

Sustainability of processed manure

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Background / Questions

- Dutch Board of Arable Farmers



- Properties of processed manure?
 - Equal to chemical fertilizer?
- Sustainability?
 - Energy consumption
 - Green House Gas production
 - Price
- Implementation in arable farming practice?
 - Fit in fertilization plan?

Background

Nitrate Directive limits N application from animal manure

Co-digested manure = manure for the ND
→ Manure surplus

- Manure surplus distribution @ high costs

Solutions (?)

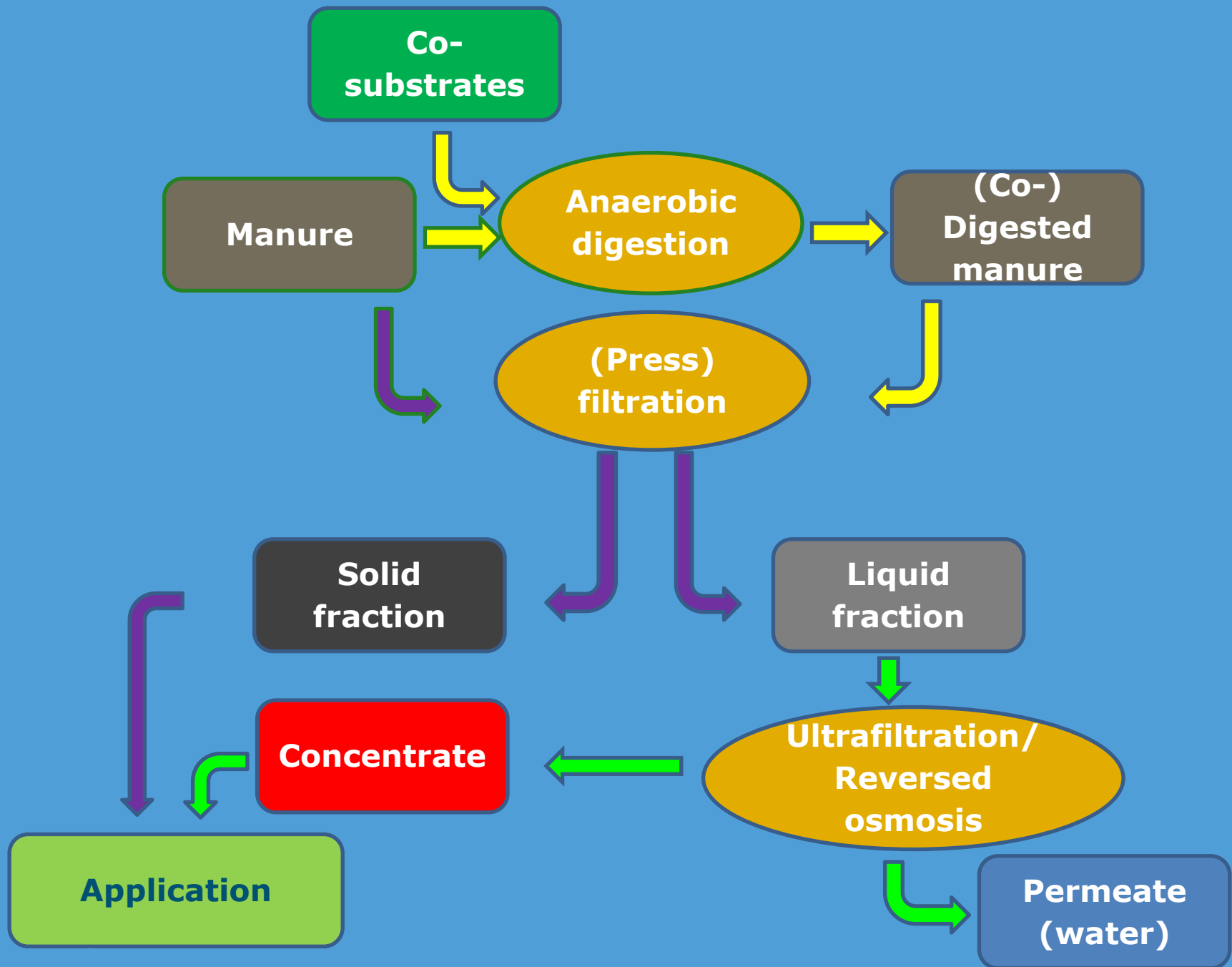


Separation and Concentration Process Flow

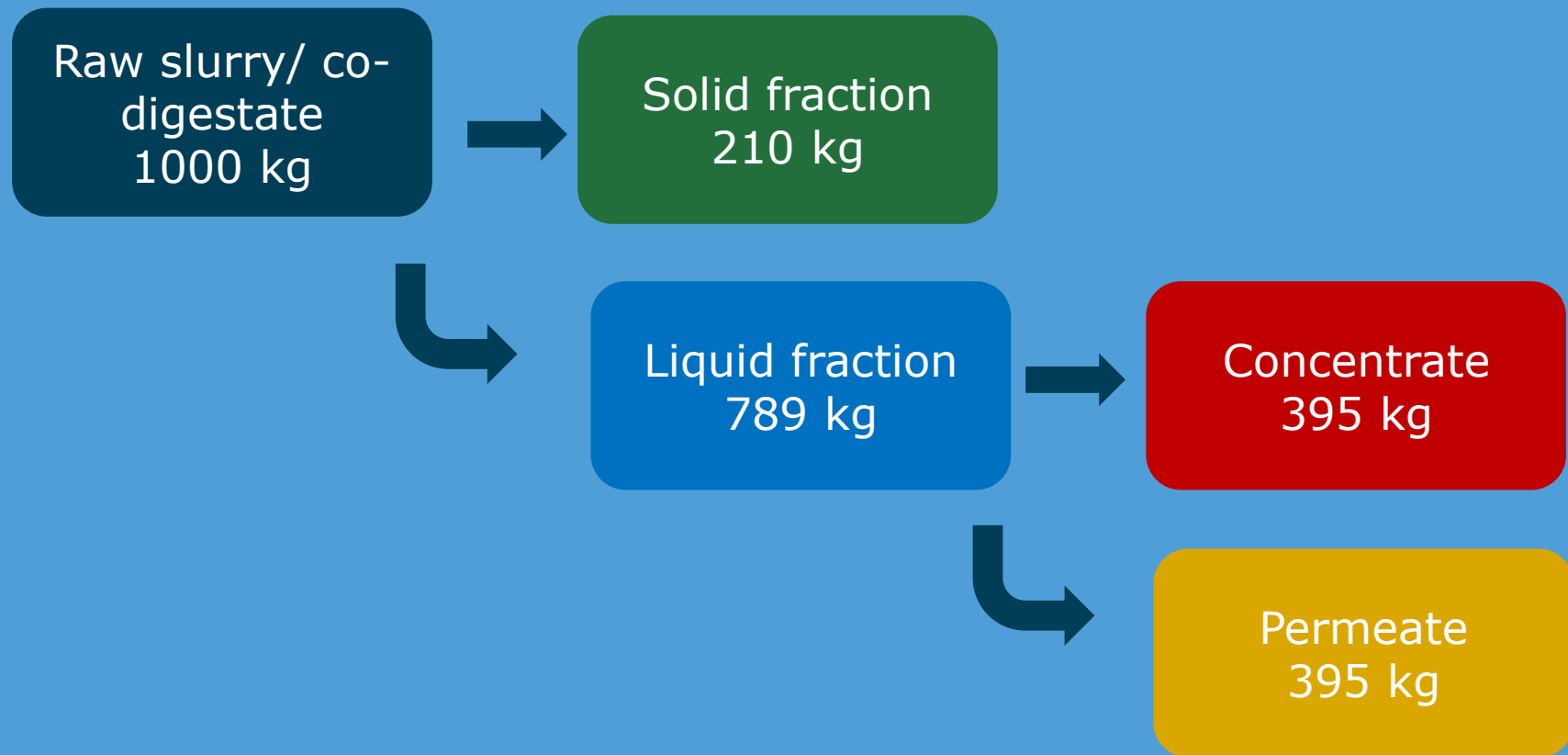


