



WASTEWATER TRANSFORMED FOR GOOD

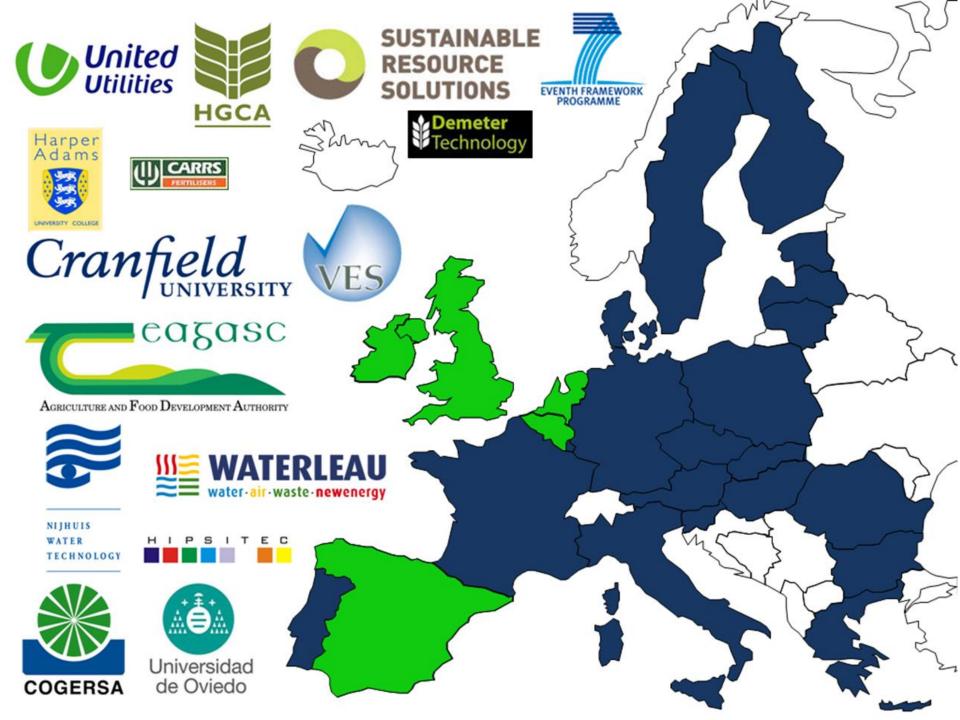
END-O-SLUDG Phosphorus Removal and Recovery

Mr. Richard Clarke (United Utilities)

&

Dr. Ruben Sakrabani (Cranfield University)

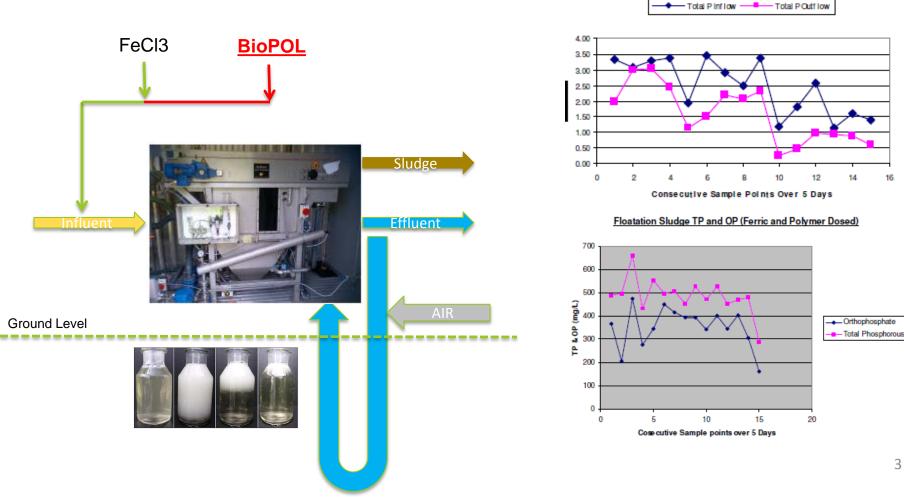
4th March 2015





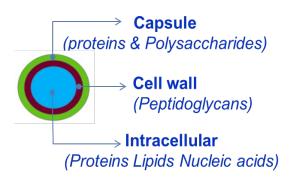
iDAF – Dissolved Air Flotation

DAF Total Phosphorous with Ferric Chloride and Polymer Dosing





Milled Sludge / Biopolymers





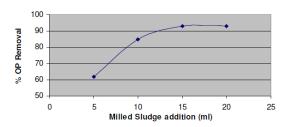
Sludge liquours with 100 mgP/l = 90% P recovery using BioPOL

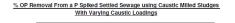


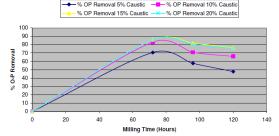


24.3% P₂O₅ (Struvite = 26.9% P₂O₅)

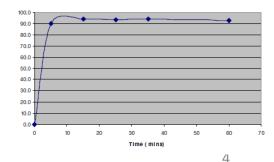
OP removal with increasing Milled Sludge addition







