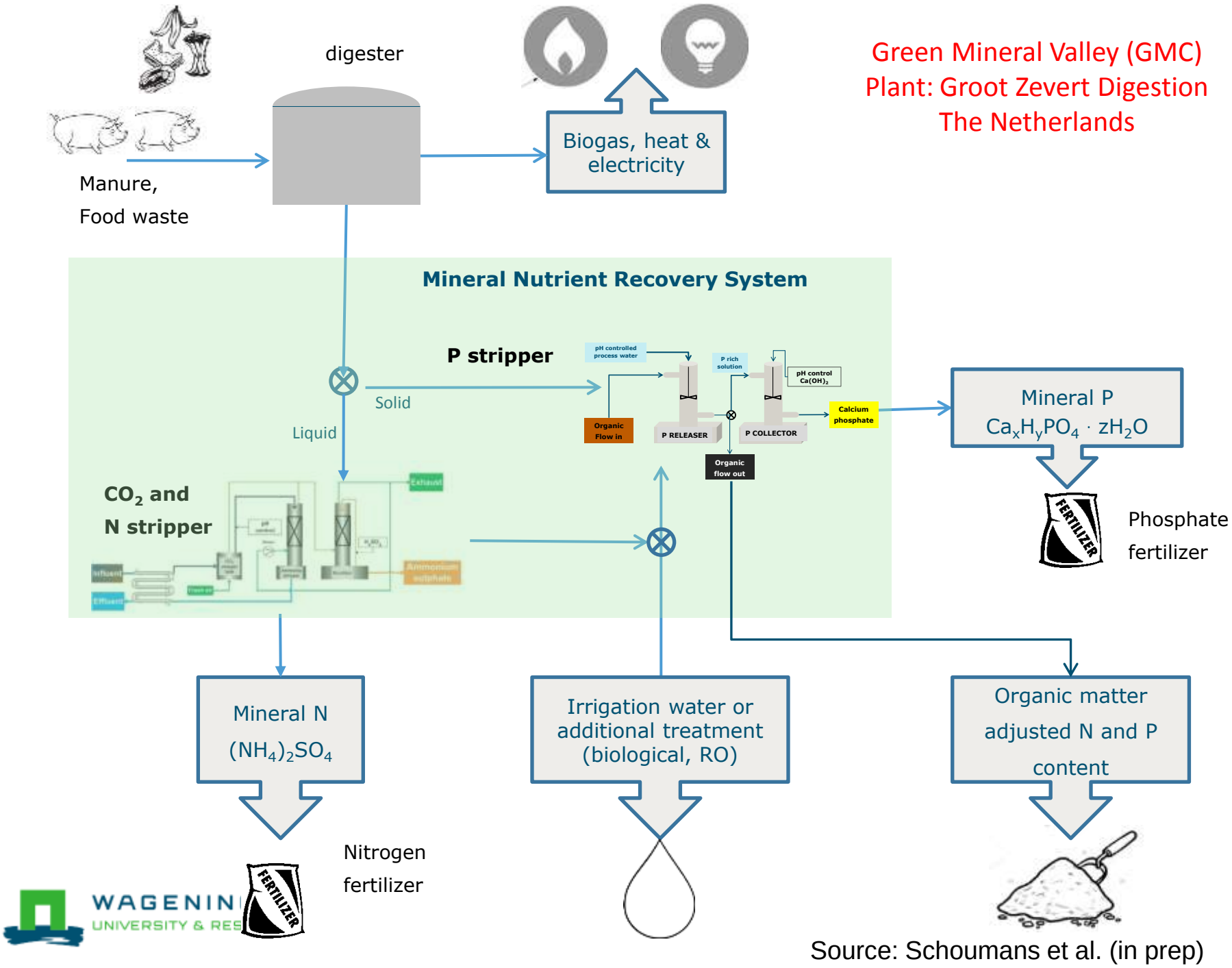
Update market prices: 2012

WAGENINGEN UNIVERSITY & RESEARCH

Compostion Ca~P from pig slurry

Type		DS	OS	Ntot	Ptot
		% (vers)	% (droog)	%N (droog)	%P_2O_5 droog
mest	gemiddelde	13.2	33.1	8.1	24.7
	st. dev	0.7	4.0	2.9	3.2
digestaat	gemiddelde	16.1	25.2	7.4	24.4
	st. dev	1.8	3.0	0.7	0.5

WAGENINGEN
UNIVERSITY & RESEARCH



Source: Schoumans et al. (in prep)

Green Mineral Valley (Pilot plant)

Interest of EU-commission (Agri):

- Valorisation of components from manure
- Free trade of fertilising products; however, different definitions are used (Nitrates Directive, Animal by-products directive, New Fertiliser Regulation & REACH)

WAGENINGEN UNIVERSITY & RESEARCH

GZV GROOT ZEVERT VERGISTING

Conclusions

- Manure is a valuable renewable source of nutrients and energy;
- Separation of manure in solid and liquid fractions valorises the agronomic use of the nutrients. Nutrients of manure can replace mineral fertilisers;
- Current developments of new technologies of manure refinery will lead to a higher quality of fertilizer products. And reduces the need for incineration or export of raw manures;
- Harmonised EU-legislation needed in relation to new products.

Thank you for your attention!

http://www.wageningenur.nl

WAGENINGEN
UNIVERSITY & RESEARCH