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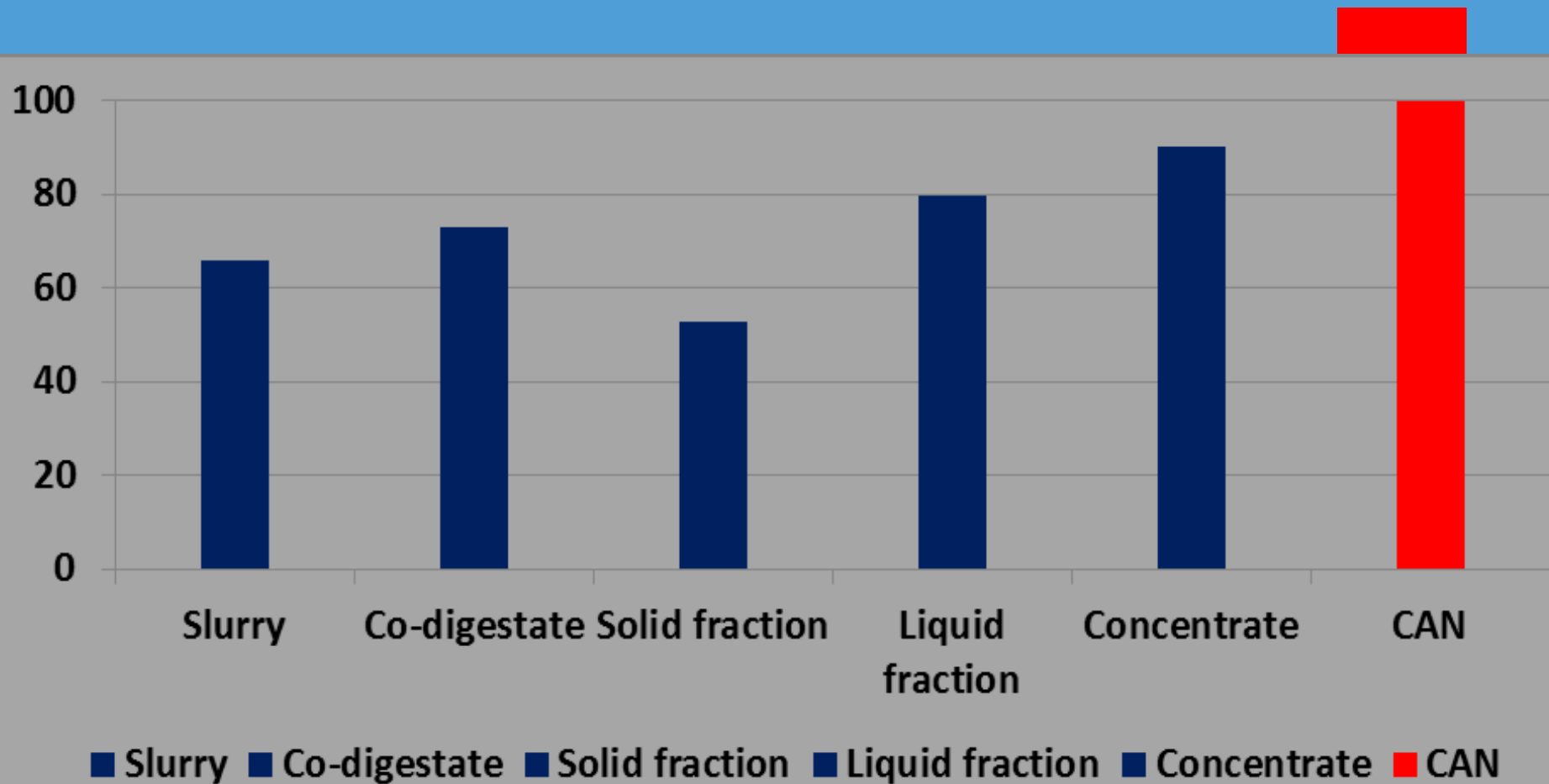
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Mass balance



Composition and efficacy: Nitrogen



Conclusions separation and concentration

- N-efficacy:

Solid fraction < Raw manure < Liquid fraction < Concentrated liquid fraction

- Concentrate:

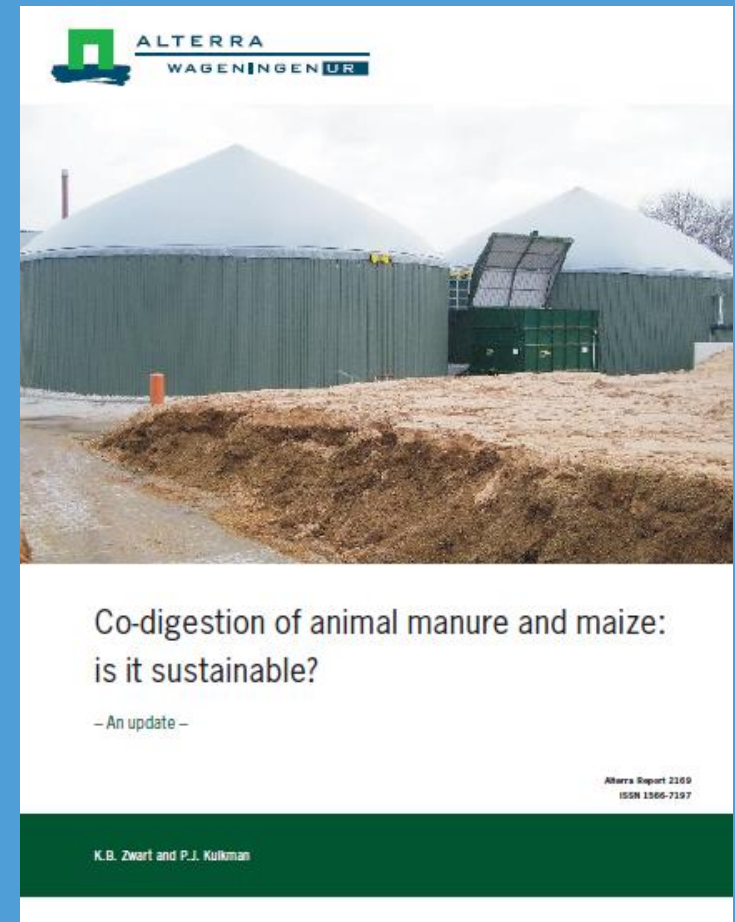
Still a very diluted solution
Not completely mineral
N-efficacy < 100%