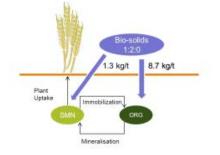
% OP Removal With Mixing Time

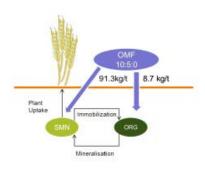


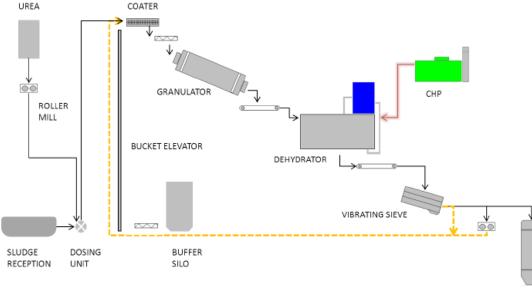


Organo Mineral Fertiliser (OMF)









Granules - General Feedback

- Consistent size
- Suitable strength for spreading
- Will spread to 24m
- Acceptable spread patterns
- Low bulk density
- Spreading in the wind might be difficult.
- Unlikely to spread further than 24m



PRODUCT SILO

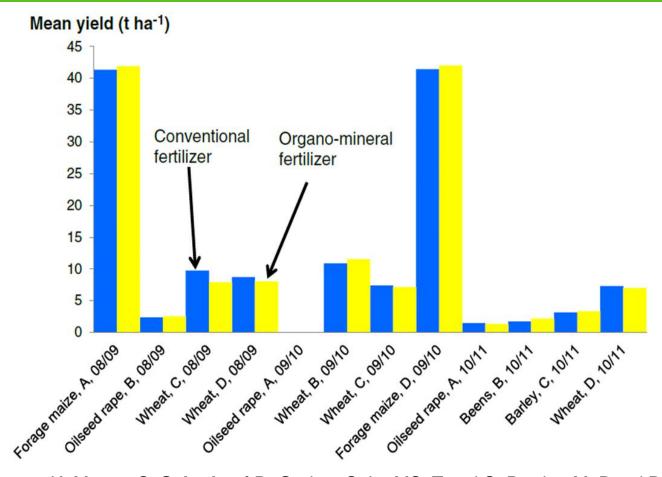


AQUACIRCA – Water 1b – April/Sept 2015

Product	Concept	Pilot	Demo	Implemented
idaf				
Biopolymers				
Low P Cake				
BioPHOS				
Organic Destruction Cell (ODC)				
Nitrogen and Phosphorus Capture (NPC)				



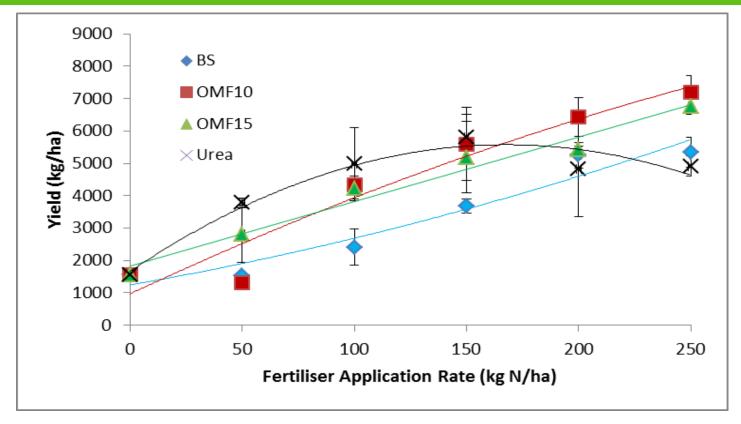
Plot trials at Broxton (Cheshire)



Deeks LK, Chaney K, Murray C, **Sakrabani** R, Gedara S, Le MS, Tyrrel S, Pawlett M, Read R, Smith GH (2013). Field evaluation of a sewage sludge derived novel organo-mineral fertilizer on combinable crops. Agronomy for Sustainable Development. 33(3), 539-549



Grass Yield in Silsoe



Pawlett M, Deeks LK, Sakrabani R (2015). Nutrient potential of biosolids and urea derived organo-mineral fertilisers in a field scale experiment using ryegrass (Lolium perenne L.). Field Crops Research (In press) 8