Sustainability aspects

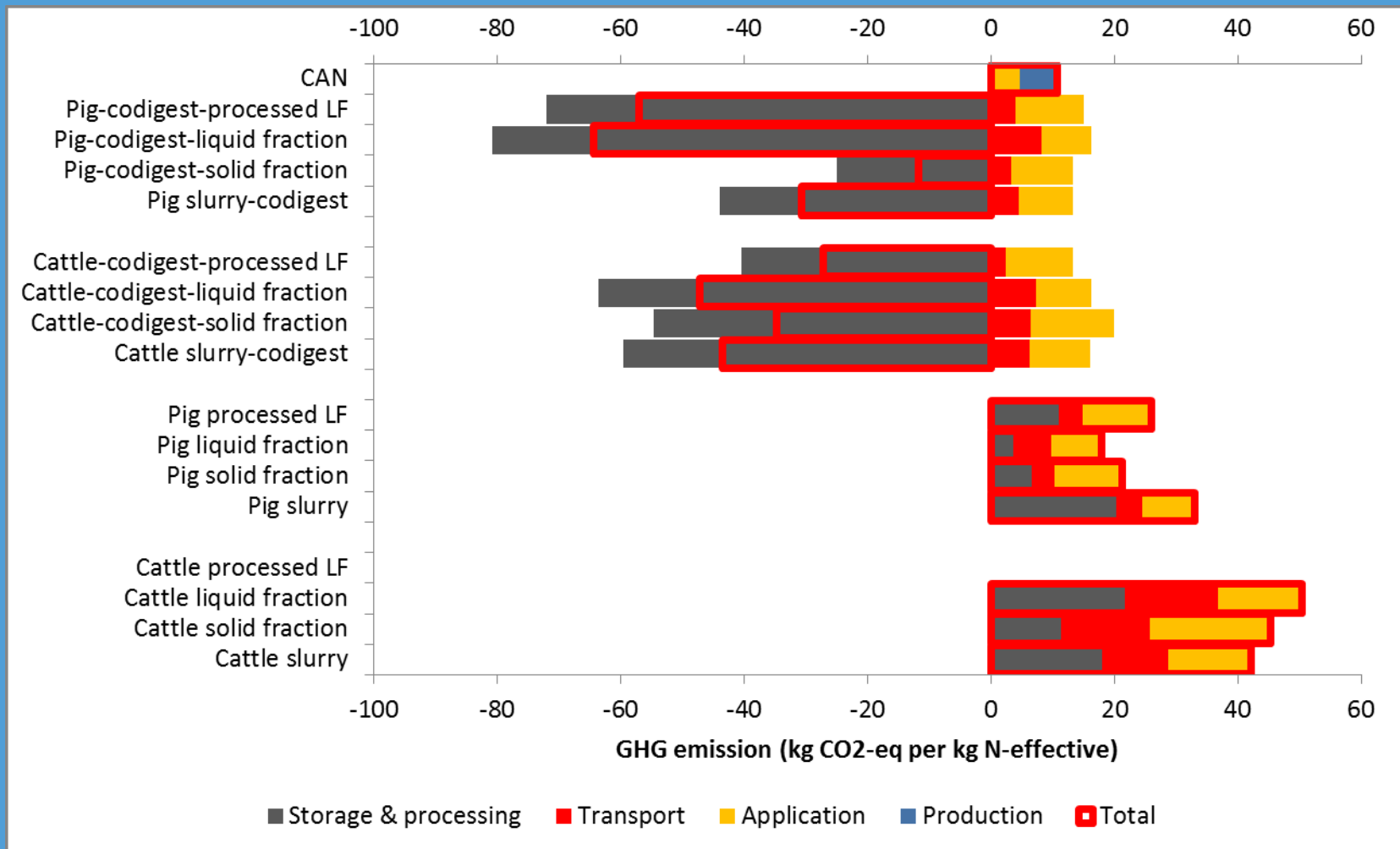
Product	Farmer	Environment	Production process
Fertilizer	Yield and N-and P- efficacy and.... €	GHG emissions (CH ₄ ; N ₂ O)	Energy → GHG (CO ₂ equivalents)
Manure			
(Co) digested manure			
Solid fraction			
Raw liquid fraction			
Processed liquid fraction			

Method:

- Restricted LCA (Zwart et al, 2009)
- Energy
- GHG emissions
 - Production
 - Transport
 - Storage & Processing
 - Application
- Expressed per kg Effective N



Results GHG balance



Conclusions GHG emissions

- Per kg N-eff
 - Fertilizer < raw manure or processed raw manure
 - Pig manure < cattle manure
 - Digested manure < raw manure

Implementation in arable farm practice

- Do processed manure products fit in fertilization schemes?



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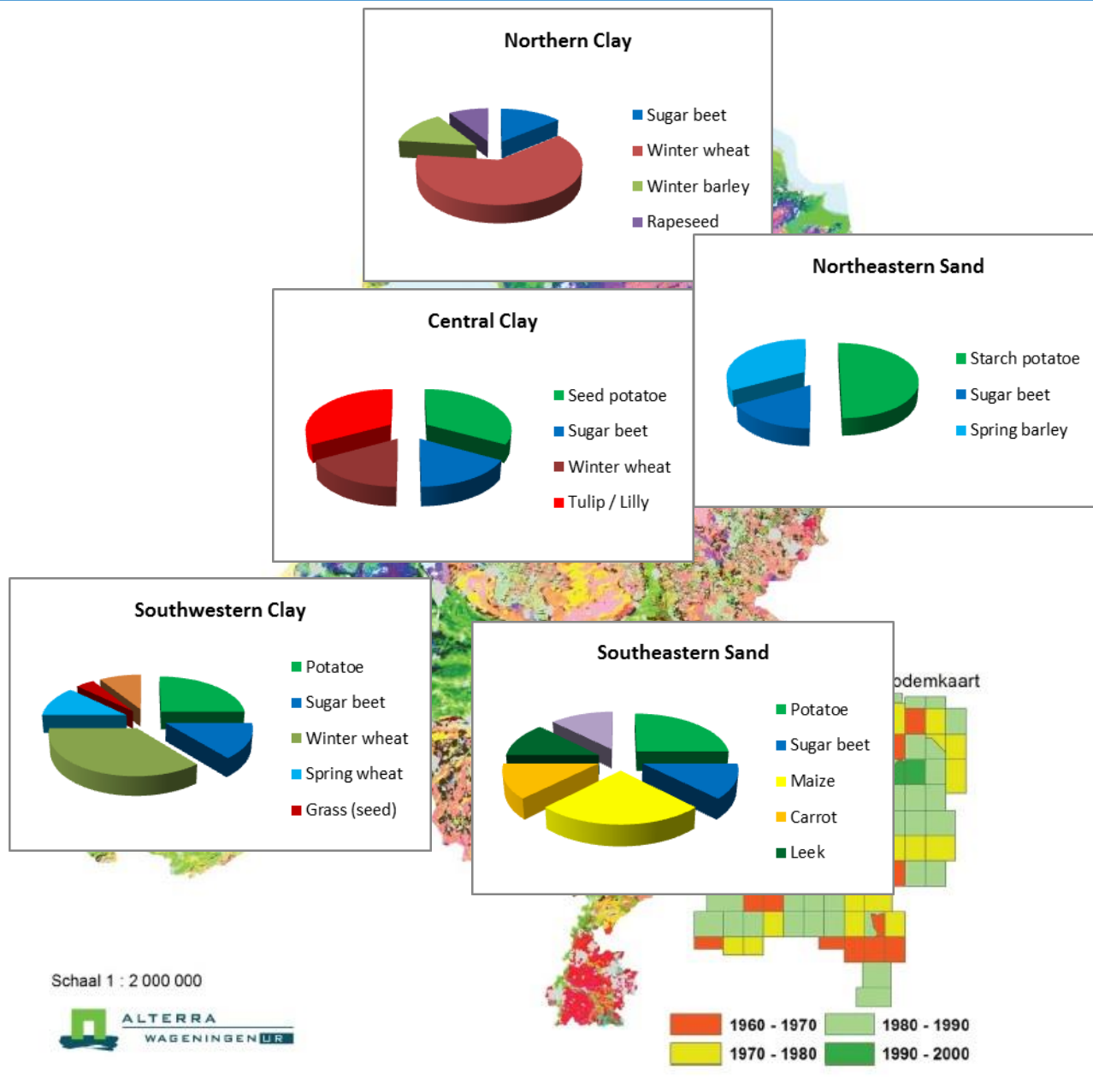
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Conditions