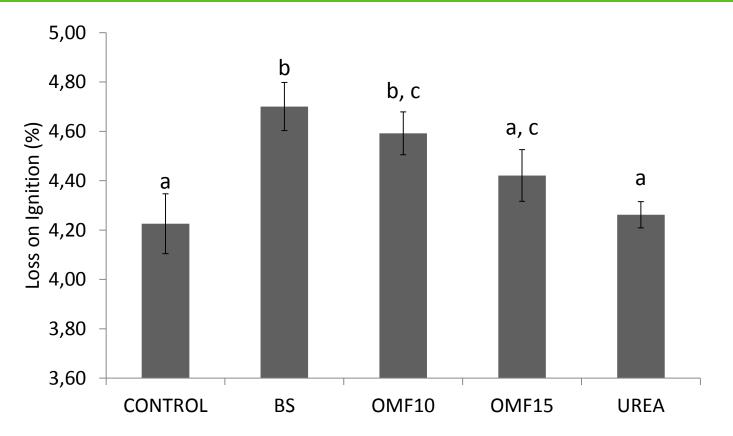


Silsoe field trials Spring 2012





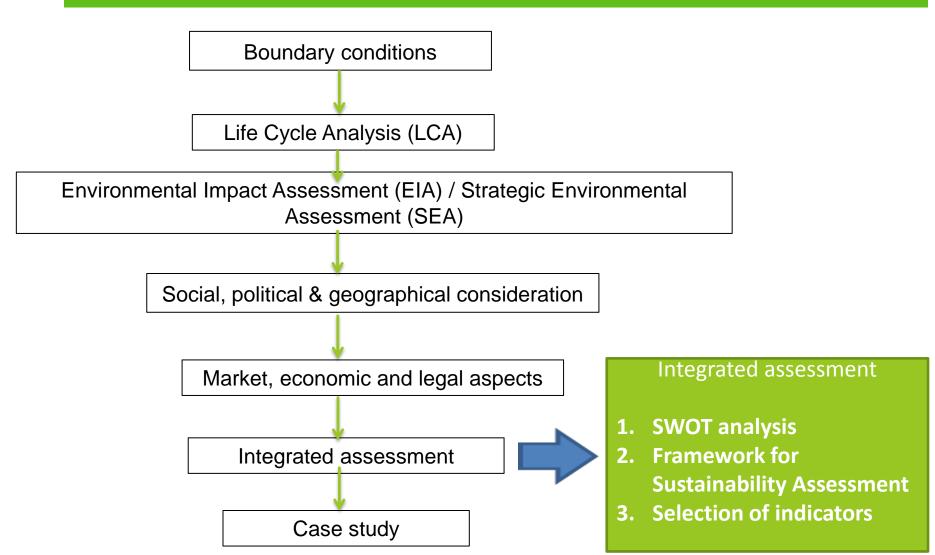
Soil organic matter – field (grass)



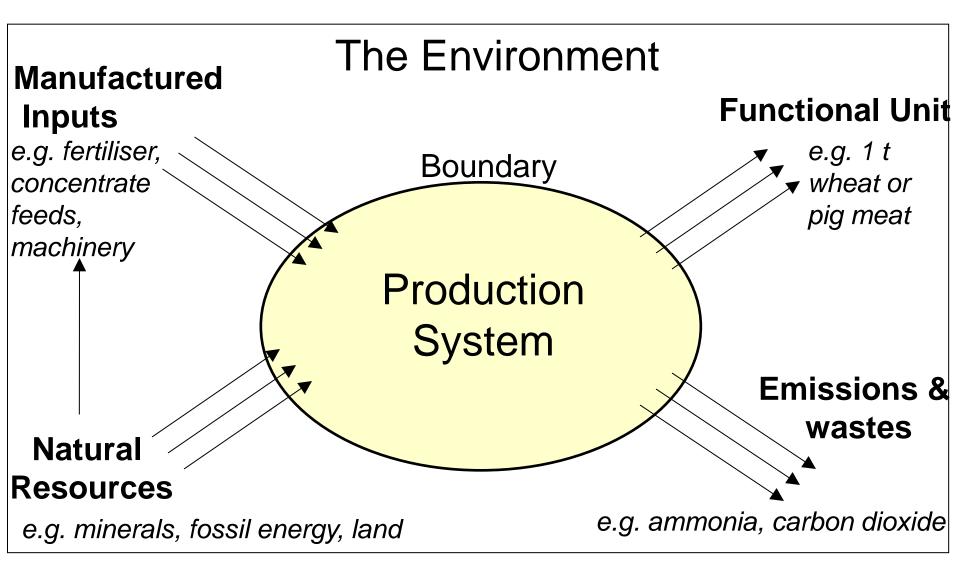
BS increased soil organic matter after 5 years



How did we assess sustainability ?



Life Cycle Assessment Concept



LCA - take home message

 new EOS downstream processing shows all burden categories to improve

Comparative results normalised per 100k PE showing the impact of the Downstream Processing System

	Primary		Eutrophication	Acidification	Abiotic resource		
	energy used,	GWP 100,	potential, kg PO ₄	potential, kg SO ₂	depletion, kg Sb		
WWTP	MJ	kg CO₂ equ	equ	equ	equ		
System C	-45,000	-5,680	-2	-62.00	-34.40		
Comparative (%)							
	Primary		Eutrophication	Acidification	Abiotic resource		
	energy used	GWP 100	potential	potential	depletion		
System C	-26.6%	-58.4%	-2.9%	-36.7%	-68.7%		





www.end-o-sludg.eu

Richard Clarke richard.clarke@uuplc.co.uk

Ruben Sakrabani

r.sakrabani@cranfield.ac.uk

Acknowledgement: The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7-ENV.2010.3.1.1-2 ENV) under grant agreement N° 265269.



unitedutilities.com