1. Model farm description, 5 regions, 2 soil types, rotations

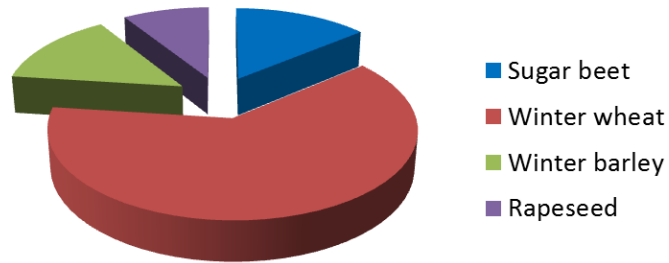


Model Farm Crops



Model Farm Crops

Northern Clay



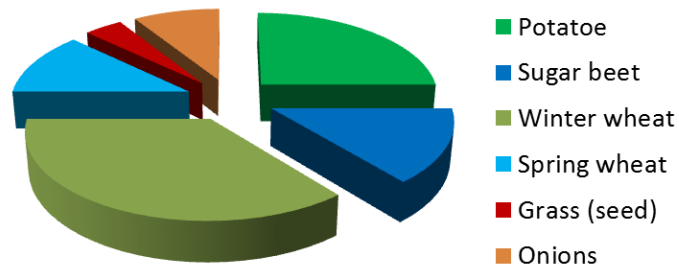
Northeastern Sand



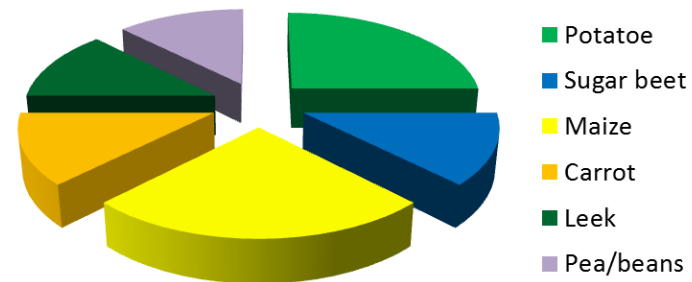
Central Clay



Southwestern Clay



Southeastern Sand

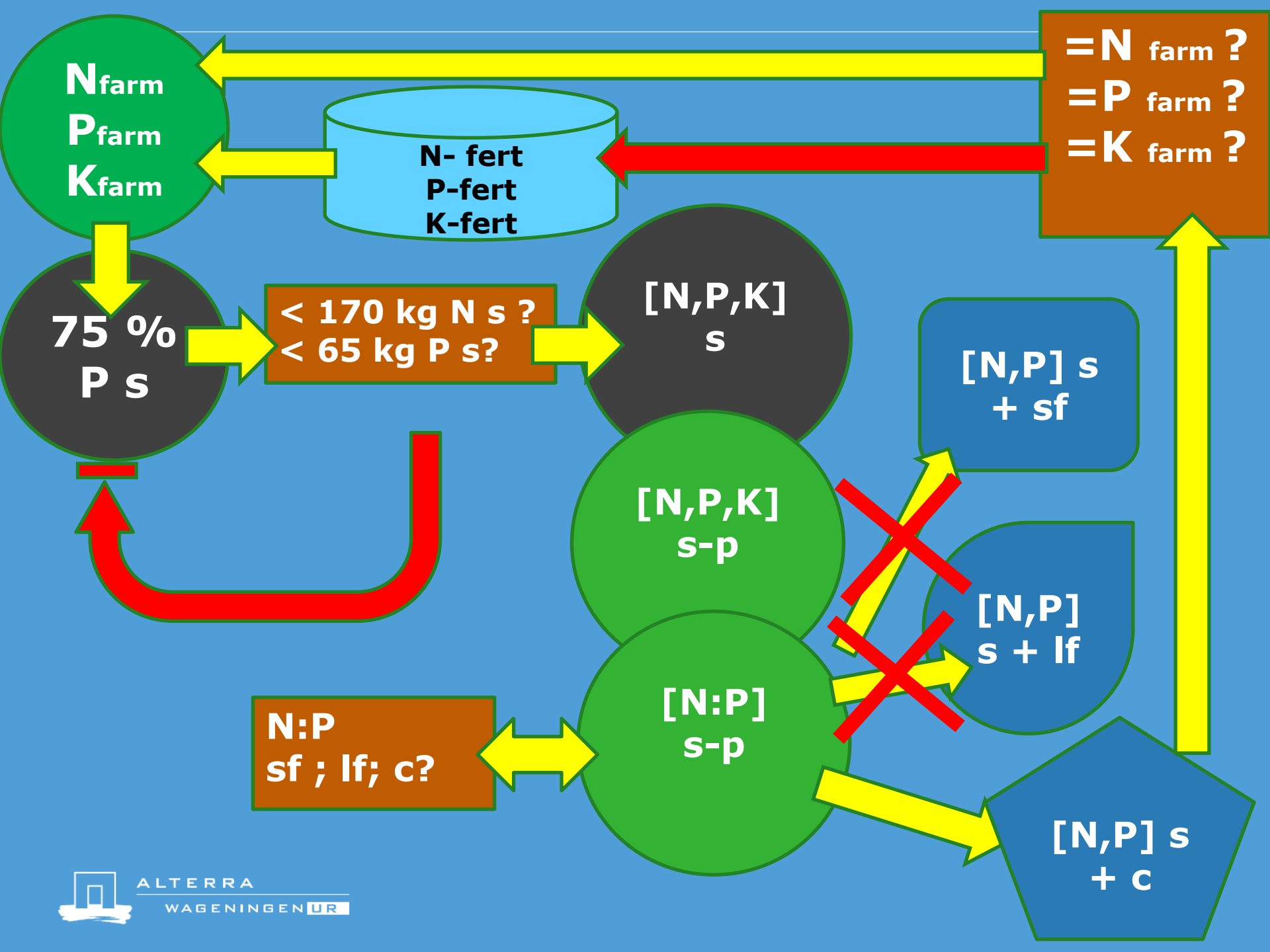


Conditions

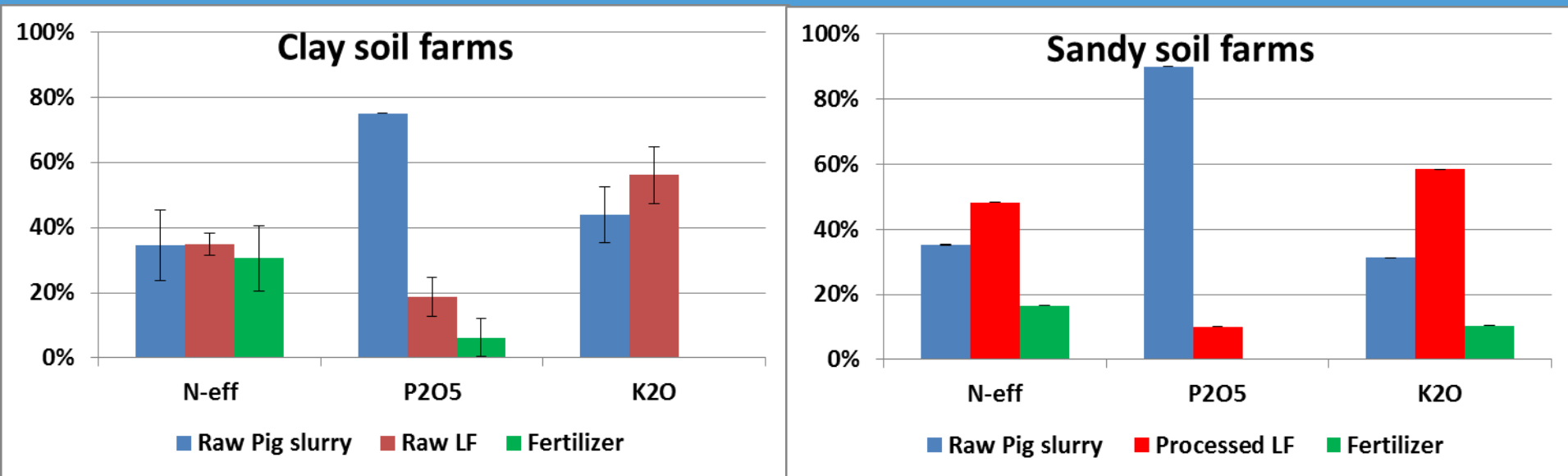
1. Model farms, 5 regions, 2 soil types, rotations
2. Total nutrient requirement per farm, using recommendations legal per crop
3. Not exceeding maximum amounts legally allowed
 - from animal manure
 - from fertilizers

Additional conditions

- Base application Pig slurry
 - Clay: 75% of P-required
 - Sand: 90% of P-required
- Optimum product selection based upon:
 1. additionally required N,P,K
 2. Using N/P and N/K ratio's of the manure products
- N-fertilization: crop level, P and K: farm level
- Raw slurry per crop: <60% of effective N



Results: Pig slurry



Conclusions implementation

- Processed manure can be implemented in current farm practice
- Regarding Pig manure:
 - Sandy soils: Concentrated mineral fraction
 - Clay soils: Raw liquid fraction

General Conclusions

- Strictly spoken processed slurries \neq chemical fertilizer N
- Processing
 - Raw manure: \rightarrow GHG increase
 - Incl. co-digestion: \rightarrow GHG decrease
- Processed slurries can be implemented in Dutch arable farming systems







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Composition P

